

**Ecological assessment of private land adjoining
Huntleigh Park**

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Cover photo

Photo of general study area from lower Silverstream Rd, with private lots on right and Girl Guide reserve on left of central gully.

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INTRODUCTION

Background to study

This project involves an ecological assessment of a group of 11 private properties in Ngaio / Crofton Downs (Map 1). The study has been commissioned by Wellington City Council to assist it to make informed decisions about the nature of a potential plan change to replace the existing, but generally inappropriate, “Rural” zoning for these properties.

Council recently approved a new set of provisions for the City’s Rural Area (Plan Change 33). As part of the review process a number of areas of land were identified on the edges of the suburban area, between established residential housing and the Outer Green Belt. Some of these areas were given special rules to give owners greater freedom to subdivide than would be permitted in the wider rural environment. The study area was not, however, treated in this way because it was considered to have characteristics that would justify a complete change of zoning.

The 11 contiguous lots are located on the eastern edge of Huntleigh Park Forest, which is one of the largest and most significant forest remnants in Wellington City (Park 1999). The lots are arranged along a minor ridge, in a rough line between Silverstream Road at the bottom and Huntleigh Park Way at the top. Several of the lots are accessed from Thatcher Crescent and Heke Street.

Three of the lots are undeveloped. Two of these lots (Lots 5 and 18 DP 20649 off Silverstream Road) are owned by a group of 9 owners who have covenanted the land as a conservation area for the regeneration of the native bush. All the rest have a house on them and in one case two (46 and 48 Silverstream Road). The areas around the houses are generally cleared of native vegetation and feature driveways and gardens. Prior to the notification of the Proposed District Plan in 1994 the properties were zoned *Residential G (Rural Residential)*, the rules of which permitted a single house plus an additional household unit that is one bedroom and no more than 50m².

For the purposes of this study, the 11 lots were grouped into 7 properties by current ownership (the two covenanted lots being both part of property 7) as shown in Map 1. The total area of these 7 properties is approx. 4.8 ha. The adjacent two lots, zoned *Conservation Site*, owned by the Girl Guides Association are also shown in Map 1 as property 8 and described in this report as the “Girl Guide reserve”. The total area of these two lots is approx. 7.1 ha, while the total area of the Wellington City Council reserve which lies to the west of the Girl Guide reserve, (including the legal road area) is approx. 8.2 ha.

Purpose of study

The objective of the study is to provide information that allows the Council to consult with the landowners and other parties on an informed basis.

Specifically, I was asked to provide information on:

- The composition of the vegetation on the land at an appropriate scale.
- A comparison of the vegetation on the private properties with the core area of the Huntleigh Park Forest and other forest remnants within the City.
- The relative importance of the different components of vegetation on the land to allow Council to successfully negotiate with the property owners to achieve the maximum benefit for indigenous ecology.
- Any information on birds, mammals, reptiles and invertebrates of the land, which may prove useful to determining its ecological value within the Wellington City context.

Acknowledgements

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GENERAL DESCRIPTION OF AREA

Physical description

The study area is located on hills between Crofton Downs and Ngaio in Wellington's north-western suburbs, on the northern side of Silverstream tributary of the Korimako Stream, the northern branch of the Kaiwharawhara catchment. The topography is mainly steep hill country with incised streams, but there are a few more gentle hills slopes (especially on the lower slopes) and broad spurs. Soils are steepland and hill brown soils (mainly Makara and Korokoro series). The drainage is mainly very good.

An ecological framework for the study area within the catchment is provided by Isobel Gabites' work on *ecodomains* in Wellington City (Boffa Miskell 2002). An ecodomain is defined as:

“An ecodomain represents a cluster of repeating key environmental factors which show through in its biological communities (the types of plants suited to the area, the wildlife populations, etc)”.

The ecodomain in the study area is Ecodomain 8, described for Wellington City as: “Band of low hill country experiencing year-round humidity and mild temperatures.” Within this ecodomain there are several *phases* identified, each of which has characteristic dominant species, as follows:

- * North aspect slopes: tawa, rimu, kahikatea, cabbage tree¹
- * South aspect slopes: nikau, kohekohe, kamahi, mamaku
- * Gullies and valleys: pukatea, kahikatea, tree ferns, riparian grasses, sedges etc.

History of Huntleigh Park vegetation

In pre-human times the study area and surrounding areas supported extensive podocarp/broadleaf forests. (Gabites 1993; Gabites 2002). The drier hillslopes were dominated by rimu, miro, rata, tawa and hinau; with kahikatea, pukatea, swamp maire, rimu, kohekohe, kamahi, mahoe, totara and silver fern on the damper or more fertile soils (Gabites 2002; Dunbar and others, 1997; Mildenhall 1993).

Small areas of the forest in or adjacent to the Ngaio valley may have been cleared by local Maori prior to the arrival of European settlers. Over the 50 years from the first wave of European settlement almost all of the remaining forest was cleared (Park, 1999). Early photographs and paintings of the era document this change (Boffa Miskell, 1998; Bremner 1983). The area known as the Crofton Downs forest, including the study area,

¹ Nikau and cabbage tree not present in the study area although cabbage tree is present elsewhere in Huntleigh Park (Enright and John 1998).

was part of the original rural sections 7,8 and 11 of the Kaiwharawhara District. The body of the forest (the WCC and Girl Guide areas and the 11 presently rural properties, but not the area to the west of the City Council reserve) was purchased from H B Halswell in 1908 by a Dr Chapple and held in trust by the Chapple and Izard families and others. A memo from the City Valuer's Office of 1931 (WCC Archives), when the property was offered to the City, gives details of the owners and includes a map.

The land was leased for farming from the trust by the Kilmister family, who farmed a large property spanning both sides of the Te Wharangi ridge which forms the western boundary of the Silverstream catchment. Some timber was likely to have been milled from the lower slope and surrounding areas (e.g. where Thatcher Crescent now runs), to service the large Chews Mill on the nearby Waikowhai (Korimako) Stream. At this time:

Casey and Meyers only farmed the valley floor and probably milked about 12-15 cows (this was pre 1900). An 1891 map showed very heavy scrub and bush growing over the whole area, the lower parts only being suitable for grazing. My father told me that his father recalled that the valley floor of what is known today as Crofton Downs has an area of virgin bush which including many large kahikatea. This was on Chew's land and was probably felled for timber. (Kilmister, 2001)

Mr Brian Kilmister (personal communication) remembers, from when he was a child in the 1940s, old skidding marks under the trees in Huntleigh Park from dragging logs. Extensive bush clearance is shown by several photos in Bremner 1983 (see especially photos from the 1910s on pp 30 and 64, showing bare slopes just north of the study area in the vicinity of the present Heke Street). However, the core area of the present Huntleigh Park forest (within and adjacent to the current WCC reserve) would have remained standing and largely ungrazed and unburnt except at the edges. This pattern is clearly shown in the views and aerial photos from the 1930s and early 1940s (photos 1 - 3). Further photos from the 1920s and 1930s (Bremner 1987) show some traces of forest protruding at the top of the hill where Huntleigh Park Way now runs.

Farming became more difficult in the 1920s and 1930s and grazing and burning largely ceased by the 1950s when Crofton Downs was first subdivided. At this time there were extensive areas of gorse on the property (Brian Kilmister, personal communication). Mr A. Leigh Hunt purchased an interest in 1927 to the whole Crofton Downs property and after 20 years secured an option to purchase the whole estate. A private company was formed around 1946 to develop the northern section of the property – most of the present Heke Street. A document of 1951, apparently a press statement prepared by Mr A Leigh Hunt, states:

As promoter of the Company, instead of stipulating for a financial gain, Mr Hunt reserves the personal right to dedicate bush lands at his discretion to bodies, associations, etc., operating in the public interest.

The document also describes the vegetation:

About one-third of Crofton Downs is covered with native forest containing practically all the varieties found in the West Coast forests of the North Island. Nearly one hundred years ago, the larger trees of the area were cut and milled at Chews saw-mill, just north of the Ngaio Railway Station, then known as "Crofton".

The forest now existing is of second growth and, being young and thoroughly healthy, is unexcelled in its indigenous beauty. A total of 38 (and a half, as a symbol) acres of this forest is to be preserved for all time. (WCC Archives, document appears to be attached to a letter to the Mayor, 13 February 1951)

Mr A. Leigh Hunt gifted 20 acres of the forest to Wellington City Council in 1951 and the adjoining area of 15 acres to the Boy Scouts and Girl Guides (reprinted from the Dominion, 25 September 1951 - WCC Archives).

In 1962, a prospectus for the sale of lots in Crofton Downs proclaimed:

"One of the greatest benefits to residents will be the expanse of standing bush on the northern slope of the valley. It should be noted that this genuine west coast bush carries absolutely no risk of fire. Indeed, had it possible to burn it, this would have been done many times over for the gorse which surrounds it has seen fires on numerous occasions and the bush... [an area of 40 acres as stated elsewhere in the prospectus]... has withstood all of them".

As described above, the core forest area has been recognised as an important forest remnant in Wellington since at least the time of subdivision. An early ecological inventory (Wellington Regional Council *et al.* 1984) described "Crofton Downs Bush" as a significant site which contained miro and diverse plant species, had a good understorey and good regeneration, was not grazed, was an accessible reasonably large area of forest, and part of a chain of forested areas providing bird corridor to City from Hutt Valley. It should be noted that this assessment applied to an area of 30 hectares, including all of the current forest area and the area now covered by the Thatcher Crescent subdivision.



Photo 1: Silverstream Valley and “Sky Farm” in 1936. Huntleigh Park centre right, future Crofton Downs centre left.

Photo 2: Looking across western Ngaio towards the Crows Nest, 1936. Huntleigh Park at far centre left.

(Photos 1 and 2 courtesy of Mr Brian Kilmister)



Photo 3. 1941 aerial photo of Silverstream Valley (Korimako Stream) and study area.

METHODS

Background

The brief called for description and assessment of the study area, in relation to its surrounding vegetation in Huntleigh Park and elsewhere. I was familiar with vegetation in the Kaiwharawhara catchment generally (e.g. Blaschke *et al.* 2004) and in more detail with close-by areas such as Karori Wildlife Sanctuary, Otari-Wilton's Bush and Otari Farm. For this project, I first read the previously-mentioned descriptions of Huntleigh Park and surrounding areas, and then inspected the study area from outside vantage points and made a reconnaissance inspection of the publicly-accessible parts of Huntleigh Park (including the Girl Guide reserve) using the foot tracks shown in Map 2. This map shows the study area in the context of Huntleigh Park reserve, and neighbouring areas including the neighbouring Girl Guide reserve and nearby WCC reserves (those in the vicinity of Waikowhai St, Makererua and Heke Streets) as well as vegetated private land to the west of Huntleigh Park. The red line shows the area delineated as primary forest by Park (1999) and the surrounding aqua as associated secondary forest. Public walking tracks are shown in purple.

The whole of the forested area shown in Map 2, including the study area, the Girl Guide reserve, the City Council reserve and the private land to the north-west, is referred to in this report as "Huntleigh Park".

Field survey

I wished to systematically describe the vegetation of all parts of the study area in relation to its neighbouring vegetation, at an appropriate level of detail to the aims of the study. This implied an emphasis on vegetation composition, structure, and site description. To do this I considered several available methods of reconnaissance-level vegetation description and sampling.

I decided to base the sampling pattern on the vegetation cover classes described by Froude (2002) which from my reconnaissance inspection and general knowledge of the area I felt were appropriate to the area, soundly based in vegetation theory and practical use and were able to be mapped at an appropriate level of detail, and could be differentiated on the good quality colour aerial photos available. I wished to sample each property and each vegetation unit adequately to cover the variation in structure and composition in each unit and each property, but not at an excessive level of detail. It was therefore appropriate to use a "systematic subjective" basis for locating sample plots, rather than a random or transect approach².

² A good discussion of alternative methods for forest monitoring is found in Handford 2004, which guided my choice of method.

For this I used the aerial photos and a brief reconnaissance of each property to place between 1 – 4 plots in each property to sample each cover class occurring within each property and, between the total of 2-4 plots in each cover class, adequately sample the composition and structure of each. This resulted in a total of 15 plots sampled in the study area, as shown in Map 4. As is normally the case in reconnaissance plot sampling in New Zealand, plots were nominally 20 x 20 m in size as shown in Map 4 but as measurements of vegetation density or frequency were not being made, a strict adherence to plot size was not necessary, rather this size was used as a guide but varied where necessary to avoid straying into another type of cover class.

Map 4 also shows the location of individual notable trees³, mainly podocarps, using the following key:

Blue = kahikatea
Purple = matai
Olive = totara
Pink = miro
Green = rimu
Red circles = milk tree

In each plot, the following parameters were described⁴:

For each tier: (>25m, 25 – 12 m, 12 – 5 m, 5 -2 m, 2m – 30 cm, <30cm)

- Species present and % ground cover for each species
- Total canopy cover
- Diameter of largest tree(s)
- Epicormics⁵ present

Ground cover class for vascular plants, non-vascular plants, litter, soil and bare rock.

Epiphytes⁶ and canopy cover for each species

Site parameters:

- Aspect
- Slope

³ The large circles in the Girl Guide reserve denote stands of trees, coloured by the predominant podocarp species.

⁴ This is a similar approach to the Reconnaissance (Recce) sheet (Allen 1993), with some modifications from the FORMAK Site Assessment form Handford (2004).

⁵ Epicormics are shoots emerging directly from a tree stem. They are an important means of regeneration for some species.

⁶ Epiphytes are plants which naturally grow upon another plant but do not derive any nourishment from it.

- Physiography
- Drainage
- Ground surface

Structural description of vegetation

Birds present

Notes on:

- Canopy condition
- Understorey condition
- Edge effects
- Weeds and animal pests.

Synthesis

After the field material was complete, I assessed all the sample plot information. On the basis of the structural description of the vegetation and the species present, I grouped the plots into vegetation units and then refined the descriptions of the vegetation units to reflect this information. The final vegetation units were similar to those proposed by Froude (2002) with slight adjustments. Finally, I reviewed the initial field classification of each plot and then mapped the boundaries of the vegetation units.

ECOLOGICAL ASSESSMENT

Previous descriptions of the vegetation

A number of earlier studies have described or mapped the vegetation of Huntleigh Park or parts thereof.

Park (1999) compiled an inventory of surviving remnants of native forest throughout Wellington City. He based the recognition of “primary” or “pre-settlement” forest (i.e. a remnant of the original forest before widespread clearance and disturbance in the nineteenth and early twentieth century) on the presence of a number of “marker species” known to have been a canopy species of pre-settlement forest. These marker species were, in approximate tree age and longevity:

Oldest	Intermediate	Youngest	Maori settlement
Northern rata ⁷	<i>Kohekohe</i>	<i>Rewarewa</i>	Karaka
Rimu	<i>Tawa</i>	<i>Kaikomako</i>	
<i>Matai</i> *	Titoki	Kowhai	
<i>Kahikatea</i>	<i>Hinau</i>	Akihiro	
Totara	Turepo	Kamahi	
<i>Miro</i>			
<i>Pukatea</i>			
Maire			
Maire tawake			

* italicised name denotes prominent canopy species in study area

Park usually mapped the primary forest remnant within an area of secondary forest that surrounded the remnant. He mapped and recorded the Huntleigh Park forest and surrounding secondary forest (which includes the forest remnant areas above Thatcher and Waikowhai Streets) as shown in Map 2. The total area of Huntleigh Park Forest as delineated in Park’s survey is approx. 48 hectares. The species and other information recorded in Park’s survey for Huntleigh Park and nearby forest remnants is shown in Table 1.

Froude (2002) undertook a baseline vegetation survey throughout Wellington City, in which she proposed the vegetation mapping units used as a basis of this study. She mapped these vegetation units for the Wellington City Council reserve portion of Huntleigh Park, as reproduced in Map 3.

⁷ Northern rata does not now occur in Huntleigh Park but is very likely to have in the past. A large stump within the forest is thought to be northern rata (B Mildenhall, Wellington Botanical Society, personal communication)

Members of the Wellington Botanical Society undertook a number of inspections of “Crofton Downs Bush” (Huntleigh Park) which culminated in a comprehensive vegetation species list for the main part of the forest area (Enright and John 1998). This species list is contained within the species list compiled for this study (Appendix 1).

The whole area of land was assessed as part of an open space study of ten sites undertaken in 1998 (Anstey 1998), in which some comments were made on the vegetation, as part of the visual significance of the site. The author summarises the significance of the vegetation as follows:

“This site is visually significant from a wide range of perspectives, being visible from a number of major suburbs and an important transport corridor. The site is an integral part of a vegetation continuum conferring identity and character and contributing to the quality of amenity for many residencies. The site forms an important buffer between the communities of Heke Street, Crofton Downs and the Thatcher Crescent area.”

Vegetation Units present in the study area⁸

Mixed broadleaved forest (FB)

Prominent species: Hinau, pukatea, kanuka, kohekohe, mahoe, mamaku, broadleaved shrubs

Height of emergent and canopy: Canopy 6-12 m, emergents, 10 -16 m.

Plots surveyed: 6/3, 7/1, 8/4

Description: A diverse unit charactered by broadleaved tree species other than tawa. Occurs in all topographical positions. Uneven canopy with gaps and some tall emergent trees. Treeferns sometimes prominent in sub-canopy. Many vines. Kohekohe often prominent below the canopy and it appears as though may become dominant in some cases.

Mahoe-dominant broadleaved forest (FM)

Prominent species: Mahoe, hinau, pigeonwood, ngaio, mamaku.

Height of emergent and canopy: Canopy 6-8 m.

Plots surveyed: 4/1/, 5/1

Description: Younger and less well-developed variant of the above unit, occurring mainly on the fringes of the forest area, and subject to continued disturbance from weeds, tracking, felling of trees, etc. Low canopy dominated by mahoe, usually quite homogenous. Range of broadleaved tree seedlings, especially kohekohe and pigeonwood.

⁸ As mapped in Map 5. Initials following vegetation unit names are the abbreviations used in Map 5.

Podocarp-broadleaved forest (FP)

Prominent species: Kaihikatea, miro, totara, matai, tawa, hinau, rewarewa, kohekohe

Height of emergent and canopy: Canopy 8-15 m, emergents, 10 -16 m.

Plots surveyed: 1/1, 2/3, 6/2, 8/1

Description: The most well-developed and “forest-like” unit containing the largest trees. Tawa is the characteristic broadleaved tree species, with a diverse range of podocarp and broadleaved tree species also present in the canopy. Many canopy gaps with regeneration in the gaps. Silver fern and broadleaved shrubs in the understorey. Occurs mainly on upper slopes and ridges/spurs.

Kohekohe-dominant broadleaved forest (FK)

Prominent species: Kohekohe, karaka, pigeonwood, puka, mahoe

Height of emergent and canopy: canopy 8-12 m

Plots surveyed: 2/1/, 2/2/, 8/3

Description: Has the most homogenous appearance of the units. Kohekohe dominant in the canopy, sometimes with almost no other canopy species. Even canopy, sometimes down to 6 metres in height. Often in sheltered gullies and lower slopes. Kohekohe usually regenerating so this unit is persistent.

Treefern land and low forest (FF)

Prominent species: Mamaku, ponga, ngaio, mahoe, broadleaved shrubs

Height of emergent and canopy: Canopy 5-9m, emergent 6-10m.

Plots surveyed: 3/1, 6/1, 8/2

Description: A variant on the young regenerating broadleaved forest, occurring in some small gullies and edges of the forest areas. Mamaku the most characteristic species but also a range of broadleaved shrubs, small trees and vines present. Podocarp as well as broadleaved tree species present as seedlings. Gorse and blackberry sometimes present under the canopy. Sometimes resulting from recent disturbance within or on edges of forest, e.g. tracks.

Forest dominated by exotic trees (FE)

Not sampled, but there are a few small areas dominated by exotic pines or willows.

Photos of vegetation units



Photo 4: Mixed broadleaved forest: Plot 6/3 with large kanuka at left.



Photo 5: Mahoe-dominated broadleaved forest: Plot 4/1. Note open nature of vegetation.



Photo6: Podocarp-broadleaved forest: Plot 2/3 with damaged totara. Sub-canopy is open and younger, suggests relatively recent grazing.



Photo 7: Podocarp-broadleaved forest: Plot 8/1 with large matai at left. Kahikatea and tawa also present in canopy.



Photo 8: Kohekohe-dominated broadleaved forest: Plot 6/6 looking across small gully.



Photo 9: Treefern land. Tall mamaku in canopy, smaller treeferns and broadleaved shrubs below.

Map of the vegetation units

After establishing the composition and structure of each of the vegetation units I mapped these units in the study area and the adjacent Girl Guide reserve. This map, at a scale of 1: 1500, is shown as Map 5. I have not attempted to reconcile my mapping units with those of Froude (2002) (Map 3), but on the basis of the common vegetation units as discussed above, I am confident that the mapping units in both studies are very similar in concept.

Vegetation on the private land in relation to other parts of Huntleigh Park Forest and other forest remnants within the City

From the vegetation description of Huntleigh Park described in previous sections, it is clear that the vegetation in the study area is similar to the rest of the forested area in Huntleigh Park, and also to neighbouring forest remnants such as Khandallah Park and the reserves above and below Heke Street. This is shown in the table below.

Within the study are the greatest density of podocarps and tawa is in the Girl Guide Reserve, but these trees are also present throughout the study area on suitable sites, particularly on spurs and upper slopes. They are also present in the Collingwood-Heke Street and the Orleans -Makererua Street reserves.

The study area properties, except for the Girl Guide reserve, have a greater proportion of their area on the edge of the forest and also contain building lots, gardens, driveways etc. They are therefore a little more disturbed than the current City Council reserve portion, and contain a greater proportion of younger and more disturbed vegetation units such as the mahoe-dominated and treefern-dominated forest and treeland. However, several of the properties with disturbed vegetation also have significant areas of older and less disturbed vegetation present. For example, property 6 has a house in the middle of the property and predominant treefern and younger regenerating vegetation in the eastern half of the property, but also some much older and less disturbed vegetation including some notable podocarp trees in the western half, very close to the house.

The study area also appears to have similar forest vegetation to the private land immediately to the north-west of Huntleigh Park⁹. The forest on this property grades into broadleaved scrub to the west and on the upper slopes, as mapped by Froude (2002) in the northern part of the WCC reserve part of Huntleigh Park.

Table 1 shows that the vegetation of Huntleigh Park including the study area is similar to larger nearby remnant forest areas such as Otari-Wilsons Bush, Khandallah Park and

⁹ This area was not inspected on the ground, only from aerial photos and from adjacent vantage points.

Trelissick. All the dominant species at Huntleigh Park are also recorded by Park (1999) as prominent species in one or more of these named areas, and this is confirmed by various accounts and species lists of the other areas (see Blaschke et al 2004 for further references and species lists). Huntleigh Park is distinguished from all other forest remnants in the area except for Otari-Wiltons Bush by its size and by the number of podocarp trees present.

Fauna - birds, mammals, reptiles and invertebrates

A range of native and introduced birds were seen or heard during field inspections, including chaffinch, blackbird, fantail, grey warbler, kereru, silvereve and tui. The native birds most commonly encountered were grey warbler, tui and fantail. The bush areas offer good bird habitat including feeding and nesting sites, and in particular a relatively large amount of fruits from podocarp trees, formerly an important part of the diet of native birds.

The range of birds seen is consistent with the sustained bird monitoring results recorded by Froude (2004). Froude did not undertake bird monitoring within Huntleigh Park but recorded monitoring results for the nearby Otari-Wilton Bush, Khandallah Park and Trelissick Park, all of which have similar vegetation to Huntleigh Park. Her results include all the species noted above and featured a significant increase in the numbers of tui in the 4-year observation period (especially at Otari-Wilton Bush), and a lesser increase in the numbers of grey warbler. It is reasonable to expect that some of the less common birds recorded at Otari-Wilton Bush, such as bellbird, shining cuckoo and morepork, may be present at Huntleigh Park. Observations by Mr Ron Chapman, a resident of Silverstream Rd, confirm that in recent years shining cuckoo (regularly in springtime), morepork and bellbird have been observed or heard in the vicinity of Huntleigh Park (R.Chapman, personal communication).

There are no known records of invertebrates, native bats or reptiles in Huntleigh Park. Invertebrates have been sampled (by Malaise trapping) over the last three summers as part of a study of parasitoid wasps in Wellington (Mr Rudi Schnitzler, Department of Biological Sciences, Victoria University of Wellington, personal communication). There is likely to be good habitat for reptiles (i.e. geckos and lizards) within the park, especially on the sunny upper spurs and slopes, while the whole of Huntleigh Park including the study area would undoubtedly offer suitable habitat for a range of native invertebrate species. Long-tailed bats have been observed in Otari-Wilton Bush and Huntleigh Park appears to have suitable bat roost sites in old hinau and kohekohe trees. Younger areas of forest should offer suitable habitat for bats in the future as regeneration proceeds.

Table 1. Huntleigh Park in relation to neighbouring forest remnants. From Park (1999)

Name of forest unit	Landform	Prominent species	Type*	Area (ha)
Huntleigh Park, Crofton Downs	Broad hillslope and all slopes	Primary remnant includes matai, hinau, tawa, kohekohe, kahikatea, rewarewa, lancewood, totara, pukatea and rimu. Secondary forest includes mapou, mahoe, karaka, ngaio, rewarewa, pigeonwood, tawa, hinau, matai, kahikatea, kaikamako, kanuka, rata (ridges)	1, 2	57.7
Above Heke Street, Ngaio	Hillslope	Mainly mahoe, mapou and karaka. Some kohekohe.	2	8.0
Orleans Makererua Street Reserve	Hillslope and adjacent gullies	Hinau, tawa, kohekohe, kaikamako, rewarewa, mahoe, kahikatea (in gully head and mid-gully), putaputaweta, wineberry, titoki, ngaio, karaka, wharangi, mapou, pukatea, mamaku, heketara, matai, milktree, cabbage tree and northern rata.	1, 2	3.1
Above Doris Gordon St. Crofton Downs	Gully and hillslope	Kohekohe, tawa, hinau, rewarewa, mahoe, ngaio karaka and solitary nikau.	1, 2	12.4
Trellisick Park Unit	Lower gorge and hillslope	Predomin. tawa, rewarewa, hinau, totara, kahikatea, kohekohe, titoki, matai (ridge), wharangi, kowhai, n. rata, karaka and kanuka. Drier N-facing slopes incl. akiraho, totara, ngaio, cabbage tree, mahoe, ohuhu, akeake, tarata, mapou, rewarewa and tawa.	1, 2	24.6
Wilton Bush and Otari Plant Museum	Hillslope and adjacent gullies	Emergent podocarp remnant of rimu, matai, totara, miro, n. rata and narrow-leaf maire. Primary forest mosaic of tawa (dominant), hinau and kohekohe with rewarewa, pukatea, puka, karaka and scattered matai and totara.	1, 2	131.6
Khandallah Park	All slopes	Primary forest is tawa/kohekohe with pigeonwood, mamaku, rewarewa, puka, lancewood, wharangi, hinau, pukatea, titoki, kaikamako and kiekie. Secondary broadleaf forest of rewarewa, mahoe, mapou, lancewood, mamaku, raurikau, fivefinger, tarata and kohuhu	1, 2	71.3

Streams and aquatic life

Huntleigh Park including the study area contains a number of small tributaries of the “Silverstream” flowing adjacent to Silverstream Road into the Korimako Stream, the main northern tributary of the Kaiwharawhara Stream. Some of the lower study area tributaries, especially those in the Girl Guide reserve and in property 7, are nearly 1 meter wide, deeply incised, offer a variety of stream habitats (e.g. small pools, riffles, rocky and pebbly stream bottoms), are well-shaded and would be permanently flowing except perhaps for short periods in the very driest conditions. These parts of the stream would have been the least likely habitats to have been burnt or regularly disturbed by stock during the decades when the land was farmed and therefore most closely approximate the original forest habitats, with a number of old standing and fallen trees present.

The Kaiwharawhara Stream environment has been described by Kingett Mitchell (2002). The riparian habitat is described in this publication as generally of good to high quality. There is a reasonable abundance and diversity of macro-invertebrates and freshwater fish, although the Kaiwharawhara Stream contains some quite disturbed portions that have been polluted and therefore overall has a lower environmental quality than some other urban streams with comparable habitat. However, the sections described above would be some of the least disturbed and best quality habitat in the Kaiwharawhara catchment.

Kingett Mitchell summarise their findings as follows:

“ Despite the land use pressure placed upon the ecological values of the stream system, Kaiwharawhara Stream retains a relatively healthy habitat. This is the result of the steep and entrenched nature of the catchment, which has minimised the effects related to sedimentation and channelisation often associated with urban stream systems. In addition, the generally high to good quality of riparian vegetation in reserves and parks are present within the catchment, which provide centres of biodiversity to aid restoration initiatives and rehabilitation...Overall ecological health of the Kaiwharawhara Stream is moderate to good.”

This quotation would accurately describe most of the stream environment in the study area.



Photo 10: Looking upstream in middle portion of main tributary of the “Silverstream”, within Girl Guide reserve. Shows incised stream bottom and small pool at lower right.

Vegetation age and succession trends

As described earlier, most vegetation in Huntleigh Park, including within the study area, is regenerating from logging, clearance and grazing in the second half of the nineteenth century and first half of the twentieth. Generally, the remnant forest in Huntleigh Park is younger than that at Otari-Wiltons Bush, with an absence of very large obviously old podocarp and broadleaved trees¹⁰. Both northern rata and the kiekie vine, indicators of old forest, are absent from Huntleigh Park. However, many of the largest and oldest podocarp trees were likely to have been removed from the area by early logging, as discussed earlier, and a large stump thought to be a northern rata has been observed in the City Council reserve part of the forest (B. Mitcalfe, Wellington Botanical Society,

¹⁰ All references to the ages of trees are from general observation of tree size and habit only. No tree ageing has been undertaken. These estimates are therefore very approximate.

personal communication). The accounts of the early vegetation discussed earlier clearly suggest that the forest vegetation in the City Council and Girl Guide reserves is a remnant of uncleared forest. Old photos (Photos 1-3) confirm this; they show much tree vegetation throughout the study area, including crowns of individual large trees.

The oldest trees are likely to be slow-growing broadleaved trees such as hinau, pukatea, tawa or kohekohe, growing in sheltered gullies or shady lower slopes, and several are likely to be more than 200 years old. Appendix 2 provides some further details on likely growth rates and ages for hinau and podocarp trees in Huntleigh Park and its vicinity.

The different vegetation units described above are in different stages of regeneration, as follows:

Mixed broadleaved forest: Canopy trees are generally 50-100 years old but may contain occasional older (remnant) trees. Some areas were subject to continued disturbance including fires. Now, the structure of the unit indicate steady regeneration of broadleaved trees including kohekohe (which may become dominant in places), and podocarps in some areas.

Mahoe-dominant broadleaved forest: A younger form of broadleaved forest, probably not more than 50 years since grazing. Continued disturbance in many areas, but will mainly continue to regenerate into more mixed broadleaved forest.

Podocarp-broadleaved forest: Similar to the mixed broadleaved forest in terms of its dynamics. Unlike at Otari-Wiltons Bush where the podocarps are old remnant trees, most of the podocarps I observed were probably not more than 100 years old and have probably regenerated in suitable sites through bird transport of seeds. Now appears to be stably regenerating in canopy gaps when a canopy tree falls.

Kohekohe-dominant broadleaved forest: In some cases this unit is younger than other broadleaved forest, resulting from early and prolific kohekohe regeneration. It now appears to be stable and self-regenerating.

Treefern land and low forest: Generally similar to the mahoe-dominated broadleaved forest. Recent succession from cleared land, subject to repeated disturbance, but likely to develop into mixed broadleaved forest, or podocarp-broadleaved forest where podocarp seedling are present.

In summary, the vegetation was strongly influence by a century of grazing and fire, as well as its environment and topography. Although it has been largely free from grazing and fire for the last few decades, most individual trees are not older than about 80 -100 years. However a number of individual trees are well over 100 years old. The mixed broadleaved, kohekohe-dominated and podocarp-broadleaved forest appear to be stable and evenly regenerating, and relatively free from significant weed or animal pest invasion. The other vegetation units and edges of the forest are subject to continued disturbance from the neighbouring residential activities.

Relative ecological significance of the vegetation units

The vegetation units proposed by Froude (2002) have proved to be well-based and I have therefore extended them to the rest of Huntleigh Park including the study area (map 5). These vegetation units as mapped are also consistent with patterns described in earlier descriptions of the vegetation in Huntleigh Park and nearby areas.

The basis of Park's (1999) inventory is important, establishing the distribution of forest remnants throughout Wellington City, based on the presence of "marker species" of primary forest. This is a sound basis for establishing the ecological significance of the vegetation in Huntleigh Park, based on the presence of the same marker species recognised by Park. The distinction of vegetation units in the study area is therefore as follows:

1. Highly ecologically significant:

Mixed broadleaved forest
Podocarp-broadleaved forest
Kohekohe-dominant broadleaved forest

2. Less ecologically significant

Treefern land and low forest
Mahoe-dominant broadleaved forest

All the first group of vegetation units contain canopy species in Park's group of marker species. Moreover, several of them are in the oldest age grouping of his marker species, and most of the rest are in the second oldest group.

This distinction reflects the vegetation as it is now, not at some future time, as the "less ecologically" significant" vegetation units are actively regenerating and most of its current area would become more ecologically significant in time if not disturbed. The significance of the vegetation of Huntleigh Park as a whole is also enhanced by the buffering provided to the older forested core by the younger regenerating forest on almost all its edges, especially to the north-west.

MANAGEMENT RECOMMENDATIONS

Because of the ecological significance of much of the native vegetation in the study area, it would be very desirable to manage this vegetation in order to maintain and enhance its ecological values, as well as its amenity value for its owners. Although lots in the study area are privately owned, it may be appropriate for Wellington City Council to support management of some of these areas for their ecological values.

In my previous report (Blaschke *et al.* 2004) I discussed management and restoration of vegetation in the Kaiwharawhara catchment in detail. Further material on management and restoration activities for the area is available from the Wellington City and Regional councils (Greater Wellington & Wellington City Council 2003) and from the Ngaio Residents Association. The main types of restoration activities relevant to the study area include the following:

Landscape considerations: Blaschke *et al.* (2004) proposed three main management zones in the Kaiwharawhara catchment, with corresponding restoration priorities, as follows:

Restoration Habitat 1 Forest and stream: Ecological management should be aimed at maintaining and enhancing the already generally high environmental quality of these areas, especially including the riparian habitat and the stream biota.

Restoration Habitat 2 Outer hills: Ecological management should be aimed at allowing the regeneration to continue unhindered where possible.

Restoration Habitat 3 Valley residential: Ecological management should be primarily through the provision of information, advocacy and suitable native plant material to private owners, focussing especially at owners in the “corridor habitats” between areas of Forest and Stream and Outer Hills habitats.

The study area was mapped within habitat 2 (Outer hills), but at the scale of this study all three zones are relevant. Huntleigh Park as a whole forms an enclave of habitat 1 (Forest and Stream) within habitat 2, while because the study area contains private residences the characteristics of habitat 3 are also relevant. Huntleigh Park, including the study area, also forms a valuable corridor between the larger forest areas of Otari-Wiltons Bush and Khandallah Park.

Plants for edge and gap plantings: It would be most desirable to plant native species appropriate to the Kaiwharawhara catchment habitats on and close to bush edges, so as to maintain the ecological integrity of the forest. Native trees and shrubs on the bush edge and in gaps on the edge provide a buffer between the older forest area and the surrounding non-forest area, and reduce the “edge effect” of wind, frost, weeds, etc on the core bush area. This does not mean that only native species should be planted in residential gardens, but that garden species are not weedy, and that generally, species planted within the forest edge should be native. A list of “best bet” native species

suitable for the Kaiwharawhara catchment is given in Blaschke *et al.* 2004, and is also available from the Ngaio Resident's Association.

Pest and weed control: The most important contribution that private owners can make to the ecological health of the study area, is to avoid planting garden species that could become weeds in the forest, and if possible to control current weed species, such as wandering willie, barberry, old man's beard, and flowering cherry. Some cultivated New Zealand species not native to Wellington, such as *Pittosporum ralphii* and *Pseudopanax lessonii*, also come into the category of weed species. It is very important not to dispose of garden weeds within the bush area. Further information on weed species, weed control and appropriate non-weedy garden species is available from Greater Wellington Regional Council and the Department of Conservation. Greater Wellington RC and some private owners undertake possum control, and animal pests do not currently appear to be a major problem in the study area. However, possum control will need to be maintained, and if feasible, extended to control of mustelids (stoats, ferrets and weasels) if bird populations are to continue to grow.

Stream management: The streams are generally in good condition, are very well shaded and do not require much addition riparian planting. The main management consideration for private owners is to keep the upper ephemeral¹¹ gully heads free of weeds, rubbish, and obstructions. If native fish are present in Silverstream or its tributaries, councils could remove the barriers to fish passage to restore more habitat for fish. It is desirable to minimise hard (impervious) surfaces in landscaping and development of yards and garden areas around the houses. This reduces stormwater runoff into the streams.

Finally, it is important to note that all these management suggestions apply equally to the native areas of lesser significance (i.e. the younger mahoe and tree-fern dominated forest and scrub), as well as the older and more significant vegetation. Well-managed young native vegetation will grow and develop into the mature forest that has significant ecological value and that private owners, visitors and the wider public can all enjoy.

¹¹ **Ephemeral** means the water flows seasonally, not permanently

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Appendix 1: Vegetation species list

Paul Blaschke and Jonathan Anderson, September-October 2005.

Species	Present in Huntleigh Pk ¹²	Present in vegetation units sampled				
		1 FB	2 FBM	3 FP	4 FK	5 FF
Gymnosperms						
<i>Dacrycarpus dacridioides</i> (kahikatea)	+	+		++		+
<i>Dacrydium cupressinum</i> (rimu)	+					
<i>Podocarpus totara</i> (totara)	+			++		
<i>Prumnopitys taxifolia</i> (matai)	+			++		+
<i>Stachypitys ferruginea</i> (miro)	+			++		
Monocotyledonous trees						
<i>Cordyline australis</i> (cabbage tree)	+					
Dicotyledonous trees and shrubs						
<i>Alectryon excelsus</i> (titoki)	+	+		+	+	+
<i>Aristotelia serrata</i> (wineberry)	+	+	+	+		
<i>Beilschmiedia tawa</i> (tawa)	+	+		++	+	+
<i>Brachyglottis repanda</i> (rangiora)	+	++	+	+	+	+
<i>Carpodetus serratus</i> (putaputaweta)	+				+	
<i>Coprosma areolata</i>	+	+	+	+	+	+
<i>Coprosma grandifolia</i> (kanono)	+	+	+	+	+	++
<i>Coprosma lucida</i>	+			+		
<i>Corynocarpus laevigatus</i> (karakā)	+	+		+	++	
<i>Coprosma rhamnoides</i>	+					
<i>Coprosma robusta</i> (karamu)	+	+	+			
<i>Coprosma rotundifolia</i>	+					
<i>Dysoxylum spectabile</i> (kohekohe)	+	++	+	++	++	++
<i>Eleocarpus dentatus</i> (hinau)	+	++	++	++		++
<i>Fuchsia excorticata</i> (kotukutuku)	+		+			
<i>Geniostoma rupestre</i> (hangehange)	+	+	++	+	+	+
<i>Griselinia littoralis</i> (broadleaf)	+					
<i>Griselinia lucida</i> (puka)	+			++	+	+
<i>Hebe stricta</i> var <i>Atkinsonii</i> (koromiko)	+					
<i>Hedycarya arborea</i> (pigeonwood)	+	+	++	++	+	+
<i>Hoheria populnea</i> var <i>sexstylosa</i> (lacebark)	+	+	+	+		
<i>Knightea excelsa</i> (rewarewa)	+	+		++	++	++
<i>Kunzia ericoides</i> (kanuka)		+				
<i>Laurelia novae-zelandiae</i> (pukatea)	+	++		+		
<i>Leptospermum scoparium</i> (manuka)	+					
<i>Leucopogon fasciculatus</i> (mingimingi)						
<i>Lophomyrtus bullata</i> (ramarama)	+				+	
<i>Macropiper excelsum</i> (kawakawa)	+	+	+	+	+	
<i>Melicope simplex</i>	+			+		
<i>Melicope simplex</i> x <i>ternata</i>	+					
<i>Melicope ternata</i> (wharangi)	+			+		
<i>Melicytus ramiflorus</i> (mahoe)	+	++	++	++	+	+
<i>Myoporum laetum</i> (ngaio)	+					

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<i>Myrsine australis</i> (mapou)	+					
<i>Olearia rani</i> (heketara)	+	+				
<i>Pennantia corymbosa</i> (kaikomako)	+	+	+	+	+	+
<i>Pittosporum cornifolium</i> (perching pittosporum)	**					
<i>Pittosporum eugenoides</i> (lemonwood)	+					+
<i>Pittosporum tenuifolium</i> (kohuhu)	+	+	+	+	+	+
<i>Pseudopanax arboreus</i> (five-finger)	+	+	+	+		+
<i>Pseudopanax crassifolius</i> (lancewood)	+	+		+		+
<i>Pseudowintera axillaris</i> (horopito)	+					
<i>Raukaua anomalus</i> (whauwhaupaku)	+					
<i>Schefflera digitata</i> (pate)	+	+			+	
<i>Solanum laciniatum</i> (poroporo)	+					
<i>Sophora microphylla</i> (kowhai)	+					
<i>Streblus heterophyllus</i> (turepo, milk tree)	+				+	
<i>Streblus banksii x heterophyllus</i>	**	+				
<i>Urtica ferox</i> (ongaonga)	+			+		
<i>Weinmannia racemosa</i> (kamahi)	+					
Monocot climbers						
<i>Ripogonum scandens</i> (supplejack)	+	+		+	+	++
Dicot climbers						
<i>Clematis forsteri</i>	+					
<i>Clematis paniculata</i> (puawananga)	+	+		+		+
<i>Metrosideros diffusa</i> (white climbing rata)	+	+		+	+	+
<i>Metrosideros fulgens</i> (rata vine)	+			+	+	
<i>Metrosideros perforata</i> (small white rata)	+			+		+
<i>Muehlenbeckia australis</i> (poheuheu)	+					+
<i>Parsonsia heterophylla</i> (akakiore)	+	+	+	+	+	+
<i>Rubus cissoides</i> (bush lawyer)	+	+	++	+		+
<i>Tetrapathea tetrandra</i> (kohia)	+	+	++	+		+
Monocot herbs and grasses						
<i>Microlaena avenacea</i> (bush rice grass)	+					
<i>Pterostylis banksii</i> (tutukiwi)	+			+		+
Lycopods						
<i>Lycopodium volubile</i> (wae wae koukou)	+					
Sedges						
<i>Uncinia banksii</i> (hook grass)	+					
<i>Uncinia uncinata</i> (hook grass)	+	+		+		+
Rushes						
<i>Juncus planifolius</i>	+					
<i>Juncus sarophorus</i>	+					
Monocot herbs						
<i>Astelia solandri</i> (kowharawhara)	+					
<i>Collospermum hastatum</i>	+					
<i>Phormium cookianum</i> (mountain flax)	+					
<i>Phormium tenax</i> (harakeke, swamp flax)	+					

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Dicot herbs						
<i>Acaena anserinifolia</i> (bidibidi)	+					
<i>Hydrocotyle moschata</i>	+					
<i>Plantago raoulii</i>	+					
<i>Ranunculus reflexus</i>	+					
<i>Urtica incisa</i>	+					
Ferns						
<i>Adiantum cunninghamii</i>	+					
<i>Anarthropteris lanceolata</i>	+					
<i>Asplenium bulbiferum</i>	+	+	+	+	+	+
<i>Asplenium flaccidum</i>	+		+	+	+	+
<i>Asplenium gracillimum</i>	+					
<i>Asplenium hookerianum</i>	**	+				
<i>Asplenium oblongifolium</i>	+	+	+	+	+	+
<i>Asplenium polyodon</i>	+			+	+	
<i>Blechnum "blackspot"</i>	+					
<i>Blechnum chambersii</i>	+	+		+	+	
<i>Blechnum discolor</i>	+					
<i>Blechnum filifolium</i>	+	+	+	+	+	+
<i>Blechnum fluviatile</i>	+					
<i>Blechnum membranaceum</i>	+					
<i>Blechnum minus</i>	+					
<i>Cyathea dealbata</i>	+	++	+	+	+	+
<i>Cyathea medullaris</i> mamaku	+	++	++	+		++
<i>Grammitis ciliata</i>	+					
<i>Histiopteris incisa</i>	+					
<i>Hymenophyllum demissum</i>	+				+	
<i>Hymenophyllum flexuosum</i>	+					
<i>Hypolepis ambigua</i>	**		+			
<i>Hypolepis lactea</i>	+					
<i>Lastreopsis glabella</i>	+	+		+	+	
<i>Lastreopsis hispida</i>	+	+	+	+	+	
<i>Leptopteris hymenopylloides</i>	+	+				
<i>Pellaea rotundifolia</i>	+				+	
<i>Phymatosorus pustulatus</i>	+	+	+	+	+	
<i>Phymatosorus scandens</i>	+		+	+		
<i>Polystichum richardii</i>	+	+		+		
<i>Pneumatopteris pennigera</i>	+					
<i>Pteridium esculentum</i>	+	+				
<i>Pteris macilenta</i>	+				+	
<i>Pyrrosia eleagnifolia</i>	+			+	+	+
<i>Rumohra adiatiformis</i>	+					
Exotic species						
<i>Acer pseudoplatanus</i> (sycamore)		+				
<i>Allium triquetrum</i> (onion weed)			+			
<i>Berberis darwinii</i> (Darwins barberry)		+				+
<i>Chlorophytum comosum</i> (spider plant)				+		
<i>Clematis vitalba</i> (old man's beard)			+	+		
<i>Crocsmia x crocosmiiflora</i> (montbrecia)			+			
<i>Cytisus scoparius</i> (broom)		+				

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<i>Hedera canariensis</i> (ivy)			+			
<i>Hedera helix</i> (ivy)			+			
<i>Lamium purpureum</i> (red dead nettle)			+			
<i>Oxalis</i> sp (oxalis)			+			
<i>Pittosporum crassifolium</i> (karo)				+		
<i>Pittosporum ralphii</i>			+	+	+	
<i>Prunus saviium</i> (flowering cherry)		+	+	+	+	
<i>Pseudopanax lessonii</i>				+		
<i>Solanum tuberosum</i> (potato)				+		
<i>Tradescantia fluminensis</i> (wandering willie)			+	+	+	
<i>Ulex europaeus</i> (gorse)		+	+	+		

Note: Presence in Huntleigh Park (Column 1) determined from species list compiled by Wellington Botanical Society over the years 1994 – 1998 (for indigenous plants) (Enright and John 1999). ** denotes species later observed by J Anderson, Wellington City Council (personal communication.)

Appendix 2: Ages of hinau and podocarp trees in the vicinity of Huntleigh Park

The older hinaus in Huntleigh Park are more common and possibly larger than those in Otari-Wiltons Bush, while a very large and clearly old pukatea, 130cm in diameter, grows in the Orleans-Makererua reserve. There are at least 20 hinau trees in the Huntleigh Park forest which are more than 50cm in diameter, with the largest known at 129 cm diameter. There are several comparably sized hinau trees at Otari-Wiltons Bush, at Trellissick Park, in the Botanical Gardens in Kelburn (Rewi Elliott, Otari-Wilton Bush, personal communication).

Published information on hinau growth rates is scanty but a likely range is 1.25 – 3mm per year over the life of an old tree. Even at a rate of 3mm per year, the largest trees in Huntleigh Park are more than 200 years old, while at a more likely range of 1.5 - 2 mm per year, this tree would be more than 300 years old. The several trees of about 70cm in diameter are likely to be well over 100 years and possibly up to 250 years old. The largest known individual podocarp trees in the forest are a miro at 51 cm diameter and a kahikatea at 81 cm diameter. At likely growth rates for podocarps in Wellington these two trees are likely to be 80 – 130 years old. Miro elsewhere in the Wellington region, e.g. at a slightly higher elevation on the Akatarawa Hill Road, have measured growth rates of well under 1mm per year. At a growth rate of 1mm per year, the largest measured miro at Huntleigh Park would be more than 250 years old.

Sources of information for Appendix 2: Blaschke 1988, Hyland 1987, Kell 1991, Lusk and Ogden (1992)