# Key Native Ecosystem Operational Plan for Karehana Bay Bush

2023-2028

# Contents

# 1. Purpose

The purpose of the five-year Key Native Ecosystem (KNE) Operational Plan for Karehana Bay Bush KNE site is to:

- Identify the parties involved
- Summarise the ecological values and identify the threats to those values
- Outline the vision and objectives to guide management decision-making
- Describe operational activities to improve ecological condition that will be undertaken (e.g., ecological weed control), who will undertake the activities and the allocated budget.

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.

This KNE Operational Plan is aligned to key policy documents that are outlined below (in Section 2).

# 2. Policy Context

Under the Resource Management Act 1991 (RMA)[1] Regional Councils have responsibility for maintaining indigenous biodiversity, as well as protecting significant vegetation and habitats of threatened species.

The KNE programme funding is allocated for under The Greater Wellington Long Term Plan (2021-2031)[2] and is managed in accordance with The Greater Wellington Biodiversity Strategy[3] that 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[4] and the Regional Pest Management Plan 2019-2039[5].

# 3. The 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. Sites with the highest biodiversity values have been identified and prioritised for management.

KNE sites are managed in accordance with five-year KNE plans prepared by Greater Wellington's Environment Restoration team. Greater Wellington works with the 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, it 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 common place | 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, i.e., 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 in order 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.

# 4. Karehana Bay Bush Key Native Ecosystem site

The Karehana Bay Bush KNE site covers 38.5 ha of coastal lowland forest. It is located on a coastal hillside just north of Plimmerton village, near the entrance to Te Awaroa o Porirua Harbour (see Appendix 1, Map 1). Set slightly inland from the coast, it is flanked by the Karehana Bay suburb, the Ngāti Toa settlement of Hongoeka, farmland and a large area of privately-owned regenerating indigenous forest.

The KNE site includes Karehana Bay Scenic Reserve (17.7 ha), the second largest area of publicly owned forest in Porirua city centre, and ten blocks of forest that are privately owned. The kohekohe-tawa forest within the scenic reserve, which is now restricted to isolated pockets, is characteristic of bush that once extended from Makara to Waikanae. The scenic reserve is classified by Porirua City Council (PCC) in the Inventory of Ecological Sites in Porirua City Council district as SES1 — the highest level of ecological significance and rarity[6]. The reserve has been used by Friends of Mana Island volunteers as a seed source for an extensive re-vegetation project on Mana Island[7].

The KNE site is closely connected to Mana Island and several other KNE sites, providing opportunities for seed dispersal by native bird species. The KNE site is 600 m west of the Taupō Swamp Complex KNE site, 2 km north of the Whitireia Coast KNE site, 3 km south of the Raroa-Pukerua Coast KNE site and 6 km from Mana Island.

# 5. Parties involved

## 5.1. Landowners

The Karehana Bay Bush KNE site has both public and private landowners:

- Porirua City Council (PCC) owns and manages 17.7 ha of the KNE site. This land is gazetted as a Scenic 'A' Reserve under the Reserves Act 1977, and it is managed in accordance with PCC's Porirua City Reserves Management Plan[8]. This plan provides for and ensures the maintenance, protection, preservation and enjoyment of heritage, natural, and recreational values
- The remaining approximately 21 ha consists of ten privately owned land blocks.

Land ownership boundaries are shown in Appendix 1, Map 2.

## 5.2. Operational delivery

Within Greater Wellington, two departments are responsible for delivering the Karehana Bay Bush KNE operational plan.

- The Environment Restoration team is the lead team for Greater Wellington and is responsible for longer-term planning and coordination of biodiversity management activities, and advice within the KNE site
- The Pest Animals and Pest Plants 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.

PCC delivers and provides funding towards biodiversity management activities within the KNE site on PCC owned land in accordance with the Porirua City Reserves Management Plan[9] and the Proposed Porirua District Plan[10].

# 6. 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.

The Karehana Bay KNE site is located within the Wellington Ecological District. It has a mild climate and mean annual rainfall of 1,020-1,030 mm[11].

## 6.1. Ecological designations

Table 1 below, lists ecological designations at all or part of the Karehana Bay Bush KNE site.

**Table 1: Designations at the Karehana Bay Bush KNE site**

| Designation level | Type of designation |
|---|---|
| National | Parts of the Karehana Bay Bush KNE site are designated as a Scenic 'A' Reserve under the Scenic Reserve New Zealand Gazette 1994:<br>• 146095: Karehana Bay Scenic Reserve<br><br>Part of the Karehana Bay Bush KNE site has been identified by DOC as a Designated Ecological Site (See Appendix 1, Map 3):<br>• 401: Karehana Bay Bush (33.92 ha) |
| District | Part of the Karehana Bay Bush KNE has been identified by PCC as a Significant Natural Area. It is listed in the Proposed Porirua District Plan[12] as:<br>• SNA035: Karehana Bay Bush (34.34 ha) |

## 6.2. Ecological significance

The Karehana Bay Bush KNE site is considered to be of regional importance because:

- It contains highly **representative** ecosystems that were once typical or commonplace in the region
- It contains ecological features that are **rare or distinctive** in the region
- It contains high levels of ecosystem **diversity**, with several ecosystem types represented within the KNE site boundary
- Its **ecological context** is valuable at the landscape scale as it contains a variety of inter-connected habitats and, provides core/seasonal habitat for threatened indigenous plant and animal species.

*Representativeness*

The Singers and Rogers[13] classification of pre-human forest vegetation indicates the KNE site would likely have comprised of one dominant ecosystem type comprising of kohekohe, tawa forest (MF6).

Most of the KNE site is still representative of this original ecosystem type (see Appendix 1, Map 4), with some parts in a modified and regenerating condition having experienced

forest clearances, selective logging, hunting and the effects of browsing pest animals. The MF6 forest ecosystem type is considered a regionally threatened ecosystem with only 16% of the original extent remaining in the Wellington region[14].

The Threatened Environment Classification system[15] (see Appendix 1, Map 5) indicates that different areas across the KNE site have varying classifications:

- Some small fringe areas on the northern and western edges of the KNE site are classified as Acutely Threatened (Environments with less than 10% indigenous cover remaining nationally)
- Areas on the western-most edge are classified as Chronically Threatened (Environments with 10-20% native vegetation cover remaining on these types of land in New Zealand)
- Most of the eastern extent of the KNE site is classified as At Risk (Environments with 20-30% native vegetation cover remaining on these types of land in New Zealand)
- A strip through the central area of the KNE site is classified as Critically Under Protected (Environments with greater than 30% native vegetation cover remaining nationally but less than 10% is legally protected).

*Rarity/distinctiveness*

New Zealand's national threat classification system[16] lists several nationally At Risk plant species that are present in the KNE site. Several species present have also been listed as regionally At Risk. Appendixes 2 and 3 contain lists of nationally and regionally At Risk species found in the KNE site.

*Diversity*

The KNE site contains kohekohe – tawa forest and a small wetland.

*Ecological context*

The KNE site is located within 6 km of several KNE sites including Taupō Swamp Complex, Whitireia Coast, Raroa-Pukerua Coast and Porirua Western Forest as well as other important ecological sites such as Te Awarua-o-Porirua Harbour and Mana Island Scenic Reserve. Together these sites form an important network of habitat linkages within the wider ecological landscape, enabling native birds to forage, breed and disperse throughout the local area. The site also provides suitable refuges for several invertebrate and lizard species that require mature forest habitat.

## 6.3. Ecological features

### Vegetation communities and plants

The Karehana Bay Bush KNE site comprises a series of valleys and hills behind Karehana Bay. There are several remnants of coastal kohekohe (*Dysoxylum spectabile*)-tawa (*Beilschmiedia tawa*) forest, some of which have emergent pukatea *(Laurelia novae-zelandiae),* miro *(Prumnopitys ferrunginea),* mataī *(Prumnopitys taxifolia*), northern rātā (*Metrosideros robusta*; Threatened-Nationally Vulnerable), willow leaved maire (*Mida salicifolia*; At Risk-Declining), and rewarewa *(Knightia excelsa*). The remnants are

adjoined and often buffered by areas of semi-mature kānuka (*Kunzea robusta*)-mānuka (*Leptospermum scoparium* var. *scoparium*) scrub. The forest contains some of the headwaters and part of the Karehana Stream.

The forest is in a state of regeneration following clearance and disturbance over the last 100 years. As a large amount of the forest was cleared, the present-day kohekohe–tawa forest remnants are found mostly in gullies. There is also a small raupō wetland present in one of the gullies. Over 150 indigenous plant species are known from this KNE site including two nationally At Risk species the native carrot (*Daucus glochidiatus)* and the large-leaved milk tree/tūrepo (S*treblus banksii))* and two regionally At Risk species. Five podocarp species occur in this forest including mataī (*Prumnopitys taxifolia*), miro (*Prumnopitys ferruginea*), tōtara (*Podocarpus totara* var. *totara*), rimu (*Dacrydium cupressinum*), and kahikatea (*Dacrycarpus dacrydioides*).

## Species

*Birds*

The KNE site provides important habitats for a range of forest birds including kererū (*Hemiphaga* novaeseelandiae), shining cuckoo/pīpīwharauroa (*Chrysococcyx lucidus*), grey warbler/riroriro (*Gerygone igata*), welcome swallow/warou (*Hirundo neoxena*), tūī (*Prosthemadera novaeseelandiae*), and silvereye/tauhou (*Zosterops lateralis*). A New Zealand falcon/kārearea (*Falco novaeseelandiae* sensu *stricto*) was reported just outside the KNE site boundary during October 2014[17] and a North Island kākā (*Nestor meridionalis septentrionalis*) was seen during 2012[18]. Both bird species were seen within the KNE site by local residents in 2018.

*Reptiles*

*Mokopirirakau* "southern North Island" (Ngahere gecko) has been found within the KNE site[19]. Lizard surveys are considered for future opportunities as several other lizard species are expected to be found within this KNE site.

*Freshwater fish and invertebrates*

Karehana Stream flows from Karehana Scenic Reserve through Karehana Park, in the residential area below the KNE site, to the sea. Macroinvertebrates were sampled at the forest edge boundary on Cluny Road and within Karehana Park in 2014[20], with the macroinvertebrate score indicating poor water quality[21,22]. Giant kōkopu (G*alaxias argenteus*), banded kōkopu (G*alaxias fasciatus*), common bully (*Gobiomorphus citidianus*), longfin eel (*Anguilla dieffenbachii*), and shortfin eel (*Anguilla australis*) [23] have been observed.

# 7. 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. Appendix 4 presents a summary of all known threats to the Karehana Bay Bush KNE site.

## 7.1. Key threats

The primary threats to the ecological values of the Karehana Bay Bush KNE site are ecological weed species, pest animals, and adverse impacts from human activities such as green waste and rubbish dumping.

Ecological weeds are widespread throughout the KNE site. Climbing and ground cover weeds have the highest ecological impact within the site. These weed species can smother native vegetation and inhibit native regeneration, resulting in altered vegetation structure and reduced species diversity. The non-local native species karaka (*Corynocarpus laevigatus*) is considered an ecological weed at the site as it is known to outcompete and displace local native species.

Pest animals such as possums (*Trichosurus vulpecula*), rats (*Rattus* spp.), mustelids (*Mustela* spp.), hedgehogs (*Erinaceus europaeus*), cats (*Felis catus*), and feral goats (*Capra hircus*) pose the greatest threats to the identified ecological values of the KNE site. Possums and feral goats inhibit regeneration of native forest understory by over-browsing palatable native plant species. Rats, mustelids, hedgehogs, and cats impact the forest and the escarpment habitat through direct predation of lizards and birds, by reducing food resources available to native species and by over-browsing native vegetation. Reinvasion of pest animals from the surrounding landscape is common and is likely to be an enduring threat to the biodiversity values within the KNE site.

Illegal rubbish dumping is known to occur around the urban edges of the KNE site and has the potential to contaminate watercourses that flow through the site. Green waste dumping in adjacent gardens can lead to the introduction of new weed species and consequently, weed infestations within the KNE site. In addition, other inappropriate materials such as treehouses and silt traps, are illegally placed in the reserve.

# 8. Vision and objectives

## 8.1. Vision

*A flourishing indigenous forest which supports a high diversity and abundance of native flora and fauna.*

## 8.2. 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 Karehana Bay Bush KNE site:

1. ***To improve the native integrity of the forest and wetland ecosystems.***
2. ***To improve regeneration of the forest and the condition of the forest canopy.***
3. ***To improve the habitat for and abundance of native species.***

# 9. Operational activities

Operational activities are targeted to work towards the objectives above (section 8). The broad approach to operational activities is described briefly below, and specific actions, with budget figures attached, are set out in the operational delivery schedule (Table 2). The primary management activities undertaken in the KNE site are ecological weed control and pest animal control.

## 9.1. Ecological weed control

Ecological weed control is undertaken to improve the regeneration of native plants and allow for the indigenous species to dominate across the KNE site.

Climbing species are the priority for weed control and previously targeted areas will be followed up and expanded on. Weed sweeps are undertaken to keep priority species under control and focuson old man's beard *(Clematis vitalba*), climbing asparagus (*Asparagus scadens)*, and mile a minute (*Persicaria perfoliata*)

Weed control through the small wetland is also prioritised, in line with objective 1 of this KNE plan, as it is of high value. This will focus on species like Japanese honeysuckle *(Lonicera japonica*), convolvulus (*Convolvulus arvensis*), and tradescantia (*Tradescantia fluminensis).* A full list of weed species present at Karehana Bay can be found in Appendix 5.

Weed surveys were undertaken in 2002[24] and 2013[25] which indicated the areas within the KNE site that had high weed infestations and the impact of weeds present. Comparisons of data from these surveys concluded that the weed control which had been undertaken since 2009/2010 was reducing the impact of weeds present.

## 9.2. Pest animal control

The aim of pest animal control is to reduce pressures on native species by controlling possum and rat densities. This allows for regeneration of areas of mature native forest and increases in populations of native birds and lizards, in line with objectives 2 and 3 of this KNE plan.

Pest animal control has been undertaken at the site by Greater Wellington since 2000, targeting possums and rats. This control consists of a network of 52 toxin bait stations positioned within the KNE site and 20 bait-stations located in a surrounding buffer zone outside of the KNE boundary to reduce reinvasion into the KNE site (see Appendix 1, Map 6). The pest animal control network is maintained and serviced by Greater Wellington on a quarterly basis.

# 10. Future opportunities

Below are suggestions of further management activities that have been identified as having the potential to improve and protect the biodiversity values of the KNE site.

## 10.1. Lizard survey

Based on records of lizards in nearby areas and the habitat types in the KNE site, there are three species of lizards that would be expected to be present in the site. However, they haven't been recorded at this site in recent times. Therefore, a lizard survey could be undertaken to determine which species are currently present in the KNE site. There are a variety of methods which could be used to achieve this including spotlighting and active ground searches, tree wraps, tracking cards, artificial cover objects, and pitfall traps. Lizard monitoring is the most effective in summer and will create a better understanding of the management and protection measures needed for lizards at the KNE site.

## 10.2. Revegetation planting

Revegetation planting could be undertaken in areas where ecological weed control has been carried out. This would increase the native plant cover and reduce the reinvasion of weed species into these areas. Revegetation planting would also provide additional resources for native birds. This is in alignment with the objectives 2 and 3 of this KNE operational plan.

# 11. Operational delivery schedule

The operational delivery schedule shows the actions planned to achieve the stated objectives for the Karehana Bay Bush KNE site, and their timing and cost over the five-year period from 1 July 2023 to 30 June 2028. The budget for years 2024/25 to 2027/28 are indicative only and subject to change.

**Table 2: Five-year operational plan for the Karehana Bay Bush KNE site**

| Objective | Management activity | Operational area | The Actions: Description/detail | Intended 5-year outcome | Implementing party | Timetable and resourcing where allocated | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 |
| 1,2 | Ecological weed control | Whole KNE site | Focus on target species within the KNE boundary<br><br>Record and GPS any new incursions of weed species | Reduce distribution and density of target species | Pest Animals and Pest Plants teams | $5,462 | $5,571 | $5,682 | $5,795 | $5,911 |
| 2,3 | Pest animal control | Whole KNE site and buffer zone control | Bait stations serviced four times annually | Possums <5% RTC*<br>Rats < 10% TTI** | Pest Animals and Pest Plants teams | $6,866 | $7,002 | $7,142 | $7,284 | $7,430 |
| **Total** | | | | | | **$12,328** | **$12,573** | **$12,824** | **$13,079** | **$13,341** |

*RTC = Residual Trap Catch. The control regime has been designed to control possums to this level but monitoring will not be undertaken. Experience in the use of this control method indicates this target will be met

**TTI = Tracking Tunnel Index. The control regime has been designed to control rats/mustelids to this level but monitoring will not be undertaken. Experience in the use of this control method indicates this target will be met

# 12. Funding contributions

## 12.1. Budget allocated by Greater Wellington

The budget for the years 2024/25 to 2027/28 are indicative only and subject to change.

**Table 3: Greater Wellington allocated budget for the Karehana Bay Bush KNE site**

| Management activity | Timetable and resourcing | | | | |
|---|---|---|---|---|---|
| | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 |
| Ecological weed control | $3,017 | $3,077 | $3,138 | $3,200 | $3,264 |
| Pest animal control | $3,433 | $3,501 | $3,571 | $3,642 | $3,715 |
| **Total** | **$6,450** | **$6,578** | **$6,709** | **$6,842** | **$6,979** |

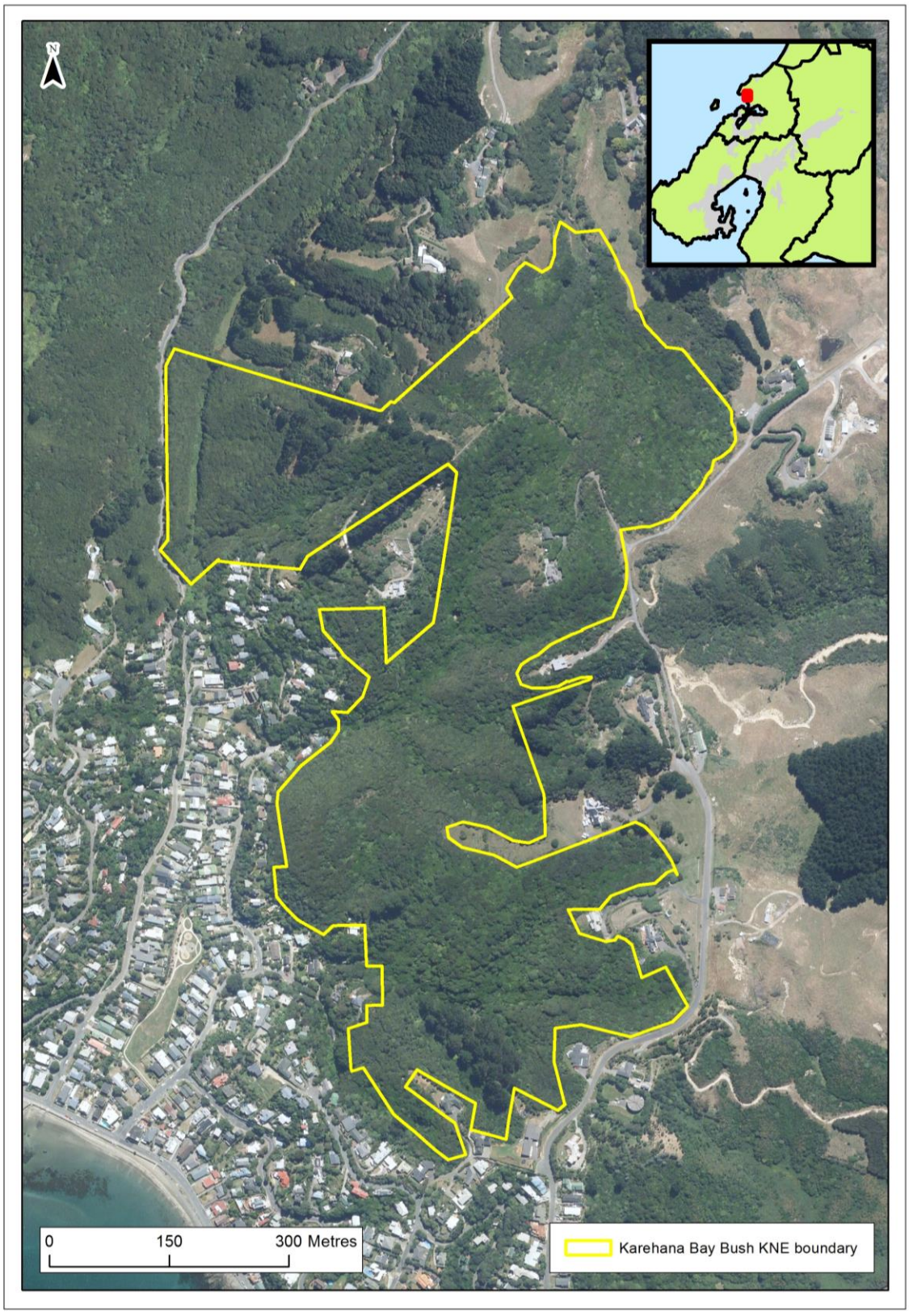
## 12.2. Budget allocated by Porirua City Council

The budget is subject to confirmation through PCC's ten-year planning process.

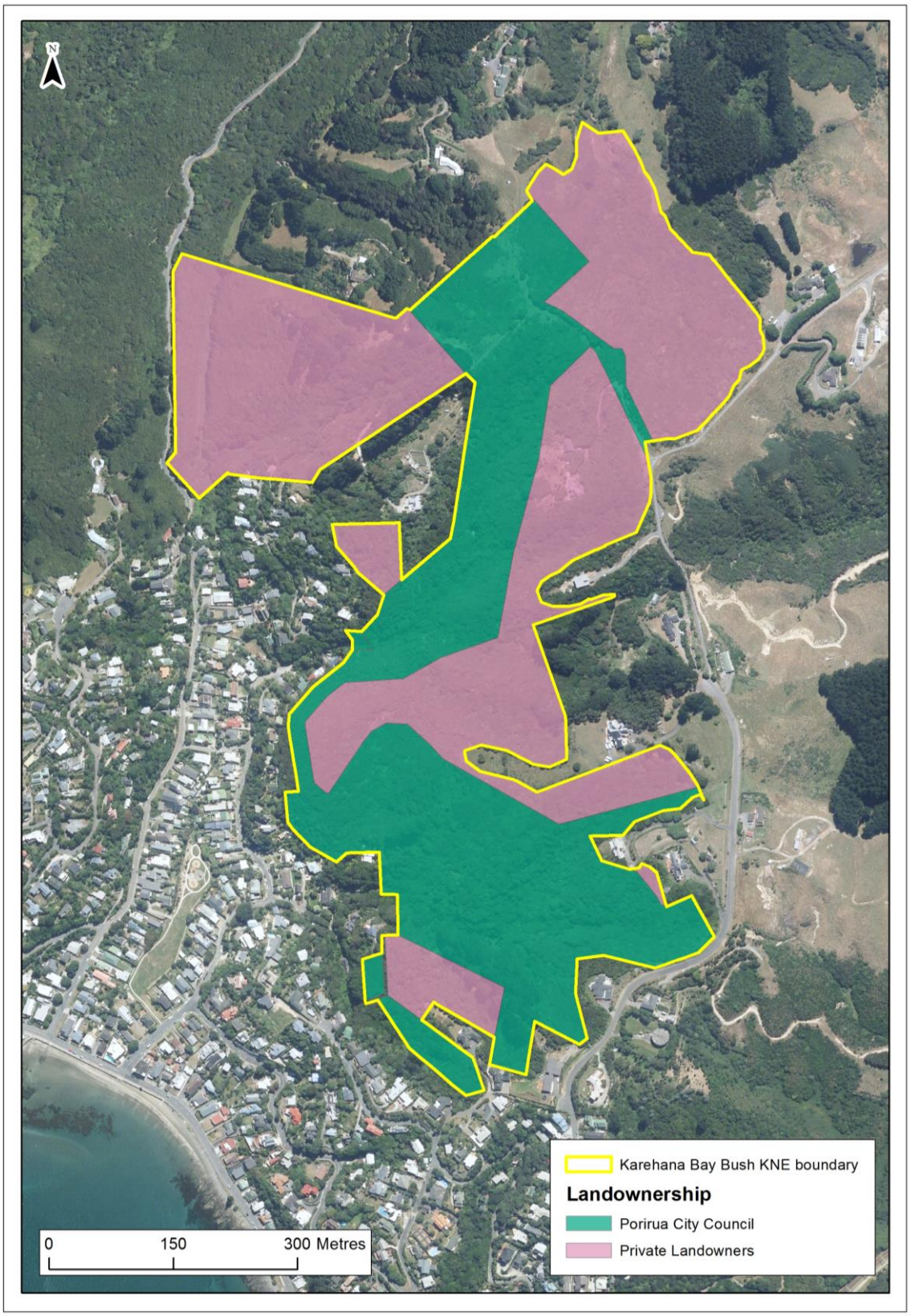
**Table 4: PCC allocated budget for the Karehana Bay Bush KNE site**

| Management activity | Timetable and resourcing | | | | |
|---|---|---|---|---|---|
| | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 |
| Ecological weed control | $2,445 | $2,494 | $2,544 | $2,595 | $2,647 |
| Pest animal control | $3,433 | $3,501 | $3,571 | $3,642 | $3,715 |
| **Total** | **$5,878** | **$5,995** | **$6,115** | **$6,237** | **$6,362** |

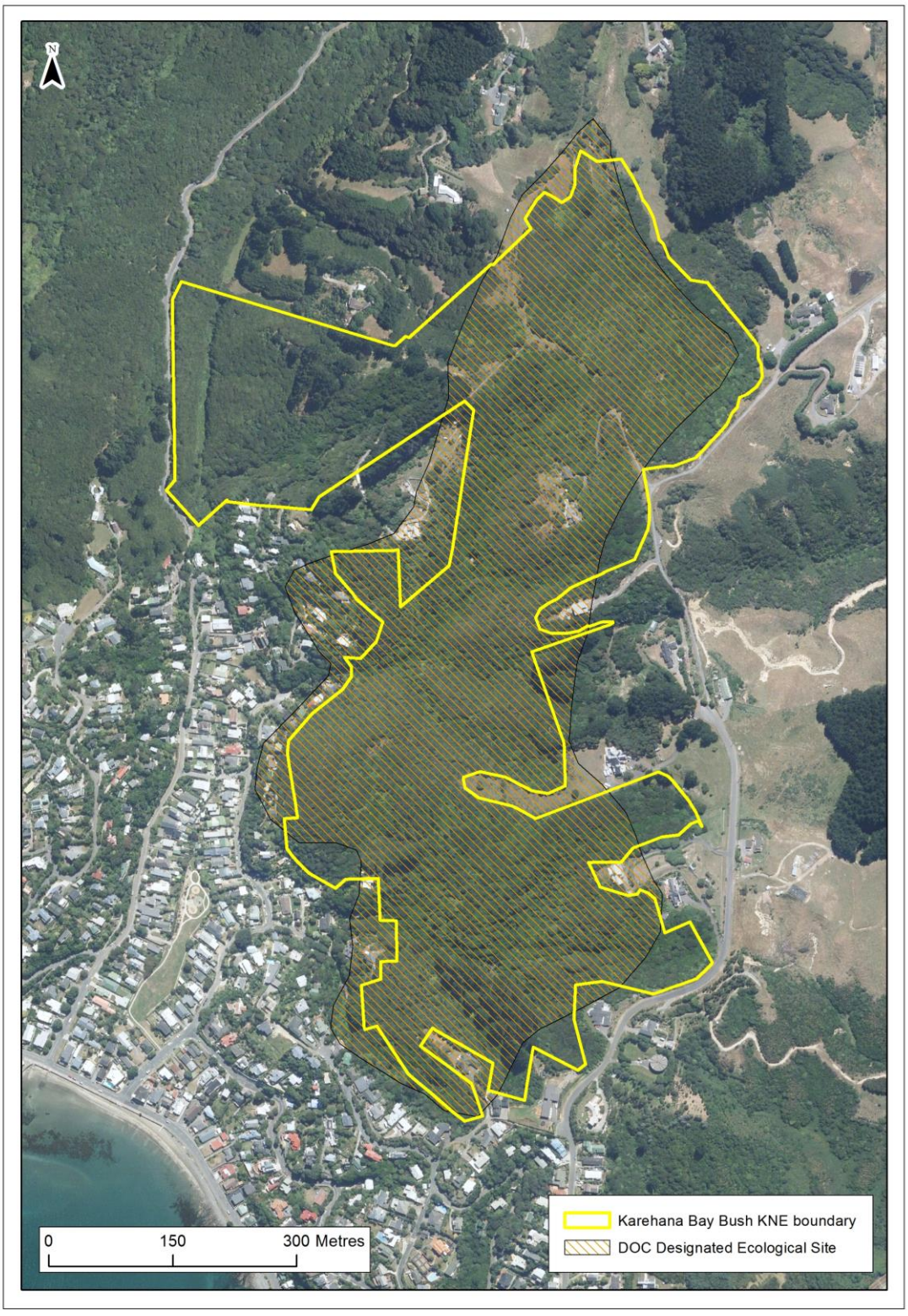
# Appendix 1: Karehana Bay Bush KNE site maps



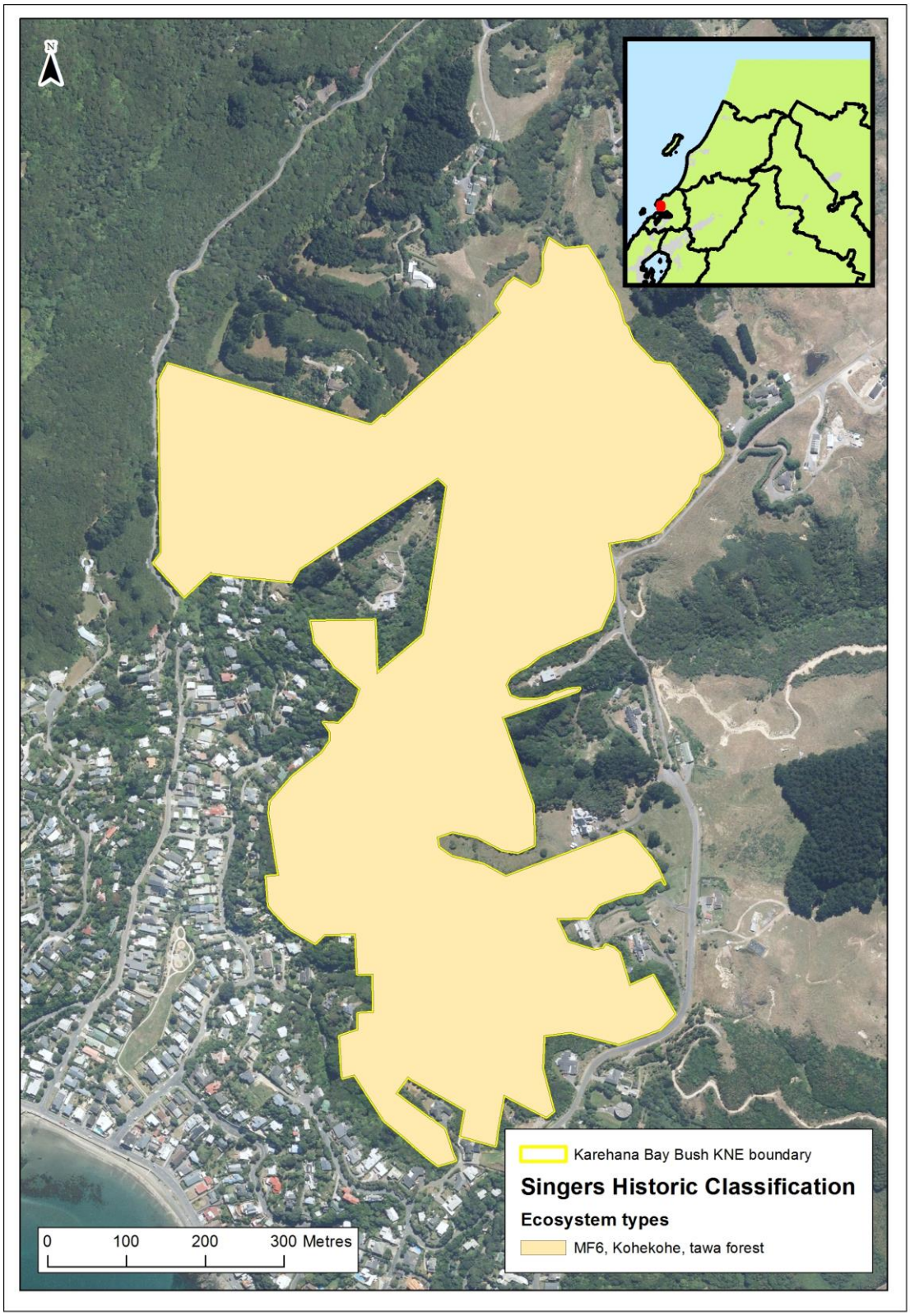

**Map 1: The Karehana Bay Bush KNE site boundary**



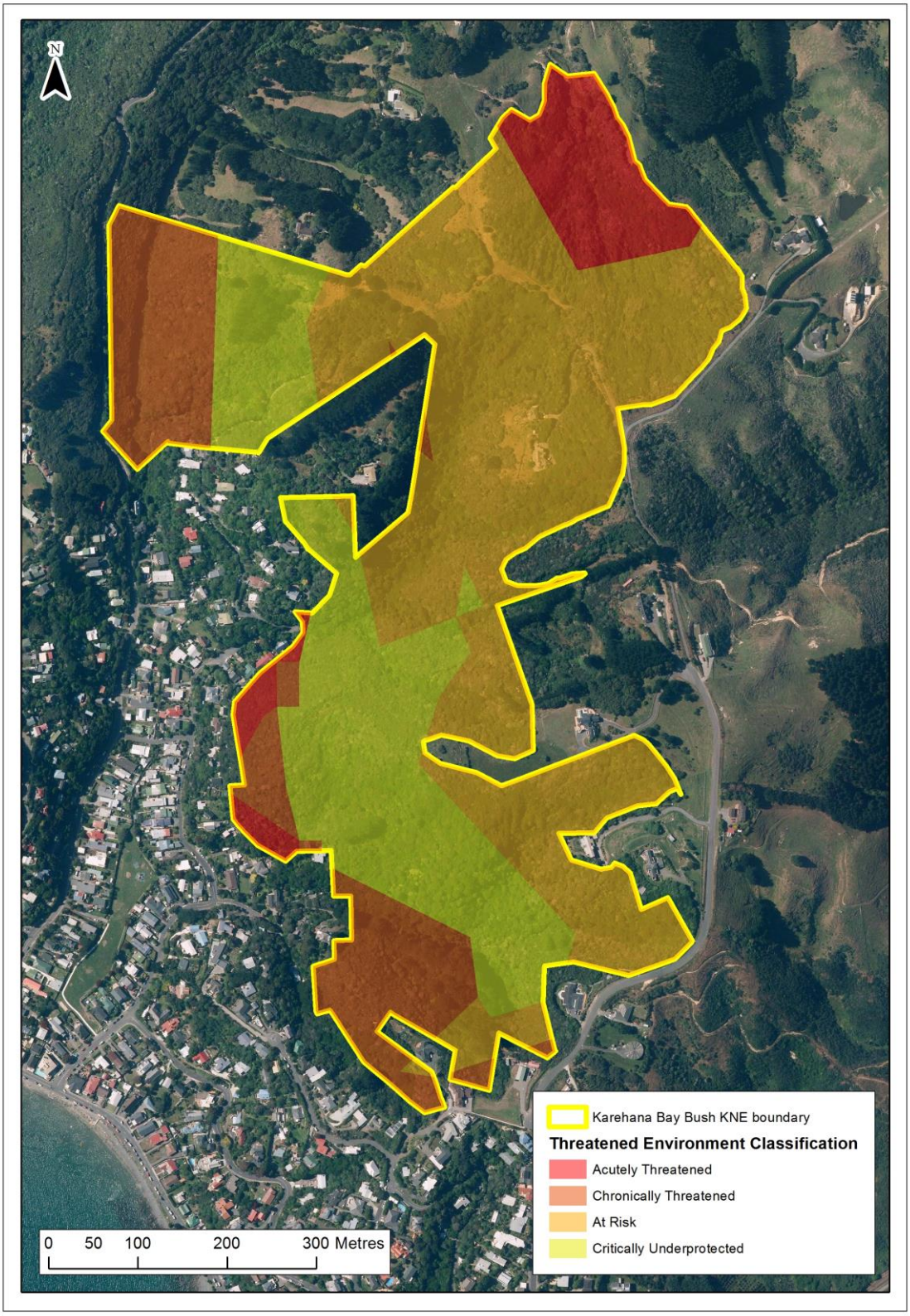

**Map 2: Land ownership boundaries within the Karehana Bay Bush KNE site**



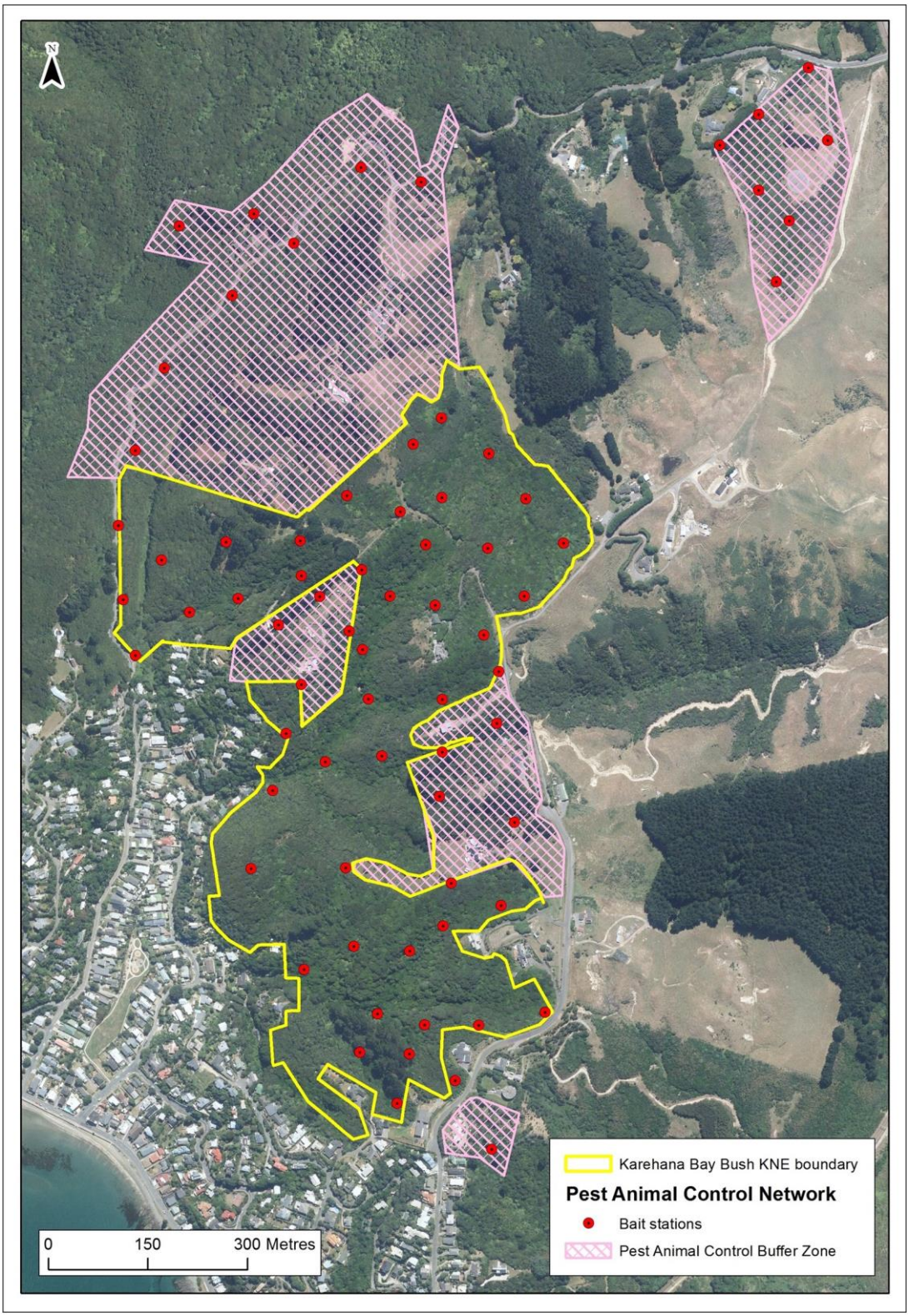

**Map 3: DOC Designated Ecological Site within the Karehana Bay Bush KNE site**




**Map 4: Forest cover classifications for the Karehana Bay Bush KNE site**




**Map 5: LENZ Threatened Classification system**




**Map 6: Pest animal control network in the Karehana Bay Bush KNE site.**

# Appendix 2: Nationally threatened species list

The New Zealand Threat Classification System lists species according to their threat of extinction. The status of each species group (plants, reptiles, etc.) is assessed over a five-year cycle[26,27,28]. Species are regarded as Threatened if they are classified as Nationally Critical, Nationally Endangered or Nationally Vulnerable. They are regarded as At Risk if they are classified as Declining, Recovering, Relict or Naturally Uncommon. The following table lists the nationally threatened species at Karehana Bay Bush KNE site.

**Table 5: At Risk species at the Karehana Bay Bush KNE site**

| Scientific name | Common name | Threat status | Observation |
|---|---|---|---|
| Plants(vascular)[29] | | | |
| *Daucus glochidiatus* | Native carrot | At Risk – declining | New Zealand Plant Conservation Network database 2014 |
| *Streblus banksii* | Large-leaved milk tree, / tūrepo | At Risk – relict | Enright et al. 1999[30] |
| Reptiles[31] | | | |
| *Mokopirirakau "southern North Island"* | Ngahere gecko | At Risk – declining | Department of Conservation 2022 |

# Appendix 3: Regionally threatened species list

A methodology to create regional threat lists 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 (e.g., 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.

The following table lists regionally threatened species that have been recorded in the Karehana Bay Bush KNE site.

**Table 6: Regionally threatened species recorded in the Karehana Bay Bush KNE site**

| Scientific name | Common name | Threat status | Observation |
|---|---|---|---|
| Plants[32] | | | |
| *Mida salicifolia* | Willow leaved maire | At Risk – declining | Enright et al. 1999[33] |
| *Streblus banksii* | Large-leaved milk tree, tūrepo | At Risk – relict | Sawyer JWD 2004[34] |
| Birds [35] | | | |
| *Hemiphaga novaeseelandiae* | New Zealand wood pigeon, Kererū | At Risk – recovering | Resident observations |
| Reptiles[36] | | | |
| *Mokopirirakau* (Southern North Island) | Ngahere gecko | At Risk – declining | Department of Conservation 2022 |

# Appendix 4: Threat table

Appendix 4 presents a summary of all known threats to the Karehana Bay Bush KNE site including those discussed in section 7.

**Table 7: Threats to the Karehana Bay Bush KNE site**

| Threat code | Threat and impact on biodiversity in the KNE site | Operational area/location |
|---|---|---|
| Ecological weeds | | |
| 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 include climbing asparagus *(Asparagus scandens*) and tradescantia (*Tradescantia fluminensis*) (see full list in Appendix 5). | Entire KNE site |
| EW-2 | Woody weed species displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key woody ecological weed species include Darwin's barberry (*Berberis darwinii*), buddleia (*Buddleja davidii*), and boneseed (*Chrysanthemoides monilifera* subsp. *monilifera*) (see full list in Appendix 5). | Entire KNE site |
| 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 include old man's beard (*Clematis vitalba*), mile a minute (*Persicaria perfoliata*), and convolvulus (*Convolvulus arvensis*) (see full list in Appendix 5). | Entire KNE site |
| Pest animals | | |
| PA-1 | Possums (*Trichosurus vulpecula*) browse palatable canopy vegetation until it can no longer recover[37,38]. This destroys the forest's structure, diversity, and function. Possums may also prey on native birds and invertebrates[39]. | Entire KNE site |
| 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[40,41] . | Entire KNE site |
| PA-3* | Mustelids (stoats[42,43] (*Mustela erminea*), ferrets[44,45] (*M. furo*) and weasels[46,47] (*M. nivalis*)) prey on native birds, lizards, and invertebrates, reducing their breeding success and potentially causing local extinctions. | Entire KNE site |
| PA-4* | Hedgehogs (*Erinaceus europaeus*) prey on native invertebrates[48], lizards[49], and the eggs[50] and chicks of ground-nesting birds[51] . | Entire KNE site |

| Threat code | Threat and impact on biodiversity in the KNE site | Operational area/location |
|---|---|---|
| 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[52,53]. | Entire KNE site |
| PA-6* | Pest and domestic cats (*Felis catus*) prey on native birds[54], lizards[55], and invertebrates[56], reducing native fauna breeding success and potentially causing local extinctions[57]. | Entire KNE site (especially near urban edges) |
| PA-7* | Rabbits (*Oryctolagus cuniculus*) and hares (*Lepus europaeus*) graze on palatable native vegetation and prevent natural regeneration in some environments[58]. In drier times hares especially, will penetrate into wetland forest areas browsing and reducing regenerating native seedlings. | Entire KNE site (especially near urban edges) |
| PA-8 | Goats (*Capra hircus*) browsing affects the composition and biomass of native vegetation in the understory tiers of forest habitats, preventing regeneration of the most palatable understory species and reducing species diversity[59]. | Entire KNE site |
| Human activities | | |
| HA-1* | Garden waste dumping often leads to ecological weed invasion into natural areas. Common weed species introduced at this KNE site include: old man's beard *(Clematis vitalba*), climbing asparagus (*Asparagus scadens* ), and mile a minute (*Persicaria perfoliata*). | KNE site boundary (urban sections) |
| HA-2* | People accessing the KNE site (for recreation, work, or research purposes) can damage native vegetation, disturb native fauna and introduce ecological weeds seeds. Light wells along tracks are likely ecological weed reinvasion points. | Entire KNE site |
| HA-3* | Fire has the potential to destroy vegetation and create opportunities for weed invasion and edge effects. | KNE site boundary (urban sections) |

*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 Karehana Bay Bush KNE site.

The distribution and density of individual species within the KNE site 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 8: Ecological weed species recorded in the Karehana Bay Bush KNE site**

| Scientific name | Common name | Priority | Level of distribution | Management aim | Notes |
|---|---|---|---|---|---|
| *Agapanthus praecox* subsp. *orientalis* | Agapanthus | 1 | Widespread and abundant | Suppression | Seeds are spread by the wind. It can become locally dominant |
| *Asparagus scandens* | Climbing asparagus | 1 | Widespread and dense | Suppression | Seeds are spread by birds and can establish in shade. It can smother the canopy of the forest |
| *Berberis darwinii* | Darwin's barberry | 1 | Patchy and abundant | Suppression | Seeds are spread by birds and can establish in shade |
| *Chrysanthemoides monilifera* | Boneseed | 1 | Patchy and dense | Suppression | Establishes in light gaps. Seeds are spread by wind |
| *Clematis vitalba* | Old man's beard | 1 | Widespread and abundant | Suppression | Smothers native plant species. Seeds are spread by the wind |
| *Cobaea scandens* | Cathedral bells | 1 | Patchy and sparse | Suppression | Potential to become a major weed of this forest |
| *Correa alba* | White correa | 1 | Patchy and sparse | Surveillance | Seeds are spread by birds into light gaps |
| *Cotoneaster glaucophyllus* | Cotoneaster | 1 | Widespread and abundant | Suppression | Seeds are spread by birds and can establish in shade |
| *Crocosmia* × *crocosmiiflora* | Montbretia | 1 | Localized and dense | Suppression | Forms dense clumps excluding native seedlings. Produces small cormels on the flower head and on existing corms and sends out creeping rhizomes to extend the colony |

| Scientific name | Common name | Priority | Level of distribution | Management aim | Notes |
|---|---|---|---|---|---|
| *Dipogon lignosus* | Mile-a-minute | 1 | Widespread and abundant | Suppression | Vigorous climber capable of smothering forest edges |
| *Elaeagnus* × *reflexa* | Elaeagnus | 1 | Patchy and abundant | Surveillance | Seeds are spread by birds and invade all types of shrublands |
| *Hedera helix* subsp. *helix* | Ivy | 1 | Patchy and sparse | Suppression | Vigorous climber of forest edges. Seeds are spread by birds and can establish in shade |
| *Hedychium gardnerianum* | Kahili ginger | 1 | Patchy and sparse | Suppression | Seeds are spread by birds and can establish in shade |
| *Jasminum polyanthum* | Jasmine | 1 | Widespread and abundant | Suppression | Vigorous climber smothers native plant species |
| *Lamium galeobdolon* | Aluminium plant | 1 | Patchy and sparse | Surveillance | Ground cover excludes native seedling regeneration |
| *Lonicera japonica* | Japanese honeysuckle | 1 | Widespread and dense | Suppression | Vigorous climber smothers native plant species. Berries are spread by birds |
| *Passiflora mixta* | Banana passionfruit | 1 | Localized and dense | Suppression | Vigorous climber smothers native plant species. Berries are spread by birds |
| *Syzygium australe* | Brush cherry | 1 | Localized and sparse | Eradication | Smothers low growing native plants. Berries are spread by birds |
| *Tradescantia fluminensis* | Tradescantia | 1 | Patchy and abundant | Suppression | Dense ground cover can prevent indigenous regeneration |
| *Corynocarpus laevigatus* | Karaka | 2 | Localized and dense | Suppression | Dominates Wellington forests and prevents local natives from growing under them |
| *Crassula multicava* subsp. *multicava* | Fairy crassula | 2 | Patchy and sparse | Surveillance | Forms dense cover preventing native seedling germination |
| *Hedychium flavescens* | Yellow ginger | 2 | Patchy and sparse | Surveillance | Seeds are spread by birds and can establish in shade |
| *Melianthus major* | Cape honey flower | 2 | Patchy and sparse | Surveillance | Spreads into light gaps |

| Scientific name | Common name | Priority | Level of distribution | Management aim | Notes |
|---|---|---|---|---|---|
| *Pinus radiata* | Radiata pine | 2 | Localized and dense | Suppression | Spreads into light gaps |
| *Prunus* sp. | Ornamental cherry | 2 | Localized and sparse | Suppression | Seeds are spread by birds |
| *Quercus* sp. | Oak | 2 | Patchy and sparse | Surveillance | Planted along some tracks |
| *Rubus* sp. (*R. fruticosus* agg.) | Blackberry | 2 | Patchy and sparse | Suppression | Occupies wet areas |
| *Alocasia brisbanensis* | Elephants' ears | 3 | Patchy and sparse | Suppression | Large perennial which occupies wet areas |
| *Buddleja davidii* | Buddleia | 3 | Localized and dense | Suppression | Forms dense impenetrable stands that are hard to eradicate |
| *Convolvulus arvensis* | Convolvulus | 3 | Widespread and abundant | Suppression | Climbs over and smothers plants. Easily confused with native species |
| *Gunnera tinctoria* | Chilean rhubarb | 3 | Patchy and sparse | Suppression | Large perennial which occupies wet areas |
| *Paraserianthes lophantha* | Brush wattle | 3 | Localized and abundant | Suppression | Establishes on disturbed sites |
| *Plectranthus ciliatus* | Plectranthus | 3 | Patchy and sparse | Suppression | Groundcover which tolerates shade |
| *Polygala myrtifolia* | Sweet pea shrub | 3 | Patchy and sparse | Suppression | Establishes on disturbed sites |
| *Senecio angulatus* | Cape ivy | 3 | Patchy and sparse | Suppression | Establishes on disturbed sites |
| *Tropaeolum majus* | Nasturtium | 3 | Patchy and sparse | Surveillance | Establishes on disturbed sites |
| *Ulex europaeus* | Gorse | 3 | Widespread and abundant | Suppression | Regional Pest Management Strategy requires boundary control |
| *Zantedeschia aethiopica* | Arum lily | 3 | Patchy and sparse | Suppression | Large perennial which occupies wet areas |

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

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