

Selwyn – Waihora

A guide to managing your drains



Sustainable Drain Management in Selwyn-Waihora

“Healthy waterways within productive land”

March 2017

This guide is being updated to reflect recent changes to the regional plan and new resources now available to help with drain management and riparian restoration.

If you have identified ecological values and mahinga kai sites* on your property, good drain management practices will help you meet the management objectives in your Farm Environment Plan.

There is some drain management advice included Environment Canterbury's [Code of Practice for Defences Against Water](#), which applies primarily to work being carried out by local authorities, but which also represents good practice for the management of smaller private drains:

- Plan work to avoid any adverse effects on the habitat, spawning times or migration of native fish.
- Check worksites before starting work for any native nesting birds. If present, plan work to avoid disturbing them.
- Plan work to avoid disturbance to key mahinga kai species including koura (freshwater crayfish) and kākahi (freshwater mussels), wherever practicable.
- Plan work to avoid disturbance of native fauna and key habitat for species such as lizards as far as practicable.
- If there is potential for fish to be stranded, have someone to recover fish and return them to an undisturbed area upstream during the work and for at least one day after work has been completed.
- Consider using native vegetation to restore areas of vegetation disturbance, to stabilise the banks and control erosion.

**Mahinga kai relates to the traditional value of food resources and their ecosystems. It refers to customary gathering of food and natural material, and the places where those resources were gathered.*

Contents

Introduction	1
Selwyn-Waihora drainage network	2
Opportunities	3
Common issues – possible solutions	5
Managing your drains	9
Riparian restoration – step by step to successful planting	11
Costs and benefits of improved drain management	15
Further information	18
Glossary	18
Acknowledgements	18
Our key messages	19
Planting project worksheet	20

Contact information

This guide has been produced as part of the Sustainable Drain Management Project – a partnership led by Waihora Ellesmere Trust with assistance from local farmers, Environment Canterbury, Selwyn District Council, Ngāi Tahu and Lincoln University. The Department of Conservation and Fonterra, with their Living Water Project, are also involved.

This guide will be updated as we receive feedback and source further information. Please let us know if there is anything you think we have missed.

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Introduction

Burnham School students planting at Coes Ford, 2011

The land surrounding Te Waihora/Lake Ellesmere has many natural springs and streams, modified waterways and constructed drainage channels. These combine to form a complex interconnected network that ultimately flows into Te Waihora/Lake Ellesmere. How this drainage network is managed can have a huge impact on the water quality and habitat of the lake and tributaries.

Around the catchment, many groups and individuals have made huge efforts over recent years to improve water quality and habitat. Lots of fantastic initiatives are underway and this guide is one way to share information and experience - to encourage and support more people to play a part in enhancing the environment of the lake and surrounding areas.

This guide is for anyone who has a role in managing drains and streams around the lake – that includes farmers, those on lifestyle blocks, and the staff from the councils and other agencies who can influence how waterways are managed. We'll present an overview of some of the opportunities and point you in the right direction for more detailed information

We're bringing together information and ideas collated over the last two years by a project team led by Waihora Ellesmere Trust (WET) with local farmers, Environment Canterbury, Selwyn District Council, Ngāi Tahu, and Lincoln University.



Te Waihora/Lake Ellesmere is the fifth largest lake in NZ and hugely significant for wildlife, fisheries and its value to Ngāi Tahu. To find out more about the lake visit www.wet.org.nz



Drainage is vital for agriculture and other land uses. The starting point for this guide is that the drainage function of the waterways must be maintained or enhanced. However, it is possible to have effective drainage and also improve water quality, biodiversity, recreation opportunities and restore some of the values of local iwi.

Read on to find out more about the drains, opportunities for improving drain management, and practical advice on how to get started.

Selwyn- Waihora drainage network

Land around the margins of Te Waihora/Lake Ellesmere is divided into several drainage schemes. Within each scheme 'classified drains' are managed for land drainage and, in some cases, flood protection by the district or regional council (or a committee of local landowners managing the scheme on the behalf of the council). Landowners in each drainage scheme pay a targeted rate, to either Selwyn District Council (SDC) or Environment Canterbury (ECan), to cover the costs of managing the schemes. **All landowners must ensure access for drain clearing is maintained** and that their activities do not cause drainage problems upstream or downstream of their land.

In total there are several thousand kilometres of classified drains, small channels which flow into the larger drains (although are dry for much of the year) and tile drains (subsurface drains) surrounding Te Waihora/Lake Ellesmere. The main focus of this guide is open drainage channels and options for improving their management.

Drains vary hugely, from the main stem of rivers such as the Halswell River, which carry significant amounts of water year round, to the shallow depressions in paddocks which are dry for most of the year but channel paddock runoff during heavy rain events. The way all of these drains are managed determines the water quality of downstream waterways and Te Waihora/Lake Ellesmere.



Halswell River

Much of the network of drains around Te Waihora/Lake Ellesmere is on relatively flat land. This means that the sediment and contaminants entering the waterways tend to settle, smothering habitats and the species that live there. Nutrients encourage excessive weed growth making drain maintenance an ongoing challenge. There are no one-size-fits-all solutions when it comes to managing drains; it depends on the type of drain, what you are trying to achieve, and what resources you have available.



Typical drain along a field boundary



Shallow depression or swale channelling runoff into drain

For more information about the schemes managed by SDC see their [5Waters Activity Plan, Part 3, Te Waihora – Stormwater, Water Races, Land Drainage](#).

For more information about the Halswell scheme, including the effects of the earthquakes, see ECan's report on [Reinstating the Halswell River after the earthquake](#).

Opportunities

An effective and efficient drain can be much more.....

Biodiversity

Biodiversity describes the variety of all biological life – from micro-organisms to plants, animals and fungi, their genes, and the ecosystems they form. It is part of the natural heritage and unique character of where we live. Across the Canterbury Plains native biodiversity has been almost completely lost, with only a few fragments of native vegetation remaining and much habitat for our native birds and insects lost. Wetlands have been drained and waterways modified¹. Drains are often the last refuges of wetland plants and habitats.

Drains are living systems and provide valuable habitat for the plants and animals that live in and near water, including a number of fish species. The riparian zones – the banks of waterways and areas surrounding springs and wetlands – can provide habitat for birds and insects and can form important corridors of biodiversity across the plains. Encouraging native biodiversity will increase birdsong and allow beneficial insect populations to thrive.



Recreation

The larger drains – the streams and rivers of the lower catchment – and Te Waihora/Lake Ellesmere provide many opportunities for locals and visitors to enjoy a range of recreational activities. These opportunities are enhanced by a healthy natural environment and some, such as swimming and boating, depend directly on the water quality.

The lake and environs is a very popular location for waterfowl hunting and various types of fishing. Rivers and streams flowing into Te Waihora/Lake Ellesmere were once world renowned as a trout fishery but this has declined drastically over recent decades. One of the major causes of this decline is believed to be the loss of suitable spawning areas as fine sediment clogs up gravel beds of drains, streams and rivers².

Healthy waterways and thriving corridors of biodiversity add to the enjoyment for the thousands of people who walk, cycle, picnic, fish and hunt around the lake and tributaries.

¹

<http://ecan.govt.nz/publications/Plans/BiodiversityStrategyFinalFeb08.pdf>

² <http://www.wet.org.nz/wp-content/uploads/2009/10/Ch06-Brown-trout-fishery.pdf>



Ngāi Tahu

Māori occupation around Te Waihora and ensuing Ngāi Tahu settlement has positioned Te Waihora as a significant part of the iwi's heritage. To Ngāi Tahu Whānui, Te Waihora represents a major mahinga kai and an important source of mana. Te Kete Ika a Rākaihautū – The Fish Basket of Rākaihautū – is the original name for the lake. Clean water and the healthy plants and animals of the lake and tributaries are necessary for the customary gathering of food and natural materials. Maintaining customary use and access is of great importance to Ngāi Tahu.

Amenity

Clean water and diverse native riparian habitats can contribute to people's general enjoyment and appreciation of an area where they live, work or play. Many people believe that land sells more readily and property values will be increased by fencing and planting riparian areas³.

Ki uta ki tai - from the mountains to the sea – is central to Ngāi Tahu resource management philosophy. It is a way of understanding the natural environment, including how it functions, how people relate to it and how it can be looked after appropriately



Good riparian (streamside) plantings buffer the stream from farming activities.

Tussock sedge (*Carex secta*) planted to overhang the water will hold the bank together and control the growth of water weeds.

³ Report on Soil Conservation and Waterway Protection in Middle Waikato, Environment Waikato 2005.
<http://www.waikatoregion.govt.nz/PageFiles/3364/tr05-14.pdf>

The drainage network – common issues, possible solutions

Water Quality

The cumulative impacts of land use adjacent to the drainage network over many years has resulted in poor water quality in Te Waihora/Lake Ellesmere and in the drains, stream and rivers that flow into it. High levels of nutrients such as nitrogen (N) and phosphorus (P) contribute to occasional algal blooms and affect the flora and fauna. Microbial contaminants from stock, indicated by the presence of *E. coli*, have made many favourite swimming spots unsafe. Nutrients and contaminants can enter the drainage network through surface run off and stock access to parts of the system.

Where stock are in or near the water there will be increased faecal contamination and raised nitrogen levels. Sediment is the main source of phosphorus in the waterways. Although some of this sediment is a result of natural processes, particularly near the Port Hills, run off from pastures and erosion in and around waterways are also major contributors. Smaller drains, channels, low points and gullies, are often overlooked but can have the greatest impact on water quality⁴. Smaller channels are often unfenced, allowing sediments and other contaminants to move freely into the larger drains.

Possible solutions

Dealing with problems at source will always be most effective – that means

employing good practice in managing effluent and irrigation. However, mitigation measures around waterways can be part of the solution.

Fencing of all waterways, including the smaller side drains and low areas where paddock drainage enters a waterway can drastically reduce the inputs of sediment and other contaminants. Where possible, focusing on the smaller side drains is recommended as this will have the greatest influence on downstream waterway health.

⁴

http://www.biol.canterbury.ac.nz/ferq/MacKenzie%20project/PDF/Handouts/Riparian_management.pdf



Establishing buffers of appropriate vegetation along waterways and around wet areas will intercept surface runoff which slows water movement allowing sediment to drop out. This will reduce the amount of sediment, and therefore phosphorous, getting into drainage channels and will also provide some shade. Any planting needs to be well designed to maximise effectiveness. Where smaller channels, depressions or gullies are discharging to drains, consider constructing small wetlands to slow water flow, remove sediment and improve water quality. These can be designed to accommodate travelling irrigators if necessary.

Excessive sediment and weed

growth

Cultivation too close to a waterway can lead to excessive sediment entering the waterway.

Some weed growth will provide food and habitat for fish and other species but excessive growth of species such as monkey musk (*Mimulus guttatus*) causes problems. Where there is no shade, invasive water weeds thrive and water temperature rises, leading to lower oxygen



levels and damaged habitat for fish and invertebrates. Weeds can trap sediment and reduce the capacity of the drainage system at times of peak flow.

Possible solutions



Shade from trees can control rampant water weed growth. Shade at the point where the water meets the stream bank can reduce germination of weeds and the amount of weed growth across the channel. Planting with suitable species, such as sedges which overhang the water (*Carex secta*), and planting on the northern bank to maximise shade, can reduce weed growth and the need for regular cleaning. The aim is not to shade out all water weeds, as they provide habitat for many species, but to reduce the areas of excessive growth. A well designed buffer of vegetation will also reduce the amount of sediment reaching the drain, further reducing the need to clean.

Habitat loss and disturbance



Many drains with year round flows are often cleaned annually with an excavator to remove weeds and sediment build up, ensuring water continues to flow freely, reducing the risk of flooding. Regular disturbance of the channel damages habitat, disturbs nesting birds, disturbing areas where fish feed and spawn. Drain clearing done at the wrong time dislodges fine sediment, causing downstream problems and can smother spawning areas for native fish and trout. Eels and other species can be dragged out by the machinery and left stranded on the banks.

Possible solutions

If drains need to be cleaned consider using low impact methods. For smaller drains walking up the channel in waders may be enough to create a fast flowing zone in the centre of the channel. Consider cutting weeds by hand and remember to remove any cut vegetation (if left in the creek it will rot reducing oxygen levels in the water).



Riffles are important habitats for stream life

- *The female trout stirs up the gravel, causing material to be washed downstream and leaving a clean, well-oxygenated gravel bed for the eggs. Any sediment deposition caused by drain clearing at the time will re-block the spaces around the gravel, cut oxygen supplies and reduce the chances of the eggs' survival.*
- *Elvers (baby eels) also live in the riffles, staying there until September or October.*

If using machinery, inspect the drain with the operator before clearing to identify any features such as riffles or habitat of threatened species like Canterbury mudfish (*Neochanna burrowsius*) which should be protected. Make sure the operator is aware of any planting that has been carried out on drain banks.



Careful clearing of a narrow channel can minimise disturbance to the banks and using an excavator with a weed rake or stream cleaning bucket which lifts weed up and over, rather than scraping up the bank, will reduce damage and allow water and organisms to escape back into the waterway.

In some drains, creating a sediment trap could be a helpful option. An area can be excavated where sediment will collect. This will need to be cleaned out periodically, but will cause less disturbance to habitat than cleaning a long stretch of the drain.

Timing for drain clearing

Think about the timing of work on drains to minimise impact on birds and fish. In smaller drains and those which are some distance from the lake only use excavators between November and April. This avoids disturbance of trout spawning (May – October) and also reduces disturbance to elvers (baby eels) that live in the gravels until September or October. In the lower reaches of any drains flowing into Te Waihora/Lake Ellesmere there may be inanga (whitebait) spawning in February and March and so there it is advisable to avoid any disturbance from February right through to November, only cleaning drains in December and January.

Loss of bank stability

Where drain banks erode or slump, large amounts of sediment can enter the system, affecting water



quality and contributing to lower capacity at times of peak flow. There are a number of things that can affect stability.

- Repeated cleaning can over widen and deepen channels, slowing water movement which in turn can lead to more sediment deposition and weed growth.
- If banks are undercut, the loss of stability can lead to erosion and further sediment entering the waterways.
- Blanket spraying of all vegetation on drain banks can cause a loss of stability as the plant roots which are holding the bank together are killed.

Possible solutions

It's important to take care with machinery and avoid over widening, deepening and undercutting of banks. A V-shaped channel will help bank stability and the establishment of vegetation. This will also create faster water flow in the centre of the channel which will reduce weed growth. Rebatting or reshaping of the banks can increase the flood capacity in times of peak flow and provide a great environment for establishing a buffer of vegetation.



Planting of drain banks can stabilise the bank and add biodiversity and shade. Where possible, use species native to the area and ensure the right plants are planted in the right place. Good planting can (particularly if it is on the northern bank of a drain) reduce the establishment and growth of invasive weeds which germinate and thrive in sunlight. This is one way of reducing the need to regularly clean a drain and will lessen the impact on the environment and also reduce the cost of drain maintenance.

For smaller waterways plant shrubs and grasses, avoiding species which may get too big.

Willows

There are some varieties of willow which have value for river protection work but the grey willow (*Salix cinerea*) and crack willow (*Salix fragilis*), which are common throughout the catchment and were often planted to stabilise stream



and river banks, are problem species. They can grow vigorously and spread, causing blockages, flooding and, in dry periods, use up water reducing the flows in waterways. Grey willow in particular is a problem as it spreads rapidly from windborne seeds, covering large areas of ungrazed land very quickly. Be sure to control any female grey willows immediately to avoid seeding.

As crack willow is male it will only spread from broken off fragments which drift downstream and take root.

Possible solutions

Removing willows is generally the best long term option around lowland drains. Get advice on willow removal, particularly for the larger trees – they can be dangerous to fell. Stumps should be left in place to prevent bank erosion.



Grey willow catkins – female on the left, male on the right

To summarise

<i>issues</i>	<i>Solutions</i>
Water quality	Exclude stock, plant buffers and construct small wetland areas in the low points and gullies
Excessive weed growth and build-up of sediment	Careful cleaning - see suggestions above Planting drain banks to create shade and intercept sediment
Habitat disturbance	Low impact cleaning by hand Identify and protect areas of high value Use a weed rake Carry out work in December and January (November – April if well away from the lake)
Loss of bank stability	Rebatter steep banks to create a V shaped channel, plant banks
Willows	Remove, leaving stumps in place

Managing your drains

Prepare a plan – do a stocktake of your drains and identify your objectives



It is a good idea to start off with what you know – what are the characteristics, including the likely peak flows, of your drains and how are they being managed now? What area of land is being drained, what is the land use, and are there opportunities to make changes? Is there a particular problem, or problems, you are trying to address and, if so, do you know what is causing or contributing to the problem?

Prioritise any work you are planning.

It's fine to tackle a project in stages over a few years. Consider starting with the smaller drains and low spots that discharge the most sediment and runoff to the bigger drains – this will make the biggest difference to water quality in the drainage system.



Get landowner permission, any consents/approvals required and know what rules apply

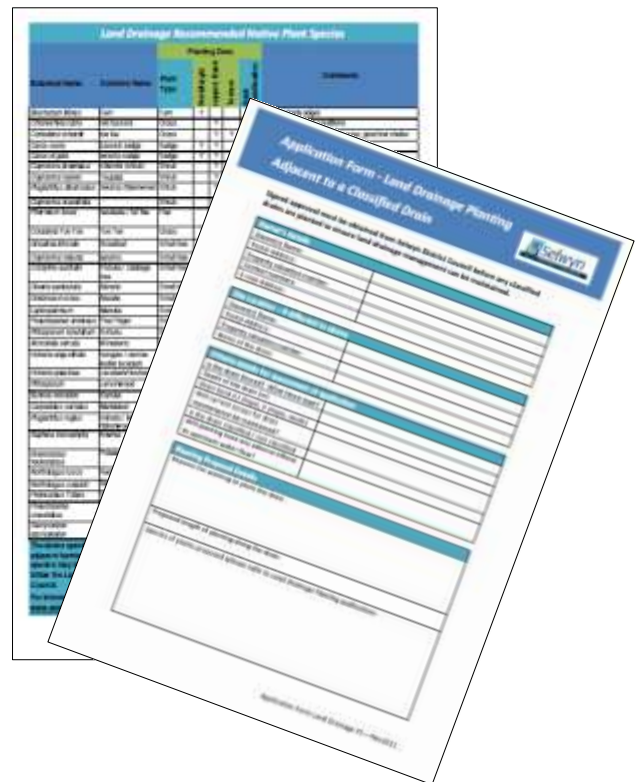
Ownership

Ownership of drains and land beside them, particularly along roads, can be tricky to determine. Check with the council where boundaries are and, if you are planning any work such as fencing or planting on drains or drain banks, check the landowners are happy with it.

Consent or Approval

For some activities, such as willow clearance that may disturb the streambed, installing a culvert, changing the course of the waterway, or creating ponds, you may require resource consent.

For work in Council managed drainage or flood control areas, including planting of grasses, shrubs and trees, approval will be required.



If your drains are managed by ECan, the [Flood Protection and Drainage Bylaw 2013](#) is now operative and written authority may be required

before you carry out work in or within 7.5 metres of the waterway. If you are planning to plant, widen, fence or do any other work in or near a drain contact the ECan Customer Service team on 0800 324 636 or email: floodbylaw@ecan.govt.nz to find out if you require an authority - there is currently no fee for this. Similarly, SDC have a process for granting approval for work around the drains they manage. Ring 03 347 2800 for details.

Plan Rules

Find out if there are any local plan rules which apply to your drains. For example, many drains will need to comply with the regional council's stock exclusion rules from the proposed Land and Water Regional Plan⁵. If the drain is a natural waterway or a modified natural waterway (or flows into a natural waterway) then all intensively farmed livestock are completely prohibited from entering it. All heavy stock are also prohibited from entering water near specific swimming sites, inanga (whitebait) spawning sites, and upstream of community drinking water supplies.

Rules prohibiting discharge of contaminants apply to all waterways, whether natural, modified or artificial. Runoff into drains should not produce any objectionable odours, adversely affect aquatic life, make the water unsafe for farm animals to drink, or result in high levels of faecal contaminants.

Rules may be updated as a result of ongoing planning work so it is advisable to check with ECan and SDC to find out how the rules apply to you.

Plant to enhance drainage

The right plants in the right place can help to address a range of issues including improving water quality, drainage function, biodiversity and amenity. The next section will help you get started.



Healthy, well vegetated riparian margins help to:

- *Improve water quality by providing a buffer to filter and trap sediment /contaminants*
- *Reduce the need for drain clearing*
- *Improve the habitat for aquatic life*
- *Bring back the birds and other wildlife*
- *Reduce bank erosion*
- *Make waterways more attractive and demonstrate good stewardship*

⁵ For details of the plan, and of Variation 1 which sets out the rules for the Selwyn Te Waihora catchment see <http://ecan.govt.nz/our-responsibilities/regional-plans/regional-plans-under-development/lwrp/Pages/Default.aspx>

Riparian Restoration – step by step to successful planting

Riparian planting - how to get started

Once you have identified your goals and made sure any consents or approvals have been obtained there are some general principles which can be applied to the majority of planting projects.

Investing in good advice and proven practices will deliver long term benefits.

Fencing and access

If you are undertaking a planting project you will need to exclude stock. A permanent fence is preferable as stock can do a lot of damage in a very short time if they gain access. You will also need to allow at least 1.5 – 2 metres from the fence line to the plants to prevent stock reaching through and grazing the seedlings. Providing an alternative drinking water supply for stock may also be necessary – the costs of this are likely to be offset by improved stock health and productivity.

Remember to allow for digger access as occasional cleaning may still be necessary, particularly in the first few years after planting.

Reshaping the banks

You may need to consider reshaping the banks before you start to create a good environment for planting. Creating a V-shaped profile can increase the efficiency of the drain and will ensure that planting causes no net loss of capacity. Aim for a slope of 1:1 or 45 degrees. If it is a classified drain you will need to discuss this with the council drainage engineers.



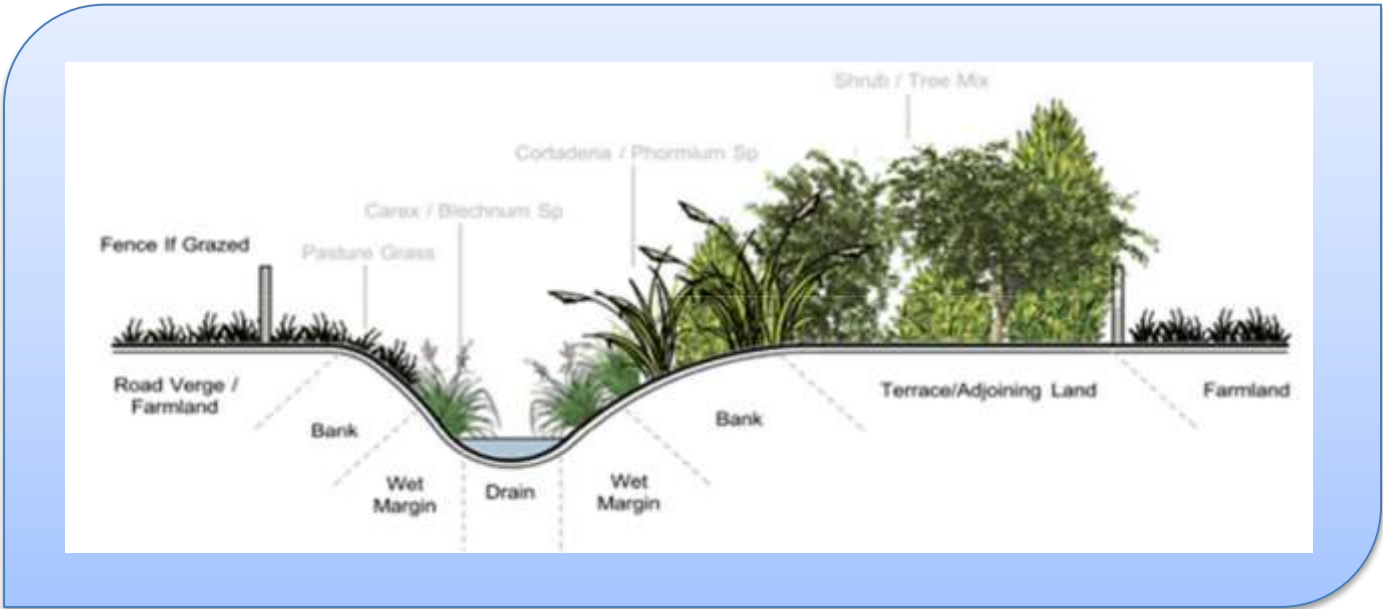
What to plant?

It helps to know a bit about the soils, the plants already growing on site, and how wet the area gets. This will help you select suitable plants for the site. Ask a restoration expert or your local council for advice if you're not sure.

Think about the different zones on your site. Each zone will require its own mix of suitable plants. The wet margin, the area nearest the water, and the drain banks which may be subject to occasional flood flows, will need different plants to those on the drier terraces. All plants, even those suitable for the wet edges of drains, should be planted well above the usual low flow water levels to ensure that flood flows can pass freely (750mm is good rule of thumb). Avoid planting anything that could cause a blockage too close to the water's edge. Flax plants in particular can grow very large and cause problems if planted too near the water.

What species will be suitable?

- Environment Canterbury – [Choosing the right plants](#)
- Selwyn District Council – [Drainage planting and design](#)
- Department of Conservation - [Plant communities of the Canterbury Plains](#)
- Crop and Food Research - [Natives to encourage diversity of pollinators](#)



If you need to maintain access for cleaning then one option is to plant a row of low growing plants such as *Carex secta* along the wet margin. An excavator can reach over these plants if cleaning is required. *Carex secta* has a particularly good root structure to help stabilise the banks.

Plant numbers and spacing

For the terrace areas well back from the wet edge, a suggested approach is to select a range of plant species that would naturally occur in groundcover or understorey, sub canopy and canopy and distribute them evenly across the site. Plant seedlings should be spaced at 1.5m distance apart (each plant occupies 2.25m²) which gives a plant density of 4500 plants per hectare.

understorey	grasses, flax and small shrubs,	40%
subcanopy	Small trees and large shrubs	45%
canopy	Large tree species	15%

ECan, SDC the Department of Conservation all have information available on suitable species, or you may be able to get advice from a local nursery. Other specialised lists are available such as one listing natives which encourage pollinator diversity.

Width of riparian planting

The ideal width of the area planted will depend on what you are trying to achieve and what resources

you have available. If the main aim is to provide shade to the water, then for smaller channels relatively narrow plantings of grasses and sedges will be sufficient. For larger drains, taller shrubs and trees (and time for them to mature) will be required. For maximum benefits a width of 10m+ on either side of a waterway has been recommended⁶ but this may not always be practical in a working landscape. A narrow strip of riparian planting will be less self-sustaining than a larger area and may be more subject to weed invasion but even a narrow buffer will make a great contribution to local biodiversity and help to improve some aspects of water quality⁷.

Seedling Orders

Suitable restoration grade seedlings, which have been grown from seed collected from plants naturally growing in the district, should be pre-ordered. Nurseries may have stocks of suitable plants available but if not they will need time to collect and grow the seed so up to 18 months notice is helpful. Using ecosourced plants, those where the seed has been sourced locally, will ensure that you get plants are well adapted to the local conditions.

⁶ Parkyn et al. (2000). <http://www.arc.govt.nz/albany/fms/main/Documents/Plans/Technical%20publications/301-350/TP350%20Review%20of%20Information%20on%20Riparian%20Buffer%20Widths%20Necessary%20to%20Support%20Sustainable%20Vegetation%20and%20Meet%20Aquatic%20Functions.pdf>.

⁷ Parkyn & Davies-Colley (2003) <http://www.niwa.co.nz/sites/default/files/import/attachments/riparian.pdf>

Site preparation



Check for existing plants of value before you start – these are free plants! Remove exotic weeds, e.g. grasses, as they will compete for any available soil moisture and will reduce the survival of newly planted seedlings. It is easier to control weeds prior to planting and herbicides are an effective means of achieving a weed free planting site. Depending on the cover, you may need to spray more than once so you'll need plenty of lead in time before planting. Spot spraying should be used along the lower lying wetter areas to ensure bank stability is not compromised and avoid spraying plants that have their roots in the waterway as herbicides should not enter the waterway. More elevated drier areas can be completely cleared of weeds before planting.

Seedling Establishment

Planting in early spring once most of the winter frosts have passed is recommended, although autumn planting is also fine in more sheltered areas. Planting work can be carried out by contractors or staff, by volunteer groups, or by family and friends. However you choose to plant, ensure the planting hole is big enough for the root ball and once planted make sure the soil is replaced and firmed down to eliminate any air pockets. Adding a slow release fertiliser tablet (20 grams) into the planting hole will greatly improve the growth and performance of the seedling. Using some form of plant protection, such as a mulch mat and plastic sleeve, will improve growth rates and make maintenance much easier.



Herbicide can be used to keep the areas around the plants clear of weeds and a plastic sleeve protects the young plants from the spray. *Carex* species can be planted without a protective sleeve as weeds around them can be effectively controlled by selective herbicides.

Maintenance

After planting, the focus is on providing the developing seedlings with adequate soil moisture levels. Where the soil is wetter, only the areas immediately around the plants should be spot sprayed so that some vegetation is retained to ensure bank stability and provide some buffer to intercept sediment while plants are becoming established. In the drier areas the priority is to control weed growth around the seedlings to prevent them from being smothered and to prevent the soil moisture being lost - total weed control is recommended. Around four to six release sprays will be needed each year for the first two to three years.

After two to three years the plants should be well established and the need to remove weeds will be reduced. The plastic sleeves can be removed at this time. It is generally more efficient to remove all the sleeves from a site at the same time as it is less likely that some will be overlooked. It may be possible to reuse some of the sleeves if they are not damaged during removal.

As the plants become established there may also be damage from pests such as rabbits, hares and pukeko. Using plastic sleeves will protect plants to some extent but pest control may also be required in some areas.

If any plants do not survive in the first year or two it is advisable to replace them. After the first few years the plants should be well grown and able to out-compete most weeds. Some ongoing weed control will be needed to keep on top of weeds which may be blown into the area or carried by water or birds. As the plants become established and produce fruit and seed, insects and birds will be encouraged to feed and natural regeneration can be expected.

Herbicides

Make sure that you have the right herbicide for the job, you are familiar with the safety data, and you have the right equipment and protective gear and you follow manufacturer's instructions.

You can get more information about herbicides from the regional council (ECan Customer Service team, 0800 324 636) or visit the [Department of Conservation website](#).

Following the steps outlined above requires commitment for the first few years but will protect your investment and should result in plant survival of 95% or more.

There are other approaches to restoration planting, such as using hand weeding rather than chemicals, but these are not covered in this guide.

Small wetlands



Small wetland areas around a depression

or a gully, or around a spring, can have significant



benefits for water quality and biodiversity. If you have tile drains, constructed wetlands to intercept the flow before it discharges to open water are worth considering. For a small wetland area the same principles apply as with a riparian strip - the site needs good preparation, planting and maintenance. The species mix can be adjusted to accommodate an irrigator and to tolerate periodic inundation by water. NIWA has produced a very [useful guide](#) to constructing small wetlands.

Monitoring your progress

Have you achieved your goals? Have there been any surprises along the way? Keep a record of work undertaken, dates which plants have been installed, and take regular photos from the same spot so you can track progress. If you are interested in ongoing monitoring of water quality and biodiversity contact local councils or community groups who may be able to help you set up a monitoring programme.

Indicative costs for a riparian planting project

Costs for a project will vary considerably depending on what you are starting off with and what you are trying to achieve.

You will need to discuss any earthworks (bank reshaping) with a contractor as the costs will depend on access, how much material is to be moved, and if it is to be removed from site. Fencing costs will also vary, depending on what type of fencing you use. A temporary fence to exclude stock may be sufficient in some cases, and relatively low cost, but a permanent post and wire fence will provide better protection for the plants if there are stock nearby.

You will need to consider the costs of site preparation, seedling purchase, other resources for planting such as fertiliser tabs and protective sleeves/mulch mats, and the cost of labour to undertake the planting. An indicative cost (2013 prices) for a project with 1000 restoration grade plants would be:

- Site preparation and plant establishment – approximately \$6000 (+gst), with around half this cost made up of plants and resources and half of labour.
- Maintenance of 1000 plants for 2 years - approximately \$4,000 (+gst), with around \$1,000 for the resources (spray) and the remainder for labour.

The estimated labour component of a project involving the planting of 1000 plants is 20 – 30 days spread over the first two years. This is around 60% of the total cost so any labour you provide yourself will be reflected in the costs.

Costs and benefits of improved drain management and riparian planting

Costs

Any consideration of costs and benefits should take into account the current drain management regime and associated costs, such as regular cleaning and weed control. If there is a fence already in place, or one is required by planning rules, then there will be no additional fencing costs from a planting project. Indicative costs for planting and initial maintenance are above.

In general, some of the costs which may apply include:

- *Compliance costs/consent fees if required*
- *Professional advice*
- *Reshaping of the drain banks*
- *Fencing, and any subsequent maintenance of the fence*
- *Provision of alternative stock drinking water source*
- *Loss of productive land¹*
- *Site preparation and planting*
- *Replacement plants (blanking)*
- *Pest control and initial maintenance (weed control)*
- *Ongoing long term maintenance (a wider/larger area of native planting will need less ongoing maintenance)*



Benefits of improved drain management

Benefits are not always easy to identify and may take several years to be realised. They can be:

- local benefits on the farm and/or contributing to the productivity of the farm
- occurring downstream of the farm, in the wider environment and to the wider community
- provision of ecosystem services⁸.

Some potential benefits which may apply include:

- *Reduced drain channel maintenance costs as weed growth reduces (as a result of shade)*
- *Improved drainage as a result of less weed growth*
- *Reduced the likelihood of flood damage as flood capacity increased*
- *Reduced faecal contamination of water and erosion of the banks when stock is kept out of the water and riparian zones*
- *Reduced erosion and scouring of channels with better protective vegetation*
- *Improved fish spawning with less fine sediment in the stream, due to clear gravel beds*
- *Reduced nutrients entering waterways, particularly phosphorus which is carried in sediment (this will be beneficial where a reduction in nutrient discharges is required)*
- *Reduced areas of gorse which fixes nitrogen, adding nitrogen to the system*
- *Improved drainage with reduced maintenance costs by replacing willows and other weeds with native species*
- *Increased shading of the water, leading to improved stream health (indicated by healthy invertebrate populations) and water quality (lower temperatures, dissolved O₂ levels)*
- *Enhanced values for Ngāi Tahu and improving mahinga kai*
- *Increased biodiversity and improved connectivity between areas of high habitat value*
- *Creating corridors of native plants which can provide stepping stones for wildlife to colonise new areas¹*
- *Improved habitat for fish and invertebrates, with the addition of leaf litter/woody debris as a food source*
- *Improved habitat for spawning fish and nesting birds*
- *Bringing birdsong back to the plains*
- *Habitat to encourage honeybees and native pollinators - [studies have shown](#) that yields can be higher when there are a diverse range of pollinators*
- *Creating areas for potential new crops, e.g., timber or flax*
- *Increased opportunities for food gathering, e.g., watercress from unpolluted waterways, fishing, waterfowl hunting*
- *The district council may consider rates relief for land retired from production*

⁸ Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth. Ecosystems and Human Well-being A Framework for Assessment, Chapter 2 Millennium Ecosystem Assessment <http://www.unep.org/maweb/documents/document.300.aspx.pdf>

Benefits continued:

- *Shelter/wind breaks will increase local humidity and can improve the microclimate in the vicinity of a drain*
- *Wind breaks and partial shade of pasture reducing moisture loss and reducing the need for irrigation*
- *Providing shelter can improve dry matter production on adjacent land*
- *Providing shelter can protect stock from temperature extremes and wind stress*
- *Fencing waterways can aid stock security, making it easier to locate and herd stock*
- *Keeping stock out of water can improve stock health and productivity*
- *Enhancing aesthetic appeal, amenity values and how an area looks. This can add to or create a sense of identity*
- *Improving amenity value and potentially property values. Improvements to drains are often on property boundaries so can be very visible*
- *Creating a positive impression of an area, which can assist in promoting and marketing produce from the area*
- *Enhancing cultural and spiritual values*
- *Creating or improving opportunities for recreation. This may include new ecotourism ventures which can bring income to a region*
- *Creating areas with potential education and research value*
- *Giving a sense of personal legacy and of making a contribution to the community*
- *Unknown future benefits to humans.....*

How the costs and benefits apply to a particular project will vary considerably, but there is a growing body of research which considers the effects of riparian restoration and the contribution of ecosystem services. More information is available on the WET website – look for the [Sustainable Drain Management page](#) under projects.



*Planting at Coes Ford Reserve, September 2011,
and the same site 18 months later.*



Further information

There is further information on the [WET website](#) and many other sources of information about specific aspects of drain management. You can also download our brochure with information about demonstration sites you can visit.

Visit www.wet.org.nz
for further information

Both [Selwyn District Council](#) and [Environment Canterbury](#) provide information about drain management:

Getting expert assistance with the planning of a project can save time and money. There are a number of local consultants, or council staff may be able to provide some technical expertise. There may also be some funding available to assist landowners undertaking projects, particularly those which enhance biodiversity. Contact your [Selwyn District Council](#) or [Environment Canterbury](#) for more information on funding assistance.

There are other programmes which may be able to provide assistance, such as the Living Water partnership (Department of Conservation and Fonterra) or the [Whakaora Te Waihora programme](#). Contact WET for suggestions about where to find the help you need.

Be flexible with your approach to drain management and riparian restoration – you will learn as you go what works well for you and may need to adapt to get the best results. Your experiences will be valuable for others too - share your successes and what you've learned along the way where you can.

Glossary

Blanking	replacing plants which have failed to thrive
Classified drain	a drain which the district or regional council is responsible for managing
ecosystem services	the benefits people obtain from ecosystems (see p. 16 for a fuller definition)
Mahinga kai	Ngāi Tahu interests in traditional food and other natural resources and the places where those resources are obtained.
Rebattering	reshaping the banks of a waterway
Riparian	the area adjacent to a waterway (including drains) or wetland
Selective herbicide	target unwanted plants while leaving the desired plant e.g., <i>C. secta</i> , unharmed-

Acknowledgements

Funding for the Sustainable Drain Management Project has been provided by the partners plus the Community Environment Fund, the Sustainable farming Fund, and Canterbury Community Trust.

Photography: -

WET – photos on p. 1

Peter Langlands – photos on p. 3

Stephen Brailsford – photos at bottom of p. 7 and on p. 17

All other photos and catchment map supplied by Environment Canterbury

Drain profile diagram courtesy of Selwyn District Council



Our key messages

Good riparian management, delivers multiple benefits such as improved water quality and biodiversity, and less growth of invasive water weeds – a win win!

- Maintain and enhance the drainage function by providing access for drain clearing equipment and avoiding planting areas or plants that could impede flows
- Keep stock out of the water – this will protect banks and stop contaminants getting into the water
- Start with the smaller drains and the ‘hotspots’ – any low points or gullies that channel runoff to the larger drains during wet periods
- Maintain a protective cover of vegetation on stream banks to filter and trap sediment and nutrients. Long grass is very effective, but mixed native grasses, shrubs and trees can also be a good option
- The ideal width/area of vegetation will depend on the situation, but for a wider drain that carries water year round allow enough space for some taller species on at least one side if possible
- Small deep drains don’t need large trees to provide shade – shrubs and grasses may be enough
- Plant taller growing species to provide shade for larger drains, especially on the north side, which will help prevent weed growth in the drain (and minimise the need for maintenance) and improve water quality
- Choose plants carefully – the right natives will grow well and encourage biodiversity back to the plains
- Avoid spraying the banks and overwidening, or deepening drains. Think about where the spoil goes and make sure contractors know about any riparian planting. Immediately regrass any disturbed areas
- Ask for advice! Talk to your local drainage engineers to make sure they are happy with your plans and ask an expert for advice about which plants to choose and how to place them.

Planting Project Worksheet

Project Name

Project objectives

1) _____

2) _____

3) _____

Landowner permission?

Checked/received
Consents or approvals?

Resources available

Labour, tech support/advice, funding

Reshaping drain profile

yes/no

Details:

New fencing required

yes/no

Details:

Pre-ordering of plants

Name of supplier:

Number of plants ordered:

Date ordered/reference:

Ecosourced? Where from:

Site Preparation *Resources needed – spray/equipment, labour*

Details of
what is required:

Key dates:

Planting *Resources needed – plants, fert tabs, protective sleeves/mulch mat, labour and equipment*

Who is planting:

Key dates:

Maintenance/Monitoring *Resources needed – spray/equipment, labour, camera*

Who is doing the work:

Key dates:

Notes

