



**Te Ngahere**  
Native Forest Management

# Te Matuku Wetland, Waiheke Island

## Restoration Plan



# Te Matuku Wetland, Waiheke Island

## Restoration Plan

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# 1 Introduction

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## 1.1 Wetland Importance

Wetlands are highly sensitive ecosystems which are declining internationally due to pressures from catchment modification, development, land use changes, invasive plants, habitat fragmentation, pollution and drainage.

Wetlands in New Zealand have been reduced to only 9.4% of their former extent, mainly due to drainage and modification for farming and urban development. Freshwater wetlands cover only 0.4% of the Auckland region. On Waiheke Island freshwater wetlands cover 1.3% of the island's land area (Auckland Council, July 2012).

Wetlands have important ecological functions and provide a number of ecosystem services, including:

- improving water quality – filtering sediment and run-off,
- flood protection – reducing flows, replenishing groundwater,
- shoreline erosion – stabilising coastal edges and protecting against storms,
- fish and wildlife habitat – providing nesting and feeding areas, supporting threatened plants,
- storing carbon and mitigating effects of climate change.

## 1.2 Te Matuku Wetland Restoration

Te Matuku Bay is an ecologically important wetland site located in the relatively remote south eastern corner of Waiheke Island, near Orapiu. It supports a range of saline and freshwater influenced wetland habitats, which grade to adjoining coastal shrubland/ forest and tidal estuary habitats.

Te Matuku Bay is of national significance due to the flora, fauna and sequence of habitat types that it supports. The wider estuary is also recognised as a Marine Reserve, as it is one of Waiheke's largest and least disturbed tidal estuaries and one of the few intact estuarine systems remaining in northern New Zealand.

There is significant community interest, especially from adjacent landowners, in the long-term protection and restoration of this site. Te Matuku Bay, and its associated wetland habitats, requires ongoing management to enhance its important ecological values. Therefore this restoration plan aims to identify the key restoration priorities for this site and to set out a user-friendly ecological restoration programme for the five year period 2013 – 2017.

## 1.3 Aims and Objectives

### 1.3.1 Aim

This restoration plan aims to identify a methodology and 5 year work programme to protect and enhance the ecological diversity of the important wetland habitats and surrounding environment at Te Matuku Bay Wetland.

### 1.3.2 Long-term goal

Ecological restoration of the Te Matuku Bay Wetland and wider catchment will lead to a structurally and ecologically diverse range of wetland habitats which grade to an intact riparian and coastal estuary vegetation sequence (ecotone). The vegetation composition will consist of predominantly native species, with weed and animal pest species significantly reduced, and will provide important habitat and food sources for native fauna. Community and local landowner engagement will be fostered to ensure a collaborative and sustainable approach. A long-term ecological restoration programme is required and this goal would be expected to be achieved in a 20-30 year time-frame.

### 1.3.3 Objectives

The following objectives have been identified for carrying out ecological restoration at Te Matuku Bay Wetland:

1. To reduce the presence of pest plants through a comprehensive programme of weed control. This will lead to enhanced wetland and coastal habitat which will benefit local wildlife and will be able to carry out ecosystem services more effectively (such as sediment filtration and flood protection).
2. To initiate an animal pest control programme around Te Matuku Bay to increase the diversity, survival and breeding success of native fauna - including birds, lizards and invertebrates. Emphasis will particularly be placed on protection of the important shorebird breeding habitat associated with the sand spit and shell banks in the bay adjacent to DOC reserve land.
3. To involve the local community in carrying out restoration tasks in order to foster local ownership of this site and raise awareness of the importance of wetland and coastal habitats.
4. To encourage neighbouring landowners to carry out ecological restoration tasks on their land, particularly weed control, animal pest control and appropriate native planting, to enhance the adjacent wetland and bush areas.

## 2 Site Overview

### 2.1 Site Location

Te Matuku Bay (also known as McLeod's Bay) is situated at the south eastern end of Waiheke Island, near the small settlement of Orapiu. Te Matuku wetland is the largest wetland on Waiheke Island and grades from mangroves to estuarine habitats and then freshwater wetland, surrounded by established coastal shrubland/ forest. Refer to Figure 1 below for site location map.

The surrounding catchment areas are predominately in native vegetation and rural landuses. Landuses include lifestyle blocks, farmland, vineyards and reserve land. There are also Oyster beds on the south west side of the bay. Te Matuku wetland is partly bounded to the north by Orapiu Road. The wetland is fed by several small tributaries, the most significant of which grades into a large raupo wetland to the east of Orapiu Road.



**Figure 1. Te Matuku Wetland site location**

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## 2.2 Landownership

Te Matuku Bay is surrounded by Council esplanade reserve along the north east and eastern edges. At the head of the bay is Passage Rock Vineyard. To the west there is farmland and the privately owned Fenwick Reserve. Adjacent to the sandpit is Te Matuku Bay Scenic Reserve (managed by Department of Conservation). Situated to the north of Orapiu Road is the 35ha Forest & Bird Goodwin-Te Haahi Reserve.

### Auckland Council managed reserve land in Te Matuku Bay includes:

- Waiheke Pioneer Cemetery Reserve (owned by Department of Conservation)
- Te Matuku Bay Esplanade Reserve
- Te Matuku Stockyard Reserve
- Squirells Reserve

## 2.3 Site Designations

### 2.3.1 Site of Ecological Significance (SES)

In the Auckland City District Plan - Hauraki Gulf Islands Section - Proposed 2006, Te Matuku Bay is recognized as a Site of Ecological Significance (SES 1) and includes the wider bay, the main stream tributaries at the head of the bay, DOC reserve land and the Forest & Bird reserve. The designated area covers 320 hectares and includes wetland, surrounding regenerating forest and marine areas. The wetland areas cover approximately 70-80 hectares. Refer to Figure 16 showing SES 1 designation map and description.

Te Matuku Bay Site of Ecological Significance is described as:

*'Te Matuku Bay is a flock site of international importance for northern New Zealand dotterels (which are classed as nationally vulnerable). The NZ dotterels also breed here. The threatened Caspian tern (nationally vulnerable) breeds here. Variable oystercatchers, an endemic species, nest along the coast. The coastal areas are used by reef herons, a nationally vulnerable species. In summer several hundred Arctic migrants, such as the bar-tailed godwit or kuaka, feed on the tidal flats at low tide or roost along the beaches at high tide. The wetlands are home to two species that are sparse nationally, the spotless crane and the banded rail. The coastal and wetland systems grade into a forested catchment, which supports a variety of forests ranging from taraire and kohekohe forest in the gullies to kauri / tanekaha forests with hard beech on the ridges.'*

In the recent report prepared by Auckland Council Biodiversity and Biosecurity Team staff to prioritise restoration of significant wetlands on Waiheke (July 2012), Te Matuku Bay SES is described as:

*'The shell spits and associated coastal landforms are regarded as being the best in the Inner Hauraki Gulf Islands Ecological District. The site has high scenic and catchment values. The wetland complex in Te Matuku Bay is connected to the complex in Awaawaroa Bay by the Fenwick Reserve on the western side of Te Matuku Bay and forms a significant linkage for wildlife. There are future plans to develop a walkway around the Council esplanade and DOC land to allow better public use of the area.'*

*The flora, fauna and habitat values of Te Matuku Bay make it a site of national significance.'*



### 2.3.2 Site of Special Wildlife Interest (SSWI)

Te Matuku Bay is also a Site of Special Wildlife Interest (SSWI) and has a SSWI ranking of 'High' (Auckland Council, July 2012). This Department of Conservation wildlife habitat ranking system involved surveys in the 1970s-80s. All natural or semi-natural areas important as habitat for one or more species of wildlife were evaluated and each site ranked, according to a set of standard criteria, into five groups on the basis of their value to wildlife, i.e. outstanding, high, moderate-high, moderate and potential (Cromarty, P. & Scott, D.A. (eds). 1995).

### 2.3.3 Archaeology and Geological sites

There are archaeological sites shown within the boundary of Te Matuku Bay in the Auckland City District Plan – Hauraki Gulf Islands Section. These are located at the Waiheke Pioneer Cemetery (burials) and at Te Matuku Point within the esplanade reserve (midden and terrace). There is also a historic track at the northwest edge of the bay (near Passage Rock Vineyard).

The Te Matuku Bay shell spit and tidal marsh are also identified as a geological item in the Auckland City District Plan – Hauraki Gulf Islands Section. This is described as an *'exemplary example of an intertidal-hightidal spit. The spit is 800m long, 5-10m wide ribbon of sand and cockle shells that has built up in the last few thousand years.'*

An Accidental Discovery Protocol will be adhered to in the event that any new archaeological features (e.g. shell middens, hangi pits, artefact material, human bones etc.) are discovered during ecological restoration operations. All work will cease immediately and appropriate authorities will be informed.

### 2.3.4 Marine Reserve

Te Matuku Marine Reserve was formally established in August 2005 and is managed by the Department of Conservation, who enforce the 'no-take' restrictions.

The 690 ha marine reserve includes all of Te Matuku Bay, apart from a small marine farm area on the outer western shore, and extends into deeper water across Waiheke Channel beyond Passage Rock.

The boundaries are from the mean high water mark around Te Matuku Bay and the bays at its entrance (Whites Bay, Little Bay, Sandy Bay and Otakawhe Bay) out to a line level with Kauri Point on Ponui Island.

A special feature of the reserve is its diverse mix of habitats. It has saltwater wetlands, broad intertidal mudflats, low lying islands, shell spits, rocky shorelines and the deep water of the Waiheke Channel around Passage Rock. Each of these distinct marine habitats provide homes for particular groups of plants and animals (DOC, 2005).

### 3 Site Description

Te Matuku Bay Wetland is an ecologically diverse site which supports a range of wetland habitat types. The area covered in this restoration plan includes the Auckland Council managed land along the boundaries of the estuary, namely Te Matuku Bay Esplanade Reserve, Waiheke Pioneer Cemetery Reserve (owned by Department of Conservation) and Te Matuku Stockyard Reserve.

Habitat types found at Te Matuku wetland are described below in Section 3.1.1

This survey and restoration plan only covers the area under Auckland Council management at Te Matuku Bay.

#### 3.1 Vegetation

The Waiheke wetland prioritisation report (Auckland Council, July 2012) summarises the vegetation character at Te Matuku Bay as, *'extensive intertidal mangrove forest covers much of the sheltered inner estuary within the Te Matuku Bay. The saline wetland of saltmarsh, saltmeadow and mangrove forest, with associated low-lying island vegetation is the best on Waiheke.*

*The freshwater wetland of raupo and associated species is of moderately-high quality, but relatively small. Forest extends to the water's edge in places, this continuous sequence of saline, freshwater and forest communities are of regional significance. A large amount of the surrounding catchment is in native vegetation (regenerating forest and scrub). Two main forest types are found in the area.*

*- kauri-tanekaha forest with kanuka*

*- taraire-tawa forest with puriri, pohutukawa, kauri and totara*

*Both forest classes are considered to be the best of their kind on Waiheke Island.'*

The Department of Conservation describes the Te Matuku Bay habitats as, *'A sequence of plants [at Te Matuku] - from eel grass on the mudflats through mangrove and salt marsh, to maritime fringing bush and finally up into lowland broadleaf forest - is special because such natural successions of changing plant communities are now rare in northern New Zealand'* (DOC, 2005).

The Te Matuku Wetland system is heavily influenced by the tide and therefore there is a high representation of saline habitat types often associated with estuaries and coastal edges. At the fringes, especially to the north of the main sandspit, there are small areas of freshwater influenced raupo-carex wetlands.

During the site survey carried out in January 2013 habitat types were identified, with exotic and native plants recorded as time allowed. It is recommended that further comprehensive botanical surveys are carried out to identify the full range of species present (e.g. any threatened plants). Refer to Appendix for native plant species list (Table 8) and weed/exotics lists (Table 9 and Table 10) compiled during site survey visit.

Habitat types recorded during site survey included: Carex-Raupo Swamp, Saltmarsh, Mangroves, Shell Banks/ Sand spit & Islands and Coastal Shrubland & Forest.

See Appendix for maps showing approximate location of wetland habitat types recorded at Te Matuku Bay (Figure 14). These boundaries are indicative as the margins of habitat types can be difficult to define as one habitat grades into the other especially in the estuary areas, or sites could not be viewed clearly. The mangrove, shell bank and islands and saltmarsh habitats will also naturally shift over time.

### 3.1.1 Habitat Types

#### Saltmarsh

Saltmarsh was present along the estuary edges and covered quite large areas. It generally consisted of single species dominated patches which had a tall sward of one of the following saltmarsh species: oioi (*Apodasmia similis*), sea rush (*Juncus kraussii*) or *Machaerina juncea*, grading from one species to the next. Coastal needle tussock (*Austrostipa stipoides*) and knobby club rush (*Ficinia nodosa*) were occasional. At the saltmarsh edge behind the narrow sand spit, *Apium* "white denticles", an unnamed native celery similar to *Apium prostratum* subspecies was found. Towards the coastal edge (landwards) small-leaved pohuehue (*Muehlenbeckia complexa*) and saltmarsh ribbonwood (*Plagianthus divaricatus*), were interspersed.

Unlike at Rangihoua Wetland there were not significant salt meadow dominated areas present. Some species associated with salt meadow habitat were recorded at the edge of the saltmarsh vegetation, including sea primrose (*Samolus repens*) and selliera (*Selliera radicans*) and these were frequent adjacent to Orapiu Road.

The saltmarsh vegetation then generally merged into mangrove-dominated areas which were more tidal. See photo below for typical view of saltmarsh vegetation (Figure 2).



**Figure 2. View of saltmarsh vegetation behind narrow sand spit**

#### Mangroves

Low-growing mangroves were frequent along the coastal edge and covered large areas at the head of Te Matuku Bay. They were associated with open mudflats and several large channels. Mangrove (*Avicennia marina* subsp. *australasica*) is a native species that forms important habitat for fish breeding grounds and juvenile fish nurseries. They are part of the coastal vegetation sequence of mudflats-mangroves-saltmarsh-wetlands (saline-influenced and freshwater) and should be maintained as an intact ecosystem.



### Shell banks/ Sand spit and islands

There was a small shell bank spit to the north of Te Matuku Point Lane peninsula which consisted mainly of coastal needle tussock with some glasswort (*Sarcocornia quinqueflora subsp. quinqueflora*).

At the head of the bay there is a large island, which unfortunately could not be accessed during the survey as it was surrounded by deep tidal channels. From a distance it appears to consist of saltmarsh vegetation including sea rush, oioi, and saltmarsh ribbonwood with low-growing manuka scrub in the centre. This island is surrounded by extensive areas of mangroves, as can be seen in the photo below.



**Figure 3. Looking towards large island at northern end of estuary (from top of hill on Orapiu Rd)**

In the eastern bay of the Te Matuku estuary (adjacent to the DOC reserve) there is a long narrow sand spit /shell bank which extends across to the east. The spit has a gently sloping sand beach to the south while the central area is raised and sparsely vegetated. To the north there are exposed mudflats which grade to saltmarsh. This range of habitats provide ideal feeding and nesting grounds for shorebirds, and this is known as an important site due to the variety of species it attracts. Refer to section 3.2.1 for more information regarding the bird species found at this site.

Vegetation along the narrow spit can be seen in the photo below (Figure 4). Coastal needle tussock was abundant with occasional knobby clubrush, flax, small-leaved pohuehue, shore bindweed (*Calystegia soldanella*) and the exotic coastal orache (*Atriplex prostrata*). Weeds observed on or near the spit included moth plant, some kikuyu, climbing asparagus and small clumps of controlled pampas.



**Figure 4. Vegetation along the narrow spit at Te Matuku Bay**

There is a smaller shell bank complex at the end of the spit, which starts from the eastern end of the bay. Vegetation consisted of saltmarsh ribbonwood, manuka, coastal needle tussock, sea rush and flax.

#### **Carex-raupo swamp**

Areas of freshwater wetland only occurred in a few locations within the area surveyed around Te Matuku Bay, as the vegetation sequence generally graded straight from coastal bush to saltmarsh or mangrove.

Adjacent to the Waiheke Cemetery Reserve there was small raupo patch and to the east there was a small gully with a carex dominated wetland. Wetland species included *Carex lessoniana*, *Machaerina juncea*, sharp spike sedge (*Eleocharis acuta*), small-leaved pohuehue, *Schoenoplectus tabernaemontani*, *Carex secta*, shore lobelia (*Lobelia anceps*), NZ blueberry (*Dianella nigra*), *Machaerina rubiginosa* and bindweed sp. (*Calystegia* sp.- probably hybrid).

To the east of Orapiu Road (on private land) there was a good example of interesting saltmarsh vegetation grading into an extensive area of raupo swamp which continues further east into several tributary arms.

Behind the narrow spit there were three main areas of freshwater wetland, which are on Te Matuku Esplanade Reserve and extend into DOC reserve land. These areas exhibit an excellent example of an intact ecological succession from mudflats, to saltmarsh, to manuka scrub and then low canopy edge forest to mature coastal forest canopy. This range of intact habitats is becoming increasingly uncommon across the Auckland Region due to human-induced habitat fragmentation, modification and development.



At the western end there is a *Bolboschoenus* sp. dominated wetland (wetland 1) with frequent giant umbrella sedge (*Cyperus ustulatus*), *Carex lesssoniana*, *Carex secta* and bindweed sp. There was occasional NZ jasmine (*Parsonsia heterophylla*), *Schoenoplectus tabernaemontani* and bird's-foot-trefoil (*Lotus pedunculatus*). Infrequent tree species within the wetland included manuka, mapou and mahoe. This is a potentially interesting wetland (wetland 1), yet unfortunately it has serious weed invasion issues, namely moth plant and mist flower, (*Ageratina riparia*). Moth plant was scrambling over native vegetation and had mature pods, whilst mist flower was frequent throughout. At the bush edges to the north and east there is woolly nightshade present.



**Figure 5. View of Wetland 1, looking north from spit**



**Figure 6. Close-up of Wetland 1 - note moth plant and mist flower in foreground**



Heading east of wetland 1 there is another low-lying area which contains raupo swamp, named wetland 2. Raupo was sparsely spaced with *Carex lesssoniana*, bindweed sp. and *Schoenoplectus tabernaemontani*. Shore lobelia and small-leaved pohuehue were occasional. *Machaerina juncea* and *Machaerina rubiginosa* occurred at the edges of the wetland. There was also a *Carex lesssoniana* dominated arm with *Machaerina rubiginosa*.



**Figure 7. Raupo dominated swamp at Wetland 2**

Opposite the end of the sandspit there is a gully that drains down to the bay and in this area another freshwater wetland occurred. This was referred to as wetland 3 and varied in character. To the south this wetland was raupo dominated with frequent bindweed sp. and some giant umbrella sedge. At the edges small-leaved pohuehue and shore lobelia occurred. To the north the wetland was dominated by *Carex lesssoniana* and giant umbrella sedge, which graded into bracken (*Pteridium esculentum*) at the edges. At the back of the wetland towards the bush edge there were woolly nightshade and moth plant present. Also there was a single pampas clump in front of the wetland.





**Figure 8. Raupo wetland at southern end of wetland 3**



**Figure 9. Northern end of wetland 3 is dominated by *Carex lessoniana***



## Coastal shrubland and forest

Coastal shrubland and forest were found along higher ground adjacent to the estuary at Te Matuku Bay.

### Waiheke Pioneer Cemetery to Stockyard Reserve

The shrubland had a dry gumland species vegetation character, which suggests that there was historically kauri present at this site. Kanuka, mapou, tanekaha, kowhai and lancewood were present in the canopy. Prickly mingimingi, koromiko, akepiro, hangehange, shining karamu, bracken and gahnia sp. were frequent in the understorey. Cordyline banksii, rangiora and tauhinu (*Pomaderris amoena*) were rare. There were a good range of ferns including: kidney fern (*Cardiomanes reniforme*), hanging spleenwort (*Asplenium flaccidum*), sickle spleenwort (*Asplenium polyodon*), Hounds tongue (*Microsorium pustulatum subsp. pustulatum*) and kiokio (*Blechnum novae-zelandiae*).

There were limited weed species present, apart from along the road edges. There was some gorse, woolly nightshade, smilax, montbretia and pampas recorded.

### Te Matuku Point Lane Peninsula

At Te Matuku Point Lane peninsula the regenerating bush was dominated by kanuka. The understorey consisted of ponga, mapou, hangehange, mahoe, manuka and *Coprosma rhamnoides*. The ground cover was relatively sparse apart from patches of rasp fern (*Doodia australis*).

Along the coastal edge there were extensive moth plant infestations which were covering native shrubs, as can be seen in the photo below (Figure 10). Frequent moth plant seedlings were seen. Woolly nightshade and climbing asparagus were common along the coast, with climbing asparagus density increasing upslope under the kanuka canopy. There was an open area near the small sand spit which was dominated by Kikuyu.



**Figure 10. Extensive moth plant infestations are present along the Te Matuku Point Lane peninsula**



### Esplanade Reserve adjacent to DOC land

Towards the end of the Te Matuku Point Lane peninsula the slope becomes steeper with pohutukawa, mapou, houpapa, kawakawa, lancewood, bracken and manuka. Gorse and woolly nightshade become more frequent, with some moth plant. The coastal environment changes to rocky shore. There is a particularly large mangeao tree (*Litsea calicaris*) at the end of the peninsula along the coastal edge (see photo below, Figure 11). Another medium sized mangeao and a sapling were also seen.



**Figure 11. Large Mangeao tree at end of Te Matuku Point Lane Peninsula**

Behind the spit there is a good example of coastal broadleaf forest which extends into the esplanade reserve. The canopy consists of mature kohekohe, taraire, puriri, kowhai and ponga. At the edge there is tawa, totara, pohutukawa and lancewood. The understorey contains nikau, tanekaha, karaka, mahoe, kawakawa, mapou and supplejack. The groundcover was relatively sparse and there were limited weeds, with only small amounts of moth plant and climbing asparagus noted at the edge.



**Figure 12. Mature coastal forest behind the narrow spit (Esplanade Reserve and DOC land)**

## 3.2 Fauna

### 3.2.1 Birds

Bird surveys were not carried out as part of site survey visits, yet several species were observed on site including: variable oyster catcher, pied stilt, spur-winged plover, kereru, kingfisher, white-faced heron, rosella, welcome swallow, bar-tailed godwit and dotterel sp. (probably NZ dotterel but only seen distantly).

Te Matuku Bay Wetland is known to provide important habitat for a range of shorebirds and potentially wetland birds, due to the diversity of wetland and estuarine habitats. The combination of shell banks, sand spit, islands and mudflats are an uncommon feature and provide important feeding and nesting grounds. Ecological restoration will provide enhanced habitat and the animal pest control programme should particularly benefit bird populations.

The avifauna importance is described in the Auckland Council wetland prioritisation report (July 2012) as:

*'Te Matuku Bay is a flock site of international importance for the northern New Zealand dotterels, which are breeding successfully on the shell spits in the bay. A number of vulnerable and threatened endemic bird species use the bay as a breeding site and the wetland is considered to be the most important wader habitat on the Waiheke Island. The wetland system is home to two threatened species the spotless crane and banded rail, the wetland may also provide habitat for North Island fern bird (sightings have not been confirmed).'*

The Australasian bittern (or matuku), a rare wetland bird, has been recorded in the bay (DOC, 2005).

The following bird species are known from the Te Matuku Bay area (collated from DOC and Auckland Council information):

Bird species	Threat Classification, Townsend et al 2008
NZ dotterel	Nationally Vulnerable
banded dotterel	Nationally Vulnerable
caspian tern	Nationally Vulnerable
white fronted tern	Declining
reef heron	Nationally Vulnerable
variable oystercatcher	Recovering
South Island pied oystercatcher	Declining
turnstone	Migrant
wrybill	Nationally Vulnerable
brown teal (pateke)	Recovering
spotless crane	Relict
banded rail	Naturally Uncommon
Australasian bittern	Nationally Endangered
knot	Migrant

**Table 1. Threat classification for bird species known from Te Matuku Bay**

### 3.2.2 Fish

Fish surveys were not carried out as part of site visits and actual survey data is not available for many Waiheke Island locations. The diversity of wetland and estuary habitats present should have the potential to support native fish populations, and could provide breeding and feeding habitat. Inanga, short-finned and long-finned eels, kokopu, mud fish and bullies can be found in wetlands.



## 4 Ecological Restoration Planning

### 4.1 Site threats

Wetlands are fragile environments and are easily impacted by a range of effects. The main site threats (in no particular priority order) for Te Matuku Bay estuary and wetlands are:

- Sediment and run-off from adjacent roads, vineyard and farmland will lead to increased nutrients and sediment entering the wetland system.
- Invasion and spread of pest plants in the wetland, along coastal edge and from neighbouring land is restricting establishment and regeneration of native wetland vegetation.
- Potential modifications to catchment, such as removal of vegetation, infilling of channels or land use changes will negatively affect the wetland ecosystem.
- Presence of animal pests will be limiting the range and number of native birds using the wetland and wider estuary area for feeding, roosting and nesting.
- Stock accessing the wetland or coastal edge will lead to trampling of wetland vegetation, erosion and nutrient inputs.
- Dumping of rubbish and organic material will damage the wetland habitat.
- Pollution e.g. from oil or chemical spills, will lead to direct threats for wildlife and long-term residual effects for sediments and wetland vegetation.

### 4.2 Restoration priorities

The following ecological restoration priorities have been identified for Te Matuku Bay as part of this restoration programme:

1. Carry out a comprehensive programme of weed control to prevent pest plants invading:
  - Coastal bush adjacent to estuary (within Esplanade Reserve)
  - Coastal edges - bordering on saltmarsh and carex-raupo areas,
  - Areas of carex-raupo swamp habitat and associated wetlands,
  - Shell banks/ Sand spit & islands.
2. Establish an animal pest control programme around the edge of the wetland and coastal habitat, to protect bird, skink and invertebrate populations. This will also help to encourage natural regeneration of native seedlings. Mustelids and rodents will be target species.
3. Encourage neighbouring landowners to carry out ecological restoration tasks on their land, particularly weed control, animal pest control and appropriate native planting, to enhance the wider Te Matuku Bay area for native wildlife.

## 4.3 Monitoring

### 4.3.1 Restoration outcomes

It is important that outcomes of restoration efforts at Te Matuku Bay Wetland can be measured as the restoration project progresses. Success of the restoration work can then be monitored and changes in habitat quality can be recorded, and methodologies adjusted accordingly. This enables the ongoing support of the project to be justified to the local community, stakeholders and Auckland Council.

The following table shows the objectives that have been identified for the restoration programme, what action will be taken to achieve this and how success will be measured (Table 2).

**Table 2. Restoration outcome monitoring**

Objective	Action	Measure
1. To reduce the presence of pest plants through a comprehensive programme of weed control. This will lead to enhanced wetland habitat which will benefit local wildlife and will be able to carry out ecosystem services more effectively (such as sediment filtration and flood protection).	Initial pest plant survey in 2013. Repeat pest plant survey every 4 years.  Weed control – herbicide application and physical removal.	Vegetation population changes between initial pest plant surveys and repeat surveys over 5 year period.  Diversity of pest plants and amount of agrichemical use decreases over time.
2. To initiate an animal pest control programme around Te Matuku Bay to increase the diversity, survival and breeding success of native fauna - including birds, lizards and invertebrates.	Baseline animal pest survey to be carried out at start of project. Carry out annual animal pest surveys.  Set up Animal Pest Control - trapping, baiting for target animal pest species. Engage local people to be involved in this programme.  Initial native fauna survey 2013. Repeat survey in 5 years time.	Population changes between baseline animal pest surveys and repeat surveys over 5 year period.  Number of animals recorded in traps. Amount of bait take.  Population changes between initial and 5 year native fauna surveys. Observation of juveniles or breeding of native species. New species recorded.
3. To involve the local community in carrying out restoration tasks in order to foster local ownership of this site and raise awareness of the importance of wetland and coastal habitats.	Identify a key local contact willing to organize community involvement.  Set up a community trapping and baiting programme at the site which involves local volunteers.	Number of volunteers involved with animal pest control.  Hours spent on checking and monitoring traps and bait stations.

Objective	Action	Measure
4. To encourage neighbouring landowners to carry out ecological restoration tasks on their land, particularly weed control, animal pest control and appropriate native planting, to enhance the adjacent wetland areas.	<p>Pest control – plant and animal undertaken on surrounding private land.</p> <p>Hold riparian/ wetland management and pest control workshops for private landowners.</p>	<p>Increase in private pest control and native planting projects on neighbouring land.</p> <p>Increase in the number of private landowners (from land surrounding Te Matuku Bay) seeking support and advice for ecological restoration from council.</p> <p>Number of pest control and riparian / wetland restoration workshops held.</p>

### 4.3.2 Animal pest control

As stated above, a baseline animal pest survey will be undertaken at the start of the restoration project. It is likely that rat and stoat populations are high in the wider area due to available habitat. There is an established network of bait stations in the DOC reserve and behind the spit, yet it seems that these have not been maintained recently.

It is recommended that animal pest control monitoring is undertaken on an annual basis, as this is beneficial for gauging whether bait control and trapping is reducing animal pest populations. This should be carried out in August or early September before the annual baiting round begins.

### 4.3.3 Native fauna survey

Auckland Council biodiversity team have recommended that surveys for wetland bird species, freshwater fish and stream invertebrate species are ideally undertaken at the start of the restoration programme. This will provide baseline data on the native animals using the current habitat and enable the same survey to be repeated in 5 years to measure if change has occurred and hopefully show improvements. Baseline monitoring allows the success of the restoration efforts to be measured and be meaningful to the community.

It is best practice to undertake baseline monitoring yet there are also cost implications and time constraints involved with undertaking native fauna surveys. Auckland Council biodiversity staff will investigate whether it is feasible to undertake fauna surveys immediately using in-house staff or contractors.

### 4.3.4 Weed control

A useful method for monitoring the effectiveness of weed control is to set up photopoint monitoring at various locations. Fixed point photography is undertaken at the start of weed control operations and then at regular intervals to show change in weed density and recovery of the surrounding vegetation.

When weed control visits are undertaken the species of weeds targeted and the amount of agrichemicals used should be recorded, as this data can be used to show a reduction in weed issues at specific sites over time.



## 5 Ecological Restoration Approach

### 5.1 Weed Control

A long-term programme of weed control is required at Te Matuku Wetland to reduce the presence of pest plants, which are invading wetland areas and restricting natural regeneration through competing for light and nutrient resources. Weed control will enhance the habitat quality of these important wetland areas, by allowing native plant diversity to increase. This will provide wide ranging benefits for native wildlife, including providing feeding and nesting habitat for birds, lizards and invertebrates.

Limited weed control has been undertaken at Te Matuku e.g. along coastal edge at Te Matuku Point Lane and DOC land. Yet there are dense infestations of weed in a number of areas. Weeds invading into the edges of raupo and saltmarsh areas, and the coastal shrubland are of particular concern.

Initial weed control requires a higher input of effort to start tackling weed issues. Then ongoing weed control visits will be needed (at least two to three visits per year for each site) over a number of years, to control regrowth and reduce the impact of weeds.

#### 5.1.1 Methodology

It is recommended that the 'forest restoration framework', which was developed by Te Ngahere, is used to address a site-led weed control approach at Te Matuku Wetland. This framework is necessary to achieve a targeted approach that focuses efforts in an effective and efficient manner, and can also be applied to wetland habitats.

The framework aims to restore native habitats by controlling invasive weeds in a manner which minimises the use of herbicides and ultimately creates an ecologically viable and self sustaining system. The programme works from initial weed control, to follow-up maintenance and progresses to the seedbank being monitored and then onto forest protection phase to limit re-invasion of weeds from neighbouring seed sources. Supplementary phases are needed for Tradescantia control and where gradual removal of weeds is required, for example if there is an erosion risk. The following table summarises the main phases of the 'forest restoration framework' (Table 3).

**Table 3. Description of restoration framework phases**

<b><i>Framework Phase</i></b>	<b><i>Description</i></b>
Initial Control	Initial control targets all plants and aims to eliminate plant pest reproduction within the site. This is achieved by cut stump application and following with an initial foliar spray application.
Follow Up Control	Follow up control targets all plants that were missed or failed to die due to numerous factors. If this phase is implemented in spring and autumn, usually only one calendar year is required to achieve this objective.

<b>Framework Phase</b>	<b>Description</b>
Seedbank Control	The seedbank control phase begins when all existing plants have been eliminated. Seedbank control targets the remaining seed in the soil layer. This phase needs implementation once a year in mid-summer to be effective. Implementation at this time allows for spring germination and enough biomass production for effective control. The duration of this phase is dependent on the seed viability of the targeted plant. It is commonly 2-4 years.
Forest (Wetland) Protection	The protection phase is achieved when all seeds and seed sources are eliminated from the area. This phase is focussed on the prevention of plants establishing from incoming seed from adjacent areas. This is required to prevent a site from slipping back to the start of the process.

It is recommended that the majority of weed control is undertaken by qualified contractors due to the variety and extent of weed issues that exist across the varied wetland habitats, which require spraying to be tackled effectively. All contractor field staff need to hold the Introductory Growsafe Certificate and ERMA Approved Handlers test certificates, and be trained in chemical application for weed control. Agrichemical management and application must adhere to NZS 8409:2004 "Management of Agrichemicals" and policies in Auckland Regional Air, Land and Water Plan.

A Lowest Toxicity Policy should be used which aims to minimise risk to users and the environment, by using herbicide with the lowest toxicity that is effective for the weed species being targeted. Extra caution is required with use of agrichemicals in wetlands and near waterways and only appropriate herbicides approved for use over the water must be used.

### **5.1.2 Weed control priorities**

A long-term programme of weed control is required at Te Matuku Wetland to reduce the presence of pest plants, which are invading wetland and coastal areas and restricting natural regeneration through competing for light and nutrient resources. Weed control will enhance the habitat quality of these important wetland areas, by allowing native plant diversity to increase. This will provide wide ranging benefits for native wildlife, including providing feeding and nesting habitat for birds, lizards and invertebrates.

In order to tackle weed control in a targeted approach at Te Matuku Wetland, weed control should be carried out in priority wetland areas as funds allow, according to priorities identified in Table 4. For ease of management, the site has been divided into Management Units according to location (refer to Figure 15).

Priority wetlands areas at Te Matuku (identified in Section 4.2 Restoration Priorities) include:

- Coastal bush adjacent to estuary (within Esplanade Reserve),
- Coastal edges - bordering on saltmarsh and carex-raupo areas,
- Areas of carex-raupo swamp habitat and associated wetlands,
- Shell banks/ Sand spit & islands.

The serious moth plant infestations along the Te Matuku Point Lane block (northern coastal edge) should be tackled as a priority at the start of the restoration programme.

For general management recommendations regarding adjacent private land see Section 5.5



**Table 4. Prioritisation of weed control at Te Matuku Bay on Auckland Council managed land**

<b>Management Unit</b>	<b>Habitats</b>	<b>Weed issues</b>	<b>Priority</b>	<b>Approach</b>
<b>Cemetery – stockyard block</b>	Saltmarsh	Generally weed free. Weed issues next to roadside include woolly nightshade, kikuyu grass and gorse.	Medium	Weeds near roadside are visible and should be controlled.
	Coastal Shrubland / Forest (gumland species)	Minimal weed issues in bush. Occasional weeds along roadside including gorse and pampas, plus dumped garden waste of montbretia and smilax.	Medium	Weed issues are mainly along bush edge or road and can be dealt with easily.
	Shell Banks & Islands	Central island in middle of estuary (could not be visited during survey) Probably limited weeds due to isolation.	Low	Avoid disturbance to shell banks and islands during bird breeding season. Access to large island is difficult due to wide permanent channels and mudflats (very tidal). Consider weed control visit in future using kayaks or boat.
<b>Orapiu road block</b>	Coastal Treeland – quite open understorey	Occasional weeds in open areas include pampas, woolly nightshade, inkweed, moth plant, Himalayan honeysuckle.	Medium	Weed issues are scattered but not spreading rapidly so can be controlled early on in restoration programme.
<b>Te Matuku Point Lane block</b>	Coastal Shrubland / Forest	Serious moth plant infestations throughout bush edge, covering native vegetation. Also more occasional climbing asparagus, woolly nightshade and gorse along coastal edge. Further upslope climbing asparagus becomes denser in places.	High	Moth plant control has been unsuccessful in past due to wrong chemical use (Glyphosate) and/or not frequent enough visits. 3 visits per year are required (spring, summer and autumn) and chemical suited to control of woody weed species (Metsulfuron) is needed to significantly reduce moth plant infestation. Repeated visits will be needed over a number of years due to density of vines and extensive seedbank and. Other weeds should be targeted at same time. Access to site is difficult and requires long walking distance.

Site	Habitats	Weed issues	Priority	Approach
<b>Peninsula block</b>	Coastal Shrubland / Forest	Moth plant, gorse, woolly nightshade, pampas scattered to dense – some control carried out.	Medium	Access is difficult in places due to steep slopes and cliffs. Weeds should be controlled where possible and there is no risk of erosion. This block borders on DOC land. This site could be accessed from end of Te Matuku Point Lane using 4WD.
<b>Sandspit block</b>	Coastal Forest	Limited weed issues. Occasional small amounts of climbing asparagus in bush, and moth plant near edge.	Medium	Weed issues relatively sparse and should be controlled at start of restoration programme to protect interesting coastal forest habitat.
	Wetland areas (carex-raupo swamp)	Wetland areas along coast have some weed issues, including moth plant and mist flower. Woolly nightshade and pampas occur at edge.	High	There are several good examples of wetlands grading into saltmarsh environment, which should be restored. Significant effort required to control weeds in wetlands due to remote location. Repeat visits required.
	Sandspit and shell banks	Small amounts of moth plant, climbing asparagus, pampas, Kikuyu occurred occasionally - otherwise limited weeds.	Medium	Avoid disturbance to shell banks and islands during bird breeding season. Limited weed issues can be targeted relatively easily, yet site is relatively remote.



## 5.2 Animal Pest Control

Rodent and stoat control at Te Matuku Wetland should be considered as an integral part of the restoration plan. Before deciding to establish an animal pest control programme the following questions need to be asked:

- What is the initial pest population?

Baseline animal pest monitoring using tracking tunnels is recommended, and then monitoring should be undertaken annually.

- Is the initial pest population likely to be affecting native biodiversity at the site and what is the outcome of successful pest control?

A variety of monitoring can be used to assess the effects of pests and to determine the results of pest control, e.g. vegetation plot monitoring, photo points, bird counts and observation, lizard monitoring. Animal pest control at Te Matuku will be particularly aiming to protect native wetland bird and shorebird populations.

The desired strategy for delivery of pest control at Te Matuku is:

- Auckland Council engages local community for support
- Local volunteers are recruited and key contact established
- Contractor conducts initial animal pest monitoring
- Auckland Council to assess scope of carrying out biodiversity monitoring
- Pest control network is set-up, once new walkway at Te Matuku Bay is established
- Maps and signage produced
- Volunteers are trained
- Volunteers maintain regular bait and trap servicing and record results
- Results provided to local co-ordinator for collating and reporting back to group and Auckland Council

### Rodent and Mustelid Control

An animal pest control programme should be established on council land at Te Matuku Bay to protect shorebird habitat and increase nesting success. A network of bait stations exist on DOC reserve land and behind the sand spit (see photo below of bait station in situ, Figure 13), but have not been maintained recently. The trap and bait station network should be extended to target rodents and mustelids. It is recommended that bait stations and traps are only installed once the track has been cut for the proposed walkway, as this will enable easier access and reduce time requirements.



**Figure 13. Existing bait station behind narrow spit at Te Matuku**

Sidekick tamper-proof rodent bait stations should be placed at 50m intervals along the margin of the wetland. Anticoagulant rodent baits can be secured in these stations making them safe from interference from children and pets. Bait stations are placed on the ground, fixed to trees. Bait stations would be numbered and their location recorded and marked on a map.

Stations would be pulse baited at monthly intervals throughout the spring and into the autumn to protect nesting and fledging birds. At other times of the year the baiting interval can be made longer.

For mustelid control, DOC 200 traps are recommended. These are placed at 200m intervals and baited with long life rabbit lure. The traps are mounted inside a sturdy wooden box with a mesh baffle at the end to prevent access by birds.

### **Safety**

Hazardous Substances and New Organisms (HSNO) regulations require warning signs to be placed at all major public entrance areas around the wetland. These will state the type of toxin, emergency phone numbers, the dates bait is to be present and contact names and phone numbers. All volunteers involved in animal pest control and monitoring should attend an animal pest control training workshop run by a suitably experienced person, so that they are aware of health and safety requirements.

## **5.3 Restoration Planting**

No restoration planting has been identified as part of this restoration programme, as natural regeneration should be allowed to occur from surrounding seed sources.

In future if gaps are created, e.g. kikuyu area at end of Te Matuku Point Lane is controlled, then restoration planting could be considered.

## **5.4 Community participation**

Local community engagement and volunteer involvement are an essential part of the Te Matuku Wetland ecological restoration programme. There is a high level of interest in the future management of Te Matuku Bay and the surrounding area. Through engagement in this restoration programme locals can develop a sense of community stewardship and increase their understanding of this important environmental area, especially of wetland habitats.

Restoration tasks that are ideally suited to volunteers and would make a significant contribution to this project include animal pest control and biodiversity monitoring e.g. birds, lizards and wetland quality. There is also the opportunity to get school groups, scout groups, youth groups etc. involved in education opportunities.



## 5.5 Recommendations for adjacent private land

At Te Matuku there is an intact wetland system from freshwater tributaries to areas of carex-raupo wetland, to saltmarsh and mangroves in the estuary – this range of connected habitats is increasingly becoming rare. The successful management of this wetland (freshwater and saltwater) requires all landowners and lessees to take a pro-active part in protecting and enhancing the wetland habitats present, as negative effects in one area will have a knock-on effect for the whole wetland system.

The following recommendations are given for leased and private land adjacent to Te Matuku Bay Estuary:

- Appropriate ecological restoration is encouraged to protect and enhance the range of wetland habitats present, as well as ensuring no loss or damage to wetlands through any operations.
- Run-off into the wetland habitats, such as from sediment, waste water and fertilizers, should be prevented or restricted through appropriate controls (which need to be regularly monitored for effectiveness). Operations that will have a negative impact on wetlands should not be carried out.
- Flow of water into the estuary should not be restricted through man-made features (where possible), such as culverts and weirs, and fish passage needs to be maintained or re-instated in all situations.
- Livestock (including cattle, sheep and horses) should be prevented from entering wetland habitats, including saltmarsh and raupo, through installation and maintenance of stock fences.
- Weed control along tributaries, wetland features and coastal edge adjacent to the estuary should be carried out to prevent the spread of weeds and enable native vegetation to regenerate. Effective weed control requires repeat visits at appropriate intervals. Auckland Council should raise awareness amongst landowners of weed issues and encourage appropriate weed control methods.
- Weed control should also be encouraged and undertaken in the wider catchment in wetland and bush areas. Land owned by Department of Conservation directly behind the Te Matuku Esplanade Reserve is a priority for future weed control. As is the land in private ownership which is adjacent to the peninsula and esplanade reserve. Encouragement and support from Council to these landowners to control weeds is important to stop the spread of weeds to management areas. Future areas to consider for weed control in the greater catchment include upstream areas of the tributary that feeds the wetland along Orapiu Rd (including 270 Orapiu Road).
- Wetland and coastal edge habitat (on private land) could be extended through planting of appropriate native species, which will create a buffer to wetland areas.
- Animal pest control (particularly targeting rodents and mustelids) is encouraged along the wetland and estuary edge and in adjacent bush areas, to tie up with the planned animal pest control programme on Auckland Council managed land. Auckland Council should discuss with Department of Conservation the possibility of reactivating the pest control bait and trap lines on reserve land behind the peninsula, as the peninsula is a priority for protection of bird species nesting in the area.

## 6 Restoration Timeline and Costs

### 6.1 Restoration Timeline

The following restoration timeline has been developed following the recommendations for wetland habitat prioritisation in this restoration plan, yet a flexible approach will need to be taken and adjustments made as the work plan is reviewed regularly. The progress of the restoration programme is dependent on a number of factors, such as the amount of funding available, the continuity of funding, the progression of weed control, successful project management, and the volunteer capacity available.

Refer to Table 7 for restoration timeline.

### 6.2 Restoration Costs

The following costs are an approximation and indicative only. Further discussions and site visits will be required to agree a specific programme of work and the required methodologies.

#### 6.2.1 Animal Pest Control

##### Year 1

Baseline monitoring for animal pests (rodents and mustelids) and planning

**Estimated cost \$7,500.00**

Establishment of animal pest control network, including volunteer training day

**Estimated cost \$17,000.00**

##### Years 2 - 5

It is anticipated that volunteers will carry out checking and maintenance of animal pest control traps and bait stations, under the guidance of Waiheke Parks Ranger. There will be ongoing costs for bait, stoat lure, and tracking ink cards and if any equipment needs replacing.

**Indicative ongoing annual animal pest control cost  
\$5,000.00**

#### 6.2.2 Weed Control

The following costs are indicative only and are based on assumptions made regarding delivery of the proposed schedule of works.

It is recommended that a team of 4 field staff carry out weed control, which allows for more effective grid-searching for weeds and coverage of areas.

Costs increase in year two (and in some cases in year 3) as weed control is undertaken in more management units and there are more frequent visits in existing units. Then costs start to steadily decrease as density of weeds reduces over time. Depending on funds available weed control may have to progress more slowly, with work started in fewer management units. It is important to follow-up work in management units in following years to prevent regrowth of weeds, rather than starting initial control at multiple sites if continued funding is not guaranteed.

Refer to table Table 5.

**Table 5. Indicative weed control costs for 5 year period at Te Matuku Bay**

Management Unit	Year 1 (2012/2013)	Year 2 (2013/2014)	Year 3 (2014/2015)	Year 4 (2015/2016)	Year 5 (2016/2017)
<b>Cemetery – stockyard block</b>	\$7,000	\$6,500	\$5,000	\$4,000	\$3,500
<b>Orapiu Road block</b>	\$4,500	\$7,500	\$4,000	\$3,500	\$3,500
<b>Te Matuku Point Lane block</b>	\$10,500	\$21,000	\$16,500	\$14,000	\$9,000
<b>Peninsula block</b>	\$0	\$8,000	\$16,500	\$10,000	\$8,500
<b>Sandspit block</b>	\$0	\$18,000	\$14,000	\$9,500	\$8,500
<b>Total Indicative Weed Control Cost</b>	<b>\$22,000</b>	<b>\$61,000</b>	<b>\$56,000</b>	<b>\$41,000</b>	<b>\$33,000</b>

### 6.2.3 Overall programme costs

This table summarises indicative overall restoration programme costs based on the full scope of recommended works in restoration plan.

**Table 6. Summary of Te Matuku Bay restoration programme indicative costings over 5 year period**

Restoration Task	Year 1 (2012/2013)	Year 2 (2013/2014)	Year 3 (2014/2015)	Year 4 (2015/2016)	Year 5 (2016/2017)
<b>Baseline animal pest control monitoring</b>	\$7,500	\$0	\$0	\$0	\$0
<b>Baseline native fauna surveys – scope to be confirmed by Auckland Council biodiversity staff</b>	TBC – biodiversity staff to investigate costs	TBC	\$0	\$0	TBC – repeat surveys
<b>Establishment of animal pest control programme</b>	\$17,000	\$0	\$0	\$0	\$0
<b>Ongoing animal pest control costs</b>	\$0	\$5,000	\$5,000	\$5,000	\$5,000
<b>Weed control</b>	\$22,000	\$61,000	\$56,000	\$41,000	\$33,000
<b>Planting</b>	\$0	\$0	\$0	\$0	\$0
<b>Total Indicative Cost by Year</b>	<b>\$46,500</b>	<b>\$66,000</b>	<b>\$61,000</b>	<b>\$46,000</b>	<b>\$38,000</b>



**Table 7. Restoration Timeline for weed control at Te Matuku Wetland over 5 year restoration period**

	Year 1 Financial Year 2012/ 2013		Year 2 Financial Year 2013/ 2014				Year 3 Financial Year 2014 / 2015				Year Financial Year 2015 / 2016				Year 5 Financial Year 2016/ 2017			
Management Unit	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter
Cemetery - stockyard block	Initial	Initial	Follow-up		Follow-up			Seedbank				Seedbank				Seedbank		
Orapiu road block	Initial	Initial	Follow-up		Follow-up			Seedbank				Seedbank				Seedbank		
Te Matuku Point Lane block	Initial	Initial	Follow-up	Follow-up	Follow-up		Follow-up	Follow-up	Follow-up		Follow-up	Follow-up	Follow-up		Follow-up		Follow-up	
Peninsula block						Initial	Follow-up	Follow-up	Follow-up		Follow-up		Follow-up		Follow-up		Follow-up	
Sandspit block			Initial	Follow-up	Follow-up	Follow-up	Follow-up	Follow-up	Follow-up		Follow-up		Follow-up		Follow-up		Follow-up	

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## 8 Appendix

**Table 8. Native species recorded during Te Matuku Wetland site survey**

Common Name	Latin Name	Notes
akepiro	<i>Olearia furfuracea</i>	
bolboschoenus	<i>Bolboschoenus sp.</i>	probably <i>B.medianus</i> and <i>B.fluviatilis</i> on site
bracken	<i>Pteridium esculentum</i>	
cabbage tree	<i>Cordyline australis</i>	some planted
clubrush sp.	<i>Isolepis sp.</i>	small <i>Isolepis sp.</i>
coastal coprosma	<i>Coprosma macrocarpa</i>	
coastal houpara	<i>Pseudopanax lessonii</i>	
five-finger	<i>Pseudopanax arboreus</i>	
flax / harakeke	<i>Phormium tenax</i>	
gahnia sp.	<i>Gahnia sp.</i>	
giant umbrella sedge	<i>Cyperus ustulatus</i>	
glasswort	<i>Sarcocornia quinqueflora subsp. quinqueflora</i>	shell banks & islands, coastal edge
gully fern	<i>Pneumatopteris pennigera</i>	
haloragis	<i>Haloragis erecta</i>	
hangehange	<i>Geniostoma ligustrifolium var. ligustrifolium</i>	
hanging spleenwort	<i>Asplenium flaccidum</i>	
hook grass sp.	<i>Uncinia sp.</i>	
hounds tongue	<i>Microsorium pustulatum subsp. Pustulatum</i>	
kahikatea	<i>Dacrycarpus dacrydioides</i>	seedling only
kanuka	<i>Kunzea ericoides var. ericoides</i>	
karaka	<i>Corynocarpus laevigatus</i>	
karamu	<i>Coprosma robusta</i>	
karo	<i>Pittosporum crassifolium</i>	some planted
kauri	<i>Agathis australis</i>	
kawakawa	<i>Macropiper excelsum subsp. excelsum</i>	
kidney fern	<i>Cardiomanes reniforme</i>	
kiokio	<i>Blechnum novae-zelandiae</i>	
knobby club rush	<i>Ficinia nodosa</i>	
kohekohe	<i>Dysoxylum spectabile</i>	
koromiko	<i>Hebe stricta var. stricta</i>	
kowhai	<i>Kowhai sp.</i>	
kuawa	<i>Schoenoplectus tabernaemontannii</i>	
lancewood	<i>Pseudopanax crassifolius</i>	
mahoe	<i>Melicytus ramiflorus</i>	
mamaku	<i>Cyathea medullaris</i>	



Common Name	Latin Name	Notes
mangeao	<i>Litsea calicaris</i>	
mangrove	<i>Avicennia marina subsp. australasica</i>	
manuka	<i>Leptospermum scoparium var. scoparium</i>	
mapou	<i>Myrsine australis</i>	
native broom	<i>Carmichaelia sp.</i>	
native celery	<i>Apium "white denticles"</i>	unnamed native celery similar to <i>Apium prostratum</i> subspecies (confirmed by Ewen Cameron, Auckland Museum)
needle tussock	<i>Austrostipa stipoides</i>	shell banks & islands, coastal edge
nikau	<i>Rhopalostylis sapida</i>	
NZ blueberry	<i>Dianella nigra</i>	
NZ jasmine	<i>Parsonsia heterophylla</i>	
oi oi	<i>Apodasmia similis</i>	saltmarsh, coastal edge
pohutukawa	<i>Metrosideros excelsa</i>	
ponga / silver fern	<i>Cyathea dealbata</i>	
prickly mingimingi	<i>Leptecophylla juniperina subsp. juniperina</i>	
pukio	<i>Carex virgata</i>	
purei	<i>Carex secta</i>	
puriri	<i>Vitex lucens</i>	
rangiora	<i>Brachyglottis repanda</i>	
rasp fern	<i>Doodia australis</i>	
raupo	<i>Typha orientalis</i>	
rautahi	<i>Carex lessoniana</i>	
rewarewa	<i>Knightia excelsa</i>	
rosy maidenhair	<i>Adiantum hispidulum</i>	
saltmarsh ribbonwood	<i>Plagianthus divaricatus</i>	coastal edge
sea primrose	<i>Samolus repens</i>	saltmarsh edge
sea rush	<i>Juncus kraussi var. australiensis</i>	saltmarsh
selliera	<i>Selliera radicans</i>	saltmarsh edge
sharp spike sedge	<i>Eleocharis acuta</i>	
shining karamu	<i>Coprosma lucida</i>	
shore bindweed	<i>Calystegia soldanella</i>	
shore lobelia	<i>Lobelia aniceps</i>	
sickle spleenwort	<i>Asplenium polyodon</i>	
small Coprosma species	<i>Coprosma sp.</i>	Possibly <i>C.spathulata</i> and <i>C.arborea</i> present
small-leaved pohuehue	<i>Muehlenbeckia complexa</i>	
supplejack	<i>Ripogonum scandens</i>	
sweet fern	<i>Pteris macilenta</i>	
tall mingimingi	<i>Leucopogon fasciculatus</i>	
tanekaha	<i>Phyllocladus trichomanoides</i>	

Common Name	Latin Name	Notes
taraire	<i>Beilschmiedia tarairi</i>	
tauhinu	<i>Pomaderris amoena</i>	
taupata	<i>Coprosma repens</i>	some planted
tawa	<i>Beilschmiedia tawa</i>	
totara	<i>Podocarpus totara</i>	
wiwi	<i>Juncus edgariae</i>	
	<i>Cordyline banksii</i>	
	<i>Collospermum sp.</i>	
	<i>Coprosma rhamnoides</i>	
	<i>Machaerina rubiginosa</i>	
	<i>Machaerina juncea</i>	formerly <i>Baumea juncea</i>
	<i>Oplismenus hirtellus</i>	

This native species list was compiled during a two-day site survey visit (carried out by M.Dublon and K. Denny on 31/1/2013 and 1/2/2013) and therefore is not exhaustive. Other species will be present and further botanical survey is recommended to form a more comprehensive native plant list over time.

**Table 9. Weed species recorded during Te Matuku Wetland site survey**

Common Name	Latin Name	Auckland RPMS Designation
agapanthus	<i>Agapanthus orientalis</i>	
mist flower	<i>Ageratina riparia</i>	Surveillance
moth plant	<i>Araujia hortorum</i>	Surveillance
climbing asparagus	<i>Asparagus scandens</i>	Surveillance
bindweed sp.	<i>Calystegia sp. - hybrid</i>	
gorse	<i>Ulex europaeus</i>	Surveillance / Containment (boundary control)
Himalayan honeysuckle	<i>Leycesteria formosa</i>	Surveillance
kikuyu grass	<i>Pennisetum clandestinum</i>	
macrocarpa	<i>Cupressus macrocarpa</i>	
montbretia	<i>Crocasmia x crocosmiiflora</i>	Surveillance
pampas	<i>Cortaderia selloana/jubata</i>	Surveillance
smilax	<i>Asparagus asparagoides</i>	
tradescantia	<i>Tradescantia fluminensis</i>	Surveillance
woolly nightshade	<i>Solanum mauritianum</i>	Surveillance / Containment (boundary control)
buffalo grass	<i>Stenotaphrum secundatum</i>	
inkweed	<i>Phytolacca octandra</i>	
grey sedge	<i>Carex divulsa</i>	Surveillance
RPMS = Auckland Regional Pest Management Strategy 2007-2012 designation for pest plants		

**Table 10. Other exotic species recorded at Te Matuku Wetland**

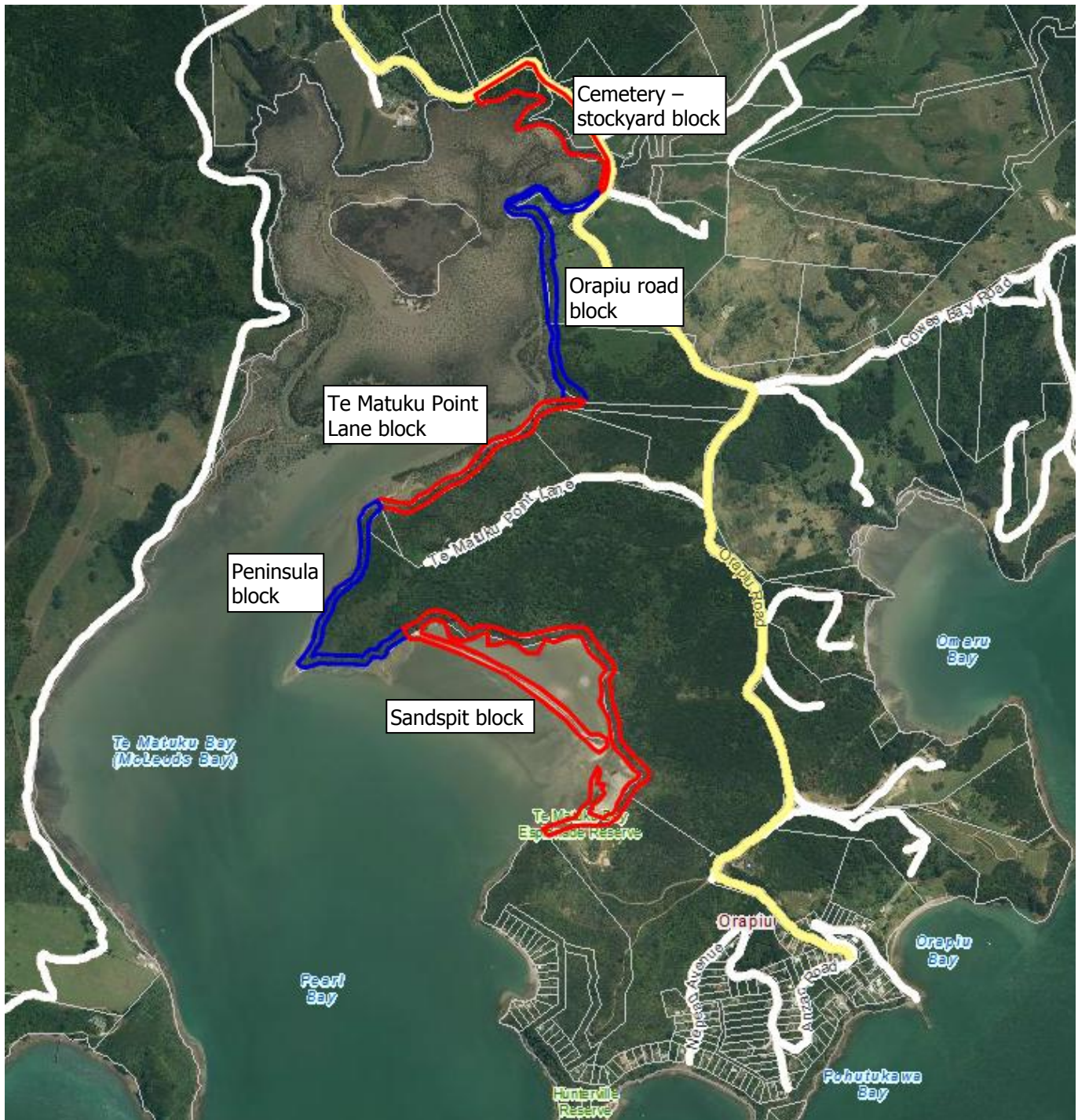
Common Name	Latin Name
rose sp.	<i>Rosa sp.</i>
scarlet pimpernel	<i>Anagallis arvensis subsp. arvensis var arvensis</i>
bird's-foot-trefoil	<i>Lotus pedunculatus</i>
paspalum	<i>Paspalum dilatatum</i>
spear thistle	<i>Cirsium vulgare</i>
sweet vernal grass	<i>Anthoxanthum odoratum</i>
coastal orache	<i>Atriplex prostrata</i>
cock's foot grass	<i>Dactylis glomerata</i>





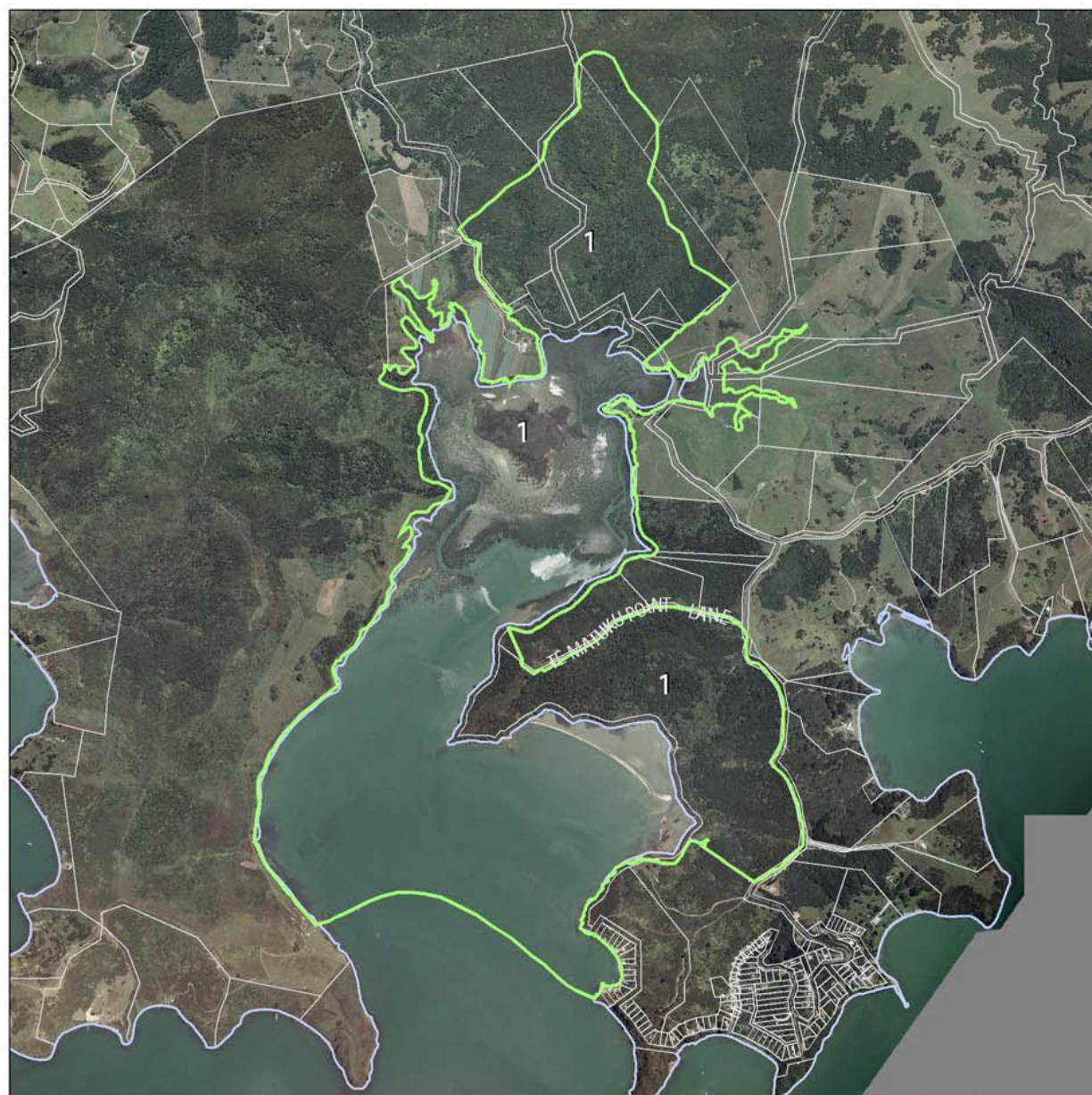
**Figure 14. Map showing location of habitat types at Te Matuku Bay**





**Figure 15. Map showing Management Units at Te Matuku Bay**





Ecology	Name of item: Te Matuku Bay Complex	Map reference: 18-9
Island: Waiheke	SES 1 (Site of Ecological Significance)	
Description of Item		
<p>Te Matuku Bay is a flock site of international importance for northern New Zealand dotterels (which are classed as nationally vulnerable). The NZ dotterels also breed here. The threatened Caspian tern (nationally vulnerable) breeds here. Variable oystercatchers, an endemic species, nest along the coast. The coastal areas are used by reef herons, a nationally vulnerable species. In summer, several hundred Arctic migrants, such as the bar-tailed godwit or kuaka, feed on the tidal flats at low tide or roost along the beaches at high tide. The wetlands are home to two species that are sparse nationally, the spotless crane and the banded rail. The coastal and wetland systems grade into a forested catchment, which supports a variety of forests ranging from taraire and kohekohe forest in the gullies up to kauri / tanekaha forests with hard beech on the ridges.</p>		

**Figure 16. SES 1 Description from Auckland City District Plan - Hauraki Gulf Islands Section - Proposed 2006**