

Key Native Ecosystem Operational Plan for Battle Hill Bush

2022-2027



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1. Purpose

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

- Identify the parties involved
- Summarise the ecological values and identify the threats to those values
- Outline the vision and objectives to guide management decision-making
- Describe operational activities to improve ecological condition (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

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

The KNE programme funding is allocated for under The Greater Wellington Long Term Plan (2021-2031)² and is managed in accordance with The Greater Wellington Biodiversity Strategy³ that sets a framework for how Greater Wellington protects and manages biodiversity in the Wellington region. Goal One of the Biodiversity Strategy - *Areas of high biodiversity value are protected or restored* - drives the delivery of the KNE Programme.

Other important drivers for the KNE programme include the Proposed Natural Resources Plan⁴, the Regional Pest Management Plan 2019-2039⁵ and Toitū Te Whenua Parks Network Plan⁶.

3. The Key Native Ecosystem Programme

The KNE Programme is a non-regulatory programme. The programme seeks to protect some of the best examples of original (pre-human) ecosystem types in the Wellington region. Sites with the highest biodiversity values have been identified and prioritised for management.

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

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

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

Representativeness	Rarity/ distinctiveness	Diversity	Ecological context
The extent to which ecosystems and habitats represent those that were once typical in the region but are no longer common place	Whether ecosystems contain Threatened/At Risk species, or species at their geographic limit, or whether rare or uncommon ecosystems are present	The levels of natural ecosystem diversity present, 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

4. Battle Hill Bush Key Native Ecosystem site

The Battle Hill Bush KNE site (37 ha) consists of a remnant of mature and regenerating kohekohe/tawa semi-coastal forest that is now considered a regionally threatened forest type. The KNE site is located on Paekākāriki Hill Road approximately 5km north of Pāuatahanui and 13km south of Paekākāriki (see Appendix 1, Map 1).

Most of the KNE site (24.5 ha) is located within Battle Hill Farm Forest Park. The remainder of the KNE site (12.5 ha) consists of two privately owned forest blocks on the opposite side of Paekākāriki Hill Road. All three forest blocks are adjacent to each other with the forest being contiguous but for a main road that bisects it (see Appendix 1, Map 2).

The Battle Hill Farm Forest Park section of the KNE site is gazetted as Scenic Reserve. One of the privately owned blocks is legally protected by a Queen Elizabeth II National Trust (QEII) open space covenant. Horokiri Stream, which is identified as a regionally significant stream for indigenous freshwater fish, flows through the KNE site. Habitats surrounding the KNE site include exotic plantation forest, farmland and regenerating indigenous forest.

5. Parties involved

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

5.1. Landowners/Land Manager

Most of the site (24.5 ha) is owned by Greater Wellington and managed by Greater Wellington's Parks department as part of Battle Hill Farm Forest Park (see Appendix 1, Map 2). Management of Battle Hill Farm Forest Park as a whole is guided by Toitū Te Whenua Parks Network Plan⁷. The remaining land within the KNE site is privately owned by two separate owners: Jeremy Collyns (8 ha) and Jacksons 2019 Limited (4.5 ha). These landowners allow areas of native forest on their land to be included in the KNE site and allow access to their land for the purposes of ecological weed and pest animal control.

5.2. Operational delivery

Within Greater Wellington, three departments are responsible for delivering the Battle Hill Bush KNE operational plan.

- The Biodiversity department is the overarching lead department for Greater Wellington on the longer-term planning and coordination of biodiversity management activities and advice within the KNE site. The Biodiversity department's KNE programme budget funds the Biosecurity department to coordinate and carry out pest control activities.
- The Biosecurity department coordinates and implements ecological weed and pest animal control measures at the KNE site.
- The Parks department primarily manages recreational access and maintains assets such as tracks within the KNE site. However, the Parks department also funds ecological restoration work within the park which has included revegetation work in the KNE site in the past. The Parks department manages an Environmental Enhancement fund which is available for environmental projects with a priority for those involving volunteers. The Park Ranger is the primary contact for volunteers and contractors undertaking work in the park.

One of the private landowners, Jeremy Collyns undertakes the pest animal control and some ecological weed control in his part of the KNE site. The collaboration between Mr Collyns and Greater Wellington staff over many years has been appreciated by both parties and has been beneficial to biodiversity outcomes.

5.3. Mana whenua partners

The Battle Hill Bush KNE site area is significant to Ngāti Toa Rangatira (Ngāti Toa), who are mana whenua partners with Greater Wellington.

Ngāti Toa has an association with Battle Hill Farm Forest Park as outlined in the Statutory Acknowledgements from the Ngāti Toa Rangatira Claims Settlement Act 2014⁸.

The area has been identified in the Proposed Natural Resources Plan (PNRP)⁹ as culturally important with particular reference to Horokiri Stream which flows through the KNE site. Table 1 below lists the values that Horokiri Stream holds for mana whenua as listed in the PNRP¹⁰.

Greater Wellington is committed to identifying ways in which kaitiakitanga can be strengthened by exploring opportunities on how mana whenua partners wish to be involved in the KNE plan development or operational delivery of the KNE site.

Table 1: Mana whenua sites of significance in Battle Hill Bush KNE site¹¹

Sites of significance	Mana whenua values
Horokiwi (Horokiri) Stream	pā, wai māori, wai ora, kai awa, nohoanga, mara kai, wāhi maumahara, wāhi tūpuna

5.4. Stakeholders

QEII administers the open space covenant on the land owned by Mr Collyns which was gazetted in 1983. They undertake a biennial inspection of the covenant to gauge its ecological condition and check that compliance with the covenant conditions is being maintained. Greater Wellington and QEII work in partnership to protect biodiversity at many ecological sites in the region including this one, as outlined in a MOU¹² between the organisations.

Members of the Mana Lions Club assist indirectly in the biodiversity management at the KNE site by trapping predators in surrounding areas of Battle Hill Farm Forest Park. They have been undertaking this work since September 2006.

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 2, below, lists ecological designations at all or part of the Battle Hill Bush KNE site.

Table 2: Designations at the Battle Hill Bush KNE site

Designation level	Type of designation
National	<p>Most of the KNE site is gazetted as Scenic Reserve:</p> <ul style="list-style-type: none"> • Battle Hill Bush Scenic Reserve <p>Most of the KNE site is designated as a Designated Ecological Site (DES) by the Department of Conservation:</p> <ul style="list-style-type: none"> • DES 442 Battle Hill Bush
Regional	<p>Parts of the KNE site are designated in GW's Proposed Natural Resources Plan (PNRP) as:</p> <ul style="list-style-type: none"> • A stream with Significant Indigenous Ecosystems - habitat for threatened and at risk fish species (Schedule F1): Horokiri Stream • A stream with Significant Indigenous Ecosystems – habitat for six or more migratory indigenous fish species (Schedule F1): Horokiri Stream
District	<p>Most of the KNE site lies within two Significant Natural Areas listed in Porirua City Council's Proposed District Plan:</p> <ul style="list-style-type: none"> • SNA 202 Battle Hill – Diggins Bush • SNA 203 Battle Hill Bush Reserve
Other	<p>Part of the KNE site is designated an Open Space Covenant by Queen Elizabeth II National Trust:</p> <ul style="list-style-type: none"> • Collyns JNP covenant

6.2. Ecological significance

The Battle Hill Bush KNE site is considered to be of regional importance because:

- It contains a highly **representative** ecosystem that was once typical or commonplace in the region
- It contains ecological features that are **rare or distinctive** in the region
- Its **ecological context** is valuable at the landscape scale as it provides core habitat in the local area for indigenous plant, bird and fresh-water fish species

Representativeness

The Singers and Rogers¹³ classification of pre-human forest vegetation indicates the KNE site would likely have originally comprised kohekohe, tawa forest (ecosystem type MF6). Only 16% of the original extent of this forest ecosystem type remains in the Wellington Region making it a regionally endangered ecosystem type¹⁴.

The dominant species of this ecosystem type would have included kohekohe (*Dysoxylum spectabile*), tawa (*Beilschmiedia tawa*) and tītoki (*Alectryon excelsus* subsp. *excelsus*) on hill slopes and kahikatea (*Dacrycarpus dacrydioides*) and pukatea (*Laurelia novae-zelandiae*) in gullies. Although the existing ecosystem is modified having experienced selective logging, clearances and exotic herbivores, parts of the KNE site are still representative of this original ecosystem type.

The Threatened Environment Classification system indicates 18 ha of the KNE site are classified as either Acutely Threatened, Chronically Threatened or At Risk. There is less than 10%, 10-20% and 20-30% respectively of native vegetation remaining on these types of land in New Zealand¹⁵. These areas of threatened environments within the KNE site are located mostly on stream terraces and lower hill slopes (see Appendix 1, Map 3).

Rarity/distinctiveness

New Zealand's national threat classification system¹⁶ lists one plant, one bird, one lizard and four freshwater fish species that are present within the site as nationally Threatened or At Risk. Two plant, three bird and one lizard species present are listed as regionally threatened. Appendices 2 and 3 contain lists of nationally and regionally threatened species found within the KNE site.

Ecological context

The KNE site is likely to be important for native birds in the local area as it contains the only mature native forest in the immediate area. It is also likely to be important in the wider landscape context, through being part of a vegetated corridor forming an ecological link between the Hutt Valley and Pukerua Bay. This link is likely to facilitate the movement of mobile species.

6.3. Ecological features

The Battle Hill Bush KNE site is located in a valley formed by a fault line running between Pāuatahanui and Paekākāriki, creating the straight-flowing Horokiri Stream which flows into the Pāuatahanui Inlet approximately 5.5km downstream of the KNE site.

The geology of the catchment is fractured greywacke and alluvial gravels. The topography is characterised by steep, strongly faulted hills. The KNE site has an altitudinal range from 70m to 260m above sea level. It is within Wellington Ecological District¹⁷ and the Western Temperate Foothills Eco-domain which has a mild climate and a mean annual rainfall of 1,150-1,400mm¹⁸.

Vegetation communities and plants

The vegetation within Battle Hill Bush KNE site today generally comprises regionally uncommon semi-coastal forest with a canopy of kohekohe, tawa and occasional podocarp species.

Vegetation in the Battle Hill Farm Forest Park portion of the KNE site comprises forest dominated by tawa and tītoki on lower hill slopes, grading into kohekohe forest on upper slopes. Swampy areas support kahikatea, pukatea and swamp maire (*Syzygium maire*). Occasional rimu (*Dacrydium cupressinum*), tōtara (*Podocarpus totara*), mataī (*Prumnopitys taxifolia*) and miro (*Prumnopitys ferruginea*) are present. The understory

contains māhoe (*Melicytus ramiflorus*), kaikōmako (*Pennantia corybosa*), nīkau (*Rhopalostylis sapida*), *Coprosma* spp. and other tree and shrub species¹⁹. There is an area of rank pasture amongst early regenerating scrub at the northern end of the KNE site.

Uncommon plant species present include the maidenhair ferns (*Adiantum diaphanum* and *A. viridescens*), gully tree fern (*Cyathea cunninghamii*), perching kōhūhū (*Pittosporum cornifolium*), greenhood orchid (*Pterostylis foliata*), and the regionally threatened species taurepo. This species is near its southern distribution limit in the KNE site. Four uncommon mosses are present: *Trichostomum brachydontium*, *Porotrichum oblongifolium*, *Leptodon smithii* and *Echinodium umbrosum*^{20,21}.

The forest of the privately owned land is dominated by kohekohe and tawa, with kahikatea, tōtara, and mataī alongside the road. Elsewhere there is nīkau, māhoe, kaikōmako, kāmahi (*Weinmannia racemosa*), kawakawa (*Piper excelsum* subsp. *excelsum*), rewarewa (*Knightia excelsa*), houhere (*Hoheria sextylosa*), lancewood (*Pseudopanax crassifolius*), lemonwood (*Pittosporum eugenioides*), broadleaf (*Griselinia littoralis*) and tree ferns²².

Species

Birds

The KNE site is used by twenty species of native bird for foraging and/or breeding. Notable species include New Zealand falcon (*Falco novaeseelandiae*), bellbird (*Anthornis melanura*), whitehead (*Mohoua albicilla*) and tomtit (*Petroica macrocephala*)²³.

The KNE site is likely to be important for native birds in the local area as it contains the only mature native forest in the immediate area. It is also likely to be important in the wider landscape context, through being part of a vegetated corridor forming an ecological link between the Hutt Valley and Pukerua Bay. This link is likely to facilitate the movement of mobile species.

Reptiles

The only species of lizard that has been recorded in the KNE site is barking gecko (*Naultinus punctatus*). The only observation of the species was recorded in 2014²⁴.

Fish (inc Kōura/crayfish)

The Horokiri Stream provides habitat for native fresh-water fish. Six species have been recorded in the reaches of stream within the KNE site including three threatened species: giant kōkopu (*Galaxias argenteus*), kōaro (*Galaxias brevipinnis*) and longfin eel (*Anguilla dieffenbachia*). The nationally vulnerable species lamprey (*Geotria australis*) was recorded in the KNE site in 1985 but not in more recent surveys. Freshwater crayfish/kōura (*Paranephrops planifrons*) has been recorded in the KNE site²⁵. Migratory fish are able to reach the sea via Horokiri Stream and Pāuatahanui Inlet.

7. Threats to ecological values at the KNE site

Ecological values can be threatened by human activities, and by introduced animals and plants that change ecosystem dynamics. The key to protecting and restoring biodiversity as part of the KNE Programme is to manage key threats to the ecological values at each KNE site. Appendix 4 presents a summary of all known threats to the Battle Hill Bush KNE site.

7.1. Key threats

The most significant threat to the ecological values of Battle Hill Bush KNE site comes from a range of ecological weeds. Dense infestations of groundcovers, scramblers and climbers are present on the stream terraces, the roadsides and the banks between the two. Woody weeds, although dispersed sparsely through the KNE site, are present in dense infestations on adjoining land, and pose an ongoing threat of incursion.

Without control, ecological weeds will spread further within the KNE site displacing indigenous vegetation, inhibiting its regeneration, and altering the structure and composition of the forest ecosystem.

Pest animals are present within the KNE site and can also adversely affect the condition of the vegetation and the fauna supported within it. Possums (*Trichosurus vulpecula*), rats (*Rattus* spp.) and stoats (*Mustela erminea*) are likely to be present in only low numbers, due to regular control being carried out. However, if control wasn't continued, these species would increase to levels that would impact native flora and fauna.

Feral goats (*Capra hircus*) are not resident in the KNE site, but occasionally enter from neighbouring land, either passing through fences or via the road, and severely browse understory plant species affecting natural forest regeneration.

Predators such as feral cats (*Felis catus*) and hedgehogs (*Erinaceus europaeus*) are present. These species prey on birds, lizards, and invertebrates.

8. Vision and objectives

8.1. Vision

A healthy native forest ecosystem resembling the forest that was originally present, that is self-regenerating and supporting a multitude of native wildlife.

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 Battle Hill Bush KNE site.

1. To increase native plant dominance and forest regeneration
2. To protect native bird populations and improve their habitat
3. To restore native vegetation to gaps in the forest ecosystem
4. To raise community awareness of the ecological values of the KNE site
5. To support the landowners in the management of the KNE site

9. Operational activities

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

9.1. Ecological weed control

The aim of ecological weed control at the KNE site is to suppress ecological weeds in order to increase native plant dominance and help facilitate natural forest regeneration.

Strategic ecological weed control has been ongoing within most of the KNE site, (within operational areas A, B and C, – see Appendix 1, Map 4) since 2002. This work was initially guided by a pest plant control plan prepared in 2004²⁶. The landowner of operational area D, Jeremy Collyns, undertook control of some of the more invasive weed species on his land, such as holly, for many years until Greater Wellington took on this work in 2016. Ecological weed control work in operational area E was initiated at this time also.

As a result of ongoing control work, woody weeds and most climbers are now sparse throughout the KNE site. However, this isn't the case for groundcovers and some climbing species which are still dense in some areas, mostly within operational area C. Despite a lot of time and effort going into the control of groundcovers, progress towards suppressing these throughout the KNE site has been slow. This is due to the resilience of these species and the substantial size of the initial infestations. The worst infestations are of tradescantia (*Tradescantia fluminensis*), selaginella/African club moss (*Selaginella kraussiana*), blackberry (*Rubus fruticosus*) and German ivy (*Senecio mikanioides*). These are found on the western stream terraces.

Ecological weed control work will continue in the KNE site using a strategic approach that will enable the continued suppression of woody weeds throughout the KNE site and the progressive control of the large infestations of groundcovers and climbers. Details of this work by operational area follows and a list of the ecological weeds recorded in the separate operational areas can be found in Appendix 5.

Operational areas A, B, D and E

Woody and climbing weeds are controlled in these areas through three-yearly searches undertaken by Biosecurity staff. Within operational areas A, D and E the focus of searches is mostly on the main spurs, ridgelines and light wells which are where woody weeds have been most prevalent in the past. However, the whole of operational area B is searched as it is younger regenerating bush and therefore more weed prone throughout. As searches are undertaken, any groundcovers observed in these areas will be recorded and these will be controlled in conjunction with groundcover control work undertaken in operational area C.

Operational area C

Groundcovers and climbers in operational area C are progressively controlled annually. Previously sprayed areas are checked every year and re-sprayed where necessary. Then initial spray work is carried out on as much new area as the allocated resources in the year allows for. An emphasis is made on removing all plants from within enclosed forest, while infestations of persistent species that are growing in the open amongst exotic grasses, such as tradescantia and selaginella, are just reduced to low levels to contain

their spread. Better control in the open areas might be achievable in the future if control is combined with revegetation. Woody weeds found during this work are also controlled.

Operational area F

This operational area is a buffer zone adjacent to the KNE site where weed control is undertaken to prevent the growth of weeds and subsequent spread of them into the KNE site. The area consists of farmland, recently retired farmland that has been planted with natives, and a small stand of radiata pines. This area is swept for weeds every three years with a focus on holly and hawthorn. Many plants of these two species have been controlled in the past in this area.

The manager of the farming operation on Battle Hill Farm Forest Park controls gorse on the farm in the course of the farm management which helps to prevent this weed species spreading into the KNE site.

9.2. Pest animal control

The objectives of pest animal control are to increase native plant regeneration and protect populations of native birds.

Control of possums and rats is undertaken across the whole KNE site using a network of poison bait stations that are re-baited every 3 months. Jeremy Collyns refills the bait stations on his land (operational area D), with bait supplied by Greater Wellington, while Greater Wellington Biosecurity staff refill the bait stations in all other operational areas.

Predator control is carried out in operational areas A, B, C and D using a network of kill-traps. Traps in operational areas A, B and C are checked and re-baited every 3 months by Biosecurity staff in conjunction with bait station servicing, while those in operational area D are serviced regularly by Mr Collyns. Trapping targets stoats, weasels (*Mustela nivalis*), hedgehogs (*Erinaceus europaeus*) and rats within the KNE site. Members of the Mana Lions Club undertake trapping in areas of Battle Hill Farm Forest Park outside the KNE site which assists the control of predators within the KNE site by reducing migration of these predators.

A map showing the locations of bait stations and traps within the KNE site can be found in Appendix 1 (Map 5).

Monitoring of possum, rat and mustelid populations is not carried out at this KNE site. However, monitoring of rats in the past and monitoring undertaken at other similar sites has shown that the control regimes being used are likely to reduce populations to levels that will allow forest habitat regeneration and will protect native birdlife.

Control of goats by shooting is undertaken when circumstances allow. Small mobs of goats occasionally move in to the KNE site but are very transient which makes control very difficult. When goats are observed within the Greater Wellington part of the KNE site, Biosecurity staff respond if they are able to. In a similar vein, Mr Collyns shoots goats that he observes on his property if he is in a position to do so at the time. Another approach that might be taken is to control goats on neighbouring land to prevent the possibility of these goats entering the KNE site.

In conjunction with Park-wide management, Greater Wellington Parks department staff undertake rabbit and hare shooting in some areas on the boundary of the KNE site, such as the camping ground edge at the southern end and the farmland boundary. Controlling rabbits and hares around the edges of the KNE site will reduce browsing of native seedlings within the KNE site understory.

9.3. Revegetation

The aim of revegetation at the KNE site is to plant several gaps that exist in the forest vegetation, with the objectives of restoring the continuity of the forest ecosystem and rendering these areas less prone to continual re-infestation by ecological weeds. These open gaps in the forest are situated on stream terraces and on slopes at the northern end of the site (see Appendix 1, Map 6).

Revegetation work will be guided by the restoration plan prepared for the site in 2011²⁷. The general approach described in the plan will be followed; however, as this plan is several years old, the resourcing detailed in the plan will be revised. The vegetation gaps will be progressively planted over several years, planting as much as can be done each year with the allocated funding. Areas on the eastern side of the stream will be planted during the term of this plan. Areas on the western side of the stream might be planted in future years once significant weed infestations on that side are brought under control.

Prior to planting being undertaken, all weed infestations within the planting area will be controlled to a point that any future control can be easily carried out with no impact on new plantings. Spraying of planting spots will be done ahead of planting and spray releasing will be done in spring following planting. Weed control, spot and release spraying, and planting will be undertaken by the Biosecurity department or contractors.

9.4. Environmental Protocols

To help protect the natural resources of the KNE site from the potential impacts of human activities, the following procedures are followed in the course of managing the KNE site as part of overall park management.

Environmental care in management

Greater Wellington operational staff follow procedures to identify and avoid damage to biodiversity values such as plant and animal communities. Procedures may include undertaking assessments of environmental effects of planned works. This limits risks to these values that could occur while carrying out the construction and maintenance of assets, ecological weed and pest animal control, and when permitting the use of the KNE site for recreational and commercial purposes.

Biosecurity guidelines²⁸ are followed by all Greater Wellington personnel when entering and working in the KNE site. Procedures involve checking for and removing seeds and plant fragments from clothing, equipment and vehicles before entering the site and ensuring construction material is free of weed material. This is particularly important regarding the ecological weed selaginella/African club moss. The spores of this species which are invisible to the naked eye can very easily be spread on footwear.

Greater Wellington Parks department staff address stream-born rubbish such as tyres, chemical containers and general rubbish by removing such items as soon as they are able.

Incursions of stock into the KNE site from the adjacent farming operation on Battle Hill Farm Forest Park are minimised by the programmed maintenance of farm boundary fences through the Parks asset management programme. Incursions of stock that still occur are addressed by Parks staff or the farmer as soon as they are discovered.

The 1.5 ha stand of radiata pines located adjacent to the southern end of the KNE site (within operational area F) is likely to be harvested within the next year. The harvesting operation risks spreading the highly impacting ecological weed selaginella, of which there is a dense infestation present in the middle of the pine block. To reduce the likelihood of spreading selaginella during the harvesting, infestations within the block will be controlled ahead of harvesting. The control work will be funded and managed by the Parks department.

Following harvesting, native bush will be restored to the area through planting, natural regeneration, and weed control. This will complement the KNE site and continue to buffer it from wind-born weed incursions.

An area of farmland on the north-eastern boundary of the KNE site was retired from farming and planted with natives by the Parks department in 2020. As this area develops it will also add value to the KNE site by expanding the area of native habitat and by buffering it from weed incursions.

Research and the collection of natural materials

Research activities and the legitimate collection of native plants and animals are managed by a permit system run by Greater Wellington's Environmental Science department. However, illegal harvesting has occurred occasionally in the Parks. This has included the collection of native orchids which are sought after by collectors and the removal of native trees for use as firewood. The Park Ranger keeps a watch for anyone illegally collecting native plants and animals from within the KNE site while carrying out their normal duties.

Minimising the impacts of other users

The potential impacts of commercial activities such as filming, and organised recreation such as orienteering are managed by the Parks department through a concessions process. Instructional information on how to avoid introducing ecological weeds and damage to ecological values is included in the conditions contained in concessions and permits issued to commercial, recreational and research users and is conveyed to other users whenever appropriate and possible.

Riding for the Disabled operates an enclosed horse arena near the southern end of the KNE site. Included in the license conditions for the operation of the facility are the requirements to avoid the spread of weed seeds from horse feed and the control of rodents in the vicinity of the building. These conditions help support the protection of biodiversity in the KNE site.

Fire control

The Greater Wellington Parks policy of only permitting open fires in the adjacent camping ground when confined to concrete fire-pads reduces the risk of an uncontrolled fire occurring and affecting the KNE site. This policy is communicated to users through onsite signage, the park information brochure and Toitū Te Whenua Parks Network Plan²⁹.

9.5. Community engagement

The purpose of community engagement is to raise awareness of the KNE site's ecological values and involve the community in management activities to protect those values. Information about the site's ecological values is conveyed to the public during appropriate events held by Greater Wellington at the site such as Battle Hill Farm Day. Observations of interesting or rare ecological occurrences such as visits by or breeding of uncommon bird species are published in social and local print media when opportunities are right.

10. Operational delivery schedule

The operational delivery schedule shows the actions planned to achieve the stated objectives for the Battle Hill Bush KNE site, and their timing and cost over the five-year period from 1 July 2022 to 30 June 2027. The budget for years 2023/24 to 2026/27 are indicative only and subject to change. Maps of operational areas can be found in Appendix 1 (see Maps 4 and 5).

Table 3: Five-year operational plan for the Battle Hill Bush KNE site

Objective	Activity	Operational area	Intended 5-year outcome	Implementing party	Timetable and resourcing where allocated				
					2022/23	2023/24	2024/25	2025/26	2026/27
1	Ecological weed control: Control woody and climbing weeds, focusing searches on main spurs, ridgelines, and light wells. Record the locations of any groundcovers found and maintain records for later control	A	Improved dominance and condition of native plant communities	Greater Wellington Biosecurity department			\$5,000		
1	Ecological weed control: Control woody and climbing weeds, focusing searches on main spurs, ridgelines, and light wells. Record the locations of any groundcovers found and maintain records for later control	D & E	Improved dominance and condition of native plant communities	Greater Wellington Biosecurity department	\$3,000			\$3,000	
1, 5	Ecological weed control: Control tradescantia on the road edge of the bush annually	D	Eradication of tradescantia in this part of the KNE site	Landowner Jeremy Collyns Greater Wellington Biosecurity department supply herbicide	\$20	\$20	\$20	\$20	\$20

Objective	Activity	Operational area	Intended 5-year outcome	Implementing party	Timetable and resourcing where allocated				
					2022/23	2023/24	2024/25	2025/26	2026/27
1	Ecological weed control: Search entire area and control all woody and climbing weeds found. Record the locations of any ground covers found and maintain records for later control	B	Improved dominance and condition of native plant communities	Greater Wellington Biosecurity department		\$4,500			\$4,500
1	Ecological weed control: Control groundcovers, climbers and woody weeds in area C, checking and re-working previous areas of control, and increasing the extent of control as resources allow. Control ground covers recorded previously in areas A, B, D and E	C A, B, D & E	Improved dominance and condition of native plant communities	Greater Wellington Biosecurity department	\$7,680	\$7,680	\$7,180	\$7,680	\$7,680
1	Ecological weed control: Search entire area and control all holly and hawthorn plants found	F	The treat of seeds of these weed species dispersing into the KNE site from this area no longer exists	Greater Wellington Biosecurity department	\$1,500			\$1,500	
1, 2	Pest animal control: Control possums and rats by maintaining and re-filling bait stations at three-monthly intervals	A, B, C & E	Improved regeneration of the native forest understory and condition of the native forest canopy and improved breeding of native birds	Greater Wellington Biosecurity department	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000

Objective	Activity	Operational area	Intended 5-year outcome	Implementing party	Timetable and resourcing where allocated				
					2022/23	2023/24	2024/25	2025/26	2026/27
1, 2, 5	Pest animal control: Control possums, rats and other predators by maintaining and re-filling bait stations and traps at three-monthly intervals	D	Improved regeneration of the native forest understory and condition of the native forest canopy and improved breeding of native birds	Landowner Jeremy Collyns Greater Wellington Biosecurity department supply bait	\$250	\$250	\$250	\$250	\$250
2	Pest animal control: Control predators by maintaining and re-baiting kill-traps at three-monthly intervals	A, B & C	Improved breeding of native birds	Greater Wellington Biosecurity department	\$750	\$750	\$750	\$750	\$750
1, 5	Pest animal control: Control feral goats when observed in the KNE site or search for them in the KNE site and on neighbouring land	A, B, C & D	Improved regeneration and structure of the native forest	Greater Wellington Biosecurity department and landowner Jeremy Collyns	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000
1	Pest animal control: Control rabbits and hares on the edges of the KNE site in conjunction with Park-wide control	F & edges of B	Improved regeneration and structure of the native forest	Greater Wellington Parks department	†	†	†	†	†
3	Revegetation Plant gaps in the forest vegetation	Planting areas shown on Map 6	Improved continuity of the forest ecosystem	Greater Wellington Biodiversity and Biosecurity departments	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000

Objective	Activity	Operational area	Intended 5-year outcome	Implementing party	Timetable and resourcing where allocated				
					2022/23	2023/24	2024/25	2025/26	2026/27
1, 2	Environmental protocols: Adhere to Greater Wellington best practice guidelines and policies aimed at protecting the natural environment while undertaking operational activities and managing recreational and commercial activities in the KNE site, including: <ul style="list-style-type: none"> • assessment of environmental effects procedures • pest plant biosecurity guidelines • fence maintenance programme • research and natural material collection permitting system • fire control policy 	Entire KNE site	Biodiversity values aren't unnecessary impacted by management, recreational or commercial activities	Greater Wellington staff and members of the public	††	††	††	††	††
4	Community engagement: Convey the biodiversity values of the KNE site and the value of protecting it to the public through public events and media releases	Entire KNE site	The public are aware of native biodiversity and are willing to protect native biodiversity values	Greater Wellington Biodiversity, Parks and Communications departments	††	††	††	††	††

† The only cost incurred in undertaking this activity is for ammunition, which is variable and minimal. This is funded by Greater Wellington Parks department. Otherwise only staff and landowner time is required.

†† In general, only staff time is required for this activity.

11. Funding contributions

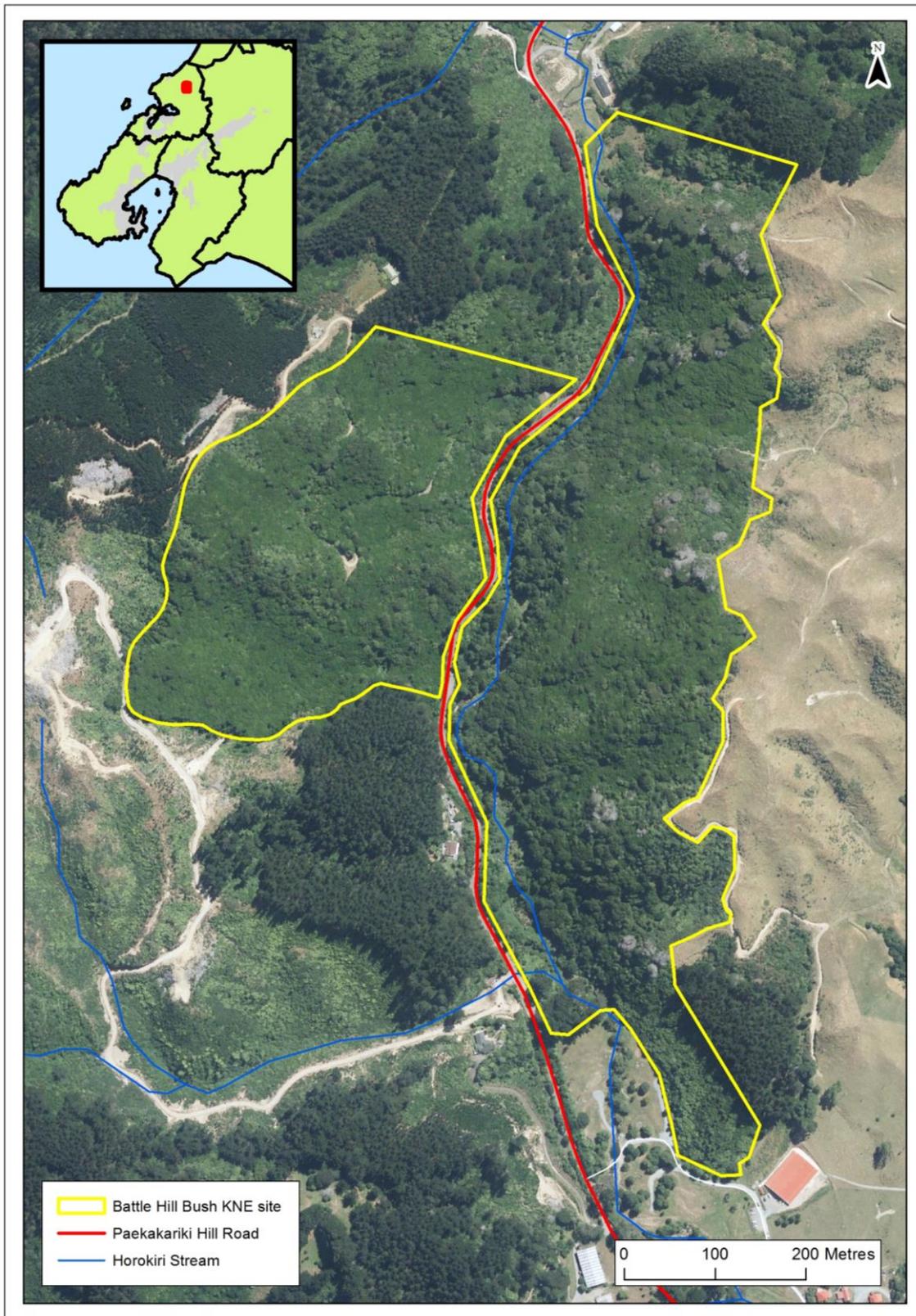
11.1. Budget allocated by Greater Wellington

The budget for the years 2023/24 to 2026/27 are indicative only and subject to change.

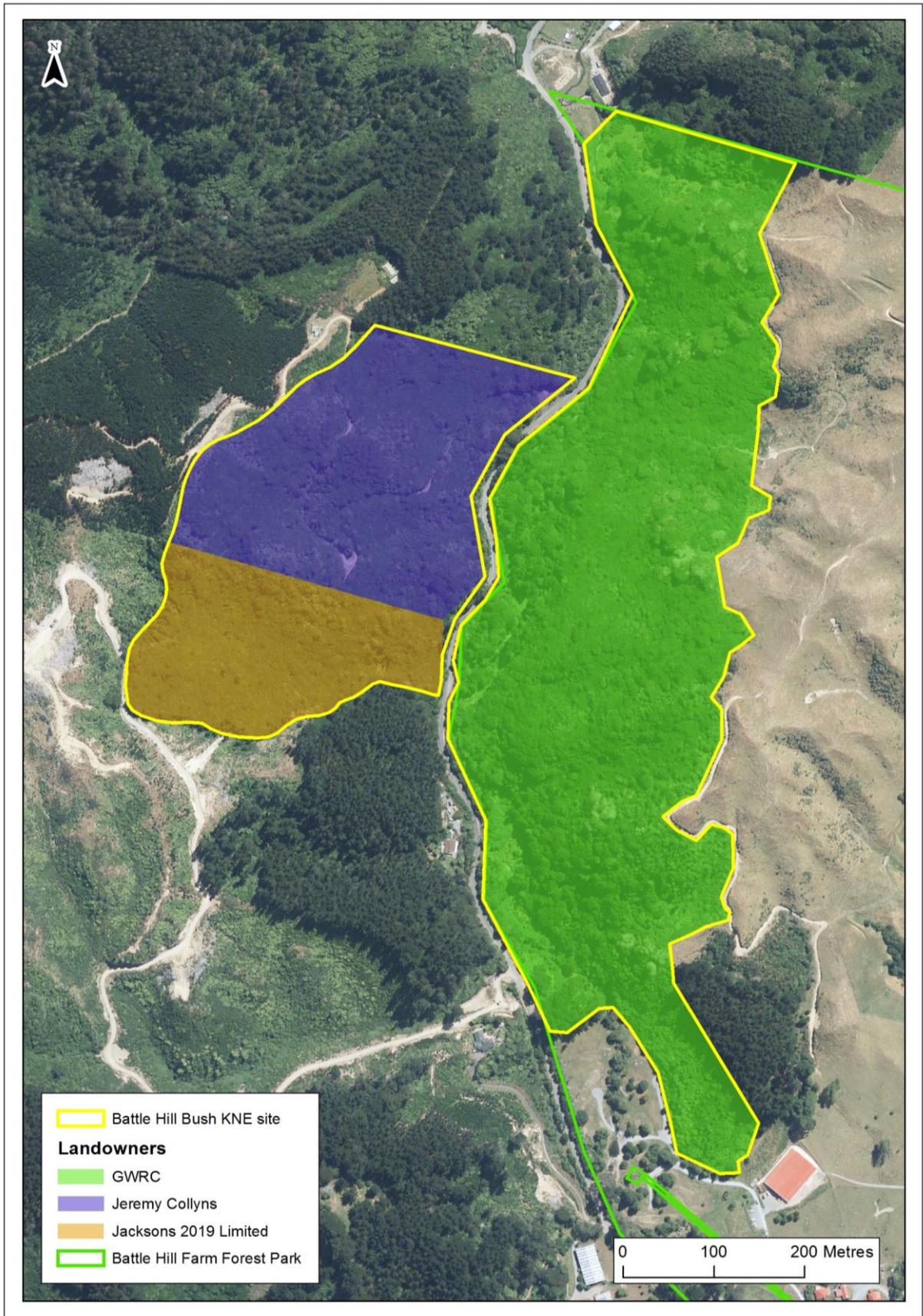
Table 4: Greater Wellington allocated budget for the Battle Hill Bush KNE site

Management activity	Timetable and resourcing				
	2022/23	2023/24	2024/25	2025/26	2026/27
Ecological weed control	\$12,200	\$12,200	\$12,200	\$12,200	\$12,200
Pest animal control	\$4,000	\$4,000	\$4,000	\$4,000	\$4,000
Revegetation	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000
Total	\$21,200	\$21,200	\$21,200	\$21,200	\$21,200

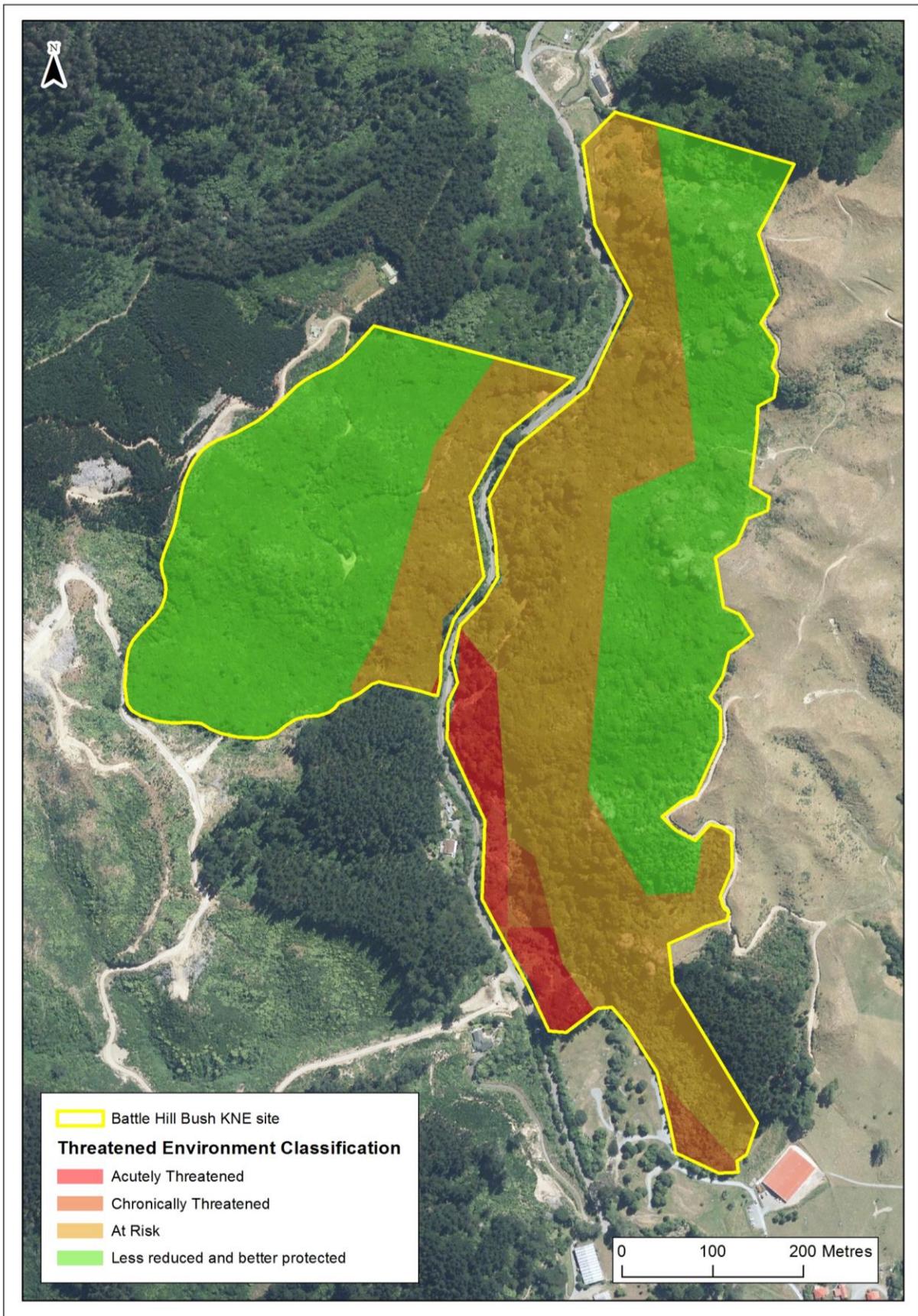
Appendix 1: Battle Hill Bush KNE site maps



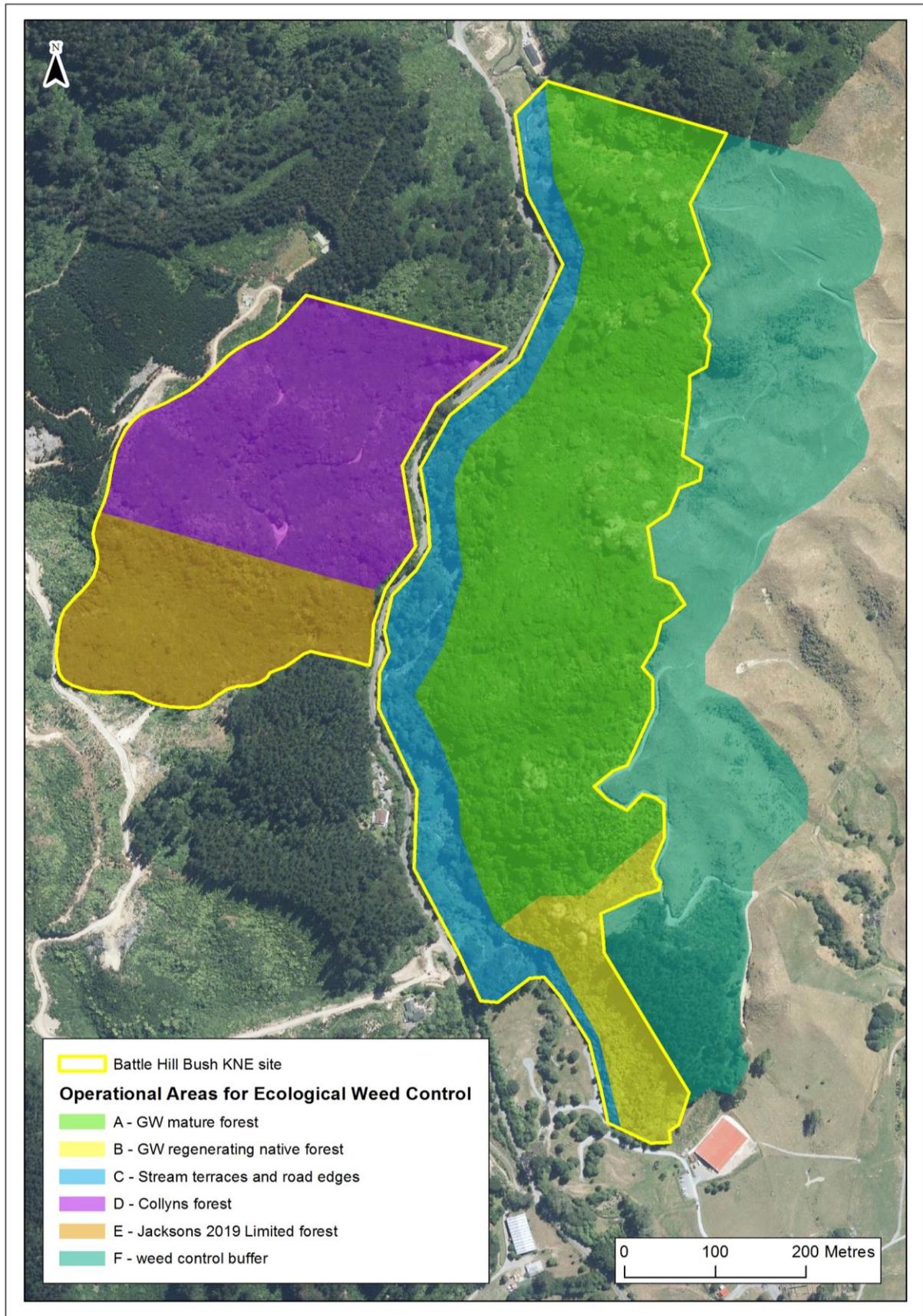
Map 1: The Battle Hill Bush KNE site boundary



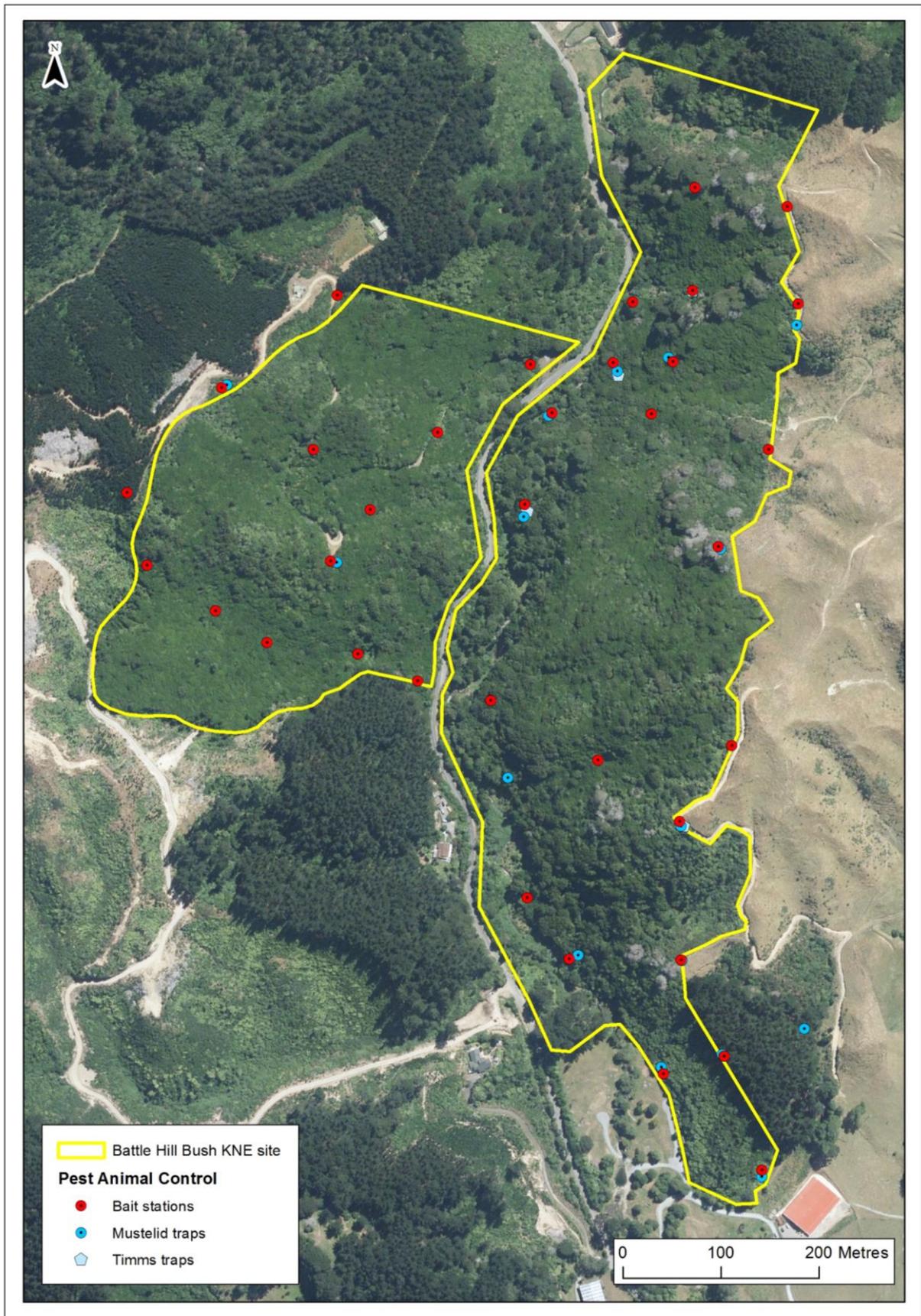
Map 2: Land ownership for the Battle Hill Bush KNE site



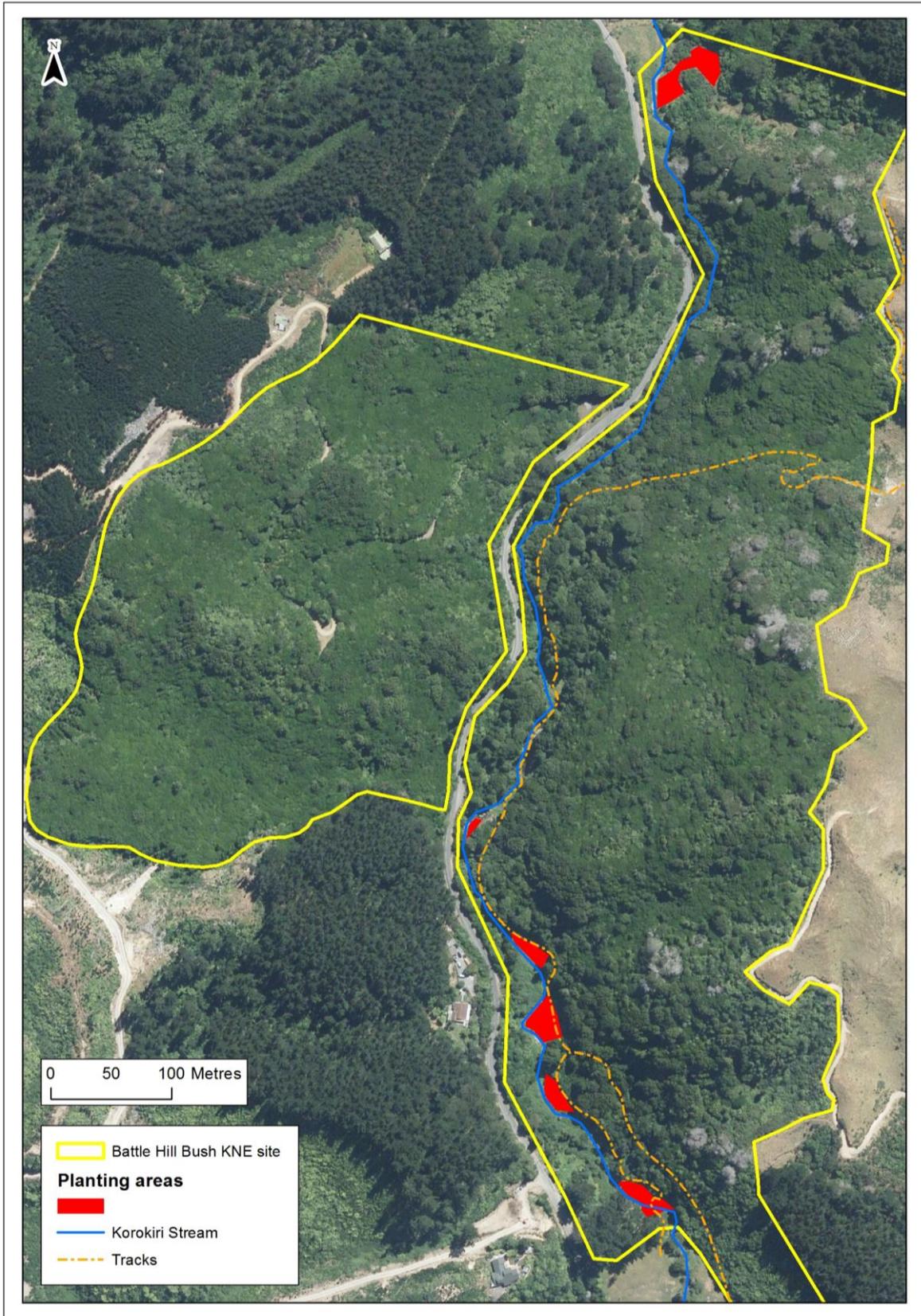
Map 3: Threatened environment classifications for the Battle Hill Bush KNE site



Map 4: Operational areas for ecological weed control in the Battle Hill Bush KNE site



Map 5: Pest animal control in the Battle Hill Bush KNE site



Map 6: Revegetation areas at the Battle Hill Bush KNE site.

Appendix 2: Nationally threatened species list

The New Zealand Threat Classification System lists species according to their threat of extinction. The status of each species group (plants, reptiles, etc) is assessed over a five-year cycle³⁰. 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 Battle Hill Bush KNE site.

Table 5: Threatened and At Risk species at the Battle Hill Bush KNE site

Scientific name	Common name	Threat status	Observation
Plants(vascular) ³¹			
<i>Pterostylis foliata</i>	Greenhood orchid	Threatened – Nationally Vulnerable	Greater Wellington Regional Council 2006 ³²
Birds ³³			
<i>Falco novaeseelandiae</i>	New Zealand falcon	Threatened – Vulnerable	McArthur N. 2021 ³⁴
Reptiles ³⁵			
<i>Naultinus punctatus</i>	Barking gecko	At Risk – Declining	Spearpoint O. 2014 ³⁶
Freshwater fish ³⁷			
<i>Anguilla dieffenbachii</i>	Longfin eel	At Risk – Declining	NIWA 2021 ³⁸
<i>Galaxias argenteus</i>	Giant kōkopu	At Risk – Declining	NIWA 2021
<i>Galaxias brevipinnis</i>	Kōaro	At Risk – Declining	NIWA 2021

Appendix 3: Regionally threatened plant species list

A methodology to create regional threat lists was developed by a collaborative group comprising representatives from DOC, regional councils and a local authority. The resulting regional threat listing methodology leverages off the NZTCS, but applies a species population threshold adjusted to the regional land area under consideration (relative to the national land area) for species that are not nationally threatened. The assigned regional threat status cannot be lower than that of the national threat status, but can be higher, (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.

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

Table 6: Regionally threatened species recorded in the Battle Hill Bush KNE site

Scientific name	Common name	Threat status	Observation
Plants ³⁹			
<i>Pterostylis foliata</i>	Greenhood orchid	Naturally Uncommon	Greater Wellington Regional Council 2006 ⁴⁰
<i>Rhabdothamnus solandri</i>	Taurepo	Endangered	Greater Wellington Regional Council 2006
Birds ⁴¹			
<i>Falco novaeseelandiae</i>	New Zealand falcon	Threatened – Critical	McArthur N. 2021 ⁴²
<i>Anas gracilis</i>	Grey teal	At Risk – Recovering	McArthur N. 2021
<i>Hemiphaga novaeseelandiae</i>	New Zealand pigeon	At Risk – Recovering	McArthur N. 2021
Reptiles ⁴³			
<i>Naultinus punctatus</i>	Barking gecko	At Risk – Declining	Spearpoint O. 2014 ⁴⁴

Appendix 4: Threat table

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

Table 7: Threats to the Battle Hill Bush KNE site

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
Ecological weeds		
EW-1	Ground covering ecological weeds smother and displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key ground covering ecological weed species for control in the KNE site include selaginella/African club moss (<i>Selaginella kraussiana</i>) and tradescantia (<i>Tradescantia fluminensis</i>), (see full list in Appendix 5).	Mainly C
EW-2	Woody ecological 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 holly (<i>Ilex aquifolium</i>), hawthorn (<i>Crataegus monogyna</i>) and karaka (<i>Corynocarpus laevigatus</i>), (see full list in Appendix 5).	Entire KNE site
EW-3	Climbing ecological 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 German ivy (<i>Senecio mikanioides</i>) and Japanese honeysuckle (<i>Lonicera japonica</i>), (see full list in Appendix 5).	Mainly C
Pest animals		
PA-1	Possums (<i>Trichosurus vulpecula</i>) browse palatable canopy vegetation until it can no longer recover ^{45,46} . This destroys the forest's structure, diversity and function. Possums may also prey on native birds and invertebrates ⁴⁷ .	Entire KNE site
PA-2	Rats (<i>Rattus</i> 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 ^{48,49} .	Entire KNE site
PA-3	Mustelids (stoats ^{50,51} (<i>Mustela erminea</i>), ferrets ^{52,53} (<i>M. furo</i>) and weasels ^{54,55} (<i>M. nivalis</i>)) prey on native birds, lizards and invertebrates, reducing their breeding success and potentially causing local extinctions.	Entire KNE site
PA-4	Hedgehogs (<i>Erinaceus europaeus</i>) prey on native invertebrates ⁵⁶ , lizards ⁵⁷ and the eggs ⁵⁸ and chicks of ground-nesting birds ⁵⁹ .	Entire KNE site

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
PA-5*	House mice (<i>Mus musculus</i>) 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 ^{60,61} .	Entire KNE site
PA-6*	Pest and domestic cats (<i>Felis catus</i>) prey on native birds ⁶² , lizards ⁶³ and invertebrates ⁶⁴ , reducing native fauna breeding success and potentially causing local extinctions ⁶⁵ .	Entire KNE site
PA-7	Rabbits (<i>Oryctolagus cuniculus</i>) and hares (<i>Lepus europaeus</i>) graze on palatable native vegetation and prevent natural regeneration in some environments ⁶⁶ . 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 (<i>Vespula</i> spp.) adversely impact native invertebrates and birds through predation and competition for food resources. They also affect nutrient cycles in beech forests ⁶⁷ .	Entire KNE site
PA-9	Goats (<i>Capra hircus</i>) browsing affects the composition and biomass of native vegetation in the understory tiers of forest habitats, preventing regeneration of the most palatable understory species and reducing species diversity ⁶⁸ .	Entire KNE site
PA-10*	Brown trout (<i>Salmo trutta</i>) and rainbow trout (<i>Oncorhynchus mykiss</i>) prey on native fish and compete with them for food resources ⁶⁹ .	Main stream course
PA-11*	Eastern rosella (<i>Platycercus eximius</i>) 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 ^{70,71} .	Entire KNE site
PA-12*	Australasian magpies are known to modify the behaviour of native birds which could inhibit the ability of native birds to feed and breed.	KNE bush margins
Human activities		
HA-1	Incursions of grazing livestock can result grazing of native vegetation inhibiting regeneration, wildlife disturbance and increasing nutrient content of soils and watercourses ⁷² .	A and B
HA-2*	Poor water quality affects a range of species found in streams. High nutrient levels and contaminants within watercourses are often caused by upstream land management practices and pollution events including development practices, forestry and agricultural practices, road run-off and storm water entering the watercourse, and septic tank leakages.	C and E

*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 Battle Hill Bush KNE site.

The distribution and density of individual species within each operational area 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 (see Table 8 below). The resulting descriptors are colour coded to indicate the threat level posed by each combination (see Table 9 below). The level of threat influences the management aim. However, there isn't a consistent correlation between the two as the management aim also considers the practicality and cost of control. It is hoped that the levels of distribution and density of most species will reduce over time as a result of control.

Table 8: Ecological weed species recorded in the Battle Hill Bush KNE site

Scientific Name	Common name	Area A (Greater Wellington mature forest)	Area B (Greater Wellington regenerating forest)	Area C (Greater Wellington stream terraces, road edges and slopes below road)	Area D (Collyns property)	Area E (Jacksons 2019 Limited property)	Management aim
<i>Acer pseudoplatanus</i>	Sycamore	Localised and sparse	Localised and sparse	Localised and sparse			Eradication
<i>Buddleia davidii</i>	Buddleia		Localised and sparse	Localised and sparse	Localised and sparse		Eradication
<i>Chamaecytisus palmensis</i>	Tree lucerne		Patchy and sparse	Patchy and sparse			Eradication
<i>Cornus</i> sp.	Strawberry dogwood		Localised and sparse			Localised and sparse	Eradication
<i>Cortaderia selloana</i>	Pampas		Patchy and sparse				Eradication
<i>Crataegus monogyna</i>	Hawthorn	Patchy and sparse	Patchy and sparse	Patchy and sparse			Eradication

Scientific Name	Common name	Area A (Greater Wellington mature forest)	Area B (Greater Wellington regenerating forest)	Area C (Greater Wellington stream terraces, road edges and slopes below road)	Area D (Collyns property)	Area E (Jacksons 2019 Limited property)	Management aim
<i>Ilex aquifolium</i>	Holly	Patchy and sparse	Patchy and sparse	Patchy and sparse	Patchy and sparse	Patchy and sparse	Eradication
<i>Lonicera japonica</i>	Japanese honeysuckle			Localised and sparse			Eradication
<i>Passiflora</i> "Tacsonia" subgroup	Banana passionfruit			Localised and sparse	Localised and sparse	Localised and sparse	Eradication
<i>Pinus</i> sp.	Wilding pines	Localised and sparse	Localised and sparse	Localised and sparse	Localised and sparse		Eradication
<i>Salix</i> sp.	Willow			Patchy and sparse			Eradication
<i>Convolvulus arvensis</i>	Convolvulus			Patchy and abundant			Suppression
<i>Corynocarpus laevigatus</i> *	Karaka	Localised and sparse	Localised and sparse	Patchy and abundant	Patchy and sparse	Patchy and sparse	Suppression
<i>Cupressus macrocarpa</i>	Macrocarpa	Localised and sparse	Localised and sparse	Localised and sparse	Localised and sparse		Suppression
<i>Hedera helix</i>	Ivy			Localised and sparse			Suppression
<i>Leycesteria formosa</i>	Himalayan honeysuckle		Widespread and sparse	Patchy and sparse	Localised and sparse	Localised and sparse	Suppression
<i>Selaginella kraussiana</i>	Selaginella/African club moss		Localised and sparse	Widespread and abundant			Suppression

Scientific Name	Common name	Area A (Greater Wellington mature forest)	Area B (Greater Wellington regenerating forest)	Area C (Greater Wellington stream terraces, road edges and slopes below road)	Area D (Collyns property)	Area E (Jacksons 2019 Limited property)	Management aim
<i>Senecio mikanioides</i>	German ivy			Patchy and dense			Suppression
<i>Tradescantia fluminensis</i>	Tradescantia	Localised and sparse	Localised and sparse	Widespread and dense	Localised and abundant		Suppression
<i>Crocsmia crocosmiiflora</i>	Montbretia		Patchy and sparse	Patchy and dense		Patchy and sparse	Suppression
<i>Cytisus scoparius</i>	Broom		Patchy and sparse	Patchy and abundant			Suppression
<i>Teline monspessulana</i>	Montpellier broom		Patchy and sparse	Patchy and abundant			Suppression
<i>Ulex europaeus</i>	Gorse		Localised and sparse	Localised and abundant	Localised and sparse	Localised and sparse	Suppression
<i>Zantedeschia aethiopica</i>	Arum lily			Patchy and abundant			Suppression
<i>Vinca major</i>	Periwinkle	Localised and abundant					Surveillance
<i>Allium triquetrum</i>	Onion weed			Patchy and abundant			Surveillance
<i>Lathyrus latifolius</i>	Everlasting pea			Localised and sparse			Surveillance

Scientific Name	Common name	Area A (Greater Wellington mature forest)	Area B (Greater Wellington regenerating forest)	Area C (Greater Wellington stream terraces, road edges and slopes below road)	Area D (Collyns property)	Area E (Jacksons 2019 Limited property)	Management aim
<i>Rubus fruticosus</i>	Blackberry		Localised and sparse	Widespread and dense			Surveillance

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

Table 9: Matrix showing the levels of threat posed by ecological weeds based on a species distribution and density at a site, and an applied colour code.

		Distribution of species		
		Localised	Patchy	Widespread
Density of species	Sparce	low	low	medium
	Abundant	low	medium	high
	Dense	medium	high	high

References

- ¹ New Zealand legislation. 1991. Resource Management Act 1991.
- ² Greater Wellington Regional Council. Greater Wellington Regional Council Long Term Plan Ko Te Pae Tawhiti: 2021 – 2031.
- ³ Greater Wellington Regional Council. 2016. Greater Wellington Regional Council Biodiversity Strategy. <http://www.gw.govt.nz/assets/council-publications/Biodiversity-Strategy-2016.pdf>
- ⁴ Greater Wellington Regional Council. Proposed Natural Resources Plan for the Wellington Region. 2019.
- ⁵ Greater Wellington Regional Council. 2019. Greater Wellington Regional Pest Management Plan 2019–2039. GW/BIO-G-2019/74
- ⁶ Greater Wellington Regional Council. 2020. Toitū Te Whenua Parks Network Plan 2020-2030.
- ⁷ Greater Wellington Regional Council. 2020. Toitū Te Whenua Parks Network Plan 2020-2030.
- ⁸ Greater Wellington Regional Council. 2019. Proposed Natural Resources Plan for the Wellington Region, Te Tikanga Taiao o Te Upoko o Te Ika a Maui. P. 352.
- ⁹ Greater Wellington Regional Council. 2015. Proposed Natural Resources Plan for the Wellington Region, Te Tikanga Taiao o Te Upoko o te Ika a Maui.
- ¹⁰ Greater Wellington Regional Council. 2019. Proposed Natural Resources Plan for the Wellington Region, Te Tikanga Taiao o Te Upoko o Te Ika a Maui. P.340.
- ¹¹ Greater Wellington Regional Council. 2015. Proposed Natural Resources Plan. P. 335.
- ¹² QEII National Trust and Greater Wellington Regional Council 2021. Memorandum of Understanding.
- ¹³ Singers NJD, Rogers GM. 2014. A classification of New Zealand's terrestrial ecosystems. Science for Conservation No. 325. Department of Conservation, Wellington. 87 p.
- ¹⁴ Singers N, Crisp P, Spearpoint O. 2018. Forest ecosystems of the Wellington Region.
- ¹⁵ Walker S, Cieraad E, Grove P, Lloyd K, Myers S, Park T, and Porteous T. 2007. Guide for users of the threatened environment classification. Version 1.1, August 2007. Landcare Research New Zealand. 34 p. plus appendix.
- ¹⁶ New Zealand Threat Classification System (NZTCS) <http://www.doc.govt.nz/about-us/science-publications/conservation-publications/nz-threat-classification-system/>
- ¹⁷ Department of Conservation 1987. Ecological Regions and Districts of New Zealand.
- ¹⁸ Greater Wellington Regional Council 2002. Eco-domains for the Wellington Region. Processes and patterns for defining diversity and distinctiveness. Greater Wellington Regional Council, Wellington.
- ¹⁹ Greater Wellington Regional Council 2006. Battle Hill Farm Forest Park Resource Statement.
- ²⁰ Greater Wellington Regional Council 2006. Battle Hill Farm Forest Park Resource Statement.
- ²¹ Owen Spearpoint, Greater Wellington, Pers Comm, 2015
- ²² Department of Lands and Survey 1984. Register of Protected Natural Areas in New Zealand. Department of Lands and Survey, Wellington.
- ²³ McArthur N. 2021. Threatened bird species in the KNE programme. Unpublished report for Greater Wellington Regional Council.
- ²⁴ Owen Spearpoint, Greater Wellington, Personal Communication 2014
- ²⁵ NIWA New Zealand Fresh Water Fish Database. Accessed 2021.
- ²⁶ Greater Wellington Regional Council 2004. Battle Hill Farm Forest Park pest plant control plan 2002-2007.
- ²⁷ Greater Wellington Regional Council. 2011. Horokiri Stream West riparian restoration – Battle Hill Farm Forest Park. Unpublished report.
- ²⁸ National Pest Control Agencies. 2013. Keep it Clean: Machinery hygiene guidelines & logbook to prevent the spread of pests and weeds.
- ²⁹ Greater Wellington Regional Council. 2020. Toitū Te Whenua Parks Network Plan 2020-2030.
- ³⁰ Department of Conservation. 2008. New Zealand Threat Classification System manual.
- ³¹ de Lange PJ, Rolfe JR, Champion PD, Courtney SP, Heenan PB, Barkla JW, Cameron EK, Norton DA, Hitchmough RA. 2013. Conservation status of New Zealand indigenous vascular plants, 2012. New Zealand Threat Classification Series 3. 70 p.
- ³² Greater Wellington Regional Council. 2006. Battle Hill Farm Forest Park Resource Statement.

-
- ³³ Robertson HA, Baird K, Dowding JE, Elliot GP, Hitchmough RA, Miskelly CM, McArthur N, O'Donnell CFJ, Sagar PM, Scofield P, Taylor GA. 2017. Conservation status of New Zealand birds, 2016. New Zealand Threat Classification Series 19.
- ³⁴ McArthur N. 2021. Threatened bird species in the KNE programme. Unpublished report for Greater Wellington Regional Council.
- ³⁵ Hitchmough R, Barr B, Lettink M, Monks J, Reardon J, Tocher M, Van Winkel D, Rolfe J. 2016. Conservation status of New Zealand reptiles, 2015. New Zealand Threat Classification Series 17. 14 p.
- ³⁶ Owen Spearpoint, Greater Wellington Regional Council, Pers Comm. 2014
- ³⁷ Goodman JM, Dunn NR, Ravenscroft PJ, Allibone RM, Boubée JAT, David BO, Griffiths M, Ling N, Hitchmough RA, Rolfe JR. 2014. Conservation status of New Zealand freshwater fish, 2013. New Zealand Threat Classification Series 7. 12 p.
- ³⁸ NIWA New Zealand Fresh Water Fish Database. Accessed 2021.
- ³⁹ Crisp, P. 2020. Conservation status of indigenous vascular plant species in the Wellington region. Greater Wellington Region Council. GW/ESCI-G-20/20.
- ⁴⁰ Greater Wellington Regional Council. 2006. Battle Hill Farm Forest Park Resource Statement.
- ⁴¹ Crisp, P. 2020. Conservation status of native bird species in the Wellington region.
- ⁴² McArthur N. 2021. Threatened bird species in the KNE programme. Unpublished report for Greater Wellington Regional Council.
- ⁴³ Crisp, P. 2020. Conservation status of indigenous lizard species in the Wellington region.
- ⁴⁴ Owen Spearpoint, Greater Wellington Regional Council, Pers Comm. 2014
- ⁴⁵ 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.
- ⁴⁶ 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.
- ⁴⁷ 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.
- ⁴⁸ 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.
- ⁴⁹ Innes JG. 2005. Ship rat. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 187–203.
- ⁵⁰ 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.
- ⁵¹ King CM and Murphy EC. 2005. Stoat. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 261–287.
- ⁵² 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.
- ⁵³ Clapperton BK, Byron A. 2005. Feral ferret. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 294–307.
- ⁵⁴ King CM. 2005. Weasel. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 287–294.
- ⁵⁵ 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.
- ⁵⁶ Jones C, Sanders MD. 2005. European hedgehog. In: King CM ed. *The handbook of New Zealand mammals*. 2nd edition. Melbourne, Oxford University Press. Pp. 81–94.
- ⁵⁷ 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.
- ⁵⁸ 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.
- ⁵⁹ Jones C, Sanders MD. 2005. European hedgehog. In: King CM ed. *The handbook of New Zealand mammals*. 2nd edition. Melbourne, Oxford University Press. Pp. 81–94.

- ⁶⁰ Ruscoe WA, Murphy EC. 2005. House mouse. In: King CM ed. The handbook of New Zealand mammals. Oxford University Press. Pp. 204–221.
- ⁶¹ 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.
- ⁶² 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.
- ⁶³ 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.
- ⁶⁴ 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.
- ⁶⁵ Gillies C, Fitzgerald BM. 2005. Feral cat. In: King CM ed. The handbook of New Zealand mammals. Oxford University Press. Pp. 308–326.
- ⁶⁶ Norbury G, Flux JEC. 2005. Brown hare. In: King CM ed. The handbook of New Zealand mammals. Oxford University Press. Pp. 151–158.
- ⁶⁷ 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.
- ⁶⁸ Parkes. JP. 2005. Feral goat. In: King CM ed. The handbook of New Zealand mammals. Oxford University Press. Pp. 374–391.
- ⁶⁹ McIntosh AR, McHugh PA, Dunn NR, Goodman JM, Howard SW, Jellyman PG, O'Brien LK, Nystrom P, Woodford DJ. 2010. The impact of trout on galaxiid fishes in New Zealand. New Zealand Journal of Ecology 34(1): 195–206.
- ⁷⁰ Wright D, Clout M 2001. The eastern rosella (*Platycercus eximius*) in New Zealand. DOC Science Internal Series 18.
- ⁷¹ Galbraith JA. 2013. Eastern rosella. In Miskelly, C.M. (ed.) New Zealand Birds Online. www.nzbirdsonline.org.nz
- ⁷² Smale MC, Dodd MB, Burns BR, Power IL. 2008. Long-term impacts of grazing on indigenous forest remnants on North Island hill country, New Zealand. New Zealand Journal of Ecology 32(1): 57–66.

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