Key Native Ecosystem Operational Plan for Whangaimoana Coast

2025-2030

Contents

1. Purpose

The purpose of this five-year Key Native Ecosystem (KNE) operational plan for Whangaimoana Coast KNE site is to:

- Identify the parties involved in preparing and delivering the operational plan
- Summarise the ecological values of the site and identify the threats to those values
- Outline the vision and objectives that guide management decision-making
- Describe the operational activities undertaken to improve ecological conditions (eg, ecological weed control), who will undertake the activities and the allocated budgets.

KNE operational plans are reviewed every five years to ensure the activities undertaken to protect and restore the KNE site are informed by experience and improved knowledge about the site. The KNE operational plan is aligned to key policy documents outlined in Appendix 1.

2. Whangaimoana Coast Key Native Ecosystem site

The Whangaimoana Coast KNE site (33ha) is located at the end of Whangaimoana Beach Road, Palliser Bay in the South Wairarapa District (see Appendix 2, Map 1). The KNE site is a coastal area made up of various interconnected ecosystems including sand dunes, coastal wetland, riparian margins, estuarine habitat and coastal cliffs. The KNE site is of importance for several threatened species, primarily shorebirds. The majority of the KNE site is legally protected under a QEII National Trust (QEII) open space covenant.

The site is an important part of community ecological restoration efforts with a long history of community restoration planting. Whangaimoana Coast KNE site forms part of the Tonganui Corridor conservation network, a series of adjoining sites stretching from the Aorangi Forest Park to the Remutaka range. Immediately adjacent to the KNE site are a pest animal and pest plant control programme at Onoke Lagoon and Onoke Spit to the west and riparian revegetation programmes along Whangaimoana stream to the east.

3. Parties involved

There are several organisations, groups and individuals that play important roles in the care of the Whangaimoana Coast KNE site.

3.1. Landowner

The majority of the KNE site is on private land within the Moanatahi property, which is owned by Michael and Robyn Warren (see Appendix 2, Map 2). The Moanatahi portion of the KNE site has been fenced off and retired from stock grazing for several years since it was placed in a QEII open space covenant in 2009 by the former owner. The Warrens support biodiversity management activities being undertaken within the KNE site.

The beach and strand area of the KNE site is Crown land administered by the Department of Conservation (DOC). Whangaimoana Beach Road provides access to the site and is administered by South Wairarapa District Council (SWDC).

3.2. Operational delivery

Within Greater Wellington, three teams are responsible for delivering the Whangaimoana Coast KNE operational plan.

- The Environment Restoration team leads the strategic planning, funding and coordination of biodiversity management activities and advice within the KNE site.
- The Pest Plants and Pest Animals teams coordinate and implement ecological weed and pest animal control measures at the KNE site with funding from the Environment Restoration team's KNE programme budget.
- The Environmental Restoration team also provides advice to landowners on sustainable land use, soil conservation and water quality on land adjacent to the KNE site. These land use activities are aligned with the broader ecological goals of the KNE programme in general and the Whangaimoana Coast KNE operational plan in particular. Moanatahi farm has an active Farm Environment Plan (FEP) focused on reducing erosion and loss of soil, which has positive effects on water quality and the biodiversity values present in this KNE site.

QEII are a management partner, with 16.6ha of the KNE site legally protected by a QEII open space covenant (see Appendix 2, Map 3). QEII actions at the site include ecological weed control, restoration planting work and biennial site visits.

3.3. Mana whenua partners

Portions of the Whangaimoana Coast KNE site area are significant to Ngāti Kahungunu ki Wairarapa and Rangitāne o Wairarapa, who are mana whenua partners with Greater Wellington.

The Statutory Acknowledgements from the Rangitāne Tū Mai Rā (Wairarapa Tamaki nui-ā-Rua) Claims Settlement Act 2017[1] and the Ngāti Kahungunu ki Wairarapa Tāmaki nui-a-Rua Claims Settlement Act 2022[2] provide further details of the

associations that Ngāti Kahungunu ki Wairarapa and Rangitāne o Wairarapa have with Raukawa Moana (Cook Strait) Coastal Marine Area.

Greater Wellington is committed to identifying ways in which kaitiakitanga can be strengthened by exploring opportunities for mana whenua partners to participate in the development or delivery of KNE operational plans.

3.4. Stakeholders

The following organisations are considered stakeholders as they undertake conservation-centred work in adjacent areas.

DOC administers the Crown land within and immediately adjacent to the KNE site. While supportive of this operational plan they are not involved in its implementation.

The Aorangi Restoration Trust (ART) maintain a network of predator kill-traps in various locations along the South Wairarapa coast including near the KNE site. The vision of ART is to improve the biodiversity of the Aorangi Forest Park and surrounding areas, while maintaining opportunities for recreation and hunting. It is a community-led project with support from several groups and agencies, including Greater Wellington.

The South Wairarapa District Council (SWDC) maintains Whangaimoana Beach Road and part of the road-end inside the KNE boundary. They periodically remove dumped rubbish and have erected various signage at the end of the road about protecting biodiversity values.

The Wairarapa Moana Wetlands Project is a collaboration between Greater Wellington, DOC, SWDC, Ngāti Kahungunu ki Wairarapa, and Rangitāne o Wairarapa. Wairarapa Moana Wetlands Project maintain a network of predator kill-traps in various locations along the South Wairarapa coast including near the KNE site. These pest animal control networks are complementary to the pest animal control at the Whangaimoana Coast KNE site.

4. Ecological values

This section describes the various ecological components and attributes that make the KNE site important. These factors determine the site's value at a regional scale and how managing it contributes to the maintenance of regional biodiversity.

4.1. Ecological designations

In 2000, DOC identified parts of the Whangaimoana Coast KNE site (see Appendix 2, Map 3) as an Area of Biological Importance based on the populations of rare dune plants and the Whangaimoana wetland ecosystem[3]. This designation was a contributing factor in the selection of the Whangaimoana Coast site for inclusion in the KNE programme.

Table 1, below, lists ecological designations at all or part of the Whangaimoana Coast KNE site.

Table 1: Designations at the Whangaimoana Coast KNE site

Designation level	Type of designation
Regional	Parts of the KNE site are designated in the Natural Resources Plan for the Wellington Region as: • Īnanga spawning habitat (Schedule F1) – Whangaimoana Stream Mouth • Significant Natural Wetland (Schedule F3) – Whangaimoana Stream Mouth
District	DOC Area of Biological Importance: • WP0129 – Whangaimoana Beach
Other	QEII Open Space Covenant 5-07-631

4.2. Ecological significance

The Whangaimoana Coast KNE site is considered to be of regional importance because:

- It contains ecological features that are **rare or distinctive** in the region, including naturally uncommon ecosystems,
- It contains high levels of ecosystem **diversity**, with several ecosystem types represented,
- Its **ecological context** is valuable at the landscape scale as it contains a variety of inter-connected habitats and provides core or seasonal habitat for seven threatened indigenous species.

Rarity/distinctiveness

Several naturally uncommon ecosystem types are present within the KNE site. These include active sand dunes (threat status: Endangered), stable sand dunes (Endangered), a lagoon (Vulnerable), shingle beach (Endangered)[4] and coastal wetland (uncommon habitat)[5].

The KNE site includes a natural wetland system (See Appendix 2, Map 4). Wetlands are now considered an uncommon habitat type in the Wellington region with less than 3% remaining of their original extent[6].

New Zealand's national threat classification system[7] lists five nationally At Risk plant species within the KNE site. The KNE site provides habitat for ten nationally Threatened or At Risk bird species. Two nationally Threatened or At Risk native fish species are known to be present, along with one nationally Threatened spider species. Appendix 3 contains a list of the nationally and regionally threatened species found within the KNE site.

Diversity

The KNE site contains several inter-connected ecosystems including sand dunes, coastal wetland, riparian margins, estuarine habitat and coastal cliffs. These multiple ecosystem types and their interconnectivity, coupled with good natural regeneration and restoration planting make it a high priority area for biodiversity management.

Ecological Context

The KNE site forms a continuation of protected habitats between the Aorangi Forest Park to the east and the Wairarapa Moana Wetlands Project to the west. Habitat values protected by those projects along the Palliser Bay coast are continuous with the ecological values of the Whangaimoana Coast KNE site. Continuous protected habitat has greater protective effect for the native species within those areas.

4.3. Ecological features

The Whangaimoana Coast KNE site is located in the Wairarapa Plains Ecological District[8]. The KNE site rises quickly from Palliser Bay on a steep shingle beach. Inland from the shingle beach, the landform varies between steep coastal cliffs and low sand dunes. Prevailing southerly winds produce strong wave action and salt spray across the KNE site. The Whangaimoana Stream mouth is usually blocked from the sea by a gravel bank. However, in storm events and very high tides this gravel bank is breached by ocean swells causing the stream to be inundated with saline water periodically.

Flora

The Singers and Rogers[9] classification of pre-human forest vegetation indicates the KNE site would have comprised mostly the tītoki/ngaio (WF1) forest ecosystem type. Only 3.2% of the original extent of this ecosystem/forest type remains in the Wellington region[10]. Unfortunately, little of the original forest ecosystem persists at the KNE site.

The Whangaimoana Stream mouth and wetland contains raupō (*Typha orientalis*) in the water of the stream and lagoon, with a mosaic of oioi (*Aposdasmia similis*), wīwī (*Juncus edgariae*) and wiwi/knobby clubrush (*Ficinia nodosa*) on the edges. Rautahi/cutty grass (*Carex geminata*), harakeke/swamp flax (*Phormium tenax*) and umbrella sedge (*Cyperus ustulatus*) dominate the stream's northern bank.

The backdune behind the Whangaimoana Stream's northern bank contains indigenous species more typical of the mature sandy soil that is present. This backdune contains native plants such as kōkihi/native spinach (*Tetragonia tetragonoides*), taupata/mirror plant (*Coprosma repens*), nihinihi/shore bindweed (*Calystegia soldanella*), horokaka/ New Zealand ice plant (*Disphyma australe*) and coastal tree daisy (*Olearia solandri*).

There are modified foredunes at the road-end and relatively unmodified foredunes along the base of the coastal cliffs to the southeast of the KNE site. The dune at the road-end has remnants of original pīngao and kōwhangatara/spinifex (*Spinifex sericeus*) growing alongside and amongst recent plantings of both species[11]. The foredunes further east from the road-end along the base of the cliffs are relatively undisturbed and the vegetation mainly consists of large areas of kōwhangatara.

The cliff vegetation is regenerating and contains species such as whaririki/coastal flax (*Phormium cookianum*), toetoe (*Austroderia toetoe*), thick-leaved māhoe (*Melicytus crassifolius*), silver tussock (*Poa cita*), hinarepe/sand tussock (*Poa billardierei*), akiraho/golden akeake (*Olearia paniculata*) and coastal tree daisy.

Fauna

Birds

Threatened bird species recorded in the KNE site include pohowera/banded dotterel (*Charadrius bicinctus*), and poaka/pied stilt (*Himantopus himantopus*). Several other threatened or at risk species present at this site include tōrea pango/variable oystercatcher (*Haematopus unicolor*), tarāpunga/red-billed gull (*Larus novaehollandiae*), tara/white-fronted tern (*Sterna striata*) and pīhoihoi/New Zealand pipit (*Anthus novaeseelandiae*). Observations of other threatened species including taranui/Caspian tern (*Hydroprogne caspia*), tāiko/black petrel (*Procellaria parkinsoni)* and the kororā/little blue penguin (*Eudyptula minor*). Tākapu/Australasian gannet (*Morus serrator*) have also been recorded.

Non-threatened species such as tūī (*Prosthemadera novaeseelandiae*), pīwakawaka/fantail (*Rhipidua fulginosa*), ruru/morepork (*Ninox novaeseelandiae*), tauhou/silvereye (*Zosterops lateralis*), riroriro/grey warbler (*Gerygone igata*), kāhu/harrier (*Circus approximans*) and karoro/southern black-backed gull (*Larus dominicanus*) have also been observed in the KNE site.

Reptiles

Northern grass skinks (*Oligosoma polychroma*) have been observed in the backdune and coastal cliff areas of the KNE site. A 2021 lizard survey of the coastal cliffs immediately northwest of the KNE site recorded only northern grass skinks[12].

Freshwater fish

Four species of native fish have been recorded at the KNE site: banded kōkopu (*Galaxias fasciatus*), upland bully (*Gobiomorphus breviceps*), tuna/longfin eel (*Anguilla dieffenbachia*) and īnanga (*Galaxias maculatus*)

Marine mammals

Palliser Bay is seasonal habitat for New Zealand fur seals (*Arctocephalus forsteri*), which are occasionally seen on the beach at the KNE site[13].

Freshwater Invertebrates

Kōura (*Paranephrops* sp.) have been recorded in the Whangaimoana Stream[14].

5. Threats to ecological values at the KNE site

Ecological values can be threatened by human activities, and by introduced animals and plants that change ecosystem dynamics. The key to protecting and restoring biodiversity as part of the KNE programme is to manage key threats to the ecological values at each KNE site. Key threats to the Whangaimoana Coast KNE site are discussed below and all known threats to the KNE site are summarised in Appendix 4.

5.1. Key threats

Ecological weeds are widespread throughout the KNE site. Ecological weeds displace native plant species such as pīngao and kōwhangatara that perform an important ecological function in dune habitats. These species bind sand together providing stability for the whole dune ecosystem.

Marram grass (*Ammophila arenaria*) is present in and dominates many landscapes within the KNE site. Marram-dominated dunes have a higher and steeper dune structure that is more unstable than would naturally occur in a pīngao and kōwhangatara dominated dune system. Marram dunes have lower floral species diversity and are more vulnerable to collapse in storm event than native-dominated dune ecosystems.

Other ecological weeds found in the KNE site include gazania (*Gazania* spp.), African daisy (*Arctotis stoechadifolia*), Cape ivy (*Senecio angulatus*), horned poppy (*Glaucium flavium*), pampas (*Cortaderia selloana*), crack willow (*Salix fragilis*) and tree lupin (*Lupinus arboreus*). Gorse (*Ulex europaeus*), karo (*Pittosporum crassifolium*) and hybrid Australian ngaio (*Myoporum* aff *insulare* × *laetum*) are present in the backdunes and coastal cliffs. Gorse can out-compete native plant species in coastal ecosystem where the natural climax community consists of low-statured scrub that fail to shade out and succeed gorse. The invasive climber blue passionflower (*Passiflora caerulea*) is also present in the backdune and stream areas. Ecological weeds are likely to be introduced to the KNE site by garden dumping and garden escapees from the local rural community.

Pest animal species are present within the KNE site and are known to prey on nesting bird species. The main pest animal threats at the KNE site are stoats (*Mustela erminea*), ferrets (*M. furo*), weasels (*M. nivalis*), hedgehogs (*Erinaceus europeaeus*) and feral cats (*Felis catus*) because of their effects on nesting birds. Rabbits (*Oryctolagus cuniculus*) and hares (*Lepus europaeus*) are threats to the native flora within the KNE site.

Due to the KNE site's south-facing aspect, storm events and storm surges are seemingly occurring more frequently and impacting dune formation and the stream channel and the ecological values in these habitats more severely.

Recreation activities within the KNE site can damage the sand dunes and shingle beach habitats and disturb wildlife, including nesting native birds. The main threat to the KNE site in this regard is motorbike and quad bike use, with some 4WD vehicle use. In addition, uncontrolled dogs can disturb and kill breeding birds and their chicks.

6. Vision and objectives

6.1. Vision

'The KNE site's ecosystems, and the vulnerable species within them, are self-sustaining and resilient to the effects of climate change'

6.2. Objectives

Objectives help to ensure that operational activities carried out are contributing to improvements in the ecological condition of the site.

The following objectives will guide the operational activities at the Whangaimoana Coast KNE site.

1. ***The structure and function of native plant communities are improved***
2. ***The habitat for threatened native coastal birds and freshwater fishes is improved***

7. Operational activities

Operational activities are targeted to work towards the objectives listed above (Section 6). The broad approach to operational activities is described below, and specific actions, with budget figures attached, are set out in the operational delivery schedule in Section 9 (Table 2).

The KNE site has been broadly divided into five operational areas based on habitat type:

- A – foredunes
- B – backdunes
- C – riparian/estuarine
- D – coastal cliffs
- E – shingle beach

See Appendix 2, Map 6 for a map of operational areas.

7.1. Ecological weed control

The aim of ecological weed control at the KNE site is to reduce the density and distribution of ecological weeds across the KNE site to improve the structure and function of native plant communities.

Previous control work has seen a significant reduction of marram grass within the KNE site. Future work builds on this progress by expanding the number of ecological weed species to be controlled.

Marram grass is still present across all the operational areas of the KNE site and will be the major target of control most years. Control will be followed by restoration with native plantings (see Section 7.3 below).

Crack willow, karo, gorse and wilding pines (*Pinus* spp.) are targeted for control in the back dune and riparian operational areas. Cape ivy, pampas, horned poppy and lupin are targeted in the foredune and shingle beach operational areas. Karo and hybrid Tasmanian x New Zealand ngaio will be targeted in the coastal cliffs area. A full list of the ecological weed species that will be controlled at some point is presented in Appendix 5.

Ecological weed control work is recorded by the Pest Plants team in GPS tracklogs and waypoints for ecological weeds, both controlled and uncontrolled.

7.2. Pest animal control

The aim of pest animal control at the KNE site is to reduce predation of native birds and lizards and to reduce herbivory on native flora. This pest animal control work links with similar predator control networks adjacent to the KNE site within the Wairarapa Moana and Aorangi Restoration Trust project areas.

A line of 12 predator control sites within the KNE boundary are supplemented by 14 traps that extend up and down the coast in a “halo” around the KNE site (see Appendix 2, Map 7). Predator control sites consist of a DOC250 kill-trap and a Timms kill-trap and are baited to target mustelids, feral cats and hedgehogs. While

not specifically targeted, rats and rabbits are sometimes also caught by these traps. These sites are checked monthly by the Greater Wellington Pest Animal team. Traps in the KNE site are exposed to blown sand and sea spray and trap mechanisms have a shorter life expectancy than traps at inland sites. Provision for trap maintenance has been adjusted accordingly.

Rabbits and hares are controlled by night shooting, carried out by the Pest Animals team. Hedgehogs are a secondary control target during night shooting operations.

Pest animal control results are recorded by the Pest Animals team in trap.nz. Night shooting results (including date, time and location) are recorded electronically.

7.3. Revegetation

The aim of revegetation work at the KNE site is to improve the structure, composition and function of native plant communities. This is being done by controlling ecological weeds and replacing them with native plants. This will increase biodiversity by reintroducing native species such as tātaraheke/sand coprosma (*Coprosma acerosa*) that would have likely occurred in the backdunes. Native beach-nesting bird species, like band dotterel, experience more predation when nesting near invasive plants like marram grass, lupin, and wilding pines. Replacing invasive weeds that degrade nesting areas with native plants will improve the habitat for threatened bird species.

Planting is undertaken annually in a staged approach, with site preparation, planting and follow-up performed by the Greater Wellington Pest Plants team. Site preparation includes controlling and clearing non-native plants in the designated planting area. Planting includes adding appropriate fertilizer and plant protectors where indicated. Planting follow-up includes checking seedling success rate, clearing non-native plants around seedlings and fixing and removing plant protectors as necessary.

A critical element of successful revegetation at the KNE site is herbivore control. Night shooting for rabbits and hares is undertaken by Greater Wellington Pest Animals operators. This night shooting reduces herbivore pressure on plantings and has been shown to have a major benefit on seedling success rates.

Revegetation is specific to each operational area (see Appendix 2, Map 6). Appendix 6 contains a list of native plant species from which species will be chosen for revegetation planting at the KNE site.

Revegetation in the foredunes area is focused on replacing invasive marram grass with spinifex and pīngao, while adding complementary native dune species like sand coprosma and sand daphne. Spinifex and pīngao dictate the dune topography and structure, while sand coprosma and sand daphne provide forage and cover for native fauna.

Planting in the wetland and estuary areas is designed to introduce native plants that provide forage opportunities for native birds (harakeke) or breeding habitat for fish (rautahi).

The primary goal of revegetation planting in the backdunes area is to “build a native hedge” to separate the beachfront from the pasture, as requested by the landowner. Species to be used are thick-leaved mahoe, taupata, and twiggy tree daisy. The current “hedge” of pine trees will be removed once the native hedge is established.

8. Future opportunities

8.1. Fencing

Four-wheel-drive vehicles and motorbikes are a persistent threat to native birds breeding in the foredune/strand area of the Whangaimoana Coast KNE site. Past attempts at informational signage and a waratah fence to indicate the breeding area have failed to completely exclude vehicular use across the beach. One area that has been effectively fenced is the foredunes at the end of Whangaimoana Road. This area is fenced with a wooden post and rope fence that is very visible to motorists. The same fencing type may be successful at containing motor vehicle traffic on the beach where shorebird nesting is taking place. Implementation of any fencing must include public consultation and have at least majority support from the local community.

9. Operational delivery schedule

The operational delivery schedule shows the actions planned to achieve the stated objectives for the Whangaimoana Coast KNE site, and their annual resourcing. The budgets for years 2025/26 to 2028/29 are subject to change. Operational areas (see Appendix 2, Map 6) are also subject to change according to operational needs over the course of the operational plan.

Table 2: Operational delivery schedule for the Whangaimoana Coast KNE site

Objective	Activity	Operational area	Intended 5-year outcome	Implementing party	Annual resourcing
1, 2	Ecological weed control: Control marram grass and other invasive species	Entire KNE site	The impacts on the target dune structure and habitat is reduced	GW Pest Plants team	$4,700
1, 2	Pest animal control: Control mustelids and hedgehogs through monthly trap servicing	Entire KNE site	Mustelids and hedgehogs are having low impacts on native fauna	GW Pest Animals team	$7,240
1, 2	Pest animal control: Night shooting	A, C, E	Protect seedlings and native revegetation	GW Pest Animals team	$2,250
1	Revegetation: Plant native dune species to replace areas of invasive weed control	Entire KNE site	Visible improvement in native composition and structure of the dune habitat	GW Pest Plants team	$2,500
Total					$16,690

10. Funding contributions

10.1. Budget allocated by Greater Wellington

The budgets for annual resourcing are indicative only and subject to change.

Table 3: Greater Wellington allocated budget for the Whangaimoana Coast KNE site

Management activity	Annual resourcing
Ecological weed control	$4,700
Pest animal control	$9,490
Revegetation	$2,500
Total	**$16,690**

Appendix 1: Policy context and the Key Native Ecosystem programme

Policy context

Under the Resource Management Act 1991 (RMA)[15] regional councils have responsibility for maintaining indigenous biodiversity, as well as protecting significant vegetation and habitats of threatened species.

Funding for the KNE programme is allocated under the Greater Wellington Long Term Plan (2021-2031)[16] and is managed in accordance with the Greater Wellington Biodiversity Strategy[17]. This sets a framework for how Greater Wellington protects and manages biodiversity in the Wellington region. Goal One of the Biodiversity Strategy – *"Areas of high biodiversity value are protected or restored"* – drives the delivery of the KNE programme.

Other important drivers for the KNE programme include the Natural Resources Plan for the Wellington Region (NRP)[18] and the Regional Pest Management Plan 2019-2039[19].

Key Native Ecosystem programme

The KNE programme is a non-regulatory programme. The programme seeks to protect some of the best examples of original (pre-human) ecosystem types in the Wellington region. Greater Wellington has identified sites with the highest biodiversity values and prioritized them for management[20].

KNE sites are managed in accordance with five-year KNE operational plans prepared by Greater Wellington's Environment Restoration team. Greater Wellington works with landowners, mana whenua and other operational delivery providers to achieve mutually beneficial goals.

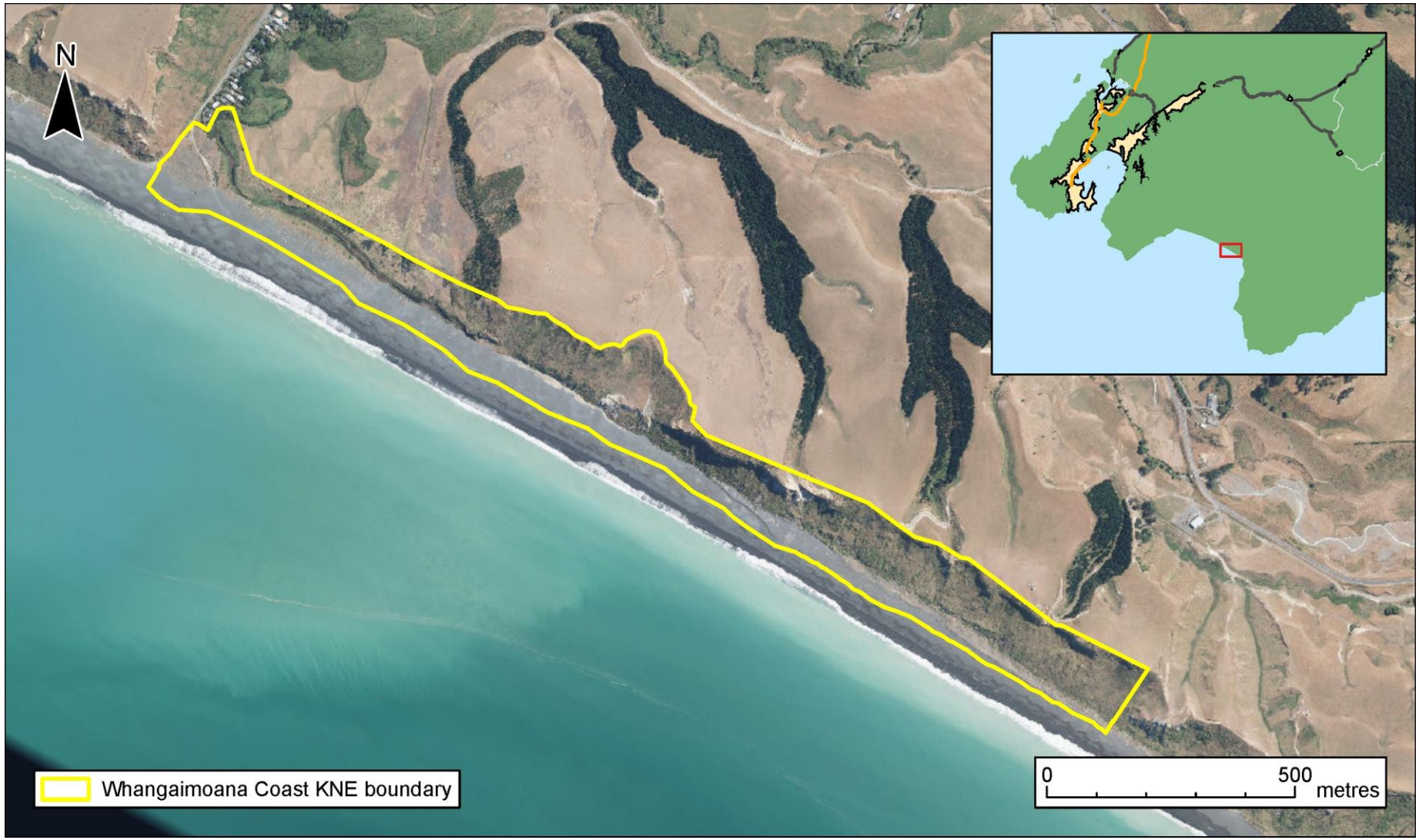
KNE sites can be located on private or publicly owned land. Any work undertaken on private land as part of this programme is at the discretion of landowners and their involvement in the programme is entirely voluntary. Involvement may just mean allowing work to be undertaken on that land. Land managed by the Department of Conservation (DOC) is generally excluded from this programme.

Sites are identified as of high biodiversity value for the purposes of the KNE programme by applying the four ecological significance criteria described below.

Representativeness	Rarity/ distinctiveness	Diversity	Ecological context
The extent to which ecosystems and habitats represent those that were once typical in the region but are no longer commonplace	Whether ecosystems contain Threatened/At Risk species, or species at their geographic limit, or whether rare or uncommon ecosystems are present	The levels of natural ecosystem diversity present, ie, two or more original ecosystem types present	Whether the site provides important core habitat, has high species diversity, or includes an ecosystem identified as a national priority for protection

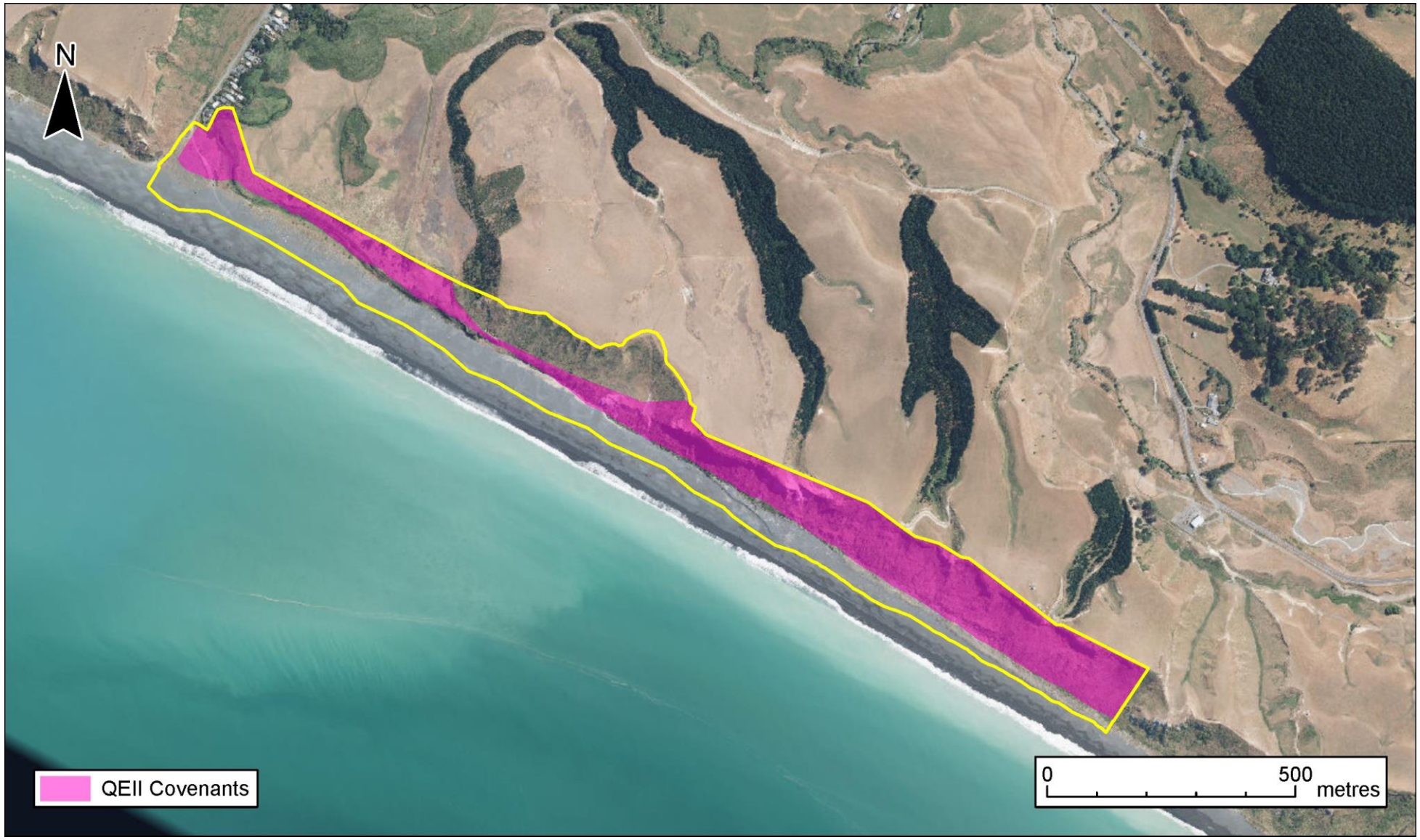
A site must be identified as ecologically significant using the above criteria and be considered "sustainable" for management to be considered for inclusion in the KNE programme. "Sustainable" for the purposes of the KNE programme is defined as: a site where the key ecological processes remain intact or continue to influence the site, and resilience of the ecosystem is likely under some realistic level of management.

Appendix 2: Whangaimoana Coast KNE site maps



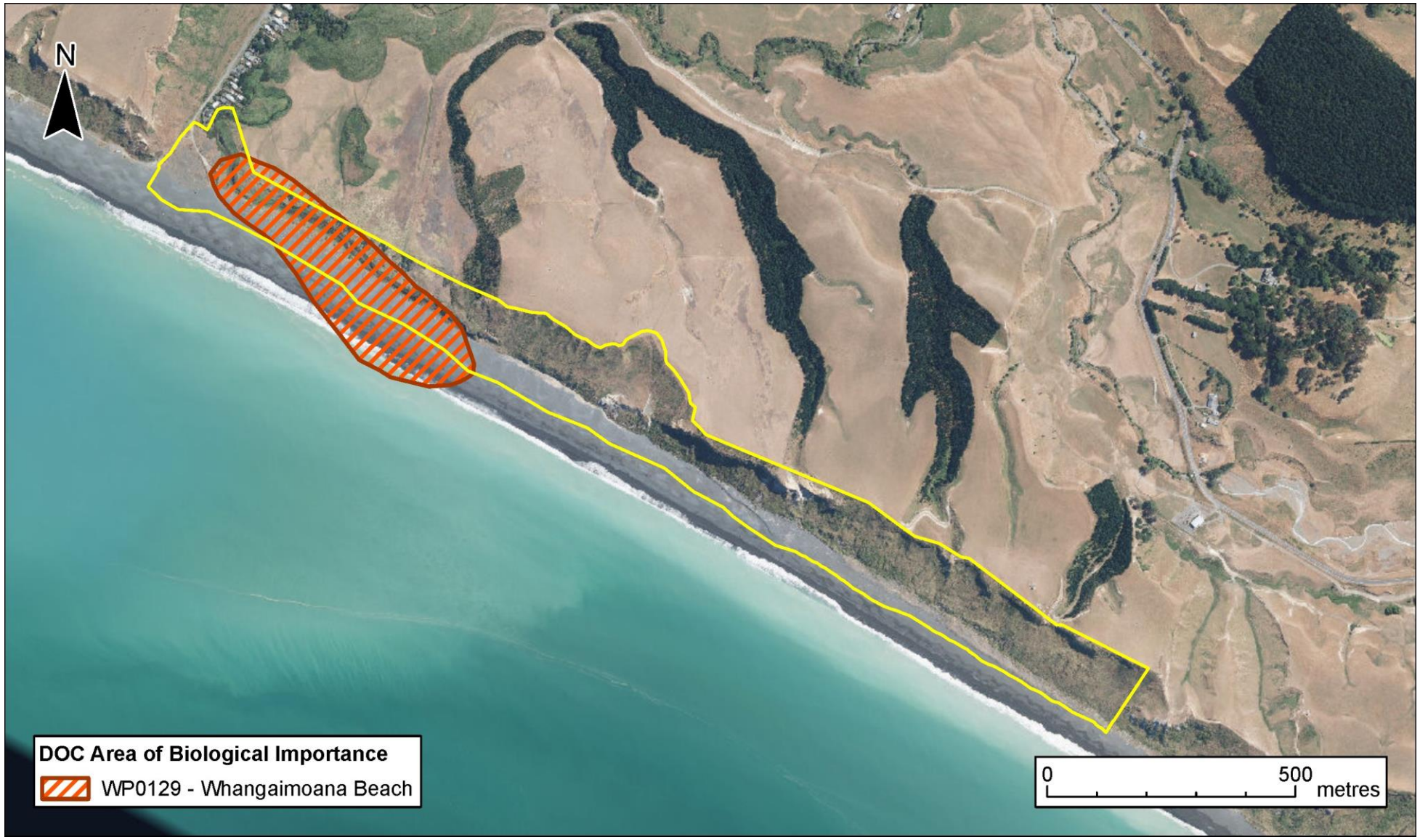
Map 1: Whangaimoana Coast KNE site boundary

Map 2: Land ownership for the Whangaimoana Coast KNE site. All the unshaded area of the KNE site is designated Crown land associated with the shoreline.

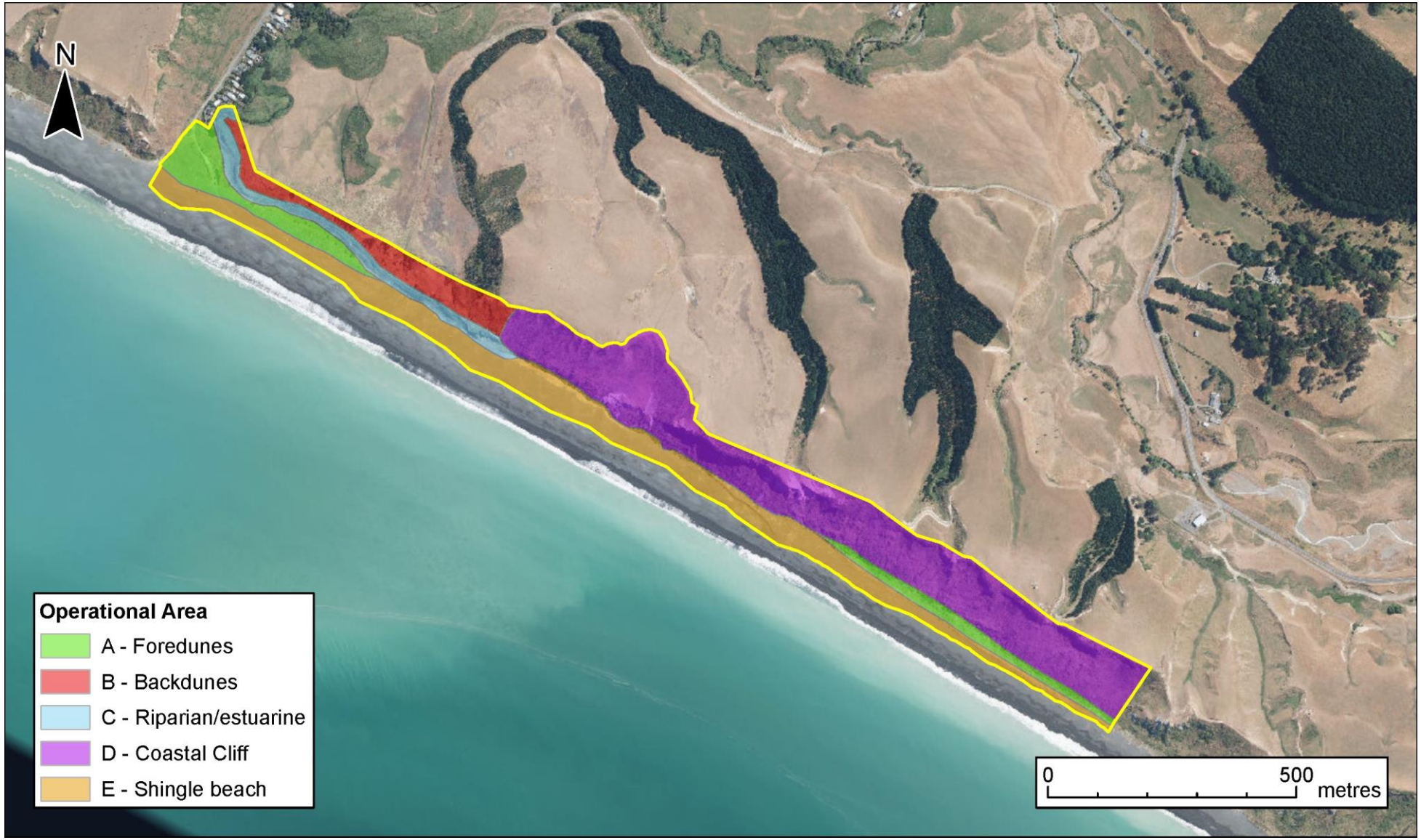


Map 3: QEII National Trust covenanted land at the Whangaimoana Coast KNE site

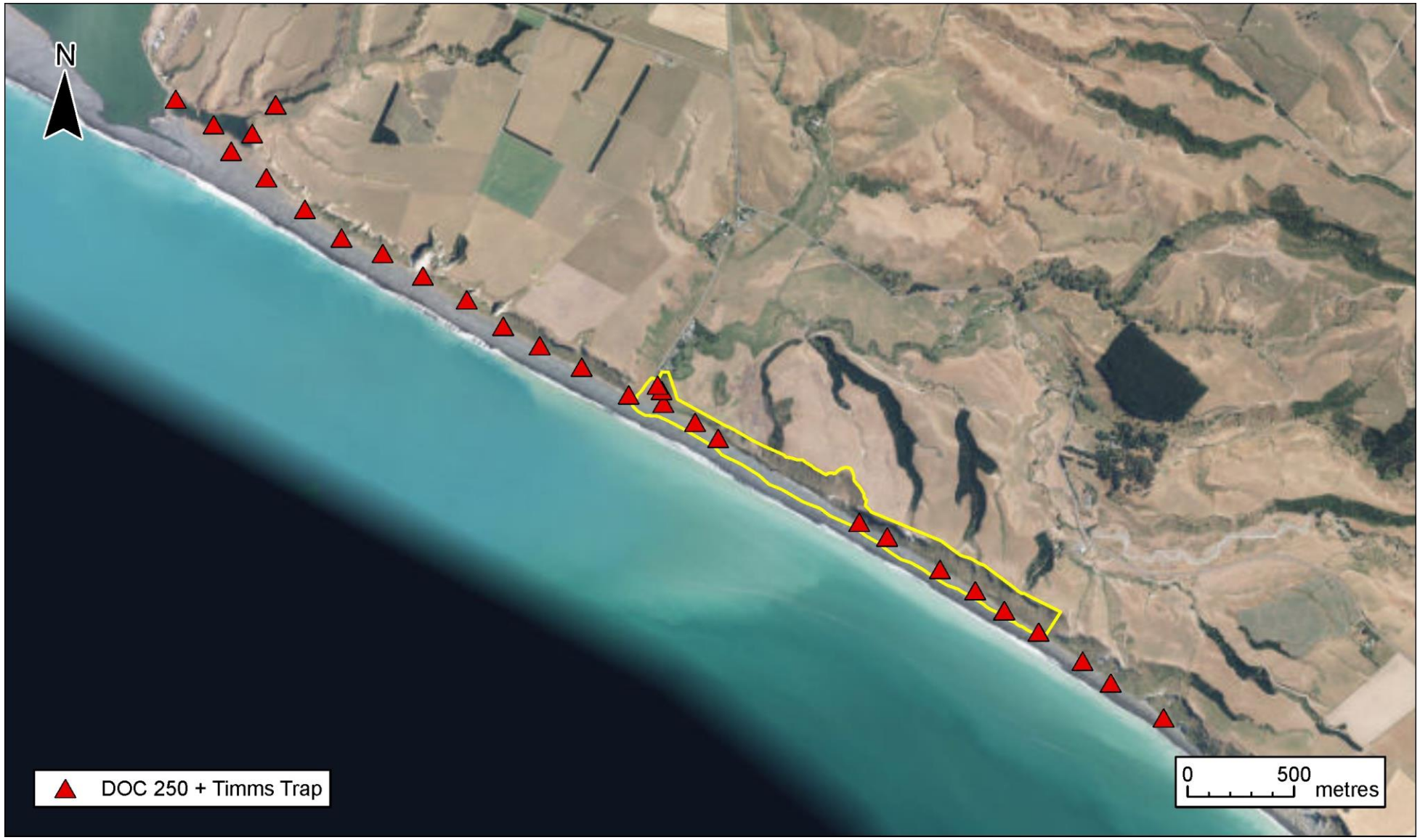
Map 4: Designated duneland and wetland habitats in and around the Whangaimoana Coast KNE site



Map 5: Area of biological importance, as identified by Department of Conservation, within the Whangaimoana Coast KNE site



Map 6: Operational areas at the Whangaimoana Coast KNE site



Map 7: Pest animal control within and adjacent to the Whangaimoana Coast KNE site

Appendix 3: Nationally and regionally threatened species list

The following table lists nationally and regionally Threatened and At Risk species that are resident in, or regular visitors to, the Whangaimoana Coast KNE site.

The New Zealand Threat Classification System (NZTCS) lists species nationally according to their threat of extinction. The status of each species group (plants, reptiles, etc) is assessed over a five-year cycle[21]. Species are regarded as Threatened if they are classified as Nationally Critical, Nationally Endangered or Nationally Vulnerable[22]. They are regarded as At Risk if they are classified as Declining, Recovering, Relict or Naturally Uncommon. A limited set of taxonomic groups have also been assigned a regional threat status. The regional threat status methodology was developed by a collaborative group comprising representatives from DOC, regional councils and a local authority. The resulting regional threat listing methodology leverages off the NZTCS, but applies a species population threshold adjusted to the regional land area under consideration (relative to the national land area) for species that are not nationally threatened. The assigned regional threat status cannot be lower than that of the national threat status, but can be higher, (eg, a Nationally Vulnerable species could be assessed as being Regionally Critical). Other assessments made in the regional threat listing process include identifying populations that are national strongholds and the use of regional qualifiers, such as natural or historic range limits.

Table 4: Nationally and regionally threatened taxa present at the Whangaimoana Coast KNE site

Scientific name	Common name	National threat status	Regional threat status	Observation
Plants (vascular) – National[23] and Regional[24] Threat Status				
Coprosma acerosa	Tātaraheke / sand coprosma	At Risk – Declining	Declining	Wairarapa Plains Ecological District report[25]
Ficinia spiralis	Pīngao	At Risk – Declining	Vulnerable	Enright, P. 2010[26]
Melicytus crassifolius	Thick-leaved māhoe	At Risk – Declining	Declining	Justin McCarthy, GWRC, pers obs 2015
Poa billardierei	Hinarepe / sand tussock	At Risk – Declining	Declining	Enright, P. 2010
Tetragonia tetragonoides	Kōkihi / New Zealand spinach	At Risk – Naturally Uncommon	Naturally Uncommon	Enright, P. 2010

Scientific name	Common name	National threat status	Regional threat status	Observation
Birds – National[27] and Regional[28] Threat Status				
Anthus novaeseelandiae	Pīhoihoi / New Zealand pipit	At Risk – Declining	Endangered	Justin McCarthy, GWRC, pers obs 2015
Charadrius bicinctus	Pohowera / banded dotterel	At Risk – Declining	Endangered	Rebergen, A. 2012[29]
Falco novaeseelandiae ferox	Kārearea / bush falcon	Nationally Increasing	Critical	S. Barton, pers comm 2016
Haematopus unicolor	Tōrea pango / variable oystercatcher	At Risk – Recovering	Endangered	Tim Park, GWRC, pers obs 2012
Hydroprogne caspia	Taranui / Caspian tern	Vulnerable	Critical	S. Barton, pers comm 2014
Larus novaehollandiae (*Chroicocephalus novaehollandiae*)	Tarāpunga / red-billed gull	At Risk – Declining	Vulnerable	S. Barton, pers comm 2014
Phalacrocorax carbo novaehollandiae	Māpunga / black shag	At Risk – Relict	Critical	S. Barton, pers comm 2016
Phalacrocorax varius varius	Kāruhirui / pied shag	At Risk – Recovering	Vulnerable	S. Barton, pers comm 2016
Procellaria parkinsoni	Tāiko / black petrel	Vulnerable	Vulnerable – Regional Migrant	T. Thompson, pers obs 2016
Sterna striata	White-fronted tern	At Risk – Declining	Endangered	S. Barton, pers comm 2014
Freshwater fish – National[30] and Regional[31] Threat Status				
Anguilla dieffenbachii	Longfin eel	At Risk – Declining	Declining	S. Barton, pers comm 2014
Galaxias maculatus	Īnanga	At Risk – Declining	Declining	Taylor & Kelly, 2003[32]
Spiders – National[33] Threat Status				
Lactrodectus katipo	Katipō	At Risk – Declining	-	Matiu Park, pers obs 2011

Appendix 4: Threat table

The following table presents a summary of all known threats to the Whangaimoana Coast KNE site including those discussed in Section 5.

Table 5: Threats to the Whangaimoana Coast KNE site

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
Ecological weeds (EW)		
EW-1	Ground covering ecological weeds smother and displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key ground covering ecological weed species for control in the KNE site include horned poppy (*Glaucium flavum*) and marram grass (*Ammophila arenaria*) which also alters dune form and function. (see full list in Appendix 5).	Foredunes, backdunes, coastal cliffs
EW-2	Woody weed species displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key woody ecological weed species for control in the KNE site include gorse (*Ulex europaeus*) and karo (*Pittosporum crassifolium*) (see full list in Appendix 5).	Backdunes, estuary
EW-3	Climbing weeds smother and displace native vegetation often causing canopy collapse, inhibit indigenous regeneration, and alter vegetation structure and composition. Key climbing ecological weed species for control in the KNE site include bindweed (*Calystegia sylvatica*) and blue passionflower (*Passiflora caerulea*) (see full list in Appendix 5).	Backdunes and estuary
Pest animals (PA)		
PA-1*	Possums (*Trichosurus vulpecula*) browse palatable canopy vegetation until it can no longer recover[34,35]. This destroys the forest's structure, diversity and function. Possums may also prey on native birds and invertebrates[36].	Entire KNE
PA-2	Rats (*Rattus* spp.) browse native fruit, seeds and vegetation. They compete with native fauna for food and can reduce forest regeneration. They also prey on invertebrates, lizards and native birds[37,38] .	Entire KNE
PA-3	Mustelids (stoats[39,40] (*Mustela erminea*), ferrets[41,42] (*M. furo*) and weasels[43,44] (*M. nivalis*)) prey on native birds, lizards and invertebrates, reducing their breeding success and potentially causing local extinctions.	Entire KNE
PA-4	Hedgehogs (*Erinaceus europaeus*) prey on native invertebrates[45], lizards[46] and the eggs[47] and chicks of ground-nesting birds[48] .	Entire KNE
PA-5*	House mice (*Mus musculus)* browse native fruit, seeds and vegetation, and prey on invertebrates. They compete with native fauna for food and can reduce forest regeneration. They also prey on invertebrates, lizards and small eggs and nestlings[49,50].	Entire KNE
PA-5	Pest and domestic cats (*Felis catus*) prey on native birds[51], lizards[52] and invertebrates[53], reducing native fauna breeding success and potentially causing local extinctions[54].	Entire KNE

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
PA-6	Rabbits (*Oryctolagus cuniculus*)[55] and hares (*Lepus europaeus*)[56] graze on palatable native vegetation and prevent natural regeneration in some environments. Rabbits are particularly damaging in sand dune environments where they graze native binding plants and restoration plantings.	Entire KNE
PA-7*	Wasps (*Vespula* spp.) adversely impact native invertebrates and birds through predation and competition for food resources. They also affect nutrient cycles in beech forests[57].	Entire KNE
Human activities (HA)		
HA-1	Garden waste dumping often leads to ecological weed invasions into natural areas. Common weed species introduced at this KNE site include arum lily (*Zantedeschia aethiopica*) and phoenix palm (*Phoenix canariensis*).	Backdunes and estuary
HA-2	Plantation forestry on adjoining land parcels to the KNE site has the potential to cause habitat loss or degradation, disturb native wildlife, damage boundary fencing and increase sediment load in watercourses via surface run-off during harvesting operations.	Backdunes
HA-3	Encroachment of residential gardens into the KNE site from urban areas causes habitat loss and introduces ecological weeds.	Backdunes and estuary
HA-4*	Barriers to native fish passage are present in streams within the KNE site preventing migrating fish from completing their life-cycle.	Stream and estuary
HA-5*	Poor water quality affects a range of species in the estuary and stream. High nutrient levels and contaminants within watercourses are often caused by upstream land management practices and pollution events including development practices, forestry and agricultural practices, road run-off and storm water entering the watercourse, and sceptic tank leakages.	Stream and Estuary
HA-6*	Dogs (*Canis lupus familiaris*), if uncontrolled or unleashed can disturb or kill nesting birds and chicks, and lizards, particularly in close proximity to walking tracks[58].	Foredunes
HA-7*	Recreational vehicles such as 4WDs and motorbikes can cause damage to dune systems and disturbance of the native ecosystem.	Foredunes and beach

*Threats marked with an asterisk are not addressed by actions in the operational delivery schedule

Appendix 5: Ecological weed species

The following table lists key ecological weed species that have been recorded in the Whangaimoana Coast KNE site by the Greater Wellington Pest Plants team, Environment Restoration Advisor, and QEII representative.

The distribution and density of individual species is recorded. Three levels of distribution (localised, patchy and widespread) and density (sparse, abundant and dense) are used to describe these aspects of infestations of each species.

Table 6: Ecological weed species recorded in the Whangaimoana Coast KNE site

Scientific name	Common name	Priority	Level of distribution	Management aim
Agapanthus praecox	Agapanthus	Medium	Patchy & dense	Suppression
Allium triquetrum	Onion weed	Low	Patchy & sparse	Suppression
Ammophila arenaria	Marram grass	High	Widespread & abundant	Suppression
Angelica pachycarpa	Angelica	Medium	Patchy & sparse	Suppression
Arctotis stoechadifolia	White Arctotis	Medium	Patchy & sparse	Suppression
Calystegia sylvatica	Bindweed	Medium	Patchy & sparse	Suppression
Cortaderia selloana	Pampas grass	High	Widespread & sparse	Suppression
Crocosmia x *crocosmiiflora*	Montbretia	Medium	Patchy & sparse	Suppression
Dimorphotheca fruticosa	Osteospermum / African daisy	Low	Widespread & sparse	Suppression
Family Poaceae	Pasture grass species	Low	Widespread & abundant	Site dependent
Glaucium flavum	Horned poppy	High	Patchy & abundant	Suppression
Lathyrus latifolius	Everlasting pea	Low	Patchy & sparse	Suppression
Lupinus arboreus	Tree lupin	High	Widespread & sparse	Suppression
Malva arboea	Tree mallow	Low	Patchy & sparse	Suppression

Scientific name	Common name	Priority	Level of distribution	Management aim
Myoporum aff *insulare* × *laetum*	Hybrid Australian ngaio	Medium	Localised & abundant	**Eradication**
Passiflora caerulea†	Blue passionflower	High	Localised & sparse	**Eradication**
Pastinaca sativa	Wild parsnip	Medium	Localised & sparse	Suppression
Pinus radiata	Wilding pine	Medium	Localised & abundant	Site dependent
*Pittosporum crassifolium**	Karo	Medium	Patchy & sparse	**Eradication**
Salix fragilis	Crack willow	High	Patchy & sparse	Suppression
Senecio angulatus	Cape ivy	High	Localised & sparse	Suppression
Stenotaphrum secundatum	Buffalo grass	Medium	Patchy & sparse	Suppression
Tradescantia fluminensis	Wandering willy	High	Localised & dense	Suppression
Ulex europaeus	Gorse	Medium	Patchy & dense	Suppression
Zantedeschia aethiopica	Arum lily	High	Patchy & dense	Suppression

* Denotes a New Zealand native plant that is not local to the KNE site

† Regional Pest Management Programme species

Appendix 6: Revegetation plant list

Plants from the following table will be used in any revegetation planting as per Section 7.3.

Table 7: Revegetation plant list for use within the Whangaimoana Coast KNE site

Scientific name	Common name	Operational area	Notes
Carex geminata	Rautahi / cutty grass	Estuary and riparian	
Coprosma acerosa	Tātaraheke / sand coprosma	Backdunes	Requires specialized sourcing
Coprosma repens	Taupata	Backdunes	
Ficinia spiralis	Pīngao	Foredunes	Requires specialized sourcing
Melicytus crassifolius	Thick-leaved mahoe	Backdunes	
Myoporum laetum	Ngaio	Backdunes and cliffs	Avoid hybrid plants
Phormium cookianum	Whararikī / mountain flax	Backdunes and cliffs	
Phormium tenax	Harakeke / flax	Estuary and riparian	
Pimelea villosa	Autetaranga / sand daphne	Backdunes	Requires specialized sourcing
Plagianthus divaricatus	Saltmarsh ribbonwood	Estuary	
Ozothamnus leptophyllus	Tauhinu	Backdunes	
Spinifex sericeus	Kōwhangatara / spinifex	Foredunes	Requires specialized sourcing

References

[1] New Zealand legislation. 2017. Rangitāne Tū Mai Rā (Wairarapa Tamaki nui-ā-Rua) Claims Settlement Act 2017.
[2] New Zealand legislation. 2022. Ngāti Kahungunu ki Wairarapa Tāmaki nui-a-Rua Claims Settlement Act 2022.
[3] Beadel S, Perfect A, Regerben A, Sawyer J. 2000. Wairarapa Plains Ecological District: survey report for the Protected Natural Areas Programme. Department of Conservation, Wellington Conservancy. WP0129 Whangaimoana Beach, P141.
[4] Holdaway RJ, Wiser SK and Williams PA 2012. Status assessment of New Zealand's naturally uncommon ecosystems. Conservation Biology, Vol 26 Issue 4 p619-629.
[5] Ausseil A-G, Gerbeaux P, Chadderton W, Stephens T, Brown D, Leathwick J. 2008. Wetland ecosystems of national importance for biodiversity. Landcare Research Contract Report LC0708/158 for Chief Scientist, Department of Conservation.
[6] Ausseil A-G, Gerbeaux P, Chadderton W, Stephens T, Brown D, Leathwick J. 2008. Wetland ecosystems of national importance for biodiversity. Landcare Research Contract Report LC0708/158 for Chief Scientist, Department of Conservation.
[7] New Zealand Threat Classification System (NZTCS) http://www.doc.govt.nz/about-us/science-publications/conservation-publications/nz-threat-classification-system/
[8] McEwen M ed. 1987. Ecological regions and districts of New Zealand. 3rd edn in four 1:500 000 maps. New Zealand Biological Resources Centre Publication No. 5. Wellington, Department of Conservation.
[9] Singers NJD, Rogers GM. 2014. A classification of New Zealand's terrestrial ecosystems. Science for Conservation No. 325. Department of Conservation, Wellington.
[10] Singers N, Crisp P, Spearpoint O. 2018. Forest ecosystems of the Wellington Region. Greater Wellington Regional Council.
[11] S. Barton 2016 and J McCarthy 2016, pers. obs.
[12] Thorp C, Bell T, Burn-Murdoch D, Goldwater N. 2021. Lizard survey of ocean beach/onoke spit and whāngaimoana beach, Wairarapa. Contract Report No. 5481, Wildlands Consultants.
[13] Taylor MJ, Kelly GR. 2003. Inanga spawning habitats in the Greater Wellington Region: Part 2 Wairarapa. NIWA Client Report CHC01/67. National Institute of Water and Atmospheric Research, Christchurch.
[14] NIWA freshwater fish database https://www.niwa.co.nz/our-services/online-services/freshwater-fish-database.
[15] New Zealand legislation. 1991. Resource Management Act 1991.
[16] Greater Wellington Regional Council. Greater Wellington Regional Council Long Term Plan Ko Te Pae Tawhiti: 2021 – 2031.
[17] Greater Wellington Regional Council. 2016. Greater Wellington Regional Council Biodiversity Strategy. http://www.gw.govt.nz/assets/council-publications/Biodiversity-Strategy-2016.pdf
[18] Greater Wellington Regional Council. 2023. Natural Resources Plan for the Wellington Region, Te Tikanga Taiao o Te Upoko o te Ika a Maui. Operative Version – 28 July 2023.
[19] Greater Wellington Regional Council. 2019. Greater Wellington Regional Pest Management Plan 2019–2039. GW/BIO-G-2019/74
[20] Crisp P, Govella S, Crouch L. 2016. Identification and prioritisation of high value terrestrial biodiversity sites for selection within the Key Native Ecosystems Programme in the Wellington region. Greater Wellington Regional Council, GW/ESCI-T-16/93.
[21] Townsend AJ, de Lange PJ, Duffy CAJ, Miskelly CM, Molloy J, Norton DA. 2008. New Zealand Threat Classification System manual. Department of Conservation, Wellington. 36 p.
[22] Rolfe J, Makan T, Tait A. 2021. Supplement to the New Zealand Threat Classification System manual 2008: new qualifiers and amendments to qualifier definitions, 2021. Department of Conservation, Wellington.

[23] de Lange PJ, Gosden J, Courtney SP, Fergus AJ, Barkla JW, Beadel SM, Champion PD, Hindmarsh-Walls R, Makan T, Michel P. 2024. Conservation status of vascular plants in Aotearoa New Zealand, 2023. New Zealand Threat Classification Series 43. Department of Conservation, Wellington.
[24] Crisp, P. 2020. Conservation status of indigenous vascular plant species in the Wellington region. Greater Wellington Regional Council. GW/ESCI-G-20/20.
[25] Beadel S, Perfect A, Rebergen A, Sawyer JWD. 2000. Wairarapa Plain Ecological District – survey report for the Protected Natural Areas Programme. Department of Conservation, Wellington.
[26] Enright P. 2010. Indigenous vascular plants along the coast from Lake Onoke to Whangaimoana Beach
[27] Robertson HA, Baird KA, Elliot GP, Hitchmough RA, McArthur NJ, Makan TD, Miskelly CM, O'Donnell CFJ, Sagar PM, Scofield RP, Taylor GA, Michel P. 2021. Conservation status of birds in Aotearoa New Zealand, 2021. New Zealand Threat Classification Series 36. Department of Conservation, Wellington.
[28] Crisp P, Robertson H, McArthur N, Cotter S. 2024. Conservation status of birds in the Wellington Region, 2023. Greater Wellington Regional Council. GW/KI-G-23/21.
[29] Rebergen A. 2012. Birds on Wairarapa Rivers and Coast in 2011-12 breeding season. Forest & Bird, Wellington.
[30] Dunn NR, Allibone RM, Closs GP, Crow SK, David BO, Goodman JM, Griffiths M, Jack CD, Ling N, Waters JM, Rolfe JR. 2018. Conservation status of New Zealand freshwater fishes, 2017. New Zealand Threat Classification Series 24. Department of Conservation, Wellington.
[31] Crisp, P, Perrie A, Morar, S. 2022. Conservation status of indigenous freshwater fish in the Wellington region. Greater Wellington Regional Council. GW/ESCI-T-22/02.
[32] Taylor MJ, Kelly GR. 2003. Inanga spawning habitats in the Greater Wellington Region: Part 2 Wairarapa. NIWA Client Report CHC01/67. National Institute of Water and Atmospheric Research, Christchurch.
[33] Sirvid PJ, Vink CJ, Fitzgerald BM, Wakelin MD, Rolfe J, Michel P. 2021. Conservation status of New Zealand Araneae (spiders), 2020. New Zealand Threat Classification Series 34. Department of Conservation, Wellington.
[34] Pekelharing CJ, Parkes JP, Barker RJ. 1998. Possum (*Trichosurus vulpecula*) densities and impacts on fuchsia (*Fuchsia excorticata*) in South Westland, New Zealand. New Zealand Journal of Ecology 22(2): 197–203.
[35] Nugent G, Sweetapple P, Coleman J, Suisted P. 2000. Possum feeding patterns. Dietary tactics of a reluctant folivore. In: Montague TL ed. The brushtail possum: Biology, impact and management of an introduced marsupial. Lincoln, Manaaki Whenua Press. Pp. 10–19.
[36] Sweetapple PJ, Fraser KW, Knightbridge PI. 2004. Diet and impacts of brushtail possum populations across the invasion front in South Westland, New Zealand. New Zealand Journal of Ecology 28(1): 19–33.
[37] Daniel MJ. 1973. Seasonal diet of the ship rat (*Rattus r. rattus*) in lowland forest in New Zealand. Proceedings of the New Zealand Ecological Society 20: 21–30.
[38] Innes JG, Russell JC. 2021. *Rattus rattus*. In *The handbook of New Zealand mammals*. 3rd Ed. (Eds CM King and DM Forsyth) Family Muridae, pp. 160-240. CSIRO Publishing, Melbourne.
[39] Murphy E, Maddigan F, Edwards B, Clapperton K. 2008. Diet of stoats at Okarito Kiwi Sanctuary, South Westland, New Zealand. New Zealand Journal of Ecology 32(1): 41–45.
[40] King C, Veale AJ. 2021. *Mustela erminea*. In *The handbook of New Zealand mammals*. 3rd Ed. (Eds CM King and DM Forsyth) Family Mustelidae, pp. 285-341. CSIRO Publishing, Melbourne.
[41] Ragg JR. 1998. Intraspecific and seasonal differences in the diet of feral ferrets (*Mustela furo*) in a pastoral habitat, east Otago, New Zealand. New Zealand Journal of Ecology 22(2): 113–119.
[42] Garvey PM, Byrom AE. 2021. *Mustela furo*. In *The handbook of New Zealand mammals*. 3rd Ed. (Eds CM King and DM Forsyth) Family Mustelidae, pp. 285-341. CSIRO Publishing, Melbourne.
[43] King C, Murphy EC. 2021. *Mustela nivalis vulgaris*. In *The handbook of New Zealand mammals*. 3rd Ed. (Eds CM King and DM Forsyth) Family Mustelidae, pp. 285-341. CSIRO Publishing, Melbourne.
[44] King CM, Flux M, Innes JG, Fitzgerald BM. 1996. Population biology of small mammals in Pureora Forest Park: 1. Carnivores (*Mustela erminea, M.furo, M.nivalis* and *Felis catus*). New Zealand Journal of Ecology 20(2): 241–251.

[45] Jones C. 2021. *Erinaceus europaeus occidentalis*. In *The handbook of New Zealand mammals*. 3rd Ed. (Eds CM King and DM Forsyth) Family Erinaceidae, pp. 79-93. CSIRO Publishing, Melbourne.
[46] Spitzen-van der Sluijs AM, Spitzen J, Houston D, Stumpel AHP. 2009. Skink predation by hedgehogs at Macraes Flat, Otago, New Zealand. New Zealand Journal of Ecology 33(2): 205–207.
[47] Jones C, Moss K, Sanders M. 2005. Diet of hedgehogs (*Erinaceus europaeus*) in the upper Waitaki Basin, New Zealand. Implications for conservation. New Zealand Journal of Ecology 29(1): 29–35.
[48] Jones C. 2021. *Erinaceus europaeus occidentalis*. In *The handbook of New Zealand mammals*. 3rd Ed. (Eds CM King and DM Forsyth) Family Erinaceidae, pp. 79-93. CSIRO Publishing, Melbourne.
[49] Murphy EC, Nathan HW. 2021. *Mus musculus*. In *The handbook of New Zealand mammals*. 3rd Ed. (Eds CM King and DM Forsyth) Family Muridae, pp. 160-240. CSIRO Publishing, Melbourne.
[50] Newman DG. 1994. Effect of a mouse *Mus musculus* eradication programme and habitat change on lizard populations on Mana Island, New Zealand, with special reference to McGregor's skink, *Cyclodina macgregori*. New Zealand Journal of Ecology 21: 443–456.
[51] King CM, Flux M, Innes JG, Fitzgerald BM. 1996. Population biology of small mammals in Pureora Forest Park: 1. Carnivores (*Mustela erminea, M.furo, M.nivalis* and *Felis catus*). New Zealand Journal of Ecology 20(2): 241–251.
[52] Reardon JT, Whitmore N, Holmes KM, Judd LM, Hutcheon AD, Norbury G, Mackenzie DI. 2012. Predator control allows critically endangered lizards to recover on mainland New Zealand. New Zealand Journal of Ecology 36(2): 141–150.
[53] King CM, Flux M, Innes JG, Fitzgerald BM. 1996. Population biology of small mammals in Pureora Forest Park: 1. Carnivores (*Mustela erminea, M.furo, M.nivalis* and *Felis catus*). New Zealand Journal of Ecology 20(2): 241–251.
[54] Gillies CA, van Heezik Y. 2021. *Felis catus*. In *The handbook of New Zealand mammals*. 3rd Ed. (Eds CM King and DM Forsyth) Family Felidae, pp. 343-370. CSIRO Publishing, Melbourne.
[55] Norbury GL, Duckworth JA. 2021. *Oryctolagus cuniculus*. In *The handbook of New Zealand mammals*. 3rd Ed. (Eds CM King and DM Forsyth) Family Leporidae, pp. 131-159. CSIRO Publishing, Melbourne.
[56] Norbury GL, Flux JEC. 2021. *Lepus europaeus occidentalis*. In *The handbook of New Zealand mammals*. 3rd Ed. (Eds CM King and DM Forsyth) Family Leporidae, pp. 131-159. CSIRO Publishing, Melbourne.
[57] Beggs JR. 2001. The ecological consequences of social wasps (Vespula spp.) invading an ecosystem that has an abundant carbohydrate resource. Biological Conservation 99: 17–28.
[58] Holderness-Roddam B. 2011. The effects of domestic dogs (Canis familiaris) as a disturbance agent on the natural environment. Thesis submitted at University of Tasmania, Hobart.

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