A Botanical Survey of the Indigenous Forest Remnants in Wellington Botanic Garden, Glenmore Street, Wellington

A report commissioned by
Friends of The Wellington Botanic Garden Incorporated

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Contents

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Summary

This document reports on a botanical survey of the indigenous forest remnants in Wellington Botanic Garden, Glenmore St, Wellington, centred on NZMS 260 Map R27 Pt. Q27 WELLINGTON Grid Reference 580900. The survey was conducted between February and April 2003.

Wellingtonians and visitors to the capital city are fortunate to have these remarkable, indigenous, forest remnants so easily accessible from the Central Business District.

Though depleted, the remnants are still largely representative of Wellington's original, lowland, podocarp-broadleaf forest: their heritage value is exceptional.

There is a substantial backlog of work, accumulated over decades, required to restore these ecosystems to health because over time, their species richness and their natural, restorative processes have been allowed to decline.

Council has invested heavily in assisting other Wellington ecological restoration projects. Now it is essential to invest appropriate resources in the task of restoring and protecting these irreplaceable, indigenous, forest remnants. This work will, of necessity, take some years.

Introduction

Purpose of a Botanic Garden

The 1990 Wellington Botanic Garden Management Plan includes the following definition of a botanic garden: "A collection of growing plants, the primary purpose of which is the advancement and diffusion of botanical knowledge." The Plan goes on to state, "Different botanic gardens focus on different aspects; some on taxonomy, others (on) plant physiology and morphology, and others on botanical education or teaching. But whatever the emphasis, *the aim is the advancement of botany as distinguished from horticulture."* (The emphasis is ours).

Significance of the Remnants

In *The Botanic Garden, Wellington, A New Zealand History 1840–1987*, 1988, Chapter 5, Shepherd and Cook describe the intrinsic value, and the outstanding historical and ecological significance of the Garden's indigenous, forest remnants.

The two passages below, written in different eras, emphasise the significance of the remaining, indigenous, lowland forest in Wellington City, of which the Garden remnants are a significant part:

> "Lowland forest is under-represented in our conservation system and all such remnants are of value although hardly any remain in their virgin state. Both the bush at Otari and in the Gardens are of considerable importance." Dr E.J. Godley. (Source, *The Botanic Garden, Wellington* Winsome Shepherd and Walter Cook. 1988. Millwood Press. Page 78).
>
> "Only 1% of Wellington's original forest remains and most of that is in

Otari Native Botanic Garden. (Source, *Wellington's Living Cloak*, Isobel Gabites. 1993. Wellington Botanical Society and Victoria University Press. Page 13).

Terms of Reference

The survey and report were commissioned in early November 2002 by the Friends of Wellington's Botanic Gardens, in consultation with Tony Williams, Curator/Manager, Wellington Botanic Gardens.

Purpose of the Survey and Report

The purpose of the survey was, "... to re-examine the health and present state of the bush remnants in the Botanic Garden ..." using the published references listed in chronological order below:

Buchanan, John. *Notes on the Colonial Botanic Garden, Wellington and its Flora.* 1875. Unpublished.

Myers, Shona C. *Native Forest Remnants of Wellington City, A Survey of Five Sites.* Biological Resources Centre, DSIR. June 1985.

Shepherd, Winsome and Cook, Walter. *The Botanic Garden, Wellington. A New Zealand History 1840–1987*, Chapter 5. 1988.

Cranshaw, Helen. *Study of the Vegetation in the Seven Native Bush Remnants in the Wellington Botanic Garden*. August 1992.

In addition to the above, a supplementary brief dated 27-11-2002, was received from Winsome Shepherd on behalf of the Friends of Wellington's Botanic Gardens. This brief and our responses are in Section 1 of the report.

Later, it was agreed that updating the taxonomy of Buchanan's 1875 list of naturally occurring indigenous plants, and some of the planted indigenous plants, in the Garden, should be done. In addition, it was decided that the plants which he listed should be grouped according to present-day taxonomic practice.

Scope of Report

The report describes the survey methods used, and comments on the present condition of these five plant communities located in the midst of a predominantly horticultural, urban setting.

The plant lists compiled by Buchanan in 1875 are compared with those listed in the 2003 survey. Lists of adventive plants in, and on the margins of, each remnant are also included.

Recommendations are made about managing the remnants sustainably as natural, indigenous ecosystems. Revision of the boundaries of some of the remnants is also recommended.

Our comments on the Isthmus Group's *Draft Landscape Development Plan for the Wellington Botanical Garden ...* June 2000, are to be found in the Appendix.

Re-surveying Cranshaw's plots was not part of the survey.

Limitations

The area occupied by the remnants today is smaller than that surveyed by Buchanan in 1875.

Autumn was too far advanced for identification of summer-flowering terrestrial orchids to species level, and it was too early for winter-flowering terrestrial orchids to be above ground.

Field Method

We surveyed each remnant by:

- walking its margins
- walking its internal paths and ways
- traversing its stream beds and gully floors
- sidling at different levels
- making forays into selected areas
- listing the indigenous and adventive plants
- making observations in the form of notes
- scanning some of the larger trees, with binoculars, for epiphytes and crown damage.

All measurements were estimated.

Organisation of the Report

Section 1 deals with the supplementary questionnaire and our responses.

Section 2 deals with threats to the remnants, including litter, climate change, invasive plants and introduced, browsing animals.

Section 3 deals with the remnants themselves. For each remnant, numbered field observations are followed by the list of its indigenous plants, followed by the list of its adventive plants.

Section 4 deals with the plant species recorded in this survey and compares them with John Buchanan's 1875 plant list.

Recommendations made about particular issues, are placed following the text where the issue is discussed. A separate list of all the recommendations is in Appendix I.

Names and Definitions

Botanical names are given for each taxon, also Māori and common names where known.

We have used the following acronyms and definitions used by the Forest Research Institute and the Department of Conservation:

d.b.h. diameter at breast height.
seedling 0cm to 135cm high.
sapling > 135cm high and < 3.0cm d.b.h.
TL the side on your left when you are looking downstream or downtrack.
TR the side on your right when you are looking downstream or downtrack.

FINDINGS

SECTION 1: Supplementary Brief and Responses

NOTE: Our responses are based on the assumption that there will be sustained pest animal and pest plant control, and regular monitoring of the condition of the remnants, as recommended later in this report.

1.1 Comment on the present health of each remnant since earlier studies and since possum poisoning.

We believe that possum poisoning which began in 1992 has helped to slow further deterioration of the remnants, but the condition of the crowns of some species, e.g. hīnau, kōtukutuku and kāmahi, is deteriorating. Some substantial hīnau trees have died, and kōtukutuku and kāmahi appear to be dying, almost certainly from drought, with browsing a contributing factor.

According to Manion 1981, there are three factors in forest decline. The theory states that for decline to occur, there must be, (1) a disposing factor such as age; (2) an inciting factor such as drought, and (3) at least one contributing factor such as diseases and insects. (For more information, refer to Appendix II). The first two of these factors are clearly operative now with respect to some hīnau and almost all the kāmahi in the Garden.

The remnants are in a relatively degraded state, and over time, their area has been reduced and encroached upon by horticultural plantings. Restoration to a condition approaching that of pre-European times will take many years of pest animal and pest plant control, and restoration plantings.

Myers 1985, describing plant community types in broadleaved forest, reported that kōtukutuku were abundant in stream valleys in the Garden, however we found very few kōtukutuku trees, only one seedling, and no saplings. We believe this species is in serious decline and close to extinction in the Garden.

Buchanan listed *Raukaua (= Pseudopanax) edgerleyi,* raukawa in 1875, as did Myers in 1985, however we found none. It is almost certain that raukawa is extinct in the Garden.

Although Buchanan listed three species of mistletoes and perching kohukohu, *Pittosporum cornifolium,* neither Myers nor Cranshaw found these, nor did we. It is almost certain that they are extinct in the Garden.

1.2 Are there areas of bush where invasives such as agapanthus are to be found and where physical interference is required?

Yes. Dense plantings of agapanthus were noted in the Play Area section of the Australian Garden / Play Area remnant. Even where they are not inside remnants, only alongside, they have the potential to be invasive, especially with climate warming. We would prefer the use of e.g. rengarenga, or whaririki, native plants ideal for groundcover in lightly shaded areas.

Infestations of tradescantia were noted, e.g. in Stable Gully, below Scrub Path, and in Glen Slope remnant above Mamaku Way. About seventy other invasive species are referred to elsewhere in our report.

1.3 Comment on the invasiveness of *Pittosporum ralphii; Myrsine australis*/māpou; *Corynocarpus laevigatus*/karaka; *Rhopalostylis sapida*/nikau.

Pittosporum ralphii

We are concerned at the obvious invasiveness of *P. ralphii*, not a naturally occurring plant of Wellington Ecological District.

RECOMMENDATION 1

Pittosporum ralphii be progressively removed from Salamanca Slope *and all the other remnants.*

Māpou

We see no reason to remove māpou. It is a natural component of Wellington indigenous ecosystems and is a particularly useful species for use as a buffer.

Karaka

Given that karaka was introduced to the Garden, (Buchanan, 1875), we believe that karaka seedlings, saplings and small trees should be removed. Monitoring will be needed to prevent any recurrence.

RECOMMENDATION 2

Karaka seedlings, saplings, and small trees be removed from the remnants.

Nīkau

We do not consider nīkau to be invasive. It is a natural component of Wellington indigenous ecosystems similar to the few moist, shaded areas of the Botanic Garden.

1.4 Is kāmahi spreading or stationary?

We saw kāmahi only on the dry, steep, north-facing slope above Serpentine Way in Salamanca Slope remnant. The trees range in size from c. 15 to 25cm d.b.h. and their average height is c. 4 metres. They have been showing signs of stress since the drought of 2000, (pers. comm. James Jones), and at present are seriously defoliated. We saw only one seedling and two saplings.

Kāmahi is highly palatable to possums (Source: *Monitoring terrestrial habitats in Wellington Conservancy – A strategy for 2003–2012*, Urlich and Brady, Department of Conservation, 2003). Despite the presence of a bait station in the vicinity, browse may be a contributing factor in the kāmahi decline, because the bait stations are filled only in winter.

Characteristically, kāmahi are found in moister sites than Salamanca Slope, and they are unlikely to survive where they are. If it is desired to establish a "security" population of this species in a moister area of the Garden, it would be wise to propagate from these trees before they decline further and become extinct. Glen Slope would be a suitable site.

1.5. Are there any young plants of *Alectryon excelsus*/tītoki, *Laurelia novae-zelandiae*/pukatea, *Elaeocarpus dentatus*/hīnau, *Knightia excelsa*/rewarewa, *Podocarpus tōtara*/tōtara, *Aristotelia serrata*/makomako, *Carpodetus serratus*/putaputawētā? Seedlings germinate on the forest floor. Would a trial of summer watering, for example in Horseshoe Gully, be worthwhile?

Seedlings of hīnau are relatively common. Seedlings of tītoki, pukatea, rewarewa, tōtara, makomako and putaputawētā are not common. We believe their scarcity is due partly to possums browsing the leaves, and rats and mice eating seed and seedlings. Tōtara and makomako are highly palatable to possums, and pukatea and putaputawētā are moderately palatable. (Urlich and Brady).

We believe the remnants should be managed in such a way as to enhance natural, ecological processes as far as possible, rather than being managed as horticultural entities. Watering would provide ground moisture but is no substitute for natural, atmospheric moisture derived from rain and dew. It would also discourage the plants from rooting more deeply, which they will need to do if drought conditions continue. Climate warming is almost inevitable, and long-term, some plant species in the remnants will almost certainly decline. This is a natural ecological process. Watering, an artificial process, would be a temporary, unsustainable intervention.

Because the remnants are small and in some cases narrow, and because they are fragmented by numerous paths and ways, they are particularly subject to the "edge effect". Establishing a buffer zone around each remnant by planting the margins with appropriate native species would provide shade and shelter from the dehydrating effects of sun and wind. Selected, restoration plantings in the remnants would also be very helpful.

1.6. The Management Plan recommends the introduction of the above-mentioned species and *Metrosideros robusta*/northern rātā and podocarps. Do you agree?

Our response is based on the assumption that only naturally occurring indigenous plant material sourced from within the Garden, or from within a two kilometre radius of the Garden will be used.

When planning supplementary plantings, care must be taken to avoid over-planting, i.e. over-compensating for the lack of large trees. Planting too many could put the nutrient balance at risk and alter the species composition of these small remnants.

Tītoki

Tītoki seedlings to c. 40cm high are present, but very few saplings. Some supplementary planting would be advisable.

Pukatea

Pukatea seedlings are present, but no saplings were seen. Some supplementary planting would be advisable, but there is limited habitat in the remnants for this moisture-loving species.

Hīnau

Hīnau seedlings are relatively common, and saplings and young trees are present. However because of the recent death of some hīnau and the decline of many others, supplementary planting is advisable.

Rewarewa

Rewarewa seedlings are not numerous, and supplementary planting is advisable.

Tōtara

Tōtara seedlings are present below Australian Path, in Australian Garden/Play Area remnant, on a well-drained face under mānuka. A small supplementary planting of tōtara could be made in other well-drained sites such as above Serpentine Way in Salamanca Slope remnant, to restore this podocarp to the ecosystem. Seed should be sourced from western Wellington trees known to be pre-European, such as the female trees at the British High Commission, Homewood Avenue, Karori, and, if it is female, the tree at 64 Homewood Avenue.

Makomako

Makomako regeneration is not abundant, but would not be expected under closed canopy forest. As a short-lived, colonising species, it could be planted to colonise sites where exotic trees or pōhutukawa will be removed, or in other places where fast-growing indigenous cover is needed.

Putaputawētā

Putaputawētā seedlings and saplings are not common, probably because of lack of suitable, moist habitat. Some supplementary planting would be advisable.

Northern rātā

Northern rātā was a dominant canopy and emergent species throughout western Wellington at the time of European settlement. In the remnants we saw two original and two planted trees. We also found six presumably planted trees, four of them located beyond the boundary of Cable Car remnant, and two beyond the present boundary of Druid Hill / Stable Gully remnant. These were obviously once part of the remnant. We saw no seedlings or saplings.

Because of the amount of space occupied by northern rātā in the canopy before they become emergent, only a small, supplementary planting would be advisable. Northern rātā need well-lit sites in order to establish and flourish. (See Recommendation 3).

Podocarps (for tōtara, see above)

As with northern rātā, because the remnants are so small, when planning supplementary planting, consideration must be given to the amount of space occupied by podocarps in the canopy before they become emergent.

Kahikatea

Shepherd and Cook (1988), state, "... along the western boundary of the reserve kahikatea would have predominated...". We found only one naturally occurring seedling (Salamanca Slope remnant), one small tree in Cable Car remnant, and one adult, by the Peacemaker

sculpture. A small supplementary planting would be advisable, however there is limited habitat for kahikatea. A suitable site would be the lower slopes of Glen Slope remnant, on the True Left of the southern reaches of Pukatea Stream.

Rimu

We found planted rimu seedlings in the Australian Garden part of the Australian Garden / Play Area remnant and some planted saplings above the east side of Mamaku Way in Glen Slope remnant. A small supplementary planting would be advisable.

Miro

We found three planted trees in Glen Slope remnant, above the east side of Mamaku Way. A small supplementary planting would be advisable.

Kaikōmako

As expected in closed-canopy forest, kaikōmako are not common, however we expected to see more on the margins. We found occasional seedlings and saplings, and a few tall specimens with small crowns. Supplementary planting would be advisable, especially in buffer zones.

Kōtukutuku

Kōtukutuku in the remnants is uncommon, stressed, and close to extinction. This results from drought and decades of possum browsing, not lack of habitat, since there are suitable sites in Glen Slope remnant and in Stable Gully remnant. We found one seedling, two dead trees and two stressed trees in Glen Slope remnant, one dead tree in the Play Area part of the Australian Garden/Play Area remnant, one 15cm d.b.h. 10m high tree and one sapling in Cable Car remnant. Urgent steps are required to rescue the remaining specimens with a sustained possum-killing operation, and to propagate from them.

RECOMMENDATION 3

Propagules of the northern rātā and kōtukutuku trees be grown on as soon as possible.

Wharangi

Wharangi seedlings, saplings and trees are not uncommon. We found wharangi in all except the Australian Garden/Play Area remnant. We see no need at present to include it in the restoration programme.

Five-finger

This palatable species is not common in the Garden and we noted several trees in poor condition. It would be a good choice for supplementary planting.

Toro

This palatable species is not common in the Garden. It would be a good choice for supplementary planting.

Patē

This is also not common in the Garden and would be a good choice for supplementary planting.

Black maire

Only one adult black maire is known in the Garden. There are no saplings but plenty of seedlings. We have requested that some of these be potted up and grown on for supplementary planting.

Kānuka

Cranshaw believed that kānuka were likely to die out in the Garden. Seedlings are uncommon except in Cable Car remnant, and we saw no saplings. It would be appropriate and highly desirable to use it to plant well-lit, well-drained gaps such as those left after exotic trees or *Pittosporum ralphii* or pōhutukawa have been felled.

RECOMMENDATION 4

Propagules of five-finger, toro, patē, black maire and kānuka be propagated and grown on for use in appropriate restoration sites as soon as possible.

SECTION 2:
Factors Affecting the Remnants

2.1 Names/Numbers of the Remnants

As the result of a discussion with the Curator/Manager, Wellington Botanic Gardens, it was agreed that for ecological and practical reasons some of the remnants should be combined for the survey. This resulted in there being five remnants surveyed instead of seven. From north to south they were:

Salamanca Slope
Druid Hill and Stable Gully (combined)
Australian Garden and Play Area (combined)
Cable Car
Glen Slope

2.2 Identification System for the Remnants

System used by Shepherd & Cook*		System used by Mitcalfe & Horne	
3	Serpentine Path Slope	1	Salamanca Slope
1	Stable Gully	2	Druid Hill/Stable Gully
4	Whau Valley	3	Australian Garden/ Play Area
2c	Gorse Path Valley	4	Cable Car
2a	Horseshoe Bend Valley	5	Glen Slope
2b	Hīnau Path Slope		

* See Appendix VI for copy of Fig. 51, *The Botanic Garden ...* , Shepherd & Cook, showing significant remnant areas of native bush, 1986. Cranshaw's system of identification, (derived from Shepherd and Cook's work), is in Appendix III.

RECOMMENDATION 5

5.1 Druid Hill and Stable Gully remnants be managed as one ecological unit, because they are contiguous, and because they are in the catchment of the same small tributary of Pipitea Stream.

5.2 Australian Garden and Play Area remnants be managed as one ecological unit, because they are contiguous, and because they are in the catchment of the same small tributary of "Pukatea Stream".

2.3 Boundaries of the Remnants

Extensions to the Remnants

We believe extensions are justified because there are botanically significant plant communities outside the remnant boundaries shown in Isthmus Group's *Draft Landscape Development Plan for the Wellington Botanical Garden ...* June 2000.

We believe the integrity and sustainability of remnants 1, 2, 3 and 4 will be improved significantly by increasing their area to include selected parts of contiguous or nearby areas.

RECOMMENDATION 6

Some of the boundaries be extended, as described below and as shown on the aerial photograph in Appendix VI.

6.1 Remnant 1

Salamanca Slope remnant to include all the vegetation:

- below Serpentine Way, down to the lawns of The Dell,
- below the Constable's Cottage,
- on the slopes below the Herb Garden,
- below Norwood Path as far north as the waterfall.

6.2 Remnant 2

Druid Hill/Stable Gully remnant to include both the remnant with original kānuka forest, and the row of planted tōtara, below Carter Observatory and above William Wakefield Way.

6.3 Remnant 3 (Note: this remnant is not bounded by a green line on the Isthmus Group aerial photograph entitled Native Forest Vegetation Plan).

Australian Garden/Play Area remnant to include both sides of the catchment of the small tributary of "Pukatea Stream", i.e. from the two small remnants between Australian Path and Epuni Path, down to Mamaku Way.

6.4 Remnant 4

Cable Car remnant to include all the vegetation in the catchment occupied by Gorse Path, down to Kew Way.

6.5 Remnant 5

Glen Slope remnant to begin immediately below Kew Way.

2.4 Need for Buffers

Because of the barely-sustainable size of the remnants and the gradual, long-term reduction of their area by the incursions of non-native species and the extension of some horticultural areas such as the Camellia Garden, we believe there is a need for buffer zones to counteract what is known as the "edge effect".

This well-known phenomenon results from the high ratio of a remnant's perimeter length to its area. Species which have not evolved to withstand the exposure and subsequent desiccation of marginal conditions, die out. They are replaced by opportunistic species, thus altering the species composition of the remnant, reducing its area and its species diversity. We believe that creating planted buffer zones will considerably improve the integrity and sustainability of the remnants.

RECOMMENDATION 7

Where needed, the margins of the remnants be closely planted with selected, appropriate native species such as māpou, kaikōmako, native broom, whararikī, big mingimingi, common koromiko, *Coprosma propinqua* and *Cortaderia fulvida*.

2.5 Interpretation and Signage

The public's appreciation and respect for the remnants will be enhanced if information is made readily available. We believe there should be signage and a brochure describing the history, significance, structure and composition of the remnants, available on site and in the Tree House.

A copy of a well-designed, informative pamphlet for Mangaweka Scenic Reserve is in Appendix VII, as an example. It is designed to be used in conjunction with numbered posts on a walkway.

RECOMMENDATION 8

8.1 Signage be installed at appropriate points describing the significance of the remnants;

8.2 An illustrated pamphlet be produced with numbered, descriptive paragraphs corresponding to numbered posts at selected "study" points on a "Remnants Walkway";

8.3 A self-guided "Remnants Walkway" be developed, to pass alongside selected parts of the remnants, using existing tracks and numbered posts corresponding to the pamphlet text.

2.6 Litter

Litter is common in the remnants. It ranges from plastic bags and glass bottles, to an old water tank, old fences, and camping gear. Litter has adverse impacts on ecological processes and on amenity values. In addition, glass presents a fire risk.

2.7 Fire Risk and Fire-fighting Capacity

The risk of fire destroying some or all of any of these irreplaceable, heritage remnants must not be under-estimated. Glass litter coupled with highly flammable species such as kānuka, mānuka and introduced conifers, and the groundcover drying out in summer, greatly increase the fire risk. To these factors must be added the risk of arson, unauthorised, informal camping, and the careless disposal of cigarette butts and used matches.

RECOMMENDATION 9

Two or more hydrants be located near each remnant.

2.8 Pest Plants and Other Adventives

The remnants are already barely sustainable because of their size and shape, their lack of buffers, and their location in a largely exotic context.

We were concerned at the weediness of parts of the remnants. It is evident from the number of pest plant species and the abundance of other adventive, invasive plants in the remnants, that weed monitoring or removal has not been a Council priority.

Myers, 1985, recommended the control of adventives, particularly tradescantia, barberry and old man's beard. All of these are present in parts of the remnants.

We note that the *Botanic Garden Native Forest Management Plan* (1993) Policy No 8, is inadequate to ensure the restoration of these highly significant remnants because in some parts, they are infested with a wide range of invasive, adventive species.

RECOMMENDATION 10

Sustained programmes be implemented to control pest plants and other invasive species, to implement the Management Plan and to restore the ecological health of the indigenous forest remnants.

2.9 Impacts of Exotic Trees

The adverse impacts of all exotic trees on the remnants include:

- competition for space
- competition for nutrients, resulting from fast growth rates
- competition for moisture, resulting from high transpiration rates
- change in the soil pH, caused by pine bark, wood, and needles, and eucalypt bark, wood and leaves
- shading, from tall, spreading crowns, inhibiting photosynthesis and seed germination
- damage, when dead or senescent exotics have to be felled, presenting a danger to the public and the understorey.

RECOMMENDATION 11

All exotic trees be progressively removed from the remnants and the remnants be monitored for invasion by these and other exotic species.

2.10 Other Invasive Plant Species

The adverse impacts of invasive plants on the remnants are mainly:

- competition for space, nutrients and moisture
- loss of indigenous character and authenticity
- loss of botanical integrity
- loss of amenity
- potential loss of an educative, tourist attraction

Among introduced, invasive species of concern found in the remnants are: acanthus, agapanthus, allseed, aluminium plant, arum lily, bamboo, barberry, blackberry, boneseed, broom, brush wattle, Cape ivy, cherry laurel, Chilean rhubarb, Chinese privet, cotoneaster, creeping buttercup, Darwin's barberry, elderberry, eleagnus, English holly, Mexican daisy, eucalypt spp., field bindweed, gorse, hawthorn, hazel pomaderris, hedge stachys, holly-leaved senecio, ivy, Japanese honeysuckle, jasmine, laburnum, lillypilly, mist flower, montbretia, Montpellier broom, old man's beard, pampas, periwinkle, radiata pine, ragwort, selaginella, Spanish heath, spur valerian, strawberry tree, sycamore, Taiwan cherry, tradescantia, tree lucerne, tutsan, umbrella sedge, veld grass, vibernum, wild ginger.

The length of the above list is evidence of some of the problems faced in managing indigenous forest remnants in a botanic garden set among suburban gardens.

RECOMMENDATION 12

The plants in the above list be progressively removed from all the remnants, and that the remnants be monitored for invasion by these and other invasive species.

Among the invasive, **indigenous** species which are not native to the Wellington Ecological District are: karo, *Hoheria populnea*, *Pittosporum ralphii*, pōhutukawa and pseudopanax hybrids.

RECOMMENDATION 13

The plants in the paragraph above be progressively removed from all the remnants and the remnants be monitored for invasion by these and other indigenous plants not native to the Wellington Ecological District.

2.11 Encroachments and Underplanting

The area of several of the remnants has been reduced by encroachments for horticultural purposes. Underplanting with exotic species (e.g. azaleas) has further compromised their naturalness, integrity and viability.

RECOMMENDATION 14

There be no more encroachments into remnants or underplanting of their margins with exotic species.

2.12 Boundary Weed Control

Weeds are being dumped from gardens adjoining the Garden boundary.

RECOMMENDATION 15

Council require weeds dumped by neighbours, to be removed from the Garden at the expense of the property owner/s.

RECOMMENDATION 16

The Garden boundaries be monitored by staff at regular intervals to check for weed invasions and the dumping of garden wastes and rubbish.

2.13 Pest Animals

Myers, 1985, and Cranshaw, 1992, referred to the threat posed by possums. We noted occasional possum scratch marks on tree trunks, mainly kohekohe, and occasional signs of possum browse. Continuing possum control is General Policy No 10 in the 1993 Management Plan, but there is no detail about the frequency of filling bait stations, and no other pest animals are mentioned.

It is typical of ecosystems where pest animals have had an impact over a sustained period, that palatable species become rare or die out. With regard to the Garden remnants, we believe the apparent extinction of mistletoes and raukawa, and the relative paucity of some other species compared with Buchanan's 1875 list, are almost certainly evidence of long-term browsing by pest animals. (For further information see, *Monitoring terrestrial*

habitats in Wellington Conservancy — A strategy for 2003–2012. S. Urlich and P. Brady, 2003, Department of Conservation, Table A4: Forest plant species recorded as palatable to possums in Wellington Conservancy, pages 86 and 87).

Possums and Rodents

Control of possums began in the Garden in 1992 and has continued intermittently since then. Bait stations are filled only in winter, which we believe is not often enough, and control of rodents has been intermittent. Rodents are known to browse plant seedlings and eat seeds.

Mustelids, Feral Cats and Magpies

Control of mustelids has been attempted without success, and control of feral cats and magpies has not been attempted. These species prey on birds and thus affect the distribution of seeds within and outside the remnants, and are presumably partly responsible for the paucity of some plant species.

Hedgehogs

Control of hedgehogs has not been attempted. These animals are known to eat up to 150 grams of insects per night to the detriment of birds in the remnants, and thus contribute to the reduction in indigenous biota.

Rabbits

Rabbits should be controlled because they browse seedlings.

We note that the Management Plan Policy No.10 is not adequate to ensure the restoration of these highly significant remnants, because they are preyed upon by a wide range of introduced animals, not only possums.

Proposal for Intensive, Sustained, Pest Animal Control

We believe that the whole of the Botanic Garden, which is part of the Town Belt, should be subject to intensive, sustained, pest animal control. The indigenous forest remnants themselves are of such significance that they should be included in the Key Native Ecosystem Programme, which is funded equally by WCC and Greater Wellington Regional Council.

RECOMMENDATION 17

Intensive, sustained pest anmal control programmes be implemented in the whole of the Botanic Garden, and the remnants be included in the KNE Programme, funded equally by WCC and Greater Wellington Regional Council, as is the rest of the Town Belt.

2.14 Staffing and Funding

In order to prevent further deterioration in the health of the remnants we believe significant, additional resources must be committed to their welfare.

RECOMMENDATION 18

A suitably-qualified and experienced person or persons be appointed exclusively to manage the indigenous forest remnants their duties to include e.g::

- setting up and maintaining a database for the remnants
- regularly monitoring key native species and communities
- removing invasive and other inappropriate species
- removing litter
- planning and implementing a restoration programme
- regularly reporting to management
- other appropriate duties.

RECOMMENDATION 19

Remuneration for such staff be commensurate with the special responsibilities of the position.

RECOMMENDATION 20

Funding to implement all the recommendations in this report be allocated in the 2003–2004 Annual Plan and successive Annual Plans.

SECTION 3:
The Remnants

3.1 Remnant 1: Salamanca Slope

Some Field Observations

Indigenous Plants

1 Groves of ponga indicate the relative dryness of the site.

2 There is **severe canopy dieback** among c. 30 kāmahi; they range from 10 to 20cm d.b.h. and some are multiple- trunked; only 2 seedlings and 2 saplings were seen.

3 Some original kānuka are 45+cm d.b.h.; one 2-trunked, 35 & 35, × 20m high, part of the original forest.

4 The kahikatea, 80cm d.b.h. × 16m high, growing near the Peacemaker sculpture, is almost certainly a parent of the kahikatea seedling on the bank beside Serpentine Way, opposite the *Schinus latifolius* var. *tomentosus*. **This seedling is the only kahikatea seedling found in the survey.**

5 The condition of the hīnau and tītoki crowns above the Begonia House and around The Dell, is good, despite their being on a north-facing, steep slope, and being older than the deteriorating hīnaus on Glen Slope; this is probably because the ones in The Dell are not shaded out by huge exotics.

6 The huge, old, kōhia vine, 12cm d.b.h. and many metres long, east of the Constable's Cottage, is among the largest we have ever seen.

7 Māhoe are not common, (perhaps because they are dioecious), and are showing signs of stress, with many epicormic shoots.

8 Kohekohe seedlings and saplings are numerous in some areas; several trees with d.b.h. to 70cm, some with possum scratches.

9 Examples of hīnau e.g. cm d.b.h.: 38: 25: 30; one 45cm × 18m high, below the Constable's Cottage; seedlings were present.

10 Karaka seedlings are dense in the gully and some other areas.

11 The groundcover is mostly leaf litter and twigs, otherwise sparse threadfern, shining spleenwort and hooked sedge.

12 The following are large specimens of their kind: māpou 18cm d.b.h. with many seedlings; kaikōmako 30cm d.b.h.; several pūriri up to 45cm d.b.h.; putaputawētā 25cm d.b.h.; rewarewa 30cm d.b.h.

13 Tītoki seedlings are up to 1m high.

Invasive plants

14 many *Pittosporum ralphii* up to 15cm d.b.h. **will eventually shade out the local native species**. (See 5 above)

15 other invasives include: agapanthus, allseed, arum lily, bamboo, broom, brush wattle (40cm d.b.h.), cherry laurel, Chilean rhubarb, cotoneaster, creeping buttercup, Darwin's barberry, eleagnus, English holly, English oak, evergreen buckthorn, gorse, hawthorn, hazel pomaderris, hedge stachys, holly-leaved senecio, ivy, Japanese honeysuckle, Japanese spindle tree, karaka, laburnum, Mexican daisy, montbretia, Montpellier broom, Norfolk pine (#0225, 80cm d.b.h.), pampas, pūriri, radiata pine, ragwort, strawberry tree, sycamore, Taiwan cherry, tradescantia, tutsan, veld grass and wild ginger.

Human impacts

16 There is a disused fence below Norwood Path.

17 There are utensils and other evidence of unauthorised use of the gully where there is a large pūriri immediately above Serpentine Way. The gully is used as short cut.

18 There are campfire remains near a *Cyathea smithii*, by the culvert just inside The Dell bush edge.

19 Much trampling of short cuts below Serpentine Way, has bared the ground and damaged plant cover over much of the area.

20 Litter is common, including building rubble and an old iron tank; bottles are a fire risk.

RECOMMENDATION 21

21.1 The proposed viewshafts from Serpentine Way to The Dell, (Isthmus Group Draft Landscape Development Plan, Page 27), **be abandoned**, because they would bring yet another disturbance to an already stressed ecosystem, opening up the bush to the drying effect of wind and sun.

21.2 A cable-and-standard barrier (similar to the one above the children's play area) be built along Serpentine Way, from the Constable's Cottage driveway to The Dell lawn, and continued around the bush edge by the lawn and stage, to almost encircle this part of the remnant, preventing people walking through it.

21.3 The stormwater which flows from Serpentine Way into the remnant below, be better controlled to prevent further scouring of the three gullies.

21.4 The disused fence and other litter be removed.

LIST 1: Some Indigenous Vascular Plants in the Indigenous Forest REMNANT NO. 1, SALAMANCA SLOPE, Wellington Botanic Garden, Glenmore Street, Wellington.

The garden is centred on NZMS 260 Map R27 Pt.Q27 WELLINGTON G.R. 580900. List compiled between February and April 2003 by B.J. Mitcalfe and J.C. Horne.

Note 1

Waipiro Stream in "The Dell Gully" flows on a bearing of approximately 015 degrees True.

Note 2

Plant species listed by previous surveyors but not found by us may be present.

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
GYMNOSPERM TREES		
– *Agathis australis*	kauri	kauri
Dacrycarpus dacrydioides	kahikatea	kahikatea
– *Phyllocladus trichomanoides*	tanekaha	tanekaha
Podocarpus totara	tōtara	tōtara
MONOCOT TREES		
Cordyline australis	tī kōuka	cabbage tree
Rhopalostylis sapida	nīkau	nīkau
DICOT TREES/SHRUBS		
Alectryon excelsus	tītoki	tītoki
Beilschmiedia tawa	tawa	tawa
Brachyglottis repanda	rangiora	rangiora
Carpodetus serratus	putaputawētā	marbleleaf
Coprosma areolata		
Coprosma grandifolia	kānono	kānono
Coprosma lucida	karamū	karamū
Coprosma propinqua		
Coprosma repens	taupata	taupata
Coprosma rhamnoides		
Coprosma robusta	karamū	karamū
– *Corokia cotoneaster*	korokio	corokia
– *Corokia macrocarpa*	whakataka	
Corynocarpus laevigatus	karaka	karaka
Dodonaea viscosa	akeake	akeake
Dysoxylum spectabile	kohekohe	kohekohe
Elaeocarpus dentatus	hīnau	hīnau
Geniostoma rupestre	hangehange	hangehange

KEY

– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
– *Hebe diosmifolia*		
– *Hebe speciosa*	napuka	purple hebe
Hebe stricta var. *atkinsonii*	koromiko	koromiko
Hedycarya arborea	porokaiwhiri	pigeonwood
– *Hoheria populnea*	houhere	lacebark
Knightia excelsa	rewarewa	rewarewa
Kunzea ericoides	kānuka	kānuka
Laurelia novae-zelandiae	pukatea	pukatea
Leptospermum scoparium	mānuka	mānuka
Leucopogon fasciculatus	mingimingi	big mingimingi
Macropiper excelsum	kawakawa	kawakawa
Melicope ternata	wharangi	wharangi
Melicytus ramiflorus	māhoe	māhoe
– *Meryta sinclairii*	puka	puka
– *Metrosideros excelsa*	pōhutukawa	pōhutukawa
Myoporum laetum	ngaio	ngaio
Myrsine australis	māpou	māpou
Nothofagus truncata	tawhai raunui	hard beech
– *Olearia albida*	tanguru	
Olearia paniculata	akiraho	akiraho
Olearia rani	heketara	heketara
Ozothamnus leptophyllus	tauhinu	tauhinu
Pennantia corymbosa	kaikōmako	kaikōmako
– *Pittosporum crassifolium*	karo	karo
Pittosporum eugenioides	tarata	lemonwood
– *Pittosporum ralphii*		
Pittosporum tenuifolium	kohuhu	kohuhu
Pseudopanax arboreus	whauwhaupaku	five-finger
Pseudopanax crassifolius	horoeka	lancewood
– *Pseudopanax laetus*		
– *Pseudopanax* (hybrids)		
Schefflera digitata	patē	patē
Solanum sp.	poroporo	poroporo
Sophora microphylla	kōwhai	kōwhai
– *Sophora tetraptera*	kōwhai	kōwhai
– *Vitex lucens*	pūriri	pūriri
Weinmannia racemosa	kāmahi	kāmahi

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
MONOCOT LIANES		
Ripogonum scandens	kareao	supplejack
DICOT LIANES		
Clematis forsteri	pikiarero	small white clematis
Metrosideros diffusa	rātā	white rātā
Metrosideros fulgens	akakura	scarlet rātā
Metrosideros perforata	aka	clinging rātā
Muehlenbeckia australis	pōhuehue	pōhuehue
Parsonsia heterophylla	kaihua	parsonsia
Passiflora tetrandra	kōhia	NZ passionfruit
Rubus cissoides	tātarāmoa	bush lawyer
FERNS		
Adiantum cunninghamii	huruhuru tapairu	common maidenhair
Asplenium bulbiferum	manamana	hen and chickens
Asplenium flaccidum	makawe o Raukatauri	hanging spleenwort
Asplenium oblongifolium	huruhuru whenua	shining spleenwort
Asplenium polyodon	petako	sickle spleenwort
Blechnum chambersii	nini	lance fern
Blechnum filiforme	pānako	thread fern
Blechnum membranaceum		
Blechnum novae-zelandiae	kiokio	kiokio
Cyathea dealbata	ponga	ponga
Cyathea medullaris	mamaku	mamaku
Cyathea smithii	kātote	soft tree fern
Grammitis billardierei		strap fern
Hymenophyllum demissum	mauku	drooping filmy fern
Hymenophyllum flabellatum	mauku	fan-like filmy fern
Lastreopsis glabella		smooth shield fern
Lastreopsis velutina		velvet fern
Microsorum pustulatum	kōwaowao	hound's tongue
Microsorum scandens	mokimoki	scented fern
Pellaea rotundifolia	tarawera	button fern
Polystichum richardii	pikopiko	common shield fern
Pteridium esculentum	rārahu	bracken
Pteris macilenta	titipo	sweet brake
Pyrrosia eleagnifolia	ota	leather-leaf fern

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
ORCHIDS		
Thelymitra sp.	māikuku	sun orchid
GRASSES		
Dichelachne crinita	pātītī	long-hair plume grass
Microlaena stipoides	pātītī	slender rice grass
Poa anceps		broad-leaved poa
Rytidosperma gracile		rytidosperma
SEDGES		
Carex dissita	pūrei	
Gahnia pauciflora	māpere	cutting sedge
Gahnia setifolia	māpere	cutty grass
Uncinia banksii		hooked sedge
Uncinia scabra		hooked sedge
RUSHES		
Luzula picta		woodrush
MONOCOT HERBS (other than above)		
Dianella nigra	tūrutu	blueberry
Libertia grandiflora	mīkoikoi	NZ iris
Phormium cookianum	whaririki	coastal flax
Phormium tenax		
DICOT HERBS (other than above)		
Centella uniflora		centella

LIST 1.1 Salamanca Slope Remnant: Some Adventive Vascular Plants

BOTANICAL NAME	COMMON NAME
Abies nordmannia	Caucasus fir
Abies pinsapo	Spanish fir
Acer pseudoplanatus	sycamore
Agapanthus praecox	African lily
Araucaria bidwillii	bunya bunya
Arbutus unedo	strawberry tree
Auracaria heterophylla	Norfolk pine
Azalea sp.	azalea
Bambusa sp.	bamboo
Berberis darwinii	Darwin's barberry
Camellia sp.	camellia
Centaurium erythraea	centaury

BOTANICAL NAME	COMMON NAME
Centranthus ruber	spur valerian
Chamaecyparis lawsoniana	Lawson's cypress
Cirsium vulgare	Scotch thistle
Clematis vitalba	old man's beard
Clematis sp.	clematis
Conyza canadensis	Canadian fleabane
Correa sp.	correa
Cortaderia sp.	pampas
Cotoneaster glaucophyllus	cotoneaster
Cotoneaster sp.	
Crataegus monogyna	hawthorn
Crepis capillaris	hawksbeard
Crocosmia X*crocosmiiflora*	montbretia
Cymbalaria muralis	ivy-leaved toadflax
Cytisus scoparius	broom
Cytisus sp.	broom
Dactylis glomerata	cocksfoot
Digitalis purpurea	foxglove
Ehrharta erecta	veld grass
Eleagnus X*reflexa*	eleagnus
Erigeron karvinskianus	Mexican daisy
Eucalyptus sp.	eucalyptus
Euonymus sp.	spindle bush
Ginkgo biloba	ginkgo
Gunnera tinctoria	Chilean rhubarb
Hedera helix	ivy
Hedychium gardnerianum	wild ginger
Hypericum androsaemum	tutsan
Hypochaeris radicata	catsear
Ilex aquilinum	English holly
Laburnum sp.	laburnum
Lilium tigrinum	tiger lily
Lonicera japonica	Japanese honeysuckle
Magnolia grandifolia	magnolia
Mahonia sp.	mahonia
Oxalis sp.	oxalis
Paraserianthes lophanta	brush wattle
Pinus radiata	radiata pine
Plantago lanceolata	narrow-leaved plantain

BOTANICAL NAME	COMMON NAME
Plantago major	broad-leaved plantain
Polycarpon tetraphyllum	allseed
Pomaderris aspera	hazel pomaderris
Protea sp.	protea
Prunus campanulata	Taiwan cherry
Prunus laurocerasus	cherry laurel
Pyracantha sp.	pyracantha
Quercus robur	English oak
Ranunculus repens	creeping buttercup
Rhamnus alaternus	evergreen buckthorn
Schinus latifolius var. *tomentosus*	
Senecio glastifolius	holly-leaved senecio
Senecio jacobaeus	ragwort
Solanum chenopodioides	velvety nightshade
Solanum nigrum	black nightshade
Sonchus oleraceus	puha
Stachys silvatica	hedge stachys
Teline monspessulana	Montpellier broom
Tradescantia fluminensis	tradescantia
Thuya plicata	western red cedar
Ulex europaeus	gorse
Viburnum sp.	viburnum
Vinca major	periwinkle
Zantedeschia aethiopica	arum lily

3.2 Remnant 2: Druid Hill/Stable Gully

Some Field Observations

Indigenous Plants

1 In the Camellia Garden there are several substantial, indigenous trees, relicts of the time before the Camellia Garden was carved out of the forest remnant. These "outriders" are several large hīnau, a northern rātā c. 12m high and an unusually large kaikōmako, d.b.h. c. 30cm, and c. 12m high. The formation of the Camellia Garden early in the 20th century made a very significant inroad into the remnant, increasing its edge:area ratio, thus exposing it to desiccation by wind and sun.

2 The kaikōmako in the Camellia Garden, not a common species in the Botanic Garden, would be a good choice to propagate from, for restoration purposes.

3 The northern rātā, one of only two naturally occurring in the Garden, has c. 20% crown dieback.

4 In the Druid Hill section, we found *Metrosideros colensoi* a species found only twice in the survey.

5 Between Carter Observatory and William Wakefield Way is a small area of original kānuka forest noted by Shepherd and Cook, 1988: "It seems likely therefore that many of the existing kānuka trees in the Garden are over one hundred years of age ... Despite the use of the denigrating word 'scrub', these kānuka trees, many of them fine centenarians, are important and must be preserved." They should be included in Druid Hill/Stable Gully remnant. This small, triangular area features a hīnau with 15cm d.b.h., an original kānuka with five trunks, all 20cm d.b.h., other kānuka with cm d.b.h. 30; 30; and one 2-trunked, 27 & 32cm d.b.h. There is good groundcover of hound's tongue, shining spleenwort, sickle spleenwort as well as undisturbed leaf litter; kohekohe seedlings and saplings and a tītoki sapling, 1.4m high, a māpou 20cm d.b.h., and a 2-trunked 20cm & 18cm d.b.h.; a 2-trunked kohuhu 15cm & 16 cm d.b.h., and akeake to 10m.

6 On the True Right of Stable Gully stream there are **two *Cyathea cunninghamii,* gully tree ferns, c. 8m high, believed to be the only ones in the Garden.** Also on the TR are nīkau seedlings and saplings to 1.5m, dense thread fern, seedlings of tawa, kōwhai and tītoki and numerous kohekohe seedlings. We noted possum scratches on some kohekohe trunks.

7 On the True Left of Stable Gully, are the only *Melicope simplex* × *M. ternata,* (sometimes informally called "Melicope mantellii" and listed as such by Buchanan), the only *Nothofagus menziesii,* silver beech, listed by Cranshaw, and the only *Beilschmiedia tarairi,* taraire, also listed by her, known in the Garden. These were not considered as part of our survey, being outside the remnant boundary.

8 Toro, a highly palatable species, is not common in the Garden. There is one below Scrub Path and one above it, near the Met Office.

9 Beside Scrub Path, we noted rewarewa with 10% canopy dieback, and two hīnau with 5% canopy dieback.

10 The two big hīnau outside the remnant, in Camellia Garden, have healthy crowns.

Invasive Plants

11 In the higher level shrubland there are numerous non-Wellington native species such as *Pittosporum ralphii* and *P. crassifolium*/karo.

12 Other invasives include: agapanthus, boneseed, broom, brush wattle, cherry laurel, cotoneaster, Darwin's barberry, eleagnus, English holly, English oak, erica sp., evergreen buckthorn, gorse, hazel pomaderris, holly-leaved senecio, ivy, Mexican daisy, montbretia, radiata pine, selaginella, sycamore, Tasmanian blackwood, tradescantia and veld grass.

RECOMMENDATION 22

The remnant be extended to include both the original kānuka forest, and the row of planted tōtara below Carter Observatory and above William Wakefield Way. They are in the head of the catchment of the stream which flows down Stable Gully and form an ecological link with the Australian Garden/Play Area remnant.

LIST 2: Some Indigenous Vascular Plants in the Indigenous Forest REMNANT NO. 2, DRUID HILL/STABLE GULLY COMBINED, Wellington Botanic Garden, Glenmore Street, Wellington.

The garden is centred on NZMS 260 Map R27 Pt.Q27 WELLINGTON G.R. 580900. List compiled between February and April 2003 by B.J. Mitcalfe and J.C. Horne.

Note 1

The stream in Stable Gully, a tributary of Pipitea Stream, flows approximately 311 degrees True.

Note 2

In discussion with Tony Williams, it was decided that the lower boundary of this remnant should be the tree fern trunk fence on the True Right of the valley floor, and the boundary on the True Left should be the path junction opposite it.

Note 3

Plant species listed by previous surveyors but not found by us may be present.

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
GYMNOSPERM TREES		
– *Agathis australis*	kauri	kauri
Dacrydium cupressinum	rimu	rimu
Podocarpus totara	tōtara	tōtara
MONOCOT TREES		
Cordyline australis	tī kōuka	cabbage tree
Rhopalostylis sapida	nīkau	nīkau
DICOT TREES/SHRUBS		
Alectryon excelsus	tītoki	tītoki
Aristotelia serrata	makomako	wineberry
Beilschmiedia tawa	tawa	tawa
– *Brachyglottis greyi*		coastal groundsel
Brachyglottis repanda	rangiora	rangiora
Carmichaelia australis	mākākā	NZ broom
– *Carmichaelia williamsii*		giant flowered broom
Coprosma grandifolia	kānono	kānono
Coprosma lucida	karamū	karamū
Coprosma repens	taupata	taupata
Coprosma rhamnoides		
– *Corokia cotoneaster*	korokio	corokia
Corynocarpus laevigatus	karaka	karaka

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
Dodonaea viscosa	akeake	akeake
Dysoxylum spectabile	kohekohe	kohekohe
Elaeocarpus dentatus	hīnau	hīnau
Geniostoma rupestre	hangehange	hangehange
Griselinia littoralis	papāuma	broadleaf
Griselinia lucida	puka	puka
– *Hebe diosmifolia*		
Hebe stricta var. *atkinsonii*	koromiko	koromiko
Hedycarya arborea	porokaiwhiri	pigeonwood
– *Hoheria populnea*	houhere	lacebark
Knightia excelsa	rewarewa	rewarewa
Kunzea ericoides	kānuka	kānuka
Leptospermum scoparium	mānuka	mānuka
Leucopogon fasciculatus	mingimingi	big mingimingi
Lophomyrtus bullata	ramarama	ramarama
Macropiper excelsum	kawakawa	kawakawa
Melicope ternata	wharangi	wharangi
Melicytus ramiflorus	māhoe	māhoe
– *Metrosideros excelsa*	pōhutukawa	pōhutukawa
Metrosideros robusta	rātā	northern rātā
Myoporum laetum	ngaio	ngaio
Myrsine australis	māpou	māpou
Myrsine salicina	toro	toro
Olearia paniculata	akiraho	akiraho
Olearia rani	heketara	heketara
Olearia solandri		coastal tree daisy
Ozothamnus leptophyllus	tauhinu	tauhinu
Pennantia corymbosa	kaikōmako	kaikōmako
– *Pittosporum crassifolium*	karo	karo
Pittosporum eugenioides	tarata	lemonwood
– *Pittosporum ralphii*		
Pittosporum tenuifolium	kohuhu	kohuhu
Pseudopanax arboreus	whauwhaupaku	five-finger
Pseudopanax crassifolius	horoeka	lancewood
– *Pseudopanax* (hybrids)		
Solanum laciniatum	poroporo	poroporo
Sophora microphylla	kōwhai	kōwhai

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
– *Vitex lucens*	pūriri	pūriri
MONOCOT LIANES		
Ripogonum scandens	kareao	supplejack
DICOT LIANES		
Clematis forsteri	pikiarero	small white clematis
Metrosideros colensoi		
Metrosideros diffusa	rātā	white rātā
Metrosideros fulgens	akakura	scarlet rātā
Metrosideros perforata	aka	clinging rātā
Muehlenbeckia australis	pōhuehue	pōhuehue
Parsonsia heterophylla	kaihua	parsonsia
Passiflora tetrandra	kōhia	NZ passionfruit
Rubus cissoides	tātarāmoa	bush lawyer
Rubus schmidelioides	tātarāmoa	bush lawyer
FERNS		
Adiantum cunninghamii	huruhuru tapairu	common maidenhair
Asplenium bulbiferum	manamana	hen and chickens
Asplenium flabellifolium		necklace fern
Asplenium flaccidum	makawe o Raukatauri	hanging spleenwort
Asplenium oblongifolium	huruhuru whenua	shining spleenwort
Asplenium bulbiferum × *A. flaccidum*		
Blechnum chambersii	nini	lance fern
Blechnum discolor	piupiu	crown fern
Blechnum filiforme	pānako	thread fern
Blechnum fluviatile	kiwakiwa	ray water fern
Blechnum membranaceum		
Blechnum novae-zelandiae	kiokio	kiokio
Cyathea cunninghamii		gully tree fern
Cyathea dealbata	ponga	ponga
Cyathea medullaris	mamaku	mamaku
Cyathea smithii	kātote	soft tree fern
Dicksonia squarrosa	wheki	wheki
Grammitis ciliata		strap fern
Hymenophyllum demissum	mauku	drooping filmy fern
Hypolepis ambigua	rarauhi nehenehe	
Lastreopsis glabella		smooth shield fern

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
Lastreopsis hispida	pongaweka	hairy fern
Lastreopsis velutina		velvet fern
Leptopteris hymenophylloides	heruheru	single crepe fern
– *Marattia salicina*	para	king fern
Microsorum pustulatum	kōwaowao	hound's tongue
Microsorum scandens	mokimoki	scented fern
Pellaea rotundifolia	tarawera	button fern
Pneumatopteris pennigera	pākau	gully fern
Polystichum richardii	pikopiko	common shield fern
Pteridium esculentum	rārahu	bracken
Pteris macilenta	titipo	sweet brake
Pteris tremula	turawera	shaking brake
Pyrrosia eleagnifolia	ota	leather-leaf fern
ORCHIDS		
Prasophyllum colensoi		leek orchid
GRASSES		
Cortaderia toetoe	toetoe	toetoe
Dichelachne crinita		long-hair plume grass
Microlaena avenacea		bush rice grass
Poa anceps		broad-leaved poa
Rytidosperma gracile		
SEDGES		
Carex dissita	pūrei	
Carex testacea		speckled sedge
Gahnia pauciflora	māpere	cutting sedge
Uncinia banksii		hooked sedge
Uncinia uncinata	matau a Māui	hooked sedge
RUSHES		
Luzula picta		woodrush
MONOCOT HERBS (other than above)		
Arthropodium cirratum	rengarenga	renga lily
Astelia solandri	kōwharawhara	perching astelia
Dianella nigra	tūrutu	blueberry
Libertia grandiflora	mīkoikoi	NZ iris
Libertia sp.		

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
Phormium cookianum	whaririki	coastal flax
COMPOSITE HERBS		
Gnaphalium sp.		
Senecio minimus		fireweed
DICOT HERBS (other than composites)		
Cardamine debilis	panapana	NZ bitter cress
Haloragis erecta	toatoa	shrubby haloragis
Hydrocotyle heteromeria		waxweed
Stellaria decipiens	kohukohu	NZ chickweed
Wahlenbergia violacea	rimuroa	a harebell

LIST 2.1 Druid Hill/Stable Gully Remnant: Some Adventive Vacular Plants

BOTANICAL NAME	COMMON NAME
Acacia melanoxylon	Tasmanian blackwood
Acer pseudoplanatus	sycamore
Agapanthus praecox	African lily
Araucaria bidwillii	bunya bunya
Arbutus unedo	strawberry tree
Berberis darwinii	Darwin's barberry
Cassia sp.	cassia
Centaurium erythraea	centaury
Centranthus ruber	spur valerian
Choisya ternata	Mexican orange blossom
Chrysanthemoides monilifera	boneseed
Cirsium vulgare	Scotch thistle
Conyza canadensis	Canadian fleabane
Cotoneaster glaucophylla	cotoneaster
Crocosmia X*crocosmiiflora*	montbretia
Cymbalaria muralis	ivy-leaved toadflax
Cytisus scoparius	broom
Dactylis glomerata	cocksfoot
Digitalis purpurea	foxglove
Echium candicans	pride of Madeira
Ehrharta erecta	veld grass
Eleagnus X*reflexa*	eleagnus
Erica sp.	heath

BOTANICAL NAME	COMMON NAME
Erigeron karvinskianus	Mexican daisy
Eucalyptus sp.	eucalyptus
Euphorbia peplus	milkweed
Galinsoga parviflora	galansoga
Hedera helix	ivy
Hypochaeris radicata	catsear
Ilex aquilinum	English holly
Iris stylosa	iris sp.
Iris pseudocorus	yellow flag
Magnolia sp.	magnolia
Mycelis muralis	wall lettuce
Oxalis sp.	oxalis
Paraserianthes lophanta	brush wattle
Phlebalium sp.	phlebalium
Pinus radiata	radiata pine
Plantago lanceolata	narrow-leaved plantain
Polycarpon tetraphyllum	allseed
Pomaderris aspera	hazel pomaderris
Prunus campanulata	Taiwan cherry
Prunus laurocerasus	cherry laurel
Pteris cretica	Cretan brake
Quercus robur	cork oak
Quercus suber	English oak
Rhamnus alaternus	evergreen buckthorn
Selaginella kraussiana	selaginella
Senecio glastifolius	holly-leaved senecio
Solanum chenopodioides	velvety nightshade
Solanum nigrum	black nightshade
Sonchus oleraceus	puha
Tradescantia fluminensis	tradescantia
Trifolium pratense	red clover
Ulex europaeus	gorse

3.3 Remnant 3: Australian Garden/Play Area

Some Field Observations

Indigenous Plants

1 There are several tōtara seedlings, and saplings to 1.5m high, in the kānuka forest above Epuni Path.

2 Hīnau examples are e.g. cm d.b.h.: 20; 45; 40; 22; 30; one 2-trunked, 15 & 18 d.b.h.; and 3.5m tall saplings.

3 Two kohekohe are below the Lookout, one 35cm d.b.h. × 10m high; the other, 10m high. Seedlings are present, and three saplings to 4m.

4 **The *Coprosma crassifolia* seedlings in the small area of the remnant above Epuni Path and west of the Lookout, were the only ones seen during the survey.**

5 Kōwhai trees include one with 40cm d.b.h.

6 Māhoe trees include e.g. cm d.b.h.: 20; 30.

7 Tītoki include one 2-trunked, 30 & 30cm d.b.h.; one 40cm, and seedlings. The crowns are mostly in good condition.

Note

The only lycopodium seen during the survey is a *Huperzia (= Lycopodium) varia* growing at the foot of a pōhutukawa immediately above the junction of Epuni Path and Myrtle Way. Since it is just outside the remmnant, we have not listed it, only noted it here.

Introduced Plants

8 The tree ferns, *Cyathea australis* and *C. cooperi*, have been planted in and near the small part of the remnant between Epuni Path and Australian Path, NNW of the Lookout. They should be relocated to an area of non-native ferns.

9 Eucalypts will soon block the view from the Lookout. They should be replaced with appropriate indigenous species to link the two small parts of the remnant above Epuni Path.

Invasive Plants

10 The azaleas, hydrangeas and other planted exotics between the pond above Myrtle Way, and Kew Way, are encroaching right into the remnant, reducing its area and compromising its naturalness, integrity and viability. This site should have instead, a buffer planting with appropriate native species to give protection to the remnant.

11 Adjacent to this remnant, under pōhutukawa, along Myrtle Way to its junction with Epuni Path, is an area of densely planted agapanthus. It would be preferable if shaded areas adjacent to indigenous remnants in the Garden were plantedwith massed rengarenga lily, a hardy native plant which would be equally effective.

12 Miscellaneous exotic plants in the stream bed and on its banks, extend from the pond above Myrtle Way down to Kew Way and from Quarry Path down to Mamaku Way. They include *Gunnera tinctoria*, Chilean rhubarb, a pest plant.

13 Other invasive plants present include acanthus, aluminium plant, bamboo, brush wattle, cherry laurel, Darwin's barberry, elderberry, English holly, fatsia, gorse, hazel pomaderris, hedge stachys, ivy, lillypilly, old man's beard, periwinkle, selaginella, sycamore, veld grass and tradescantia.

Human Impacts

14 There is an old fence above Quarry Path, and miscellaneous rubbish behind the nursery, above Quarry Path.

15 The stream bed from the pond down to Kew Way is lined with stone, which has destroyed its naturalness and may contribute to scouring of the natural streambed, by increasing peak-flow velocities.

RECOMMENDATION 23

23.1 The True Right boundary of this remnant be the crest of the spur on which the nursery is built.

23.2 Stormwater flows be controlled to stop the scouring of the streambed, especially upstream of the Moreton Bay fig.

23.3 The exotic cyatheas be removed from above Epuni Path and relocated to an area of exotic ferns.

23.4 The streamsides in the lower part of the gully, from near the Moreton Bay fig, down to Mamaku Way, which are greatly modified by exotic plantings, be cleared and replanted with indigenous species such as moisture-loving ferns, sedges and rushes.

LIST 3: Some Indigenous Vascular Plants in the Indigenous Forest REMNANT NO. 3, AUSTRALIAN GARDEN AND PLAY AREA COMBINED, Wellington Botanic Garden, Glenmore Street, Wellington.

The garden is centred on NZMS 260 Map R27 Pt.Q27 WELLINGTON G.R. 580900. List compiled between February and April 2003 by B.J. Mitcalfe and J.C. Horne.

Note 1

The stream in these two remnants, a tributary of "Pukatea Stream", flows on a bearing of approximately 306 degrees True.

Note 2

Plant species listed by previous surveyors but not found by us, may be present.

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
GYMNOSPERM TREES		
– *Agathis australis*	kauri	kauri
Dacrydium cupressinum	rimu	rimu
Podocarpus totara	tōtara	tōtara
MONOCOT TREES		
Cordyline australis	tī kōuka	cabbage tree
Rhopalostylis sapida	nīkau	nīkau
DICOT TREES/SHRUBS		
Alectryon excelsus	tītoki	tītoki
Aristotelia serrata	makomako	wineberry
Brachyglottis repanda	rangiora	rangiora
Coprosma crassifolia		thick-leaved coprosma
Coprosma grandifolia	kānono	kānono
Coprosma lucida	karamū	karamū
Coprosma repens	taupata	taupata
Coprosma rhamnoides		
Coprosma robusta	karamū	karamū
Corynocarpus laevigatus	karaka	karaka
– *Dodonaea viscosa*	akeake	akeake
Dysoxylum spectabile	kohekohe	kohekohe
Elaeocarpus dentatus	hīnau	hīnau
– *Entelea arborescens*	whau	whau
Fuchsia excorticata (dead)	kōtukutuku	tree fuchsia
Geniostoma rupestre	hangehange	hangehange
Griselinia littoralis	papāuma	broadleaf
– *Hebe diosmifolia*		

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
Hebe stricta var. *atkinsonii*	koromiko	koromiko
Hedycarya arborea	porokaiwhiri	pigeonwood
– *Hoheria populnea*	houhere	lacebark
Hoheria populnea *var. sexstylosa*	houhere	lacebark
Knightia excelsa	rewarewa	rewarewa
Kunzea ericoides	kānuka	kānuka
Laurelia novae-zelandiae	pukatea	pukatea
Leptospermum scoparium	mānuka	mānuka
Leucopogon fasciculatus	mingimingi	big mingimingi
Macropiper excelsum	kawakawa	kawakawa
Melicytus ramiflorus	māhoe	māhoe
– *Metrosideros excelsa*	pōhutukawa	pōhutukawa
Myoporum laetum	ngaio	ngaio
Myrsine australis	māpou	māpou
– *Olearia albida*	tanguru	
Olearia rani	heketara	heketara
Ozothamnus leptophyllus	tauhinu	tauhinu
Pennantia corymbosa	kaikōmako	kaikōmako
– *Pittosporum crassifolium*	karo	karo
Pittosporum eugenioides	tarata	lemonwood
– *Pittosporum ralphii*	karo	karo
Pittosporum tenuifolium	kohuhu	kohuhu
Pseudopanax arboreus	whauwhaupaku	five-finger
Pseudopanax crassifolius	horoeka	lancewood
– *Pseudopanax* (hybrids)		
Schefflera digitata	patē	patē
Solanum sp.	poroporo	poroporo
Sophora microphylla	kōwhai	kōwhai
– *Sophora tetraptera*	kōwhai	kōwhai
– *Vitex lucens*	pūriri	pūriri
MONOCOT LIANES		
Ripogonum scandens	kareao	supplejack
DICOT LIANES		
Clematis forsteri	pikiarero	small white clematis
Metrosideros fulgens	akakura	scarlet rātā
Metrosideros perforata	aka	clinging rātā

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
Parsonsia heterophylla	kaihua	parsonsia
Passiflora tetrandra	kōhia	NZ passionfruit
FERNS		
Asplenium bulbiferum	manamana	hen and chickens
Asplenium flaccidum	makawe o Raukatauri	hanging spleenwort
Asplenium oblongifolium	huruhuru whenua	shining spleenwort
Blechnum chambersii	nini	lance fern
Blechnum filiforme	pānako	thread fern
Blechnum membranaceum		
Blechnum novae-zelandiae	kiokio	kiokio
Cyathea dealbata	ponga	ponga
Cyathea medullaris	mamaku	mamaku
Cyathea smithii	kātote	soft tree fern
Hymenophyllum demissum	mauku	drooping filmy fern
Lastreopsis glabella		smooth shield fern
Lastreopsis velutina		velvet fern
– *Marattia salicina*	para	king fern
Microsorum pustulatum	kōwaowao	hound's tongue
Microsorum scandens	mokimoki	scented fern
Pellaea rotundifolia	tarawera	button fern
Pneumatopteris pennigera	pākau	gully fern
Polystichum richardii	pikopiko	common shield fern
Pteridium esculentum	rārahu	bracken
Pteris tremula	turawera	shaking brake
Pyrrosia eleagnifolia	ota	leather-leaf fern
GRASSES		
– *Anemanthele lessoniana*		gossamer grass
Microlaena avenacea		bush rice grass
Microlaena polynoda		
Rytidosperma gracile		rytidosperma
SEDGES		
Carex dissita	pūrei	
Uncinia banksii		hooked sedge
Uncinia uncinata	matau a Māui	hooked sedge

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
MONOCOT HERBS (other than above)		
Arthropodium candidum	repehina papa	small renga lily
Arthropodium cirratum	rengarenga	renga lily
Astelia solandri	kōwharawhara	perching astelia
Dianella nigra	tūrutu	blueberry
Libertia grandiflora	mīkoikoi	NZ iris
Phormium tenax	harakeke	swamp flax
COMPOSITE HERBS		
Senecio minimus		fireweed
DICOT HERBS (other than composites)		
Cardamine debilis	panapana	NZ bitter cress
– *Colensoa physaloides*	hānea	colensoa
– *Elatostema rugosum*	parataniwha	
Wahlenbergia violacea	rimuroa	a harebell

LIST 3.1: Australian Garden/Play Area Remnant: Some Adventive Vascular Plants

BOTANICAL NAME	COMMON NAME
Acanthus mollis	bear's breeches
Acacia melanoxylon	Tasmanian blackwood
Acer pseudoplanatus	sycamore
Acmena smithii	lillypilly
Agapanthus praecox	African lily
Ageratina riparia	mist flower
Alnus sp.	alder
Arbutus unedo	strawberry tree
Bambusa sp.	bamboo
Berberis darwinii	Darwin's barberry
Camellia sp.	camellia
Chamaecyparis lawsoniana	Lawson's cypress
Cirsium vulgare	Scotch thistle
Clematis vitalba	old man's beard
Convolvulus arvensis	field bind weed
Conyza canadensis	Canadian fleabane
Crocosmia X*crocosmiiflora*	montbretia
Cytisus scoparius	broom

BOTANICAL NAME	COMMON NAME
Duchesnea indica	Indian strawberry
Dactylis glomerata	cocksfoot
Cyathea australis	rough tree fern
Cyathea cooperi	
Cymbalaria muralis	ivy-leaved toad flax
Digitalis purpurea	foxglove
Ehrharta erecta	veld grass
Eucalyptus sp.	eucalyptus
Euphorbia peplus	milkweed
Ficus macrophylla	Moreton Bay fig
Galeobdolon luteum	aluminium plant
Galinsoga parviflora	galinsoga
Geranium robertianum	herb Robert
Grevillea sp.	grevillea
Gunnera tinctoria	Chilean rhubarb
Hedera helix	ivy
Ilex aquilinum	English holly
Laburnum	laburnum
Lamium amplexicaule	henbit
Lauris nobilis	bay
Leucodendron sp.	leucodendron
Linaria sp.	linaria
Magnolia sp.	magnolia
Malus sp.	apple
Myosotis silvatica	garden forget-me-not
Oxalis sp.	oxalis
Paraserianthes lophanta	brush wattle
Pinus sp.	pine
Plantago lanceolata	narrow-leaved plantain
Polycarpon tetraphyllum	allseed
Pomaderris aspera	hazel pomaderris
Prunus campanulata	Taiwan cherry
Rhododendron sp.	rhododendron
Sambucus nigra	elderberry
Selaginella kraussiana	African club moss
Solanum chenopodioides	velvety nightshade
Solanum nigrum	black nightshade
Stachys silvatica	hedge stachys
Tradescantia fluminensis	tradescantia

BOTANICAL NAME	COMMON NAME
Trifolium pratense	red clover
Trifolium repens	white clover
Ulex europaeus	gorse
Urtica urens	small nettle
Vinca major	periwinkle

3.4 Remnant 4: Cable Car

Some Field Observations

Indigenous Plants

1 The quality of the remnant on the slopes on the True Right above the creek downstream of the culvert under Gorse Path, is impressive, with up to 90% kohekohe in all age ranges, and up to 40cm d.b.h. Seedlings and saplings are numerous. A large pukatea, 70cm d.b.h. × 20m+ high is a notable component of this remnant.

2 We noted that the kōtukutuku tree, 15cm d.b.h. × 10m tall, was moribund. This is almost certainly the result of drought and browse on this palatable, moisture-loving species. We saw only one seedling, 1m high. It is sobering to compare today's situation, when the species seems to be approaching extinction in the Garden, with Myers' 1985 statement, "... kōtukutuku ... are abundant in the stream valleys. "

3 Examples of possibly original kānuka are: cm d.b.h. 40; 30 × 15m high; 45 × 18m high, and several more in the 15 to 20m high range. Numerous seedlings indicate that kānuka is successfully regenerating on the slopes above and below Gorse Path. If the pōhutukawa there are selectively pruned and later removed, this will allow the area to revert eventually to kānuka, and later still, broadleaf forest.

4 In a light gap on the True Left of the gully above the Gorse Path culvert, there is dense, abundant regeneration of both indigenous and adventive species. Indigenous species include hīnau, māpou, pigeonwood, kohekohe, kānono, ngaio, hangehange and rangiora. This is clear evidence of how prolific, natural germination can be, when conditions become suitable.

5 **We saw one *Raukaua anomalus* seedling, a species not recorded by Buchanan. This was the only one seen on the survey.**

6 On the gully floor above Horseshoe Bend, about 15m inside the bush edge, is a ***Dicksonia fibrosa* wheki ponga, probably the only naturally occurring one in the Garden**, re-sprouted from its fallen trunk.

7 Examples of wharangi are: cm d.b.h.: 16; 12; 10; 8; 15 × 12m high; one 2-trunked, 15 & 15. We saw possum territorial marking and possible browse on some wharangi.

8 The upper part of the remnant has some big ngaio7s, e.g. one, 4-trunked, cm d.b.h. 30 & 20 & 45 & 20 × 15m+; one 45 × 15m+, and a cabbage tree 15m high.

9 Māhoe is under stress, with most trees producing many epicormic shoots and showing up to 15% dieback.

10 The northern rātā: #1336 above Grass Way, and the un-numbered rātā with 3 trunks, cm d.b.h. 15 & 5 & 15, also above Grass Way, and the two multi-trunked rātā #1398 and #1186, while not in the remnant, should be monitored to ensure their survival and their contribution to the continued existence of this species in the Garden.

11 A 6m kahikatea, (self-sown, pers. comm. W. Shepherd) is below Gorse Path and just above the stone wall on Kew Way.

12 A labelled tōtara, cm d.b.h. 40 and 15m high is on the TL of Gorse Path, on the lawn just outside the proposed boundary of the remnant.

13 The following are two large specimens of species not common in the Garden or in Wellington city ecosystems: kaikōmako 25cm d.b.h. × 12m high at Gorse Path culvert, and toro, (labelled specimen), 25cm d.b.h. We saw one toro seedling 40cm high. Toro seedlings are very few throughout the Garden.

14 Some kaikōmako, a highly palatable species, were showing probable browse damage.

15 We noted a hīnau sapling 1.7m high under pōhutukawa. A 3-trunked hīnau, cm d.b.h. 30 & 30 & 20, near Glen Entrance has 10–15% dieback.

16 We noted a tītoki with some crown dieback or browse just above Kew Way on the TL of the gully above Horseshoe Bend.

17 A large, planted, black beech 70cm d.b.h. and 20m high is on/near the Garden boundary, close to Upland Road.

Invasive Plants

18 The huge exotic trees have reached a height and spread such that their removal is essential for the survival of the remnant.

19 A grove of multi-stemmed pōhutukawa taller than 12m, above lower Gorse Path should be selectively pruned to reduce their spread and to encourage the growth of indigenous species already present, such as kānuka, toro and hīnau. The remnant should be monitored for, and cleared of, pōhutukawa seedlings.

20 There are dense patches of *Pittosporum ralphii* which should be removed as soon as possible.

21 Other invasives include: agapanthus, aluminium plant, arum lily, bay, broom, brush wattle, Chinese privet, Cape ivy, cherry laurel, cotoneaster, Darwin's barberry, eleagnus, elm, English holly, evergreen buckthorn, field bindweed, gorse, hazel pomaderris, hedge stachys, ivy, jasmine, laburnum, montbretia, old man's beard, pūriri, radiata pine, rhododendron, stinking iris, strawberry tree, sycamore, Taiwan cherry, tradescantia, tree lucerne and veld grass.

Human Impacts

22 Neighbours' garden wastes are on, and over, the Garden boundary.

23 Litter, such as bottles, is present near the Garden boundary

24 There is deep scouring of the creek bed, 3m deep × 4 to 6m wide, above the culvert in Gorse Path gully.

RECOMMENDATION 24

24.1 Council consult with the appropriate authorities to find a solution to the continuing scouring of this creek bed.

24.2 The huge exotic trees in the head of the valley and near the North Terrace entrance, and the pōhutukawas above lower Gorse Path be selectively pruned and eventually removed.

24.3 If the survey pegs between the Botanic Garden and private properties from Upland Road to the ends of North Terrace, and Glen Road cannot be found, the boundary be re-surveyed.

24.4 This boundary be fenced with permanent materials to exclude weed species which might otherwise invade.

24.5 Rubbish dumped by neighbours on the Garden boundary be removed at their expense.

LIST 4: Some Indigenous Vascular plants in the Indigenous Forest REMNANT NO. 4, CABLE CAR REMNANT, Wellington Botanic Garden, Glenmore Street, Wellington.

The garden is centred on NZMS 260 Map R27 Pt.Q27 WELLINGTON G.R. 580900. List compiled between February and April 2003 by B.J. Mitcalfe and J.C. Horne.

Note 1

The stream in this remnant, a tributary of "Pukatea Stream", flows on a bearing of approximately 286 degrees True.

Note 2

Plant species listed by previous surveyors but not found by us may be present.

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
GYMNOSPERM TREES		
Dacrycarpus dacrydioides	kahikatea	kahikatea
Podocarpus totara	tōtara	tōtara
MONOCOT TREES		
Cordyline australis	tī kōuka	cabbage tree
DICOT TREES/SHRUBS		
Alectryon excelsus	tītoki	tītoki
Aristotelia serrata	makomako	wineberry
Brachyglottis repanda	rangiora	rangiora
Coprosma areolata		thin-leaved coprosma
Coprosma lucida	karamū	karamū
Coprosma propinqua		
Coprosma repens	taupata	taupata
Coprosma rhamnoides		
Coprosma robusta	karamū	karamū
Corynocarpus laevigatus	karaka	karaka
Dodonaea viscosa	akeake	akeake
Dysoxylum spectabile	kohekohe	kohekohe
Elaeocarpus dentatus	hīnau	hīnau
Fuchsia excorticata	kōtukutuku	tree fuchsia
Geniostoma rupestre	hangehange	hangehange
Hebe stricta var. *atkinsonii*	koromiko	common koromiko
Hebe parviflora	koromiko taranga	tree hebe
Hedycarya arborea	porokaiwhiri	pigeonwood
– *Hoheria populnea*	houhere	lacebark
*Hoheria sexstylos*a	houhere	lacebark

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
Knightia excelsa	rewarewa	rewarewa
Kunzea ericoides	kānuka	kānuka
Laurelia novae-zelandiae	pukatea	pukatea
Leucopogon fasciculatus	mingimingi	big mingimingi
Macropiper excelsum	kawakawa	kawakawa
Melicope ternata	wharangi	wharangi
Melicytus ramiflorus	māhoe	māhoe
– *Metrosideros excelsa*	pōhutukawa	pōhutukawa
Metrosideros robusta	rātā	northern rātā
Myoporum laetum	ngaio	ngaio
Myrsine australis	māpou	māpou
Myrsine salicina	toro	toro
– *Nothofagus solandri* var. *solandri*	tawhai rauriki	black beech
Pennantia corymbosa	kaikōmako	kaikōmako
– *Pittosporum crassifolium*	karo	karo
Pittosporum eugenioides	tarata	lemonwood
– *Pittosporum ralphii*		
Pittosporum tenuifolium	kohuhu	kohuhu
– *Plagianthus regius*	mānatu	lowland ribbonwood
Pseudopanax arboreus	whauwhaupaku	five-finger
Pseudopanax crassifolius	horoeka	lancewood
– *Pseudopanax* (hybrids)		
Raukaua anomalus		
Sophora microphylla	kōwhai	kōwhai
– *Vitex lucens*	pūriri	pūriri
MONOCOT LIANES		
Ripogonum scandens	kareao	supplejack
DICOT LIANES		
Metrosideros fulgens	akakura	scarlet rātā
Metrosideros perforata	aka	clinging rātā
Muehlenbeckia australis	pōhuehue	pōhuehue
Parsonsia heterophylla	kaihua	parsonsia
Passiflora tetrandra	kōhia	NZ passionfruit
FERNS		
Asplenium bulbiferum	manamana	hen and chickens
Asplenium hookerianum		Hooker's spleenwort
Asplenium oblongifolium	huruhuru whenua	shining spleenwort

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
Blechnum chambersii	nini	lance fern
Blechnum filiforme	pānako	thread fern
Blechnum membranaceum		
Cyathea dealbata	ponga	ponga
Cyathea medullaris	mamaku	mamaku
Dicksonia fibrosa	whekī ponga	whekī ponga
Dicksonia squarrosa	whekī	whekī
Lastreopsis glabella		smooth shield fern
Lastreopsis velutina		velvet fern
Microsorum pustulatum	kōwaowao	hound's tongue
Polystichum richardii	pikopiko	common shield fern
Pteris macilenta	titipo	sweet brake
Pyrrosia eleagnifolia	ota	leather-leaf fern
GRASSES		
– *Anemanthele lessoniana*	hunangāmoho	wind grass
Rytidosperma gracile		rytidosperma
SEDGES		
Carex dissita	pūrei	
Uncinia banksii		hooked sedge
MONOCOT HERBS (other than above)		
Arthropodium cirratum	rengarenga	renga lily
Dianella nigra	tūrutu	blueberry
Libertia sp.	mīkoikoi	NZ iris
Phormium cookianum	whaririki	coastal flax

LIST 4.1 Cable Car Remnant: Some Adventive Vascular Plants

BOTANICAL NAME	COMMON NAME
Agapanthus praecox	African lily
Arbutus unedo	strawberry tree
Berberis darwinii	Darwin's barberry
Ceanothus sp.	ceanothus
Chamaecyparis lawsoniana	Lawson's cypress
Chamaecytisus palmensis	tree lucerne
Cirsium vulgare	Scotch thistle
Clematis vitalba	old man's beard
Convolvulus arvensis	field bindweed

BOTANICAL NAME	COMMON NAME
Conyza canadensis	Canadian fleabane
Cotoneaster glaucophyllus	cotoneaster
Crocosmia X*crocosmiiflora*	montbretia
Cupressus lusitanicus var. *benthamii*	Bentham's cypress
Cyperus eragrostis	umbrella sedge
Cytisus scoparius	broom
Dactylis glomerata	cocksfoot
Ehrharta erecta	veld grass
Eleagnus X*reflexa*	eleagnus
Eucalyptus sp.	eucalyptus
Fraxinus sp.	ash
Galeobdolon luteum	aluminium plant
Hedera helix	ivy
Hydrangea macrophylla	hydrangea
Ilex aquilinum	English holly
Iris foetidissima	stinking iris
Jasminum sp.	jasmine
Laburnum sp.	laburnum
Laurus nobilis	bay
Ligustrum sinense	Chinese privet
Linaria sp.	linaria
Magnolia sp.	magnolia
Pinus radiata	radiata pine
Pomaderris aspera	hazel pomaderris
Prunus campanulata	Taiwan cherry
Prunus laurocerasus	cherry laurel
Prunus persica	peach
Pteris cretica	Cretan brake
Rhamnus alaternus	evergreen buckthorn
Rhododendron sp.	rhododendron
Senecio angulatus	Cape ivy
Solanum chenopodioides	velvety nightshade
Solanum nigrum	black nightshade
Stachys silvatica	hedge stachys
Tradescantia fluminensis	tradescantia
Ulex europaeus	gorse
Viburnum sp.	viburnum
Zantedeschia aethiopica	arum lily

3.5 Remnant 5: Glen Slope

Some Field Observations

Indigenous plants

1 We noted the impressive stature of the hīnau-tītoki forest above and below Hīnau Path. It includes a senescent, hollow-trunked, almost certainly original hīnau, 1.2m d.b.h., on Hīnau Path, c. 12m from its junction with Rangiora Path. However some hīnau are dead, some are dying, and many have dieback. This is almost certainly the result of drought, but shading by massive oaks and conifers, and capture of runoff by paths are certain to be contributing factors.

Hīnau of a range of ages are abundant; examples: cm d.b.h.: 15; 22; 30; 12; 32; 20; 22; 19; 19; 15; 22; 10; 60; 65; 50; 40; 30; 40; 60; 60; 35; 30; 30; one 3-trunked, 12 & 20 & 25. There is one dead/dying hīnau 30cm d.b.h., between Annie's seat and the Play Area.

2 Tītoki are abundant. Examples: cm d.b.h.: 20; 45; 40; 50; 30; 33; 50; 42; 1 × 2-trunked, 40 & 30; 1 × 2-trunked 10 & 20; and 3 saplings. However tītoki appear to be affected by shading from large exotics overhead.

3 Kohekohe are vigorous and numerous in all tiers.

4 We saw *Metrosideros colensoi,* our second sighting only.

5 Karaka has the potential to crowd out other species and will become the dominant tree if unchecked. Examples are: cm d.b.h.: 40 × 16m high; 30 × 16m high and seedlings are very dense in places. We saw that some small karaka trees had already been felled.

6 We found one kiekie, a young plant with several stems, and about 10 tufts of leaves, above "Pukatea Stream", on the TL, near the upstream culvert. **This was the only kiekie seen on the survey.**

7 Examples of pigeonwood: cm d.b.h.: 18; one 4m high; one 2-trunked 15 & 8 × 10m high. Pigeonwood are not common in the Garden.

8 Kōtukutuku are very stressed, some moribund, with many epicormic shoots. Examples are: cm d.b.h.: 15 (dead); 10 (dead); 16; 18; and only 1 seedling.

9 Examples of pukatea: cm d.b.h. 55 × 18m high; 40; 70; 80; 45; and seedlings.

10 The northern rātā, 80cm d.b.h., is one of only two naturally occurring northern rātā in the Garden.

11 Examples of kānuka, possibly original: cm d.b.h. 45; 40 × 18m high.

12 *Adiantum viridescens,* (categorised as scarce in Wellington Conservancy), is widespread on parts of the western slopes.

13 The black maire, 60cm d.b.h. × 18m high, possibly original, is the only one known in the Garden. It has 5% canopy dieback. At present it has c. 100 tiny seedlings. At our request, some of these are being potted up and grown on by Garden staff.

14 Tawa is not common in the Garden. There is one with 28cm d.b.h., up spur from the black maire and there are three 50cm high seedlings near the black maire.

15 A 2.2m high matai sapling, the only matai known in the Garden, is near Cranshaw peg, Transect 1, 1992.

16 There are large ngaio, e.g. cm d.b.h.: 30; 40; 45; 50 × 20m high; two 40 × 18m high.

17 Beside two large, multi-trunked lillypilly trees near Glen Entrance, is a tōtara 15m high with two trunks, 20 & 30cm d.b.h. It appears to be seriously restricted by the lillypillys, one of which is only 1m away.

18 Miro: two, of several planted: cm d.b.h. 30; 30 × 14m high;

19 Toro, cm d.b.h. 28, leaning over Hīnau Path; 20; 17; 23 × 12m high near northern rātā.

20 Kaikōmako, not common throughout; one 20 cm d.b.h. × 15m high

21 Examples of five-finger: cm d.b.h. 22; 45 × 10m high, in the canopy.

22 Wharangi seedlings and saplings are not uncommon; 2 wharangi 4m high, on Magpie Lawn edge above Rangiora Path.

23 Rewarewa examples: cm d.b.h.: 40; 50; one 3-trunked, 15 & 17 & 32; one 2-trunked, 45 & 26; one 3-trunked 8 & 20 & 30.

24 Nīkau seedlings and saplings are numerous.

25 A planted rimu sapling is 5m high. Two seedlings are 1.2m high and 1m high (dead).

26 Kōwhai: two 2-trunked, 20 & 25; 25 & 25, with label #1925.

27 Dense hound's tongue and threadfern groundcover in places.

28 Red beeches, (planted), #s 1031, 1032, 1033, 1036, 1037, etc, are below the Play Area.

29 One of the planted red beeches by Rangiora Path, at the southeastern corner of Magpie Lawn, is dead, probably a drought casualty.

30 A large tarata, 40 cm d.b.h. × 16m is beside the path up from the black maire.

Invasive Plants

31 Large English oaks and other exotics, especially conifers, are now of such stature and spread that they are shading out the crowns of e.g. tītoki and hīnau, and will almost certainly contribute to their eventual demise.

32 Other examples of exotic trees down Rangiora and Aka Paths are #0859; #2580 70cm dbh; #0863.

33 Old man's beard is 1m north of #2580 (= 2nd OMB on TR), and above Rangiora Path; and at the junction of Rangiora Path and Magpie Lawn, beside the dying red beech.

34 Japanese honeysuckle is on TR of Rangiora Path.

35 *Pseudopanax laetus*, a non-Wellington tree, like *P. lessonii,* is hybridising with *P. arboreus* and *P. crassifolius.*

36 Blackberry thickets to 2m high are c. 40m down valley from black maire, on the bank above Mamaku Way; also dense tradescantia.

37 Other invasives include: agapanthus, alder, barberry, blackberry, broom, brush wattle, cherry laurel, Chilean rhubarb, cotoneaster, Darwin's barberry, eleagnus, English holly, hedge stachys, *Hoberia populnea* var.*populnea,* holly-leaved senecio, ivy, Japanese honeysuckle, jasmine, karaka, laburnum, lillypilly, Mexican daisy, mist flower, montbretia, old man's beard, pine sp., pōhutukawa, *Pseudopanax laetus,* pūriri, selaginella, strawberry tree, sycamore, Taiwan cherry, tradescantia, tree lucerne, tutsan and veld grass.

RECOMMENDATION 25

25.1 Tradescantia and selaginella be removed from the stream bed and banks.

25.2 If the survey pegs between the Botanic Garden and the adjacent, private properties on Glen Road and Mariri Road cannot be found, the boundary be re-surveyed.

25.3 This boundary be fenced with permanent materials to exclude weed species which might otherwise invade.

25.4 Rubbish dumped by neighbours on the Garden boundary be removed at their expense.

LIST 5: Some Indigenous Vascular plants in the Indigenous Forest REMNANT NO. 5, GLEN SLOPE, Wellington Botanic Garden, Glenmore Street, Wellington.

The garden is centred on NZMS 260 Map R27 Pt.Q27 WELLINGTON G.R. 580900. List compiled between February and April 2003 by B.J. Mitcalfe and J.C. Horne.

Note 1

"Pukatea Stream", a tributary of Pipitea Stream, flows on a bearing of approximately 020 degrees True.

Note 2

Plant species listed by previous surveyors but not found by us may be present.

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
GYMNOSPERM TREES		
– *Agathis australis*	kauri	kauri
Dacrydium cupressinum	rimu	rimu
– *Libocedrus plumosa*	kawaka	kawaka
Podocarpus totara	tōtara	tōtara
Prumnopitys taxifolia	matai	matai
Stachypitys ferruginea (= *Prumnopitys ferruginea*)	miro	miro
MONOCOT TREES		
Cordyline australis	tī kōuka	cabbage tree
Rhopalostylis sapida	nīkau	nīkau
DICOT TREES/SHRUBS		
Alectryon excelsus	tītoki	tītoki
Aristotelia serrata	makomako	wineberry
Beilschmiedia tawa	tawa	tawa
Brachyglottis repanda	rangiora	rangiora
Coprosma grandifolia	kānono	kānono
Coprosma lucida	karamū	karamū
Coprosma propinqua		
Coprosma repens	taupata	taupata
Coprosma rhamnoides		
Coprosma robusta	karamū	karamū
– *Corokia cotoneaster*	korokio	corokia
Corynocarpus laevigatus	karaka	karaka
Dodonaea viscosa	akeake	akeake
Dysoxylum spectabile	kohekohe	kohekohe

KEY

– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
Elaeocarpus dentatus	hīnau	hīnau
Fuchsia excorticata	kōtukutuku	tree fuchsia
Geniostoma rupestre	hangehange	hangehange
Hebe parviflora (= *"H. arborea"*)	koromiko taranga	tree hebe
Hebe stricta var. *atkinsonii*	koromiko	koromiko
Hedycarya arborea	porokaiwhiri	pigeonwood
– *Hoheria populnea*	houhere	lacebark
*Hoheria sexstylos*a	houhere	lacebark
Knightia excelsa	rewarewa	rewarewa
Kunzea ericoides	kānuka	kānuka
Laurelia novae-zelandiae	pukatea	pukatea
Macropiper excelsum	kawakawa	kawakawa
Melicope ternata	wharangi	wharangi
Melicytus ramiflorus	māhoe	māhoe
– *Metrosideros excelsa*	pōhutukawa	pōhutukawa
Metrosideros robusta	rātā	northern rātā
Myoporum laetum	ngaio	ngaio
Myrsine australis	māpou	māpou
Myrsine salicina	toro	toro
Nestegis cunninghamii	maire	black maire
– *Nothofagus fusca*	tawhai raunui	red beech
Olearia rani	heketara	heketara
Ozothamnus leptophyllus	tauhinu	tauhinu
Pennantia corymbosa	kaikōmako	kaikōmako
Pittosporum eugenioides	tarata	lemonwood
– *Pittosporum ralphii*		
Pseudopanax arboreus	whauwhaupaku	five-finger
Pseudopanax crassifolius	horoeka	lancewood
– *Pseudopanax laetus*		
– *Pseudopanax* (hybrids)		
Schefflera digitata	patē	patē
Sophora microphylla	kōwhai	kōwhai
– *Vitex lucens*	pūriri	pūriri
MONOCOT LIANES		
Freycinetia baueriana	kiekie	kiekie
Ripogonum scandens	kareao	supplejack

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
DICOT LIANES		
Clematis forsteri	pikiarero	small white clematis
Clematis paniculata	puawānanga	white clematis
Metrosideros colensoi		
Metrosideros diffusa	rātā	white rātā
Metrosideros fulgens	akakura	scarlet rātā
Metrosideros perforata	aka	clinging rātā
Muehlenbeckia australis	pōhuehue	pōhuehue
Parsonsia heterophylla	kaihua	parsonsia
Passiflora tetrandra	kōhia	NZ passionfruit
Rubus cissoides	tātarāmoa	bush lawyer
FERNS		
Adiantum viridescens		maidenhair
Asplenium bulbiferum	manamana	hen and chickens
Asplenium flaccidum	makawe o Raukatauri	hanging spleenwort
Asplenium oblongifolium	huruhuru whenua	shining spleenwort
Asplenium polyodon	petako	sickle spleenwort
Blechnum chambersii	nini	lance fern
Blechnum filiforme	pānako	thread fern
– *Blechnum fluvatile*	kiwakiwa	ray water fern
Blechnum membranaceum		
Cyathea dealbata	ponga	ponga
Cyathea medullaris	mamaku	mamaku
Cyathea smithii	kātote	soft tree fern
Dicksonia fibrosa	wheki ponga	wheki ponga
Dicksonia squarrosa	whekī	whekī
Hymenophyllum demissum	mauku	drooping filmy fern
Hypolepis ambigua	rarauhi nehenehe	
Lastreopsis glabella		smooth shield fern
Lastreopsis hispida	pongaweka	hairy fern
Lastreopsis velutina		velvet fern
Leptopteris hymenophylloides	heruheru	single crepe fern
– *Marattia salicina*	para	king fern
Microsorum pustulatum	kōwaowao	hound's tongue
Microsorum scandens	mokimoki	scented fern
Pellaea rotundifolia	tarawera	button fern
Pneumatopteris pennigera	pākau	gully fern

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
Polystichum richardii	pikopiko	common shield fern
Pteridium esculentum	rārahu	bracken
Pteris macilenta	titipo	sweet brake
Pyrrosia eleagnifolia	ota	leather-leaf fern
ORCHIDS		
Earina mucronata	peka a waka	Spring orchid
GRASSES		
Cortaderia sp.	toetoe	toetoe
Microlaena avenacea		bush rice grass
Poa anceps		broad-leaved poa
Rytidosperma gracile		rytidosperma
SEDGES		
Carex dissita	pūrei	a sedge
Uncinia banksii		hooked sedge
Uncinia scabra		hooked sdege
Uncinia uncinata	matau a Māui	hooked sedge
MONOCOT HERBS (other than above)		
Arthropodium cirratum	rengarenga	renga lily
Astelia solandri	kōwharawhara	perching astelia
Dianella nigra	tūrutu	blueberry
Libertia grandiflora	mīkoikoi	NZ iris
Phormium sp.		flax
DICOT HERBS		
Cardamine debilis	panapana	NZ bitter cress

LIST 5.1 Glen Slope Remnant: Some Adventive Vascular Plants

BOTANICAL NAME	COMMON NAME
Abies cephalonica	Grecian fir
Acanthus mollis	bear's breeches
Acer pseudoplanatus	sycamore
Acmena smithii	lillypilly
Agapanthus praecox	African lily
Ageratina riparia	mist flower
Alnus sp.	alder
Arbutus unedo	strawberry tree
Bambusa sp.	bamboo

BOTANICAL NAME	COMMON NAME
Berberis glaucocarpa	barberry
Centaurium erythraea	centaury
Chamaecyparus lawsoniana	Lawson's cypress
Chamaecytisus palmensis	tree lucerne
Cirsium vulgare	Scotch thistle
Clematis vitalba	old man's beard
Conyza canadensis	Canadian fleabane
Cotoneaster glaucophyllus	cotoneaster
Crocosmia X*crocosmiiflora*	montbretia
Cymbalaria muralis	ivy-leaved toadflax
Cyperus eragrostis	umbrella sedge
Cytisus scoparius	broom
Dactylis glomerata	cocksfoot
Digitalis purpurea	foxglove
Ehrharta erecta	veld grass
Eleagnus X*reflexa*	eleagnus
Erigeron karvinskianus	Mexican daisy
Fuchsia (cult.)	fuchsia
Galinsoga parviflora	galinsoga
Geranium maderense	Madeira geranium
Gnaphalium sphaericum	Jersey cudweed
Gunnera tinctoria	Chilean rhubarb
Hedera helix	ivy
Hedychium gardnerianum	wild ginger
Hydrangea macrophylla	hydrangea
Hypericum androsaemum	tutsan
Hypochaeris radicata	catsear
Ilex aquilinum	English holly
Iris pseudocorus	yellow flag
Jasminum sp.	jasmine
Laburnum	laburnum
Linaria sp.	linaria
Lonicera japonica	Japanese honeysuckle
Lunaria annua	honesty
Oxalis sp.	oxalis
Paraserianthes lophanta	brush wattle
Parietaria judaica	pellitory of the wall
Physalis peruviana	Cape gooseberry
Pinus sp.	pine

BOTANICAL NAME	COMMON NAME
Plantago lanceolata	narrow-leaved plantain
Pomaderris aspera	hazel pomaderris
Prunus campanulata	Taiwan cherry
Prunus laurocerasus	cherry laurel
Pteris cretica	Cretan brake
Quercus robur	English oak
Rhododendron sp.	rhododendron
Rubus fruticosus agg.	blackberry
Sambucus nigra	elderberry
Selaginella kraussiana	African club moss
Senecio angulatus	Cape ivy
Senecio glastifolius	holly-leaved senecio
Sequoia sempervirens	Californian redwood
Sisyrinchium iridioides	blue-eyed grass
Solanum chenopodioides	velvety nightshade
Solanum nigrum	black nightshade
Stachys silvatica	hedge stachys
Tradescantia fluminensis	tradescantia
Tropaeolum majus	garden nasturtium
Vicia sp.	vetch

LIST 6: COMBINED LIST OF INDIGENOUS VASCULAR PLANTS IN ALL THE REMNANTS

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
GYMNOSPERM TREES		
– *Agathis australis*	kauri	kauri
Dacrycarpus dacrydioides	kahikatea	kahikatea
Dacrydium cupressinum	rimu	rimu
– *Libocedrus plumosa*	kawaka	kawaka
– *Phyllocladus trichomanoides*	tanekaha	tanekaha
Podocarpus totara	tōtara	tōtara
Prumnopitys taxifolia	matai	matai
Stachypitys (= *Prumnopitys*) *ferruginea*	miro	miro
MONOCOT TREES		
Cordyline australis	tī kōuka	cabbage tree
Rhopalostylis sapida	nīkau	nīkau
DICOT TREES/SHRUBS		
Alectryon excelsus	tītoki	tītoki
Aristotelia serrata	makomako	wineberry
Beilschmiedia tawa	tawa	tawa
– *Brachyglottis greyi*		coastal groundsel
Brachyglottis repanda	rangiora	rangiora
Carmichaelia australis	mākākā	NZ broom
– *Carmichaelia williamsii*		giant flowered broom
Carpodetus serratus	putaputawētā	marbleleaf
Coprosma areolata		thin-leaved coprosma
Coprosma crassifolia		thick-leaved coprosma
Coprosma grandifolia	kānono	kānono
Coprosma lucida	karamū	karamū
Coprosma propinqua		
Coprosma repens	taupata	taupata
Coprosma rhamnoides		
Coprosma robusta	karamū	karamū
– *Corokia cotoneaster*	korokio	corokia
Corynocarpus laevigatus	karaka	karaka
Dodonaea viscosa	akeake	akeake
Dysoxylum spectabile	kohekohe	kohekohe
Elaeocarpus dentatus	hīnau	hīnau

KEY

– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
Fuchsia excorticata	kōtukutuku	tree fuchsia
Geniostoma rupestre	hangehange	hangehange
Griselinia littoralis	papāuma	broadleaf
Griselinia lucida	puka	puka
– *Hebe diosmifolia*		
Hebe parviflora	koromiko taranga	tree hebe
– *Hebe speciosa*	napuka	purple hebe
Hebe stricta var. *atkinsonii*	koromiko	koromiko
Hedycarya arborea	porokaiwhiri	pigeonwood
– *Hoheria populnea*	houhere	lacebark
*Hoheria sexstylos*a		
Knightia excelsa	rewarewa	rewarewa
Kunzea ericoides	kānuka	kānuka
Laurelia novae-zelandiae	pukatea	pukatea
Leptospermum scoparium	mānuka	mānuka
Leucopogon fasciculatus	mingimingi	big mingimingi
Lophomyrtus bullata	ramarama	ramarama
Macropiper excelsum	kawakawa	kawakawa
Melicope ternata	wharangi	wharangi
Melicytus ramiflorus	māhoe	māhoe
– *Meryta sinclairii*	puka	puka
– *Metrosideros excelsa*	pōhutukawa	pōhutukawa
Metrosideros robusta	rātā	northern rātā
Myoporum laetum	ngaio	ngaio
Myrsine australis	māpou	māpou
Myrsine salicina	toro	toro
Nestegis cunninghamii	maire	black maire
– *Nothofagus fusca*	tawhai raunui	red beech
Nothofagus solandri var. *solandri*	tawhai rauriki	black beech
– *Olearia albida*	tangaru	tangaru
Olearia paniculata	akiraho	akiraho
Olearia rani	heketara	heketara
Olearia solandri		coastal tree daisy
Ozothamnus leptophyllus	tauhinu	tauhinu
Pennantia corymbosa	kaikōmako	kaikōmako
– *Pittosporum crassifolium*	karo	karo
Pittosporum eugenioides	tarata	lemonwood

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
– *Pittosporum ralphii*		
Pittosporum tenuifolium	kohuhu	kohuhu
Plagianthus regius	mānatu	lowland ribbonwood
Pseudopanax arboreus	whauwhaupaku	five-finger
Pseudopanax crassifolius	horoeka	lancewood
– *Pseudopanax laetus*		
– *Pseudopanax* (hybrids)		
Raukaua anomalus		
Schefflera digitata	patē	patē
Solanum laciniatum	poroporo	poroporo
Solanum sp.	poroporo	poroporo
Sophora microphylla	kōwhai	kōwhai
– *Sophora tetraptera*	kōwhai	kōwhai
– *Vitex lucens*	pūriri	pūriri
Weinmannia racemosa	kāmahi	kāmahi
MONOCOT LIANES		
Freycinetia baueriana	kiekie	kiekie
Ripogonum scandens	kareao	supplejack
DICOT LIANES		
Clematis forsteri	pikiarero	small white clematis
Clematis paniculata	puawānanga	white clematis
Metrosideros colensoi		
Metrosideros diffusa	rātā	white rātā
Metrosideros fulgens	akakura	scarlet rātā
Metrosideros perforata	aka	clinging rātā
Muehlenbeckia australis	pōhuehue	pōhuehue
Parsonsia heterophylla	kaihua	parsonsia
Passiflora tetrandra	kōhia	NZ passionfruit
Rubus cissoides	tātarāmoa	bush lawyer
Rubus schmidelioides	tātarāmoa	bush lawyer
FERNS		
Adiantum cunninghamii	huruhuru tapairu	common maidenhair
Adiantum viridescens		maidenhair
Asplenium bulbiferum	manamana	hen and chickens
Asplenium flabellifolium		necklace fern
Asplenium flaccidum	makawe o Raukatauri	hanging spleenwort
Asplenium hookerianum		Hooker's spleenwort

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
Asplenium oblongifolium	huruhuru whenua	shining spleenwort
Asplenium polyodon	petako	sickle spleenwort
Asplenium bulbiferum × *A. flaccidum*		
Blechnum chambersii	nini	lance fern
Blechnum discolor	piupiu	crown fern
Blechnum filiforme	pānako	thread fern
Blechnum fluviatile	kiwakiwa	ray water fern
Blechnum membranaceum		
Blechnum novae-zelandiae	kiokio	kiokio
Cyathea cunninghamii		gully tree fern
Cyathea dealbata	ponga	ponga
Cyathea medullaris	mamaku	mamaku
Cyathea smithii	kātote	soft tree fern
Dicksonia fibrosa	whekī ponga	whekī ponga
Dicksonia squarrosa	whekī	whekī
Grammitis billardierei		strap fern
Grammitis ciliata		strap fern
Hymenophyllum demissum	mauku	drooping filmy fern
Hymenophyllum flabellatum	mauku	fan-like filmy fern
Hypolepis ambigua	rarauhi nehenehe	
Lastreopsis glabella		smooth shield fern
Lastreopsis hispida	pongaweka	hairy fern
Lastreopsis velutina		velvet fern
Leptopteris hymenophylloides	heruheru	single crepe fern
– *Marattia salicina*	para	king fern
Microsorum pustulatum	kōwaowao	hound's tongue
Microsorum scandens	mokimoki	scented fern
Pellaea rotundifolia	tarawera	button fern
Pneumatopteris pennigera	pākau	gully fern
Polystichum richardii	pikopiko	common shield fern
Pteridium esculentum	rārahu	bracken
Pteris macilenta	titipo	sweet brake
Pteris tremula	turawera	shaking brake
Pyrrosia eleagnifolia	ota	leather-leaf fern

KEY
– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
ORCHIDS		
Prasophyllum colensoi		leek orchid
Thelymitra sp.	maikuku	sun orchid
GRASSES		
Anemanthele lessoniana	hunangāmoho	gossamer grass
Cortaderia toetoe	toetoe	toetoe
Cortaderia sp.	toetoe	toetoe
Dichelachne crinita		long-hair plume grass
Microlaena avenacea		bush rice grass
Microlaena polynoda		
Microlaena stipoides	pātītī	slender rice grass
Poa anceps		broad-leaved poa
Rytidosperma gracile		rytidosperma
SEDGES		
Carex dissita	pūrei	a sedge sp.
Carex testacea	pūrei	speckled sedge
Gahnia pauciflora	māpere	cutting sedge
Gahnia setifolia	māpere	cutty grass
Uncinia banksii		hooked sedge
Uncinia scabra		hooked sedge
Uncinia uncinata	matau a Māui	hooked sedge
RUSHES		
Luzula picta		a woodrush
MONOCOT HERBS (other than above)		
Arthropodium candidun	repehina papa	
Arthropodium cirratum	rengarenga	renga lily
Astelia solandri	kōwharawhara	perching astelia
Dianella nigra	tūrutu	blueberry
Libertia grandiflora	mīkoikoi	NZ iris
Libertia sp.	mīkoikoi	NZ iris
Phormium cookianum	whaririki	coastal flax
Phormium tenax	harakeke	swamp flax
COMPOSITE HERBS		
Senecio minimus		fireweed
Gnaphalium sphaericum		Japanese cudweed

KEY

– = Not naturally occurring in Wellington Ecological District.

BOTANICAL NAME	MĀORI NAME	COMMON NAME
DICOT HERBS (other than composites)		
Cardamine debilis	panapana	NZ bitter cress
Centella uniflora		centella
– *Colensoa physaloides*	hānea	colensoa
– *Elatostema rugosum*	parataniwha	
Haloragis erecta	toatoa	shrubby haloragis
Hydrocotyle heteromeria		waxweed
Stellaria decipiens	kohukohu	NZ chickweed
Wahlenbergia violacea	rimuroa	a harebell

SECTION 4:
John Buchanan's Survey

We assume that in 1875, Buchanan surveyed the whole Botanic Garden, i.e. the original 13 acres plus the 54 acres of Wesleyan land added in 1874. By contrast, our survey covered only the forest remnants as they are today.

We have updated the relevant sections of Buchanan's lists of indigenous vascular plants, by using current plant names and the current plant categories used by most botanists.

Regarding the *introduced* indigenous plants listed by Buchanan, in Group 7, pages 9–11, we have listed only those which we found in the remnants.

We have *not* listed what he called "*accidental plants, chiefly British weeds*" in his Group 9, pages 13–16, or exotic grasses, pages "11a" and "11b", or Group 11, introduced and exotic ferns, page 17, or Group 12, introduced, ornamental exotics, pages 18, "18a", 2, 3, 4, and 5, or Group 13, Pinetum, pages 21–26.

LIST 7: Indigenous, Naturally occurring Vascular Plants in Wellington Botanic Garden, Listed by John Buchanan, in "Notes on the Colonial Botanic Gardens, Wellington and Its Flora", (A Paper Read to the Wellington Philosophical Society on 4 October 1875), Compared With the Indigenous, Naturally occurring Vascular Plants Listed in the Botanical Survey of the Indigenous Forest Remnants by Mitcalfe and Horne in 2003.

Note 1

Buchanan did not number all the pages of his Paper. We have therefore numbered the un-numbered page which follows page 11, as 11a.

Note 2

Species names in { } are those which Buchanan used but which are now obsolete, with no modern equivalents.

Note 3

Botanical names which have changed recently are indicated by the = sign, followed by their previous name [synonym].

KEY: Found in 2003 survey = •
Not found in 2003 survey = 0

CURRENT BOTANICAL NAME	BUCHANAN'S LIST Page / Line		NOTES
GYMNOSPERM TREES			
Dacrycarpus dacrydioides	3/22	•	
Dacrydium cupressinum	3/23	•	
Podocarpus totara	3/21	•	
Stachypitys (= *Prumnopitys*) *ferruginea*	3/20	•	

CURRENT BOTANICAL NAME	BUCHANAN'S LIST Page / Line		NOTES
MONOCOT TREES AND SHRUBS			
Cordyline australis	12/2	•	
Cordyline banksii	12/3	0	
DICOT TREES AND SHRUBS			
Alectryon excelsus	4/14	•	
Aristotelia serrata	4/5	•	
Beilschmiedia tawa	5/26	•	
Brachyglottis repanda	5/10	•	
Carpodetus serratus	4/16	•	
Coprosma foetidissima	5/5	0	
Coprosma grandifolia	4/33	•	
Coprosma lucida	4/32	•	
Coprosma rhamnoides	5/4	•	
Coprosma robusta	5/1	•	
Coprosma tenuicaulis	5/3	0	
Coprosma propinqua × *C. robusta*	5/2	0	
Dysoxylum spectabile	4/10	•	
Elaeocarpus dentatus	3/12	•	
Fuchsia excorticata	4/25	•	
Geniostoma rupestre	5/17	•	
Griselinia lucida	7/13	•	
Hebe arborea	5/22		Name obsolete;syn. *H. parviflora*
Hebe parviflora	5/21	•	
Hedycarea arborea	5/28	•	
Hoheria populnea	4/2	•	
*Hoheria sexstylos*a	4/3	•	
Ileostylus micranthus	7/29	0	
Knightia excelsa	3/18	•	
Korthalsella salicornioides	7/31	0	
Kunzea ericoides	4/20	•	
Laurelia novae-zelandiae	3/16	•	
Leptospermum scoparium	4/19	•	
Leucopogon fasciculatus	5/12	•	
Lophomyrtus bullata	4/21	•	
Lophomyrtus obcordata	4/22	0	
Macropiper excelsum	5/35	•	

CURRENT BOTANICAL NAME	BUCHANAN'S LIST Page / Line		NOTES
Melicope ternata	4/7	•	
Melicope simplex × *M.ternata*	4/8	•	Outside remnant
Melicytus ramiflorus	3/31	•	
Metrosideros robusta	3/14	•	
Myoporum laetum	5/24	•	
Myrsine australis	5/15	•	
Myrsine salicina	5/14	•	
Nestegis cunninghamii	5/31	•	
Olearia paniculata	5/8	•	
Olearia rani	5/7	•	
Ozothamnus leptophyllus	5/9	•	
Pennantia corymbosa	4/12	•	
Pimelea prostrata	5/29	0	
Pittosporum cornifolium	7/11	0	
Pittosporum eugenioides	3/34	•	
Pittosporum tenuifolium	3/33	•	
Pseudopanax arboreus	4/29	•	
Pseudopanax crassifolius	4/28	•	Buchanan listed this as planted and naturally occurring.
Pseudowintera axillaris	3/29	0	
Raukaua edgerleyi	4/27	0	
Schefflera digitata	4/30	•	
Solanum aviculare	5/19	0	
Streblus heterophyllus	5/33	0	
Syzygium maire	4/23	0	
Tupeia antarctica	7/30	0	
Weinmannia racemosa	4/17	•	
MONOCOT LIANES			
Ripogonum scandens	6/30	•	
DICOT LIANES			
Clematis colensoi	6/11		Name obsolete; syn. *C. forsteri*
Clematis forsteri	6/10	•	
Clematis paniculata	6/9	•	
Metrosideros colensoi	6/19	•	
Metrosideros diffusa	6/18	•	
Metrosideros fulgens	6/17	•	

CURRENT BOTANICAL NAME	BUCHANAN'S LIST Page / Line		NOTES
Metrosideros perforata	6/20	•	
Muehlenbeckia australis	6/27	•	
Muehlenbeckia complexa	6/28	0	
Parsonsia capsularis	6/25	0	
Parsonsia heterophylla	6/24	•	
Passiflora tetrandra	6/22	•	
Rubus australis	6/13	0	
Rubus cissoides	6/15	•	
Rubus schmidelioides	6/14	•	
PSILOPSIDS, LYCOPODS, QUILLWORTS			
Huperzia varia	17/23	0	
Lycopodium billardierei	17/24		Name obsolete; syn. *H. varia*
Tmesipteris forsteri	17/25	0	
FERNS			
Adiantum diaphanum	16/19	0	
Adiantum hispidulum	16/18	0	
Arthropteris tenella	17/16	0	
Asplenium flabellifolium	17/2	•	
Asplenium flaccidum	17/5	•	
Asplenium sp. { var. a }	17/6		Data insufficient for ID
Asplenium sp. { var. b }	17/7		Data insufficient for ID
Asplenium hookerianum	17/4	•	
Asplenium oblongifolium	17/1	•	
Asplenium polyodon	17/3	•	
Blechnum chambersii	16/31	•	
Blechnum filiforme	16/26	•	
Blechnum fluviatile	16/30	•	
Blechnum novae-zelandiae	16/27	•	
Blechnum sp. { var. a }	16/28		Data insufficient for ID
Blechnum sp. { var. c }	16/29		Data insufficient for ID
Ctenopteris heterophylla	17/15	0	
Cyathea dealbata	16/6	•	
Cyathea medullaris	16/7	•	
Cyathea smithii	16/8	•	
Dicksonia squarrosa	16/9	•	
Grammitis billardierei	17/14	•	

CURRENT BOTANICAL NAME	BUCHANAN'S LIST Page / Line		NOTES
Histiopteris incisa	16/24	0	
Hymenophyllum demissum	16/13	•	
Hymenophyllum dilatatum	16/10	0	
Hymenophyllum javanicum	16/11		Name obsolete; syn. unknown
Hymenophyllum sanguinolentum	16/12	0	
Hypolepis ambigua	16/20	•	
Lastreopteris hispida	17/13	•	
Lastreopsis microsora	17/12	0	
Lastreopsis velutina	17/11	•	
Leptolepia novae-zelandiae	16/16	0	
Leptopteris hymenophylloides	17/22	•	
Lindsaea linearis	16/17	0	
Microsorum pustulatum	17/21	•	
Microsorum scandens	17/20	•	
Pellaea rotundifolia	16/21	•	
Pneumatopteris pennigera	17/18	•	
Polystichum richardii	17/9	•	
Polystichum vestitum	17/8	0	
Pteridium esculentum	16/22	•	
Pteris macilenta	16/25	•	
Pteris tremula	16/23	•	
Pyrrosia eleagnifolia	17/19	•	
Rumohra adiantiformis	17/10	0	
Trichomanes endlicherianum	16/14	0	
Trichomanes venosum	16/15	0	
ORCHIDS			
Icthyostomum (= *Bulbophyllum*) *pygmaeum*	7/18	0	
Drymoanthus adversus	7/19	0	
Earina autumnalis	7/14	0	
Earina mucronata	7/15	0	
Microtis unifolia	9/15	0	
Prasophyllum colensoi	9/21	•	
Pterostylis banksii	9/16	0	
Pterostylis graminea	9/17	0	
Pterostylis trullifolia	9/18	0	
Thelymitra longifolia	9/19	0	

CURRENT BOTANICAL NAME	BUCHANAN'S LIST Page / Line		NOTES
Thelymitra pulchella	9/20	0	
Winika cunninghamii	7/17	0	
GRASSES			
Chionochloa conspicua	11a/31	0	
Dichelachne crinita	11a/28	•	
Dichelachne micrantha	11a/29	0	
Echinopogon ovatus	11a/27	0	
Lachnagrostis filiformis	11a/30	0	
Microlaena avenacea	11a/25	•	
Oplismenus imbecillus	11a/26	0	
Poa anceps	11a/33	•	
Rytidosperma setifolium	11a/32	0	
SEDGES			
Carex forsteri	11a/17	0	
Carex sp. { *ternaria* }	11a/18	0	
Gahnia setifolia	11a/12	•	
Isolepis prolifer	11a/9	0	
Isolepis sp. { *globosa* }	11a/10	0	
Isolepis sp. { *riparia* }	11a/11	0	
Lepidosperma australe	11a/13	0	
Uncinia banksii	11a/15	•	
Uncinia ferruginea	11a/16	0	
Uncinia uncinata	11a/14	•	
RUSHES			
Juncus australis	11a/4	0	
Juncus planifolius	11a/5	0	
Luzula banksiana	11a/8	0	
MONOCOT HERBS (other than grasses, sedges, rushes)			
Arthropodium cirratum	12/4	•	
Astelia cunninghamii	7/21		Name obsolete; syn. *A. solandri*
Astelia solandri	7/22	•	
Dianella nigra	9/25	•	
Libertia ixioides	9/23	0	
Phormium cookianum	12/6	•	
Phormium tenax	12/5	•	

CURRENT BOTANICAL NAME	BUCHANAN'S LIST Page / Line		NOTES
COMPOSITE HERBS			
Cotula australis	8/35	0	
Cotula coronopifolia	8/34	0	
Craspedia uniflora	9/1	0	
Euchiton involucratus	9/4	0	
Helichrysum filicaule	9/2	0	
Lagenifera sp.	8/33	0	
Pseudognaphalium luteo-album	9/3	0	Adventive
Senecio scaberulus	9/6	0	
Senecio wairauensis	9/5	0	
Vittadinia australis	8/34	0	
DICOT HERBS (other than composites)			
Acaena anserinifolia	8/18	0	
Cardamine debilis	8/10	•	
Centella uniflora	8/29	•	
Epilobium nummularifolium	8/23	0	
Epilobium pubens	8/25	0	
Epilobium rotundifolium	8/24	0	
Geranium australe	8/14	0	Adventive
Geranium molle	8/16	0	Adventive
Geranium sessiliflorum	8/15	0	
Gonocarpus aggregatus	8/21	0	
Haloragis erecta	8/20	•	
Hydrocotyle elongata	8/27	0	
Hydrocotyle moschata	8/28	0	
Nertera dichondrifolia	8/30	0	
Ranunculus amphitrichus	8/7	0	
Ranunculus parviflorus	8/8	0	Adventive
Ranunculus reflexus	8/6	0	
Scleranthus biflorus	9/11	0	
Stellaria decipiens	8/12	•	
Urtica incisa	9/13	0	
Wahlenbergia littoralis	9/9	0	*W. gracilis* recorded by Buchanan has now been split into *W. littoralis* and *W. ramosa*.
OR *W. ramosa*	9/9	0	

LIST 8: SOME INTRODUCED INDIGENOUS VASCULAR PLANTS IN WELLINGTON BOTANIC GARDEN, LISTED BY JOHN BUCHANAN, IN "NOTES ON THE COLONIAL BOTANIC GARDEN, WELLINGTON AND ITS FLORA", (A PAPER READ TO THE WELLINGTON PHILOSOPHICAL SOCIETY ON 4 OCTOBER 1875), COMPARED WITH THE INTRODUCED INDIGENOUS VASCULAR PLANTS LISTED IN THE BOTANICAL SURVEY OF THE INDIGENOUS FOREST REMNANTS BY MITCALFE AND HORNE IN 2003.

KEY: Found in 2003 survey = •

Not found in 2003 survey = 0

CURRENT BOTANICAL NAMES	BUCHANAN'S LIST, Page / Line	
Agathis australis	11/34	•
Brachyglottis greyi	10/37	•
Corynocarpus laevigatus	10/13	•
Dodonaea viscosa	10/11	•
Entelea arborescens	10/9	•
Griselinia littoralis	10/19	•
Olearia albida	10/27	•
Olearia solandri	10/29	•
Phyllocladus trichomanoides	11/36	•
Pittosporum crassifolium	10/6	•
Pseudopanax crassifolius	10/17	•
Sophora tetraptera	10/15	•

LIST 9: INDIGENOUS VASCULAR PLANTS IN ALL THE REMNANTS COMBINED, LISTED IN THE 2003 MITCALFE/HORNE SURVEY, COMPARED WITH BUCHANAN'S 1875 LIST.

NOTE: This list does not indicate (1) whether the plants are naturally occurring, or (2) whether they are native to Wellington Ecological District. This information is available by referring to the list for each remnant.

KEY: Listed by Buchanan = •

Not listed by Buchanan = 0

CURRENT BOTANICAL NAME	
GYMNOSPERM TREES	
Agathis australis	•
Dacrycarpus dacrydioides	•
Dacrydium cupressinum	•
Libocedrus plumosa	0
Phyllocladus trichomanoides	•
Podocarpus totara	•

Prumnopitys taxifolia	0
Stachypitys (=*Prumnopitys*) *ferruginea*	•
MONOCOT TREES	
Cordyline australis	•
Rhopalostylis sapida	0
DICOT TREES/SHRUBS	
Alectryon excelsus	•
Aristotelia serrata	•
Beilschmiedia tawa	•
Brachyglottis greyi	•
Brachyglottis repanda	•
Carmichaelia australis	0
Carmichaelia williamsii	0
Carpodetus serratus	•
Coprosma areolata	0
Coprosma crassifolia	0
Coprosma grandifolia	•
Coprosma lucida	•
Coprosma propinqua	0
Coprosma repens	0
Coprosma rhamnoides	•
Coprosma robusta	•
Corokia cotoneaster	0
Corynocarpus laevigatus	0
Dodonaea viscosa	0
Dysoxylum spectabile	•
Elaeocarpus dentatus	•
Fuchsia excorticata	•
Geniostoma rupestre	•
Griselinia littoralis	0
Griselinia lucida	•
Hebe diosmifolia	0
Hebe parviflora	•
Hebe speciosa	0
Hebe stricta var. *atkinsonii*	0
Hedycarya arborea	•
Hoheria populnea	•
*Hoheria sexstylos*a	•
Knightia excelsa	•

Kunzea ericoides	•
Laurelia novae-zelandiae	•
Leptospermum scoparium	•
Leucopogon fasciculatus	•
Lophomyrtus bullata	•
Macropiper excelsum	•
Melicope ternata	•
Melicytus ramiflorus	•
Meryta sinclairii	0
Metrosideros excelsa	0
Metrosideros robusta	•
Myoporum laetum	•
Myrsine australis	•
Myrsine salicina	•
Nestegis cunninghamii	•
Nothofagus fusca	0
Nothofagus solandri var. *solandri*	0
Olearia albida	0
Olearia paniculata	•
Olearia rani	•
Olearia solandri	0
Ozothamnus leptophyllus	•
Pennantia corymbosa	•
Pittosporum crassifolium	0
Pittosporum eugenioides	•
Pittosporum ralphii	0
Pittosporum tenuifolium	•
Plagianthus regius	0
Pseudopanax arboreus	•
Pseudopanax crassifolius	•
Pseudopanax laetus	0
Pseudopanax (hybrids)	0
Raukaua anomalus	0
Schefflera digitata	•
Solanum laciniatum	0
Solanum sp.	0
Sophora microphylla	0
Sophora tetraptera	0
Vitex lucens	0
Weinmannia racemosa	•

MONOCOT LIANES	
Freycinetia baueriana	0
Ripogonum scandens	•
DICOT LIANES	
Clematis forsteri	•
Clematis paniculata	•
Metrosideros colensoi	•
Metrosideros diffusa	•
Metrosideros fulgens	•
Metrosideros perforata	•
Muehlenbeckia australis	•
Passiflora tetrandra	•
Rubus cissoides	•
Rubus schmidelioides	•
FERNS	
Adiantum cunninghamii	0
Adiantum viridescens	0
Asplenium bulbiferum	0
Asplenium flabellifolium	•
Asplenium flaccidum	•
Asplenium hookerianum	•
Asplenium oblongifolium	•
Asplenium polyodon	•
Asplenium bulbiferum × *A. flaccidum*	0
Blechnum chambersii	•
Blechnum discolor	0
Blechnum filiforme	•
Blechnum fluviatile	•
Blechnum membranaceum	0
Blechnum novae-zelandiae	•
Cyathea cunninghamii	0
Cyathea dealbata	•
Cyathea medullaris	•
Cyathea smithii	•
Dicksonia fibrosa	0
Dicksonia squarrosa	•
Grammitis billardierei	•
Grammitis ciliata	0
Hymenophyllum demissum	•
Hymenophyllum flabellatum	0

Hypolepis ambigua	•
Lastreopsis glabella	0
Lastreopsis hispida	•
Lastreopsis velutina	•
Leptopteris hymenophylloides	•
Marattia salicina	0
Microsorum pustulatum	•
Microsorum scandens	•
Pellaea rotundifolia	•
Pneumatopteris pennigera	•
Polystichum richardii	•
Pteridium esculentum	•
Pteris macilenta	•
Pteris tremula	•
Pyrrosia eleagnifolia	•
ORCHIDS	
Prasophyllum colensoi	•
Thelymitra sp.	0
GRASSES	
Anemanthele lessoniana	0
Cortaderia toetoe	0
Cortaderia sp.	0
Dichelachne crinita	•
Microlaena avenacea	•
Microlaena polynoda	0
Microlaena stipoides	0
Poa anceps	•
Rytidosperma gracile	0
SEDGES	
Carex dissita	0
Carex testacea	•
Gahnia pauciflora	0
Gahnia setifolia	•
Uncinia banksii	•
Uncinia scabra	0
Uncinia uncinata	•
RUSHES	
Luzula picta	0

MONOCOT HERBS OTHER THAN ABOVE	
Arthropodium candidun	0
Arthropodium cirratum	•
Astelia solandri	•
Dianella nigra	•
Libertia grandiflora	0
Libertia sp.	•
Phormium cookianum	•
COMPOSITE HERBS	
Gnaphalium sphaericum	0
Senecio minimus	0
Senecio sp.	0
DICOT HERBS OTHER THAN COMPOSITES	
Cardamine debilis	•
Centella uniflora	•
Colensoa physaloides	0
Haloragis erecta	•
Hydrocotyle heteromeria	0
Stellaria decipiens	•
Wahlenbergia violacea	0

APPENDIX I:
List of all Recommendations in the Report

RECOMMENDATION 1, page 6

Pittosporum ralphii be progressively removed from Salamanca Slope *and all the other remnants.*

RECOMMENDATION 2, page 6

Karaka seedlings, saplings, and small trees be removed from the remnants.

RECOMMENDATION 3, page 9

Propagules of the northern rātā and the remaining kōtukutuku trees be grown on as soon as possible.

RECOMMENDATION 4, page 10

Propagules of five-finger, toro, patē, black maire and kānuka be propagated and grown on for use in appropriate restoration sites as soon as possible.

RECOMMENDATION 5, page 11

5.1

Druid Hill and Stable Gully remnants be managed as one ecological unit, because they are contiguous, and because they are in the catchment of the same small tributary of Pipitea Stream.

5.2

Australian Garden and Play Area remnants be managed as one ecological unit, because they are contiguous, and because they are in the catchment of the same small tributary of "Pukatea Stream".

RECOMMENDATION 6, page 12

Some of the boundaries be extended, as described below and shown on the aerial photograph in the Appendix:

6.1

Remnant 1

Salamanca Slope remnant to include all the vegetation:

- below Serpentine Way, down to the lawns of The Dell,
- and below the Constable's Cottage,
- and on the slopes below the Herb Garden,
- and below Norwood Path as far north as the waterfall.

6.2

Remnant 2

Druid Hill/Stable Gully remnant to include both the remnant with original kānuka forest, and the row of planted tōtara, below Carter Observatory and above William Wakefield Way.

6.3

Remnant 3 (Note: this remnant is not bounded by a green line on the Isthmus Group aerial photograph entitled "Native Forest Vegetation Plan").

Australian Garden/Play Area remnant to include both sides of the catchment of the small tributary of "Pukatea Stream", i.e. from the two small remnants between Australian Path and Epuni Path, down to Mamaku Way.

6.4

Remnant 4

Cable Car remnant to include all the vegetation in the catchment occupied by Gorse Path, down to Kew Way.

6.5

Remnant 5

Glen Slope remnant to begin immediately below Kew Way.

RECOMMENDATION 7, page 12

Where needed, the margins of the remnants be closely planted with selected, appropriate native species such as māpou, kaikōmako, native broom, whararikí, big mingimingi, common koromiko, *Coprosma propinqua* and *Cortaderia fulvida*.

RECOMMENDATION 8, page 13

8.1

Signage be installed at appropriate points describing the significance of the remnants.

8.2

An illustrated pamphlet be produced with numbered, descriptive paragraphs corresponding to numbered posts at selected study points on a "Remnants Walkway".

8.3

A self-guided "Remnants Walkway" be developed, to pass alongside selected parts of the remnants, using existing tracks and numbered posts corresponding to the pamphlet text.

RECOMMENDATION 9, page 13

Two or more hydrants be located near each remnant.

RECOMMENDATION 10, page 14

Sustained programmes be implemented to control pest plants and other invasive species, to implement the Management Plan and to restore the ecological health of the indigenous forest remnants.

RECOMMENDATION 11, page 14

All exotic trees be progressively removed from the remnants and the remnants monitored for invasion by these and other exotic species.

RECOMMENDATION 12, page 15

The plants in the above list be progressively removed from all the remnants, and that the remnants be monitored for invasion by these and other invasive species.

RECOMMENDATION 13, page 15

The plants in the paragraph above be progressively removed from all the remnants and the remnants be monitored for invasion by these and other indigenous plants not native to the Wellington Ecological District.

RECOMMENDATION 14, page 15

There be no more encroachments into remnants or underplanting of their margins, with exotic species.

RECOMMENDATION 15, page 15

Council require weeds dumped by neighbours, to be removed from the Garden at the expense of the property owner/s.

RECOMMENDATION 16, page 15

The Garden boundaries be monitored by staff at regular intervals to check for weed invasions and the dumping of garden wastes and rubbish.

RECOMMENDATION 17, page 16

Intensive, sustained pest animal control programmes be implemented in the whole of the Botanic Garden.

17.1

The indigenous forest remnants be included in the KNE Programme, funded 50%-50% by WCC and Greater Wellington - The Regional Council, as is the rest of the Town Belt.

RECOMMENDATION 18, page 17

A suitably-qualified and experienced person or persons be appointed exclusively to manage the indigenous forest remnants.

RECOMMENDATION 19, page 17

Remuneration for such staff be commensurate with the special responsibilities of the position.

RECOMMENDATION 20, page 17

Funding to implement all the above recommendations be allocated in the 2003—2004 and successive Annual Plans.

RECOMMENDATION 21, page 19

21.1

The proposed viewshafts from Serpentine Way to The Dell, (Isthmus Group Draft Landscape Development Plan, Page 27), *be abandoned*, because they would bring yet another disturbance to an already stressed ecosystem, opening up the bush to the drying effect of wind and sun.

21.2

A cable-and-standard barrier (similar to the one above the children's play area) be built along Serpentine Way, from the Constable's Cottage driveway to The Dell lawn, and continued around the bush edge by the lawn and stage, to almost encircle this part of the remnant, preventing people walking through it.

21.3

The stormwater which flows from Serpentine Way into the remnant below, be better controlled to prevent further scouring of the three gullies.

21.4

The disused fence and other litter be removed.

RECOMMENDATION 22, page 26

The remnant be extended to include both the original kānuka forest, and the row of planted tōtara below Carter observatory and above William Wakefield Way. They are in the head of the catchment of the stream which flows down Stable Gully, and form an ecological link with the Australian Garden/Play Area remnant.

RECOMMENDATION 23, page 34

23.1

The True Right boundary of this remnant be the crest of the spur on which the nursery is built.

23.2

Stormwater flows be controlled to stop the scouring of the streambed, especially upstream of the Moreton Bay fig.

23.3

The exotic cyatheas be removed from above Epuni Path and relocated to an area of exotic ferns.

23.4

The streamsides in the lower part of the gully, from near the Moreton Bay fig, down to Mamaku Way, which are greatly modified by exotic plantings, be cleared and replanted with indigenous species such as moisture-loving ferns, sedges and rushes.

RECOMMENDATION 24, page 42

24.1

Council consult with the appropriate authorities to find a solution to the continuing scouring of this creek bed.

24.2

The huge exotic trees in the head of the valley and near the North Terrace entrance, and the pōhutukawas above lower Gorse Path be selectively pruned and eventually removed.

24.3

If the survey pegs between the Botanic Garden and private properties from Upland Road to the ends of North Terrace, and Glen Road cannot be found, the boundary be re-surveyed.

24.4

This boundary be fenced with permanent materials to exclude weed species which might otherwise invade.

24.5

Rubbish dumped by neighbours on the Garden boundary be removed at their expense.

RECOMMENDATION 25, page 49

25.1

Tradescantia and selaginella be removed from the stream bed and banks.

APPENDIX II:
Factors in Forest Decline

In *Black Maire (*Nestegis cunninghamii*) decline in the Haurangi Forest Park,* (Conservation Advisory Science Notes: 159. Department of Conservation. 1997), Gordon Hosking describes Manion's (1981) three-factor theory of forest decline.

The theory states that for decline to occur, there must be:

(1) **A predisposing factor,** i.e. a condition which predisposes a stand to decline but which does not in itself initiate the process. The most common predisposing factor is age, i.e. old trees are more likely to decline than young ones.

(2) **An inciting factor**, i.e. some perturbation which puts additional pressure on the predisposed tree or stand, and initiates the decline process. The most common inciting factors are climatic, in particular drought.

(3) **Contributing factors**, i.e. factors which drive the decline process to completion. These are largely insects and diseases, the opportunists always waiting to take advantage of the weak and dying. They are often the most obvious sign of decline.

APPENDIX III:
Names and numbers used for the remnants

MITCALFE/HORNE, 2003	ISTHMUS GROUP	CRANSHAW
1 Salamanca Slope	1 Salamanca Slope	1 Stable Gully
		1a Druid Hill
2 Druid Hill/Stable Gully	2 Druid Hill	2a Play Area
		2b The Glen
		2c Cable Car
3 Australian Garden/Play Garden	3 Stable Gully	3 Above Rose Area
4 Cable Car	4 Australian Garden	4a Australian Garden
5 Glen Slope	5 Play Area	
	6 Cable Car	
	7 Glen Slope	

* From *Draft Landscape Development Plan for the Wellington Botanic Garden, Anderson Park, and Bolton Street Memorial Park*. Isthmus Group. June 2000.

APPENDIX IV:
Comments on Isthmus Group's *Draft Landscape Development Plan for Wellington Botanic Garden…* June 2000

PAGE 24

Policy 1: Exotic conifers should be removed from the indigenous remnants. Any plantings of exotic conifers should be not less than 20m from the margin of any indigenous remnant.

Policy 2: We support this, provided the species are all native to Wellington Ecological District.

Policy 3: No indigenous vegetation should be removed from the remnants.

PAGE 25

Policy 3: We support this.

Salamanca Slope: The remnant should go right down to the edge of The Dell. No planting is necessary to frame the edge of The Dell, except native, buffering species, as recommended in our report.

Druid Hill: This remnant is already contiguous with Stable Gully remnant**.** Cork oaks should eventually be replaced with appropriate native species because the oaks are seeding into the remnant.

Stable Gully: We support the proposal.

Below Australian Garden: We oppose what is proposed for this site.

Play Area: We oppose what is proposed for this site.

PAGE 26

Cable Car: All of the slope above Gorse Path should be included in the remnant.

Glen Slope: All exotic trees should be removed from this remnant.

Native Plantings: Because these plantings are located **outside the boundaries** of the indigenous remnants, we can support the use of indigenous plant species which are sourced from outside Wellington Ecological District. Exceptions are those which have invasive potential for the remnants, for example, *Pittosporum ralphii.*

PAGE 27

Policy 2: We are not clear about the meaning here. Our response would depend on what exactly constitutes "characteristic" and/or "an identifiable feature".

Serpentine Way slope: We oppose this proposal in its entirety.

Skyline Plantings: We support the "General comments", provided that the ten species selected include indigenous podocarps, northern rātā and black maire. These were recorded by Buchanan and others as notable components of the original forest in the Garden.

PAGE 28

Druid Hill: Among the species replacing the large, mature exotic conifers, there should be podocarps, northern rātā and black maire.

PAGE 28–29

North Terrace Pines: We strongly prefer Option 3, and recommend that the plantings be of species naturally occurring in Wellington Ecological District.

PAGE 29

Mariri Ridge: Exotic conifers should be removed from the remnant, not just "not be replaced". Other exotics should also be removed.

Plantings Above Myrtle Way: All exotic conifers should be removed and replaced with podocarps native to Wellington Ecological District.

PAGE 30

Backdrop Feature Planting

Plantings above the Begonia House: Exotic species should be removed and replaced with trees native to Wellington Ecological District.

PAGE 32

Plantings around the Carter Observatory/Thomas King Observatory: Pōhutukawa should be replaced with northern rātā.

Plantings along Grass Way from the Cable Car Lookout to the Play Area: Plantings on the True Left of Grass Way should be of species recommended for buffer zones. Pōhutukawa should be replaced with northern rātā.

PAGE 33

Valley between Australian Garden and Pukatea Stream: We oppose this proposal. The valley should be restored with appropriate indigenous, streamside species.

APPENDIX V:
Map: Significant remnant areas of native bush, 1986.

From *The Botanic Garden Wellington.* Shepherd and Cook. 1988. (Page 76).

APPENDIX VI:
Aerial Photograph of Wellington Botanic Garden

This shows amendments to the boundaries of the remnants, as proposed by Mitcalfe and Horne, using Vegetation Plan from Isthmus Group's *Draft Landscape Development Plan for the Wellington Botanic Garden,* June 2000.

APPENDIX VII:
Mangaweka Scenic Reserve pamphlet

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