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Streams and stream margins

What's in a stream?

Streams provide habitat and food for hundreds of plants and animals, from tiny algae to two metre eels. Streams also provide freshwater for people and stock to drink and places for people to swim and play. Aquatic plants need nutrients and sunlight to grow. Fish and other stream animals need clean, healthy places to live and breed, and wholesome food to eat. People need clean safe water.

Over the last few decades, the level of pollution being discharged directly to rivers and streams in the Wellington region has decreased. But our investigations tell us that the level of nutrients and other contaminants that trickle overland into the rivers is not decreasing.

Rain washes oil, dirt and grime off roads and picks up soil, fertiliser and animal manure from crops and pasture. The resulting runoff ends up in streams and rivers.

It's vital to look after the small streams and keep them clean and healthy. Polluted streams feed into larger streams, rivers and lakes polluting them also. Lower reaches of the river system can become unsuitable or even impossible for many plants and animals to live in. They can also become unsafe for people to swim in, and the water can be unpalatable or unsuitable for stock to drink.

It doesn't have to end that way. This booklet contains some basic information about why and how to look after stream margins so that the stream and the wider environment, including people, will benefit.

The Horokiri Stream at Battle Hill Farm Forest Park December 2003. This section of the stream was fenced from stock and planted in winter 1998.



Why bother with the margins?

Fencing and planting any stream margin can improve the stream's water quality and habitat, and improve natural bush links through the wider landscape. This is known as **riparian management**. Riparian management is a stream treatment solution that works over the long term. The stream stays healthy and the stream margins don't need the high level of maintenance for bank protection that open streams can.

The condition of a stream is directly affected by the condition of its margin. Stream margins in a reasonably natural, unmodified condition help keep the streams in a reasonably natural condition. This applies to urban and rural streams.

Rural stream margins

These are some benefits to farmers from fencing and planting rural stream margins.

- Reduced bank erosion and stream maintenance over the long term.
- Shade and shelter for stock in the paddock.
- Stock are kept out of boggy streamside areas.
- Improved paddock management, and easier stock mustering.
- Help with meeting industry environmental targets, such as those in the Dairying and Clean Streams Accord.

There are benefits from fencing even without plants on the margins.

- Stock can't damage stream banks and beds, and pollute the stream directly.
- Grass growing in the margins can prevent sediment in runoff from reaching the stream.
- The habitat at the edge of larger rivers, where the slower flowing water provides important habitat for aquatic life, is protected.
- Nitrate in groundwater and surface water passing through wetland seeps beside the streams is transformed into nitrogen gas by a process called de-nitrification. This nitrate would otherwise go straight from the farm to the stream.



Karori Stream in Wellington two years after planting.



Urban stream margins

These are some benefits from planting urban stream margins.

- More attractive scenery and improved amenity value.
- Nicer recreation areas and places where children play.
- Increased abundance and variety of birds in the area.
- Less waste land available for rubbish, weeds and pests.
- Less need for concrete and stonewall lined streams.

On urban land, minding stream margins generally means clearing blackberry and other weeds from the stream banks and margins and then planting those areas with native grasses, shrubs and trees.

Cleaning up stormwater will also benefit urban streams. Stormwater carries litter and other water borne contaminants into the streams.

How pollutants affect streams

Nutrients (nitrogen and phosphorus), sediment and germs are the most common contaminants affecting water quality in streams and other waterways.

Pollutant	Source of pollutant	How it reaches the stream	Why it's a problem
Nitrogen (as nitrate, nitrite, or ammonia)	<ul style="list-style-type: none"> fertilisers used on pasture, crops or lawns urine and dung from stock dairy shed wastewater faeces from dogs, birds etc sewage leaks 	<ul style="list-style-type: none"> washed overland by rain (nitrate is soluble in water) leached through the soil transported in water through subsurface drains stock access direct discharges carried from roads in stormwater pipes 	<ul style="list-style-type: none"> speeds up weed growth in the water increases the likelihood of algal blooms ammonia can kill fish
Phosphorus	<ul style="list-style-type: none"> fertilisers used on pasture, crops or lawns dung from stock dairy shed wastewater soil sediment faeces from dogs, birds etc sewage leaks 	<ul style="list-style-type: none"> attached to soil that is washed overland by rain stock access direct discharges attached to soil and carried from roads in stormwater pipes 	<ul style="list-style-type: none"> speeds up weed growth in the water increases the likelihood of algal blooms
Sediment	<ul style="list-style-type: none"> exposed soil new tracks earthworks road runoff in stormwater 	<ul style="list-style-type: none"> washed overland by rain stream bank erosion slips carried from roads in stormwater pipes 	<ul style="list-style-type: none"> can make water unpalatable for stock changes the colour and clarity of the water murky streams are unsafe for swimming smothers stony stream beds
Germs (like bacteria, viruses, and parasites)	<ul style="list-style-type: none"> dung from stock faeces from dogs, birds etc sewage 	<ul style="list-style-type: none"> stock access poorly managed farm effluent irrigation carried from roads in stormwater pipes sewer overflows into stormwater pipes direct discharges 	<ul style="list-style-type: none"> makes water unsafe for drinking contact with the water can cause sickness or skin rashes can affect suitability of water for milking shed use

What can a planted stream margin do?

A planted stream margin is good for water quality

- Streamside plants use nutrients (nitrogen and phosphorus) so less of them reach the stream where they would promote weed and algae growth.
- Plants prevent soil from the margins from washing into the stream.
- Wetland plants growing in streamside seeps (the wet areas seeping into the stream) can remove about 90% of the nitrate passing through them.

Seep areas are easy to recognise because of the sedges or rushes growing in them. If possible, the entire seep should be fenced from stock.





Koaro



Inanga

A planted stream margin is good for fish and other stream life

- Natural variations in stream channel shape are retained or restored, promoting the variety of stream habitats (riffles, runs and pools) that fish and other aquatic life need.
- Overhanging plants and bits of wood that drop into the stream provide hiding places for fish.
- Up to half the diet of many native fish is insects that live on land rather than in the stream. Streamside plants provide food and habitat for these insects.
- Streamside grasses provide places for native fish to spawn. Inanga, one of the whitebait species, lay their eggs out of the stream in streamside vegetation close to the sea in late summer or early autumn. Shortjaw kokopu, banded kokopu, and koaro lay their eggs on the banks of small streams during high flows in autumn.
- Streamside plants slow down water temperature increases in small streams.
- Shade provided by streamside plants slows down the growth of weeds and algae in the stream.



Kereru



Piwakawaka

A planted stream margin is good for land-based native wildlife

- Some 450 species of native insect, 200 native crustaceans, molluscs and worms, and four frog species live in healthy streamside areas, or visit them regularly.
- Plants provide food for many of New Zealand's 88 remaining indigenous land bird species both directly with their flowers and berries, and indirectly, with the huge variety of insects that associate with the plants. The wider the variety of plants, the wider the variety and seasonality of the food supply for birds. Some birds will only fly short distances for food, especially in the breeding season.



Summer flax flowers provide food for tui. The huge decrease in abundance and diversity of honeyeaters throughout mainland New Zealand over the last century may be limiting the regenerative capacity of a wide range of native flowering species. Planting stream margins in native plants that are attractive to tui and bellbirds, especially near existing areas of bush, helps link up bush areas and allows birds to get to food more easily. This strengthens their populations and helps the native bush too.



A planted stream margin is good for people

- There is a greater abundance, diversity and health of mahinga kai (food gathering areas) for species like eels, whitebait, water cress and koura (freshwater crayfish).
- Stream banks are more natural and stable, so less bank and stream maintenance is required.
- Planted stream margins are attractive and add value to nearby properties.
- People go to streams and rivers that look nice for picnicking, swimming, bird watching, fishing, food gathering and so on. This is the stream's amenity value.

A planted stream margin is good for the stream itself

- Streamside plants help enhance and protect the mauri (the spiritual essence to Maori) of the water body.

What a difference the shade makes!

Loss of shade has a very destructive effect on stream life. Sunlight speeds up weed growth and heats up the water, especially in summer.

Small rural streams like this suffer from high levels of contamination and high water temperatures. Migratory fish find it difficult to get through these sections to the cooler, cleaner water upstream.



Stream weeds

Like all plants, weeds and algae need sunlight to grow. More sunlight on the water means more weed growth. Weeds can

- suffocate stream life by removing oxygen from the water
- smother the beds of stony bottomed streams where aquatic insects and native fish would otherwise live
- make stones slippery for people crossing the stream or swimming in rivers, and
- block water intakes.

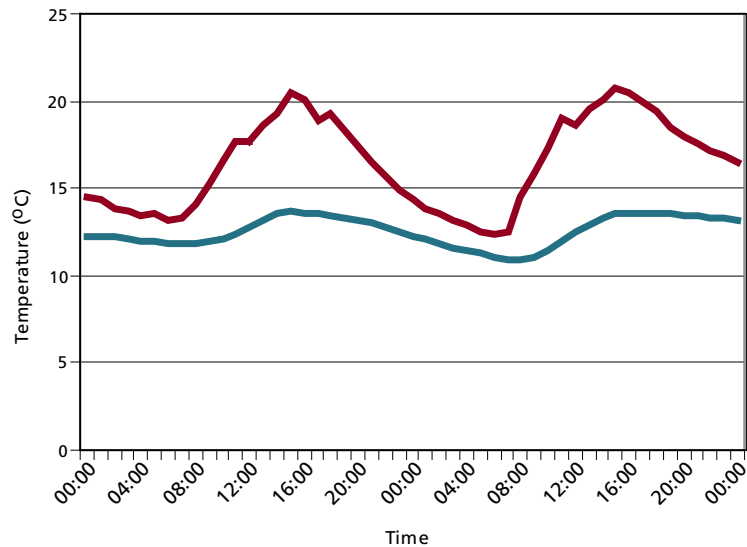
Stream temperature

The cooler the water, the more oxygen there is in it. Fish can be harmed when temperatures go over 25 degrees C and many aquatic insects need the water to be less than 20 degrees C. Aquatic insects have huge ecological importance because they break down organic matter and are food for fish, like trout. It's important to look after them by keeping water temperatures below 15 degrees.



Redfinned Bully

Water temperatures recorded in two rivers over two days in February 2003. The well-shaded Wainuiomata River (in blue) had lower, more stable temperatures than the Horokiri Stream (in red), which flows through open farmland. Low, stable water temperatures provide better habitat for aquatic plants and animals.



Horokiri Stream



Wainuiomata River

How much shade is enough to make a difference?

Small amounts of water heat up more easily than large amounts, so it's more important to maintain dense shade on smaller streams than on large streams or rivers.

Water temperatures start decreasing when over 200 metres of the stream is shaded provided the water is less than about 10 cm deep. To keep water temperatures at the low levels needed for stream life, up to five kilometres of stream margin need to be shaded.

Stock out of streams

Drains, creeks, streams and rivers flowing through farms should all be fenced to keep animals out so that they can't damage the banks and pollute the stream directly. The fence may be a temporary electric fence or a permanent fence.

Fencing off a riparian margin takes that land out of use and many landowners feel this is land they can't afford to lose. But without management, erosion might gradually claim the land anyway. Retiring and planting the stream margin can save it from being permanently lost in the next flood.



Fencing farm drains

Farm drains can be fenced about a metre from the water's edge. The kind of fence (permanent electric or permanent 8 wire) depends on the kind of animals that need to be kept away.

Some farm drains get clogged with weeds and sediment. If the drain is fenced and grass is left to grow high beside it, less sediment will get in and less weeds will grow in the drain because there will be lower levels of nutrients in the water which will be exposed to less sunlight. This can mean that the drain doesn't have to be cleared as often, which means less disturbance for the eels and other stream life that live there.

If it isn't practical to fully fence the drain, a compromise could be a permanent fence on one side and a moveable fence on the other.

Fencing seeps and swamps

Seeps are wet areas beside streams that act as small wetlands.

Seeps and swamps act as mini-treatment areas for runoff from the farm. Up to 90 percent of the nitrate in the runoff and shallow groundwater near the stream can be removed in a streamside seep. Seeps also filter out some sediment and phosphorus from overland runoff and reduce the amount of faecal bacteria that reaches the stream.

Fencing seeps and swamps also stops stock from getting stuck in them.

Fencing small streams

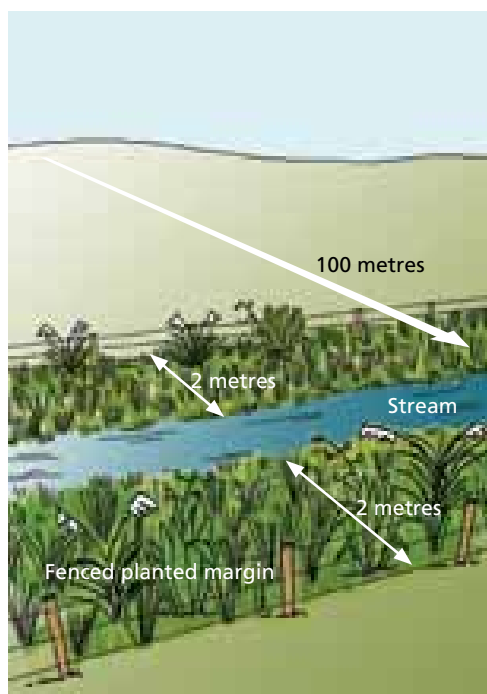
It is very important to protect small rural streams from stock. If the small streams at the top of the catchment get polluted with stock effluent and sediment, their combined effect downstream is practically impossible to reverse.

The kind of fence (permanent electric or permanent 8 wire) depends on the kind of animals to be kept away.

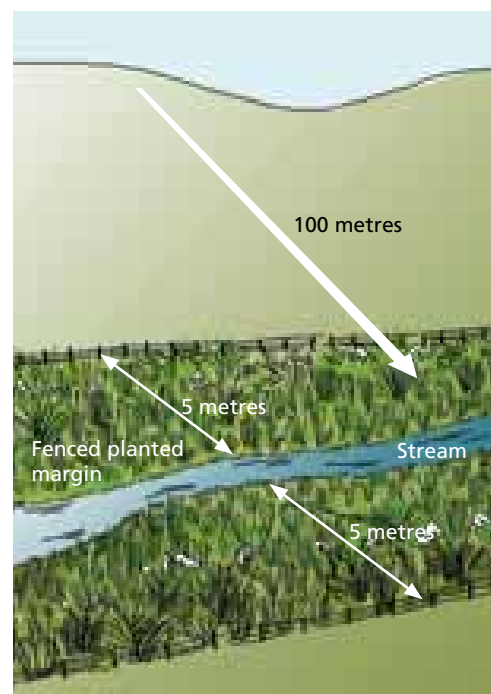
The optimum distance between the fence and the stream depends on

- the topography of the surrounding land (flat, rolling or hilly), and
- the source of the stream flow.

For small streams on gently rolling land, it's best to have a stream margin width that is about two metres for every 100 metres of sloping pasture leading into the stream. For steeper land, there should be five metres of stream margin width for every 100 metres of slope.



In gently rolling pastoral land, the distance from the stream to the fence should be at least two metres for every 100 metres of pasture leading to the stream.



In steep pastoral land, the distance from the stream to the fence should be at least five metres for every 100 metres of pasture leading to the stream. Accommodate stream meanders within the fenced margin.

Studies on small rural Waikato streams that were fenced and planted more than 10 years ago show that they eventually doubled in width, returning to the more natural, wide and shallow channel shape that exists in the bush. Because of this, the distance between the stream and any new fence needs to be sufficient to accommodate some stream widening. Once this has happened, and provided the stream margins are well planted, the stream channel is likely to be reasonably stable.

Fencing larger streams

On most streams, the fence needs to be at least five metres from the stream if the fence is to survive the next flood. It is more work, and cost, to maintain a few plants in a narrow fenced area than it is to maintain more plants in a bigger area.

This is because after three or four years, closely planted shrubs and trees will shade out weeds and survive most floods with little maintenance. The wider the planted area, the easier it can sustain itself without maintenance.

Where to put the fence will need to be worked out case by case, but an important consideration is how vulnerable the banks are to erosion.

Putting fences within five metres of a large stream or river can only be seen as a short term measure. It is not sustainable for the fence or the plants.

Reduce costly fence repairs after floods



Flood damage to fences can be expensive to repair. Some ways to reduce or avoid this expense are

- put the fence far enough back to allow the stream to overtop its banks within a planted area and without damaging the fence
- put a moveable electric fence in high risk areas
- use cyclone wire droppers that pop out instead of stapled wooden battens.

Bridges and culverts

Generally, the most stream friendly stock crossing structures are permanent stock bridges with curbing to prevent effluent runoff to the stream. Most farm bridges don't require a resource consent.



Culverts can be stream friendly, provided they allow passage for fish and flood flows. Information about how to design and construct culverts is given in Greater Wellington's booklet *Fish friendly culverts and rock ramps in small streams*. Most culverts require a resource consent from Greater Wellington.

There is some information about consent requirements at the back of this booklet, or you can contact the consents help desk on 0800 496 734, or check the regional plan user guide on www.gw.govt.nz.



Planting for results

Control weeds

Weed control is essential. This is particularly important on urban streams, where dense weed cover on the stream banks, especially blackberry, makes planting extremely difficult. On fenced rural streams, weed control can be done two months before planting because the main competing plant is usually grass.

Greater Wellington staff are available to help assess sites for weeds and plan their eradication. They will help work out which weeds to target first, and what herbicides or other control methods to use. Weed control on overgrown weedy stream margins needs to be planned for and started at least a year before planting.

Once plants are in the ground, they need ongoing weed control for at least two years. Poorly managed weed control before and after planting is a major cause of native plant death in re-vegetation projects.

For more information about weed control beside streams, see Greater Wellington's booklet *Controlling problem weeds in riparian zones*.



Plant sizes

Grasses, shrubs and trees all need to be at least knee high (PB3) when planted.

When to plant

The planting season ranges from late autumn to early spring, depending on local conditions.

In dry sandy areas like the Kapiti Coast it's best to plant early in the season (May and June). This gives the plants more time to establish deep roots to help them survive their first summer. Planting early is also a good idea for many dry areas in the Wairarapa. In cooler areas, it may be more important to time the planting so that the young plants avoid as many frosts as possible.

For more information about preparing sites and how to plant, see Greater Wellington's booklet *Restoration planting: a guide to planning restoration planting projects in the Wellington region*.



Plant densely

Most streamside plants should be planted about 1 – 1 ½ metres apart. Within a few years they will shade out most weeds and later they will provide effective shade to the stream. Natives planted wider apart may never form a continuous canopy cover, and the ground between them will be easily colonised by weeds.

It takes 4,444 plants to cover one hectare at 1.5 metre spacings (five metres both sides of a stream for one kilometre). At 2.5 metre spacings, only 1,600 plants are necessary but this leaves 2,844 plant sites unoccupied, and weeds will take advantage of this space. Time and money spent controlling the weeds may cost as much as the trees would have cost in the first place.

Toetoe and flax can be planted closer, about a metre apart, and large trees like ribbonwood, lemonwood and wineberry can be planted about two metres apart.



The hebe, cabbage trees and toetoe in this photo were planted about 1.5 metres apart 18 months before this photo was taken in January 2004. They are already closing up the gaps that weeds would otherwise grow in.

Let some sunlight through

Full shade is more important on small streams than larger streams. Small streams less than a metre wide can be effectively shaded by toetoe and shrubs less than three metres high.

Streams more than about a metre wide don't need to be completely shaded. Seventy percent shade is enough for most streams to achieve the benefits of cool water and low weed growth, especially if the smaller streams upstream are well shaded and nutrients from farm runoff and stormwater are kept out.

Full canopy closure shades out the sunlight loving plants like sedges, toetoe and flax near the stream's edge. Without these groundcover plants there is increased risk of bank erosion.

On urban streams, full canopy closure could take the stream out of view and remove a large part of its amenity value.



These sedges were planted less than half a metre apart on the edge of an urban stream in Wellington in July 2003. By January 2004 they had more than tripled in size despite being completely submerged under high flows on numerous occasions throughout the winter and spring.

What to do with big trees

Where good shade is necessary but full canopy closure over the stream isn't possible or desirable, plant the tallest trees on the northern side of the stream. This is also a good idea for urban streams if people want to have tracks or picnic areas near the stream.

Plant big trees four or five metres from the stream edge. Big leafy trees remove a lot of soil moisture and dry out the stream bank. If they are planted too close to stream edges, rain washes pollutants and soil over bare, dry stream banks and into the stream.

Avoid making flooding worse

Wherever possible the floodway should be included in the fenced-off area. The floodway is the broad channel where the water flows swiftly in a flood and not the area where the floodwater merely spills over, which is the broader floodplain.

Species planted in a floodway mustn't block the passage of water because that can cause flooding upstream. For example, willows and poplars tend to choke small streams and make floods worse, but species like toetoe, grasses, and shrubs do not.



Willows on the lower Waitohu Stream, Kapiti Coast, 2003. On large rivers willows can be useful if they are well maintained, but they can spread out and choke streams like this one.

Native species can protect stream banks

The velocity and erosive force of flood water, together with the gravel and debris it carries, can cause serious damage to stream banks. Plants on the outside bends of streams are exposed to higher water velocities, particularly during flood flows, and need to have good deep rooting ability. There are lots of native plants which happily grow there and do a good job of preventing erosion.

Landcare Research have investigated ten native tree species for their bank protection performance in terms of root spread, root depth and plant biomass. Of those that grow in the Wellington region, top performers for root spread are manatu (ribbonwood), ti kouka (cabbage tree), and kohuhu. Manatu, ti kouka and karamu perform best for root depth. For plant biomass, which is a measure for the root mass overall, manatu and ti kouka are the best. See the next section of this booklet for more information about these plants.

A look around at similar sites on the same watercourse will reveal what native plants are doing well. In the meantime, if no plants are growing there, shrub willow can be used as a quick fix to stabilise the bank edge. These willows should be seen as a nursery crop. That is, they must be pruned, thinned and eventually removed to allow the native plants to take over. Willows can become a problem in some watercourses, so a good management regime is important. Further advice is available from Greater Wellington.

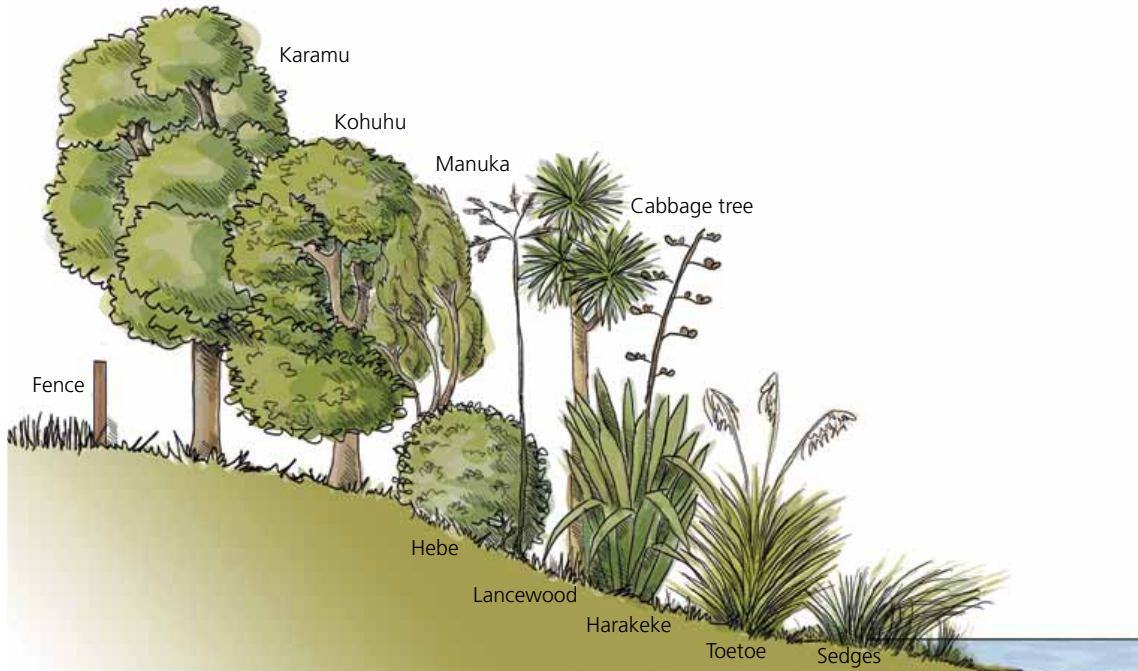
Where to plant what

In general, put big plants away from the stream edge.

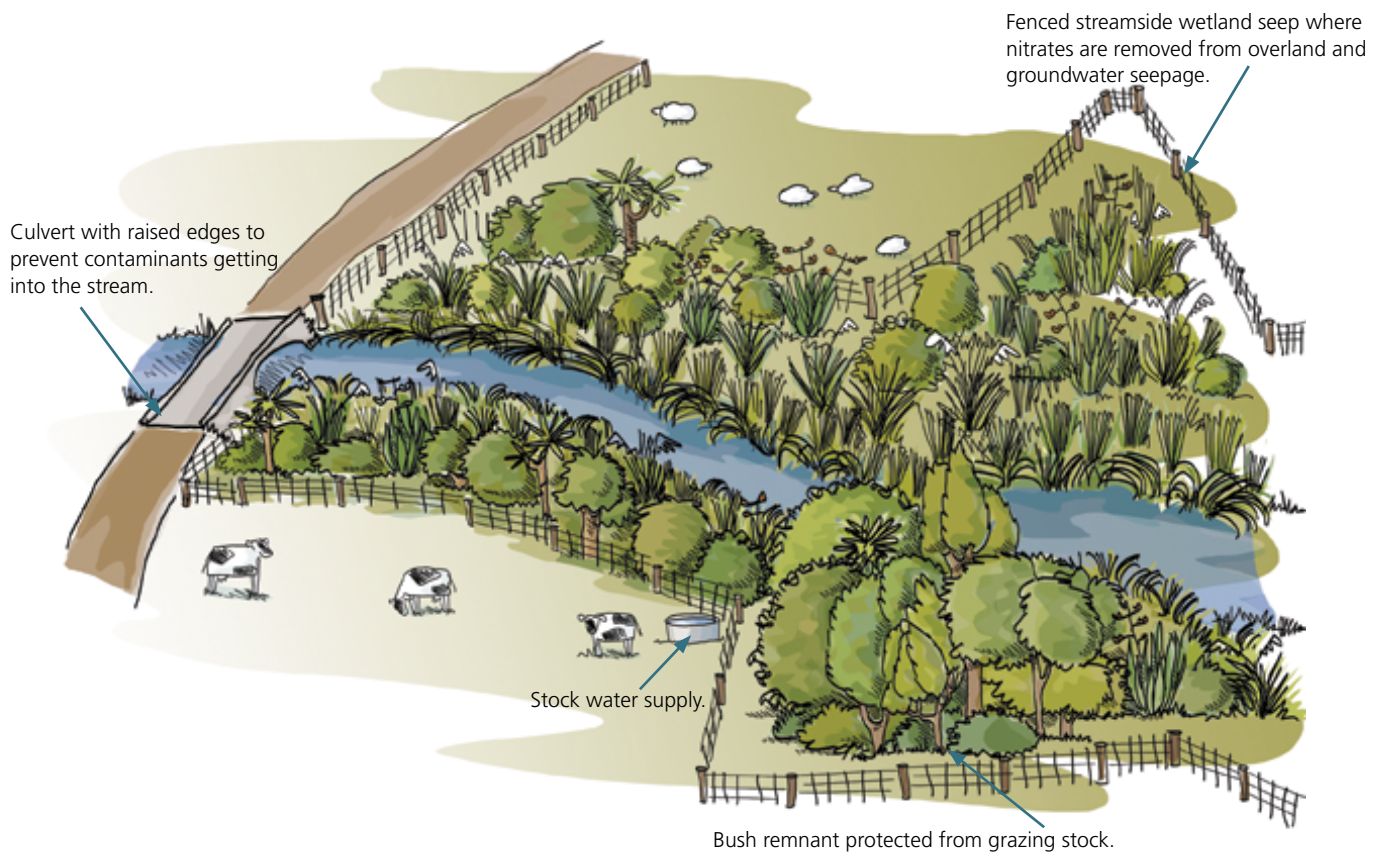
Leave about a metre of grass growing without shrubs or trees on the inside of the fence so that stock won't try to eat the young plants and so the branches of grown trees won't damage the fence. The grass that grows there filters the overland runoff.



Leave about a metre between the plants and fence.



An example of where to plant streamside species. Big trees should be furthest from the stream. Shrubs like manuka and hebe are suited to mid bank areas, and plants that are tolerant of wet soils and occasional flooding, like cabbage trees and toetoe, can be planted near the stream edge.



Top streamside species

Hardy colonising species

Our experience with planting streamside areas around the Wellington region has helped us learn which are the most vigorous, fast growing species that can cope with a variety of climate conditions, including drought and frost. Species listed here like streamside environments or forest margins and establish reasonably easily in open pasture or beside urban parks and roads.

All these species are native to the Wellington region. As well as their hardiness, they have been selected for their ability to provide food and habitat for insects and birds, so that the wider ecosystem gains along with the stream.

Planting native plants beside streams strengthens native ecosystems, and will help reverse the decline in regional biodiversity.



Akiraho (*Olearia paniculata*)

Two years old, 1.6 metres. From the daisy family, this very hardy shrub to small tree grows up to six metres tall, can stand light soils and is found along forest margins and in scrub. Akiraho is mostly a coastal and lowland plant that likes open sunlight and is frost hardy when mature. Akiraho is very leafy all year round, has masses of flowers in mid summer, with seeds dispersing into autumn. Plant them at least a metre from the fence to about two metres from the stream edge.



Harakeke, swamp flax (*Phormium tenax*)

Two and a half year old, 2 metres. Flax is tough, likes open sunlight, and grows best in alluvial soils although it grows well in lowland swamps and dry hillsides. Maori used every part of the plant, especially for weaving. The flowers, which grow on stems up to five metres tall, are produced throughout summer and are attractive to birds, especially tui and bellbirds. A flax grown from a fan cut from a mature plant will grow about two metres high within about two years. It can be planted near streams but not in areas that are subject to fast flowing water because mature flax plants form dense clumps of rigid fans that present considerable resistance to flood waters. High flows can sweep plants away, along with some of the stream bank.





Karamu (*Coprosmia robusta*)

Two and a half years old, 2 metres. This shrub or small tree with leathery leaves grows up to six metres tall and is found throughout NZ in lowland forests. It is tough, likes open sunlight, and is frost hardy. Its late summer berries are food for waxeyes, bellbirds, kereru, and tui.

Karamu is extremely good at getting established even in open pasture, so its hardiness and popularity with birds makes it an essential revegetation species. Plant them at least a metre from the fence to about two metres of the stream edge.



Kohuhu (*Pittosporum tenuifolium*)

Two and a half years old, 1.5m. A coastal to lower mountain forest tree up to eight metres tall. Found all over the country except in the west of the South Island. Kohuhu is tough, frost hardy, likes sun, and flowers from mid to late spring. Its capsules mature from mid summer to early autumn providing food for bellbirds and tui.

Kohuhu develop substantial root spread and root depth giving them good soil holding ability so if bank protection is necessary they can be planted right up to the stream edge.



Makomako, wineberry (*Aristotelia serrata*)

Five years old, 2 metres. A very common, fast growing semi-deciduous small tree up to ten metres tall found throughout NZ in forests and scrubland, along forest margins and roadsides. Fruit were eaten raw by Maori and liquid from boiled leaves was applied to skin ailments. Makomako likes open sunlight and is frost hardy. Its flowers and berries provide food for bellbird, tui, kereru and waxeye from spring to early summer. Plant them at least a metre from the fence to about three metres of the stream edge.





Manatu, lowland ribbonwood (*Plagianthus regius*)

Five years old, 3 metres. A common lowland forest tree up to 15 metres tall that, unusually, is regularly leafless in winter. Flowers (see picture) mid-spring to mid summer with fruiting through summer to early autumn. Manatu likes open sunlight and is frost hardy. Plant them at least a metre from the fence to about two metres of the stream edge.

Manatu develop substantial root spread and root depth giving them good soil holding ability so if bank protection is necessary, they can be planted right up to the stream edge.



Manuka (*Leptospermum scoparium*)

Five years old, 2.5 metres. Manuka is found mostly in open habitats throughout NZ. It is a fast growing reasonably frost hardy shrub, up to 4 metres tall, that establishes well in disturbed land. The flowers and capsules can be present from spring to early winter. The insects pollinating the manuka are attractive to fantails and other insect eating birds. The roots of young manuka are extremely sensitive to handling so never untangle the roots during re-potting or planting. Put the plant directly in the hole, anywhere from a couple of metres from the stream edge to within a metre of the fence. In exposed sites, plant less hardy species under established manuka later on, or leave the area to regenerate naturally.



Ngaio (*Myoporum laetum*)

Five years old, 2 metres. A leafy tree up to ten metres high whose spreading branches shade out understorey vegetation. Ngaio likes open sunlight, and is frost hardy when mature but can recover from light frosts when young. It flowers mid-spring to mid-summer and the berries ripen through summer and autumn, providing food for bellbirds and tui. Plant them at about two metres from the fence to about two metres of the stream edge.





Toetoe – spring flowering (*Cortaderia fulvida*)

Five years old, 2 metres. This native grass, which is actually a type of sedge, is tough and likes open sunlight. Summer flowering toetoe (*Cortaderia toetoe*) can also be used. Toetoe grows up to two metres high within two to three years of planting and is best planted within three or four metres of the stream edge.

The roots of toetoe plants are good at holding onto stream banks and the dense leaves close to the ground can filter sediments and other pollutants in overland runoff and help prevent soil being washed into streams. High river flows can sweep over toetoe without damaging the plant or the stream bank.



Ti kouka, cabbage tree (*Cordyline australis*)

18 months old, 1.6 metres. An icon NZ tree that reaches up to 20 metres tall, ti kouka grows along edges of forests and swamps and along river banks. Cooked tap roots, the core of the trunk, and the tender shoots were all important food for Maori. Leaves were an important source of fibre. Ti kouka is tough, likes open sunlight, and flowers in early summer with berries from mid-summer to mid-autumn (see picture) providing food for bellbirds, tui and kereru. It is extremely good at getting established even in open pasture and damaged trees can sprout new branches. Ti kouka develop substantial root spread and root depth giving them good soil holding ability and can be planted right up to the stream edge.



Other useful plants



Horoeka, lancewood (*Pseudopanax crassifolius*)

Five years old, > 5 metres. Round headed tree up to 15 metres tall, found in forest and shrubland throughout NZ from sea level to 760m. Horoeka is tough and likes open sunlight. Its juvenile form has stiff sword like leaves, and once it reaches about five metres tall the leaves become shorter and the trunk branches.

Flowers and fruit provide food for bellbirds, grey warbler, kaka, waxeyes, and tomtit from mid-summer to mid-autumn.



Kawakawa, pepper tree (*Macropiper excelsum*)

Three years old, 1 metre. A small densely-branched aromatic tree or shrub up to six metres high that grows in shady sheltered areas throughout NZ north of Banks peninsula. Maori laid smouldering wet leaves on the ground to act as an insecticide for crops. Kawakawa flowers and fruits at most times of the year providing food for bellbird, kereru and tui. It is frost tender and needs to be planted after other species are established, at least a metre from the fence to about four metres of the stream edge.



Kohekohe (*Dysoxylum spectabile*)

A spreading canopy tree up to 15 metres high which, in the southern North Island, is found mostly in coastal forests like the Kapiti coast. Kohekohe stands out in New Zealand's flora for being winter flowering and capable of providing winter food for bellbird, kereru, tui (and kaka!).





Koromiko (*Hebe stricta*)

Five years old, 2 metres. There are over 100 species in the hebe genus in NZ. Most grow in open habitats, but some, like the koromiko, are common in shrubland and forest margins, making them a good riparian plant.

Koromiko grows up to about two metres tall, is tough, frost hardy and likes open sunlight. It flowers from late summer through to autumn attracting insects, which are food for fantails and other insect eating birds. Koromiko should be planted more than two metres from the stream edge.



Kowhai (*Sophora microphylla*)

Ten years old, > 3 metres. An elegant spreading tree up to 10 metres tall that grows throughout NZ mostly at lower altitudes at forest margins. Young plants can get eaten by rabbits and may need to be protected.

In spring, kowhai flowers produce large quantities of nectar which is extremely popular with bellbirds, tui and waxeyes. Kereru feed on the leaves and flowers. Kowhai is tough, likes open sunlight and is frost hardy when mature.



Mahoe, whiteywood (*Melicytus ramiflorus*)

Two years old, 1.5 metres. One of the commonest trees in NZ, small usually spreading tree up to 10 m high. Flowers late spring and summer with berries in summer and autumn. Used by Maori for the friction method of fire lighting.

Mahoe is tough, but can be sensitive to frosts when young. It likes partial shade and provides food for bellbirds, tui, kereru, waxeye and others. Mahoe leaves decompose rapidly, and can provide a good food supply for instream herbivores.





Pukio, sedge (*Carex secta*)

Six months old, 400 mm. One of the best known carcies, pukio forms a thick trunk (made up from old roots and stems) that can grow up to 1 m tall. The leaves and flower heads are very droopy giving it a tussock-like appearance and allowing it to hang over the water providing shelter for stream life. It is tough, likes open sunlight, and is frost hardy when mature.

Pukio can be planted right at the stream edge, but the plants need to be at least knee high (PB3 or PB5) when planted. Anything smaller will get washed out by high flows, pulled out by pukeko, or swamped by grass and other weeds.



Tarata, lemonwood (*Pittosporum eugenioides*)

Five years old, 2 metres. A lowland to lower mountain forest tree up to 12 metres tall found all over the country. Tarata is frost hardy, likes partial shade, and flowers from late spring to early summer.

Tarata develop substantial root spread and root depth giving them good soil holding ability and if bank protection is necessary, they can be planted right up to the stream edge.



Totara (*Podocarpus totara*)

Five years old, 2 metres. Totara is found throughout NZ, mostly in lowland forest on fertile alluvial well-drained soils. It grows up to 30 metres tall, likes open sunlight, is frost hardy and attractive to birds. One of the largest trees in the forest, this is the most prized tree of Maori. Its timber was the best for building massive war canoes, and it was the main timber used for carving.

Totara flowers in early summer and smooth red berries form in late summer. Totara look good planted in groups.





Advice and financial support

Private land

Greater Wellington staff are available to advise all landowners around the region about what and where to plant on streamside areas on their properties. If requested, they will prepare a streamside management plan.

In some selected catchments, Greater Wellington can provide financial support to landowners wanting to plant stream margins. These catchments were selected because the streams have high ecological value but streamside conditions in some areas of the catchment could be compromising the condition of the stream's habitat.

In the selected catchments, Greater Wellington support will cover the costs of plants, planting, and weed control for two years. After that, the plants are the responsibility of the landowners. If there are stock on the property, streams must be fenced from stock access before funding is made available.

For more information about the Riparian Management Programme, contact the Land Management Officer - biodiversity at 0800 496 734 or email riparian@gw.govt.nz.

Public land

Greater Wellington can help community groups wanting to rehabilitate or restore

- rivers and streams
- wetlands
- estuaries
- dunes and the coast

Any non-profit group can apply. The application round is advertised in all local newspapers each September. Preference is given to projects that

- help the environment over the long term
- aim to become self-supporting
- promote community involvement
- help people take more responsibility for caring for the environment

For more information about Take Care, the Community Environmental Care Programme, contact the Take Care co-ordinator at 0800 496 734 or email caregroups@gw.govt.nz.

Wetlands

Greater Wellington can help people wanting to restore a wetland on their property. Any landowner with a wetland can qualify for financial assistance and free advice, including the preparation of a wetland management plan. Information about wetland restoration is in Greater Wellington's booklet *A beginner's guide to wetland restoration*.



For more information about the Wetland Incentives Programme, contact Greater Wellington on 0800 496 734 or email wetlands@gw.govt.nz.

Consent requirements for activities in and around water bodies

Regional rule round up

There is no legal difference between a modified water course, a creek, a stream and a river. They are all “rivers” under the Resource Management Act 1991, where they are defined as

a continually or intermittently flowing body of fresh water; and includes a stream and modified water course; but does not include any artificial watercourse (including an irrigation canal, water supply race, canal for the supply of water for electricity power generation, and farm drainage canal)

A modified river is still a river. Activities in the beds of rivers need permission from regional councils, either as a regional rule or a resource consent.

Resource consents are also required to discharge any contaminant into water, wherever it is, unless there is a regional rule that specifically allows the discharge.

Regional rules are in Greater Wellington’s Regional Freshwater Plan. Here is a general description of some rules that apply, but if you want to build a bridge, culvert or stock crossing, or discharge any contaminant, read the rules on our web site or contact the Consents Help Desk on 0800 496 734.

Consent requirements apply regardless of land ownership.

Bridges and culverts

Bridges up to six metres long can be constructed over rivers without a resource consent (find out about the conditions from staff at Greater Wellington). To comply with this rule, no part of the bridge can be in the bed of the river, and the bridge must not obstruct any flood flows. A building permit may be needed if the bridge is more than one metre high (check with the Building Inspector at the city or district council).

In most circumstances, installing a culvert in a river will require a resource consent from the regional council (find out about the conditions from staff at Greater Wellington). There is information about how to design and construct culverts in Greater Wellington’s booklet *Fish friendly culverts and rock ramps in small streams*.

Artificial watercourses, such as most farm and roadside ditches, are not rivers. Culverts in the beds of artificial watercourses, or bridges placed over them, are allowed without permission from regional councils.

Discharges

Discharges into water need permission from regional councils regardless of whether the water is in a lake, a river, a creek, a wetland, a drain or an artificial water course. Discharges to water are restricted by the Resource Management Act 1991, which defines water as

(a) Means water in all its physical forms whether flowing or not and whether over or under the ground:

(b) Includes fresh water, coastal water, and geothermal water:

(c) Does not include water in any form while in any pipe, tank, or cistern.

Greater Wellington's Regional Freshwater Plan allows discharges of stormwater to water in some circumstances. Other discharges to water require resource consents.

For more information about resource consent requirements, you can contact the consents help desk on 0800 496 734, check the regional plan user guide on www.gw.govt.nz, or email regional.plan.enquiries@gw.govt.nz.

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Notes