

Appendix 1

CHECKLIST OF ECOLOGICAL UNITS IN OTANEWAINUKU ECOLOGICAL DISTRICT

Key

Extent

* absent or present due to natural disturbance

H present due to human intervention

P Present

Mn Minor

C Common

Mj Major

Change

- decrease

0 no change

+ increase

Protection status

1. Represented in the reserve system.
2. Under-represented in the reserve system.
3. Under-represented in the reserve system and a major part of original landscape, but not greatly reduced in extent.
4. Under-represented in the reserve system, major part of original landscape now greatly reduced in extent.

Land systems

1. Whakamarama Plateau
2. Northern Mamaku Plateau
3. Papamoia Hills
4. Rotoiti Breccia Ignimbrite Fan
5. Otamarakau Hills
6. Sand Dunes
7. Matata Hills
8. Otuhepo Hills

BIOCLIMATIC ZONE	HYDROLOGICAL ELEMENT	LAND SYSTEM (PRESENT EXTENT)	VEGETATION TYPE	LANDFORM	FORMER EXTENT ¹	PRESENT EXTENT	CHANGE	PROTECTION STATUS
Dune habitats								
Coastal	palustrine, estuarine	6	Dune hollow wetlands	dune hollow	C	C	0	1
Coastal	terrestrial	6	<i>Ficinia nodosa</i> / <i>Muehlenbeckia complexa</i> vineyard and sedgeland	rear dune	C	C	+	1
Coastal	terrestrial	6	Spinifex sandfield and grassland	fore dune	C	C	-	1
Freshwater wetlands								
Lowland	palustrine	2	<i>Baumea teretifolia</i> sedgeland	lagoon margin	+	P	0	1
Lowland	palustrine	2	Lake	lake	Mn	P,H		
Lowland	palustrine	2	<i>Manuka/Baumea rubiginosa-Gabnia xanthocarpa</i> -toetoe/ <i>Sphagnum</i> shrubland	wetland	Mn	P	0	2
Semi-coastal	palustrine	4	(<i>Manuka</i>)-(grey willow)-(swamp coprosma)/raupo- <i>Gleichenia microphylla</i> - <i>Baumea</i> sp. (<i>B. teretifolia</i> ?)/ <i>Sphagnum</i> shrub-sedge-fern-reedland	alluvial flat	Mn	P	-	2
Lowland	palustrine	2	<i>Manuka</i> -harakeke-toetoe-raupo/ <i>Baumea tenax</i> - <i>B. teretifolia</i> - <i>B. arthropophylla</i> -swamp kiokio sedge-shrubland	alluvial flat	Mn	P	-	2
Lowland	palustrine	2	<i>Manuka</i> -monoao/ <i>Baumea teretifolia-Gleichenia dicarpa-Sphagnum</i> sedge-shrubland	wetland	Mn	P	0	2
Lowland	palustrine	2	<i>Manuka</i> -monoao/ <i>Gabnia-Astelia grandis-Gleichenia dicarpa/Sphagnum</i> shrubland and scrub	mire	Mn	Mn	+	2
Lowland	palustrine	2	<i>Manuka</i> -swamp coprosma scrub and shrubland	lagoon margin mire	*	P	0	2

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BIOCLIMATIC ZONE	HYDROLOGICAL ELEMENT	LAND SYSTEM (PRESENT EXTENT)	VEGETATION TYPE	LANDFORM	FORMER EXTENT ¹	PRESENT EXTENT	CHANGE	PROTECTION STATUS
Coastal	palustrine	7	Manuka scrub and shrubland	swamp	C	+	-	4
Semi-coastal	palustrine	4,2		swamp	Mn	P	-	2
Lowland	palustrine	2,1		lagoon margin	Mn	P	-	2
Lowland	palustrine	2	<i>Myriophyllum pedunculatum</i> herbfield	lagoon margin	+	P	0	1
Coastal	palustrine	4,5,6,7	Raupo reedland	swamp	Mn	P	-	2
Semi-coastal	palustrine	2,3,4,7			Mn	P	-	2
Lowland	palustrine	2			Mn	P	-	2
Coastal	palustrine	4,5,7	Sedge-grass-reed wetland associations	swamp	C	Mn	-	4
Semi-coastal	palustrine	2,3,4,5,7		swamp	Mn	Mn	-	2
Lowland	palustrine	2		swamp	Mn	Mn	-	2
Scrub and shrubland								
Lowland	terrestrial	2	Kamaha-toetoe-kanono-mahoe-wao scrub and shrubland	gully	*	P	+	1
Lowland	terrestrial	2	Manuka-toetoe shrubland (other broad-leaved species locally dominant).	flat	*	P	0	2
Lowland	terrestrial	2	Mahoe-mahoe-wao-kohuhu-toetoe-bracken-wheki-pate scrub and shrubland	bluffs	*	P	+	1
Lowland	terrestrial	2	Manuka-bracken-kiokio fernland	gorge, hillslope	*	P	+	1
Lowland	terrestrial	2	Mingimingi-kiokio-kamaha scrub and shrubland	steep face	*	P	+	1
Lowland	palustrine	2	<i>Myriophyllum pedunculatum</i> subsp. <i>novae-zelandiae</i> herbfield	wetland	P	P	0	2
Semi-coastal	terrestrial	2	Rewarewa-kanuka-kamaha-kiokio-mamaku shrubland	steep hillslope and gorge face, ridge	*	P	+	1

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BIOCLIMATIC ZONE	HYDROLOGICAL ELEMENT	LAND SYSTEM (PRESENT EXTENT)	VEGETATION TYPE	LANDFORM	FORMER EXTENT ¹	PRESENT EXTENT	CHANGE	PROTECTION STATUS
Coastal	terrestrial	7	Secondary scrub, shrubland and fernland	hillslope	*	Mn	+	2
Semi-coastal	terrestrial	2,3,4,5,7		hillslope	*	Mn	+	2
Lowland	terrestrial	1,2		hillslope	*	Mn	+	2
Montane	terrestrial	1		hillslope	*	Mj	+	2
Lowland	palustrine	2	Tanekaha/manuka scrub and shrubland	alluvial terrace	-	P	-	2
Lowland	terrestrial	2	Tanekaha-rewarewa/manuka scrub	gorge, hillslope	*	P	+	2
Lowland	terrestrial	2	Tawa-hinau/kamahi-toetoe-kanono-mahoe-wao treeland	gully	*	P	+	2
Treefernland								
Coastal	terrestrial	4,7	Mamaku treefernland	gully, hillslope	*	Mn	+	1
Semi-coastal	terrestrial	1,2,3,4,5,7,8		gully, hillslope	*	Mn	+	1
Lowland	terrestrial	1,2		gully, hillslope	*	Mn	+	1
Forest								
Semi-coastal	terrestrial	7	Hard beech forest	hillslope, gorge	Mn	C	Mn	4
Lowland	terrestrial	2		hillslope, gorge	C	C	Mn	4
Coastal	terrestrial	7	Hard beech-pohutukawa forest	hillslope	C	C	-	1
Lowland	terrestrial	2	Hard beech-silver beech forest	flat and gentle hillslopes	Mn	Mn	-	2
Lowland	terrestrial	2	Hard beech-tanekaha-tawa forest	hillslope	C	Mn	-	4
Lowland	terrestrial	2	Kahikatea-maire tawake forest	plateau, alluvial terrace	C	+	-	4
Semi-coastal	terrestrial	1,2,4	Kamahi forest	hillslope	*	Mn	+	2
Lowland	terrestrial	1,2		hillslope	*	Mn	+	2
Lowland	terrestrial	2	Kamahi-rewarewa/tawheowheo forest	hillslope	*	P	+	2
Coastal	terrestrial	7	Kanuka forest	hillslope	*	Mn	+	1
Semi-coastal	terrestrial	1,2,4,5,7		hillslope	*	Mn	+	2
Lowland	terrestrial	2		hillslope	*	Mn	+	2
Semi-coastal	terrestrial	2	(Kauri)/podocarps-broadleaved	hillslope	P	P	-	1
Lowland	terrestrial	2	species forest	hillslope	P	P	-	1

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BIOCLIMATIC ZONE	HYDROLOGICAL ELEMENT	LAND SYSTEM (PRESENT EXTENT)	VEGETATION TYPE	LANDFORM	FORMER EXTENT ¹	PRESENT EXTENT	CHANGE	PROTECTION STATUS
Lowland	terrestrial	2	Kauri/tanekaha-tawari	hillslope	*	P	-	1
Semi-coastal	terrestrial	3	Kauri rickers/tawari forest	hillslope	*	P	-	2
Semi-coastal	terrestrial	3,4	Mangeao forest	hillslope	*	Mn	+	2
Lowland	terrestrial	1,2	(Miro)/tawa-kamahia-tawari forest	exposed ridge	C	C	-	1
Coastal	terrestrial	7	(Northern rata)-(rimu)/tawa-	hillslope	C		-	4
Semi-coastal	terrestrial	1,2,3	kohekohe forest	hillslope	Mj	P	-	4
Lowland		2	(Northern rata)-(rimu)-(miro)/tawa-hinau-kamahia forest	gully, gorges	*	C	+	1
Semi-coastal	terrestrial	2,4	Pole podocarp forest	alluvial terrace	*	P	-	2
Lowland	terrestrial	2		hillslope	*	P	-	2
Coastal	terrestrial	4,6,7	Pohutukawa forest and treecland	hillslope		Mj	Mn	4
Coastal	terrestrial	7	(Northern rata)/tawa-kohekohe forest	hillslope	*	P	0	2
Semi-coastal	terrestrial	1,2,3,4,7		hillslope	*	C	+	2
Coastal	terrestrial	7	Pohutukawa-kanuka forest	hillslope	*	Mn	0	1
Lowland	geothermal	2	Pohutukawa x northern rata-kamahia forest	hillslope, stream gully, terrestrial	P	P	-	2
Lowland	geothermal	2	Pohutukawa x northern rata/ mingimingi-prostrate kanuka forest	hillslope, terrestrial	P	P	-	2
Lowland	terrestrial	2	Porokaiwhiri-mahoe-mamaku-wheki kamahi-tawari-(miro) forest	steep face	*	P	+	2
Lowland	terrestrial	2	(Pukatea)-(rimu)/tawa-mamaku-rewarewa forest	plateau	*	C	+	2
Lowland	terrestrial	2	Pukatea-(rimu)/tawa-pukatea-(hinau) forest	plateau	*	C	+	2
Coastal	terrestrial	7	Rewarewa/broadleaved species-	hillslope	*	Mn	+	2
Semi-coastal	terrestrial	1,2,4,7	treefern forest	hillslope	*	Mn	+	2
Lowland	terrestrial	1,2		hillslope	*	Mn	+	2
Coastal	terrestrial	7	Rewarewa/kamahia forest	hillslope	*	P	0	2
Semi-coastal	terrestrial	1,2,3,4		hillslope	*	Mn	+	2
Lowland	terrestrial	1,2		hillslope	*	Mn	+	2

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BIOCLIMATIC ZONE	HYDROLOGICAL ELEMENT	LAND SYSTEM (PRESENT EXTENT)	VEGETATION TYPE	LANDFORM	FORMER EXTENT ¹	PRESENT EXTENT	CHANGE	PROTECTION STATUS
Semi-coastal	terrestrial	3	Rewarewa/kamahi-kohekohe-mangao forest	hillslope	*	P	+	1
Coastal	terrestrial	7	Rewarewa/kanuka forest	hillslope	*	P	+	2
Semi-coastal	terrestrial	2,4,7		hillslope	*	P	Mn	2
Lowland	terrestrial	2		hillslope	*	P	+	2
Semi-coastal	terrestrial	2	Rewarewa/kanuka-kamahi-(mangao)-(titoki) forest	steep hillslope, gorge face, ridge	*	Mn	+	2
Semi-coastal	terrestrial	2	Rewarewa-(rimu)/tawa-kamahi forest	ridges, hillslope	*	C	+	2
Lowland	terrestrial	2	Rewarewa/tawa forest	hillslope	*	C	+	2
Lowland	terrestrial	2	(Rimu)/tawa-rewarewa-hinau forest	hillslope	*	C	+	2
Lowland	terrestrial	2	(Rimu)/tawa-rewarewa-hinau-kamahi forest	hillslope	*	C	+	2
Lowland	terrestrial	2	(Rimu)-(miro)/tawa-rewarewa forest (with local hard beech)	gorges	*	C	+	2
Lowland	terrestrial	1,2	Rimu/tawa-kamahi-tawari-forest	hillslope	Mn	Mn	-	1
Semi-coastal	terrestrial	1,2,3	(Rimu)-(miro)-(totara-kotukutuku)-(tanekaha)/tawa-hinau-rewarewa-kamahi-tawari-tawheowheo forest	hillslope	Mn	Mn	-	1
Lowland	terrestrial	1,2		hillslope	Mn	Mn	-	1
Lowland	terrestrial	1,2,3	(Rimu)-(northern rata)/tawa-kamahi-rewarewa-mangao forest	hillslopes, plateau	Mj	Mn	-	4
Lowland	terrestrial	2	Rimu-northern rata/tawa-kamahi-tawari forest	hillslope	*	C	+	2
Lowland	terrestrial	2	Rimu-red beech/tawa-kamahi-tawari-hard beech-silver beech forest	hillslopes, plateau	C	Mn	-	1
Lowland	terrestrial	2	(Rimu)-(tanekaha)/tawa-kamahi-tawari forest	hillslope	*	Mn	+	2
Lowland	terrestrial	2	Rimu/tawa-rewarewa-kamahi forest	hillslope	*	Mn	+	2
Lowland	terrestrial	2	Rimu/tawa-kamahi-hard beech forest	hillslope	Mn	Mn	-	2

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BIOCLIMATIC ZONE	HYDROLOGICAL ELEMENT	LAND SYSTEM (PRESENT EXTENT)	VEGETATION TYPE	LANDFORM	FORMER EXTENT ¹	PRESENT EXTENT	CHANGE	PROTECTION STATUS
Lowland	palustrine terrestrial	1	Rimu/tawari-kamahi/ <i>Gabnia xanthocarpa</i> forest	plateau	*	*	-	2
Lowland	terrestrial palustrine	1	(Rimu)/tawari-whēki-maire tawake forest	plateau	*	*	0	1
Lowland	terrestrial	2	Silver beech-hard beech-(tawari)-(kamahi) forest	flat	*	C	-	4
Semi-coastal Lowland	terrestrial	1,2	Tanekaha forest	hillslope	Mn	Mn	-	2
Lowland	terrestrial	1,2		hillslope	Mn	Mn	-	2
Semi-coastal	terrestrial	2	Tanekaha-rewarewa/kamahi forest	hillslope	*	Mn	-	2
Lowland	terrestrial	2	(Tanekaha)-(rimu)/tawari-kamahi-tawari-hard beech forest	hillslope	*	Mn	-	2
Lowland	terrestrial	2	Tawari-hard beech forest	steep face	1	Mn	-	2
Lowland	terrestrial	2	Tawari-kamahi-tawari-hard beech-silver beech forest	plateau, hillslope	*	Mn	+	1
Lowland	terrestrial	2	Tawari-kamahi-hard beech-tawari-hinau forest	hillslope, plateau	*	Mn	+	2
Lowland	terrestrial	2	Tawari-kamahi-red beech-hard beech/whēki-whēki ponga-makomako-manuka-mahoe forest and scrub	flat and gentle hillslopes	*	Mn	+	2
Lowland	terrestrial	1,2	Tawari-rewarewa forest	hillslope	*	C	+	1
Lowland	terrestrial	2	Tawari-rewarewa/mahoe-porokaiwhiri-pate-makomako-mamaku forest and shrubland	hillslope	*	Mn	+	2
Semi-coastal	terrestrial	1,2,3,4,7	Tawari-rewarewa-pukatea-kohekohe forest	hillslope, plateau	*	C	+	2
Lowland	terrestrial	1,2,3	Tawari forest	hillslope, plateau	*	C	+	1
Semi-coastal Lowland	terrestrial	3	Tawari forest	exposed ridges	*	Mn	+	2
Lowland	terrestrial	1,2			*	Mn	+	1
Montane	terrestrial	1	Tawari-tawhewheo forest	hillslope	P	P	-	2

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BIOCLIMATIC ZONE	HYDROLOGICAL ELEMENT	LAND SYSTEM (PRESENT EXTENT)	VEGETATION TYPE	LANDFORM	FORMER EXTENT ¹	PRESENT EXTENT	CHANGE	PROTECTION STATUS
Montane	terrestrial	1	Tawari-tawheowheo-orihou- <i>Dracophyllum traversii</i> forest	hillslope	P	P	-	2
Geothermal								
Lowland	geothermal	2	<i>Lycopodiella cernua</i> fernland	hillslope, terrestrial	Mn	P	0	2
Lowland	geothermal	2	(Dead pohutukawa ⇔ northern rata)/ prostrate kanuka-mingimingi scrub	hillslope, terrestrial	*	*	+	2
Lowland	geothermal	2	(Dead pohutukawa ⇔ northern rata)/ prostrate kanuka-mingimingi scrub	hillslope, terrestrial	*	*	+	2
Lowland	geothermal	2	Mingimingi-prostrate kanuka-manuka scrub ⇔ <i>Histiopteris tincta</i> fernland ⇔ <i>Hypolepis distans</i> fernland ⇔ gorse scrub	hillslope, gully, terrestrial	P	P	-	2
Lowland	geothermal	2	Prostrate kanuka-manuka-mingimingi scrub	hillslope, terrestrial	P	P	-	2
Lowland	geothermal	2	(Dead pohutukawa x northern rata)/ wheki- <i>Gabnia setifolia</i> treefernland	hillslope, terrestrial	*	*	+	2
Lowland	geothermal	2	(Dead pohutukawa x northern rata)/ wheki-kamahi treefernland	hillslope, terrestrial	*	*	+	2
Lowland	geothermal	2	Nonvegetated raw-soilfield	Flat, hillslope, cliff, stream margins, terrestrial	P	P	0	2
Bluffs and landslide scars								
Coastal	terrestrial	7	Bluffs	rock face	P	P	0	1
Semi-coastal	terrestrial	1,2,3,4,7		rock face	P	P	0	2
Lowland	terrestrial	1,2,3		rock face	P	P	0	2
Montane	terrestrial	1		rock face	P	P	0	2
Coastal	terrestrial	7	Landslide scars	hillslope	*	P	0	1
Semi-coastal	terrestrial	3,7		hillslope	*	P	0	1
Lowland	terrestrial	1,3		hillslope	*	P	0	1
Montane	terrestrial	1		hillslope	*	P	0	2

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Appendix 2

VEGETATION TYPE DESCRIPTIONS

These descriptions were compiled from information collected during the current survey and earlier surveys (Beadel 1985a&b, 1987, 1994a, In prep; Nicholls 1964, 1965a-f, 1985a; King 1984a; Clarkson 1981a, 1982, 1983a&b; Wallace 1994; Shaw 1991).

The RAPs which contain each general vegetation type are listed next to the type name.

Sand dune vegetation

Dune hollow wetlands

A series of dune hollow wetlands occur along the coast behind the foredune. Other species forming reedlands and sedgelands include harakeke, *Baumea articulata*, pampas, *Schoenoplectus tabernaemontani*, ririwaka (*Bolboschoenus fluviatilis* and *B. medianus*), *Carex virgata* and *Pericaria decipiens*. A common association is raupo reedland (see description below). These wetlands are often associated with small streams.

Searush, *Baumea juncea*, marsh ribbonwood, *Cyperus ustulatus*, oioi, *Schoenoplectus pungens* and spike sedge occur locally. Bachelor's button or arrow grass locally form a low herbfield.

Spinifex sandfield and grassland **(RAP 22)**

Unmodified foredunes support spinifex sandfield and grassland. Scattered associates include panahi (*Calystegia soldanella*), perehia (*Deyeuxia billardierei*) and pingao. Near Otamarakau was a small colony of hinarepe (sand tussock, *Austrofestuca littoralis*). Modified dunes support marram tussockland.

Ficinia nodosa / Muehlenbeckia complexa vineland and sedgeland **(RAP 22)**

On the rear dunes *Ficinia nodosa* and pohuehue (*Muehlenbeckia complexa*) are common and marram occurs locally. Occasional associates include *Calystegia soldanella*, perehia, *Oxalis rubens*, catsear, pampas, *Zoysia pauciflora*, *Carex pumila*, bracken, lupin and harestalk. West of Hauone, scattered emergent shrubs occur, including pohutukawa, taupata, akeake, houpara, *Eucalyptus botryoides* and kawakawa. East of Hauone towards Ohinekoao Stream these species become larger and more common. Near Matata are scattered small kanuka saplings (from Beadel unpublished data).

Wetland vegetation

Wetland vegetation comprises only a small proportion of the vegetation of the district. Nevertheless, it is diverse, almost every wetland being

different. This reflects water table fluctuations and levels, fertility and the origin of the wetland (man-made or natural). However only broad descriptions have been made.

Myriophyllum pedunculatum (RAP 54, 62)
subsp. novae-zelandiae herbfield

Myriophyllum pedunculatum subsp. *novae-zelandiae* is the predominant species and forms a low herbfield. There is scattered *Lachnagrostis lyalli* with local *Eleocharis gracilis* and manuka seedlings. *Lilaeopsis novae-zelandiae* occurs locally in small hollows.

This type occurs in the lowland zone.

Raupo reedland (RAP 27, 29, 46, 47, 48)

Raupo often forms a dense sward with swamp millet locally common. Other associates include *Schoenoplectus tabernaemontani*, *Baumea rubiginosa*, *B. tenax*, *Eleocharis acuta*, *E. gracilis*, *Juncus edgariae*, *J. pallidus* and *J. prismatocarpus*. Emergent grey willow occurs locally.

Baumea teretifolia sedgeland (RAP 62)

This type occurs at the Big Lake (lowland zone) and comprises a dense sward of *Baumea teretifolia*.

Sedge-grass-reed wetland associations (RAP 7, 29, 48)
(Semi-coastal)

Small wetlands in damp gullies in pasture or secondary scrub occur throughout. These have been induced by clearing, burning and logging and continue to be modified by grazing of domestic stock or feral animals. Composition is variable. In the semi-coastal and coastal zones, common associates include raupo, swamp millet, purei (*Carex virgata* and *C. secta*), spike sedge, lotus, water purslane, Yorkshire fog, grey willow, *Cyperus ustulatus*, harakeke, manuka, *Baumea rubiginosa*, *Carex maorica* with local maru (burr reed; *Sparganium subglobosum*).

On the Whakamarama Plateau, lowland zone common associates include toetoe, *Juncus effusus*, *Juncus edgariae*, *Sphagnum*, Yorkshire fog, lotus, browntop, *Carex dipsacea*, spike sedge, *Juncus acuminatus* and *Juncus microcephalus*, with infrequent *Astelia grandis*.

There are often emergent shrubs, including wheki, tawari and kapuka.

(Manuka)-(grey willow)-(Coprosma tenuicaulis)/raupo-Gleichenia microphylla-Baumea teretifolia/Sphagnum shrub-sedge-fern-reedland (RAP 26, 29)

Scattered manuka, grey willow and hukihuki (*Coprosma tenuicaulis*) are emergent over varying amounts of raupo, waewae kaka (*Gleichenia microphylla*) and *Baumea teretifolia*. Occasional associates include purei (*Carex secta* and *C. virgata*), harakeke, *Sphagnum*, swamp millet, karetu (*Hierochloa redolens*) and *Coprosma propinqua* subsp. *propinqua* × *C. robusta*.

***Manuka-harakeke-toetoe-raupo/Baumea tenax-
B. teretifolia-B. arthrophylla-swamp kiokio
sedge-sbrubland*** (RAP 7)

Manuka, harakeke, toetoe and raupo are scattered over a dense cover of *B. tenax*, *B. teretifolia*, *B. arthrophylla*, and swamp kiokio. Other species present include *Hebe corriganii*, *Carex secta*, grey willow, wheki, *Sphagnum* and waewae kaka.

This type occurs in RAP 7. A few examples of maire tawake occurs in logged tawa forest along the western margin of the wetland.

***Manuka-monoao/Gahnia-Astelia grandis-
Gleichenia dicarpa/Sphagnum sbrubland
and scrub*** (RAP 26, 62)

Manuka and monoao are scattered or sometimes form an open canopy over varying amounts of *Gabnia* (*G. xanthocarpa* and locally *G. rigida*), *Astelia grandis*, *Gleichenia dicarpa* and waewae kaka. *Baumea rubiginosa* is locally common. *Sphagnum* generally forms a dense ground cover.

Type occurs in the lowland zone.

***Manuka-Coprosma tenuicaulis
scrub and sbrubland*** (RAP 26, 54, 62)

Manuka and hukihuki (*Coprosma tenuicaulis*) are dominant. Associates present at some sites include pole kahikatea and grey willow. The understorey includes *Baumea tenax*, *Baumea rubiginosa* and local tupari maunga (*Gabnia xanthocarpa*), *Astelia grandis*, *Carex virgata* and *Hydrocotyle novae-zeelandiae*.

Type occurs in the lowland zone.

Tanekaha/manuka scrub and sbrubland (RAP 7)

Type occurs along stream margins in RAP 7. Scattered tanekaha is emergent over manuka. Occasional associates include harakeke, toetoe and horoeka.

Understorey components include waewae kaka, *Baumea rubiginosa*, *B. tenax*, swamp kiokio and koromiko.

Grey willow forest (RAP 46, 47, 48)

Type occurs in wetlands in the coastal, semi-coastal and lowland zones.

Grey willow forms the canopy with local scattered manuka. Maire tawake was recorded from one site in McLaren Falls Park. The understorey is often dominated by indigenous species, including swamp kiokio, kiokio, *Baumea tenax*, and purei (*Carex secta* and *C. virgata*).

Manuka scrub and sbrubland (RAP 7, 10, 27, 43, 62)

Manuka forms the canopy. Associates present at a few sites include hukihuki (*Coprosma tenuicaulis*), emergent pole kahikatea and grey willow. Local gorse and Spanish heath occur on drier sites.

The understory is variable and includes waewae kaka, *Baumea tenax*, hukihuki (*Coprosma tenuicaulis*), *Sphagnum cristatum*, *Nertera scapanioides*, swamp kiokio, swamp millet, Yorkshire fog, lotus and spike sedge, *Ranunculus amphitrichus*, and *Pratia angulata* with local waewae kaka, *Coprosma tayloriae*.

Type occurs in the coastal, semi-coastal and lowland zones.

Secondary scrub, shrubland and fernland

Secondary scrub, shrubland and fernland (RAP 3, 4, 6, 7, 8, 10, 12, 13, 14, 17, 19, 21, 25, 27, 28, 29, 30, 31, 32, 33, 39, 40, 42, 44, 48, 50, 51, 52, 55, 56, 57, 58, 60, 61, 62)

Secondary scrub, shrubland and fernland occur on regenerating cleared or burnt sites. Manuka or bracken are often common. Common associates which are sometimes dominant include whauwhaupaku, kanuka, karamu (*Coprosma robusta* and *C. lucida*), mapou, hangehange, tutu, koromiko, toetoe, tawiniwini (*Gaultberia antipoda*), kohuhu, kiokio, gorse, kamahi, makomako, mamaku, wheki and horoeka. Emergent rewarewa, pines and kanuka occur locally. In the coastal zone mingimingi, taumingi (*Leptecophylla juniperina*), akepiro, wharariki and pohutukawa are often common in association with manuka and bracken.

Common ground cover species include *Morelotia affinis*, bracken, *Coprosma rhamnoides*, wahu (*Drosera auriculata*), patiti (*Microlaena stipoides*), turutu, kiokio, ground orchids, lichens (*Cladia retipora*, *Cladina leptoclada*, *Cladonia capitellata*) and mosses (*Hypnum cupressiforme*), puakarimu (*Lycopodium deuterodensum*) and seedlings of the above canopy species. There are local Spanish heath, pampas, willow-leaved hakea and prickly hakea. Exotic grasses and herbs are common where domestic stock are grazed and occur on regenerating cleared or burnt sites in the coastal, semi-coastal and lowland zones.

On Te Weraiti in the sub-montane and upper lowland zones, predominant species are *Raukaua anomalus*, mingimingi, kiokio, tawari and tawheowheo, with scattered emergent rewarewa. Frequent associates include toetoe, kapuka, wheki, kaikawaka, tataramoa (*Rubus cissoides*), wharariki, orihou (*Pseudopanax colensoi*), hupiro (*Coprosma foetidissima*), kanono, *Gabnia* and *Dracophyllum traversii*.

Alongside the Pongakawa Stream in the semi-coastal zone, putaputaweta, kanuka, wheki and kohuhu are emergent over kiokio, ringfern and bracken with local pole rimu and kamahi, mingimingi and rewarewa. Emergent kauri rickers occur at one site in the Rapurapu Ecological Area and on steep scrub faces above a middle reach of the Mangapapa Stream.

Mamaku treefernland (RAP 4, 8, 16, 17, 21, 27, 40, 42)

Mamaku is dominant in canopy with occasional kamahi, whauwhaupaku, karamu and emergent rewarewa.

Middle tier is often sparse and includes hangehange and kanono.

Ground tier includes pakau (*Pneumatopteris pennigera*), kiokio, seedlings of mahoe, kanono, rewarewa, porokaiwhiri, pate and leaf litter.

Forest

Hard beech forest

(RAP 7, 12, 14, 25)

Hard beech dominant in the canopy with local tawa, kamahi, tawari, tanekaha and emergent rewarewa, infrequent emergent rimu and in the semi-coastal zone mamaku, pukatea and nikau.

Middle tier components include kamahi, tawari, tanekaha, maire taiki (*Mida salicifolia*), toru, neinei, ponga, toropapa, mingimingi, piupiu, *Coprosma spatulata* subsp. *spatulata* and *C. lucida* with local pole rimu and miro.

Ground cover includes leaf litter, *Gabnia pauciflora*, puakarimu, seedlings of above, miro, toropapa, *Coprosma lucida*, kiekie, turutu and kiokio.

This type occurs in the lowland and semi-coastal zones.

Hard beech-pohutukawa forest

Hard beech is dominant with occasional pohutukawa. Pohutukawa becomes increasingly less common further inland. Local associates include kanuka, tawa, rewarewa and mangeao. Kamahi, mida (*Mida salicifolia*), mapou, heketara and pole hard beech often form a subcanopy.

Common middle tier species include hangehange, *Coprosma lucida*, mingimingi, toropapa, taumingi, ti ngahere, bracken, niniao (*Helichrysum lanceolatum*) and ponga.

Leaf litter dominates the ground cover with scattered turutu, kowaowao, *Acianthus sinclairii*, kakaha (*Astelia fragrans*), matau, *Schoenus tendo* and *Gabnia pauciflora*.

This type occurs only in the coastal and semi-coastal zones on the eastern side of the district.

Hard beech-tanekaha-tawa forest

(RAP 7, 28)

Hard beech is common and forms a discontinuous canopy with varying amounts of tanekaha and in gullies tawa. Local emergent rimu. Occasional associates include rewarewa, tawari, kamahi, kanuka, mihimihi and emergent rimu. Tawa associates include rewarewa, pukatea, mahoe and mangeao.

Middle tier components include tawari, rewarewa, mamaku, miro, pole rimu, kamahi, tanekaha, heketara, ponga, *Coprosma rhamnoides*, hukihuki, taumingi, wheki, horoeka, bracken and mingimingi.

Ground tier species include rata vine (*Metrosideros fulgens*), kiekie and seedlings of above, moss, kiokio, *Blechnum fluviatile* and *Blechnum filiforme*.

Mangemange and kareao are common.

Kahikatea-maire tawake forest

(RAP 10)

Canopy dominated by varying amounts of kahikatea and maire tawake; frequent associates are kamahi, tawa and pukatea.

Common middle tier species include all of the above, mapou, wheki, ponga, kanono, mahoe, horoeka, rimu and miro.

Ground tier components include *Nertera dichondrifolia*, kahikatea seedlings, kareao, tataramoa (*Rubus australis*), putaputaweta and matau. *Blechnum filiforme* and local *Sphagnum*.

Type now known from only one site in the lowland zone, but was possibly more common in the past. Maire tawake is known from only a handful of sites on the semi-coastal and lowland zones of the district.

Kamahi forest

(RAP 1, 17, 18, 54, 55)

Kamahi dominates the canopy with local associates of rewarewa, pole rimu, pole tawa, hinau, mapou, tanekaha and heketara.

Common middle tier species include rimu, tanekaha, rewarewa, ponga, hangehange, rata vine (*Metrosideros fulgens*), with local kohekohe. Mamangi (*Coprosma arborea*) occurs within RAP 1 Wainui River.

Ground cover is mainly leaf litter with occasional hooked sedges, ponga, kiokio, mangemange, *Oplismenus imbecillis*, seedlings of the above species and local toropapa, *Schoenus tendo* and waewaekoukou (*Lycopodium volubile*).

In the upper lowland zone where kamahi forest has developed on landslide scars the understorey comprises mainly mahoe, kanono, pate and tawari and the groundcover is dense with abundant pate, hangehange and ferns, including pakau, kiokio and katote (*Cyathea smithii*).

Type occurs in semi-coastal and lowland zones, often the result of burning and clearing but also the result of natural disturbance, for example: landslides.

Kanuka forest

(RAP 8, 14, 27, 30)

Kanuka dominant in canopy with local emergent rewarewa. Local canopy associates include mahoe, mangeao, mapou, mamaku, kohuhu and kamahi, and in coastal and semi-coastal zones pohutukawa and puriri.

Common middle tier associates include kawakawa, hangehange, mapou, rewarewa, whauwhaupaku, kamahi, ponga, porokaiwhiri and mahoe. Mingimingi, taumingi, wharariki, akepiro and rangiora are locally common in the coastal zone.

Ground cover components include leaf litter, *Lycopodium deuterodensum*, hangehange, *Poa anceps* subsp. *anceps*, matau, huruhuruwhenua (*Asplenium oblongifolium*), seedlings of middle tier species, *Polystichum richardii*, kiokio, *Adiantum cunninghamii*, rereti (*Blechnum chambersii*) with *Doodia australis* on coastal and semi-coastal sites.

Type induced by burning of hillslopes in the coastal, semi-coastal and lowland zones.

(Kauri)/podocarps-broad leaved species

A few large kauri occur in forest otherwise characteristic of (rimu)-(miro)-(Hall's totara)-(tanekaha)/tawa-hinau-rewarewa-kamahi tawari-tawheowheo forest, on steep broken country beside the Wairoa River near Lower Kaimai, six miles further south beside its tributary, the Mangapapa, and on the steep faces above Rapurapu and Kakahu streams. In the areas of forest where kauri was burnt many years ago, kauri saplings and rickers occur locally in the consequent low forest and shrubland. Canopy associates include kauri, Hall's totara, tawa, rewarewa and tawari. (Nicholls 1965a, b).

Middle tier species include tanekaha, tawa, totara, miro, tawari, mingimingi, *Coprosma lucida* and toru (*Myrsine salicina*).

Ground cover includes *Astelia trinervia*, kanono, toropapa and *Blechnum fraseri*, kiekie and mangemange are common lianes.

***Kauri (rickers)/tanekaha-tawari forest* (RAP 8)**

Kauri (rickers) are emergent over tanekaha and tawari.

Common middle tier associates include *Astelia trinervia*, kiokio, toropapa, mingimingi, kamahi, tawari, *Schoenus tendo*, bracken and *Coprosma lucida* with scattered juvenile kauri and tanekaha.

Ground cover includes leaf litter, kenehu (*Trichomanes reniforme*), puakarimu and kamahi.

***Kauri rickers/tawari forest* (RAP 8)**

Kauri rickers are emergent over a predominantly tawari canopy with occasional kamahi, Hall's totara and rewarewa.

Common middle tier species include korokio (*Corokia buddleioides*), tawari, rata vine (*Metrosideros fulgens*) and Hall's totara.

Ground cover is dominated by *Astelia trinervia* and *Gabnia pauciflora* with local puakarimu.

***Mangeao forest* (RAP 8, 46)**

Mangeao dominant in canopy with occasional associates of rewarewa, kamahi, kohekohe and scattered mamaku, mahoe, pukatea and titoki. Large kohekohe often form a dense subcanopy tier. Ngaio occurs in RAP 18.

Common middle tier species include kohekohe, kawakawa, ponga and mahoe.

Ground cover is mainly leaf litter with scattered seedlings of the above species especially kawakawa and ferns such as rereti, *Blechnum filiforme* and mouku (*Asplenium bulbiferum*).

This forest type has developed following logging and small pockets of mangeao forest are common on farmland on the higher part of the Rotoiti Breccia Fan. These are generally heavily grazed and the understory virtually non-existent.

***(Miro)/tawa-kamahi-tawari forest* (RAP 2, 3, 4, 6)**

Type occurs on exposed ridges in lowland zone. Local infrequent emergent miro occurs over a canopy dominated by varying amounts of tawa, kamahi and tawari. Tawari is locally mono-dominant. Infrequent associates include Hall's totara, rimu, rewarewa, hinau, tanekaha, totara, porokaiwhiri and tawheowheo.

Common middle tier species include kamahi, tawari, kanono, porokaiwhiri, miro, tawa, ponga, mahoe, mangemange, kareao, wheki, tawheowheo, toro, toropapa with local neinei, horopito and kareao.

Common ground cover species are *Hymenophyllum demissum*, hangehange, kanono, mouku, bush rice grass, piupiu, *Leptopteris hymenophylloides*, kiwikiwi (*Blechnum fluviatile*) and seedlings and saplings of the canopy and understorey species.

(Northern rata)-(rimu)/tawa-kobekohe forest (RAP 1, 2, 4, 8, 12, 17, 24, 27, 36, 44, 49)

Scattered to common emergent rimu, local northern rata and infrequent kahikatea and miro are emergent over a canopy with varying dominance of tawa, kohekohe, rewarewa, pukatea and kamahi. Common associates include hinau, mangeao, mamaku. Puriri occurs locally throughout, often forming small groves, sometimes in gullies, sometimes on the flat plateau, with local tanekaha and hard beech in gorges.

Kohekohe often form a subcanopy. Kamahi and tawari occur very locally, and maire tawake locally on the western side of the Papamoa Range.

Common middle tier species include pole tawa and kohekohe, kawakawa, kanono, ponga, wheki, kareao, mahoe, mamaku, kiekie, mapou, porokaiwhiri and nikau, with local toropapa. Pole hinau, rewarewa, pukatea and mangeao are fairly common.

Ground cover is often dense and includes crown fern, *Blechnum filiforme*, *B. fraseri*, mouku, bush rice grass, seedlings of the above species and *Hymenophyllum demissum*.

Common lianes are kiekie, kareao and mangemange.

This forest type was probably the dominant forest cover in the semi-coastal zone before human settlement.

(Northern rata)/tawa-kobekohe forest (RAP 1, 2, 5, 6, 8, 11, 14, 17, 27, 49)

Tawa is the dominant canopy species, overtopped infrequently by northern rata and rimu. Kohekohe is common in the canopy. Large pukatea are often common in gullies and there is local tanekaha and hard beech in gorges. Other canopy associates include mangeao, rewarewa and kamahi. Kohekohe often forms the subcanopy tier.

Common middle tier species are porokaiwhiri, ponga, kawakawa, mangeao, tawa, kohekohe, kareao, kiekie, mangemange, rata vine (*Metrosideros fulgens*) and nikau.

Common ground cover species include *Hymenophyllum demissum*, crown fern, *Lastreopsis hispida*, *L. glabella*, mouku, bush rice grass and seedlings of the above.

This forest type has been lightly logged or modified by crown fires. It occurs in the coastal and semi-coastal zones.

Pohutukawa forest and treeland (RAP 27)

Pohutukawa is the dominant canopy species. Locally, the pohutukawa are widely spaced and mahoe, mamaku and houpara with local brush wattle form a subcanopy.

Kawakawa is common in the middle tier. Other species include *Coprosma robusta*, koromiko, rangiora, hangehange, taupata, mahoe, mamaku, houpara, brush wattle and pampas.

Ground cover is mainly leaf litter. Plants include *Doodia australis*, *Pteris macilenta*, matau, kiokio, *Ficinia nodosa*, *Poa anceps* subsp. *anceps*, *Machaerina sinclairii* and buffalo grass.

***Pohutukawa-kanuka forest* (RAP 27)**

Pohutukawa and kanuka form the canopy with occasional puriri, mapou, mahoe, kamahi and local houpara. There is local emergent rewarewa. In gullies mamaku is common with scattered whau.

Common middle tier species include mapou, hangehange, whauwhaupaku, ponga, mamaku and kawakawa. On steep ridge crests *Coprosma lucida* is common in association with hukihuki, mingimingi, mapou and koromiko.

Common ground cover species include *Adiantum bispidulum*, *Pteris macilenta*, kiokio, matau and seedlings of mahoe, hangehange and porokaiwhiri.

***Pole podocarp forest* (RAP 10, 33)**

The canopy composition varies, but kahikatea alone or with tanekaha are two chief species. Rimu is common with local miro and totara, and infrequent matai. Domestic stock were grazed at most of the sites which were inspected and the understorey was generally sparse.

Species present in the middle tier include saplings of canopy species, horoeka, wheki, kamahi, mapou and local swamp maire and tawa.

Ground cover includes leaf litter and scattered rereti and kiwkiwi (*Blechnum fluviatile*), tataramoa, seedlings of above, *Blechnum filiforme* and local *Sphagnum* and *Pratia angulata*. Lianes include *Rubus schmidelioides*.

***Rewarewa/broadleaved species-treefern forest* (RAP 3, 5, 8, 9, 23, 24, 25, 27, 31, 36, 39, 40, 52, 57)**

Secondary forest developed following repeated burning and clearing. Rewarewa is common in the canopy or emergent over varying canopy associates including a selection of kamahi, mamaku, kanuka, mangeao, porokaiwhiri, mahoe and local makomako, pate, kanono, tanekaha, whauwhaupaku, hinau, mapou, heketara, horoeka, pole rimu, totara, mihimihi, pukatea and kohekohe.

Rewarewa is locally dominant. Some sites contain good rimu regeneration.

Common middle tier species include hangehange, mamaku, ponga, mangeao, kanono, mahoe, porokaiwhiri, rangiora, kareao, mapou, *Coprosma rhamnoides*, *Coprosma lucida* and rewarewa.

Ground cover includes rereti, pakau, kiokio, ponga, leaf litter, seedlings of above species, matau and turutu.

Rewarewa/kamahi forest (RAP 1, 4, 7, 8, 9, 10, 12, 19, 25, 27, 28, 30, 31, 33, 42, 51)

Rewarewa is commonly emergent over kamahi. Occasional canopy associates include kanuka, mamaku, mahoe, mangeao, kohuhu, putaputaweta, hinau, porokaiwhiri and tawa. There is local pole rimu and tanekaha. At some sites scattered emergent radiata pine occurs with maritime pine around margins.

The middle tier is often diverse and includes kawakawa, kohekohe, porokaiwhiri, ponga, mapou, heketara, rewarewa, miro, mahoe, kanono, tanekaha, horoeka, wheki, hangehange, mangemange and rangiora. Hall's totara, kahikatea, rimu and *Coprosma spathulata* occur locally.

Leaf litter is often abundant. Ground cover species include seedlings of the above species, matau, *Oplismenus imbecillis*, *Pteris macilenta*, *Lastreopsis* species, *Doodia australis*, kareao, piupiu and *Metrosideros diffusa*.

Type occurs in semi-coastal and lowland zones, and has arisen following burning or clearing.

Rewarewa/kamahi-kobekohe-mangeao forest (RAP 8, 40)

Scattered rewarewa are emergent over a kamahi-dominant canopy with kohekohe and mangeao commonly present. Occasional associates include kanuka, hinau, porokaiwhiri, tawa and mamaku along with rare emergent rimu. Large puriri occur in some gullies in association with nikau, gully tree fern and kareao.

Common middle tier species include kohekohe, mangeao, heketara, kawakawa and hangehange.

Ground cover comprises leaf litter, with occasional matau, bush rice grass, *Lastreopsis hispida*, *L. glabella*, *Asplenium bulbiferum*, *A. bookerianum* and seedlings.

Rewarewa/kanuka forest (RAP 13, 14, 27, 32, 36, 44)

Rewarewa is commonly emergent over a canopy of kanuka with varying amounts of kamahi.

Other local canopy associates include mamaku, mahoe, heketara, kohuhu, mihimihi, infrequent mangeao and, in the coastal zone, pohutukawa.

Common middle tier species include kapinga, mingimingi, *Coprosma lucida*, taumingi, hangehange and whauwhaupaku. Tanekaha, heketara and kohekohe occur locally.

Ground cover components include hooked sedges (*Uncinia uncinata*), turutu, waewaekoukou, *Oplismenus imbecillis*, *Hymenophyllum sanguinolentum*, kiokio with local concentrations of puakarimu on ridge crests.

Type has arisen following burning or clearing in the coastal, semi-coastal and lowland zones.

(Rimu)-(miro)-tawa-kamahi-tawari forest (RAP 4, 6, 7, 8, 25, 41, 59)

Local emergents of rimu and miro over a canopy with varying dominance of tawa, kamahi and tawari. Occasional associates of Hall's totara, rewarewa, hinau and emergent tanekaha and northern rata.

Middle tier species commonly include kamahi, tawari, tawa, ponga and kareao, hinau, toropapa, mahoe, horoeka and mangemange, porokaiwhiri, wheki and kanono, with local horopito.

Ground tier includes occasional aspleniums, piupiu, *Leptopteris bymenophylloides*, mauku (filmy ferns), matau and seedlings of the above.

Mangemange, kiekie and kareao are common lianes.

Type occurs mainly in the upper lowland zone. Where this type has been logged, emergent podocarps are rare.

(Rimu)-(miro)-(tanekaha)/tawa-binau-rewarewa-kamahi-tawari-tawheowheo forest (RAP 3, 7)

Type occurs along gorges and on very steep ridges and faces in the lowland and semi-coastal zones.

Occasional rimu, miro, Hall's totara, tanekaha emergent over locally frequent to abundant tawa, kamahi and tawari with occasional hinau, rewarewa and tawheowheo. Emergent northern rata occur very occasionally throughout, with local pukatea and kohekohe in deep gullies.

Middle tiers include frequent to abundant kamahi and tawari. Occasional poles of all the other hardwood tree species and the podocarps; heketara, horoeka, ponga, wheki, hangehange, kanono, lancewood, mapou, mingimingi, horopito, porokaiwhiri. Kotukutuku and punui (*Cyathea cunninghamii*) occur locally in gullies.

Ground tier often comprises piupiu, waekura (*Sticherus cunninghamii*), astelias, gahnias and seedlings and saplings of all the hardwoods and podocarps. Common lianes are kiekie, mangemange, kareao.

(Rimu)-(northern rata)/tawa-kamahi-rewarewa-mangeao forest (RAP 2, 4, 5, 6, 14, 28, 60)

Tawa in canopy often co-dominant with kamahi overtopped by scattered emergent rimu. Common associates include rewarewa, mangeao, hinau, mamaku, kamahi, scattered tawari and, particularly on flatter sites, pukatea. Emergent northern rata (dead or alive), miro and kahikatea may be present with local tanekaha and hard beech in gorges.

Middle tiers are often dense and diverse and include kamahi, tawari, pole tawa, kanono, ponga, mahoe, hangehange, kawakawa, pate, porokaiwhiri, punui, wheki, mamaku, ponga, rata vine (*Metrosideros fulgens*), kiekie and supplejack. Pole rewarewa, hinau and mangeao are fairly common.

Ground tier is also thick and includes kanono, kawakawa, mouku, *Blechnum filiforme*, piupiu, *Hymenophyllum demissum*, *Leptopteris*

hymenophylloides, bush rice grass, astelias, matau, young treeferns and seedlings. Kiekie, kareao and mangemange are common lianes.

Epiphytes kowharawhara (*Astelia solandri*) and kahakaha (*Collospermum bastatum*) are common.

Type occurs in the lowland zone.

Rimu-red beech/tawa-kamahi-tawari-hard beech-silver beech forest (RAP 53, 62)

This type is confined to broken country and apparently poorly drained minor basins in the upper Mangorewa catchment, on the north-eastern fall of the Mamaku plateau. It comprises a fine mosaic of “sub-types”. In general, red beech occurs on the more fertile sites, hard beech on impoverished soils, silver beech in cold gullies and along streams. Tawa, kamahi and scattered emergent rimu occur throughout. Occasional associates include tawari, pokaka, toatoa and Hall’s totara.

Common middle tier species include *Astelia fragrans*, *Gabnia pauciflora*, kamahi, tawa, hangehange, kanono, tawheowheo with infrequent miro, rimu, totara kotukutuku and horopito (*Pseudowintera axillaris*), mahoe and juvenile *Nothofagus* spp.

Ground cover includes leaf litter, piupiu and *Lindsaea trichomanoides*, and seedlings of tawari, toatoa and rimu.

Rimu/tawari-kamahi/Gahnia xanthocarpa forest

A few small stands of rimu occur in the unlogged forests on the highest southern part of the Whakamarama Plateau. The largest stand covers about 5 ha of flat ground (500 m a.s.l.) at the head of a tributary of the Ngamuwahine Stream (Nicholls 1985a). Abundant rimu are emergent over tawari, kamahi and pole rimu, with scattered associates of porokaiwhiri, broadleaf, wheki, pokaka, toropapa, kanono and horopito (*Pseudowintera axillaris*).

Waewaekaka locally abundant in the ground tier with scattered bush rice grass, wheki, *Libertia micrantha* and *Sphagnum*.

(Rimu)/tawari-wheki-maire tawake forest

Scattered emergent rimu over a canopy comprising tawari, wheki and maire tawake. Occasional associates include miro, kamahi, tawa, pukatea. (Maire tawake may not be present at all sites.)

Common middle tier species include wheki-ponga, wheki, kamahi, tawa, tawari, mapou and maire tawake.

Common ground tier species are bush rice grass, matau, kiwikipi, piupiu and *Blechnum procerum*.

Type occurs on poorly drained swampy ground on the top of the Whakamarama Plateau.

Tanekaha forest (RAP 1, 4, 7, 10, 12, 21, 44)

Tanekaha forest generally occurs in gorges, on steep spurs, ridges and on hillslopes above rivers and streams. Tanekaha forms the canopy with local associates of rimu, totara, kamahi, hinau and tawari.

Common middle tier species include kamahi, heketara, mihimihi, tawari, horoeka, rimu, Hall's totara, miro, mingimingi, taumingi, rewarewa, *Coprosma lucida* with toropapa, mapou and hangehange.

Common ground cover includes *Astelia trinervia*, mosses, *Lycopodium deuterodensum*, kiokio, turututu, *Gabnia pauciflora*, *Astelia trinervia*, *Schoenus tendo* and *Sticherus cunninghamii*.

Mairehau reaches its southern limit of distribution in this type near the confluence of the Opuiki River and Mangaonui Stream. *Corunastylis pumila* was also recorded from this site.

Type occurs in the semi-coastal and lowland zones.

Tawa forest (RAP 1, 5, 7, 12, 25, 41, 42, 51, 58)

Infrequent rimu, miro, Hall's totara and dead northern rata are sometimes emergent over tawa dominant canopy with scattered associates of tawari, rewarewa, hinau, kamahi, mangeao and pukatea. Tanekaha and hard beech often occur in gorges, and kotukutuku occurs locally in gullies.

Common middle tier species include ponga, kiekie, porokaiwhiri, mahoe, rata vine (*Metrosideros fulgens*), rewarewa and mangemange, kanono, hangehange, wheki and pate.

Ground tier includes leaf litter, kiekie, piupiu, bush rice grass, *Hymenophyllum demissum*, pakau, hooked sedges and *Blechnum filiforme*.

Type is result of logging or crown fires in the lowland zone.

Tawa-kamahi-tawari-hard beech-silver beech forest (RAP 12, 26, 61)

This type is the result of logging in rimu-red beech/tawa-kamahi-tawari-hard beech-silver beech forest for podocarps in the 1920s and for red beech 1945-55 (Nicholls 1965b).

Canopy comprises various admixtures, often comprising hard beech and silver beech, tawa and kamahi, and tawari. There are infrequent rimu and toatoa.

Middle tier components include tawari, kanono, kamahi, whauwhaupaku, tawa, toropapa, *Raukaua anomalous* with local miro and toatoa.

Ground cover components include crown fern, toropapa, kanono, astelias, kowaowao, tawari, hooked sedges and seedlings of above.

Type occurs in the lowland zone.

Tawa-rewarewa forest (RAP 3, 5, 6, 7, 8, 10, 39)

Tawa and rewarewa common in the canopy with varying amounts of pukatea, hinau and other canopy associates include kamahi, ponga and local tawari and mangeao, and local tanekaha and hard beech in gorges. There is the odd emergent rimu and northern rata. Varying combinations of mamaku, mahoe, porokaiwhiri and ponga often form a subcanopy.

Common middle tier associates include ponga, kanono, mahoe, porokaiwhiri, mamaku, rewarewa, tawa and hangehange.

In the semi-coastal zone, taurepo and nikau occur locally.

Common ground cover comprises rereti, pakau, *Hymenophyllum demissum*, *Blechnum filiforme*, seedlings of the above species, mouku and *Lastreopsis hispida*. Scrambling lianes are locally abundant and include mangemange, kiekie and kareao.

This type occurs in the lowland, and locally in the semi-coastal zone. It has generally been logged or modified by crown fires.

Tawa-rewarewa-pukatea-kohekohe forest (RAP 1, 3, 5, 8, 9, 12, 13, 14, 16, 18, 19, 20, 21, 23, 30, 31, 32, 33, 34, 35, 36, 37, 52, 55, 56, 57)

The canopy is dominated by varying amounts of tawa, rewarewa, pukatea and kohekohe. This type is the result of logging or crown fires in (northern rata)-(rimu)/tawa-rewarewa-pukatea-kohekohe. Other canopy associates include hinau, mangeao, mamaku, kamahi, pole rimu with local puriri, titoki and aka. Tanekaha, Hall's totara and hard beech often occur on steep sites. A few emergent rimu remain at several sites with local epiphytic puka (*Griselina lucida*). Local small stands of podocarp regenerations occur on ridges. Kotukutuku is local in gullies, particularly on the eastern side of the district. Puriri occurs locally.

Common middle tier species are mahoe, ponga, mamaku, porokaiwhiri, rangiora, hangehange, kawakawa, rewarewa, kanono, kohekohe, tawa in association with local nikau, wheki, pukatea.

Common ground cover species include pakau, rereti, mouku, *Blechnum filiforme*, *Leptopteris hymenophylloides* and seedlings of the above species. Kiekie, kareao and rata vine (*Metrosideros fulgens*) are locally common. *Asplenium lamprophyllum* occurs locally on the western side of the Kaimai Ranges.

Type occurs in the coastal and semi-coastal zones.

Tawari forest (RAP 8)

Tawari dominant in canopy with occasional associates of kamahi, tanekaha and toatoa.

Middle tier species include porokaiwhiri, ponga, Hall's totara, mapou, rewarewa, miro, horopito, tawheowheo and tanekaha with local neinei and *Corokia buddleioides*.

Leaf litter is common on the ground. Species present include ponga, *Sticherus cunninghamii*, rewarewa, matau, rata vine (*Metrosideros fulgens*), puakarimu, mapere (*Gabnia setifolia*), seedlings of rewarewa and tawari with local *Coprosma spathulata* subsp. *spathulata*.

Type occurs in lowland and semi-coastal zones.

Tawari-tawheowheo forest (RAP 2, 3)

Occurs in the sub-montane zone and upper lowland zone.

Tawari and tawheowheo forms the canopy with local *Myrsine salicina*.

Middle tier species include tawari, tawheowheo, hupiro, kakaha (*Astelia fragrans*), wheki, mingimingi, puka and kamahi with local horopito (*P. axillaris* and *P. colorata*).

Ground cover includes leaf litter, mosses, kahaka, *Gabnia pauciflora*, *Blechnum procerum*, *Hymenophyllum demissum*.

Epiphytes are common and include *Rumobra adiantiformis*, kenehu (*Trichomanes cardiomanes*) and *Hymenophyllum demissum*.

**Heavily logged rimu/
tawa forest** (RAP 1, 4, 7, 17, 18, 24, 25,
33, 34, 38, 40, 42, 45, 51, 61)

This forest type has been induced through heavy, often repeated, logging of tall podocarp/tawa forest. Though logged rimu/tawa forest often retains a more or less intact canopy of tawa and associates, some sites which have been very heavily logged have what can be more accurately described as a discontinuous canopy.

It mainly comprises scattered emergent tawa, rewarewa and pukatea over a lower canopy of mamaku, mahoe, porokaiwhiri, pate, other broadleaved species and rata vine (*Metrosideros fulgens*).

Common mid-tier species include porokaiwhiri, kaponga and wheki.

Common ground cover species include piupiu with local *Blechnum fraseri* and *Hymenophyllum demissum*. Kiekie is locally abundant on the ground and scrambling up trees and there are also local thickets of mangemange and kareao.

On logging tracks there is often a cover of mixed exotic grasses and herbs, toetoe, matata, bracken, gorse, Spanish heath. Secondary shrubs beside logging tracks include makomako, kotukutuku, wheki, wheki ponga, mahoe, tataramoa (*Rubus cissoides*), with local mahoe-wao (*Melicytus lanceolatus*), tawa and mangeao.

Nevertheless, local pockets of more intact tawa forest (similar to (rimu)-(northern rata)/tawa-kamahi-rewarewa-mangeao forest) occur on some less accessible sites.

Geothermal

Pohutukawa × northern rata dominant forest (RAP 15)

This forest type is variable and occurs in the Taheke Geothermal Area. In places pohutukawa × northern rata (to c.20 m) and kamahi form the canopy with occasional wheki and karamu. *Gabnia setifolia* and *Histiopteris incisa*, mingimingi, wheki, and manuka are common in the understorey. Patches of bracken, turutu, *Hypolepis distans*, *Paesia scaberula* and *Gleichenia microphylla* are present.

Elsewhere pohutukawa forms an open canopy over an understorey dominated with mingimingi, prostrate kanuka and *Histiopteris incisa*. Kamahi and *Gabnia setifolia* are also present.

In other places emergent pohutukawa × northern rata to 20 m are emergent over prostrate kanuka and mingimingi. Wheki, *Histiopteris incisa*, *Gabnia setifolia*, and *Hypolepis distans* are also present.

***Prostrate kanuka-manuka-mingimingi scrub* (RAP 15)**

This type occurs in the Taheke Geothermal Area. Prostrate kanuka to 2 m tall, and manuka and mingimingi are dominant. Occasional *Histiopteris incisa*, *Lycopodiella cernua* and pohutukawa × northern rata seedlings. Gorse and kanuka become common on cooler margins.

Elsewhere dead trees of pohutukawa × northern rata are emergent over prostrate kanuka to 2 m and mingimingi are dominant. Occasional *Histiopteris incisa*, *Lycopodiella cernua* and pohutukawa × northern rata seedlings.

In one place, several dead pohutukawa × northern rata trees occur over a canopy of manuka, mingimingi, gorse, tawiniwini, turutu and *Gabnia setifolia*. Occasional wheki, *Histiopteris incisa* and *Paesia scaberula* present. This area has been geothermally active in the recent past.

***Mingimingi-prostrate kanuka-manuka scrub* ⇔ (RAP 15)
Histiopteris incisa fernland ⇔ *Hypolepis distans fernland***

This type occurs in the Taheke Geothermal Area. A varied vegetation type where mingimingi is dominant with smaller areas dominated by prostrate kanuka, manuka, *Histiopteris incisa*, and gorse. Wilding radiata pine and pohutukawa × northern rata are occasional emergents, with gorse becoming more abundant on cooler soils. Scattered dead pohutukawa × northern rata are also present. In open steep areas *Gabnia setifolia*, *Histiopteris incisa*, *Hypolepis distans*, and bracken become common. Blackberry, turutu, wheki, *Lycopodiella cernua*, kamahi, hangehange, kohuhu and mamaku are also present. Towards the boundary with pine plantation, mingimingi is still the dominant species with increasing amounts of gorse, hangehange, mamaku, *Histiopteris incisa*, and wheki.

***Manuka-prostrate kanuka-Lycopodiella cernua shrubland* (RAP 15)**

This type occurs in the Taheke Geothermal Area. Manuka and prostrate kanuka are dominant with *Lycopodiella cernua* common in the understorey. Raw-soilfield forms a cover for about 30% of this unit. Gorse becomes common on cooler soils. Other species present include *Paesia scaberula*, kiokio, *Juncus edgariae*, *Gleichenia microphylla*, *Schizaea bifida* (at least eight plants), tawiniwini, pohutukawa × northern rata seedlings.

***Histiopteris incisa-mingimingi fernland* (RAP 15)**

This type occurs in the Taheke Geothermal Area. *Histiopteris incisa* and mingimingi are dominant with wheki also present. Occasional *Gabnia setifolia*, kamahi, gorse and manuka present.

***Lycopodiella cernua fernland* (RAP 15)**

Lycopodiella cernua dominates these areas.

***(Dead pohutukawa × northern rata)/wheki-kamahi-Gabnia setifolia treefernland* (RAP 15)**

This type occurs in the Taheke Geothermal Area. Several dead pohutukawa × northern rata trees occur over wheki and *Gabnia setifolia*. Occasional

pohutukawa × northern rata to 10 m tall with manuka, mingimingi, hangehange, kohuhu also present. *Lycopodiella cernua* is present in the understorey. In places wheki and kamahi are dominant.

Non-vegetated raw soilfield

(RAP 15)

This type occurs in the Taheke Geothermal Area. Heated bare ground, mudpools, steaming ground, fumaroles, hot springs and sulphur deposits. Occasional small patches of mingimingi and manuka are present.

Other

Lake

(RAP 7, 62)

Bluffs

(RAP 3, 12, 14)

Bluffs occur throughout the ecological district (for example: Matata Scenic Reserve, Te Weraiti, Papamoia Range and Mangorewa Gorge) and support distinct plant associations. Coastal bluff vegetation comprises a sparse cover of wharariki, *Morelotia affinis*, kama (*Gaultheria oppositifolia*), totorowhiti (*Dracophyllum strictum*), akepiro, taumingi, mingimingi, *Schoenus tendo*, puakarimu, manuka and locally ground orchids (including *Thelymitra carnea*). There is sometimes a luxuriant cover of tuhara (*Machaerina sinclairii*) and kiokio, often associated with seepages.

On semi-coastal bluffs in RAP 14, species present include kiokio, wharariki, *Schoenus tendo*, tuhara, totorowhiti, toetoe, mingimingi, manuka with mihimihi locally along the edges.

In the lowland zone, bluffs exposed to the sun often support a low cover of rewarewa, kamahi, *Coprosma lucida*, mingimingi, koromiko and *Schoenus tendo*. Towards the base of the bluffs where surrounding vegetation supplies shade, rata vines (*Metrosideros fulgens*, *M. perforata*), *Lindsaea viridis*, *Trichomanes elongatum*, *T. endlicherianum*, *Hymenophyllum demissum*, *H. ferrugineum*, kiokio, rereti, *Blechnum nigrum*, *Epilobium* species and *Adiantum cunninghamii* are common.

In the sub-montane zone, species present on rock faces include kiokio, mingimingi, kaikawaka, kamahi, kapuka, rata vine (*Metrosideros fulgens*), *Nertera depressa*, waekura and waewaekoukou.

Landslide scars

(RAP 3)

Landslide scars occur along several of the steeper ridge systems in the district. Early colonising species of these sites include *Gabnia setifolia*, matata, kiokio, toetoe, crown fern and seedlings of kamahi, rewarewa, makomako and kotukutuku. Along forest margins, common species include pate, rangiora, hangehange, nikau, ponga and kiekie.

Species present in the sub-montane zone include *Lycopodium scariosum*, *Leucopogon fraseri*, bracken, kiokio, *Deyeuxia avenoides*, and orchids (including *Thelymitra longifolium*, *Orthoceras novae-zeelandiae* and *Corunastylis nuda*) and *Dracophyllum traversii*.

Appendix 3

CHECKLIST OF NATIVE VASCULAR PLANTS IN OTANEWAINUKU ECOLOGICAL DISTRICT

The following list is compiled from the Otanewainuku Ecological District P.N.A. survey, previous vegetation surveys by the author, and computerised Christchurch herbarium (NZCHR) database.

Nomenclature follows Allan (1961), Moore and Edgar (1970), Healy and Edgar (1980), Brownsey, Given and Lovis (1985), Connor and Edgar (1987), and Webb, Sykes and Garnock-Jones (1988).

Abbreviations used

- aff. : affinities with
agg. : aggregate, comprising more than one species.
cf. : compare with
incl. : including
s.l. : sensu lato, in the broad sense
sp. : species (singular)
spp. : species (plural)
s.s. : sensu stricto, in the narrow sense
subsp. : subspecies
× : hybrid
var. : variety
* : possibly adventive

Gymnosperms

<i>Agathis australis</i>	kauri
<i>Dacrycarpus dacrydioides</i>	kahikatea
<i>Dacrydium cupressinum</i>	rimu
<i>Libocedrus bidwillii</i>	kaikawaka
<i>Phyllocladus toatoa</i>	toatoa
<i>Phyllocladus trichomanoides</i>	tanekaha
<i>Podocarpus hallii</i>	Hall's totara
<i>Podocarpus totara</i> var. <i>totara</i>	totara
<i>Prumnopitys taxifolia</i>	matai
<i>Prumnopitys ferruginea</i>	miro

Monocot. trees and shrubs

<i>Cordyline australis</i>	ti kouka
<i>Cordyline banksii</i>	ti ngahere, forest cabbage tree
<i>Cordyline australis</i> × <i>C. banksii</i>	
<i>Phormium cookianum</i>	wharariki, mountain flax
<i>Phormium tenax</i>	harakeke, flax
<i>Rhopalostylis sapida</i>	nikau

Dicot. trees and shrubs

<i>Alectryon excelsus</i> subsp. <i>excelsus</i>	titoki
<i>Alseuosmia macrophylla</i>	toropapa
<i>Alseuosmia pusilla</i>	
<i>Aristotelia fruticosa</i>	
<i>Aristotelia serrata</i>	makomako, wineberry
<i>Beilschmiedia tawa</i>	tawa
<i>Brachyglottis kirkii</i> var. <i>kirkii</i>	kohurangi
<i>Brachyglottis repanda</i>	rangiora
<i>Carmichaelia australis</i>	makaka, maukoro
<i>Carpodetus serratus</i>	putaputaweta
<i>Coprosma arborea</i>	tree coprosma
<i>Coprosma foetidissima</i>	hupiro
<i>Coprosma grandifolia</i>	kanono
<i>Coprosma lucida</i>	karamu
<i>Coprosma propinqua</i> var. <i>propinqua</i>	mingimingi
<i>Coprosma propinqua</i> var. <i>propinqua</i> × <i>C. robusta</i>	
<i>Coprosma rhamnoides</i>	
<i>Coprosma robusta</i>	karamu
<i>Coprosma rotundifolia</i>	
<i>Coprosma spathulata</i> subsp. <i>spathulata</i>	
<i>Coprosma tayloriae</i>	
<i>Coprosma tenuicaulis</i>	hukihuki
<i>Coprosma tenuifolia</i>	
<i>Coriaria arborea</i> var. <i>arborea</i>	tutu
<i>Corokia buddleioides</i> (incl. <i>C. b.</i> var. <i>linearis</i>)	korokio
<i>Corynocarpus laevigatus</i>	karaka
<i>Dactylanthus taylorii</i>	pua o te reinga
<i>Dodonaea viscosa</i>	akeake
<i>Dracophyllum latifolium</i>	neinei
<i>Dracophyllum strictum</i>	totorowhiti

<i>Dracophyllum subulatum</i>	monoao
<i>Dracophyllum traversii</i>	
<i>Dysoxylum spectabile</i>	kohekohe
<i>Elaeocarpus dentatus</i>	hinau
<i>Elaeocarpus bookerianus</i>	pokaka
<i>Fuchsia excorticata</i>	kotukutuku
<i>Gaultheria antipoda</i>	tawiniwini
<i>Gaultheria antipoda</i> × <i>G. oppositifolia</i>	koropuka
<i>Gaultheria antipoda</i> × <i>G. paniculata</i>	koropuka
<i>Gaultheria oppositifolia</i>	kama
<i>Gaultheria paniculata</i>	koropuka
<i>Geniostoma ligustrifolium</i> var. <i>ligustrifolium</i>	hangehange
<i>Griselinia littoralis</i>	kapuka
<i>Griselinia lucida</i>	puka
<i>Hebe corriganii</i>	
<i>Hebe stricta</i> var. <i>stricta</i>	koromiko
<i>Hedycarya arborea</i>	porokaiwhiri
<i>Helicbrysum lanceolatum</i>	niniao
<i>Ileostylus micranthus</i>	pirita, green mistletoe
<i>Ixerba brexioides</i>	tawari
<i>Knighitia excelsa</i>	rewarewa
<i>Kunzea ericoides</i> var. <i>ericoides</i>	kanuka
<i>Kunzea ericoides</i> var. <i>microflora</i>	prostrate kanuka
<i>Laurelia novae-zelandiae</i>	pukatea
<i>Leionema nudum</i>	mairehau
<i>Leptecophylla juniperina</i>	prickly mingimingi
<i>Leptospermum scoparium</i>	manuka
<i>Leucopogon fasciculatus</i>	mingimingi
<i>Leucopogon fraseri</i> s.s.	patotara
<i>Litsea calicaris</i>	mangeao
<i>Lophomyrtus bullata</i>	ramarama
<i>Lophomyrtus bullata</i> × <i>L. obcordata</i>	
<i>Lophomyrtus obcordata</i>	rohutu
<i>Macropiper excelsum</i> subsp. <i>excelsum</i>	kawakawa
<i>Melicope simplex</i>	poataniwha
<i>Melicope simplex</i> × <i>M. ternata</i>	
<i>Melicope ternata</i>	wharangi
<i>Melicytus lanceolatus</i> (incl. <i>M. l.</i> var. <i>latior</i>)	mahoe-wao
<i>Melicytus ramiflorus</i> subsp. <i>ramiflorus</i>	mahoe
<i>Metrosideros excelsa</i>	pohutukawa

<i>Metrosideros excelsa</i> × <i>M. robusta</i>	
<i>Metrosideros robusta</i>	northern rata
<i>Mida salicifolia</i> (incl. <i>M. s.</i> var. <i>myrtifolia</i>)	mida
<i>Myoporum laetum</i>	ngaio
<i>Myrsine australis</i>	mapou
<i>Myrsine salicina</i>	toro
<i>Neomrytus pedunculata</i>	rohutu
<i>Nestegis lanceolata</i>	white maire
<i>Nestegis montana</i>	rororo
<i>Nothofagus fusca</i>	red beech, tawhai raunui
<i>Nothofagus fusca</i> × <i>N. solandri</i> (WAIK 11323; Nicholls 1989)	tawhai
<i>Nothofagus fusca</i> × <i>N. truncata</i>	tawhai
<i>Nothofagus menziesii</i>	silver beech, tawhai
<i>Nothofagus truncata</i>	hard beech, tawhai raunui
<i>Olearia cheesemanii</i>	
<i>Olearia furfuracea</i>	akepiro
<i>Olearia pachyphylla</i> ¹	
<i>Olearia rani</i> var. <i>colorata</i>	heketara
<i>Ozothamnus leptophyllus</i>	tauhinu
<i>Pennantia corymbosa</i>	kaikomako
<i>Peraxilla tetrapetala</i>	
<i>Pimelea longifolia</i>	taranga
<i>Pimelea prostrata</i>	pinatoro
<i>Pimelea tomentosa</i>	
<i>Pittosporum cornifolium</i>	tawhirikao
<i>Pittosporum crassifolium</i>	karo
<i>Pittosporum eugenioides</i>	tarata
<i>Pittosporum kirkii</i>	
<i>Pittosporum tenuifolium</i> subsp. <i>colensoi</i>	rautawhiri
<i>Pittosporum tenuifolium</i> subsp. <i>tenuifolium</i>	kohuhu
<i>Plagianthus divaricatus</i>	marsh ribbonwood, makaka
<i>Pomaderris</i> aff. <i>phlylicifolia</i>	
<i>Pseudopanax arboreus</i>	whauwhaupaku, five finger
<i>Pseudopanax colensoi</i> var. <i>colensoi</i>	orihou
<i>Pseudopanax crassifolius</i>	horoeka, lancewood
<i>Pseudopanax crassifolius</i> × <i>P. lessonii</i>	

1. Doubtful record. There are old records of *O. pachyphylla* from the ecological district (P. de Lange pers. comm.)

<i>Pseudopanax lessonii</i>	houpara
<i>Pseudowintera axillaris</i>	horopito
<i>Pseudowintera colorata</i>	horopito
<i>Quintinia serrata</i> (incl. <i>Q. acutifolia</i> and <i>Q. elliptica</i>)	tawheowheo
<i>Raukaua anomalus</i>	
<i>Raukaua edgerleyi</i>	raukawa
<i>Rhabdotohamnus solandri</i>	taurepo
<i>Schefflera digitata</i>	pate
<i>Solanum aviculare</i> f. <i>aviculare</i>	
<i>Streblus heterophyllus</i>	turepo
<i>Syzygium maire</i>	maire tawake, swamp maire
<i>Toronja toru</i>	toru
<i>Tupeia antarctica</i>	pirita
<i>Urtica ferox</i> (NZFRI 20875; J.F.F. Hobbs 1964)	ongaonga
<i>Weinmannia racemosa</i>	kamahi, tawhero
Monocot. Lianes	
<i>Freycinetia banksii</i>	kiekie
<i>Ripogonum scandens</i>	kareao, supplejack
Dicot. Lianes	
<i>Calystegia sepium</i> subsp. <i>roseata</i>	pohue
<i>Calystegia soldanella</i>	panahi
<i>Clematis cunninghamii</i>	ngakau-kiore
<i>Clematis foetida</i>	akakaiku
<i>Clematis forsteri</i>	poananga
<i>Clematis paniculata</i>	puawananga
<i>Metrosideros carminea</i>	akakura
<i>Metrosideros colensoi</i>	rata
<i>Metrosideros diffusa</i>	rata
<i>Metrosideros fulgens</i>	rata
<i>Metrosideros perforata</i>	aka
<i>Muehlenbeckia australis</i>	puka
<i>Muehlenbeckia complexa</i>	pohuehue
<i>Parsonsia capsularis</i>	akakiore
<i>Parsonsia heterophylla</i>	akakaikiore
<i>Passiflora tetrandra</i>	kohia
<i>Rubus australis</i>	tataramoa
<i>Rubus australis</i> × <i>R. cissoides</i>	
<i>Rubus cissoides</i>	tataramoa

<i>Rubus schmidelioides</i> var. <i>schmidelioides</i>	akatataramoa
<i>Tetragonia tetragonioides</i>	kokihi
Lycopods and psilopsids	
<i>Huperzia varia</i>	Whiri-o-Raukatauri
<i>Lycopodiella cernua</i>	maatukutuku
<i>Lycopodium deuterodensum</i>	puakarimu
<i>Lycopodium scariosum</i>	matukutuku
<i>Lycopodium volubile</i>	waewaekoukou
<i>Tmesipteris elongata</i>	
<i>Tmesipteris lanceolata</i>	
<i>Tmesipteris tannensis</i>	
Ferns	
<i>Adiantum cunninghamii</i>	huruhuru tapairu
<i>Adiantum diaphanum</i>	huruhuru tapairu
<i>Adiantum fulvum</i>	huruhuru tapairu
<i>Adiantum viridescens</i>	huruhuru tapairu
<i>Anarthropteris lanceolata</i>	
<i>Arthropteris tenella</i>	
<i>Asplenium bulbiferum</i>	mouku
<i>Asplenium bulbiferum</i> × <i>A. flaccidum</i>	petako-paraharaha
<i>Asplenium bulbiferum</i> × <i>A. lamprophyllum</i>	petako-paraharaha
<i>Asplenium flaccidum</i>	
<i>Asplenium gracillimum</i>	petako-paraharaha
<i>Asplenium bookerianum</i>	petako-paraharaha
<i>Asplenium lamprophyllum</i>	petako-paraharaha
<i>Asplenium oblongifolium</i>	huruhuruwhenua
<i>Asplenium polyodon</i>	petako
<i>Azolla filiculoides</i>	retoretore
<i>Blechnum chambersii</i>	rereti
<i>Blechnum colensoi</i>	peretao
<i>Blechnum discolor</i>	petipeti, crown fern
<i>Blechnum filiforme</i>	panako
<i>Blechnum fluviatile</i>	kiwikiwi
<i>Blechnum fraseri</i>	
<i>Blechnum membranaceum</i>	
<i>Blechnum minus</i>	swamp kiokio
<i>Blechnum minus</i> × <i>B. novae-zelandiae</i>	
<i>Blechnum nigrum</i>	

<i>Blechnum novae-zelandiae</i>	kiokio
<i>Blechnum penna-marina</i> subsp. <i>alpina</i>	
<i>Blechnum procerum</i>	
<i>Blechnum vulcanicum</i>	korokio
<i>Botrychium bifforme</i>	
<i>Ctenopteris heterophylla</i>	
<i>Cyathea cunninghamii</i>	punui, gully tree fern
<i>Cyathea dealbata</i>	ponga, silver fern
<i>Cyathea medullaris</i>	mamaku, black tree fern
<i>Cyathea smithii</i>	katote (soft tree fern)
<i>Deparia petersenii</i>	
<i>Dicksonia fibrosa</i>	wheki-ponga, skirt fern
<i>Dicksonia lanata</i>	tuakura
<i>Dicksonia squarrosa</i>	wheki, rough tree fern
<i>Diplazium australe</i>	
<i>Doodia australis</i>	pukupuku
<i>Gleichenia dicarpa</i>	tangle fern
<i>Gleichenia microphylla</i>	waewaekaka
<i>Grammitis billardierei</i>	
<i>Grammitis magellanica</i> subsp. <i>notbofageti</i>	
<i>Grammitis pseudociliata</i> (Bellingham 1985)	
<i>Histiopteris incisa</i>	matata, water fern
<i>Hymenophyllum armstrongii</i>	mauku
<i>Hymenophyllum atrovirens</i>	mauku
<i>Hymenophyllum bivalve</i>	mauku
<i>Hymenophyllum demissum</i>	irirangi
<i>Hymenophyllum dilatatum</i>	matua mauku
<i>Hymenophyllum ferrugineum</i>	mauku
<i>Hymenophyllum flabellatum</i>	mauku
<i>Hymenophyllum flexuosum</i>	mauku
<i>Hymenophyllum lyalli</i>	mauku
<i>Hymenophyllum malingii</i>	mauku
<i>Hymenophyllum minimum</i> (de Lange 1988)	mauku
<i>Hymenophyllum multifidum</i>	mauku
<i>Hymenophyllum rarum</i>	mauku
<i>Hymenophyllum revolutum</i>	mauku
<i>Hymenophyllum sanguinolentum</i>	piripiri
<i>Hymenophyllum scabrum</i>	mauku
<i>Hymenophyllum</i> aff. <i>flexuosum</i> (AK 177370; Mt Burnett)	

<i>Hypolepis ambigua</i>	
<i>Hypolepis distans</i>	
<i>Hypolepis lactea</i>	
<i>Hypolepis rufobarbata</i>	
<i>Lastreopsis glabella</i>	
<i>Lastreopsis hispida</i>	
<i>Lastreopsis microsora</i> subsp. <i>petangularis</i>	
<i>Lastreopsis velutina</i>	
<i>Leptolepia novae-zelandiae</i>	
<i>Leptopteris hymenophylloides</i>	heruheru
<i>Leptopteris hymenophylloides</i> × <i>L. superba</i>	heruheru
<i>Leptopteris superba</i>	heruheru
<i>Lindsaea linearis</i>	
<i>Lindsaea trichomanoides</i>	
<i>Lindsaea viridis</i>	
<i>Lygodium articulatum</i>	mangemange
<i>Marattia salicina</i>	para, kingfern
<i>Microsorium novae-zelandiae</i>	
<i>Microsorium pustulatum</i>	kowaowao (hounds tongue fern)
<i>Microsorium scandens</i>	mokimoki
<i>Ophioglossum coriaceum</i>	
<i>Paesia scaberula</i>	matata
<i>Pellaea rotundifolia</i>	tarawera (button fern)
<i>Pneumatopteris pennigera</i>	pakau
<i>Polystichum neozelandicum</i> subsp. <i>neozelandicum</i>	pikopiko, shield fern
<i>Polystichum silvaticum</i>	
<i>Polystichum vestitum</i>	puniu (prickly shield fern)
<i>Polystichum wauranum</i>	pikopiko, shield fern
<i>Pteridium esculentum</i>	bracken (bracken)
<i>Pteris macilenta</i>	sweet fern
<i>Pteris tremula</i>	turawera (shaking brake)
<i>Pyrrhosia eleagnifolia</i>	leather-leaf fern
<i>Rumohra adiantiformis</i>	
<i>Schizaea bifida</i>	
<i>Schizaea dichotoma</i> (Shaw 1991)	
<i>Sticherus cunninghamii</i>	waekura
<i>Trichomanes elongatum</i>	
<i>Trichomanes endlicherianum</i>	

Trichomanes reniforme

Trichomanes strictum

Trichomanes venosum

Orchids

Acianthus sinclairii

Aporostylis bifolia

Caladenia sp. (aff. *C. catenata*)

Corunastylis nuda

Corunastylis pumila

Corybas sp. (*C. rivularis* agg.)

Diplodium alobulum

Diplodium trullifolium

Drymoanthus adversus

Earina autumnalis

raupeka

Earina mucronata

peka-a-waka

Gastrodia cunninghamii

huperei

Icthyostomum pygmaeum

piripiri

Microtis oligantha (Smale 1985a)

Microtis unifolia

maikaika

Nematoceras acuminatus

Nematoceras macranthus

Nematoceras trilobus

Orthoceras novae-zeelandiae

maikaika

Prasopbyllum colensoi

Pterostylis "aff. *montana*"

Pterostylis banksii

tutukiwi

Pterostylis cardiostigma (Irwin J.B. pers. comm.)

Pterostylis graminea

Pterostylis paludosa (NZFRI 15753)

Simpliglottis cornuta

Singularybas oblongus

Thelymitra carnea

Thelymitra cyanea

Thelymitra hatchii

Thelymitra ixiooides (Shaw 1991; Gudex 1963)

Thelymitra longifolia

maikuku

Thelymitra pauciflora

Winika cunninghamii

Grasses

<i>Cortaderia fulvida</i>	toetoe
<i>Cortaderia toetoe</i>	toetoe
<i>Deyeuxia</i> aff. <i>quadriseta</i> "Volcanic Plateau"	
<i>Deyeuxia avenoides</i>	
<i>Dichelachne crinita</i>	patiti
<i>Echinopogon ovatus</i>	
<i>Hierochloe redolens</i>	karetu
<i>Isachne globosa</i>	swamp millet
<i>Lachnagrostis billardierei</i>	perehia
<i>Lachnagrostis filiformis</i>	
<i>Lachnagrostis lyallii</i>	
<i>Microlaena avenacea</i>	bush rice grass
<i>Microlaena stipoides</i>	patiti
<i>Oplismenus hirtellus</i> subsp. <i>imbecillis</i>	
<i>Poa anceps</i> subsp. <i>anceps</i>	
<i>Poa breviglumis</i>	
<i>Rytidosperma clavatum</i>	
<i>Rytidosperma gracile</i>	
<i>Rytidosperma unarede</i>	
<i>Spinifex sericeus</i>	kowhangatara
<i>Stenostachys gracilis</i>	
<i>Zoysia pauciflora</i>	

Sedges

<i>Baumea arthrophylla</i>	
<i>Baumea articulata</i>	
<i>Baumea juncea</i>	
<i>Baumea rubiginosa</i>	
<i>Baumea tenax</i>	
<i>Baumea teretifolia</i>	
<i>Bolboschoenus fluviatilis</i>	ririwaka
<i>Bolboschoenus medianus</i>	ririwaka
<i>Carex breviculmis</i>	
<i>Carex dipsacea</i>	
<i>Carex dissita</i>	
<i>Carex echinata</i>	
<i>Carex flagellifera</i>	manaia
<i>Carex forsteri</i>	
<i>Carex inversa</i>	

<i>Carex lambertiana</i>	
<i>Carex maorica</i>	
<i>Carex pumila</i>	
<i>Carex secta</i>	purei
<i>Carex sinclairii</i>	
<i>Carex solandri</i>	
<i>Carex spinirostris</i>	
<i>Carex subdola</i>	
<i>Carex testacea</i>	
<i>Carex virgata</i>	purei
<i>Carex</i> sp. (<i>C. geminata</i> agg.)	rautahi
<i>Cyperus ustulatus</i> f. <i>ustulatus</i>	toetoe upokotangata
<i>Desmoschoenus spiralis</i>	pingao
<i>Eleocharis acuta</i>	
<i>Eleocharis gracilis</i>	
<i>Eleocharis sphacelata</i>	
<i>Ficinia nodosa</i>	wiwi
<i>Gabnia lacera</i>	tarangarara
<i>Gabnia pauciflora</i>	takahikahi
<i>Gabnia rigida</i>	takahikahi
<i>Gabnia setifolia</i>	mapere
<i>Gabnia xanthocarpa</i>	tupari-maunga
<i>Isolepis cernua</i>	
<i>Isolepis distigmatica</i>	
<i>Isolepis habra</i>	
<i>Isolepis inundata</i>	
<i>Isolepis pottsii</i>	
<i>Isolepis prolifer</i>	
<i>Isolepis reticularis</i>	
<i>Lepidosperma australe</i>	
<i>Lepidosperma laterale</i>	
<i>Machaerina sinclairii</i>	tuhara
<i>Morelotia affinis</i>	
<i>Schoenoplectus pungens</i>	
<i>Schoenoplectus tabernaemontani</i>	kapungawha
<i>Schoenus maschalinus</i>	
<i>Schoenus tendo</i>	wiwi
<i>Uncinia banksii</i>	matau
<i>Uncinia distans</i>	matau
<i>Uncinia ferruginea</i>	matau

<i>Uncinia filiformis</i>	matau
<i>Uncinia gracilentata</i>	matau
<i>Uncinia rupestris</i> (incl. <i>U. angustifolia</i>)	matau
<i>Uncinia scabra</i>	matau
<i>Uncinia uncinata</i>	kamu, matau a Maui
<i>Uncinia zotovii</i>	matau

Rushes

<i>Juncus australis</i>	wi
<i>Juncus edgariae</i>	wi
<i>Juncus kraussii</i> subsp. <i>australiensis</i>	wi (sea rush)
<i>Juncus pallidus</i>	wi
<i>Juncus planifolius</i>	
<i>Juncus prismatocarpus</i>	
<i>Juncus sarophorus</i>	wi
<i>Luzula picta</i> var. <i>limosa</i> (Bellingham 1985)	
<i>Luzula picta</i> var. <i>picta</i>	

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

<i>Apodasmia similis</i>	oioi
<i>Astelia fragrans</i>	kakaha
<i>Astelia grandis</i>	mauri
<i>Astelia solandri</i>	kowharawhara
<i>Astelia</i> sp. (unnamed; aff. <i>A. nervosa</i>)	mauri
<i>Astelia trinervia</i>	mauri
<i>Collospermum bastatum</i>	kahakaha
<i>Collospermum microspermum</i>	
<i>Cordyline pumilio</i>	ti rauriki
<i>Cordyline banksii</i> × <i>C. pumilio</i>	
<i>Dianella nigra</i>	turutu
<i>Lemna minor</i>	karearea
<i>Libertia grandiflora</i>	mikoikoi
<i>Libertia ixioides</i>	mikoikoi
<i>Libertia micrantha</i>	
<i>Potamogeton cheesemanii</i>	manihi
<i>Potamogeton suboblongus</i>	rerewai
<i>Sparganium subglobosum</i>	maru, burr reed
<i>Triglochin striata</i>	arrow grass
<i>Typha orientalis</i>	raupo

Composite herbs

<i>Anaphalioides trinervis</i>	puatea
<i>Celmisia gracilentia</i>	
<i>Cotula coronopifolia</i>	bachelor's button
<i>Euchiton audax</i>	
<i>Euchiton collinus</i>	
<i>Euchiton delicatus</i>	
<i>Euchiton involucratus</i>	
<i>Euchiton limosus</i>	
<i>Euchiton sphaericus</i>	
<i>Lagenifera pumila</i>	papataniwhaniwha
<i>Pseudognaphalium luteoalbum</i> agg.	pukatea
<i>Raoulia glabra</i>	
<i>Senecio minimus</i>	

Dicot. herbs (other than composites)

<i>Acaena anserinifolia</i>	piripiri
<i>Callitriche muelleri</i>	
<i>Cardamine</i> sp. (<i>C. debilis</i> agg. "Long Style" of Pritchard 1957)	panapana
<i>Centella uniflora</i>	
<i>Dichondra</i> "large flower" (unnamed; aff. <i>D. brevifolia</i>)	
<i>Dichondra repens</i>	Mercury Bay weed
<i>Disphyma australe</i> subsp. <i>australe</i>	horokaka
<i>Drosera auriculata</i>	
<i>Drosera binata</i>	
<i>Drosera spatulata</i>	
<i>Elatostema rugosum</i>	parataniwha
<i>Epilobium alsinoides</i> s.s.	
<i>Epilobium atriplicifolium</i>	
<i>Epilobium billardioreanum</i> s.s.	
<i>Epilobium brunnescens</i> subsp. <i>minutiflorum</i>	
<i>Epilobium insulare</i>	
<i>Epilobium komaravianum</i>	
<i>Epilobium nerteroides</i>	
<i>Epilobium nummulariifolium</i>	
<i>Epilobium pallidiflorum</i>	tawarewa
<i>Epilobium pedunculare</i>	
<i>Epilobium pubens</i>	

<i>Epilobium rotundifolium</i>	
<i>Epilobium tenuipes</i> s.s.	
<i>Galium perpusillum</i>	
<i>Galium propinquum</i>	mawe
<i>Geranium potentilloides</i> var. <i>potentilloides</i>	
<i>Glossostigma elatinoides</i>	
<i>Gonocarpus aggregatus</i>	
<i>Gonocarpus incanus</i>	piripiri
<i>Gonocarpus micranthus</i> subsp. <i>micranthus</i>	
<i>Gratiola nana</i> (de Lange 1988)	
<i>Gratiola sexdentata</i>	
<i>Gunnera monoica</i>	
<i>Gunnera prorepens</i>	
<i>Haloragis erecta</i> subsp. <i>erecta</i>	toatoa
<i>Hydrocotyle dissecta</i>	
<i>Hydrocotyle elongata</i>	
<i>Hydrocotyle heteromeria</i>	
<i>Hydrocotyle microphylla</i>	
<i>Hydrocotyle moschata</i>	
<i>Hydrocotyle novae-zeelandiae</i>	
<i>Hydrocotyle pterocarpa</i>	
<i>Hypericum japonicum</i>	
<i>Hypericum</i> sp. (aff. <i>H. japonicum</i>)	
<i>Hypsela rivalis</i>	
<i>Lilaeopsis novae-zelandiae</i>	
<i>Lobelia anceps</i>	punakuru
<i>Montia fontana</i>	
<i>Myosotis forsteri</i>	
<i>Myriophyllum pedunculatum</i> subsp. <i>novae-zelandiae</i>	
<i>Myriophyllum propinquum</i>	
<i>Nertera ciliata</i>	
<i>Nertera depressa</i>	
<i>Nertera dichondrifolia</i>	
<i>Nertera scapanioides</i>	
<i>Nertera villosa</i>	
<i>Oxalis magellanica</i>	
<i>Oxalis rubens</i>	
<i>Parabebe catarractae</i> (de Lange 1988)	
<i>Pelargonium inodorum</i>	kopata

<i>Peperomia tetraphylla</i>	
<i>Peperomia urvilleana</i>	
<i>Persicaria decipiens</i>	tutunawai
<i>Plantago raoulii</i>	kopakopa
<i>Plantago triandra</i> var. <i>triandra</i>	
<i>Potentilla anserinoides</i>	kowai
<i>Pratia angulata</i>	panakenake
<i>Pratia perpusilla</i>	
<i>Ranunculus amphitrichus</i>	kawariki
<i>Ranunculus glabrifolius</i>	kawariki
<i>Ranunculus limosella</i>	
<i>Ranunculus reflexus</i>	maruru
<i>Rorippa divaricata</i>	
<i>Rorippa palustris</i>	
<i>Samolus repens</i>	makaokao
<i>Selliera microphylla</i>	
<i>Selliera radicans</i>	remuremu
<i>Sicyos australis</i>	
<i>Solanum americanum</i>	small-leaved nightshade
<i>Stellaria decipiens</i>	kohukohu
<i>Urtica incisa</i>	
<i>Viola cunninghamii</i>	
<i>Viola filicaulis</i>	
<i>Viola lyalli</i>	
<i>Wahlenbergia pygmaea</i> subsp. <i>pygmaea</i>	
<i>Wahlenbergia</i> sp.	

Appendix 4

CHECKLIST OF ADVENTIVE VASCULAR PLANTS IN OTANEWAINUKU ECOLOGICAL DISTRICT

(From current survey and Beadel 1991, 1993b, 1994a&b unless otherwise quoted.)

Gymnosperms

<i>Pinus patula</i>	patula pine
<i>Pinus pinaster</i>	maritime pine
<i>Pinus radiata</i>	radiata pine

Dicot. trees and shrubs

<i>Acacia dealbata</i>	silver wattle
<i>Acacia mearnsii</i>	black wattle
<i>Acacia melanoxylon</i>	Tasmanian blackwood
<i>Acacia verticillatum</i>	prickly Moses
<i>Berberis glaucocarpa</i>	barberry
<i>Buddleja davidii</i>	buddleia
<i>Chamaecytisus palmensis</i>	tree lucerne
<i>Cotoneaster glaucophyllus</i>	cotoneaster
<i>Crataegus monogyna</i>	hawthorn
<i>Cytisus scoparius</i>	broom
<i>Erica lusitanica</i>	Spanish heath
<i>Erythrina × sykesii</i>	coral tree
<i>Eucalyptus botryoides</i>	eucalyptus
<i>Hakea salicifolia</i>	willow-leaved hakea
<i>Hakea sericea</i>	prickly hakea
<i>Hydrangea macrophylla</i>	hydrangea
<i>Leycesteria formosa</i>	Himalayan honeysuckle
<i>Ligustrum sinense</i>	Chinese privet
<i>Lupinus arboreus</i>	lupin
<i>Lycium ferocissimum</i>	African boxthorn
<i>Malus × domestica</i>	apple tree
<i>Myoporum insulare</i>	Australian ngaio
<i>Paraserianthes lophantha</i>	brush wattle
<i>Paulownia tomentosa</i>	paulownia

<i>Populus alba</i> cv. "Nivea"	silver poplar
<i>Prunus persica</i>	peach tree, nectarine
<i>Rubus phoenicolasius</i>	Japanese wineberry
<i>Rubus</i> sp. (<i>R. fruticosus</i> agg.)	blackberry
<i>Salix cinerea</i>	grey willow
<i>Salix fragilis</i>	crack willow
<i>Senna multiglandulosa</i>	buttercup bush
<i>Solanum mauritianum</i>	woolly nightshade
<i>Tecomaria capensis</i>	Cape honeysuckle
<i>Teline monspessulana</i>	Montpellier broom
<i>Ulex europaeus</i>	gorse
Dicot. Lianes	
<i>Actinidia chinensis</i>	kiwifruit
<i>Celastrus orbiculatus</i>	climbing spindle berry
<i>Cobaea scandens</i>	cathedral bells
<i>Elaeagnus</i> x <i>reflexa</i>	elaeanthus
<i>Hedera helix</i>	ivy
<i>Lonicera japonica</i>	Japanese honeysuckle
<i>Senecio mikanioides</i>	German ivy
Lycopods	
<i>Sellaginella kraussiana</i>	creeping clubmoss
Grasses	
<i>Agrostis capillaris</i>	browntop
<i>Agrostis stolonifera</i>	creeping bent
<i>Aira caryophyllea</i>	silvery hairy grass
<i>Ammophila arenaria</i>	marram
<i>Anthoxanthum odoratum</i>	sweet vernal
<i>Axonopus fissifolius</i>	narrow-leaved carpet grass
<i>Bromus diandrus</i>	ripgut brome
<i>Bromus hordeaceus</i>	soft brome
<i>Cortaderia jubata</i>	pampas
<i>Cortaderia selloana</i>	pampas
<i>Dactylis glomerata</i>	cocksfoot
<i>Digitaria sanguinalis</i>	summer grass
<i>Elytrigia pycnantha</i>	sea couch
<i>Eragrostis brownii</i>	bay grass
<i>Festuca rubra</i> subsp. <i>rubra</i>	red fescue

<i>Glyceria fluitans</i>	floating sweetgrass
<i>Holcus lanatus</i>	Yorkshire fog
<i>Lagurus ovatus</i>	haretail
<i>Lolium perenne</i>	rye grass
<i>Miscanthus nepalensis</i>	Himalaya fairy grass
<i>Paspalum dilatatum</i>	paspalum
<i>Paspalum distichum</i>	Mercer grass
<i>Pennisetum clandestinum</i>	kikuyu grass
<i>Poa annua</i>	annual poa
<i>Poa pratensis</i>	Kentucky bluegrass
<i>Pseudosasa japonica</i>	bamboo
<i>Rytidosperma racemosum</i>	danthonia
<i>Schedonorus phoenix</i>	tall fescue
<i>Sporobolus africanus</i>	ratstail
<i>Stenotaphrum secundatum</i>	buffalo grass
<i>Vulpia bromoides</i>	vulpia hair grass

Sedges

<i>Carex demissa</i>	
<i>Carex divulsa</i>	grey sedge
<i>Carex lurida</i>	sallow sedge
<i>Carex ovalis</i>	oval sedge
<i>Cyperus brevifolius</i>	globe sedge
<i>Cyperus eragrostis</i>	umbrella sedge
<i>Isolepis marginata</i>	
<i>Isolepis sepulcralis</i>	
<i>Rhynchospora capitellata</i> (NZFRI 21536, E.M. Miller 1995)	

Rushes

<i>Juncus acuminatus</i>	sharp-fruited rush
<i>Juncus articulatus</i>	jointed rush
<i>Juncus bufonius</i>	toad rush
<i>Juncus bulbosus</i>	
<i>Juncus canadensis</i> (NZFRI 13307, M.C. Smale 1984)	
<i>Juncus conglomerata</i>	soft rush
<i>Juncus effusus</i>	soft rush
<i>Juncus microcephalus</i>	South American rush
<i>Juncus tenuis</i>	track rush

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

<i>Allium triquetrum</i>	three-cornered garlic
<i>Asparagus scandens</i>	climbing asparagus
<i>Crocosmia x crocosmiiflora</i>	montbretia
<i>Hedychium flavescens</i>	wild ginger
<i>Hedychium gardnerianum</i>	kahili ginger; wild ginger
<i>Tradescantia fluminensis</i>	tradescantia
<i>Zantedeschia aethiopica</i>	arum lily

Composite herbs

<i>Achillea millefolium</i>	yarrow
<i>Aster subulatus</i>	sea aster
<i>Bellis perennis</i>	daisy
<i>Bidens frondosa</i>	beggars' ticks
<i>Carduus nutans</i>	nodding thistle
<i>Carduus tenuiflorus</i>	winged thistle
<i>Cirsium arvense</i>	California thistle
<i>Cirsium vulgare</i>	Scotch thistle
<i>Conyza albida</i>	fleabane
<i>Crepis capillaris</i>	hawksbeard, hawksear
<i>Erigeron karvinskianus</i>	Mexican daisy
<i>Gamochaeta spicata</i>	cudweed
<i>Hypochoeris radicata</i>	catsear
<i>Leontodon taraxacoides</i>	hawkbit
<i>Leucanthemum vulgare</i>	oxeye daisy
<i>Mycelis muralis</i>	wall lettuce
<i>Senecio bipinnatisectus</i>	Australian fireweed
<i>Senecio elegans</i>	purple groundsel
<i>Senecio jacobaea</i>	ragwort
<i>Sonchus asper</i>	prickly puha, prickly sow thistle
<i>Sonchus oleraceus</i>	puha
<i>Taraxacum officinale</i>	dandelion

Dicot. herbs (other than composites)

<i>Acaena agnipila</i>	Australian sheep's burr, yarrow
<i>Acaena novae-zelandiae</i>	piripiri
<i>Acetosa acetosella</i>	sheep's sorrel
<i>Alternanthera sessilis</i>	

<i>Anagallis arvensis</i>	scarlet pimpernel
<i>Cakile maritima</i>	sea rocket
<i>Callitriche stagnalis</i>	starwort
<i>Cannabis sativa</i>	hemp, cannabis
<i>Carpobrotus edulis</i>	ice plant
<i>Centaureum erythraea</i>	centaury
<i>Cerastium arvense</i>	
<i>Cerastium fontanum</i> subsp. <i>triviale</i>	mouse-ear chickweed
<i>Cerastium glomeratum</i>	annual mouse-ear chickweed
<i>Cerastium holosteoides</i>	mouse-ear chickweed
<i>Cichorium intybus</i>	chicory
<i>Clinopodium vulgare</i>	
<i>Daucus carota</i>	wild carrot
<i>Digitalis purpurea</i>	foxglove
<i>Epilobium ciliatum</i>	tall willow herb
<i>Epilobium ciliatum</i> × <i>E. pallidiflorum</i>	
<i>Epilobium obscurum</i>	tall willow herb
<i>Euphorbia peplus</i>	milkweed
<i>Foeniculum vulgare</i>	fennel
<i>Fragaria vesca</i>	wild strawberry
<i>Fumaria muralis</i>	scrambling fumitory
<i>Galium aparine</i>	cleavers, bedstraw
<i>Galium palustre</i>	marsh bedstraw
<i>Geranium molle</i>	dove's foot
<i>Geranium robertianum</i>	herb Robert
<i>Linum bienne</i>	
<i>Lotus pedunculatus</i>	lotus
<i>Ludwigia palustris</i>	water purslane
<i>Lycopus europeus</i>	gypsy wort
<i>Lythrum hyssopifolia</i>	hyssop loosestrife
<i>Lythrum portula</i>	
<i>Madia sativa</i> (Irving & Skinner 1985)	Chilean tarweed
<i>Malva neglecta</i>	dwarf mallow
<i>Malva parviflora</i>	mallow
<i>Mentha pulegium</i>	penny royal
<i>Myosotis arvensis</i>	forget-me-not
<i>Myosotis laxa</i> var. <i>caespitosa</i>	forget-me-not

<i>Orobanche minor</i>	broomrape
<i>Oxalis pes-caprae</i>	Bermuda buttercup
<i>Parentucellia viscosa</i>	tarweed
<i>Persicaria hydropiper</i>	water pepper
<i>Persicaria persicaria</i>	willow weed
<i>Physalis peruviana</i>	cape gooseberry
<i>Phytolacca octandra</i>	inkweed
<i>Plantago australis</i>	swamp plantain
<i>Plantago lanceolata</i>	narrow-leaved plantain
<i>Potentilla anglica</i>	trailing cinquefoil
<i>Prunella vulgaris</i>	selfheal
<i>Ranunculus flammula</i>	spearwort
<i>Ranunculus repens</i>	creeping buttercup
<i>Raphanus raphanistrum</i> subsp. <i>raphanistrum</i>	wild raddish
<i>Raphanus sativa</i>	
<i>Rorippa nasturtium-aquaticum</i>	watercress
<i>Rumex obtusifolius</i>	dock
<i>Sagina procumbens</i>	pearlwort
<i>Scrophularia auriculata</i>	water betony
<i>Sigesbeckia orientalis</i> (Creswell 1975)	
<i>Silene gallica</i>	catchfly
<i>Solanum nigrum</i>	black nightshade
<i>Solanum pseudocapsicum</i>	Jerusalem cherry
<i>Stellaria media</i>	chickweed
<i>Trifolium dubium</i>	suckling clover
<i>Trifolium pratense</i>	red clover
<i>Trifolium repens</i>	white clover
<i>Tropaeolum majus</i>	garden nasturtium
<i>Verbascum thapsus</i>	woolly mullein
<i>Verbena bonariensis</i>	purple-top
<i>Veronica arvensis</i>	field speedwell
<i>Veronica serpyllifolia</i>	turf speedwell

Appendix 5

CHECKLIST OF WILDLIFE SPECIES IN OTANEWAINUKU ECOLOGICAL DISTRICT

Information from Fauna Survey Unit unpublished; Department of Conservation 1993a; Beadel 1994b, Mayhill 1994; Bull *et al.* 1985; Pickard and Towns 1988; Department of Conservation Biosite Database; Department of Conservation unpubl. records; K. Owen and A. Garrick pers. comm.

(i) Mammals

Native

Chalinolobus tuberculatus North Island long-tailed bat

Mystacina tuberculata rhyacobia Central short-tailed bat

Introduced (feral)

Bos taurus feral cattle

Capra hircus feral goat

Cervus elaphus scoticus red deer

Dama dama dama fallow deer

Erinaceus europaeus occidentalis European hedgehog

Felis catus house cat

Lepus europaeus occidentalis brown hare

Macropus eugenii dama wallaby

Mus musculus house mouse

Mustela erminea stoat

Mustela nivalis vulgaris weasel

Mustela putorius furo ferret

Oryctolagus cuniculus cuniculus European rabbit

Rattus norvegicus Norway rat

Rattus rattus ship rat

Sus scrofa feral pig

Trichosurus vulpecula brushtail possum

(ii) Birds

Native

Acanthisitta chloris granti North Island rifleman; titipounamu

*Anas gracilis*¹ grey teal; tete

1. Species which may occur in the district but whose presence has not been confirmed.

<i>Anas rybnchotis variegata</i>	New Zealand shoveler: kuruwhengi
<i>Anas superciliosa superciliosa</i>	grey duck; parera
<i>Anthornis melanura melanura</i>	bellbird; korimako; makomako
<i>Anthus novaeseelandiae novaeseelandiae</i>	New Zealand pipit; pihoihoi
<i>Apteryx australis mantelli</i>	North Island brown kiwi
<i>Ardea novaehollandiae novaehollandiae</i>	white-faced heron
<i>Aythya novaeseelandiae</i>	New Zealand scaup; papango
<i>Botaurus stellaris poiciloptilus</i> ²	Australasian bittern; matuku
<i>Bowdleria punctata vealeae</i>	North Island fernbird; matata
<i>Callaeas cinerea wilsoni</i>	North Island kokako
<i>Charadrius bicinctus bicinctus</i>	banded dotterel; tuturiwhatu
<i>Charadrius obscurus aquilonius</i>	northern New Zealand dotterel; tuturiwhatu
<i>Chrysococcyx lucidus lucidus</i>	shining cuckoo; pipiwharauauroa
<i>Circus approximans</i>	Australasian harrier; kahu
<i>Cyanoramphus auriceps auriceps</i> ¹	yellow-crowned parakeet; kakariki
<i>Eudynamys taitensis</i>	long-tailed cuckoo; koekoea
<i>Falco novaeseelandiae</i>	New Zealand falcon; karearea
<i>Gerygone igata</i>	grey warbler; riroriro
<i>Haematopus unicolor</i>	variable oystercatcher; torea; toreapango
<i>Halcyon sancta vagans</i>	New Zealand kingfisher; kotare
<i>Himantopus himantopus leucocephalus</i>	Australasian pied stilt; poaka
<i>Hemiphaga novaeseelandiae novaeseelandiae</i>	New Zealand pigeon; Kereru
<i>Hirundo tabitica neoxena</i>	welcome swallow
<i>Hymenolaimus malacorhynchos</i>	blue duck; whio
<i>Larus dominicanus dominicanus</i>	southern black-backed gull; karoro
<i>Larus novaehollandiae scopulinus</i>	red-billed gull; tarapunga
<i>Moboua albicilla</i>	whitehead; popokatea
<i>Nestor meridionalis septentrionalis</i>	North Island kaka
<i>Ninox novaeseelandiae novaeseelandiae</i>	morepork; ruru
<i>Petroica australis longipes</i>	North Island robin; toutouwai
<i>Petroica macrocephala toitoi</i>	North Island tomtit; miromiro
<i>Phalacrocorax melanoleucos brevirostris</i>	little shag; kawaupaka

1. Species which may occur in the district but whose presence has not been confirmed.

2. Species likely to have occurred in the district in the past and which may still occur locally but whose presence has not been confirmed.

<i>Phalacrocorax carbo novaehollandiae</i>	black shag; kawau
<i>Phalacrocorax sulcirostris</i>	little black shag
<i>Phalacrocorax varius varius</i>	pied shag; karuhiruhi
<i>Poliiocephalis rufopectus</i>	New Zealand dabchick; weweia
<i>Porphyrio porphyrio melanotus</i>	pukeko
<i>Porzana tabuensis plumbea</i> ¹	spotless crane; paweto
<i>Prosthemadera novaeseelandiae</i> <i>novaeseelandiae</i>	tui
<i>Rallus philippensis</i> ¹	banded rail; moho- pereru
<i>Rhipidura fuliginosa placabilis</i>	North Island fantail; piwakawaka
<i>Sterna caspia</i> ¹	Caspian tern; taranui
<i>Sterna striata</i>	white-fronted tern; tara
<i>Tadorna variegata</i>	paradise shelduck; putangitangi
<i>Vanellus miles novaehollandiae</i>	spur-winged plover
<i>Zosterops lateralis lateralis</i>	silvereeye; tauhou
Introduced	
<i>Acridotheres tristis</i>	common myna
<i>Alauda arvensis</i>	skylark
<i>Anas platyrhynchos platyrhynchos</i>	mallard
<i>Branta canadensis maxima</i>	Canada goose
<i>Callipepla californica brunnescens</i>	California quail
<i>Carduelis carduelis</i>	goldfinch
<i>Carduelis chloris</i>	greenfinch
<i>Carduelis flammea</i>	redpoll
<i>Cygnus atratus</i>	black swan
<i>Emberiza citrinella</i>	yellowhammer
<i>Fringilla coelebs</i>	chaffinch
<i>Gymnorhina tibicen hypoleuca</i>	white-backed magpie
<i>Meleagris gallopavo</i>	wild turkey
<i>Passer domesticus</i>	house sparrow
<i>Phasianus colchicus</i>	ring-necked pheasant
<i>Platycercus eximius</i>	eastern rosella
<i>Prunella modularis</i>	hedge sparrow (dunnock)
<i>Sturnus vulgaris</i>	starling
<i>Synoicus ypsiloborus</i>	brown quail
<i>Turdus merula</i>	blackbird
<i>Turdus philomelos</i>	song thrush

1. Species which may occur in the district but whose presence has not been confirmed.

(iii) Reptiles

Native

<i>Cyclodina aenea</i>	copper skink
<i>Hoplodactylus granulatus</i>	forest gecko
<i>Hoplodactylus maculatus</i>	common gecko
<i>Oligosoma striatum</i>	striped skink
<i>Naultinus elegans elegans</i>	green gecko

Introduced

<i>Lampropholis delicata</i>	rainbow skink
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(iv) Amphibians

Native

<i>Leiopelma hochstetteri</i>	Hochstetter's frog
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Introduced

<i>Litoria aurea</i>	golden bell frog
<i>Litoria raniformis</i>	southern bell frog

(v) Fish (Gavin Williamson, Department of Conservation pers. comm.)

Native

<i>Anguilla australis</i>	shortfinned eel
<i>Anguilla dieffenbachii</i>	longfinned eel
<i>Cheimarrichthys fosteri</i>	torrentfish
<i>Galaxias argenteus</i>	giant kokopu
<i>Galaxias brevipinnis</i>	koaro
<i>Galaxias fasciatus</i>	banded kokopu
<i>Galaxias maculatus</i>	inanga
<i>Galaxias postvectis</i>	shortjaw kokopu
<i>Geotria australis</i>	lamprey
<i>Gobiomorphus basalis</i>	crans bully
<i>Gobiomorphus cotidianus</i>	common bully
<i>Gobiomorphus gobioides</i>	giant bully
<i>Gobiomorphus hubbsi</i>	bluegilled bully
<i>Gobiomorphus buttoni</i>	redfinned bully
<i>Retropinna retropinna</i>	common smelt

Introduced

<i>Carassius auratus</i>	goldfish
<i>Gambusia affinis</i>	mosquitofish
<i>Oncorhynchus mykiss</i>	rainbow trout
<i>Salmo trutta</i>	brown trout

Scardinius erythrophthalmus rudd
Tinca tinca tench

(vi) Snails (P. Mayhill pers. comm.)

Allodiscus dimorphus
Allodiscus granum
Allodiscus miranda
Allodiscus planulatus
Allodiscus tessellatus
Allodiscus tullia
Allodiscus urquharti
Archiobanella sp.
Austroiotula sp.¹
Cavellia anguicula
Cavellia buccinella
Cavellia colensoi
Cavellia irregularis
Cavellia reeftonensis
Cavellia roseveari
Charopa coma
Chaureopa depressa
Chaureopa subdepressa
Cionella lubrica
Cytora cytora
Cytora fasciata
Cytora bedleyi
Cytora torquilla
Delos coresia
Delos sp.¹
Delos jeffreysiana
Dorilaoma ariel
Fectola infecta
Fectola mira
Flammulina chiron
Flammocharopa costulata
Flammulina sp.¹
Flammulina crebriflammis
Flammocharopa feredayi

1. Recognised as separate entities but given informal names only in Mayhill (1994).

Flammulina perditia
Flammulina zebra
Geminoropa cookianum
Geminoropa buttoni
Geminoropa moussoni
Geminoropa subantialba
Haurakora sp.¹
Huonodon bectori
Huonodon pseudoleioda
Hydrocena purchasi
Iotula sp.¹
Iotula allochroida
Iotula sericata
Iotula sp.¹
Kokopapa sp.¹
Laoma conicula
Laoma domus
Laoma mariae
Laoma marina
Liarea egea
Liarea hochstetteri
Litopunctum sp.
Mocella eta
Mocella cf *manawataubia*
Mocella northern maculata
Mocella prestoni
Mocella segregata
Otoconcha dimidiata
Oxychilus cellarius
Paracharopa bianca
Paracharopa chrysaugia
Paracharopa fuscosa
Paracharopa titirangiensis
Paryphanta busbyi
Pasmaditta miserabilis
Phenacharopa pseudanguicula
Phenacobelix giveni

1. Recognised as separate entities but given informal names only in Mayhill (1994).

Pbenacobelix sp.¹
Pbenacobelix ponsonbyi
Pbrixgnathus brunneus
Pbrixgnathus erigone
Pseudegestula goulstonei
Pseudegestula montivaga
Punctum caputspinulae
Punctum conella
Punctum elaiodes
Punctum lateumbilicata
Punctum minuta
Punctum sp.¹
Punctum pirongiaensis
Punctum serratocostata
Rengakora sp.¹
Rengakora rimutaka
Rhytida greenwoodi
Robapapa sp.¹
Roscoeia sp.¹
Schizoglossa novoseelandica
Serpbo kivi
Sinploya parva
Sinploya pilsbryi
Suteria ide
Taguabelix campbellica
Taguabelix pseudelaiodes
Taguabelix viridula
Thalassobelix ziczag
Therasia traversi
Therasia zelandiae
Therasiella celinde
Therasiella neozelanica
Therasiella sp.
Therasiella serrata
Therasiella tamora
Tornatellides novoseelandica
Tubuaia novoseelandica

1. Recognised as separate entities but given informal names only in Mayhill (1994).

Appendix 6

CONSERVATION STATUS OF TAXA IN OTANEWAINUKU ECOLOGICAL DISTRICT

WILDLIFE

Mammals (status from Hitchmough 2002)

Acutely Threatened, Nationally Vulnerable

Chalinolobus tuberculatus North Island long-tailed bat

At Risk, Range Restricted

Mystacina tuberculata rhyacobia Central short-tailed bat

Birds (status from Hitchmough 2002)

Acutely Threatened, Nationally Endangered

*Botaurus stellaris poiciloptilus*¹ Australasian bittern

Callaeas cinerea wilsoni North Island kokako

Hymenolaimus malacorhynchos whio, blue duck

Nestor meridionalis septentrionalis North Island kaka

Acutely Threatened, Nationally Vulnerable

Falco novaeseelandiae New Zealand falcon

*Sterna caspia*¹ Caspian tern

Chronically Threatened, Serious Decline

Apteryx australis mantelli North Island brown kiwi

Chronically Threatened, Gradual Decline

Cyanoramphus auriceps auriceps yellow-crowned kakariki

Hemiphaga novaeseelandiae kereru; New Zealand pigeon

Eudynamis taitensis long-tailed cuckoo

Charadrius bicinctus bicinctus banded dotterel

At Risk, Sparse

Bowdleria punctata vealeae North Island fernbird

Charadrius obscurus acqilonius northern New Zealand dotterel

Phalacrocorax sulcirostris little black shag

Poliocephalus rufopectus New Zealand dabchick

1. Species likely to have occurred in the district in the past and which may still occur locally but whose presence has not been confirmed.

<i>Porzana pusilla</i> ssp. <i>affinis</i> ¹	marsh crake
<i>Porzana tabuensis</i> ssp. <i>plumbea</i>	spotless crake
<i>Rallus philippensis</i> ¹	banded rail

Reptiles (status from Hitchmough 2002)

Data Deficient

<i>Oligosoma striatum</i>	striped skink
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Amphibians (status from Hitchmough 2002)

At Risk, Sparse

<i>Leiopelma hochstetteri</i>	Hochstetter's frog
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Fish (status from Hitchmough 2002)

Chronically Threatened, Gradual Decline

<i>Galaxias argenteus</i>	giant kokopu
<i>Galaxias postvectis</i>	shortjaw kokopu

At Risk, Sparse

<i>Geotria australis</i>	lamprey
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PLANTS (status from de Lange *et al.* 2004)

Acutely Threatened, Nationally Critical

<i>Sicyos australis</i>	mawhai, native cucumber
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Acutely Threatened, Nationally Endangered

<i>Olearia pachyphylla</i> ²	
<i>Rorippa divaricata</i>	matangoa, New Zealand cress

Chronically Threatened, Serious Decline

<i>Brachyglottis kirkii</i> var. <i>kirkii</i>	Kirk's daisy, kohurangi
<i>Dactylanthus taylorii</i>	pua o te reinga
<i>Marattia salicina</i>	para, kingfern
<i>Pimelea tomentosa</i>	
<i>Pittosporum kirkii</i>	thick-leaved kohuhu
<i>Pterostylis paludosa</i>	green hooded orchid

1. Species likely to have occurred in the district in the past and which may still occur locally but whose presence has not been confirmed.

2. Doubtful record. There are old records of this species from the ecological district (P. de Lange pers. comm.).

Chronically Threatened, Gradual Decline

<i>Austrofestuca littoralis</i>	hinarepe, sand tussock
<i>Desmoschoenus spiralis</i>	pingao
<i>Mida salicifolia</i>	mida
<i>Olearia cheesemanii</i>	
<i>Peraxilla tetrapetala</i>	pirirangi, red mistletoe
<i>Raukawa edgerleyi</i>	raukawa
<i>Tupeia antarctica</i>	pirita, green mistletoe

At Risk, Sparse

<i>Corunastylis pumila</i>	leek orchid
<i>Corunastylis nuda</i>	leek orchid
<i>Hymenophyllum</i> aff. <i>flexuosum</i> (AK17730; Mt Burnett)	mauku, filmy fern
<i>Hymenophyllum atrovirens</i>	mauku, filmy fern
<i>Lindsaea viridis</i>	fern
<i>Microsorium novae-zelandiae</i>	fragrant fern
<i>Peperomia tetraphylla</i>	
<i>Schizaea dichotoma</i>	
<i>Tetragonia tetragonioides</i>	

At Risk, Range Restricted

<i>Kunzea ericoides</i> var. <i>microflora</i>	prostrate kanuka
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Appendix 7

COMMON PLANT NAMES USED IN THE TEXT

akeake	<i>Dodonea viscosa</i>
akepiro	<i>Olearia furfuracea</i>
arrow grass	<i>Triglochin striata</i>
bachelor's button	<i>Cotula coronopifolia</i>
black beech	<i>Nothofagus solandri</i> var. <i>solandri</i>
bracken	<i>Pteridium esculentum</i>
buddleia	<i>Buddleja davidii</i>
burr reed	<i>Sparganium subglobosum</i>
catsear	<i>Hypochoeris radicata</i>
eucalyptus	<i>Eucalyptus botryoides</i>
gorse	<i>Ulex europaeus</i>
grey willow	<i>Salix cinerea</i>
Hall's totara	<i>Podocarpus hallii</i>
hangehange	<i>Geniostoma rupestre</i> var. <i>ligustrifolium</i>
harakeke	<i>Phormium tenax</i>
hard beech	<i>Nothofagus truncata</i>
harestalk	<i>Lagarus ovatus</i>
heketara	<i>Olearia rani</i>
hinarepe	sand tussock; <i>Austrofestuca littoralis</i>
hinau	<i>Elaeocarpus dentatus</i>
horoeaka	lancewood; <i>Pseudopanax crassifolius</i>
houpara	<i>Pseudopanax lessonii</i>
hukihuki	<i>Coprosma tenuicaulis</i>
hupiro	<i>Coprosma foetidissima</i>
kahikatea	<i>Dacrycarpus dacrydioides</i>
kaikawaka	<i>Libocedrus bidwillii</i>
kamaha	<i>Weinmannia racemosa</i>
kamu	<i>Uncinia uncinata</i>
kanono	<i>Coprosma grandifolia</i>
kanuka	<i>Kunzea ericoides</i> var. <i>ericoides</i>
karaka	<i>Corynocarpus laevigatus</i>
karamu	<i>Coprosma robusta</i>

kareao	<i>Ripogonum scandens</i>
karetu	<i>Hierochloa redolens</i>
kauri	<i>Agathis australis</i>
kawakawa	<i>Macropiper excelsum</i> var. <i>excelsum</i>
kiekie	<i>Freycinetia baueriana</i> subsp. <i>banksii</i>
kiokio	<i>Blechnum novae-zelandiae</i>
kiwikiwi	<i>Blechnum fluviatile</i>
kohekohe	<i>Dysoxylum spectabile</i>
kohuhu	<i>Pittosporum tenuifolium</i> subsp. <i>tenuifolium</i>
koromiko	<i>Hebe stricta</i> var. <i>stricta</i> and <i>Hebe corriganii</i>
kotukutuku	<i>Fuchsia excorticata</i>
kowaowao	<i>Microsorium pustulatum</i>
lotus	<i>Lotus pedunculatus</i>
lowland ribbonwood	<i>Plagianthus regius</i>
lupin	<i>Lupinus arboreus</i>
mahoe	<i>Melicytus ramiflorus</i> subsp. <i>ramiflorus</i>
mahoe wao	<i>Melicytus lanceolatus</i>
maire tawake	swamp maire; <i>Syzygium maire</i>
maire taiki	mida; <i>Mida salicifolia</i>
mairehau	<i>Leionema nudum</i>
makomako	<i>Aristotelia serrata</i>
mamaku	<i>Cyathea medullaris</i>
mangeao	<i>Litsea calicaris</i>
mangemange	<i>Lygodium articulatum</i>
manuka	<i>Leptospermum scoparium</i>
mapou	<i>Myrsine australis</i>
maritime pine	<i>Pinus pinaster</i>
marram	<i>Ammophila arenaria</i>
marsh ribbonwood	<i>Plagianthus divaricatus</i>
matai	<i>Prumnopitys taxifolia</i>
matau	hooked sedges; <i>Uncinia</i> spp.
mida	<i>Mida salicifolia</i>
mihimihi	toro; <i>Toronia toru</i>
mingimingi	<i>Leucopogon fasciculatus</i>
miro	<i>Prumnopitys ferruginea</i>
monoao	<i>Dracophyllum subulatum</i>
mouku	<i>Asplenium bulbiferum</i> s.s.

neinei	<i>Dracophyllum latifolium</i>
ngaio	<i>Myoporum laetum</i>
nikau	<i>Rhopalostylis sapida</i>
northern rata	<i>Metrosideros robusta</i>
oioi	<i>Apodasmia similis</i>
pakau	<i>Pneumatopteris pennigera</i>
pampas	<i>Cortaderia selloana</i>
pate	<i>Schefflera digitata</i>
pinus	<i>Pinus radiata, P. pinaster</i>
pingao	<i>Desmoschoenus spiralis</i>
piupiu	crown fern; <i>Blechnum discolor</i>
pohutukawa	<i>Metrosideros excelsa</i>
ponga	silver fern; <i>Cyathea dealbata</i>
prickly hakea	<i>Hakea sericea</i>
prickly mingimingi	<i>Leptecophylla juniperina</i> subsp. <i>juniperina</i>
prostrate kanuka	<i>Kunzea ericoides</i> var. <i>microflora</i>
puakarimu	<i>Lycopodium deuterodensum</i>
puka	broadleaf; <i>Griselinia littoralis</i>
pukatea	<i>Laurelia novae-zelandiae</i>
punui	<i>Cyathea cunninghamii</i>
puriri	<i>Vitex lucens</i>
putaputaweta	<i>Carpodetus serratus</i>
rangiora	<i>Brachyglottis repanda</i>
bracken	bracken; <i>Pteridium esculentum</i>
raupo	<i>Typha orientalis</i>
red beech	<i>Nothofagus fusca</i>
rereti	<i>Blechnum chambersii</i>
rewarewa	<i>Knightia excelsa</i>
rimu	<i>Dacrydium cupressinum</i>
sea couch	<i>Elytrigia pycnantha</i>
searush	<i>Juncus kraussii</i> subsp. <i>australiensis</i>
silver beech	<i>Nothofagus menziesii</i>
Spanish heath	<i>Erica lusitanica</i>
sphagnum	<i>Sphagnum cristatum</i>
spike sedge	<i>Eleocharis acuta</i>
spinifex	<i>Spinifex sericeus</i>
swamp coprosma	<i>Coprosma tenuicaulis</i>

swamp kiokio	<i>Blechnum minus</i>
swamp millet	<i>Isachne globosa</i>
tanekaha	<i>Phyllocladus trichomanoides</i>
taumingi	<i>Leptecophylla juniperina</i> subsp. <i>juniperina</i>
taupata	<i>Coprosma repens</i>
taurepo	<i>Rhabdothamnus solandri</i>
tawa	<i>Beilschmiedia tawa</i>
tawari	<i>Ixerba brexioides</i>
tawheowheo	<i>Quintinia serrata</i> (incl. <i>Q. acutifolia</i> and <i>Q. elliptica</i>)
ti kouka	<i>Cordyline australis</i>
titoki	<i>Alectryon excelsus</i>
ti ngahere	<i>Cordyline banksii</i>
toatoa	<i>Phyllocladus toatoa</i>
toetoe	<i>Cortaderia fulvida</i>
toro	<i>Myrsine salicina</i>
toropapa	<i>Alseuosmia macrophylla</i>
toru	<i>Toronia toru</i>
totara	<i>Podocarpus totara</i>
totorowhiti	<i>Dracophyllum strictum</i>
tuhara	<i>Machaerina sinclairii</i>
turutu	<i>Dianella nigra</i>
tutu	<i>Coriaria arborea</i>
waewae kaka	<i>Gleichenia microphylla</i>
tupari maunga	<i>Gabnia xanthocarpa</i>
water purslane	<i>Ludwigia palustris</i>
wharariki	<i>Phormium cookianum</i>
whau	<i>Entelea arborescens</i>
whauwhaupaku	<i>Pseudopanax arboreus</i>
wheki ponga	<i>Dicksonia fibrosa</i>
wheki	<i>Dicksonia squarrosa</i>
wild strawberry	<i>Fragaria vesca</i>
willow-leaved hakea	<i>Hakea salicifolia</i>
Yorkshire fog	<i>Holcus lanatus</i>

Appendix 8

GLOSSARY OF TECHNICAL TERMS

Adventive: Arriving from outside; in contrast to native.

Alluvial Flat: Refer to Landform.

Alluvial Terrace: Refer to Landform.

Basin: Refer to Landform.

Bioclimatic Zone: The broad distribution of vegetational zones along altitudinal gradients, where, a particular climatic regime dictates the character of the natural ecosystem. See section on bioclimatic zones in text.

For example: Coastal zone, semi-coastal zone, lowland zone, submontane zone.

Buffer: A zone surrounding a natural area, which reduces the effect of external influences upon the features within the natural area, for example: vegetation such as modified forest/scrub or a stream.

Buffering: Refer to Recommended Area for Protection Selection Criteria.

Canopy: The layer or layers formed by the uppermost crowns or their parts. The concept is applicable to any kind of vegetation. In forests it includes lianes and epiphytes.

Cliff: Refer to Landform.

Coastal Zone: Refer to Bioclimatic Zone.

Communities: A collection of populations of animals, and plants, that occur naturally together in a common environment of any size.

Conservation Value: The relative merit of a natural feature within a regional or national context (for example: within an ecological region or ecological district).

Crown fires: Crown fires are fires, which have swept across the canopy and killed previous emergent trees and some canopy trees, resulting in a mosaic effect.

Diversity: The range of the natural physical and biotic components in the landscape, including species, communities, ecosystems, landforms, soil sequences, and dynamic systems and processes.

Dune Hollow: Depression or low area between dunes, may have groundwater at surface (refer to Landform section).

Ecological Character: The distinguishing features of a particular place, definable in terms of biotic composition, climatic, edaphic and topographical factors.

Ecological Class: A category which describes the broad ecological patterns within an ecological district in terms of bioclimatic zone, hydrological class, vegetation structural class, and land system. For example: a coastal palustrine reedland on uplifted marine terrace.

Ecological District: A local part of New Zealand where geological, topographical, climatic and biological features and processes, including the broad cultural pattern, interrelate to produce a characteristic landscape and range of biological communities. New Zealand has been subdivided into 268 such districts, setting the level for assessing the representativeness of major ecosystem types in the national network of Protected Natural Areas.

Ecological Region: A group of adjacent ecological districts with closely related ecological characteristics, or, in some cases, a single very distinctive ecological district. New Zealand has been subdivided into 85 such regions.

Ecological Unit: The ecological unit is the linking, in tandem, of a natural community type (usually a vegetation type) and a physical environment type (usually a landform type) (Myers *et al.* 1987). For example, mountain beech forest on colluvial mountain sideslopes or red tussockland on moraine.

Endangered: Refer to rarity.

Endemic: Occurring naturally in, and restricted to, a particular country, region or locality. Refer to Indigenous.

Estuarine: Refer to Hydrological Class.

Exotic: Introduced from abroad.

Fernland: Refer to Vegetation Structural Class.

Foredune: Refer to Landform.

Forest: Refer to Vegetation Structural Class.

Gorge: Refer to Landform.

Grass/Sedge/Rushland: Refer to Vegetation Structural Class.

Gully: Refer to Landform.

Habitat: The part of the environment in which a plant or animal lives. An organism usually has adaptations, which allow it to live in that particular part of the environment, and it may be more or less restricted to that habitat.

Herbfield: Refer to Vegetation Structural Class.

Hillslope: Refer to Landform.

Hydrologic Class: One of five descriptive categories used in classifying the influence of water on the character of the biotic elements. If water is not a significant influence, a site is considered terrestrial. On sites where water is a major

feature, the characteristics of the soils and biota will be strongly influenced by the nature of the water body (for example: palustrine, lacustrine, estuarine) and its nutrient content.

Terrestrial: Free water has an insignificant role in the ecological character of these areas.

Estuarine: Tidal and non-tidal saline wetlands associated with a coastal body of water with a free connection to the open sea, and where fresh water, derived from land drainage (usually rivers) is mixed with sea water.

Palustrine: A wetland community/environment characterised by emergent vegetation, which may, or may not, have freestanding water present.

Lacustrine: A lake community /environment lacking persistent emergent vegetation.

Riverine: A system of flowing freshwater.

Indigenous: Native to, occurring naturally in, and characteristic of a particular country, region or locality. All the indigenous features of New Zealand give it its own distinctive character.

Induced: Native vegetation established after destruction or disturbance of the previous cover, and which may dominate for many decades, but is essentially different from the original vegetation, for example: raupo reedland, manuka scrub.

Lacustrine: See Hydrologic Class.

Landform: All the physical, recognisable, naturally formed features of land, having a characteristic shape, for example: hill, valley or alluvial fan. In the PNA Programme, classification of a landform emphasises its ecological significance rather than its geomorphological or geological significance. Landform Definitions-after Soons and Selby (1982), Bayfield and Benson (1986) and interpretation by the author.

Alluvial Flat: Flat area associated with river, over which the river course is unconfined; wetlands frequent.

Alluvial Terrace: Flat to gently sloping area of alluvium of variable height above river level. May be periodically flooded.

Basin: Concave to almost flat area on hillside; may be the site of water accumulation.

Cliff: Very steeply sloping to vertical rock face at inland locations.

Dune Hollow: Low concave area or depression between dunes, may have groundwater at surface.

Foredune: A coastal dune parallel to the shoreline at the landward margin of the beach.

Gorge: A steep-sided narrow drainage-way cut into bedrock.

Gully: Deep incision into hillslope due to fluvial action.

Hillslope: Slope unit on which drainage lines are predominantly parallel.

Rear Dune: A coastal dune parallel to the shoreline landward of the foredune.

Ridge: The top (often acute angled) of a divide between two drainage ways.

Seepage Swamp: Swamp zone on hillside.

Land System: An area throughout which there is a general coherence and unity of physical and biological attributes.

Local: Refer to rarity.

Lowland Zone: See Bioclimatic Zone.

Native: Not known to have been introduced by human agency.

Natural Area: A place characterised by indigenous species or ecosystems, or a place or landform not or scarcely modified from an indigenous condition.

Some natural areas will be identified as suitable for evaluation of ecological quality and representativeness, and hence also be study areas. Some of these may be of sufficient quality to become Recommended Areas for Protection. In some instances one natural area may embrace more than one study area.

or:

A tract of land which supports vegetation and landforms considered to be in a predominantly natural state; identified as a suitable unit for evaluation of ecological quality and representativeness and has potential to be recommended for protection.

Natural Diversity: Refer to Recommended Area for Protection Selection Criteria.

Naturalness: Degree to which, ecological units/communities/ ecosystems retain their original character. Refer to Original Natural Ecosystem.

Also refer to Recommended Area for Protection Selection Criteria.

Nature Conservation Value: A relative value assessment for nature conservation purposes based on scientific criteria derived from ecological, and biogeographical theory (diversity, naturalness, rarity etc) and on the social value placed on those criteria.

Original Natural Ecosystem: Original natural landscape—the original state of an ecosystem and the landscape is that which prevailed before the arrival of humans in New Zealand with their domesticated and commensal animals and plants. A major objective of most nature conservation strategies in New Zealand is to protect indigenous ecosystems and landscapes that most closely approximate this state. In Otanewainuku Ecological District it applies to areas where the landscape has remained in, returned to, or is returning to its probable original state (i.e. mature or steady-state forest) of the pre-Polynesian period.

Palustrine: See Hydrologic Class.

Pattern: Refer to Recommended Area for Protection Selection Criteria.

Primary: Native vegetation which has never been logged or cleared.

Protected Natural Area (PNA): A legally protected area, characterised by indigenous species or ecosystems, in which the principal purpose of management is retention of the indigenous state.

Rare: Refer to Recommended Area for Protection Selection Criteria.

Rarity: Refer to Recommended Area for Protection Selection Criteria.

Rear Dune: Refer to Landform.

Recommended Area for Protection (RAP): An area identified as priority for protection because it is one of the best remaining natural areas in an ecological district. A RAP is intended to be the basis of a proposal for a new protected natural area.

Recommended Area for Protection Selection Criteria: Seven selection criteria are used for identifying Recommended Areas for Protection in the PNA Programme: representativeness; diversity and pattern; rarity and special features; naturalness; long-term ecological viability; size and shape; buffering and surrounding landscape.

Representative: The extent to which an area represents or exemplifies the components of the natural diversity of a larger reference area, for example: representation in reserves of the current natural diversity of an ecological district, or representation of the original natural landscape.

The identification and evaluation of the key representative natural areas in all ecological districts is the principal objective of the PNA Programme.

Natural Diversity: Natural diversity refers to the range of the natural physical and biotic components in the landscape including species, plant and animal communities, ecosystems, landforms, soil sequences, and dynamic systems and processes.

Pattern: An ecological term describing the arrangement of species, communities and habitats according to spatial and environmental gradients.

Rarity: A measure of the paucity of numbers or occurrences of elements of natural diversity (for example: species, communities).

Naturalness: Involves the assessment of the degree which an area (for example: vegetation ecosystem) has been free from the effects of human disturbance and intervention. It is also an assessment of the indigenous content of the area.

Viability: The ability of an area's plant communities (or in some cases a particular species) to maintain themselves in the long term, in the absence of any special effort to perpetuate them. Regeneration and vigour of a particular species, and the size and stability of communities are important factors for evaluation.

Size and Shape: Larger areas with "compact shape" are generally inherently more viable and better for the protection of the features present.

Buffering: Protection of an area (or a particular community) from outside modifying influences, given by natural features (catchment boundaries, rock barriers, surrounding vegetation) or, in some cases, fences or other artificial structures.

Surrounding Landscape: The land which surrounds and influences a particular natural area.

Site: An area of land surface for which a specific statement can be made of aspect, slope, exposure, ground water, underlying geological material and vegetation. The size of a site may vary quite widely depending on the degree of uniformity required for sampling.

Reedland: Refer to Vegetation Structural Class.

Representative: Refer to Recommended Area for Protection Selection Criteria.

Ridge: Refer to Landform.

Riverine: Refer to Hydrologic Class.

Sandfield: Refer to Vegetation Structural Class.

Scrub: Refer to Vegetation Structural Class.

Secondary: Secondary native vegetation, seral regrowth after destruction or disturbance.

Seepage Swamp: Refer to Landform.

Semi-coastal Zone: Refer to Bioclimatic Zone.

Site: Refer to Recommended Area for Protection Selection Criteria.

Size and Shape: Refer to Recommended Area for Protection Selection Criteria.

Shrubland: Refer to Vegetation Structural Class.

Study Area: A tract of land with indigenous vegetation delineated as suitable for rapid field survey in order to identify the ecological patterns and the natural diversity of an ecological district.

A study area is an arbitrary unit, defined, appropriate to circumstances - it may be defined by the boundary of a remnant forest stand; a catchment; a legal title; or in largely undifferentiated environments by grid squares or other manageable, arbitrarily bound areas.

Submontane Zone: See Bioclimatic Zone.

Succession: The process of change in the appearance, composition and structure of a community. This usually occurs over a number of years. Change may be due to biotic factors, site factors, or both.

Surrounding Landscape: Refer to Recommended Area for Protection Selection Criteria.

Terrestrial: See Hydrologic Class.

Threatened species: Definitions from de Lange *et al.* (2004).

Acutely Threatened

Acutely Threatened taxa are those which meet the criteria specified by Molloy *et al.* (2002) for the categories 1. Nationally Critical, 2. Nationally Endangered, and 3. Nationally Vulnerable.

1. Nationally Critical

Taxa which qualify as Nationally Critical because of their small population size (≤ 250 mature individuals), or the number of sub-populations known (≤ 2 , with ≤ 200 mature individuals in the largest of these), or their area of occupancy (0.01 km^2), or their predicted decline rate ($\geq 80\%$ in the next 10 years). Fuller definitions are provided by Molloy *et al.* (2002).

2. Nationally Endangered

Taxa characterised by their small population size (250-1,000 mature individuals), ≤ 5 sub-populations known (with either ≤ 300 mature individuals in the largest population or the total area of occupancy $\leq 0.1 \text{ km}^2$), and a moderate to high recent predicted decline ($\geq 30\%$ of the total population or habitat area over the last 100 years, or predicted to occur within the next 10 years); or those taxa typified by small to moderate population sizes (1,000-5,000 mature individuals), ≤ 15 sub-populations (with $\leq 200-500$ mature individuals in the largest or the total area of occupancy is $0.1-1 \text{ km}^2$), and a high recent or predicted decline ($\geq 60\%$ of the total population or habitat area over the last 100 years, or this is predicted to occur within the next 10 years). Fuller definitions are provided by Molloy *et al.* (2002).

3. Nationally Vulnerable

Taxa characterised by their small to moderate population size (1,000-5,000 mature individuals), ≤ 15 sub-populations (either with 300-500 mature individuals in the largest sub-population or occupying a total area of $0.1-1 \text{ km}^2$), and with either an initially historic but continuing decline rate of 30-60% in total population size or habitat area over the last 100 years, or a predicted decline of 30-60% in the total population likely in the next 10 years. Fuller definitions are provided by Molloy *et al.* (2002).

Chronically Threatened

Chronically Threatened taxa are those which meet the criteria specified by Molloy *et al.* (2002) for the categories 1. Serious Decline, and 2. Gradual Decline.

1. Serious Decline

Taxa qualify if they occur as moderate to large populations where there is a moderate to large predicted decline (with total population size $> 5,000$ mature individuals, > 15 sub-populations, and either > 500 mature individuals in the largest sub-population or the total area of occupancy $> 1 \text{ km}^2$, with a predicted decline rate of $> 30\%$ in total population over the next 10 years), or taxa exist as small to moderate sized

populations with a small to moderate predicted decline (with total population <5,000 mature individuals, ≤ 500 mature individuals in the largest sub-population, or total area of occupancy $\leq 1 \text{ km}^2$, with a predicted decline rate of 5-30% in the total population over the next 10 years). Fuller definitions are provided by Molloy *et al.* (2002).

2. Gradual Decline

Taxa qualify if they occur as moderate to large populations with small to moderate predicted declines (total population size >5,000 mature individuals, >15 sub-populations, and either >500 mature individuals in the largest sub-population or the total area of occupancy >1 km², with a decline rate of 5-30% in total population over the next 10 years, which is predicted to continue beyond 10 years). Fuller definitions are provided by Molloy *et al.* (2002).

At Risk

These are taxa which do not qualify as Acutely or Chronically Threatened but which exist as widely scattered, small sub-populations or have restricted ranges. Although such taxa are not currently considered threatened, their small population size and aspects of their biology and ecology place them at potential risk, which is why they are listed here as either 1. Sparse, or 2. Range Restricted.

1. Sparse

Taxa that, for largely undetermined reasons, occur within typically small and widely scattered populations. This distribution appears wholly natural, and is not considered the result of past or recent anthropogenic disturbance. However, as the candidate taxa usually occur in small numbers at any given site, they are naturally susceptible to extirpation within parts of their range.

2. Range Restricted

Taxa whose distribution is naturally confined to specific substrates (e.g. ultramafic rock), habitats (e.g. high alpine fell field), or geographic areas (e.g. subantarctic islands). Range Restricted taxa occupy an area of <100 km² and within that area they are under no obvious or immediate threat. However, because of their distribution they are naturally susceptible to extirpation.

Non-Resident Native

Taxa whose natural presence in New Zealand is either sporadic or temporary (1. Vagrant), or they have succeeded in recent (≤ 50 years) establishing themselves beyond their point of introduction (2. Coloniser).

1. Vagrant

Taxa whose occurrences, though natural, are sporadic and typically transitory. Most (if not all) fail to establish themselves beyond their point of arrival because of reproductive failure or for specific ecological reasons. Also includes those vagrants which are currently known in the

New Zealand Botanical Region only from historic herbarium specimens but which remain extant in their country of origin, and so retain the potential to re-establish themselves.

2. Coloniser

Taxa which have arrived without direct or indirect human assistance and which have been successfully reproducing in the wild for <50 years.

Data Deficient

Taxa that are suspected but not definitely known to belong to any of the above categories due to a lack of current information about their present-day distribution and abundance. It is hoped that listing such taxa will stimulate research to find out the true category or threat. For a fuller definition see Molloy *et al.* (2002).

Treefernland: Refer to Vegetation Structural Class.

Treeland: Refer to Vegetation Structural Class.

Tussockland: Refer to Vegetation Structural Class.

Vegetation Structural Class: Vegetation classification based on the type of plant, which is dominant in the canopy, for example: forest, reedland. These are based on Atkinson (1985), with the following abbreviated definitions:

Forest: more than 80% trees in the canopy.

Treeland: less than or equal to 80% trees in the canopy.

Scrub: More than 80% shrubs in the canopy.

Sbrubland: Less than or equal to 80% shrubs in the canopy.

Tussockland: Herbaceous plants, including grasses, land sedges and rushes, with leaves densely bunched at the base. This includes flax and toetoe.

Grass/Sedge/Rusbland: Herbaceous monocotyledons with narrow linear leaves not densely bunched at the base.

Reedland: Tall herbaceous monocotyledons with linear leaves containing spongy mesophyll tissue.

Fernland: dominated by ferns.

Sandfield: Bare sand exceeds the area covered by any one class of plant growth form.

Treefernland: Dominated by treeferns.

Vineland: Dominated by vines.

Herbfield: dominated by small herbaceous plants not included in the above categories.

Vegetation Type: A term, which includes the dominant canopy species and structural class of an area of vegetation, for example: rimu/tawa-kamahi forest, *Ficinia nodosa*/*Muehlenbeckia complexa* sedge-vineland.

In addition, cover values and tiers are included, i.e:

(tawa): less than 5% cover of the bracketed species.

(rimu)/tawa: indicates less than 5% cover of rimu emergent over a canopy of tawa.

tawa-hinau: indicates tawa and hinau occur in the same tier.

⇔: mosaic of vegetation types

Viability: Refer to Recommended Area for Protection Selection Criteria.

Vineland: Refer to Vegetation Structural Class.

Vulnerable: Refer to Recommended Area for Protection Criteria.