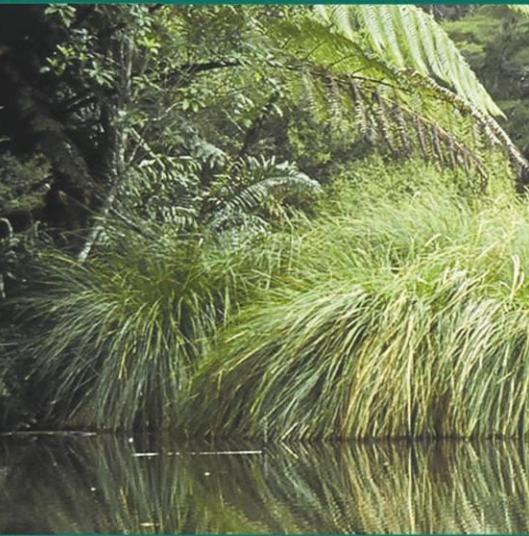


DRAFT

RESTORATION PLAN FOR WAITARERE SAND DUNES AND WAIRARAWA STREAM



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Restoration Plan for Waitarere Sand Dunes and Wairarawa Stream

Contract Report No. 2548

Prepared for:

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Date:

March 2011

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1. INTRODUCTION

Waitarere Beach is a popular coastal holiday location in the Horowhenua District, with a significant permanent population. Horizons (Manawatu-Wanganui) Regional Council (Horizons) wishes to support the ecological restoration efforts of the Waitarere Beach Progressive and Ratepayers Association (WBPRA). The WBPRA are a highly motivated group who have concerns about weed infestations, particularly coastal wattle (*Acacia sophorae*), on the dunes in front of the township. Horizons commissioned Wildland Consultants to assess the status of the local ecosystem and develop a restoration plan to guide the WBPRA.

The project area includes the dunes of the coastal reserve along the residential beach frontage, a strip extending for over two kilometres. It also includes the banks of the Wairarawa Stream where it flows through the township from its source in the Wairarawa Lagoons. The outfall of the stream flows across the beach adjacent to the access point at Waitarere Beach Road. Both of these environments have been heavily modified by an influx of exotic plant species. Indigenous vegetation is scarce (see Section 4.1), other than spinifex (*Spinifex sericeus*) and pingao (*Ficinia spiralis*) on the foredune. Karo (*Pittosporum crassifolium*) may be found in the mid- and rear-dunes, but is regarded as an invasive pest species in this environment (see Section 9.1.5).

As this report is written primarily as a guiding document for the Waitarere Beach community, all species will be identified by both common name and scientific name in the first instance, but common plant species will then be identified only by common name in the text. Less well-known species that don't have a common name, or those species with a common name that is not unique, will also be identified by a scientific name. A full list of plants by botanical name is provided in Appendix 8.

2. MANAGEMENT PRIORITIES AND VISIONS

2.1 Waitarere Beach Progressive and Ratepayers Association (WBPRA) vision

Discussions with the committee of the WBPRA (Sue Ellis pers. comm.) indicate that their primary priorities are:

- the removal of the woody weed species,
- the enhancement of the dune environment through planting indigenous coastal plants,
- the preservation of visual and recreational values.

They would prefer that the dune environment be kept as open as possible in order to protect sea views, with attractive, well-defined beach access tracks.

2.2 Local authority management priorities

Horizons and the Horowhenua District Council (HDC), as the regional and local authorities, have a responsibility to ensure that wind erosion of the dunes is kept within manageable limits (Madden 1999). This includes ensuring that significant amounts of drifting sand are not carried inland to the residential area, and that beach-front infrastructure is protected from drifting sand. To this end, the vegetation cover on the dunes must:

- be kept intact in order to control dune blow-outs,
- maintain the shape of the dunes as far as possible,
- trap loose surface sand.

The HDC has been managing a portion of the beach-front as a Dune Restoration Area since the early 2000s. They have also been actively controlling woody weeds in the coastal reserve. Plans are in place for the development of a recreational walkway along Wairarawa Stream, linking the beach with the Wairarawa Lagoons.

This restoration plan is intended to build on both Councils' management initiatives. It may expand upon some strategies, but should not be taken as an alternative to the existing or envisioned HDC management operations (as discussed with Dough Tate, HDC Parks and Reserves, December 2010)

2.3 Other considerations

The Levin-Waitarere Surf Club currently lacks clear views of the beach from its clubrooms, due to the development of high marram-induced dunes. The club would like to remedy this situation for recreational safety reasons (Peter Shore pers.com). This is addressed in Section 9.4.

3. GOALS AND OBJECTIVES

This report outlines the existing ecological values and management issues of the Waitarere Beach dune system and Wairarawa Stream. It presents a strategy for weed control, and the restoration of indigenous vegetation. The goal is to enhance the natural character (greater proportion of indigenous species and habitats) and biodiversity values of the area. The priorities outlined in Section 2 above will be taken into account as far as practicable.

4. ECOLOGICAL CONTEXT

4.1 Ecological history

Waitarere Beach lies in the central part of the Foxton Ecological District, an area dominated by a large, active sand-dune system (Ravine 1992). Sand carried from the Volcanic Plateau by the Whanganui, Rangatikei, and Manawatu Rivers is driven in a south and east direction by prevailing currents and winds, and accumulates along the Horowhenua and Kapiti coasts to form dynamic dunes.

During the last 120 years, the process has been accelerated by farming and forest practices further inland. This has led to the formation of new lines of coastal dunes, which, due to their unconsolidated nature, are punctuated by blow-outs (dune erosion areas) with swales (dune depressions) that often contain ephemeral wetlands¹ along the inshore extent. As more sand is deposited, new dunes are formed and older dunes are covered by coastal vegetation. This process leads to an advance in the coastline.

Less than 5% of the Foxton Ecological District now has predominantly indigenous vegetation (Ravine 1992). Ravine (1992) suggests that, prior to the arrival of European settlers, spinifex and pingao would have been most common on the seaward side of the foredunes, while the back face of dunes and rear dunes would have been covered by shrubs such as tauhinu (*Ozothamnus leptophyllus*), sand coprosma (*Coprosma acerosa*), and possibly matagouri (*Discaria toumatou*). Wetlands in the swales and basins would have been dominated initially by sedges, and then succeeded by oioi (*Apodasmia similis*), toetoe (*Austroderia fulvida* or *A. toetoe*), cabbage tree (*Cordyline australis*), and flax (harakeke - *Phormium tenax*). Within a kilometre of the coast, small forest trees, such as ngaio (*Myoporum laetum*), rewarewa (*Knightia excelsa*), and mahoe (*Melicactus ramiflorus*), would be common on the older rear dunes. Further inland, mature forest would be present on the deeper soils, with wetter areas dominated by kahikatea (*Dacrycarpus dacrydioides*), pukatea (*Laurelia novae-zelandiae*), and maire tawake (*Syzygium maire*).

4.2 Conservation of coastal dune and wetland vegetation

Coastal dunes and wetlands are identified as threatened habitats in the Wellington Conservancy Conservation Management Strategy (Department of Conservation 1996). They are poorly represented in land parcels administered by the Department of Conservation or in other protected natural areas. Plant communities of dunes and wetlands are, therefore, high priorities for protection and restoration. Coastal dunes and wetlands are also considered to be National Priorities for Protection (Ministry for the Environment 2007a&b).

4.3 Study area description

The study area covers c.28.7 ha, and takes in the dunes of the coastal strip, the Wairarawa Stream, and the Wairarawa Lagoons.

The 25.1 ha coastal strip occupies a zone of young sand dunes. Such dunes are inherently unstable despite an impression of permanence (Madden 1999). The area is undergoing constant growth (known as accretion) from the deposition and accumulation of sand. This creates bare habitat which is generally initially colonised by spinifex. Most of the dune area in front of the houses has developed since 1965 (Figure 1). The maximum extent of the dunes in 1965 (the yellow line) has been superimposed (and adjusted for scale) in the 2010 image.

The stream and lagoons occupy the remaining 3.6 ha of the study area. The Wairarawa Lagoons lie in a wetland basin in the relict rear dunes a kilometre inland of

¹ Ephemeral wetlands are wetlands that fill with water, usually from overland flows or rain events, during wetter parts of the year but are often dry by the end of the summer.

the township. The stream flows from these lagoons through farmland, pine plantation, passes through the township, and on to the sea. The course of the stream has been straightened artificially, and it flows through several culverts in the residential area before reaching the sea. The Lagoons themselves are fed by a network of drains and minor waterways, including a link to the Oparau Lagoons further inland.



Figure 1: Waitarere Beach in 1965 (left) and 2010 (right). The yellow line indicates the comparative width of the dunes in 1965 and 2010.

5. METHODS

Relevant information from previous surveys and ecological management reports was collated and reviewed prior to field work being carried out.

5.1 Field work

The site was inspected on 18 November 2010. The study area was surveyed on foot as far as possible, or observed from a viewpoint where access across private property could not be obtained.

The ground-based survey involved walking through the entire area to locate remnant indigenous habitats and any remaining rare plant species. All locations of weed species were identified, particularly on the perimeter of the project area, along access tracks, clearings, and the Wairarawa Stream. These areas are most vulnerable to weed invasion, or have a previous record of infestation. Vegetation types and weed species

were recorded and marked by GPS (Garmin 60Csx). The GPS data (Appendix 6) and aerial field maps were used to produce vegetation habitat and weed maps (Figures 2 and 4).

5.2 Weed maps

Weed distributions and densities were mapped onto aerial photographs at a scale of 1:3,000 (Figure 4) using waypoint data recorded at the observation point in the field for each weed species occurrence (Appendix 6). Weed species (i.e. individual waypoints) were grouped with other occurrences, or other species on the maps if, at a scale of 1:3,000, a polygon better represented species occurrence and abundance.

A brief description of species and extent were mapped onto aerial photography. Extent of each species within each polygon is given as one of the following:

- a percentage cover within a defined area
- an estimate using '<' or '>' (if exact numbers of plants were not easily defined, e.g. Japanese honeysuckle (*Lonicera japonica*))
- a location for isolated individuals or small patches.

Common plant names used on the maps are defined in Appendix 1.

6. NATURAL RESOURCES

6.1 Vegetation and habitat types

The study area has been divided into two broad habitats; the coastal dunes, and the Wairarawa Stream and Lagoons. Within these two broad divisions, several vegetation and habitat types are identified - five from the dunes and three from the stream. These are shown in Figure 2 (two sheets).

6.1.1 Waitarere Beach dunes

The dunes are dominated mainly by exotic grasses and trees; having only developed during the last 50 years, during which time there were few indigenous species surrounding the site that could colonise the area. There has been little opportunity for indigenous species to attain a significant presence in the ecosystem. Spinifex is the exception to this, as it forms the major component of the vegetation on the front face of the foredune.

1. Spinifex grassland

Location: Seaward face of foredune.

Area: 4.85 ha

Spinifex is dominant along the seaward (front) face of the dunes, with occasional patches of marram (*Ammophila arenaria*), pingao, exotic ice plant (*Carpobrotus* species; note that these are Unwanted Organisms under the Biosecurity Act 1993), and indigenous shore bindweed (*Calystegia soldanella*).

Figure 2 - Sheet 1 of 2

Figure 2 - Sheet 2 of 2

2. Marram-lupin shrub-grassland

Location: Top and rear of foredune and mid dune area.

Area: 15.33 ha

Marram and lupin (*Lupinus arboreus*) are the dominant species, with dense patches of ice plant and gazania (*Gazania linearis*). Coastal wattle, agapanthus (*Agapanthus praecox*), karo, taupata (*Coprosma repens*), boxthorn (*Lycium ferocissimum*), evergreen buckthorn (*Rhamnus alaternus*), banksia (*Banksia integrifolia*), and radiata pine seedlings (*Pinus radiata*) are sparsely (<1%) scattered throughout.

3. Marram-cocksfoot grassland ↔ karo-taupata-exotic species shrubland

Location: Either side of Wairarawa Stream on rear dunes

Area: 3.53 ha

Marram is the dominant groundcover, mixed with cocksfoot (*Dactylis glomerata*) and other exotic grasses. There are many patches (5<20% cover over the total area) of shrubs (karo, taupata, banksia, boxthorn, and buckthorn) up to 3 m tall. Other species present include sparse scattered coastal wattle, agapanthus, radiata pine, lupin, and ornamental garden plants.

4. Coastal wattle shrubland

Location: Southern end of study area on mid- and rear dunes.

Area: 1.07 ha

Coastal wattle (up to 3 m tall) is dominant but shows significant levels of dieback in places following chemical control (undertaken by HDC). Taupata and karo are also present in the canopy. The understory is negligible, although marram is present around the margins.

5. Macrocarpa forest

Location: South of Wairarawa Stream on rear dunes.

Area: 0.3 ha

Macrocarpa (*Cuppressus macrocarpa*) forms a dense canopy, with marram and exotic grasses in the understory along the margins.

6.1.2 Wairarawa Stream

The stream environment is largely exotic; modifications over the last 100 years or so have resulted in the disappearance of the indigenous vegetation cover. Pasture grasses are prevalent around the lagoons and along the upper margins of the stream. The vegetation of the lower reaches and tidal area comprise a mosaic of mainly herbaceous weeds (both on the banks and in the water) and ornamental garden species that have established from nearby gardens.

6. Pukio-exotic species wetland

Location: Lower Wairarawa Stream

Area: 0.45 ha

Exotic weeds dominate both the banks and the open water, including water celery (*Apium nodiflorum*), mercer grass (*Paspalum distichum*), and reed sweetgrass (*Glyceria maxima*). Pukio (*Carex secta*) is present in patches. The banks are frequently shaded by exotic trees and shrubs.

7. Radiata pine/pasture treeland

Location: Upper Wairarawa Stream

Area: 0.43 ha

Radiata pine shades the stream. Tall fescue (*Schedonorus arundinaceus*) and other exotic pasture grasses line the banks.

8. Open water and pasture

Location: Wairarawa Lagoons

Area: 2.74 ha

The lagoons comprise open water with scattered areas of knobby clubrush (*Ficinia nodosa*) around the margin. Grazed pasture grows right to the edge of lagoons and is dominated by exotic grass species, with scattered areas of knobby clubrush.

6.2 Flora

Forty-three indigenous coastal and wetland species were recorded (Appendix 1). Two species are considered threatened or at risk (see Table 1). A further two species (karo and pohutukawa (*Metrosideros excelsa*)), indigenous to other parts of New Zealand, have been introduced to the site and are now considered weeds (also refer to Section 9.3).

Table 1: Threat status of threatened plant species recorded at Waitarere Beach.

Species	Common Name	National Status ¹	Regional Status ²
<i>Coprosma acerosa</i>	Sand coprosma	Declining	Gradual decline
<i>Ficinia spiralis</i>	Pingao	Relict	Gradual decline

¹ National plant threat rankings as per De Lange P.J., Norton D.A., Courtney S.P., Heenan P.B., Barkla J.W., Cameron E.K., Hitchmough R. and Townsend A.J. 2009: Threatened and uncommon plants of New Zealand (2008 revision). *New Zealand Journal of Botany* 47:61-96.

² Regional plant threat rankings as per Sawyer J.W.D. 2004: Plant Conservation Strategy: Wellington Conservancy (excluding Chatham Islands) 2004-2010. Department of Conservation, Wellington Conservancy, Wellington. 84 pp

At least 108 introduced species were identified and are listed in Appendix 1. Fifty-four of these (listed in Appendix 2) are included as pest plants in the Horizons Regional Pest Management Strategy (RPMS; Horizons 2007). Seven other species (not specifically mentioned in the RPMS) are also listed as potential pest plants in this environment.

6.3 Fauna

6.3.1 Birds

A range of common coastal bird species have been recorded amongst the dunes and along the beach (Todd *et al.* draft report), including black-backed gulls, black shags, variable oystercatchers, and pied stilts. Dabchick and white heron have been reported from the lagoons in 2008 (Astrid van Meeuwen-Dijkgraaf pers. comm. 2010). Pheasants are common in the rear dunes, and are probably nesting in the undergrowth. Five of the bird species seen at the site are nationally threatened or at risk. The complete list of observed bird species and their risk status¹ is provided in Table 2.

Table 2: Bird species noted at Waitarere Dunes and Wairewara Lagoon.

Common Name	Scientific Name	National Threat Status (Regional Threat Status if Applicable)
White heron	<i>Egretta alba modesta</i>	Threatened - Nationally Critical (Regionally Critical)
New Zealand dabchick	<i>Poliocephalus rufopectus</i>	Threatened - Nationally Vulnerable (Regionally Critical)
Pied stilt	<i>Himantopus himantopus leucocephalus</i>	At Risk - Declining
Black shag	<i>Phalacrocorax carbo novaehollandiae</i>	At Risk - Naturally Uncommon
Variable (black) oystercatcher	<i>Haematopus unicolor</i>	At Risk - Recovering (Regionally Endangered)
Black-backed gull	<i>Larus dominicanus dominicanus</i>	Not Threatened
Pheasants	<i>Phasianus colchicus</i>	Introduced and Naturalised

6.3.2 Fish

Wildlands (2007) carried out a survey of the Wairarawa Stream, and identified three fish species in the waterway and lagoons. A healthy population (70) of shortfin eels was noted in the lagoons. Common bullies (10 sightings) were recorded in the wetland and upper waterway. Inanga were simply recorded as 'abundant' in the lower stream, but not seen at all in the upper parts of the system. It was surmised that the dense growth of water celery prevented further migration of inanga upstream, but didn't pose an obstacle to the much stronger eels.

The report suggested that, while the eels and inanga remain migratory, returning to the sea to complete their life-cycles, the bully population is probably land-locked, blocked by the dense aquatic weed growth. The only other fish species mentioned is

¹ Bird threat rankings as per Miskelly C.M., Dowding J.E., Elliott G.P., Hitchmough R.A., Powlesland R.G., Robertson H.A., Sagar P.M., Scofield R.P., Taylor G.A. 2008: Conservation status of New Zealand birds, 2008. *Notornis* 55. 117-135.

yellow-eyed mullet, which was recorded in the mouth of the stream in the NIWA freshwater fish database. Fish species and their national threat status¹ are listed in Table 3.

Table 3: Fish species noted in Wairawara Stream and Wairawara Lagoon

Common Name	Scientific Name	National Threat Status (Regional Threat Status if Applicable)
Shortfin eel	<i>Anguilla australis</i>	Not threatened
Inanga	<i>Galaxias maculatus</i>	Not threatened
Common bully	<i>Gobiomorphus cotidianus</i>	Not threatened
Yellow-eyed mullet	<i>Aldrichetta forsteri</i>	Not threatened

6.3.3 Lizards

The dunes provide a suitable habitat for at least three lizard species: common gecko (*Hoplodactylus maculatus*; Not threatened²), common skink (*Oligosoma nigriplantare*; Not threatened), and spotted skink (*Oligosoma lineoocellatum*; Relict). No lizards were observed during the site visit.

7. RESTORATION ISSUES AND OPTIONS

Coastal environments can present challenges for establishing effective cover of indigenous vegetation for a range of reasons. Revegetation efforts may be adversely affected by frost, summer drought, and damage by rabbits. This can be discouraging for community volunteers undertaking the restoration. This section explores some of the aspects that affect the success of restoration planting and methods that may improve success rates.

Factors that can affect restoration success include specific site climatic factors, site preparation, maintenance of plantings, the types and grades of plants used (sourcing plants), plant density and spacing, damage by inappropriate activities in the area.

7.1 Site climate factors

Dunes can be a harsh environment to establish plants in. Lack of tall sheltering vegetation means that the area is exposed to salt laden winds, which dry out the plants and the ground. The area can also experience significant frosts (especially during May to September). Summer droughts are common. Dune systems often are also nutrient poor which adds to the difficulty of establishing plants.

¹ Freshwater fish threat rankings as per Allibone R., David B., Hitchmough R., Jellyman D., Ling N., Ravenscroft P., Waters J. 2010: Conservation status of New Zealand freshwater fish, 2009. New Zealand Journal of Marine and Freshwater Research iFirst publication 27 September 2010.

² Lizard threat rankings as per Hitchmough R., Hoare J., Jamieson H., Newman D., Tocher M., Anderson P., Lettink M., Whitaker A. 2010: Conservation status of New Zealand reptiles, 2009. New Zealand Journal of Zoology 37(3). 203-224.

Strategies that may be employed to counter these inhibiting environmental factors include:

- Use plant species that will quickly provide cover and microhabitats. A list of suitable species is provided in Table 4/Appendix 5.
- Wherever possible, use existing vegetation cover (even dead standing coastal wattle) or land forms to provide shelter.
- Ground cover plants are more likely to succeed on open dune sites rather than taller shrub species.
- As the ground cover plants become established, these can be inter-planted with shrub species. More plants can then be established in the shelter of the established plantings.
- Plant frost tolerant species in winter to allow time for the root systems to develop before summer drought sets in.
- Plant frost sensitive species in late August/September, because generally there are fewer frosts, or in the shelter of established plants. The success will depend on whether there is sufficient rain to help establish these plants.

7.2 Site preparation and maintenance

- Site preparation is one of the most important stages of planting. It is very important that persistent and/or invasive weeds are removed prior to planting. Other than drought and frosts, overtopping by weeds is the single most common factor for failure of restoration projects.
- Be prepared to undertake weed control for at least three years following planting (based on the planting densities given in Section 6.4). Weed control will be necessary at least until the canopy closes, and is likely to be an ongoing requirement in a system such as this.
- Plantings will need to be released from weed competition (that is weeded) two times a year for the first two years. Limited infilling planting may be required where plants die. Weeding can be reduced or stopped once the canopy has closed.
- Weed invasion may increase after droughts and restoration areas may require additional weed control and possibly also replanting of badly affected areas.
- Pest animal control will need to be undertaken immediately prior to and following planting operations. Pest control of rabbits on an ongoing basis will be required at this site.

7.3 Sourcing plants

- The recommended species for the various management units are listed in Table 4.

- Supplementary species should be planted once a good indigenous cover has established and will enhance plant and habitat diversity.
- All plants should be sourced from local Levin/Kapiti Coast genetic stock, and should generally be grown from seed. This will avoid genetic contamination of local species. Local plants are better suited to local conditions.
- PB3 grade stock is recommended for most of the species to be planted.
- A lower cost option for restoration planting is to use predominantly root trainer grade plants, with only the slower growing tree and fern species supplied in PB3 grade. If root trainers make up the majority of the planting mix, effective site preparation and ongoing maintenance are critical for the successful establishment of the plants.
- Plants should be sourced from natural populations, but sometimes collecting seeds requires permission from the relevant landowner¹. Care needs to be taken to safeguard the viability and sustainability of the source populations. Most reputable plant nurseries have the necessary collection permits in place with the Department of Conservation.
- All plants brought onto the site should be free of weeds especially any potentially troublesome species.
- Plants need to be ordered one to three years prior to planting to allow suppliers to source seed and grow stock. Early orders or “indent” orders may attract lower prices².

7.4 Planting density and siting

- Plant at densities appropriate for the species being used. This will achieve relatively rapid ‘canopy closure’ and reduce opportunities for weed establishment.
- Low growing species and wetland plants need to be planted at close spacings such as c.0.4-0.6 m.
- Taller growing and dryland species can be spaced at 1-1.2 m spacings. However, tree species should be planted at least 3-5 m spacings.
- Toetoe (*Austroderia toetoe*), koromiko (*Hebe stricta*), and harakeke are very useful for rapid canopy closure where plantings 1-2 m in height are required. They will also provide good shelter belts behind which to plant other species.

¹ Most or all seed will be able to be collected from lands administered by DOC.

² Most root trainer stock can be available within a year, but some species may require a longer lead-in time, e.g. up to two years.

- Species have been selected to suit each specific management area. This includes consideration of site drainage, expected plant height, growth rates, potential for shading or loss of views.
- Any sites that are planted using the suite of low-growing species (i.e. <1 m) will require ongoing maintenance. For this reason these species should only be used where there is a specific requirement for low growing species. Low growing species are suggested along access paths and view shafts.

7.5 Recreational use

The site is adjacent to a holiday and residential area. Often dunes and beach areas are regarded primarily as a recreational resource, rather than a fragile ecosystem. Foot and vehicular traffic in the dunes will have a detrimental effect on newly planted vegetation, and even established plants will suffer from repeated disturbance (e.g. trampling) over a period of time. The runners of species like spinifex and pingao are easily broken by trampling.

On the other hand, it is often the case that high usage areas, such as beach access points, are generally the places that are perceived to benefit most from restoration planting (Madden 1999), due to their high public visibility. Therefore, initial planting should take place in small, easily manageable areas, near well defined access points. Planting areas should be fenced off, even if it is only with warratahs and a single wire, to discourage entry by people. Use signs attached to the fence to help explain why it is important to keep out.

8. RESTORATION STRATEGIES

8.1 Restoration vision

Many New Zealanders imagine that the natural state of coastal sand dunes is that of permanent grassland. However in reality a healthy coastal system only has grass-like species on the foredunes, low ground cover species and shrubs on more inland dunes, which then grades into taller scrub and eventually tall forest further inland. So although a rolling grassland dune might be the vision for some sectors of the community, it is not necessarily a feasible outcome.

Many of the grasses currently associated with dune areas are exotic species, dominated particularly by marram (which increases erosion problems, refer to Section 8.2). Indigenous coastal grasses, such as spinifex and pingao usually thrive only on the foredunes, seldom occurring at distances greater than 30-40 metres from the high tide mark (Bergin & Herbert 1998, Bergin 1999). Sand tussock (*Poa billiardierei*; At Risk-Declining) can grow in stable areas of the rear dunes, but this species is vulnerable to disturbance, and is unlikely to persist adjacent to a residential area and its associated impacts (Bergin 2000). A more appropriate scenario will see marram and other exotic plant species gradually replaced with low-growing indigenous shrub and tree species.

8.2 Erosion management

The sand-binding abilities of coastal grasses have an important influence upon the shape and dynamics of the dune environment. Marram, with its remarkable ability to bind sand (Gadgil 2006), forms dunes that are both steep and high. Erosion events are infrequent, but, due to the uneven nature of the root network, tend to lead to catastrophic blowouts when they do occur. These often involve large volumes of sand, and are difficult to revegetate and repair.

Dunes formed under indigenous species, such as spinifex and pingao are known to be lower and less steep than those formed under marram (Bergin & Herbert 1998, Bergin 1999). Erosion events occur frequently, but are seldom catastrophic; they are of a much smaller scale, and are easily managed.

Several small woody shrub species (e.g. sand coprosma, tauhinu, sand daphne (*Pimelea villosa*)) are also known for their ability to bind sand, although generally in conjunction with existing indigenous grasses. These species establish particularly well on the rear dunes and in the lee of the foredunes. Once shrubland vegetation becomes established, erosion is significantly reduced, in terms of both frequency and severity.

8.3 Restoration management units

The area has been divided into eight management units, based on the vegetation and habitat types described in Section 6.1. The approach for each management unit, including weed control and indigenous planting, is outlined below. In general, pest plants that can be easily controlled will be targeted first, followed by those that pose the greatest ecological threats. Indigenous plantings will be initiated in strategically located nodes that will be gradually expanded in size over successive years. Beach access points will be identified; these may be delineated with boardwalks and rope barriers (see Section 8.7). Finally, the responsibility for the management of the project will lie with the local community, a strategy that will heighten awareness and enhance the chances of success.

8.4 Planting nodes

The use of planting nodes is a strategy that allows for the establishment of small areas of healthy, well protected plants to act as a core for future expansion to the restoration planting area. Ideally, node sites should be sheltered from extreme weather, protected from physical disturbance, and meet the environmental requirements of the plant species (drainage, nutrients, substrate, etc). Once the plants within the node are established, further restoration plantings may be progressively added around the perimeter to expand the restored area. Using planting nodes allows a large restoration project to be broken up in to smaller more manageable units and expanded as time and resources allow.

A limited number of nodes should be established initially, and their progress monitored. The planting strategies for nodes in successive years may then be reassessed and modified.

There are four broad node types, according to the environment in which they are located:

- Spinifex/pingao: low grassland species with sand-binding potential. Located only on the front face of the foredunes.
- Shrubland: mainly low growing woody species, which will eventually grow taller than the marram. Provides foraging and nesting habitat for coastal birds. Located along the top and rear of the foredunes, and the entirety of the rear dunes.
- Stream: riparian (streamside) species that overhang the water. Sedges, harakeke, and low-growing shrubs. Provides habitat for wading birds. Located alongside the lower reaches of the Wairarawa Stream, including the tidal area. Some species may be more tolerant of salt-water than others.
- Wetland: riparian (streamside) and swamp species that overhang the water. Sedges, harakeke, shrubs, and tall trees. Provides habitat and food for waders, waterfowl, and terrestrial birds. Located along the upper reaches of the Wairarawa Stream and around the lagoons.

Figures 3a to 3c illustrate the suggested sites for initial planting nodes for the dunes and wetland areas. Note that there are no nodes located in areas where extensive weed control is required before planting can take place. Existing and projected walking and access tracks are also illustrated.

Suggested plants for each node type are presented in Table 4.

8.5 Potential boardwalks and signage

A large number of unformed trails currently cross the dunes at intervals. The use of these can damage vegetation and accelerate erosion. HDC is initiating a series of board and chain walkways through the dunes, linking public access points to the beach (Figure 3). These should ideally be angled through the dune area in such a way that the prevailing wind blows across, and not up, the track. This helps prevent sand movement. It is envisaged that a lateral trail along the rear of the dunes will connect these walkways, allowing easy access for residents from their properties. Strategic location of new planting areas to form a barrier, together with associated fencing, would channel visitors onto the walkways, and reduce the impact of foot traffic in the restoration areas.

Public information panels could be positioned at access points and adjacent to planting sites to help raise public awareness of the restoration efforts. If relevant, these signs could also display warnings about potential hazards from weed and pest animal control.

A walkway along the stream, from the beach to the lagoon, via Rua Ave and Hudson Reserve, has been proposed by the HDC. There is potential for this walkway to be extended to completely encircle the proposed wetland restoration areas of the lagoons. It is recommended that the majority of the track is positioned at least 2-5 m from the stream and lagoon margins to allow the establishment of riparian vegetation. Riparian vegetation will help improve water quality through shading, and provide habitat for aquatic and other species. A meandering track could occasionally touch the stream or lagoon at intervals and allow views over the water.

Table 4: Plant species recommended for use by Management Unit

Scientific Name	Common Name	Node Type ¹	Management Unit							
			1	2	3	4	5	6	7	8
<i>Apodasmia similis</i>	oioi	st						✓ ²		
<i>Aristotelia serrata</i>	makomako; wineberry	f							✓	
<i>Austroderia toetoe</i>	toetoe	sh st w						✓	✓	✓
<i>Beilschmiedia tawa</i>	tawa	f							✓	
<i>Bolboschoenus caldwellii</i>	purua grass	st						✓ ¹		
<i>Bolboschoenus fluviatilis</i>	purua grass	w						✓		
<i>Calystegia soldanella</i>	shore bindweed	sp	✓	✓						
<i>Carex secta</i>	pukio	st w						✓	✓	✓
<i>Carex testacea</i>	speckled sedge	sh		✓						
<i>Carex virgata</i>	purei	st w						✓	✓	✓
<i>Coprosma acerosa</i>	sand coprosma	sh		✓						
<i>Coprosma propinqua</i> var. <i>propinqua</i>	mingimingi	w							✓	✓
<i>Coprosma repens</i>	taupata	sh			✓	✓	✓			
<i>Coprosma robusta</i>	karamu	sh st							✓	
<i>Cordyline australis</i>	cabbage tree	sh st w								✓
<i>Cyperus ustulatus</i>	upokotangata	st w						✓	✓	✓
<i>Dacrycarpus dacridiodes</i>	kahikatea	w								✓
<i>Dacrydium cupressinum</i>	rimu	f							✓	
<i>Discaria toumatou</i>	matagouri	sh			✓					
<i>Dodonea viscosa</i>	akeake	sh			✓	✓				
<i>Elaeocarpus dentata</i>	hinau	f							✓	
<i>Euphorbia glauca</i>	sea spurge	sh		✓						
<i>Ficinia nodosa</i>	wiwi	sh		✓	✓				✓	
<i>Ficinia spiralis</i>	pingao	sp	✓	✓						
<i>Hebe stricta</i>	koromiko	f							✓	
<i>Hedycarya arborea</i>	pigeonwood	f							✓	
<i>Knightia excelsa</i>	rewarewa	sh						✓	✓	
<i>Kunzea ericoides</i>	kanuka	sh w			✓	✓	✓		✓	✓
<i>Laurelia novae-zelandiae</i>	pukatea	f								✓
<i>Leptospermum scoparium</i>	manuka	f							✓	✓

¹ sp = spinifex/pingao; sh = shrubland; st = stream; w = wetland; f = forest.

² Only plant near coast.

Scientific Name	Common Name	Node Type ¹	Management Unit							
			1	2	3	4	5	6	7	8
<i>Melicytus ramiflorus</i>	mahoe	sh st w			✓	✓	✓			✓
<i>Muehlenbeckia complexa</i>	pohuehue	sh st w		✓	✓			✓	✓	✓
<i>Myoporum laetum</i>	ngaio	sh st			✓	✓	✓			
<i>Myrsine australis</i>	mapou	f							✓	
<i>Olearia solandri</i>	coastal tree daisy	sh		✓	✓	✓				
<i>Ozothamnus leptophyllus</i>	tauhinu	sh			✓	✓				
<i>Pennantia corymbosa</i>	kaikomako	f							✓	
<i>Phormium tenax</i>	harakeke	sh st w						✓	✓	✓
<i>Pimelea villosa</i>	sand daphne	sh		✓						
<i>Pittosporum eugenioides</i>	tarata	w							✓	✓
<i>Pittosporum tenuifolium</i>	kohukohu	w						✓	✓	✓
<i>Plagianthus divaricatus</i>	saltmarsh ribbonwood	st						✓ ¹		
<i>Poa billardierei</i>	hinarepe; sand tussock	sp	✓	✓						
<i>Podocarpus totara</i>	totara	f					✓		✓	
<i>Pseudopanax arboreus</i>	five finger	f							✓	
<i>Pseudopanax crassifolius</i>	horoeaka; lancewood	f							✓	
<i>Schoenoplectus tabernaemontani</i>	kapungawha	w						✓		
<i>Sophora microphylla</i>	kowhai	sh st					✓		✓	✓
<i>Spinifex sericeus</i>	spinifex	sp	✓	✓						
<i>Syzygium maire</i>	maire tawake (swamp maire)	w								✓
<i>Typha orientalis</i>	raupo	w						✓		

¹ Only to be planted near coast.

Figure 3 - Sheet 1 of 3

Figure 3 - Sheet 2 of 3

Figure 3 - Sheet 3 of 3

8.6 Management units - outcomes and strategies

This section briefly outlines the primary goal for each of the management units, and the strategies required to reach these goals. Management units correspond to habitat types (see Section 5.1) and are presented in Figure 3.

8.6.1 Area 1: The front of the foredunes

Goal

A low dune grassland, with controllable levels of erosion, and the ability to easily integrate the effects of sand deposition and storm damage.

Strategies

- Removal of marram and introduced ice-plant incursions.
- Enhancement plantings of spinifex and pingao.
- Physical protection of planting sites until well-established.

Spinifex is currently the dominant grass species in this area, with pingao and shore bindweed also present. Marram and iceplant are mainly limited to small patches that are feasible to control (see Appendix 3 for control procedure). Additional plantings of spinifex and pingao would do best in sheltered areas (see Table 4 and Appendix 5 for planting recommendations), and should also be planted in areas exposed by the removal of the marram. Areas of new planting should be fenced to discourage entry of people and animals.

One large patch of marram on the front face of the foredune, adjacent to the surf-club, is likely to leave a significant area exposed after control (see Section 8.4). It may be appropriate to use temporary retaining walls here to trap sand and limit erosion until spinifex can be established.

This area is dynamic, and will frequently undergo changes due to erosion and sand deposition. As the coastline advances, the newer dunes will be colonized by sand-binding grasses, while the area currently occupied by spinifex will stabilise, and indigenous coastal shrubland will establish if that is the dominant adjacent cover.

8.6.2 Area 2: The top and rear of the foredune

Goal

A coastal shrubland, with a mean height of around 1 metre.

Strategies

- Removal of isolated weeds.
- Establishment of indigenous vegetation nodes.
- Maintain marram as a 'nursery species' with the long-term goal of replacement by indigenous species.
- Physical protection of planting sites until well established.
- Identification and demarcation of beach access points.

Marram and lupin populations in this area are large and well established; it is neither desirable nor feasible to eradicate these in the short term. Large scale removal of these species would only provide opportunities for fresh weed invasions. Instead, nodes of indigenous coastal shrubs (e.g. taupata, tauhinu, coastal tree daisy (*Olearia solandri*), sand coprosma, sea spurge (*Euphorbia glauca*) and sand daphne) could be planted amongst the existing marram, taking advantage of the shelter it provides as a nursery species. As these plants mature, the nodes could be progressively expanded with fresh plantings and natural recruitment; the marram and lupin will gradually be suppressed as they are over-topped by the shrubs (Gadgil 2006). Areas of new planting would establish more quickly if fenced to discourage access by humans and animals.

It would also be desirable to discourage the use of unformed tracks/routes through this area, in order to reduce trampling of vegetation and erosion opportunities. Beach access tracks should have board and chain walkways and rope barriers (see Section 7.5).

Other weed species in this area are scattered, isolated, and in relatively low numbers. Each pocket could be quickly and easily controlled by community efforts, although the area should be monitored for any new occurrences of these species. See Appendices 2 and 3 for a list of weeds present and specific control procedures, and Appendix 6 for GPS locations of known weed infestations.

As the soils on these dunes mature, the natural progression of vegetation development could eventually see the shrubland give way to taller tree species in the long term.

8.6.3 Area 3: The rear dunes

Goal

A coastal shrubland, with a mean height of around 1 metre. Pockets of taller scrub vegetation in the depressions and swales.

Strategies

- Removal of isolated weeds.
- Council control of woody weeds and pest plants.
- Establishment of indigenous vegetation nodes.
- Maintain exotic grassland as 'nursery species'.
- Physical protection of planting sites until well established.

Marram and lupin form the groundcover with rank pasture grasses in this area of older dunes, and woody weed species occur in well-established patches. Many of these are regarded as pest plant species under the Regional Pest Plant Strategy (RPMS) (Horizons 2007), and would be best controlled by a combination of chemical application and other types of removal (see Appendix 3 for specific procedures). As with Area 2, nodes of indigenous coastal shrubs, such as tauhinu, sand coprosma, taupata, karamu, and matagouri, could be planted amongst the existing groundcover, and progressively enlarged over subsequent years. The basins and swales amongst the rear dunes provide an opportunity to plant a variety of taller species without affecting

sightlines across the top of the vegetation. Indigenous species that are commonly found in such micro-habitats include flax, toetoe, cabbage tree, and koromiko; other suitable species would include kanuka (*Kunzea ericoides*), ngaio, and mahoe.

8.6.4 Area 4: Coastal wattle shrubland

Goal

Coastal shrubland.

Strategies

- Progressive council control and thinning of coastal wattle shrubland.
- Gradual replacement with indigenous shrubs.

This area contains the largest and densest infestation of coastal wattle in the study area. Removal of the population in the short term is neither feasible nor desirable. Unless it was widely planted with indigenous species shortly after clearance, coastal wattle would quickly regenerate on the site, along with other weed species. Instead, this area should be sprayed to suppress growth, and the canopy progressively thinned to allow limited light to pass through (see Appendix 3 for procedures). This would allow the planting of broad-leaved indigenous shrub species, such as taupata, karamu, and mahoe, beneath the canopy. As the new plantings become established, the coastal wattle would be finally removed entirely through poisoning and felling.

8.6.5 Area 5: Macrocarpa forest

Goal

Coastal shrubland and treeland.

Strategies

- Progressive control and removal of macrocarpa, from the interior outwards.
- Staged replacement with indigenous species.

This area is adjacent to several private properties, and could have originated from a historically planted hedge or shelter belt. The landowners in this area need to be consulted prior to the removal of the trees, and their wishes taken into account.

This area is small enough to be removed at one time, through poisoning and felling. However, it may be more effective to remove and replant the core of the stand first, leaving a margin of macrocarpa trees standing to act as shelter for the new plantings, as well as maintaining the wind-break for nearby houses. The remaining macrocarpa would be removed once the indigenous plants had become established, making way for the expansion of the replanted area. Depending upon the wishes of the adjacent landowners, the replacement vegetation could either continue the general plan of planting lower growing shrub species, or could be composed of taller, denser species such as totara (*Podocarpus totara*), kanuka, ngaio, mahoe, or rewarewa.

8.6.6 Area 6: Lower Wairarawa Stream

Goal

A waterway clear of aquatic pest plants, with a clear passage for fish between Wairarawa Lagoons and the sea. Sedge/flax/shrubland between 50 cm and 3 m tall on the banks.

Strategies

- Council control of pest plant species.
- Council investigation and replacement of culverts to allow unhindered fish passage.
- Establishment of indigenous vegetation nodes.
- Physical protection of planting sites until well established.

A significant proportion of the exotic weeds in and alongside the lower Wairarawa Stream, where it flows through the residential and forestry areas, are listed as pest plant species by the RPMS (Horizons 2007). These require control through a coordinated effort by Horizons, HDC, and landowners, using specified procedures, followed by monitoring to ensure control is successful. Control requirements should be determined before any other work is initiated in this area. In general, control will begin at the upstream limit of the infestation, and progressively move downstream.

Several small trees of coastal tea-tree (*Leptospermum laevigatum*) were found around the forestry buildings. These were probably planted. This species is a serious weed species on the dunes on Matakana Island, and large resourcing is currently being expended in order to control it. It is strongly recommended to remove this species and monitor the site for a few years to ensure that this species has not naturalised at this site.

A significant portion of the stream margin within the forestry area has been used as a dumping site for excess pine cuttings and other forestry waste, in various states of decay. If this area is to be included in the restoration plan, the removal of this material would greatly facilitate access.

Existing patches of pukio and oioi, particularly adjacent to the camp ground, could act as the nuclei for new plantings of indigenous streamside vegetation, including sedges (e.g. pukio, purei, and upokotangata), flaxes (harakeke), large grasses (toetoe), and shrubs and lianes (koromiko, pohuehue (*Muehlenbeckia complexa*), and kohukohu (*Pittosporum tenuifolium*)). Restoration nodes elsewhere along the stream will have to begin from scratch.

When planting smaller species, care should be taken to keep the seedlings clear of taller weeds (preferably by removing them altogether), such as rape or tall fescue, until the plant is well established. Around the mouth of the stream, salt tolerant species such as marsh ribbonwood and purua grass (*Bolboschoenus fluviatilis* and *B. caldwellii*) could be considered instead of salt sensitive species. Raupo may be considered for planting in the upstream area, but should be treated with caution, as it can form dense patches and could fill the entire stream.

Areas of new planting should be fenced to reduce physical disturbance until the seedlings have become established. This is particularly important along the Hudson Reserve section of the stream, as this is the area used most by the public.

Eventually, the flanking vegetation will shade the stream, effectively suppressing the growth of aquatic weeds. At the same time, this will enhance the habitat for inanga and eels by providing hiding places along the banks. Flaxes and indigenous shrubs will enhance both nesting and foraging habitat for native birds.

8.6.7 Area 7: Upper Wairarawa Stream

Goal

A waterway clear of aquatic pest plants. Sedge/harakeke/shrubland between 50 cm and 3 m tall on the banks.

Strategies

- Establishment of indigenous vegetation nodes.
- Physical protection of the streamside vegetation.

This area extends from the forestry block to the outlet from the Wairarawa Lagoons, and is lined for almost the entire length with mature radiata pine treeland. As the pines do not significantly obstruct light levels, there is no current necessity for their removal, and indigenous planting nodes similar to that in the lower waterway may be established on the banks. As with the lower stream, planted seedlings should be kept clear of encroaching weeds and exotic grasses. Planting spots will need to be prepared prior to planting.

As the area is already currently fenced to exclude stock in the adjacent pastures, there appears to be little requirement for further permanent protection of the planting sites. Temporary mesh fencing in order to prevent pukeko and rabbit damage would be advisable. The area should be monitored to ensure that the existing fencing is effective. If not, protection requirements should be reassessed. All work in this management unit will require the express permission of landowners.

8.6.8 Area 8: Wairarawa Lagoons

Goal

An indigenous wetland habitat. Sedge/harakeke/treeland.

Strategies

- Establishment of indigenous vegetation nodes.
- Physical protection of the lagoon margins.

Planting in this area will continue the theme of planting nodes of indigenous wetland species, similar to those mentioned for the upper and lower waterway. As the margins

of the lagoons have been grazed by stock, there is practically little requirement for weed control prior to planting, although rank grasses may require clearing from around seedlings later. However, the restoration area will need to be securely and permanently fenced to exclude stock and to protect plants. This will also safeguard potential bird nesting sites amongst the undergrowth (e.g dabchick) and help improve the water quality in the lagoons by reducing faecal contamination. Fencing of the area is likely to require a coordinated approach, involving the agreement and resources of all stakeholders in the project.

This far inland, the soil profile is mature enough to support primary lowland swamp forest, of the sort described by Ravine (1992) (see Section 3). It may be desirable for taller tree species such as kahikatea and maire tawake to be included in the plantings around the lagoons. It should be noted that even if such species are not deliberately planted, they may eventually self-introduce as the habitat develops, particularly in the absence of browsing by stock.

9. RESTORATION MANAGEMENT GUIDELINES

9.1 Weed control

9.1.1 Pest plant priority classes for control

The priority for control of each pest plant species has been assessed. Each pest plant species has been assigned to one of the five classes. These are defined below. Class 1 species are the highest priority for control. Environmental pest plants are listed by class in Appendix 2, and specific control strategies for particular species are specified in Appendix 3. Other pest plant species may be discovered during the course of the restoration project, or may invade from adjacent areas.

Class 1 pest plant species are those species which are listed as ‘zero-density’ or ‘containment (non-control area)’ by the RPMS (Horizons 2007). These species are regarded as posing a serious widespread environmental threat, and should be eradicated if possible, regardless of infestation size. Two pest plant species within this class are present at Waitarere.

Class 2 pest plant species are those species which are listed as ‘containment (control area)’ or ‘site-led’ by the RPMS (Horizons 2007), present only in low numbers or density at the site. These species are regarded as posing a significant potential or actual environmental threat, and could be eradicated. Also included are those environmental pest plants present in low numbers, but not listed in the RPMS. Eighteen pest plant species within this class were recorded at Waitarere.

Class 3 pest plant species are those species which are listed as ‘containment (control area)’, ‘site-led’, or ‘boundary control’ by the RPMS (Horizons 2007). These species are regarded as posing a significant environmental threat, but eradication will be a long term process. Efforts should focus on preventing the spread of these species in the short term. Three species at Waitarere fall into this category.

Figure 4 - Sheet 1 of 3

Figure 4 - Sheet 2 of 4

Figure 4 - Sheet 3 of 3

Class 4 pest plant species are those species which are listed as ‘boundary control’ by the RPMS (Horizons 2007), or pose only a limited environmental threat and are present in low to moderate numbers.

Class 5 exotic species are those species which pose no environmental threat, but may be controlled for aesthetic reasons.

9.1.2 Control hazards

In many cases, the optimal control methods involve hazardous techniques or materials. Any spraying, poisoning, or felling of environmental pest plants should be carried out by Horizons or HDC appointed contractors or HDC-approved volunteers, using approved methods. Horizons may also wish to oversee the disposal of pest plant remains.

Aerial or broadcast spraying of herbicide is not recommended for two reasons:

1. proximity of residential and recreational areas could pose a health risk;
2. herbicide effectiveness is significantly reduced by salt residue on vegetation in a coastal environment.

The use of a controlled or direct applicator, or direct poisoning techniques in the case of woody weeds, ensures that herbicide is applied only to the target species, and that the chemical effectiveness is maximised.

9.1.3 Community weed control

The community may best contribute to weed control by being vigilant for pest plant seedlings, and hand pulling them as they appear. This technique is particularly effective for woody weed species, as it greatly reduces the spread of the population. Care should be taken in the disposal of hand pulled remains, as many species are able to re-sprout from vegetative fragments; simply throwing the remains away is only likely to compound the problem. The appearance of larger infestations or plants should be reported to the HDC.

9.1.4 Nursery species

When well established, otherwise undesirable exotic weed species can sometimes have value as a ‘nursery species’, providing shelter for indigenous seedlings in an otherwise exposed environment. In this instance, marram and lupin in the dunes, and tall fescue in the wetlands, could perform this role. As the woody species overtop the grasses, the loss of light will suppress the exotic population. However, this will need to be monitored (see Section 10) and the weeds may need to be controlled once indigenous plants are established, to achieve the best outcomes.

9.1.5 Indigenous weeds

At least two species found at Waitarere Beach are regarded as weeds in the southern North Island, even though they are indigenous to other parts of New Zealand. One of these, karo, is an aggressive competitor that rapidly invades new habitats and excludes

the original vegetation (Miskelly 1999). It would be desirable for this species to be eliminated from the dunes. The other is pohutukawa, which may significantly transform the environment with its large persistent root system (Miskelly 1999). Local residents may not want all mature trees removed, however all seedlings of this species should be removed to prevent spread.

9.1.6 Local exotic seed sources

Waitarere Beach is flanked to the north and south by large radiata pine plantations, with dense populations of coastal wattle planted along the coastal front to protect these forests from erosion. Consequently, while it is feasible to greatly reduce the populations of these species in the coastal reserve through control techniques, a ready supply of seed from these sources means that new seedlings will always continue to establish. Ongoing monitoring will be required to ensure that these species are kept from spreading within the project area. The forest managers should be approached and encouraged to gradually remove coastal wattle along the coast.

A vacant section is present adjacent to the dunes in the northern part of the beach. This section (approx 0.25 ha) is covered by a dense stand of exotic shrubs, mainly buckthorn and boxthorn. Even though it lies outside of the coastal reserve, it would be desirable if provision could be made for pest plant control on this land, otherwise it will continue to act as a seed source.

9.1.7 'Green' waste

The clumped infestations of various brightly flowered exotic plant species which are present in scattered locations are likely to have established from dumping of garden waste. Advocacy amongst the residential community and holiday visitors would raise awareness of the ecological consequences of this practise, and also increase knowledge of the correct disposal facilities for garden waste in the District.

9.2 Fish passage (Wairarawa Lagoons)

An annual survey of culverts in the stream bed should be undertaken to ensure that fish passage is unobstructed. Any blockages or obstacles should be removed. The downstream end of culverts (at the north end of Rua Ave, for example) should be assessed to make certain that the action of floodwater has not scoured the stream-bed, forming a barrier to fish migration.

A reduction in the density of water celery in the waterway would greatly enhance the habitat for inanga. Wildland Consultants (2007) suggest that the dense infestation of water celery blocks access to the upper stream and wetlands for this species.

9.3 Threatened plants

Two threatened plant species are known to be present at Waitarere Beach: pingao and sand coprosma. Pingao is being actively planted and managed by HDC in the foredunes, while sand coprosma was observed occurring in a few distinct clumps along the rear of the foredune. Three other species are known to have occurred in the dunes historically (Madden 1999), and are still present elsewhere in the District. These are

sand tussock, sand daphne, and sea spurge. While sand tussock may not be suitable for reintroduction (see Section 8.1), sand daphne and sea spurge could both potentially thrive amidst shrubland vegetation on the dunes, particularly if kept free of marram.

9.4 The Surf Club

The clubrooms of the Levin-Waitarere Surf Club are located adjacent to the end of Waitarere Beach Road. Since the construction of the clubrooms, sand deposition in marram dominated vegetation has led to the development of a tall foredune in front of the building, blocking the view of the beach from the tower (Madden 1999; Peter Shore pers. comm.). Beach patrols, and temporary towers on the foredune, are not proving as effective as hoped when patrolling the beach. As this is a public safety issue, significant steps may need to be taken to remedy the situation. Those being considered by the club include:

- building new club-rooms closer to the beach.
- redeveloping the existing clubrooms.
- mechanically reshaping the dune to restore the view.
- a combination of all three options.

In the event of the implementation of the first or third of these options, there will be substantial structural modifications of the foredune, leaving a large area of exposed sand. While this presents an immediate opportunity to establish indigenous species on the modified dune, the area will require careful management until replacement plantings become established.

9.5 Residential gardens

Several areas were noted in the dunes where residential gardens have been extended beyond the property boundary and encroach into the coastal reserve; in one instance a small ball court has been constructed. Some of these appear to have existed for several decades. The rehabilitation of these areas within the coastal reserve should be undertaken by the Council over a reasonable timeframe. The Council could work with the adjacent landowner in order to best integrate these garden extensions into the restoration environment, and to raise awareness of suitable indigenous coastal species to replace introduced garden plants and, over time, replace all exotic species with indigenous species.

9.6 Pest animal control

Rabbits are the main animal pest species that can compromise dune restoration activities. There is evidence of rabbits at Waitarere Beach.

Control using Pindone is the most reliable and successful strategy. The best timing is late autumn, when weather is more settled, other food sources are reduced, there are fewer people about, and plantings are about to commence. Extreme care must still be exercised to avoid non-target species, such as indigenous fauna and domestic pets. A potentially suitable procedure is outlined in Appendix 4. This has been used successfully and safely on beaches close to large human settlements (>20,000 people).

10. MONITORING

Monitoring of vegetation and fauna is essential in order to measure the ongoing success of the weed control and ecosystem restoration initiatives. As the restoration site is a relatively small area, it will be possible to monitor the entire site with a series of strategically placed permanent photopoints, combined with regular weed and fauna surveys. Reporting should take place at intervals according to the requirements of the project. It is vital that complete records are kept of all planting, weed control operations, and pest animal control at the time that they occur.

10.1 Photopoints

Permanent photopoints are used to capture a time series of the vegetation or landscape at regular intervals. This is particularly useful to observe changes in growth patterns, vegetation density, and/or, sand deposition. It is recommended that permanent photopoints be established adjacent to replanting nodes, significant weed infestations, and at high points to record representative portions of the project area. Locations may be marked with a stake, or simply by recording a GPS point. The direction and focus of the photograph should be determined for each photopoint prior to the initial observation, and repeated as closely as possible for successive photographs. Each time a new photo is taken, notes should be made on the size, density, and extent of the dominant vegetation type, along with other species or environmental factors of interest.

Photopoints should be established prior to any restoration activities commencing. Photopoints should be remeasured at six monthly intervals (spring and autumn) for the first two years after which annual or biennial photos would be sufficient. Additional photopoints to monitor particular features or management can be established as required.

10.2 Weed surveys

Ongoing weed surveys are an important management tool, especially to assess the success of weed control operations, and to identify any new species and infestations that may establish. Regular surveys should also involve the review of weed control priorities.

The areas generally most vulnerable to reinvasion by weeds are the reserve boundaries, the banks of the stream, public access points, and bare areas exposed by erosion or weed control. Most of this particular site will be vulnerable to weed reinvasion. It is therefore recommended that a full survey be undertaken at least annually for the first five years with longer, e.g. two or five year, intervals thereafter. The community could be encouraged to report any new infestations on an *ad hoc* basis.

10.3 Wildlife surveys

The density and diversity of the local fauna is often the most useful indicator of ecosystem health available. Formal surveys should be conducted by experienced observers prior to restoration commencing and then repeated during both summer and winter observations every three to five years. Casual observations of uncommon or unusual species should be recorded; including species, date and any notations about activity. Residents could be encouraged to keep a log of species seen that is compiled on a regular basis to share with the community.

11. TIMELINE FOR UNDERTAKING RESTORATION

The weed management and restoration planting required for Waitarere Beach and Wairarawa Stream is a multi-year undertaking. A five-year work programme and schedule has been provided in Table 5 to supplement the existing restoration schedule. Suggestions have been made as to which parties (local residents, or councils) should be responsible for the restoration action; although it will be appropriate to involve all stakeholders whenever possible. This schedule of actions is a guide only, and can be modified as required by circumstances.

A walk-through site inspection to monitor control operations and identify any significant changes should be undertaken annually by an experienced restoration ecologist.

12. TIMELINE TO IMPLEMENT RESTORATION

Table 5: Proposed restoration schedule

Year	Vegetation Restoration	Pest Control	Other
1	<ul style="list-style-type: none"> Finalise initial planting schedule (Horizons/HDC) Prepare initial dune and lagoon restoration node locations for planting (all) Procure plants (Horizons/HDC) Construct fencing/barriers around node locations (all) Establish initial restoration nodes (all) 	<ul style="list-style-type: none"> Prioritise Class 1 & 2 pest plant species for initial control (Horizons/HDC) Initiate control strategies for Class 3 & 4 species (Horizons/HDC) Hand pull and dispose of isolated seedlings (all) Initiate rabbit control (Horizons/HDC) 	<ul style="list-style-type: none"> Initiate monitoring strategies (Horizons/HDC/other) Initiate track development (HDC) Initiate stream access negotiations for private land (HDC) Construct public signage (Horizons/HDC) Advocate for residential awareness regarding garden species in the coastal environment (all)
2	<ul style="list-style-type: none"> Assess success of initial plantings and revise planting priorities as necessary (all) Replace any losses, and expand node size (all) Plant bare areas left by weed control (all) 	<ul style="list-style-type: none"> Assess success of initial control and revise pest priorities as necessary (Horizons/HDC) Continue to target Class 1 & 2 pest plant species (Horizons/HDC) Continue other control strategies (Horizons/HDC) 	<ul style="list-style-type: none"> Continue monitoring strategies (Horizons/HDC) Continue track development as necessary (HDC) Continue advocacy for residential/public awareness (all)
3	<ul style="list-style-type: none"> As for Year 2, but also: Finalise locations of stream and secondary dune and lagoon restoration nodes as necessary (all) Establish and protect stream and secondary dune and lagoon restoration nodes (all) 	<ul style="list-style-type: none"> Assess control success and revise pest priorities (Horizons/HDC). Continue ongoing control strategies (Horizons/HDC) 	<ul style="list-style-type: none"> As for Year 2 but also: Assess monitoring data, and revise strategies as necessary (Horizons/HDC)
4	<ul style="list-style-type: none"> As for Year 2 	<ul style="list-style-type: none"> As for Year 3 	<ul style="list-style-type: none"> As for Year 2, with revisions
5	<ul style="list-style-type: none"> As for Year 2, but also: Assess natural recruitment, and revise planting priorities as necessary (all) 	<ul style="list-style-type: none"> As for Year 3 	<ul style="list-style-type: none"> As for Year 4 Review restoration plan and progress, update and expand implementation programme.

13. CONCLUSIONS

The dunes of Waitarere Beach, along with Wairarawa Lagoon, are valuable environmental assets in the Horowhenua District. They could be greatly enhanced as indigenous habitats and public recreational resources through continued weed control management and restoration initiatives, particularly if the Wairarawa Stream were included in the programme as an environmental link. However, it is unlikely that the suggested outcome of a 'native grassland' dominating the rear dunes dune habitat (reference to come) is sustainable over time.

The replacement of the existing exotic scrub and marram vegetation with low growing indigenous shrubs is a more suitable goal for this environment. This report suggests restoration and weed control strategies that can be implemented in particular areas over a five-year duration. Ongoing monitoring will be required during and following restoration and weed control operations to assess the success of project, to ensure the objectives are met, and to guard against the (re)invasion of pest plant species from local seed sources. Advocacy of both the residential community and holiday visitors is required to highlight the value of the environment and educate people about the correct disposal of weeds and other garden waste.

Careful placement and management of beach access tracks will help reduce the impact on vegetation of foot traffic across the dunes, thereby enhancing the chances of successful establishment and continued growth of indigenous plants in restored areas, and also reducing the frequency of erosion events. The establishment of a walking track along the banks of the Wairarawa Stream to the Wairarawa Lagoons will facilitate the restoration of the environment and help raise public awareness of the issues surrounding the habitat, as well as establishing a new recreational resource for the community of Waitarere Beach.

To ensure success, this project requires an ecological restoration project manager to manage the project. This manager would need to be experienced with managing small projects and co-ordinating the various interested parties, obtaining funding, undertaking regular site inspections to monitor the programme, and identifying key management actions to retain and enhance any conservation gains that are made.

ACKNOWLEDGMENTS

We would like to thank Fleur Maseyk and Craig Mitchell of Horizons Regional Council for initiating this project and for logistical support. We would also like to thank Peter Shore and Doug Tate of Horowhenua District Council, and the Waitarere Beach Progressive and Ratepayers Association committee for their input and comments.

Aerial photography used in this report was provided courtesy of Horizons Regional Council. The historic (1965) aerial photograph in Figure 1 is used with the courtesy of the Horowhenua Historical Society Inc.

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VASCULAR PLANT SPECIES RECORDED IN THE WAITARERE SAND DUNES AND WAIRARAWA STREAM

INDIGENOUS SPECIES

Monocot. trees and shrubs

Cordyline australis ti kouka, cabbage tree

Dicot. trees and shrubs

Coprosma acerosa sand coprosma, tarakupenga
Coprosma repens taupata
Coprosma rhamnoides
Coprosma dumosa
Metrosideros excelsa (adventive) pohutukawa
Myoporum laetum (planted) ngaio
Ozothamnus leptophyllus tauhinu
Pittosporum crassifolium (adventive) karo
Plagianthus divaricatus (planted) marsh ribbonwood, makaka
Pseudopanax arboreus five finger, whauwhaupaku
Pseudopanax crassifolius × *P. lessonii* (planted)
Solanum aviculare var. *aviculare* poroporo

Dicot. lianes

Calystegia soldanella panahi, shore bindweed
Muehlenbeckia complexa pohuehue

Ferns

Asplenium oblongifolium huruhuruwhenua
Pteridium esculentum rarahi, bracken
Pteris macilenta sweet fern
Microtis unifolia agg. maikaika

Grasses

Chionochloa flavicans f. *flavicans* (planted) snow tussock
Lachnagrostis billardierei perehia; sand wind grass
Spinifex sericeus kowhangatara, spinifex
Zoysia pauciflora (possibly planted)

Sedges

<i>Carex geminata</i> agg.	rautahi
<i>Carex secta</i>	pukio
<i>Carex testacea</i>	
<i>Carex virgata</i>	purei
<i>Cyperus ustulatus</i> f. <i>ustulatus</i>	upokotangata
<i>Ficinia nodosa</i>	wiwi, knobby club rush
<i>Ficinia spiralis</i>	pingao
<i>Isolepis prolifera</i>	
<i>Schoenoplectus pungens</i>	

Rushes

<i>Apodasmia similis</i> (planted)	oioi
<i>Juncus pallidus</i> (planted)	wi

Monocot. herbs (other than orchids, grasses, sedges, and rushes)

<i>Lemna minor</i>	karearea
<i>Phormium cookianum</i> (planted)	wharariki, mountain flax
<i>Phormium tenax</i> (planted & natural)	harakeke, flax
<i>Potamogeton</i> sp.	

Composite herbs

<i>Cotula coronopifolia</i>	bachelor's button
<i>Pseudognaphalium luteoalbum</i> agg.	
<i>Senecio glomeratus</i>	fireweed

Dicot. herbs (other than composite)

<i>Acaena novae-zelandiae</i>	piripiri
<i>Oxalis rubens</i> (planted & natural)	sand oxalis
<i>Persicaria decipiens</i>	tutunawai
<i>Tetragonia implexicoma</i>	

NATURALISED AND EXOTIC SPECIES**Gymnosperms**

<i>Cupressus macrocarpa</i>	macrocarpa
<i>Pinus radiata</i>	radiata pine

Monocot. trees and shrubs

Phoenix canariensis
Yucca gloriosa

Phoenix palm
 yucca

Dicot. trees and shrubs

Acacia dealbata
Acacia mearnsii
Acacia sophorae
Aeonium haworthii
Banksia integrifolia
Chrysanthemoides monilifera
Cotoneaster glaucophyllus
Euonymus japonicus
Leptospermum laevigatum
Leycesteria formosa
Lupinus arboreus
Lycium ferocissimum
Melilotus indica
Opuntia vulgaris
Paraserianthes lophantha
Populus alba 'Nivea'
Populus sp.
Prunus persica
Prunus sp.
Rhamnus alaternus
Rubus fruticosus agg.
Salix cinerea
Salix fragilis
Salix matsudana 'Tortuosa'
Ulex europaeus

silver wattle
 black wattle
 coastal wattle
 pinwheel aeonium
 banksia
 boneseed
 cotoneaster
 Japanese spindleberry
 coast tea tree
 Himalayan honeysuckle
 lupin
 boxthorn
 King Island melilot
 prickly pear
 brush wattle
 silver poplar
 poplar
 peach tree, nectarine
 plum
 Italian evergreen buckthorn
 blackberry
 grey willow
 crack willow
 tortured willow
 gorse

Monocot. lianes

Asparagus scandens
Monstera deliciosa

climbing asparagus
 fruit salad plant

Dicot. lianes

Calystegia silvatica
Lonicera japonica
Rumex sagittatus
Senecio angulatus
Vinca major

greater bindweed
 Japanese honeysuckle
 climbing dock
 cape ivy
 periwinkle

Grasses

Agrostis stolonifera
Ammophila arenaria

creeping bent
 marram

<i>Anthoxanthum odoratum</i>	sweet vernal
<i>Arundo donax</i>	giant reed
<i>Briza maxima</i>	large quaking grass
<i>Bromus diandrus</i>	rippgut brome
<i>Bromus willdenowii</i>	prairie grass
<i>Austroderia selloana</i>	pampas
<i>Cynodon dactylon</i>	Indian doab
<i>Dactylis glomerata</i>	cocksfoot
<i>Ehrharta erecta</i>	veldt grass
<i>Glyceria declinata</i>	sweetgrass
<i>Glyceria maxima</i>	reed sweetgrass
<i>Holcus lanatus</i>	Yorkshire fog
<i>Lagurus ovatus</i>	harestail
<i>Lolium perenne</i>	rye grass
<i>Paspalum distichum</i>	mercier grass
<i>Poa annua</i>	annual poa
<i>Schedonorus arundinaceus</i>	tall fescue
<i>Sporobolus africanus</i>	ratstail
<i>Stenotaphrum secundatum</i>	buffalo grass
<i>Vulpia myuros</i> var. <i>myuros</i>	vulpia hair grass

Grasses

<i>Agapanthus praecox</i>	agapanthus
<i>Allium triquetrum</i>	onion weed
<i>Aloe maculata</i>	spotted aloe
<i>Crocasmia ×crocosmiiiflora</i>	montbretia
<i>Kniphofia praecox</i>	red hot poker
<i>Tradescantia fluminensis</i>	tradescantia
<i>Watsonia meriana</i>	watsonia
<i>Zantedeschia aethiopica</i>	arum lily

Composite herbs

<i>Achillea millefolium</i>	yarrow
<i>Arctotheca calendula</i>	cape weed
<i>Bellis perennis</i>	lawn daisy
<i>Conyza sumatrensis</i>	broad-leaved fleabane
<i>Crepis capillaris</i>	hawksbeard
<i>Gazania linearis</i>	gazania
<i>Hypochoeris radicata</i>	catsear
<i>Osteospermum fruticosum</i>	rain daisy, dimorphotheca
<i>Senecio elegans</i>	purple groundsel
<i>Sonchus oleraceus</i>	puha, sow thistle
<i>Taraxacum officinale</i>	dandelion

Dicot. herbs (other than composites)

<i>Apium nodiflorum</i>	water celery
<i>Brassica napus</i>	rape
<i>Carpobrotus edulis</i>	ice plant
<i>Fumaria muralis</i>	scrambling fumitory
<i>Galium aparine</i>	cleavers
<i>Geranium molle</i>	dovesfoot cranesbill
<i>Lepidium bonariense</i>	Argentine cress
<i>Lotus pedunculatus</i>	lotus
<i>Modiola caroliniana</i>	creeping mallow
<i>Myosotis scorpioides</i>	water forget-me-not
<i>Myosotis sylvatica</i>	garden forget-me-not
<i>Ornithopus pinnatus</i>	yellow serradella
<i>Orobanche minor</i>	broomrape
<i>Persicaria maculosa</i>	willow weed
<i>Plantago lanceolata</i>	narrow-leaved plantain
<i>Ranunculus repens</i>	creeping buttercup
<i>Ranunculus sceleratus</i>	celery-leaved buttercup
<i>Rumex acetosella</i>	sheep's sorrel
<i>Rumex conglomeratus</i>	clustered dock
<i>Rumex obtusifolius</i>	broad-leaved dock
<i>Sedum acre</i>	stonecrop
<i>Silene gallica</i>	catchfly
<i>Solanum chenopodioides</i>	velvety nightshade
<i>Solanum tuberosum</i>	potato
<i>Stellaria media</i>	chickweed
<i>Trifolium repens</i>	white clover
<i>Vicia sp.</i>	vetch

SIGNIFICANT PEST PLANT SPECIES AND THEIR CONTROL STATUS

Species	Common Name	Class	Horizons Pest Status ¹
<i>Chrysanthemoides monilifera</i>	boneseed	1	containment (non-control)
<i>Leptospermum laevigatum</i>	coastal tea tree	1	
<i>Rhamnus alaternus</i>	buckthorn	1	containment (non-control)
<i>Agapanthus praecox</i>	agapanthus	2	site-led
<i>Arundo donax</i>	giant reed	2	site-led
<i>Asparagus scandens</i>	climbing asparagus	2	
<i>Austroderia selloana</i>	pampas	2	site-led
<i>Banksia integrifolia</i>	banksia	2	
<i>Carpobrotus edularis</i>	ice plant	2	site-led
<i>Crocsmia xcrocsmiiflora</i>	montbretia	2	site-led
<i>Euonymus japonicus</i>	Japanese spindleberry	2	site-led
<i>Glyceria maxima</i>	reed sweetgrass	2	containment (control)
<i>Leycesteria formosa</i>	Himalayan honeysuckle	2	site-led
<i>Lonicera japonica</i>	Japanese honeysuckle	2	site-led
<i>Lycium ferocissimum</i>	boxthorn	2	site-led
<i>Metrosideros excelsa</i>	pohutukawa	2	
<i>Monstera deliciosa</i>	fruit salad plant	2	
<i>Opuntia vulgaris</i>	prickly pear	2	
<i>Paraserianthes lophantha</i>	brush wattle	2	site-led
<i>Phoenix canariensis</i>	Phoenix palm	2	
<i>Pinus radiata</i>	radiata pine	2	
<i>Pittosporum crassifolium</i>	karo	2	
<i>Populus alba</i>	silver poplar	2	site-led
<i>Prunus xdomesticus</i>	plum	2	site-led
<i>Rumex sagittatus</i>	climbing dock	2	site-led
<i>Salix cinerea</i>	grey willow	2	containment (control)
<i>Salix fragilis</i>	crack willow	2	site-led
<i>Sedum acre</i>	stonecrop	2	
<i>Senecio angulatus</i>	Cape ivy	2	site-led
<i>Senecio angulatus</i>	cape ivy	2	
<i>Tradescantia fluminensis</i>	tradescantia	2	site-led
<i>Vinca major</i>	periwinkle	2	site-led
<i>Watsonia meriana</i>	watsonia	2	site-led
<i>Zantedeschia aethiopica</i>	arum lily	2	
<i>Acacia dealbata</i>	silver wattle	3	
<i>Acacia mearnsii</i>	black wattle	3	
<i>Acacia sophorae</i>	coastal wattle	3	site-led
<i>Aeonium haworthii</i>	pinwheel aeonium	3	
<i>Allium triquetrum</i>	onion weed	3	
<i>Aloe maculata</i>	spotted aloe	3	
<i>Ammophila arenaria</i>	marram	3	site-led
<i>Calystegia silvatica</i>	greater bindweed	3	
<i>Gazania linearis</i>	gazania	3	
<i>Kniphofia praecox</i>	red hot poker	3	
<i>Lupinus arboreus</i>	lupin	3	site-led
<i>Osteospermum fruticosum</i>	rain daisy, dimorphotheca	3	
<i>Salix matsudana</i> 'Tortuosa'	tortured willow	3	
<i>Yucca gloriosa</i>	yucca	3	
<i>Cotoneaster glaucophyllus</i>	cotoneaster	4	

Species	Common Name	Class	Horizons Pest Status ¹
<i>Populus</i> sp.	poplar	4	
<i>Prunus persica</i>	peach tree, nectarine	4	
<i>Rubus fruticosus</i> agg.	blackberry	4	boundary
<i>Ulex europaeus</i>	gorse	4	boundary
<i>Cuppressus macrocarpa</i>	macrocarpa	5	

¹ Horizons (2007).

CONTROL STRATEGIES FOR MAJOR PEST PLANT SPECIES

Pest Plant	General Strategy	Control Method	Post Control
Wattle <i>e.g. coastal wattle, brush wattle</i>	Target isolated individuals first. Progressively thin dense clumps. Plant indigenous shrub species amongst beneath the tall trees.	Apply triclopyr by cutting or drilling methods. Fell, then swab stump of isolated trees. Hand pull seedlings. In dense clumps, thin the canopy gradually by removing selected branches rather than felling entire trees.	Remove and contain felled/seedling material. Progressively thin canopy of dense stand until indigenous sub-canopy well established, then fell and swab remaining trees. Monitor for seedlings, control as necessary.
Other woody weeds <i>e.g. buckthorn, boxthorn, banksia, pine, karo</i>	Target isolated individuals first, then dense clumps. Focus on female trees (where applicable) to limit flowering.	Apply glyphosate or Tordon by cutting or drilling methods. Fell, then swab stump. Hand pull seedlings.	Preferably remove felled/seedling material. Re-treat stumps biannually until regrowth ceases. Monitor for seedlings, control as necessary.
Marram	Only control on foredune. Start at windward end of population, or work away from adjacent indigenous vegetation.	Dig out small isolated clumps. Spray with glyphosate using a controlled applicator.	Dispose of rhizomes and dead vegetation. Replant and manage exposed areas.
Lupin	Only control on foredune.	Dig out small isolated clumps. Spray with glyphosate using a controlled applicator. Slash larger plants and swab stump.	Preferably remove slashed/seedling material. Re-treat stumps biannually until regrowth ceases. Monitor for seedlings, control as necessary.
Ice plant	Only control on foredune, and around plantings. Target isolated clumps first.	Roll up mats from one end. Hand pull remaining stems. Do not apply herbicide.	Remove and mulch vegetation. Monitor for regrowth and control as necessary.
Boneseed	Currently present only as isolated plants.	Slash and swab stumps of larger plants with glyphosate. Hand pull smaller plants/seedlings.	Monitor for regrowth/new seedlings and control as necessary.
Corm plants <i>e.g. Agapanthus, watsonia, montbretia</i>	Target isolated individuals first, then dense clumps.	Dig up entire isolated plants, particularly corms. Spray dense clumps with glyphosate, using a controlled applicator.	Remove and contain/burn all vegetation. Respray site 2-3 times over six months before replanting. Monitor for regrowth and new seedlings. Control as necessary.
Aquatic weeds <i>e.g. sweetgrass, water celery, mercer grass</i>	Start upstream, work down.	Hand pull submerged plants. Spray terrestrial plants with glyphosate, using a controlled applicator. NB: resource consent required to spray over water.	Cover banks with weed-mat for 4-6 months to prevent terrestrial regrowth. Survey stream for aquatic regrowth biannually, hand pull as necessary

RABBIT CONTROL STRATEGY

Engage a local operator with the correct applicators licence approval, and ensure the contractor is willing to utilise the skills of local volunteers. The local Medical Officer of Health (MOH) must be notified of the intention to use Pindone at least six weeks prior. As most of this is land managed by the Horowhenua District Council (HDC), early discussions with the Council will be necessary to ensure agreement with the proposals and to allow time for preparation of an Assessment of Environmental Effects. During the time lapse this will involve, the wider community must be advised of the impending programme. Newspaper advertisements and mail box flyers are both important, along with public and personal meetings with any concerned residents, if required. During this phase, it is critical to gain community support for the control programme. Close liaison with a beach care group on the need for rabbit control is an important element, so these people can be the first point of contact for any apprehensive members of the community. Public notices of the control programme will need to be posted closer to the time, at the request of the MOH.

The control programme should be managed by the contractor but involve local volunteers where possible, for example to lay and collect baits. This ensures the 'local knowledge' of the community and the trust of neighbours can be utilised to the greatest extent. Too many operations have been compromised due to contractors based some distance away from the site only undertaking pest control when they 'can fit it in'.

One pre-feed with non-toxic bait can be an important tool to identify the density and locations of rabbit populations. The areas with higher rabbit numbers can then be supplied with higher amounts of Pindone bait, and areas of lower rabbit density with lesser amounts. To minimise human or pet contact with bait, it is recommended to lay baits at sunset, and collect any remnants at sunrise the next day. Each area where bait is laid should be marked with a small bamboo stake (or similar) located nearby. This process should be repeated at 3-5 day intervals, with baits laid in response to uptake until few baits are taken or signs of fresh activity cease. Most rabbits will end their days underground in burrows, further limiting the risk to people and pets. Following these guidelines will result in the safest control while ensuring maximum effectiveness.

SUGGESTED RESTORATION SPECIES BY MANAGEMENT UNIT

Management Unit	Scientific Name	Common Name
1	<i>Calystegia soldanella</i>	shore bindweed
	<i>Ficinia spiralis</i>	pingao
	<i>Poa billardierei</i>	hinarepe; sand tussock
	<i>Spinifex sericeus</i>	spinifex
2	<i>Calystegia soldanella</i>	shore bindweed
	<i>Carex testacea</i>	speckled sedge
	<i>Coprosma acerosa</i>	sand coprosma
	<i>Euphorbia glauca</i>	sea spurge
	<i>Ficinia nodosa</i>	wiwi
	<i>Ficinia spiralis</i>	pingao
	<i>Muehlenbeckia complexa</i>	pohuehue
	<i>Olearia solandri</i>	coastal tree daisy
	<i>Pimelea villosa</i>	sand daphne
	<i>Poa billardierei</i>	hinarepe; sand tussock
<i>Spinifex sericeus</i>	spinifex	
3	<i>Coprosma repens</i>	taupata
	<i>Discaria toumatou</i>	matagouri
	<i>Dodonea viscosa</i>	akeake
	<i>Ficinia nodosa</i>	wiwi
	<i>Kunzea ericoides</i>	kanuka
	<i>Melicytus ramiflorus</i>	mahoe
	<i>Muehlenbeckia complexa</i>	pohuehue
	<i>Myoporum laetum</i>	ngaio
	<i>Olearia solandri</i>	coastal tree daisy
<i>Ozothamnus leptophyllus</i>	tauhinu	
4	<i>Coprosma repens</i>	taupata
	<i>Dodonea viscosa</i>	akeake
	<i>Kunzea ericoides</i>	kanuka
	<i>Melicytus ramiflorus</i>	mahoe
	<i>Myoporum laetum</i>	ngaio
	<i>Olearia solandri</i>	coastal tree daisy
5	<i>Ozothamnus leptophyllus</i>	tauhinu
	<i>Coprosma repens</i>	taupata
	<i>Knightia excelsa</i>	rewarewa
	<i>Kunzea ericoides</i>	kanuka
	<i>Melicytus ramiflorus</i>	mahoe
	<i>Myoporum laetum</i>	ngaio
	<i>Podocarpus totara</i>	totara
<i>Sophora microphylla</i>	kowhai	
6	<i>Apodasmia similis</i>	oioi ¹
	<i>Austroderia toetoe</i>	toetoe
	<i>Bolboschoenus caldwellii</i>	purua grass
	<i>Bolboschoenus fluviatilis</i>	purua grass
	<i>Carex secta</i>	pukio
	<i>Carex virgata</i>	purei
	<i>Cyperus ustulatus</i>	upokotangata

¹ Only plant in wet areas near the coast.

Management Unit	Scientific Name	Common Name
	<i>Muehlenbeckia complexa</i>	pohuehue
	<i>Phormium tenax</i>	harakeke
	<i>Pittosporum tenuifolium</i>	kohukohu
	<i>Plagianthus divaricatus</i>	saltmarsh ribbonwood ¹
	<i>Schoenoplectus tabernaemontani</i>	kapungawha
	<i>Typha orientalis</i>	raupo
7	<i>Aristotelia serrata</i>	makomako; wineberry
	<i>Austroderia toetoe</i>	toetoe
	<i>Beilschmiedia tawa</i>	tawa
	<i>Carex secta</i>	pukio
	<i>Carex virgata</i>	purei
	<i>Coprosma propinqua</i> var. <i>propinqua</i>	mingimingi
	<i>Coprosma robusta</i>	karamu
	<i>Cyperus ustulatus</i>	upokotangata
	<i>Dacrydium cupressinum</i>	rimu
	<i>Elaeocarpus dentata</i>	hinau
	<i>Hebe stricta</i>	koromiko
	<i>Hedycarya arborea</i>	pigeonwood
	<i>Knightia excelsa</i>	rewarewa
	<i>Kunzea ericoides</i>	kanuka
	<i>Leptospermum scoparium</i>	manuka
	<i>Muehlenbeckia complexa</i>	pohuehue
	<i>Myrsine australis</i>	mapou
	<i>Pennantia corymbosa</i>	kaikomako
	<i>Phormium tenax</i>	harakeke
	<i>Pittosporum eugenioides</i>	tarata
	<i>Pittosporum tenuifolium</i>	kohukohu
	<i>Podocarpus totara</i>	totara
	<i>Pseudopanax arboreus</i>	five finger
	<i>Pseudopanax crassifolius</i>	horoeaka; lanewood
	<i>Sophora microphylla</i>	kowhai
8	<i>Austroderia toetoe</i>	toetoe
	<i>Carex secta</i>	pukio
	<i>Carex virgata</i>	purei
	<i>Coprosma propinqua</i> var. <i>propinqua</i>	mingimingi
	<i>Cordyline australis</i>	cabbage tree
	<i>Cyperus ustulatus</i>	upokotangata
	<i>Dacrycarpus dacrydioides</i>	kahikatea
	<i>Kunzea ericoides</i>	kanuka
	<i>Laurelia novae-zelandiae</i>	pukatea
	<i>Leptospermum scoparium</i>	manuka
	<i>Melicytus ramiflorus</i>	mahoe
	<i>Muehlenbeckia complexa</i>	pohuehue
	<i>Phormium tenax</i>	harakeke
	<i>Pittosporum eugenioides</i>	tarata
	<i>Pittosporum tenuifolium</i>	kohukohu
	<i>Sophora microphylla</i>	kowhai
	<i>Syzygium maire</i>	maire tawake; swamp maire

¹ Only plant in wet areas near the coast.

GPS DATA FOR IDENTIFIED FEATURES

GPS Point	Feature	Notes	Latitude	Longitude
Indigenous Species				
440	<i>Carex testacea</i>		-40.5534691	175.1939786
442	<i>Carex testacea</i>		-40.55363724	175.1938547
466	sand coprosma	2 plants	-40.5559535	175.1937891
478	<i>Carex testacea</i>		-40.55686084	175.1934944
498	pingao	planted	-40.54522533	175.1962233
509	<i>Carex testacea</i>		-40.54391113	175.1965638
526	<i>Carex testacea</i>		-40.54086347	175.1974305
554	sand coprosma		-40.54434473	175.1975492
557	sand coprosma	6 plants	-40.54446375	175.1975243
571	tauhinu	2 plants	-40.54552272	175.1970924
Weeds and Selected Exotic Species				
418	radiata pine	seedling	-40.54906198	175.195771
419	marram	southern extent of large marram patch on foredune - see 420	-40.54947839	175.1947853
420	marram	northern extent of large marram patch on foredune - see 419	-40.54851598	175.1951598
421	ice plant	large mat on foredune	-40.548605	175.1950852
422	marram	western extent of marram patch on foredune - see 423	-40.55096593	175.1944411
423	marram	eastern extent of marram patch on foredune - see 422	-40.55118067	175.1948482
425	marram	marram on foredune	-40.5520218	175.1943042
426	boxthorn		-40.55230703	175.1945654
427	banksia	view point 4 plants	-40.55238322	175.194891
428	climbing dock		-40.55235766	175.1953163
429	radiata pine	seedling	-40.55230871	175.1953163
430	yucca		-40.55256511	175.1951987
432	agapanthus		-40.55297608	175.1950804
433	buckthorn		-40.55293065	175.1950387
434	banksia	previously controlled, resprouting	-40.55281145	175.1949777
436	coastal wattle		-40.55301773	175.1940763
437	coastal wattle		-40.55310449	175.1940109
439	coastal wattle		-40.55344479	175.193943
441	coastal wattle	2 plants	-40.55359466	175.19382
443	coastal wattle		-40.55378644	175.1937738
445	crack willow	dumped, resprouting	-40.553897	175.193598
447	lupin	controlled area	-40.55479486	175.193752
448	pampas		-40.55490173	175.1941012
448	boxthorn		-40.55490173	175.1941012
449	watsonia		-40.55499326	175.1943857
450	karo		-40.55506015	175.1941875
451	artemisia		-40.55506786	175.1942582
452	lupin	controlled area	-40.55519108	175.1942989
453	buckthorn		-40.55518035	175.1941616
454	agapanthus		-40.55521857	175.1939712

GPS Point	Feature	Notes	Latitude	Longitude
454	buckthorn		-40.55521857	175.1939712
455	agapanthus	8 plants	-40.55530767	175.1939523
455	yucca		-40.55530767	175.1939523
456	agapanthus		-40.55538068	175.1939476
457	banksia	previously controlled, resprouting	-40.55536844	175.1940556
458	karo		-40.555494	175.1940242
458	watsonia		-40.555494	175.1940242
458	yucca		-40.555494	175.1940242
458	agapanthus		-40.555494	175.1940242
459	karo		-40.5556209	175.1940635
460	agapanthus		-40.55565485	175.1939984
461	banksia	2 plants	-40.55576197	175.193975
463	prickly pear	garden origin, could be deliberately planted	-40.55606447	175.194108
463	boxthorn		-40.55606447	175.194108
464	buckthorn		-40.55607017	175.1939601
464	coastal wattle		-40.55607017	175.1939601
465	coastal wattle		-40.55600437	175.1938515
465	karo		-40.55600437	175.1938515
468	banksia		-40.55615089	175.1938374
469	banksia		-40.5562021	175.1939419
469	karo		-40.5562021	175.1939419
470	agapanthus		-40.55635289	175.1939854
471	karo	2 plants	-40.5564347	175.1939636
472	agapanthus		-40.55647921	175.1938888
472	banksia		-40.55647921	175.1938888
473	pig's ear	possible garden waste dumping site	-40.5565041	175.1938593
473	watsonia	possible garden waste dumping site	-40.5565041	175.1938593
473	pinwheel	possible garden waste dumping site	-40.5565041	175.1938593
474	coastal wattle		-40.55647971	175.1938299
475	radiata pine	previously controlled, resprouting	-40.55654241	175.1936574
476	buckthorn	3 plants	-40.55661667	175.1938123
476	coastal wattle		-40.55661667	175.1938123
478	coastal wattle		-40.55686084	175.1934944
479	coastal wattle		-40.55681524	175.1932028
480	coastal wattle	controlled area	-40.55701523	175.1932489
482	coastal wattle	northern extent of coastal wattle shrubland (sprayed) - see 488	-40.5571444	175.1933639
484	yucca	2 plants	-40.55810873	175.1930474
485	yucca		-40.55837234	175.193024
486	radiata pine	previously controlled, resprouting	-40.55849338	175.1929126
488	coastal wattle	southern extent of coastal wattle shrubland (sprayed) - see 482	-40.55865339	175.1929163
489	boxthorn		-40.5585668	175.1932761
490	dimorphotheca		-40.55850009	175.1932772
490	climbing dock		-40.55850009	175.1932772
491	brush wattle		-40.55836229	175.1933633
491	yucca		-40.55836229	175.1933633
492	cape ivy		-40.55814084	175.1931639

GPS Point	Feature	Notes	Latitude	Longitude
493	pampas		-40.55814067	175.1934659
494	radiata pine	seedling	-40.54818062	175.1957617
495	marram	marram on foredune	-40.54793185	175.1953598
496	marram	marram on foredune	-40.54597819	175.1961161
497	marram	marram on foredune	-40.54564359	175.1961873
500	coastal wattle		-40.54488846	175.1964646
501	coastal wattle		-40.54498754	175.196581
502	coastal wattle		-40.54468914	175.1964813
503	radiata pine	seedling	-40.54465561	175.1964973
504	marram	marram on foredune	-40.54436526	175.1960611
505	marram	southern extent of large patch of marram on foredune - see 506	-40.54432109	175.1963446
506	marram	northern extent of large patch of marram on foredune - see 505	-40.54415018	175.1963801
507	coastal wattle		-40.54416049	175.1964875
508	karo	view point - large plant against fence	-40.54416443	175.1966563
510	gorse		-40.54382815	175.19664
510	coastal wattle		-40.54382815	175.19664
511	marram	marram on foredune	-40.54377845	175.1962388
514	radiata pine	seedling	-40.54327486	175.1967906
515	yucca		-40.5432389	175.1968155
516	yucca		-40.54277865	175.1967656
517	coastal wattle		-40.54234606	175.1970483
519	radiata pine		-40.54204758	175.1972107
520	coastal wattle		-40.54174759	175.1973111
520	radiata pine	seedling	-40.54174759	175.1973111
521	coastal wattle		-40.54146814	175.197452
522	coastal wattle		-40.54132724	175.1972008
523	marram	marram on foredune	-40.54127695	175.1971583
524	radiata pine	seedling	-40.54107838	175.1975057
524	coastal wattle		-40.54107838	175.1975057
525	yucca		-40.54084713	175.1972616
527	coastal wattle		-40.540336	175.1976913
529	montbretia		-40.53985412	175.1977877
530	coastal wattle		-40.53967274	175.197856
530	radiata pine	seedling	-40.53967274	175.197856
531	coastal wattle		-40.53948247	175.1979453
532	radiata pine	seedling	-40.53949831	175.1977654
532	marram	marram on foredune	-40.53949831	175.1977654
533	aloe		-40.53968221	175.1981473
534	agapanthus		-40.53985706	175.1982171
535	coastal wattle	previously controlled, resprouting	-40.5399428	175.1981169
536	coastal wattle		-40.54026048	175.1981206
537	coastal wattle		-40.54089071	175.1979445
537	boxthorn		-40.54089071	175.1979445
538	climbing dock		-40.54101711	175.1977784
539	coastal wattle		-40.54133822	175.1976866
539	boxthorn		-40.54133822	175.1976866
540	climbing dock		-40.54142565	175.1977338
541	coastal wattle	view point	-40.54171817	175.1976349
542	climbing dock		-40.54193066	175.1976614
543	radiata pine	seedling	-40.54208471	175.1974639
544	coastal wattle	view point - vacant lot	-40.54249241	175.1974642

GPS Point	Feature	Notes	Latitude	Longitude
544	boxthorn	view point - vacant lot	-40.54249241	175.1974642
545	coastal wattle		-40.54288577	175.1971909
546	coastal wattle		-40.54294294	175.1972467
547	karo		-40.54341492	175.1972673
547	dimorphotheca		-40.54341492	175.1972673
547	pohutukawa		-40.54341492	175.1972673
548	pohutukawa		-40.54379814	175.1972036
548	agapanthus		-40.54379814	175.1972036
549	agapanthus		-40.54407642	175.1973697
550	periwinkle		-40.54418472	175.1977086
551	prickly pear	on fence corner; garden origin, could be deliberately planted	-40.54407181	175.1974971
552	buckthorn		-40.54418639	175.1975553
553	boxthorn		-40.54432075	175.1974411
554	boxthorn		-40.54434473	175.1975492
554	buckthorn		-40.54434473	175.1975492
555	pampas		-40.54436845	175.1977623
555	agapanthus		-40.54436845	175.1977623
555	banksia	view point	-40.54436845	175.1977623
555	macrocarpa		-40.54436845	175.1977623
556	agapanthus		-40.54446006	175.197596
556	karo		-40.54446006	175.197596
556	boxthorn		-40.54446006	175.197596
556	climbing dock		-40.54446006	175.197596
557	boxthorn	3 plants	-40.54446375	175.1975243
557	karo	view point - 3 plants	-40.54446375	175.1975243
557	periwinkle		-40.54446375	175.1975243
558	climbing dock		-40.54443693	175.1974183
559	coastal wattle		-40.54446417	175.1973156
560	boxthorn		-40.5443858	175.1971637
560	buckthorn		-40.5443858	175.1971637
561	velvety nightshade		-40.5445096	175.1969313
562	buckthorn		-40.54469844	175.1970596
563	buckthorn	seedling	-40.54475242	175.19717
564	boxthorn	view point - 6 plants	-40.54482258	175.1972778
564	buckthorn	view point - 8 plants	-40.54482258	175.1972778
564	karo	view point - 3 plants	-40.54482258	175.1972778
565	boxthorn		-40.54487631	175.1971878
565	karo		-40.54487631	175.1971878
566	boxthorn	view point - 4 plants	-40.54510555	175.19735
566	karo	view point - 2 plants	-40.54510555	175.19735
567	buckthorn	3 plants	-40.54518267	175.1972734
567	boxthorn		-40.54518267	175.1972734
568	banksia		-40.54538115	175.1975452
568	radiata pine		-40.54538115	175.1975452
568	macrocarpa		-40.54538115	175.1975452
569	buckthorn	2 plants	-40.54538048	175.1973847
569	karo		-40.54538048	175.1973847
570	karo	2 plants	-40.54555013	175.1973972
572	climbing dock		-40.54568575	175.1971772
572	buckthorn	view point - very big plant	-40.54568575	175.1971772
573	agapanthus		-40.5459336	175.1974816
573	macrocarpa		-40.5459336	175.1974816
573	silver poplar	previously controlled? dense regrowth	-40.5459336	175.1974816
574	macrocarpa		-40.54620836	175.19752

GPS Point	Feature	Notes	Latitude	Longitude
575	crack willow		-40.54659158	175.1970378
575	grey willow		-40.54659158	175.1970378
575	silver poplar		-40.54659158	175.1970378
575	blackberry		-40.54659158	175.1970378
576	giant reed		-40.54701612	175.1973514
577	pampas		-40.54679601	175.1970277
578	gorse		-40.54710153	175.1975785
579	tradescantia		-40.54751091	175.1980818
580	agapanthus		-40.54735551	175.1976516
580	red-hot poker		-40.54735551	175.1976516
581	coastal wattle		-40.54732609	175.1975061
582	coastal wattle		-40.54734184	175.1973134
583	buckthorn	2 plants	-40.54736012	175.1972344
584	boneseed		-40.54741024	175.1971685
585	karo		-40.54753957	175.1970212
585	buckthorn		-40.54753957	175.1970212
587	agapanthus		-40.54780528	175.1969091
588	agapanthus		-40.54794014	175.1969503
588	buckthorn		-40.54794014	175.1969503
588	boxthorn		-40.54794014	175.1969503
589	agapanthus		-40.54806696	175.1969916
589	buckthorn		-40.54806696	175.1969916
590	coastal wattle		-40.5481631	175.1968335
590	radiata pine		-40.5481631	175.1968335
591	radiata pine		-40.54827693	175.1967422
591	karo	view point - 2 plants	-40.54827693	175.1967422
591	agapanthus		-40.54827693	175.1967422
592	agapanthus		-40.54844515	175.1966964
592	buckthorn		-40.54844515	175.1966964
593	agapanthus		-40.5485511	175.1969167
593	climbing dock		-40.5485511	175.1969167
593	cape ivy		-40.5485511	175.1969167
593	buffalo grass		-40.5485511	175.1969167
593	plum tree		-40.5485511	175.1969167
594	karo		-40.548677	175.1966903
594	buckthorn		-40.548677	175.1966903
595	giant reed		-40.54905167	175.2039763
Artificial Features				
422	stormwater outfall		-40.55096593	175.1944411
424	track		-40.55123708	175.1941689
427	track		-40.55238322	175.194891
431	garden waste dump site		-40.55277633	175.1951474
435	track		-40.55286937	175.1947917
438	track		-40.55320306	175.1942194
444	vehicle access		-40.55388736	175.1937325
446	track		-40.55424644	175.1936686
452	track		-40.55519108	175.1942989
456	track		-40.55538068	175.1939476
462	track		-40.55584269	175.193829
467	track		-40.55606104	175.1935891
477	track		-40.55674357	175.1936419
478	exotic 'garden'	view point - cleared area, planted with garden species	-40.55686084	175.1934944
481	track		-40.55705085	175.1930998
483	track		-40.55733684	175.1933877

GPS Point	Feature	Notes	Latitude	Longitude
484	track		-40.55810873	175.1930474
487	track		-40.55855633	175.1928515
499	track		-40.54494051	175.1964032
512	track		-40.54349279	175.1964545
513	stormwater outfall		-40.5433591	175.1965259
518	track		-40.54239728	175.1971272
519	garden waste dump site	view point	-40.54204758	175.1972107
528	formed track		-40.5402531	175.1976726
534	garden waste dump site		-40.53985706	175.1982171
542	exotic 'garden'	view point - cleared area, planted with garden species	-40.54193066	175.1976614
547	exotic 'garden'	view point - cleared area, planted with garden species	-40.54341492	175.1972673
586	garden waste site		-40.54777728	175.1970021





Plate 1: Coastal wattle seedling in the rear dune.



Plate 2: Coastal wattle shrubland. The dead plants are the result of a targeted herbicide control programme.



Plate 3: Watsonia in the rear dune.



Plate 4: Boxthorn, karo, and evergreen buckthorn shrubs.



Plate 5: Water celery in the mouth of the Wairarawa Stream.



Plate 6: Aquatic weeds in the Wairarawa Stream.



Plate 7: Culvert mouth, Wairarawa Stream.

LIST OF COMMON NAMES USED IN THE TEXT

agapanthus	<i>Agapanthus praecox</i>
annual poa	<i>Poa annua</i>
Argentine cress	<i>Lepidium bonariense</i>
arum lily	<i>Zantedeschia aethiopica</i>
bachelor's button	<i>Cotula coronopifolia</i>
banksia	<i>Banksia integrifolia</i>
black wattle	<i>Acacia mearnsii</i>
blackberry	<i>Rubus fruticosus</i> agg.
boneseed	<i>Chrysanthemoides monilifera</i>
boxthorn	<i>Lycium ferocissimum</i>
broad-leaved dock	<i>Rumex obtusifolius</i>
broad-leaved fleabane	<i>Conyza sumatrensis</i>
broomrape	<i>Orobanche minor</i>
brush wattle	<i>Paraserianthes lophantha</i>
buffalo grass	<i>Stenotaphrum secundatum</i>
Cape ivy	<i>Senecio angulatus</i>
cape ivy	<i>Senecio angulatus</i>
cape weed	<i>Arctotheca calendula</i>
catchfly	<i>Silene gallica</i>
catsear	<i>Hypochoeris radicata</i>
celery-leaved buttercup	<i>Ranunculus sceleratus</i>
chickweed	<i>Stellaria media</i>
cleavers	<i>Galium aparine</i>
climbing asparagus	<i>Asparagus scandens</i>
climbing dock	<i>Rumex sagittatus</i>
clustered dock	<i>Rumex conglomeratus</i>
coast tea tree	<i>Leptospermum laevigatum</i>
coastal wattle	<i>Acacia sophorae</i>
cocksfoot	<i>Dactylis glomerata</i>
cotoneaster	<i>Cotoneaster glaucophyllus</i>
crack willow	<i>Salix fragilis</i>
creeping bent	<i>Agrostis stolonifera</i>
creeping buttercup	<i>Ranunculus repens</i>
creeping mallow	<i>Modiola caroliniana</i>
dandelion	<i>Taraxacum officinale</i>
dovesfoot cranesbill	<i>Geranium molle</i>
fireweed	<i>Senecio glomeratus</i>
five finger, whauwhaupaku	<i>Pseudopanax arboreus</i>
fruit salad plant	<i>Monstera deliciosa</i>
garden forget-me-not	<i>Myosotis sylvatica</i>
gazania	<i>Gazania linearis</i>
giant reed	<i>Arundo donax</i>
gorse	<i>Ulex europaeus</i>
greater bindweed	<i>Calystegia silvatica</i>
grey willow	<i>Salix cinerea</i>

harakeke, flax	<i>Phormium tenax</i>
harestail	<i>Lagurus ovatus</i>
hawksbeard	<i>Crepis capillaris</i>
Himalayan honeysuckle	<i>Leycesteria formosa</i>
huruhuruwhenua	<i>Asplenium oblongifolium</i>
ice plant	<i>Carpobrotus edulis</i>
Indian doab	<i>Cynodon dactylon</i>
Italian evergreen buckthorn	<i>Rhamnus alaternus</i>
Japanese honeysuckle	<i>Lonicera japonica</i>
Japanese spindleberry	<i>Euonymus japonicus</i>
kahikatea	<i>Dacrycarpus dacrydioides</i>
karearea	<i>Lemna minor</i>
karo	<i>Pittosporum crassifolium</i>
King Island melilot	<i>Melilotus indica</i>
kowhangatara, spinifex	<i>Spinifex sericeus</i>
large quaking grass	<i>Briza maxima</i>
lawn daisy	<i>Bellis perennis</i>
lotus	<i>Lotus pedunculatus</i>
macrocarpa	<i>Cupressus macrocarpa</i>
maikaika	<i>Microtis unifolia</i> agg.
maire tawake, swamp maire	<i>Syzygium maire</i>
marram	<i>Ammophila arenaria</i>
marsh ribbonwood, makaka	<i>Plagianthus divaricatus</i>
matagouri	<i>Discaria toumatou</i>
mercier grass	<i>Paspalum distichum</i>
montbretia	<i>Crocasmia ×crocosmiiflora</i>
narrow-leaved plantain	<i>Plantago lanceolata</i>
ngaio	<i>Myoporum laetum</i>
oioi	<i>Apodasmia similis</i>
onion weed	<i>Allium triquetrum</i>
pampas	<i>Cortaderia selloana</i>
panahi, shore bindweed	<i>Calystegia soldanella</i>
peach tree, nectarine	<i>Prunus persica</i>
perehia; sand wind grass	<i>Lachnagrostis billardierei</i>
periwinkle	<i>Vinca major</i>
Phoenix palm	<i>Phoenix canariensis</i>
pingao	<i>Ficinia spiralis</i>
pinwheel aeonium	<i>Aeonium haworthii</i>
piripiri	<i>Acaena novae-zelandiae</i>
plum	<i>Prunus</i> sp.
pohuehue	<i>Muehlenbeckia complexa</i>
pohutukawa	<i>Metrosideros excelsa</i>
poplar	<i>Populus</i> sp.
poroporo	<i>Solanum aviculare</i> var. <i>aviculare</i>
potato	<i>Solanum tuberosum</i>
prairie grass	<i>Bromus willdenowii</i>
prickly pear	<i>Opuntia vulgaris</i>
puha, sow thistle	<i>Sonchus oleraceus</i>
pukatea	<i>Laurelia novae-zelandiae</i>
pukio	<i>Carex secta</i>
purei	<i>Carex virgata</i>
purple groundsel	<i>Senecio elegans</i>

radiata pine	<i>Pinus radiata</i>
rain daisy, dimorphotheca	<i>Osteospermum fruticosum</i>
rape	<i>Brassica napus</i>
rarahu, bracken	<i>Pteridium esculentum</i>
ratstail	<i>Sporobolus africanus</i>
rautahi	<i>Carex geminata</i> agg.
red hot poker	<i>Kniphofia praecox</i>
reed sweetgrass	<i>Glyceria maxima</i>
ripgut brome	<i>Bromus diandrus</i>
rye grass	<i>Lolium perenne</i>
sand coprosma, tarakupenga	<i>Coprosma acerosa</i>
sand oxalis	<i>Oxalis rubens</i>
scrambling fumitory	<i>Fumaria muralis</i>
sheep's sorrel	<i>Rumex acetosella</i>
silver poplar	<i>Populus alba</i> 'Nivea'
silver wattle	<i>Acacia dealbata</i>
snow tussock	<i>Chionochloa flavicans</i> f. <i>flavicans</i>
spotted aloe	<i>Aloe maculata</i>
stonecrop	<i>Sedum acre</i>
sweet fern	<i>Pteris macilenta</i>
sweet vernal	<i>Anthoxanthum odoratum</i>
sweetgrass	<i>Glyceria declinata</i>
tall fescue	<i>Schedonorus arundinaceus</i>
tauhinu	<i>Ozothamnus leptophyllus</i>
taupata	<i>Coprosma repens</i>
ti kouka, cabbage tree	<i>Cordyline australis</i>
toetoe	<i>Austroderia fulvida</i>
toetoe	<i>Austroderia toetoe</i>
tortured willow	<i>Salix matsudana</i> 'Tortuosa'
tradescantia	<i>Tradescantia fluminensis</i>
tree-lupin	<i>Lupinus arboreus</i>
tutunawai	<i>Persicaria decipiens</i>
upokotangata	<i>Cyperus ustulatus</i> f. <i>ustulatus</i>
veldt grass	<i>Ehrharta erecta</i>
velvety nightshade	<i>Solanum chenopodioides</i>
vetch	<i>Vicia</i> sp.
vulpia hair grass	<i>Vulpia myuros</i> var. <i>myuros</i>
water celery	<i>Apium nodiflorum</i>
water forget-me-not	<i>Myosotis scorpioides</i>
watsonia	<i>Watsonia meriana</i>
watsonia	<i>Watsonia</i> sp.
wharariki, mountain flax	<i>Phormium cookianum</i>
white clover	<i>Trifolium repens</i>
willow weed	<i>Persicaria maculosa</i>
wiwi, knobby club rush	<i>Ficinia nodosa</i>
yarrow	<i>Achillea millefolium</i>
yellow serradella	<i>Ornithopus pinnatus</i>
Yorkshire fog	<i>Holcus lanatus</i>
yucca	<i>Yucca gloriosa</i>