



# Taharoa Domain Kai Iwi Lakes Native Revegetation Plan



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Compiled for Kaipara District Council  
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October 2010



# Forward

This report was requested by Kaipara District Council in 2010.

The council requested a report giving direction in the process of returning the Taharoa Domain, otherwise known as Kai Iwi Lakes, to a state of native vegetation.

The current vegetation consists of a mix of native scrub such as manuka with scattered larger forest species, exotic forest (*Pinus radiata*), rapidly spreading acacia species, pampas and other exotic species which pose a potential threat of spreading.

This report gives direction and advise on possible solutions to eradicate the exotic pest plants, allow natural regeneration and supplementary planting of native vegetation.

Commencement of the project should start immediately and it is expected that the project would take up to 10 years to complete all primary tasks. Primary tasks are to eradicate pest plants and replant with native species in selected areas.

Ongoing pest plant management at a lower level will need to be ongoing.

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Aerial photograph of the Taharoa Domain taken in January 2009.



# Overview of the Revegetation Project

Much of the Taharoa domain land area is covered with vegetation comprising native plants and other exotic species of which some are problems due to their invasive nature. Exotic forestry species have also spread into open areas and vegetated areas.

The aim is to have the bulk of the domain returned to native vegetation with areas set aside for amenities such as the camping grounds, areas for day visitors, the water ski club grounds and open grass areas along with recreational walking and biking tracks around the lakes.

The removal of exotic timber crops is in steady progress with areas being designated to be returned to native vegetation.

The cost of eradicating the pest plant species will be high and very time consuming and will be a 10 to 20 year project with a large visual impact being made within the first 5 years. It is ideal that the first sweep of all the zones (see zones on page 13) is completed within the first 5 years. Some zones will have been dealt with several times each year. If the pest plants are not eradicated in a timely fashion then the project becomes more of a containment situation with little gain each year. Seed stock needs to be eradicated in each zone and then followed up with seedling eradication.

In most cases the native forest will naturally re-grow but there is options of assisting this with seed dispersal and planting of native species. In open areas a first generation of species will cover the ground and form a shelter for the second generation of large tree species to grow in. In time the second generation will in most areas outgrow the first generation and form a dense forest. If left to do this naturally it will take many decades.

There are three main objectives:

- Pest Plant Eradication
- Replanting of Native Species
- Control of pest animal

The first two main objectives will be operating simultaneously in various zones around the lakes however each zone needs to have the pest plant eradication done first then followed up with planting if it is to happen at all in that zone. Ongoing pest plant eradication will need to continue at a lower level for a few decades.

Animal pests such as possums, rats, mice and mustelidae need to be poisoned or trapped on a regular basis.

Possums destroy vegetation by eating leaves, buds, flowers, seeds and young seedlings making it harder for native plants to survive.

Rats and mice eat seeds and seedlings. Rats also eat eggs and young birds etc. These three animals if in large numbers destroy forests before they start or prevent/reduce natural replacements getting established.

Mustelidae eat meat and any small animal or insects are at risk.

Any grazing animal pest such as goats need to be shot if any arrive into the domain.

For the healthy return of the forest the animal pests must be kept to a minimum and this needs to be an on-going project. This is likely to be best managed by the Domain Manager and be part of his/her routine jobs.

Funding for the eradication of pest plants and the replanting needs to be allocated by council for a long period.

Funding in the vicinity of \$100,000 to \$150,000 + gst per year would make a good dent in the project. Funding higher amounts will certainly make it easier and faster. If funding is less, then as previously mentioned, the project will take a lot longer, and gains will be slow as pest plant seed stock trees will be less likely controlled.

Additional funding support may be available from various government bodies.

It is recommended that some liaison with Members of Parliament and Government is sought out.

# Exotic Pest Plant Eradication Methods

There is a wide range of eradication methods for plants. Most methods are listed below. As the domain has such a range of pest plants in a range of maturity and in a wide variety of sites, several different methods may be used for a single species. For recommendations on control for individual species see Eradication Methods for Each Species on page 9.

## Hand weeding

Used for seedlings that can be pulled out easily. This is no good for species which will sprout from any small root which may have broken off in the ground.

## Cutting down

Simply cut down the plant as near to ground level as possible making sure there is no green shoots or branches that will keep growing. Some species will shoot out from a leaf scar on young plants or they may form a callous and shoot out again. These will require 'Stump Painting'.

## Ring barking (see picture next page)

Ring-barking is an alternative to using herbicides on trees with a sufficiently large trunk. With a sharp chisel, axe or chainsaw make two deep parallel cuts into the sapwood right around the base of the plant or cut out a deep section about 100mm thick around the trunk. Vigorous ring-barking is recommended for many species. Cuts 3-5cm deep into the tree (under the bark layer) should be no less than 5cm apart and all the bark should be removed from between the cuts. This method is not always successful as a callous may grow to heal the wound, or the plant may re-sprout from the base. Frilling is preferable.

WARNING: Only use this method where the trees will not eventually fall onto tracks and the waters edge or places where there will be no risk to people or property.

## Lethal Injection (Drill & Fill)

Generally best for big trees, uses less herbicide than most other methods and uses minimal amounts of water. Can generally be used all year round. Aim is to access the cambium layer (under bark) so deep holes are not necessary. Drill a 10mm diameter hole on a downward angle of about 45 degrees to a depth of about 80mm at intervals of about 80mm around the trunk and inject a mix of herbicide into the hole using a livestock vaccination gun. Each hole will take about 5mls. After injecting the holes you can wrap tape around the trunk covering the holes. This keeps the cambium layer from drying out so fast, reduces risks of rain washing the chemical out and marks the tree so you can clearly see it from a distance. You can also write a date on the tape so you can monitor speed of death for various species.

WARNING: Only use this method where the trees will not eventually fall onto tracks and the waters edge or places where there will be no risk to people or property.

## Cut and squirt

Good for soft trees such as tobacco weed (quicker to do than drilling). Cut a notch in a downward angle in the trunk and squirt concentrated herbicide in notch. Use a live stock vaccination gun. Generally use all year round.

WARNING: Only use this method where the trees will not eventually fall onto tracks and the waters edge or places where there will be no risk to people or property.

## Frilling (see picture next page)

This uses more herbicide and requires a complete ring around trunk to be made. Herbicide can run off. It is superior to stump painting for large trees, some hardwoods and self-sprouting species. Semi-frilling (feathering) can hold herbicide more effectively.

WARNING: Only use this method where the trees will not eventually fall onto tracks and the waters edge or places where there will be no risk to people or property.

## Stump painting (see picture next page)

Application of herbicide to cut stump surface. Solution is usually 10% herbicide in water. We do not recommend using diesel as advised on some labels. Cut the stump off level so that herbicide does not run off.

The cambium layer (the slippery zone under the bark) must be coated, as this is where most growth sprouts from.

'Feathering' of bark of hardwood species and big trees is generally recommended. This means peeling back the bark so that the cambium layer is well coated and more herbicide mix can be applied.

'Painting' can be done by paint brush, drench gun, knapsack or pistol-grip sprayer. Pistol-grip sprayers are especially recommended, as they don't spill if tipped over and require only one hand to operate.

Stump painting should not be used for trees which re-sprout from the cut branches and trunks which will lay on the ground (e.g. Flame trees, Willows).

## Vial treatment

Used to give selective control of rhizomatous or layering creepers (jasmine, convolvulus, ivy, etc.). Individual flower vials are ideal for this, and are available from garden centres.

Cut vines 5-10 m apart, place end of vine in bottom of bottle containing concentrated herbicide. Vine sucks up herbicide and kills 2-to-many metres away.

Follow up monthly on missed spots.

## Weed wiping

This is particularly useful for grasses, rushes and soft herbs. Non-selective herbicides (e.g. glyphosate) can be made to act in a selective manner using a hockey stick type wiper. Likewise a residual herbicide (e.g. Metsulfuron, Amitrole, 2,4-D) can be applied by wiper to minimise or even eliminate residues, as the herbicide is contained within the plant rather than drifting or dripping onto the ground. Most or all of the herbicide is broken down within the weed. Look for a weed wiper that has a narrow or controlled release reservoir.

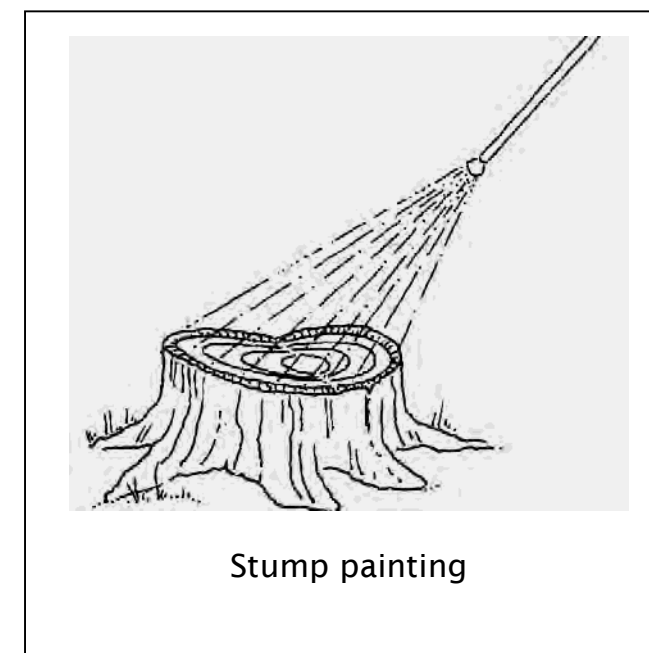
## Hand dig

Usually only suitable if the entire root system can be dug out. Soil disturbance can lead to more weeds. Not recommended for re-sprouting species (e.g. tradescantia), as any fragments left will re-grow.

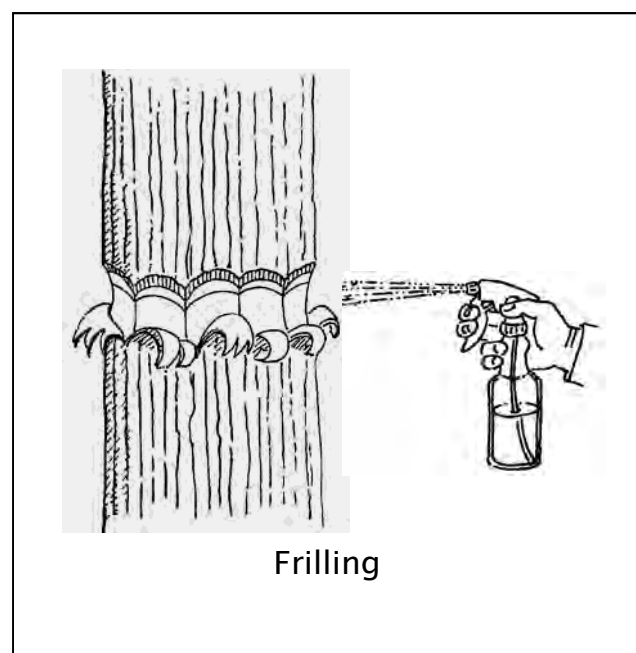
## Foliage spray

Can be used to apply non-selective herbicides semi-selectively. To ensure minimum drift of spray :

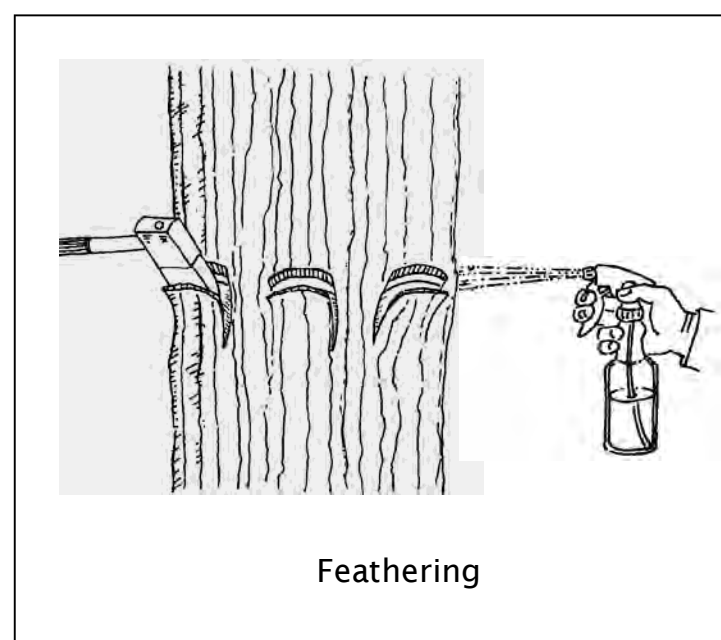
- Do not spray if there is any wind.
- Use a medium sized nozzle or adjust nozzle so that droplet size is such that the spray doesn't 'float' away'.
- Ideally use a marker dye with the spray mix to avoid missing areas or spraying areas twice.
- Always test the sprayer with water before starting and clean & adjust nozzles if necessary.
- Avoid spraying plants above shoulder height. It is better to cut plants to a more manageable height and minimise spray damage to desirable species.



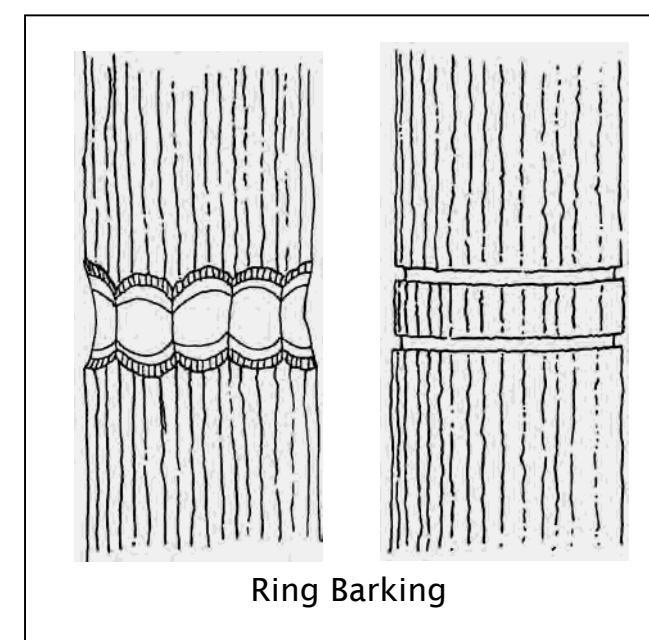
Stump painting



Frilling



Feathering



Ring Barking

# Herbicides

**Given the quite unique water catchment area of the lakes it is favourable to tend towards the side of very cautious with regards to using large quantities of herbicides.**

People who apply herbicides need to follow manufacturers guidelines for safe handling and they should be an experienced spray handler who holds their Grow Safe Certificate or at the least be supervised by an experienced certificate holder.

## Glyphosate

(Roundup® G2, Renew, Glyphosate 360, Trounce®, Zero, Touchdown, etc)

This is non selective, ie generally kills most plants, leaving bare ground. Sites often colonised by more weeds.

Foliar contact active only, cannot be taken up by roots. Non-volatile.

Low toxicity, non-residual, site can be planted on immediately.

Preferred for grasses and other monocots, useful for vines and some shrubs. Only herbicide generally permissible over water (Roundup G2 is the safest glyphosate formulation to use over water). Check your Regional Council rules for any restrictions on use over water.

Useful for stem/stump treatment.

## Metsulfuron

(Escort®, Meturon®, Mustang®, Meteor 600, Eradicate 600, Matrix etc)

Kills ferns, conifers and most broadleaf spp except Solanum spp. Generally not effective on grasses or other monocots, however high rates will kill almost anything.

Acts systemically i.e will spread through entire plant to roots.

Non-volatile. Low toxicity, however short but very active residue, apply with extreme care, works at very low rates. Replant sites only after seedlings appear naturally.

Preferred for hard-to-kill shrubs, trees. Very useful for vines.

Recommended for stem/stump treatment

## Triclopyr

(Grazon®, Vanguard, Victory, Renovate, Brushoff® etc)

Kills conifers and broadleaf spp. Doesn't kill grasses, sedges, flax or other monocots or ferns.

Foliar active, slightly root active.

Low-volatility.

Moderately low toxicity, short soil residue. Replant sites only after seedlings appear naturally.

Preferred for many shrubs and trees, some vines.

Preferred for broadleaf control amongst monocots (grasses, flax, etc).

Useful for stem/stump treatment.

## Tordon® Brushkiller (contains Triclopyr + Picloram)

Kills conifers and most broadleaf spp. Doesn't kill grasses, sedges, flax or other monocots.

It acts systemically. i.e will spread through entire plant to roots Low volatility.

Moderately low toxicity, long soil residue, apply with extreme care, works at very low rates.

Replant sites only after seedlings appear naturally. Preferred for many shrubs and trees.

Recommended for stem/stump treatment,

## Vigilant®

A pre-mixed gel containing picloram.

Kills a wide range of species and acts systemically. i.e. will spread through entire plant to roots. Non-volatile, low toxicity. Long term soil residue, and very soluble, moves with soil water so can kill plants off-site after rain. May also move across roots to another plant. Apply with care. Cuts should be as horizontal as possible to prevent dripping and where possible cuts should be made above 5cm off the ground. Apply the herbicide as soon as possible and no more than five minutes after cutting. Do not use a large "glob" of gel as pictured on the label (only small amounts are required to kill many woody and perennial broadleaf plants). Apply right across the stem surface. Avoid using excessively in one area. Very useful for woody weeds including climbers and woolly nightshade and also kills rhizomatous plants and ground covers.

## Amitrole (Activated Amitrole, Amitrole 4L)

A non-selective, ie generally kills most plants, leaves bare ground. Sites often colonised by more weeds. Acts systemically i.e will spread through entire plant to roots. Non-volatile,

Moderate toxicity, but corrosive. Moderate soil residue, apply with care. Replant sites only after seedlings appear naturally. Preferred for several hard-to-kill species, not otherwise recommended. Useful for stem/stump treatment

## Penetrant

(Pulse®, Boost®, Freeway, Dewdrop, Kiwi Buddy etc)

An additive used to improve ability of herbicide to penetrate leaf cuticle or stomata, thereby raising effectiveness or lowering cost. It generally works much more effectively than mere "spreaders" or "stickers". Usually causes rapid uptake of herbicide, thereby lowering rainfast periods from hours to minutes. It should always be added last to spray mix to prevent foaming. Rates used should always relate to percentage of spray mix (normally 0.1% or 1 part per 1000), not to litres per hectare of penetrant or herbicide.



# Exotic Plants to be Eradicated

There are many species of exotic plants which have made their way in to the Taharoa Domain, whether by human hand, birds, animals or by wind dispersal. They may not have been a pest at the time of arrival but as they have spread and our mindset has changed they have become a pest plant which needs to be removed.

Some exotic species in the domain are not a threat or are of such a low threat that they do not need to be eradicated at this stage. In time plants which are of a low threat may be eradicated more for a sense of trying to return the domain to almost purely native plants.

We must define what a pest plant is before we can decide what needs to be removed. Any plant which is on the pest plant lists from Northland Regional Council or Biosecurity should be removed. However there are others which are not listed in these resources which also need to be removed.

Any exotic plant which has an invasive habit which does any of the following should be removed:

- Exotic plants with growth rates which are faster than native species so that they smother out native plants.
- Exotic plants which disperse many seeds which have high germination success in a wide range of environments.
- Exotic plants which by way of their growth habits form or attempt to form a monoculture.
- Exotic plants which pose a threat of spreading to surrounding properties particularly where the management of them is not likely to occur.
- Exotic plants which do not provide a food source for native creatures and thus creating a void of creatures in the domain.

We need to remind ourselves when considering what a weed (pest plant) is, one way of looking at it is that 'any plant which is in the wrong place or an undesirable place can be considered a weed'. So for farmers we can understand that often manuka or totara are weeds when they appear in pasture lands and equally pine trees and escaped forestry and landscape species are weeds when they start to populate an area which should be native vegetation.

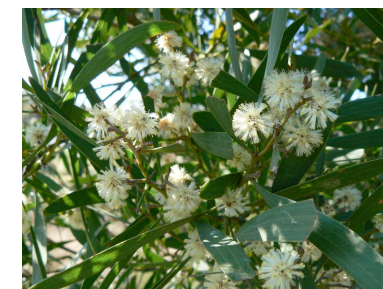
The 4 worst Pest Plants (pictured below) which are in massive numbers and are very invasive are: Pine trees (*Pinus radiata* and other pinus species), Black Wattle (*Acacia mearnsii*), Blackwood (*Acacia melanoxylon*), Pampus (*Cortaderia selloana*).



*Pinus radiata*



*Cortaderia selloana*



*Acacia melanoxylon*



*Acacia mearnsii*

Another 4 plants (pictured below) which may become a bigger problem if they are not dealt with relatively soon are:

Coastal Banksia (*Banksia integrifolia*), Gorse (*Ulex europaeus*), Spanish Heath (*Erica lusitanica*) and Prickly Hakea (*Hakea sericea*).



*Banksia integrifolia*



*Ulex europaeus*



*Erica lusitanica*



*Hakea sericea*

Other plants which are in small numbers but may as well be removed from areas which are not designated as amenity planting (in the camp grounds) unless considered a weed within those areas are:

Alaska spruce (*Picea sitchensis*), Banksia (*Banksia marginata*), Black peppermint (*Eucalyptus amygdalina*), Poplars (populous species), Silver dollar tree (*Eucalyptus cinerea*), Redwood (*Sequoia sempervirens*), Silver tree (*Leucodendron argenteum*), Norfolk island pine (*Araucaria heterophylla*), Monkey apple or lilly pilly (*Acmena smithii*), Loquat (*Eriobotrya japonica*), Gum trees (*Eucalyptus* species), Flowering Gum (*Eucalyptus leucoxylon* var.), Fig (*Ficus* species), Casuarina (*Casuarina* species), Australian or Tasmanian Ngaio (*Myoporum acuminatum*), Bamboo (*Bambusa* species), banana passionfruit (*Passiflora mollissima*), Buddleia (*Buddleia* species), Callistemon (*Callistemon* species), Cape/Brush Wattle (*Acacia baileyana*), Plum trees (*Prunus* species), Grape vine (*Vitis vinifera*), Lily of the valley (*Convallaria majalis*), Golden Wattle (*Acacia longifolium*).



# Eradication Methods for Each Species

## Pine Tree

*Pinus radiata* and other *pinus* species

### Origin

California

### General description

Fast growing tall conical shaped tree with needle leaves and cones. Sticky sap, coarse bark.

### Habitats

*Pinus radiata* will grow on sand, withstand a certain amount of salt spray, and even several degrees of frost won't harm it. So it flourishes from coastal areas to high altitudes. It needs only 600 mm of rain a year, which means it can grow almost anywhere in New Zealand.

### Dispersal

Pines seed very efficiently from pine cones. The wind-blown seeds are widely distributed and need no nurturing to take root.

### Impact on environment

They compete for forest space with native trees and plants, but provide none of the advantages these offer, such as berries and nectar, to encourage bird life and insects. Pine needles form a carpet which discourages regeneration of native forest floor species.

In areas where native forest re-growth is being encouraged pines are visually intrusive.

### Methods of eradication

Most pine species will not re-grow if they are cut down, provided all branches and needle formation below the cut are cleaned off the stump. If this is done carefully the use of herbicide is not required. You may use: Hand-weeding, cutting off, cut & squirt, lethal injection, frilling, stump painting, ring barking (deep and wide).



## Pampas (common & purple)

*Cortaderia selloana*, *C. jubata*

### Origin

South America

### General description

Clump-forming grasses up to 4m tall. Leaves with cutting edges, dark green with hairs on underside of midrib, bluish green above; dead leaves spiral like wood shavings. Showy, erect, pink, purple or white seedheads through autumn.

### Habitats

Coastal & lowland shrub communities, forest margins, sand dunes, cliffs, riverbeds, roadsides, waste places, plantations, railway lines, quarries, most disturbed areas. Tolerates wide range of conditions but not shade.

### Dispersal

Large amounts of seeds produced, dispersed by wind and water.

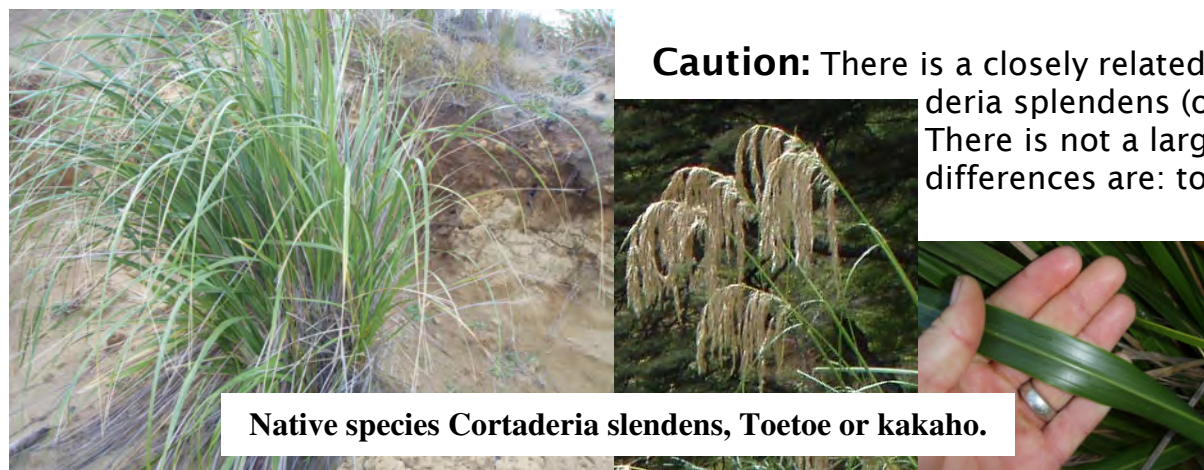
### Impact on environment

Competes with & smothers other vegetation. Creates fire risk, harbours pests e.g. rabbits, possums, rats.

### Methods of eradication

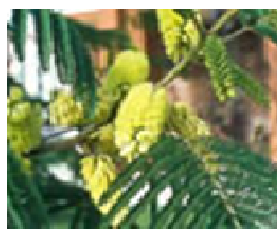
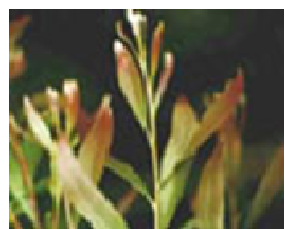
Hand weed or use a grubber on small plants, weed wipe, foliage spray (ensure total cover).

**Caution:** There is a closely related native plant which looks very similar called *Cortaderia splendens* (one of several species called toetoe or kakaho). There is not a large number of these plants around the lake. The key differences are: toetoe has a richer green, it flowers in spring (not autumn like pampus), its flower heads tend to be thinner and have a slight arch to them, the edges of the leaves are almost smooth and is not as cutty as pampus.



Native species *Cortaderia splendens*, Toetoe or kakaho.



Blackwood (*Acacia melanoxylon*)Black Wattle (*Acacia mearnsii*)

Similar species are Willow Leaved Hakea (*Hakea salicifolia*) (left) and Brush Wattle (*Paraserianthes lophantha*) (right).

## Blackwood and Black wattle

*Acacia spp.*

Also known as: wattle

### Origin

Australia

### General description

Shrubs to large trees. Two groups of Acacias: those with pinnate leaves (leaflets arranged in two rows on either side of stalk); & those with flat phyllodes (extensions of stem). Flowers are spikes or many-flowered round heads & usually yellow or cream. Long flat seedpods.

### Habitats

Roadsides, waste places, shrubland. Thrive in most areas but prefer poor or stony soil with good drainage & full sun.

### Dispersal

Seed prolifically & regenerate well after fire. Some species form dense stands by suckering.

### Impact on environment

Dense stands are a serious threat to regenerating bush. Nitrogen fixer.

### Methods of eradication

Hand weed seedlings minimising soil disturbance, feathering, frilling, ring bark and paint with herbicide, stump painting, foliage spray.



## Coastal banksia

*Banksia integrifolia*

Also known as: coast banksia

### Origin

Australia

### General description

Erect, fast-growing, evergreen tree less than 8m tall. Leaves may be irregularly-toothed when young, upper side of leaves green, undersides silvery & felted. Masses of pale yellow flower spikes (Mar-Aug).



### Habitats

Prefers sunny, poor, dry areas (e.g. dunes, gumland scrub, shrubland).

### Dispersal

Spreads locally by seed fall.

### Impact on environment

Threat to well-drained sites especially sand dunes. Forms dense thickets in open areas.

### Methods of eradication

Hand weeding seedlings and small plants, Stump painting.

## Gorse

*Ulex europaeus*

### Origin

Europe

### General description

Erect, spiny, much-branched perennial shrub less than 2m tall. Green-brown spiny stems & branchlets, woody when mature. Bright yellow pea-like flowers (May-Nov), black seed pods explode in summer.



### Habitats

Open areas, riverbeds, pasture, scrubland, forest margins. Widespread throughout NZ.

### Dispersal

Seeds spread locally less than 8m away after ejection from pods, also spread by birds & in gravel & soil.

### Impact on environment

Rapidly forms dense impenetrable infestations that compete vigorously with native re-growth, reduce pasture productivity, harbour pests (e.g. rabbits and possums), and are a fire hazard. Recovers quickly after burning and if left long enough, will act as a nursery crop for native seedlings; though as a nitrogen fixer changes soil composition, affecting the type of native bush that will grow there.

### Methods of eradication

Hand weeding seedlings, foliage spray (ensure total cover), Stump painting



## Spanish Heath

*Erica lusitana*

### Origin

South West Europe

### General description

Erect woody perennial shrub growing up to 2m high. Small needle-like leaves in whorls of 3-4. Impressive mass of white bell-shaped flowers in March to December.



### Habitats

Hillside pastures, scrubland, grassland, open disturbed areas, roadsides. Abundant and widespread especially in areas with moderate to high rainfall, poor acidic soils and low fertility.

### Dispersal

Seeds spread by wind or animal contact.

### Impact on environment

Forms dense infestations that crowd out regeneration of native seedlings especially on new disturbed ground.

### Methods of eradication

Spreading lime heavily often kills or reduces vigour sufficiently to allow succession, however may have similar impacts on some native species. Using about a handful of lime at the base of each plant will usually kill it.

Hand weeding small plants, weed wipe, foliage spraying.

## Prickly hakea

*Hakea sericea*

### Origin

Australia

### General description

Prickly, woody, spreading, evergreen shrubs greater than 3m tall. Stiff, sharp, needle-like leaves. Clusters of small, white flowers (Jun-Aug) close to the stem. Woody fruit beaked with winged black seeds.



### Habitats

Roadsides, open hillsides, shrublands. Prefers open, sunny positions.

### Dispersal

Winged seed dispersed by wind & colonises well after a fire. Also spreads from hedges.

### Impact on environment

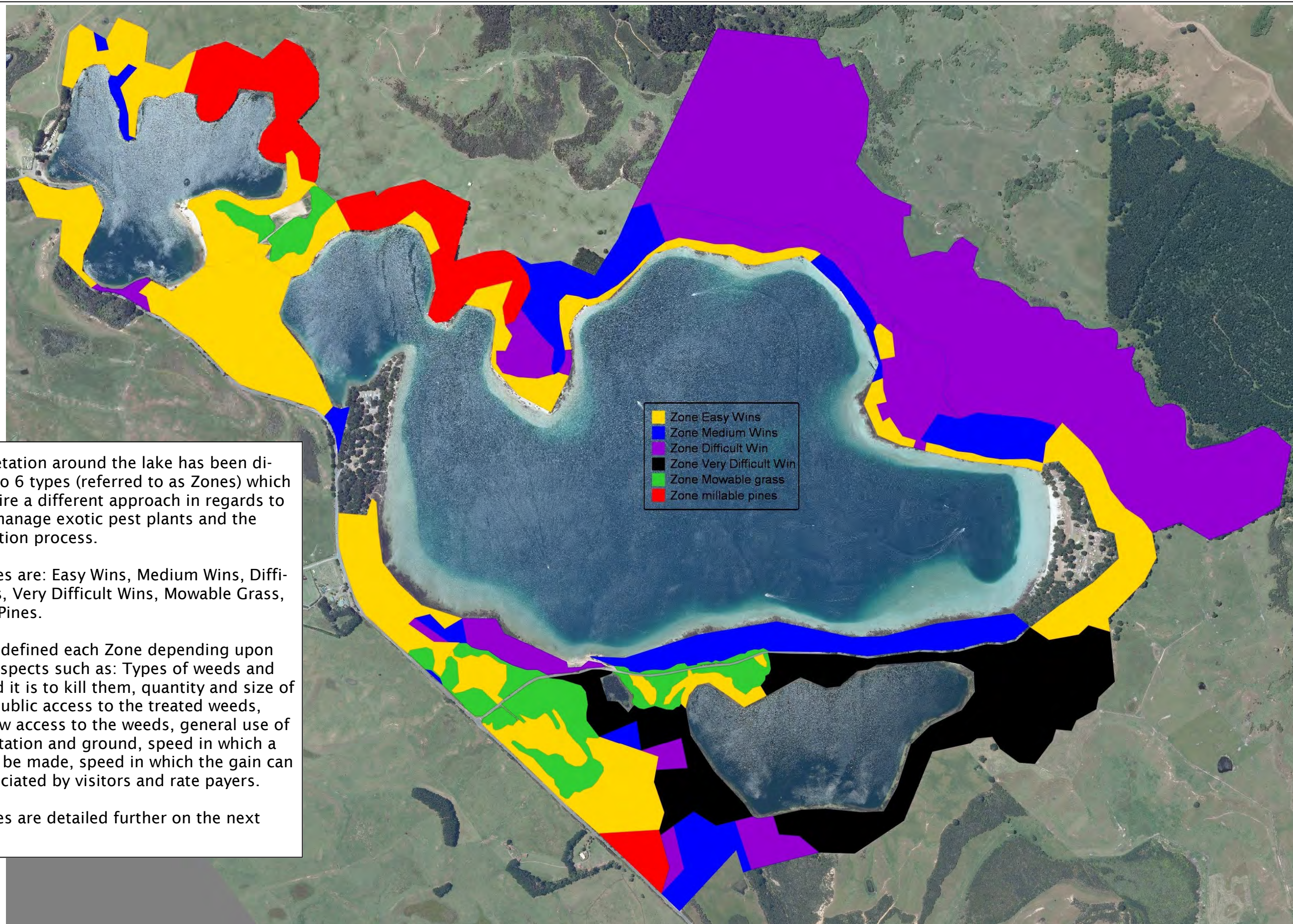
Forms dense stands that spread quickly but as they act as a nursery tree they are not considered serious pests. May decrease recreational use of an area because of spiny habit.

### Methods of eradication

Hand weed seedlings and small plants, cut below lowest leaves (no herbicide is necessary on stump), foliage spray.



# Zones of Existing Vegetation



The vegetation around the lake has been divided into 6 types (referred to as Zones) which will require a different approach in regards to how to manage exotic pest plants and the revegetation process.

The Zones are: Easy Wins, Medium Wins, Difficult Wins, Very Difficult Wins, Mowable Grass, Millable Pines.

We have defined each Zone depending upon several aspects such as: Types of weeds and how hard it is to kill them, quantity and size of weeds, public access to the treated weeds, work crew access to the weeds, general use of the vegetation and ground, speed in which a gain can be made, speed in which the gain can be appreciated by visitors and rate payers.

The Zones are detailed further on the next page.







# Planting of Native Species

During the process of eradicating exotic pest plants, native plants will come up naturally where there is seed present. This is likely to be the case over most of the ground. Once a first generation of forest is established a second generation of larger tree species along with a more diverse range of smaller forest floor species will naturally arrive being brought in by birds and wind.

The first generation of native forest is likely to be a mix of mostly the following:

Manuka ( <i>Lepstospermum scoparium</i> )	Kanuka ( <i>Kunzea ericoides</i> )
Karamu ( <i>Coprosma robusta</i> )	Hangehange ( <i>Geniostoma rupestre</i> )
Harakeke ( <i>Phormium tenax</i> )	Cabbage tree ( <i>Cordyline australis</i> )
Pohutukawa ( <i>Metrosideros excelsa</i> )	Akepiro ( <i>Olearia furfuracea</i> )
Koromiko ( <i>Hebe stricta</i> )	Kumarahou ( <i>Pomaderris kumeraho</i> )
Mahoe ( <i>Melicytus ramiflorus</i> )	Mingimingi ( <i>Leucopogon fasciculata</i> )
Putaputaweta ( <i>Carpodetus serratus</i> )	Mapou ( <i>Myrsine australis</i> )
Kohuhu ( <i>Pittosporum tenuifolium</i> )	Karo ( <i>Pittosporum crassifolium</i> )
various small leaved <i>Coprosma</i> (such as <i>Cop. parviflora</i> , <i>Cop. rhamnoides</i> )	
along with various grasses and ferns.	

The second generation of larger forest tree will include species such as:

Totara ( <i>Podocarpus totara</i> )	Rewarewa ( <i>Knightia excelsa</i> )
Tanekaha ( <i>Phyllocladus trichomanoides</i> )	Tarairi ( <i>Beilschmiedia tarairi</i> )
Karaka ( <i>Corynocarpus laevigata</i> )	Kahikatea ( <i>Dacrycarpus dacrydioides</i> )
Kowhai ( <i>Sophora microphylla</i> )	Rimu ( <i>Dacrycarpus cupressium</i> )
Kauri ( <i>Agathis australis</i> ).	

Both the generations of forest can be assisted to speed up the process.

Areas of ground which are not likely to grow much or do not grow a first generation of forest should either have seeds dispersed over the ground or have supplementary planting done however, planting is much more costly than seed dispersal.

For seed dispersal, collect the seeds in mass and mix with sand or sawdust to thin the seed out and then disperse by hand, hand held seed/fertiliser spreader or helicopter.

If doing supplementary planting it is ideal to plant in autumn once the ground is moist. Planting can be done into spring however success rates will reduce if there is a dry summer. If planting into spring it is best to do the hillside (particularly North facing) first and do the flats or area which retain the moisture in the ground a little longer.

Some first generation species are easier to grow (often this is due to the ease of seed harvest as well) in a nursery situation than other species and will perform better when transplanted to the ground. The more common of these species are: Manuka, Kanuka, Karamu, Cabbage tree, Harakeke, Mapou and Pohutukawa.

It is important to plant (or disperse the seed) in areas where the species would naturally grow in ratios that are appropriate i.e in swampy areas there should be more harakeke and less kanuka etc and on dry hillside more manuka and kanuka than harakeke etc.

Second generation forest species can be planted to speed up the process of forming a mature looking forest by decades. This is certainly the case with plants like kauri which seeds are dispersed a short distance by wind from plants which take decades to reach a reproductive age. Species such as totara will come much faster due to its vast number of seeds produced each year being carried long distances by birds.

With any planting it is ideal to try and make it look natural. Even though people in the industry can easily identify planted areas it is important that in 20 years time visitors will look at the area and perhaps never realise that the lake was once an almost monoculture of pines or acacia.

A method of doing this is to plant differing areas of the lake each year rather than working your way around the lakes.

You can also plant large tree species of differing mixes in different areas using random patterns. This can be achieved by having several planters and giving them a set area with X amount of trees and letting each of them plant in which ever pattern or style they like. This seems quite simple but it is effective and creates differing spacing's in differing sections. Some people will plant in a regular sort of shape, some will plant in easiest access areas, some will plant in lines that seem to follow contours of the land and others just plant completely randomly. Just like in the natural forest, tree spacing (sometimes appearing too close) vary and sometimes seem to cluster in groups or form patterns. I personally call this technique random cluster planting. I recommend it for all areas.

Further on in the document you will see areas where there is suggested planting to be done with various mixes.

Plants need to be eco-sourced from the area. The term eco-source does not imply a set radius from the site. An understanding of how plants reproduce is needed to ascertain how far away seeds can be harvested from to fit with the concept of eco-sourcing. Plants which drop their seed straight on the ground below them or have a small distance of dispersal have a small area where seed should be collected from (perhaps 20km maximum). Plants which have their seed carried great distances by birds have a larger area that seed can be collected from. Other things to consider is how flowers are pollinated and how fast a plant reaches the age it will reproduce. Experienced nursery people and revegetation experts will know what parameters are acceptable for each species. In some cases local seed stock of harder to grow species will not be available and it is expected that as a worst case scenario plants will be grown from seeds collected from around North of Auckland. If council can have plants grown on contract it would be best and mean that the seeds can be harvested from appropriate places.



The number of plants needs to be assessed more accurately for each area at the time of planting. It is expected that allowances of existing plants is taken into consideration when calculating the number of plants to put it.

Species availability will vary from time to time and it is highly recommended that a contract for growing plants for the domain is established with one or two nurseries. Some species will require 2-3 years to get up to grade while the bulk of first generation only take a year however seed harvesting needs to be considered in the timing so it is usually best to contract them before seed harvest time so they can have stock ready for the year following seed harvest. i.e harvest in summer to autumn, germinate over winter spring, prick out and grow on over spring to summer to have ready for planting in autumn so it takes 15-18 months to produce small grade plants and often large species require 1-2 more years depending upon the grade of stock desired.

Note: The estimated costs are based on commercial nurseries supplying with contract planters doing the work. With the use of volunteers these costs will be reduced. Estimated prices exclude GST.

Prices are based on ideal sizes and not the cheapest grade. If the cheapest and smallest grades are selected the cost of supply and planting will be reduced however the success rates and timeframe until total close over of foliage occurs will take longer. For cheap grades expect to reduce the cost by approximately 20-35%.

### Seed dispersal areas. Total 18.96ha. (Refer to map on page 18)

These areas are to have first generation seed dispersed over them if the native plants don't come up naturally in sufficient numbers. It is expected that they will, however, we need to consider the possibilities. This is to be done after the pine forest has been removed and at least a 12 month period has lapsed so that any weed species can be assessed and controlled.

The volume of seed is hard to calculate however the more seed dispersed the higher the number of plants there will be. Many seeds will be eaten or will die off when summer approaches when the seedlings will be small.

Seed is usually purchased in grams from seed merchants however in this case seed will need to be harvested from local plants in mass. The volume required may be as much as 200 litres or more of seed which will need to be mixed with sand or sawdust at a rate of 1 litre of seed to 50 or more litres of sand/sawdust. If seed is to be dispersed by helicopter then consultation with a pilot will need to be had as to the volume of mix he would expect to spread per hectare.

Harvesting would need to happen from February to March for most species needed.

Estimated Costs:

The labour required to collect seed varies considerably depending upon what seed stocks are like on the plants at harvest time. However at an educated guess the cost could range from \$10,000 to \$15,000 for the seed. To aid the process a large concrete area would be needed for processing of manuka and kanuka seed. In addition to this the helicopter would cost perhaps \$2,000-\$4,000.

### Swamp edge areas. Total area 3.7ha. (Refer to map on page 18)

These are areas that would suit a mix of mostly harakeke and other swamp edge plants. Many rushes naturally occur around the land and so an addition of some species is all that is needed. Species to be planted would include Harakeke (*Phormium tenax*) and Ti kouka (*Cordyline australis*). Areas around the lake edge already have a high density of plants so the numbers for each area will need to be assessed at the time of planting. In open areas in the grasslands the planting can be at a density of 1 plant per 1.5 square metres. Plant size for harakeke can be 1/2 to 2 litre grade and ti kouka should be 1.5 to 3 litre grade. With these grades planting into grass that has been cut back is sufficient. Ti kouka dies easily from many types of spray so caution is recommended.

Note: Whilst this sort of area would be ideal for many of the wetland grasses there is no *Carex* species identified as existing around the lakes in the 'Reserve Management Plan, Taharoa Domain, January 2002' and on field trips to the site in 2010 none were noticed.

Estimated Costs:

Near the lake the area is 2.08ha with possibly 1 plant per 10 square metres making a total of 2080 plants at a cost of approximately \$3 to \$6 each supplied and planted giving a total of \$6,240 to \$12,480.

In the open areas the area is 1.62ha with 1 plant per 1.5 square metres making a total 10,800 plants at a cost of approximately \$3 to \$6 each supplied and planted giving a total of \$32,400 to \$64,800.

### Low lying areas. Total area 5.44ha. (Refer to map on page 18)

These are areas that mostly have existing first generation species and are low lying around the edge of the lake and may from time to time have seasonal high water level covering them and are to be planted mostly with kahikatea and other lowland forest species such as swamp maire (*Syzygium maire*), puketea (*Laurelia novae-zealandia*), putaputaweta (*Carpodetus serratus*), karamu (*Coprosma robusta*), ti kouka (*Cordyline australis*), harakeke (*Phormium tenax*) and small leaved *Coprosma* such as *Cop. rhamnoides*, *Cop. areolata*, *Cop. propinqua*. It is likely that there will be sufficient number of manuka or kanuka in the areas however if not then they could also be added. Plants can be added at 1 plant per 20 square metres. The tree species should be of 1.5 to 3 litre grade and other species could be 1/2 to 2 litre grades.

Estimated Costs:

The area is 5.44ha with possibly 1 plant per 20 square metres making a total of 2720 plants at a cost of approximately \$3 to \$6 each supplied and planted giving a total of \$8,160 to \$16,320.

Note: The area which was burnt off a few hundred metres before pine beach will likely need first generation species planted with the above species. This area was not assessed in detail as the fires were burning at the time of the last site visit.



### **Pohutukawa forest areas. Total area 15.96ha. (Refer to map on page 18)**

These areas are generally dryer slopes of sand, sandstone etc which will suit the pohutukawa better than many other species. Most of these areas have little vegetation left having just had pine trees removed and could be planted with a strong mix of pohutukawa and first generation species in grades from 1/2 litre to 1 litre with a few large grade pohutukawa in selected sites where a bigger impression is desired.

#### Estimated Costs:

The areas with very little vegetation is approximately 7ha, to plant 1 plant per 2 square metres gives a total of 35,000 plants at a cost of approximately \$3 to \$6 each supplied and planted giving a total of \$105,000 to \$210,000.

For the areas with existing vegetation of approximately 9ha with 1 plant per 50 square metres makes a total of 1800 plants at a total supplied and planted cost of \$5,400 to \$10,800.

### **Kauri forest areas. Total area 31.4ha. (Refer to map on page 18)**

These areas which have existing first generation and some second generate forest establishing which could have kauri added to them at a rate of 1 plant per 100 square metres. They need to be of a 3-5 litre grade at an age of 3-5 years at a height of 60cm to 120cm and not too root bound.

#### Estimated Cost:

Kauri cost a little more than many other species and given the labour intensive job of planting in a wide spread area the estimated cost of \$9 to \$12 cost per plant supplied and planted is expected. A total of 3140 plants will be needed at a total cost of \$28,260 to \$37,680.

### **First generation areas. Total area 1.13ha. (Refer to map on page 18)**

These areas require first generation species to be planted. These areas will give an instant impression of work being done on the approach to Pine Beach. Plants of 1/2 litre grade need to be planted at 1 plant per 1.5 square metres. Species range is to consist of species such as Manuka (*Lepstospermum scoparium*), Kanuka (*Kunzea ericoides*), Karamu (*Coprosma robusta*), Harakeke (*Phormium tenax*), Cabbage tree (*Cordyline australis*), Koromiko (*Hebe stricta*), Mahoe (*Melicytus ramiflorus*), Putaputaweta (*Carpodetus serratus*), Mapou (*Myrsine australis*), Kohuhu (*Pittosporum tenuifolium*), Karo (*Pittosporum crassifolium*) and *Coprosma rhamnoides*

#### Estimated Costs:

The area is 1.13ha making a total of 7,530 plants at a cost of approximately \$3 each supplied and planted giving a total of \$22,590.

### **Second generation areas. Total area 23.26ha. (Refer to map on page 18)**

Areas which have existing first generation plants established (see note about pine beach hillside below) and the addition of large forest tree species will improve the biodiversity of the area, help the return of birds and generally advance the natural process. Total area 23.26ha.

Pine Beach hillside (9.85ha) will need a mix of first generation species and second generation species. We recommend this so that the appearance of the amenity area is returned to a mature forest look faster. Around the lower edge a higher number of pohutukawa are to be planted to provide shade under spreading branches.

Larger tree species should be of a 1 to 3 litre grade and should include such species as Rimu (*Dacrycarpus cupressium*), Totara (*Podocarpus totara*), Rewarewa (*Knightia excelsa*), Tanekaha (*Phyllocladus trichomanoides*), Tarairi (*Beilschmiedia tarairi*), Karaka (*Corynocarpus laevigata*), Kahikatea (*Dacrycarpus dacrydioides*), Kowhai (*sophora microphylla*) and Kauri (*Agathis australis*).

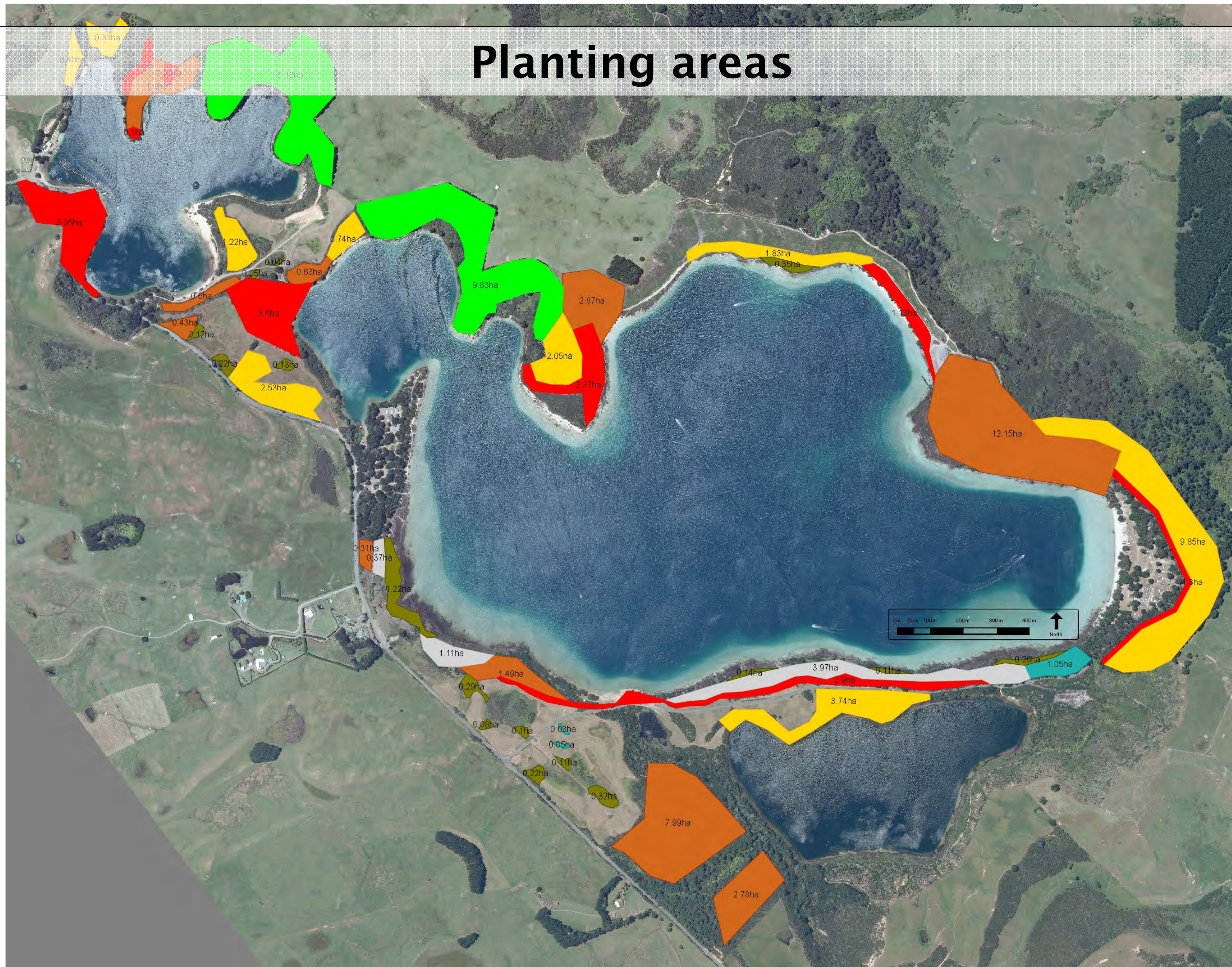
#### Estimated Costs:

For the areas with very little vegetation on the hillside above pine beach being approximately 10 ha with 1 plant per 2 square metres makes a total of 50,000 plants. 90% of these need to be first generation species in a 1/2 litre grade at a cost of \$3 each supplied and planted giving a total of \$135,000 plus 5000 trees at \$3 to \$6 each totalling \$15,000 to \$30,000.

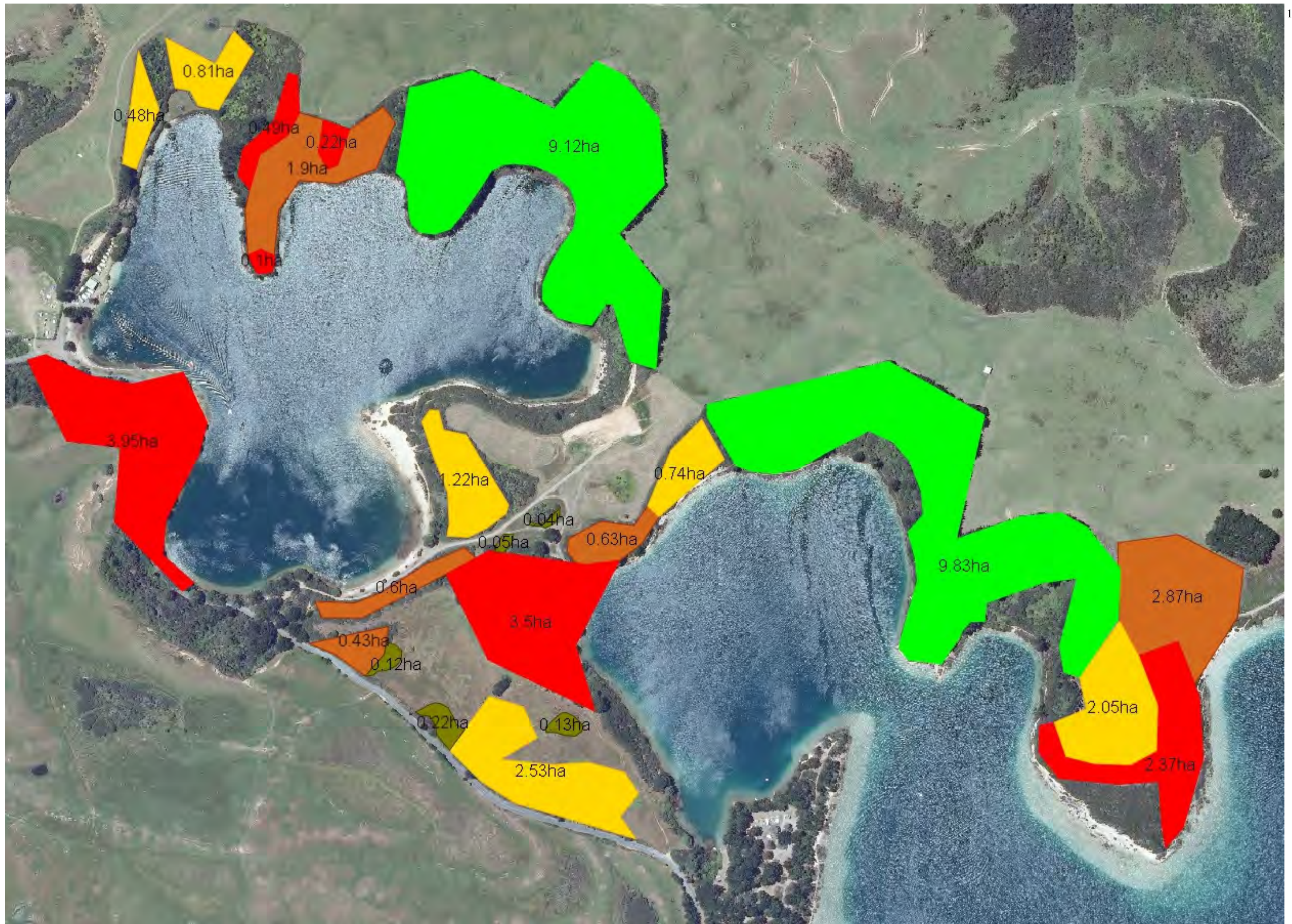
For areas where the second generation are being supplemented to existing first generation then they can be spaced at 1 plant per 100 squares metres so for the 13ha a total of 1300 plants at a cost of approximately \$7 given the labour intensive job of planting in a wide spread area makes a total of approximately \$9,100.



# Planting areas

















# Native Plant Images

Fruit and seeds which are easy to harvest for dispersal with their usual harvest periods noted.

Foliage images of some of the first generation species.



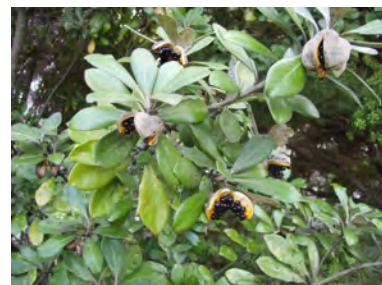
Karamu fruit with two seeds in each. Summer—Autumn.



Karo seeds. Very sticky. Summer—autumn.



Pohutukawa seeds. Late summer.



Karo



Coprosma parviflora



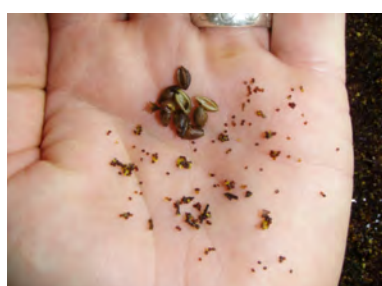
Manuka



Cabbage tree or Ti kouka



Mahoe fruit with up to 10 seeds each. Summer.



Hangehange, open seed capsules with tiny seeds. Summer.



Harakeke (flax) seeds. Late summer.



Kohuhu AKA black matipo



Coprosma rhamnoides growing under manuka



Koromiko



Hangehange



Mapou fruit with 1 seed per fruit. Summer



Manuka seed capsules with hundreds of tiny seeds in each. Any time of year.



Mahoe



Mapou AKA mapua, matipo, red matipo



Mingimingi (one of several plants with this name).



Putaputaweta



Cabbage tree fruit with up to 20 seeds in each. Summer—Autumn.



Kanuka seed capsules with hundreds of dust like seeds in each. Late summer.



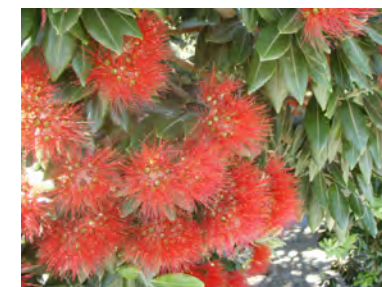
Kumerahou



Harakeke or NZ flax



Akepiro



Pohutukawa



Karamu



# Archaeology Sites

There are 40 archaeology sites identified which need to be considered when doing planting. These sites are not to have earth disturbance so they are not to be planted on. You may disperse seed or leave the site untouched and allow it to naturally revegetate.

★ Archaeology sites

During the process of planting or weed control there may be other sites discovered. If any staff identify a site which they suspect to be an archaeology site they must notify their supervisor who will notify the project manager at KDC.

For more information about these sites see the document titled: Archaeological Site Survey of Five Areas Proposed for Logging at Taharoa Domain, Kaipara, May 2010 Michael Taylor and Annetta Sutton ARCHAEOLOGY NORTH LTD, PO Box 7294, Wanganui



## Recreation Tracks (Walking and Bicycle use)

Many walking tracks and former forestry service tracks exist around the domain and it is intended that these tracks are joined to form a range of recreation tracks used for walking and bicycling around the lake. These tracks will form service tracks for weed control crews to get fast and easy access to much of the sites in need of work. The majority of the tracks need to be kept or constructed to suit quad bike access for work crews and to allow for cyclists to pass each other or walkers in relative safety.

— Walk / Bicycle Tracks

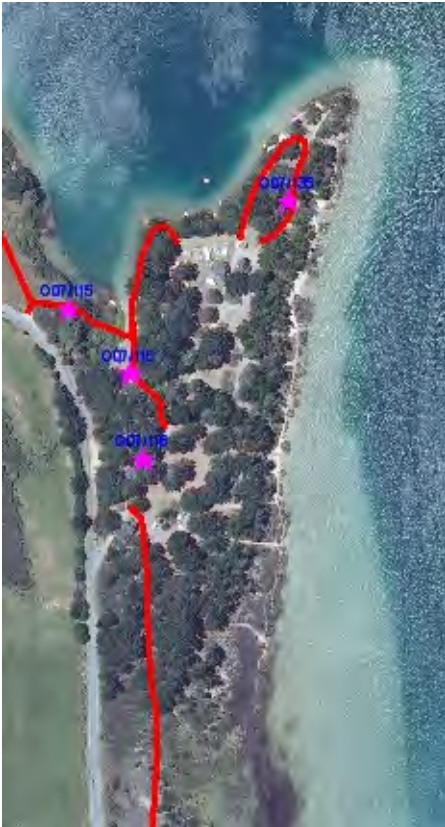
The tracks form an integral part of the management of the domain along with allowing recreational use of the domain. It will allow easy access to public to areas where work is being done which will help public see progress and 'get on-board with the project'. Thus this needs to be one of the first jobs done.

The track passes by many archaeology sites which will allow opportunity for signs to be erected for public education purposes.

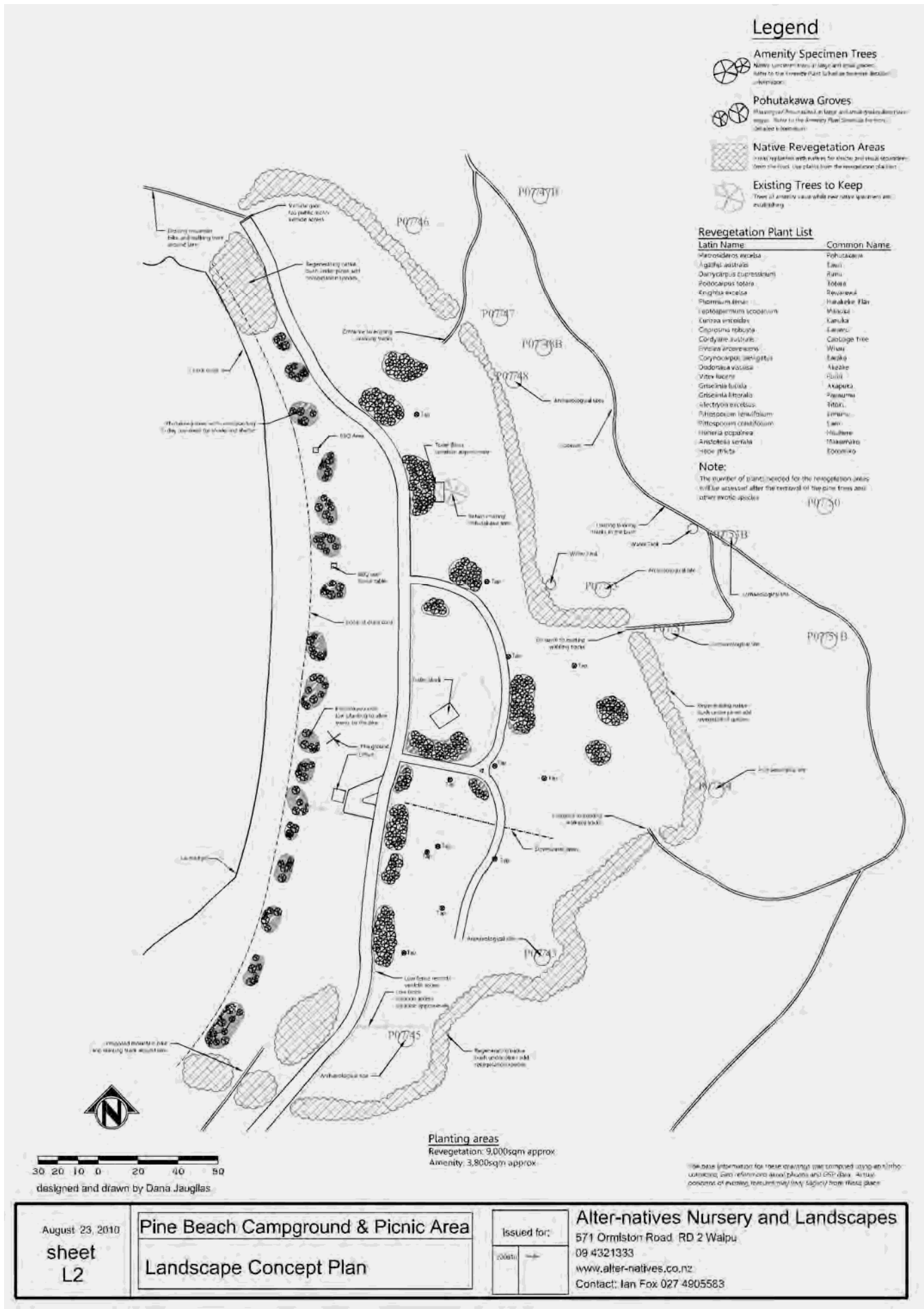


# Archaeology Sites and Recreation Tracks close ups of key areas

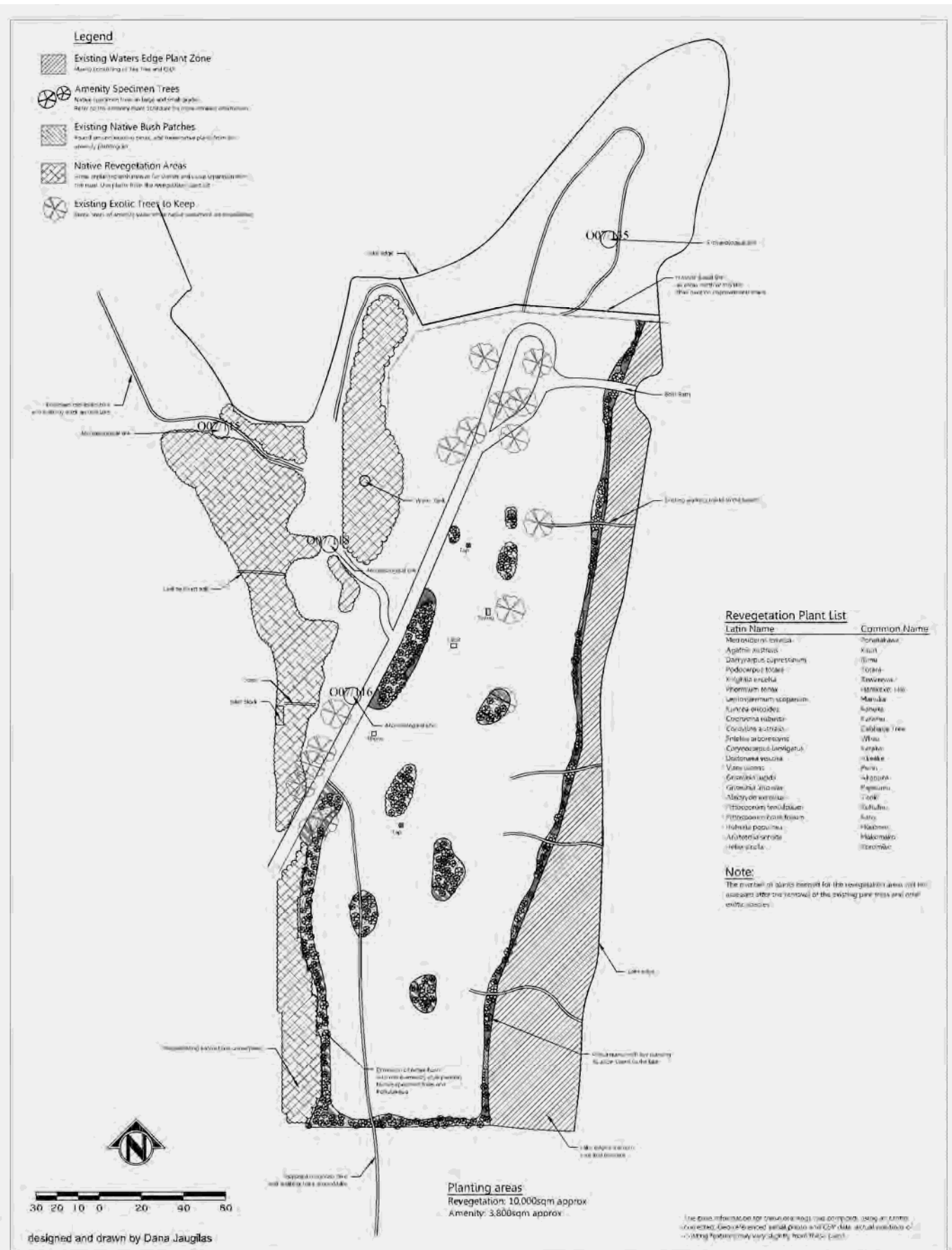
These images show close up views of all archaeology sites identified in the archaeology report (previously mentioned) and the proposed/existing tracks.











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# Reference of information

**Information from the below sources along with experience of using herbicides as well as growing, supplying and implementing native revegetation planting was used in the compiling of this document.**

## **Documents**

Reserve Management Plan, Taharoa Domain, Compendium Document January 2002  
Archaeological Site Survey of Five Areas Proposed for Logging at Taharoa Domain, Kaipara, May 2010

## **Liason**

Kaipara District Council staff: Stephen Soole  
Kaipara District Councillor: Julie Geange  
Michael Taylor of Archaeology North Ltd  
And numerous other people.

## **Websites**

Department of Conservation  
Auckland Regional Council  
Northland Regional Council  
New Zealand Biosecurity  
Weed Busters New Zealand  
Weeds Australia  
WWF Australia  
Washington State University  
Ohio State University  
University of Missouri - Centre for Agroforestry