Key Native Ecosystem Operational Plan for Haruātai/Pareomatangi

2025-2030

Contents

1. Purpose

The purpose of this five-year Key Native Ecosystem (KNE) operational plan for Haruātai/Pareomatangi 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. Haruātai/Pareomatangi Key Native Ecosystem site

The Haruātai/Pareomatangi KNE site (12.7ha) is located on the northern edge of Ōtaki township and 200m west of State Highway 1 (Appendix 2, Map 1). The KNE site is recognised as the second largest swamp forest located in the Kāpiti Coast District[1] and comprises one of the few remaining examples of dune swamp forest in the region[2]. The KNE site contains several distinct habitat types including mixed duneland forest, mature remnant kahikatea-pukatea swamp forest, and reedland/sedgeland wetlands.

Part of the Haruātai/Pareomatangi KNE site is scheduled as a Significant Natural Wetland in the Natural Resources Plan (NRP)[3] for its representativeness and rarity.

A major focus of site management is weed control. Since the last iteration of this plan the site extent has been reduced by 9.5ha by removing degraded areas of forest and scrubland to the west. The intention of this is to focus resources on the most intact ecosystem remnants where weed threats are more manageable within existing budgets.

The KNE site is predominantly surrounded by farmland and some residential development. It is located nearby to several other coastal and wetland KNE sites including Otepua-Paruāuku Wetlands, Ōtaki Coast, Waitohu Coast and Wetlands, Lake Waiorongomai and Stream, and Te Horo Forest Remnants. Together these KNE sites form an important network of habitat linkages within the wider landscape, enabling coastal, wetland and forest birds to forage, breed and disperse throughout the local area.

3. Parties involved

There are several organisations and individuals that play important roles in the care of the Haruātai/Pareomatangi KNE site.

3.1. Landowners

There are three landowners within the KNE site:

- Tungia TH Trust, a privately run family Trust (8.7ha)
- Land Information New Zealand (LINZ) (3.8ha)
- Kapiti Coast District Council (KCDC) (0.2ha)

Land ownership boundaries are provided in Appendix 2, Map 2.

3.2. Operational delivery

Within Greater Wellington, three teams are responsible for delivering the Haruātai/Pareomatangi 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.

Kāpiti Coast District Council (KCDC) funds and delivers management of parts of the KNE site as Ecological Sites of Significance in accordance with the Kāpiti Coast District Plan[4]. KCDC also manages a small part of the KNE site as a Recreation Reserve in accordance with the Haruātai Park Management Plan[5].

The Tungia TH Trust undertake revegetation planting on their land within the KNE site. This planting is funded by KCDC and Greater Wellington. Members of the Tungia TH Trust and Greater Wellington will meet annually to discuss the priority management actions to be undertaken on their property.

3.3. Mana whenua partners

The Haruātai/Pareomatangi KNE site is located within the rohe (district) of Ngā Hapū o Ōtaki who are one of Greater Wellington's six mana whenua partners in the region. In accordance with the Integrated Catchment Management Agreement[6] for the Ōtaki River Catchment, Greater Wellington is committed to identifying ways in which kaitiakitanga can be strengthened by exploring opportunities of how Ngā Hapū o Ōtaki wish to be involved in the plan development or operational delivery of the KNE site.

Ngā Hapū o Ōtaki have previously been involved in the management of the KNE site through their local university, Te Wānanga o Raukawa (TWOR). The KNE site was utilised for practical lessons through the Kaitiakitanga Pūtaiao (Environmental Management) course offered to students at TWOR. The Tungia TH Trust and the Crown agreed for TWOR to undertake biodiversity management on their lands.

The LINZ-owned land block which includes part of the KNE site is subject to a Treaty of Waitangi claim.

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

Table 1, below, lists ecological designations at all or part of the Haruātai/Pareomatangi KNE site.

Table 1: Designations at the Haruātai/Pareomatangi KNE site

Designation level	Type of designation
National	Part of the Haruātai/Pareomatangi KNE site has been identified by DOC as a Designated Ecological Site: • 342: Haruātai Park Forest (10.5ha) Part of the Haruātai/Pareomatangi KNE site has been identified by DOC as a Recommended Area for Protection (RAP): • RAP 2(2): Haruatai Park (4.59ha)
Regional	Part of the Haruātai/Pareomatangi KNE site is scheduled under Greater Wellington's Natural Resources Plan (NRP)[7] as Ecosystems and Habitats with Significant Indigenous Biodiversity Values: • Significant Natural Wetland: Haruatai Park Forest (7.33ha) (Schedule F3)
District	Parts of the Haruātai/Pareomatangi KNE have been identified by KCDC as Ecological Sites of Significance. They are listed in the KCDC District Plan Heritage Register[8] as: • K015: Haruatai Park Forest (5.79ha) • K211: State Highway 1 South, Ōtaki (2.62ha)

4.2. Ecological significance

The Haruātai/Pareomatangi 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, including one naturally uncommon ecosystem
- It contains high levels of ecosystem **diversity**, with several ecosystem types represented
- Its **ecological context** is valuable at the landscape scale as it comprises an important habitat 'stepping stone' between other remnants in the wider landscape.

Representativeness

The Threatened Environment Classification system[9] indicates that the entire KNE site is considered Acutely Threatened with less than 10% indigenous cover remaining and that the habitat is under-protected on a national scale.

The Singers and Rogers[10] classification of pre-human ecosystems in New Zealand indicates that three ecosystem types were present within the KNE site (See Appendix 2, Map 3). These were comprised of kahikatea-pukatea forest (WF8), tōtara-mataī broadleaved dune forest (WF6), and a swamp mosaic of flaxland (WL18), raupō reedland (WL19) and coprosma, twiggy tree daisy scrub (WL20).

Aspects of these original ecosystem types are still evident within the KNE site today. The WF8 and WF6 forest ecosystem types once present within the KNE site are considered regionally threatened ecosystems with only 1% and 2% respectively of their original area remaining in the Wellington region[11].

Rarity/distinctiveness

One naturally uncommon ecosystem type[12,13] is present within the KNE site which comprises stable sand dunes with a classification of 'Endangered'.

New Zealand's national threat classification system[14] lists two plant and two bird species found in the KNE site as Nationally Threatened. The 2020 conservation status of indigenous vascular plant species in the Wellington region report[15] also lists one plant species as Regionally Threatened within the KNE site. Nationally and Regionally Threatened species are listed in Appendix 3.

Only approximately 2.3% of the original extent of wetlands remain in the Wellington region[16]. The Haruātai Park swamp forest is scheduled as a Significant Natural Wetland in the NRP[17] and comprises one of the few remaining examples of dune swamp forest in the Foxton Ecological District[18]. Haruātai Park Forest wetland is considered one of the very few remnants remaining of the once widespread wetlands on the Kāpiti Coast[19].

Diversity

For a relatively small site many habitat types are represented. The most significant of these is the intact swamp forest remnant containing a high diversity of plant species. The remnant extends to a dry stable dune ridge demonstrating a now rare ecotone and marked change in species composition. Additionally, the areas of open sedgeland and reedland provide important representations of wetland habitats favoured by native waterfowl.

Ecological context

The Haruātai/Pareomatangi KNE site is locally isolated but is within 4km of several other KNE sites, namely Otepua-Paruāuku Wetlands, Waitohu Coast and Wetlands, Lake Wairongomai, Otaki Coast, and Te Horo Forest Remnants. Haruātai/Pareomatangi would have once formed part of a continuous forest and wetland sequence connected by the Waitohu stream.

4.3. Ecological features

The Haruātai/Pareomatangi KNE site is located within the Foxton Ecological District[20] which is characterised by Holocene sand-dune country. The climate is warm with westerly to north-westerly winds prevailing with frequent gales and an annual rainfall ranging between 800-1,000mm[21].

The swamp forest remnant is situated on the edge of a sandplain at the top of a parabolic dune[i] and is recognised as the second largest swamp forest located in the Kāpiti Coast District[22,23]. A drainage channel through farmland maintains an ephemeral hydrological connection to the Waitohu stream. The KNE site is also described as a 'recharge dune wetland' system which comprises a hydrological sink, supplied with water stored in shallow unconfined aquifers in the adjacent dunes[24]. The KNE site has significant carbon sequestration values[25].

Flora

The Haruātai/Pareomatangi KNE site contains several distinctly different habitat types and comprise a variety of species types and tree age classes. These characteristics indicate the site is a good example of a self-sustaining, mature swamp forest[26]. The KNE site is described below in eight vegetation communities present (See Appendix 2, Map 4).

Main kahikatea-pukatea swamp forest (Operational area A)

The central eastern portion of the KNE site comprises remnant kahikatea (*Dacrycarpus dacrydioides*)-pukatea (*Laurelia novae-zelandiae*) swamp forest situated in a wet dune hollow[27]. The forest block has undergone modification in the past but is now in a stage of advanced regeneration with scattered mature trees, some rising to 15m tall[28,29]. The canopy is generally dense, comprised predominantly of kahikatea and pukatea with māhoe (*Melicytus ramiflorus*), tawa (*Beilschmiedia tawa*) and occasional rimu (*Dacrydium cupressinum*) and swamp maire (*Syzygium maire*) also present. The understory is dominated by kawakawa (*Piper excelsum*), thin-leaved coprosma (*Coprosma areolata*), swamp coprosma (*Coprosma tenuicaulis*), red matipo (*Myrsine australis*), shining coprosma (*Coprosma lucida*), hangehange (*Geniostoma ligustrifolium*), kohekohe (*Didymocheton spectabilis*), supplejack (*Ripogonum scandens*) and numerous Native fern species such as kiokio (*Parablechnum novae-zelandiae*), climbing hard fern (*Blechnum filiforme*) and hound's tongue fern (*Phymatosorus diversifolius*). Two stands of mamaku (*Cyathea medullaris*) tree fern are present towards the northern most boundary[30].

The Nationally Threatened plant species, poroporo (*Solanum aviculare* var. *aviculare*), has previously been observed in the undergrowth of the main forest block[31].

[i] Parabolic dunes are typically U- or V-shaped dunes, characterised by short to elongated trailing ridges, which terminate downwind. They can be formed from blowouts or from the migration of sand at the landward end of a dune field.

Ephemeral wetland (Operational area B)

The northwestern corner within the main forest block contains a small ephemeral wetland. The wetland is comprised predominantly of *Carex secta* with *Carex virgata*, tī kōuka (*Cordyline australis*), swamp millet (*Isachne globosa*), *Carex lessoniana*, *Carex dissita, Carex maorica* and *Isolepis prolifera* also common. In summer when the area dries out it becomes infested with weeds, predominantly beggar's ticks (*Bidens frondosa*).

North-eastern kahikatea-pukatea forest fragment and linkage (Operational area C)

The northeastern most corner of the KNE site comprises a small stand of mature kahikatea-pukatea swamp forest with a regenerating understorey of kawakawa. This area is subject to edge effects and contains numerous weed species around the forest margins including arum lily (*Zantedeschia aethiopica*), gorse (*Ulex europaeus*), hawthorn (*Crataegus monogyna*) and blackberry (*Rubus* spp.). This small forest stand is gradually being reconnected to the main forest remnant with revegetation planting.

South-eastern sedgeland/rushland wetland (Operational area D)

The south-eastern corner of the KNE site comprises a wetland situated within a steep sided dune hollow. The wetland contains large areas of open water predominantly surrounded by raupō (*Typha orientalis*), wīwī (*Juncus edgariae)* and *Machaerina tenax*[32]. *Isolepis prolifer* and jointed wire rush (*Apodasmia similis*) are also prevalent throughout the wetland. Significant willow (*Salix* spp.) stands are present within the wetland interior with gorse and blackberry also scattered throughout. The northern and western wetland margins are situated on a steep dune face that drops down from surrounding pasture into the wetland hollow. These areas comprise a narrow strip of regenerating scrub including māhoe, tī kōuka, red matipo, and mamaku[33]. A small remnant stand of swamp forest is present on the southern edge with a canopy comprising of kahikatea with pukatea, swamp maire and māhoe. Woody species, ferns and vines dominate the understorey with notable infestations of arum lily, gorse, and English ivy (*Hedera helix*).

Southern kahikatea-pukatea forest fragment and linkage (Operational area E)

This operational area comprises a small strip of mature kahikatea-pukatea swamp forest located between operational areas A and D and buffered by retired pasture dominated by gorse and scattered mahoe. The scrub and forest margins also contain numerous weed species including arum lily, gorse, hawthorn and climbing asparagus (*Asparagus scandens*) as well as mature polar (*Populus* spp.) planted along the boundary of the playing fields.

Duneland margin (Operational area F)

Directly adjoining the western edge of the main kahikatea-pukatea swamp forest is a stable dune ridge with remnant and regenerating duneland forest. This area comprises mature tōtara (*Podocarpus totara*) along with scattered tawa, mataī (*Prumnopitys taxifolia*), tītoki (*Alectryon excelsa*), kohekohe, māhoe, and red matipo. Many weed species are also present including cherry (*Prunus* spp.), hawthorn, gorse, climbing asparagus, old man's beard (*Clematis vitalba*), and African clubmoss (*Selaginella kraussiana*) and these will continue to invade from

thickly infested land to the west. Regenerating māhoe, kawakawa and kohekohe saplings are common in the understorey.

Fauna

Birds

Information about native fauna within the KNE site is scarce. However, the KNE site does provide habitat for several common native bird species, including kereru (*Hemiphaga novaeseelandiae*), tētē-moroiti/grey teal (*Anas gracilis*), riroriro/grey warbler (*Gerygone igata*), kōtare/New Zealand kingfisher (*Todiramphus sanctus vagans*), pūkeko (*Porphyrio melanotus melanotus*), tūī (*Prosthemadera novaeseelandiae*), pīwakawaka/New Zealand fantail (*Rhipidura fuliginosa*), korimako/bellbird (*Anthornis melanura*) and tauhou/silvereye (*Zosterops lateralis*)[34,35].

Fish

The only fish species detected by environmental DNA sampling in December 2024 was tuna/shortfin eel (*Anguilla australis*). Given the poor connectivity to other waterways the paucity of other species is unsurprising.

Invertebrates

Apart from a giant land snail survey in 2024[36] no formal invertebrate surveys have been carried out at the site. No *Powelliphanta traversi otakia* were found within the KNE site.

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 Haruātai/Pareomatangi KNE site are discussed below and all known threats to the KNE site are summarised in Appendix 4.

5.1. Key threats

The primary threats to the ecological values of the Haruātai/Pareomatangi KNE site are ecological weeds and pest animals.

Ecological weeds are widespread throughout the KNE site and include climbing, woody, ground-covering and marginal aquatic weeds. The presence of ecological weeds can affect the biodiversity values of a habitat by out-competing and displacing native plants, inhibiting seedling establishment, affecting the structure and composition of ecosystems and altering hydrological conditions that sustain the wetland ecology. This further hinders the natural regeneration of native vegetation and reduces species diversity and the availability of food resources for native animals.

The presence of highly invasive exotic groundcover species such as African clubmoss, tradescantia (*Tradescantia flumenensis*), and arum lily present the highest threat to the most ecologically intact parts of the site. In addition, exotic climbers within and adjacent to the KNE site present a significant threat to the forest canopy and regeneration potential of the site. These include species such as old man's beard, climbing asparagus (*Asparagus scandens*), banana passionfruit (*Passiflora* sp.) and Japanese honeysuckle (*Lonicera japonica*).

Mustelids, such as stoats (*Mustela erminea*), weasels (*Mustela nivalis*) and ferrets (*Mustela furo*), are one of the greatest threats to native fauna at the KNE site. These pest species prey on native forest and wetland birds, particularly while nesting. Feral and domestic cats (*Felis catus*) also impact on populations of native animals through direct predation. Omnivorous pest animal species include possums (*Trichosurus vulpecula*), hedgehogs (*Erinaceus europaeus*), rats (*Rattus* spp.) and mice (*Mus musculus*). These species pose an enduring threat to the biodiversity values within the KNE site both through direct predation and by feeding on native foliage and/or fruit, degrading habitat and out-competing native species for food and resources. Additionally, rabbits (*Oryctolagus cuniculus*) and hares (*Lepus europaeus*) browse native seedlings, impacting on forest regeneration.

6. Vision and objectives

6.1. Vision

The Haruātai/Pareomatangi KNE site comprises well connected forest and wetland habitats dominated by native vegetation communities, supporting thriving populations of native birds

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 Haruātai/Pareomatangi KNE site.

1. ***To protect and restore the main forest block, increasing the regeneration potential of the forest***
2. ***To increase the extent of the kahikatea-pukatea forest type by increasing the connectivity between the small, isolated forest stands to the main forest block***
3. ***To improve wetland condition within the KNE site***
4. ***To protect essential habitat for native forest and wetland bird species that utilise the KNE site***
5. ***To support mana whenua landowners in their restoration objectives at the KNE site***

7. Operational activities

Operational activities are targeted at working 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 primary management activities undertaken in the KNE site are ecological weed control, pest animal control and revegetation.

The KNE site has been divided into six operational areas based on the vegetation communities present (See Appendix 2, Map 4).

7.1. Ecological weed control

The aim of ecological weed control at the Haruātai/Pareomatangi KNE site is to protect the main swamp forest and facilitate natural regeneration of native plant species, particularly in the small, isolated forest remnants in line with objectives 1, 2, 3 and 4 of this plan. This will be achieved by reducing the distribution and density of existing weed populations across the KNE site through targeted control and preventing the establishment of new weed species within the mature forest block by multi-species weed sweeps.

The KNE site contains numerous ecological weed species, in the forest interior and around the wetland and forest margins across the entire KNE site. Greater Wellington undertakes weed control on an annual basis targeting weed species that have the highest ecological impact (see Appendix 5).

Targeted control of priority exotic groundcover species is undertaken on an annual basis within the main kahikatea-pukatea swamp forest (operational area A) and through other areas of the KNE site as new infestations are identified. Further control will focus on reducing reinvasion of climbers into the main forest block by establishing a buffer zone along the western dune boundary.

Targeted weed control will also be undertaken to remove willows from the south-eastern sedgeland/rushland wetland (operational area D). Areas being planted are cleared of weeds beforehand and released in the first year after planting. This applies mainly to the north-eastern kahikatea-pukatea forest fragment and linkage (operational area C), but in future will extent to the southern kahikatea-pukatea forest fragment and linkage (operational area E).

7.2. Pest animal control

Greater Wellington's Pest Animals team control mammalian browsers and predators within the Haruātai/Pareomatangi KNE site and the wider Ōtaki area with a poison bait-station and mustelid-trap network as part of the Regional Predator Control Programme (RPCP) which is under review currently. The pest animal control network within the KNE site comprises 14 DOC 250 kill-traps, and 7 Sentry Plus bait stations to target mustelids, feral cats, possums and rats (see Appendix 2, Map 5).

7.3. Revegetation

The aim of revegetation at the Haruātai/Pareomatangi KNE site is to increase native plant species dominance, increase the resilience, structure and natural function of native plant communities, link the fragmented forest remnants, enhance essential habitat for native birds and support landowners in undertaking restoration activities on their land in line with all objectives outlined in Section 6.2. All plants will be eco-sourced and suitable species for the site.

Revegetation planting will continue to be undertaken within operational area C to link the smaller swamp forest to, and buffer the edge of, the main swamp forest remnant (operational area A). Once this is complete, the revegetation will move to operational area E and eventually to the south-eastern sedgeland/rushland wetland (operational area D), although not likely within the timeframe of this plan. The plant species to be used and the extent of revegetation undertaken in these areas will be determined on an annual basis in collaboration with KCDC and the Tungia TH Trust. This revegetation work will be funded by Greater Wellington with contributions likely through the contestable KCDC Heritage Fund.

7.4. Fencing

The aim of fencing at the KNE site is to protect existing native plants from stock browse and damage, increase native plant regeneration, particularly within the forest understorey, and enhance essential habitat for native birds in line with the objectives Section 6.2.

Over the last 10 years there have been significant upgrades to many of the fences surrounding the site. However, there continue to be sections in severe states of disrepair. While no site-specific budget is allocated for fencing in this plan, the KNE programme can contribute to fencing costs through general funds. Discussion will continue with the Tungia TH Trust and LINZ to ensure the site is effectively excluded from stock access.

7.5. Monitoring

The Haruātai/Pareomatangi KNE site is part of Greater Wellington's Wetland Health State of the Environment (SoE) monitoring programme. This monitoring is undertaken by the Knowledge and Insights team on a five-yearly basis at key wetland sites in the region. The Haruātai/Pareomatangi KNE site was first surveyed in 2017/2018, again in 2022/2023 and will next be surveyed in 2027/2028. As part of this survey the vegetation composition, soil condition, plant nutrient status, wetland condition and wetland pressure index are recorded in plots throughout the complex. Information from these surveys will be used to identify trends in wetland health and areas for improvement to guide management activities at the KNE site.

8. Future opportunities

8.1. Expansion of the KNE site

With significant further funding the site could be extended back into the remnants to the west but is only advisable once threats to the current site extent are being sustainably managed. Extending the site would be a large restoration project involving fencing, planting, weed and pest animal control.

8.2. Improving knowledge of the KNE site ecology

In the immediate term efforts could be focussed on improving our knowledge of native fauna utilising the site. Baseline lizard monitoring and regular bird monitoring would be useful.

9. Operational delivery schedule

The operational delivery schedule shows the actions planned to achieve the stated objectives for the Haruātai/Pareomatangi KNE site, and their annual resourcing. The budgets are subject to change. Operational areas (see Appendix 2, Map 4) are also subject to change according to operational needs over the course of the operational plan.

Table 2: Operational delivery schedule for the Haruātai/Pareomatangi KNE site

Objective	Activity	Operational area	Intended 5-year outcome	Implementing party	Annual resourcing
1, 3	Ecological weed control Control priority groundcover weeds: African clubmoss, tradescantia, and arum	A, B, C, F	Priority groundcover weeds are eradicated from the site allowing native understorey vegetation to flourish	GW Pest Plants team	$3,360
3	Ecological weed control Control of priority weeds within the wetland interior	D	The wetland interior is largely free of priority weeds (willow, arum, gorse, blackberry) allowing regeneration of native wetland vegetation	GW Pest Plants team	$1,760
1, 2, 3, 4	Ecological weed control Undertake surveys for new weed infestations	Entire site	New infestations of priority weeds are not able to establish	GW Pest Plants and Environment Restoration teams	$600
1, 2, 3, 4, 5	Ecological weed control Site preparation for revegetation planting	C, D, E	New areas of gorse and blackberry are cleared each year enabling planting with native species	GW Pest Plants team	$1,760
1, 3, 4	Pest animal control Traps are serviced monthly, and bait stations are serviced on a three monthly basis	Entire KNE site and wider landscape	Populations of native fauna have increased	GW Pest Animals team	$4,830

Objective	Activity	Operational area	Intended 5-year outcome	Implementing party	Annual resourcing
1, 2, 3, 5	Revegetation Planting of suitable native species	C, D, E	Forested areas are reconnected and buffered through native planting	GW Environment Restoration team, KCDC, Tungia TH Trust and mana whenua	$5,130
1, 2, 3, 4, 5	Fencing Work with the landowners to repair or replace sections of fence in poor condition	A, F	Stock are effectively excluded from accessing the KNE site	GW Environment Restoration team, Landowners	TBC
1, 3, 4	SOE wetland health monitoring of vegetation	Entire KNE site	Trends in wetland health are quantified, informing management decisions	GW Knowledge and Insights team	Funded through the SOE monitoring programme
Total					$8,600

10. Funding contributions

10.1. Budget allocated by Greater Wellington

This budget is indicative only and subject to change.

Table 3: Greater Wellington allocated budget for the Haruātai/Pareomatangi KNE site

Management activity	Annual resourcing
Ecological weed control	6,440
Pest animal control	4,830
Revegetation	1,100
Fencing	-
Total	**$12,750**

*Funded through the Regional Predator Control Programme

10.2. Budget allocated by KCDC

The budget is subject to confirmation through the Kāpiti Coast District Council long-term planning process.

Table 4: KCDC allocated budget for the Haruātai/Pareomatangi KNE site

Management activity	Annual resourcing
Ecological weed control	1,130
Pest animal control	-
Revegetation	4,000
Fencing	-
Total	**$5,130**

Appendix 1: Policy context and the Key Native Ecosystem programme

Policy context

Under the Resource Management Act 1991 (RMA)[37] 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)[38] and is managed in accordance with the Greater Wellington Biodiversity Strategy[39]. 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)[40], the Regional Pest Management Plan 2019-2039[41].

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[42].

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.

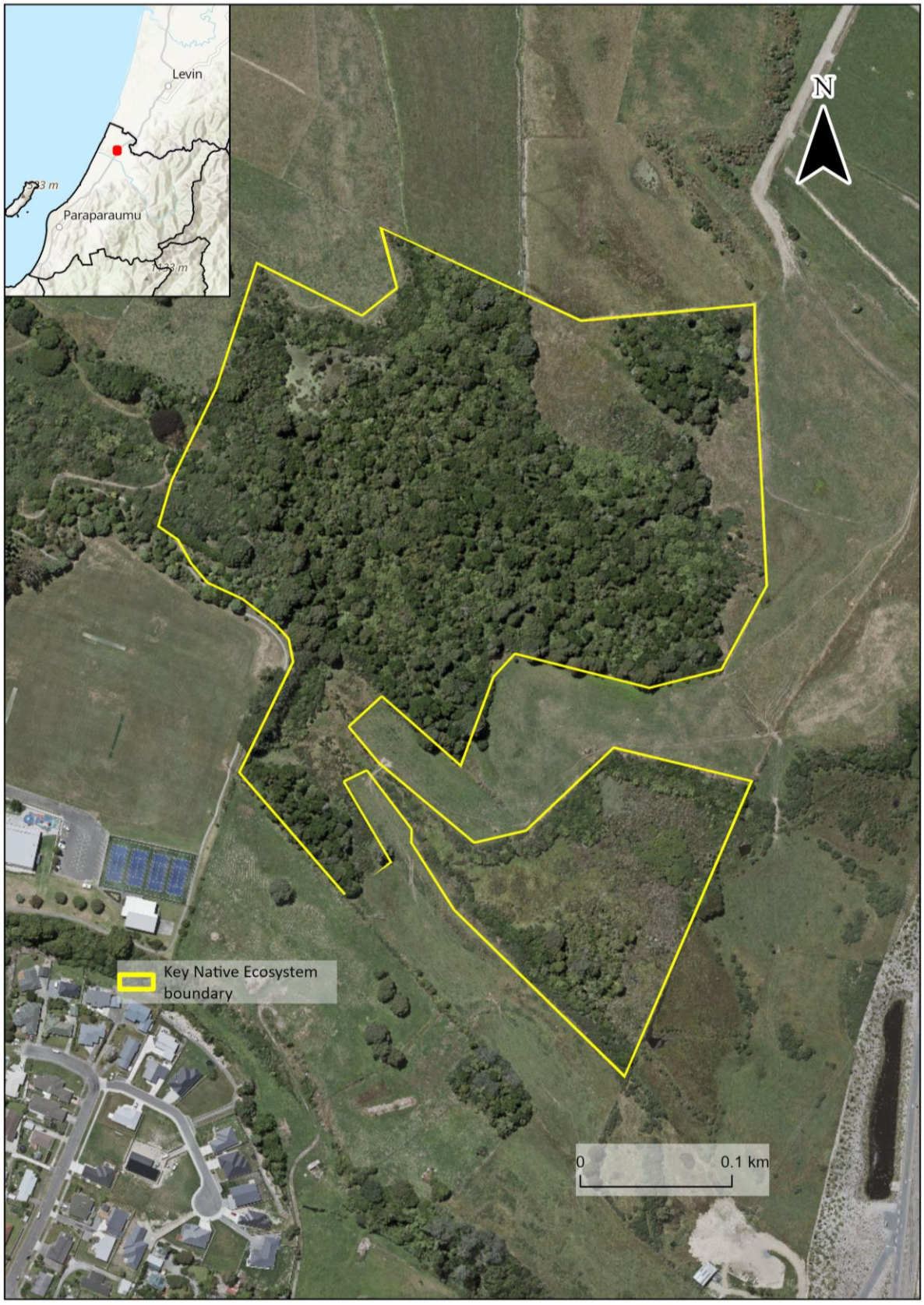
KNE sites can be located on private or publicly owned land. Any work undertaken on private land as part of this programme is at the discretion of landowners and their involvement in the programme is entirely voluntary. Involvement may just mean allowing work to be undertaken on that land. Land managed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

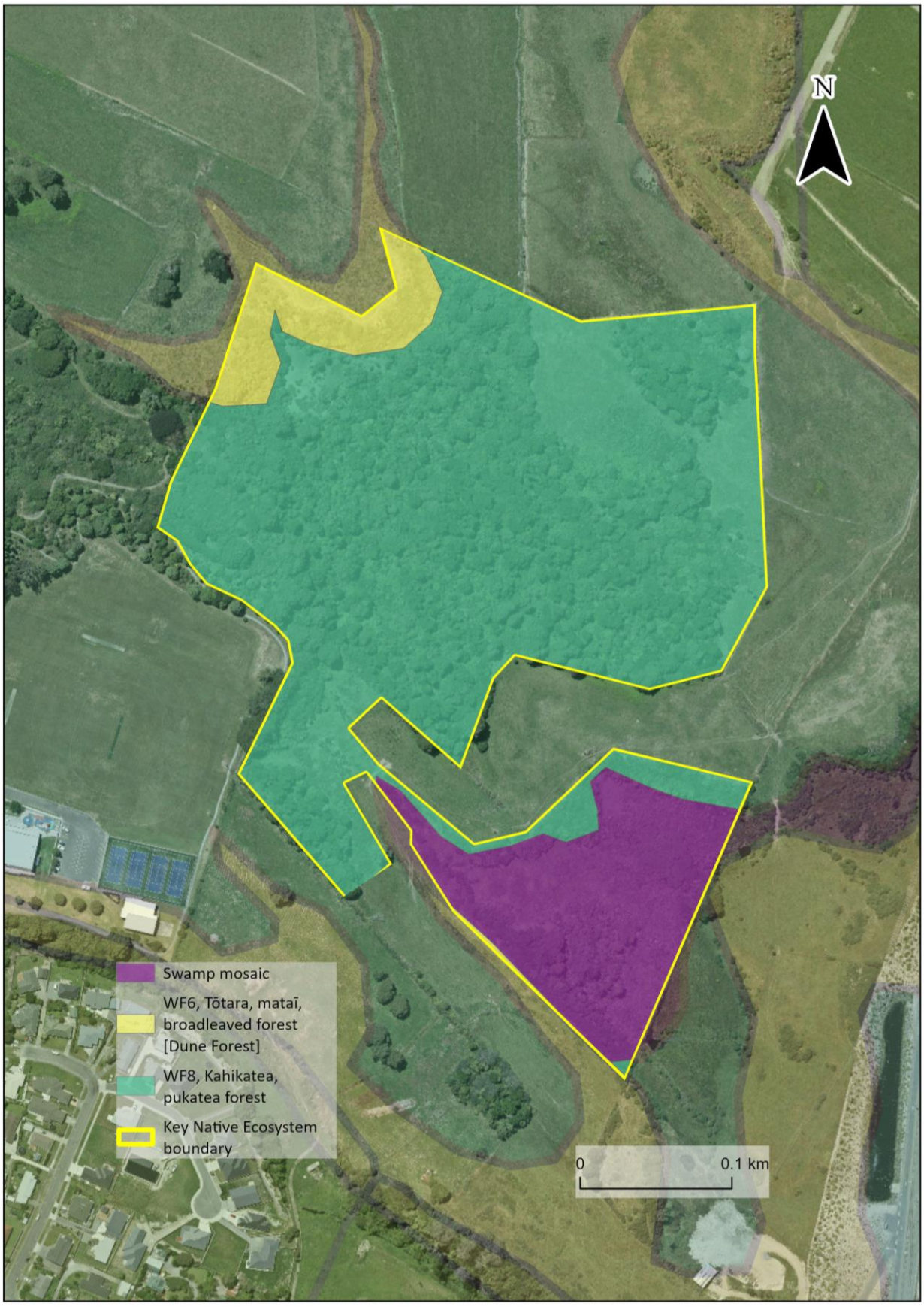
A site must be identified as ecologically significant using the above criteria and be considered “sustainable” for management to be considered for inclusion in the KNE programme. “Sustainable” for the purposes of the KNE programme is defined as: a site where the key ecological processes remain intact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

Appendix 2: Haruātai/Pareomatangi KNE site maps

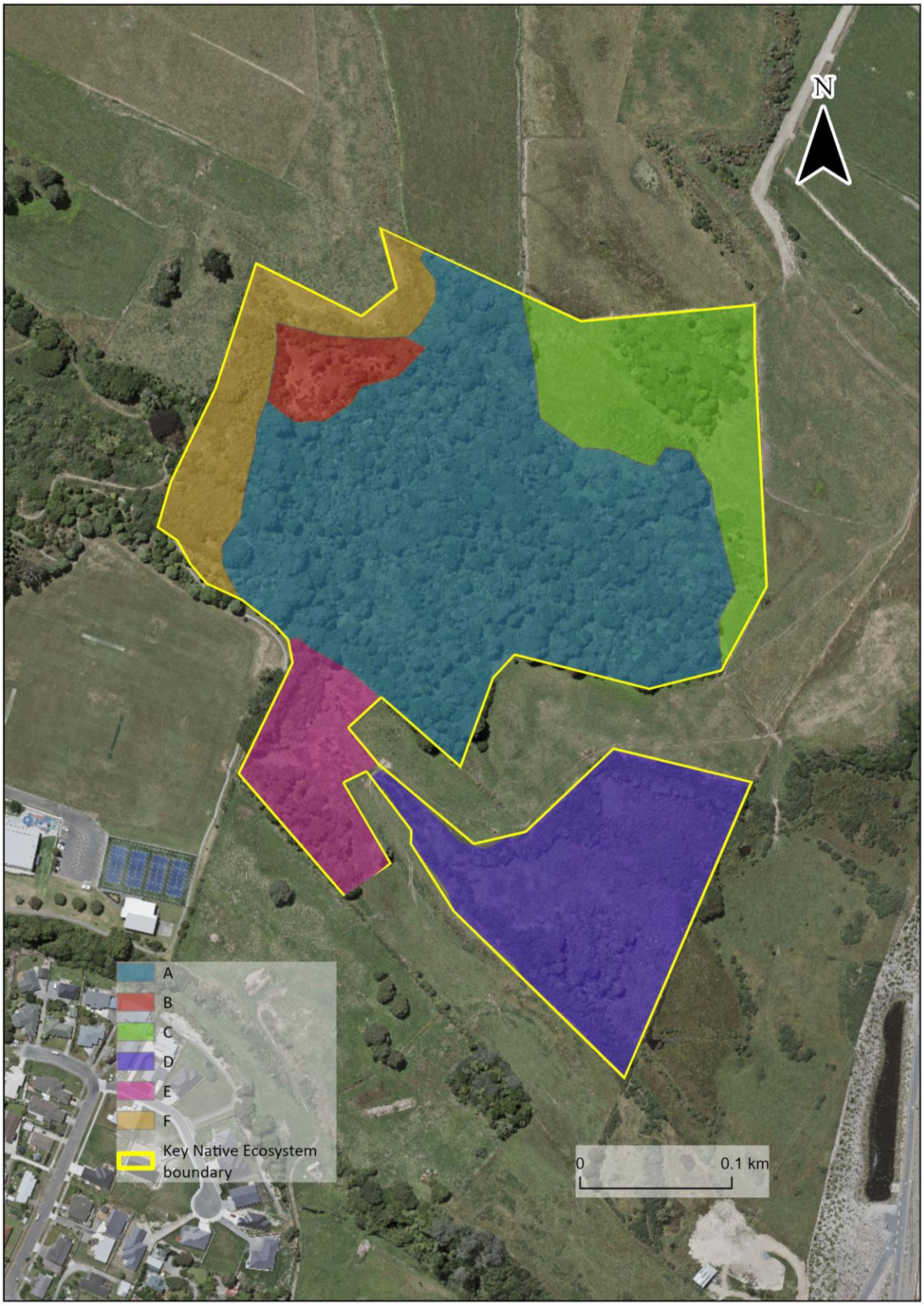


Map 1: The Haruātai/Pareomatangi KNE site boundary

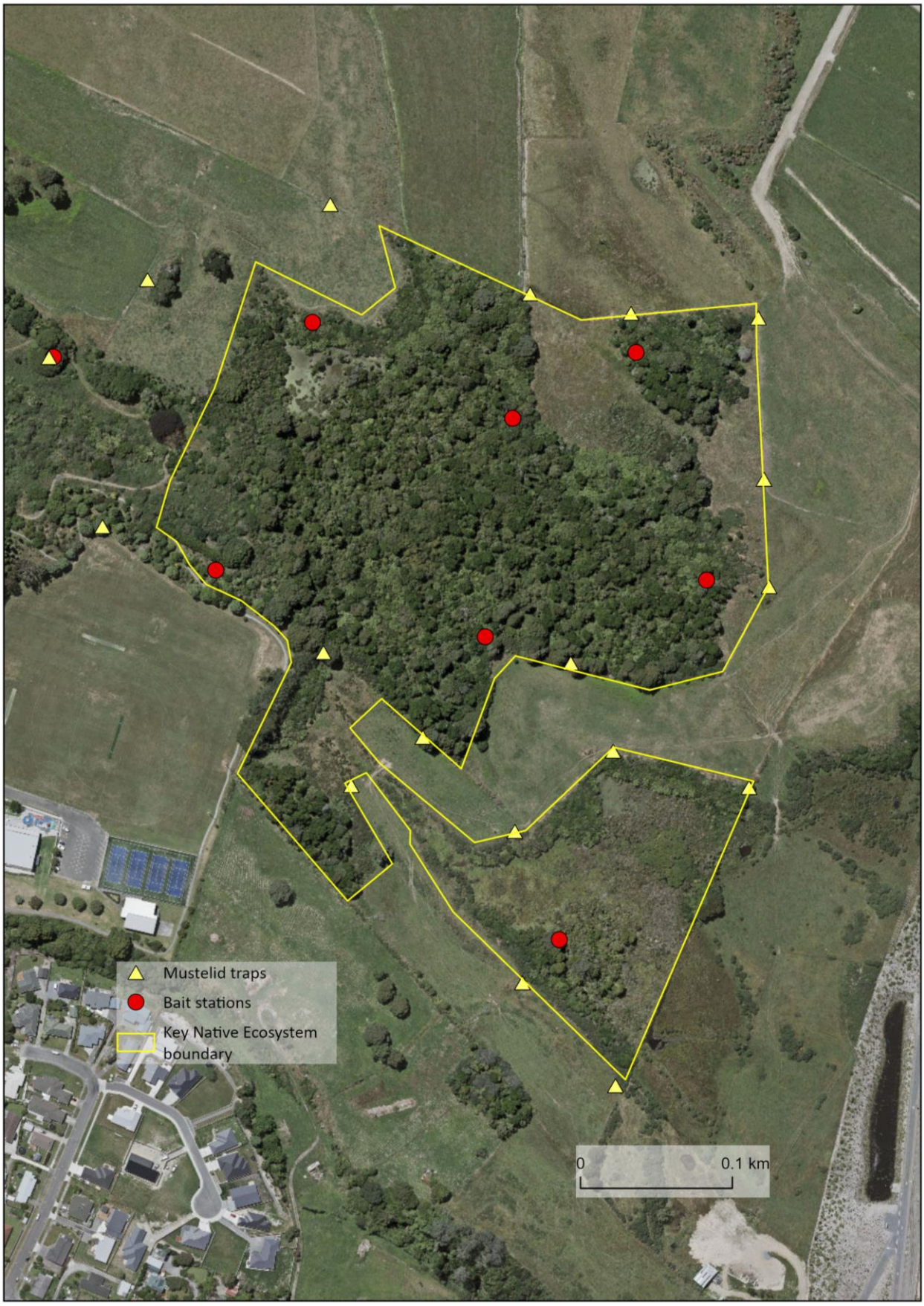
Map 2: Land ownership for the Haruātai/Pareomatangi KNE site



Map 3: Singers and Rogers classification of pre-human forest vegetation types for the Haruātai/Pareomatangi KNE site



Map 4: Ecological weed control operational areas in the Haruātai/Pareomatangi KNE site



Map 5: Pest animal control in the Haruātai/Pareomatangi 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 Haruātai/Pareomatangi 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[43]. Species are regarded as Threatened if they are classified as Nationally Critical, Nationally Endangered or Nationally Vulnerable[44]. 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 5: Nationally and regionally Threatened and At Risk species present within the Haruātai/Pareomatangi KNE site

Scientific name	Common name	National threat status	Regional threat status	Observation
Plants (vascular) – National[45] and Regional[46] Threat Status				
Solanum aviculare var. *aviculare*	Poroporo	Threatened – Nationally Endangered	Threatened – Regionally Endangered	P A Handford & Associates Ltd, 2012[47]
Syzygium maire	Maire tawake / swamp maire	Threatened – Nationally Declining	Threatened – Regionally Declining	P A Handford & Associates Ltd, 2012
Birds – National[48] and Regional[49] Threat Status				
Anas gracilis	Tētē-moroiti / grey teal	Not threatened	Threatened – Regionally Recovering	Hamish Carson pers. obs.

Scientific name	Common name	National threat status	Regional threat status	Observation
Hemiphaga novae-zealandiae	Kereru	Not threatened	Threatened – Regionally Recovering	Ebird database[50]

Appendix 4: Threat table

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

Table 6: Threats to the Haruātai/Pareomatangi 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 African clubmoss (*Selaginella kraussiana*) 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 for control in the KNE site include cherry (*Prunus* spp.), hawthorn (*Crataegus monogyna*) and gorse (*Ulex europaeus*) (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 for control in the KNE site include old man's beard (*Clematis vitalba*), climbing asparagus (*Asparagus scandens*) and English ivy (*Hedera helix*) (see full list in Appendix 5).	Entire KNE site
EW-4	Aquatic weeds outcompete native aquatic species and choke watercourses. Key semi-aquatic ecological weed species include beggar's ticks (*Bidens frondosa*) and water celery (*Apium nodiflorum*) (see full list in Appendix 5).	B, D
Pest animals (PA)		
PA-1	Possums (*Trichosurus vulpecula*) browse palatable canopy vegetation until it can no longer recover[51,52]. This destroys the forest's structure, diversity and function. Possums may also prey on native birds and invertebrates[53].	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[54,55] .	Entire KNE site
PA-3	Mustelids (stoats[56,57] (*Mustela erminea*), ferrets[58,59] (*M. furo*) and weasels[60,61] (*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[62], lizards[63] and the eggs[64] and chicks of ground-nesting birds[65] .	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[66,67].	Entire KNE site
PA-5*	Pest and domestic cats (*Felis catus*) prey on native birds[68], lizards[69] and invertebrates[70], reducing native fauna breeding success and potentially causing local extinctions[71].	Entire KNE site
PA-6*	Rabbits (*Oryctolagus cuniculus*)[72] and hares (*Lepus europaeus*)[73] 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. In drier times hares especially, will penetrate into wetland forest areas browsing and reducing regenerating native seedlings.	Entire KNE site
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[74].	Entire KNE site
PA-8*	Eastern rosella (*Platycercus eximius*) parakeets are known to out-compete native red-crowned parakeets for nest-sites and are a vector of avian diseases. The continued presence of eastern rosella in the KNE site could limit the ability of red crowned parakeets to establish functional populations in future[75,76].	Entire KNE site
PA-9*	Australasian magpie (*Gymnorhina tibicen*) are a known nest predator of native bird species and are known to modify the behaviour of native birds which could inhibit the ability of native birds to feed and breed[7778].	Entire KNE site
Human activities (HA)		
HA-1	Agricultural practices, particularly grazing livestock, can result in pugged soils, grazed native vegetation inhibiting regeneration, wildlife disturbance and increased nutrient content of soils and watercourses[79].	A, F
HA-2*	Recreational use such as off-track walking and mountain biking can damage and disturb native ecosystems. It is also likely to disturb native fauna and introduce ecological weeds.	A, F
HA-3*	Urbanisation brings residential gardens closer to the KNE site risking further introductions of ecological weeds.	E
HA-4*	Barriers to native fish passage are present in streams within the KNE site preventing migrating fish from completing their life-cycle.	A, B, E
HA-5*	Land use activities that alter the local hydrology, such as development schemes and sub-divisions can affect the water levels that sustain wetland ecosystems.	A, B, C, D, E
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[80].	A, F

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
Other threats		
OT-1	Small forest remnants are affected by environmental impacts on their edges such as changing environmental conditions (eg, soil moisture or temperature levels), changing physical environment (eg, different plant assemblages compared to the interior) and changing species interactions (eg, increased predation by invasive species)[81,82].	Entire KNE site
OT-2*	A lack of legal protection can leave a site at risk of future development or destruction and resources invested in the site may be wasted. All of this site is uncovenanted, having no protection status.	Entire KNE site

*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 Haruātai/Pareomatangi KNE site.

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 7: Ecological weed species recorded in the Haruātai/Pareomatangi KNE site

Scientific name	Common name	Priority	Level of distribution	Management aim
Acacia sp.	Wattle	Low	Localised and sparse	Exclusion
Acanthus mollis	Bear's breeches	High	Localised and sparse	Eradication
Acer sp.	Sycamore	Moderate	Widespread and abundant	Exclusion
Agapanthus praecox subsp. *orientalis*	Agapanthus	Low	Localised and sparse	Exclusion
Apium nodiflorum	Water celery	Low	Patchy and dense	No management
Asparagus plumosa	Asparagus fern	High	Localised and sparse	Exclusion
Asparagus scandens	Climbing asparagus	High	Patchy and abundant	Exclusion
Berberis glaucocarpa	Barberry	Moderate	Patchy and abundant	Suppression
Bidens frondosa	Beggar's ticks	Low	Patchy and dense	No management
Buddleja davidii	Buddleia	Moderate	Localised and sparse	Exclusion
Calystegia silvatica	Great bindweed	Low	Localised and sparse	Suppression
Chamaecytisus palmensis	Tree lucerne	Low	Localised and sparse	Suppression
Cotoneaster sp.	Cotoneaster	Moderate	Localised and sparse	Exclusion
Clematis vitalba	Old man's beard	High	Localised and sparse	Exclusion
Cortaderia selloana	Pampas	Moderate	Localised and sparse	Exclusion
*Corynocarpus laevigatus**	Karaka	Moderate	Patchy and abundant	Suppression

Scientific name	Common name	Priority	Level of distribution	Management aim
Crataegus monogyna	Hawthorn	Moderate	Patchy and abundant	Suppression
Crocosmia × *crocosmiiflora*	Montbretia	Moderate	Patchy and abundant	Suppression
Cupressus macrocarpa	Macrocarpa	Low	Localised and sparse	Exclusion
Gunnera tinctoria	Chilean rhubarb	High	Localised and sparse	Exclusion
Hedera helix	Ivy	High	Patchy and dense	Suppression
Hedychium sp.	Ginger	High	Localised and sparse	Exclusion
Hydrangea macrophylla	Hydrangea	Low	Localised and sparse	Exclusion
Ilex aquifolium	Holly	High	Localised and sparse	Exclusion
Ligustrum sinense	Chinese privet	Moderate	Localised and sparse	Exclusion
Lonicera japonica	Japanese honeysuckle	High	Localised and sparse	Exclusion
Lupinus arboreus	Tree lupin	Low	Patchy and abundant	No management
Lycium ferocissimum	Boxthorn	Moderate	Localised and sparse	Exclusion
*Metrosideros excelsa**	Pohutukawa	Low	Localised and sparse	Suppression
Passiflora sp.	Banana passionfruit	High	Localised and sparse	Exclusion
Pinus radiata	Radiata pine	Low	Localised and sparse	Exclusion
*Pittosporum crassifolium**	Karo	Moderate	Localised and sparse	Exclusion
Populus alba	Silver poplar	Moderate	Localised and dense	Exclusion
Populus nigra	Lombardy poplar	Low	Localised and sparse	Exclusion
Prunus sp.	Cherry	High	Patchy and abundant	Suppression
Prunus × *domestica*	Plum	Low	Localised and sparse	Exclusion
Pseudopanax lessonii and hybrids*	Houpara	Moderate	Widespread and sparse	Suppression

Scientific name	Common name	Priority	Level of distribution	Management aim
Quercus sp.	Oak	Low	Localised and sparse	Exclusion
Rhododendron ponticum	Rhododendron	Low	Localised and sparse	Exclusion
Rubus fruticosus agg.	Blackberry	High	Patchy and dense	Suppression
Salix sp.	Willow	High	Patchy and dense	Exclusion
Sambucus nigra	Elder	Low	Patchy and sparse	Suppression
Selaginella kraussiana	African club moss	High	Localised and abundant	Eradication
Solanum pseudocapsicum	Jerusalem cherry	Low	Patchy and sparse	No management
Tradescantia fluminensis	Tradescantia	High	Localised and dense	Eradication
Ulex europaeus	Gorse	Moderate	Widespread and abundant	Suppression
*Vitex lucens**	Puriri	Low	Localised and sparse	Exclusion
Zantedeschia aethiopica	Arum lily	High	Patchy and sparse	Suppression

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

References

[1] Rob Cross, Kāpiti Coast District Council, pers comm 2015.
[2] Thompson K. 2012. Hydrological assessments of ten wetlands in the Wellington region and recommendation for sustainable management: a holistic approach. Prepared for Greater Wellington Regional Council. 150 p. plus appendices.
[3] 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.
[4] Kapiti Coast District Council. 1999. Kapiti Coast District Plan Heritage Register E: Ecological Sites (areas of significant indigenous vegetation and significant habitats of indigenous flora).
[5] Kapiti Coast District Council. 1993. Haruatai Park Management Plan. 23p.
[6] Ngā Hapū o Ōtaki, Greater Wellington Regional Council (Catchment Management Group), Integrated Catchment Management Agreement, Ōtaki River Catchment. 2016. Greater Wellington Regional Council.
[7] 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.
[8] Kāpiti Coast District Council. 1999. Kāpiti Coast District Plan Heritage Register E: Ecological Sites (areas of significant indigenous vegetation and significant habitats of indigenous flora).
[9] Walker S, Cieraad E, Grove P, Lloyd K, Myers S, Park T, Porteous T. 2007. Guide for users of the threatened environment classification, Version 11, August 2007. Landcare Research New Zealand. 34p plus appendix.
[10] Singers NJD, Rogers GM. 2014. A classification of New Zealand's terrestrial ecosystems. Science for Conservation No. 325. Department of Conservation, Wellington. 87p.
[11] Singers N, Crisp P, Spearpoint O. 2018. Forest Ecosystems of the Wellington Region. Greater Wellington Regional Council, Publication No. GW/ESCI-G-18-164, Wellington.
[12] Williams PA, Wiser S, Clarkson B, Stanley MC. 2007. New Zealand's historically rare terrestrial ecosystems set in a physical and physiognomic framework. New Zealand Journal of Ecology 31(2): 119–128.
[13] Holdaway RJ, Wiser SK, Williams PA. 2012. Status assessment of New Zealand's naturally uncommon ecosystems. Conservation Biology 26: 619–629.
[14]New Zealand Threat Classification System (NZTCS) http://www.doc.govt.nz/about-us/science-publications/conservation-publications/nz-threat-classification-system/
[15] Crisp P. 2020. Conservation status of indigenous vascular plant species in the Wellington region. Greater Wellington Regional Council, Publication No. GW/ESCI-G-20/20, Wellington.
[16] Ausseil AG, 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.
[17] 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.
[18] Thompson K. 2012. Hydrological assessments of ten wetlands in the Wellington region and recommendation for sustainable management: a holistic approach. Prepared for Greater Wellington Regional Council. 150 p. plus appendices.
[19] Thompson K. 2012. Hydrological assessments of ten wetlands in the Wellington region and recommendation for sustainable management: a holistic approach. Prepared for Greater Wellington Regional Council. 150 p. plus appendices.
[20] McEwen WM (compiler). 1987. Ecological Regions and Districts of New Zealand. New Zealand Biological Resources Centre Publication No. 5. Department of Conservation, Wellington.
[21] McEwen WM, (Ed.) 1987. Booklet to accompany SHEET 2. Descriptions of Districts in central New Zealand, from Meremere to Eastern Hawkes Bay. Ecological Regions and Districts of New Zealand. Wellington, Department of Conservation. 92 p.
[22] Rolfe J. 1989. RAP(2) 2 Haruatai Park. 195-197.
[23] Rob Cross, Kāpiti Coast District Council, pers comm 2015.

[24] Thompson K. 2012. Hydrological assessment of ten wetlands in the Wellington region and recommendations for sustainable management: a holistic approach.
[25] Thompson K. 2012. Hydrological assessment of ten wetlands in the Wellington region and recommendations for sustainable management: a holistic approach.
[26] Thompson K. 2012. Hydrological assessment of ten wetlands in the Wellington region and recommendations for sustainable management: a holistic approach.
[27] P A Handford & Associates Ltd. 2012. Restoration Plan for Haruātai, Otaki.
[28] P A Handford & Associates Ltd. 2012. Restoration Plan for Haruātai, Otaki.
[29] Rolfe J. 1989. RAP(2) 2 Haruatai Park. 195-197.
[30] Thompson K. 2012. Hydrological assessment of ten wetlands in the Wellington region and recommendations for sustainable management: a holistic approach.
[31] P A Handford & Associates Ltd. 2012. Restoration Plan for Haruātai, Otaki.
[32] P A Handford & Associates Ltd. 2012. Restoration Plan for Haruātai, Otaki.
[33] P A Handford & Associates Ltd. 2012. Restoration Plan for Haruātai, Otaki.
[34] Mike Urlich, Greater Wellington Regional Council, pers obs 2014.
[35] eBird: An online database of bird distribution and abundance. eBird, Ithaca, New York. Available: http://www.ebird.org. (Accessed: August 2019).
[36] Macdermid K. 2024. Night surveying of existing and potential habitat of *Powelliphanta traversi otakia*, A report for Greater Wellington Regional Council.
[37] New Zealand legislation. 1991. Resource Management Act 1991.
[38] Greater Wellington Regional Council. Greater Wellington Regional Council Long Term Plan Ko Te Pae Tawhiti: 2021 – 2031.
[39] Greater Wellington Regional Council. 2016. Greater Wellington Regional Council Biodiversity Strategy. http://www.gw.govt.nz/assets/council-publications/Biodiversity-Strategy-2016.pdf
[40] 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.
[41] Greater Wellington Regional Council. 2019. Greater Wellington Regional Pest Management Plan 2019–2039. GW/BIO-G-2019/74
[42] 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.
[43] 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.
[44] 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.
[45] de Lange PJ, Rolfe JR, Barkla JW, Courtney SP, Champion PD, Perrie LR, Beadel SM, Ford KA, Breitwieser I, Schonberger, I, Hindmarsh-Walls R, Heenan PB, Ladley K. 2018. Conservation status of New Zealand indigenous vascular plants, 2017. New Zealand Threat Classification Series 22. Department of Conservation, Wellington.
[46] Crisp, P. 2020. Conservation status of indigenous vascular plant species in the Wellington region. Greater Wellington Regional Council. GW/ESCI-G-20/20.
[47] P A Handford & Associates Ltd. 2012. Restoration Plan for Haruātai, Otaki.
[48] 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.
[49] 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.
[50] ebird.org/atlasnz/checklist/S137312984
[51] 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.

[52] 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.
[53] 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.
[54] 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.
[55] 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.
[56] 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.
[57] 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.
[58] 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.
[59] 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.
[60] 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.
[61] 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.
[62] 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.
[63] 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.
[64] 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.
[65] 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.
[66] 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.
[67] 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.
[68] 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.
[69] 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.
[70] 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.
[71] 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.
[72] 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.
[73] 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.

[74] 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.
[75] Wright D, Clout M 2001. The eastern rosella (Platycercus eximius) in New Zealand. DOC Science Internal Series 18.
[76] Galbraith JA. 2013. Eastern rosella. In Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz
[77] Morgan JD, Waas R, Innes J. 2006. The relative importance of Australian magpies *(Gymnorhina tibicen)* as nest predators of rural birds in New Zealand, New Zealand Journal of Zoology, 33:1, 17-29.
[78] Morgan D, Waas J, Innes J. 2006. Do territorial and non-breeding Australasian Magpies (*Gymnorhina tibicen*) influence the local movements of rural birds in New Zealand? IBIS International Journal of Avian Science, Volume 148, Issue 2.
[79] Smale MC, Dodd MB, Burns BR, Power IL. 2008. Long-term impacts of grazing on indigenous forest remnants on North Island hill county, New Zealand. New Zealand Journal of Ecology 32(1): 57–66.
[80] 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.
[81] Young A, Mitchell N. 1994. Microclimate and vegetation edge effects in a fragmented podocarp-broadleaf forest in New Zealand. Biological Conservation 67: 63–72.
[82] Norton DA. 2002. Edge effects in a lowland temperate New Zealand rainforest. DOC Science Internal Series 27. Department of Conservation, Wellington.

Greater Wellington Regional Council:

Wellington office
PO Box 11646
Manners Street
Wellington 6142

T 04 384 5708
F 04 385 6960

Upper Hutt office
PO Box 40847
Upper Hutt 5018

T 04 526 4133
F 04 526 4171

Masterton office
PO Box 41
Masterton 5840

T 06 378 2484
F 06 378 2146

Follow the Wellington Regional Council

info@gw.govt.nz
www.gw.govt.nz

August 2025
GW/BD-G-25-23