Key Native Ecosystem Operational Plan for Haruātai/Pareomatangi

2020-2025

Contents

1. Purpose

The purpose of the five-year Key Native Ecosystem (KNE) Operational Plan for Haruātai/Pareomatangi KNE site is to:

- Identify the parties involved
- Summarise the ecological values and identify the threats to those values
- Outline the objectives to improve ecological condition
- Describe operational activities (eg, ecological weed control) that will be undertaken, 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

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

Plans and Strategies that guide the delivery of the KNE Programme are:

Greater Wellington Long Term Plan

The Long Term Plan (2018-2028)[2] outlines the long term direction of the Greater Wellington Regional Council (Greater Wellington) and includes information on all our major projects, activities and programmes for the next 10 years and how they will be paid for. This document outlines that Greater Wellington will actively manage selected high value biodiversity sites. Most of this work is undertaken as part of the KNE Programme.

Proposed Natural Resources Plan

The Proposed Natural Resources Plan (PNRP) provides the high level strategic framework which sets out how Greater Wellington, Mana whenua partners and the community work together and includes:

- Guiding Principles that underpin the overall management approach of the plan (eg, Kaitiakitanga)
- Sites with significant indigenous biodiversity values
- Sites of significance to mana whenua (refer Schedules B, C, Schedule D)

Greater Wellington Biodiversity Strategy

The Greater Wellington Biodiversity Strategy[3] (the Strategy) is an internal document that sets a framework that guides how Greater Wellington protects and manages biodiversity in the Wellington region to work towards the Vision.

Vision

Healthy ecosystems thrive in the Wellington region and provide habitat for native biodiversity

The Strategy provides a common focus across Greater Wellington's departments and guides activities relating to biodiversity. The Vision is underpinned by four operating principles and three strategic goals. Goal One drives the delivery of the KNE Programme.

Goal One

Areas of high biodiversity value are protected or restored

3. The Key Native Ecosystem Programme

The KNE Programme is a voluntary programme of work. There is no statutory obligation for Greater Wellington to do this work. Greater Wellington invites selected landowners to discuss whether they would like to be involved in the programme. When work is done on private land, 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.

The programme seeks to protect some of the best examples of original (pre-human) ecosystem types in the Wellington region by managing, reducing, or removing threats to their ecological values. Sites with the highest biodiversity values have been identified and prioritised for management. 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, 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 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.

KNE sites can be located on private or publicly owned land. However, land managed by the Department of Conservation (DOC) is generally excluded from this programme.

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

4. Haruātai/Pareomatangi Key Native Ecosystem site

The Haruātai/Pareomatangi KNE site (22.2 ha) is located on the northern edge of Ōtaki township and 1 km west of State Highway 1 (Appendix 1, Map 1). The KNE site is recognised as the second largest swamp forest located in the Kāpiti Coast District[4] and comprises one of the few remaining examples of dune swamp forest in the region[5]. The KNE site contains a number of distinctly different 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 Schedule F3 the Proposed Natural Resources Plan (PNRP)[6] for its representativeness and rarity.

The KNE site is predominantly surrounded by farmland and residential areas but is located within 3km of several other coastal and wetland KNE sites including; Otepua-Paruāuku Wetlands, Ōtaki Coast and Waitohu Coast and Wetlands. These KNE sites are thought to form an important network of habitat linkages within the wider ecological landscape, enabling coastal, wetland and forest birds to forage, breed and disperse throughout the local area.

5. Parties involved

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

5.1. Landowners

The Haruātai/Pareomatangi KNE site has both private and public landowners:

- Tungia TH Trust, a privately run family Trust, own the eastern most portion of the KNE site (11.5 ha). Part of this land is currently leased and managed by an adjacent farm
- The Crown, through the Office of Treaty Settlements, own the north-eastern section (9.0 ha). Part of this land is currently leased and managed by an adjacent farm
- The Kāpiti Coast District Council (KCDC) own the southern arm of the KNE site (1.6 ha)

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

5.2. Operational delivery

Within Greater Wellington, the Biodiversity department is the overarching lead department for the coordination of biodiversity management activities and advice within the KNE site. The Biosecurity department coordinates and carries out pest control activities.

KCDC fund and deliver management of parts of the KNE site as Ecological Sites of Significance in accordance with the Kāpiti Coast District Plan[7]. KCDC also manage a small part of the KNE site as a Recreation Reserve in accordance with the Haruātai Park Management Plan[8] and has undertaken extensive structural planting on the banks around the southern KNE boundary to provide reinforcement and shading.

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 and opportunities where iwi members could be involved in undertaking restoration management activities within the KNE site.

5.3. 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[9] for the Ōtaki River Catchment, Greater Wellington is committed to identifying ways in which kaitiakitanga can be strengthened by exploring opportunities on 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.

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.

6.1. 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 (See Appendix 1, Map 3): • 342: Haruātai Park Forest (10.5 ha) Part of the Haruātai/Pareomatangi KNE site has been identified by DOC as a Recommended Area for Protection (RAP): • RAP 2(2): Haruatai Park (4.59 ha)
Regional	Part of the Haruātai/Pareomatangi KNE site is scheduled under Greater Wellington's Proposed Natural Resources Plan (PNRP)[10] as Ecosystems and Habitats with Significant Indigenous Biodiversity Values: • Significant Natural Wetland: Haruatai Park Forest (7.33 ha) (Schedule F3)
District	Parts of the Haruātai/Pareomatangi KNE have been identified by KCDC as Ecological Sites of Significance (See Appendix 1, Map 4). They are listed in the KCDC District Plan Heritage Register[11] as: • K015: Haruatai Park Forest (5.79 ha) • K211: State Highway 1 South, Ōtaki (2.62 ha)

6.2. 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
- It contains high levels of ecosystem **diversity**, with several ecosystem types represented within the KNE site boundary, including several naturally uncommon ecosystems
- Its **ecological context** is valuable at the landscape scale as it contains a variety of inter-connected habitats and, provides core/seasonal habitat for indigenous plant and animal species within the KNE site

Representativeness

The Threatened Environment Classification system[12] 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.

Wetlands are now considered an uncommon habitat type in the Wellington Region with approximately 2.3% of their original extent remaining[13]. The Haruātai Park Forest wetland is scheduled as a Significant Natural Wetland in the PNRP[14] and comprises one of the few remaining examples of dune swamp forest, now rare in the Foxton Ecological District[15]. Haruātai Park Forest wetland is considered one of the very few remnants remaining of the once widespread wetlands on the Kāpiti Coast[16].

Rarity/distinctiveness

One naturally uncommon ecosystem type[17,18] is present within the KNE site which comprises stable sand dunes with a classification of 'Endangered'.

New Zealand's national threat classification system[19] lists one plant species as Nationally Threatened within the KNE site. The Conservation status of indigenous vascular plant species in the Wellington region report 2020[20] also lists one plant species as Regionally Threatened within the KNE site. Nationally Threatened species are listed in Appendix 2 and Regionally Threatened species in Appendix 3.

Diversity

The Singers and Rogers[21] classification of pre-human ecosystems in New Zealand indicates that three ecosystem types were present within the KNE site. These were comprised of kahikatea-pukatea forest (WF8) and tōtara- mataī broadleaved dune forest (WF6) across the majority of the site. A swamp mosaic of flaxland (WL18), raupō reedland (WL19) and coprosma, twiggy tree daisy scrub (WL20) was prominent around the south-eastern corner which is now recognised as wetland.

Aspects of these original ecosystems types are still evident within the KNE site today, although in a modified and regenerating condition. 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[22].

Ecological context

The Haruātai/Pareomatangi KNE site is located within 4 km of a number of other KNE sites, namely Otepua-Paruāuku Wetlands, Waitohu Coast and Wetlands, Lake Wairongomai and Otaki Coast.

6.3. Ecological features

The Haruātai/Pareomatangi KNE site is located within the Foxton Ecological District[23] 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 800-1,000 mm[24].

The swamp forest remnant is situated on the wet north-west 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[25],[26]. A tributary of the Waitohu River catchment feeds in to the KNE site at the northern boundary. 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[27]. The KNE site also has significant carbon sequestration values[28].

Vegetation communities and plants

The Haruātai/Pareomatangi KNE site contains a number of 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[29]. The KNE site has been described below in eight vegetation communities' present (See Appendix 1, Map 5).

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[30]. 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 15 m tall[31,32]. The canopy is generally dense comprising 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 (*Dysoxylum spectabile*), 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 also present towards the northern most boundary[33].

Additionally, the Nationally Threatened plant species, poroporo (*Solanum aviculare var. aviculare*), has previously been observed in the undergrowth of the main forest block[34].

Ephemeral wetland (Operational area B)

The north western corner within the main forest block contains a small ephemeral wetland. The wetland comprises predominantly of *Carex secta*, *Carex virgata* and tī kōuka (*Cordyline australis*) with swamp millet (*Isachne globosa*), *Carex lessoniana*, *Carex dissita* and *Isolepis* spp. characterising the wetter areas. Kahikatea, marbleleaf (*Carpodetus serratus*), swamp Coprosma, pukatea, and rough tree fern (*Dicksonia squarrosa*) are more prominent in lower lying areas[35,36].

[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.

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

The north-eastern most corner of the KNE site comprises a small stand of mature kahikatea-pukatea swamp forest which is poorly connected to the main forest block. The understorey is currently in poor condition however, does comprise scattered kawakawa, red matipo and some native fern and vine species. This area is subject to edge effects and comprises numerous weed species around the forest margins including; arum lily (*Zantedeschia aethiopica*), gorse (*Ulex europaeus*), hawthorn (*Crataegus monogyna*) and barberry (*Berberis glaucocarpa*). This small forest stand is largely surrounded by pasture grassland with nodes of planted native tree and scrub species also present.

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*[37]. *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 (*Rubus fruticosus* agg.) 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 with dense areas of blackberry[38]. A small remnant stand of swamp forest is present on the southern edge with a canopy comprising predominantly of kahikatea with pukatea, swamp maire and māhoe. Woody species, ferns and vines dominate the understorey and notable infestations of arum lily and gorse are present.

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

A small stand of mature kahikatea-pukatea swamp forest is also located in the southern-most arm of the KNE site. The area between this isolated forest stand and the main kahikatea-pukatea forest block comprises of regenerating scrub dominated by māhoe situated on a gentle dune rise[39]. The scrub and forest margins also comprise numerous weed species including; arum lily, gorse, hawthorn and barberry.

Duneland forest and linkage area (Operational area F)

Directly adjoining the western edge of the main kahikatea-pukatea swamp forest is a large area comprising a mosaic of native and exotic treeland situated on an elevated sandplain[40]. This duneland forest comprises predominantly of poplar (*Populus* spp.) with scattered native tree species such as tawa, mataī (*Prumnopitys taxifolia*), tītoki (*Alectryon excelsa*), māhoe, red matipo and isolated mature tōtara (*Podocarpus totara*) also present. Regenerating māhoe, kawakawa and kohekohe saplings dominate the understory. This forest composition suggests this area is drier and more mesophytic in character than the main swamp forest[41,42].

North-western kahikatea forest remnant (Operational area G)

The north western corner of the KNE site comprises an area of loosely connected native swamp forest with some areas currently unfenced and grazed. The canopy cover ranges

from very open through to small areas of closed canopy. The vegetation comprises predominantly of kahikatea with occasional pukatea and tawa. Broadleaf species such as kohekohe, tawa, small-leaved milk tree (*Streblus heterophyllus*), swamp maire, puka (*Griselinia lucida*) and māhoe are also common throughout[43].

Mixed planted native treeland and shrubland (Operational area H)

The south-western arm of the KNE site, which boarders the playing fields and adjoins the main kahikatea-pukatea swamp forest, comprises a mix of native treeland and shrubland species including scattered tōtara, rimu, māhoe, lacebark (*Hoheria sexstylosa*), kahikatea, tī kōuka, and *Coprosma robusta*. Extensive restoration planting has previously been undertaken in this area. Planted species include; tītoki, rewarewa (*Knightia excelsa*), kowhai (*Sophora microphylla*), lemonwood *(Pittosporum eugenioides*) and harakeke flax (*Phormium tenax*)[44].

Species

Birds

Information about native fauna present within the KNE site is currently scarce. However, the KNE site does provide habitat for a number of common native bird species, including kereru (*Hemiphaga novaeseelandiae*), grey warbler (*Gerygone igata*), New Zealand kingfisher (*Todiramphus sanctus vagans*), pūkeko (*Porphyrio melanotus melanotus*), tūī (*Prosthemadera novaeseelandiae*), New Zealand fantail (*Rhipidura fuliginosa*), bellbird (*Anthornis melanura*) and silvereye (*Zosterops lateralis*)[45,46].

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 threats to the ecological values at each KNE site.

7.1. Key threats

The primary threats to the ecological values of the Haruātai/Pareomatangi KNE site are ecological weed species, pest animals and altered hydrology.

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 exotic climbers throughout the KNE site have the highest ecological impact and include species such as; blackberry, old man's beard (*Clematis vitalba*), blue morning glory (*Ipomoea indica*), climbing asparagus (*Asparagus setaceus*), banana passionfruit (*Passiflora* sp.), and Japanese honeysuckle (*Lonicera japonica*). In addition,

the non-local native species, karaka (*Corynocarpus laevigatus*) and karo (*Pittosporum crassifolium*) are also considered ecological weeds at the site as they are known to outcompete and/or hybridise with local native species.

Mustelids, such as stoats (*Mustela erminea*), weasels (*Mustela nivalis*) and ferrets (*Mustela furo*), are the biggest threats to the identified ecological values of the KNE site. These pest species predate native wetland bird species, particularly nesting birds, chicks and eggs. Other pest animal species such as feral cats (*Felis catus*), possums (*Trichosurus vulpecula*), hedgehogs (*Erinaceus europaeus*) and rats (*Rattus* spp.) are also likely to pose an enduring threat to the biodiversity values within the KNE site by over-browsing native vegetation, out-competing native species for food and resources and through direct predation.

While the key threats discussed in this section are recognised as the most significant, a number of other threats to the KNE site's values have also been identified. Table 2 presents a summary of all known threats to the Haruātai/Pareomatangi KNE site (including those discussed above), detailing which operational areas they affect, how each threat impacts on ecological values, and whether they will be addressed by operational activities. A map of operational areas can be found in Appendix 1 (see Map 5).

Table 2: Summary of all threats to ecological values present at the Haruātai/Pareomatangi KNE site

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
Ecological weeds		
EW-1	Climbing weeds smother and displace native vegetation often causing canopy collapse, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species include: old man's beard (*Clematis vitalba*) and Japanese honeysuckle (*Lonicera japonica*) (see full list in Appendix 4)	Entire KNE site
EW-2	Ground covering ecological weeds smother and displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species for control include: tradescantia (*Tradescantia fluminensis*) and arum lily (*Zantedeschia aethiopica*) (see full list in Appendix 4)	Entire KNE site
EW-3	Woody weed species displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species include: gorse (*Ulex europaeus*), hawthorn (*Crataegus monogyna*) and barberry (*Berberis glaucocarpa*) (see full list in Appendix 4)	Entire KNE site
EW-4	Marginal aquatic weeds out-compete native aquatic species and choke watercourses. Key weed species include: beggar's ticks (*Bidens frondosa*) and water celery (*Apium nodiflorum*) (see full list in Appendix 4)	B, D

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
Pest animals		
PA-1	Mustelids (stoats[47,48] (*Mustela erminea*), ferrets[49,50] (*M. furo*) and weasels[51,52] (*M. nivalis*)) prey on native birds, lizards and invertebrates, reducing their breeding success and potentially causing local extinctions	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[53,54]	Entire KNE site
PA-3	Feral, stray and domestic cats (*Felis catus*) prey on native birds[55], lizards[56] and invertebrates[57], reducing native fauna breeding success and potentially causing local extinctions[58]	Entire KNE site
PA-4	Possums (*Trichosurus vulpecula*) browse palatable canopy vegetation until it can no longer recover[59,60]. This destroys the forest's structure, diversity and function. Possums may also prey on native birds and invertebrates[61]	Entire KNE site
PA-5	Hedgehogs (*Erinaceus europaeus*) prey on native invertebrates[62], lizards[63] and the eggs[64] and chicks of ground-nesting birds[65]	Entire KNE site
PA-6*	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-7*	Rabbits (*Oryctolagus cuniculus*) and hares (*Lepus europaeus*) graze on palatable native vegetation and prevent natural regeneration in some environments[68]. 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-8*	Wasps (*Vespula* spp.) adversely impact native invertebrates and birds through predation and competition for food resources. They also affect nutrient cycles in beech forests[69]	Entire KNE site
Human activities		
HA-1	Agricultural practices, particularly grazing livestock can result in pugging soils, grazing native vegetation inhibiting regeneration, wildlife disturbance and increasing nutrient content of soils and watercourses[70]	G
HA-2*	Recreational use of walkways and tracks within the forest can cause damage and disturbance of the native ecosystem. It is also likely to disturb native fauna and introduce ecological weeds	A, H
HA-3*	Land use activities that alter the local hydrology, such as compaction, increased run-off, reduced infiltration and increased evaporation from development schemes and agricultural practices, can affect the water levels that sustain wetland ecosystems[71]	Entire KNE site

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
HA-4*	Dogs (*Canis lupus familiaris*), if uncontrolled/unleashed can disturb or kill nesting birds and chicks, and lizards within the KNE site, particularly in close proximity to walking tracks[72]	A, H
Other threats		
OT-1*	Small forest remnants are effected 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)[73,74]	Entire KNE site

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

8. Vision and objectives

8.1. Vision

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

8.2. Objectives

Objectives help to ensure that operational activities carried out are actually 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 native plant understorey regeneration**
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 landowners in their restoration objectives at the KNE site**

9. Operational activities

Operational activities are targeted to work towards the objectives above (Section 8) by responding to the threats outlined in Section 7. The broad approach to operational activities is described briefly below, and specific actions with allocated budget, are set out in the operational delivery schedule (Table 3).

It is important to note that not all threats identified in Section 7 can be adequately addressed. This can be for a number of reasons including financial, legal, or capacity restrictions.

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 eight operational areas based on the vegetation communities present (See Appendix 1, Map 5). These are:

A: Main kahikatea-pukatea swamp forest (6.3 ha)

B: Ephemeral wetland (0.4 ha)

C: North-eastern kahikatea-pukatea forest fragment and linkage (1.4 ha)

D: South-eastern sedgeland/rushland wetland (2.4 ha)

E: Southern kahikatea-pukatea forest fragment and linkage (0.5 ha)

F: Duneland forest and linkage area (1.4 ha)

G: North-western kahikatea forest remnant (3.0 ha)

H: Mixed planted native treeland and shrubland (1.6 ha)

9.1. Ecological weed control

The aim of 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 incursion of new weed species in to the mature forest block by multi-species weed sweeps across the KNE site.

The KNE site contains numerous ecological weed species with the largest known infestations previously recorded during a survey in 2011[75] in the forest interior and around the wetland and forest margins across the entire KNE site. Greater Wellington will undertake weed control on an annual basis targeting weed species that have the highest ecological impact (see Appendix 4).

Targeted weed control

Targeted control of priority exotic climbing species will be 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). Control will focus on controlling climbers located around associations of mature native vegetation with the intention of releasing them from the competitive pressures of these climbers. Priority

climbing weed species include but are not limited to; old man's beard, Japanese honeysuckle, blue morning glory, banana passionfruit and climbing asparagus.

Targeted weed control will also be undertaken annually around plantings within the north-eastern kahikatea-pukatea forest fragment and linkage (Operational Area C), the south-eastern sedgeland/rushland wetland (Operational Area D) and the southern kahikatea-pukatea forest fragment and linkage (Operational Area E). Control will focus on releasing KCDC's previous year's plantings to reduce competitive pressures. A gorse windbreak will be left around kahikatea plantings until they are well established to enhance survival success.

Multi-species weed control

A multi-species weed control sweep will be undertaken within the north-eastern kahikatea-pukatea forest fragment and linkage (Operational Area C) and the southern kahikatea-pukatea forest fragment and linkage (Operational Area E). Control in these areas will target woody, groundcover and climbing weed species with the intention of reducing the incursion of weed species around the margins, promoting natural regeneration of the understorey and supporting connection between the small forest fragments to the main forest block. Priority weed species include but are not limited to; blackberry, gorse, hawthorn, old man's beard and arum lily.

Multi-species weed control will also be undertaken within the wetland areas including; the ephemeral wetland (Operational Area B) and the south-eastern sedgeland/rushland wetland (Operational Area D). Weed control in these areas will focus on targeting woody and climbing weed species around the wetland margins. Priority weed species for control include but are not limited to; blackberry, old man's beard, hawthorn, gorse and African club moss (*Selaginella kraussiana*). Willows located within the interior south-eastern sedgeland/ rushland wetland (Operational Area D) are likely to affect the hydrological integrity of the wetland and therefore, are prioritised for control over the duration of this plan. Willows will be controlled via ground-based methods where access is permissible on foot.

A multi-species weed sweep will be undertaken within the north-western kahikatea forest remnant (Operational Area G) on an annual basis following the installation of the stock-proof fence. Weed control in this area will focus on targeting incursions of woody, climbing and groundcover weed species that are likely to emerge once stock are excluded from the area to support native understorey regeneration.

9.2. Pest animal control

Greater Wellington's Bioworks 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 Possum Predator Control Programme (RPPCP). The pest animal control network within the KNE site comprises 23 DOC 250 kill-traps, 23 Timms traps and 10 pelifeed bait stations to target mustelids, feral cats, possums and rats (see Appendix 1, Map 4).

9.3. 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 this plan. All plants should be eco-sourced from the Foxton Ecological District.

Revegetation planting will be undertaken within the north-eastern kahikatea-pukatea forest fragment and linkage area (Operational Area C), the south-eastern sedgeland/rushland wetland (Operational Area D) and the southern kahikatea-pukatea forest fragment and linkage area (Operational Area E). Revegetation of these areas is aimed at enhancing connection between the isolated forest fragments and the main forest block as well as minimising edge effects and protecting the main forest block and wetland from the incursion of weed species. Additionally, a strategic planting approach will be taken around thin fringes of gorse growing on the edges of the forest blocks. These areas will not be controlled and instead planted around with the aim of isolating them and eventually shading them out. 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 and KCDC.

Revegetation planting will also be undertaken within the north-western kahikatea forest remnant (Operational Area G) following the installation of fencing. The aim of planting in this area is to advance regeneration of the understorey and forest margins; however, will only be undertaken if the density of natural regeneration is insufficient over time. Revegetation planting of this area will be determined by the Greater Wellington's Biodiversity department and the landowner.

9.4. Fencing

The aim of fencing at the KNE site is to protect existing native plant species from stock browse and damage, increase native plant regeneration, particularly within the forest understorey, and enhance essential habitat for native birds in line with objectives 1, 2, 4 and 5.

Within the past few years, new fencing has been installed around some parts of the south eastern sedgeland/rushland wetland (Operational Area D) to exclude stock from the wetland in accordance with Rule 97 of the PNRP[76], and also around the southern kahikatea-pukatea forest fragment and linkage (Operational Area E) to protect this area from stock browse.

However, part of the fenceline around the northern section of the south eastern sedgeland/rushland wetland (Operational Area D) is in disrepair and does not effectively exclude stock from entering the wetland. Stock cause damage to the vegetation composition and negatively affect the water quality within the wetland. Additionally, stock still have access to the north-western kahikatea forest remnant (Operational Area G) causing damage to the existing forest stand and significantly reducing natural understorey regeneration.

Therefore, Greater Wellington will support the landowners and provide funding towards the installation of new fencing around the northern section of the south eastern sedgeland/rushland wetland (see Appendix 1, Map 7) and the north-western kahikatea forest remnant (see Appendix 1, Map 8) within the term of this plan.

9.5. Monitoring

A series of seven photopoint monitoring sites will be set up within the Haruātai/Pareomatangi KNE site in 2020/21. The photopoint locations will comprise of both aerial (via drone) and ground-based sites to provide a complete and accurate depiction of the entire site. Photos will be taken annually by the Greater Wellington Biodiversity Advisor for the KNE site at each photopoint location to provide a visual record of changes in native and exotic vegetation composition in response to the management activities undertaken and natural ecological processes occurring. This visual record over time may be used to help guide future management actions undertaken at the site.

The Haruātai/Pareomatangi KNE site is part of Greater Wellington's Wetland Health State of the Environment (SoE) monitoring programme that is undertaken by the Environmental Science department on a five-yearly basis at key wetland sites in the region. The Haruātai/Pareomatangi KNE site was first surveyed in 2017/2018 and will be surveyed again in 2021/2022. 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. The follow-up survey in 2021/2022 will be used to identify trends in wetland health and areas for improvement to guide management activities at the KNE site.

10. Future opportunities

Below is a list of some further management and community engagement activities that have been identified as having the potential to improve the biodiversity values of the site or would provide information to further our understanding of the present values and how to protect them:

- Undertake a revegetation planting event aimed at re-connecting Ngā Hapū o Ōtaki iwi members with Haruātai/Pareomatangi and its traditional values as well as enhancing the connectivity between isolated forest fragments and the main forest block
- Provide opportunities for Ngā Hapū o Ōtaki iwi members to undertake pest animal trapping, ecological monitoring and/or weed control within the KNE site which helps whānau members remain connected with the land and the forest
- Undertake a baseline bird monitoring survey within the KNE site to provide information about what bird species utilise the site and what management may be required
- Undertake a baseline lizard and invertebrate survey within the KNE site to better understand what species exist and what management may be required
- Reporting of wildlife sightings through citizen science platforms such as inaturalist and eBird

11. Operational delivery schedule

The operational delivery schedule shows the actions planned to achieve the stated objectives for the Haruātai/Pareomatangi KNE site, and their timing and cost where allocated over the five-year period from 1 July 2020 to 30 June 2025. The budget for years 2021/22 to 2024/25 are indicative only and subject to change. A map of operational areas can be found in Appendix 1 (see Map 5).

Table 3: Five-year operational plan for the Haruātai/Pareomatangi KNE site

Objective	Management activity	Operational area	The Actions: Description/detail	Intended 5 year outcomes	Delivery	Frequency and funding where allocated				
						2020/21	2021/22	2022/23	2023/24	2024/25
1, 2, 3, 4	Ecological weed control	A, Entire KNE site as required	Control of priority exotic climber species to release mature native tree species	No new infestations of priority climber species and existing infestations are eradicated or suppressed to a level that prevents further spread	GWRC Biosecurity department	✓	✓	✓	✓	✓
1, 2, 3, 4	Ecological weed control	C, D, E	Targeted weed control around previous year's plantings	Suppression of priority weed species to a level that enables successful establishment of revegetation planting	GWRC Biosecurity department	✓	✓	✓	✓	✓
1, 2, 3, 4	Ecological weed control	C, E	Control of priority woody, groundcover and climbing weed species within linkage areas	Suppression of priority weed species to a level which prevents new weed incursions in to the main forest block; increased connectivity from native understorey regeneration	GWRC Biosecurity department	✓	✓	✓	✓	✓

Objective	Management activity	Operational area	The Actions: Description/detail	Intended 5 year outcomes	Delivery	Frequency and funding where allocated				
						2020/21	2021/22	2022/23	2023/24	2024/25
1, 3, 4	Ecological weed control	B, D	Control of priority ecological weed species within wetland areas	Suppression of priority weed species in marginal areas to prevent any new weed incursions in to the wetland proper; willow infestations are eradicated and new willow growth is controlled annually as it is discovered	GWRC Biosecurity department	✓	✓	✓	✓	✓
1, 2, 4	Ecological weed control	G	Control of priority ecological weed species within fenced remnant forest areas	Any emergent priority weed species are controlled annually as they are discovered and there is an established native understorey that is continuing to regenerate	GWRC Biosecurity department		✓†	✓†	✓†	✓†
1, 2, 3, 4	Pest animal control	Entire KNE site and wider landscape	Traps and bait stations serviced on a three monthly basis (RPPCP)	Browsing pest animal populations are maintained to: possums <5% RTC*; rats <10% TTI**; mustelids <2% TTI** to facilitate native vegetation growth	GWRC Bioworks department	✓	✓	✓	✓	✓
1, 2, 3, 4	Revegetation	C, D, E	Revegetation planting of forest margins and designated planting areas as determined on an annual basis	Suppression of priority weed species to prevent any new weed incursions in to the main forest block and an increase in the diversity and regeneration of native plant communities in marginal/linkage areas	GWRC Biodiversity department, KCDC, landowner	✓^ $4,000	✓^ $4,000	✓^ $4,000	✓^ $4,000	✓^ $4,000

Objective	Management activity	Operational area	The Actions: Description/detail	Intended 5 year outcomes	Delivery	Frequency and funding where allocated				
						2020/21	2021/22	2022/23	2023/24	2024/25
1 2, 4	Revegetation	G	Revegetation planting within the understorey and margins of fenced remnant forest areas	An increase in native understorey establishment that is diverse and regenerating	GWRC Biodiversity department, landowner		✓† $2,000	✓† $2,000	✓† $2,000	✓† $2,000
1, 2, 4, 5	Fencing	G	Fencing installation around areas of kahikatea forest remnant	The kahikatea forest remnant is completely excluded from stock and understorey regeneration has increased	GWRC Biodiversity department, landowner	✓† $4,000				
1, 2, 3, 4	Monitoring	Entire KNE site	Aerial and ground-based photopoint photos taken at specified locations at the KNE site	Changes in native and exotic vegetation composition overtime are determined and is being used to inform management	GWRC Biodiversity department	✓ (staff time only)	✓ (staff time only)	✓ (staff time only)	✓ (staff time only)	✓ (staff time only)
1, 2, 3, 4	Monitoring	Entire KNE site	SOE wetland health monitoring of vegetation	Trends in wetland health are quantified and areas for improvement are identified	GWRC Environmental Science department		✓			

*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

^ = This work is reviewed annually and partially subject to KCDC's contestable Heritage and/or Riparian Funds

† = The timeframe for this action is indicative only and may be undertaken at any time over the duration of this plan.

12. Funding contributions

12.1. Budget allocated by Greater Wellington

The budget for the years 2021/22 and 2024/25 are indicative only and subject to change.

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

Management activity	Timetable and resourcing				
	2020/21	2021/22	2022/23	2023/24	2024/25
Ecological weed control	$3,000	$5,000	$5,000	$5,000	$5,000
Revegetation	-	$2,000	$2,000	$2,000	$2,000
Fencing	$4,000†	-	-	-	-
Total	**$7,000**	**$7,000**	**$7,000**	**$7,000**	**$7,000**

† = The timeframe for this action is indicative only and may be undertaken at any time over the duration of this plan.

12.2. Budget allocated by KCDC

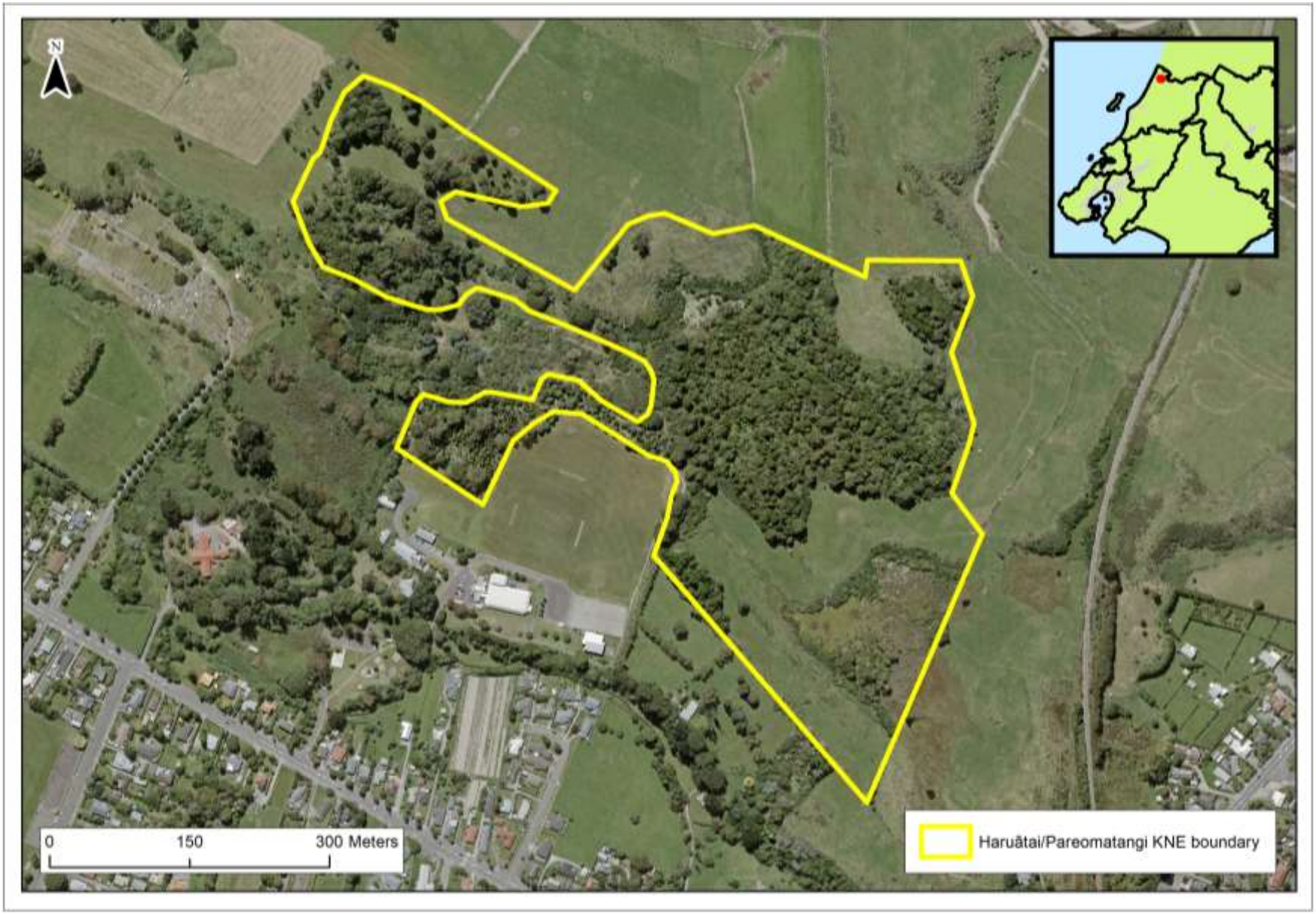
The budget is subject to confirmation through a ten-year planning process.

Table 5: KCDC allocated budget for the Haruātai/Pareomatangi KNE site

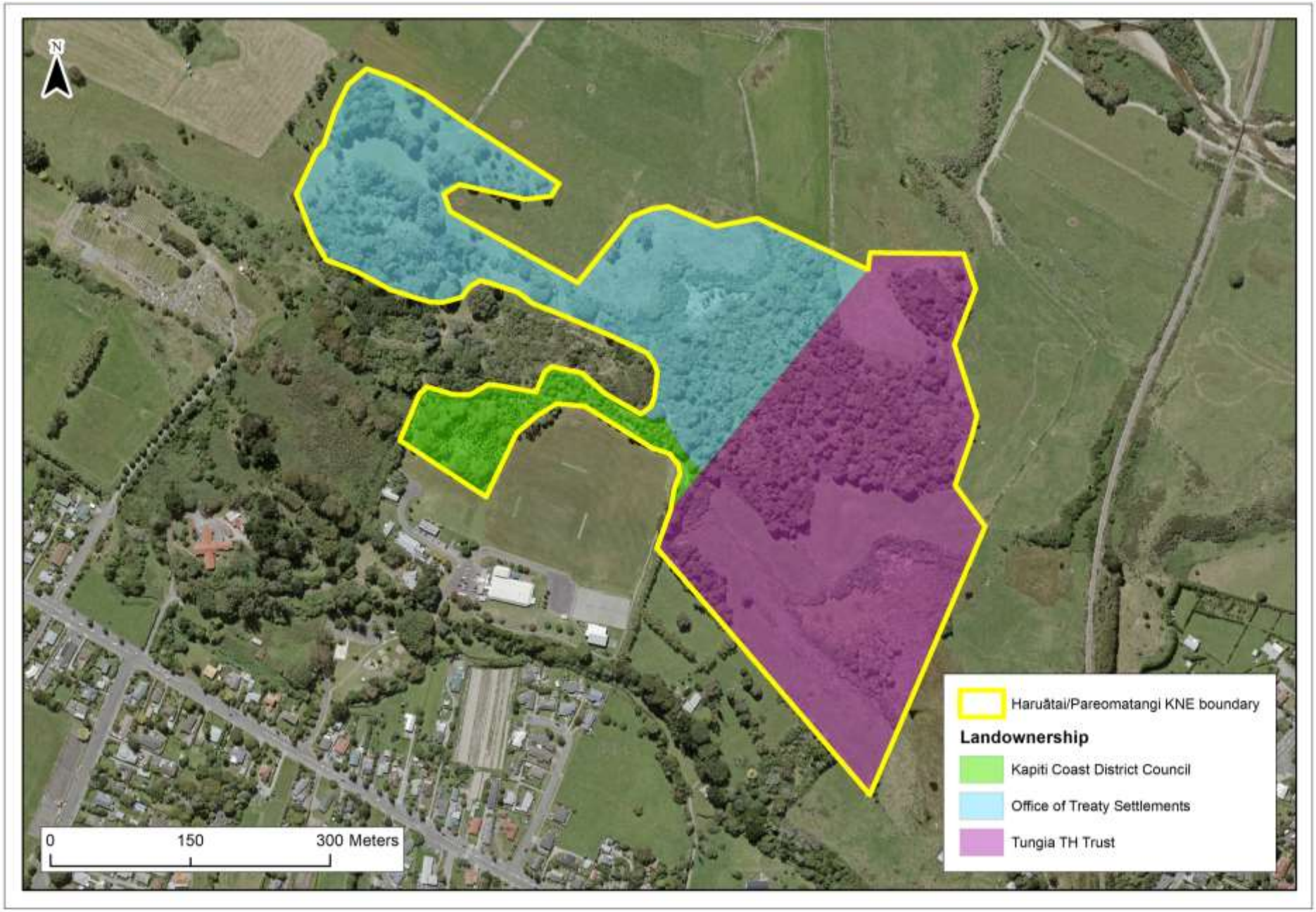
Management activity	Timetable and resourcing				
	2020/21	2021/22	2022/23	2023/24	2024/25
Ecological weed control	$1,000	$1,000	$1,000	$1,000	$1,000
Revegetation	$4,000 or 400-500 plants^	$4,000 or 400-500 plants^	$4,000 or 400-500 plants^	$4,000 or 400-500 plants^	$4,000 or 400-500 plants^
Total	**$5,000**	**$5,000**	**$5,000**	**$5,000**	**$5,000**

^subject to continued funding by KCDC through their contestable Heritage and/or Riparian Funds.

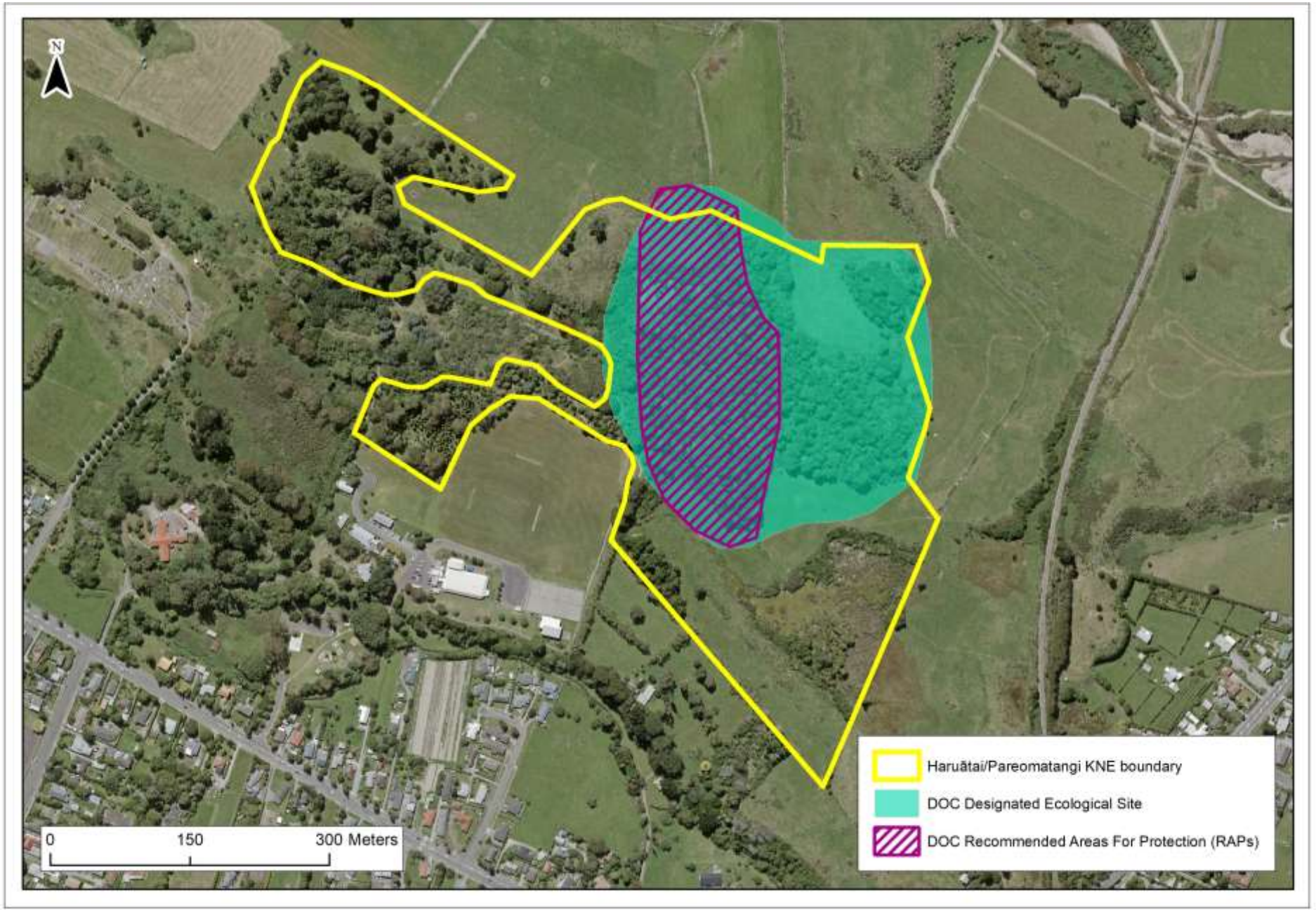
Appendix 1: Site maps



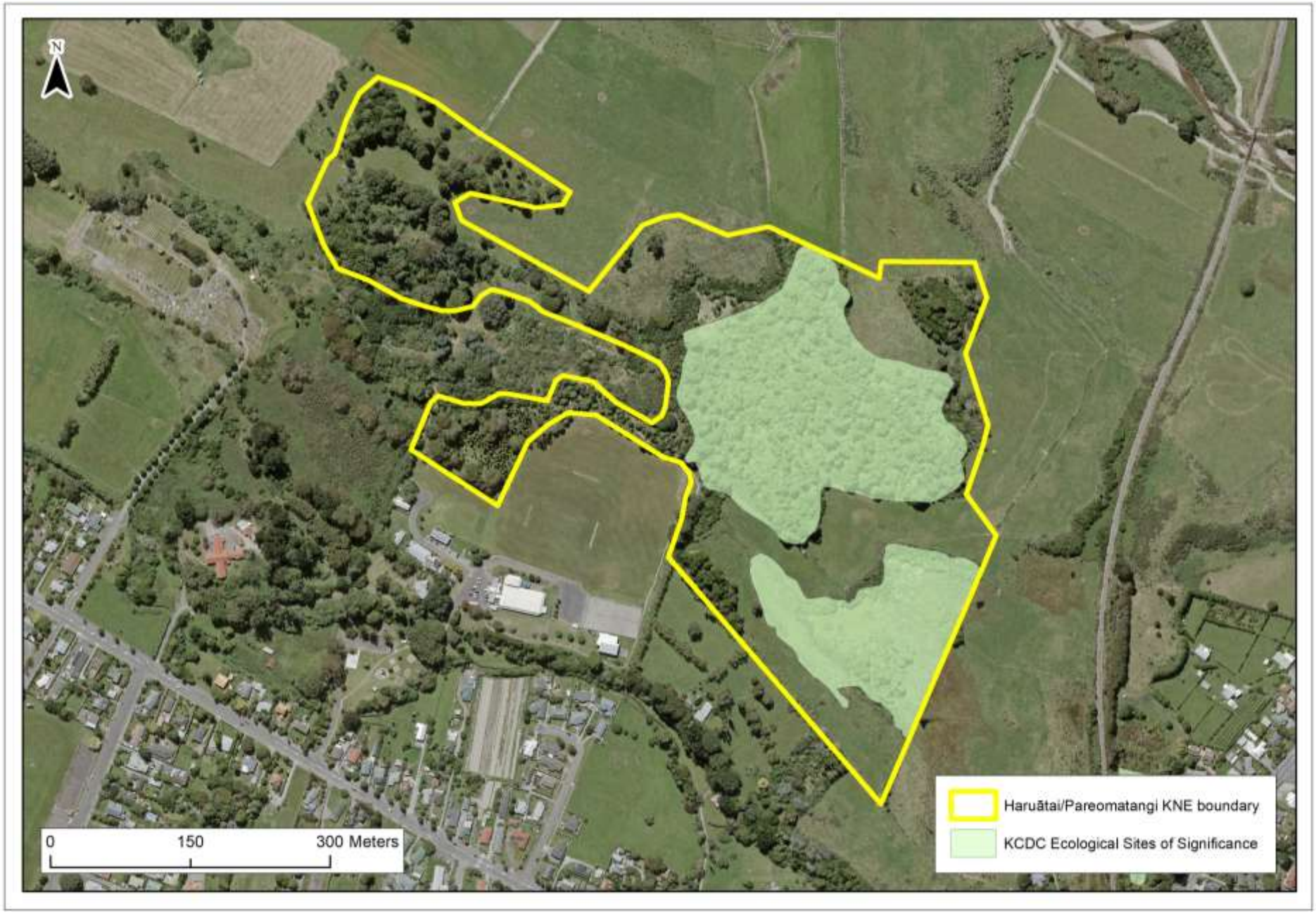
Map 1: The Haruātai/Pareomatangi KNE site boundary



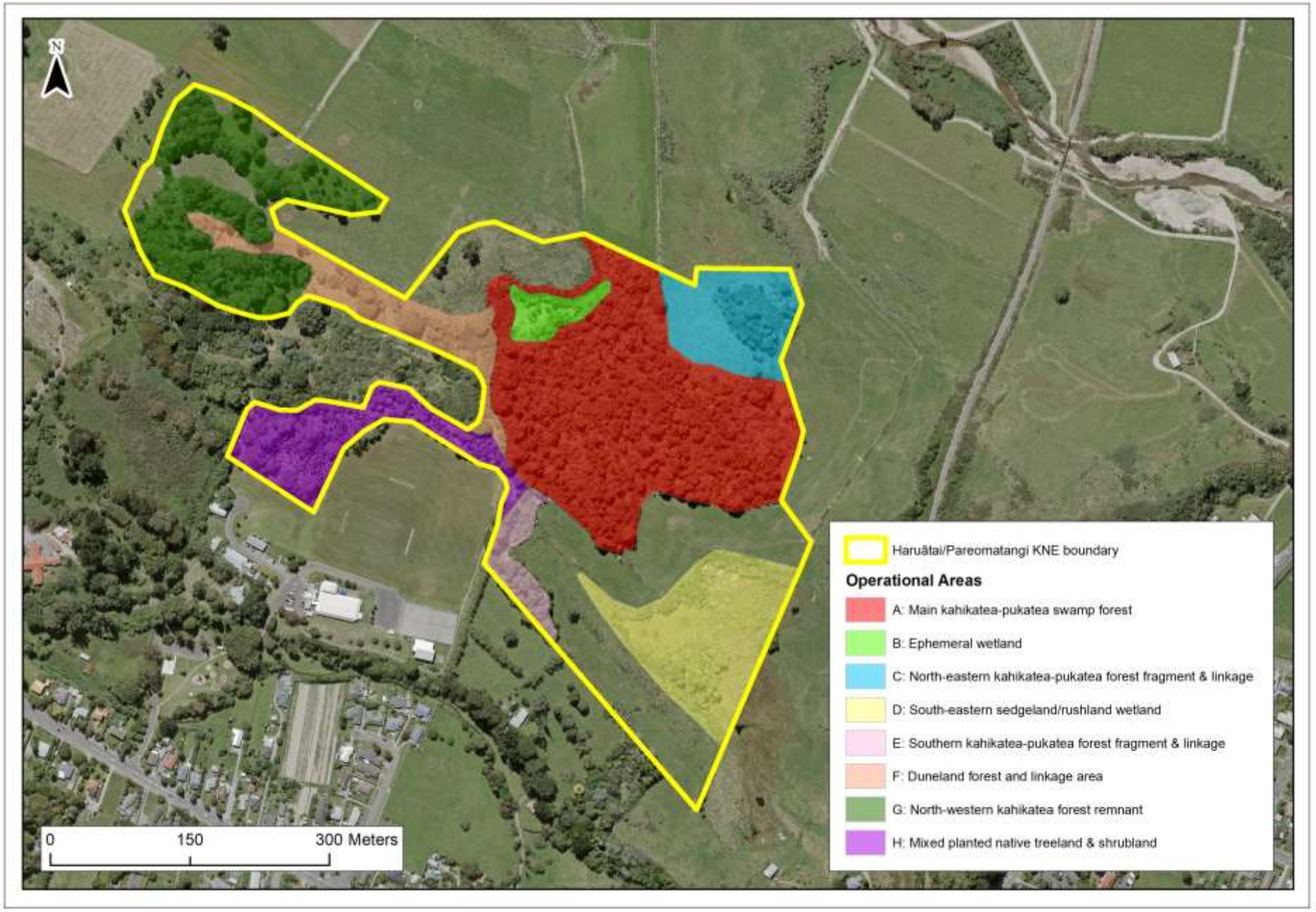
Map 2: Land ownership boundaries within the Haruātai/Pareomatangi KNE site



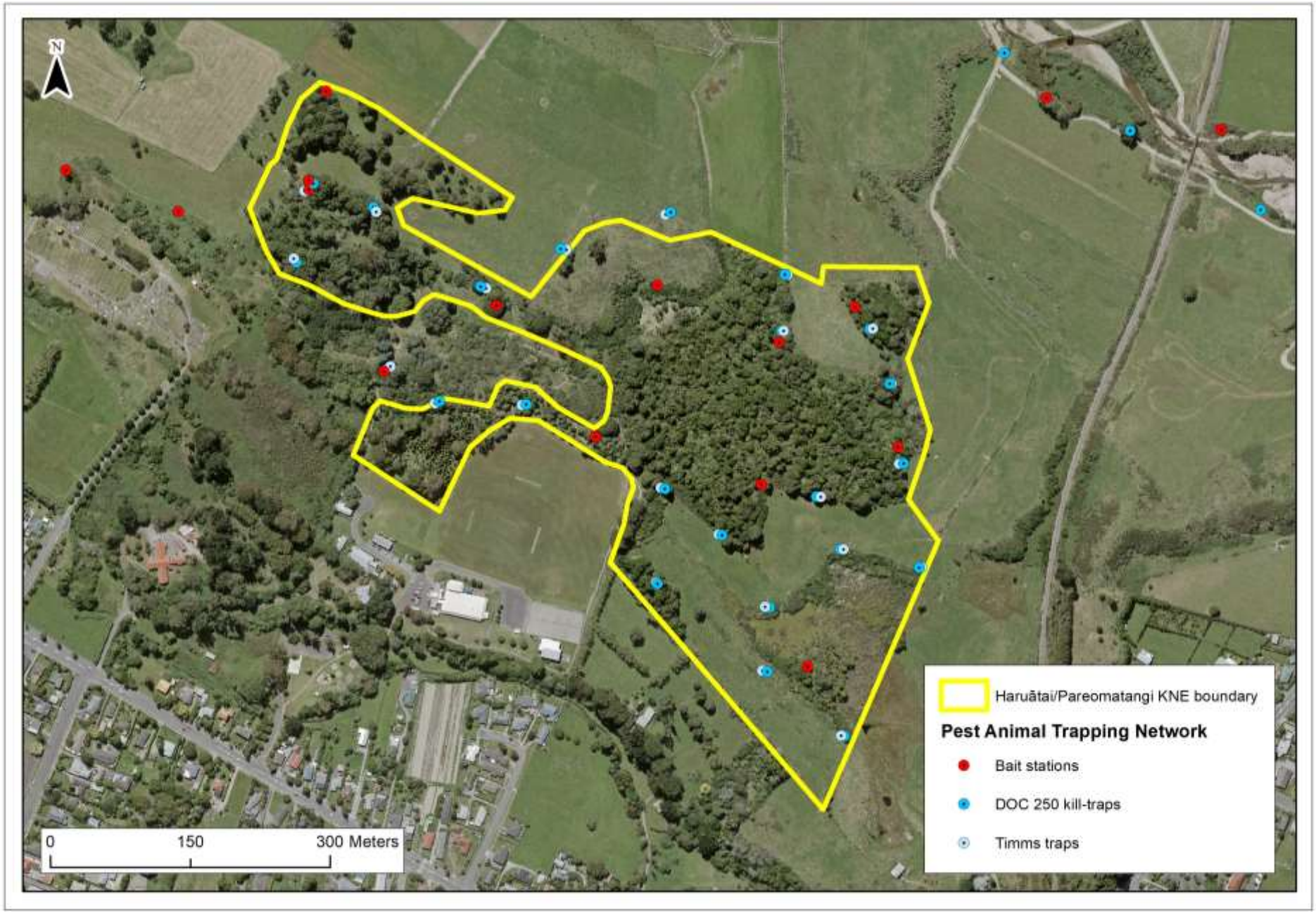
Map 3: DOC Designated Ecological Sites and Recommended Areas for Protection within the Haruātai/Pareomatangi KNE site



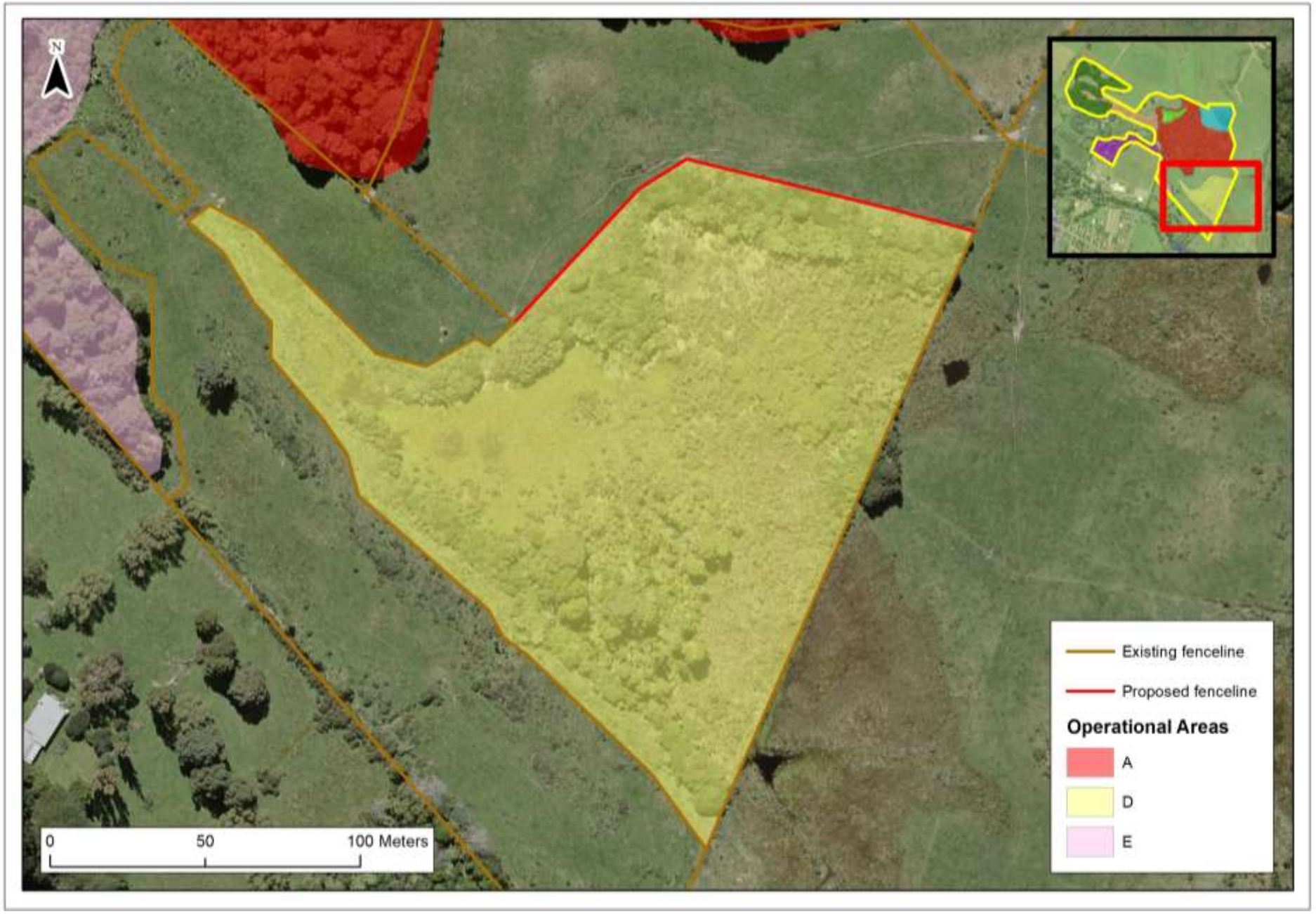
Map 4: Designated KCDC Ecological Sites of Significance within the Haruātai/Pareomatangi KNE site



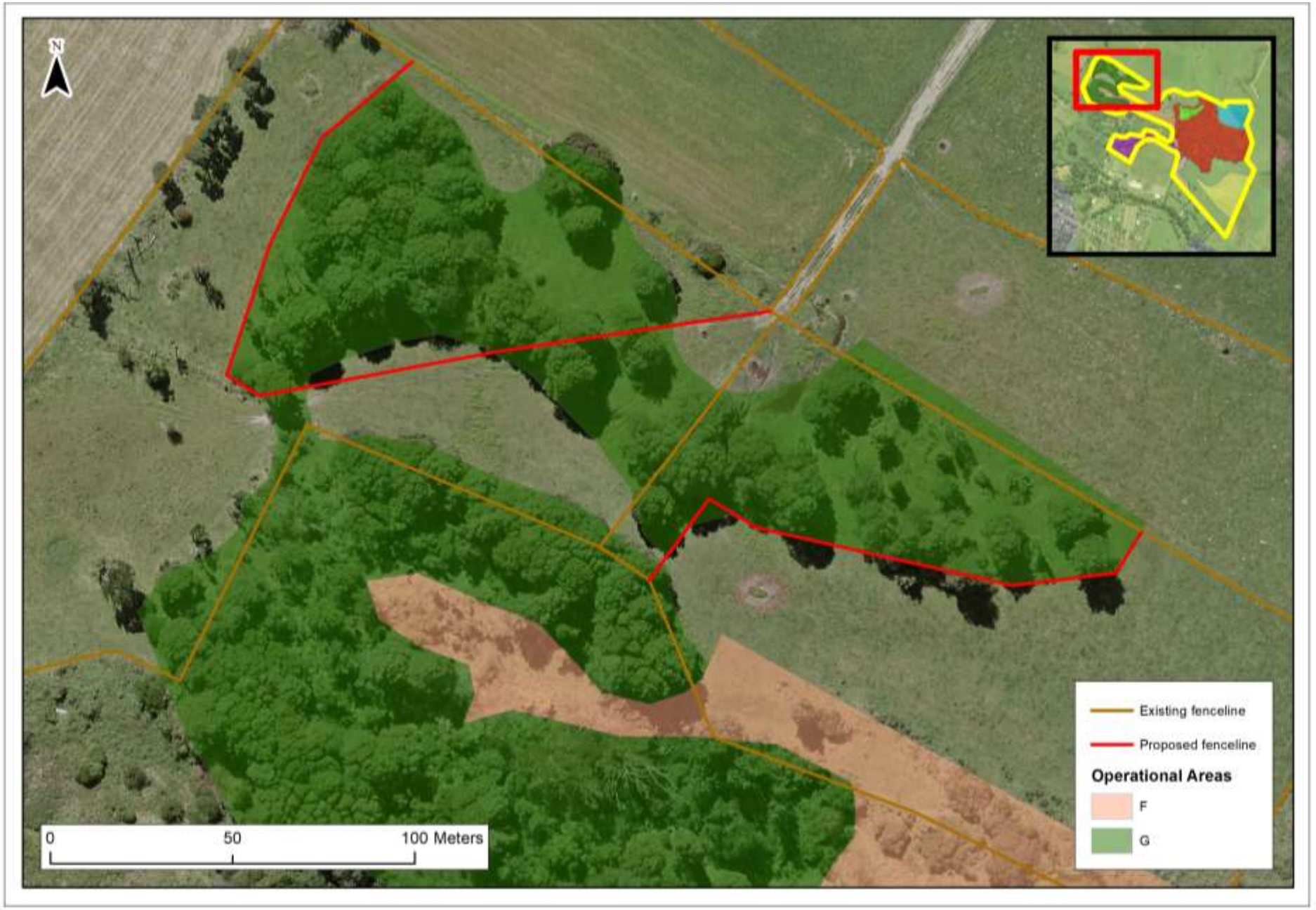
Map 5: Operational areas in the Haruātai/Pareomatangi KNE site



Map 6: Location of the pest animal control network within the Haruātai/Pareomatangi KNE site



Map 7: Location of existing and proposed fencing within the Haruātai/Pareomatangi KNE site



Map 8: Location of existing and proposed fencing around the north-western kahikatea forest remnant within the Haruātai/Pareomatangi 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[77]. 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 Threatened and At Risk species that are resident in, or regular visitors to, the Haruātai/Pareomatangi KNE site.

Table 6: Threatened and At Risk species at the Haruātai/Pareomatangi KNE site

Scientific name	Common name	Threat status	Observation
Plants(vascular)[78]			
Solanum aviculare var. aviculare	Poroporo	Threatened – Nationally Vulnerable	P A Handford & Associates Ltd, 2012[79]
Syzygium maire	Swamp maire	Threatened – Nationally Critical	P A Handford & Associates Ltd, 2012; Hurley, 2019[80]

Appendix 3: Regionally threatened plant species list

The following table lists regionally threatened species that have been recorded in the Haruātai/Pareomatangi KNE site. Native plant species have been identified in the Conservation status of indigenous vascular plant species in the Wellington region report 2020[81].

Table 7: Regionally threatened plant species recorded in the Haruātai/Pareomatangi KNE site

Scientific name	Common name	Threat status	Observation
Plants			
Solanum aviculare var. aviculare	Poroporo	Threatened – Regionally Vulnerable	P A Handford & Associates Ltd, 2012[82]

Appendix 4: Ecological weed species

The following table lists key ecological weed species that have been recorded in the Haruātai/Pareomatangi KNE site.

Table 8: Ecological weed species recorded in the Haruātai/Pareomatangi KNE site

Scientific Name	Common Name	Priority	Weed type
Asparagus scandens	Climbing asparagus	Severe	Climber
Asparagus setaceus	Asparagus fern	Severe	Climber
Clematis vitalba	Old man's beard	Severe	Climber
Hedera helix	Ivy	Severe	Climber
Passiflora sp.	Banana passionfruit	Severe	Climber
Acer sp.	Sycamore	High	Woody weed
Berberis glaucocarpa	Barberry	High	Woody weed
Cortaderia selloana	Pampas	High	Exotic grass
*Corynocarpus laevigatus**	Karaka	High	Woody weed
Hedychium sp.	Ginger	High	Groundcover
Ilex aquifolium	Holly	High	Woody weed
Ipomoea indica	Blue morning glory	High	Climber
Lonicera japonica	Japanese honeysuckle	High	Climber
Populus alba	Silver poplar	High	Woody weed
Prunus sp.	Cherry	High	Woody weed
Rubus fruticosus agg.	Blackberry	High	Climber
Salix sp.	Willow	High	Woody weed
Selaginella kraussiana	African club moss	High	Groundcover
Tradescantia fluminensis	Tradescantia	High	Groundcover
Ulex europaeus	Gorse	High	Woody weed
Zantedeschia aethiopica	Arum lily	High	Groundcover
Acacia sp.	Wattle	Moderate	Woody weed
Acanthus mollis	Bear's breeches	Moderate	Groundcover
Agapanthus praecox subsp. *orientalis*	Agapanthus	Moderate	Groundcover
Apium nodiflorum	Water celery	Moderate	Marginal aquatic
Bidens frondosa	Beggars ticks	Moderate	Marginal aquatic
Buddleja davidii	Buddleia	Moderate	Woody weed
Calystegia silvatica.	Great bindweed	Moderate	Climber
Cotoneaster sp.	Cotoneaster	Moderate	Woody weed
Crataegus monogyna	Hawthorn	Moderate	Woody weed

Scientific Name	Common Name	Priority	Weed type
Crocosmia × crocosmiiflora	Montbretia	Moderate	Groundcover
Gunnera tinctoria	Chilean rhubarb	Moderate	Groundcover
Ligustrum sinense	Chinese privet	Moderate	Woody weed
Lycium ferocissimum	Boxthorn	Moderate	Woody weed
*Pittosporum crassifolium**	Karo	Moderate	Woody weed
Populus nigra	Lombardy poplar	Moderate	Woody weed
Rhododendron ponticum	Rhododendron	Moderate	Woody weed
Sambucus nigra	Elder	Moderate	Woody weed
Solanum pseudocapsicum	Jerusalem cherry	Moderate	Groundcover
*Vitex lucens**	Puriri	Moderate	Woody weed
Chamaecytisus palmensis	Tree lucerne	Low	Woody weed
Cupressus macrocarpa	Macrocarpa	Low	Woody weed
Hydrangea macrophylla	Hydrangea	Low	Groundcover
Lupinus arboreus	Tree lupin	Low	Woody weed
*Metrosideros excelsa**	Pohutukawa	Low	Woody weed
Pinus nigra	Black pine	Low	Woody weed
Pinus radiata	Radiata pine	Low	Woody weed
Prunus × domestica	Plum	Low	Woody weed
Quercus sp.	Oak	Low	Woody weed

* Denotes a New Zealand native plant that is not local to the Wellington Region

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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

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