

**SURVEY AND QUANTIFICATION OF
CLIFFTOP PŌHUTUKAWA FOREST IN
THE ŌRĀKEI WARD, AUCKLAND**
(PŌHUTUKAWA FOREST IN THE ŌRĀKEI WARD)



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1. EXECUTIVE SUMMARY

The Tāmaki Drive Protection Society (the Society) is a locally elected not-for-profit organisation whose main objective is to promote the protection and preservation of Tāmaki Drive and Ōrākei Ward for its amenity, ecological, economic and transport value. As part of their endeavour, the Society has commissioned Wildland Consultants Ltd to carry out a survey of the coastal, clifftop pōhutukawa forest remnants within the Tāmaki Drive/Ōrākei Ward area. The survey consisted of an initial desktop survey focussing on coastal vegetation, and was followed up by a ground truthing survey. Results indicate that the indigenous-dominated vegetation is the most abundant vegetation type, covering approximately 23.3 ha (46%) of the area surveyed. Of the total indigenous-dominated vegetation, pōhutukawa (*Metrosideros excelsa*) forest makes up 64% (which is 29% or 14.8 ha of the total area surveyed). In contrast, exotic-dominated vegetation comprises 5.9 ha (12%).

Some of the indigenous-dominated vegetation, including pōhutukawa forest, is old growth while most is regenerating (60-80 years). Much of the regenerating indigenous vegetation can be characterised as amenity planting, or hosts a range of exotic weeds in the understorey. Furthermore, much of the exposed coastal cliffs along the north-eastern extent of the area surveyed are dominated by exotic weeds including pampas (*Cortaderia selloana*), tree privet (*Ligustrum lucidum*), Chinese privet (*L. sinense*), boneseed (*Chrysanthemoides monilifera*), sweet pea shrub (*Polygala myrtifolia*) and gorse (*Ulex europaeus*). This should be priority area for control and revegetation of indigenous pōhutukawa forest.

2. INTRODUCTION

The Tāmaki Drive Protection Society is preparing a submission to Auckland Council requesting amendments to the regulations that protect coastal vegetation within the Tāmaki Drive Masterplan (2012). To this end, the client has commissioned Wildland Consultants Ltd to undertake a desktop survey, followed by a ground truth survey, of the area within the Tāmaki Drive Masterplan that addresses the following:

- Review of relevant existing ecological information.
- Current schedule of trees and areas of protected vegetation.
- Vegetation analysis including identification of both exotic and indigenous species where possible, particularly coastal pōhutukawa forest.
- Identification of trees of ecological significance that should receive protected status, particularly pōhutukawa.
- Review of threats to ecological viability, including pest plant infestations.
- Recommendations for further study.

Based on the information collated during the ground truth and desktop surveys, broad management recommendations are outlined with the goal of maintaining and improving ecological integrity of natural and planted areas of Tāmaki Drive.

3. BACKGROUND

The Tāmaki Drive Protection Society is a locally elected not-for-profit organisation whose main objective is to promote the protection and preservation of Tāmaki Drive for its amenity, ecological, economic and transport values. In 2012 The Ōrākei Local Board, with strong support from the Tāmaki Drive Protection Society, produced the first draft of the Tāmaki Drive Masterplan (henceforth referred to as ‘the Masterplan’; for a map of area considered within the Masterplan refer to Appendix 1), which was subsequently approved by the Auckland Council. The Masterplan focuses on preserving the unique environment of Tāmaki Drive, which extends from Mechanics Bay to Glover Park from west to east, and Tāmaki Drive to St Heliers Bay Road from north to south; within the Masterplan area are Whenua Rangatira, a large cultural reserve, and Kēpa Bush, a large conservation reserve. The area included in the Masterplan, along with much of urban Auckland, has been subject to policy changes resulting in reduced protection for vegetation, particularly along the coast.

Prior to the Resource Management (Simplifying and Streamlining) Amendment Act 2009, the coastal protection yard¹ required that the natural character of the coastal environment to be retained by means of preventing the destruction in any way of indigenous vegetation and exotic trees of a nominated size. Following the 2009 Amendment, protection of vegetation is limited to individual trees or groups of trees that have been scheduled under the Proposed Auckland Unitary Plan (PAUP), and vegetation within classified Significant Ecological Areas (SEAs). A key objective of the Masterplan is to protect and preserve the natural character of Tāmaki Drive², describing the area as a “seaside village” with “coastal character,” an “environment connecting the land and sea,” and an area with “unique ecology.” Ecologically, the trees are a critically important component of Tāmaki Drive, including their role in forming a wildlife corridor for indigenous fauna, yet the Society fears that many are not protected under any legislation.

4. METHODS

Information was collated primarily from digital resources utilising a variety of databases and websites, particularly from Auckland Council. A desktop vegetation survey was carried out using Google Earth Pro (Version 7.1.5.1557, imagery shot 21/05/2015), Google Street View (imagery shot February 2012) and Quantum GIS (2.10.1) to visually identify vegetation within Tāmaki Drive. Where possible, vegetation was identified down to the species level and categorised as indigenous or exotic. Where species-level or individual specimen identification was not possible, the vegetation was categorised based on its habitat type (e.g. mixed indigenous-exotic scrub, regenerating indigenous coastal forest).

A map of vegetation and habitat types was created, utilising coloured polygons to distinguish between exotic and indigenous vegetation. The area of canopy cover by

¹ Coastal protection yard is defined as a yard measured in a landward direction from mean high water springs (PAUP 2013).

² Tāmaki Drive will henceforth refer to the area included in the Masterplan, and is not limited to the seaside road unless specifically stated.

the aerial view was estimated for both indigenous and exotic vegetation. A ground truth survey was carried out on 13 November 2015 with fine weather and light south-easterly winds. The ground truthing survey involved a roadside survey in areas with vehicle access to quantify the species diversity and density, especially of the understorey. In areas without vehicle access, such as the coastal area between St Heliers Bay and Glover Park, a survey on foot was carried out. Information from the ground truthing survey was collated with that collected during the Stage 1 desktop survey, resulting in habitat descriptions of canopy and sub-canopy vegetation. A list of all plant species identified in the Masterplan area is presented in Appendix 2.

The most recent list of scheduled trees (updated: 16/10/2015) was sourced from Land Information New Zealand (LINZ). Significant Ecological Areas and public space according to the PAUP were also sourced from LINZ. Lastly, all of the coastal cliff areas were compiled based on information provided by Auckland Council that fall within the PAUP Vegetation Management provisions, which apply within 20 metres of the top of a cliff with a slope exceeding 18 degrees where the cliff is located within 150 metres of mean high water spring (MHWS). These protected areas and individual trees are mapped in Figure 2.

The ecological values were evaluated based on background research and surveys, and the potential effects on those values were assessed. Opportunities to avoid, remedy, or mitigate potential adverse effects were investigated.

5. ECOLOGICAL CONTEXT

The study site is centrally located in the Tāmaki Ecological District, at the mouth of the Waitemata Harbour. The Tāmaki Ecological District, which encompasses the heavily urbanised isthmus between the Manukau and Waitemata Harbours, is one of the most modified ecological districts in New Zealand (Lindsay *et al.* 2009). Few areas of indigenous vegetation remain, covering just 11.7% of the Ecological District (Land Cover Database 3¹).

Vegetation in the Tāmaki Ecological District was initially cleared during early Polynesian occupation and then by subsequent rural and urban development. Some kauri (*Agathis australis*) remnants with hard beech (*Fuscospora truncata*) remain on the North Shore and very small patches of volcanic boulderfield remain on volcanic cones. In city parks, there are remnants of lowland forest and fringes of pōhutukawa present on coastal cliffs. Mangroves (*Avicennia marina* subsp. *australasica*) have been reduced from their former extent but are still present in estuaries and harbours (Lindsay *et al.* 2009). Most remaining areas of indigenous vegetation are heavily impacted by edge effects, invasion by introduced animal and plant pests, and their isolation from larger, more contiguous tracts of indigenous vegetation (Myers 2005). Reflecting this pattern of clearance, 32% of Tāmaki Ecological District lies on ‘Acutely Threatened’ Land Environments (land where <10% of indigenous vegetation cover remains; refer to Walker *et al.* 2007).

¹ LCDB3 - Landcare Research *Manaaki Whenua*, 2012.

Prior to human settlement, Auckland's eastern bays from Ōrākei Basin to West Tāmaki Point were probably dominated by pōhutukawa forming a contiguous belt of coastal forest along the steep cliffs and headlands of Tāmaki Drive. In the open areas, mixed coastal broadleaved species forest would have dominated amongst brackish estuarine vegetation and freshwater wetlands in the low lying areas that are now Mission Bay, Kohimarama and St Heliers Bay. Little of these vegetation types remain in the Tāmaki Ecological District, with coastal forest in particular reduced to c.2% of its original extent (Lindsay *et al.* 2009).

Today, Tāmaki Drive is characterised by planted pōhutukawa along the coastal walkway from Okura Point to Achilles Point. Coastal forest dominated by pōhutukawa with occasional karaka (*Corynocarpus laevigatus*), ngaio (*Myoporum laetum*), pūriri (*Vitex lucens*), tarata (*Pittosporum eugenioides*) and karamū (*Coprosma robusta*) still persists in small remnant forests throughout Tāmaki Drive. Mixed exotic shrubland and scrub dominate the open coastal cliffs while pōhutukawa form the dominant canopy along the seaward side of the road. Parks and reserves are characterised by specimen trees of pōhutukawa, sheoak (*Allocasuarina littoralis*), Moreton Bay fig (*Ficus macrophylla*), Norfolk pine (*Lagunaria patersonia* subsp. *patersonia*) and Queensland brush box (*Lophostemon confertus*).

All freshwater wetlands and associated freshwater vegetation along Tāmaki Drive has been drained and filled, and converted into parks and sports fields, while small remnants of brackish estuarine vegetation persist on the south-western coastline associated with Ōrākei Basin.

6. VEGETATION ANALYSIS

A desktop analysis of the c.50 ha vegetation within the boundaries of the Masterplan revealed 34 indigenous species and 78 naturalised and exotic species. These species comprised 20 distinct habitat types (listed in Table 1), which are grouped broadly into four general types in Figure 1. Of those identified, indigenous-dominated vegetation was dominant in the canopy, comprising approximately 23.3 ha (46%) of the total area surveyed. Pōhutukawa was the dominant species visible from desktop analysis, comprising 64% of indigenous vegetation and 29% of total vegetation. Exotic vegetation was dominated by deciduous dominated treeland (51% of exotic species), followed by exotic coastal scrub (12%, including boneseed, gorse, sweet pea shrub and pampas) and exotic grassland (9%). Individual species that were prevalent within the exotic composition were Phoenix palm (*Phoenix canariensis*, 6%), tree privet, Norfolk Island pine (*Araucaria heterophylla*), oak (*Quercus* sp.) and Moreton bay fig (*Ficus macrophylla*; all around 4%). Additionally, 42% of the vegetation analysed comprised mixed indigenous-exotic vegetation (c.21 ha).

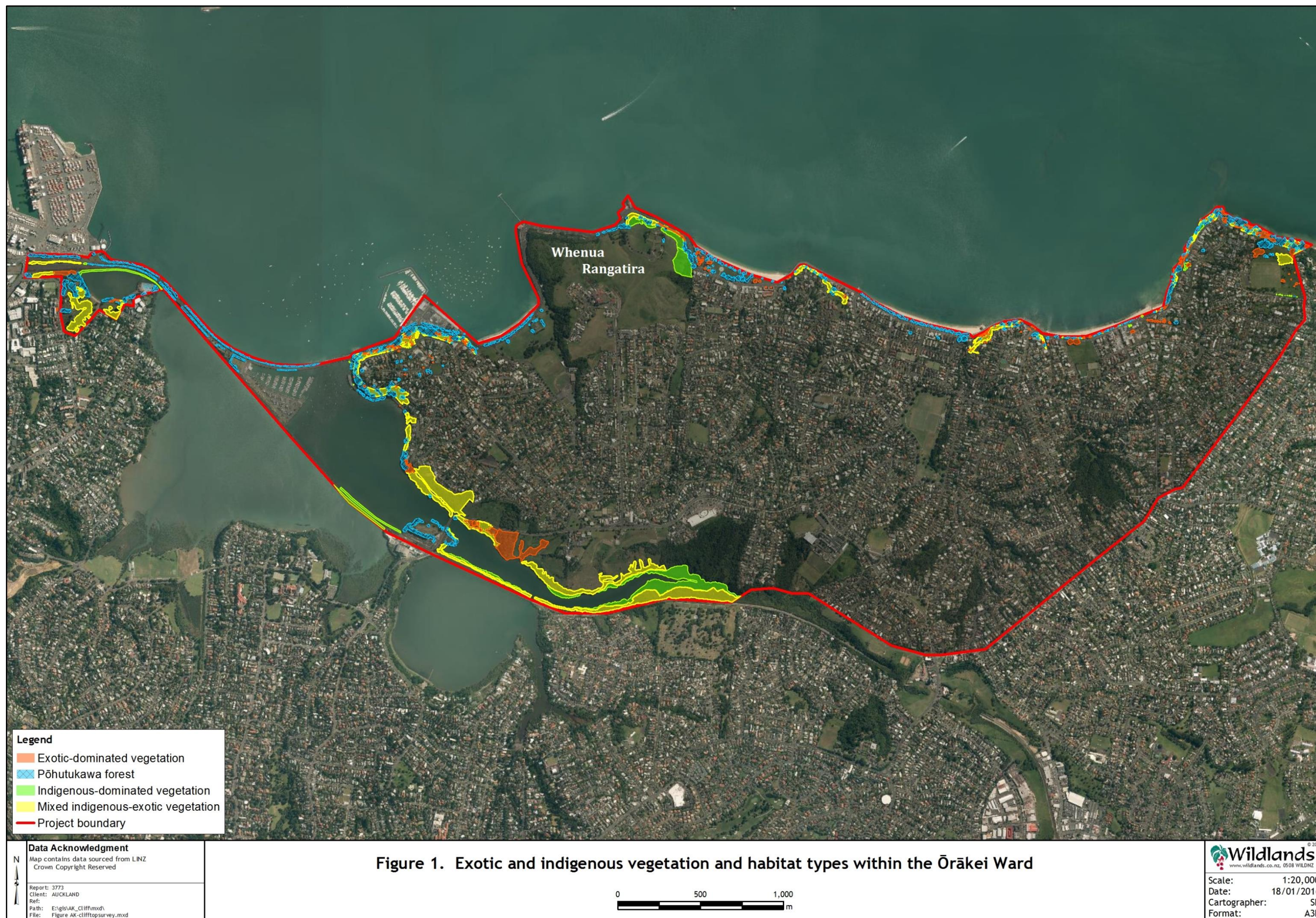


Table 1: Summary of habitat types by area (e = exotic, i = indigenous, m = mixed)

Habitat Type	Area (ha)	Proportion of Total Vegetation Surveyed
Arundo tussockland (e)	0.11	0.2%
Boneseed-gorse shrubland (e)	0.00	0.0%
Boneseed-sweet pea shrub-gorse-pampas shrubland (e)	0.51	1.0%
Common hazel-Norfolk Island Hibiscus treeland (e)	0.09	0.2%
Deciduous dominated treeland (e)	3.23	6.4%
Exotic dominated scrub (e)	0.03	0.1%
Exotic grassland (e)	0.50	1.0%
Exotic treeland (e)	0.82	1.6%
LIGluc or LIGsin treeland (e)	0.24	0.5%
Mangrove scrub (i)	7.04	14.0%
mixed exotic-indigenous forest (m)	0.45	0.9%
mixed exotic-indigenous scrub (m)	4.66	9.3%
mixed exotic-indigenous shrubland (m)	13.34	26.6%
mixed exotic-indigenous treeland (m)	2.50	5.0%
mixed indigenous shrubland (i)	0.18	0.4%
Pampas-agapanthus-gorse-cabbage tree scrub (e)	0.07	0.1%
pampas-bamboo tussockland (e)	0.25	0.5%
Pōhutukawa treeland (i)	14.78	29.5%
Regenerating coastal broad leaf forest (i)	1.32	2.6%
Total Exotic	5.86	11.7%
Total Indigenous	23.32	46.5%
Total Mixed	20.96	41.8%
Total Surveyed	50.14	100.0%

6.1 Protected vegetation within the Masterplan area

6.1.1 Whenua Rangatira

Whenua Rangatira is a reserve dominated by indigenous coastal forest around the headland west of Takaparawhau and Ōkahu Bay, and is co-managed by Ngāti Whātua Ōrākei and Auckland Council. The vegetation within Whenua Rangatira is characterised by regenerating mixed coastal broadleaved species forest, with pōhutukawa-lined cliffs along the seaward side. A comprehensive ecological management plan has been implemented since 2001, with thousands of indigenous plants put in the ground from 2001 to 2012 (Ngāti Whātua o Ōrākei, 2012). As the ecology of Whenua Rangatira is under protection by Ngāti Whātua Ōrākei and Auckland Council, this report has not addressed vegetation within the cadastral boundaries of Whenua Rangatira (Figure 1).

6.1.2 Significant Ecological Areas

Much of the coastal vegetation and marine area within the Masterplan is within an SEA overlay. Under the PAUP, most vegetation alteration or removal within an SEA

requires resource consent, unless falling under certain exceptions¹. However, vegetation removal of 300 m² or less within an SEA for the purpose of building a platform or access way for a dwelling is a Controlled activity. This means that consent is required but will always be granted, sometimes with certain conditions imposed to minimise adverse ecological impacts. This condition reduces the protection to indigenous vegetation within SEAs.

6.1.3 Scheduled trees and groups of trees

All scheduled trees within the Masterplan area are mapped in Figure 2 (and listed in Appendix 3). The scheduled trees are mixed indigenous and exotic species with few pōhutukawa relative to the number present within the Masterplan area; however, many of the pōhutukawa present within the Masterplan area sit within an SEA and/or on public land that is otherwise protected (Figure 2).

All pōhutukawa within the coastal area of Tāmaki Drive and the Ōrākei Ward area should be added to the scheduled trees/groups of trees given they provide significant ecological, amenity and economic values (the latter due to their ability to reduce coastal erosion and stabilise cliffs).

6.1.4 Public space

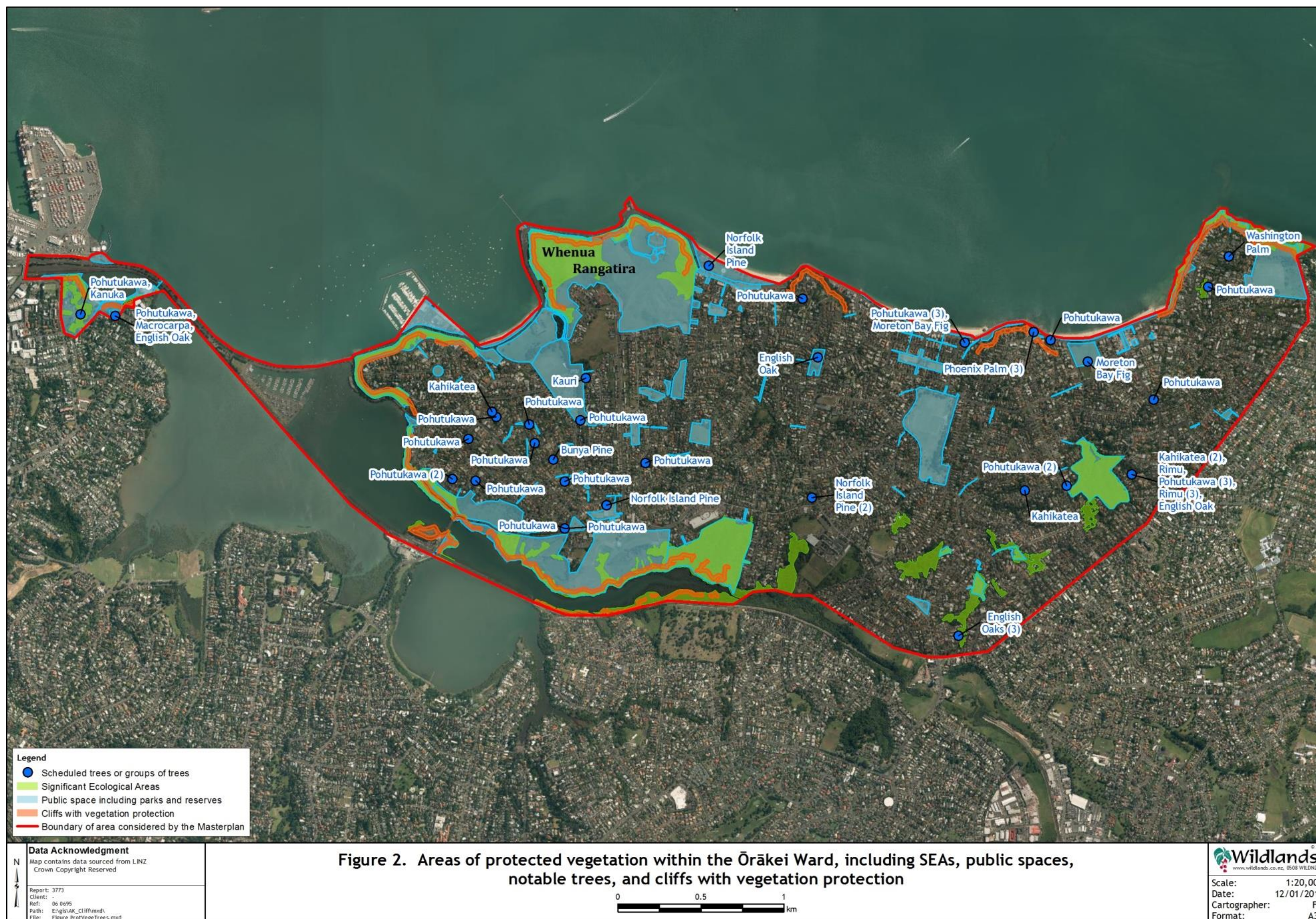
Over twenty land parcels classified as “open public space” under the PAUP are scattered throughout the area considered in the Masterplan. These include areas that range in use from sports and active recreation fields (Glover Park) to informal recreation (Madills Farm Recreation Reserve) and conservation areas (Dingle Dell Reserve). They also range in size from the large Kepa Bush Reserve (13.6 ha) to the small unnamed conservation reserve at 18 and 20 Pamela Place, St Heliers (0.3 ha, combined). Some of the vegetation within these public places has been included in the desktop survey, but will not be ground-truthed due to their already protected status.

6.2 At risk vegetation within the Masterplan area

6.2.1 Private land

Private land accounts for the majority of the area within that considered by the Masterplan. Regardless of whether or not private properties extend to the coast, all within a few hundred metres of the coast provide important ecosystem services for the surrounding public spaces (i.e. beaches), including cliff stabilisation, buffering from storms, and habitat for indigenous flora and fauna. Furthermore, much of the vegetation on private land provides amenity values for people utilising public space along the coast or in reserves, parks and walkways.

¹ Vegetation management in SEAs is permitted in the following situations: biosecurity tree works; deadwood removal; vegetation alteration or removal for routine maintenance and repair of existing tracks, lawns, gardens, fences and other lawfully established activities; vegetation alteration or removal for customary use; emergency tree works; existing forestry and farming activities; pest plant removal; conservation planting; vegetation alteration or removal for routine, maintenance within 3 m of existing dwelling; vegetation alteration or removal for routine, maintenance within 3 m of existing buildings greater than 100 m²; tree trimming within 10 m of existing buildings.



Vegetation within private property is dominated by exotic species, with pōhutukawa being the most common indigenous species.

7. ECOLOGICAL VALUES

Green space is declining in Auckland as urban intensification drives the removal of vegetation and the proportional increase of impermeable surfaces (Wyse *et al.* 2015). The removal of vegetation, particularly indigenous trees, results in a loss of food and habitat resources for indigenous fauna and a reduction in ecosystem services and ecological integrity. Furthermore, aspects of community well-being, natural character and Māori customary values are lost as vegetation in both the public and private domain is altered or removed (Brown *et al.* 2015).

Tāmaki Drive has a rich history from early cultural settlement to modern tourism, recreation and coastal living (Masterplan 2014). The land, sea and ecology of Tāmaki Drive have played an important role throughout its history, with its distinctive coastal cliffs, estuarine and brackish mangroves, as well as wetlands and forests. Within a local context, vegetation within Tāmaki Drive provides valuable habitat for indigenous fauna including birds and skinks. Pōhutukawa, pūriri and karaka which occur along the Drive are valuable food sources for indigenous birds. Tāmaki Drive and its urban forests provide a refuge for indigenous flora and fauna with a predominantly urbanised landscape.

The value of coastal vegetation throughout Tāmaki Drive is reflected by the fact that most of the coastal area is classified as an SEA. As such, vegetation in 15 separate parcels identified as SEAs has been deemed to meet one or more sub-criterion of significance as per the PAUP. These are listed in Table 2 and mapped in Figure 2.

Table 1: Sub-criterion met by one or more of the 15 SEAs within the Masterplan area.

Sub-Criteria Code	CRITERIA MET	Sub-Criteria Met	Site Specific Details
1A	Representative sites	representative of <10% natural extent within Ecological District	Pōhutukawa, pūriri, karaka, broadleaved forest, WF5
2A	Threatened ecosystems	Threatened Ecosystems	Pōhutukawa, pūriri, karaka, broadleaved forest, WF5
2B	Threatened ecosystems	Threatened Species	<i>Anguilla dieffenbachii</i> , <i>Fissidens berteroi</i> , <i>Galaxias maculatus</i> , <i>Haematopus finschi</i> , <i>Himantopus himantopus leucocephalus</i> , <i>Larus novaehollandiae scopulinus</i> , <i>Pimelea tomentosa</i> , <i>Ranunculus acaulis</i> , <i>Sterna caspia</i> , <i>Sterna striata striata</i> (n=10)
2C	Threatened ecosystems	LENZ LVL 4 remaining vegetation	10-20% left, <10% indigenous cover left
3A	Diversity	Habitat diversity	CL1, WF5, SA1

Sub-Criteria Code	CRITERIA MET	Sub-Criteria Met	Site Specific Details
4B	Stepping stones, migration pathways, and buffers	Buffer	Buffers a protected area Buffers an SEA
5D	Uniqueness or distinctiveness	Supports species of type locality for taxon	<i>Acaena novae-zelandiae</i> , <i>Gomphonema novozelandicum</i> , <i>Navicula climacospheniae</i> , <i>Potamogeton cheesemanii</i> (n=4)

Although much of the pōhutukawa are planted and/or are for amenity purpose, the coastal vegetation along the cliffs and walkway of Tāmaki Drive provide a wildlife corridor for indigenous flora and fauna. The reserves and coastal pōhutukawa forests are some of the few remaining areas of indigenous vegetation in the locality, and thus are likely to act as ‘stepping stone’ habitat for mobile fauna travelling across and throughout the Auckland isthmus.

Within a local context, the coastal cliffs dominated by pōhutukawa are considered to have relatively high ecological values. They form a significant portion of the largest area of coastal indigenous vegetation remaining in the eastern bays area. Tāmaki Drive is characterised by a semi-contiguous, narrow band of coastal vegetation along the cliffs and headlands on the landward side of Tāmaki Drive. Interpretation of aerial photography indicates that vegetation was present along these cliffs and the coastal walkway in 1940 (Auckland GIS Viewer), which suggests that most of the larger trees are likely to be over 100 years old.

Due to its size and isolation from large areas of vegetation, forest and scrub habitats within the Masterplan area are essentially all ‘edge’ habitat. This means they do not contain true forest interior conditions such as elevated humidity and shade, and lower temperatures. Edge habitats are also more vulnerable to drying winds and pest plant invasions, some of which are visible in the aerial photography. Despite these conditions, the coastal forest canopy is dominated by pōhutukawa, with floristically diverse regeneration present in isolated areas. As such, the pōhutukawa forest along Tāmaki drive is considered to be a representative example of an ecosystem type that once would have covered much of coastal areas of the Tāmaki Ecological District.

The site likely supports a range of common indigenous bird species, particularly nectar feeding birds such as tūī (*Prosthemadera novaeseelandiae novaeseelandiae*) which feed on flowering pōhutukawa and harakeke (*Phormium tenax*). Coastal forest is also potential habitat for indigenous skinks such as copper skink (*Oligosoma aeneum*). Large-fruited species such as taraire (*Beilschmiedia tarairi*) and karaka are likely to attract kereru (*Hemiphaga novaeseelandiae*) on a seasonal basis.

8. THREATS

Natural areas within the Masterplan face a range of threats, both anthropogenic and natural in origin. As a coastal environment, the area is subject to flooding, erosion and inundation by rising sea levels, intense storms and king tide events. Increasing temperatures as a result of climate change also put vegetation at risk of disease and competition by introduced species that are more suited to warmer conditions.

Evidence of ecological degradation caused by slips is present along the cleared areas of coastal cliffs of Tāmaki Drive, although areas where mature pōhutukawa are present show little if any evidence of erosion or slips. Coastal wetlands and mangrove forests that likely dominated the low-lying basins would have provided buffering during large storm events and flooding.

Inundation of the walkway and road of Tāmaki Drive is common during king and spring tide events, especially when coinciding with storms. On many occasions, Tāmaki Drive has closed due to “wild weather” and “flooding” (NZ Herald 1 September 2015), which is predicted to increase in frequency with climate change (Easterling *et al.* 2009).

In addition to natural threats, anthropogenic activities pose a significant threat to the survival of indigenous flora and fauna, particularly in urban environments. Such threats include clearance for development and the introduction and spread of pest plants. Pest plants are common throughout the project area (exotic tree species comprise c.11% of the canopy and were visually observed throughout the majority of the understorey), some of which occur in locally abundant infestations, particularly where historical clearance of indigenous vegetation has occurred.

Lack of legal protection poses an ongoing threat, which could potentially affect much of the vegetation on private land throughout the Masterplan area. Recent changes in environmental regulation have substantially reduced the protected status of indigenous and exotic trees alike, particularly on private land.

9. RECOMMENDATIONS FOR FURTHER SURVEY

This report covers a relatively small coastal area of the Auckland region, which is becoming increasingly urbanised. Urban forests are becoming less abundant and more isolated across the world’s cities, yet their value is identified in countless rules and policies, community groups, organisations and economic enterprises. As such, the scope for a regional study of Auckland’s urbanised coasts is necessary. It is acknowledged that this is an extensive undertaking, so focussing on the most urban environments is recommended as a priority. These areas include the cliffs around Hobson Bay and next to the Parnell cliffs in the Waitemata Ward which complete the landforms and background to Tāmaki Drive. The value of coastal environments for amenity, ecological and recreational purposes, and their changes over time and threats of survival, are important to document so we may know how to protect, enhance and restore these characteristic environments.

Ideally, large scale studies of state of the environment in regards to coastal pōhutukawa forest, which is such an iconic part of the Auckland region, would be carried out by government agencies. However, such community-lead studies (usually supported by government funding) logically provide more benefit directly to the communities themselves due to the engagement of small-scale and locally-oriented organisation with their surrounding environments. Benefits extend to surrounding communities that witness neighbouring engagement, as well as to future generations who will benefit from base-line information being available within their environment. Therefore, increasing the capacity of community-engaged studies by increasing the funding pool for ecological, social and economic research within a local community is recommended to be provided by government agencies.

Within the Masterplan area, further study to identify as far as practical the location or address of pōhutukawa that are not on the present Schedule of Trees or Groups of Trees under PAUP, nor on public road or reserve land, but are on private land. These trees should be identified and submitted as a subject of later recommendation for addition to the Schedule to ensure they receive protected status.

10. CONCLUSIONS

A desktop survey (Stage 1) was undertaken of clifftop coastal vegetation within the Tāmaki Drive Masterplan, with an emphasis on quantifying the presence of pōhutukawa. The vegetation cover of indigenous and exotic vegetation was quantified using aerial maps of the survey area, which covered c.50 ha. Indigenous-dominated vegetation (c.46%) is common throughout the survey area, of which c.64% is pōhutukawa. Mixed indigenous-exotic scrub is slightly less dominant (c.42%), and exotic-dominated vegetation accounts for c.12%. Although the latter accounts for the smallest area, coastal areas including scarps and cliffs dominated by exotic vegetation are likely to be more prone to erosion and slips (many such slips are visible on historical and current aerial photography). Furthermore, this study was carried out with an emphasis on dominant canopy species and therefore pest plant and exotic vegetation within the understorey or sub-canopy were not taken into account. The ground truthing survey revealed exotic vegetation throughout the understorey of many otherwise indigenous-dominated canopy areas.

Pōhutukawa, along with other broadleaved coastal forest species, provide a range of ecological services. Coastal vegetation is important in reducing coastal erosion and provides buffer during extreme weather events. Furthermore, pōhutukawa along the coastal margin act as a wildlife corridor for indigenous fauna, forming a contiguous band of vegetation around the coast. Pōhutukawa is also important for its amenity value throughout the Auckland region.

The threats of coastal erosion are natural, but have been exacerbated by urbanisation throughout the study area. Furthermore, pest plant infestations that dominate open areas can contribute to the effects of erosion. Indigenous coastal vegetation, particularly pōhutukawa forest along the cliffs, can effectively prevent light-demanding pest plants from establishing. Indigenous species such as pōhutukawa have adapted to extreme coastal conditions and are important in maintaining geological features and reducing coastal erosion (Bergin & Hosking 2006).

One of the most serious threats indigenous coastal forests face in Auckland is the lack of legal protection, particularly on private land. Due to the weakening of the Resource Management Act under the Streamlining and Simplification Amendment (2009), protection of trees has reduced to include only notable trees and groups of trees that were nominated in 2012. The current regulations regarding tree protection permit landowners to remove coastal forest for a multitude of reasons, making the coastline vulnerable to pest plant infestations, erosion and a loss of amenity.

Pest plant control is recommended throughout the coastal area of the Tāmaki Drive and Ōrākei Ward area, along with revegetation of pōhutukawa along clifftops where vegetation has been removed. This recommendation is regardless of whether the coastal area is within private or public land. Many of these coastal cliffs harbour pest plants which are wind-dispersed and therefore have the ability to colonise inner Hauraki Gulf Islands. Furthermore, it is recommended that protected status be granted to all pōhutukawa within the area surveyed, which are not otherwise protected under any legislation, as they provide a range of important ecological, social and economic services.

This report has focused on presenting a quantification of the relative amount of indigenous and exotic-dominated canopy vegetation within the Masterplan area. The Client hopes to use this information as a baseline so that changes in vegetation type and cover can be monitored in the future. Further studies are recommended to extend the Masterplan area from Achilles Point to the Glendowie Boating Club, and to the mouth of the Tāmaki Estuary. This will result in a continuous coastal conservation area throughout the Eastern Bays. This recommendation has the support of the Tāmaki Estuary Protection Society.

Additional studies are recommended to document and quantify coastal forest, with a focus on pōhutukawa, throughout urbanised Auckland.

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MAP OF AREA COVERED
BY THE MASTERPLAN

WHAT DO WE MEAN BY TĀMAKI DRIVE?



Pteris tremula turawera, shaking brake

Monocot. herbs (other than orchids, grasses, sedges, and rushes)

Arthropodium cirratum rengarenga
Astelia banksii kakaha, pūwharawhara, wharawhara,
kōwharawhara
Phormium tenax harakeke, flax

NATURALISED AND EXOTIC SPECIES

Gymnosperms

Araucaria heterophylla Norfolk Island pine
Cryptomeria japonica Japanese cedar
Cupressus macrocarpa macrocarpa
Pinus radiata radiata pine

Monocot. trees and shrubs

Archontophoenix cunninghamiana bangalow palm
Asparagus aethiopicus bushy asparagus
Phoenix canariensis Phoenix palm

Dicot. trees and shrubs

Acacia mearnsii black wattle
Acer pseudoplatanus sycamore maple
Allocasuarina littoralis she-oak
Buddleja salvifolia South African buddleia
Callistemon sp. bottlebrush
Chrysanthemoides monilifera boneseed
Corylus avellana common hazel
Cotoneaster glaucophyllus cotoneaster
Erica lusitanica Spanish heath
Erythrina ×sykesii coral tree
Eucalyptus sp. eucalyptus
Euonymus japonicus Japanese spindleberry
Ficus carica fig
Ficus macrophylla Moreton Bay fig
Lagunaria patersonia subsp. *patersonia* Norfolk Island hibiscus tree
Lantana camara lantana
Ligustrum lucidum tree privet
Ligustrum sinense Chinese privet
Lophostemon confertus Queensland brush box
Lupinus arboreus lupin
Opuntia vulgaris prickly pear
Paraserianthes lophantha brush wattle
Polygala myrtifolia sweet pea shrub

<i>Populus</i> sp.	poplar
<i>Prunus campanulata</i>	Taiwan cherry
<i>Quercus ilex</i>	holm oak
<i>Quercus palustris</i>	pin oak
<i>Quercus robur</i>	English oak
<i>Salix babylonica</i>	weeping willow
<i>Senecio angulatus</i>	Cape ivy
<i>Solanum mauritianum</i>	woolly nightshade
<i>Teline monspessulana</i>	Montpellier broom
<i>Ulex europaeus</i>	gorse

Monocot. lianes

<i>Asparagus asparagoides</i>	smilax
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Dicot. lianes

<i>Anredera cordifolia</i>	madeira vine, mignonette vine
<i>Araujia hortorum</i>	moth plant
<i>Calystegia silvatica</i>	greater bindweed
<i>Hedera helix</i>	ivy
<i>Ipomoea indica</i>	blue morning glory
<i>Jasminum polyanthum</i>	jasmine
<i>Lonicera japonica</i>	Japanese honeysuckle
<i>Vinca major</i>	periwinkle

Ferns

<i>Nephrolepis cordifolia</i>	tuber ladder fern
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Grasses

<i>Arrhenatherum elatius</i> subsp. <i>elatius</i>	tall oat grass
<i>Cenchrus clandestinus</i>	kikuyu grass
<i>Cortaderia selloana</i>	pampas
<i>Dactylis glomerata</i>	cocksfoot
<i>Phyllostachys</i> sp.	bamboo

Sedges

<i>Cyperus papyrus</i>	papyrus
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Monocot. herbs (other than orchids, grasses, sedges, and rushes)

<i>Agapanthus praecox</i>	agapanthus
<i>Clivia</i> sp.	clivia
<i>Crocasmia ×crocismiiflora</i>	montbretia
<i>Hedychium gardnerianum</i>	kahili ginger, wild ginger

Composite herbs

Ageratina adenophora
Cirsium vulgare
Erechtites valerianifolia
Erigeron karvinskianus
Pericallis ×hybrida

Mexican devil
Scotch thistle
Brazilian fireweed
Mexican daisy
cineraria

Dicot. herbs (other than composites)

Acanthus mollis
Brassica rapa subsp. *sylvestris*
Crassula multicava
Daucus carota
Digitalis purpurea
Foeniculum vulgare
Galium aparine
Geranium robertianum
Impatiens sodenii
Myosotis sp.
Phytolacca octandra
Plantago lanceolata
Solanum nigrum
Tropaeolum majus
Vicia disperma

bear's breeches
wild turnip
fairy crassula
wild carrot
foxglove
fennel
cleavers
herb Robert
shrub balsam
forget-me-not
inkweed
narrow-leaved plantain
black nightshade
garden nasturtium
small French tare

LIST OF SCHEDULED TREES WITHIN THE MASTERPLAN AREA (updated:16/10/2015)

ID	Common Name	Botanical Name	Auckland District	#	Location/Street Address	Legal Description	Easting	Northing
87	Pōhutukawa, Kānuka	<i>Metrosideros excelsa</i> ; <i>Kunzea ericoides</i>	Isthmus	2	Gladstone Road, Parnell (Sir Dove Myer Robinson Park)	Pt Allotment 5 SECT 2 SBRS OF Auckland	1759340.75	5920217
88	Pōhutukawa, Macrocarpa, English Oak	<i>Metrosideros excelsa</i> ; <i>Cupressus macrocarpa</i> ; <i>Quercus robur</i>	Isthmus	3	Judge Street 12, Judges bay (St Stephens church/cemetery/ reserve)	Pt Allotment 3 SECT 2 SBRS OF Auckland	1759549.813	5920208
90	Norfolk Island Pine	<i>Araucaria heterophylla</i>	Isthmus	2	Tāmaki Drive 40-44, Mission Bay (Melanesian Mission House)	Lot 2 DP 22640	1763117.25	5920510
91	Phoenix Palm (3)	<i>Phoenix canariensis</i>	Isthmus	3	Long Drive/Tāmaki Drive intersection, St Heliers		1765070.442	5920111
92	Washington Palm	<i>Washintonia filifera</i>	Isthmus	1	Springcombe Road 9, St Heliers	Lot 1 DP 26904	1766244.375	5920568
165	Norfolk Island Pine (2)	<i>Araucaria heterophylla</i>	Isthmus	2	Kohimarama Road 177, Kohimarama	Lot 27 DP 27807	1763736.625	5919117
166	English Oak	<i>Quercus robur</i>	Isthmus	1	Kohimarama Road 65, Kohimarama (Kohimarama Reserve)	Lot 1 DP 28945	1763773.125	5919958
167	Pōhutukawa (3), Moreton Bay Fig	<i>Metrosideros excelsa</i> ; <i>Ficus macrophylla</i>	Isthmus	4	Tāmaki Drive 301, Kohimarama (cnr Sage Road)	Lot 62 DEEDS 326	1764657.688	5920049
168	Moreton Bay Fig	<i>Ficus macrophylla</i>	Isthmus	1	Tāmaki Drive 353-359 (Vellenoweth Green), St Heliers	Pt Allotment 25 DIST OF Tāmaki	1765397.375	5919935
169	Pōhutukawa	<i>Metrosideros excelsa</i>	Isthmus	1	Tāmaki Drive 347, (road reserve outside service station), St Heliers		1765173.416	5920063
170	Pōhutukawa (2)	<i>Metrosideros excelsa</i>	Isthmus	2	Long Drive 106, St Heliers	Lot 2 DP 46553	1765269.625	5919188
239	English Oaks (3)	<i>Quercus robur</i>	Isthmus	3	St Heliers Bay Road 349, St Heliers	Lot 4 DP 205773	1764619.875	5918285
696	Pōhutukawa	<i>Metrosideros excelsa</i>	Isthmus		Selwyn Avenue 31, Mission Bay	Pt Lot 2 DP9001	1763682.375	5920312
697	Pōhutukawa	<i>Metrosideros excelsa</i>	Isthmus		Nehu Street 2A, Ōrākei	Lot 2 DP 193891	1762251.188	5918930

ID	Common Name	Botanical Name	Auckland District	#	Location/Street Address	Legal Description	Easting	Northing
698	Pōhutukawa	<i>Metrosideros excelsa</i>	Isthmus		Ngaio Street 9, Ōrākei	Lot 77 DP 38388	1761715.5	5919217
699	Pōhutukawa	<i>Metrosideros excelsa</i>	Isthmus		Ngaiwi Street 12, Ōrākei	Lot 9 DP 21287	1761673.625	5919468
700	Bunya Pine	<i>Araucaria bidwillii</i>	Isthmus		Paerimu Street 15, Ōrākei	Lot 469 DP 38384	1762182.125	5919344
701	Norfolk Island Pine	<i>Araucaria heterophylla</i>	Isthmus		Reihana Street 106, Ōrākei	Lot 27 DP 46795	1762503.5	5919070
702	Pōhutukawa	<i>Metrosideros excelsa</i>	Isthmus		Reihana Street 42, Ōrākei	Lot 60 DP 37686	1762346.313	5919581
703	Pōhutukawa (2)	<i>Metrosideros excelsa</i>	Isthmus		Sudeley Street 34, Ōrākei	Lot 2 DP 188152	1761575.375	5919227
704	Kauri	<i>Agathis australis</i>	Isthmus		Takitimu Street 50A, Ōrākei	Lot 83 DP 37694	1762377.625	5919834
705	Pōhutukawa	<i>Metrosideros excelsa</i>	Isthmus		Tautari Street 37, Ōrākei	Lot 395 DP 38385	1762071	5919443
706	Pōhutukawa	<i>Metrosideros excelsa</i>	Isthmus		Tautari Street 77, Ōrākei	Lot 1 DP 114386	1762250.625	5919212
707	Pōhutukawa	<i>Metrosideros excelsa</i>	Isthmus		Tautari Street 9, Ōrākei	Lot 345 DP 38385	1761839.625	5919601
708	Pōhutukawa	<i>Metrosideros excelsa</i>	Isthmus		Apihai Street 5, Ōrākei	Lot 2 DP 59108	1762037.75	5919555
709	Pōhutukawa	<i>Metrosideros excelsa</i>	Isthmus		Kurahaupo Street 45, Ōrākei	Lot 296 DP 58659	1762737.375	5919323
710	Kahikatea	<i>Dacrycarpus dacrydioides</i>	Isthmus		Sayegh Street 31, St Heliers	Lot 5 DP 40694	1765016.75	5919160
854	Kahikatea	<i>Dacrycarpus dacrydioides</i>	Isthmus		Tautari Street 5, Ōrākei	Lot 343 DP 45581	1761815.875	5919631
872	Pōhutukawa	<i>Metrosideros excelsa</i>	Isthmus		Clarendon Road 43 & 74, St Heliers	Lot 2 DP 79406	1766119	5920383
909	Pōhutukawa	<i>Metrosideros excelsa</i>	Isthmus		Tuhimata Street 26-28, St Heliers	Lot 1 DP 20407	1765791.875	5919706
997	Kahikatea (2), Rimu, Pōhutukawa (3), Rimu (3), English Oak	<i>Dacrycarpus dacrydioides</i> , <i>Dacrydium cupressinum</i> , <i>Metrosideros excelsa</i> , <i>Quercus robur</i>	Isthmus	9	Parkside Street 27A, B, C, St Heliers	Lot 3 DP 412715	1765660	5919256



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