

# Key Native Ecosystem Operational Plan for Battle Hill Bush

2018-2021



greater WELLINGTON  
REGIONAL COUNCIL  
Te Pane Matua Taiao





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## 1. Purpose

The purpose of the three-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 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 three 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)<sup>1</sup>.

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

### **Greater Wellington Long Term Plan**

The Long Term Plan (2018-2028)<sup>2</sup> outlines the long term direction of 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)

### **Parks Network Plan**

Management of Battle Hill Farm Forest Park as a whole is guided by the Greater Wellington Parks Network Plan (PNP)<sup>3</sup> and the Battle Hill Farm Forest Park Sustainable Land Use Plan<sup>4</sup>. These plans guide the recreational and amenity uses of Battle Hill Farm Forest Park as well as identifying opportunities to protect biodiversity values.

## Greater Wellington Biodiversity Strategy

The Greater Wellington Biodiversity Strategy<sup>5</sup> (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 Key Native Ecosystem (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 three-year KNE plans prepared by the Greater Wellington’s Biodiversity department. Greater Wellington works with the landowners, mana whenua and other operational delivery providers to achieve mutually beneficial goals.

#### **4. Battle Hill Bush Key Native Ecosystem site**

The Battle Hill Bush KNE site (40 ha) comprises remnants of a regionally threatened kohekohe/ tawa semi-coastal forest and a section of a tributary of Horokiri/Horokiwi Stream (see Appendix 1, Map 1). Most of the KNE site (26.5 ha) lies within the western margin of Battle Hill Farm Forest Park and is gazetted as Scenic Reserve. Within the KNE site is 13.5 ha of private land of which 8.5 ha is legally protected by an open space covenant issued by the Queen Elizabeth II National Trust (QEII). The KNE site is bisected by Paekākāriki Hill Road approximately 5 km north of Pāuatahanui and 13 km south of Paekākāriki. Habitats surrounding the KNE site comprise indigenous forest, exotic plantation forest and farmland.

#### **5. Parties involved**

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

##### **5.1 Landowners**

Most of the site (26.5 ha) is owned by Greater Wellington as part of Battle Hill Farm Forest Park (see Appendix 1, Map 2). The remaining land within the KNE site is privately owned by two separate owners; Jeremy Collyns (8.5 ha) and Stephen and Bronwyn Scott (5 ha). These landowners allow 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, the Biodiversity, Biosecurity and Parks departments are responsible for implementing the KNE operational plan. The Biodiversity department is the overarching lead department for Greater Wellington on the coordination of biodiversity management activities and advice within the KNE site. The Biosecurity department coordinates and carries out pest control activities. The Parks department manages recreational access and maintains assets such as the track within the KNE site.

Landowner Jeremy Collyns undertakes ecological weed and pest animal control on his land.

QEII administers the open space covenant on the land owned by Jeremy Collyns. They undertake a biennial inspection of the covenant to check that compliance with the covenant conditions is being maintained. Greater Wellington and QEII work in partnership to protect biodiversity at a number of sites, including this one, as outlined in a MOU<sup>6</sup> between the organisations.

### 5.3 Mana whenua partner

Ngāti Toa Rangatira (Ngāti Toa) are Greater Wellington’s mana whenua partners in Battle Hill Bush KNE site. Greater Wellington is committed to exploring opportunities on how Ngāti Toa wish to be involved in operational delivery at the KNE site.

**Table 1: Ngāti Toa sites of significance in Battle Hill Bush KNE site<sup>7</sup>**

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

Greater Wellington recognises the value and importance of working with mana whenua in their roles as kaitiaki in areas within the KNE site. The KNE operational plan activities will:

- make a small but valuable contribution to the overall expected PNRP outcomes including protecting native vegetation in the Horokiwi Stream catchment
- ensure people working in KNE sites understand the requirements of the Accidental Discovery Protocol
- endeavour to ensure that Ngāti Toa’s values for the site are protected

In addition, Greater Wellington will work across Council on initiatives to achieve mutual benefit including the Internship monitoring programme of the cultural health and wellbeing of KNE sites.

#### **Battle Hill Farm Forest Park**

Ngāti Toa considers that Battle Hill Farm Forest Park has great historical significance as it was the site of an important battle between Government forces and a party of Ngāti Toa and other iwi, under Te Rangihaeata, hence the name “Battle Hill”<sup>8</sup>.

The origins for the events that took place there lie in the escalating conflict between the Crown and Māori over the ownership of Harataunga (the Hutt Valley). After several violent skirmishes between the Crown, settlers and Māori in the Hutt, the Crown decided to attack Te Rangihaeata, who they held responsible for the conflict. In 1846, Crown forces moved to the Porirua region in pursuit of Te Rangihaeata, who had built a stockaded pa at Pauatahanui named Mataitaua<sup>9</sup>.

Te Rangihaeata, realising that Mataitaua pa would probably fall to the cannons of the HMS Driver, sought refuge in the dense Horokiwi forest and established a series of defences on Battle Hill. Crown forces pursued Te Rangihaeata and attacked the hill defences. Return fire from Te Rangihaeata halted the attack, killing three Government

troops. Sending to Porirua for backup mortars, the government force settled into a siege and bombarded Te Rangihaeata's pa for several days not knowing that Te Rangihaeata had tricked them into believing he and his men were on one part of the hill when they were elsewhere. Eventually Te Rangihaeata decided to move north to Poroutawhao and vacated his position<sup>10</sup>.

Battle Hill is regarded as a waahi tapu site for Ngāti Toa given the ferocity of the Battle that occurred here. According to iwi tradition, Ngāti Toa lives were lost on Battle Hill during this period. These lives and the battle which Ngāti Toa participated in at this site establish a perpetual connection between Ngāti Toa and Battle Hill<sup>11</sup>.

Along with the rich history associated with the name, Ngāti Toa valued the rich native vegetation housing native bird species such as karearea (New Zealand Bush Falcon) and the North Island kaka. The fauna were able to feast upon the rich offerings of the bush and iwi were also able to collect rongoa (traditional Maori medicine) from the forest<sup>12</sup>.

The Te Puka and Horokiri Streams running near and through sections of the park were rich with kaiawa such as tuna and inanga and can still be fished further downstream outside of the park today<sup>13</sup>.

## 5.4 Stakeholders

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.

The manager of the farming operation on adjacent areas of Battle Hill Farm Forest Park assists in the protection of the KNE site through the ongoing exclusion of his stock.

The KNE site contains well used public walking tracks. The stream is used for swimming and there is a campground immediately adjacent to the KNE site. Visitors to the KNE site and wider area may be interested in the biodiversity management of the KNE site and are therefore considered stakeholders.

## 6. Ecological values

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

The 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/Horokiwi Stream which flows into the Pāuatahanui Inlet approximately 5.5 km 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 70 m to 260 m above sea level. It is within Wellington Ecological District<sup>14</sup> and the Western Temperate Foothills Eco-domain which has a mild climate and a mean annual rainfall of 1,150-1,400 mm<sup>15</sup>.

Of note in recognising the ecological values at the Battle Hill Bush KNE site are the following:

**Threatened environments:** The Threatened Environment Classification system (LENZ)<sup>16</sup> is a broad classification system which shows how much indigenous vegetation remains within land environments, how much is legally protected and how past vegetation loss and legal protection are distributed across New Zealand's landscape. Six threat categories cover New Zealand. Within the KNE site are areas that fall within the following categories (see Appendix 1, Map 3):

- Acutely Threatened (Environments with less than 10% indigenous vegetation remaining nationally); found on stream margins and the valley floor.
- Chronically Threatened (Environments with 10-20% indigenous vegetation remaining nationally); found on the valley floor and lower slopes.
- At Risk (Environments with 20-30% indigenous vegetation remaining nationally); found on lower slopes.

**Threatened species:** One nationally At Risk<sup>17</sup> and five regionally uncommon plant species are found here, including the only self-sustaining population of taurepo (*Rhabdothamnus solandri*) in the Wellington region. This species is near its southern distribution limit within the KNE site (see Appendices 2 and 3). The KNE site provides habitat for one nationally Threatened and one At Risk bird species and five At Risk fish species (Appendix 2).

The Singers and Rogers (2014)<sup>18</sup> classification of pre-human vegetation indicates the Battle Hill Bush KNE site comprised kohekohe-tawa forest (MF6), and kamahi-broadleaved-podocarp forest (MF8). There is only 16% of the original extent of kohekohe-tawa forest remaining in the Wellington region, making it a regionally endangered ecosystem type<sup>19</sup>.

The vegetation within Battle Hill Bush KNE site today generally comprises regionally uncommon semi-coastal forest with a canopy of kohekohe (*Dysoxylum spectabile*) tawa (*Beilschmiedia 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 (*Alectryon excelsus* subsp. *excelsus*) on lower hill slopes, grading into kohekohe forest on upper slopes. Swampy areas support kahikatea (*Dacrycarpus dacrydioides*), pukatea (*Laurelia novae-zelandiae*) and swamp maire (*Syzygium maire*). Occasional rimu (*Dacrydium cupressinum*), tōtara (*Podocarpus totara*), mataī (*Prumnopitys taxifolia*) and miro (*Prumnopitys ferruginea*) are present. The understorey contains māhoe (*Melicytus ramiflorus*), kaikōmako (*Pennantia corybosa*), nīkau (*Rhopalostylis sapida*), *Coprosma* spp. and other tree and shrub species<sup>20</sup>. There is an area of rank pasture in the north of the site and an area of plantation pine (*Pinus radiata*) forest on the south-eastern margins of the site.

Uncommon 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 four mosses (*Trichostomum*

*brachydontium*, *Porotrichum oblongofolium*, *Leptodon smithii* and *Echinodium umbrosum*)<sup>21,22</sup>.

The QEII covenant area is dominated by kohekohe and tawa, with kahikatea, tōtara, and mataī alongside the road. Elsewhere there is nīkau, māhoe, kaikōmako, treeferns, kāmahi (*Weinmannia racemosa*), kawakawa (*Piper excelsum* subsp. *excelsum*), rewarewa (*Knightia excelsa*), houhere (*Hoheria sextylosa*), lancewood (*Pseudopanax crassifolius*), lemonwood (*Pittosporum eugenioides*) and regenerating broadleaf (*Griselinia littoralis*)<sup>23</sup>. The remaining privately-owned land contains forest that is of similar composition to that found in the adjoining QEII covenant.

The KNE site is used by a number of native bird species for breeding/foraging including most notably, the New Zealand falcon (*Falco novaeseelandiae*), red-crowned parakeet (*Cyanoramphus novaezelandiae*), bellbird (*Anthornis melanura*), whitehead (*Mohoua albicilla*) and pied tomtit (*Petroica macrocephala toitoi*)<sup>24,25</sup>. The KNE site is also likely to be important for native birds in the wider landscape context, being an ecological link with the Hutt Valley and Pukerua Bay (through vegetated corridors)<sup>26</sup> and Pāuatahanui Inlet (via the Horokiri/Horokiwi Stream). These links are likely to facilitate movement of mobile species.

The Horokiri/Horokiwi Stream provides habitat for several fish species, including five threatened species: giant kōkopu (*Galaxias argenteus*), kōaro (*Galaxias brevipinnis*), lamprey (*Geotria australis*), redfin bully (*Gobiomorphus huttoni*) and longfin eel (*Anguilla dieffenbachia*)<sup>27</sup>. Migratory fish can reach the sea via Horokiri Stream and Pāuatahanui Inlet.

A barking gecko (*Naultinus punctatus*) was recorded in the KNE site in 2014<sup>28</sup>.

## 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 main threat to Battle Hill Bush KNE site is from ecological weeds. Without control, ecological weeds will continue to spread within the KNE site displacing indigenous vegetation, inhibiting its regeneration and, altering the structure and composition of the forest ecosystem.

Dense infestations of ground-covers, scramblers and climbers are present on the stream terraces, the road-sides and the banks between the two. Woody weeds are dispersed sparsely throughout the KNE site, but are present in greater densities on adjoining land, where they're likely to pose an ongoing threat of incursion.

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 now only present in low numbers, due to regular control being carried out. However, if

control isn't continued, these species will increase through reproduction and immigration to levels that will impact native flora and fauna.

Whilst feral goats (*Capra hircus*) are not resident in the KNE site, they frequently enter from neighbouring properties, either passing through fences or via the road, and severely browse understory plant species, affecting natural forest regeneration.

Predators such as cats (*Felis catus*) and hedgehogs (*Erinaceus europaeus*) that prey on birds, lizards and invertebrates, are likely to be present.

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 Battle Hill Bush 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 management activities.

**Table 2: Summary of all threats to ecological values present at 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 weed species for control include tradescantia ( <i>Tradescantia fluminensis</i> ), African club moss ( <i>Selaginella kraussiana</i> ) and blackberry ( <i>Rubus fruticosus</i> ), (see full list in Appendix 4).	C
EW-2	Woody weed species displace native vegetation, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species include holly ( <i>Ilex aquifolium</i> ), hawthorn ( <i>Crataegus monogyna</i> ) and pine ( <i>Pinus radiata</i> ), (see full list in Appendix 4).	A, B, C, D, E, F
EW-3	Climbing weeds smother and displace native vegetation often causing canopy collapse, inhibit indigenous regeneration, and alter vegetation structure and composition. Key weed species include: German ivy ( <i>Senecio mikanioides</i> ) and convolvulus ( <i>Convolvulus arvensis</i> ), (see full list in Appendix 4).	A, B, C, D, E
Pest animals		
PA-1	Possums ( <i>Trichosurus vulpecula</i> ) browse palatable canopy vegetation until it can no longer recover <sup>29,30</sup> . This destroys the forest's structure, diversity and function. Possums may also prey on native birds <sup>31</sup> and invertebrates.	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 <sup>32,33</sup> .	Entire KNE site

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
PA-3	Mustelids (stoats <sup>34,35</sup> ( <i>Mustela erminea</i> ) and weasels <sup>36,37</sup> ( <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 <sup>38</sup> , lizards <sup>39</sup> and the eggs <sup>40</sup> and chicks of ground-nesting birds <sup>41</sup> .	Entire KNE site
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 <sup>42,43</sup> .	Entire KNE site
PA-6*	Feral, stray and domestic cats ( <i>Felis catus</i> ) prey on native birds <sup>44</sup> , lizards <sup>45</sup> and invertebrates <sup>46</sup> , reducing native fauna breeding success and potentially causing local extinctions <sup>47</sup> .	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 <sup>48</sup> .	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 <sup>49</sup> .	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 <sup>50</sup> .	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 <sup>51</sup> .	C
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 <sup>52,53</sup> .	Entire KNE site
Human activities		
HA-1	Agricultural practices on adjacent farmland and livestock breaching boundary fences can result in pugged soils, grazed native vegetation inhibiting regeneration, wildlife disturbance and increased nutrient content of soils and watercourses <sup>54</sup> .	A, B, C
HA-2	Recreational use such as orienteering, and commercial activities such as film making can cause damage and disturbance of the native ecosystem. It is also likely to disturb native fauna and introduce ecological weeds.	A, B, C

Threat code	Threat and impact on biodiversity in the KNE site	Operational area/location
HA-3	Management activities such as track development, pest control and ecological monitoring can damage and destroy vegetation, and cause the accidental introduction of weed species through the carriage of seeds and plant fragments on machinery, equipment and clothing.	Entire KNE site
HA-4*	Harvesting of plantation forestry within the KNE site and on adjoining land parcels has the potential to cause habitat loss or degradation, disturb native wildlife, damage boundary fencing and increase sediment load in watercourses via surface run-off during harvesting operations.	B, D, E
HA-5	Poor water quality affects a range of species in the stream. High nutrient levels and contaminants within watercourses are often caused by upstream land management practices and pollution events including development practices, forestry and agricultural practices, rubbish dumping and septic tank leakages.	C
Other threats		
OT-1*	A lack of legal protection can leave a site at risk of future development or destruction and resources invested in the site may be wasted. Part of this KNE site is private property and uncovenanted, having no protection status.	E

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

The codes alongside each threat correspond to activities listed in the operational delivery schedule (Table 3), and are used to ensure that actions taken are targeted to specific threats. A map of operational areas can be found in Appendix 1 (see Map 4).

## 8. Objectives

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

The following objectives will guide the operational activities at Battle Hill Bush KNE site.

1. **To improve the structure\* and function† of native plant communities**
2. **To improve the habitat for native birds**
3. **To raise community awareness of the ecological values of the KNE site**
4. **To engage and support the landowner in the management of the KNE site**

\* The living and non-living physical features of an ecosystem. This includes the size, shape, complexity, condition and the diversity of species and habitats within the ecosystem.

† The biological processes that occur in an ecosystem. This includes seed dispersal, natural regeneration and the provision of food and habitat for animals.

## 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 budget figures attached, 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 main management activities that will be undertaken in the KNE site are ecological weed and pest animal control.

### 9.1 Ecological weed control

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

Intensive ecological weed control has been ongoing within much of the KNE site (operational areas A, B and C, see Appendix 1, Map 4) since 2002. Since 2004, this work had been guided by a pest plant control plan prepared for Battle Hill Farm Forest Park<sup>55</sup>.

Jeremy Collyns, the land owner of operational area D, has undertaken control of some of the more invasive weed species such as holly on his land in the past. During the last two years Greater Wellington has picked up this work in conjunction with initiating comprehensive control work in operational area E.

As a result, good control of woody weeds has been achieved throughout the KNE site. However, control of ground covers and climbers has been slow. Ecological weed control work will continue in the KNE site using approaches that will continue to suppress woody weeds throughout the KNE site, and progressively control large infestations of ground covering and climbing weeds that are mostly isolated to operational area C. Only ecological weed species listed as priority 1 in Appendix 4 will be controlled during the term of this plan. Priority 2 species will be controlled in future years.

#### ***Operational areas A, B, D and E***

Woody and climbing weeds are controlled in these areas by Biosecurity staff carrying out three-yearly searches for weed plants. 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 ground covering weeds observed in these areas will be recorded and these will be controlled at a later date in conjunction with ground cover control work undertaken in operational area C.

#### ***Operational area C***

Ground covering and climbing weeds in operational area C will be progressively controlled annually. Each year previously sprayed areas will be checked and re-sprayed

where necessary, and then initial spray work will be carried out on as much new area as the allocated resources in each year will allow.

### **Operational area F**

This area of farmland adjacent to the KNE site is checked for re-sprouting and new holly and hawthorn plants every three years to prevent the regeneration and subsequent spread of these species into the KNE site. Many plants of these two species have been controlled in this area in past years.

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 from spreading into the KNE site.

## **9.2 Pest animal control**

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

Possum and rat control 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 and C using a network of kill-traps. These traps are checked and re-baited every 3 months by Biosecurity staff in conjunction with bait station servicing. Predator trapping is also being undertaken in areas of Battle Hill Farm Forest Park outside the KNE site by members of the Mana Lions Club. This control programme will assist the control of predators within the KNE site by reducing migration of predators to the site.

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

Parks department staff and landowner Jeremy Collyns shoot goats observed within the KNE site on an *ad hoc* basis. Small mobs of goats occasionally move in and out of the KNE site from various directions. The very transient nature of goats within the KNE site makes them very difficult to control.

Parks department staff undertake rabbit and hare shooting in some areas on the boundary of the KNE site such as the camping ground and adjacent track at the southern end of the KNE site. Controlling rabbits and hares around the edges of the KNE site will reduce the browsing pressure on native seedlings within the adjacent forested areas of the KNE site reducing the impact on forest regeneration locally.

## **9.3 Community engagement**

The purpose of community engagement in the KNE site is to raise awareness of the KNE site's ecological values and to increase the interest in and value placed on native biodiversity by the public. Information about the KNE site's ecological values and the

management undertaken through the KNE programme is conveyed to the public during public events held at the park and through occasional press articles.

#### **9.4 Park management**

Greater Wellington undertakes management activities at the KNE site in ways that help to protect the natural resources of the KNE site. This includes using best practice methods when undertaking ecological weed and pest animal control, and undertaking the following activities.

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. The greatest opportunity for stock to enter the KNE site is through gates left open by the public. New signs requesting the public to close gates have been installed at all gates. Incursions of stock that still occur are addressed by Parks staff or the farmer as soon as they are discovered.

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

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.

Greater Wellington operational staff follow procedures, which may include assessments of environmental effects, to identify and avoid damage to biodiversity values such as plant and animal communities. 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 guidelines<sup>56</sup> 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.

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. Research activities and the legitimate collection of native plants and animals are managed by a permit system run by the 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.

An enclosed horse arena is being built adjacent to the south end of the KNE site by the organisation Riding for the Disabled. Included in the licence 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 will help support the maintenance of biodiversity in the KNE site.

A 1.5 ha stand of radiata pines located at the southern end of the KNE site will be harvested at some point beyond the term of this plan. Once the pines have been harvested, this area will be allowed to naturally regenerate back to native bush.

## 10. Operational delivery schedule

The operational delivery schedule shows the actions planned to achieve the stated objectives for Battle Hill Bush KNE site, and their timing and cost over the three-year period from 1 July 2018 to 30 June 2021. The budget for the 2019/20 and 2020/21 years are indicative only and subject to change. Maps of ecological weed control operational areas and pest control can be found in Appendix 1 (see Maps 4 and 5).

**Table 3: Three year operational delivery schedule for the Battle Hill Bush KNE site**

Objective	Threat	Activity	Operational area	Delivery	Description/detail	Target	Timetable and resourcing		
							2018/19	2019/20	2020/21
1,2	EW-1, EW-2, EW-3	Ecological weed control	A (2018-19), D & E (2019-20)	Greater Wellington Biosecurity department	Control priority 1 woody and climbing weeds focusing searches on main spurs, ridgelines and light wells. Record the locations of any ground covering weeds found and maintain records for later control (see appendix 4 for priority weed species).	Reduce density and distribution of target species	\$5,000	\$3,000	Nil
1,2	EW-1, EW-2, EW-3	Ecological weed control	B	Greater Wellington Biosecurity department	Search entire area and control all priority 1 woody and climbing weeds found. Record the locations of any ground covering weeds found and maintain records for later control (see appendix 4 for priority weed species).	Reduce density and distribution of target species	Nil	Nil	\$5,000
1,2	EW-1, EW-3	Ecological weed control	A, B, C, D & E	Greater Wellington Biosecurity department	Control ground covering weeds recorded in areas A, B, D and E. Control ground covering and climbing weeds in area C, checking and re-working previous areas of control, and increasing the extent of control as resources allow.	Reduce density and distribution of target species	\$7,200	\$7,200	\$7,200

Objective	Threat	Activity	Operational area	Delivery	Description/detail	Target	Timetable and resourcing		
							2018/19	2019/20	2020/21
1,2	EW-2	Ecological weed control	F	Greater Wellington Biosecurity department	Search entire area and control all holly and hawthorn plants found.	Reduce density and distribution of target species	Nil	\$2,000	Nil
1,2	PA-1, PA-2	Pest animal control	A, B, C & E	Greater Wellington Biosecurity department	Control possums and rats by maintaining and re-filling bait stations at three month intervals.	Possums: < 5% RTC* Rats: < 10% TTI**	\$2,450	\$2,450	\$2,450
1,2,4	PA-1, PA-2	Pest animal control	D	Landowner – Jeremy Collyns	Control possums and rats by maintaining and re-filling bait stations at three month intervals.	Possums: < 5% RTC* Rats: < 10% TTI**	\$250 (bait only)	\$250 (bait only)	\$250 (bait only)
2	PA-3, PA-4	Pest animal control	A, B & C	Greater Wellington Biosecurity department	Control predators by maintaining and re-baiting kill-traps at three monthly intervals.	Mustelids: < 5% TTI**	\$800	\$800	\$800
1,2	PA-7	Pest animal control	B, C	Greater Wellington Parks department	Control rabbits and hares on KNE site edges.	Minimal to no browsing of native plants by rabbits and hares	Nil†	Nil†	Nil†
1,2,4	PA-9	Pest animal control	A, B, C & D	Greater Wellington Parks department and landowner– Jeremy Collyns	Control feral goats by shooting when possible.	Minimal to no browsing of native plants by feral goats	Nil†	Nil†	Nil†

Objective	Threat	Activity	Operational area	Delivery	Description/detail	Target	Timetable and resourcing		
							2018/19	2019/20	2020/21
1	HA-1	Park management	Boundary of KNE site	Greater Wellington Parks department	Maintain boundary fences to prevent access to the KNE site by livestock.	No impact on the KNE site by livestock	††	††	††
1,2	HA-2, HA-3, HA-5	Park management	Entire KNE site	Greater Wellington Parks, Biodiversity, Biosecurity & Environmental Science departments	Adhere to Greater Wellington best practice guidelines and policies aimed at protecting the natural environment while undertaking operational activities.	Minimal impacts are imposed on biodiversity values by operational activities	Nil†	Nil†	Nil†
3		Community engagement	Entire KNE site	Greater Wellington Parks and Biodiversity departments	Incorporate information about the biodiversity values of the KNE site into community events and media.	Increased community awareness of the values of the KNE site	Nil†	Nil†	Nil†
Total							\$15,700	\$15,700	\$15,700

\*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 created 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<sup>57</sup>.

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

†† This cost varies annually and cannot be predicted at this time. Funded by Greater Wellington Parks department.

## 11. Funding contributions

### 11.1 Budget allocated by Greater Wellington

The budget for the 2019/20 and 2020/21 years are indicative only and subject to change.

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

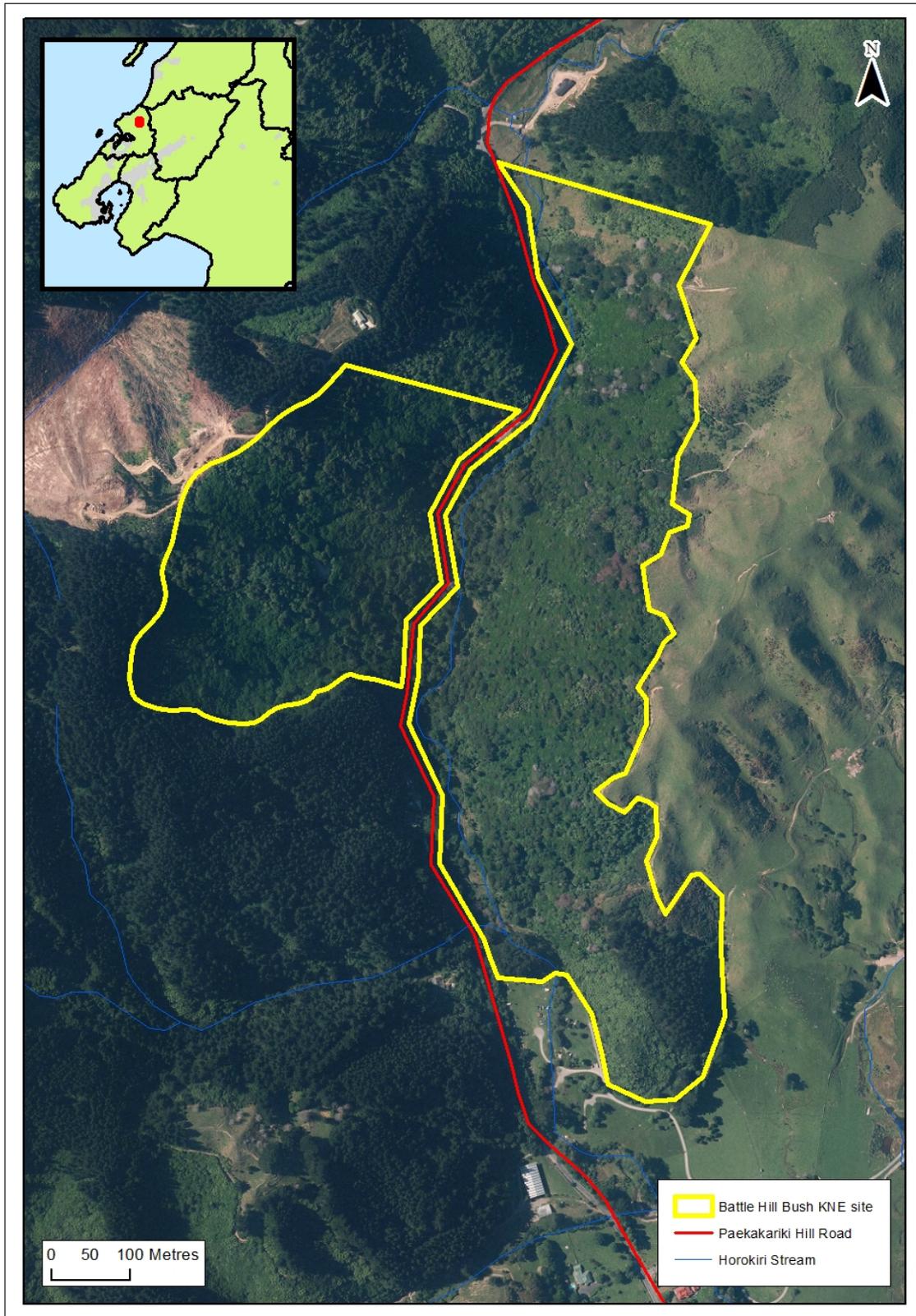
Management activity	Timetable and resourcing		
	2018/19	2019/20	2020/21
Ecological weed control	\$12,200	\$12,200	\$12,200
Pest animal control	\$3,500	\$3,500	\$3,500
<b>Total</b>	<b>\$15,700</b>	<b>\$15,700</b>	<b>\$15,700</b>

## 12. Future opportunities

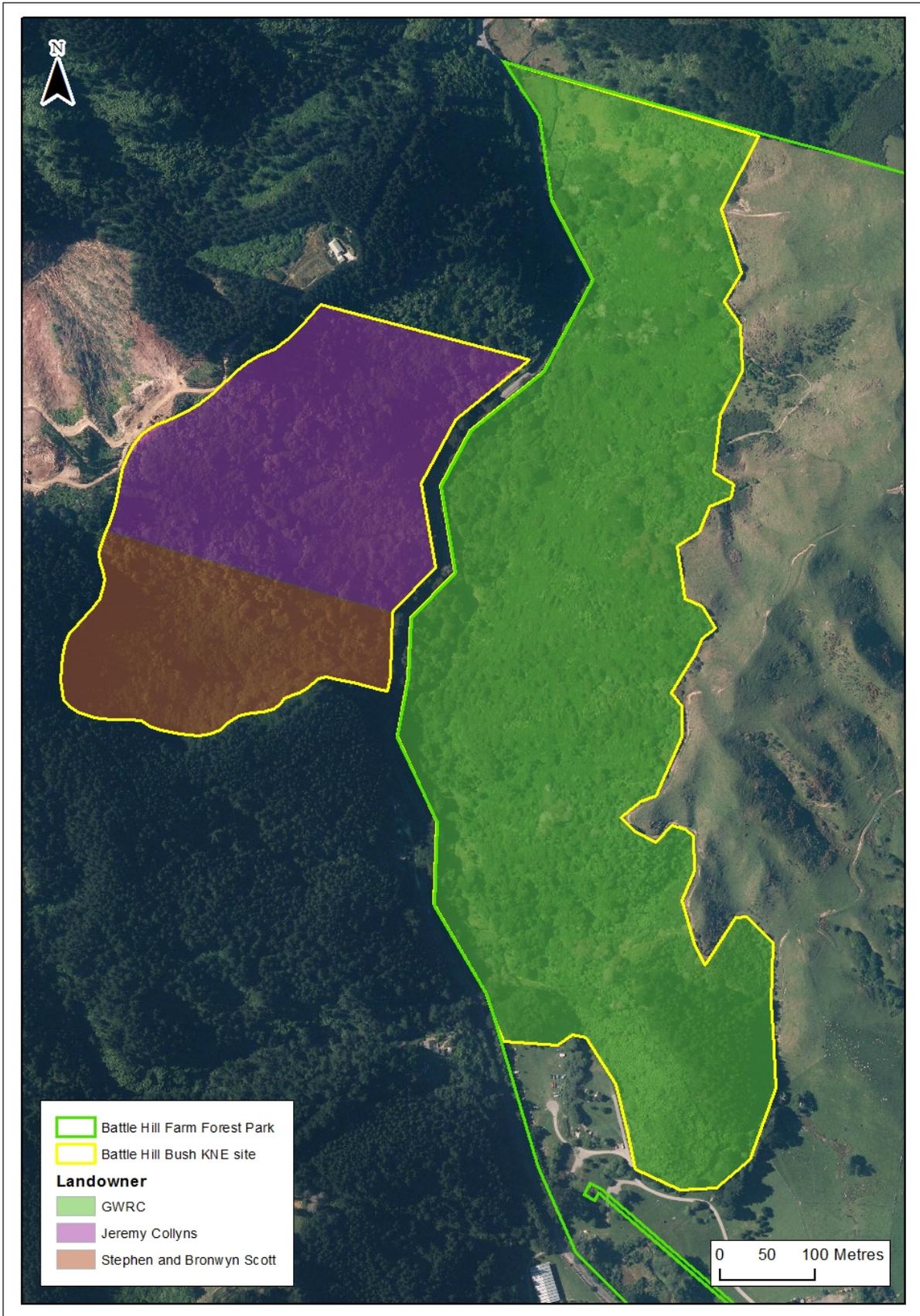
### 12.1 Revegetation

If an ecological enhancement project is sought by either a community or corporate group or for the purpose of environmental mitigation, revegetation of the stream terraces (operational area C) is recommended. Planting has been undertaken in several areas on the true left of the stream in the past. These areas would benefit from infill planting and the many parts of the true right that are currently inundated with weeds would benefit from planting following weed control. The aim of planting the stream terraces would be to establish a continuity of native habitat from the existing forest edge to the edge of the stream, which would provide riparian habitat and shading along the stream, and reduce weed incursions. The restoration plan prepared for the area in 2011<sup>58</sup> would be used to guide work.

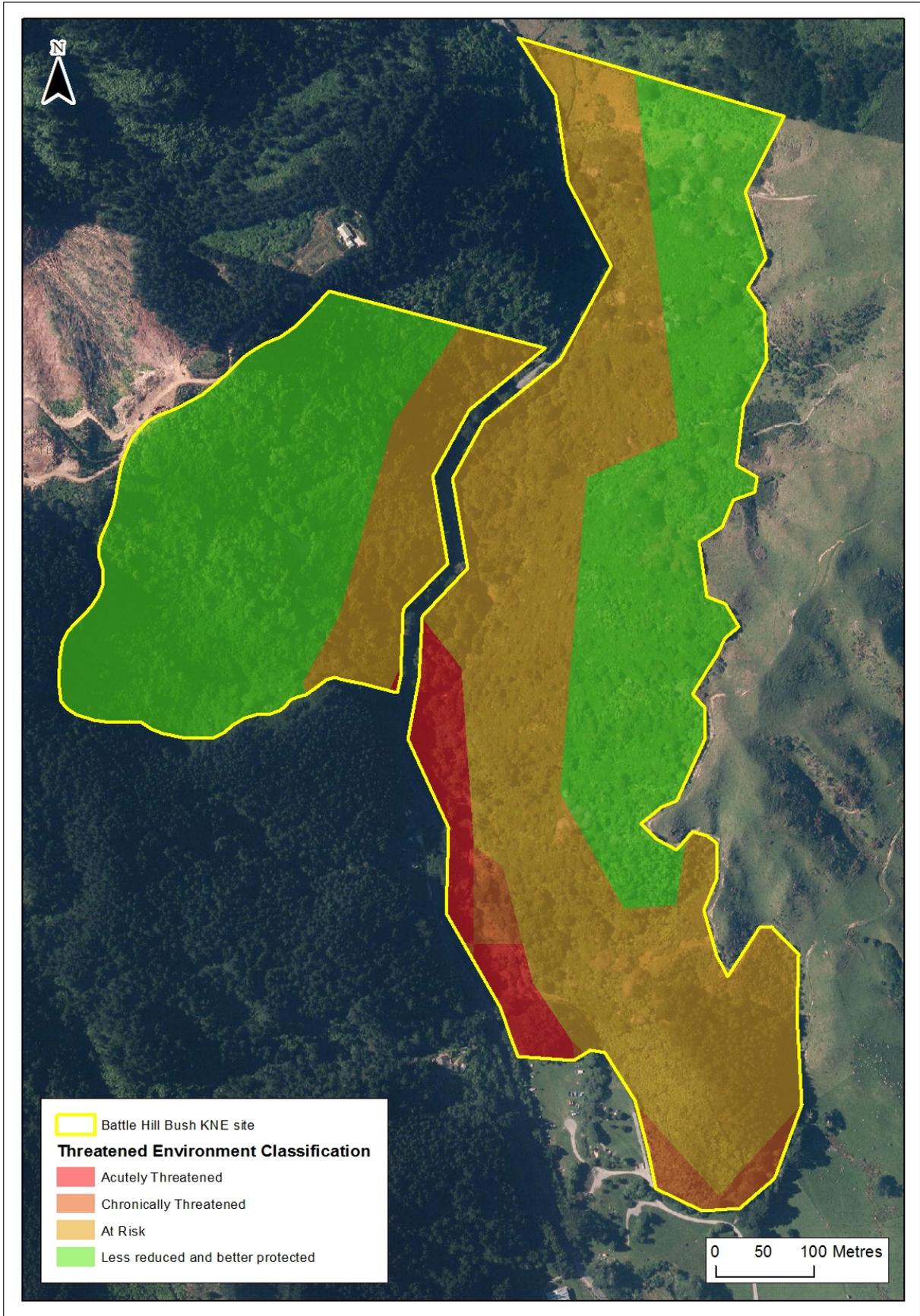
## Appendix 1: Site maps



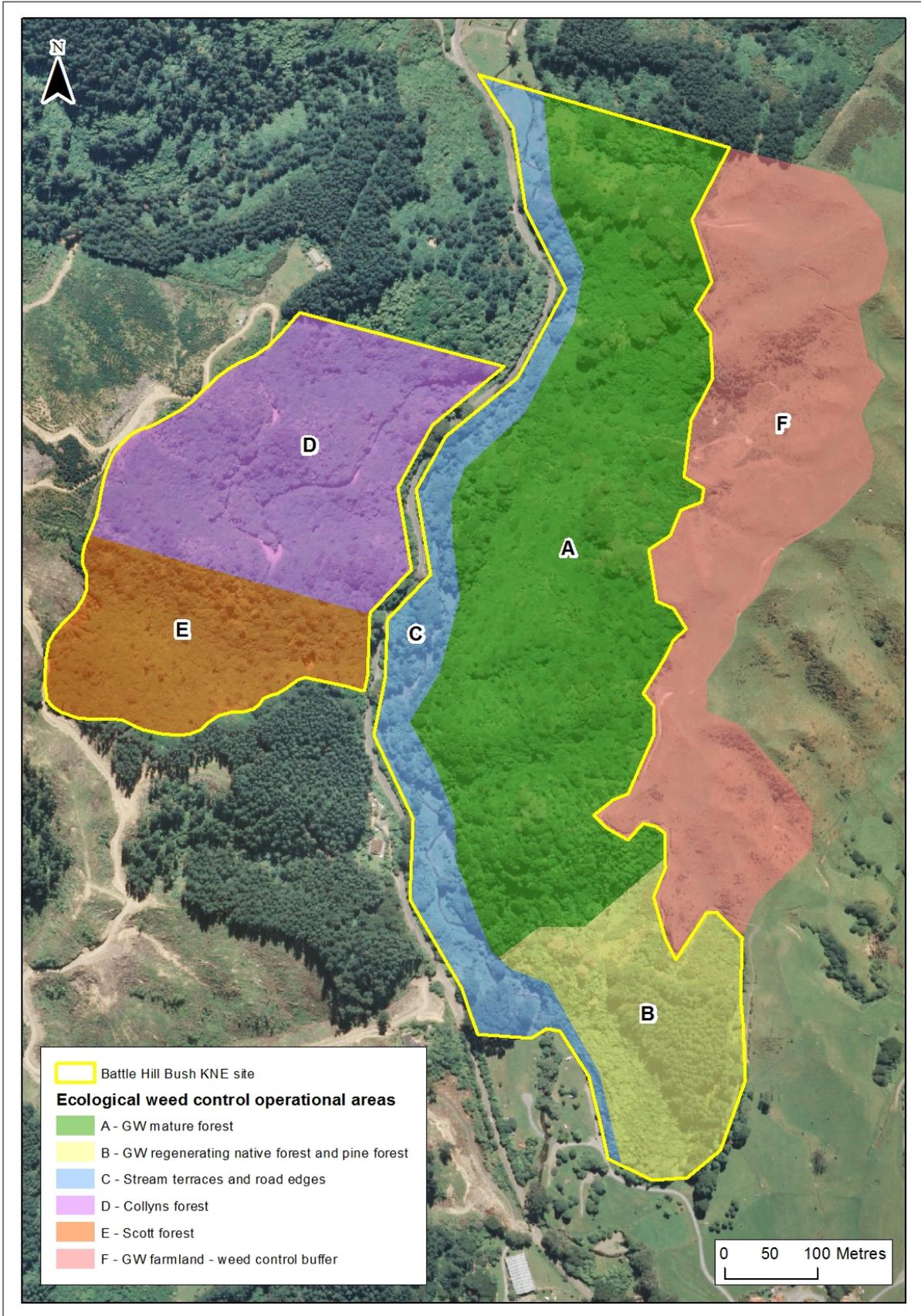
Map 1: The Battle Hill Bush KNE site boundary



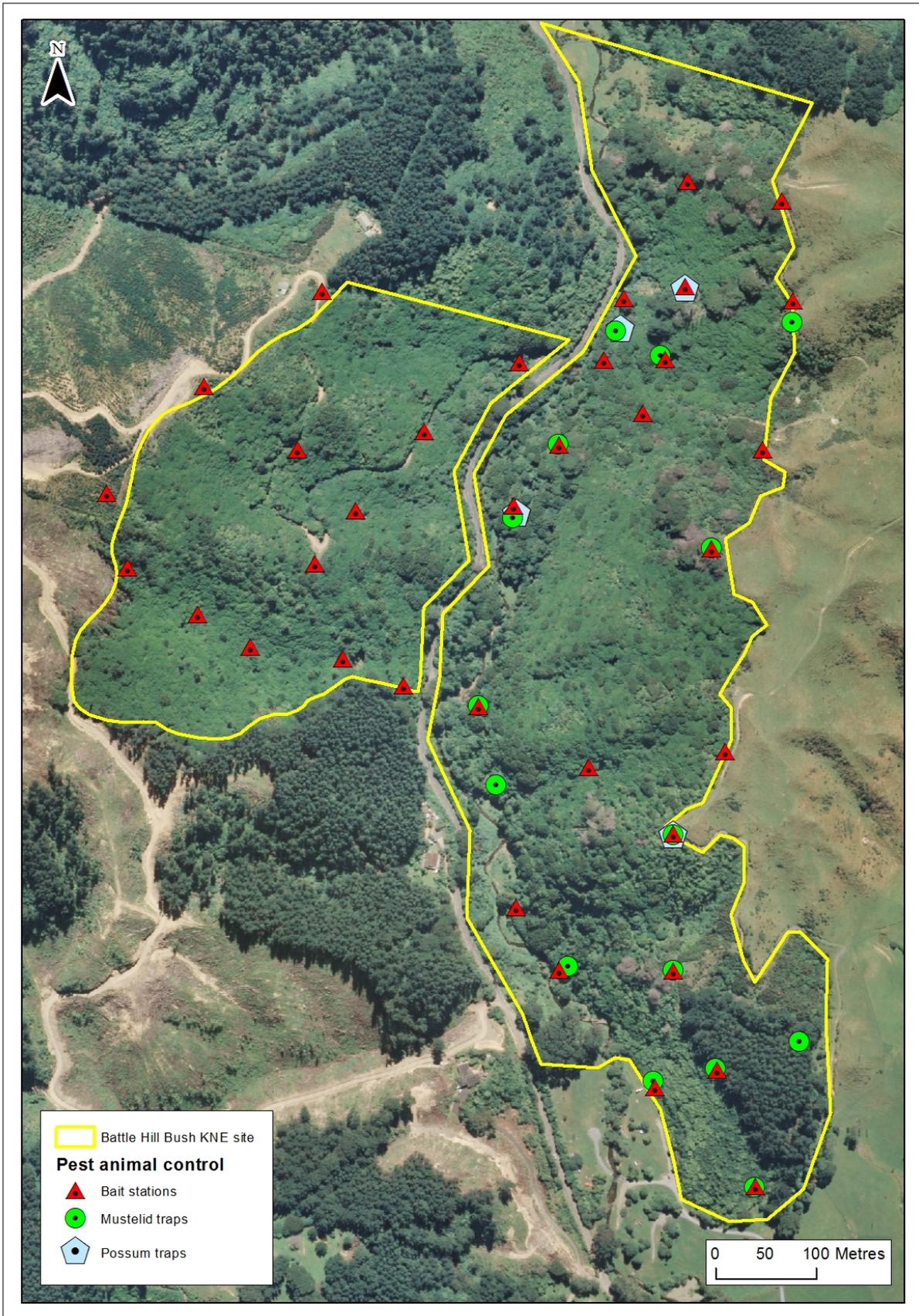
Map 2: Battle Hill Bush KNE site landowners



Map 3: Land Environment New Zealand threat classifications for Battle Hill Bush KNE site



Map 4: Ecological weed control operational areas in Battle Hill Bush KNE site



Map 5: Pest animal control in 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 three-year cycle<sup>59</sup>. 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
<b>Plants (vascular)<sup>60</sup></b>			
<i>Pterostylus foliata</i>	Greenhood orchid	At Risk-Naturally Uncommon	Greater Wellington Regional Council 2006 <sup>61</sup>
<b>Birds<sup>62</sup></b>			
<i>Cyanoramphus novaeseelandiae</i>	Red-crowned parakeet, kākāriki	At Risk-Relict	Ebird database <a href="http://ebird.org/content/newzealand/">http://ebird.org/content/newzealand/</a> (accessed April 2015)
<i>Falco novaeseelandiae</i>	New Zealand falcon, kārearea	Threatened-Nationally Vulnerable	Greater Wellington Regional Council 2006
<b>Freshwater fish<sup>63</sup></b>			
<i>Anguilla dieffenbachii</i>	Longfin eel	At Risk-Declining	NIWA Freshwater Fish Database
<i>Galaxias argenteus</i>	Giant kōkopu	At Risk-Declining	NIWA Freshwater Fish Database
<i>Galaxias brevipinnis</i>	Kōaro	At Risk-Declining	NIWA Freshwater Fish Database
<i>Geotria australis</i>	Lamprey	At Risk-Declining	NIWA Freshwater Fish Database
<i>Gobiomorphus huttoni</i>	Redfin bully	At Risk-Declining	NIWA Freshwater Fish Database

### Appendix 3: Regionally threatened species list

The following table lists regionally threatened species that have been recorded in the Battle Hill Bush KNE site. Native plant species have been identified in the Plant Conservation Strategy, Wellington Conservancy 2004-2010<sup>64</sup>.

**Table 6: Regionally threatened plant species recorded at Battle Hill Bush KNE site**

Scientific name	Common name	Threat status	Observation
<b>Plants</b> <sup>65</sup>			
<i>Adiantum diaphanum</i>	Tuberous maidenhair	At Risk - Data Deficient	Greater Wellington Regional Council 2006 <sup>66</sup>
<i>Adiantum viridescens</i>	Maidenhair	At Risk - Sparse	Greater Wellington Regional Council 2006
<i>Cyathea cunninghamii</i>	Gully tree fern	At Risk - Sparse	Greater Wellington Regional Council 2006
<i>Pittosporum cornifolium</i>	Perching kōhūhū	At Risk - Sparse	Greater Wellington Regional Council 2006
<i>Rhabdothamnus solandri</i>	Taurepo	At risk - Regionally Critical	Greater Wellington Regional Council 2006

## Appendix 4: Ecological weeds

The following table lists ecological weed species that have been recorded in Battle Hill Bush KNE site in order of priority for control. Species have been prioritised for control according to their impact and the practicality of control<sup>67</sup>. The distribution and density of individual species is described for operational areas A, B, C and E. 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. Distribution and density information for operational area D is not known at this time.

**Table 7: Ecological weed species recorded in the Battle Hill Bush KNE site**

Scientific Name	Common name	Priority	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 E (Scott property)
<i>Acer pseudoplatanus</i>	Sycamore	1	Localised and sparse	Localised and sparse	Localised and sparse	
<i>Buddleia davidii</i>	Buddleia	1		Localised and sparse	Localised and sparse	
<i>Chamaecytisus palmensis</i>	Tree lucerne	1		Patchy and sparse	Patchy and sparse	
<i>Convolvulus arvensis</i>	Convolvulus	1			Patchy and abundant	
<i>Cornus</i> sp.	Strawberry dogwood	1		Localised and sparse		Localised and sparse
<i>Cortaderia selloana</i>	Pampas	1		Patchy and sparse		
<i>Crataegus monogyna</i>	Hawthorn	1	Patchy and sparse	Patchy and sparse	Patchy and sparse	
<i>Cupressus macrocarpa</i>	Macrocarpa	1	Localised and sparse	Localised and sparse	Localised and sparse	
<i>Hedera helix</i>	Ivy	1			Localised and sparse	
<i>Ilex aquifolium</i>	Holly	1	Patchy and sparse	Widespread and sparse	Patchy and sparse	Patchy and abundant
<i>Leycesteria formosa</i>	Himalayan honeysuckle	1		Widespread and sparse	Patchy and sparse	Localised and sparse
<i>Lonicera japonica</i>	Japanese honeysuckle	1			Localised and sparse	
<i>Pinus</i> sp.	Wilding pines	1	Localised and sparse	Localised and sparse	Localised and sparse	
<i>Salix</i> sp.	Willow	1			Patchy and sparse	

Scientific Name	Common name	Priority	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 E (Scott property)
<i>Selaginella kraussiana</i>	African club moss	1		Localised and sparse	Widespread and abundant	
<i>Senecio mikanioides</i>	German ivy	1			Patchy and dense	
<i>Tradescantia fluminensis</i>	Tradescantia	1	Localised and sparse	Localised and sparse	Widespread and dense	
<i>Vinca major</i>	Periwinkle	1	Localised and abundant			
<i>Allium triquetrum</i>	Onion weed	2			Patchy and abundant	
<i>Crocasmia × crocosmiiflora</i>	Montbretia	2		Patchy and sparse	Patchy and dense	Patchy and sparse
<i>Cytisus scoparius</i>	Broom	2		Patchy and sparse	Patchy and abundant	
<i>Lathyrus latifolius</i>	Everlasting pea	2			Localised and sparse	
<i>Rubus fruticosus</i>	Blackberry	2		Localised and sparse	Widespread and dense	
<i>Teline monspessulana</i>	Montpellier broom	2		Patchy and sparse	Patchy and dense	
<i>Ulex europaeus</i>	Gorse	2		Localised and sparse	Localised and abundant	Localised and sparse
<i>Zantedeschia aethiopica</i>	Arum lily	2			Localised and sparse	

## References

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- <sup>1</sup> New Zealand legislation. 1991. Resource Management Act 1991.
- <sup>2</sup> Greater Wellington Regional Council. Greater Wellington Regional Council Long Term Plan: 2018 – 2028.
- <sup>3</sup> Greater Wellington Regional Council. 2011. Parks Network Plan. GW/CP-G-11/101.
- <sup>4</sup> P A Handford & Associates Ltd, 2010. Battle Hill Farm Forest Park Sustainable Land Management Plan.
- <sup>5</sup> Greater Wellington Regional Council. 2016. Greater Wellington Regional Council Biodiversity Strategy. <http://www.gw.govt.nz/assets/council-publications/Biodiversity-Strategy-2016.pdf>
- <sup>6</sup> QEII National Trust and Greater Wellington Regional Council 2013. Memorandum of Understanding.
- <sup>7</sup> Greater Wellington Regional Council. 2015. Proposed Natural Resources Plan. P. 299.
- <sup>8</sup> Greater Wellington Regional Council. 2015. Proposed Natural Resources Plan. P. 323.
- <sup>9</sup> Greater Wellington Regional Council. 2015. Proposed Natural Resources Plan. P. 324.
- <sup>10</sup> Greater Wellington Regional Council. 2015. Proposed Natural Resources Plan. P. 324.
- <sup>11</sup> Greater Wellington Regional Council. 2015. Proposed Natural Resources Plan. P. 324.
- <sup>12</sup> Greater Wellington Regional Council. 2015. Proposed Natural Resources Plan. P. 323.
- <sup>13</sup> Greater Wellington Regional Council. 2015. Proposed Natural Resources Plan. P. 324.
- <sup>14</sup> Department of Conservation 1987. Ecological Regions and Districts of New Zealand.
- <sup>15</sup> Greater Wellington Regional Council 2002. Eco-domains for the Wellington Region. Processes and patterns for defining diversity and distinctiveness. Greater Wellington Regional Council, Wellington.
- <sup>16</sup> 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.
- <sup>17</sup> Department of Conservation 2008. New Zealand Threat Classification System manual.
- <sup>18</sup> Singers NJD, Rogers GM 2014. A classification of New Zealand's terrestrial ecosystems. Science for Conservation No. 325. Department of Conservation, Wellington.
- <sup>19</sup> Crisp P, Govella S, Crouch L. 2016. Identification and prioritisation of high value terrestrial biodiversity sites for selection within the Key Native Ecosystems Programme in the Wellington region.
- <sup>20</sup> Greater Wellington Regional Council 2006. Battle Hill Farm Forest Park Resource Statement.
- <sup>21</sup> Greater Wellington Regional Council 2006. Battle Hill Farm Forest Park Resource Statement.
- <sup>22</sup> Owen Spearpoint, Greater Wellington, Personal Communication 2015
- <sup>23</sup> Department of Lands and Survey 1984. Register of Protected Natural Areas in New Zealand. Department of Lands and Survey, Wellington.
- <sup>24</sup> Greater Wellington Regional Council 2006. Battle Hill Farm Forest Park Resource Statement.
- <sup>25</sup> Kim Broad, Greater Wellington, Personal Observation 2014.
- <sup>26</sup> Greater Wellington Regional Council. 2010. Parks Network Plan.
- <sup>27</sup> NIWA 2014. New Zealand freshwater fish database. National Institute of Water and Atmospheric Research. Accessed December 2014.
- <sup>28</sup> Owen Spearpoint, Greater Wellington, Personal Communication 2014
- <sup>29</sup> 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.
- <sup>30</sup> 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.
- <sup>31</sup> 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.
- <sup>32</sup> 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.
- <sup>33</sup> Innes JG. 2005. Ship rat. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 187–203.
- <sup>34</sup> 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.
- <sup>35</sup> King CM and Murphy EC. 2005. Stoat. In: King CM ed. *The handbook of New Zealand mammals*. Oxford University Press. Pp. 261–287.

- 
- <sup>36</sup> King CM. 2005. Weasel. In: King CM ed. The handbook of New Zealand mammals. Oxford University Press. Pp. 287–294.
- <sup>37</sup> 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.
- <sup>38</sup> 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.
- <sup>39</sup> 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.
- <sup>40</sup> 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.
- <sup>41</sup> 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.
- <sup>42</sup> Ruscoe WA, Murphy EC. 2005. House mouse. In: King CM ed. The handbook of New Zealand mammals. Oxford University Press. Pp. 204–221.
- <sup>43</sup> 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.
- <sup>44</sup> 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.
- <sup>45</sup> 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.
- <sup>46</sup> 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.
- <sup>47</sup> Gillies C, Fitzgerald BM. 2005. Feral cat. In: King CM ed. The handbook of New Zealand mammals. Oxford University Press. Pp. 308–326.
- <sup>48</sup> Norbury G, Flux JEC. 2005. Brown hare. In: King CM ed. The handbook of New Zealand mammals. Oxford University Press. Pp. 151–158.
- <sup>49</sup> 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.
- <sup>50</sup> Parkes. JP. 2005. Feral goat. In: King CM ed. The handbook of New Zealand mammals. Oxford University Press. Pp. 374–391.
- <sup>51</sup> 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.
- <sup>52</sup> Wright D, Clout M 2001. The eastern rosella (*Platycercus eximius*) in New Zealand. DOC Science Internal Series 18.
- <sup>53</sup> Galbraith JA. 2013. Eastern rosella. In Miskelly, C.M. (ed.) New Zealand Birds Online. [www.nzbirdsonline.org.nz](http://www.nzbirdsonline.org.nz)
- <sup>54</sup> 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.
- <sup>55</sup> Greater Wellington Regional Council 2004. Battle Hill Farm Forest Park pest plant control plan 2002-2007.
- <sup>56</sup> National Pest Control Agencies. 2013. Keep it Clean: Machinery hygiene guidelines & logbook to prevent the spread of pests and weeds.
- <sup>57</sup> Moylan S, McArthur N, Spearpoint O, Crisp P. 2015. Rodent tracking tunnel monitor May 2015. Greater Wellington Regional Council, Wellington.
- <sup>58</sup> Greater Wellington Regional Council. 2011. Restoration Plan for Horokiri Stream West – Battle Hill Bush. Unpublished report. BIOD-7-1126
- <sup>59</sup> Department of Conservation. 2008. New Zealand Threat Classification System manual.

<sup>60</sup> Lange P, Rolfe J, Champion P, Courtney S, Heenan P, Barkla J, Cameron E, Norton D, Hitchmough RA 2013. Conservation status of New Zealand indigenous vascular plants, 2012. New Zealand Threat Classification Series 3.

<sup>61</sup> Greater Wellington Regional Council. 2006. Battle Hill Farm Forest Park Resource Statement.

<sup>62</sup> Robertson H, Dowding J, Elliot G, Hitchmough RA, Miskelly C, O'Donnell C, Powlesland R, Sagar P, Scofield P, Taylor G. 2013. Conservation status of New Zealand birds, 2012. New Zealand Threat Classification Series 4.

<sup>63</sup> Goodman JM, Dunn NR, Ravenscroft PJ, Allibone RM, Boubee 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.

<sup>64</sup> Sawyer JWD. 2004: Plant conservation strategy, Wellington Conservancy (excluding Chatham Islands), 2004–2010. Department of Conservation, Wellington.

<sup>65</sup> Sawyer JWD 2004: Plant conservation strategy, Wellington Conservancy (excluding Chatham Islands), 2004–2010. Department of Conservation, Wellington.

<sup>66</sup> Greater Wellington Regional Council. 2006. Battle Hill Farm Forest Park Resource Statement. 68 p.

<sup>67</sup> Greater Wellington Regional Council. 2004. Battle Hill Farm Forest Park pest plant control plan 2002-2007.



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