wetland restoration guide

Preserving our Wildlife Water Wonderlands in the Bay of Plenty

the key to a successful restoration project is careful and thorough planning, and commitment to continued care.

This guide is brought to you by the Bay of Plenty Wetlands Forum, comprised of the Department of Conservation, Environment Bay of Plenty and Fish & Game New Zealand. We are committed to wetland restoration in the region. If you need help with your project, we are happy to provide free advice.

(See page 15 for contact details.)

Environment Bay of Plenty Regional Council

Department of Conservation *Te Papa Atawhai*

Fish & Game New Zealand

so you want to create or restore a wetland?

then you already know that wetlands are very special places.

what is a wetland?

A wetland is just that – wet land. In general terms, any land that is permanently or frequently wet and supports a natural ecosystem of plants and animals adapted to wetland living is called a wetland. Damp land without wetland plants, such as temporary ponds, low-lying land with patches of rushes, or temporary watercourses, are not wetlands. They may however be good places to restore or convert into a permanent wetland.

Wetlands are some of New Zealand's most diverse habitats, being home to an amazing range of plants and animals, many of which are not found anywhere else in the world. They are also some of our most rare and at risk ecosystems.

Protecting and restoring wetland habitats can benefit us in many ways...

- Recreation
- Wildlife habitat
- Water absorption during wet periods
- Sediment collection
- Aesthetics
- Reduced stock loss
- Hunting
- Nutrient filtering
- Water release during dry periods
- Stabilise banks
- Maori cultural resources

Conservation and restoration projects make a big difference. It's not difficult to create the right conditions for our intriguing wetland wildlife.

There are groups and individuals throughout the Bay of Plenty already repairing our neglected wetlands. You may like to join an established group or start your own project.

New Zealand scaup (male)

Photography: Brian Chudleigh


Swamp - Raupo reedland


Seepage


Estuarine


Marsh

types of wetland in the Bay of Plenty

Swamps

Most wetlands in the Bay of Plenty are swamps. They are formed by groundwater seepage or surface run-off, for example from streams, and are usually permanently wet. Typical vegetation includes harakeke (flax), cabbage trees, raupo, sedges and rushes, scrub and forest.

Seepage

A sloping area with a steady flow of groundwater and/or surface water, but with less volume than a stream or spring. Low plants, like mosses, cushion plants or sedges are typical. Many of these can be found around the Rotorua Lakes.

Estuarine

Habitats in tidal zones, such as salt marshes and mudflats, with herbfields, rushlands, scrublands and mangroves.

Other

Marshes, ephemeral wetlands, fens, mires and bogs are some of the other types of wetland found in the Bay of Plenty.

Visit DOC website to help identify wetland types.


Ephemeral Wetland - Arohaki Lagoon

step by step wetland restoration

step 1 getting started

- Consult neighbours
- Get free advice from organisations (DOC, Fish & Game, Environment Bay of Plenty - See page 15)

page 6

step 2 information gathering

- What have you got now?
- How does water flow into/around/out of wetland?
- How does the wetland fit in the landscape?
- Resource consent requirements?

page 6

step 3 defining your project goals

- Native plants and birds
- Freshwater fish
- Water quality/nutrient filtering
- Beautification
- Game bird shooting
- Screens/views
- Education
- Rongoa Maori

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step 4 drawing a concept plan

- Wetland layout
- Pre-existing features
- Planting zones / planting patterns
- Location bunds, ponds, maimai, viewing platforms, bird hides

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step 5 develop your wetland

- Final shape and depth
- Consents in place
- Complete earthworks

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step 6 what plants, where and how many

- Restoration area and sections
- Soils and Site Conditions
- Wet > dry zones

Native Plants for Wetlands Page 13

page 10

step 7 where to get your plants

- Ecosourcing
- Nursery
- Propagate yourself?

page 10

step 8 preparing your site for planting

- Weed control
- Preparing the ground

For weed identification and control talk to the agencies listed on page 15

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step 9 planting

- Lay out plants
- Planting
- Mulching
- Marking

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step 10 establishment and ongoing maintenance

- Clearing around plants
- Weed maintenance
- Watering
- Protection from wind
- Monitoring and measuring success
- pest animal control

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Ongoing planning

step 1

getting started

Environment Bay of Plenty, the Department of Conservation, Fish & Game New Zealand and your district or city council can give you advice to help guide you through the process. They will be able to tell you whether you need resource consent and, in some cases, may provide funding assistance.

Contact details can be found on page 15.

Ephemeral kahikatea wetland

step 2

information gathering

Take a good look at what you have and how it sits in the landscape around it. Draw a baseline sketch taking into consideration:

- What is there now?
- What was there originally?
- What do you want it to look like?
- Will it affect your neighbours upstream/downstream?
- Do you need Resource Consent? A Wetland Management Agreement may be all that is required.

Maintaining water levels is of utmost importance.

- How does water flow into, around and out of the wetland?
- Is the original, main source of water adequate or will you need to do some work to bring water back in? This could be as simple as blocking your farm drain.
- Technical advice on water budgets and water control structures can be useful.
- It is normal for water levels in a wetland to fluctuate. Trying to fix the level may increase weed invasion and change plant assemblages over time. You should maintain natural fluctuations wherever possible.

HOT TIP ***Water levels are a frequently overlooked component for the indefinite success of your wetland. Seek advice.***

The water level and how much it fluctuates will determine what plants and animals the wetland can support.

Mark water levels at different times of the year with a depth marker (a wooden post is ideal). Use stakes to mark the edges of the winter and summer water levels. This will help you decide if the water levels need restoring, how wildlife might use it and what to plant where.

Typical water level marker

step 3

defining your goals

Your concept plan and the end result will depend on your goals, so have a clear end point in mind. You can achieve more than one goal (for instance, a habitat designed for waterfowl could also attract native birds) but have a primary goal to work towards.

What do you want to achieve?

Wildlife habitat

You need some open water with an irregular shoreline and dense surrounding aquatic emergent vegetation. Buffering plants are important to provide shelter and privacy for birds. You might like to set up nesting or roosting islands and a hide for bird watching. The bigger and more diverse your wetland and those in the area, the more diverse your birdlife will be. A dryland bush area next to your wetland will greatly enhance diversity.

Most natural wetlands in New Zealand are primarily waterlogged soil, rather than areas of open water.

Creating open-water ponds can diversify a habitat but is not necessarily wetland restoration. Restoration can be as simple as fencing a wetland and managing weeds. If you want to create open water, choose areas that have been historically cleared of natural vegetation, drained or taken over by weeds, rather than wetlands that have not been disturbed.

Gamebird shooting

Design an open water pond with easy flight lines for waterfowl, particularly ducks and provide good, safe shooting zones. Fish & Game New Zealand can provide you with advice.

Improving water quality

For nutrient filtering, a long, narrow wetland is ideal. If your wetland is short and wide you may need to work out a way of slowing the water down so it can retained for as long as possible. A shallow wetland with lots of vegetation will be more effective than open water.


Photography: Brian Chudleigh

Australasian bittern


Photography: Brian Chudleigh

North Island fernbird


Photography: Brian Chudleigh

Spotless crake

Freshwater fish habitat

Wetlands with connections to rivers and streams offer excellent opportunities to develop habitat for freshwater fish. You will need to ensure that passage is open all the way to the ocean first. Creating open water areas that can be effectively shaded is crucial and provide valuable rearing and spawning habitat for whitebait and eel species. You could also incorporate some logs and large stumps to provide habitat. Ask agency staff for directions if you would like to visit an example.

Restoration of degraded wetlands

You are most likely to be working with an existing wetland. If you would like simply to restore a wetland closer to its original state, you would be doing less construction work and more weed control, while ensuring water regimes are fully functioning. Your strategies for weed control would be more about maintaining the native plant cover you have and encouraging those plants to spread. Your plantings would not need to be as substantial, as you would be more likely to be supplementing or adding buffers to what you already have. Restoring degraded wetlands can sometimes be quite complex, but can also be as simple as knocking out a few willows and building a fence.

step 4

drawing a concept plan

Plan according to the setting you have so that when it comes to fence, excavate and plant you know exactly where everything should go.

You may be able to work with your neighbours to restore a larger area or to extend riparian areas for streams feeding into the wetland.

Take into account:

- Wetland layout
- Pre-existing features
- Restoration area and sections
- Water inflows and outflows
- Planting zones
- Plant mixes
- Islands for roosting (with no or short vegetation for waders)
- Nesting islands (with taller vegetation for water fowl)
- Location of bunds, ponds, maimai, hides and viewing platforms

Planting zones

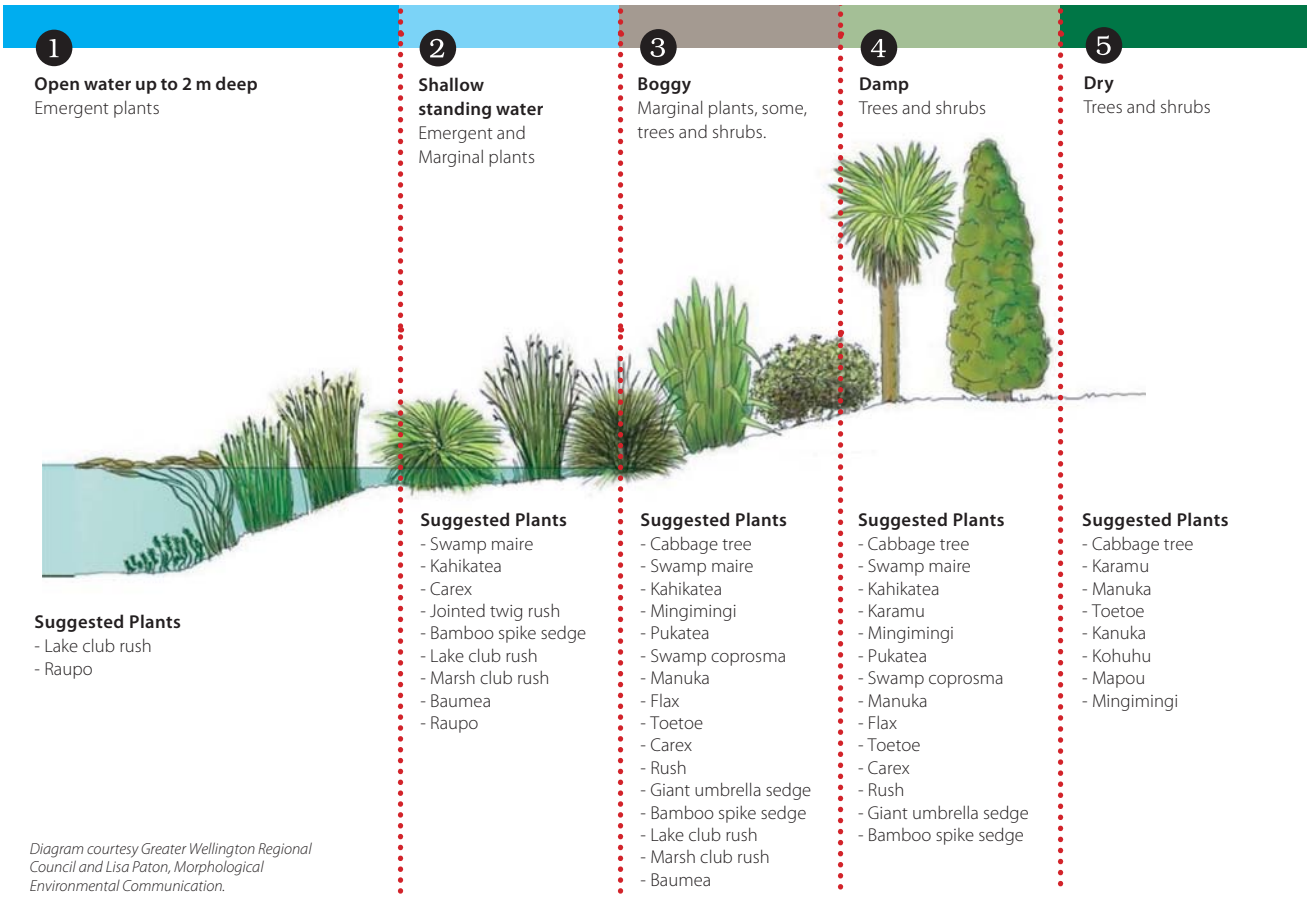
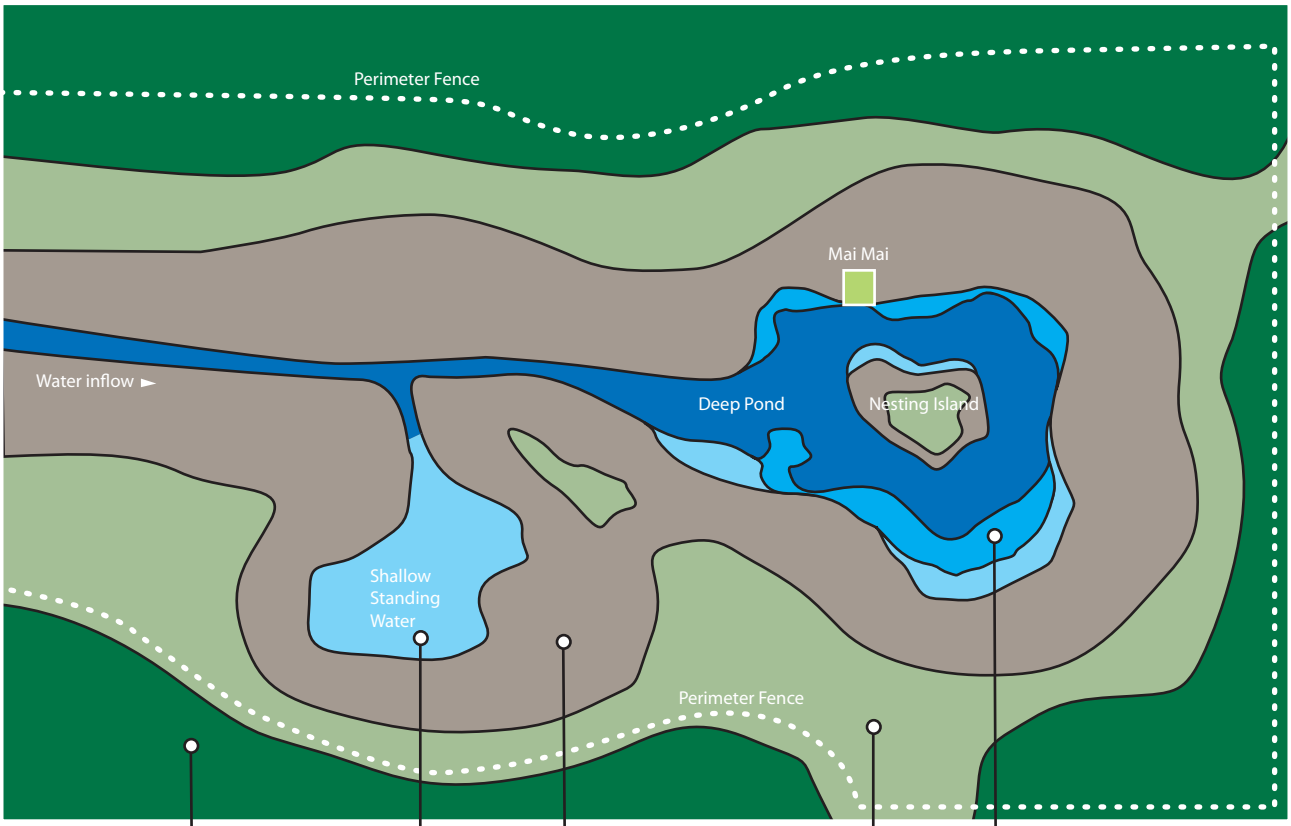


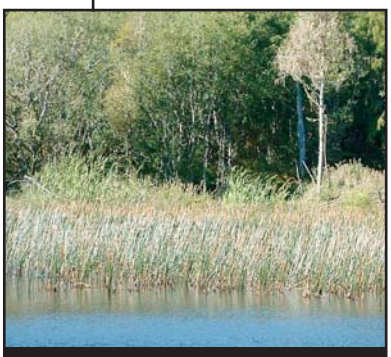
Diagram courtesy Greater Wellington Regional Council and Lisa Paton, Morphological Environmental Communication.

Here's how your planting plan could look... (refer to color key at the top of "planting zones")

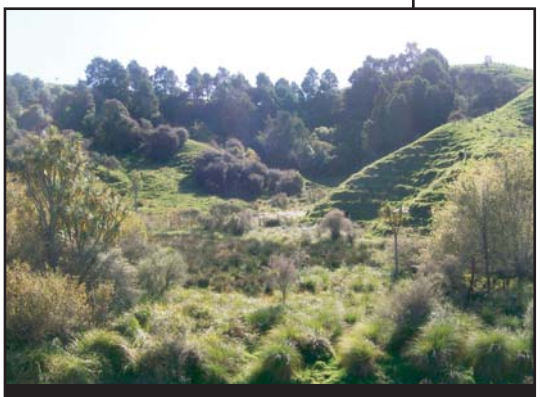


Shows zones 2-5 - raupo in shallow water in the foreground, grades to mingimingi, manuka and kahikatea and then up the hill into a dryland forest.

Rushland with mingimingi, cabbage trees and flax - Zones 3-4.



Eleocharis sphacelata (bamboo spike sedge) and raupo in Zone 1.



Carex sedgeland and rushland - Zones 2-3

Manuka, cabbage tree toetoe wetland - Zones 4-5. In a planting in these zones you would use mostly manuka (50-70%) to fill in the area, with cabbage tree, toetoe and other species in clumps amongst it.

step 5

develop your wetland

If you are not doing any earthworks or building water control structures, you will go straight to the next step.

- Complete the concept plan and have a design of the final wetland shape and contours, including water depth.
- Discuss your design with an expert or agency representative and use a reputable contractor.
- Make sure you have any required resource consents or a Wetland Management Agreement in place before you start any construction works.
- If you are using earthmoving machinery, check that it is not carrying weeds. If it arrives with big clumps of mud and obvious weed fragments, clean it with a high pressure hose before it enters your wetland area.
- This is a good time to build your fences and mulch any large areas of treated weeds like blackberry, as a first step in planting preparation.

step 6

what plants, where and how many

Prepare a planting plan

- Try to replicate an existing natural wetland in the area.
- Identify different zones so that you know which plant species to use where (see page 13 for plant lists).
- Keep things simple to start with. You can inter-plant and add more specialised plants later.
- Plant a small section at a time, rather than spreading plants too thinly. This helps establish a cover faster, which reduces maintenance.
- Clearly mark off the zone that you will be starting on first.
- Pace out the area and use the tables below to work out how many of each plant you will need.

Plant spacings

sedges and rushes	0.5 m
shrubs	1.0m
small trees	1.5-2.0m
large trees	3.0m

(step 6 continued)

Spacing	Plants per m²
0.5m	4
1.0m	1
1.5m	0.44
2.0m	0.25
3.0m	0.11

Source: Natural Environments

HOT TIP *You will get better survival rates using pb2 and PB3 sized plants – good quality PB2's are the most cost effective, provided you do proper maintenance. (PB = planter bag)*

step 7

where to get your plants

- Use native plants that have been grown from locally sourced seed.
- Buy from a reputable wholesale native plant nursery, as close to your location as possible. Local nurseries often source seed from the local area. This is important – ask them!
- At the very least get native plants grown from seed collected in the Bay of Plenty.
- Draw your concept plant, then place your order with the nursery. You may need to adjust your plan for the year depending on plant availability.
- If you are involved in a large project, consider entering into a contract with a specialist nursery.
- Some agencies may provide you with free plants to get you started.
- Do NOT remove plants from the wild.

step 8

preparing your site for planting

Weed control

- Identify all weed infestations on your map.
- Take into account weeds outside your wetland that will re-infest it, for example large grey willow nearby or crack willow upstream, and pampas on the dry areas around the wetland.
- Prioritise where to start.
- Talk to a pest plant officer at the Department of Conservation or Environment Bay of Plenty for help with a weed control strategy and advice on the best methods.
- You may need to start weed control a year or so ahead of planting if you have heavy infestations.
- Follow up at least three months before planting.
- Spray the grass in your planting area a month before planting.

HOT TIP ***This initial control will not be your last! Weeds require persistent effort over time. If you do not control your weeds properly you will lose all the good work that you have done.***

For more information on weed control visit www.weedbusters.org.nz or www.envbop.govt.nz , or consult your local agency.

Fencing

- Fence your wetland *before* you plant to protect it from stock damage.
- If you can, include a buffer strip around the wetland and/or any riparian zones upstream.

Pest animal control

- Pests like rabbits, hares and possums can destroy your plantings. Talk to a pest animal officer at Environment Bay of Plenty or the Department of Conservation for advice.
- It is important that animal pest control be done before plants go in the ground.
- Pukekos will also pull out small plants. Properly planted PB 2 grade plants should fix this. (Pukekos are a protected game bird and cannot be killed without permission from Fish & Game New Zealand except by a licensed game bird hunter during the season.)

"DOC 200" pest animal trap

step 9

planting

- Soak plants well and make sure they do not sit in the sun for too long.
- Lay the plants out where they need to be before you start.
- If you're planting as a group, lay the plants out according to the plan, and/or provide everyone with a copy.
- In wet areas, around the water's edge and in shallow water, plant in summer when water levels are low and the water is warm. Otherwise, plant hardy frost-tolerant species in autumn and frost-sensitive species in spring.
- In warmer coastal areas with fewer frosts a lot of planting can be done over winter.
- Plants that need shelter or shade can be planted one or two years later, once cover has developed.
- Plant in groups or clumps, rather than alternating species.
- Avoid scattering too sparsely, or creating straight lines or rows.
- Plant in line with natural features, such as gullies and ridges, not across them.
- Make sure plants are planted in the correct moisture zone.

HOT TIP ***Buy bamboo stakes and dip the tops in paint to mark your plants. A flush of weeds can make your plants hard to find.***

Make sure you plant correctly to maximise survival.

Clear all weeds from your planting site. Dig a hole deeper and larger than the root ball of your plant

Remove planter bag. Place the plant in the hole and fill the hole with soil to the height shown above. Press gently around the plant.

Water well because a good soak will help the plant to get established

Put mulch, compost and/or bark chips around the plant, not touching the stem

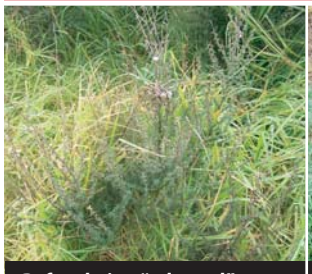
step 10

maintenance and monitoring

Maintenance is the key to survival of your plants and success of your project.

- Keep working on weed control. Plantings will need to be 'released' from competing weed growth at least three times in the first year, after which every spring and autumn may be sufficient. Keep a close eye on your site as you may need to do it more often.
- You will have less maintenance to do after about three years when the plant canopy closes, but you will need to continue with regular weed control until then.
- If you are using herbicide be careful not to spray your plants. Using a selective herbicide may be an option.
- A spray cone on the nozzle will avoid spray drift. Don't spray when it's windy!
- Mulch can help control weeds but you need to remain vigilant as they may still come through.
- Grass can provide some shelter and help hold moisture in the soil, but you will need to clear an area around each plant until their heads are above the surrounding vegetation.
- Remove weeds entirely.
- Check for new weeds, both in and near to your wetland.
- Control new infestations before they become well established.
- Keep your fences in good order.
- Monitor your planting for signs of pest animals. If you see signs of presence or browsing step up your control.

HOT TIP ***Photos are a good way of monitoring plant survival rates, pest and weed control, and success of the project generally.***



Before being "released"

...and after

Spray cone on nozzle to avoid spray drift

plant guide

The following pages provide a list of recommended plants for Bay of Plenty wetlands. It is not intended to be an exhaustive list. These plants are a good base for any wetland restoration project, and are tolerant to a range of conditions. Most are readily available from local native plant nurseries, although a few will be found only at specialist nurseries or require expert advice to propagate.

plant guide key

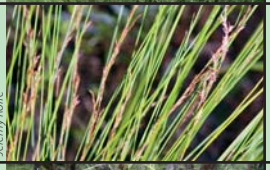
FSNW	Attracts birds **F** = fruit **S** = seeds **N** = nectar **W** = wildlife shelter/nesting
10m	Approx max height
	Full sun
	Partial sun
	Full shade
	Drainage - good
	Drainage - moderate
	Drainage - poor
	Wind sensitive
	Frost sensitive

When to Plant: Means at what stage in the project. Early are the pioneer species that can go in first on bare site. Mid and late species require some shelter from other plants as they can be frost tender or generally grow in moderate to heavy shade.

Enrichment planting: to add diversity to your planting

Plant Name		Visual Descritpion Planting Proportions	When to Plant	Restoration Aim	Planting Conditions: Zone	Light	Drainage	Wind/Frost	Animal Browse
Cabbage tree Ti Kouka *Cordyline australis*	 DOC	**Tree** Moderate numbers in groups	Early/late	FSN 10m	3 4 5				
Swamp maire Maire tawake *Syzygium maire*	 Peter de Lange	**Tree** Few - enrichment planting	Early/late (late in areas with heavy frosts)	F 15m	2 3 4				Possums (young and mature trees)
Kahikatea *Dacrycarpus dacrydioides*	 DOC	**Tree** Concentrate plantings to create stands. Few to moderate numbers	Early	FS 30m	2 3 4				
Pukatea *Laurelia novae-zelandiae*	 Jeremy Rolfe	**Tree** Plant a few - enrichment planting	Late	25m	3 4				
Karamu *Coprosma robusta*	 Jeremy Rolfe	**Shrub** Moderate numbers in appropriate zone	Early	FS 2-4m	4 5				Rabbits, hares, cattle. But not possums
Mingimingi *Coprosma propinqua*	 Jeremy Rolfe	**Shrub** Few	Mid	F 3m	3 4				
Swamp coprosma *Coprosma tenuicaulis*	 Jeremy Rolfe	**Shrub** Few	Early	F 3m	3 4				
Manuka *Leptospermum scoparium*	 John Smith-Dodsworth	**Tree** Many in appropriate zones. These would make up the bulk of most plantings.	Early	4m	3 4 5				
Flax Harakeke *Phormium tenax*	 Peter de Lange	Moderate numbers - plant in groups away from species that will shade them later.	Early	N 2m	2 3 4				
Toetoe* *Cortaderia fulvida*	Scion	**Grass** *Throughout the BOP, especially in inland districts.* Few	Early	2m	3 4 5				Rabbits, young plants
Toetoe* *Cortaderia toetoe*	 Scion	**Grass** *South of Tauranga only. More coastal.* Few	Early	2m	3 4 5				Rabbits, young plants

***Important note:** Similar to invasive pampas grass which should not be planted. Pampas has bushy erect flower heads November/December and dead leaves curl at the base; versus toetoe which droops and flowers in January/February and has a white waxy substance at the base of the leaves.

Plant Name		Visual Descritpion Planting Proportions	When to Plant	Restoration Aim	Planting Conditions: Zone	Light	Drainage	Wind/Frost	Animal Browse
Carex PUKIO *Carex secta*	 John Smith-Dodsworth	**Sedge** Many in appropriate zones. These would make up the bulk of the plantings in wetter areas.	Early	W 2m	2, 3, 4				
Carex *Carex virgata*	 John Smith-Dodsworth	**Sedge** Many in appropriate zones. These would make up the bulk of the plantings in wetter areas.	Early	W 1m	3, 4				
Carex *Carex geminata*	 John Smith-Dodsworth	**Sedge** Few	Early	1m	3, 4				
Jointed twig rush *Baumea articulata*	 John Smith-Dodsworth	**Rush** Few - enrichment planting; limited by zone.	Early	W 1.8m	2				
Rush *Baumea tenax*	 Jeremy Rolfe	**Rush** Few - enrichment planting.	Early	0.5m	3, 4				
Giant umbrella sedge *Cyperus ustulatus*	 John Smith-Dodsworth	**Sedge** *Some die back in winter.* Few - enrichment planting.	Early	0.8m	3, 4				
Bamboo spike sedge *Eleocharis sphacelata*	 John Smith-Dodsworth	**Rush** Few - enrichment planting; limited by zone.	Early	1.2m	1, 2				
Lake club rush *Schoenoplectus tabernaemontani*	 John Barkla	**Rush** *Propogate by subdivision.* Few - enrichment planting; limited by zone.	Early	W 2m	2, 3				
Marsh club rush *Bolboschoenus fluviatilus*	 John Smith-Dodsworth	**Upright sedge** *Stems die back over winter.* *Propogate by subdivision.* Few - enrichment planting.	Early	1.5m	2, 3				
Baumea *Baumea rubiginosa*	 John Smith-Dodsworth	**Sedge** Few - enrichment planting.	Early	1m	2, 3				
Raupo *Typha orientalis*	 John Smith-Dodsworth	**Grass** *Dies off in winter. Can be hard to propogate by division.* Few - enrichment planting.	Early	W 2m	1, 2				

help and advice

freely available from...

Agency	Type of advice	Contact details
Environment Bay of Plenty	• Wetland design • Pest plants and pest animals • Planting advice • Resource consent requirements/ permitted activities • Wetland Management Agreements • Possible funding assistance • Legal protection • Helpful publications	0800 ENV BOP (368 267) www.envbop.govt.nz
Department of Conservation	• Wetland design • Native wildlife • Pest plants and pest animals • Planting advice • Legal protection • Helpful publications	Bay of Plenty Conservancy Office | 07 349 7400 Tauranga Area Office | 07 578 7677 Rotorua Lakes Area Office | 07 348 3610 Rangitaiki Area Office (Murupara/Whakatane) | 0800 366 1080 Opotiki Area Office (East Coast/Hawkes Bay Conservancy) | 07 315 1001 www.doc.govt.nz
Fish & Game New Zealand, Eastern Region	• Wetland design • Gamebird habitat • Pest plants and pest animals • Planting advice	0800 434 742 www.fishandgame.org.nz
District or City Council	• Vegetation clearance • Subdivision • Possible rates relief or other incentives • Legal protection • Possible funding assistance	Western Bay of Plenty | 07 571 8008 | www.wbopdc.govt.nz Tauranga City | 07 306 9009 | www.tauranga.govt.nz Kawerau | 07 323 8779 | www.kaweraudc.govt.nz Rotorua | 07 348 4199 | www.rdc.govt.nz Whakatane | 07 306 0500 | www.whakatane.govt.nz Opotiki | 07 315 3030 | www.odc.govt.nz Taupo | 07 376 0899 | www.taupodc.govt.nz
QEII National Trust	• Covenants	National phone | 0508 QE2TRUST (732 878) BOP Representative (Stephen Hall) | 07 544 1227 www.nationaltrust.org.nz

Other regional councils with useful information on wetland restoration

- **Auckland Regional Council** | www.arc.govt.nz
- **Environment Waikato** | www.ew.govt.nz
- **Horizons (Manawatu/Wanganui)** | www.horizonsmw.govt.nz
- **Greater Wellington Regional Council** | www.gw.govt.nz
- **Tasman District/Regional Council** | www.tdc.govt.nz

Other useful websites

- www.weedbusters.org.nz - for weed identification and control
- www.nzpcn.org.nz - (The New Zealand Plant Conservation Network) for information on native plants and weeds
- www.bush.org.nz - (The New Zealand Ecological Restoration Network) for general restoration information
- www.landcare.org.nz - (NZ Landcare Trust) "Sustainable land management through community involvement"

Recommended Reading

- P Johnson and P Gerbeaux (2004). **Wetland Types of New Zealand.** Wellington, Department of Conservation. ISBN 0-478-22604-7 (An electronic version of this publication is available on the DOC website.)
- R Buxton (1991). **New Zealand's wetlands: A management guide.** Wellington, Department of Conservation and the former Environmental Council. ISBN 0-478-01199-7
- T Porteous (1993). **Native forest restoration: A practical guide for landowners.** QEII National Trust. ISBN 0-908-67146-6
- **NZ Farm Environment Award Trust** Practical Guide to Natural Features on Farms. www.nzfeatrust.org.nz

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Environment Bay of Plenty REGIONAL COUNCIL

Fish & Game

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All plant photos courtesy NZCPN except toetoe - courtesy Scion.