

A Landscape Plan for Waikanae Estuary



A Restoration Vision for restoring the estuary
to as close to its natural state as possible

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Te Papa Atawhai

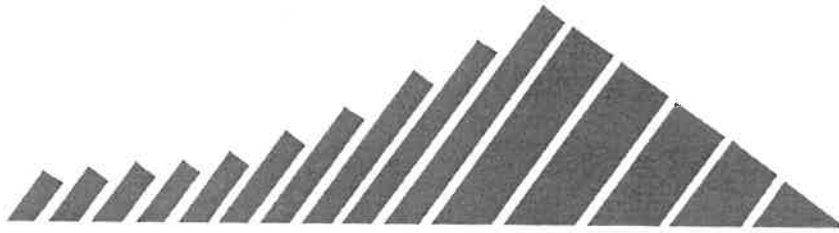


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Cover Image: Waikanae Estuary, June, 2005

1. Summary

This Landscape Plan sets out a vision for restoring the Waikanae Estuary to as close to its natural state as possible. It is centred mainly on the Waikanae Estuary Scientific Reserve, but also embraces the adjoining land administered by the Department of Conservation on the southern side of the estuary, and the land administered by Kapiti Coast District Council, as public open space, on the northern side. It recognises that, for the purposes of ecological restoration, the Waikanae Estuary is a natural entity.

The tidal area of the Waikanae Estuary comprises one of the more significant unmodified areas for indigenous wildlife habitat in the lower North Island. Its very high biodiversity value as a habitat for wading and migratory birds has led to a large area of its southern portion being protected from alteration and development, and gazetted Scientific Reserve.

The terrestrial (non-tidal) parts of the estuary, however – including most of the Reserve – have been subject to considerable modification. They are, in the main, becoming increasingly dominated by invasive, exotic plant species that unless controlled will make ecological restoration of the Waikanae Estuary's natural state increasingly difficult.

Much of this modification has been a consequence of the rivermouth becoming restricted in position in recent decades, in parallel with the residential development of Paraparaumu and Waikanae. In its natural state, the Waikanae Estuary would be different ecologically than it is today, but restricting the rivermouth has transformed an environment that is naturally one of constant change into one of relative stability. Many of the estuary's terrestrial environments that would have been subjected to the changing course of the river as it meets the sea are becoming covered with woody vegetation instead.

Very little of this woody vegetation is comprised of indigenous local species. Much is of invasive exotic species, many actively spreading, as a result of which the majority of the terrestrial portion of the Waikanae Estuary is progressively deteriorating from its natural, indigenous state. It is the prospect of such an important natural area becoming dominated by vegetation of invasive exotic species that has led to this Restoration Vision.

A Restoration Vision for such an environment needs to be made with regard to its particular ecology and history. Therefore, a close examination has firstly been made of:

- the processes that have historically shaped the Waikanae Estuary and created its vegetative cover
- the estuary's present vegetation pattern and the changes it is undergoing
- the vegetation pattern of Kapiti coastal sand country that is in a more natural state than the estuary.

A Landscape Plan has subsequently been developed. It acknowledges that much of the terrestrial land at the Waikanae Estuary, while only recently formed by estuary and marine processes, has now been long stabilised and is being increasingly covered with woody species – most of which are invasive and exotic.

Recognising that the Waikanae Estuary is a significant place for birdlife, the aim of the Landscape Plan is to replace these invasive, exotic species that are bird-distributed with native woody species that are also spread by birds.

The Landscape Plan proposes:

- comprehensive removal of the more invasive, non-native woody species that, unless removed, could eventually dominate the estuary's vegetation;
- a future indigenous vegetation cover of woodland and coastal forest in most of the estuarine environments that have stabilised and are no longer under the influence of coastal and rivermouth processes;
- a series of planting sites covering the range of environments within the estuary, which could become nodes for restoration of an indigenous natural vegetation cover.

The area of the Waikanae Estuary embraced by this Restoration Vision is a large and ecologically complex area. Large scale photo-mapping of the estuary in order to distinguish the different vegetation types, indicate future vegetation trends and pinpoint the locations for proposed restoration planting is an integral part of the Landscape Plan.

2. Waikanae Estuary: its significance as a natural area

The tidal rivermouth, brackish lagoons, sand dunes and wetlands of the Waikanae Estuary form one of the most important natural coastal environments in the lower North Island, and a vital habitat for coastal wildlife.



Figure 1: A flock of birds takes flight at the mouth of the Waikanae River

However, surrounded as it is by new residential development and with a long history of human activity, the Waikanae Estuary is also a much modified environment, as well as a popular recreational area.

The values and significance of the Waikanae Estuary are myriad:

Aesthetic:

The estuary's aesthetic appeal is aptly illustrated by an excerpt from 'The Waikanae Estuary' by Gertrude Dempsey:

The estuary of the Waikanae River is a lovely place. Turn inland from the beach, and here is a new country, a flat land of quiet curves of river flowing serene and softly between its banks and islands of sand...

Its sounds are the distant voice of the sea and the small cry of the stilt. An enchantment of peace lies upon this land, with its immensity of sky arching overhead, its clouds reflected in the river's rippling distortion and in the mirror of still pools. The birds are at home here...

Maori history:

The Waikanae Estuary has a long history of Maori inhabitation. The entire area is held precious as a landscape that has sustained people, and as wahi tapu. When Ngati Awa settled the Waikanae coast in the 1820s, three pa – Waimeha, Kenakena and Arapawaiti – were centred on the estuary. It was also the site of a major battle; Kuititanga. Prior to that, the Waikanae Estuary provided important coastal access for the many waterways criss-crossing the coastal plains.

Biodiversity:

(i) As an estuary with an inter-tidal zone still predominantly in its natural state: *The area supports a variety of habitat types, including shallow lakelets, fixed and moving dunes, mud flats, sand flats, herbfield and salt marsh. This total area, although much decreased in size over the past decades by natural and unnatural means, is still one of the largest areas of this type of 'association' in the lower North Island.*

Kennedy & Webber

(ii) As a site for native birds, the value for which the Waikanae estuary was deemed a Scientific Reserve:

The estuary attracts a greater number of birds than any other place in the Wellington region, and it has become increasingly important as wildlife habitats such as the mouth of the Hutt River, Porirua Harbour and the Pauatahanui Inlet have been damaged by pollution and development...

...because it is the most accessible area in the region for watching and studying seashore and wading birds, it has become a valuable scientific resource and the bird population has been regularly documented.

Falconer, Fleming & Wodzicki

(iii) For estuarine wetland vegetation:

For botanists, this place is unique in the Wellington region for study of salt marsh vegetation and dune and lakelet areas. The estuary is also very popular during whitebait runs.

Falconer, Fleming & Wodzicki

Recreation:

The estuary is an important example of a wild, open-space area on a predominantly urbanised coast:

(i) While the general condition of the Estuary has been gradually deteriorating the demands of people have been escalating. Never before have so many people come to see and study birds in this area, the best of its kind conveniently close to Wellington...

Falconer, Fleming & Wodzicki

(ii) It is obvious that this coastline will provide the major marine recreational outlet for the region... The requirements are not only those of today, but those of 20 years, or more hence.

Department of Lands & Survey

An ecological vision to restore the Waikanae Estuary to as close to its natural state as possible needs to recognise that it is a cultural landscape as well as a wild, natural area and to consider its multiple values. The vision set out in this Landscape Plan recognises the estuary's high natural biodiversity values, and the fact that much of it has been declared a Scientific Reserve in order to protect them.

Accordingly, a restoration planting strategy has been created to encourage indigenous vegetation of the kind that might have developed at the estuary had natural conditions prevailed historically. In recognition of the area's high public recreational use, the proposed Restoration Planting Sites are located in the vicinity of current and proposed access-ways through the estuary landscape.

3. An ecological restoration vision: principles and key concepts

The essential meaning of 'restoration' is a return to a previous condition. An integral part of an ecological restoration vision is achieving a recognition and understanding of the natural ecosystem and the patterns and processes by which it has been damaged, lost or fragmented by human agency. However, this does not commit the vision to re-establishing the precise natural environment of the Waikanae River corridor which existed prior to human habitation. Not only would that exclude the community, but it would be impossible ecologically.

Ecological restoration has regard to the ecological integrity of an ecosystem, and to its rehabilitation and repair using local plants and animal species to replace exotic species that have degraded its integrity. In an environment like the Waikanae Estuary that is as much a cultural landscape as a wild natural area, an ecological restoration vision must integrate several factors:

- the indigenous values that have prevailed in the estuary's historical ecology, and that shape its intrinsic values, notably its exceptional biodiversity value as habitat for coastal birds, and the Scientific Reserve status of much of its area;
- the ecological integrity of Waikanae Estuary as a sandy coast estuary;
- that as a river mouth and estuarine ecosystem whose biota has been substantially re-constituted by exotic species, the estuary now functions differently than it did when it was predominantly an indigenous ecosystem; notably its ecosystem processes of seed dispersal, competition, et cetera;
- the various ecological realities that will continue because the Waikanae Estuary is part of a cultural landscape in which human demands are growing.

This Restoration Vision for the Waikanae Estuary is underwritten by several core ecological restoration principles and concepts:

RESTORATION ECOLOGY: the aspect of ecology in which the emphasis is on re-establishing and revitalising the patterns and processes of an ecosystem that have been damaged, lost or fragmented. The situation at the Waikanae Estuary is common to many restoration projects: the area has been so modified that precise historic evidence of species' presence is lacking, and the restoration is forced to rely on studies of remnants or ecological principles that suggest what *should* live on the site. As a

result, the restoration of an ecosystem ultimately and inescapably depends on human perceptions, understandings - and choices.

NATURAL RESTORATION: where the rehabilitation and repair of an area with plants and animals is proceeding or is able to proceed by the natural processes of seed dispersal, seedling establishment, et cetera, that have always been in place to maintain the ecosystem.

ASSISTED RESTORATION: where the rehabilitation and repair of an area with plants and animals needs human agency to: establish seedlings, seed dispersers et cetera; eliminate weed species; control predator species; et cetera.

ECOLOGICAL INTEGRITY: an important concept in restoration ecology and ecological restoration because it refers to our sense of the wholeness and wellbeing of ecological systems, including the *processes* operating in and across the landscape by which such systems are maintained.

Ecological integrity is integral to the Resource Management Act concept of the intrinsic value of ecosystems (sec7d), incorporating, 'the essential characteristics that determine an ecosystem's integrity, form, functioning and resilience'.

This principle influences a number of the Act's purposes and principles concerning the remedying and mitigating of adverse environmental effects, the preservation of natural character, the protection of areas of significant indigenous value, and the relationship of Maori to ancestral environments.

It is a useful principle in restoration projects of this kind because in its primary reference to wholeness it recognises and gives value to the indigenous, natural state of an environment and the processes by which its recovery and maintenance can proceed from the non-indigenous state.

INDIGENOUS ECOLOGICAL VALUES: those features of a local landscape that are native to it and give it its own distinctive character, as opposed to those that derive historically from human activity introducing them from elsewhere. In a cultural landscape like the Waikanae Estuary, indigenous ecological values co-exist or survive in intimate association with non-indigenous, exotic values.

CULTURAL LANDSCAPE: a landscape whose character or quality has been significantly altered by human influences. Its ecology can include indigenous values, natural vegetation, exotic species and weeds. The range between these elements is a continuum: from a predominantly natural cover through to a landscape completely lacking in natural vegetation.

NATURAL VEGETATION: the pattern of plants indigenous to, or comprising the naturally evolved character, of a place.

EXOTIC SPECIES: The great majority of woody species at the Waikanae Estuary are exotic species whose biological identity and ecological character have evolved in the ecosystems of another country and been introduced to New Zealand by human agency. New Zealand has a long history of introduction of species from other countries to perform functions in the landscape such as flood protection, stabilisation of sand dunes and timber production, on the principle that the native, indigenous species available are either inadequate for the purpose or there is no knowledge of their suitability.

WEED SPECIES: species that are not native to a site but which spread rapidly and compete with native species when introduced, often to the extent of replacing them. Estuary, sand dune and riverbank environments with their young fertile soil derived from flood events, open non-forest habitat, and proximity to gardens – such as at the Waikanae Estuary today – are particularly vulnerable to weeds.

4. Determining the estuary's natural state: from history and local ecology

A sandy coast river mouth like the Waikanae Estuary is, by nature, an environment of constant change – of land being formed and re-formed by the actions of tide and flood. This state of nature at the Waikanae Estuary has been altered in recent decades by human activity to fix the position of the river mouth, with the coastal land surrounding the estuary coming under development. As the first biological study of the estuary – that led to its gazettal as Scientific Reserve in the 1970s – stated:

Maintenance of the estuary's landscape, with its extensive areas of bare sand, driftwood, tidal flats and shallow ponds has depended on periodic flooding by the river or the tide, alone or generally in combination. If the position of the river mouth is fixed, the bare sand will tend to become covered by vegetation, unless steps are taken to maintain the sand in other ways... Such changes would inevitably result in a reduction of bird habitats and therefore in a reduction of the birds to be seen.

Falconer, Fleming & Wodzicki

In fact, in the third of a century since that study and the fixing of the position of the river mouth, there has been very little change in the area of bare sand and tidal flats. There has, however, been considerable change in the sand dune element since the 1970s, with comprehensive vegetation cover developing where there was once much more mobile sand.

In developing an ecological restoration vision, two types of information are needed:

- ecological change that has been occurring historically in the vegetation cover at the Waikanae Estuary;
- evidence elsewhere in the coastal sand dunes and wetlands of the Kapiti district of plant species and vegetation no longer present at the Waikanae Estuary, but that should be considered in an ecological restoration plan.

4.1 The historical development of the present-day estuary landscape

The Waikanae Estuary was an early focus of European settlement in the Kapiti district in the mid-19th century, but there is very limited historical evidence of the ecology of the estuary in that period. Existing evidence indicates the youth of the landscape encompassed in this project. The clearest proof of this is the changing course of rivers across the coastal sand belt. An 1872 map of the area shows an 'old course' of the Waikanae River taking a completely different course to the sea than it does today, flowing through the present South Marsh area to emerge well to the south.

This map and others drawn in 1880 and 1890 clearly show the Waikanae and the Waimeha rivers diverging immediately below the railway bridge and rejoining near the coast by the current outlet to the sea; the Waimeha flowing south through the dunes before its confluence with the Waikanae (MacLean & MacLean). From such evidence of environmental change at the estuary, it is not surprising that a youthful landscape prevails, with only the early stages of indigenous vegetation development occurring.

Despite the changing river mouth, there is evidence of the sand dune country within the estuarine environment supporting an indigenous woody vegetation cover – indicative of some degree of stability. The 1872 survey map shows a line delineating the limits of forest well inland from the coast. Esler, in a 1969 study of the Kapiti Coast coastal sand country, considered that prior to Maori firing of the sand country most of the dunes were forested, with forest composed of mahoe (*Melicytus ramiflorus*), ngaio (*Myoporum laetum*), kowhai (*Sophora microphylla*) and totara (*Podocarpus totara*). The very limited present-day evidence, a few miles north at Pekapeka, suggests that kanuka (*Kunzea ericoides*) would also have been a major forest species.

Photographs dated 1942 which were examined for the 1975 Ecological Report on the estuary show the dunes inland from the sand-flat supporting low manuka (*Leptospermum scoparium*) and scrub, with taller kanuka in places (Kennedy & Webber). Manuka and kanuka were very rare on these dunes in 1975. Manuka is no longer present there today, and mature kanuka survives as two trees in the adjacent Kotuku Park subdivision [Fig. 2].



Figure 2: Remnant kanuka in the Kotuku Park subdivision

The 1942 photographs also indicate pingao, a plant not seen in recent times, to have been present in the sand flats of the estuary. The foredunes behind the sand flats that today feature dense marram with increasing woody weed species (gorse, boxthorn) were covered by open marram.

Introduced to the Waikanae Estuary in the early 1900s to stabilise sand, marram was abundant when the ecologist Leonard Cockayne described the area in 1911. It co-dominated in the mobile sand dunes with spinifex (*Spinifex sericeus*) and *Scirpus nodosus*, in front of shrub-covered dunes made up of manuka, lupin, tauhinu (*Cassinia leptophylla*) and toe toe (*Cortaderia toe toe*). The fixed dunes behind were covered by kanuka, coastal shrub daisy (*Olearia solandri*), aruhe (bracken) and ti kouka (cabbage tree, *Cordyline australis*), with introduced shrubs.

Photographic evidence from 1942 and 1955 indicates that the estuary has undergone great change in the last half-century. The main vegetation changes have been the formation of new marsh areas and the loss of areas by a changing estuary environment and alteration from increasing human population pressure.

In 1942, only two of today's three marsh areas existed and the North Marsh was far more extensive than it is today. The Oxbow at Arapawaiti was still connected to the river, but had the same form as today. The South Marsh was not formed until the early 1950s, when the river broke through the spit and left the old river course exposed. The marsh was forming by 1952 through sand accumulation, by which time considerable areas of the spit were beginning to be vegetated.

At the time of the 1975 ecological study, the Waikanae Estuary was regionally important as one of the only areas of salt marsh vegetation in the Wellington region.

Today, it has a fraction of the salt marsh vegetation it had then. Contraction of salt marsh is expected to continue as a consequence of the fixing of the river mouth with the construction of a mole in the 1970s, reducing the creation of new tidal salt-flat areas.

As the position of the river mouth has become fixed, the areas of sand flat and salt marsh have become progressively covered in vegetation due to lack of tidal inundation, caused by sand accretion south of the mole. Areas that were salt marsh with halophytic (salt-tolerant) species have tended to become invaded by non-halophytic species, with a considerable effect on bird fauna and fish-spawning as a result.

4.2 The evidence of local ecology

As well as what can be discerned about the indigenous vegetation from the historical evidence at the estuary, the local coastal sand country also contains clues. In regard to this Landscape Plan, this latter evidence mainly concerns the question of woody vegetation. The historic evidence indicates that the estuary's sand dunes have stabilised sufficiently in the past to support woody vegetation, as they do at present for invasive, exotic species.

There is limited evidence in the Pekapeka dunes a few kilometres north of the estuary of tall kanuka woodland occurring close to the foredunes (with minor amounts of mapou (*Myrsine australis*), kohuhu (*Pittosporum tenuifolium*) and mahoe), running from the dune crest down to the edge of the dune hollows [Fig.'s 3 & 4].



Figures 3 & 4: Kanuka woodland, Pekapeka dunes

There is similar evidence in close proximity to the Waikanae Estuary of mature kahikatea (*Podocarpus dacrydioides*) occurring in the dune wetlands of the estuary environment. This evidence is now limited to a single tree occurring in the Kotuku Park subdivision [Fig. 5].



Figure 5: Evidence of kahikatea, Kotuku Park subdivision

The choice of species for restoration planting at the estuary has been informed by observing the occurrence and growth of species in the local ecological area; notably in the restoration plantings at Waimeha Lagoon [Fig. 6] and recent plantings in some residential properties in the Waikanae/Pekapeka area [Fig. 7].



Figure 6: Restoration plantings at Waimeha Lagoon



Figure 7: Recent residential plantings in the vicinity

5. The ecology of the Waikanae Estuary: vegetation – indigenous and invasive exotic species

5.1 Vegetation mapping

In order to provide an operational, on-the-ground framework for the Landscape Plan, the vegetation of the Waikanae Estuary has been mapped. This builds on a series of prior studies that classified and mapped the vegetation of the estuary (Kennedy & Webber; Wassilieff, Clark & Gabites; Department of Lands & Survey (1986); Kapiti Coast District Council).

One of these, the *Coastal Vegetation Survey* undertaken in 2005 by the Kapiti Coast District Council for its Coastal Management Strategy, is particularly useful for the Landscape Plan as it indicates precisely the location of invasive, woody weed species.

These prior studies are important as they document the ongoing ecological changes in the estuary throughout recent decades – notably the vegetating of the sand dune element and the contraction of both salt meadow and salt marsh vegetation following the fixing of the river mouth.

The vegetation of the Waikanae Estuary has been mapped both as it is presently [Map 2 – *Present Day Vegetation*], and as it could be if the ecological restoration proposed in this Landscape Plan was undertaken [Map 3 – *Potential Vegetation*]. The classification on which the vegetation mapping units is based integrates the plant types that predominate with the sand dune and estuarine landforms.

The vegetation types are summarised – both for present-day and potential vegetation respectively – as follows:

The present-day vegetation of the Waikanae Estuary:

1. **Bare, tidal sand flats**
2. **Moving sand dunes:** marram dominant
3. **Stabilised sand dunes:** marram and lupin dominant
4. **Stabilised sand dunes:** becoming wooded
5. **Inland sand flats:**
 - (a) blackberry and gorse dominant
 - (b) mown pasture
 - (c) tree plantings
 - (d) wetland; fescue & rushes dominant
6. **Submergent estuarine wetland** (salt meadow)

7. Emergent estuarine wetland (salt marsh)
8. Estuarine swamp (raupo swamp)
9. Lagoons, lakelets, watercourses, river channels and open sea.

The potential vegetation of the Waikanae Estuary:

1. Bare, tidal sand flats
2. Moving sand dunes: spinifex and pingao (*Desmoschoenus spiralis*) dominant
3. Stabilised sand dunes; shrubland: taupata (*Coprosma repens*), ngaio dominant
4. Stabilised sand dunes; woodland: kanuka, ngaio, totara dominant
5. Inland sand flats: formerly farmed;
 - (a) drier sites: kanuka and totara dominant
 - (b) wetter sites: kahikatea, harakeke (*Phormium tenax*), ti kouka, kowhai dominant
 - (c) managed areas: pasture and riverbank tree plantings
6. Submergent estuarine wetland (salt meadow)
7. Emergent estuarine wetland (salt marsh);
 - (a) largely natural: oioi (*Leptocarpus similes*) with ribbonwood (*Plagianthus divaricatus*), and harakeke
 - (b) very modified: kahikatea, harakeke, ti kouka, kowhai dominant
8. Estuarine swamp (raupo swamp)
9. Lagoons, lakelets, watercourses, river channels and open sea.

5.2 From present-day to potential vegetation

The primary objective of this Landscape Plan is the strategic planting of local indigenous species that would have naturally colonised the estuary's terrestrial environments had there been local sources of indigenous natural vegetation. It proposes that planting begins with small sites to establish nodes from which a wider-ranging indigenous vegetation cover can establish.

The purpose of the large-scale mapping of the estuary's vegetation is twofold:

- to provide a spatial framework on which to plan the planting as the Restoration Project develops
- to gauge the trend of the future vegetation changes.

The predicted changes in vegetation cover if ecological restoration is initiated can be seen by comparing the maps of present-day and potential vegetation.

The concept of potential vegetation allows for the fact that the Waikanae Estuary is an environment in which major change in future vegetation cover is inevitable. On

current trends, very little of the estuary's terrestrial vegetation will be as it is now in twenty years. Unless there is a major change in the tidal structure of the estuary, scarcely any salt-marsh vegetation will remain. Most of the stationary dunes will be in woody vegetation, with only minor areas in the marram grass cover that characterises the estuary's dune areas today.

The potential vegetation map indicates the vegetation that could develop within the Waikanae Estuary if comprehensive ecological restoration was possible, as opposed to leaving the land unmanaged and under increasingly invasive, woody species.

Should a restoration programme get underway soon, changes predicted to occur in the next twenty years or so in each vegetation type are summarised below:

1. **Bare, tidal sand flats:** little change in extent, but contraction likely
2. **Moving sand dunes:** from marram dominant to spinifex and pingao
3. **Stabilised sand dunes:** from marram grass to shrubland of taupata and ngaio
4. **Stabilised sand dunes:** from becoming wooded with exotic species to young woodland of kanuka, ngaio, totara
5. **Inland sand flats:**
 - (a) **drier sites:** from blackberry and gorse to young woodlands of kanuka and totara dominant
 - (b) **wetter sites:** from fescue and rushes to young forest of kahikatea, with ti kouka, kowhai, harakeke
6. **Submergent estuarine wetland (salt meadow):** substantial contraction in area
7. **Emergent estuarine wetland (salt marsh):** contraction in area, with kahikatea, harakeke, ti kouka established in portions that have been degraded by farming
8. **Estuarine swamp (raupo swamp):** little change
9. **Lagoons, lakelets, watercourses, river channels and open sea:** little change, other than likely spread inland as a result of sea-level rise.

6. Future options for the estuary's vegetation: leave alone or rehabilitate to a more indigenous, natural state

As well as providing a plan for restoration planting, a Restoration Vision for the Waikanae Estuary also means considering the likely future vegetation that would develop should no biodiversity management of the estuary be undertaken. The two future options are:

1. Leave the estuary alone with no management of its vegetation.

Given the recent history of ecological change and considering current trends, major future change in the vegetation cover and appearance of the Waikanae Estuary is inevitable with or without restoration. Throughout the Waikanae Estuary, establishment of native woodland species that could form an alternative woody cover is barely happening, largely as a result of the distance of seed sources of these species. This situation is likely to continue in the foreseeable future.

Without restorative management, the vegetation of the terrestrial (non-tidal) parts of the estuary will progressively develop through to woodlands and shrublands dominated by the invasive exotic species that are currently establishing: boxthorn, gorse, buckthorn, willows, pampas grass.

2. Implement restorative management to restore the estuary's vegetation to as close to its natural state as possible.

There are three options:

- (i) Comprehensive removal of certain invasive weed species, with no planting of local native species.
- (ii) Comprehensive removal of certain invasive weed species, with cluster planting of local native species.
- (ii) Comprehensive removal of certain invasive weed species, with comprehensive planting of local native species.

Comprehensive planting of the estuary's terrestrial areas is not a practical option for restoration in the immediate or near future, given the resources of both planting stock and people that a programme of such scale would require.

The second option – comprehensive removal of certain invasive weed species, with cluster planting of local native species – is proposed as the basis for initiating the ecological restoration in this Landscape Plan. More comprehensive planting could follow depending on the success of the initial plantings.

7. A Landscape Plan for the Waikanae Estuary: rehabilitative management and restorative planting

This Restoration Vision is for the land on the southern side of the estuary which is administered by the Department of Conservation (DOC) as the Waikanae Estuary Scientific Reserve and adjoining land, and the land on the northern side administered by Kapiti Coast District Council (KCDC) as public open space [Map 1].

At present, most of the land no longer subject to the changing course of the river meeting the sea is becoming covered with woody vegetation of mainly invasive, exotic species. In the absence of management to restore the indigenous biodiversity of the estuary, this trend will continue. Waikanae Estuary would become highly valuable as an indigenous wildlife habitat and protected as a scientific reserve, but an environment in which the vegetation is no longer indigenous.

Recognising that the Waikanae Estuary is a significant place for birdlife, the aim of the Landscape Plan is to replace these invasive, exotic species that are bird-distributed with native woody species that are also spread by birds.

Implementing this Plan will be a major undertaking; planting even the initial Restoration Planting Sites proposed will require tens of thousands of plants in the next five years, a permanent workforce to do so, as well as the assistance of local community groups (such as the newly formed Waikanae Estuary Scientific Reserve Care Group). In addition, rehabilitative management of the land within Waikanae Estuary to remove invasive, exotic weed species will be as integral as restorative planting.

7.1 Rehabilitative management

If this Restoration Vision is to be implemented, it is imperative that the seed sources of invasive, exotic species are removed across the Waikanae Estuary Restoration Project Area, as well as from the Restoration Planting Sites itemised in Section 8. A Rehabilitation Plan needs to be developed for this.

The priority species for comprehensive removal, in order of urgency, are: buckthorn, boxthorn, gorse, boneseed, karo (a non-local native species), pampas grass, all willows, wild cherry, buddleia. Blackberry, honeysuckle and tall fescue, all major weed species throughout the estuary, would be more practically removed in association with the restoration planting.

The *Coastal Vegetation Survey* (Kapiti Coast District Council) provides an excellent and detailed map of most of the estuary, identifying the location of invasive weed species. It will need to be complemented by careful, on-the-ground coverage of the occurrence of invasive weed species.

7.2 Restorative planting

Restoration planting is proposed on the principle of small cluster plantings established as nodes for natural regeneration of indigenous species.

The evidence from restoration projects in coastal sand dunes in the Wellington region, in which invasive, exotic weeds are as abundant as they are at Waikanae Estuary, is that ongoing intensive management is imperative for plantings to survive and prosper. At Waikanae Estuary, this will only be possible in small areas. Accordingly, a major part of this Landscape Plan is the identification of a series of Restoration Planting Sites.

8. The Restoration Planting Sites

A series of sixteen sites is proposed to initiate the restoration of indigenous vegetation cover in an environment of high biodiversity value, much of it protected as a Scientific Reserve, but overwhelmingly dominated by non-indigenous plant species [Map 4]. The network of planting sites is designed to establish nodes for the future spread of indigenous species.

Eight sites are located on the southern bank of the Waikanae river mouth, in both the Scientific Reserve and the Department of Conservation administered land near the Arapawaiti Oxbow. Eight sites are located on land administered by Kapiti Coast District Council on the northern bank of the river mouth.

The sixteen Restoration Planting Sites (RPS) have been selected to cover the range of vegetation types and habitats in which restoration is considered necessary to replace a vegetation cover dominated by invasive, exotic species. The sites are mapped on Map 3 of this Landscape Plan, and illustrated in the summary descriptions of each site below. For each site, two 'zones' are delineated: those for initial planting, and those for subsequent planting.

At this stage, the objective of the Landscape Plan and Restoration Vision is to identify and locate each RPS and summarise the species to be planted, rather than to prescribe the relative numbers and plant layout.. That task will need to be done subsequently and separately, depending on the adoption of this Landscape Plan and the availability of resources to undertake planting.

The primary purpose of the planting at this point is not to attempt to plant the large areas of the estuary for which ecological restoration is envisaged, but to get a range of appropriate species established and assess how they survive in each environment.

An important feature of this restoration will be eco-sourcing of seeds and plants. Eco-sourcing means sourcing seeds and plants from the local region. Plants sourced and grown from the local area are better adapted to conditions there, are more likely to survive and will help to preserve the distinctiveness of plants from the region. Each RPS is small, as appropriate to the intensive

management planting that will be necessary given the weed competition that prevails throughout the terrestrial portion of the estuary. Each RPS is also located in proximity to public access-ways in order that the Restoration Vision for Waikanae Estuary is apparent to visitors to the area. Aesthetically pleasing and ecologically sound plantings that will not block views will be a priority.

Once further work has been completed on the project DOC may look to putting in a loop track so the public can enjoy the full benefits of the plantings, including interpretive panels with information on the flora and fauna. It is hoped this will include photo points which will be used for recording growth and progress of this project over the years.

RPS 1. Young sand dunes at western edge of estuary



Figure 8: RPS 1

The proposed planting site is located in both the mobile and stationary dune area immediately inland from the main beach and on either side of the access-way.

In the mobile dune area, the species to be planted are the indigenous sand dune plants pingao and spinifex with the objective of eventually replacing the marram that was introduced to the estuary in the early 20th century to stabilise dune movement. Both pingao and spinifex would have occurred naturally, but neither do currently. A small area of pingao and spinifex has been recently planted to some success at the Manly Street access to the main beach.

In the stationary dune area, the species to be planted are the woody indigenous species manuka, tauhinu, toe toe, and ngaio, with lesser amounts of ti kouka (cabbage tree). The objective of planting is to replace the present cover in which the marram grass that stabilized the dunes is being succeeded by fescue, blackberry and lupin and

increasing numbers of gorse, karo, boxthorn and buckthorn. The species proposed for planting are known to have occurred historically in the dunes.

In parallel with this planting, gorse, karo, boxthorn, broom and buckthorn should be eliminated from the entire extent of the dune area delineated on the Present Day Vegetation map. The fescue, blackberry, climbing dock and lupin growth will need to be removed from the immediate cluster planting area prior to planting.

It is suggested that select sections of beach access be fenced to protect new plants and a wooden beach walkway be installed near the beach edge to protect the area from blow out. Primary plants, pingao and spinifex could be planted on the foredune with sand daphnia (*Pimelea prostrata*) and sand coprosma (*Coprosma acerosa*) planted in secondary areas.

RPS 2. Young sand dunes & estuarine wetland at western edge of estuary



Figure 9: RPS 2 - Young sand dunes



Figure 10: RPS 2 - Estuarine wetland

The proposed planting site is located adjacent to the northern Manly Street access to the Waikanae Estuary Scientific Reserve, and on either side of the access-way through the Reserve. The site is chosen because it includes both sand dune and estuarine wetland habitat.

The main species proposed for the sand dune area are manuka, ngaio, taupata, toe toe, tauhinu and coastal shrub daisy with minor amounts of mahoe, mapou, kowhai, and akeake (*Dodonaea viscosa*) in wetter parts. The main species for the wetland area are harakeke, ti kouka, toe toe and makaka.

In parallel with this planting, any gorse, karo, boxthorn and buckthorn should be eliminated from the surrounding area, and the dense fescue, blackberry and lupin growth removed from the immediate cluster planting area.

RPS 3. Older sand dunes and edge of South Marsh



Figure 11: RPS 3

The proposed planting site is located adjacent to the southern Manly St access to the Waikanae Estuary Scientific Reserve, and on either side of the accessway through the reserve. It spans from the highest point of the dune ridge down to the marsh margin.

Kanuka, ngaio, taupata, karamu (*Coprosma robusta*) and coastal shrub daisy, with minor amounts of mahoe, mapou, kowhai and akeake on the lower slopes, are proposed for the sand dune area. Harakeke, ti kouka, and toe toe are proposed for the marsh margin.

RPS 4. Road margins adjoining South Marsh and Puketewhaino Lagoon



Figure 12: RPS 4

The very narrow buffer zone between the Waikanae Scientific Reserve and Paraparaumu's Manly Street is currently covered with dense weed growth dominated by blackberry and tall fescue adjoining the wetland vegetation of the South Marsh and Puketewhaino Lagoon.

Ecologically, a wetland edge environment such as this would be dominated by harakeke with taller woody species on the upper, drier sites: ti kouka, toe toe, kowhai, mahoe and a variety of sedges.

Planting some of these species is proposed, but in a series of approximately ten 'micro-sites' along the narrow buffer zone in order that the established views across the estuary from Manly Street residences is not obliterated by tree growth.

RPS 5. Older sand dune inland from main tidal lagoon of estuary



Figure 13: RPS 5

The proposed planting site is located adjacent to the southern Manly St access to the Waikanae Estuary Scientific Reserve, and on either side of the access-way through the Reserve. It is the major site for planting of indigenous woody species.

As is the case throughout most of the older dune area inland from the tidal lagoon, very little indigenous woody growth is present, and that is largely taupata. However, the numerous exotic woody species growing well suggest that indigenous tree species will also.

At present, the site is dominated by large willow trees which have been recently poisoned, a large buddleia, abundant boxthorn and rapidly-spreading buckthorn; all of which need to be removed from the surrounding area.

The main indigenous woody species to be planted is kanuka, with lesser amounts of totara, ngaio, mapou, karamu and kohuhu and minor amounts of ti kouka (*Cordyline australis*), kowhai and ake ake planted along the pathway.

The dense ground cover of periwinkle, broom, tall fescue and blackberry will need to be eliminated from the planting site prior to planting, and managed after planting to prevent its re-establishment. Bracken does not necessarily have to be removed as it provides shelter for new native plants.

RPS 6. Young sand dunes and estuarine wetland inland from main tidal lagoon



Figure 14: RPS 6

The proposed planting site is located adjacent to the southern Kotuku Park access to the Waikanae Estuary Scientific Reserve, and on either side of the access-way and boardwalk.

The area comprises a low-lying area of stationary sand that is predominantly wetland, and for which indigenous woody wetland species are proposed in the planting mix. The area contains a considerable indigenous wetland element, with harakeke, oioi and shrub coprosma (*Coprosma propinqua*), but there is also vigorous growth of blackberry, tall fescue, boxthorn, gorse, karo and willow that needs to be removed.

Following the removal of weed species, it is proposed that kahikatea, ti kouka, toe toe, mahoe, karamu, harakeke, kowhai and kohuhu are planted in wetland areas, with kanuka, totara, ngaio, and mahoe on drier areas.

RPS 7. Young, low sand dunes adjoining main tidal lagoon of estuary



Figure 15: RPS 7

The proposed planting site is located in the area of newly-forming dunes seaward of the southern Kotuku Park access to the Waikanae Estuary Scientific Reserve. It is currently immediately inland from the main tidal lagoon's outlet to the sea, and easily accessible from the Kotuku Park (Takahe Drive) entrance to the Scientific Reserve.

The dunes here are low and dominated exclusively by marram. It is proposed that the marram is replaced by pingao and spinifex for both of which the site is highly suitable. Areas of the back dune can be planted in *Carex pumila*. There is an expanding area of gorse in the immediate vicinity, and several plants of bone seed and karo that need to be removed. There is evidence of rabbit in this area and it is suggested that rabbits be controlled at some stage.

RPS 8. Wetland area of Otaihanga Oxbow



Figure 16: RPS 8

The purpose of the proposed planting is to initiate coastal lowland wetland forest in the Waikanae Estuary environment, in order to complement the restoration of these species in the Otaihanga Domain nearby.

Farming and drainage has seriously modified the portion of the Oxbow proposed for ecological restoration from its natural state as an estuarine wetland with a tidal (high spring tide) influence. The subsequent growth of pasture weeds is such that it will not be possible to return it to estuarine wetland.

However, as a wetland in an estuary protected for its bird habitat, it is a potentially valuable environment. Its value in this regard would be enhanced by modification of the drainage works that have drastically altered water-flow through the Oxbow. Re-opening the watercourse through the proposed RPS would increase the extent of open water that was its historic state.

The proposed planting is on the basis that re-opening of the old Oxbow watercourse is possible. It aims to establish a rim of harakeke, toe toe, ti kouka and kowhai around the open water area, with a surrounding growth dominated by *Carex litorosa*, and pukatea (*Laurelia novae-zelandiae*)

RPS 9. Young mobile sand dunes at the eastern edge of the estuary



Figure 17: RPS 9

The proposed planting site comprises the only non-tidal land on the northern bank of the rivermouth that is within the Waikanae Estuary Scientific Reserve. It is located in the mobile sand dune area immediately inland from the main beach and on either side of the access-way. The area is currently in low open dunes, and contains the only substantial area of naturally occurring spinifex at the Waikanae Estuary. There is also considerable marram here.

The aim of planting is to complement the spinifex with pingao so the marram should be carefully removed in conjunction with this planting. Also added to the planting should be Beach Spurge or Waiuu-o-kahukura (*Euphorbia glauca*), Sand Coprosma and *Pimelea arenaria*.

RPS 10. Young stationary sand dunes at the eastern edge of the estuary



Figure 18: RPS 10

The proposed planting site is located in the recently stabilised area of dunes immediately inland from RPS9. It is readily accessible from the Waimanu Lagoon access to the estuary.

The area is currently dominated by marram and karo (*Pittosporum crassifolium*), but woody growth of lupin, boxthorn, willow and taupata is fast establishing. Like its equivalent environment on the western Manly Street edge of the Scientific Reserve, this is an area of high public visibility and access which – now stabilized – will be predominated by invasive, exotic woody species unless planted with native ones. Planting of taupata, ngaio, ti kouka, toe toe and harakeke is proposed for the site.

RPS 11. Old mole (seaward) between Waimanu Lagoon and rivermouth



Figure 19: RPS 11

RPS 12. Old mole (inland) between Waimanu Lagoon and rivermouth



Figure 20: RPS 12

The sites RPS11 and RPS12, which extend right into the river mouth, have been formed by the mole that was constructed in the 1970s to fix the course of the river's meeting with the sea, rather than being natural estuary landforms.

The sites have been forwarded for restoration planting because they are areas of high public visibility and access that would provide very good 'gateways' for the Waikanae Estuary Restoration Project. Currently, the sites are somewhat bleak and unattractive and dominated by weed growth.

Landscape planting rather than restoration planting is proposed here, with the intention of establishing groves (rather than forests) of appropriate coastal trees.

The growth of trees taupata, ngaio and understorey shrubs (kawakawa (*Macropiper excelsum*) in the existing groves at the Waimanu Lagoon vehicle access-way suggests that, with appropriate landscape management, groves of local indigenous species could be readily established and would enhance the area greatly.

Tree species should be similar to those proposed for the establishment of indigenous woodland on other Restoration Planting Sites. They should include kowhai, ngaio, taupata and ti kouka. Margins could be planted mainly with harakeke, shore ribbonwood and harakeke.

RPS 13. Estuarine wetland margin adjoining river, near Waimanu Lagoon



Figure 21: RPS 13

The proposed planting site comprises the tidal riverbank opposite the area of mown grass between Waimanu Lagoon and North Marsh on the northern shore of the estuary. The riverbank walkway forms its landward margin.

Located next to a high-traffic public walkway means the site is one of very high visibility. It is also one seriously affected by invasive, exotic weed species: pampas grass, gorse, tall fescue, wattles and Norfolk pine.

Removal of the pampas grass is proceeding; that of gorse and tall fescue should follow, with intensive planting of ngaio, taupata, kanuka, ti kouka, coastal shrub daisy and kowhai on drier sites, and harakeke, toe toe and makaka on wetter sites.

RPS 14. Margins of North Marsh, near Waimanu Lagoon



Figure 22: RPS 14

The North Marsh is the outstanding natural area on the northern shore of the Waikanae Estuary. It contains the best example of marsh shrubland (dominated by tall, old coastal shrub daisy) in the entire estuary. It is surrounded by very modified vegetation, but is in surprisingly good condition nonetheless.

It is identified as an RPS in order that the small level of modification – that is, the presence of some gorse – can be managed to retain the marsh's high biodiversity value.

Gorse should be removed from the marsh immediately, and the margins (particularly along the walkway) planted with harakeke.

RPS 15. High stationary sand dune on north bank of estuary



Figure 23: RPS 15

Between the tidal river bank and Weggery Drive is a high dune that has recently stabilised and become vegetated with increasingly woody growth. Most of this is of invasive, exotic species that have self-seeded: pines, wattle, tree lucerne, willow and gorse. Unless removed, the vigorous growth and spread of the pines and wattles will lead eventually to tall, closed wooded growth.

The land is publicly administered by the Kapiti Coast District Council, but is unkempt in appearance. Restoration planting of this site is considered the priority for the northern portion of the Waikanae Estuary Restoration Project.

The vigorous growth of woody exotic species suggests that a woodland/forest of local indigenous species could be readily established. Some intensive planting of kanuka has recently been undertaken at the easternmost edge of the site. It is suggested that the entire dune slope above the river be similarly planted to initiate a kanuka/totara woodland. The upper portion should be planted with lower-stature species in order to preserve Weggery Drive views.

Species proposed for the planting are mainly kanuka with minor amounts of ngaio, mahoe, karamu, kohuhu, mapou, ti kouka, ake ake and totara. Planting should be at a level in intensity to ensure rapid cover.

RPS 16. Margins of lagoon on north bank of estuary



Figure 24: RPS 16 - Lagoon



Figure 25: RPS 16 - Riverbank

The lagoon is a major feature of the upper-river area of Waikanae Estuary. Some intensive indigenous planting of the lagoon margins has recently been undertaken,

and it is suggested that this be extended to the adjacent riverbank area, and the portion of the lagoon incorporated in the Waikanae River Restoration Project.

It is proposed that the adjacent river margins and lagoon have the pampas removed and be planted with harakeke and ti kouka and the lagoon with *Carex litorosa*, *Coprosma propinqua*, ngaio and kanuka additionally.

List of suggested plants for restoration areas

Common Name	Maori Name	Scientific Name
Trees and Shrubs		
	Tauhinu	<i>Ozothamnus leptophyllus</i>
Sand coprosma	taatarakeke	<i>Coprosma acerosa</i>
Shrub coprosma		<i>Coprosma propinqua</i>
	Taupata	<i>Coprosma repens</i>
Cabbage tree	Ti kouka	<i>Cordyline australis</i>
	Karamu	<i>Coprosma robusta</i>
	Ake ake	<i>Dondonaea viscosa</i>
	Pukatea	<i>Laurelia novae-zelandiae</i>
	Oioi	<i>Apodasmia similis</i>
	Manuka	<i>Leptospermum scoparium</i>
	Kanuka	<i>Kunzea ericoides</i>
	Kawakawa	<i>Macropiper excelsum</i>
	Mahoe	<i>Melicytus ramiflorus</i>
	Ngaio	<i>Myoporum laetum</i>
	Mapou	<i>Myrsine australis</i>
Coastal shrub daisy		<i>Olearia solandri</i>
	Harakeke	<i>Phormium tenax</i>
		<i>Pimelea arenaria</i>
Sand daphnia		<i>Pimelea prostrata</i>
	Karo	<i>Pittosporum crassifolium</i>
	Kohuhu	<i>Pittosporum tenuifolium</i>
Ribbonwood	Makaka	<i>Plagianthus divaricatus</i>
Lowland Ribbonwood	Maanatu	<i>Plagianthus regius</i>
	Kaikomako	<i>Pennantia corymbosa</i>
	Kahikatea	<i>Dacrycarpus dacrydioides</i>
	Totara	<i>Podocarpus totara</i>
	Kowhai	<i>Sophora microphylla</i>
Scrub pohuehue	poohuehue	<i>Muehlenbeckia complexa</i>
New Zealand spinach	kookihi	<i>Tetragonia implexicoma</i>
Grasses, Rushes and like plants		
Jointed wire rush	Oioi	<i>Apodasmia similis</i>
Sand tussock	Hinarepe	<i>Austrofestuca littoralis</i>
	Toe toe	<i>Cortaderia toe toe</i>
		<i>Bolboschoenus caldwellii</i>
Marsh clubrush	Kukuraho	<i>Bolboschoenus fluviatilis</i>

		<i>Carex flagellifera</i>
Cutty grass	Rautahi	<i>Carex geminata</i>
	Puurei	<i>Carex secta</i>
Speckled sedge		<i>Carex testacea</i>
Swamp sedge	Puurei	<i>Carex virgata</i>
		<i>Carex litorosa</i>
		<i>Carex pumila</i>
Giant umbrella sedge	Upoko Tangata	<i>Cyperus ustulatus</i>
	Pingao	<i>Desmoschoenus spiralis</i>
		<i>Juncas kraussii</i> var. <i>australiensis</i>
		<i>Juncas pallidus</i>
Three square		<i>Schoenoplectus pungens</i>
Lake clubrush	Kapungawha	<i>Schoenoplectus</i> <i>tabernaemontani</i>
		<i>Spinifex sericeus</i>
Herbs		
Beach Spurge	Waiuu-o-kahukura	<i>Euphorbia glauca</i>

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Waikanae Estuary Restoration Project - Restoration Planting Sites

Legend:



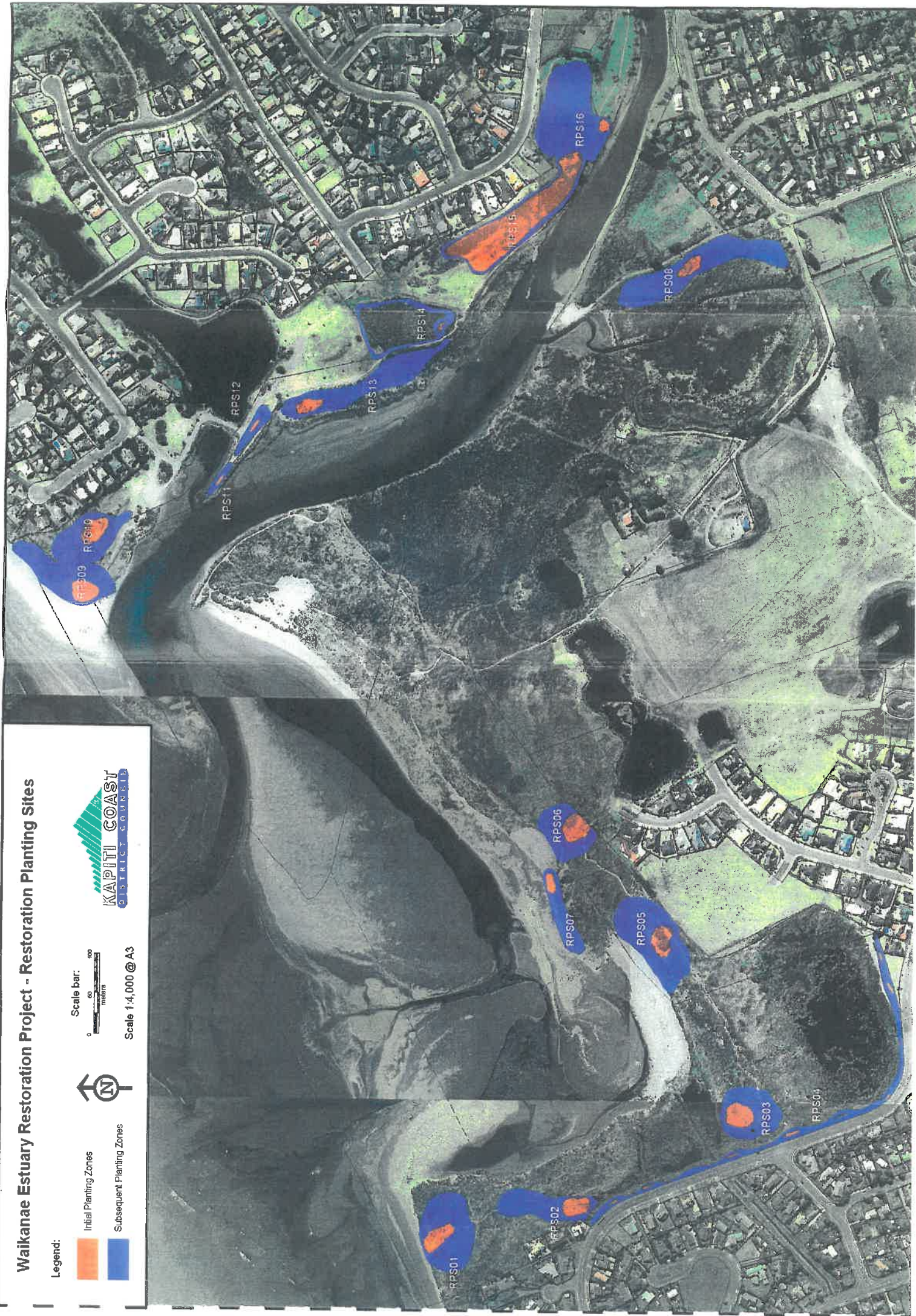
Initial Planting Zones

Subsequent Planting Zones



Scale bar:
0 60 120
meters

Scale 1:4,000 @ A3



Waikanae Estuary Restoration Project Present Day Vegetation

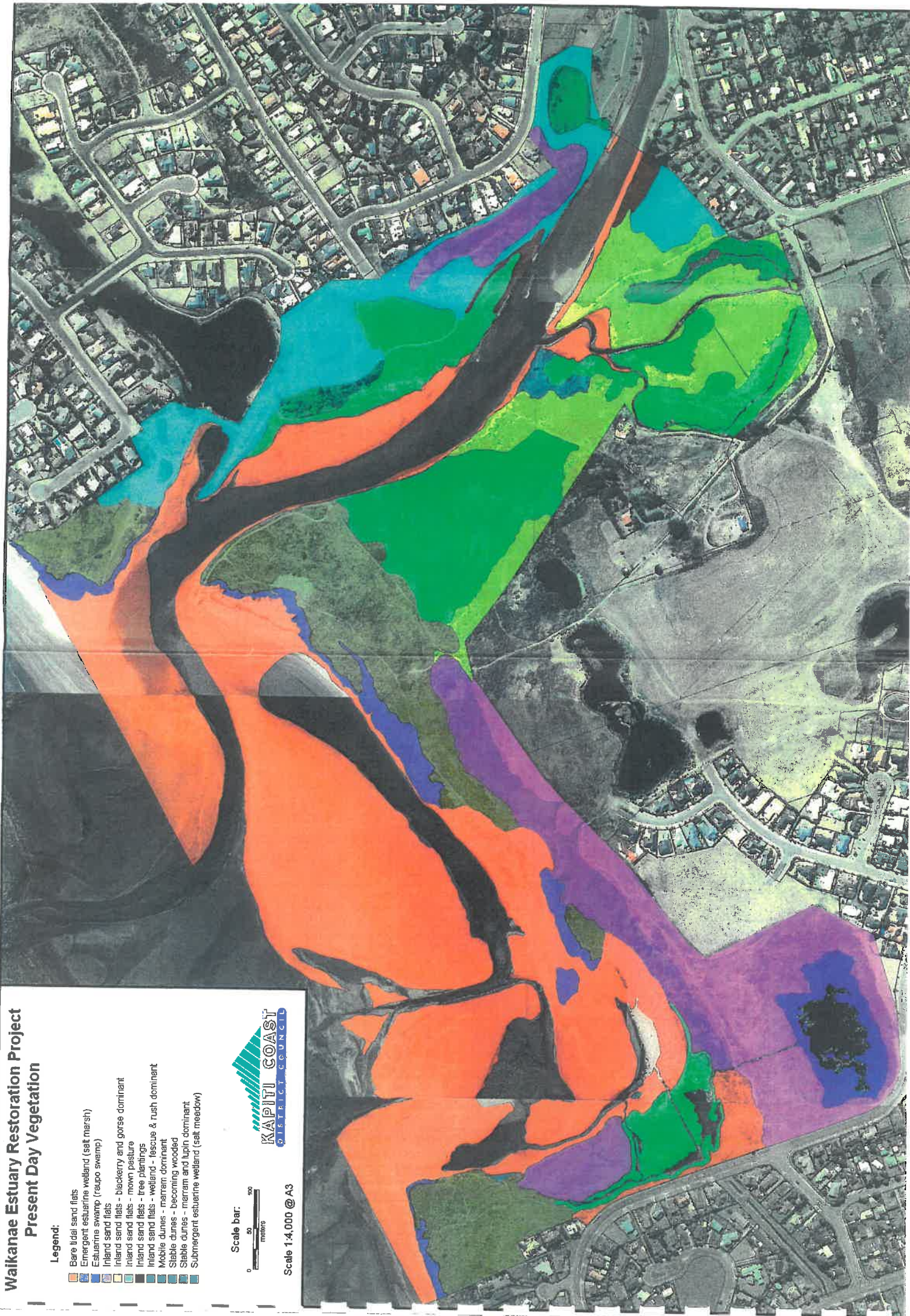
Legend:

- Bare tidal sand flats
- Emergent estuarine wetland (salt marsh)
- Estuarine swamp (raupo swamp)
- Inland sand flats
- Inland sand flats - blackberry and gorse dominant
- Inland sand flats - mown pasture
- Inland sand flats - tree plantings
- Inland sand flats - wetland - fescue & rush dominant
- Mobile dunes - marram dominant
- Stable dunes - becoming wooded
- Stable dunes - marram and lupin dominant
- Submergent estuarine wetland (salt meadow)

Scale bar:



Scale 1:4,000 @ A3



Waikanae Estuary Restoration Project Potential Vegetation

Legend:

- Bare tidal sand flats
- Emergent estuarine wetland - kahikatea, harakeke, ti kouka & kowhai
- Emergent estuarine wetland - drier sites - kahikatea, harakeke, ti kouka & kowhai
- Estuarine swamp (raupo swamp)
- Inland sand flats - drier sites - kahikatea, harakeke, ti kouka, kowhai
- Managed amenity areas (pasture and riverbank tree plantings)
- Mobile dunes - spinifex and pingao dominant
- Stable dunes - kanuka, ngalo & totara dominant
- Stable dunes - taupata, ngalo dominant
- Submergent estuarine wetland (salt meadow)

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Scale 1:4,000 @ A3

