



Te Ngahere
Native Forest Management

Puhipuhi Rapid Ecological Assessment
March-April 2016

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Te Ngahere

Executive Summary

Te Ngahere was engaged to complete a Rapid Ecological Assessment of terrestrial ecology at Puhipuhi, Northland. Surveys were undertaken of vegetation, birds, kauri snail and long-tailed bat in March and April 2016.

Exotic pasture and cutover and standing plantation radiata pine forest are the dominant land cover types within the permit area. The main native vegetation types observed include podocarp broadleaf forest where towai and/or totara are the dominant canopy species and manuka and towai shrubland. Notable species in podocarp broadleaf include poroporo and crimson rata in podocarp broadleaf forest and toatoa in shrubland. There are also existing records for hutu and thismia within the survey area.

The most frequent native bird species observed utilising the forested areas were fantail and grey warbler. The fauna recorded with threat classifications were New Zealand pipit, black shag, North Island brown kiwi and kauri snail. The use of habitat outside of Puhipuhi Forest remnants and Papanui/ Umuwhawha Forest by kiwi is still not confirmed. Long-tailed bats were not recorded.

The areas surveyed did not cover all habitats present. Further ecological surveys are recommended, if exploratory drilling is undertaken within native vegetation (including podocarp broadleaf forest and shrubland). If clearance is required, the vegetation type should be stated in any consent process to ensure the vegetation is adequately assessed prior to clearance.

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1 Introduction

1.1 Overview

Te Ngahere was contracted by Pattle Delamore Partners to carry out a Rapid Ecological Assessment at Puhipuhi for Evolution Mining New Zealand who hold a mineral exploration permit.

The purpose of this assessment was to conduct a rapid ecological assessment to identify whether there are at risk terrestrial species or ecosystems within the boundaries of the exploration permit.

The objectives of this assessment were to:

- Provide baseline information on the terrestrial ecological values of the mineral exploration permit area, including the presence of threatened and invasive species.
- Ground truth the literature review produced by Biosearches (2015).
- Determine areas where knowledge gaps remain and additional investigation could be directed in the future.

1.2 Scope of work

Terrestrial Ecological Assessment was carried out for the following taxa:

- Terrestrial and wetland vegetation.
- Terrestrial and wetland birds, including kiwi.
- Kauri snail.
- Long-tailed bat.

The taxonomic groups selected for this assessment are those which could contain significant or threatened species. Surveys of lizard and frog fauna was not undertaken as part of this rapid assessment. These surveys would require longer periods to assess (i.e. deploying and retrieval of artificial lizard refuges) by experts holding the required permits.

Access to some areas within the site was not possible, as permission had not been granted or no contact could be made with the landowner. Therefore, this report does not represent an assessment of the full permit area. Additional work is recommended at locations where surveying has not been carried out, if these areas are likely to be affected by future exploration or mining activities. Survey locations are shown in Figure 1; these indicate the centre of the area surveyed.

1.3 Site Description

Puhipuhi is situated north of Whangarei within the Whangaruru Ecological District, Northland. The extent of the exploration permit area is shown in Figure 1. The dominant land cover by area is pasture, followed by similar coverage of exotic forestry and native vegetation. The largest remnants of native vegetation within the permit boundaries are the south-eastern part of Papanui/ Umuwhawha Forest situated in the south-west of the permit area and Puhipuhi Road remnants in the north (Figures 1 and 2). Both of these forests are connected to Russell State Forest north of the site. The Puhipuhi Road remnants are buffered by commercial pine forestry. Within this forestry land there are areas of shrubland and native forest. Fragments of native and exotic forest are present within farmland.

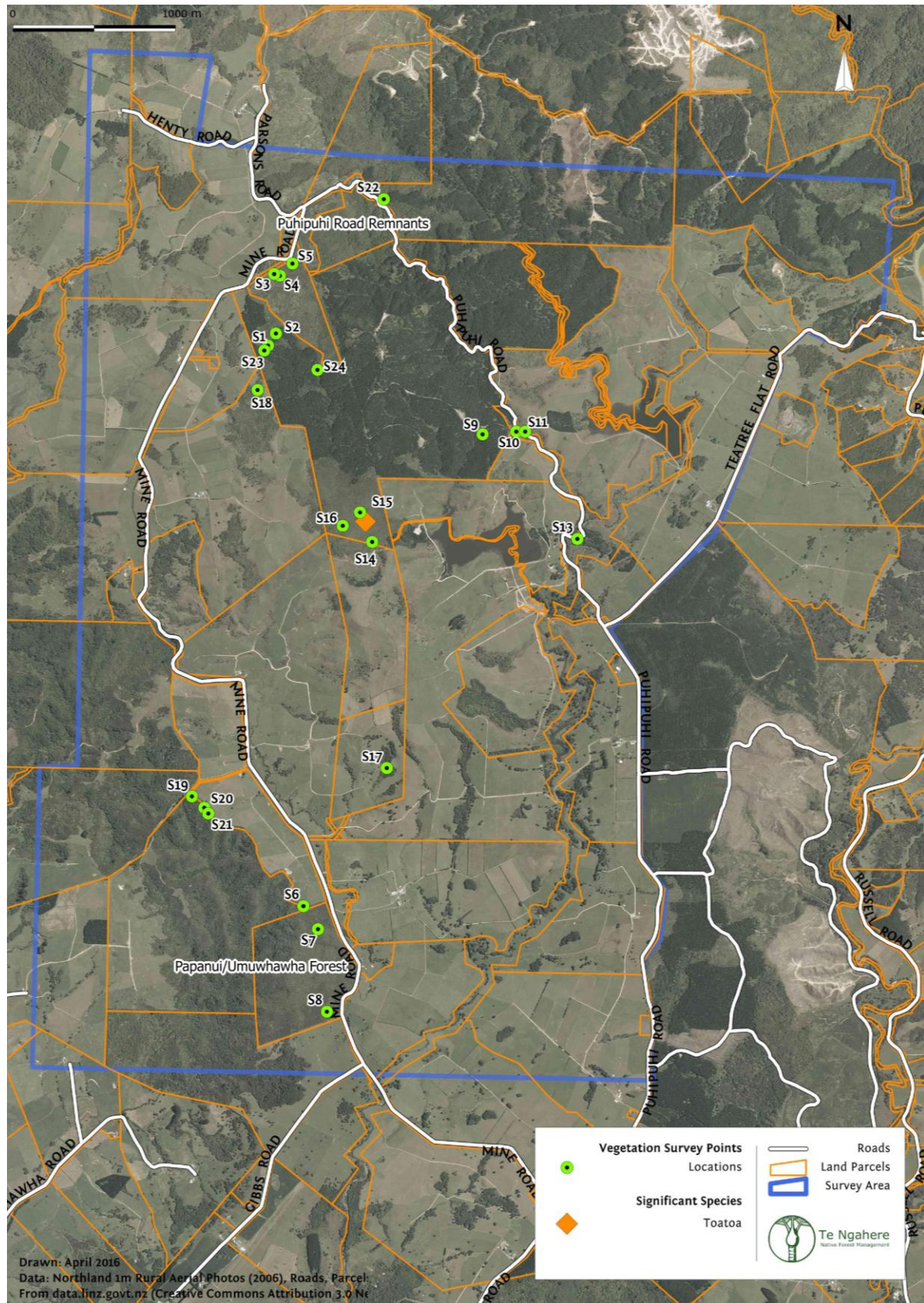


Figure 1: Approximate location of walkover surveys and notable plant species

2 Vegetation

2.1 Methods

Vegetation was surveyed on the 14-17 March and 2 April 2016. This involved a rapid walkover survey over a range of habitat types identified as potentially high in value, where access was granted and within the area of interest. Plant species present were recorded and Atkinson (1985) vegetation descriptions of vegetation tiers with up to 5 dominant emergent, canopy, subcanopy and understorey species recorded in each survey area. If changes in the type of vegetation were encountered while moving through an area, either a new survey was started or second Atkinson description was undertaken. This information has been used to describe the different vegetation types across the site. Sites surveyed are shown in Figure 1. Vegetation and canopy notes were also taken from the roadside where possible and in addition to the descriptions of vegetation tiers and aerial photography contributed to the vegetation map in Figure 2.

The dominant landcover types within the permit area are exotic pasture and cutover and standing plantation radiata pine forest. The native vegetation types of the permit area are discussed in the following sections with towai and totara podocarp-broadleaf and manuka shrubland dominating the larger, more continuous vegetated areas. Small patches of vegetation were often dominated by totara canopy or mixed native/exotic (often totara dominant). For a full species inventory per survey area see Appendix 1.

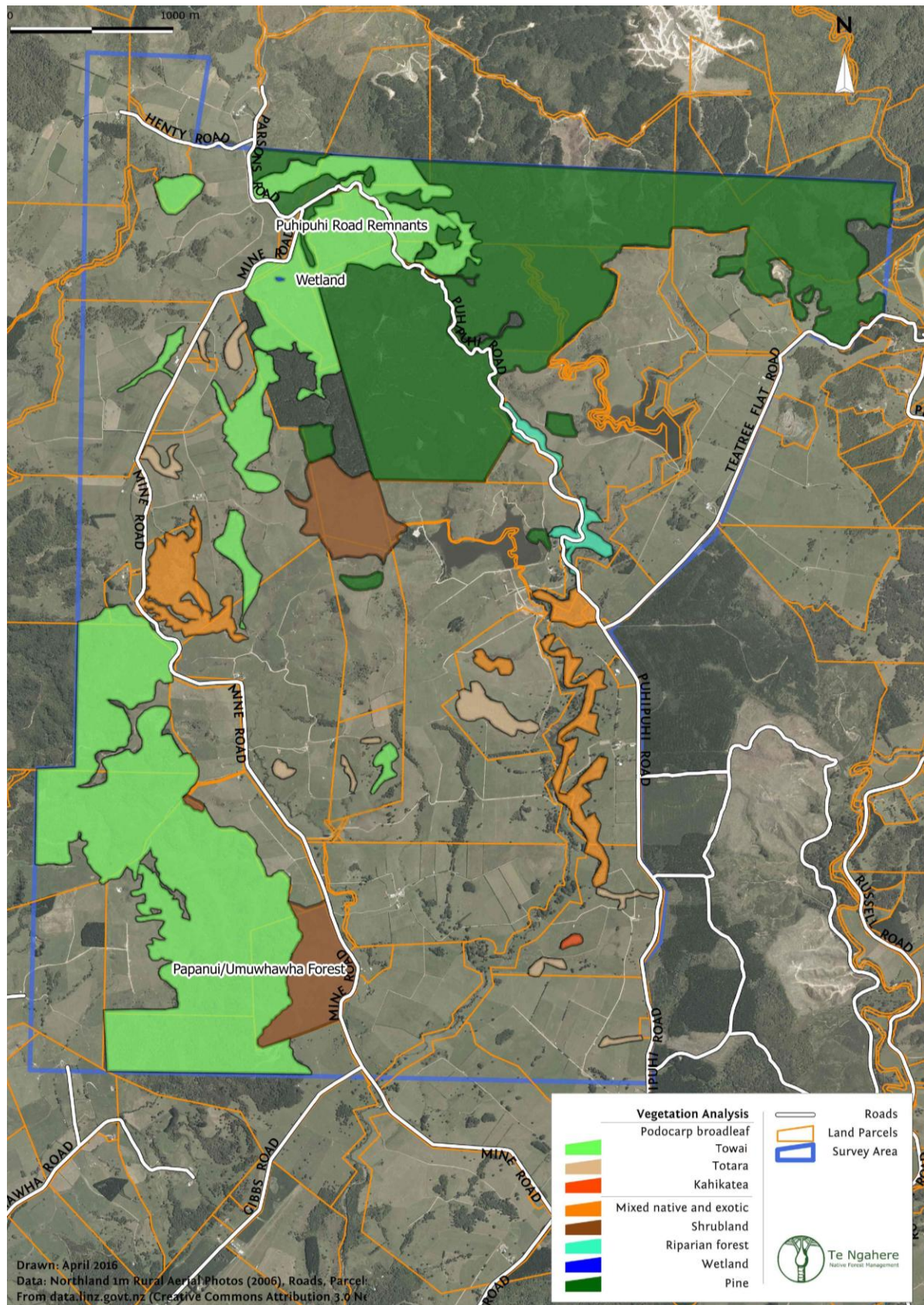


Figure 2: Habitat types observed from rapid ecological surveys and roadside observations

2.2 Podocarp broadleaf forest

Puhipuhi exploration permit area is situated within the warm sub-humid zone of New Zealand, where warm temperate forest (WF) occurs. The historic or potential vegetation types classified by Singers et al. (2014) for Puhipuhi include:

- WF9 Taraire, tawa, podocarp forest (locally includes towai) found on basaltic derived Aclay loams.
- WF11 kauri, podocarp, broadleaved forest (towai more common at higher altitudes) found on ultic soils.

2.2.1 Towai

Towai and taraire forests are both common inland podocarp forest types for the Whangaruru Ecological District (Booth 2005).

Towai (*Weinmannia silvicola*) was found to be a dominant feature across a range of habitat types and is often associated with podocarp species such as totara (*Podocarpus totara*), kahikatea (*Dacrycarpus dacrydioides*) and rimu (*Dacrydium cupressinum*). This includes the Puhipuhi Road remnants (survey sites S1, S2, S3, S21, S22, S23 and S24) where canopy is dominated by towai with varying amounts of emergent totara, rimu, kahikatea, rewarewa (*Knightia excelsa*), pigeonwood (*Hedycarya arborea*) along with occasional pine near edges and scattered kauri (*Agathis australis*). Subcanopy includes dominant wheki (*Dicksonia squarrosa*), kanono (*Coprosma grandifolia*), pigeonwood, soft mingimingi (*Leucopogon fasciculatus*), mahoe (*Melicytus ramiflorus*), ponga/ silver fern (*Cyathea dealbata*). Abundant understorey species include kiokio (*Blechnum novae-zelandiae*), wheki, turutu (*Dianella nigra*), swamp bush lawyer (*Rubus australis*), mapou (*Myrsine australis*), crown fern (*Blechnum discolor*), *Metrosideros perforata*, toropapa (*Alseuosmia macrophylla*), hen and chicken fern (*Asplenium bulbiferum*) and supplejack (*Ripogonum scandens*). There is also locally abundant treefern canopy (mainly wheki).

Within the towai dominant areas there are also pockets of taraire (*Beilschmiedia tarairi*)-tawa (*Beilschmiedia tawa*) forest. This includes S5 where the canopy consists of taraire-tawa with occasional totara, pigeonwood and rewarewa. The subcanopy contains ponga, kanono, hangehange (*Geniostoma ligustrifolium*), wheki and crown fern in the understorey.

There are also taraire dominant pockets (sometimes co-dominant with towai) along with kahikatea, totara and a subcanopy with mahoe, pigeonwood, kanono, pockets of the treeferns ponga and wheki, along with supplejack, threadfern (*Blechnum filiforme*), hangehange, kiekie, karamu (*Coprosma robusta*), crown fern and hen and chicken fern.

Exotic species are mainly restricted to edges and open patches (see Figure 3). These species include the occasional wilding pine (*Pinus radiata*), aristeia (*Aristea ecklonii*), gorse (*Ulex europaeus*), wandering Jew (*Tradescantia fluminensis*) and pampas (*Cortaderia jubata* and *C. selloana*).



Figure 3: Towai canopy with gorse on the edge

2.2.2 Totara

Within the Whangaruru Ecological District, Totara forest is the most common podocarp forest type, and is often the sole dominant species (Booth 2005). This is a feature of numerous small patches of forest within open farmland. Within these areas the canopy is dominated by totara and Hall's totara (*Podocarpus laetus*) but there are also some pockets of kahikatea canopy, isolated kahikatea, rimu and towai. These sites were generally observed from the roadside and consisted of smaller scattered patches of vegetation, sometimes fenced off from stock.

Other areas of podocarp forest include a pocket of kauri greater than 10m tall and rimu emergents at S17 that also contain totara, taraire, kohekohe (*Dysoxylum spectabile*), nikau (*Rhopalostylis sapida*) and an understorey which includes thread fern.

Exotic weed species occur on the edge of some of these areas, including gorse, both pampas species and woolly nightshade (*Solanum marginatum*).

2.2.3 Kahikatea

Only one patch of vegetation in Figure 2 is shown as podocarp broadleaf - kahikatea. However, kahikatea is a feature of most areas of native vegetation, with pockets in the canopy particularly common within Podocarp broadleaf - totara.

2.3 Shrubland

Manuka (*Leptospermum scoparium*)/ kanuka (*Kunzea robusta*) shrubland is the most common and widespread shrubland in the Whangaruru Ecological District (Booth 2005). This is representative of Puhipuhi. Manuka is often co-dominant with other species such as totara, towai and mamaku (*Cyathea medullaris*). Kanuka was also present at more fertile sites.

Two main areas of shrubland occur within the permit area. These include a mix of manuka and treefern dominated forest with occasional broadleaf (mainly towai) and coniferous species such as tanekaha (*Phyllocladus trichomanoides*) and rimu. This includes Papanui/Umuwhawha Forest (survey sites S6, S7, S8, S19 and S20) in addition to a second area within forestry and private land (survey sites S14, S15 and S16).

In manuka dominant forest the canopy is predominantly manuka with occasional towai (sometimes dominant, see Figure 4), totara, Hall's totara, mapou, tanekaha, pigeonwood and rimu. Subcanopy species include mapou, five finger (*Pseudopanax arboreus*), shining karamu (*Coprosma lucida*), hangehange, pigeonwood, mingimingi, pockets of treeferns, including wheki. The understorey consists of primarily tanglefern (*Gleichenia dicarpa*), turutu (*Dianella nigra* and *D. latissima*), gahnia, lace fern (*Paesia scaberula*), kiokio, hook sedge (*Carex uncinata*), and bracken (*Pteridium esculentum*).

The shrubland within plantation forestry land includes areas of very open canopy. These areas are distinctly different from shrubland observed elsewhere with dense rupestral *Astelia solandri* and *Earina autumnalis* growing on the rocky ground, rather than epiphytically. A mature regionally significant toatoa (*Phyllocladus toatoa*) was also found in this area. Both these elements are likely indicators of the low fertility and rocky habitat at this site.

The open canopy of these shrubland areas means that gorse is not shaded out and is more widespread away from forest edges. Other exotic species include blackberry (*Rubus fruticosus* agg.) and Japanese honeysuckle (*Lonicera japonica*) on edges (survey point S8).



Figure 4: Open canopy with towai and manuka

2.4 Exotic forest

2.4.1 Pine forest

Areas of commercial plantation pine forest (survey S9) and smaller patches on private agricultural properties are dominated by exotic radiata pine. However, the subcanopy under mature pine stands is dominated by native species such as mamaku, pate (*Schefflera digitata*), kanono and wheki along with an understorey of gahnia, kiokio, hangehange and tanglefern.

2.4.2 Mixed native-exotic

Mixed native-exotic vegetation was viewed primarily from the road side and consisted of a range of canopy species including natives (totara, rimu, kahikatea, coprosmas, mahoe and treeferns), and exotics (pine, eucalypts, macrocarpa (*Cupressus macrocarpa*) and poplars as farm windbreaks). These patches contained a large number of exotic species including pampas, gorse, woolly nightshade, Japanese honeysuckle, tutsan (*Hypericum androsaemum*), jasmine (*Jasminum polyanthum*), elaeagnus (*Elaeagnus x reflexa*), barberry (*Barberry glaucocarpa*), banana passionfruit (*Passiflora tripartita*), kiwifruit (*Actinidia deliciosa*) and loquat (*Eriobotrya japonica*).

2.5 Wetlands and riparian vegetation

2.5.1 Wetlands

Raupo reedland is the most common wetland vegetation type in this district (Booth 2005). The vegetation at S4 consists of reedland with the open freshwater area dominated by tall spike sedge (*Eleocharis sphacelata*) (see Figure 5). *Isolepis reticularis* and a pocket of raupo (*Typha orientalis*) were also present. The canopy of the forest edges around the wetland consists of a mix of native species including towai, pigeonwood, mapou and manuka. The subcanopy and understorey included kiokio, wheki, mingimingi, mapou, and occasional toetoe (*Austroderia fulvida*) in open areas.

Within areas of wet pasture, scattered wetland vegetation has been planted including harakeke/ flax (*Phormium tenax*), kahikatea and wheki.

Access was not possible to fully assess the two dammed lakes within the permit area. From available viewpoints these lakes appear to contain limited wetland vegetation, with pasture extending to the water's edge.

Other wetland areas were not accessible/ visible for this survey.



Figure 5: Small wetland with tall spike sedge

2.5.2 Riparian vegetation

Less mature riparian vegetation is present near streamsides with mixed canopy and open areas with sedges and toetoe. Canopy generally consists of native species predominantly manuka, mahoe, mamaku, kahikatea, pigeonwood and totara canopy. The main subcanopy and understorey species include bracken, rata, pate, hangehange, gorse, lace fern, *Coprosma rhamnoides*, thread fern, kiokio and basket grass (*Oplismenus hirtellus*). Sites surveyed include S10, S11 and S13.

Weed species are more prevalent in open riparian areas and include pampas, blackberry, woolly nightshade, gorse and Mexican devil (*Ageratina adenophora*).

2.6 Notable species

Toatoa is not nationally threatened but is considered a regionally significant species (Booth 2005 and NZPCN 2016). A mature toatoa was found in an area of shrubland habitat on commercial forestry land (Figure 2) and likely to be elsewhere in similar habitat.

The regionally significant tree, hutu (*Ascarina lucida* var. *lucida*) was not recorded within the permit area. Hutu is rare in the North Island and has a scattered population. However, this species has been recorded at Puhipuhi in 1999 (Martin and Ogden 2002). The exact location for where specimens were collected is not given, but it is likely to be in wet areas podocarp broadleaf forest or shrubland.

Crimson rata (*Metrosideros carminea*) is not a threatened species, but is considered regionally significant by Booth (2005) and can be heavily browsed on by possums (NZPCN 2016). This was sighted within podocarp broadleaf forest at S1, S2, S18 and S23.

Poroporo (*Solanum aviculare* var. *aviculare*) was also noted at vegetation edges (S1, S18 and S23) and is classified as At Risk (Declining) with qualifiers including data poor, sparse and being threatened overseas (de Lange et al. 2012). This species prefers open shrubland or forest margins and can be a weed in urban areas (NZPCN 2016). This species is likely to occur elsewhere in disturbed areas/ forest margins of a range of habitat types.

Other notable features include occurrence of usually epiphytic species such as orchids and astelia growing on the ground within shrubland habitat in forestry land/ private land. This was not noted in any other areas.

Surveying was undertaken outside the flowering period for *Thismia rodwayi* (November-February) (NZPCN 2016). However, it has been noted previously in taraire remnant forest in the Puhipuhi area (Reynolds 1982). This species is saprophytic and is found in deep leaf litter in forest or scrub (NZPCN 2016). Habitats where deep litter was noted include areas where ground searches were undertaken for kauri snail, particularly in the podocarp broadleaf habitat areas.

Machaerina complanata was not recorded during this survey. The records for this species here are historic (from 1888) and it is presumed extinct at this locality (McCluggage 2000).

2.7 Environmental weed species

A full list of exotic plant species observed can be found in Appendix 1. The main weed species noted across the site include gorse, woolly nightshade, white and purple pampas and Japanese honeysuckle. The environmental weed species recorded are listed in Table 1. These are species included on the Northland Regional Pest Management Strategies (RPMS), listed as weeds of the Northland Regional Council website or in the National Pest Plant Accord.

Weed species are generally confined to bush edges and roadsides, with the exception of gorse which occasionally contributing to canopy within shrubland which lacked sufficient canopy closure to suppress this species. However, gorse can aid in the recruitment of native plant species and regeneration (Sullivan et al. 2007) and should not be a focus of weed control efforts in these shrubland areas.

Table 1: Environmental invasive plant species recorded within the permit area. See Appendix 1 for all other exotic plant species recorded.

Botanical name	Common name	Northland RPMS*	Observed habitat within the permit area	National Pest Plant Accord (MPI 2012)
<i>Acacia verticillata</i>	Prickly moses	CPCA	Roadsides	
<i>Ageratina adenophora</i>	Mexican devil		Roadsides	
<i>Ageratina riparia</i>	Mistflower		Roadsides	
<i>Buddleja davidii</i>	Buddleia	CPCA	Roadsides	
<i>Cortaderia jubata</i>	Purple pampas	Suppression	Pasture, light gaps and roadsides	yes
<i>Cortaderia selloana</i>	White pampas	Suppression	Pasture, light gaps and roadsides	yes
<i>Cotoneaster sp.</i>	Cotoneaster	CPCA	Roadsides	
<i>Delairea odorata</i>	German ivy	CPCA	Native forest edges	
<i>Elaeagnus x reflexa</i>	Elaeagnus	CPCA	Roadsides	
<i>Hypericum androsaemum</i>	Tutsan		Streamsides and roadside banks	yes
<i>Jacobaea vulgaris</i>	Ragwort	Suppression	Pasture, forestry and native forest edges	
<i>Jasminum polyanthum</i>	Jasmine	CPCA	Roadside edges of native forest	
<i>Lonicera japonica</i>	Japanese honeysuckle	CPCA	Shrubland edges	yes
<i>Passiflora tripartita var. auayensis</i>	Banana passionfruit	CPCA	Roadsides and native forest edges	yes
<i>Pinus radiata</i>	Radiata pine (wilding)	CPCA	Podocarp broadleaf forest and shrubland	
<i>Roldana petasiti</i>	Velvet groundsel	CPCA	Shrubland	
<i>Solanum marginatum</i>	Woolly nightshade	CPCA	Pasture, shrubland, light gaps and edges in pine forests	yes
<i>Tradescantia fluminensis</i>	Wandering Jew	CPCA	Podocarp broadleaf forest	yes
<i>Ulex europaeus</i>	Gorse	Suppression	Pasture, shrubland, pine forest and native forest edges	

*CPCA (Community Pest Control Area status) or Suppression on the Northland Regional Pest Management Strategies 2010-2015 (RPMS) (Northland Regional Council 2010).

3 Fauna

3.1 Terrestrial and wetland birds

Birds were surveyed across the site using Five minute bird counts, playbacks, Kiwi Call Counts and incidental records of other species seen on site. Five minute bird counts of species seen and heard were carried out in all surveyed areas.

A total of 31 bird species were recorded on the site including 17 native species and one hybrid (mallard x grey duck). The most regularly recorded species during bird counts were fantail, grey warbler and Australian magpie. The highest number of species recorded in a habitat/ forest type was 15 (shrubland and open/ farmland).

Access was not available to assess the two dammed lakes within the permit area. The only wetland area surveyed was the small dammed wetland within the Puhipuhi Road remnants (survey point S4) (Figure 2). A Five minute bird count was conducted at this wetland in the early morning. After this count was completed, playback recordings were used to try to solicit response calls from the following cryptic bird species: North Island fernbird (*Bowdleria punctata vealeae*), marsh crake (*Porzana pusilla affinis*), and spotless crake (*Porzana tabuensis*).

Bioresearches (2015) identified 14 species with threat classifications (Robertson et al. 2013) as potentially present based on the Atlas of Bird Distribution in New Zealand 1999-2004 (Robertson et al. 2007) which collated surveys from across New Zealand and presented the results in 10 by 10 km grids. Three of these species were recorded during this current assessment, including the Threatened (Nationally Vulnerable) North Island brown kiwi. Incidental observations of two bird species with low level threat classifications were made in open farmland areas. New Zealand pipit which is classified as At Risk (Declining) was regularly observed and a single black shag, classified as At Risk (Naturally Uncommon) was observed in flight and is likely to use the waterways within the site. This survey did not record the other 11 threatened species which are associated with water or wetland habitats. Only a single wetland site was surveyed. No wetland species were seen or responses heard at this wetland. This site is small and was sufficiently disturbed during vegetation surveying (following the bird survey) that cryptic species should have been flushed if they were present.

Table 2: Bird species recorded by habitat, from Five minute bird counts, Kiwi call counts and incidental records

Scientific name	Common name	Pine	Podocarp broadleaf	Riparian forest	Shrubland	Wetland	Nocturnal counts	Open/ farmland
<i>Circus approximans</i>	Australasian harrier							•
<i>Turdus merula</i>	Blackbird*	•	•					
<i>Phalacrocorax carbo novaehollandiae</i>	Black shag							•
<i>Callipepla californica</i>	California quail*							•
<i>Fringilla coelebs</i>	Chaffinch*	•		•	•			
<i>Platycercus eximius</i>	Eastern rosella*	•	•					
<i>Rhipidura fuliginosa placabilis</i>	Fantail	•	•	•	•	•		
<i>Carduelis carduelis</i>	Goldfinch*							•
<i>Gerygone igata</i>	Grey warbler	•	•	•	•			
<i>Passer domesticus</i>	House sparrow*							•
<i>Acridotheres tristis</i>	Myna*				•			
<i>Hemiphaga novaeseelandiae</i>	Kereru, Kukupa, NZ pigeon							•
<i>Todiramphus sanctus vagans</i>	New Zealand kingfisher				•			
<i>Gymnorhina tibicen</i>	Australian magpie*	•	•	•	•	•		
<i>Anas platyrhynchos</i>	Mallard*				•			•
<i>A. Platyrhynchos x superciliosa</i>	Mallard x grey duck hybrid							•
<i>Ninox novaeseelandiae novaeseelandiae</i>	Morepork			•			•	
<i>Anthus novaeseelandiae novaeseelandiae</i>	New Zealand pipit							•
<i>Apteryx mantelli</i>	North Island brown kiwi						•	
<i>Petroica macrocephala toitoi</i>	North Island tomtit		•		•	•		
<i>Tadorna variegata</i>	Paradise Shelduck	•		•	•			
<i>Pavo cristatus</i>	Peafowl*				•		•	
<i>Phasianus colchicus</i>	Pheasant*							•
<i>Porphyrio melanotus melanotus</i>	Pukeko			•				•
<i>Zosterops lateralis lateralis</i>	Silvereye, waxeye		•	•	•	•		
<i>Alauda arvensis</i>	Skylark*							•
<i>Prosthemadera novaeseelandiae novaeseelandiae</i>	Tui		•		•			
<i>Hirundo neoxena neoxena</i>	Welcome swallow		•		•			•
<i>Egretta novaehollandiae</i>	White-faced heron							•
<i>Emberiza citrinella</i>	Yellowhammer*				•			
<i>Vanellus miles novaehollandiae</i>	Spur-winged plover				•			•
	Number of species	7	9	8	15	4	3	15

3.2 Kiwi

North Island brown kiwi are classified as Threatened (Nationally Vulnerable) (Robertson et al. 2013). Surveying for North Island brown kiwi was carried out near forestry and forest fragments to the south of the Puhipuhi Road remnants and around the Papanui/Umuwhawha Forest to determine their distribution outside of the main forest areas. This followed the National Kiwi Call Scheme procedure outlined in Robertson and Colbourne (2003). Four counts were made on the nights of 14 and 15 March 2016. Surveys were carried out for 2 hours from at least 45 minutes after sunset. High points with wide views towards forest edges were selected as survey locations.

Male kiwi were heard by both observers on 15 March 2016 (see Figure 6). These calls were both estimated to be approximately 500m from the observers. This was towards the maximum extent of which calls could be heard from these locations. In ideal conditions kiwi can be heard from up to 1.5km away (Robertson and Colbourne 2003). However, background noise (possums, morepork and peafowl), wind and lack of elevation over the surveyed area would have limited this distance. No female response calls were heard, but could have been outside the audible range as the Papanui/Umuwhawha forest continues northwest of the survey points. No calls were heard in the Puhipuhi Road forest remnants, shrubland or forest fragments within agricultural land.

Kiwi are found in shrubland and forest remnants across the Whangaruru Ecological District (Booth 2005). Their presence has been recorded in both the Puhipuhi Road remnants and Papanui/Umuwhawha Forest (Booth 2005) which are partially within the tenement area. Their numbers in the Puhipuhi Road remnants, where no calls were heard, were described as low at the beginning of the 2000s (R. Pierce, pers. comm. cited in Booth 2005). The survey points only covered the southern parts of these remnants and surrounding forest patches in an attempt to determine the distribution within the wider area.

Kiwi can be found in a wide range of habitats including exotic pine forestry and regenerating scrub providing sufficient invertebrate resources and cover are present (Potter 1990). Their habitat use around the Puhipuhi Forest remnants warrants further study as kiwi will cross pasture to use other fragments outside their primary habitat. Figure 7 shows the known locations (Booth 2005) and potential habitat use at this site based on evidence from Potter (1990) that North Island brown kiwi will cross up to 330m of pasture to use forest fragments and travel up to 1200m from their primary habitat if there was some forest cover in-between.

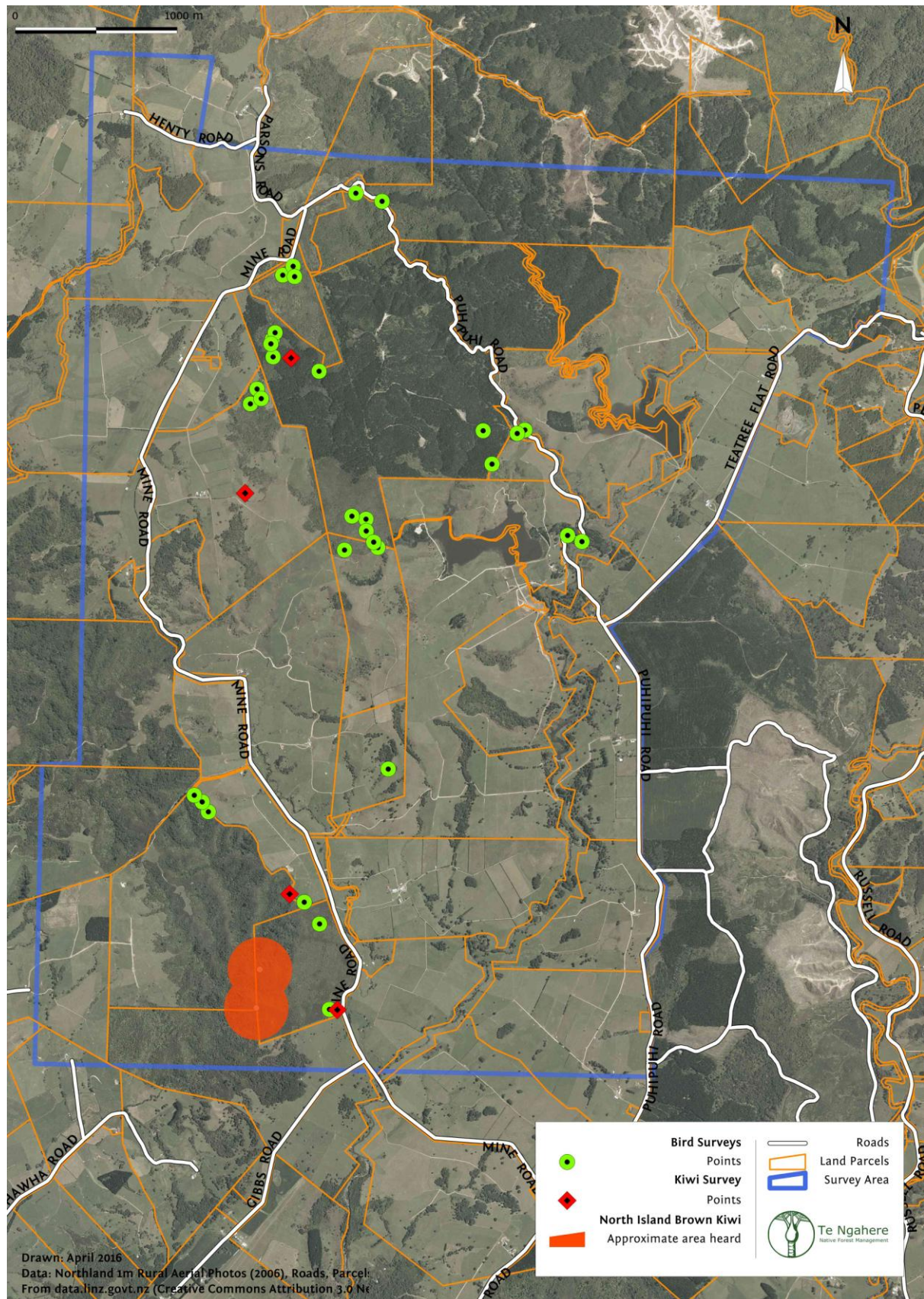


Figure 6: Locations of Five minute bird counts, Kiwi Call Counts and approximate locations of kiwi heard

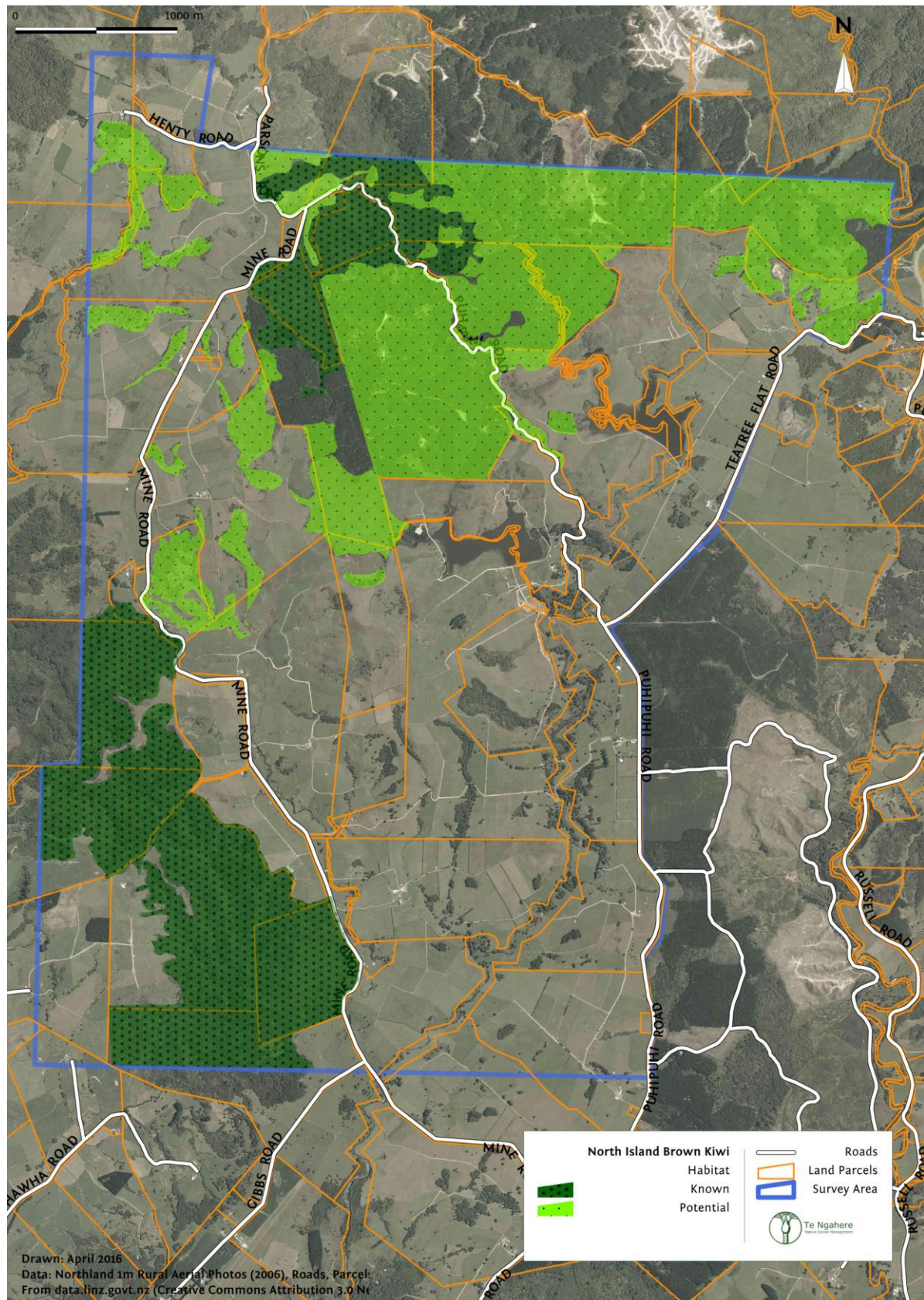


Figure 7: Known and potential habitat used by North Island brown kiwi

3.3 Kauri snails

The kauri snail (*Paryphanta busbyi*) is a large and relatively conspicuous predatory snail species (see Figure 8) which enables surveying to be carried out as part of a rapid assessment. This is the more widely distributed of the two kauri snail species and is naturally found in northern New Zealand from Warkworth north and has been introduced to locations in Huia, Awhitu and Kaimai (Parish et al. 1995).

Targeted ground searches were carried out to survey for kauri snail and other ground mollusc species. Suitable habitat in native forest and scrub such as areas of accumulated leaf litter with moist ground or wood were identified for surveying. An area of 1m either side of 5m transects (10m²) was searched, as well as a quick search of preferred habitat nearby. Finding shells was considered as a positive record of presence.

Kauri snail shells were located in the DOC shrubland of survey point S7 and DOC podocarp broadleaf forest survey point S2. This suggests they are present across Podocarp broadleaf forest and shrubland in the permit area where there are accumulations of leaf litter. They are listed as in At Risk (Mahlfeld et al. 2012). The ground searches found no evidence of other species.



Figure 8: Kauri snail shell from Papanui/Umuwhawha Forest

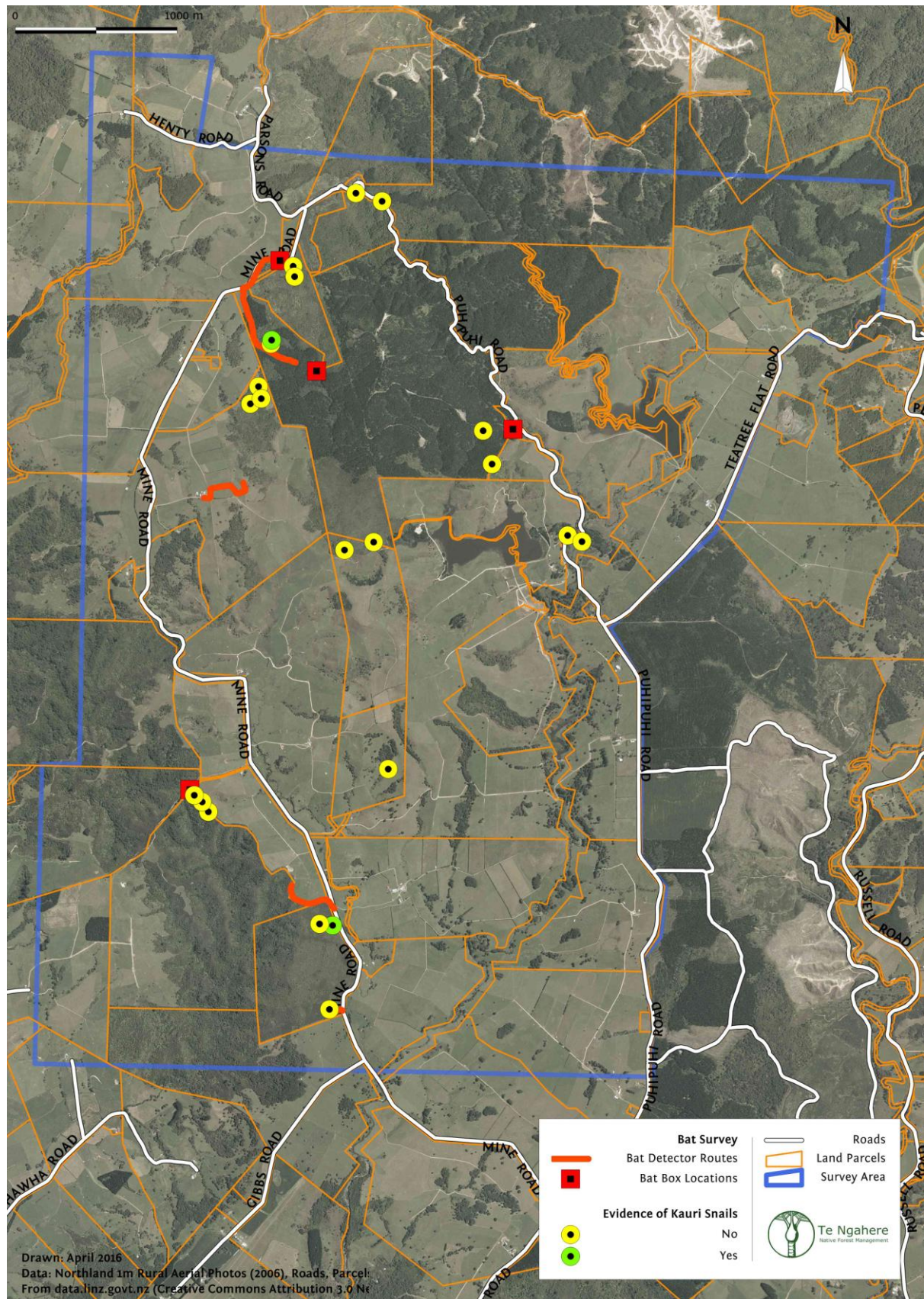


Figure 9: Locations of handheld bat detector survey routes, bat recorder locations and kauri snail surveys

3.4 Bats

Both handheld bat detectors and bat recorders were used to survey for North Island long-tailed bat/ pekapeka (*Chalinolobus tuberculatus* "North Island") which are classified as Threatened (Nationally Vulnerable) in O'Donnell et al. (2013). They are not listed at Puhipuhi but are present in several locations within the Whangarei District and the Whangaruru Ecological District (Honnor et al. 2011; Booth 2005). Booth (2005) recommends that further surveying is necessary to determine their distribution. This is the only bat taxa which could be present at the site as lesser short-tailed bat (*Mystacina tuberculata*) are associated with large areas of old growth forest (Lloyd 2001).

Handheld bat detectors were used at four sites at dusk on 14 and 15 March 2016, prior to carrying out kiwi call counts. Between 80 to 950m was surveyed along suitable foraging habitat, such as bush edges (Figure 9). The detectors were set at the frequency used to pick up long-tailed bat calls (40kHz).

Bat recorders were set up to remotely record echolocation calls over three to 14 fine nights at potential foraging sites. These sites were selected at edges to forest (native and pine) and/or near water. The bat recorders were set up to record from 19:00 to 07:00 and 18:30 to 07:30 New Zealand Standard Time. The recordings at an additional location by survey point S14 were not usable due to background noise from a nearby waterfall.

Two types of bat recorders were used: a frequency compression bat recorder and a digital bat recorder. Both recorders produce amplitude against time graphs for both 28 and 40kHz (the frequencies for recording both species of bats in New Zealand). The digital bat recorder also converts the echolocation calls to lower frequency recordings which are audible to humans (Lloyd 2009).

The bat recorders and handheld detectors did not record any evidence of the presence of long-tailed bats at the site. Surveying for bats in New Zealand is difficult because they occur in low numbers and have cryptic behaviours (Sedgeley et al. 2012). They also use different habitats and many different roost sites throughout the year (O'Donnell 2001; O'Donnell and Sedgeley 1999).

The main foraging habitats for long-tailed bats are along edges, such as roads through forests and margins between forest and grassland (O'Donnell 2000). They are generalist insectivores (Gurau 2014).

Over summer bats occupy communal roosts for breeding and raising young (Sedgeley et al. 2012). It is these maternity roosts which are the most significant trees to be protected. They are usually located in large trees often with epiphytes and hollows. This survey was conducted outside of this period and therefore does not enable the presence of maternity roosts to be assessed. However, there were sufficiently large trees present, especially in the Puhipuhi Road remnants and podocarp broadleaf forest sections of Papanui/ Umuwhawha forest, but also scattered large trees throughout the permit area. Further surveying within the site could be carried out over the summer period while maternity roosts would be in use.

3.5 Animal pests

Possums (*Trichosurus vulpecula*) were observed with the plantation forestry and heard during all kiwi surveys (shrubland, podocarp broadleaf and mixed native and exotic forest). There was evidence of their presence in the Puhipuhi Road remnants (browsing on

kohekohe, droppings and potential canopy dieback) and the shrubland of Papanui/Umuwhawha Forest (potential canopy dieback). Possums will move to feed in native forest, pine plantations and pasture to make use of resources. They are listed as a Suppression Animal in the Northland Regional Pest Management Strategies 2010-2015 (Northland Regional Council 2010). Pest control was being carried out in Papanui/Umuwhawha by DOC (leghold traps) and on private properties for possums (Timms traps and shooting) and Mustelids (DOC 200 traps). Other pests which could be present include rats, mice, mustelids (stoats, ferrets and weasels) and feral cats.

4 Summary of notable species

This assessment identified the presence of plants (toatoa, crimson rata and poroporo), birds (black shag, New Zealand pipit and North Island brown kiwi) and kauri snail which have threat classifications or are listed as regionally significant. Additional listed species which have been recorded at Puhipuhi outside of this survey are hutu and thismia. Long-tailed bats were not recorded but are present in the wider district. The known and potential distribution of these species across the site is summarised in Table 3.

Table 3: Recorded and potential locations for notable species

Notable species	Recorded locations	Potential locations
Toatoa	Ridge within shrubland (S15)	Main shrubland areas. Infertile ridges, around bogs/other poorly drained land (NZPCN 2016)
Poroporo	Edges of podocarp broadleaf forest at S1, S18 and S23	Across the site at any forest edges including mixed native and exotic vegetation
Hutu	Not recorded during this survey but known from Puhipuhi (Martin and Ogden 2002)	Wet areas of podocarp broadleaf forest or regenerating sites
Thismia	Not recorded, survey outside of flowering	Podocarp broadleaf and shrubland where there is deep leaf litter
NZ pipit	Farmland throughout	Open sites or farmland throughout
Black shag	Flying across the road north of where Papanui/Umuwhawha Forest is adjacent to Mine Road	Any waterbodies across the site
North Island brown kiwi	Papanui/Umuwhawha Forest. Kiwi have been recorded in the Puhipuhi Forest remnants.	Forest, shrubland and pine including fragments near known habitat (see Figure 7)
Kauri snail	Podocarp broadleaf forest and shrubland	Deep leaf litter Podocarp broadleaf forest and shrubland
Long-tailed bat	Not recorded	Podocarp broadleaf forest, shrubland and pine, including edges and clearings
Lizards/ frogs	Not surveyed. One casual observation of geckos heard in shrubland in Papanui/Umuwhawha Forest during kiwi survey	Podocarp broadleaf forest, shrubland and other areas of vegetation

5 Recommendations

This survey does not constitute an Assessment of Environmental Effects, but was produced as a rapid survey with the purpose to provide baseline terrestrial ecology information. If significant native vegetation or habitats are cleared or disturbed a full assessment should be carried out.

Additional surveying should be undertaken if clearance of native forest, shrubland or wetland is proposed. This should include:

1. An ecological assessment of fauna and of vegetation which will be cleared or disturbed. Where habitat contains deep leaf litter this should be undertaken during the flowering season for *Thismia rodwayi*.
2. Further Kiwi call counts or the use of acoustic recorders should be undertaken, if work sites are near potential kiwi habitat identified in this report.
3. Geckos and skinks will be present within forest and shrubland sites. Surveys are recommended if clearance podocarp broadleaf, mixed, riparian, shrubland vegetation is planned. This should be undertaken by a licensed expert that holds a permit to handle these taxa in this area.

Where exploration drilling is undertaken in pasture sites away from native vegetation no further ecological assessment would be recommended.

6 Summary

This assessment identified 168 plant species, 31 bird species and 1 species of kauri snail. Long-tailed bats were not recorded.

The main land cover types are pasture and commercial pine forest. The main native vegetation/ habitat types identified were podocarp broadleaf forest with towai and totara canopy and shrubland with towai and manuka canopy. Other habitats include wetlands, riparian vegetation and areas of mixed native-exotic vegetation.

Regionally significant species or species with threat classifications are present in shrubland (toatoa, hutu, thismia, North Island brown kiwi and kauri snail), podocarp broadleaf forest (crimson rata, hutu, thismia, kiwi and kauri snail), forest edges (kiwi and poroporo), wetlands/waterways (black shag and potentially other bird species) and open pasture (New Zealand pipit). The hutu and thismia are based on records from 1999 and 1982, respectively.

Remaining gaps in our understanding of the terrestrial ecological values of the permit area are:

- The distribution of kiwi outside of Puhipuhi Road remnants and Papanui/ Umuwhawha Forest.
- The presence of long-tailed bats.
- The gecko, skink and frog fauna present.
- The vegetation and fauna present in habitats where access was not granted or were not assessed in this survey (i.e. dammed lakes and several native forest remnants).

Further ecological assessments are recommended if there will be clearance or disturbance of podocarp broadleaf, shrubland, wetland, riparian and mixed native vegetation.

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Appendix 1: Plant Species Inventory

*denotes exotic species

Site number		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	Additional
Ferns and fern allies																									
<i>Adiantum cunninghamii</i>	Common maidenhair								•																
<i>Adiantum hispidulum</i>	Rosy maidenhair											•													
<i>Asplenium bulbiferum</i>	Pikopiko, hen and chicken fern	•								•												•			
<i>Asplenium flaccidum</i>	Hanging spleenwort	•			•				•	•		•	•	•			•	•	•		•	•			•
<i>Asplenium oblongifolium</i>	fork fern	•			•	•				•				•				•				•			
<i>Asplenium polyodon</i>	Sickle spleenwort	•	•				•		•	•			•		•		•					•			
<i>Blechnum discolor</i>	Petipeti, crown fern	•	•			•								•				•				•		•	
<i>Blechnum filiforme</i>	Thread fern	•											•				•	•	•			•	•		
<i>Blechnum fraseri</i>												•										•		•	
<i>Blechnum novae-zelandiae</i>	Kiokio	•		•	•		•	•	•	•	•	•	•			•			•	•	•	•	•		•
<i>Blechnum parrisiae</i>	Rasp fern		•							•				•			•					•			
<i>Cardiomanes reniforme</i>	Kidney fern		•		•									•											
<i>Cyathea dealbata</i>	Ponga, silver fern	•		•			•		•	•	•	•	•	•			•	•	•	•	•	•	•		•
<i>Cyathea medullaris</i>	Mamaku	•		•		•				•	•			•			•		•				•		•
<i>Cyathea smithii</i>	Katote	•																							
<i>Deparia petersenii</i> subsp. <i>congrua</i>													•												
<i>Dicksonia squarrosa</i>	Wheki	•	•	•	•	•	•		•	•		•	•	•		•	•		•	•		•	•	•	•
<i>Gleichenia dicarpa</i>	Tangle fern				•		•	•	•			•		•					•	•		•			
<i>Hymenophyllum demissum</i>														•											
<i>Hymenophyllum dilatatum</i>	Matua mauku, filmy fern	•			•			•														•			
<i>Hymenophyllum sanguinolentum</i>	Piripiri, filmy fern												•									•			
<i>Hymenophyllum</i> sp.													•		•	•									
<i>Hypolepis ambigua</i>		•																				•			
<i>Hypolepis distans</i>									•	•							•		•						
<i>Loxogramme dictyopteris</i>	Lance fern														•			•							
<i>Lycopodium volubile</i>	Climbing clubmoss, waewaekoukou					•				•		•			•				•		•	•			
<i>Lygodium articulatum</i>	Mangemange	•																				•			
<i>Microsorium pustulatum</i> subsp. <i>pustulatum</i>	Kowaowao, hound's tongue	•		•	•			•	•	•		•	•	•								•			

Site number		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	Additional
<i>Microsorium scandens</i>	Mokimoki, fragrant fern	•																							
<i>Paesia scaberula</i>	Lace fern, pig fern	•			•		•		•	•		•						•	•				•		
<i>Phlegmariurus varius</i>	Clubmoss													•											
<i>Pneumatopteris pennigera</i>	Gully fern	•																							
<i>Pteridium esculentum</i>	Rarahue, bracken			•		•	•		•		•	•		•				•						•	•
<i>Pyrrosia eleagnifolia</i>	Leather leaf fern		•				•		•	•	•	•	•		•		•	•				•			•
<i>Sticherus cunninghami</i>	Waekura, umbrella fern											•										•			
<i>Tmesipteris sp.</i>	Fork fern												•	•								•			
Dicot trees, shrubs and lianes																									
<i>Acacia verticillata</i> *	Prickly moses																								•
<i>Accacia sp</i> *																									•
<i>Actinidia deliciosa</i> *	Kiwifruit																							•	•
<i>Alnus glutinosa</i> *	Alder																								•
<i>Alseuosmia banksii</i> var. <i>banksii</i>																			•						
<i>Alseuosmia macrophylla</i>	Toropapa	•	•			•													•			•			
<i>Aristotelia serrata</i>	Makomako, Wineberry	•											•					•				•			
<i>Barberry glaucocarpa</i> *	Barberry							•					•												•
<i>Beilschmiedia tarairi</i>	Taraire			•		•											•	•			•				•
<i>Beilschmiedia tawa</i>	Tawa		•			•												•				•			
<i>Brachyglottis repanda</i>	Rangiora, bushman's friend			•																					
<i>Buddleja davidii</i> *	Buddleia																								•
<i>Calystigia sepium</i> x	Bindweed																				•				
<i>Carpodetus serratus</i>	Putaputaweta								•									•							
<i>Casuarina sp</i> *	Sheoak																								•
<i>Clematis paniculata</i>	White clematis, puawananga					•												•							
<i>Coprosma grandifolia</i>	Kanono	•	•	•	•	•				•	•	•						•	•	•		•	•	•	•
<i>Coprosma lucida</i>	Shining karamu						•	•	•					•					•			•			
<i>Coprosma rhamnoides</i>		•	•	•			•	•	•	•		•	•	•			•	•	•						•
<i>Coprosma robusta</i>	Karamu																			•					•
<i>Coprosma spathulata</i>									•																
<i>Cotoneaster sp</i> *	Cotoneaster							•																	•
<i>Delairea odorata</i> *	German ivy																				•				
<i>Dysoxylum spectabile</i>	Kohekohe		•			•			•								•	•							

Site number		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	Additional
<i>Elaeagnus x reflexa</i> *	Elaeagnus																								•
<i>Elaeocarpus dentatus</i> var. <i>dentatus</i>	Hinau																					•			
<i>Eriobotrya japonica</i> *	Loquat																								•
<i>Eucalyptus</i> sp.*	Eucalyptus																								•
<i>Fraxinus excelsior</i> *	Ash																								•
<i>Fuchsia excorticata</i>	Kotukutuku, tree Fuchsia	•																•							
<i>Gautheria antipoda</i>	bush snowberry				•			•										•				•			
<i>Geniostoma ligustrifolium</i> var. <i>ligustrifolium</i>	Hangehange	•		•		•	•		•	•		•	•	•				•	•		•	•	•		•
<i>Griselinia lucida</i>	Puka																	•							
<i>Hakea sericea</i> *	prickly hakea																		•						
<i>Hebe stricta</i>	Koromiko							•														•			•
<i>Hedycarya arborea</i>	Porokaiwhiri, Pigeonwood	•	•	•	•	•	•	•	•	•		•	•	•			•	•	•			•	•	•	•
<i>Hoheria populnea</i>	Lacebark, hoheria																								•
<i>Hypericum androsaemum</i> *	Tutsan																								•
<i>Jasminum polyanthum</i> *	Jasmine																								•
<i>Knightia excelsa</i>	Rewarewa					•											•	•	•	•	•	•	•		
<i>Kunzea robusta</i>	Kanuka				•		•							•								•		•	
<i>Laurelia novae-zelandiae</i>	Pukatea		•															•							
<i>Leionema nudum</i>	Mairehau															•						•			
<i>Leptecophylla juniperina</i> subsp. <i>juniperina</i>	Prickly mingimingi																		•						
<i>Leptospermum scoparium</i>	Manuka				•		•	•	•	•	•				•	•		•	•	•		•			
<i>Leucopogon fasciculatus</i>	Tall mingimingi		•	•	•	•	•	•			•	•		•		•		•	•			•	•	•	•
<i>Lonicera japonica</i> *	Japanese honeysuckle					•			•	•	•														•
<i>Lophomyrtus bullata</i>	Ramarama																	•							•
<i>Melicytus ramiflorus</i>	Mahoe	•								•	•	•					•	•	•			•	•		•
<i>Metrosideros carminea</i>	Crimson rata	•	•															•				•			
<i>Metrosideros diffusa</i>	white rata																					•			
<i>Metrosideros perforata</i>	Akatea, white rata	•	•	•			•					•	•	•		•	•					•			•
<i>Myrsine australis</i>	Mapau			•		•	•	•	•	•		•	•	•			•	•	•			•		•	•
<i>Oleria rani</i>	Heketara			•	•	•												•				•			
<i>Passiflora tripartita</i> var. <i>azuayensis</i> *	Banana passionfruit																								•
<i>Persicaria decipiens</i>	Willowherb										•														
<i>Pittosporum eugenioides</i>	Tarata, lemonwood																								•

Site number		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	Additional
<i>Populus sp*</i>	Poplar																								•
<i>Pseudopanax arboreus</i>	Whauwhaupaku, five finger			•			•		•											•	•	•			
<i>Pseudopanax crassifolius</i>	Horoeka, lancewood					•												•				•			
<i>Quercus rubra*</i>	Red oak																								•
<i>Ripogonum scandens</i>	Kareao, supplejack		•			•											•	•	•			•			
<i>Roldana petasiti*</i>	Velvet groundsel							•																	
<i>Rubus australis</i>	Tataramoa, swamp bush lawyer		•																•					•	
<i>Rubus cissoides</i>	Tataramoa, bush lawyer		•															•			•	•			•
<i>Schefflera digitata</i>	Pate	•				•				•	•		•					•	•			•			•
<i>Sequoia sempervirens*</i>	Redwood																								•
<i>Solanum aviculare</i> var. <i>aviculare</i>	Poroporo	•																•					•		
<i>Solanum marginatum</i>	Woolly nightshade, tobacco weed																								•
<i>Syzygium australe*</i>	Brush cherry																					•			
<i>Ulex europaeus*</i>	Gorse	•	•	•		•	•		•	•	•	•		•		•		•				•	•		•
<i>Verbena bonariensis</i>	Purple top										•														
<i>Weinmannia silvicola</i>	Towai		•	•			•	•				•	•	•		•		•	•	•	•	•	•	•	•
Monocots																									
<i>Aristea ecklonii*</i>	Aristea			•										•				•							
<i>Astelia hastata</i> (syn. <i>Collospermum</i>)	Widowmaker					•											•					•			•
<i>Astelia solandri</i>	Kaiwharawhara	•	•	•				•	•					•		•	•	•				•			
<i>Austroderia fulvida</i>	Toetoe			•	•						•			•					•		•				
<i>Carex dissita</i>													•						•		•				
<i>Carex lambertiana</i>	Forest sedge			•	•																				
<i>Carex uncinata</i>	Hook sedge	•			•					•		•				•		•	•		•	•			
<i>Carex virgata</i>						•			•	•															
<i>Cordyline banksii</i>	Ti ngahere														•							•			
<i>Cortaderia jubata*</i>	Purple pampas									•				•											
<i>Cortaderia selloana*</i>	White pampas	•	•				•			•	•	•		•								•	•		•
<i>Crocsmia x crocosmiiflora*</i>	Montbretia								•																
<i>Cyperus (exotic)*</i>					•																				
<i>Cyperus ustulatus</i>	Giant umbrella sedge																								•

Site number		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	Additional		
<i>Dendrobium cunninghamii</i>	Pekapeka, winika					•																					
<i>Dianella latisma</i>									•													•					
<i>Dianella nigra</i>	Turutu		•		•	•	•	•	•	•		•		•				•	•					•			
<i>Earina autumnalis</i>	Raupeka, Easter orchid		•										•		•			•				•					
<i>Earina mucronata</i>	Bamboo orchid, peka-a-waka																•										
<i>Eleocharis sphacelata</i>	Kutakuta, tall spike sedge				•																						
<i>Freycinetia banksii</i>	Kiekie					•										•	•	•			•	•	•				
<i>Gahnia pauciflora</i>	Cutting sedge																				•						
<i>Gahnia setifolia</i>	mapere, razor sedge	•		•			•	•		•				•					•			•	•	•			
<i>Isolepis reticularis</i>					•																						
<i>Juncus pallidus</i>	Giant rush			•	•		•			•	•																
<i>Microlaena avenacea</i>	bush rice grass									•				•													
<i>Microlaena stipoides</i>	meadow rice grass	•																					•				
<i>Oplismenus hirtellus subsp. Imbecillis</i>	Basket grass					•			•	•			•				•	•							•		
<i>Phormium tenax</i>	Harakeke, flax							•	•													•			•		
<i>Pterostylis sp.</i>	Greenhood orchid (not in flower)																			•							
<i>Rhopalostylis sapida</i>	Nikau	•				•											•	•			•		•				
<i>Schoenus tendo</i>	kauri sedge													•													
<i>Tradescantia fluminensis</i> *	Wandering jew					•																					
<i>Typha orientalis</i>	Raupo				•																						
Conifers																											
<i>Agathis australis</i>	Kauri	•					•								•		•					•					
<i>Cupressus macrocarpa</i> *	Macrocarpa																								•		
<i>Dacrycarpus dacrydioides</i>	Kahikatea	•		•			•		•		•		•				•	•			•		•		•		
<i>Dacrydium cupressinum</i>	Rimu		•	•		•	•									•	•	•	•			•	•		•		
<i>Phyllocladus toatoa</i>	Toatoa														•												
<i>Phyllocladus trichomanoides</i>	Tanekaha						•	•	•						•				•			•					
<i>Pinus radiata</i> *	Radiata pine	•	•	•		•	•			•									•			•	•	•	•	•	
<i>Podocarpus laetus</i>	Hall's totara			•										•				•	•			•			•		
<i>Podocarpus totara</i>	Totara	•			•		•		•	•	•	•	•	•		•	•	•	•		•	•			•		
<i>Prumnopitys ferruginea</i>	Miro	•																•				•					

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Dicot herbs																									
<i>Acaena anserinifolia</i>	Hutiwai, pipiriri, bidibid																	•							
<i>Ageratina adenophora</i> *	Mexican devil										•	•													
<i>Ageratina riparia</i> *	Mistflower		•	•														•							
<i>Centella uniflora</i>	Centella						•		•			•												•	
<i>Digitalis purpurea</i> *	Foxglove									•		•		•			•						•		•
<i>Gamochaeta sp</i> *	Cudweed											•													
<i>Geranium sp.</i> *	Herb Robert																	•							
<i>Haloragis erecta subsp. Erecta</i>	Toatoa					•												•							
<i>Jacobaea vulgaris</i> *	Ragwort	•								•											•				
<i>Lobelia anceps</i>	NZ lobelia						•																		
<i>Nertera dichondrifolia</i>	Nertera				•					•				•				•	•						
<i>Phytolacca octandra</i> *	Inkweed										•														
<i>Ranunculus sp</i> *	Buttercup				•																				
<i>Rubus fruticosus agg.</i> *	Blackberry	•				•		•	•			•						•							•
<i>Solanum nigrum</i> *	Black nightshade									•							•								