Part 2: **Improving the stream environment**

LIVING STREAMS Handbook

Living Streams™

Environment Canterbury
Your regional council

Living Streams

Community involvement in improving the health of Canterbury waterways

What is Living Streams?

Living Streams is an Environment Canterbury programme designed to improve practices that have an impact on water quality and maintain the health of waterways.

The programme is based on building working partnerships with the community and involves identifying issues, collating local knowledge and developing practical steps to improve the health of our waterways.

Through the programme, individuals and groups are eligible for help and support to restore their streams, including:

- An assessment of the current stream health
- Advice on actions and plans to improve stream health
- Advice on funding and assistance with resource consents if necessary
- Encouragement and facilitation of wider community involvement in projects.

Although not everyone can be part of the formal Living Streams programme, Environment Canterbury's Resource Care staff will assist landowners with any projects relating to sustainable land and stream management.

This handbook was created as part of the Living Streams programme to help you to restore the streams you care about. The practical tips listed are from people experienced in stream restoration, such as landscape architects, nursery owners and community group leaders. As with all the best advice, it has been gained though practical experience.

The team at Environment Canterbury wish you the best of success for your project.

Stream definition: In this handbook we have included all of the smaller waterways under the term 'stream'. This includes farm drains.

LIVING STREAMS Handbook

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Part 2: Improving the stream environment

The following sections are supplied separately and available from Environment Canterbury:

Part 1: Investigations and planning

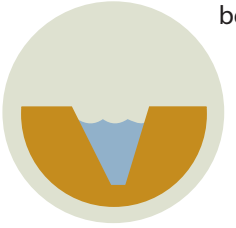
Part 3: Planting and maintenance

Case Study: Drain gets a facelift

Hinds sharemilker Ben Stock says a desire to "do the right thing" was a key motivator behind his decision to fence off and enhance plantings along a spring fed drain in Mid Canterbury.

"The drain was really ugly and full of weeds. We were spending $1000 a year cleaning it out and I felt that if riparian zones do what they're supposed to do, like creating a nice flowing stream, I would be able to reduce what I spend and help the environment."

The fences and plantings are positioned to enable the digger to reach over and clear the drain. Ben planted cabbage trees and pittosporums in groups so the digger could easily work between them. In time, when the plantings have established, there should be less drain cleaning required.



Resource consent was obtained to reshape the banks, creating a V shape which allows the water to flow faster.

"The drain was really ugly and full of weeds."

The area Ben has targeted covers about one kilometre of the drain; both sides are fenced two to three metres from the water and planted with native plants. Ben's advice: "When faced with thousands of plants, it can be daunting, collect what you need from the nursery in manageable bites."

"I'd recommend staging the plantings in 500m sections; otherwise there is too much work maintaining them. The spraying needs to be done at our busiest time of the year. If there is just a small section it is easier for me to get out and do it."

Occasionally Ben hires contractors to spray the weeds. Weed control, he says, is the key to success. "Make sure the site is sprayed at least twice before the plants go in. After planting, the first two sprays are critical."

Bank reshaping

In this section you will be asked to consider whether the banks of your stream need reshaping. Included are some tips on limiting the damage that bank reshaping can cause.

If your stream has steep-sided, unstable banks it can be useful to reshape them before you do any fencing or planting. Steep-sided, unstable banks are often encountered in drains that are regularly cleared with mechanical excavators.

Improving the slope of the banks will mean:

- Bank erosion is less likely
- Plantings are less likely to reduce the flood carrying capacity of the stream.

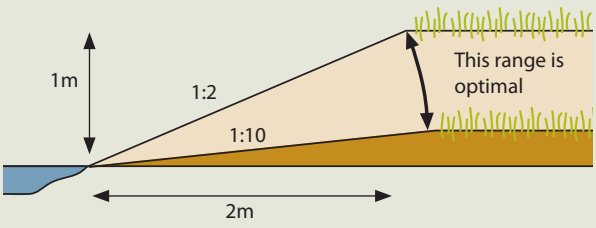
However, the process of reshaping the banks, called rebattering, may release sediment into the stream and can cause environmental damage. To make sure that best practise is followed, Environment Canterbury requires you obtain a resource consent, which guides you through the steps you can take to minimise damage.

Above right: Banks are unstable and may need reshaping.

Right: Bank has been reshaped to prevent erosion and aid planting. Note that banks are yet to be grassed and fenced.

Tips for bank reshaping

- Ideally, banks of drains should be less than 1m vertical to 2m horizontal (see diagram).
- Other waterways, such as streams, may have sections that are steep and eroding and need battering to this ratio before it is possible to plant them.
-  'V' shaped drains help water to flow faster, reducing sedimentation and weed growth. However, many species of fish like undercut banks, so consider leaving some of this habitat if you have fish in your stream.
-  Keep the riffles: riffles are areas of shallow, fast-flowing water in which the surface is rough or broken by rocks. They are the preferred habitat of many species of fish and insects. Mark these and other features that are not to be disturbed.
- Timing: to minimise the impact on aquatic life, work in non-tidal zones from November to April, and tidal zones from November to February.
- The site will be vulnerable to erosion following battering. To minimise damage, avoid rebattering long stretches at a time, sow grass seed to re-vegetate disturbed areas and exclude stock from the banks until it is stabilised.



Be very careful when removing old gorse hedges as the soil underneath is particularly crumbly and erosion-prone.

Removing Willows

Crack willows can be a problem in streams because they grow too large and:

- Cause blockages and divert flows
- Drop branches which float downstream, lodge and re-grow
- Suck up water, reducing flows
- Shade out plantings.

In addition, they are often in the way of sensible fence lines. However, they protect the stream bank and bed from erosion, and their removal disturbs sediment. This section will give you some tips on limiting the damage that willow removal can cause.

Get a professional

If possible, get an experienced person to help you with your willow removal, especially for the really big trees. Willows are notoriously dangerous to fell.

In this photo willows were completely removed leading to erosion.

A strategy for willow removal

1. Clear out the understorey of small willows taking care to also remove all green woody material from the ground, such as willow branches and twigs. It is best to chip these and take them away, but alternatively you can just pile them up somewhere on site. This minimises the contact the bits of willow have with the ground and therefore the amount that sprout new shoots.
2. Leave an intact canopy of stable, straight willows. Taking out all the willows opens the ground to weed invasion. It may be necessary to remove some trees that are in the way of sensible fence lines, and are at risk of falling over and breaking fences or blocking the stream.
3. Plant native plants underneath the willow canopy. Refer to *Planting & Maintenance booklet,* pages 10 and 11.
4. When your native plants are well established and a canopy of native plants is formed (5-10 years), kill the standing willows by drilling or hacking into the base and poisoning with glyphosate. Make sure you correctly follow the instructions and safety requirements of the herbicide. Note: If your natives are having trouble growing under the willows due to lack of sun, it may be necessary to remove some trees or branches to let in some light.
5. If you want to, wait until you are certain that the willows are dead and then fell them. It can take several months for them to die completely. It is important to either be trained or use a trained person for tree felling as it can be very dangerous. Don't worry about damaging the native plants as they will soon recover and fill in the gaps. It isn't necessary to remove or further break down the dead willows as they will not re-grow and will quickly rot.

A resource consent may be required for the removal of willows. Refer to *Living Streams Handbook*, page 12.

For notes on other weed control methods see *Planting & Maintenance booklet,* page 13.

Look for threatened plants: it is surprising how many threatened plants show up before any work begins, especially in overgrown and forgotten willow swamps. If a site is cleared and chemical is sprayed around all these precious and usually quite inconspicuous gems will be lost.

Above: Stumps are left to prevent bank erosion.

Below: Understorey willows removed and natives planted.

Are you in a river rating district?

These areas have special management plans aimed at reducing the risk of flooding. If your stream is in one of these districts you may be eligible for financial assistance to help with willow removal.

Contact Customer Services at Environment Canterbury to find out if you are in a river rating district and get advice. Phone 0800 324 636.

Fencing

Does the stream you want to improve run through a livestock farm? Fencing off a vegetated strip next to the stream creates a buffer, filtering land run-off before it reaches the stream.

Fencing also prevents stock from defecating in the stream and stirring up sediment, major causes of stream pollution.

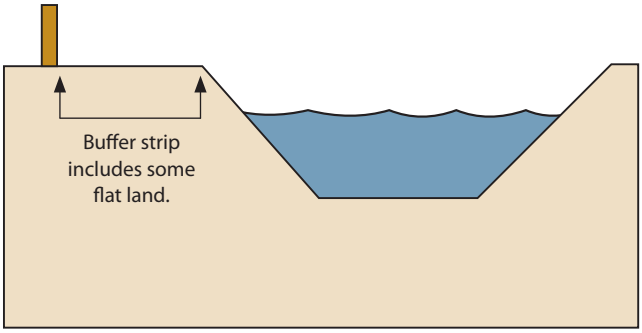
This section will guide you through the many things to think about when positioning a fence along a stream; read carefully – once up, fences seldom get moved.

Choosing a fence line that make sense

Within reason, the wider the buffer between stock and the stream the more effective it will be in filtering run-off.

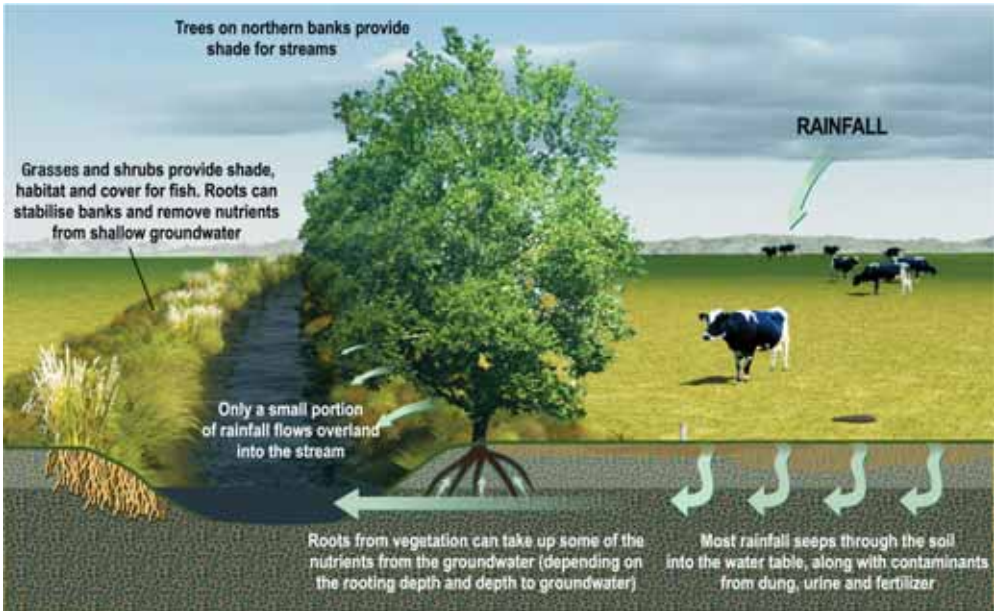
The following sections will help you decide how wide a buffer to leave, based on the unique conditions of your project or the amount of 'threat' to the stream.

1. Position fences according to the slope of the land



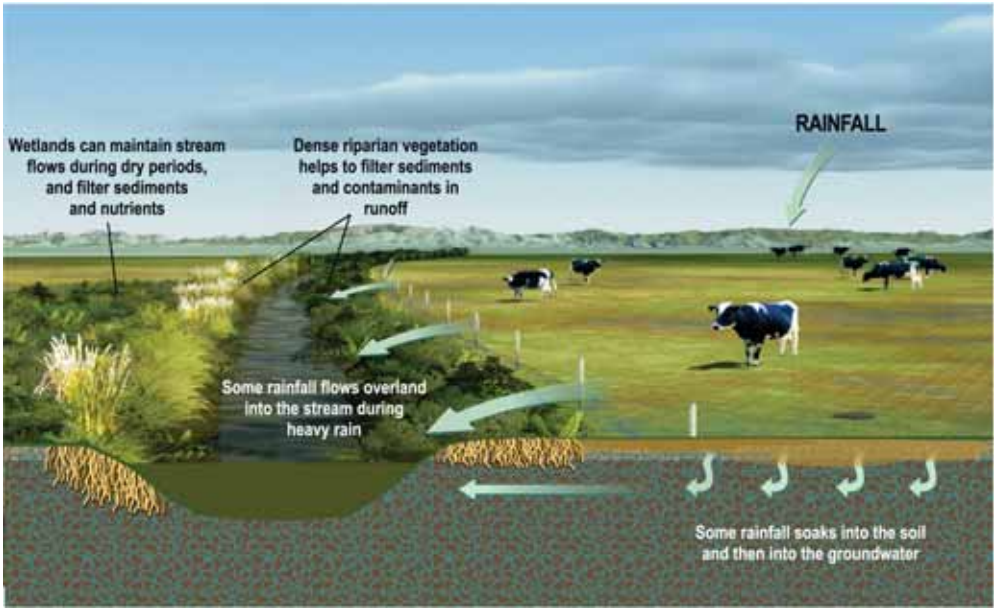
- Where practical, position fences to include some flat land next to the stream. Run-off moves more slowly across flat land than sloping land, allowing more time for it to soak in.
- The steeper the slope draining into the stream, the wider the buffer width needs to be. As a rough guide, fence off 3m for slight gradients, 3-5m for gentle slopes and 10-20m for steeper land.

2. Position fences according to the soils drainage ability



Free-draining soils

- In free-draining soils (above) most water will move through the soil and into the shallow groundwater then into the stream. The roots of riparian plants can help remove nutrients from shallow groundwater before it reaches the stream.
- Position fences to leave a minimum buffer width of 2m on flat, free draining ground.



Poorly drained soils

- On poorly drained soils, most water will flow over the surface of the ground, carrying soil and nutrients directly into the stream.
- Position fences to leave a minimum buffer width of 4m on flat, poorly drained soils.

Carex plants helping to filter run-off and shade the stream.

3. Position fences according to what you plan to plant

Consider if you will be leaving a grass margin or planting native plants.

Although it looks untidy, long grass does an excellent job of filtering sediment and nutrients from paddock run-off.

Native plants on the other hand shade the stream. This cools the water, reducing weed growth and providing better conditions for stream life. If you can only plant on one side of the stream, plant the north side as this provides more shade.

Think about which plants you plan to use: some need more space than others, and some need to be planted further back from the water than others. This will affect where you put the fencelines.

Small plants

When planting small plants, such as the native sedge *Carex secta* and *Coprosma propinqua*, a 2m wide buffer may be wide enough.

Large plants

When planting large plants plan to leave enough space, for example:

- Toitoi: 2.5 - 3m buffer
- Flax: 3.5 - 4m buffer
- Shrubs: 3m buffer
- Narrow trees (e.g. cabbage tree and ribbonwood): 3m buffer
- Other trees: 4m buffer

Refer to *Planting & Maintenance booklet*, page 12 for more information.

The 1.5m rule

As a general rule, don't plant within 1.5m of the fence, otherwise as they grow, plants can short out electric fences. Exceptions may be made when planting narrow plants such as cabbage trees, ribbonwoods and lacebarks.

Plants correctly planted 1.5m from fence to allow space for growth.

4. Position fences to allow for natural waterway changes

Set permanent fencing back far enough to allow for bank erosion or for changing stream meanders, particularly in wide flood plains of U shaped valleys.

5. Be careful about fencing in flood prone areas

Erect permanent fences above any flood prone areas and fence parallel with the way the stream floods, so the fence does not collect debris.

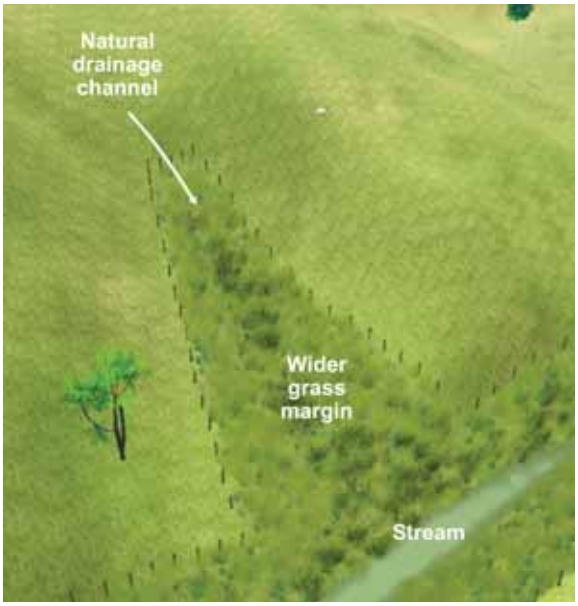
6. Fence off low spots

Land run-off usually flows into a stream at low points. For example, water is channelled into naturally lower points in times of high rainfall; border dyke irrigation drains to low points and natural drainage channels form in the hill country.

These low points may contain wetlands, which also help remove nutrients and sediment from run-off. Consider fencing off these areas.

Above: Low points in paddocks are best fenced off.

Below: Natural drainage channel fenced off.



7. Fence off springs and drains

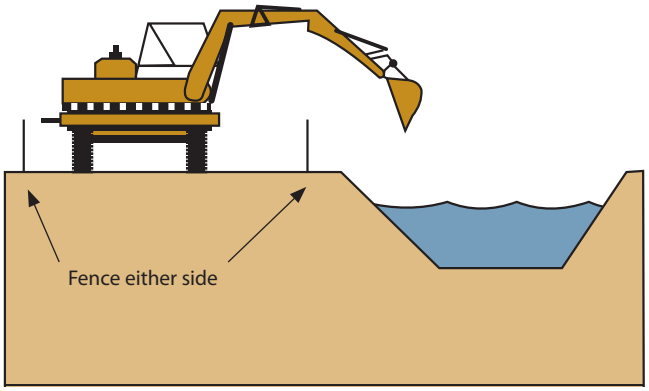
Excluding stock from springs, and drains that feed into streams, is particularly important. If stock defecate in these, the water quality of the whole stream is affected.

8. Where necessary, leave access for diggers

Drains, and streams in drainage schemes, may need to be mechanically cleaned from time to time to remove weeds, silt or debris. Planting and fencing can restrict access for drain maintenance.

Options for streams that require mechanical maintenance:

- Position a fence so that a digger can reach over the top and clear the channel. Plant low growing plants or leave a grass margin between the fence and the stream.
- For bigger streams, place a fence far enough back to allow a digger to work between the fence and the bank. Plant the bank with low growing plants or leave a grass margin. Taller species can be placed on the other side of the digger track, well away from the water.
- Use a temporary fence and leave gaps in plantings to allow the digger to get to the bank at certain spots.



South side is best for diggers

Plants on the north side of streams provide more shade to the stream when planted. It is therefore recommended that if you need to choose one side for digger access, you choose the south side.

- If drain clearance is an issue, talk to the Environment Canterbury river engineers.

9. Be careful fencing along stop banks

Environment Canterbury river engineers drive along the side of stop banks to check they are in good condition. For this reason they prefer that fences or plants are not placed on, or 3m either side of, the stop banks. Tree roots can also affect the structure and integrity of stopbanks.

The right fence for the right job

A sturdy well-maintained fence designed to suit your stock types is essential. One sheep or cattle beast getting though your fence can set your plantings back by years!

If you're running sheep or goats, you'll need a conventional post and 7-8 wire fence (preferably with netting).

Conventional fencing is also the safest option for cattle. A well-maintained three-wire electric fence can be a cheaper option for cattle, providing the power source is consistent and the fence is checked regularly.

An electrified outrigger can be a good idea for both cattle, horses and goats to reduce fence damage and rubbing and leaning. If you're running deer, you will need a more expensive two metre mesh deer fence (adapted from *Managing your bush block*. Appendix).

For a discussion on the uses and relative costs of the various types of fences refer to Appendix 'QE11 Covenant fencing: relative costs'.

When fencing flood prone areas:

- Use fewer uprights and less wire – this way less debris will catch. Do not use netting.
- Put wires on the downstream side of posts so the staples pop and the wire drops rather than rather than pulling out the posts and strainers.
- Use un-barbed staples so wires can pop more easily.

Refer to the *Planting & Maintenance booklet*, pages 8-11 for information on plants that can be planted in flood prone areas.

Stock water options

Now that you've fenced off the waterway, what are the stock water options?

Troughs

Putting in a reticulated stock water system can be expensive but costs will be offset by improved stock health and productivity.

Putting in trough water also allows you to deliver animal remedies and supplements though the trough water systems.

Troughs keep stock out of the stream.

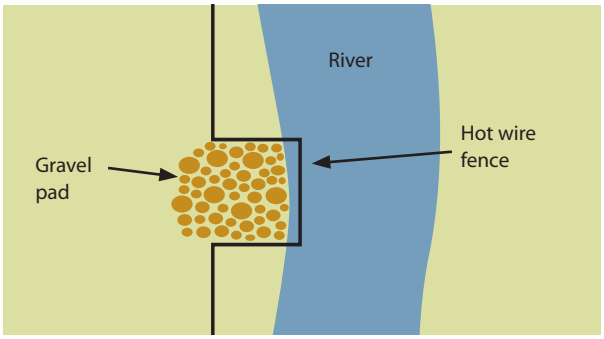
Alternative to troughs

If it is not possible to put in troughs, consider limiting the access for stock drinking.

When choosing the access points, avoid the outside of the bend. Here the water flows faster and the bank is the most prone to erosion. Banks on the inside of bends are less erosion-prone and usually shallower. Avoid positioning access points on steep banks.

At access points try setting fences so stock can reach their heads under the fence to drink, but can't get their hooves in the water. Gravel the area the stock will be standing on.

Note: This is not advised for large numbers of animals.



Stock crossing options

If stock are regularly walking through the stream, they will be making a mess of it. One study found that a 246 cow herd deposited 37kg of faecal matter during two crossings of a stream. They concluded that cows are 50 times more likely to deposit their waste in a stream than on a stock lane (Davies-Colley et al. 2002. See Appendix). Install a culvert or bridge and limit the mud and animal waste going into the stream.

Culvert or bridge?

Bridges generally have less impact on stream banks, stream beds and water flow than culverts. They can be expensive but will often be a sound investment because they generally require less maintenance and can provide many benefits for farm infrastructure.

Culverts can be a cheaper option for streams that don't carry a lot of sediment and don't flood too high. They need to be chosen carefully and installed well to avoid causing erosion and restricting fish movements.

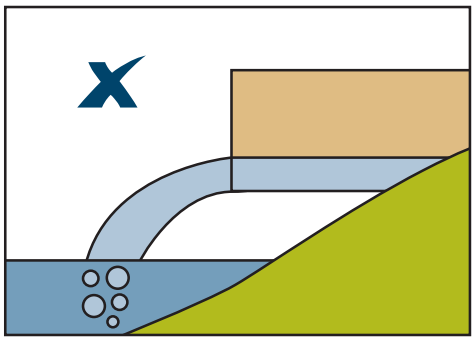
Although installing a bridge or culvert may soon become a permitted activity, currently a resource consent is required. In your application consider the following principles:

Getting culverts right

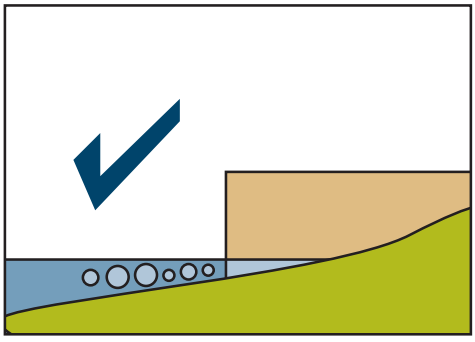
Correct size and installation will generally save money in the long term as culverts will be less likely to fail and need replacing.

- Putting in the right size culvert is important. If you get it wrong you will restrict flood flows, often leading to flood water bypassing the culvert or shifting it. Make the culvert as wide as, or wider than, the average width of the stream. If there is a culvert upstream, look at its size and make yours one size bigger.
- Position the culvert so that it is on the same angle and direction as the stream.
- Allow natural stream bed material to settle on the culvert floor along its length so that it is easier for fish to swim through.

- Use armouring material, such as rocks, around the culvert and especially below the outlet to reduce erosion.
- Consider building a spillway for extreme floods. Talk to Environment Canterbury or an engineer for design advice.
- Where possible set the floor of the culvert below the streambed level. Waterfalls increase the chance of erosion and prevent fish swimming upstream. If an existing culvert has such a drop, build a simple rock ramp for fish.



Culvert at wrong level



Culvert at right level

Building better bridges

- Construct your bridge high enough to avoid blocking high stream flows.
- Minimise your bridge span to keep the costs down.
- Construct raised lips on the edges of the bridge to prevent run-off into the stream.
- Channel run-off from the bridge into grassy filter areas.

Maintenance

Maintenance of grass margins

If you have decided to leave a grass margin, rather than plant the margins of the stream, there will still be some maintenance requirements. Check for weeds such as gorse, broom, hemlock and blackberry. Be prepared to clear weeds at least once per year.

Managing weeds in stock-free areas

Water weeds (e.g. water cress, monkey musk and floating sweet grass) can increase dramatically in slow flowing streams where stock are excluded. This can raise water levels by 50cm, which may be a problem in some areas.

Short term:

More frequent drain/ stream clearing may be necessary in the first few years after fencing. Refer to page 11 for advice on leaving digger access.

A weed cleaning rake bucket minimises damage.

Medium term:

Fewer nutrients and less sediment entering stream should lead to slower water weed growth. Streamside grasses and sedges along narrow streams may reduce light sufficiently to control instream weed growth.

Longer term:

Establishing trees and shrubs will reduce light levels and thus stream weed growth.

Mechanical drain maintenance

If you clear weeds using an excavator, don't clear too close to the edges of the stream, otherwise you will undercut the bank and lose plants. Use a weed clearing rake bucket. Give clear instructions to the digger operator.

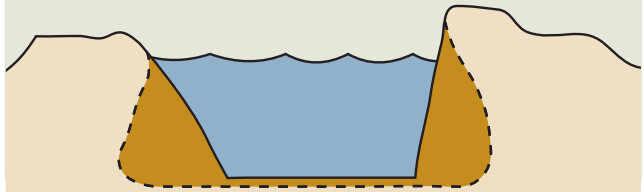
In non tidal areas, October to April is the best time to carry out drain maintenance as it will have the least impact on fish and birds. In tidal areas, October to February is best. If you suspect you have the endangered Canterbury mudfish in your drains contact Environment Canterbury or the Department of Conservation for advice on maintenance. Mudfish need aquatic plants to live in and feed off.

Take care when clearing drains

Key

Excavation close to the bank edge has led to banks becoming undercut and unstable.

Best practice excavation not too close to banks.



Bank has been undercut and the cabbage tree is vulnerable to falling in.

Appendix

Covenant fencing: Relative costs

This guide shows relative costs for effective fence designs that provide QEII covenant protection. As well as materials and labour, factors that affect costs include stocking regime, terrain, climate, soils and location. The less complicated the fence, the lower the labour costs. Post digging, battens, electric outriggers and electric wires all add to labour costs.

Electric — *Lower cost*

Rangitikei forest remnant: 4-wire (all electric) fence.

Uses
- Dairy/cattle stocking regime
- Flat country
- Forest in good condition
- Wetland
- Easily monitored areas.

Points
- Maintenance programme needed to keep wires, posts and connections in good condition.
- Voltage along the fence needs to be checked regularly.
- To limit short-outs, spray or slash vegetation off wires. Fewer wires (2–3) allow stock to trim vegetation through fence.
- Use only where common on rest of farm (as stock are trained to them).

Whangarei riparian margin: 2-wire (all electric) fence.

Netting — *Medium cost*

Masterton lowland forest: netting with 1 electric wire.

Multiple uses
- Especially sheep stocking regime.

Points
- Discourages pests such as pigs, goats or deer.
- Suitable to use with Y posts in drier areas.
- Barbed or electric wire reduces stock pressure.
- Can corrode in coastal situations.
- Less suitable for strongly undulating terrain.

Banks Peninsula penguin habitat: netting fence.

Y Post — *Medium cost*

Horowhenua podocarp remnant: Y posts with electric outriggers.

Uses
- High country
- Rocky soils
- Drier areas
- Sheep stocking regime.

Points
- Reduces the need to dig post holes.
- Easy to electrify.
- Suitable to use with netting.
- Easy to use as tie-downs.
- Will not burn in a grass fire.
- Electric outriggers or barbed wires discourage cattle pressure.
- Can pull or loosen in wet soils.
- Can corrode in coastal situations.

Central Hawke's Bay totara-beech remnant: 6-wire Y post fence.

Post and Batten — *Highest Cost*

Hastings forest: 8-wire (1 barbed) post and batten fence.

Uses
- Sheep stocking regime
- High stock pressure
- Vulnerable rare/threatened plants.
- Remote locations.

Points
- Wires must be on the outside of the posts (the animal side).
- Electric or barbed wires can deter stock pressure.
- Around bush it is easier to repair a fence without battens, especially when damaged by a treefall.
- May not be suitable for unstable ground.
- Having more wires e.g. 8-9 is cheaper than using battens.

Franklin kauri-broadleaved forest: 8-wire (1 electric) post and batten fence.

– A QEII document. For more information visit www.openspace.org.nz

Funding

Environment Enhancement Fund (EEF) and Honda TreeFund

Environment Canterbury has a contestable fund that can assist with individual or group project costs within the Canterbury region.

The fund is operated annually to encourage a range of biodiversity initiatives on private land.

Projects funded in the past have included fencing streams and riparian enhancement and planting. Grants up to a maximum of $5000 per property are available, with financial assistance normally covering 50% of the plant and fencing material costs.

Criteria for EEF funding

Land ownership: Projects should generally be on private, customary or coastal land.

Project ownership: Group projects need identified leadership.

Geographic spread: The aim is to ensure a fair distribution of projects across the Canterbury region.

Representativeness: The extent to which an area represents a habitat type or ecosystem that is typical of the area concerned.

Ecological context: Projects must provide a benefit to indigenous biodiversity and play an important role in the health of the wider ecosystem over the long term.

Criteria for Honda TreeFund

To qualify, projects must use New Zealand native trees to support any of the following:

- Establishment of native tree populations
- Water run off control
- Erosion control
- Regional parks or other planting for beautification
- Biodiversity protection and restoration
- Urban stream enhancement
- Coastal protection and restoration planting
- The Cancer Society SunSmart Schools Accreditation Programme.

Characteristics of a successful application

Successful applications in previous years have included a wide variety of projects. Some characteristics of these applications you might like to consider when writing your application are:

- A clear description of the project and the works proposed
- A well prepared project management plan
- A realistic timeline over which the project would be complete
- An outline of the probable maintenance requirements and who would be responsible for these
- A realistic costing for the project.

Timeframe

June – EEF and Honda TreeFund opens

End of August – applications to the Fund close.

December – decisions announced and funds made available to successful projects early the following year.

How do I apply?

Funding applications must be made on the Environment Enhancement Fund form. For more information, or to request an application form, phone (03) 353 9007 or toll free on 0800 324 636. Applications may be downloaded from http://www.ecan.govt.nz/About+Us/Awards/

Other funding opportunities and advice

Below is a list of other funding opportunities for stream restoration projects.

For further information go to the Funding Information Service (FIS) website www.fis.org.nz.

Biodiversity Condition Fund

Department of Conservation/ Ministry for the Environment

Phone: 0800 862020

Email: biofunds@doc.govt.nz

The Pacific Development and Conservation Trust

Phone: (04) 495 9387

Email: trusts@dia.govt.nz

Habitat Protection Fund

Phone: (04) 499 2930

Email: info@wwf.org.nz

Lottery grants – Environment and Heritage

Phone: 0800 824 824

Email: grantsonline@dia.govt.nz

Nature Heritage Fund

Phone: (04) 471 0726

Email: NHF-Admin@doc.govt.nz

Sustainable Management Fund

Phone: (04) 437 7400

Email: funds@mfe.govt.nz

BOC Where There's Water Community Environmental Grants

Phone: 0800 111 333

Email: wtw@nzwwa.org.nz

District councils

Some district councils also have funding available.

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