Te Ngahere
Native Forest Management

Puketāpapa- Pukewīwī/ Mt Roskill Assessment of Ecological Effects

Ecological Restoration and Consultancy

Puketāpapa- Pukewīwī/ Mt Roskill Assessment of Ecological Effects

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Te Ngahere

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1 Introduction

Applicant(s):	Tūpuna Maunga Authority/ Auckland Council
Site address:	1109 Dominion Road, Mount Roskill, Auckland 1041
Legal description:	Section 1 SO 454876
Site Area:	90,730m^2
Operative Plan:	Auckland Unitary Plan Operative in part (updated 25 July 2019) (Auckland Council, 2019b)
Zoning:	Open Space - Conservation Zone
Overlay(s):	Historic Heritage, Outstanding Natural Feature, Quality-Sensitive Aquifer Management Area, Regionally Significant Volcanic View shaft and Height Sensitive Areas.

Puketāpapa is managed by the Tūpuna Maunga Authority supported by Auckland Council. The maunga is a sacred place for mana whenua. Tūpuna Maunga Authority (2016) noted in reference to maunga Wairuatanga/ spiritual value that:

"They are taonga tuku iho (treasures handed down the generations) and inspire reverence and aroha.

The Tūpuna Maunga are restorative nourishing places. This is an expression of the inherent connection between people and place.

Protection and enhancement of the mauri and wairua of the Tūpuna Maunga is paramount.

The tihi is the most sacred part of the maunga to mana whenua and this will be reflected in the nature of activities that are appropriate on different parts of the maunga."

It is proposed that in order to restore the tihi/summit, removal of exotic trees is undertaken to open up sightlines in conjunction with native plantings in appropriate areas to increase native biodiversity values without impeding sightlines or affecting archaeological sites. This report covers the ecological effects of these proposed works on Puketāpapa outlined in:

1. Arborlab- *Puketapapa tree removal methodology*
2. Te Ngahere *Puketāpapa- Pukewiwi/ Mt Roskill Planting Plan 2019*

This report only covers ecological effects and does not cover amenity and arboricultural effects of exotic tree removal.

1.1 Site description

Puketāpapa is located within the Puketāpapa Local Board and is administered by the Tūpuna Maunga Authority with some infrastructure maintained by Watercare and some adjoining government body land administered.

Land use includes cultural activities, parking, underground reservoir and/or associated infrastructure, dogs (leashed) (Tūpuna Maunga Authority, 2016) and vehicle access to below the tihi/ restricted access to the tihi.

The geology of the site includes main rock of basalt (scoria bassanite) and lithic tuff (lapilli tuff) (GNS Science, 2016). The site has no streams present with some over land flows paths that connect to the Te Auaunga Awa/ Oakley Creek catchment (Waitematā Harbour receiving environment) (Auckland Council, 2019a).

The site does not contain any current native ecosystems (Auckland Council, 2019a) with vegetation/ trees scattered across the site dominated by exotic species, with fewer natives also present.

1.2 Methodology

Site visits were undertaken in July and August of 2019 including a walkover survey of the whole site noting existing ecological values. A literature and botanical collections search and review of the Auckland Unitary Plan were also undertaken in order to assess the current and historical ecological values of the site.

2 Ecological values

2.1 Historical vegetation

The vegetation of the maunga has been influenced historically by Māori land use, quarrying, planting and farming practices. This is reflected by the open nature of most of the site with a range of large exotic trees, dominance of kikuyu grass (*Cenchrus clandestinus*) and scattered areas of native trees and grasses present today.

Based on Auckland Council (2019a) the site has been broadly categorised as potential WF7 Pūriri, podocarp, broadleaf forest/ngahere prior to human influence. WF7 - Pūriri Ngahere is an ecosystem type present in highly fertile areas associated with volcanic and alluvial deposits, which is now classified as Critically Endangered in the Regional IUCN Threat Status (Singers et al., 2017). Three distinct variations of this ecosystem type occur, dependent on characteristics associated with differences in alluvial components and volcanic composition of the soil (Singers et al., 2017). For Puketāpapa WF7 variant has not been listed by Auckland Council (2019a). However historically it would have included variant WF7.2 known as "rock forest" due to the volcanic influences.

In all cases for WF7, pūriri (*Vitex lucens*) is present as a significant component within the mixed broadleaf canopy. Other prominent species include kohekohe (*Dysoxylum spectabile*), karaka (*Corynocarpus laevigatus*), and taraire (*Beilschmedia tarairi*), with additional species composition varying dependent on soil and site characteristics. Podocarps including kaihikatea (*Dacrycarpus dacrydioides*) and tōtara (*Podocarpus totara* var. *totara*) would be present as secondary successional species along with a mix of smaller broadleaf species (Singers et al., 2017).

Tāmaki Makaurau has had human occupation for around 1000 years (Tūpuna Maunga Authority, 2016). Historic management of the site is likely to have been similar to other maunga including clearance of tall vegetation replaced with native grasslands such as pātītī (*Microlaena stipoides*) and *Rytidosperma* spp., in addition to cultivated areas with large gardens extending into surrounding fertile lands (Esler, 2004; Tūpuna Maunga Authority, 2016; Burns et al., 2013).

Esler (2004) discusses pasture management on Auckland maunga and notes that following European settlement many of Auckland's maunga were extensively quarried. Once these were returned to pasture, kikuyu and buffalo grass were often used to cover scars of miss-management. Kikuyu spread across many of the maunga and cattle were used to control its spread and minimise the increased fire risk Esler (2004) has described the site in 1974 as being "*Grossly infested with thistles and other short term weeds and diminished pasture (with Microlaena, ryegrass and cocksfoot) through severe grazing. Sparse kikuyu grass*".

2.2 Existing vegetation

The vegetation of Puketāpapa does not include any areas designated as Significant Ecological Areas under the Auckland Unitary Plan (Auckland Council, 2009b), but includes small amounts of native plantings and open areas with a mix of native and exotic tree species which are outlined in Figure 1 and Table 1.

Figure 1: Outline of vegetation areas on Puketāpapa

Table 1: Vegetation on Puketāpapa (for a full list of exotic trees see Arborlab 2019).

* indicates species included in the RPMP (Auckland Council, 2019c).

Vegetation Area	Native vegetation	Exotic vegetation
A Open kikuyu grass with native and exotic amenity trees and harakeke plantings.	Native vegetation within this area includes: Amenity gardens beside the road with pōhuehue (*Muehlenbeckia complexa* var. *complexa*). Planted harakeke (*Phormium tenax*) areas with tī kōuka (*Cordyline australis*). Amenity native trees including pūriri (*Vitex lucens*), pōhutukawa (*Metrosideros excelsa*), kōwhai (*Sophora microphylla*) and tōtara (*Podocarpus totara* var. *totara*). Native plants growing in the phoenix palms include para (*Pteris tremula*), taupata (*Coprosma repens*), huruhuruwhenua (*Asplenium oblongifolium*) and karo (*Pittosporum crassifolium*)	This area is dominated by open areas of kikuyu grass with occasional exotic trees. Exotic trees include an avenue of large phoenix palms (*Phoenix canariensis*)* along with occasional silver poplar (*Populus alba*). The phoenix palm are host to a number of native and exotic epiphytes including Morten bay fig (*Ficus macrophylla*)* and tuber ladder fern (*Nephrolepis cordifolia*).
B Native and exotic canopy with areas of mown understorey including pātītī.	Key native canopy species include pūriri, pōhutukawa and clusters of nīkau (*Rhopalostylis sapida*). Within the understorey there are occasional patches of pātītī grass (*Microlaena stipoides*) and naturally regenerating tī kōuka, karamū (*Coprosma robusta*), taupata, coastal karamū (*Coprosma macrocarpa*), porokaiwhiri (*Hedycarya arborea*) and karo.	Exotic trees within this area include large evergreen magnolia (*Magnolia grandiflora*), box elder (*Acer negundo*), tree privet (*Ligustrum lucidum*)*, *Prunus* sp., Morten Bay fig (*Ficus macrophylla*)* and Brazilian pepper tree (*Schinus terebinthifolius*)*. In addition to these there are a number of exotic conifer species such as Himalayan cedar (*Cedrus deodara*), Japanese cedar (*Cryptomeria japonica*), atlas cedar (*Cedrus atlantica 'Glauca'*), Norfolk Pine (*Araucaria heterophylla*) and coast redwood (*Sequoia sempervirens*). Occasional weed seedlings or groundcovers through the area include woolly nightshade (*Solanum mauritianum*)*, phoenix palm*, tradescantia* (*Tradescantia fluminensis*), Rhamnus* (*Rhamnus alaternus*) seedling, Italian jasmine* (*Jasminum humile*), cotoneaster* (*Cotoneaster glaucophyllus*), panic veldt grass (*Ehrharta erecta*), kikuyu grass (*Cenchrus clandestinus*) and grey sedge (*Carex divulsa*)*.
C Former quarry area dominated by weed species with occasional native shrubs or ferns.	Around the top of the quarry clusters of native species are present including karamū, kawakawa (*Piper excelsum* subsp. *excelsum*), tarata (*Pittosporum eugenioides*), kōhūhū (*Pittosporum tenuifolium*), karo, whaririki (*Phormium cookianum* subsp. *hookeri*) and pōhuehue. Small pockets below the quarry face also include pātītī among exotic	The quarry slopes and top include manna ash (*Fraxinus ornus*), spindle tree (*Euonymus europaeus*) *and Cotoneaster* sp. Below the quarry also includes common river oak (*Casuarina cunninghamiana*) and manna ash. A mature Rhamnus was also noted. Quarry slopes and face also includes a range of low growing weed species that are smothering most of the surface this includes kikuyu grass, gorse* (*Ulex europaeus*), mist flower* (*Ageratina riparia*),

Vegetation Area	Native vegetation	Exotic vegetation
	grasses (see Figure 4) with occasional native trees including pōhutukawa and kānuka (*Kunzea robusta*). Several fern species were also noted through this area including huruhuruwhenua (*Asplenium oblongifolium*), pāraharaha (*Microsorum pustulatum* subsp. *pustulatum*) and ota (*Pyrrosia eleangnifolia*). Woolly rock fern (*Cheilanthes distans*) was also present in clumps on the quarry face where not being out-competed by kikuyu (See Figure 2).	periwinkle* (*Vinca major*), Italian jasmine* and smilax* (*Asparagus asparagoides*). Of these species kikuyu and mist flower appear to be smothering the largest area of the quarry face.
D Open kikuyu grass area with occasional amenity trees and a cluster of holm oaks and pōhutukawa with pātītī.	This area includes some occasional native canopy/ amenity trees including tī kōuka, pōhutukawa and ngaio (*Myoporum laetum*). Below an area of exotic holm oak canopy (*Quercus ilex)*) and pōhutukawa some natural regeneration is taking place including kawakawa, karamū, karo, Pseudopanax sp, nīkau, parapara (*Pisonia brunoniana*) and pātītī grass among exotic grasses.	This area is dominated by open areas of kikuyu grass with occasional single or groups of mature exotic amenity trees. Key species include fan palm (*Washingtonia robusta), Prunus sp.*, manna ash (*Fraxinus ornus*) and a grove of holm oak. Exotic grasses in the holm oak understorey include panic veldt grass and grey sedge* competing with native pātītī. Other weed species around the boundary of the maunga include arum lily* (*Zantedeschia aethiopica*), nasturtium (*Tropaeolum majus*), woolly nightshade, agapanthus* (*Agapanthus praecox*), ginger* (*Hedychium gardnerianum*) and spider plan (*Chlorophytum comosum*).
E Tihi area, primarily open grass with a roundabout garden.	Native species within this area include a planted amenity garden in the roundabout with tī kōuka, taupata (*Coprosma repens*), karo, mikoikoi (*Libertia ixioides* 'Goldfinger') and whahariki (*Phormium cookianum* subsp. *hookeri*). A bare garden within the reservoir area also holds some tī kōuka.	This area is dominated by open kikuyu grass and an area of reservoir with mowed grass. A small garden area within the reservoir currently only holds *Prunus* sp.
F Open kikuyu area with occasional amenity tree and a cluster of Himalayan cedar.	This area is dominated by exotic species with only occasional native species regenerating under exotic canopy including kawakawa, karamū, karo, taupata, tī kōuka, karaka and small pockets of pātītī grass on edges of conifer canopy. A single parapara sapling was also noted. On the slopes below the tihi among dense kikuyu grass a native piri piri (*Acaena novae-*zelandiae) was also noted.	This area is dominated by open area of kikuyu grass and patches of exotic trees. This includes most commonly Himalayan cedar (*Cedrus deodara*), but also Yunnan poplar (*Populus yunnanensis*), English hawthorn (*Crataegus laevigata*) and monkey apple* (*Syzygium smithii*). Occasional low growing weed species such as bear's breeches (*Acanthus mollis*), tradescantia*, grey sedge*, nasturtium (*Tropaeolum majus*), black nightshade (*Solanum nigrum*), jasmine* (*Jasmine polyanthum*), English ivy* (*Hedera helix*) and Italian arum* (*Arum italicum*). Weed trees naturally regenerating within the area include Japanese spindle* (*Euonymus japonica*) and woolly nightshade*.

Figure 2: Quarry face in Vegetation Area 2 with kikuyu grass encroaching from the top and scattered patches of native woolly cloak fern on areas of open rock face along with weeds such as smilax and mistflower.

Figure 3: Bare understorey of Himalayan cedar with occasional natives such as kawakawa

Figure 4: Pātītī among exotic grasses below sheoak canopy

Overall open areas are dominated by open pasture rank with kikuyu grass with scattered trees primarily exotic. This includes 160 exotic trees (37 species) and 82 native trees (10 species) (Arborlab, 2019).

Exotic trees, climbers and groundcovers noted that have Auckland Regional Pest Management Plan (Auckland Council, 2019c) include but are not limited to monkey apple, Chinese privet, tree privet, Japanese spindle, Japanese honeysuckle, tradescantia, phoenix palm, smilax, Brazilian pepper tree, English ivy, mistflower, periwinkle and woolly nightshade. Please see Appendix B for a full list of exotic species and RPMP designations.

Native plants are largely restricted to occasional amenity trees and gardens, some fern species around the quarry, small amounts of natural regeneration under native and exotic trees and pātītī grass in shaded areas.

These areas are of low ecological value.

2.3 Threatened ecosystems and plant species

Puketāpapa contains three tree species with National threat status (de Lange et al., 2018), with two Myrtaceae species Threatened (Nationally Vulnerable) due to the threat of myrtle rust (Table 2).

Table 2: Summary of threatened vascular plant species of Puketāpapa

Name	National threat status (de Lange et al., 2018)	Auckland threat status (Stanley et al., 2005)	Notes
Kānuka (*Kunzea robusta*)	Species now considered Threatened (Nationally Vulnerable) due to the unknown potential effect of Myrtle Rust. Qualifiers include designated and data poor.		
Parapara (*Pisonia brunoniana*)	At Risk- Relict (qualifier threatened overseas)	Regionally Endangered	Natural populations are largely restricted to offshore islands but would have previously been in Auckland. Likely to have established from nearby planted specimen tree. Presence is not significant.
Pōhukukawa (*Metrosideros excelsus*)	Species now considered Threatened (Nationally Vulnerable) due to the unknown potential effect of Myrtle Rust. Qualifiers include designated and data poor.		Throughout, likely a mix of planted and self-established.

2.4 Ecological function

The site is not a Significant Ecological Area. However given the number of mature exotic and native trees across the site it will be providing some ecological functions within the site and the wider ecological context. This includes:

1. Stepping stone function. The surrounding areas have no close areas of significant vegetation the closest areas being at Lynfield Reserve (1.8km), Te Tātua a Riukiuta/ Big King Reserve (1.9km) and Alan Wood Reserve (1.9km). Vegetation therefore may provide intermittent habitat for species with the ability to disperse at this scale and would limit species that require greater ecological integrity or smaller distances.
2. Ecosystem services. This could include functions such as nutrient cycling and

purification of air provided by larger trees.

2.5 Auckland Unitary Plan

The area has a no Significant Ecological Area overlays across from the Auckland Unitary Plan (Auckland Council, 2019b).

2.6 Fauna

2.6.1 Birds

Native bird species observed during site visit included: riroriro/grey warbler (*Gerygone igata*), pūkeko (*Porphyrio melanotus*) and kōtare (*Todiramphus sanctus*). These species are listed as not threatened (Robertson et al., 2017). Additional urban native species likely to use this site include native kererū (*Hemiphaga novaeseelandiae*), tūī (*Prosthemadera novaeseelandiae novaeseelandiae*) and pīwakawaka/fantail (*Rhipidura fuliginosa placabilis*).

Introduced species noted include song thrush (*Turdus philomelos*), blackbird (*T. merula*), Indian myna (*Acridotheres tristis*), rock pigeon (*Columba livia*) and skylark (*Alauda arvensis*). The rock pigeon appear to be in particular abundance and are utilising the large phoenix palms for roosting.

Bird species observed on Puketāpapa on iNaturalistNZ include native kererū and tūī and exotic spotted dove (*Streptopelia chinensis tigrina*) and blackbird (*Turdus merula merula*) (iNaturalistNZ 2019).

Native birds will be using both native and exotic trees across the site for habitat including feeding, roosting and breeding.

2.6.2 Bats

Crewther (2016) modelled the distribution of long-tailed bats for Auckland Council. Puketāpapa is located within an area considered not to be suitable habitat under the model. The model considers distance to roads and rivers, temperature, land cover, population density, elevation and precipitation.

2.6.3 Reptiles/ Herpetofauna

No formal herpetological survey has been undertaken as part of this assessment. However it is likely that the site is dominated by plague skink (*Lampropholis delicata*) which has an RPMP status for sustained control (Auckland Council 2019c). It is possible that native copper skink (*Oligosoma aeneum*) are present at the site, they have been recorded on inaturalist 2019 as being elsewhere in the Puketāpapa Local Board. Copper skink is considered not threatened (Hitchmough et al 2016) and the likelihood of any other native skinks or geckos being present is low.

2.6.4 Invertebrates

No surveys were undertaken. However is likely that that diversity would be low especially within open areas due to the historical habitat loss on the site and dominance of kikuyu as pasture.

2.6.5 Animal pests

Animal pests are present on the maunga including rats (*Rattus* spp.) and possums (*Trichosurus vulpecula*) and contractor control is currently being undertaken (see section 3.2.2).

2.7 Biosecurity

The Tūpuna Maunga Authority has a programme of environmental weed control and animal pest control (as discussed on page 19).

Myrtle rust (*Austropuccinia psidii*) is a risk for the site as a significant proportion of the vegetation is established pōhutukawa trees. Some risk will be reduced through the removal of exotic myrtle species such as eucalyptus and monkey apple. However, there is also a risk to the site through the introduction of new nursery stock of mānuka, kānuka and *Metrosideros* species in the proposed restoration plantings.

Kauri dieback (*Phytophthora agathidicida*) is not a risk for the site as no kauri (*Agathis australis*) are present, although a single kauri was noted in a neighbouring property adjacent to area D (Figure 1).

3 Assessment of Ecological Effects

3.1 Proposed works

The proposed works on Puketāpapa have been initiated to restore the sightlines to and from the tihi and enhance the ecological values of the site. This includes the removal of exotic trees that inhibit tihi sightlines and selective restoration planting where sightlines and archaeological sites will not be disturbed.

3.1.1 Exotic tree removal

Proposed exotic tree removal from the site includes up to 160 exotic trees within the Tūpuna Maunga Authority administered areas. This includes 37 species including 7 species considered to be environmental weed species with an RPMP status. These are outlined below in Table 3 and their Regional Pest Management Plan RPMP status (Auckland Council, 2019c) noted.

Table 3: Key exotic trees to be removed with RPMP status (Auckland Council, 2019c)

Botanical name	Common name	RPMP status
Acer negundo	Box elder	None but is a research priority
Banksia integrifolia	Coastal banksia	Parks- site led, Whole Region- sustained control
Eriobotrya japonica	Loquat	Whole Region- sustained control
Ficus macrophylla	Morten bay fig	Whole Region- sustained control
Ligustrum lucidum	Tree privet	Parks- site led, Whole Region- sustained control
Phoenix canariensis	Phoenix palm	Parks- site led, Whole Region- sustained control
Prunus sp.	Cherry	Unconfirmed species as not in flower or leaf during survey. However three *Prunus* spp. are included on the RPMP.
Schinus terebinthifolius	Brazilian pepper tree	Whole Region- sustained control
Syzygium smithii	Monkey apple	Parks- site led, Whole Region- sustained control

Arborlab (2019) has considered a range of operational requirements in determining trees for removal and proposed methods including archaeological sensitivity, noise, natural features, traffic, topography, built features and modifications, tree features (dimensions, numbers, structure), health and safety, cost and efficiency. The report also outlines two native trees both mature pōhutukawa that may need trimming to allow access for cranes. This includes removal of one branch from each tree to be undertaken by a qualified arborist and not affect overall tree health.

An additional 25 exotic trees are to be retained where crane removal is not possible on the south eastern slope. This includes monkey apple, English hawthorn and Himalayan cedar.

3.1.2 Planting plan

The planting plan (Te Ngahere 2019) includes:

- Low amenity of native species to maintain sightlines and CPTED (Crime Prevention through Environmental Design).
- Pā harakeke, primarily harakeke but also some lower growing natives along edges such as toetoe and pōhuehue.
- Buffer plantings with rongoā species
- Pātītī management areas using herbicide regimes to promote its spread.
- Tītoki, kōwhai and nīkau amenity trees.
- Stump planting as a non soil disturbance method of introducing low growing natives and climbers along the top of the quarried road edge.

Additional areas of Community gardens are proposed with Pā harakeke/ māra kai/ threatened plant gardens but are not part of this application due to requiring further archaeological investigation.

These areas are outlined below in Figure 5. Conservation planting is a permitted activity in Open Conservation Zone and a Discretionary activity for Historic Heritage Places (Category A) (Auckland Council, 2019b). Only indigenous species have been listed for planting for ecological restoration purposes. The planting plan requires eco-sourcing from the Tāmaki Ecological District and/ or culturally appropriate plants to be used.

Figure 5: Proposed planting/ management areas on Puketāpapa from Te Ngahere 2019.

3.2 Existing ecological restoration works on Puketāpapa

The Tūpuna Maunga Authority already undertakes ecological restoration activities on Puketāpapa including the following:

3.2.1 Environmental weed control programme

This includes the targeting of RPMP weed species (below 4m in height) across the Puketāpapa area.

3.2.2 Animal pest programme

Ongoing animal pest control is being undertaken on Puketāpapa. This includes:

- Rabbit control on an as need basis (one night shoot and fumigation).
- Possum control is undertaken using tree-mounted timms traps and has been serviced by contractors ANAJ (August, November, April, June).
- Rat control undertaken by contractors ANAJ.

3.3 Ecological effects

3.3.1 Effects on vegetation

The removal of exotic vegetation and the planting of native plants will have a positive benefit to the vegetation of the site in the following ways:

1. Increase in diversity and connectedness of native plant habitat.
2. Increase in native seed source for the surrounding area.
3. Reduced seed source of RMPP weed species.

Possible adverse effects include:

1. Potential damage to existing native trees such as pōhutukawa, pūriri and nīkau through the removal process of exotic trees.

3.3.2 Faunal effects

Fauna within the site includes native and exotic invertebrates and bird species. There is not considered to be suitable habitat for bats (Crewther, 2016) and herpetofauna have not been covered under this report. The removal of exotic vegetation and the planting native species will have a positive benefit to the fauna of the site in the following ways:

1. Increase in habitat availability for native fauna including birds and invertebrates through an increase in native vegetated areas including low open native habitat preferred by some species of native invertebrates (such as native butterflies) and skinks.
2. Increase in phenology diversity (fruiting and flowering seasons) through the introduction of a wider range of native plant species.

Possible adverse effects include:

1. Loss of exotic habitat including fruit/nectar availability and nesting sites until plantings establish.

2. Disturbance during bird breeding season.

3.4 Biosecurity considerations

The Arborlab (2019) plan also includes the removal of exotic myrtle species (monkey apple, kanooka gum (*Tristaniopsis laurina*), bottlebrush and brush box) that could be potential host plants for myrtle rust reducing the potential innoculum within the area. There is potential for native myrtle plantings to be or become infected with myrtle rust. Species included are in low numbers and include rātā (*Metrosideros diffusa*) and akatea (*Metrosideros perforata*). Mature pōhutukawa (*Metrosideros robusta*) is also throughout the site these could be assessed for myrtle rust prior to introducing rātā and akatea. Any myrtle species planted in the future should be from nurseries that follow the New Zealand Plant Producers Incorporated (NZPPI) nursery protocols for Myrtle rust. No kauri are present onsite or included in the planting plan.

3.5 Summary of ecological effects and proposed mitigation

Table 4: Summary of Assessment of Ecological Effects[1]

Issue	Ecological Effect without mitigation	Recommended avoidance, remediation or mitigation to reduce adverse effects
Vegetation clearance of exotic trees throughout the site	This will be low with: • Temporary loss of vegetation cover and habitat for native and exotic wildlife (e.g. birds and lizards). Mature native trees and existing plantings will be available for refuge. • Removal of some RPMS species removing weed seed sources. • Potential disturbance to surrounding native vegetation.	Overall there will be a positive effect with: • Minimising damage through tree removal methodology including the use of cranes and manual dismantling of the exotic trees ensures minimal damage to surrounding native vegetation. • Continued weed and animal pest control throughout wider site to restore and enhance habitat. • Native planting (as per the scope of works) to reinstate lost vegetation and improve habitat. • Retention of large native trees that already provide food and roosting habitat for native faunal species.
Restoration planting	This will be negligible with potential introduction of myrtle rust (already present within the Auckland Region) through the planting of *Metrosideros* species.	Overall there will be a positive effect with: • Increase in native vegetation cover to provide habitat for native fauna and flora will have a positive effect. • Creation of more continuous habitat areas and increasing the amount of low habitat utilised by some native species.
Disturbance to birds from tree removal	Negligible. Only temporary loss of bird habitat and disturbance during breeding season.	Overall there will be a positive effect with: • Where possible minimise noise and construction activities to outside the peak of the breeding season (August-January). • Continue to carry out animal pest control to support the establishment of native bird populations. This could be increased before, during and after exotic tree removal. • Native planting will replace some lost food sources and create a larger area of potential habitat. • Existing native vegetation on the site is to be retained and will provide some refuge.
Ecosystem function	This would be low with: • Temporary loss of stepping stone function from the removal of 160 exotic trees while native plantings are establishing (as per Scope of works). Some function retained from existing native plants. • Temporary reduction in	Overall there will be a positive effect on ecosystem function with: • Over 8991 native plants being planted (this excludes the community gardens and stump plantings that are pending a trial and any infill planting needed). There will also be an increase in diversity of native species through planting providing more native habitat likely better suited to other indigenous species. • It is also not anticipated that there will be

Issue	Ecological Effect without mitigation	Recommended avoidance, remediation or mitigation to reduce adverse effects
	ecosystem services that will be replaced and enhanced by plantings once established.	a long term loss in ecosystem services due to the variety and number of native plants to be planted.

[1]Note: This report does not cover amenity and arboricultural effects of exotic tree removal.

4 Summary

The proposal by the Tūpuna Maunga Authority to undertake exotic tree removal and restoration planting on Puketāpapa does not include any notable residual ecological effects and will have an overall positive effect on the existing ecological values of the site.

Some potential adverse effects have been noted, and it is recommended that the following is undertaken in addition to the recommendations of Arborlab (2019) and Te Ngahere (2019) plans to minimise potential effects through:

- Continue the existing environmental weed control programme.
- Continue the Animal pest control throughout the site and include additional animal pest control for rats and possums if tree removal occurs outside the months of August, November, January or April.
- Limit the works to outside the main bird breeding season of August – January.

References

Arborlab. 2019. *Puketapapa Tree removal Methodology.* August 2019

Auckland Council. 2019a. *Auckland Council Geomaps.* [Retrieved August 2019] https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html

Auckland Council. 2019b. *Auckland Unitary Plant Operative in part (updated 25 July 2019).* Auckland Council, Auckland.

Auckland Council. 2019c. *Mahere ā-Rohe Whakahaere Kaupapa Koiora Orotā mō Tāmaki Makaurau 2019-2029 Auckland Regional Pest Management Plan 2019-2029.*

Burns, B.R, Dodd, M.B and Hartnett, T. 2013. *Auckland's green volcanic heart: groundcover vegetation and soils of the Auckland volcanic cone reserve network.* Journal of the Royal Society of New Zealand. 43:4, 184-197.

Crewther, K. 2016. *Report on modelled distribution of long-tailed bats in the Auckland Region.* Report prepared for Auckland Council.

De Lange, P.J, Rolfe J.R, Barkla J.W, Courtney S.P, Champion P.D, Perrie L.R, Beadel S.M, Ford K.A, Breitwiesser I, Schönberger I, Hindmarsh-Walls R, Heenan P.B and Ladley K. 2018. Conservation status of New Zealand indigenous vascular plants, 2017. *New Zealand Threat Classification Series 3.* Department of Conservation, Wellington.

Esler, A. 2004. *Wild Plants in Auckland.* Auckland University Press. Auckland.

GNS Science. 2016. *Digitisation of GNS Geological maps (1:50,000 scale).*

Hitchmough, R, Barr, B, Lettink, M, Monks, J, Reardon, J, Tocher, M, van Winkel, D and Rolfe, J. 2016. *Conservation status of New Zealand reptiles, 2015.* Department of Conservation, Wellington.

iNaturalistNZ. 2019. https://inaturalist.nz/ Accessed 08.08.19 and 20.08.19.

Jones, K. L. 2007. *Caring for archaeological sites: Practical guidelines for protecting and managing archaeological sites in New Zealand.* New Zealand Department of Conservation. Wellington.

Robertson, H.A., Baird, K., Dowding, J.E., Elliott, G.P., Hitchmough, R.A.; Miskelly, C.M., McArthur, N., O'Donnell, C.F.J., Sagar, P.M., Scofield, R.P. and Taylor, G.A. 2017. Conservation status of New Zealand birds, 2016. *New Zealand Threat Classification Series 19.* Department of Conservation, Wellington.

Singers N., Osborne B., Lovegrove T., Jamieson A., Boow J., Sawyer J., Hill K., Andrews J., Webb C. 2017. *Indigenous terrestrial and wetland ecosystems of Auckland.* Auckland Council. Auckland.

Stanley, R, de Lange PJ, Cameron, EW. 2005. Auckland regionally threatened and uncommon vascular plants list. *Auckland Botanical Society Journal* 60: 152-157.

Te Ngahere. 2019. Puketāpapa- Pukewīwī/ Mt Roskill planting plan 2019. Prepared for Tūpuna Maunga Authority. Updated 10.10.19

Tūpuna Maunga Authority. 2016. *Tūpuna o Tāmaki Makaurau Integrated Management Plan*. Tūpuna Maunga Authority. Auckland.

Appendix A Native Plant Species Inventory

Table A1: Native plant species inventory

Latin name	Common name(s)	Vegetation Area					
		A	B	C	D	E	F
Gymnosperm trees and shrubs							
Podocarpus totara var. *totara*	Tōtara	■					
Monocotyledonous trees and shrubs							
Cordyline australis	Tī kōuka, cabbage tree	■	■		■	■	
Rhopalostylis sapida	Nīkau		■				
Dicotyledonous trees and shrubs							
Alectryon excelsus subsp. *excelsus*	Tītoki		■				
Coprosma macrocarpa subsp. *minor*	Coastal karamū, large-fruited karamū		■				
Coprosma repens	Taupata	■	■			■	
Coprosma robusta	Karamū	■	■	■			■
Hedycarya arborea	Porokaiwhiri, pigeonwood		■				
Kunzea robusta	Kānuka			■			
Metrosideros excelsa	Pōhutukawa		■		■		
Myoporum laetum	Ngaio				■		
Piper excelsum subsp. *excelsum*	Kawakawa			■	■		■
Pittosporum crassifolium	Karo	■	■	■	■	■	
Pittosporum eugenioides	Tarata, lemonwood			■			
Pittosporum tenuifolium	Kōhūhū, black matipo			■			
Pisonia brunoniana	Parapara						■
Pseudopanax crassifolius x P. lessonii	Hybrid pseudopanax		■		■		
Sophora microphylla	Kōwhai, small-leaved kōwhai	■					
Vitex lucens	Pūriri	■	■				
Dicotyledonous lianes and related trailing plants							
Muelhenbeckia complexa var. *complexa*	Pōhuehue, small-leaved muehlenbeckia, wire vine	■		■			
Ferns							
Asplenium oblongifolium	Huruhuruwhenua, shining spleenwort	■		■			
Cheilanthes distans	Woolly rock fern			■			
Microsorum pustulatum subsp. *pustulatum*	Hound's tongue, pāraharaha			■			
Pteris tremula	Shaking brake, tender brake	■					■
Pyrrosia eleagnifolia	Ota, leather-leaf fern		■	■			
Grasses							
Microlaena stipoides	Pātītī, meadow rice grass, slender rice grass		■		■		■
Monocotyledonous herbs (other than orchids, grasses, sedges, and rushes)							
Libertia ixioides 'Goldfinger'	Mikoikoi, New Zealand iris (cultivar)					■	
Phormium cookianum subsp. *hookeri*	Whaririki			■		■	
Phormium tenax	Harakeke, flax	■					
Dicotyledonous herbs - other than Composites							
Acaena novae-zelandiae	Piri-piri						■

Appendix B Exotic Plant Species Inventory

Table B1: Exotic Plant Species Inventory including RPMP (Auckland Council, 2019c) status for Parks and Whole Region. For a full list of exotic tree species please see Arborlab (2019). PC is Progressive Containment, SC Sustained Control and GNR Good Neighbour Rule.

Latin name	Common name(s)	Parks		Whole Region					Vegetation Area					
		Site-led	GNR	Exclusion	Eradication	Progressive containment	sustained control	GNR	A	B	C	D	E	F
Dicotyledonous herbs - composites														
Ageratina riparia	Mist flower						x				■			
Senecio skirrhodon	Gravel groundsel									■	■			
Dicotyledonous herbs - other than Composites														
Acanthus mollis	Bear's breeches													■
Cymbalaria muralis	Ivy-leaved toadflax										■			
Galium aparine	Cleavers										■			
Gomphocarpus sp.	Swan plant										■			
Myosotis arvensis	field forget-me-not										■			
Solanum nigrum	Black nightshade										■			■
Trifolium repens	White clover										■			
Tropaeolum majus	Nasturtium											■		■
Veronica persica	Scrambling speedwell										■			
Vinca major	Periwinkle						x				■			
Dicotyledonous lianes and related trailing plants														
Araujia sericifera	Moth plant, kapok vine	x	x				x				■			
Hedera helix	English ivy						x				■			■
Jasminum polyanthum	Jasmine	x					x					■		
Lonicera japonica	Japanese honeysuckle	x					x				■			
Dicotyledonous trees and shrubs														
Acer negundo var. *negundo*	Box elder									■				
Casuarina cunninghamiana	Common river oak										■			
Cotoneaster glaucophyllus	Cotoneaster, large-leaved cotoneaster						x			■				
Cotoneaster sp.	Cotoneaster										■			
Euonymus japonicus	Japanese spindle						x							■
Euonymus europaeus	Spindle tree										■			
Ficus macrophylla	Morten Bay Fig									■				
Fraxinus ornus	Manna ash										■	■		

Latin name	Common name(s)	Parks		Whole Region					Vegetation Area					
		Site-led	GNR	Exclusion	Eradication	Progressive containment	sustained control	GNR	A	B	C	D	E	F
Jasminum humile	Italian Jasmine						x							
Ligustrum lucidum	Tree Privet	x					x							
Ligustrum sinense	Chinese privet	x					x							
Magnolia grandiflora	Bull bay, southern magnolia, laurel magnolia, evergreen magnolia													
Populus alba	Silver poplar													
Populus yunnanensis	Yunnan poplar													
Prunus sp.	Flowering cherry													
Quercus ilex	Holm oak													
Rhamnus alaternus	Rhamnus	x	x				x							
Schinus terebinthifolius	Brazilian pepper tree						x							
Solanum mauritianum	Woolly nightshade	x	x				x							
Syzygium smithii	Monkey apple, common lilly pilly	x					x							
Ulex europaeus	Gorse						x	x						
Ferns														
Nephrolepis cordifolia	Tuber ladder fern						x							
Grasses														
Cenchrus clandestinus	Kikuyu grass													
Ehrharta erecta	Panic veldt grass													
Gymnosperm trees and shrubs														
Araucaria heterophylla	Norfolk pine													
Cedrus deodara	Himalayan cedar													
Cedrus atlantica 'Glauca'	Atlas cedar													
Crytomeria japonica	Japanese cedar													
Sequoia semperviens	Redwood													
Monocotyledonous lianes														
Asparagus asparagoides	Smilax, bridal creeper						x							
Monocotyledonous trees and shrubs														
Phoenix canariensis	Phoenix palm, Canary Island date palm	x					x							
Washingtonia robusta	Fan palm													
Rushes and allied plants														

Latin name	Common name(s)	Parks		Whole Region					Vegetation Area					
		Site-led	GNR	Exclusion	Eradication	Progressive containment	sustained control	GNR	A	B	C	D	E	F
Agapathus praecox (most cultivars, from 2022)	Agapanthus	x	x				x							
Arum italicum	Italian arum						x							
Chlorophytum comosum	Spider plant													
Hedychium gardnerianum	Kahili ginger, wild ginger													
Tradescantia fluminensis	Tradescantia						x							
Zantedeschia aethiopica	Arum lily						x							
Sedges														
Carex divulsa	Grey sedge						x							