Toitū te marae a Tāne

Restoration Planting Techniques

Absolutely Positively
Wellington City Council
Me Heke Ki Pōneke

ISBN number 978-0-947521-17-2

Ihirangi
Contents

Te whakamahere kaupapa whakatō tipu kia toitū ai **4**
Planning a restoration planting project

Te tīpako me te rapu tipu pai **21**
Selecting and sourcing quality plants

Te whakarite i te wāhi whakatō tipu **26**
Site preparation

Ngā tikanga whakatō tipu kia toitū ai **34**
Restoration planting techniques

Te tiaki me te aroturuki **50**
Maintenance and monitoring

Toitū te marae a Tāne-mahuta,
Toitū te marae a Tangaroa,
Toitū te tangata.

If the land is well and the sea is well, the people will thrive.

Our Council vision - 'Kiā mahi ngātahi mō Poneke mō tonā āpōpō' 'Working together for Wellington's future', is most beautifully illustrated by the way Council and community are working together to protect and restore the natural environment of this place.

Our vision is for our city to again be ringed with dense indigenous forests, feeding restored healthy streams, wetlands, and coastal environments. It is for forests echoing with native birdsong and the buzz of insects and scurry of native lizards. It is for streams filled with īnanga and kōura. It is for great rātā, rimu and kahikatea dominating the treescape, above an understorey of lower trees and impenetrable vines and ferns.

Wellington was once cloaked in forest just like this before most of it was lost to fire and axe. However since 1992 Wellington City Council and thousands of Wellingtonians have been working together on an incredible restoration journey.

We've established the globally renowned Zealandia, which with Otari-Wilton's Bush is at the heart of this restoration vision. Over nearly 30 years, Council has acquired huge tracts of land to create our Outer Green Belt. This landscape is rapidly regenerating from largely grass and gorse, supported by sustained pest management and over 120 community groups undertaking active restoration - weed control, planting and predator control all over our city. Many thousands more householders are back yard trappers. This is truly community wide kaitiakitanga.

Our exciting journey together continues. 'Toitū te marae a Tāne' is a guide to how best to plant and restore precious taonga, from planning a restoration project, to what to plant and where to plant in Wellington's diverse natural environment. I know from my own hands-on involvement, that it will be a wonderful resource for us all in our restoration work.

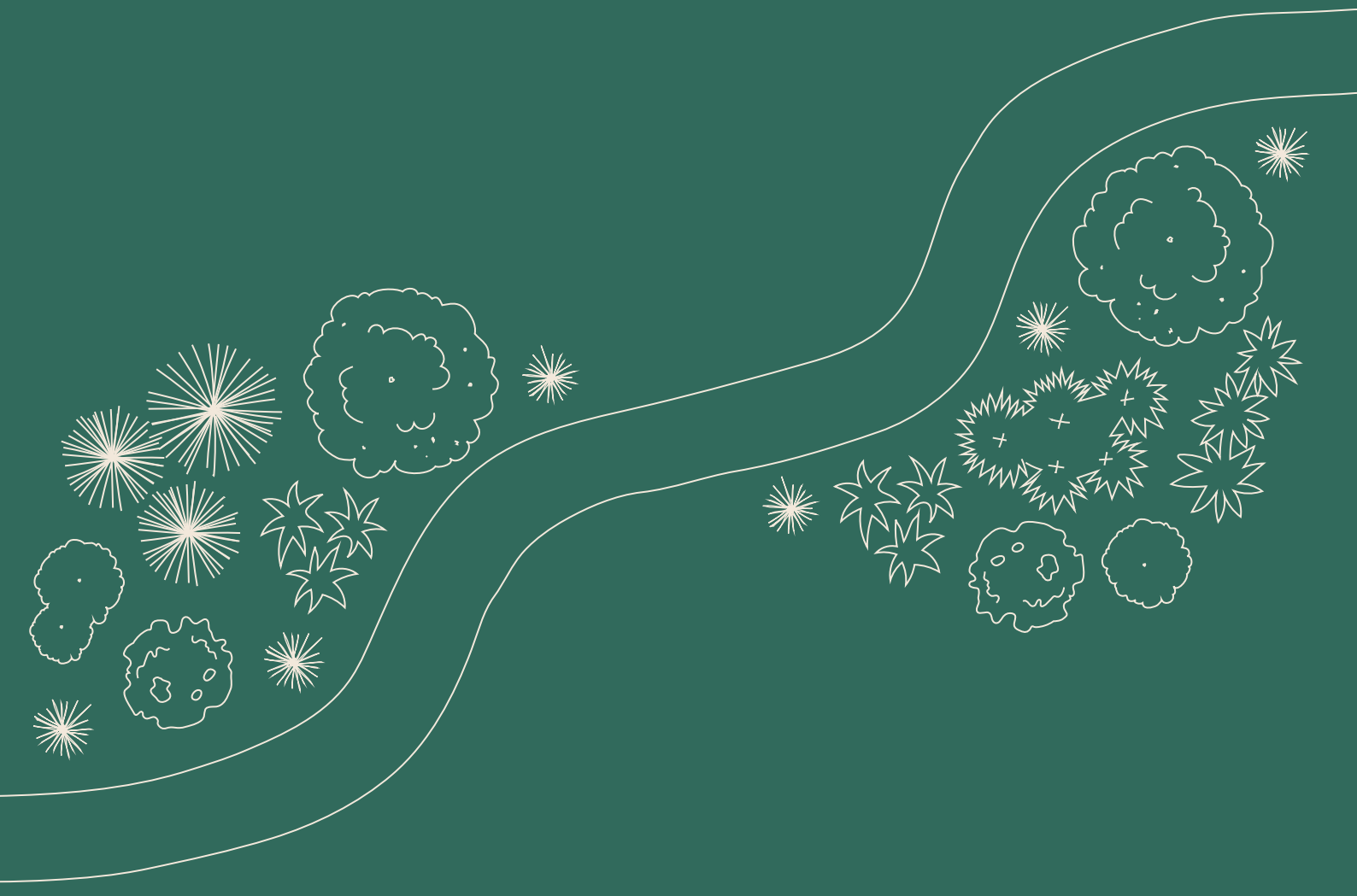
Mana tiaki,

We care for these places, to protect the environment for its own sake and for future generations.

Mayor Andy Foster

Te whakamahere kaupapa whakatō tipu kia toitū ai
Planning a restoration planting project

Today only 5% of Wellington's original lowland broadleaf-podocarp forest and 1% of original coastal forest remains. Most of our streams and wetland areas have been drained, channelled or piped completely to make way for housing, roading, industry and rail.



The Wellington landscape was once cloaked in a lush and diverse range of plants and animals from hilltops to sea and coast to coast. Northern rata was a common sight emerging through the canopy along with rimu, mataī, kahikatea and tōtara. Below them stood a dense canopy of tawa, kohekohe, kāmahi, tītoki, pukatea and kōwhai. The forest interiors were thick with climbers like kiekie and supplejack, and the forest floor carpeted with ferns. Tīeke, piopio, toutouwai, kōkako, hihi, banded rail, little spotted kiwi, weka, kererū, kākā and huia would have called through the trees and tuatara would have scurried in and out of sea bird burrows feasting on eggs. Dunes were home to dotterels, skinks and an array of moths and insects, and estuaries were spilling with wading birds, fish and vast mats of sedges and rushes.

Community groups, landowners, Council and other organisations are working tirelessly to protect and restore native plants and habitat throughout the city. Collectively, this is an amazing effort that can be built upon every year, in every park and backyard in Wellington.

How to use this planning guide

This planning guide and associated factsheet series provides tools and techniques to help anyone wanting to carry out native restoration planting in Wellington.

Use this guide to plan your project, then choose the relevant sections in this booklet that match the activities you are carrying out (eg site preparation, planting, monitoring etc) and the plant list for the environment you are planting in (eg sand dunes, inland hillslopes, wetlands etc).

Steps to successful restoration planting

Restoration planting in Wellington requires careful plant selection, ground preparation and ongoing management. Before putting plants in the ground, take the time to assess your site, get good advice and make a plan.

Key advice from experienced restoration planters in Wellington

Plan your project well - particularly assessing your site conditions and choosing plant species that can handle those conditions in the first few years.

Be aspirational but start small and really look after your plants in the first three to four years.

Get good advice right at the beginning from other community groups, neighbouring landowners and Council Rangers .

Ask lots of questions first.

Answering some of them may reduce the workload substantially or put you in touch with a community group working in your area already.

"Find your local Park Ranger - they are really helpful. They get things done and can access other resources in Council."

Garth, Highbury, Polhill Reserve planting volunteer

Te whakamahere kaupapa whakatō tipu
Planning your planting project

Restoration planting in Wellington requires careful plant selection, matching plants to site conditions, ground preparation and ongoing management. Before putting plants in the ground, take the time to assess your site, talk to people who could help, and make a plan.

"Right plant in the right place."

1. **What do you want to achieve? Do you want to restore an existing site, encourage birds, create a community project etc?**
   Check out other restoration projects on similar sites and find out how they have been done.
   Tool: Planning your planting project

2. **Where is your site, what are the conditions and what does it look like now?**
   Map out or draw your proposed site. Council Webmaps has downloadable maps that show existing vegetation and property boundaries. Include key features like existing native plants and weeds, animal pests, conditions like shelter, wet/dry areas, prevailing winds, special habitats etc.
   Tools: Planning your planting project - Guide to site assessment, Site Assessment Template

3. **Who can help?**
   Contact your local Wellington City Council Ranger or another community group/landowner doing similar work. Council Rangers can help with selection and sourcing of plants, advice about animal control and weed clearance on public land, communication between other organisations etc. If your project is larger than your own backyard, think about who you could get involved like neighbours, local predator control groups, schools, recreational groups etc. If you are working on public land you need to work with Council to establish a joint work programme and get permission. For example, any weed spraying needs to be done by Council approved contractors. Council will help to develop an MOU (Memorandum of Understanding) with your group that sets out everyone's responsibilities.
   Contact Wellington City Council Rangers
   04 499 4444

4. **What work will you do, when and how?**
   Write a plan that sets out the work that needs to be done and when. This helps to ensure for example that all the weeding and pest control is done before your plants go in the ground. It is useful to have at least a 5 year plan in Wellington because it takes time for plants to grow, particularly on windy and exposed sites. Make your plan 'fit for purpose' - include the information you (and your group) need - it doesn't have to be onerous. Talk your plan over with your Council Ranger, particularly if you need assistance with work on public land as Council needs to plan ahead for contractors and growing plants.
   Tools: Planning your planting project, Project Calendar Template, Site Assessment Template, Wellington City Council Restoration Guides and Plant Lists

5. **Site prep, planting and monitoring - make it happen!**
   Getting the ground ready and getting your plants in is really rewarding. Check out Wellington City Council resources for each stage you are at, talk to others doing restoration planting or your local Council Ranger for advice, assistance and inspiration.
   Tools: Sourcing, growing and selecting good quality native plants for your site, Site preparation for restoration planting projects in Wellington, Restoration Planting Techniques for the Wellington conditions, Maintenance and monitoring your restoration planting in Wellington.

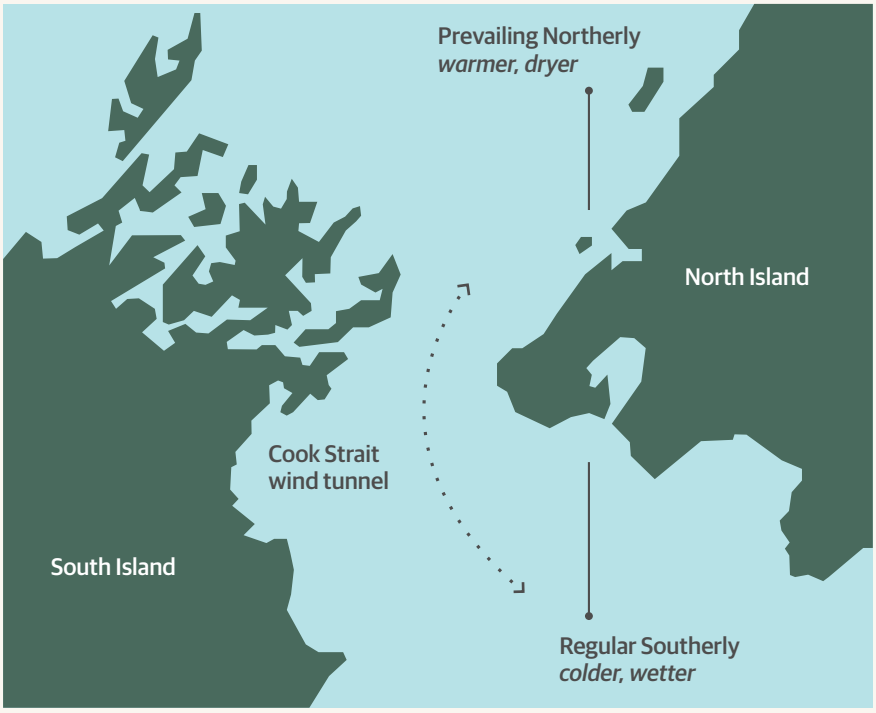
Te pānga o ngā 'Hau o Pōneke' ki ngā wāhi whakatō tipu
Impact of 'Welly Winds' on planting sites

Site conditions in Wellington vary enormously, depending on proximity to the sea, the form of the land, altitude, shelter and drainage.

The Wellington City Council area covers a large peninsula. At a broad scale different parts of the peninsula are characterised by particular combinations of geological, topographical and climatic conditions, as illustrated in image (right).

Strong winds funnel through Cook Strait from both the north and south. Planting sites exposed to the prevailing north-westerlies tend to be warmer and more prone to drying out. Planting sites exposed to south-easterlies are generally cooler and moister. In storms, strong winds can damage your plants and the salt carried onshore may burn young foliage.

When you plan your planting project, knowing the wind direction and frequency will help work out whether you need additional shelter or water for plants as well as how to choose the right plants for your site.

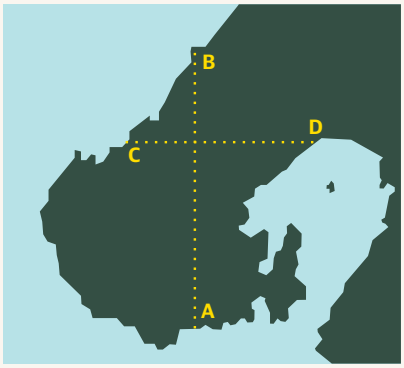


(Above) The Wellington peninsula adjoins Cook Strait

(Below) The Wellington peninsula showing the areas of strongest coastal influence.

Typical types of environmental conditions across the Wellington Peninsula

In very broad terms, there are five types of environments and related conditions that occur across the Wellington peninsula, as indicated by the coloured bands beneath each cross-section.

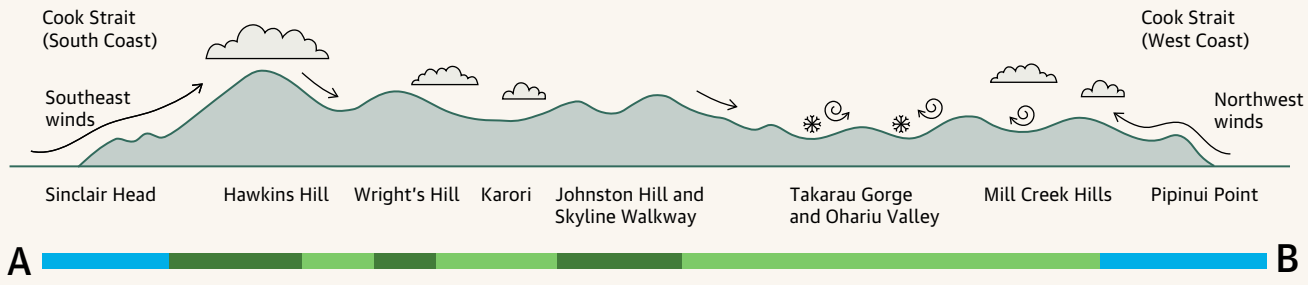


Cross-section lines for diagrams below.

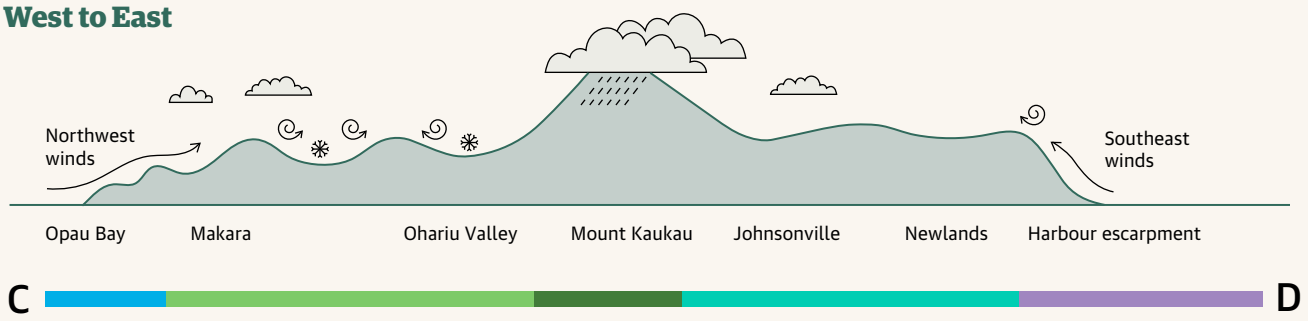
Key	Environment type	Likely conditions
	Coastal fringe - exposed to open sea	Very strong winds with drying effect despite moderately high rainfall; sharply drained steep seaward slopes; low sunshine hours.
	Inland valleys and basins	Turbulent drying winds; rain is seasonal but soils tend to retain moisture; valley and basin bottomlands tend to be moist, cold and prone to frost.
	Ridgelines and hilltops	Strong winds; high rainfall; low sunshine hours; lower year-round temperatures due to higher altitude; poor soils that can be waterlogged or leached of nutrients.
	Inland valleys and basins	Winds moderated by sheltering central ridges; mild and humid; deeper more fertile soils.
	Coastal fringe - harbour	Protected from north-westerly winds; frost-free; tends to dry out due to sharp drainage on steep escarpment.

Cross sections of Wellington Peninsula

South to North



West to East



Ngā whāinga
Goals

"Aim big, start small - be happy with small, it's better than doing nothing! If only one or two landowners are interested in the beginning, start with them and do it well - it will catch on! The mood has changed now in New Zealand and people are keen."

Rebecca, Makara Estuary

What do you want to achieve and why?

Having an idea of what you want to achieve helps to define where to start, what you need and how to plan your work programme.
It is also useful if you are applying for funding and resources. Before you start planting, ask yourself:

- What do I want to achieve? Eg create habitat for birds and other wildlife; clean up the stream; create shelter and stable banks?
- What are the main actions I need to take to do this?
- How much can I realistically get done each year?
- What advice and resources do I need?
- How will I track progress and know I'm succeeding?

If you have a broad idea about what you want to achieve (like creating 'islands' of native bush for birds) but no site, talk to Wellington City Council about possible locations. If you already have a project on public land (like building mountain bike tracks), talk to Council about support you can get to expand this work to include restoration planting.

Community group hard at work clearing around restoration plants, controlling the competing long grass

"We started out planting along the sides of new mountain bike tracks to fill in the bare ground. Then it became about getting a greater diversity of plants and a canopy over the tracks. Then the goal moved to planting the top of Polhill itself. Now my goal is restoring a podocarp forest and planting 1000 nīkau back in Polhill! It's taken a while to get to understand how we can meet this goal but now I'm looking 100-200 years ahead..."

Garth, Highbury, who plants in the Polhill Reserve

Examples of basic draft plan

Private landowner on a lifestyle block in Ohariu Valley	
Goal	Our small bush remnant is flourishing and is connected to our stream with native vegetation that attracts birds.
Work that needs to be done	Fence stock from the bush block and stream to stop impacts of grazing and protect new seedlings - bush block is the priority because there are open patches where wind is blowing through.
	Control the rabbits and possums to stop damage to bush block and new seedlings.
	Spot spray the grass before planting to make weed control more manageable.
	Source plants that are going to survive the winds in the valley.
	Plant a buffer around bush to create shelter and plant stream sides to link it to the bush.
	Keep the plants alive by continued weed and pest control.
Resources and advice	Use existing farm plan and google maps to help map out planting areas.
	Neighbouring farm has already planted streamside, so could have some good advice on what plants survive best.
	Wellington City Council could help us with plant supply and advice.
	Makaracarpa Group might be able to help on planting days.
Measures of success	Plant 500 plants a year for eight years until the entire site has been planted.
	Ninety per cent of plants have survived three years after planting.
	Bird counts show native bird numbers are increasing.
	Seedlings are regenerating in the bush remnant.

Examples of basic draft plan

Residents' group in a new housing area in Churton Park	
Goal	We want native birds frequently seen in our neighbourhood using native plants for food and habitat.
Work that needs to be done	Do some bird counts to see what birds are present now so we have something to measure from.
	Encourage household owners in the neighbourhood to plant native trees that attract birds and would have naturally grown here.
	Find two sites of at least 500m² and densely plant them to provide 'islands' of bird habitat.
	Control weeds and pest animals to protect plantings and birds.
Resources and advice	Information about how to do bird monitoring.
	Information about what trees used to grow here and how to source them – check Council restoration guides for inland planting.
	Wellington City Council could provide plants for our 'islands'.
	Need a contact list of neighbours.
Measures of success	Within two years, at least one tree that provides food for birds has been planted in half of properties in the neighbourhood.
	Within three years, 1000 native plants have been planted in the neighbourhood.
	Annual garden bird counts show increased numbers of native birds after five years.

Wāhi
Place

Where is your site and what are the current conditions?

Once you have a broad idea of what you want to achieve, assess your site to identify the climatic conditions, opportunities, issues and what is feasible over time. Be prepared to adapt your ideas to fit the site conditions and wider context if need be.

Your assessment will help work out which plants are most likely to survive in the various conditions on site and how to stage your planting over time.

Record your site assessment in a way that you can refer to it easily. For example, on a map, aerial photo or table. Check out Wellington City Council's *WebMap* for property, infrastructure and hazard information, as well as contours, aerial photo views and the Wellington City Council reserve track network. You could also use a google map, or existing property information like a farm plan.

Example of a site assessment for bush block and streamside restoration

Site Assessment Paddock B Bush block and gully

Topography	Rolling but some steeper bits in gully area.
Hydrology	Damp through centre of bush block in winter. Good moisture all year around in centre of gully, drier areas in paddocks.
Soil	Good deep rich soil in bush block. Deep but compacted soil around gully, becomes very water logged in winter. Drier soils in paddocks except in winter.
Aspect & wind	Northerlies - dry and warm. Gusty across ridgelines.
Exposure to salt	None.
Temperature	Some frost.
Size and shape	Good sized existing bush block, but exposed on edges. Large open paddock area to plant, might need to do in stages working from bush block outwards, stream heads need protection from grazing.
Current vegetation	Māhoe, kaikomako, matipo, tōtara and mamaka trees in bush block – find out what other plants would have grown here. Canopy cover in bigger bush block. Sparse vegetation and little shelter along stream. Grass in paddocks. Weeds: gorse, blackberry. Small blocks grazed under.
Wildlife	Pests: goats, rabbits etc.
Access	4WD and access to bush block and gully.
Opportunities	Native seed source in bush block, some species missing though so good to reintroduce other plants.
	Good to add bird attracting species.
	Use gorse as shelter for new seedlings.
	Gradually close in ridge area to fence line. Link the bush blocks with stream.
Issues	Investigate the cost of fencing in straight line – pink line or following the stream areas - which would retain grazing on the ridges. Redo fence in block A to exclude sheep. Fencing gully splits paddock, need to sort out access for stock management.

Check list of site conditions to consider

Topography (shape of the land)	What is the altitude range? How much is steep, moderately steep, undulating or flat land? Topography can affect temperature, drainage, shelter and ease of access.
Hydrology	In what stream catchment(s) does your land lie? Is the stream a natural watercourse along its length or has it been channelled or piped above or below your site in ways that could affect water quality and fish access? Are there areas that look drought-prone, damp or poorly drained?
Soil	What is the soil like in different parts of the site? What depth, texture and colour is it? Clay soils can be fertile but prone to waterlogging and compaction; sandy soils are less fertile and sharply drained; humus-rich soils have good texture due to plentiful organic matter.
Aspect & wind	What direction do different parts of your site face? How much is exposed to the warmer but drier prevailing north-westerly wind? How much to the colder but often rain-bearing south-easterly? Is there any exposed ridgetop land that might be exposed to winds from all directions? Are there sheltered spots in gullies and valleys?
Exposure to salt	The salt carried by onshore winds can damage plants, particularly along the shore and coastal escarpments. Plant native in these areas that are adapted to withstand salt exposure.
Temperature	How cold does your site get? Prolonged cold can inhibit plant growth and frosts can damage plants that are not frost-hardy.
Size and shape	How big is the total area you are contemplating? If quite large, are there obvious parts that could be progressively tackled in stages over time? Is the area long and thin or reasonably compact? Shapes with more 'edge' are more exposed to wind and pest invasion.
Current vegetation	What species are present (exotic and native), at what height and stages of succession are they? Are there any rare or threatened species present? Does the existing vegetation already form a complete canopy over any part of the site? (Remember lower-growing herbs and shrubs can also create a canopy in places like foredunes.) If not, is it likely existing plants will form a canopy with time if kept clear of weed competition? What invasive weeds are present? Is your site so weed-prone that you will need to clear it back to bare ground?
Wildlife	What birdlife, reptiles and invertebrates have you observed on site? What wildlife species are known to be or likely to be present (ask Wellington City Council). Are any threatened species amongst these and, if so, what are their habitat requirements?
Access	What is the vehicle and/or foot access like for such activities as bringing in quantities of plants and mulch? Is there a suitable holding area to temporarily store plants and other materials? Will you need to clear or cut any tracks? Is difficult access on any of the planting area likely to deter less physically able volunteers?
Opportunities	For example; using existing vegetation as shelter for new plantings, linking sites across the landscape, working with neighbouring restoration groups, introducing rare species, providing recreational benefits, controlling soil erosion etc.
Challenges	For example; significant weed infestations, flooding, sea level rise, difficult access, large areas, fire risk etc.

Create a planting plan

Draw a planting plan to help picture the spatial dimensions of your project - it doesn't have to be a work of art, just enough to help define the purpose (eg buffer, early stage shelter plants etc), tolerances (eg frost hardy, wind tolerant, riparian plants etc) and quantities of plants needed.

An aerial photograph saved from Wellington City Council *WebMap* can be a very useful base map.

Taking into consideration the information from your site assessment and your objectives, match the plants to these conditions.

It is really useful to talk through this picture with a Wellington City Council Ranger or restoration specialist to help develop and refine your planting programme.

Create a plant list

Plants have different tolerances to different conditions like salt spray, wind, sunlight etc. Look at your site or use the diagram below to identify which broad environment you are restoring eg coastal sand dunes, hilltops, riparian margins etc.

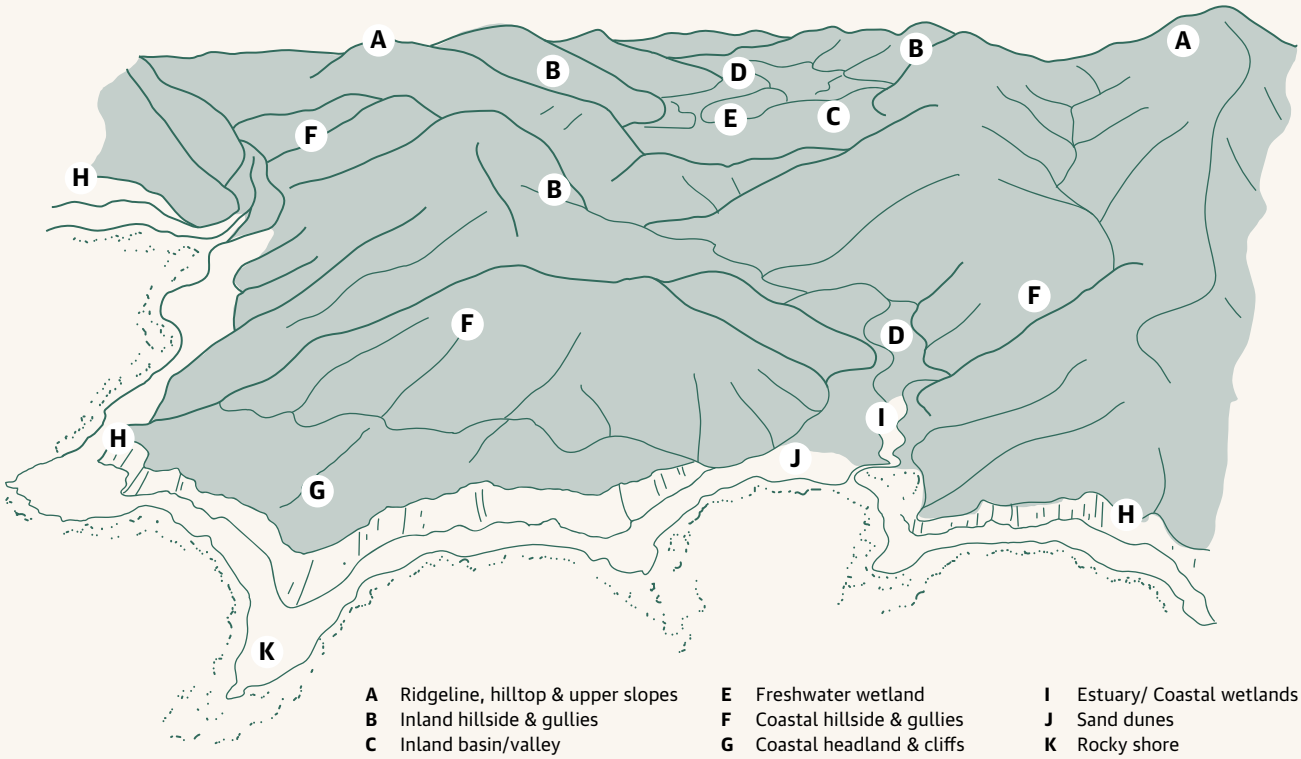
Use this information along with your site assessment to develop your plant list. Wellington City Council factsheets including a plant list for each environment type are listed below.

Identify your stage of planting

Plant succession is a natural process that sees a bare site colonised with early stage or 'primary' species and then gradually overtaken by successive groups of later stage or 'secondary' species until a stable mature community of plants is achieved. A mature community of plants could be, for example tall forests, grasslands, scrub or turf fields, depending on the environment and site conditions.

In restoration planting, we often aim to speed up the successional process through mass planting of seedlings on bare sites (rather than relying on natural seed distribution) and planting tall-growing tree species within established lower vegetation.

Look at your site and identify which stage of succession you are at, there may be areas of bare land and existing vegetation to work with. Use this information when you select your plants. The plant lists in the Wellington City Council Restoration Planting guide categorise the plants into early and later stage planting.



A Ridgeline, hilltop & upper slopes
B Inland hillside & gullies
C Inland basin/valley
D Riparian
E Freshwater wetland
F Coastal hillside & gullies
G Coastal headland & cliffs
H Coastal escarpment
I Estuary/ Coastal wetlands
J Sand dunes
K Rocky shore

Environmental sites

Tāngata
People

"Human infrastructure is key, though there isn't one right answer, as each project has different people involved and a different way of organising things. Start small and build up. Adapt with who is there when you start and the opportunities that then come along. For example, working with the Brooklyn School has been wonderful for us. Now is the right time to be planting trees, people are aware and there is lots of good will."

Garth, Highbury, Polhill Reserve planting volunteer

Who can help?

If your project is larger than your own backyard, think about who you could get involved like neighbours, local pest control groups, schools, recreational groups etc. Having a group of people involved needs some organisation but it shares the load and the reward.

"Find your local Park Ranger – they are really helpful. They get things done and can access other resources in Council."

Garth, Highbury, Polhill Reserve planting volunteer

Council Rangers can help with project planning, selecting and sourcing plants, advice on weed and pest control and linking to other groups and resources.

If you are working on public land you will need permission from Council. Council Rangers can help to develop a joint work programme and a Memorandum of Understanding (MOU) that sets out everyone's responsibilities and expectations.

Whakamahere Plan

"When you are planting in the beginning, start small, really small – I've noticed that even in a small area it takes a lot of time to keep on top of the weeds."

Sue, Owhiro Bay

What work will you do, when and how?

When you are drawing your planting plan, think about the sequence of work that needs to take place to establish your restoration planting. Allow one to two years for site preparation and plant propagation. In Wellington it can take four to six years after planting before the plants are established, ie the canopy has closed over. It can take even longer in really exposed windy areas.

Compile a staged work schedule over several years to keep track of your work. See the example on the next page or download a template restoration planting project tracking spreadsheet to start from.

Remember that planting every year will see a build-up of tasks. In addition, if you are planting more than one site each year (eg a streamside and a bush block) this will multiply the work effort needed.

Make sure it will be manageable – unless you have a lot of volunteers or resources, doing a small area well each year is often more effective than doing a large mass planting.

Joakim ensures plants are establishing well, the community group Te Motu Kairangi is restoring coastal forest at Scorching Bay.

Example 1: General work plan

Year 1	Winter	Spring	Autumn
	Baseline monitoring: gather whatever information you need so you can measure progress as your project develops. Plant supply: allow at least two years for propagation of species. Either: (a) order eco-sourced plants from external supplier, or (b) obtain permits to gather eco-sourced seeds or other propagating material and grow your own plants.	Prepare planting site: spray/start digging out any weed infestations. Talk to Wellington City Council about help with aggressive weeds.	Prepare planting site: follow up control of weed infestations. Talk to Wellington City Council about help with aggressive weeds.
Year 2	**Winter**	**Spring**	**Autumn**
	Prepare planting site: cut and clear sprayed weeds. Planting can start this year if weeds have been well controlled and plants available. Plant supply: order any other eco-sourced plants not being supplied by Wellington City Council for delivery next winter from external supplier.	Plant supply: order plants, tree shelters and mulch from Wellington City Council for planting next winter. Site maintenance, including controlling any regrowth of aggressive weeds.	Site preparation, including controlling any regrowth of aggressive weeds.
Year 3	**Winter**	**Spring**	**Autumn**
	Plant and mulch: make sure that plants are matched to suit conditions. Check plants after 4-6 weeks; firm in any plants that were poorly planted or have been loosened by wind; prune any spindly/wind-vulnerable plants. Stake plants that look vulnerable or if they might be hard to locate through long grass.	'Release' or clear competing weeds from around plants, especially after growth flushes in spring and autumn. If signs of invasive weeds re-growing, dig out or cut and paste with herbicide.	'Release' or clear competing weeds from around plants, especially after growth flushes in spring and autumn. If signs of invasive weeds re-growing, dig out or cut and paste with herbicide.
Year 4	**Winter**	**Spring**	**Autumn**
	Plant and mulch, fill any gaps where plants have died, stake if needed.	Release at least twice during growing season. Assess plant losses in late spring and order replacement plants for infill planting next winter. If more than 15-20% have died, review species choice and site conditions.	Monitor and maintain as required.
Year 5	**Winter**	**Spring**	**Autumn**
	Replacement planting and mulch into gaps where plants have died.	Monitor and maintain as required.	Monitor and maintain as required.
Year 6-8	**Winter**	**Spring**	**Autumn**
		Monitor and maintain as required until plants close over the ground. Watch for re-emergence of weeds and dig out or treat with herbicide, or notify Wellington City Council if further assistance is required. Continue to assess plant losses, especially in drought years, and arrange replacement planting as required.	Monitor and maintain as required.
Canopy closure	**Winter**	**Spring**	**Autumn**
	Enhancement planting: consider potential for planting enhancement species into established planting and order plants.	Enhancement planting: consider potential for planting enhancement species into established planting and order plants.	Monitor and maintain as required.

Te aroturuki me te rikoata kokenga
Monitor and record your progress

"Monitoring is useful to check survival rate, particularly which plants do and don't survive. The important thing is to work out what is the most useful information to collect for your project and for who."

Garth, Highbury, Polhill Reserve planting volunteer

Basic monitoring should be carried out at every restoration planting site. The purpose of monitoring is to track the progress of your project. For restoration planting, a key measure is the survival rate of your plants. Other measures are numbers and diversity of birds present, evidence of natural regeneration, reduction of pest animals or weed infestations. The information you record needs to relate to your overall goal and the work you are doing to achieve that goal.

During your planning phase:

- Decide on what you need to measure to track progress, for example annual plant survival rates, presence of native birds etc.
- Set up a simple record sheet of what is to be measured and when.
- Record any baseline data about your site before you start planting so you have a comparison to work from. For example, if your goal is to increase native bird species at your site, you need to know what the current species are.
- Stake out (or GPS) a fixed location(s) to use as a photo point to show progress.

For more information such as how to assess plant survival rates, check out the Wellington City Council guide: *Restoration Planting Sites*

Monitoring plant growth and checking plant survival within the site.

Te tīpako me te rapu tipu pai
Selecting and sourcing quality plants

For restoration planting to be successful, young seedlings need to survive and thrive. This is no easy task in Wellington's rugged, windy and exposed coastal environments. Choices about the type of plants, where they are sourced from, where to put them on a site and how well they are planted are all important factors that can make a big difference to the success of any project.

He aha ai me whakatō tipu taketake?
Why plant natives?

"My key recommendation for an exposed site like this – keep it native – non-natives don't survive! Find out what plants are suited to your site and just choose a few hardy species at the beginning to create some shelter. Add in trees you like, to attract birds, later on."

Ian, Churton Park

Eight good reasons to use native plants in Wellington

1. **Better survival rates** - local native plants are adapted to the rugged landscape and conditions so they are more likely to survive than non-natives or natives from other parts of the country.
2. **Less work and resources** - native plants in Wellington seldom need fertiliser and are self-sufficient once established.
3. **Stabilise Wellington's soils and steep slopes** - local native plants have evolved with the Wellington soils and landscape so naturally function better as stabilisers and have existing relationships with soil bacteria and fungi allowing better uptake of nutrients and water.
4. **Help restore Wellington's natural character** - only 1% of the original coastal forests and 5% of lowland forests remain in Wellington.
5. **Provide habitat and food for native wildlife** - native plantings create corridors or 'stepping stones' between the few remaining mature forest and wetland areas, extending food sources and habitat for birds, bees and insects. These species then help spread native seeds and pollen across Wellington.
6. **Improve water quality flowing to the harbour and out to sea** - native plants act like sponges, filtering sediment and nutrients from the water. This helps threatened species like giant kokopu that live in Wellington streams, as well as fishing grounds in the harbour and along the coast.
7. **Make the most of resource consent requirements** - many resource consents require land remediation. Developing a native plant restoration plan at the beginning of any land development can save time and money when it comes to planting. For example, by ensuring top soils are retained and not compacted during construction, making the most of existing shelter and vegetation, selecting plants for slope stabilisation, shelter etc.
8. **Personal satisfaction and connection with your neighbours** - anyone who has done the hard yards restoring native plants will attest to the satisfaction in seeing the landscape change from weeds and degraded landscapes to thriving habitat for birds and wildlife.

Te tīpako tipu mō tō wāhi whakatō tipu
Selecting plants for your site

Choosing the right plants for your site is critical for long term success.

Plants have characteristics that make them more or less suitable to environmental conditions like wind or salt exposure, soil moisture, terrain and light levels. Some plants need shelter to grow and may not survive on exposed land.

It is often best to start with a limited range of hardy, quick-growing plants in an area you have time to look after in the first year. Start in more sheltered areas (eg gullies, stream sides, around existing bush) and work your way towards more exposed areas over time.

Plant lists for a range of environments across Wellington are found in the Wellington City Council guide: *Restoration planting sites*.

Chose eco-sourced plants

Eco-sourced plants have been grown from the seed of wild plants that naturally occur in a particular local area or ecosystem. These plants are easier to care for and more likely to survive because they are better adapted to the conditions of their local area.

Wellington City Council only uses eco-sourced native plants for restoration planting. This helps to preserve the unique genetic material of Wellington's local plants and avoids the risk of planting non-local species that could become invasive.

If you source plants from sources other than the Wellington City Council nursery, make sure they have been eco-sourced from the Wellington area.

If you want to propagate your own plants, ask Wellington City Council for advice, a copy of its eco-sourcing guidelines and how to apply for a seed collection permit.

Taupata is one of Wellington's hardier plants, an essential plant for all coastal areas, such as at this site in Paekawakawa Reserve, Island Bay.

Te rapu tipu pai
Sourcing quality plants

The Wellington City Council Berhampore Nursery produces on average 100,000 eco-sourced plants a year for restoration planting. Community groups and residents can apply for free plants for restoration planting.

The nursery grows a selected list of species, focusing mainly on those that have good survival rates when planted in Wellington's conditions, especially on exposed sites. The plants available vary from year to year to cover a range of priorities, such as riparian planting to improve water quality and reduce erosion, or coastal planting where there has been extensive loss of habitat. If you are wanting plants that are not currently available, contact the Council for advice or to request that the nursery grow them in another year.

The Wellington Forest & Bird nursery and other community nurseries also grow a wide range of eco-sourced plants for restoration work and community groups.

Several commercial nurseries and garden centres produce native plants in Wellington. If you order from a commercial nursery or garden centre, specify Wellington eco-sourced plants.

It can take up to 18 months or more to grow plants from seed into plantable seedlings. Some native species such as rimu only seed every 5-10 years, this is the reason they are only available sometimes. Order plants early to ensure you can get them in time for your planting season.

Berhampore nursery: eco-sourced trees and shrubs ready for dispatch for the new planting season.

Growing your own plants

If you want to grow your own plants, you could set up a back-yard nursery or work with other groups who already have nurseries and may have spare space.

Collecting any plant material (fruit, seeds, seedlings etc) from parks and reserves requires a permit from Wellington City Council. If the land is private, always get permission from the landowner.

There are several options for sourcing propagation material:

- Growing from seed - ask for advice as some species are more difficult to propagate than others.
- Growing from cuttings - cuttings can be an easier option with species that are difficult to grow from seed. Use this option sparingly, though, as cutting-grown plants are clones of the original and lack the genetic diversity of seed-grown plants. If using this technique, harvest the cuttings off a wide variety of plants and areas to maximise genetic diversity.
- Transplanting seedlings - moving young naturally regenerating seedlings can be a viable option for some species however many native plants do not like root disturbance and do not successfully transplant from the forest floor.
- Spreading seed - spreading seed or forest litter is a way to encourage seedling regeneration but should be considered with caution as seeds may not germinate unless the right conditions are present on your own site. Moreover, removal of forest litter can disrupt the environment.
- Be careful about using seeds or cuttings from garden plants as they may be hybrids or variegated varieties and become invasive, eg Pseudopanax hybrids are a major problem throughout Wellington reserves and commonly appear as garden plants.

Plants to avoid

A number of native plants that do not naturally occur in Wellington City have become a problem because they grow so well here that they compete with or hybridise with locally indigenous plants. Using Wellington eco-sourced seedlings will avoid this problem.

Non-local Native Plants

Some non-local plants commonly found in Wellington are the two species of Karo (Pittosporum crassifolium and P. ralphii), pūriri, pōhutakawa, Northland lacebark and karaka. Karaka was planted by Māori in orchard-like groves and is now being spread by Kererū.

Avoiding spreading weeds and pests to your planting site

All planting stock should arrive from a nursery weed, pest and disease free and be the species ordered. However, always check each plant for weeds, any live animals (eg moths, geckos), eggs etc before planting them. Check any mulch and soil coming to your site as well. This will help keep unwanted pests out of your site and reduce possible spread to neighbouring areas. If in doubt, ask a Ranger for identification of the plants delivered and any possible pests and weeds.

Karo thicket on the coastal hillsides in Houghten Bay. Strathmore and Breaker Bay have similar hillsides covered in mostly karo groves with little local indigenous vegetation.

Karo is a native plant to New Zealand but would not naturally have grown in Wellington. It has become very invasive, taking up habitat from local Wellington plants.

Te whakarite i te wāhi whakatō tipu
Site preparation

Site preparation is crucial to success and helps with the ongoing maintenance of native plants, weeds and animal pests.

"Everybody loves planting, and lots of people think that's what looking after these sites is all about – but planting is only 5% of the job, the other 95% is good site preparation and good maintenance."

Peter, Trelissick Park Group

Ngā tarutaru
Weeds

For restoration planting, weeds are unwanted plants that compete with your planted or regenerating seedlings by smothering, blocking light or using water and nutrients.

Weeds need to be controlled before and after your seedlings go in the ground to ensure their survival.

The type of weeds at your site will determine the lead-in time before planting. Some problem weeds, such as blackberry, Japanese honeysuckle or climbing asparagus need to be treated repeatedly to get them under control. If you plant too soon and weeds regrow, it will be more difficult to control them without damaging your seedlings.

Some typical weed situations in Wellington are outlined here. For more advice on the best approach, check out the Weedbusters website or contact Wellington City Council (04 499 4444) and ask for a Biosecurity Technical Advisor.

Using herbicides

As a general principle, herbicide use should be minimised to reduce the risks of spray drift and residue build-up in the soil. However for aggressive weeds, herbicide can be more effective than hand or machine pulling and is much less labour-intensive. The choice will depend on your own preference, land ownership, the type of weeds, and your resources.

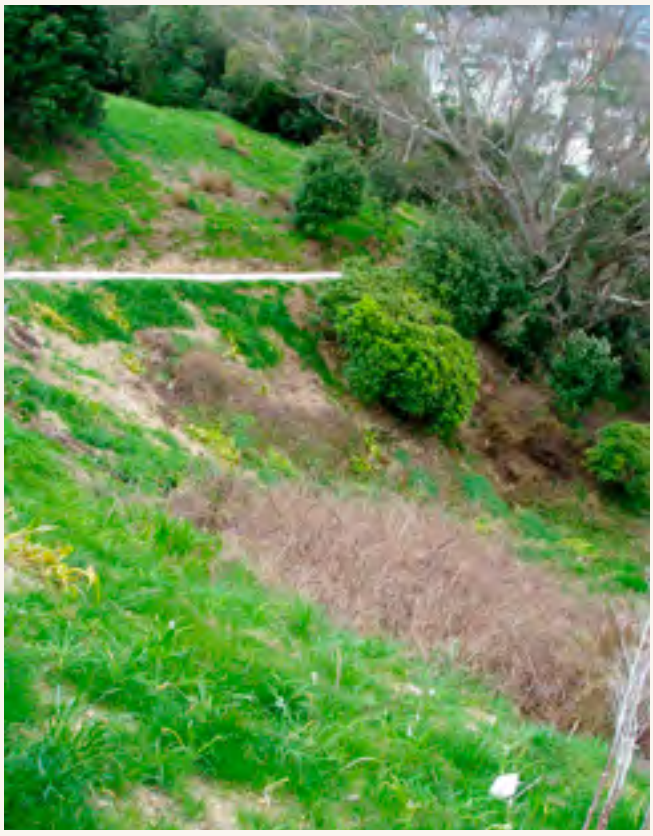
- Anyone using herbicides on Council land must have a permit and be qualified. This includes paste-on herbicides like 'Vigilant' (useful for treating regrowth of problem woody weeds). Contact Council to get advice on approved contractors or get a permit.
- If you are spraying on your own land, consider doing a Growsafe training course. This covers the safe and effective use of herbicides.

Easy-to-control weeds

Grass and annual weeds typically only take one season to control. Hand clearing is an option but be aware that seeds love to germinate on disturbed ground. If you are hand pulling these types of weeds, plant sooner rather than later to fill in the bare ground. Laying grass and annual weeds back around the base of the plant on bare ground can help retain moisture in the ground and stop weeds growing back.

Spraying with non-residual herbicide, like glyphosate, in the preceding growing season can give new plants a head start against future weed growth. Try to minimise the amount of spraying:

- Treat only as much of the site as you intend to plant the following winter.
- Rather than doing 'scorched earth' blanket spraying, spot spray circles on the ground to clear a place for each new plant.



Spot-sprayed site with difficult-to-control blackberry and Elaeagnus x reflexus. Now the site has been treated, the next stage is to cut down the dead growth in preparation for planting.

Good site preparation is key to the success of planting sites. Leave piles of dead material to naturally break down and compost.

Aggressive and difficult to control weeds

Some weed species are highly invasive and difficult to eradicate from a site due to their persistent root systems, seeds or ability to sprout from fragments. They usually require effort over several seasons to remove. You can apply for an environmental grant to cover costs of contracting a qualified spray contractor.

If you have enough volunteers, or can contract labour, then either digging out by hand or machine can be the best option, followed by 'mop-up' spraying of any regrowth.

Usually it takes two growing seasons to remove aggressive weeds:

- Year 1 - spray the infestations, leave to die off, cut and clear, leave over the winter and the following spring to allow regrowth to appear;
- Year 2 - spray any regrowth. In some instances, a further year could be required.

Herbicides required to kill aggressive weeds can leave residues in the soil that can damage young seedlings. Consider delaying planting in such areas for a year.

Aggressive weeds most often encountered in Wellington

- **Gorse and broom**
  The seed remains viable in the ground for up to 40 years. Pulling plants out and exposing bare ground can create a flush of dense new growth which is more problematic than older growth.

  Single bushes can be cut and the stump treated to stop regrowth. Where gorse and broom are growing thickly over an area, complete removal may not be your best option unless you have the time and ability to remove all the new growth.

Instead, you can use these weeds as shelter for young seedlings.

Cut strips or small clearings within the gorse and broom and plant seedlings into them. Areas where gorse and broom are tall, straggly and starting to open out are great for planting into, especially on very exposed sites.

Your plants will eventually shade out gorse. Broom can persist for longer so additional cutting, treating and inter-planting may be required.

(Top) Planted site with a large pile of gorse, left to break down on site. If the gorse doesn't present a fire hazard this is an ideal way to compost your weed pests.

(Below) Strips within the gorse were cleared for planting at Oku Street Reserve. The remaining gorse is providing shelter on the exposed site and will, eventually, be overshadowed by the planting.

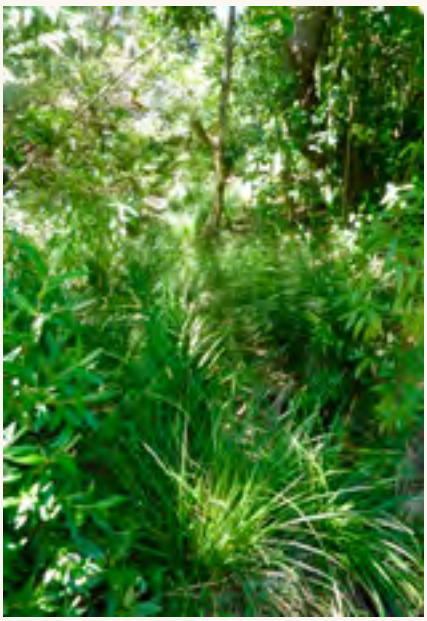
- **Blackberry and fennel**
  Blackberry patches are often best sprayed in two stages. The first spray will usually kill most of the plants then a re-spray will kill off the rest. Once fully dead, cut the plants down leaving the slash in piles on the ground to rot. Allow one to two years for effective control and for any spray residue to break down. Any stumps that show regrowth after that can easily be removed using a grubber or treated with paste-on herbicide.
- **Wandering willie (Tradescantia fluminensis)**
  This is a difficult weed to control as any small stem sections left behind will regrow. Rake or hand-pull small areas during dry conditions and either bury the weeds beneath at least 300mm of soil in a hole, cover with black plastic to block light and allow to rot down, or place the weeds in bags and remove from the site. Rolling this weed into mats can be a useful technique where it covers the ground thickly.

  The spray used to kill this weed can have an adverse effect on some mature trees as well as many other native plants. As a result it can only be applied by a qualified contractor. Wandering Willie grows rapidly, so ongoing weeding to remove any regrowth before it spreads again is vital. Wellington City Council is trialling biocontrol with the release of beetles that attack this weed but it could be years before the results are known.

Example of Wandering willie management

(Above) Extensive infestation of Wandering Willie in the upper reach of a stream.

(Left) Manchester St, small forest stream, cleared of Wandering Willie.



(Right) Restored stream after clearance of extensive Wandering Willie infestation.

Other hard-to-eradicate weeds

Do not plant into sites where the following weeds are present until all sign of them is gone - cape ivy, cathedral bells, climbing asparagus, periwinkle elaeagnus, English ivy, ginger, Japanese honeysuckle, Japanese knotweed, old man's beard, banana passionfruit and pampas.

Sites with these weeds are often best converted to grass for at least a year after the main control work is done. The grass covers the exposed soil while allowing observation for any signs of weed regrowth that can then be treated before planting starts.

If you are removing weeds from a site, contact Wellington City Council to find out whether they can go to green waste or need to be landfilled, or composted on site.

Is pōhuehue a weed?

Pōhuehue (Muehlenbeckia australis) is a vigorous scrambling or climbing native plant that grows naturally in places where there is plentiful light, such as cliff faces, scrub, regenerating bush and forest edges - and restoration planting sites!

Some people regard it as a weed because its rampant growth can smother planting. The natural function of pōhuehue is to protect exposed bush edges and disturbed sites, providing cover for native trees to emerge through it. Clear it away from around your young seedlings, but let it grow in the gaps - it will keep weeds down and is an important insect habitat, especially for native moths and butterflies.

(Left) Banana passionfruit and Old man's beard are two climbing weeds that are difficult to eradicate. Trace back to the main growing point, cut and paste the stump. With climbers, ensure all cut foliage and stems have no contact with the ground or they will regrow.

(Right) Pōhuehue climbing over the top of a Koromiko.

Preparing ground for planting after weed control

Weed debris will eventually rot down and contribute to the organic matter in the soil. Moving debris into piles makes it easier to move around a site.

Usually weed clearance is enough ground preparation. Occasionally, if the ground is very compacted, ripping might be required using a digger with ripping blades.

Where large trees, like macrocarpas or pines have been removed, leave the site for several years to allow the debris and pine duff to settle and rot down, especially where the ground under the trees has been compacted and/or dominated by woody tree roots that make planting difficult. Cover these sites with mulch to inhibit weed invasion in the interim.

(Above) After old conifer trees were cleared from this site on Hutchison St, in 2015 the tree debris was removed and the site was partly mulched, making follow-up work safer and easier.

(Below) Hutchison St site four years later.

Ngā kīrehe ka tirotiro haere
Browsing animals

"Our biggest threat to plants is rabbits, not just on exposed sites, but in the bush. Get on top of rabbit control and get help from Council if you need it."

Garth, Highbury, Polhill Reserve planting volunteer

The most common animals in Wellington that might trample or browse newly planted, nutrient-rich seedlings are rabbits, hares, feral goats, possums and, to a lesser extent, pukeko.

Check out Pest Detective to help identify which animal pests are at your site. You may need to control pest animals before planting if numbers are high.

For Council reserves, contact your ranger or the Council Biosecurity Officer - Pest Animals to arrange animal pest control.

In rural areas, fence all stock out of areas to be planted with native plants.

Taupata (left) and pīngao (right) can quickly be destroyed by rabbit browse. Photographer: Michael Bergin.

Pest animal deterrents

Use re-useable physical protection such as plant protectors or hare nets for pest animals like rabbits and hares.

Where animal numbers are high and control is difficult or reinvasion likely, plants can be sprayed with an animal deterrent before they leave the nursery which may help them through the first three months of establishment. One product, used to make plants unpalatable to rabbits and hares for up to three months, is Plantskydd. Always wash your hands thoroughly after handling plants with Plantskydd applied to them.

Ongoing monitoring of pest animals will be the key to plant survival. Keep a close watch for signs of damage, especially when the plants are still young and vulnerable.

Take note of which plant species are browsed and what is left alone. You may need to restrict your plant species selection to unpalatable plants.

(Above) Young nikau seedling browsed by rabbits. Rabbits in Wellington feed both in open areas and in bush.

(Right) Tree shelters being used to protect from the wind and rabbit browse, combination of green corflute shelters and composting coconut fibre shelters.

Ngā tikanga whakatō tipu kia toitū ai
Restoration planting techniques

Restoration planting is no easy task in Wellington's rugged, windy and exposed coastal environments. The following techniques have been collated from the experiences of community groups, landowners and Council staff in Wellington.

Te whakatō tipu i ngā marama mākū
Plant during wetter months

The best time to plant natives in Wellington is from mid-May to mid-August when the soil is moist. Ground moisture is the most important factor for plants to get a good start in life. Planting out of the main planting season can result in very stressed plants that take longer to grow and are less resilient.

If circumstances necessitate late planting, water plants thoroughly at planting time and for the following weeks. Use mulch or weed mats to help retain moisture in the ground.

At well sheltered sites where ground moisture is available for longer periods (like along stream sides or in sheltered gullies), planting can start earlier, around April, and finish in early spring.

If you are planting coastal dunes, aim for June-July as this is when the moisture in the Wellington dune systems is highest.

Dress up warm for winter planting in Wellington. Dig holes around your site to ensure there is good ground moisture if planting early in the season.

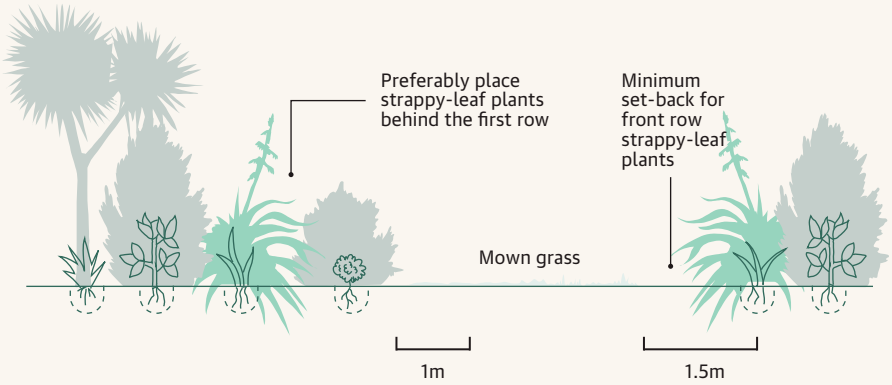
Me tika te tipu mō te āhua o te whenua
Match the plant with the site conditions

Plants can generally be mixed randomly however there are some situations where particular plants will need to be sorted out for planting in specific locations. Here are some common examples.

Wellington City Council park rangers can provide advice on your plant selection and how to match plants to suitable microsites.

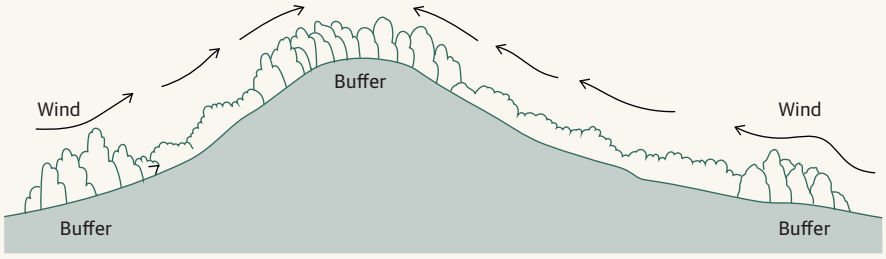
Strappy-leaved plants

Plants with fibrous, strappy leaves such as flax, cabbage trees and toetoe should be kept at least 1.5m back from all tracks and mown areas as these types of leaves can tangle with mowing and trimming equipment. On these edges use mainly smaller-growing plants such as hebes and coprosmas.



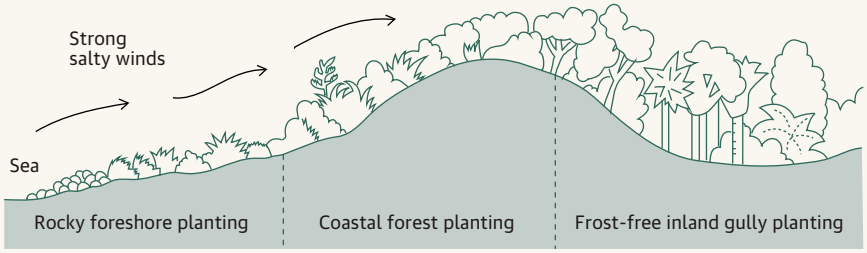
Buffer plants

Use plants that are wind hardy and fast growing on the most exposed parts of your planting area, such as around the edges or on the tops of spurs. They will provide shelter to the rest of the planting.



Microsites

Adapt your plant selection as conditions change inland. Information on the suitability for each species to different conditions is provided in the plant list tables. See the *Restoration Planting Sites* guide that suits your location.

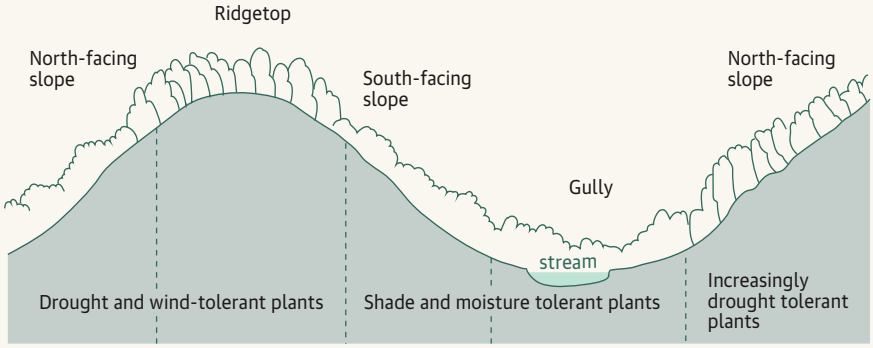


Gullies

In gullies use species that are moisture and shade tolerant and, on upper slopes and the tops of spurs and ridges, species that are drought and wind tolerant.

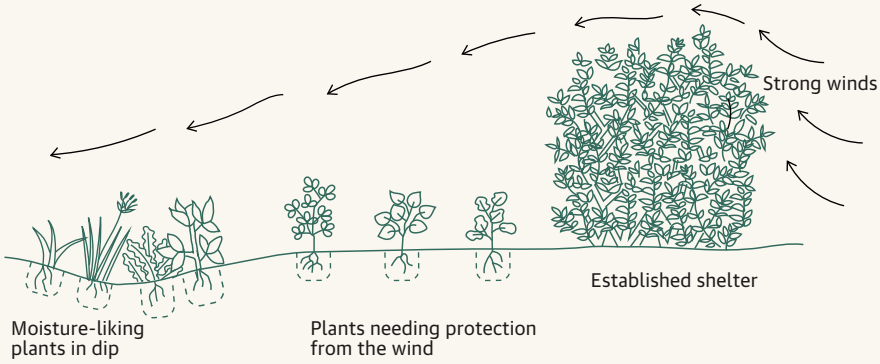
Stream and wetland edges

Different species are best suited to the immediate water's edge and to the bank above. Check Restoration planting for riparian areas in Wellington



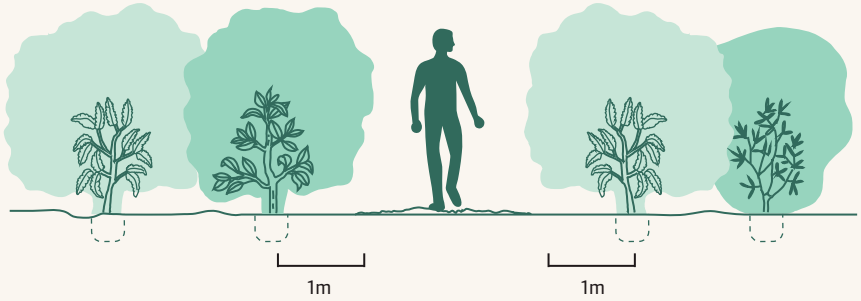
Sheltered microsites

Observe variations at the close-range scale of plant locations, such as dips and hollows with more moisture and sheltered spots in the lee of existing planting.



Track sides

Plant smaller-growing species beside tracks to prevent overgrowth and the need for future trimming or removal to keep the track clear. Plant at least 1 metre from the track edge and think what size and shape plants will ultimately grow.



Views and services

Avoid planting tree species that will, in the long term, block any desirable views or interfere with powerlines. Avoid planting directly over any underground services known to cross your planting site.

Me māwehe ngā tipu kia kapi ai te kāuru o te ngahere
Space plants to achieve canopy closure

"Nature is a vacuum, as soon as you pull something out, it will fill back up again with a weed - especially in Wellington where the wind blows seed around all the time."

Sue Reid, Owhiro Bay

One of the aims of restoration planting is to achieve canopy closure over the ground as soon as possible. The canopy shades the ground, which shades out light-hungry weeds and reduces moisture loss from exposed soil.

Plants grow at different rates, depending on the species, site conditions and where each plant is located. In Wellington it can take anything from four to nine years to get good canopy closure. To speed canopy closure, space plants at the following distances from each other:

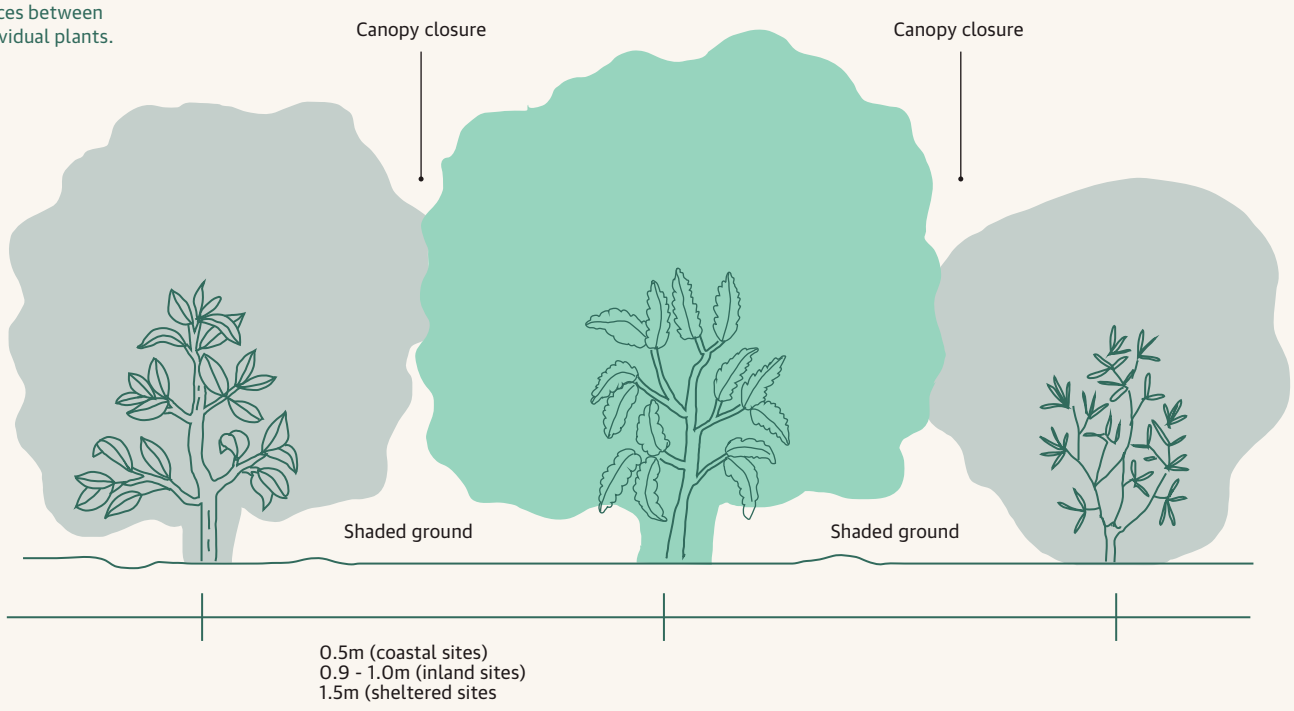
- On coastal sites, plant at 0.5 metre spacings. Coastal plants contend with harsh conditions, often growing slower and smaller than they might at other sites.
- In well sheltered environments (eg gullies), plant at 1 to 1.5 metre spacings.
- On inland and more sheltered sites, plant at 1 metre spacings.

This should achieve canopy after two to three years in sheltered sites (eg riparian areas, lower slopes). On other more exposed sites (eg windy sites, upper hill slopes, hilltops) canopy closure may take as long as four to nine years.

If you are planting within existing forest or scrub, increase the diversity of species, spacings will vary depending on the mix of plants already at the site. See Forest enhancement planting in Wellington for further detail.

Fill in any gaps in your planting where plants die to reduce the likelihood of weed spread.

The canopy closes when plant growth merges to fill the spaces between individual plants.



Me āta mahi kia tika ai te whakatō i ia tipu
Take the time to plant each plant well

The way a plant is put in the ground can affect how its roots grow and whether it will survive. Planting young plants well is particularly important in the exposed and often steep Wellington conditions.

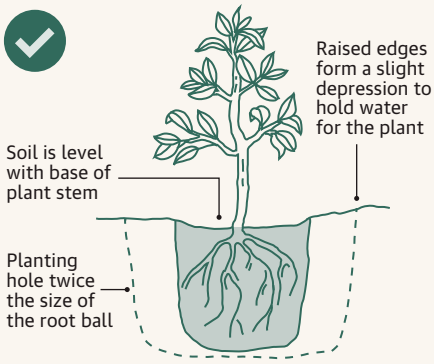
Dig the hole deep enough so the base of the plant stem is not buried (risk of collar rot or smothering) and not sitting high (wobbly plant, exposed roots).

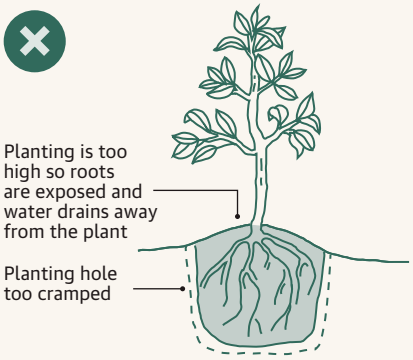
- If you dig too deep, place soil back in the base of the hole to get the right depth.
- Make sure there is no green matter below the plant (it will rot and the plant will sink).

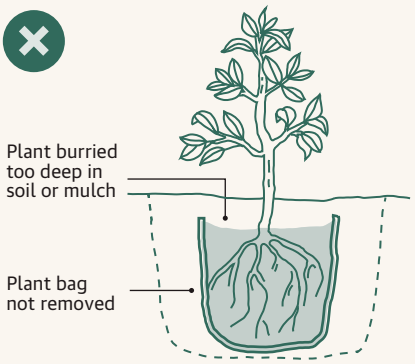
Dig the hole wide enough, about twice the width of the root ball, so there is friable soil for roots to easily grow into.

- Break up any lumps and firm down the soil around the plant to avoid air pockets and to stabilise the plant in Wellington's windy climate.

Form a slight depression to catch water.

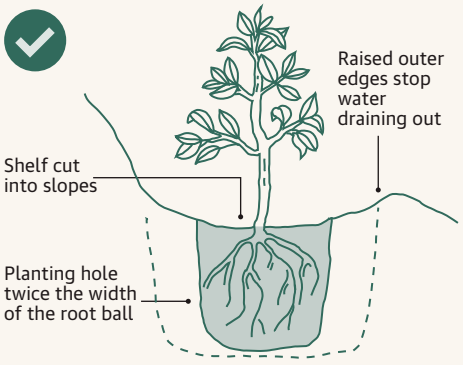


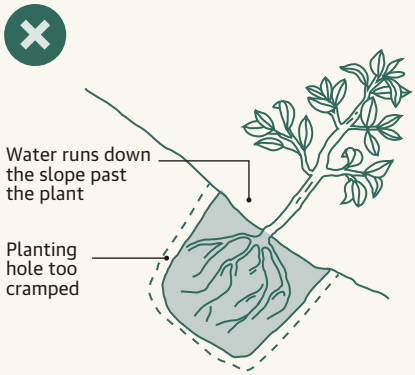




Planting on a slope

Dig into the slope, form a small shelf and plant each plant upright. This will provide a stable base and help the plant collect water rather than let it run off. Planting onto steep slopes is a common situation in Wellington. It can be hard work, with rocky soil and tricky footing, but it's worth the effort.





Tips for planting native plants

Handle plants gently
Carrying plants by their stems and 'yanking' plant bags off are common causes of damage. If bags are hard to remove, cut them off,

If in a hard pot, tap the top of the pot with the plant upside down, holding your hands across the top of the soil area.

Soak plants before planting
Plants will establish far better if they have adequate moisture at planting time. Pre-soaking the plants is good practice, especially where it's not feasible to water plants such as on steep slopes. If the plants or the ground is dry, soak the plants in a stream or in tubs of water with their planter bags on before planting.

Remove the plastic planter bag before planting
Inexperienced volunteers sometimes forget this and the evidence is buried out of sight until the plant fails to thrive.

Gently loosen the roots before planting if they have started growing into a ball
Some plants have fragile roots or are susceptible to root rot, so be careful if you are teasing out root systems. If the roots are tightly entwined together (root-bound) gently make shallow vertical cuts in the outside of the root ball to promote outward growth.

Avoid over-compacting soil in the planting hole
The soil should be firm enough so the plant doesn't wobble in the wind and you can't pull it out easily, but not rammed so tight that water cannot percolate down and the plant roots cannot expand easily into it.

Avoid putting any spray residue from spot-spraying into the plant hole
Slice off the top layer of soil if it has been spot-sprayed and place to one side, being careful not to mix it with the backfill soil from the planting hole. Don't put back around the plant.

See video demonstration
Tim Park from Wellington City Council shows how to plant a tree online at *youtube.com/watch?v=_gkWxLvCVzII*

Understand your plants' requirements Especially important to site some species well to ensure the plant will grow. Some species will be happy in just about any position.

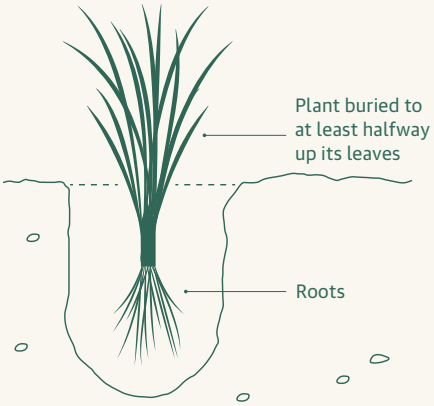
If you research your plant and observe the species growing naturally you will gain an understanding of where the species will thrive.

Climbers
See fact sheet for enhancement planting. Generally climbers need a cool root run, ie plant in the shade but in a position that they can climb out into the sun.

Planting spinifex and pīngao on coastal dunes

Sand-binding dune plants, spinifex and pīngao, require a different planting technique to other species. They must be planted at least half-way up the leaves to thoroughly bury the crown of the plant. This stimulates them to grow through the sand. If they are not buried, they will not be stimulated to grow and may be blown or washed away. See Restoration planting on coastal dunes, rocky shore and turf fields in Wellington for further information.

Diagram of planting spinifex and pīngao



Wairākau Mulch

"We have used mulch extensively, it has been fantastic, it keeps the moisture in and the weeds down. Mulch needs to be at least 30-50mm thick. Lay it around the plant, but away from the stem so it doesn't damage it. We tried using carpet at one stage, but it wasn't permeable enough, so light showers of rain didn't get through to the plants. There are new weed mats that are more permeable and will biodegrade – we are still pulling out old bits of carpet. If we could get mulch to our steeper sites we would!"

Peter, Trelissick Park Group

Mulch is a layer of natural material laid over the ground around new plants. It improves plant survival by helping to retain ground moisture, adding nutrients and slowing weed growth. Options for mulch include basic wood chip, natural matting materials and several tailored commercial products. When considering mulch, weigh up the costs, availability and how you will get the product around your planting site. Always ensure there is good ground moisture before you apply mulch - if you mulch onto dry ground, it will stay dry.

Woodchipper mulch can be 'blanket' spread over the site before planting. If using this technique, it is best to leave the mulch for a year to settle and partially break down before planting into it. If newly spread mulch is too deep, don't plant into it as the plants will end up sitting above the soil level once the mulch settles.

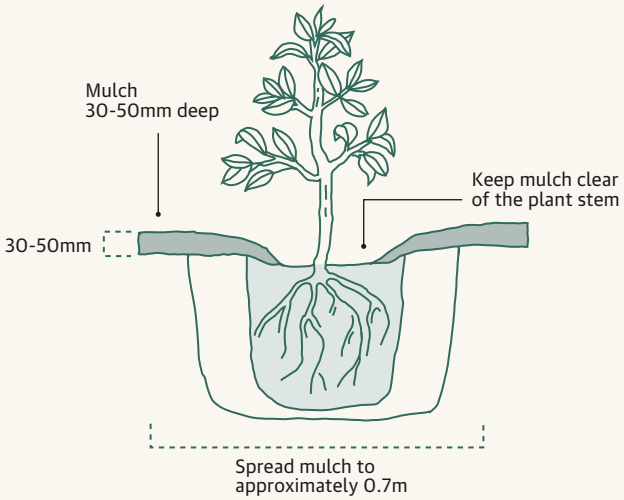
Wood mulch can also be spread in circles around each plant after planting (see below). This is a useful technique if blanket mulching is unfeasible due to difficult access or steep slopes. Barrowing or bucketing mulch by hand is labour-intensive so don't aim to cover all the ground on the site - annual weeds, like grass, that might grow on the uncovered spaces can provide useful shelter and shade to your plants.

Wellington City Council can supply and deliver woodchipper mulch to restoration sites when it is available.

Wood chip mulch in use around individual trees.

Wood mulch should be 30-50mm deep and at least 0.7m in diameter around the plant.

Keep the mulch away from the base of your plants to prevent collar rot.



Natural fibre carpet/matting squares can be used effectively as a mulch by laying them on the ground around each plant with enough space around the plant stem to allow for several years' growth. It can be a low-cost option if you have a source of old or offcut material. However, use only pure wool or natural fibre that will completely rot down, including any reinforcing fibre and backing. Plastic content or artificial fibres, such as nylon, do not rot but disintegrate into tiny strands that pollute the environment. Avoid products that may have been treated with preservatives or chemicals that could end up polluting the soil.

Wool mulch mats are a purchased product, supplied either pre-cut to size or in a roll, and need to be pegged into position. They will break down over time, usually well after the plants are self-sufficient. Ensure the ground is clear of weeds and very damp before laying.

EcoCover is another type of mat product, which is made from wastepaper. It, too, needs to be pegged to the ground and breaks down in a few years. It will suppress weeds for at least three years, by which stage the plants should not need intensive releasing (weeding). Some of these types of weed mats are also impregnated with fertiliser, which is released to the plants as the mats break down. Avoid using fertiliser impregnating products for riparian plantings as they can leach nutrients into the waterway.

Wool mats in use around small restoration plants.

Whakahaumako
Fertiliser

Most indigenous plants do not need added fertiliser, especially if they have been chosen for the local conditions. Fertiliser can be expensive, so it is best used to give plants a good head start in areas where the soil lacks nutrients, like dunes. In these situations, use fertiliser tablets, broken up in the base of the planting hole and covered with a thin layer of sand or soil to avoid root-burn.

Fertilisers are unnecessary for riparian plantings because the nutrient levels tend to be high in these areas. The fertiliser can also leach into the waterway.

Poupou tipu
Plant stakes

Placing a bamboo or wooden stake next to young plants can be useful even though it adds time and cost to a planting project. Experience at existing restoration planting sites in Wellington shows that staking is useful when:

- Grass growth is so rapid that plants disappear from view. Just a bamboo stake with fluorescent paint on the tip may be enough to prevent plants being stood on or cut down by line trimming.
- Emergent trees are being planted amongst fast growing under-storey species so they can be easily located and pruned around where necessary.

Ngā tioata pupuri wai
Water retention crystals

During dry periods, it can be tempting to water your plants. Sometimes it will assist them to survive but it can also cause problems because it encourages shallow root growth towards the surface. Left to themselves, the plants are likely to develop deeper rooting systems which will sustain them far better in periods of stress.

While your plants are establishing, consider deliberately leaving long grass in the spaces between them to provide shelter and shade. It can be enough to help plants pull through dry periods.

Water retention crystals have been used for many years to help retain moisture for planting. When it rains the crystals absorb moisture and expand, then gradually shrink and release the water back to the plants during dry periods. If you have a site where plants will likely dry out, place a few granules in the bottom of the hole during planting, following the manufacturer's guidelines.

Ngā kaiwhakaruruhau tipu
Plant protectors

"Our biggest threat to young plants is rabbits, not just on exposed sites, but in the bush. Get help from Council to get on top of rabbit control. Plant protectors, or tree shelters, are useful to reduce rabbit browsing. They also protect young plants from the wind. Biodegradable ones are better because they break down as the plant grows so you don't need to go back and collect them."

Garth, Highbury, who plants in the Polhill Reserve

Plant protectors help young plants to establish by providing wind shelter and protection from rabbits and hares. They also help to locate plants in long grass. The most common plant protectors are made of corflute, and a range of biodegradable products are coming on to the market. Plant protectors need to be well staked to stop them blowing away in Wellington winds. The combined cost of plant protectors and stakes is initially high but once plants are established, the materials can be re-used.

Plant proectors in use. Here, along the edge of a mowing strip, they highlight the edge of the planting area.

Te whakahaere rā whakatō tipu kia angitu ai
Running a successful planting day

"My advice for planting days and working bees - keep it simple. Only have one or two jobs that need doing. With regard to health and safety - have a look at the site a couple of days before people are due to come, and check it is safe to work at. We have health and safety information that we send out before a planting day or working bee, then we go through it again on the day."

Peter, Trelissick Park Group

Great organisation is key to getting volunteers to help you out on planting

Set your date(s) early

Schedule your planting days well ahead of time. If you have a large planting site, try splitting the planting between different groups who come on different days - it's easier to manage fewer volunteers planting fewer plants in one go.

Promote your planting date online about two weeks before.

Organise to get your plants and mulch on site

If your plants are coming from the Wellington City Council nursery, we may be able to help transport them to your site. Check this when you order your plants.

Try to get your plants delivered as close to your planting site as possible as this cuts down work pushing wheelbarrows or carrying plants. If you have ordered a large number of plants to plant over several days or weeks, designate a site to store them where you can keep them protected and watered.

If you are having mulch delivered, make sure it is piled somewhere close to the site where volunteers can easily barrow it to plants.

Community planting day, upper Kaiwharawhara Stream, restoring the stream bank with a mix of trees, shrubs and grasses. Photo credit Otari-Wilton Bush.

"Keep it simple, keep it social, keep it short! We started out doing day-long planting days, it's too much.

Now we do two hours then have a slap-up afternoon tea. We work in a smaller area all together so people don't get too spread out. That way it's more fun and no one is plugging away on their own.

It feels like a team effort."

Rebecca, Makaracarpas, Makara

Estimate how many plants to set out

The number of plants that can be planted in one session depends on the fitness and skill level of volunteers, the type of terrain and factors like how hard the soil is and whether plants are being mulched. Allow for slower progress if you have inexperienced volunteers and if the digging will be hard.

Inexperienced planters might take 15-20 minutes to plant one plant well, whilst experienced volunteers could plant one every 5-10 minutes depending on terrain. Emphasise to all volunteers that every plant needs care and attention and doing it well can help plant survival.

(Above) Place groups of plants out on site before volunteers arrive to ensure the plants are set out correctly.

Set out plants and any equipment before people arrive

When planting with volunteers, particularly large groups, it is essential that plants are set out where you want them to go before planters arrive. Doing this means you are free to walk around and check plants are going into the ground correctly.

Setting out plants on steep slopes can be difficult as they tend to roll downhill. In these situations, have volunteers dig planting holes at required spacings first then set plants in the holes to be planted. Make sure the people setting out plants know how to match each plant to a suitable location on the site.

Demonstrate how to plant

Always start with a planting demonstration. Experienced people can benefit from refreshing their skills and any new volunteers need to be shown how to dig a hole, how to take the plant out of the bag, place the soil back around the plant and firm the plant into the ground.

Have designated supervisors

Allocate at least one person to run the planting day and supervise as their sole activity. It's the best way to ensure plants are planted correctly in the right places. Make sure materials like stakes and mulch are on hand where needed and volunteers understand when and how to use them. When planting with large groups, especially children, have experienced planters working alongside them.

- **Inexperienced volunteers** need clear instructions and checking to see how they're getting on, especially when English is not their first language.
- **School groups** need to be well supervised and generally require some assistance with digging holes deep enough. A ratio of 1:3 adults to children helps with ensuring quality control.

Health and safety – know your site and communicate any risks

Check your site before volunteers arrive to make sure it's safe for planting, for example are there any flooded streams, fallen unstable trees, wasp nests or poisonous plants. Create a list of the health and safety issues that might arise and decide how you will manage these.

Brief all volunteers at the start of the day on the health and safety risks and how they can be safe. Your supervisor can brief anyone who arrives later before they go on site. Simple actions like wearing sturdy shoes and gloves, keeping spades low to the ground, safe working distances when using tools, stretching before you start work, rotating between tasks, bending correctly, looking out for uneven ground, steep drop offs, planting holes and keeping away from streams will deal with a lot of health and safety issues. Consider doing short warm-up exercises before planting starts, to avoid or reduce strains or injury. You can provide information to people prior to the day to make sure they wear appropriate clothing, bring any supplies needed (eg gloves, drink bottle) and know how to take responsibility for themselves on site. Have sunscreen, a first aid kit and water available if possible.

Have a plan for rubbish

Have bins or bags on site to collect planter bags and containers, any general waste, recyclables and food scraps. Talk to your ranger about removal of larger items of rubbish like tyres . If these can be placed next to a road they can be collected. All hard containers and plant trays should be returned to Berhampore Nursery. Recycle plastic bags if possible.

Thank your volunteers!

Make sure to thank your volunteers, if they feel appreciated they are more likely to come back and help another day or support the project through donations and positive comments!

School children under supervision on a planting day.

A successful school planting day will encourage students to continue to to maintain the planting site.

Support the base of the root ball when taking plants out of a pot or bag to avoid root damage.

Template for planting day briefing

Thanks for coming to _____ to help us today!

We couldn't do this work without people like you helping us out!

My name is _____ and our supervisors for the day are _____

Please ask one of us if you have any questions or need any help during the day.

This area is special because _____

_____

_____

Our aim for today is to _____

Key tasks are:

_____

_____

To make sure everyone is safe on site can you all please (list any on-site risks and health and safety actions, eg wear gloves, use sunscreen, keep away from specific areas etc):

_____

_____

Toilets are located _____

We have water, sunscreen, first aid kit located _____

Wellington is a really difficult place to survive as a young plant, so every plant we put in the ground today needs a bit of extra care and attention.

[Planting demonstration]

_____

_____

[Provide any special instructions, eg plants are set out for you, work in teams of two or three, put all planter bags in the containers provided etc]

_____

_____

_____

_____

If you don't know the person planting next to you, introduce yourself!
Help each other out and above all enjoy yourself!

_____

_____

_____

_____

Te tiaki me te aroturuki
Maintenance and monitoring

"Everybody loves planting, and lots of people think that's what looking after these sites is all about – but planting is only 5% of the job, the other 95% is good site preparation and good maintenance."

Peter, Trelissick Park Group

Te toro i ngā wāhi whakatō tipu
Site visits

Volunteers are often keen to do planting but less enthusiastic about the maintenance that is essential to get good rates of plant survival. You will need commitment within your group for weeding or 'releasing' the plants on a regular basis. Visit your site a couple of weeks after planting and then at least every quarter to check on progress.

Two to three weeks after planting, visit the site and check for:

- Wobbly plants that haven't been properly firmed into the ground or not planted deep enough. 'Socketing' occurs, which is when the plants - buffeted by the wind, rotate in the ground, eventually causing the plants to break or die as the roots snap.
- Orphan plants that were overlooked and not actually put in the ground.
- Buried plants that have been planted too deep or partially buried in mulch, which may cause smothering, stem damage or collar rot.

The plant has not been planted deep enough and the roots are now exposed to the air.

The plant has socketed in the ground, exposing the root system.

Te whakahaere/whakawātea tarutaru
Weed control/releasing your plants

The purpose of releasing plants is to protect them from weeds or grass that are competing for light, moisture and nutrients. There is no need to make the site completely weed free. In Wellington's windy climate, long grass in the gaps between plants can provide useful shelter and shade, provided it's not so tall that it falls over onto your plants. Bare ground between plants can dry out rapidly and become infested with weeds.

Visit your site regularly so that you can work out which weeds are a problem, and which can be left without causing harm to your new seedlings. Check out the Weedbusters website *weedbusters.org.nz* if you need help identifying weeds or finding out how to best control and dispose of them.

There are several options for releasing plants:

- Hand releasing - pulling out weeds around the base of your plants is often enough to get them through the first summer. Most weed material can be left around your plants to mulch them. However, any weeds that regenerate from stems (eg wandering willie) or bulbs/rhizomes (eg montbretia) should be completely removed from between plants.
- Mechanical releasing - using a line trimmer/weed-eater or other machinery to cut back weeds. Make sure the operator is experienced because it is very easy to get too close to the seedlings and ring bark them or completely slice them off. If the grass is long your plants can be very difficult to see - hand release around them first and then use a line trimmer if need be. On smaller sites, it is just as easy to use hand shears. If working on Wellington City Council land you will require competency sign-off from your ranger before using power tools.
- Paste-on herbicide can be useful for treating any regrowth of problem woody weeds. Wellington City Council authorisation is required to use herbicides on Wellington City Council reserve land. Cut the problem plants close to the ground and apply the herbicide paste to the freshly cut surface. Do not use paste if rain is forecast within 12 hours as it could be washed off and damage desirable plants. Follow the label instructions closely, wear gloves and wash your hands before handling other plants to avoid inadvertent application.
- Spray releasing - should only be used as a last resort as spray drift can adversely affect young plants and over-spraying can result in weed species' resistance. Ensure that spraying is carried out by people who hold the relevant spray qualifications and approvals.

Young seedlings sheltered by grass growth. They need releasing only enough to prevent the grass smothering them. The plants further down the slope have pushed through the long grass and no longer need releasing.

Mate atu he tētēkura, ara mai rā he tētēkura
Replacing plants that die

It is not unusual for some plants on a planting site to die. Occasionally, quite large losses can occur. Where plants die, wider gaps are created that take much longer for the canopy to close over. It is worthwhile replacing dead plants, a process referred to as 'infilling'.

With a smaller site you may be able to do a rough count of all gaps needing a replacement plant but with larger sites an estimate based on representative areas will be more feasible. Use the formula below to work out survival rate and replacement plant numbers required.

The percentage rate of plant loss is useful to assess how serious your losses are. Between 5% and 10% would not be unexpected but if you have over 20% a review of your planting and maintenance, including overall species selection, might be needed.

When ordering your replacement plants, look to see which species failed and which are doing well and order mainly the ones that have done well, even if that means having less diversity in the short term.

Think about where the plant losses have occurred and whether there is any correlation with microsites. For example, if there was a 50% plant loss on a steep, exposed north-facing bank compared to 10% loss on the remainder of your site, you would replant mainly the species that survived on the bank for the infill planting and a wider range of the species for the rest of the site.

Formula for working out plant survival rates and number of replacement plants required

1: Plant survival rates

i. Mark out a 10 x 10 metre plot (100m²) within your overall planting where the amount of plant loss looks typical of the whole area.

ii. If plant spacings were 1 metre, there would have been around 100 plants in your 10 x 10 metre plot.

iii. Count the plants within the plot. If 75 plants remain, then 25 plants out of the original 100 have died, ie a 75% survival rate (or 25% loss rate).

2: Estimate of replacement plants needed for a 1,200m² planting area

i. Work out your survival rate and loss rate as above.

ii. Work out how many plants you had in the ground originally for the whole area. Eg for a 1,200m² planting, planted at 1 metre spacings there would be 1,200 plants in the ground.

iii. Multiply the original number of plants by the loss rate. Eg for 1,200 plants at a 25% loss rate = 1,200 * 0.25 = 300 replacement plants.

Planting a pukatea in a carefully selected location.

Mate atu he tētēkura,
ara mai rā he tētēkura.

When one plant frond
dies, another plant frond
rises to take its place.

Te aroturuki Monitoring

How do you know your planting project is succeeding? If progress is slow, can you figure out why? If you monitor your site and record the changes over time you can learn from your experience and use the information to improve your likelihood of success.

Monitoring helps to:

- Keep track of what works and what doesn't - for example regrowth of aggressive weeds, result of damage from animal or site conditions that could be affecting survival, like wind or moisture.
- Work out if, and how many, replacement plants are needed and at what spacings.
- Decide when later stage plantings that require more shelter can be added in.
- Show your volunteers that their efforts are worthwhile to attract future support.
- Report outcomes to partners, sponsors and funders.
- Plan for the future and prioritise your next steps.

"Monitoring is useful to check survival rate, particularly which plants do and don't survive. The important thing is to work out what is the most useful information to collect for your project and for who."

Garth, Highbury, who plants in the Polhill Reserve

Infill planting at Worser Bay. Wellington City Council staff assisting Worser Bay school children to plant wiwi in the backdunes.

He aha ngā mea me aroturuki
What to monitor

Monitoring can be as simple or complex as you decide. The key is to make sure you record information that shows change and reflects your overall goal. For example, if your goal is to attract native birds to your site, one of the measures of success for your project will be whether native bird numbers have increased over time.

Set up a simple record sheet to track what you are going to measure and when. Record any baseline data about your site before you start planting so you have a comparison to work from. Refer to example on the following page spread.

Monitoring plant survival

Work out and record your plant survival each year by either counting your plants in a specific area or working out the percentage of survival based on the size of the area and the numbers of trees planted.

Record whether there are particular species that have died, particular locations where more plants have died (eg slopes facing south, streamside etc) and any events that might have caused this (eg storms, floods, obvious rabbit damage etc).

Monitoring other outcomes

There are likely to be other outcomes you need to monitor to reach your goal. For example, are native bird numbers actually increasing? Is the bush regenerating itself?

There are a few basic techniques you can use to monitor these types of outcomes as well as a wide range of good resources available for more complex species monitoring.

Bird presence – 5 minute bird count

Stand in a fixed point (mark or GPS this so you can use it each time), record the number and species of all birds seen and heard. Record any weather variables (eg wind, temperature, rain etc). Schedule twice a year, generally March and September. For more information see the Department of Conservation five-minute bird count information and resources, or New Zealand eBird website *ebird.org*. This is a great way to record bird observations.

Counting seedlings

One basic technique for measuring seedlings including natural regeneration, is to set up a monitoring plot. Stake out a 10 metre x 10 metre square somewhere that represents your site. Visit the plot at the same time each year and record the number, type and height of all seedlings (ie including the ones you didn't plant). You can then compare your annual findings.

Photo points

Photo points can be a very effective way of showing your progress over time. Select a view that will show useful information about your planting project. Mark (or GPS) a fixed point where you will take your photo from. Record the direction you were looking and the height of the camera. Take a photo at least once a year so you can compare changes over time periods and seasons.

Record any observations about what you see on your monitoring sheet, like weed growth, variation in plant height, damage etc. Save your photos using their date in the title and a brief explanation so you can easily locate them again.

iNaturalist is another digital tool to help you record living things in your planting area. Visit *inaturalist.org*

Example of progress photos of restoration planting on inland hillslopes in Crofton Downs

November 2014
I McGregor

January 2017
I McGregor

August 2018
I McGregor

Lifestyle block in Ohariu Valley

Goal		**Our small bush remnant is flourishing and is connected to our stream with native vegetation that attracts native birds.**							
Measures of success		**Baseline**	**Year 1**	**Comments**	**Year 2**	**Comments**	**Year 3**	**Comments**	**Year ...**
Plant 500 plants a year for eight years until all the site area has been planted		N/A	500	Species lists on order form in file; siting of plants marked on planting plan	500		400		
Ninety per cent of plants have survived three years after planting.	Area A Bush	Planted at avg 1 metre spacings	100%	Gorse popping up, pulled out	90%	All Manuka growing well, northern side	90%	Added extra species into gaps	
	Area B Stream	Planted at avg 0.8 metre spacings	90%	Grass growing tall, have staked plants so easy to find	90%	Range of species, others look healthy, infilled	70%	Stream flooded, lost grasses along the edge	
Bird counts to measure bird presence.	Sept	5	4	3 starlings, 1 tūī	5	3 starlings, 2 tūī,	10	3 tūī, 4 fantail, 3 starlings	
	March	3	4	2 starlings, 2 fantails	3	3 fantails	8	5 fantail, 1 starling, 1 rosella, first kererū seen!	
	Total	**8**	**8**		**8**		**18**		
Seedlings are regenerating in the bush remnant -measured in June in a 10 x 10 metre plot.	Total	5	5	Pigeonwood	10	Pigeonwood, māhoe	15	Pigeonwood, māhoe	
	Number of native species	1	1		2		4		
Photo Points									
PP1: GPSxxx view west	*PP1:*	1/3/2017	1/6/2017; 16/3/2018		13/6/2018; 10/3/2018		21/6/2019; 1/3/2019		
PP2: GPSxxx view west	*PP2:*	1/3/2017	1/6/2017; 16/3/2018		13/6/2018; 10/3/2018		21/6/2019; 1/3/2019		
Other observations			Looks like the blackberry control along the stream was successful, haven't seen any coming up. Watch gorse - is seeding across the fence line.		Rabbit and possum numbers still low across the farm. Pulling gorse from paddock site, leaving it around bush block, doesn't seem to have grown any bigger.		Check planting of stream plants to see if need to plant further back next time or use different plant. Keep an eye on the presence of rosellas - not seen in the area before.		

He mōhiohio anō
More information

Links

Further information on how dune systems absorb the forces of the sea
coastalrestorationtrust.org.nz

Resources about coastal dune restoration
coastalrestorationtrust.org.nz

Identifying and controlling weeds
weedbusters.org.nz/weed-information/weed-list/?weed-search=pampas

Identifying what animal pests are at your site
www.pestdetective.org.nz/

Controlling animal pests
www.gw.govt.nz/pest-animals/

Identifying native plants
www.nzpcn.org.nz/

Planning riparian restoration on farms and open sites
www.dairynz.co.nz/environment/waterways/riparian-planner/

Taking note of bird numbers
ebird.org.nz

Explore and share your observations from the natural world
inaturalist.nz

Contributors

Thank you to Wellingtonians who are a fabulous asset to Wellington's indigenous biodiversity, helping to protect and restore our dunes, wetlands, streams and forests.

Contact

Wellington City Council
Park Rangers 04 499 4444

ISBN number 978-0-947521-17-2

J010720

Absolutely Positively
Wellington City Council

Me Heke Ki Pōneke