

Vegetation in Owhiro Stream catchment, Wellington South Coast

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INTRODUCTION

Owhiro Stream flows out to Wellington's South Coast on the western side of Owhiro Bay. At its mouth, Owhiro Stream is unprepossessing, its former estuary restricted by housing, roads, and beach modifications, and access to the lower reaches of the stream estuarine area forbidden by bold "No Entry" signs. Only the ever-wheeling gulls seem to be at home here.

However, this unpromising appearance belies the significance of the Owhiro Stream and its catchment. Owhiro Stream is the only substantially un piped stream flowing to Wellington City's South Coast within the urban area. It offers habitat to at least four species of native fish and a variety of other stream biota. The catchment covers an area of just under 10 km² (3.5% of the area of Wellington City) and stretches up to the heart of the suburb of Brooklyn, not much more than a couple of kilometres from the centre of the city. The catchment includes most of the wider suburbs of Brooklyn and Owhiro Bay as well as the Brooklyn suburban centre, and includes five primary schools and one light industrial area associated with Wellington City's main landfills. However, more than 80% of the catchment area is not residential and most of this area of former farmland is now covered in regenerating forest.

The vegetation and land use of the catchment reflect this diversity. The vegetation and flora are not notable in the sense of pristine or old forest, or rare species. But the area of predominantly native regenerating vegetation is large in the context of Wellington City, and the catchment as a whole is a good example of Wellington's urban/rural interface and the issues associated with this sort of area.

In this article I will describe the Owhiro catchment and its vegetation and flora, based largely on a number of Wellington Botanical Society and other species lists compiled over the last 20 years. There are several ecological restoration groups now working in the catchment. I will summarise their work and discuss some of the issues concerning ecological restoration in the catchment and this type of urban setting.

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THE OWHIRO CATCHMENT

The Owhiro catchment occupies a fan-shaped area of 965 ha in southern Wellington City, flowing into Tapu Te Ranga Marine Reserve at Owhiro Bay in the south-west corner of urban Wellington. The boundaries of the upper catchment approximately define the suburb of Brooklyn.

The Owhiro catchment has four main sub-catchments (Fig. 1). The largest is Careys Gully, occupying the whole western part of the catchment and rising to about 490 m asl near Hawkins Hill. It is entirely vegetated by regenerating native forest and scrub, apart from two large landfills and some light industrial and commercial use at the bottom of the sub-catchment. Maori Gully occupies the central-northern part of the catchment. It is bounded on its north-eastern side by housing on the western side of Brooklyn, and also contains a landfill but otherwise has a regenerating forest cover similar to that of Careys Gully. The Brooklyn Valley sub-catchment is much smaller than Careys and Maori Gullies but is far better known, as the stream occupying this sub-catchment runs down the edge of suburban Brooklyn. The Brooklyn Valley stream (often called the Owhiro Stream) arises at the northern end of Brooklyn and contains almost all the urban part of the catchment, including the Brooklyn suburban centre. However, a significant part of this sub-catchment is also regenerating bush. Finally, Tawatawa or Prestons Gully is a small gully in the south-east of the catchment, which in the 1960s was dammed behind another small short-lived landfill. Most of this sub-catchment is now formally reserved (Tawatawa Reserve) and it contains advanced regeneration at its head at the southern end of the suburb of Kingston. There is a small unnamed stream at the head of this sub-catchment.

Geology and soils

Most of the catchment is underlain by typical Wellington greywacke, with a mantle of hill and stepland soils derived from greywacke, greywacke colluvium and loess (Korokoro, Makara and Terawhiti soil series; Bruce 2000). There are limited areas of alluvial and colluvial material in the bottoms of the valleys, particularly in the kilometre of the Owhiro Stream nearest to Owhiro Bay. All these areas have been built on or are grassed and used as playing fields. Estuarine and sand dune and rock platform areas on the coast are very restricted.

Climate

The catchment experiences a 'typical' southern Wellington coastal climate, grading into a climate very similar to that experienced at the meteorological station at Kelburn (Salinger 2000). Mean annual rainfall is about 1200 mm per year. The catchment is very exposed to cold winds at its surrounding high points and on the southerly coast.

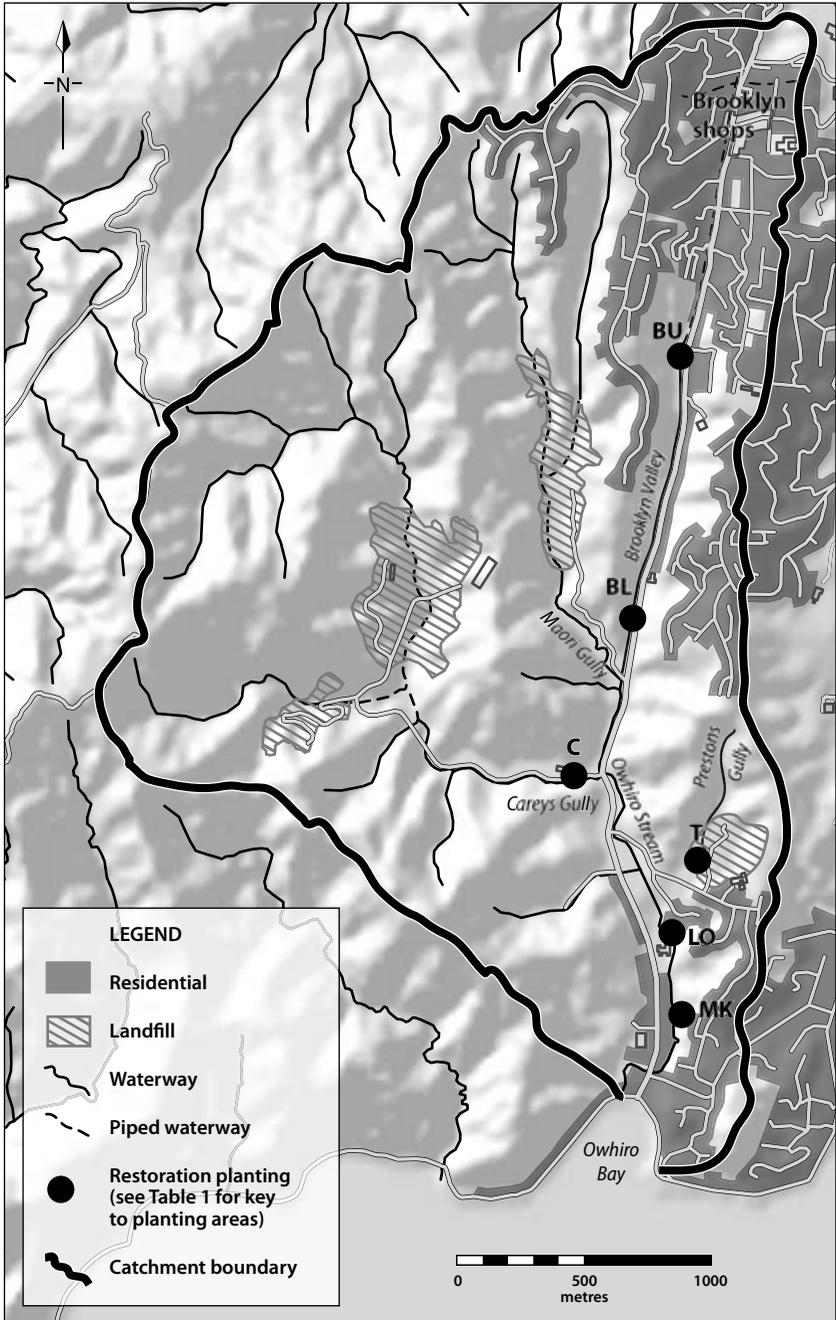


Figure 1. Map of Owhiro catchment.

Owhiro Stream

Owhiro Stream has a combined stream length of 24 km in its main stem and permanent tributaries and an estimated mean annual flow of 40 l/s near the mouth (Cameron 2002). Regular water quality testing is undertaken, largely because of the presence of the landfills, and some known water quality issues in the past. Overall the stream is characterised as slightly to moderately contaminated, with periodic ‘spikes’ of contaminants such as copper and zinc as well as suspended sediments.

Owhiro Stream biota

There are currently four freshwater fish species known in the stream from surveys in the last decade: longfin eel, shortfin eel, redfin bully and banded kokopu, as well as freshwater crayfish. This is a remnant of a larger freshwater fish fauna, with 10 species including one introduced species having been recorded on the Freshwater Fish Database since the 1960s (Cameron 2002). There is a reasonably diverse macro-invertebrate fauna in Careys Gully and Maori Gully but not in Brooklyn Valley (Cameron 2002).

Land use history

In pre-settlement times the catchment would have been almost entirely forested except for a few small areas close to the coast dominated by wharariki, some pockets of coastal scrub with abundant climbers, and possibly very small swamp or other wetland areas (Gabites 1993).

Farming by Europeans began in the middle of the nineteenth century. There were earlier gardens maintained by Maori close to Ohiro Road, in areas reserved for Maori when Wellington was settled by the New Zealand Company (Gabites 1993; Collins 2010). By the early twentieth century the catchment would have been almost entirely deforested and used for grazing of drystock and dairy cows, supplying some of Wellington’s early milk supplies.

Residential development of suburban Brooklyn (in the northern and eastern margins) began around the turn of the twentieth century and gradually increased (Vickers 1983). By the late 1920s the basic shape of Brooklyn suburb had been established, but the growth of Kingston, Kowhai Park, and Ashton Fitchett Heights were all post-World War II developments. Owhiro Bay was a small seaside settlement, which has only grown slowly since its establishment.

The headwaters of the Brooklyn Valley were filled in during the early twentieth century development of Brooklyn suburb, the Brooklyn shopping area being situated directly above the junction of the main headwater tributaries of the Brooklyn Stream.

After the 1950s the catchment was grazed less intensively; grazing had largely ceased by the early 1980s. Regeneration over most of the catchment has proceeded since before the end of grazing, and is well protected in gullies and on sheltered slopes. The most well developed vegetation is in the headwaters of Careys Gully ('protected' by the largest landfill which restricts access into the area) and Tawatawa Reserve. There are no discrete areas of pre-settlement forest in the catchment. There are some small areas of pine trees, mainly established in lower Careys Gully.

Currently at least 80% of the area of the catchment is now regenerating bush of one kind or another, close to 10% urban, a few percent occupied by small areas of grazing land, pine plantation, or grassed areas, and almost 5% occupied by bare ground occupied by landfill (estimates based on current aerial photos and Cameron 2002).

VEGETATION IN THE CATCHMENT

Wellington Botanical Society and others have botanised in various parts of the catchment, and adjacent areas, for some time. There are seven species lists for inland parts of the catchment, as well as several others for the Wellington South Coast, listed on the New Zealand Plant Conservation Network (NZPCN) database. I also know of several other informal species lists for parts of the catchment. Thus, we have a reasonable knowledge of the flora of the catchment, which I will discuss below. The combined known species list for the catchment is shown in Appendix 1. It should be noted that not all areas have been botanised equally, and some of the lists have been compiled on short duration reconnaissance trips. Nevertheless I consider that there is enough information to gain a reasonable picture of the vegetation and flora as a whole.

Careys Gully and Maori Gully

These sub-catchments have quite similar and surprisingly diverse floras, with a reasonably wide range of broadleaved trees and shrubs including tawa, kamahi, titoki, hīnau, pukatea, puka and porokaiwhiri, all typical of old-growth broadleaved forest, and suggesting that traces of forest may have survived the farming period. This is not surprising in light of the steep slopes and incised gullies in many parts of the catchment that were too inaccessible to fell and burn completely and where subsequent stock browsing was always light. There is a reasonable range of lianes including two species of *Clematis* and three species of *Metrosideros*. Occasional steep bluffs in these sub-catchments are bare rock, or covered with coastal flax with a few emergent cabbage trees. A further feature is the diverse range of ground ferns: more than 30 in each sub-catchment, and a combined flora of

49 species of ferns and lycopods including four species of tree fern.

Brooklyn Valley and Tawatawa Reserve

The eastern part of the catchment has, overall, a less diverse flora and its vegetation is much more altered and depleted than the rest of the catchment, with one exception. The headwaters of the stream within Tawatawa Reserve contain a small area of relatively mature kohekohe-ngaio forest which is possibly the oldest forest in the catchment (many decades old). Unlike the more mature forest in the western part of the catchment, this forest fragment is easily accessible by a walking track around the Tawatawa Reserve. This reserve has a reasonably diverse broadleaved shrub and fern flora, although not as diverse as the Careys and Maori Gully headwaters.

A notable feature in the middle Brooklyn Valley is a small karaka grove behind 320 Ohiro Road, planted by Maori in the middle nineteenth century beside cultivation areas of this time (Boffa Miskell 2003). Karaka is also recorded from Maori Gully.

Stream and estuary

A number of riparian and wetland plants have been recorded in various parts of the catchment (*Carex* and *Juncus* species). There are no original wetlands remaining in the catchment and few areas of naturally impeded drainage.

South Coast

Because of the shape of the catchment, the area of coastal environment, including the estuary of the Owhiro Stream, is very small. All parts of the coastal escarpment at Owhiro Bay have been very heavily modified. Likewise the former estuary has been significantly restricted on both sides of Owhiro Bay Parade, so that there is hardly any indigenous estuarine element remaining, nor any indigenous littoral vegetation. However, there is a noticeable coastal influence in at least the southern third of the catchment. For example, taupata is common on lower hillsides in the lower catchment and Tawatawa Reserve, while it is not recorded in the headwaters of Careys or Maori Gullies. It is unclear whether akeake occurs naturally in the catchment although it has been fairly widely planted. Gabites (in Boffa Miskell 2003) regarded the southern half of the catchment as a coastal environment.

Weeds

As might be expected, Owhiro catchment is also host to a large number of adventive plant species including some troublesome weeds. I do not have full records but those weeds most threatening indigenous communities include blackberry, boneseed, climbing dock, broom, flowering cherry, elaeagnus,

gorse, German and Cape ivy, old man's beard, Japanese honeysuckle, sycamore and wandering willie. Of these the most widespread and persistent is blackberry, occupying large sections of streamsides and lower slopes throughout the lower valley. The greatest diversity of weed species occurs in the Brooklyn Valley, as might be expected given the adjacency of this valley to garden escapes and human disturbance. A number of the most troublesome weeds are lianes and climbers, including climbing dock, elaeagnus, German and Cape ivy, old man's beard and Japanese honeysuckle, especially at the edges of the regenerating forest. Gorse is fairly common but not nearly as widespread as it was 20 years ago, and is not persistent.

Some non-Wellington New Zealand natives are well established, including karo, houhere (*Hoheria populnea*), pohutukawa, *Pittosporum ralphii* and *P. crassifolius* × *P. lessonii* hybrids.

Animal pests

A range of animal pests affect vegetation in the catchment. Goats are among the most destructive. There are significant populations ranging through the Wellington south-west peninsula, destroying vegetation and inhibiting regeneration, but a control programme for the whole south-western Wellington Peninsula began in 2011. Possums, rats and mustelids are present in significant numbers, all predating birds and other fauna and possums destroying vegetation too. Little is known of their specific numbers or impacts, but the councils maintain an extensive network of bait stations and traps throughout most of the non-residential parts of the catchment for all these pests.

Total catchment flora

The known flora of the Owhiro catchment is listed in Appendix 1. This flora is an amalgamation of seven species lists compiled for different parts of the catchment between 1993 and 2009, listed in Appendix 2. These lists are mainly available on the New Zealand Plant Conservation Network; the list for Brooklyn Valley is supplemented by personal observation. I have not included species confined strictly to the very small area of coastal cliffs and littoral habitats because I consider that any species occurring only on these habitats should be considered as a 'South Coast' species rather than as an Owhiro catchment species. Note that there are some rare and threatened species such as Cook's scurvy grass (*Lepidium oleraceum*) in this group of species. Note also that surrounding areas and catchments such as Paekawakawa Reserve, Tapu Te Ranga, Karori Wildlife Sanctuary, and Long Gully have also been botanised and have species lists available on the New Zealand Plant Conservation Network website.

Successional trends

Most native vegetation seen in the catchment now reflects about 40-70 years of regeneration from pasture, as active grazing largely ceased between the 1950s and 1970s. Only at the head of Tawatawa Reserve and in the depths of Maori and Careys Gullies is the vegetation older, where fire and grazing pressures are likely to have been lighter right throughout the pastoral period.

The current vegetation has regenerated mainly through gorse, which grew rapidly after grazing ceased. Broom was a common companion species, and occasionally mānuka on sunny upper slopes and spurs. Regeneration through kanuka (Sullivan et al. 2007) appears to have been rare. Native broadleaved shrubs established or were present under the gorse canopy, including hangehange, rangiora, karamū, koromiko, kawakawa and most commonly mahoe. The last-named quickly became the canopy dominant, resulting in the 4-8 metre high canopy which is currently so ubiquitous in Wellington (Gabites 1993; Sullivan et al. 2007). Mahoe-dominant low forest can be established only 15-20 years after the cessation of grazing and appears to persist at least several decades, a period which we are still in the middle of in the Owhiro catchment and elsewhere. Only slowly will seedlings of tawa, hīnau, tītoki, kamahi and porokaiwhiri germinate, survive and then appear in occasional gaps in the mahoe canopy. The rate and pattern of arrival of these mainly bird-distributed species depends on the local abundance of the right species of birds, and the location of the nearest patches of mature forest. In the case of the Owhiro catchment, the nearest such patches containing these species are small pockets to the west in the Kaiwharawhara (Karori Sanctuary) and Long Gully catchments.

MANAGEMENT OF VEGETATION AND ECOSYSTEMS

The Owhiro catchment is in a range of public and private tenures and the existing forest vegetation has varying degrees of security. A significant area within the catchment, both private and public, is designated as Open Space. Of the public land, the only formal scenic reserves are the Tawatawa and Oku Scenic Reserves in the south-eastern part of the catchment, designated in 2010.

Private land in the catchment has both residential and rural zoning but is mostly residential. Some is not developed and the vegetation in these areas is not legally protected. Development of this land for future subdivision could lead to loss of ecological and amenity values. For example, a well-publicised subdivision of 5.5 hectares at 282 Ohiro Road (less than 1km south of Brooklyn shops) in the early 2000s resulted in the total clearance

of vegetation at the site, significant reshaping of the contours, stream infill and sedimentation into the Owhiro Stream, for which the developer was prosecuted.

The three landfills in the catchment (two of which are leased to private operators) have destroyed significant areas of vegetation under and adjacent to fill surfaces, possibly including riparian or wetland habitats. However, they have also provided relatively secure and undisturbed protection to vegetation above the landfill. For example, water quality indices for upper Careys Gully are generally the best in the catchment (Cameron 2002). Most of the land in the headwaters of Maori and Careys Gullies is council-owned Open Space.

On a more local scale, several community groups have been working to replant areas with native species, thereby aiming to enhance the natural successional processes summarised above, and improve environmental values in the catchment. The remainder of the article documents this programme.

Activities of restoration groups

Southern Environmental Association has been active since the 1990s. They have been an effective advocacy group throughout south Wellington, and have also undertaken significant replanting at Tawatawa Reserve, planting forest and wetland species throughout this sub-catchment. Restoration work is guided by an unpublished restoration plan developed by Dr Maggy Wassilieff and Robert Logan. SEA maintain a large plant nursery within the Tawatawa Reserve at Murchison Street.

Friends of Owhiro Stream (FOOS) has been active since 2002. They are involved in advocacy and awareness-raising for the values of the Owhiro Stream, and also have a weed control and planting programme on riparian and lower slopes in several parts of the Brooklyn Valley sub-catchment. FOOS maintain a small plant nursery on a Wellington City Council site in Mornington. FOOS have been supported by Greater Wellington Regional Council's "Take Care" programme since 2003. Restoration work has been generally guided by a restoration plan developed by Isobel Gabites for Wellington City Council (Boffa Miskell 2003), currently under revision.

Mokai Kainga Trust established community gardens beside the lower Owhiro Stream near Owhiro Bay in early 2010. These gardens incorporate a small riparian area planted with stock from the FOOS nursery and other sources.

Wellington City Council, in association with Owhiro Bay residents, established riparian plants along the lower Careys Gully stream in 2001-02 and have undertaken planting in various part of the Southern Landfill area.

Owhiro Bay School established vegetation along the lower Owhiro Stream under the EnviroSchools environmental programme and with Greater Wellington Regional Council support.

Known planted species and generalised locations of planting in the catchment by the above groups are shown in Table 1. This list is not exhaustive in terms of planting areas and sources as not all early planting records are available, and there are undoubtedly small areas of planting that I am not aware of, but to my knowledge it is reasonably accurate as to the species planted. Note that Appendix 1 includes all species recorded in the catchment, whether naturally occurring (native or adventive) or planted. Appendix 1 indicates only seven native species (all trees but one) that are known to be planted but not recorded wild in the catchment. Table 1 gives the most authoritative guidance on which native species in the full species list are planted, and where.

Restoration habitats

Hillslopes

Planting by FOOS has been only on lower slopes, between the riparian margin and the edge of regenerating mahoe forest. These areas tend to be very weed-infested, mainly with the vines blackberry, old man's beard and Cape ivy, as well as broom. Planting is preceded by relatively intensive control of these weed species by spraying, mechanical crushing and hand weeding. Species used in rehabilitation of these habitats are the broadleaved tree and shrub species shown in Table 1, with wharariki on the steepest slopes.

Riparian areas

These areas also tend to be very weed-infested, mainly with blackberry, as well as broom. Planting is preceded by relatively intensive control of these species by spraying, mechanical crushing and hand weeding. Species used in rehabilitation of these habitats are the species shown in Table 1, as well as toetoe, with wharariki on the steepest slopes.

Nature of restoration carried out

Ecological restoration means many things to many people. Literally interpreted, ecological "restoration" is impossible or almost impossible to carry out in most circumstances (Hobbs 2007; Innes et al. 2012). There are two reasons for this. Firstly, even the simplest ecosystem has so many components, inter-related in so many ways, and so imperfectly understood by us, that to genuinely restore a lost or seriously damaged natural ecosystem is beyond scientific capability. Secondly, even if it were scientifically (and financially) possible, what ecosystem would we restore?

Table 1. Species planted in restoration planting, Owhiro catchment.

Key to areas planted and source: BL = lower Brooklyn Valley; BU = upper Brooklyn Valley; C = Careys Gully; LO = lower Owhiro Valley; MK = Mokai Kainga; T = Tawatawa Gully at Murchison St.; L = local ecosourced (FOOS and SEA nurseries); B = WCC Berhampore nursery ; G = local gardens (unverified).

Species	Scientific name	Areas planted	Source
akeake	<i>Dodonaea viscosa</i>	BL,T,C	L,B
akiraho	<i>Olearia paniculata</i>	BL,T,C	L,B
five-finger	<i>Pseudopanax arboreus</i>	BL,BU,T,C	L,B
tree fuchsia	<i>Fuchsia excorticata</i>	BL	L,B
harakeke, swamp flax	<i>Phormium tenax</i>	BU,BL,C,LO,MK,T	L,G
hinau	<i>Elaeocarpus dentatus</i>	BL,T	L
kahikatea	<i>Dacrycarpus dacrydioides</i>	BL	B
kakaha, bush lily	<i>Astelia fragrans</i>	T	L
karamū	<i>Coprosma robusta</i>	BL, BU,T	B
kānono	<i>Coprosma grandifolia</i>	BL,T,C,LO	L, B
kohekohe	<i>Dysoxylum spectabile</i>	BL	B
kōhūhū	<i>Pittosporum tenuifolium</i>	BL,T,C	L,B
koromiko	<i>Veronica stricta</i>	BL,BU,C	B
koromiko taranga	<i>Veronica parviflora</i>	BL,T,C	B
kōwhai	<i>Sophora microphylla</i>	BL,BU,T,C,LO	L,B
makomako	<i>Aristotelia serrata</i>	BL,T,LO	L,B
mānuka	<i>Leptospermum scoparium</i>	BL,LO,MK	B
ngaio	<i>Myoporum laetum</i>	BL,BU,C,LO	B
nikau	<i>Rhopalostylis sapida</i>	BL	B
northern rātā	<i>Metrosideros robusta</i>	BL,T	L,B
oiio, jointed wire rush	<i>Apodasmia similis</i>	MK	?
patē	<i>Schefflera digitata</i>	BL	B
poa	<i>Poa cita</i>	BL,BU	B
porokaiwhiri	<i>Hedycarya arborea</i>	BL,T	L
poroporo	<i>Solanum laciniatum</i>	MK	?
puka	<i>Griselinia lucida</i>	BL,T	L
pūrei	<i>Carex secta</i>	BL,BU,LO,MK	L,B
putaputawētā	<i>Carpodetus serratus</i>	BL,T	L
rewarewa	<i>Knightia excelsa</i>	BL	L,B
tarata	<i>Pittosporum eugenioides</i>	BL,BU,T,C	L,B
taupata	<i>Coprosma repens</i>	BL,C,LO	L,B
tawa	<i>Beilschmiedia tawa</i>	BL,T	L
tī kōuka, cabbage tree	<i>Cordyline australis</i>	BL,BU,C,LO,MK	L
tītoki	<i>Alectryon excelsus</i>	BL,T	L
toetoe	<i>Austroderia toetoe</i>	BL,BU,C,LO	B
totara	<i>Podocarpus totara</i>	BL,MK	B
wharangi	<i>Melicope ternata</i>	BL	B
wharariki, mountain flax	<i>Phormium cookianum</i>	BL	B

I have earlier described the ‘natural’ vegetation of the catchment, based on the work of Gabites and others. We can be reasonably confident that all local native species listed in Appendix 1 have naturally grown in the catchment. But at what if any point were exactly these species the natural flora of the catchment, given that ecosystems are constantly changing in response to disturbance, adding or losing species, and more recently in response to human disturbance?

In New Zealand, 1840 is often taken as a baseline for restoration, or for determining what is “natural”, adopting an arbitrary, although reasonable, date marking the start of widespread European disturbance (Atkinson 1988). This date excludes pre-1840 disturbance by Maori, which was significant in many parts of New Zealand, including Wellington.

In Owhiro catchment, therefore, restoration groups are not attempting an impossible theoretical goal. Rather, as mentioned above, as far as I am aware they are merely trying to replant areas currently occupied by introduced weeds and enhance natural ecosystem processes, using species known to have grown naturally in the catchment within the last hundred years. Another reason for planting woody native species in the catchment is to broaden the range of species available through regeneration; this is worthwhile ecologically in the light of the findings of Sullivan et al. (2007) who showed that species richness is often lower through gorse regeneration than through native pioneers such as kanuka. As Sullivan et al. (2007) succinctly conclude, “current management through benign neglect will benefit from some benevolent intervention”.

In the case of FOOS, the Owhiro Stream itself and its margins are the main focus. The area on which planting has occurred is tiny in relation to the size of the catchment; well under 1%. Much of the planting has the aim of improving the stream habitat, by stabilising the banks, and providing shade and variety of habitat for fish and other fauna. These activities may be more accurately described as “rehabilitation and enhancement” rather than “restoration”. But the latter term is often used, because it is the term that has taken hold in New Zealand and internationally, and I am happy to follow this convention.

The main purposes of this rehabilitation and enhancement activity, especially in urban areas, include (Atkinson 1988; Meurk 2003; Sullivan et al. 2009; Innes et al. 2012):

Restore ecosystem function

This is the most basic and ultimately the most important purpose: to retain enough ecosystem processes for the ecosystem to function naturally and in good health. For example, enough key species reproducing, water retained and cycled, nutrients cycled and stored, etc.

Restore ecosystem services

If the ecosystem is functioning healthily it can provide a range of services essential for humans to survive. These include water and nutrient storage and cycling, fresh air to breathe, pollination of crops (including home garden species), and carbon storage. This last example is a particularly important service that permanent woody vegetation performs. If the Owhiro catchment continues to regenerate as it does now (especially if plant and animal pests are also reduced), this function will increase.

Improve habitat

As vegetation increases in biomass, diversifies and improves in condition, even in relatively small areas (Sullivan et al. 2009), its habitat values increase, particularly for bird species. This is particularly true for Owhiro catchment because the catchment is a natural corridor between the Karori Sanctuary, where there are breeding populations of bird species absent or rare elsewhere in Wellington, and all of Wellington's southern and eastern suburbs. This habitat may also be of value for bats, and to a lesser extent reptiles and terrestrial invertebrates. Owhiro Stream is a key habitat for freshwater fish and other freshwater biota; this is a habitat which is vastly diminished in Wellington (Wellington City Council 2007).

Improve amenity

All the above improve people's amenity, wellbeing and enjoyment of their local neighbourhood. Also the presence of vegetated natural areas improves visual amenity, cultural and even spiritual values and allows a number of recreation activities.

Improve awareness

Finally, but crucially, the presence of natural areas in urban settings is very important in raising awareness in urban communities about natural areas and their values. People are thereby enabled to value and advocate for other natural areas in New Zealand and internationally, or to maintain and restore these areas.

In summarising these purposes of restoration, I am aware that several of them are related to ecosystems as places where humans live, work and recreate in, influencing those ecosystems in many ways. In my view, we can only understand ecosystems, and manage them, if we recognise that humans are part of those ecosystems too (Meurk 2003).

Choosing appropriate species for restoration

Most species in Table 1 are common species in Wellington City. For example, most of the dicotyledonous species are broadleaved shrub and small tree species common in hillslope succession. On the lower hillslopes,

FOOS have planted small numbers of larger trees in places; for example tawa, northern rātā, rewarewa and hīnau, and the podocarps kahikatea and totara. Only a very limited range of riparian species have been planted, notably pūrei and harakeke. *Poa cita* has been planted successfully on narrow margins between the upper stream bank and the road where the infertile soil, harsh conditions and the need for a small plant that does not overhang the road gutter has meant a very restricted choice of species.

All the restoration groups involved in planting have had a policy of eco-sourcing, generally from local seed sources (Owhiro catchment or within a couple of kilometres from the catchment). Plants supplied from the Wellington City Council nursery and those planted with the support of the Take Care programme have been eco-sourced as a matter of council policy. The principal exception to this approach is that harakeke from local gardens was planted by FOOS in its first two years in the middle catchment. Another possible exception has been some planting of akeake on lower hillslopes and on stream gully sides, whereas akeake is generally only thought of as a strictly coastal species in Wellington (Barbara Mitcalfe, pers. comm.). In the last few years when wharariki became available from the WCC nursery it has been planted more extensively on shallow soil and outcrop slope habitats.

In my opinion this approach to eco-sourcing is pragmatic and appropriate to the area. Its emphasis is on local origin rather than strict purity—in that the harakeke from local gardens and the plants propagated from local seed sources cannot be guaranteed to be only originating from ‘natural’ populations. However, that comment may be true of many other ostensibly eco-sourced planting stock.

Restoration groups and their council advisers have the benefit of a good number of well-documented reference sites in and around the catchment; i.e., the same sites from which the species lists that contribute to Appendix 1 have been compiled. Thus we can be reasonably confident that the species in Appendix 1 and Table 1 are genuinely ‘natural’ to the catchment, even in this ever-changing urban environment. Looking slightly further afield there are useful guides available for plants truly native and appropriate to the relevant parts of Wellington Ecological District in which Owhiro catchment occurs. These include the Wellington Regional Native Plant Guide (Greater Wellington Regional Council 2010) and the “Best Bets” plant species guide developed for the nearby Kaiwharawhara catchment (Blaschke et al. 2004).

I would also contend that replanting in the catchment provides an opportunity for less common species, maybe including rare or threatened species also to be planted as part of the conservation of those species. It may

be argued that these species are not listed as being present at the reference sites. However, if they were always rare, or threatened, the fact that they are not listed from reference sites should not be the only consideration. If we are reasonably confident that the species could have been in the catchment in the past (i.e. the catchment is part of the known range of the species and there is an appropriate ecological habitat in the catchment for it), we can obtain material for propagation from a suitable source, and have the resources to establish and maintain a population, why should we not do so, thereby assisting the critical plant conservation needs of New Zealand?

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REFERENCES

- Atkinson, I.A.E. 1988. Presidential address: opportunities for ecological restoration. *New Zealand Journal of Ecology* 11: 1–12.
- Blaschke, P.M.; Forsyth, F.; Anstey, C. 2004. Priorities for ecological restoration of the Kaiwharawhara catchment, Wellington City. Report to Wellington City Council and Greater Wellington Regional Council.
- Boffa Miskell Ltd. 2003. Owhiro Stream restoration: concepts for Friends of Owhiro Stream. Report for Wellington City Council.
- Bruce, J.G. 2000. The soils of Wellington. *In*: McConchie, J.; Winchester, D.; Willis, R. *ed.* Dynamic Wellington: a contemporary synthesis and exploration of Wellington. Institute of Geography, Victoria University of Wellington. Pp. 93–121.
- Cameron, D. 2002. An ecological assessment of Owhiro Stream. Report to Wellington City Council. MWH New Zealand Ltd.
- Collins, H. 2010. Ka mate ka ora! The spirit of Te Rauparaha. Steele Roberts.
- Gabites, I. 1993. Wellington's living cloak: a guide to the natural plant communities. Wellington Botanical Society and Victoria University Press.
- Greater Wellington Regional Council. 2010. Wellington Regional Native Plant Guide. www.gw.govt.nz/assets/Be-the-Difference/Biodiversity/Wellington-Regional-Native-Plant-Guide-Revised-Edition-2010-Web.pdf
- Hobbs, R.J. 2007. Setting effective and realistic restoration goals: key directions for research. *Restoration Ecology* 15: 354–357.

- Innes, J.; Lee, W.G.; Burns, B.; Campbell-Hunt, C.; Watts, C.H.; Phipps, H.; Stephens, R.T. 2012. Role of predator-proof fences in restoring New Zealand's biodiversity: a response to Schofield et al. (2011). *New Zealand Journal of Ecology* 36: 232-238.
- Meurk, C.D. 2003. Cities and cultural and ecological keys to biodiverse futures. *In*: Dawson, M.I. ed. Greening the city – bringing biodiversity back into the urban environment. Proceedings Royal New Zealand Institute of Horticulture conference, Christchurch, October 2003. Pp. 301–310.
- Salinger, M.J. 2000. The windy city? A climate of contrast. *In*: McConchie, J.; Winchester, D.; Willis, R. ed. Dynamic Wellington: a contemporary synthesis and exploration of Wellington. Institute of Geography, Victoria University of Wellington. Pp. 75–91.
- Sullivan, J.J.; Williams, P.A.; Timmins, S.M. 2007. Secondary forest succession differs through naturalised gorse and native kanuka near Wellington and Nelson. *New Zealand Journal of Ecology* 31: 22–38.
- Sullivan, J.J.; Meurk, C.D.; Whaley, K.J.; Simcock, R. 2009. Restoring native ecosystems in urban Auckland: urban soils, isolation, and weeds as impediments to forest establishment. *New Zealand Journal of Ecology* 33: 60–71.
- Vickers, J. 1983. Early Brooklyn. Millwood Press.
- Wellington City Council. 2007. Biodiversity Action Plan. Wellington City Council.

APPENDIX 1. VASCULAR PLANTS OF OWHIRO CATCHMENT

(P) = known only from planted individuals

Botanical Name	Maori and/or Common English Name	Tawa-tawa	Careys Gully	Maori Gully	Brooklyn Valley
Native gymnosperm tree trees					
<i>Dacrycarpus dacrydioides</i> (P)					✓
<i>Podocarpus totara</i> (P)					✓
Native monocot trees					
<i>Cordyline australis</i>	ti kōuka, cabbage tree	✓	✓	✓	
<i>Rhopalostylis sapida</i> (P)	nikau				✓
Native dicot trees and shrubs					
<i>Alectryon excelsus</i>	tītoki	✓		✓	
<i>Aristotelia serrata</i>	makomako, wineberry	✓	✓	✓	
<i>Beilschmiedia tawa</i>	tawa			✓	
<i>Brachyglottis repanda</i>	rangiora	✓	✓	✓	✓
<i>Carpodetus serratus</i>	putaputawētā, marble leaf	✓	✓	✓	✓
<i>Coprosma areolata</i>	thin-leaved coprosma	✓			
<i>Coprosma grandifolia</i>	kānono		✓	✓	✓
<i>Coprosma lucida</i>	shining karamū		✓		

Botanical Name	Maori and/or Common English Name	Tawa- tawa	Careys Gully	Maori Gully	Brooklyn Valley
<i>Coprosma propinqua</i>	mingimingi	✓	✓	✓	
<i>Coprosma propinqua</i> × <i>C. robusta</i>		✓	✓	✓	
<i>Coprosma repens</i>	taupata	✓			
<i>Coprosma rhamnoides</i>		✓	✓	✓	
<i>Coprosma rigida</i>			✓		
<i>Coprosma robusta</i>	karamū		✓	✓	
<i>Coprosma rotundifolia</i>	round-leaved coprosma			✓	
<i>Corynocarpus laevigatus</i>	karaka			✓	✓
<i>Dodonaea viscosa</i> (P?)	akeake	✓			
<i>Dysoxylum spectabile</i>	kohekohe	✓			
<i>Elaeocarpus dentatus</i>	hīnau			✓	
<i>Fuchsia excorticata</i>	kōtukutuku, tree fuchsia		✓	✓	✓
<i>Gaultheria antipoda</i>	tāwiniwini, bush snowberry		✓		
<i>Geniostoma rupestre</i> var. <i>ligustrifolium</i>	hangehange	✓	✓	✓	✓
<i>Griselinia lucida</i>	puka, broadleaf		✓		
<i>Hedycarya arborea</i>	porokaiwhiri, pigeonwood		✓	✓	
<i>Helichrysum lanceolatum</i>	niniao		✓		
<i>Hoheria sexstylosa</i>	houhere, lacebark		✓		
<i>Hoheria populnea</i>	houhere, lacebark			✓	
<i>Knightia excelsa</i>	rewarewa, NZ honeysuckle		✓	✓	
<i>Kunzea ericoides</i>	kānuka	✓	✓		
<i>Laurelia novae- zelandiae</i>	pukatea			✓	
<i>Leptospermum scoparium</i>	mānuka	✓	✓	✓	✓
<i>Macropiper excelsum</i>	kawakawa	✓	✓	✓	✓
<i>Melicope ternata</i>	wharangi	✓			
<i>Melicope simplex</i> × <i>M. ternata</i>		✓			
<i>Melicytus ramiflorus</i>	māhoe, whiteywood	✓	✓	✓	✓
<i>Metrosideros robusta</i> (P)	rātā, northern rātā	✓			✓
<i>Myoporum laetum</i>	ngaio	✓			

Botanical Name	Maori and/or Common English Name	Tawa- tawa	Careys Gully	Maori Gully	Brooklyn Valley
<i>Myrsine australis</i>	māpou	✓	✓	✓	
<i>Olearia paniculata</i>	akiraho		✓	✓	
<i>Olearia rani</i>	heketara, tree daisy			✓	
<i>Olearia solandri</i>	takupurenga, coastal tree daisy	✓	✓		
<i>Ozothamnus leptophyllus</i>	tauhinu, cottonwood	✓	✓	✓	
<i>Pennantia corymbosa</i>	kaikōmako	✓		✓	
<i>Pittosporum eugenioides</i> (P)	tarata, lemonwood	✓	✓		✓
<i>Pittosporum tenuifolium</i>	kōhūhū			✓	
<i>Pseudopanax arboreus</i>	whauwhaupaku, five- finger	✓	✓	✓	
<i>Pseudopanax crassifolius</i> × <i>P. lessonii</i>	pseudopanax hybrids	✓			✓
<i>Raukaua anomalus</i>		✓			
<i>Schefflera digitata</i>	patē, seven-finger		✓	✓	✓
<i>Solanum aviculare</i>	poroporo	✓			
<i>Solanum laciniatum</i>	poroporo			✓	
<i>Sophora microphylla</i>	kōwhai		✓		
<i>Urtica ferox</i>	ongaonga, tree nettle	✓	✓	✓	✓
<i>Veronica parviflora</i>	koromiko taranga, tree hebe	✓	✓		
<i>Veronica stricta</i>	koromiko	✓	✓	✓	✓
<i>Weinmannia racemosa</i>	kāmahi		✓		
Native monocot lianes					
<i>Freycinetia banksii</i>	kiekie			✓	
<i>Ripogonum scandens</i>	kareao, supplejack		✓	✓	
Native dicot lianes					
<i>Clematis forsteri</i>	pikiarero, small white clematis	✓	✓		
<i>Clematis paniculata</i>	puawānanga, white clematis			✓	
<i>Metrosideros diffusa</i>	akatea, white rātā	✓	✓	✓	
<i>Metrosideros fulgens</i>	akakura, scarlet rātā			✓	
<i>Metrosideros perforata</i>	aka, clinging rātā		✓	✓	
<i>Muehlenbeckia australis</i>	pōhuehue	✓	✓	✓	✓

Botanical Name	Maori and/or Common English Name	Tawa- tawa	Careys Gully	Maori Gully	Brooklyn Valley
<i>Muehlenbeckia complexa</i>	pōhuehue	✓			
<i>Parsonia capsularis</i>	aka kaikiore, NZ jasmine	✓			
<i>Parsonia heterophylla</i>	aka kaikiore, NZ jasmine	✓	✓	✓	
<i>Rubus cissoides</i>	tātārāmoa, bush lawyer	✓		✓	
<i>Tetragonia implexica</i>	kōkihi, NZ climbing spinach	✓			
Native lycophytes					
<i>Huperzia varia</i>	whiri o Raukatauri, hanging clubmoss		✓		
<i>Lycopodium fastigiatum</i>	mātukutuku, alpine clubmoss		✓		
Native ferns					
<i>Adiantum cunninghamii</i>	huruhuru tapairu, common maidenhair fern	✓	✓	✓	
<i>Asplenium appendiculatum</i> subsp. <i>maritimum</i>	ground spleenwort		✓		
<i>Asplenium bulbiferum</i>	mouku, hen & chickens fern	✓	✓	✓	
<i>Asplenium flabellifolium</i>	necklace fern	✓		✓	
<i>Asplenium flaccidum</i>	makawe o Raukatauri, hanging spleenwort	✓	✓	✓	
<i>Asplenium gracillimum</i>	hen & chickens fern	✓			
<i>Asplenium hookerianum</i>	Hooker's spleenwort	✓		✓	
<i>Asplenium oblongifolium</i>	huruhuru whenua, shining spleenwort	✓	✓	✓	✓
<i>Asplenium polyodon</i>	petako, sickle spleenwort	✓	✓	✓	
<i>Blechnum chambersii</i>	rereti, lance fern	✓	✓	✓	
<i>Blechnum discolor</i>	piupiu, crown fern			✓	
<i>Blechnum filiforme</i>	pānako, thread fern	✓	✓	✓	
<i>Blechnum fluviatile</i>	kiwikiwi, creek fern		✓	✓	✓
<i>Blechnum membranaceum</i>				✓	
<i>Blechnum minus</i>	swamp kiokio		✓	✓	

Botanical Name	Maori and/or Common English Name	Tawa- tawa	Careys Gully	Maori Gully	Brooklyn Valley
<i>Blechnum novae- zelandiae</i>	kiokio		✓	✓	
<i>Blechnum penna- marina</i>	little hard fern		✓		
<i>Blechnum procerum</i>	small kiokio	✓	✓		
<i>Blechnum vulcanicum</i>	mountain hard fern		✓		
<i>Ctenopteris heterophylla</i>	taupeka, comb fern		✓	✓	
<i>Cyathea dealbata</i>	ponga, silver fern	✓	✓	✓	
<i>Cyathea medullaris</i>	mamaku, black tree fern	✓	✓	✓	✓
<i>Cyathea smithii</i>	kātote, soft tree fern			✓	
<i>Dicksonia squarrosa</i>	whekī, rough tree fern		✓		
<i>Grammitis billardierei</i>	paretao, common strap fern			✓	
<i>Histiopteris incisa</i>	mātātā, water fern		✓	✓	
<i>Hymenophyllum demissum</i>	irirangi, drooping filmy fern		✓	✓	
<i>Hymenophyllum flexuosum</i>			✓	✓	
<i>Hymenophyllum multifidum</i>	much-divided filmy fern			✓	
<i>Hymenophyllum sanguinolentum</i>	piripiri, scented fern		✓	✓	
<i>Hypolepis ambigua</i>	rarauhi nehenehe, common pig fern	✓		✓	
<i>Hypolepis rufobarbata</i>	sticky pig fern		✓		
<i>Lastreopsis glabella</i>	smooth shield fern	✓	✓	✓	
<i>Lastreopsis velutina</i>	velvet fern	✓			
<i>Lastreopsis hispida</i>	pongaweka, hairy fern			✓	
<i>Leptopteris hymenophylloides</i>	heruheru, single crape fern			✓	
<i>Loxogramme dictyopteris</i>	whare-ngārara, lance fern		✓	✓	
<i>Microsorium pustulatum</i>	kōwaowao, hound's tongue fern	✓	✓	✓	✓
<i>Microsorium scandens</i>	mokimoki, fragrant fern			✓	
<i>Paesia scaberula</i>	mātātā, ring fern	✓	✓	✓	
<i>Pellaea rotundifolia</i>	tarawera, button fern	✓	✓	✓	

Botanical Name	Maori and/or Common English Name	Tawa-tawa	Careys Gully	Maori Gully	Brooklyn Valley
<i>Pneumatopteris pennigera</i>	pākau, gully fern	✓	✓	✓	
<i>Polystichum neozelandicum</i> subsp. <i>zerophyllum</i>	black shield fern	✓			
<i>Polystichum "richardii"</i> agg.	pikopiko, common shield fern		✓	✓	
<i>Polystichum vestitum</i>	pūniu, prickly shield fern		✓	✓	
<i>Pteridium esculentum</i>	rārahu, bracken	✓	✓	✓	✓
<i>Pteris macilenta</i>	titipo, sweet brake			✓	
<i>Pteris tremula</i>	turawera, shaking brake	✓	✓	✓	
<i>Pyrrosia eleagnifolia</i>	ota, leather-leaf fern	✓	✓	✓	
<i>Trichomanes endlicherianum</i>				✓	
<i>Trichomanes venosum</i>	veined bristle fern			✓	
Native orchids					
<i>Pterostylis banksii</i>	tutukiwi, a greenhood orchid sp.			✓	
<i>Simpliglottis cornuta</i>	green bird orchid			✓	
Native grasses					
<i>Austroderia fulvida</i>	toetoe	✓		✓	
<i>Austroderia toetoe</i>	toetoe	✓			
<i>Microlaena polynoda</i>				✓	
<i>Microlaena stipoides</i>	pātiti, meadow rice grass		✓	✓	
<i>Poa anceps</i>	broad-leaved poa	✓	✓		
<i>Poa cita</i>	wī, silver tussock		✓	✓	
Native sedges					
<i>Carex dissita</i>		✓			
<i>Carex flagellifera</i>	mānaia, Glen Murray tussock	✓	✓	✓	
<i>Carex geminata</i>	rautahi		✓		
<i>Carex secta</i>	pūrei		✓	✓	
<i>Carex virgata</i>	swamp sedge	✓			
<i>Cyperus ustulatus</i>	upoko tangata, giant umbrella sedge	✓			
<i>Isolepis prolifer</i>	three-square	✓			
<i>Uncinia uncinata</i>	matau a Māui, hooked sedge		✓	✓	

Botanical Name	Maori and/or Common English Name	Tawa- tawa	Careys Gully	Maori Gully	Brooklyn Valley
Native rushes					
<i>Apodasmia similis</i> (P)	oioi, jointed wire rush	✓			
<i>Juncus edgariae</i>	wī, leafless rush	✓			
<i>Juncus pallidus</i>	wī, giant rush	✓			
<i>Juncus sarophorus</i>	wī			✓	
<i>Luzula picta</i>		✓		✓	
Native monocot herbs (other than orchids, grasses, sedges, rushes)					
<i>Astelia fragrans</i>	kakaha, bush lily	✓	✓		
<i>Astelia solandri</i>	kōwharawhara, perching astelia		✓		
<i>Lemna minor</i>	kārearea, duckweed	✓			
<i>Libertia ixioides</i>	mikoikoi, NZ iris		✓		
<i>Phormium cookianum</i>	wharariki, coastal flax	✓		✓	
<i>Phormium tenax</i>	harakeke, swamp flax	✓			
Native composite herbs					
<i>Cotula coronopifolia</i>	bachelor's buttons	✓			
<i>Euchiton audax</i>	cudweed	✓			
<i>Euchiton</i> sp.				✓	
<i>Leptinella squalida</i>			✓	✓	
<i>Senecio minimus</i>		✓		✓	
<i>Senecio rufiglandulosus</i>			✓		
<i>Vittadinia australis</i>	vittadinia		✓		
Native dicot herbs (other than composite herbs)					
<i>Acaena anserinifolia</i>	piripiri, bidibid	✓	✓	✓	
<i>Aciphylla squarrosa</i>	taramea, spaniard		✓	✓	
<i>Anisotome aromatica</i>	kopoti, common aniseed		✓		
<i>Australina pusilla</i>			✓		
<i>Cardamine</i> sp.	panapana, NZ bitter cress	✓	✓	✓	
<i>Centella uniflora</i>	centella		✓		
<i>Crassula sieberiana</i>			✓		
<i>Dichondra repens</i>	Mercury Bay weed	✓			
<i>Epilobium linnaeoides</i>				✓	
<i>Epilobium rotundifolium</i>	round-leaved willowherb		✓		
<i>Galium propinquum</i>			✓		

Botanical Name	Maori and/or Common English Name	Tawa-tawa	Careys Gully	Maori Gully	Brooklyn Valley
<i>Haloragis erecta</i>	toatoa, shrubby haloragis	✓			
<i>Hydrocotyle elongata</i>			✓		
<i>Hydrocotyle moschata</i>	hairy pennywort	✓	✓	✓	
<i>Hydrocotyle novae-zelandiae</i>		✓		✓	
<i>Leucopogon fraseri</i>	pātotara, dwarf mingimingi		✓		
<i>Nertera depressa</i>	bead plant		✓		
<i>Oxalis magellanica</i>	oxalis		✓		
<i>Ranunculus reflexus</i>	mārūrū, hairy buttercup	✓	✓	✓	
<i>Stellaria parviflora</i>	kohukohu, NZ chickweed	✓			
<i>Urtica incisa</i>	ongaonga, scrub nettle		✓	✓	
<i>Viola filicaulis</i>	forest violet		✓		
<i>Wahlenbergia</i> sp.	rimuroa			✓	
Adventive gymnosperm trees					
<i>Pinus radiata</i>	radiata pine	✓			✓
Adventive dicot trees and shrubs					
<i>Acer pseudoplatanus</i>	sycamore				✓
<i>Berberis darwinii</i>	Darwin's barberry		✓	✓	✓
<i>Chrysanthemoides monilifera</i>	boneseed	✓			✓
<i>Cytisus scoparius</i>	broom	✓			✓
<i>Elaeagnus × reflexa</i>					✓
<i>Leycesteria formosa</i>	Himalaya honeysuckle				✓
<i>Lupinus arboreus</i>	tree lupin	✓			✓
<i>Paraserianthes lophanta</i>	brush wattle				✓
<i>Prunus avium</i>	flowering cherry				✓
<i>Rubus fruticosus</i> agg.	blackberry	✓			✓
<i>Ulex europaeus</i>	gorse	✓			✓
Adventive dicot lianes					
<i>Clematis vitalba</i>	old man's beard				✓
<i>Lonicera japonica</i>	Japanese honeysuckle	✓			
Adventive grasses					
<i>Agrostis capillaris</i>	browntop	✓			

Botanical Name	Maori and/or Common English Name	Tawa- tawa	Careys Gully	Maori Gully	Brooklyn Valley
<i>Cortaderia selloana</i>	pampas grass	✓			
<i>Dactylis glomerata</i>	cocksfoot	✓			✓
<i>Ehrharta erecta</i>	veld grass	✓			
Adventive sedges					
<i>Cyperus eragrostis</i>	umbrella sedge	✓			
Adventive monocot herbs (other than orchids, grasses, sedges and rushes)					
<i>Sisyrinchium</i> sp.		✓			
<i>Tradescantia fluminensis</i>	tradescantia, wandering willie	✓			✓
Adventive composite herbs					
<i>Achillea millefolium</i>	common yarrow	✓			
<i>Arctotheca calendula</i>	Cape weed	✓			
<i>Cirsium vulgare</i>	Scotch thistle, kotimana	✓			
<i>Conyza</i> sp.		✓			
<i>Delairea odorata</i>	German ivy				✓
<i>Helminthotheca echioides</i>	ox tongue	✓			
<i>Hypochoeris radicata</i>	catsear	✓			
<i>Jacobaea vulgaris</i>	ragwort	✓			
<i>Leucanthemum vulgare</i>	ox-eye daisy				✓
<i>Senecio angulatus</i>	Cape ivy				✓
<i>Senecio glastifolius</i>	holly-leaved senecio	✓			✓
<i>Senecio vulgaris</i>	groundsel	✓			
Adventive dicot herbs (other than composite herbs)					
<i>Brassica rapa</i>	wild turnip	✓			
<i>Callitriche stagnalis</i>	starwort	✓			
<i>Cedronella canariensis</i>	balm of Gilead				✓
<i>Digitalis purpurea</i>	foxglove				✓
<i>Dipsacus sylvestris</i>	wild teasel	✓			
<i>Foeniculum vulgare</i>	fennel	✓			
<i>Galium aparine</i>	cleavers	✓			
<i>Melanoselinum decipiens</i>	parsnip palm	✓			
<i>Nasturtium officinale</i>	watercress	✓			
<i>Orobancha minor</i>	broomrape	✓			
<i>Parietaria judaica</i>	pellitory of the wall	✓			

Botanical Name	Maori and/or Common English Name	Tawa- tawa	Careys Gully	Maori Gully	Brooklyn Valley
<i>Phytolacca octandra</i>	inkweed	✓			
<i>Plantago coronopus</i>	buck's-horn plantain	✓			
<i>Plantago lanceolata</i>	narrow-leaved plantain	✓			
<i>Polygonum aviculare</i>	wireweed	✓			
<i>Ranunculus repens</i>	creeping buttercup	✓			✓
<i>Rumex sagittatus</i>	climbing dock	✓			✓
<i>Solanum chenopodioides</i>	velvet nightshade	✓			✓
<i>Solanum nigrum</i>	black nightshade				✓
<i>Stachys silvatica</i>	hedge stachys	✓			
<i>Stellaria media</i>	chickweed	✓			
<i>Trifolium repens</i>	white clover	✓			

APPENDIX 2. SPECIES LISTS USED IN COMPILING APPENDIX 1

- Beale, S.H. 2005. Evidence in the matter of a private plan change request (Plan Change 30) in relation to land at Ohiro Road, Brooklyn. (Unpublished evidence presented at plan change hearing, dated 4 April 2005.)
- Mitcalfe, B.; Horne, C. 1994. Plant checklist for Careys Gully stream middle branch and true right head, centred on NZMS 260 map R27, Wellington, GR 555851. (NZPCN website.)
- Mitcalfe, B.; Horne, C. 1993. Plant checklist for some indigenous vascular plants of true right head of "Maori Gully" stream which has its source immediately south of Polhill trig; centred on NZMS 260 R27 map Wellington, G.R. 567864. (NZPCN website.)
- Mitcalfe, B.; Horne, C. 1994. Plant checklist for some indigenous vascular plants of the true left head of "Maori Gully" stream, centred on NZMS 260 R27 map Wellington, G.R. 570870. (NZPCN website.)
- Mitcalfe, B.; Horne, C. 1997. Plant checklist for vascular plants on land owned by William and Sharon Tervit, 48 Ashton Fitchett Drive, Brooklyn, Wellington. (NZPCN website.)
- Wassilieff, M. C.; Logan, R. (no date) Plant Checklist for forested valley west of Frobisher Street, Island Bay, Wellington (indigenous species). (NZPCN website.)
- Wellington Botanical Society. 2009. Tawatawa Reserve, Island Bay, Wellington. Plant checklist for catchment with regenerating indigenous coastal forest, gorse shrublands and some exotic forest, north-west of Frobisher Street, Island Bay, centred on NZMS 260 R27 map Wellington, G.R. 576847. (Unpublished, Chris Horne.)