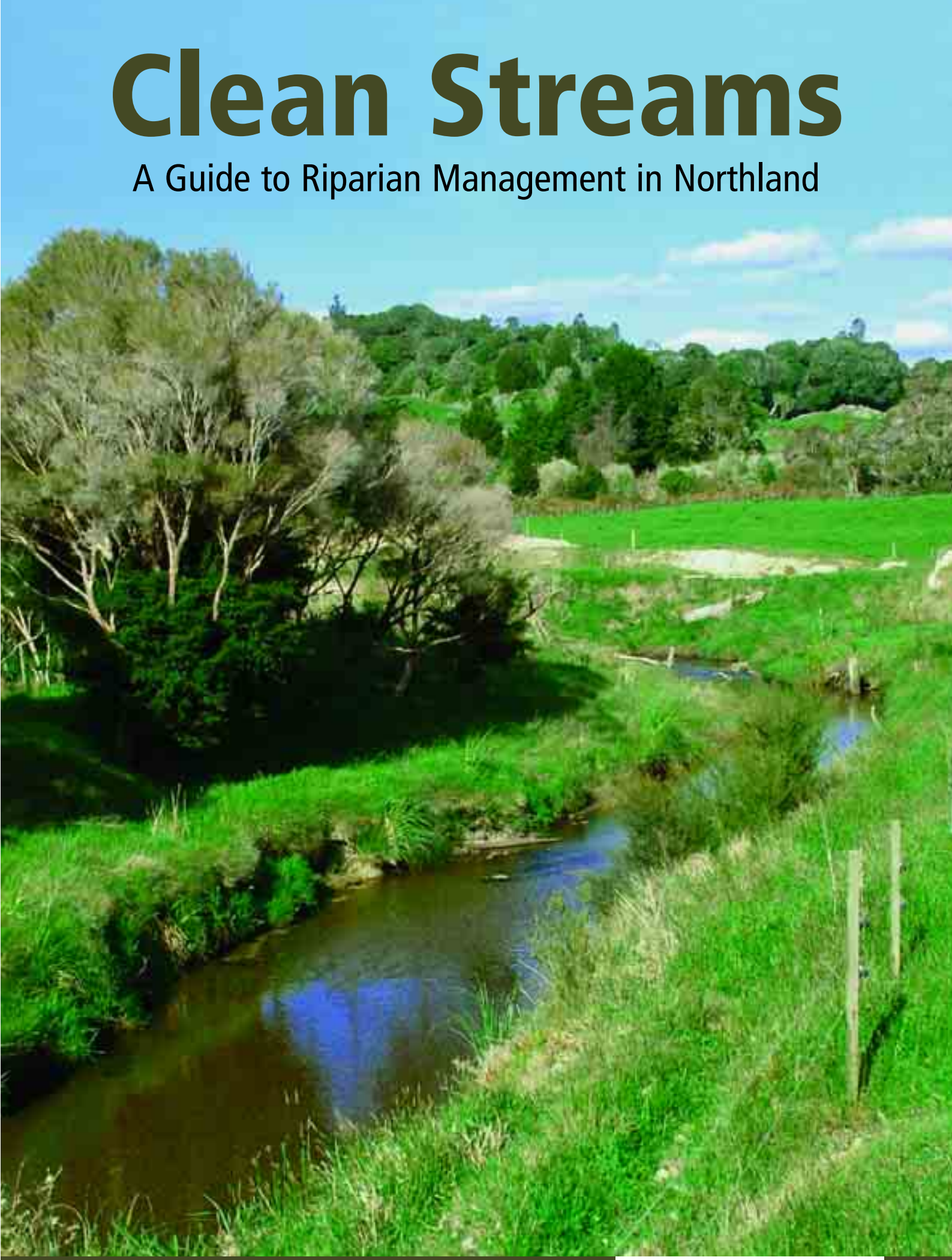
Clean Streams

A Guide to Riparian Management in Northland



CARING FOR NORTHLAND AND ITS ENVIRONMENT

NORTHLAND REGIONAL COUNCIL

Foreword

Water is a valuable resource that unfortunately is all too often taken for granted.

As a region, we underestimate our reliance on clean water and sometimes forget that this resource is not unlimited. Many of the region's key industries, including farming and horticulture, rely heavily on water.

Good quality water is vital to our survival and demand for it is increasing as Northland's population grows. It is not overstating the situation to say that water quality is now one of the key environmental issues facing our region. Northland's famed tourist attractions – its beaches, rivers and lakes – are all directly affected by the water that drains from the land, into rivers and to the coast.

As an environmental management authority, the Northland Regional Council has a duty to ensure that water quality parameters are maintained and, where possible, enhanced for future generations.

Local and Central Government, farming groups, landowners and others are taking many positive steps to clean up our streams – precious assets which for too long have not received the attention they deserve.

The Dairying and Clean Streams Accord is a giant step forward for the dairy industry to help in achieving the aim of clean, healthy water in dairying areas. The Regional Action Plan sets minimum targets to help Northland join the rest of New Zealand in a national effort to improve water quality.

The Northland Regional Council adopts an educational approach, by pointing out the advantages for everybody of changing practices that have created pollution problems in the region.

This Clean Streams booklet is filled with advice and help from many experts in land and water catchment management. There are many good and practical ideas that can be easily implemented.

It's time to work together on securing good quality water for our future.

Mark Farnsworth
Chairman, Northland Regional Council

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Contents

This booklet is designed to help you maximise both economic and environmental performance

This booklet provides information about **how to manage your riparian margins** to improve water quality, freshwater life bank stability and biodiversity values, as well as enhance your land. There is no single answer for clean streams, and the management of your riparian margins may change from paddock to paddock. Management can range from total exclusion of stock and revegetation to periodic grazing. There are many different approaches you can take, depending on your budget, the type of waterways on your land and your individual management and environmental goals.

What do we mean by waterways and riparian margins?

The term **riparian** includes the land beside waterways (rivers, streams, creeks, drains, ponds, wetlands, springs, estuaries and the coast) that go through or border your land (see figure 1). It is also important to think about gullies, which often do not hold water but can be responsible for channelling runoff into main waterways during wet periods. To achieve clean streams it is important to combine riparian management with good land management practices.

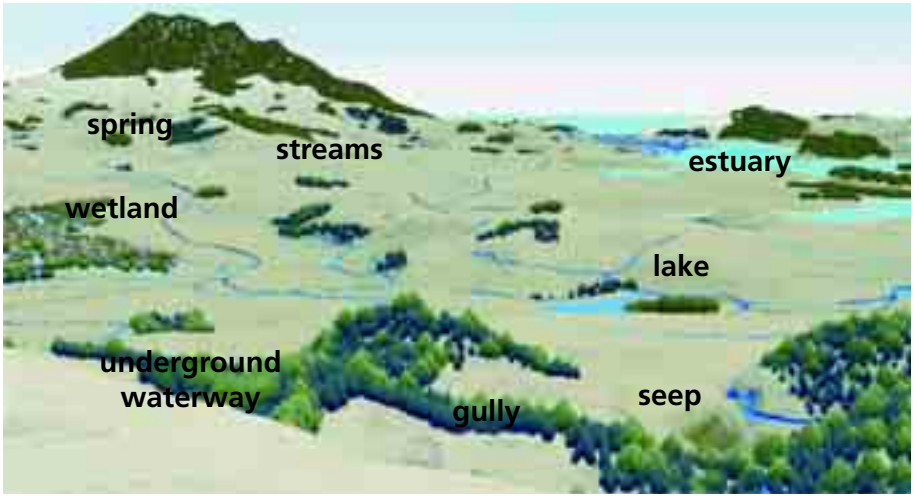


Figure 1: Examples of waterways in a farming catchment.

Managed riparian margins

Keeping ahead of the play

If you are working with the land and your local environment is important to you, managing your waterways can have many benefits. Well-managed riparian margins will help you meet market demands, enhance your farm and stock management, and protect water quality and freshwater life into the future.

Water quality in rivers and lakes is a major issue in Northland. Water quality varies greatly from pristine in upper native forest catchments through to highly impacted in lowland catchments used for intensive farming. From water quality monitoring we know that most streams are unsafe for swimming at certain times, for example after heavy rain. In general, the more forest in the catchment, the higher the quality of the waterways.

Fenced and planted gully.

Fenced stream boundary.

Pugged area next to stream.

What's in it for me?

Landowners say that managing riparian margins has benefited their property by:

- Increasing land values including amenity and recreation values.
- Increased farm production from more accurate fertiliser application and better pasture management.
- Providing shade and shelter.
- Reducing stock losses, saving money on replacements or vet bills.
- Saving time with stock management.
- Providing habitat for native species and pollinating and other beneficial insects.
- Reducing bank erosion, protecting valuable productive soil.
- Improving stock health through better quality stock water giving better production.

The news is not all bad. There are many good examples in Northland where profitable farming businesses have adopted good environmental management and reduced their effects on waterways.

Meeting the market

New Zealand's internationally recognised clean, green image plays an important role in marketing our agricultural and horticultural products to overseas customers. Many industries now have environmental guidelines and quality assurance programmes in place that include aspects of waterway management.

Milk tanker on a farm.

Stream and gully fenced with forestry trees planted on the gully sides.

Management is not always total exclusion

Where flooding is common, just putting up a temporary electric fence next to the waterway when the cows are in the paddock will make a difference. In other situations, a two-wire electric fence set back from a river, lake or wetland can allow grass to provide an excellent filter for runoff. If nitrogen in ground water is an issue then using wetlands and swamps as filters is an important action that can be taken to look after water quality. It does not need to happen all in one year – small changes over several years can make a big difference to water quality.

Environmental Fund planting project.

Help available

Northland Regional Council

The Northland Regional Council offers assistance to landowners wanting to protect and enhance their riparian margins. Land Management staff members are able to give advice, work with communities interested in integrated catchment management and help run local workshops. The Regional Council also has limited funding available through the Environmental Fund. This is a contestable fund to provide assistance to landowners undertaking environmental projects. Rates of assistance are variable. For more information contact the Land Management staff at the Regional Council.

Stock in stream.

Dexcel

If you need further advice or support regarding waterway management or would like to discuss how it impacts on the rest of your farm system, then please feel free to talk to your local Dexcel Consulting Officer or contact us at Dexcel on 07 8583776.

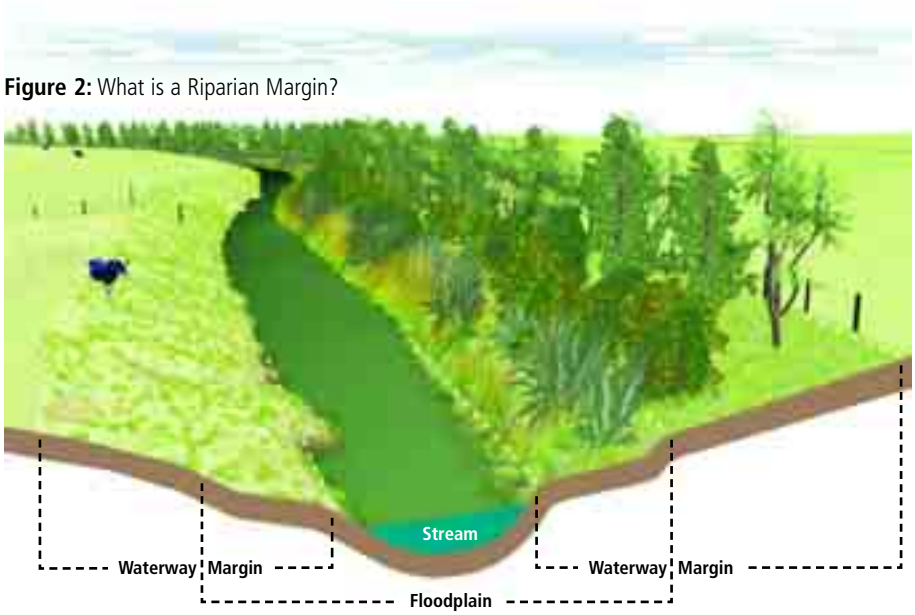
If you are keen to get quick answers to your questions then have a look at Dexcel's *envirodirect.co.nz.* This is a free on-line tool to help you answer your questions directly or put you in touch with service providers operating in your region that can help. For example if you would like to find out about who can design you a stock crossing then check out envirodirect.co.nz for a local provider.

Riparian management basics

Managing riparian margins can help

The area beside waterways that forms the interface between water and land is called the riparian margin (figure 2). This area is a crucial buffer between land use activities and the water. A well-managed riparian margin needs to be free from stock damage, so they can perform a number of important roles.

Figure 2: What is a Riparian Margin?



Riparian margins can be managed for several different objectives

Well-managed riparian margins protect **water quality** by:

- Filtering surface runoff.
- Taking up nutrients (through plant roots).
- Removing nitrogen (bacteria in wet riparian soils can remove substantial quantities of nitrogen from water, releasing it to the atmosphere as nitrogen gas).
- Preventing stock access when they are fenced (reducing bank trampling and direct inputs to waterways of sediment, nutrients, and harmful faecal bacteria.
- Helping to keep banks stable.

Well-managed riparian margins can improve **biodiversity** and provide food and habitat for **freshwater life** by:

- Protecting fish spawning habitat – for example inanga spawn in areas of tall native grasses growing in or close to the water in the lower floodplains of rivers.
- Providing leaf litter, which is important food for aquatic animals.
- Shading the water – important for reducing water temperature for sensitive freshwater life. Shade also reduces the growth of nuisance plants in waterways and reduces temperatures
- Providing for more diverse plant and animal communities.
- Providing important native wildlife corridors and habitat.

Kukupa.

Riparian area managed for stability, shade and shelter.

How land use practices affect water

One of the first steps towards cleaner water on your land is to understand more about how land use can affect water. Understanding the principles means you can adapt management to suit your situation.

What you do on your land will affect the water downstream and ultimately our beaches and coastal areas. The water passing through your land will eventually end up at the coast carrying everything extra with it. Northland generally has slow flowing rivers ending in shallow harbours, which are easily affected by pollutants.

What's in it for me?

Managing riparian margins can also provide benefits by:

- Stabilising banks.
- Reducing stock losses (fencing them out of dangerous wet areas).
- Enhancing the farm landscape.
- Habitat for pollinating insects.
- Reducing the need to clear drains and streams of aquatic weeds and silt.
- Excluding stock from natural water (which can sometimes carry disease organisms).
- Making stock and grazing management easier.

There are four main pollutants coming from rural land – nitrogen, phosphorus, sediment and faecal matter (containing bacteria and viruses).

Table 1 shows why these things are a problem and how they get into water from your land.

Table 1: Sources of waterway pollutants

Pollutant	Effects	Source of pollutant	How it gets to water
Nitrogen	• Feeds nuisance plant and algae growth in waterways • Algae and nuisance plants affect stream life, block water intakes and make water unpleasant for swimming and drinking • Ammonia can be toxic to fish	• Urine from stock • Nitrogen in fertiliser • Ammonia in farm dairy effluent.	• Moves down through soil (leaching) into ground water and subsurface drains, which feed into streams • Surface runoff • Stock in and crossing in streams • Discharges from oxidation ponds.
Phosphorus	• Feeds nuisance plant and algae growth in waterways • Algae and nuisance plants affect stream life, block water intakes and make water unpleasant for swimming and drinking	• Dung from stock • Phosphate in fertiliser • Farm dairy effluent • Soil sediment	• Soil and bank erosion (phosphorus binds to soil particles) • Surface runoff • Discharges from oxidation ponds • Stock in streams • Subsurface drains
Sediment	• Makes water murky and affects stream life • Poor water clarity makes water unsafe for swimming • Builds up in estuaries and harbours leading to mangrove spread and smothering of shellfish beds • Makes water unpleasant and unsafe for drinking	• Slips • Recent drain cleanings • Stream bank erosion and trampling • Roads tracks and races • Surface of paddocks especially pugged and cultivated areas	• Surface runoff • Stream bank collapse • Slips
Faecal matter (bacteria, viruses)	• Human health risk from swimming and drinking • Can affect stock health if present in stock water	• Dung from stock • Farm dairy effluent • Septic tank overflow • Feral animals	• Stock in streams • Subsurface drains • Discharges from oxidation ponds • Surface runoff • Poorly managed effluent irrigation • Poorly managed septic systems

The Regional Council has rules relating to works within the Riparian Management Zone and these should be considered when undertaking any land disturbance or discharging concentrated animal effluent adjacent to a water body. Please contact Regional Council staff if you are considering work in this area (see inside back cover for more details).

Landowners and Council staff measuring water quality.

Prevention is better than cure!

What happens on land affects water.

Well-managed riparian margins provide the last opportunity to keep pollutants out of waterways. However, adopting good management practices will help reduce pollution levels at their source, as well as enhancing your business.

Good land management practices include:

- Matching land uses to contour and soil types.
- Managing grazing to avoid concentrating animals near waterways during wet weather to reduce pugging, pasture damage and soil erosion.
- Avoiding overgrazing steep slopes and areas beside waterways.
- Providing shade, shelter and water troughs for stock, away from waterways.
- Choosing the appropriate fertiliser and applying in accordance with the "Fertiliser Code of Practice" to keep fertilisers and chemicals out of riparian margins.
- Managing your dairy effluent effectively including feed pads and stand-off areas.
- Minimising runoff from farm tracks and races by providing cut-offs into grassed areas.
- The retirement of steeper headwaters into a timber crop or native regeneration.
- Preventing silage leachate from reaching water.
- Retaining wet swampy areas as sponges and filters.
- Providing low impact crossing areas for stock and vehicles.

For more information about management practices to improve environmental outcomes on your land, ask your advisor or contact Land Management Staff at the Northland Regional Council on 09 438 4639 or check out the website at www.nrc.govt.nz.

Finding the right approach

Using research undertaken in New Zealand and overseas over the last decade, five key approaches to managing riparian margins on farms have been identified.

These approaches are based on the goals of:

- Improving water quality.
- Enhancing freshwater life.
- Improving native habitat.
- Maximising productivity.
- Increasing aesthetic, landscape and cultural values.
- Minimising flooding problems.

The way you decide to manage your riparian margins will ultimately depend on your individual goals.

Fenced drain.

Five key approaches

Here are five key approaches to managing riparian margins:

1. **Animals out:** Preventing stock access to rivers, streams, drains, wetlands, lakes estuaries and the coast.
2. **Fenced grass waterway margin:** Maintaining an ungrazed grass strip beside waterways of at least one metre wide on flat land and wider on sloping land.
3. **Vegetated margins:** Replanting native vegetation beside waterways in a fenced, ungrazed strip.
4. **Managed wetlands:** Managing wetlands, seeps, swamps and gullies.
5. **Managed floodways:** Managing riparian margins to maintain the ability of rivers and streams to carry floodwaters.

On some properties, a mix of all five approaches may be needed, while on others it may be appropriate to focus on one.
Figure 3 (page 10) shows the different approaches and how they can each achieve different benefits for your farm business, water quality, freshwater life and waterway banks. The success of each approach will depend on how you manage the riparian margin itself and the surrounding and upstream land.

Fenced seep.

Figure 3: The benefits of different riparian management.

Animals out
- Reduces sediment
- Improves bank stability
- Encourages regeneration

Replanted native
- Shade and shelter for stock in adjacent paddocks

Managed wetlands
- Habitat for native birds, insects and plants

Developing a plan for action

When considering how to manage riparian margins better, it is helpful to think about what you want to achieve and to set realistic goals. It might work best to do a little bit each year at critical places. That way you can learn what works best for you, and it is easier to keep up with maintenance.

Here are some things to think about when planning[1]:

- What do I value about the stream, drain, river, lake, wetland or estuary on my land?
- What, if anything, is wrong with the condition of the water and riparian margin? And where do I go to get more information?
- How is my land contributing to the condition of the water?
- What things are most important to me to protect or improve about the water and riparian margin? For example freshwater life, water quality and stable banks.
- What management approaches listed in this booklet will help improve the riparian margin to meet my priority goals?
- What resources (incentives and advice from agencies, funding organisations, community groups and industry) are available to help with riparian management?
- What challenges am I likely to face in managing riparian margins on my land and how can I best plan to deal with those challenges? For example flooding, plant and animal pests.
- What are the costs and benefits to me of managing a riparian margin? Where are the areas on the land that will give the biggest benefit for the least cost?
- How does riparian management fit in with other priorities for the property?
- How will my management affect land and water quality downstream? For example effects on popular swimming areas or shellfish gathering areas.
- How will upstream activities affect me?
- What are my neighbours doing about riparian management? Is there scope to work together? For example, setting up or joining a landcare group.
- How much time and money have I got to maintain managed riparian margins?

[1] Based on Ministry for the Environment, 2000.

Animals out - fencing stock from water

What will it achieve?

Fencing riparian margins to keep stock out of water can achieve:

- Better water quality by reducing the amount of faecal matter and sediment directly deposited into the waterway. You will also slightly reduce some of the nitrogen and phosphorous going into your waterways but additional management options will be needed if nutrient reduction is your main goal.
- Better aquatic habitat by preventing damage to the stream bed and reducing the amount of sediment reaching the waterway.
- More stable banks by preventing treading and erosion.

Fenced off ditch.

What's in it for me?

Fencing stock out of waterways can:

- Reduce stock losses.
- Reduce bank erosion and drain maintenance costs.
- Conserve soil.
- Improve stock health by preventing access to unsafe water supplies.

Excluding stock from riparian margins and water is regarded as the best "first step" to improve water quality in rural Northland.

Deciding where to put your fence

You may need to set your fence back if banks are unstable or prone to flooding. There are positives and negatives for either fencing to follow the bends of riparian margins or putting in a straight-line fence. A straighter fence needs less material and construction but might mean lost grazing and areas of potential weed problems. Consider it if access to the area is needed for weed control and gravel removal. Fenced banks are less likely to collapse but may still get damaged by floods.

Consider the overall layout of your property. Fencing waterways can be of more value if they are used to both improve subdivision for grazing management and as a stock control measure.

Fenced estuary margin on a farm.

Fenced seep.

What sort of fence is best?

A riparian fence will depend on individual farm circumstances, but should be stock-proof. If you are running dairy cattle on flood-prone areas, a one or two-wire electric fence with permanent posts is usually the best option. For sheep, four electric wires are needed. It is essential to have a gate or another way of extracting stock if they get into the fenced area. A retractable gate made of two to four electrified tapes is a low-cost option.

Access

Occasionally you may need to use machinery to clear weeds, silt, gravel or debris out of a channel. An electric fence can be dropped using pin lock insulators or removed to allow machinery access. With a more substantial fence you might need to leave enough space between the bank edge and the fence for machinery to work. It may be sufficient to only do this on one side of the channel rather than both. Where the waterway forms a boundary between two properties, access from both sides will be needed so cleaning can alternate between properties.

Remember that you may need a resource consent from the Northland Regional Council to do work in the riparian margin – this is to ensure that damage to the stream bed and freshwater life is minimal. Give Land Management or Consents staff a call on 09 438 4639 if you need more information.

Making temporary fencing work for you

To help avoid impacts on water, you can use temporary electric fences to protect sensitive areas at critical times. For example, run a tape around wet areas and seeps during winter when grazing particular paddocks. This will avoid pugging, which damages the soil and creates dirty runoff. Pugging also damages grass growth, affecting farm productivity. Fencing the area off while stock are in the paddock will provide a wider vegetative filter for runoff, reduce the chance of stock getting bogged and keep them away from the liver fluke host breeding areas.

A temporary electric fence can also be used on slopes to keep cattle out of springs and wet areas that drain towards a stream. This allows the grass in the fenced area to filter dirty runoff coming from pugged pasture upslope, before it reaches the stream. When the soil is drier, the fence can be removed and the grass grazed.

Managing riparian margins without fences

In some situations, it is not practical to fence all the riparian margins on your land. While not optimal, there are some options for management without fencing:

- Provide troughs with clean water away from natural water.
- Provide shade and shelter away from natural water.
- Keep stock numbers lower in paddocks with water to minimise damage.
- Avoid grazing paddocks with unfenced riparian margins during wet periods.
- Graze sheep, young stock or lighter stock in paddocks with water access.
- Monitor grazing and move stock if they start to damage banks.
- Put in crossings in the areas where stock naturally cross water.

These options will help minimise the effects of stock on water in the areas that are difficult to manage or until you have more resources for fencing.

Periodically grazed river margin with stock water to prevent animals getting into the river.

Stock watering options

Fencing off riparian margins may remove a valuable source of stock water. Putting in a reticulated stock water system (using water extracted from streams, dams or bores) can be expensive, but will improve stock health and productivity. Studies show that a large variety of bacteria and viruses can be transmitted to stock from drinking water contaminated by animals and their waste[2]. Putting in trough water also allows you to deliver animal remedies and supplements through your water system.

The Resource Management Act allows you to take as much water as you need from rivers, streams, lakes or ground water bores for reasonable stock watering, as long as it does not have an adverse effect on the environment.

For more information, contact Land Management staff at the Northland Regional Council on 09 438 4639.

2 Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand.

Coping with floods

Flooding is a major factor (and challenge) in the management of a riparian margin. When making decisions in these areas you will need to take into account height, frequency and duration of floods, flood control schemes and stopbanks.

Fencing

Flooding can be one of the biggest challenges for maintaining fences beside waterways. If a fence is frequently flooded, it needs to be flood-proofed to prevent it being broken by the force of the water or debris building up on the wires. Simple one to two-wire electric fences are less likely to collect flood debris and therefore be swept away in floods. They are also easier to stand back up after a flood event but will need a cut-off switch to prevent the entire circuit from shorting out when the water rises.

For dry-stock farmers who opt for seven to nine wires with posts and battens, flooding can cause expensive damage. Suggestions to reduce the damage and cost of repairs include:

- Try five-wire electric fencing along the most flood-prone sections.
- Construct separate "blow-out" sections across flood channels.
- Put fence wires on the downstream side of posts so the wire is able to lie flat providing less resistance to the water flow.
- Use un-barbed staples so wires can pop more easily.
- Avoid using battens in flood-prone sections to reduce snagging.
- Using hanging fences where the panels hinge upward as the water level rises.

Another option is to attach the fence wires to battens that are fastened to the top of the post with light wire loops. Under the pressure of floodwaters the loops break allowing the fence to collapse.

Where there is potential for flooding, it is best to put your fence further away from the waterway. This is especially important if stopbanks are present or on the outside bends of rivers where there is the greatest potential for erosion. When locating the fence, think about where the height of the bottom wire is in relation to expected flood levels. After large floods, it can be helpful to record the flood height to help with the placement of fences in the future.

Planting

Be careful to choose appropriate plants when planning any tree planting in an area that may be prone to flooding. Plants may impede flood flows by reducing the channel size, trap debris when bigger or be swept away with time and money wasted. Trees, shrubs, or long rank vegetation can trap sediment and debris from floodwaters.

Trees can impede flood flows to cause problems upstream. If planting close to the water choose smaller grasses and flaxes that will bend with the flows. Further back in flood-prone areas, trees will need maintaining and can be pruned to provide a single stem that will more easily allow water past. Maintenance is the key; if you are planting trees in flood prone areas you need to have the time to maintain them. Prunings and wind throw must be removed from areas that flood. If time is scarce, stick with low growing species such as flax or a grass sward.

Where planting is unadvisable the areas may need to be grazed periodically to prevent grass growing long and rank and trapping sediment (refer to Fenced Grass Riparian Margins).

Willows planted too close to a river - note flood debris.

Fenced grass riparian margins

Grassed riparian margin.

For the purposes of this booklet, grass riparian margins are fenced, ungrazed or infrequently grazed strips on the edge of rivers, streams, drains, lakes, estuaries and the coast in areas where farm dairy effluent is not irrigated to land. (Refer to page 12 for more details)

What can grass riparian margins achieve?

The main role of a grassed riparian margin is to improve water quality through sediment and nutrient removal, which also provides benefits for freshwater life. Grasses, native sedges and rushes are the most effective filter for removing sediment, bacteria and nutrients from surface runoff on relatively level ground.

A grassed riparian margin will filter runoff best when water flows through it in a sheet rather than in channels. The slower the water flow the better the filter will work.

A dense grass sward slows runoff so that sediment, phosphorus (which binds to soil particles) and faecal matter can settle out before the runoff reaches waterways. Studies show that up to 90 percent of sediment can be caught in an effectively constructed filter strip. Faecal bacteria that get trapped in a grass filter strip will die off in sunlight.

Although trees and shrubs can be planted, they should not shade the grass enough to reduce its density.

In addition to the benefits of keeping stock out of waterways, a well-managed grass riparian margin provides:

- Improved water quality by filtering sediment, phosphorus and faecal matter out of surface runoff.
- Improvement for freshwater life by reducing sediments entering waterways.
- Improvement in bank stability by having a protective groundcover of grasses.

Where is a fenced grass margin most important?

In the Northland region, grass riparian margins will be most effective at improving water quality[3]:

- Along drains and small headwater streams that feed into the floodplain rivers.
- In areas with significant surface runoff.
- Beside waterways that are strip-grazed in autumn and winter.
- In the hilly upper reaches of streams.
- Beside vegetated drains in areas with poor soil drainage or pugging and moderate slopes.
- Where paddocks are cultivated.

[3] Quinn, 1999.

The effectiveness of a grass waterway margin will depend on[4]:

- Keeping the grass healthy and vigorous to encourage dense, low growth and to allow it to filter effectively.
- The type of vegetation next to the watercourse – a dense grass sward makes the best filter.
- The porosity of the soil – water seeps rapidly through very porous soils, taking soluble nutrients into waterways.
- The width of the grass margin – within reason, the wider the better!
- The slope of the land beside the waterway – where adjacent land is steep, the grass margin will need to be wider, or may not be the most effective management option. You might need to consider alternative land uses to reduce erosion and adopt careful pasture, stock and farm track management.

In areas where tile and mole drains are widely used, a grass riparian margin will not be as effective. This is because excess nutrients are bypassing the margin by leaching through the soil, into the drains and flowing directly into waterways.

Trees well out of flood plain.

Management to maximise nutrient and sediment removal from a grass riparian margin

How wide?

In general, the steeper and longer the slope is that feeds into the waterway, the wider the grass riparian margin needs to be. The most recent New Zealand research[5] recommends that for gently rolling land, widths of one to three metres per 100 metres of slope feeding into the waterway are ideal. In areas with steeper slopes and poorly draining soils, a grass margin of 10 to 15 metres per 100 metres of the adjacent slope is recommended.

For example, in a relatively flat area, where there is a 100-metre slope feeding into the waterway, a margin width of between one to three metres would be sufficient. However, in a steeper area, with the same length slope, a margin width of 10 to 15 metres would be desirable for maximum filtration. This is shown in Figure 4 (right).

Figure 4: Working out how wide your grass riparian margin needs to be for filtering.

Often runoff flows in defined channels across paddocks to reach waterways. Put in wider grass margins in areas where you know runoff is channelled into waterways during times of high rainfall and runoff, shown in Figure 5 (overleaf). On hill country farms with long slopes, wide margins are most effective across drainage channels. Plants such as flax can deflect water flows if planted across the channel.

Where a fence has been placed close to a waterway, the grass strip does not provide much filtering benefit. However, during wet periods a temporary fence will provide a wider strip for filtering. Any electric fence will need to be well maintained to ensure the grass and weeds do not short out the fuse.

[4] Northland Regional Council.

[5] Collier et al., 1995.

Figure 5: Using grass margins to filter channelled runoff.

Grazing to maintain effectiveness and manage weeds

Weed growth and trapping of flood-borne sediment can be a problem in grass riparian margins and it is important to manage this early. Page 30 provides information on weed control but occasional grazing can also be a practical way to manage weeds and keep the grass healthy. Long, dry grass can also be a fire hazard.

Light grazing can be an acceptable management option on some sites where filtering of sediment and runoff is desired, providing:

- There is a temporary fence adjacent to the waterway to keep the cattle out while grazing.
- Grazing is in short bursts 1-2 times per year to minimise damage and runoff potential and maintain a thick grass sward.
- Tree and shrub planting or natural regeneration is not damaged.
- Stock have access to trough water.
- Avoid grazing margins during winter or wet periods to prevent pugging and runoff.
- Grass is given plenty of time to regrow before wet periods.
- Only sheep and lighter young stock are grazed, as they are less damaging to banks and soil than heavy cattle.
- The bank is reasonably stable.
- You are not within a whitebait/inanga spawning area between March and May. Any grazing beside waterways should stop in February so grass can grow enough to filter any runoff, prevent erosion and provide inanga habitat.

For more information about weed control, refer to the Planting Guide of this booklet or contact your local Biosecurity officer at the Northland Regional Council on 09 438 4639.

What's in it for me?

Fenced grass riparian margins can:

- Reduce stock losses.
- Reduce bank erosion and maintenance costs of drains.
- Conserve soil.
- Improve stock health by preventing access to unsafe water supplies.
- Improve water quality in farm waterways, providing cleaner water for house and farm uses and downstream water users.

Stream crossing options

What's the problem?

If you have places on the farm where stock and vehicles regularly cross streams or rivers, it is time to start thinking about alternatives. Regular river crossings by stock have been highlighted as one of the main sources of water pollution in rural areas.

Studies indicate that stock directly depositing their waste into waterways has an equal or greater, impact on water quality compared to runoff [6]. One study measured that a 246-cow herd deposited 37 kilograms of faecal matter during two crossings of a stream[7]. The study concluded that cows are 50 times more likely to deposit their waste in a stream than on a race.

Bacteria and sediment levels in waterways downstream of where stock cross through the waterway generally exceeds water quality guidelines[8]. This poses a health risk to people swimming in streams and to stock where stream water is being used for stock drinking water supply. It also affects in-stream plants and animals.

Stream crossing.

Stock crossings are good for business

Good stream crossings also make a big difference to the stream environment by:

- Preventing stock damage to the stream bed.
- Protecting stream habitat for fish and insects.
- Improving water quality by reducing the amount of sediment and bacteria getting into the stream from stock movement.

Looking at the options

To keep stock and animal waste out of waterways, culverts and bridges are the best options for crossings.

Culverts are a good option for streams that do not carry too much sediment and do not flood too high. However, they need to be chosen carefully and installed well to make sure they do not cause erosion and restrict the movement of fish.

Bridges generally have less impact on stream banks, beds and water flow than culverts. They can be expensive but will often be a sound investment because they do not require as much maintenance and can provide farm benefits such as all weather access.

6 Davies-Colley, Nagels, Donnison, Muirhead paper (2001)

7 Davies-Colley, RJ, Nagels, JW, Smith, R, Young, R, Phillips, C. 2002: Water quality impact of cows crossing an agricultural stream, the Sherry River, New Zealand. Poster presented at the 6th International Conference on Diffuse Pollution, Amsterdam, September/October 2002.

8 Environment Canterbury, unpublished report 2001: Notes on water quality analysis of Cust Main Drain stock crossing of Bradshaw dairy herd, October 2001. 3pp. Unpublished report by Adrian Meredith.

Poorly-designed culvert.

Well-designed culvert.

Getting culverts right

There are a several things to consider when you are putting in a stream culvert. Getting your sizing and installation right will generally save you money in the long term by avoiding failure and the need for replacement, not to mention erosion and damage to the stream.

When you are building, replacing or upgrading a culvert, consider the following good management practices[9]:

1. When it comes to choosing a culvert, bigger is generally better if you are concerned about blockages, erosion from over-topping or if high downstream water levels restrict water flow.
2. Make sure the width of the culvert is the same as or wider than the average width of the stream. This will help avoid bypassing or blow-outs in floods.
3. Position the culvert so that the gradient and alignment are the same as the stream.
4. Set the floor of the culvert below the streambed level to avoid vertical drops at the downstream end. Do not create a waterfall because this increases the chance of erosion and also means fish will not be able to swim upstream past it.
5. Use armouring materials such as rocks around the culvert and especially below the outlet to reduce erosion.
6. Check the culvert manufacturers' recommendations about the depth of fill to put over your pipe to make sure it can withstand loads.
7. Consider building a spillway to cope with extreme floods. A spillway is an area to the side of a culvert where water can flow if the culvert overtops. It should be wide and level across the path of the flow and grassed to prevent scouring. Talk to the Regional Council or an agricultural engineer for advice about good design.
8. Allow natural streambed material to settle on the culvert floor along its length so that it is easier for fish to swim through.

It is important to make sure your stream culverts are not restricting fish movement upstream. Poorly installed culverts can affect our trout, whitebait and eel fishery and our rare native fish. The main thing is to make sure the culvert is not altering the natural gradient and bed of the stream.

[9] Tasman District Council et al. Stream Crossings pamphlet; Cawthron Institute pamphlet; FEA booklet (2003).

If you have an existing culvert that drops down to the streambed preventing fish passage, consider building a simple rock ramp for fish. Use large rocks to form a zigzag staircase from the stream bed up to the downstream outlet of the culvert. This will slow down water flow and form small pockets for fish to rest. It will also reduce the energy of the water coming out of the culvert, but should not cause water to back up during floods.

If your culvert is large, it is a good idea to get advice from an agricultural engineer – check out www.envirodirect.co.nz for a local consultant who can help. It is advisable to talk to the Northland Regional Council before installing a new bridge or culvert, or greatly increasing the size of an existing culvert. Finally, the key to keeping your culverts in good working order is regular maintenance. Check your culverts for debris build-up at regular intervals, especially after heavy rain and flooding.

Resource Consent requirements

Generally culverts are permitted activities and do not require consent. However where culverts are likely to restrict the free flow of water, cause damming of water, create adverse flooding or erosion problems or large amounts of fill are proposed, a consent from the Regional Council may be required. In such situations contact the Consents staff at the Regional Council.

Building sound bridges

If you are thinking about putting in a bridge, work through the following steps to help you figure out what you need:

Step 1:

Think about what you will be using the bridge for. This will help determine your design specifications. For example, large dairy herds might benefit from a wider deck surface, while heavy vehicles will require stronger load-bearing design.

Step 2:

Contact both your local District Council and the Regional Council to get advice on where to locate your bridge and about design and consent requirements. Your District Council may require:

- A land use consent to prepare the site for the bridge.
- A building consent for the construction of the bridge.
- The Northland Regional Council may require a consent if earthworks are required.

Well-designed farm bridge.

Step 3:

Contact your local bridge builder and engineer to discuss bridge designs to suit your situation – check out www.envirodirect.co.nz for a local consultant who can help. You will need to take into account:

- Stream bank material.
- Stream bed profile.
- Flood flows.
- Bridge use.
- Preferred construction materials.

Step 4:

Consider the following good management practices[10]:

- Use standardised plans and materials to reduce the time and cost of design. Any bridge design will need to comply with NZ Industry Standards.
- Construct your bridge high enough so as not to impede high stream flows, which would make floods worse and threaten your investment.
- If possible, minimise your bridge span to keep costs down.
- Raise the bridge above its approaches to reduce runoff on to the bridge, where it will pool and may overflow into the stream.
- Construct your bridge with raised lips on the edges of the deck to prevent runoff into the waterway.
- Channel runoff from the bridge out into grassy filter areas where possible, rather than straight down the bank to the stream.

Your local bridge builder will be able to estimate the cost of a suitable bridge. Using standard designs with precast abutments and deck slabs can reduce the time and cost of construction.

Once your bridge is up, do not forget to put up a sign stating the weight and speed restrictions.

Consent Requirements

Single span bridges are generally permitted but consent is required for any bridge that has footings in the water. Contact the Consents staff at the Regional Council for more details.

[10] Environment Canterbury pamphlet (2003); Tasman District Council et al.

Revegetating riparian margins

Revegetating riparian margins involves re-establishing native grasses, shrubs and trees for long-term protection. Exotic trees can also be used to stabilise eroding banks and provide initial shade and shelter. This may involve protecting native vegetation already present to allow natural regeneration, replanting with seedling trees, or a combination of the two.

Replanted farm riparian margin.

What are the benefits?

The major benefit of having more native trees in your riparian margins is the protection of freshwater life and improved local biodiversity.

Ecosystem and biodiversity benefits:

- Shade, habitat and cool water for freshwater life.
- Food for fish and insect life in the water.
- Habitat for native plants and animals on the banks.
- A corridor for native insects, animals plants and birds.

Water quality benefits:

- Filters some faecal matter, sediment and nutrients out of surface runoff.
- Takes up some nitrogen and phosphorous in plant roots.
- Improves bank stability if grasses are not shaded out.

What's in it for me?

Replanting riparian margins can provide:

- Shade and shelter for stock on the other side of the fence.
- The ability to manage edge trees for timber.
- Recreational opportunities such as duck-shooting and improved fishing.
- An attractive feature to look at (providing weeds are well-managed!)
- A uniquely New Zealand landscape.
- An increase in land values.

On-farm riparian discussion.

Plan well to meet your goals

One of the secrets of a successful riparian planting is to be clear about your goals and to plan your approach to achieve them. While protecting freshwater life and local biodiversity are the key benefits of revegetation, you might also want to maintain or improve bank stability, improve water quality and enhance your farm. It is important to incorporate these extra goals into a planting plan, as they will require different management.

How wide should I go?

For a project that provides maximum benefits for freshwater life while allowing some filtering and bank stability, it is best to retire between 5 to 10 metres of riparian margin. To create a self-sustaining piece of bush on the edge of a waterway where weed management is minimal, you will need at least 10 metres[11]. Local biodiversity will benefit the most where riparian margins are able to provide wildlife corridors and link existing pieces of bush.

Caution is needed when planting for stability and shade. Trees grow!

Balancing shade and bank stability goals for streams and rivers

Providing shade is one of the most important ways to enhance stream life. Shade keeps water temperatures down for stream life and prevents nuisance water weeds and algae from growing. Leaf litter from native plants throughout the year also provides a food source for stream life. At least 200 metres of stream length must be shaded to achieve a reduction in stream temperature. It is worth considering sun angles before planning any planting, as it is easier to achieve shading on the north side and on smaller streams or rivers.

Research[12] indicates that if you want to replant your stream bank with natives but keep your banks stable, it is important to maintain a good cover of grasses on the bank edge. Planting too densely can shade out the native grasses and sedges on the very edge of your bank that often do the most to hold them.

Under natural conditions, forest streams are wider and shallower than pasture streams. Restoring native vegetation with maximum shade for stream life is likely to result in the channel widening and becoming shallower over a period of up to 20 years. In practice, this means bank erosion will probably increase for a reasonable period of time, which is not good news for many farmers.

[11] Parkyn et al., 2000.

[12] Rutherford et al., 1999.

Close-up of native sedges on a stream bank.

If bank erosion is an issue on your farm, here are some practical tips to help you achieve a balance between replanting and erosion control:

- Keep shade levels at between 50 to 70 percent to make sure the grasses and sedges on the bank are not shaded out. Scientists estimate that 50 to 70 percent shade occurs where your combined bank and vegetation height is about equal to the stream channel width[13].
- Keep shade levels low in areas where erosion is a problem.
- On small narrow streams, plant long grass or sedge species (for example, native Carex species) that provide some stream shade, native habitat and bank stability.
- In a wide riparian margin, plant trees back from the stream and let grasses occupy the immediate bank.

If restoration is your top priority, and you want minimum weed control and maintenance, and you are prepared to accept some initial erosion, then plantings that provide up to 90 percent shade for the stream will create conditions that are close to native forest. Make sure you plant far enough back from the channel to allow for the erosion that is likely before your trees are well-established.

Using trees to stabilise stream banks

Prevention is better than cure. Where possible, retain existing native vegetation and protect the banks from stock trampling and vegetation removal.

Planting fast-growing vegetation such as shrub willows can be a good short-term option on an eroding stream bank. Shrub willows grow to a maximum of four metres and have a root system that can provide a protective root mat across the bare stream bank and bed.

[13] Davies-Coley, RJ and Rutherford, JC, 2001.

Any shrub willows planted for erosion control near streams will need ongoing management such as thinning and pruning to keep the lower branches above flood levels.

Make sure to keep tree willows and species such as crack willow, weeping willow and silver poplar away from riparian edges. Before planting it is wise to consider any long-term management needs, such as pruning of trees in flood-prone areas.

Avoid planting narrow channel reaches where trees might impede floodwaters.

Any large, dense growing trees should not be considered within five metres of the stream edges. They will suppress undergrowth by creating a dense canopy causing renewed bank erosion followed by entry of silt and other pollutants into the water. Large trees are more likely to cause erosion by wind throw when at their full height. However, larger trees further back than five metres may be suitable.

New research into the use of natives for bank stabilising shows that ribbonwood is deep-rooting and has a good root spread[14]. Planting ribbonwood (Plagianthus regius) alongside exotics will help maintain a mostly native planting on your banks. The native tree ferns, while slow growing, have a very good root system for stabilising stream banks close to the water.

For more information about appropriate species, spacings and planting techniques, refer to page 29 or contact the Land Management staff at the Northland Regional Council on 09 438 4639. If you would like more information about erosion control advice, ask for a copy of Northland Regional Council's 'Trees for the Land' booklet, available from all offices.

Improve water quality with an extra filter

If you want to build a water quality filter into your revegetated margin to deal with surface runoff, you will need to include a grass or sedge strip of at least one metre wide on the paddock edge. Check page 17 for more information about how these areas need to be managed.

[14] Phillips et al, 2001.

Planting guide

If you have decided to plant your riparian margin, this section provides you with practical advice on how to go about it, including when, how and what to plant.

Prepare a planting plan

If you have a large margin that you would like to replant over time, it could be helpful to prepare a planting plan:

- Have a good look at your site to check out the slope steepness and length beside the waterway and the areas that flood easily.
- Decide how wide an area you can afford to remove from grazing and replant, given your goals for the project and the constraints of the site. Think about where you might need access gates or walkways.
- Divide your riparian margin into the three plant zones (see Figure 6) and make a list of plants you can use in each zone. Work out roughly how many plants you will need – refer to Table 2 for details.
- Think about how much area you can afford to plant in any one year and do not forget to factor in the labour. You will need to keep the area free from pests and weeds, especially in the first three years, see page 34 for more information.
- Visit your local wholesale native plant nursery to find out what species they stock, costs, and how many plants you might be able to order. If you can, use plants sourced locally as they will be best adapted to local conditions. Some nurseries will raise seedlings from your own seed if you are able to collect it. Local seed stock also helps maintain the ecological integrity of your plantings.
- If possible get another opinion on your planting plan to ensure you have the right species in the right place, a knowledgeable local person is ideal.
- Order plants well in advance - six months to a year is ideal.

Planted riparian zone.

What to plant where

A riparian margin can generally be divided into three zones (A, B or C) for planting (Figure 6). The basic plant list in Table 2 gives an idea of the different plants that will suit your riparian margin. This list includes plants that should grow in most parts of Northland on exposed grass-covered riparian margins. It also includes plants for wetlands or seeps (zone D) – see page 34 for information about managing these areas. If you would like more information about other native plants that are specially suited to your local area, talk to the Northland Regional Council or your local Department of Conservation office. They can provide you with a copy of the handy Native Planters Guide for Northland.

When selecting the right plants for your site, it is important to choose:

- Species appropriate to each planting zone (A, B, C).
- Species that can tolerate local conditions on the site such as wind, soil moisture and frost.
- Only coastal species if you are in a coastal area.
- High quality plants grown from local stock that have been well-hardened to open conditions.

Figure 6: Riparian margin planting zones.

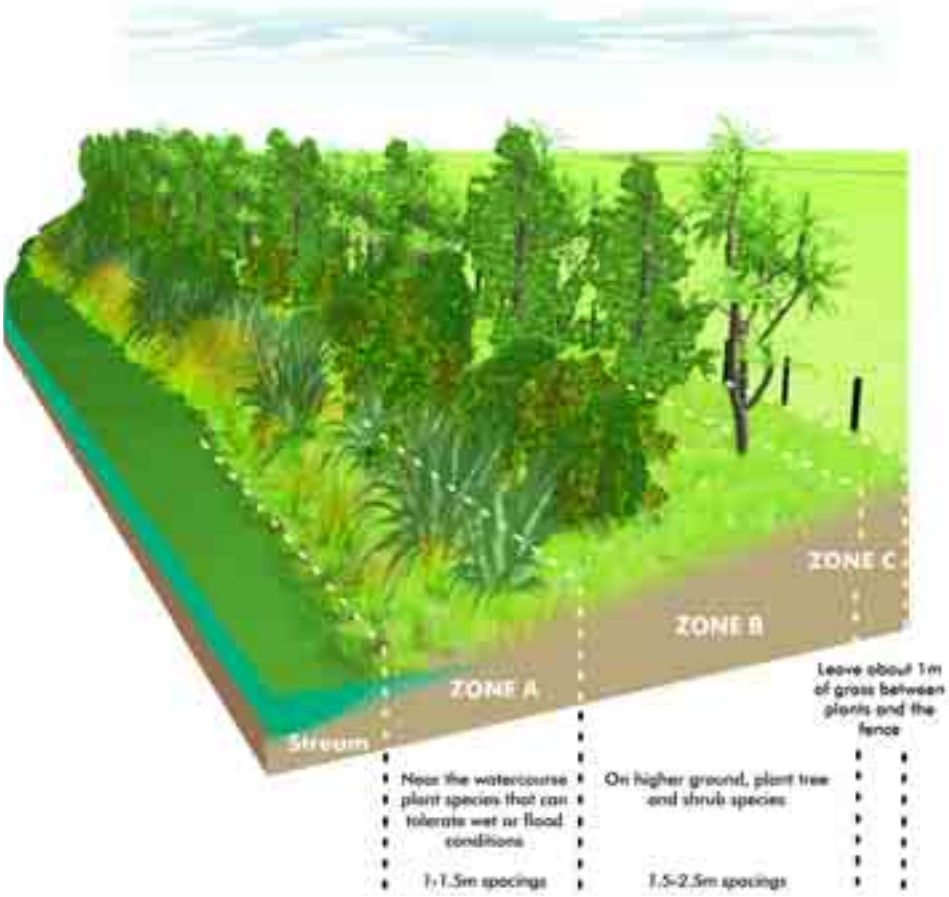


Table 2: Native Waterway Margin Plant Species for Northland Region

Scientific Name	Common Name	Plant Type	Suitable for:				Tolerant of:							Suitable for:			Planting	
			Zone A	Zone B	Zone C	Wetlands or Seeps	Heavy Frost	Light Frost	Boggy Soils	Flooding	Periodic Flooding	Dry Soil	Full Sun	Coastal Zones	Bank Stability	Attracting Birds	Growth Rate	Recommended Plant Spacings
A. Primary plantings (suitable for planting on open, exposed sites)																		
Blechnam novae zelandiae	Kiokio	Fern	✓			✓	✓	✓	✓		✓	✓	✓		✓		Med	0.4-0.6m
Carex secta	Pukio	Grass	✓			✓	✓	✓	✓	✓	✓		✓	✓	✓		Med/Fast	0.4-0.6m
Cortaderia splendens	Coastal toetoe	Grass	✓	✓	✓		✓	✓			✓	✓	✓	✓	✓	✓	Med/Fast	0.7-1.0m
Cortaderia fulvida	Toetoe	Grass	✓	✓	✓		✓	✓				✓	✓		✓		Med/Fast	0.7-1.0m
Phormium tenax	Flax; Harakeke	Flax	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	Medium	1.0-1.2m
Aristotelia serrata	Wineberry	Shrub		✓	✓		✓	✓				✓	✓		✓	✓	Fast	1.0-1.5m
Coprosma propinqua	Mingimingi	Shrub		✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	Med/Fast	1.0-1.5m
Coprosma repens	Taupata	Shrub		✓				✓				✓	✓	✓		✓	Fast	1.0-1.5m
Coprosma robusta	Karamu	Shrub		✓			✓	✓			✓	✓	✓		✓	✓	Fast	1.0-1.5m
Cordyline australis	Cabbage tree	Tree		✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	Medium	0.5-1.0m
Dodonaea viscosa	Akeake	Small tree		✓				✓				✓	✓	✓	✓		Fast	1.0-1.5m
Hebe stricta	Koromiko	Shrub		✓			✓	✓				✓	✓	✓	✓		Fast	1.0-1.5m
Kunzea ericoides	Kanuka	Tree		✓			✓	✓				✓	✓	✓	✓		Medium	1.0-1.5m
Leptospermum scoparium	Manuka	Small tree		✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	Fast	1.0-1.5m
Melicytus ramiflorus	Mahoe	Shrub		✓				✓					✓	✓		✓	Medium	1.0-1.5m
Pittosporum crassifolium	Karo	Small tree		✓				✓				✓	✓	✓	✓		Fast	1.0-1.5m
Pittosporum eugenioides	Lemonwood	Tree		✓			✓	✓				✓	✓		✓	✓	Fast	1.0-1.5m
Pittosporum tenuifolium	Kohuhu	Small tree		✓			✓	✓				✓	✓				Medium	1.0-1.5m
Plagiantus divaricatus	Saltmarsh ribbonwood	Small tree		✓		✓		✓	✓		✓		✓	✓	✓		Slow	1.0-1.5m
Plagianthus regius	Manatu/Ribbonwood	Tree		✓		✓	✓	✓	✓		✓		✓		✓	✓	Med/Fast	1.0-1.5m
Pseudopanax arboreus	Five finger	Small tree		✓				✓				✓	✓		✓	✓	Fast	1.0-1.5m
Sophora microphylla	Kowhai	Tree		✓				✓					✓			✓	Medium	1.0-1.5m
B. Secondary plantings (these prefer shelter from existing plants, for a more comprehensive list refer to the Native Planters Guide)																		
Agathis australis	Kauri	Tree		✓								✓	✓				Med/Slow	1.0-1.5m
Carpodetus serratus	Putaputaweta	Small tree		✓				✓					✓			✓	Medium	1.0-1.5m
Cyathea species	Tree ferns	Tree fern		✓											✓		Slow	1.0-1.5m
Dacrycarpus dacrydioides	Kahikatea	Tree		✓		✓	✓	✓	✓		✓		✓			✓	Med-Slow	1.0-1.5m
Dacrydium cupressinum	Rimu	Tree		✓				✓								✓	Slow	1.0-1.5m
Dicksonia squarrosa	Tree ferns	Tree fern		✓				✓							✓		Medium	1.0-1.5m
Podocarpus totara	Totara	Tree		✓			✓	✓				✓	✓		✓	✓	Med/Fast	1.0-1.5m
Schefflera digitata	Pate	Small tree		✓				✓			✓		✓		✓	✓	Fast	1.0-1.5m

Native plants in bags waiting to be planted.

Good timing

Most native species should be planted between late April and early September. If soil moisture levels are high enough it can be better to plant in autumn (late April to early June). This allows plants to establish themselves in spring, before any summer dry spells. If you get harsh frosts, do your planting in spring.

Ideally plant the most hardy species first to establish initial cover (for example manuka/kanuka, cabbage trees and karamu Coprosma robusta). After one-two years, plant the frost and wind tender or slower growing species (for example, tree ferns, rimu and kahikatea) at wider spacings.

Exotic trees can be purchased bare-rooted but native trees are usually bought in bags or root trainers. Make sure the plants you purchase have been hardened off in the open for at least two weeks before planting.

To reduce maintenance you can buy bigger trees (up to a metre tall). But when selecting plants check they are not root bound and that the root mass is big enough to support the height of the plant. If you plant smaller seedlings, you will need to release them regularly from weeds.

Getting the site ready

Fencing

All areas where you plan to plant natives or any tree other than poplar poles protected by a plastic sleeve should be fenced to exclude stock before you start. Fencing should be permanent, because areas planted with natives will not cope with grazing.

Weed control

Give your plants a head start, and reduce your future workload, by clearing planting areas of invasive weeds. Weeds such as kikuyu, climbing asparagus, moth plant and woolly nightshade need controlling beforehand – they grow quickly and will smother or out-compete young seedlings. Page 35 provides information about dealing with specific weeds.

Use either a herbicide or a spade to clear weeds and grass in circles of about 1 metre out from each plant. Glyphosate herbicides are good for removing many weeds in large areas and are generally accepted as the safest sprays to use beside water. You do not need to get a consent to spray beside waterways if you use herbicides approved by the Environmental Risk Management Authority (ERMA). Make sure you follow the manufacturers' instructions and take steps to avoid the herbicide getting into the water or affecting non-target species.

Native plants are very sensitive to herbicides, so it is best to spray well before you intend to plant. Make sure you use herbicides at the recommended rates and spray in an S-shaped pattern to avoid overlap. Use a spade to clear grass and weeds on smaller areas if you have the time.

Having mulch on hand can help avoid weed problems later. A thick layer of newspaper weighed down with clods of soil, or a large square of carpet or non-synthetic underlay split to place around the tree, makes effective mulch. Take care not to place any organic mulch up against the stems of native plants as it can damage them.

The most effective way to deal with unwanted tree species like invasive poplars and willows is to treat the stumps with herbicide immediately after cutting. A herbicide gel (Vigilant) is commercially available and easy to use. Alternatively, drill holes in the base of each willow tree at a 45° angle and inject 80ml of glyphosate (this method only works in summer). Avoid putting live willow off-cuts in or near waterways, as they will take root and grow – and you will end up back at square one!

The Regional Water and Soil Plan for Northland permits clearing of weeds from the very edge of waterways. It is important to make sure you minimise the amount of sediment and vegetation that ends up in the waterway because it can obstruct water flow and affect fish passage. It is also important to replant as soon as you can to help stabilise the banks. Any earthworks or other vegetation clearance in riparian zones may need a consent.

Please contact Consents staff at the Regional Council for more information.

Pest control

Possums, rabbits and hares will consume native seedlings on pasture land so it pays to do some control before you plant. If you know what the pests in your area prefer to consume, choose some of their less favourite species to plant densely along the fencelines. Using larger trees (with trunks thicker than a finger width) discourages hares from slicing them off. Commercial repellents can also be used to protect young trees from rabbits and possums – these are available from horticultural suppliers or stock and station agents. For more information about pest control, see page 36.

Pukeko will also eat native plantings and will be quick to nibble and uproot your flax and sedge plantings. Planting bigger seedlings (40cm high) can help keep them away.

For information on plant and animal pest control contact the Biosecurity Officers at the Northland Regional Council.

Possum.

Hare.

Landcare planting group.

Getting your plants in the ground

- An overcast, wet and windless day is best for planting.
- Handle plants carefully to avoid root damage.
- Set out plants in their zones and correct spacings.
- Dig a good size hole and loosen the soil.
- Place a heaped tablespoon of 1-2 year slow release fertiliser in the hole, and mix a small amount of loose earth with the fertiliser to prevent it from burning the roots.
- Set the plant in the hole and fill three quarters full. Give the plant a very gentle lift to set the roots in a natural position and continue filling with soil, firming as you go.
- Water at the time of planting if possible. In dry areas, you may need to continue watering during summer for the first two to three years.
- Stake plants to help find them again at weeding time (bamboo stakes with the ends dipped in white acrylic paint are easy to find later).
- Take care that the seedling is not too deeply buried.
- Use mulch to help control weeds later and retain moisture.
- A variety of wholesale plant nurseries operate in Northland, who can supply good quality plants at a reasonable price.

For more information about planting techniques contact the Northland Regional Council for a copy of the Trees for the Land booklet.

Ongoing maintenance

Maintaining riparian fences may be regarded as a lower priority for maintenance compared with other farm fences. But remember that you are also protecting a planted asset behind those fences, which could quickly be devalued if your stock gain access.

Silviculture

Native shrubs and trees will need little tending once a canopy is established except where flood flows are a problem. Where trees have been planted for erosion control or timber production, silviculture and maintenance are essential to prevent problems such as blockage of flood flows. They will need some initial form pruning to maintain a good central leader and thinning within 5 years. This should be followed by some side pruning 5 to 10 years after planting to reduce shading of grasses and shrubs underneath. Ideally exotic erosion control trees should be treated as a temporary measure until native species become established.

Do not plant any large trees within 5 metres of steep bank edges to prevent toppling when mature. Refer to Figure 6 on page 28 for planting zones. For more information on commercial planting refer to the Trees for the Land booklet available from all Regional Council offices.

Additional planting

You cannot expect 100 percent success with tree plantings, but if you plant good quality seedlings of the right species, at the right time of the year and protect them well, you can expect 70 to 80 percent to survive. It is helpful to replant in the spaces where you have lost trees, to reduce gaps for weeds to grow in the future. Most deaths will occur in the first few months, so keep an eye on your plantings and if you need to replant, do it as soon as you can to keep weeds out.

Once the hardy pioneer species are established, other native plants might start regenerating amongst your planting as birds spread seed. If you would like to speed up this process, plant additional trees and shrubs in the gaps between established plants. There are many slower growing species you can introduce under the shelter of the pioneer species – the plant list in Table 2 (page 29) gives some examples and an indication of good trees for attracting birds.

For further information the Native Planters Guide for Northland has good information.

What's in it for me?

- Increase in habitat for native plants and animals.
- Shade and shelter for stock and pastures.
- Increase in land value.

Native riparian plantings.

Managing weeds and pests

Newly planted seedlings marked with stakes.

To successfully establish native plants it is important to make time to protect your plants from weeds and pests.

Weed control

Planted riparian margins are often criticised as being havens for weeds. There is no doubt, you will need to commit some time and resources to maintaining your planting if you want to keep the area weed-free. A weed problem is most likely to arise where trees and shrubs are planted too small, there are existing weeds present, there is poor preparation before planting, plants are poorly released or planted too far apart.

Principles for keeping on top of weeds

There are some general principles you can follow to keep weed control manageable along planted riparian margins, saving you time and money:

- Remove all weeds from the site before you fence or plant it.
- If you do not have much time for weed control, plant larger plants at close spacing (no more than 1.5 metres apart) to reduce weed competition. Planting close may cost more upfront but will pay off in the long-term.
- Start by planting a smaller area and maintaining it well, moving on to other areas once the initial site does not need so much attention.
- Check on weed growth regularly in planted areas, especially during spring and summer. Controlling weeds in the early stages is generally much easier than dealing with mature infestations.
- Consider paying someone else to weed your planted areas during busy periods if you do not have time. It might save you the cost of replacing your plants the following winter.
- Release your plants regularly for the first few years to avoid high plant losses. Once seedlings start to shade the ground, you will not need to do so much.
- Keep on top of shade-tolerant weeds.
- Use stakes to mark the position of seedlings – this can help you to find them for releasing.
- Identify your weeds and get good advice about the most efficient and effective way to control them. Contact your Regional Council, local plant pest contractor or farm supply store for advice about specific control methods.
- Take care with herbicides around native plants because they are very sensitive. Avoid blanket spraying as this will open up gaps for invasive weeds.

Table 3: Methods and Herbicides for Controlling Weeds

Weed	Control methods	Suggested herbicides
Buffalo Grass *(Stenotaphrum secundatum)*	Limited physical control of small infestations by hand pulling can be effective. Spray the foliage with herbicide.	Glyphosate 10ml/litre plus penetrant.
Climbing Asparagus *(Asparagus scandens)*	Physical control by cutting the plant and digging out all of the tubers. All tubers must be destroyed to avoid regrowth, by burning or sun baking in a black plastic bag. Chemical control by cutting the vines back to approximately 60cm, and spraying existing foliage. Best results during growing season (Spring & Summer).	Glyphosate 20ml/litre plus penetrant.
Kikuyu Grass *(Pennisetum clandestinum)*	Physical control is limited. Digging will leave deep rhizomes, or small sections of these, which will regrow. Spray the foliage with herbicide. If the kikuyu is rank, an option is to cut or graze back and spray the regrowth.	Glyphosate 10ml/litre.
Moth Plant *(Araujia sericifera)*	Physical control by pulling, or digging out as much of the root system as possible. Leave the plant to compost (if growing on a tree, leave on the tree). Best done before the seed pods develop (early Autumn). Bury any seed pods in a deep hole, do not burn them. Chemical control by either: • Cutting large vines 20cm above ground. Paint or swab the cut area with herbicide. • Spray the foliage (best for small vines only).	For cut vines use either: • Vigilant gel; • 1 part Glyphosate to 5 parts water. For foliage use either: • Grazon 6ml/litre; • Escort 5gm/10 litres; • Versatill 10ml/litre plus penetrant.
Smilax *(Asparagus asparagoides)*	Physical control by cutting the plant and digging out all of the tubers. All tubers must be destroyed to avoid regrowth, by burning or sun baking in a black plastic bag. Chemical control by cutting the vines back to approximately 100cm, and spraying existing foliage. Best results during growing season (Spring & Summer).	Glyphosate 20ml/litre plus penetrant.
Wandering Jew *(Tradescantia fluminensis)*	Remove plants by hand or rake them up as a mat, do not spread fragments as they will grow. Compost on site in black plastic bags or bury the plants in a deep hole. Spray foliage with herbicide.	Grazon 6ml/litre plus penetrant.
Wild Ginger Kahili Ginger *(Hedychium gardnerianum)* Yellow Ginger *(Hedychium flavescens)*	Physical control by digging up plant and rhizome. Stems and foliage will compost normally. Rhizomes must be destroyed by sun baking in a black plastic bag, or by crushing, drying and burying them in a deep hole. Chemical control by either: • Cut down the plant and treat the stump/rhizome with herbicide (stems and foliage left to compost); • Spray the foliage with herbicide.	For cut stems/rhizomes use either: • Escort 1gm/litre; • Vigilant gel. For foliage use: Escort 5g/10 litre plus penetrant.
Woolly Nightshade *(Solanum mauritianum)*	Physical control of small plants by pulling or digging up. Chemical control by either: • Cut down the plant and swab the stump with herbicide; • Make a cut in the stem and inject herbicide (make a ring (ringbark) of downward cuts around the stem and apply herbicide to the cut); • Spray the foliage with herbicide.	For stumps and cuts use either: • Vigilant gel; • 1 part Glyphosate to 5 parts water; • 1 part Tordon to 10 parts water; • 1 part Amitrole to 10 parts water. For foliage use either: • Tordon 10ml/litre • Amitrole 20ml/litre

For detailed information about specific weeds, contact the Northland Regional Council on 09 438 4639 to talk to a Biosecurity Officer and get a fact sheet, or check out the NRC website at www.nrc.govt.nz.

Wandering Jew in riparian area.

Control of common riparian weeds

The most common weeds growing along waterway margins in Northland are kikuyu, climbing asparagus, smilax, blackberry, Tradescantia (wandering jew), willow, woolly nightshade, black nightshade and inkweed. Table 3 (page 35) gives some basic information about control of some of these weeds.

Pest control

It is important to protect your riparian margins (and your investment in them) from animal pests too. The following is a brief description of some of the main pests and their control. Regional Council Biosecurity Officers can help with more detail on control methods.

Rabbits and hares

Planting larger trees will reduce the impact that rabbits and hares will have, but ongoing control is important for smaller plants. Rabbits and hares need to be controlled all year around until the diameter of the plant stems are fairly large to prevent them from being bitten through or ring-barked. A variety of control methods are available, including shooting, fumigant poisons, baits and exclusion fencing.

It may be useful to try animal repellents to deter rabbits and hares – these are available from horticultural suppliers or stock and station agents or you can make your own up.

Possum bait station in riparian area.

Possums

In most areas, ongoing possum control will be necessary to protect your plantings. Possum control also has the added benefits of reducing the amount of pasture they eat and protecting your fruit trees and gardens. There are a variety of control methods available, each with their own positive and negative aspects. Bait stations for possums can be an effective low-input control method in waterway margins. Traps are higher maintenance, but once you have purchased them the only cost is your labour. Night shooting can also help in narrow waterway margins, but is not usually effective in larger bush areas.

Goats

Goats can make short work of lush young plantings and they will get through most fences. Not running goats on your property is the best way to reduce this risk. Feral goats should be eradicated.

Other pests

As your planting matures, it will attract birds, lizards, frogs and insects. Controlling rats, mice, stoats, ferrets and cats will help keep your planting a healthy habitat for the native wildlife. Most of these pests can be targeted together with certain poisons, but each requires a different trapping method if poisons are not used.

Managing wetlands, seeps and swamps

Spring or seep in the landscape.

Indigenous wetlands are unique and threatened features of the Northland landscape. Most of Northland's wetlands have been destroyed or severely modified. Northland Regional Council encourages landowners with significant indigenous wetlands on their properties to consider protecting and restoring these areas as important natural habitats.

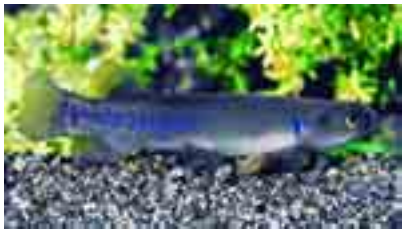
Smaller wet areas, seeps and swamps can also play a valuable role in filtering pollutants out of runoff and ground water. This section focuses on how to manage these areas to protect water quality. If you would like to know more about wetland restoration, the Regional Council has a brochure called The Beginners Guide to Wetland Restoration and Land Management staff members are able to help with advice. Another good resource is Environment Waikato's Wetland Restoration fact sheets at www.ew.govt.nz.

If you are protecting a wetland, you might be eligible for a grant from Northland Regional Council's Environmental Fund. The fund provides 50 to 66% percent of the total costs of environmental projects that meet its criteria – they must be of long-term benefit to the local environment and clearly show evidence of good resource management.

Contact the Land Management Officers at the Northland Regional Council on 09 438 4639 to find out more.

What can managing wetlands achieve?

Think of wet areas as giant filtering sponges – sometimes described as the kidneys of the landscape. Wetland plants slow the flow of water off the land and in times of flood, water is absorbed into the organic wetland soils reducing flood peaks. In summer, stored water is released slowly to maintain water flows, providing better habitat for stream life.



Banded Kokupu.

Wetland plants trap waterborne sediment, cleaning up water before it gets to rivers and streams. This increases water quality and reduces the downstream effects of flooding and sediment build-up in streams and harbours. In the right conditions, bacteria living in damp wetland soils can convert up to 90 percent of the nitrogen in farm runoff into nitrogen gas, which is then released into the atmosphere. This helps prevent algal blooms and nuisance plant growth in our waterways.

In summary, managing wet areas, seeps and swamps on your farm can:

- Improve water quality by filtering sediment, faecal bacteria, nitrogen and phosphorous from runoff.
- Improve water quality by removing soluble nitrogen from runoff and re-surfacing ground water – in some soils managed wetlands are the most effective solution to reducing the amount of nitrogen reaching waterways.
- Provide habitat for eels, native fish, birds and insects, improving local biodiversity.
- Reduce stock losses from bogging and improve stock management.
- Help reduce flood peaks and maintain summer water flows.

Wetlands filter nitrogen from water.

Where is wetland management most important?

Managing wet areas, seeps and swamps will have the most impact on water quality in the headwaters of catchments. It is also a very important management approach in areas where waterways are particularly sensitive to nitrogen or where high nitrogen levels in ground water have been identified as a problem.

Water must remain in the wetland for as long as possible to gain the most benefit for water quality. A series of small wetlands may be a viable option down a catchment.

What's in it for me?

Managing wet areas, seeps and swamps can:

- Increase stock production by removing access to liver fluke breeding areas.
- Improve pasture growth with fertiliser being applied on the most productive land.
- Help reduce flood peaks and maintain summer water flows.
- Improve recreational opportunities, such as duck shooting.
- Reduce stock losses from wet areas.
- Improve stock management.
- Reduce nitrogen levels in water passing through them.

To drain or not to drain…

On a purely economic basis, the capital outlay of draining wet areas might be cheaper than buying more land. Before draining an area, you will require a resource consent. There is also a risk that the drained area will remain wet, and you will have the ongoing cost of drain maintenance. When you take this into account it can sometimes be more profitable to put a fence up instead, concentrate on your better land and leave your wetland filters intact. Fencing out stock can also save you money in animal health and time spent on stock management.

Replanting on the edge of a wet area.

Managing your natural filters

Once nitrogen has found its way into ground water, it can only be treated where the ground water reappears at the surface, for example, at springs, wetlands and seeps. Keeping these wet areas and plants is essential if you want nitrogen removed from emerging ground water. If there is plenty of suitable organic matter, low oxygen levels and reasonable water retention time, more than 90 percent of nitrogen can be removed[15].

For wet areas to be effective as filters they:

- Must remain wet for all or most of the year. Many wet areas on farms have already been drained. If you want them to improve water quality, they will need to stay wet.
- Must be fenced off from stock. Most sedges, rushes and flax are palatable to stock. These plants need to be protected as they have an important role in slowing flow, filtering water, and providing a carbon source for the bacteria that remove nitrogen. Cattle trampling will also reduce the ability of wet areas to absorb water.
- May need some planting. Native sedges, raupo, rushes and flax grow well in these areas and are easy and cheap to get. They can all be split and the sections planted out. Trees can be counter-productive in or beside wetland areas as they dry the soil out and shade the smaller plants.

If you really want to make good use of wetlands, swamps and seeps to improve water quality on your farm, you can use them to filter runoff from a variety of sources. For example:

- Direct tile and mole drains into wetlands before they flow into streams.
- Divert race and track runoff into wetland areas but take care not to smother the area with sediment.

[15] Ministry for the Environment, 2000.

Using temporary fencing as a management tool

If some of the wet areas on your farm are too difficult or inconvenient to fence permanently, you will still achieve some water quality benefits if you use a temporary electric fence during the wetter months. It might take a bit of extra time to put up a fence before you let the stock into paddocks in winter but it will keep the ground from getting pugged and make a difference to the amount of polluted runoff leaving your farm. As for the lost grazing, often the wet areas pug up quickly in winter and are of limited feed value anyway – it could be better to save them for summer grazing when feed is short.

The Council has rules protecting indigenous wetlands. Indigenous wetlands are those that are permanently or seasonally wet, greater than 50m^2 in size and contain indigenous vegetation such as raupo, flax, sedges, kahikatea, cabbage tree or mangroves. Consent is required for any work undertaken within the wetland area.

Care needs to be taken when working around or upstream of an indigenous wetland to ensure that you do not impact on the water levels in the wetland. If the work around the wetland will divert or dam the water flowing into or through the wetland then consent is required. The Land Operations Department at the Regional Council can help you with the identification of your wetland area and the impacts upon it.

Wetlands act as natural filters and provide habitat.

Managing drains for multiple benefits

The many roles of a farm drain

Drains are essential for the development and improvement of many farm businesses. They can, depending on management:

- Reduce flooding.
- Lower water tables.
- Increase flooding downstream.

But there is more to farm drains than meets the eye. It is important to realise that farm drains:

- Are not isolated waterways. They almost always flow into natural streams that connect into rivers, wetlands, lakes and estuaries channelling surface runoff (and pollutants) from paddocks. This means they act as very efficient channels for nutrients and faecal bacteria to travel into larger waterways.
- Can be important habitats for some of our endangered wetland plants and animals such as eels, trout, whitebait and native water birds.

This section provides some ideas about how to manage your drains to meet your farm objectives as well as maintain water quality and habitat for native plants and animals.

A well vegetated farm drain.

Managing drains to reduce maintenance

Drains only need to be maintained if they are becoming blocked with silt or weeds. Maintaining drains is a cost to the farm business and, depending on how you do it, can also affect water quality and wildlife.

Prevention is always better than cure. Manage your drains to reduce the need for maintenance, keeping costs down.

Good management practices that can reduce the need for drain maintenance include:

- Fence all drains to reduce siltation from stock damage to drain banks. Where permanent fencing is not practical, use a single electric wire to stop cattle from crossing.
- Only spray the weeds in the bed of the drain, not those on the banks, because grassy banks are more stable than bare banks.
- Leave an ungrazed grass strip beside drains to filter nutrients and sediment from runoff. Make the strip wider at low points where runoff collects.
- If you are cultivating in paddocks with drains, make sure you stop far enough away from the drain bank to stop anything entering the water.

- If you want to plant trees, plant taller trees on the north banks of drains to provide shade – this will reduce weed growth and water temperature. But remember to allow for access for cleaning equipment on the south bank. Grow lower plants that will not disrupt cleaning – for example, the native grass Carex secta.
- Establish drains with a "V" shaped profile, rather than a U-shaped profile. This will concentrate flow and help provide a weed-free central channel that does not need much maintenance.
- Ensure good access to drains so that they are easy to get to if you do need to clear them. This includes putting in gateways in drain fences. Poor access can make the job more time-consuming and difficult, increasing your costs.

Water weeds have good points[16]

Weedy plants in drains can be a problem when they block channels, increasing water tables and flooding. But that is not always the case.

It is a good idea to decide whether the weeds in your drain really are a problem before you spend time and money to remove them. Water plants can provide many benefits:

- They stabilise banks and bed sediments, helping to reduce erosion. Removing them can cause the bank to slump and the drain to silt up.
- They provide habitat for fish, koura, insects and birds.
- They take up dissolved nutrients from the water, helping to lower the amount of nutrients flowing into downstream rivers and lakes where they can cause nuisance algal blooms.

There are plenty of reasons for leaving weedy water plants alone if they are not interfering with drainage or causing a flood risk.

Reducing the impact of mechanical drain clearing

Mechanical drain clearing with a digger is one the most common methods used by farmers. While this method can be quick and seem effective, mechanical clearing can:

- Change the shape of drains and the way water flows, reducing their long-term effectiveness.
- Disturb silt and make drain water dirty, affecting fish and insect life.
- Remove insects, fish, eels and crayfish from the drain alongside sediment and weeds.
- Distribute weed fragments downstream where they can regrow and cause further problems.

[16] NIWA, 2003.

To reduce the impacts of mechanical drain clearing, consider the following good management practices[17]:

- Use a digger with a weed-rake or a stream-cleaning bucket because this allows water and stream life to escape back into the drain.
- Inspect the drain with the digger driver beforehand. Identify any riffles or areas that should not be disturbed and mark these with aerosol paint or pegs.
- Clearing only part of your property in any one year, try and stagger the clearance over several years to minimise the effect on water downstream.
- Create V-shaped drain profiles rather than wide, flat bottomed ones with steep sides (U-shaped).
- Leave a buffer of weed at the lower end of the drain to trap silt. Clean this area last.
- Make sure that diggers are cleaned thoroughly to reduce the risk of weed being spread into new areas.
- When you are clearing smaller drains, put straw bales or filter fabrics downstream to reduce sediment flowing into other waterways.
- Avoid excavating during peak fish spawning and migration and bird nesting periods. Only clear tidal zone drains between October and January. Avoid disrupting the main whitebait spawning period from February to April. Clear drains in other areas between November and April.

Creating a V-Shaped channel[18]

Drains are typically cleared leaving steep vertical banks and wide, flat bottoms. This spreads out water flow, slowing it down and causing the build-up of sediment. Slower water becomes warmer, which in turn encourages weed and algae growth.

Figure 7: A V-shaped Drain.

[17] Ministry for the Environment, 2001; Environment Canterbury, unpublished draft (b).

[18] Environment Canterbury, unpublished draft (b).

Ideally, the slopes of drain banks should be less than 1:2 – that is one vertical unit to two horizontal units of distance (Figure 7). This maintains a faster water flow in the centre of the channel, reducing sediment build-up and weed growth. The gently-sloping edges will regrass quickly, making banks more stable.

Effective chemical spraying

Herbicide sprays are often used to control weeds in drains because sprays are cheaper than mechanical clearing. Spraying is effective but can have some damaging effects on stream life and water quality. Some sprays such as diquat and paraquat are toxic to freshwater life even at very low concentrations. Consent is required when spraying over water for any chemical that is not licensed for application over water. The licence information is available on the product label or from the supplier.

To reduce the impacts of spraying, consider the following good management practices[19]:

- Do not spray the whole length of the drain. Instead only spray stretches of 10-20 metres and leave the next 10-20 metres undisturbed to keep vegetation that can still trap silt and nutrients.
- Spray at minimum effective rates more often, rather than at high concentrations and less often.
- Only spray the centre of the drain where water flow is faster. This will leave the edges undisturbed to provide cover and habitat and bank stability.
- Do not spray during peak fish spawning and migration periods. In tidal areas, only spray between October and January. In non-tidal areas, only spray between November and April.
- Spray ephemeral drains (seasonally wet) when they are dry.
- Spray weeds when they are smaller to reduce the amount of dead vegetation that stays in the drain and reduce the risk of blockages.
- Use contact herbicides, which act directly on plant tissue.
- Contact Northland Regional Council to check whether you need a resource consent to spray in waterways or drains.

Drainage districts

If you have a District Council drain running through your property, you will need to make sure you manage them following the guidelines set by your local District Council or drainage district.

[19] Ministry for the Environment, 2001; Environment Canterbury, unpublished draft (b).

Pulling the threads together

So what does all this mean for your property? It will depend on:

- Where you live in Northland – soil types and environmental issues will vary.
- Where your farm is located within your local catchment – management needs will differ if you are in the headwaters or on the edge of an estuary by the sea.
- What you want to achieve on your property and downstream from it.
- What resources you have access to – information, advice, plants, money and time.

Chances are that a combination of the five different approaches in this booklet will meet your needs. Innovation and adaptability are the hallmarks of New Zealand farmers so enjoy making the information in this booklet work to suit your corner of Northland.

Remember, you are not on your own. Farmers right across Northland and New Zealand are considering how to best manage their properties to maximise both economic and environmental performance to make sure they comply with Regional Council rules, the Northland Clean Streams Accord and overseas consumer demands. Talk to your neighbours and exchange ideas. Also attend local field days.

And do not forget to ask for help when you need it – contact the Northland Regional Council for site-specific advice and assistance about keeping streams clean.

Consider the catchment-wide approach. Gains in cleaner streams can be multiplied through working with your neighbours and other people in the catchment. Land Management staff at the Regional Council can assist with technical information, maps and sourcing funding.

Stream Health Monitoring and Assessment Kit

SHMAK kits are designed to allow farmers, schools and landcare groups to monitor the health of their stream. These simple kits can measure clarity, pH, temperature, velocity, insect life and conductivity, which is a gross measure of pollution.

For further information about these kits, contact NIWA Instrument Systems, P.O. Box 8602, Christchurch, telephone 03 343 7890.

Calculate the costs

	Component	Quantity	Unit Price	Total
Fencing	**1 or 2 wire electric**			
	2.3 mm wire			
	Posts (8m spacing)			
	Insulators etc…			
	Labour			
	Other			
			Sub-total	
	Standard 7 Wire			
	2.5 mm wire			
	Posts (5m spacing)			
	Battens			
	Staples etc…			
	Labour			
	Other			
			Sub-total	
Planting	**Site preparation and maintenance**			
	Herbicide			
	Type 1			
	Type 1			
	Labour			
	Mulch			
	Other			
			Sub-total	
Plants				
	Slow release fertiliser (30gm per plant)			
	Plants			
	Size 1			
	Size 2			
	Size 3			
	Size 4			
	Other			
			Sub-total	
Additional costs you may need to consider				
	Gates			
	Stock crossing (culverts & bridges)			
	Earthworks for fences or stock crossings			
	New stock water supply			
	Extending an existing water supply			
	Consent costs for appropriate activities			
	Other			
			Sub-total	
			TOTAL	

The Riparian Management Zone

The Regional Council has rules relating to works within the Riparian Management Zone and these should be considered when undertaking any land disturbance or discharging concentrated animal effluent adjacent to a water body. These rules generally allow activities, except where extensive works are being undertaken within five metres of the bed of a river where the slope is less than 8 degrees. For example, clearing more than 200m^2 of vegetation unless it is a pest species, exposing more that 200m^2 of soil or disturbing more than 50m^3 of earth.

Steeper slopes of greater than 8 degrees are more restricted to ensure that erosion and sedimentation of the water body is limited.

The dominant slope being the slope over which more than 50% of the land disturbance will occur. The rules do not apply where the dominant slope falls away from the edge of a river or lake.

When undertaking land disturbance activities it is also advisable that you consider practices such as:

- Minimising the amount of vegetation, slash, soil and other debris entering into the water.
- Undertaking the works in a way which minimise erosion of the area where you are working.
- Revegetating exposed areas of soil.
- Avoiding mixing or storing fuels, agrichemicals, or other substances in this area.
- If archaeological remains or features are uncovered that the Northland Regional Council is informed.

The Riparian Management Zone setback which applies to spray irrigation is slightly different. You are able to discharge wastewater (liquid effluent) from animal effluent treatment and/or storage facilities into or onto land; and you are also able to discharge animal effluent (stormwater runoff and/or washdown water) from a stock yard, sale yard or wintering barn or other similar facilities into or onto land, but you must ensure that the wastewater is not applied within 20 metres of any river, stream, open drain, lake or wetland unless there is a planted and fenced riparian management zone. If you have any questions about whether or not what you are doing meets the rules in the Plan then contact the Planning and Policy Department of the Regional Council.

Reference list

Australian and New Zealand Environment and Conservation Council, and Agriculture and Resource Management Council of Australia and New Zealand, 2000: Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Volume 3 – Primary Industries – Rationale and Background Information.

Collier KJ, Cooper AB, Davies-Colley RJ, Rutherford JC, Smith CM and Williamson RB, 1995: Managing riparian zones: A contribution to protecting New Zealand's rivers and streams. (2 volumes). Department of Conservation, Wellington.

Davies-Colley RJ and Rutherford JC, 2001: Some Approaches to Measuring and Modelling Riparian Shade. In Proceedings of the International Ecological Engineering Conference, 25-29 November 2001, Lincoln University.

Hill RB and Kelly J, 2002: Riparian Characteristics Survey Manual.

Environment Waikato Technical Report 2002/07. Environment Waikato, Hamilton.

Land and Water Resources Australia Research and Development Corporation, 1996: River Management Issue Sheets. LWRRDC, National Riparian Lands Programme, Canberra.

Ministry for the Environment, 2001: Managing Waterways on Farms: A guide to sustainable water and riparian management in rural New Zealand. Ministry for the Environment, Wellington.

New Zealand Dairy Board, 2001. Dairy Industry Environmental and Animal Welfare Policies Pamphlet.

Northland Regional Council. Land Beside Water Factsheet Series. Northland Regional Council, Whangarei.

Parkyn SM, Shaw W and Eades P, 2000: Review of information on riparian buffer widths necessary to support sustainable vegetation and meet aquatic functions. NIWA Client Report ARC00262.

Phillips C, Marden M and Rowan D, 2001: Soil stabilising characteristics of native riparian vegetation in New Zealand. Paper presented to NZARM Conference 2001, Hamilton/ Landcare Research.

Quinn JM, 1999: Towards a riparian zone classification for the Piako and Waihou River catchments. Environment Waikato Technical Report TR99/16.

Rutherford JC, Davies-Colley RJ, Quinn JM, Stroud MJ and Cooper AB, 1999: Stream Shade – Towards a Restoration Strategy. NIWA and Department of Conservation.

Taranaki Regional Council: Riparian Management Guide. (Pamphlet). Taranaki Regional Council, Stratford.

Wright, David and Terence Jacobson, 2000: Managing Streamsides: Stock Control, Fencing and Watering Options. Department of Primary Industries, Water and Environment, Tasmania.

Contacts for more information

Northland Regional Council

WHANGAREI: 36 Water Street, Private Bag 9021, Whangarei;
Phone 09 438 4639, Freephone 0800 002 004, Fax 09 438 0012.

OPUA: Unit 10, Industrial Marine Park, Opua;
Phone 09 402 7516, Fax 09 402 7510.

DARGAVILLE: 61B Victoria Street, Dargaville;
Phone 09 439 3300, Fax 09 439 3301.

KAITAIA: 192 Commerce Street, Kaitaia;
Phone 09 408 6600, Fax 09 408 6601.

Environmental Hotline: 0800 504 639

Website: www.nrc.govt.nz

QEII National Trust

The QEII National Trust helps private landowners protect areas of bush and wetland on their property by using covenants. For more information, visit www.nationaltrust.org.nz or phone 0508 732 878.

Fish and Game New Zealand, Northland Region

Fish and Game New Zealand provides specialist advice and support for landowners seeking to enhance wetlands or develop farm ponds for game bird habitat. Funding may be available and approved projects can receive up to 50 percent financial support. For more information, visit www.fishandgame.org.nz or phone (09) 438 4135.

Department of Conservation

Department of Conservation staff can provide advice on how to identify, maintain, protect, and where necessary, enhance conservation values. Check out DoC's website www.doc.govt.nz or phone the Northland Conservancy Office (09) 430 2470.

New Zealand Landcare Trust

The New Zealand Landcare Trust helps with community group projects and may be able to provide funding. For more information, visit www.landcare.org.nz or phone northern regional representative Helen Moodie (09) 436 3170.

Your District Council

Some councils offer help for landowners restoring and protecting wetlands. Check with your local council for more information. You may also need to contact your District Council about resource consents.

CARING FOR NORTHLAND AND ITS ENVIRONMENT

WHANGAREI: 36 Water Street, Private Bag 9021, Whangarei; Phone 09 438 4639, Fax 09 438 0012.

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