

Motu Ecological District

Survey Report for the Protected Natural Areas Programme



Department of Lands and Survey

Motu Ecological District

Survey Report for the Protected Natural Areas Programme

**B.D. Clarkson, L.J. Daniel, F.B. Overmars and
S.P. Courtney**

**New Zealand Protected Natural Areas
Programme No. 6
ISSN 0112 - 9252**

**Published by the Department of Lands and Survey,
Wellington, New Zealand.
1986.**

SUMMARY

The coastal and lowland zones of the Motu Ecological District were surveyed and mapped, as a pilot study for the New Zealand Protected Natural Areas Programme, testing a rapid ecological survey method. Thirty-nine vegetation-landform combinations (Ecological Super-Units) were recognised and used as the main basis for assessing the representativeness of the existing Protected Natural Areas. Several special features of high conservation significance were also considered, for example, the presence of threatened plant and animal species. Twenty Priority Natural Areas containing the best remaining examples of Ecological Super-Units either poorly or not represented, and as many special features as possible, were identified. In total, these cover approximately ¹⁷12,100 ha and are mainly grouped in three forested corridors: "Whanarua-Kereu", "Motu" and "Torere", which link with proposed Ecological Areas and the proposed Wilderness Area in Raukumara State Forest Park. The remaining priority areas include small offshore islands and small remnants of former common vegetation types, such as kahikatea forest.

	<u>C O N T E N T S</u>	PAGE
1.	INTRODUCTION	1
2.	CHARACTER OF MOTU ECOLOGICAL DISTRICT	2
2.1	Ecological Districts	2
2.2	Boundaries of Motu Ecological District	2
2.3	Geology	4
2.4	Landform and topography	7
2.5	Soils	8
2.6	Climate	10
2.7	Vegetation and flora	11
2.8	Wildlife	14
3.	SURVEY METHODOLOGY	17
3.1	Determination of Priority Ecological Classes for survey	17
3.2	Delineation of Survey Areas	17
3.3	Rapid ecological survey	18
3.4	Modifications to survey card	19
3.5	Definition of Bioclimatic Zones	21
3.6	Landform	22
3.7	Analysis	24
3.8	New Zealand Forest Service survey data	24
3.9	Other survey data	25
4.	VEGETATION AND LANDFORM	26
4.1	Descriptions of vegetation types	26
4.2	Checklist of Ecological Super-Units	26
4.3	Vegetation map	27
4.4	Rare and endangered Species	27
4.5	Limits of distribution	28
4.6	Tawa or tawaroa?	29

	PAGE
5. WILDLIFE	31
5.1 Assemblages of species	31
5.2 Rare, endangered and uncommon species	31
5.3 Endemism	32
6. NATURE CONSERVATION EVALUATION AND PROPOSALS	33
6.1 Objectives and methods	33
6.2 Checklist of Survey Areas	33
6.3 Checklist of ecological resources in existing and proposed Protected Natural Areas	33
6.4 Ecological resources not in existing or proposed Protected Natural Areas	35
6.5 Selection of Priority Natural Areas	43
6.6 Priority Natural Areas	44
7. ACKNOWLEDGEMENTS	63
8. REFERENCES CITED	65
9. APPENDICES	71
I. Descriptions of the vegetation types of the District	71
II. Checklist of indigenous vascular plants	84
III. Checklist of adventive vascular plants	103
IV. Checklist of vertebrate wildlife habitats and distribution	110
V. Checklist of Survey Areas of the coastal and lowland zones	118
VI. Checklist of ecological resources in existing and proposed Protected Natural Areas of the District	142

FIGURES

1. The Motu Ecological District	3
2. Vegetation types of coastal and lowland zones	23
3. Existing and proposed Protected Natural Areas and Priority Natural Area corridors	36
4 - Priority Natural Areas	53
10.	

TABLES

1. Checklist of Ecological Super-Units of the coastal and lowland zones	38
2. Special features of high conservation priority	42

THE MOTU P.N.A. SURVEY TEAM

Scientific Leaders:

B.D.Clarkson	Botany Division, DSIR, Rotorua.
L.J.Daniel	Department of Lands and Survey, Gisborne.
J.L.Nicholls	Forest Research Institute, Rotorua.

Survey Team Leader:

F.B.Overmars	S.E.S., Department of Lands and Survey, Gisborne.
--------------	---

Assistant Survey Team Leader:

S.P.Courtney	S.E.S., Department of Lands and Survey, Gisborne.
--------------	---

Survey Team Members:

F.Anderson	S.E.S., Department of Lands and Survey, Gisborne.
D.M.Chadwick	S.E.S., Department of Lands and Survey, Gisborne.
T.Higham	S.E.S., Department of Lands and Survey, Gisborne.
H.F.X.Keane	S.E.S., Department of Lands and Survey, Gisborne.
F.J.McRobie	S.E.S., Department of Lands and Survey, Gisborne.
K.Vollebregt	S.E.S., Department of Lands and Survey, Gisborne.
M.Weissing	S.E.S., Department of Lands and Survey, Gisborne.
D.Wood	S.E.S., Department of Lands and Survey, Gisborne.

1. INTRODUCTION

This report describes a PILOT ecological survey undertaken between November 1983 and April 1984 in Motu Ecological District in the eastern Bay of Plenty, as part of the New Zealand Protected Natural Areas (PNA) Programme.

The survey's primary, inter-related objectives were:

1. To document the natural vegetation and landforms of the Motu Ecological District and to evaluate their value for nature conservation, in the context of the PNA Programme's principal objective of protecting representative samples of the full range of New Zealand's natural ecological diversity.

The lowland and coastal zones were preferentially selected for survey because large scale land use changes (including horticultural and exotic forest development) have recently begun in these areas, and formal nature conservation designation is limited to three very small scenic reserves. In contrast, the upland and mountain zones of the District lie mostly in the Raukumara State Forest Park. They are well represented in proposed Protected Natural Areas, have been subject to considerable ecological survey by the N.Z. Forest Service and no utilisation is planned in the Forest Park for the period of the current management plan up to 1993 (N.Z. Forest Service, 1983). Five scenic reserves of moderate size also lie in these zones.

2. To test the feasibility of rapid ecological surveys for nature conservation evaluation purposes in New Zealand, and specifically the methodology proposed in Rapid Ecological Survey of Natural Areas (Park, 1983), in a large area of predominantly natural or near natural forest.

This methodology was devised to provide a national "coarse filter" survey of the natural diversity of New Zealand, especially in areas such as the Motu Ecological District which, comparatively, are scientifically poorly known.

The Motu Ecological District is approximately 260 000 ha in area. The target coastal and lowland areas of the district totalled about 50 000 ha. Of this about 35 000 ha were surveyed; permission for access could not be gained to the remaining 15 000 ha (Figure 1).

2. CHARACTER OF MOTU ECOLOGICAL DISTRICT

2.1 Ecological Districts

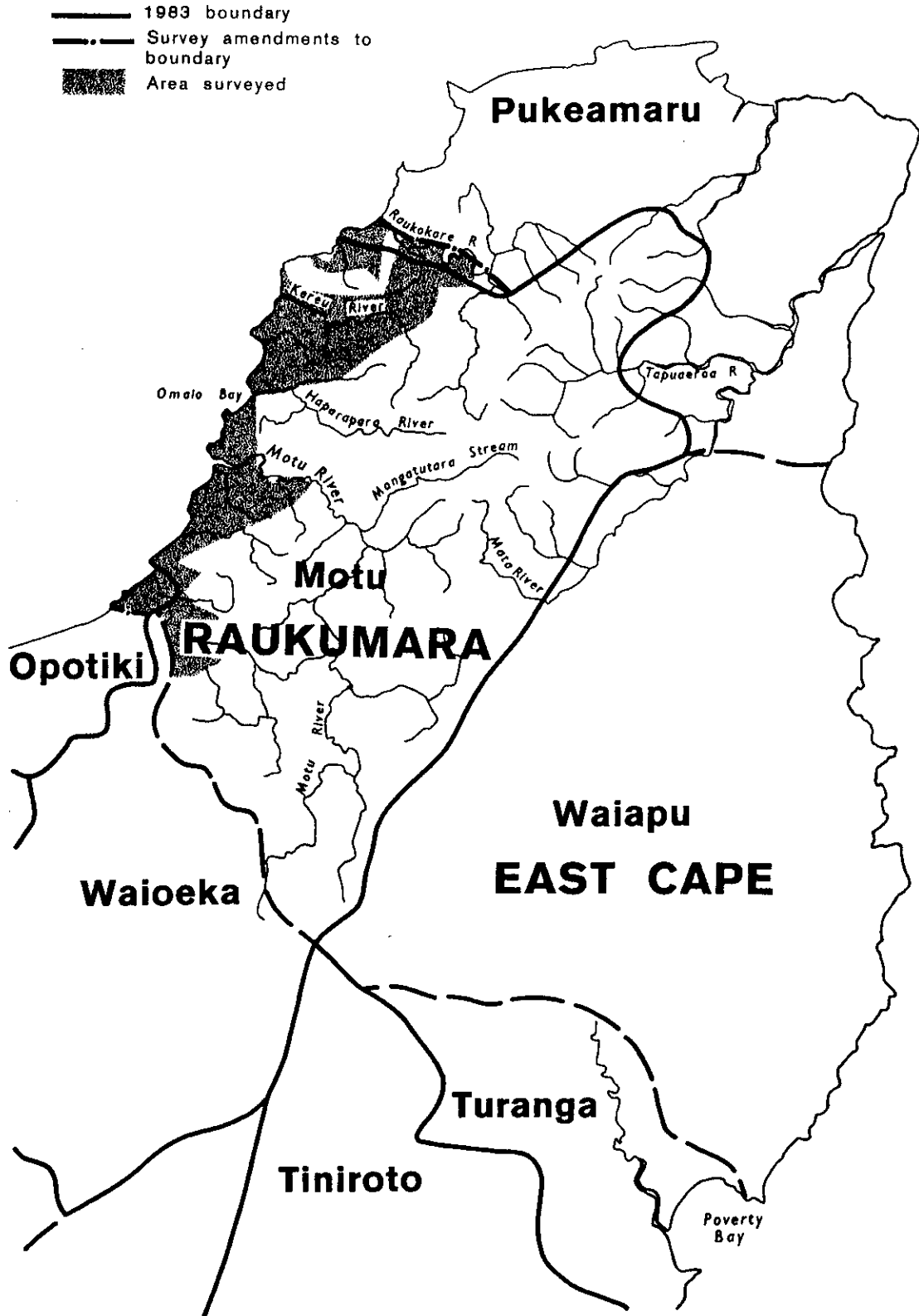
An ecological district is a geographic area with a recognisably distinctive pattern of characteristic natural ecosystems. It is distinguished from other areas on the basis of homogeneity in patterns of geology, landform, climate, soil, flora and the extent and nature of indigenous vegetation (Simpson, 1982). New Zealand has been mapped at a scale of 1:500,000 into 268 such Districts. The concept of Ecological District provides a tool to be used in organising and assessing ecological information. It may also enhance understanding of, and identity with, local ecological characteristics and so promote awareness of landscape values and stewardship of heritage (ibid.).

2.2 Boundaries of Motu Ecological District

The Motu Ecological District is part of the wider Raukumara Ecological Region, and extends from the tops and eastern flanks of the Raukumara Range to the Bay of Plenty coastline (Figure 1). As considered at the time of survey, the district was bounded:

- in the west, south and southeast, by the catchment boundaries of the Torere, middle Motu and upper Waiaua Rivers; and thence to the Raukumara Range by a line excluding the atypically wide valley of the uppermost Motu catchment;
- in the east and northeast, by the Raukumara Range and the upper headwaters of east and northward-flowing rivers of the East Cape region (Waikohu, Mata, Waiapu, Awatere, Whangaparaoa, and Waikura Rivers). The boundary here is well defined by climatic and geological features i.e. rainshadow effect and softer Tertiary rocks of East Cape region respectively;
- in the north, by the geological boundary between Cretaceous greywackes and Tertiary sandstones and siltstones, roughly the northwesterly trending lowest reach of the Raukokore River, and the northern end of the Raukumara Range (see Kingma, 1965);

Figure 1 - The Motu Ecological District



- in the northwest, by the coastline of the eastern Bay of Plenty.

The boundaries outlined above are slightly amended from those shown on the second edition maps of Ecological Regions and Districts of New Zealand prepared by the N.Z. Biological Resources Centre in 1983. The two changes made on the basis of the present survey were:

- the inclusion of the entire Torere catchment, to complete the representation of coastal headlands and embayments that are features of the coastal edge of the District.
- the extension of the northeastern coastal boundary about 2.5 km northeastwards to coincide more closely with the geological boundary between the Cretaceous indurated sandstones of the Raukumara Range and the Tertiary sediments of the East Cape (*ibid.*). There is a zone of transition in geology, landform and vegetation on the northern side of the Raukokore River.

The broad scale boundaries on the southwest, southeast and northeast mountainous edges of the District were not examined in the present survey.

The Motu Ecological District shares boundaries with:

- the Waioeka District, which is sufficiently similar to be included in the same ecological region;
- the Opotiki District of the Whakatane Ecological Region;
- the Pukeamaru and Waiapu Districts of the East Cape Ecological Region.

2.3 Geology

The dominating landform of the District is the Raukumara Range. This fold mountain system trends north-northeastward and is the northernmost continuation of the Urewera, Huiarau and other North Island axial mountain ranges (Kingma, 1965). Landforms (e.g. river and coastal terraces) derived from Quaternary erosion and deposition complement the Range and occur primarily in coastal and lowland zones.

The Range consists of hard sedimentary rocks, loosely termed "greywackes", of dark grey-green, silty to gritty sandstone and dark blue-grey mudstone laid down as deep water sediments in Permian to Cretaceous time (280-130 million years B.P.). Speden (1972) included these rocks in the Torlesse Supergroup. They are generally unfossiliferous, and have been intensely compressed, folded, faulted, shattered and lightly metamorphosed to render them highly jointed and fractured (Healy, 1983). In the far northeast of the District, a more simple anticlinal dome of similar though partly younger, fossiliferous and Late Cretaceous rocks forms the northern end of the Range. A narrow band of these younger rock formations occurs along the southwest boundary of the District (Speden, 1973).

Although the rocks themselves are geologically old, uplift here (Kaikoura Orogeny) has occurred only during late Tertiary and Quaternary times. The Raukumara peninsula is being uplifted in titled blocks by compressional forces resulting from the subduction of the Pacific tectonic plate. Uplift rates are 2-3 mm per year along the northern and eastern coasts, decreasing to the west to about 0.5 mm per year along the coast at the Motu River mouth (Berryman, 1982). Although very few active faults are mapped anywhere in the Raukumara region, it is one of the most geologically active parts of the country. Uplift is apparently episodic in up to 3-4 m steps along the north and east coasts, with proportionately smaller uplift steps to the west, at approximately 1000 year intervals and associated with large earthquakes approaching 8 on the Richter Scale (*ibid.*). The District lies within a region which has a mean return period (years) for intensity MMVI earthquakes of 5 years (Smith and Berryman, 1983).

Between headlands where the greywacke basement rocks reach the coast, there is a series of narrow seaward-sloping marine terraces which were cut during Pleistocene higher sea-level periods and have subsequently been uplifted¹. Quaternary aggradation features include the alluvial terraces

1. Evidence of marine gravels up to 130m a.s.l. was seen in recently exposed road cuttings in Houpoto forest (G.R. N70: 005306). These appear to represent remnants of considerably older marine terraces.

of the rivers, sand and gravel dune and beach systems, and small swamps. The major rivers of the District carry large amounts of sediment from their eroding headwaters and form narrow valley flats and alluvial plains in their lower reaches. Large tributaries of the Motu River are also locally bordered by alluvial flats in its major tributaries (Rawea, Takaputahi, Whitikau and Mangatutara streams).

A further major influence has been a succession of tephra deposits from major volcanic eruptions in the Rotorua-Taupo region, 80-150km to the southwest. The late Pleistocene and Holocene sequence has been traced and recorded over the central North Island, Bay of Plenty and Gisborne areas by Healy, Vucetich and Pullar (1964) and Vucetich and Pullar (1969), and mapped by Pullar (1973).

At Maraenui, near the centre of the Motu District's coastal zone, the following sequence has been described (Pullar, 1973):

(a) less than 5 cm,	Tarawera Ash, 1886 eruption
(b) less than 10cm,	Taupo Pumice, <u>c</u> 1800 yrs BP
(c) less than 10cm,	Whakatane Ash, <u>c</u> 5180 yrs BP
(d) less than 20cm,	Mamaku Ash, <u>c</u> 7050 yrs BP
(e) less than 10cm,	Waiohau Ash, <u>c</u> 11 250 yrs BP
(f) 41 cm,	Rotorua Ash, <u>c</u> 13 450 yrs BP
(g) 30 cm,	Okareka Ash, <u>c</u> 17 000 yrs BP
(h) 25 cm,	Kawakawa Tephra, <u>c</u> 20 000 yrs BP
(i) 107 cm,	Mangaone Lapilli, <u>c</u> 32 000 yrs BP
(j) 132 cm,	Rotoehu Ash, <u>c</u> 42 000 yrs BP

The few road-cuts seen during the present ecological survey, primarily in Houpoto exotic forest, indicated considerable variation in tephra layer thicknesses. Some broad ridges showed layers up to three metres deep, and others had only thin ash lying on weathered greywacke. The District pattern is likely to be one of thick deposits on flat and gently sloping land, with colluvial deposits locally on hillslopes and at hill bases, and comparatively thin deposits on narrow ridges and steep hill slopes where tephra has been washed off. Thicknesses also decrease steadily to the northeast with increasing distance from the eruption centres.

No commercially significant occurrences of metallic minerals are known in the Motu Ecological District (Speden, 1982).

2.4 Landforms and Topography

The Raukumara Range forms a rugged and somewhat irregular mountain spine along the southeast side of the District. The range separates the catchments of the eastern Bay of Plenty from those of the East Cape region. Its altitude varies from about 1000 m in the south to its highest point, Mt Hikurangi (1764 m), in the northeast. Other high points include Mts Arowhana (1439 m), Whanokao (1618 m), Aorangi (1272 m) and Raukumara (1413 m).

From the central mountain range there is a series of generally west to north trending ridge systems and deep river valleys which extend more or less to the Bay of Plenty coast. This general relief has been fashioned by high mean annual rainfall and a relatively high incidence of intense rainfalls acting on a fairly erodible substrate, especially the crush zones. The high rates of tectonic uplift are matched by current erosion processes (Healy, 1983), resulting in a typical youthful landscape still undergoing active fluvial erosion. River down-cutting has produced a dendritic drainage pattern with steepened or over-steepened deeply incised v-shaped valleys. Slopes are susceptible to debris sliding and debris avalanching. However, possibly because the primary forest cover is still largely intact, actual active erosion is at present far less extensive than in the cleared hill country of the adjacent East Cape region.

Landforms are generally more subdued towards the coast. In places, major spurs reach the coast, to end in steep, rugged headlands shelved by rock platforms. The greywacke rocks offer high resistance to marine erosion and the coastline is eroding only very slowly (Tortell, 1981).

Between the headlands are narrow low alluvial terraces and higher old coastal terraces up to 10-50 m a.s.l. (more or less continuous between Omaio and Whanarua Bay). They usually have a small scarp

where they meet the sea. The coast between headlands is indented, with gravel beaches on the long exposed reaches, as at Torere, Hawai, Maraenui, Omaio and Raukokore, and finer sand and pebbles in the numerous little secluded bays. No significant coastal erosion is occurring (East Coast Regional Development Council, 1979).

There are a number of very small islands lying within 100-200 metres off the coast which are generally connected to the mainland by the surrounding wave-cut platforms at low tide.

A notable landform feature is the Houpoto Basin which, during Pleistocene higher sea-level periods, contained an arm of the sea behind the Maraenui Hills. This basin contains a proportionately high extent of low-lying, gently rolling land.

From southwest to northeast the major rivers of the District are the Torere, Hawai, Motu, Haparapara/Waikakariki, Kereu, Maraehako and Raukokore. The Torere, Hawai and Maraehako have relatively small catchments not extending to the central Range; the Waikakariki-Haparapara and Kereu are intermediate in length and catchment size; and the Raukokore and Motu have substantial catchments and flows. These rivers have a substantial degree of fall, especially in the upper reaches, a further consequence of rapid geological uplift (Healy, 1983). Waterfalls are common on small tributaries. The southeast and northeast sides of the District are drained by the headwaters of the Waipaoa, Mata, Tapuaeroa, Awatere and Whangaparaoa Rivers.

There are no lakes and only one known lakelet (G.R. N71:306314) in the Motu Ecological District.

2.5 Soils

Soil survey of the Motu District has been restricted to reconnaissance level (1:250,000), reported in General Survey of the Soils of North Island, New Zealand (D.S.I.R., 1954).

The soils of the District are mainly derived from layers of volcanic ash or tephra deposited during periodic volcanic eruptions in the central North Island during geologically very recent time. Pumice from the Taupo eruption (121 A.D.), is the predominant soil-forming tephra in the eastern Bay of Plenty (Pullar and Birrell, 1973). On recently formed river flats, peat swamps and sand dunes, the mineral constituents of soils are derived chiefly from the volcanic material eroded off the hills. Only on the sharper ridges and steep slopes of the hill and mountain country has the ash and pumice mantle been washed away completely and skeletal soils formed on the exposed greywacke bedrock.

The predominant soils of the District are steepland skeletal soils derived from weathering of the underlying indurated sandstones and modified by varying thicknesses of tephra. Because of slope steepness these soils are relatively unstable and are periodically rejuvenated by erosion. A characteristic soil profile is 15-22 cm of brown to yellowish brown sandy loam derived from mixed ash overlying sandstone rocks (Gibbs and Pullar, 1961). These soils are relatively well-drained and fertile. Where the tephra is thin the underlying sandstone and argillite rocks have weathered to produce a 15-30 cm layer of infertile stony loam between the hard rocks and tephra. Deep tephra deposits and associated soils occur in some shallow valleys and on exceptionally broad ridges.

On the terrace, rolling and hilly lands near the coast are light, friable, well-drained and moderately fertile yellow-brown pumice soils and yellow-brown loams. Soils formed in deep Taupo pumice have visible pieces of unweathered pumice and are classed as yellow-brown pumice soils, whereas soils formed in older tephra are more weathered and classed as yellow-brown loams. Where the tephra is thick, previous soils (palaeosols) formed in older tephra beds may be buried underneath the recent soils.

The tephra parent materials have a great effect on the water-retention, erosion resistance and chemical character of the derived soils. They tend to have a high allophane clay content which binds up organic matter and phosphate. Tephra soils may be naturally deficient in trace elements such as cobalt, selenium and boron.

2.6 Climate

The only climate station in the District at Te Kaha was established in 1982. Knowledge of the climate is based mainly on extrapolations from the East Cape and Opotiki stations (data courtesy of the N.Z. Meteorological Service), and from experience of the district.

The climatic patterns of the District are strongly related to its position as part of New Zealand in the southern oceans, and to its mostly hilly and mountainous character. The Raukumara Range provides a barrier to the prevailing moisture-laden winds approaching across the Bay of Plenty, and from the east and north. It also creates a strong climatic gradient from the coast to the mountains. The area generally has a mild, humid, near sub-tropical climate on the coast, changing to a harsh mountainous climate in the Raukumara Ranges. The climate of the whole District, except the high peaks of the range, favours forest.

The rainfall isohyet map shows that mean annual rainfall is lowest along the narrow coastal strip, from 1025 mm at Omaio up to 1600 mm at Raukokore. This rises to 2400-2800 mm over the southern part of the main divide, and to over 4000 mm on the highest peaks of the Raukumara Range to the northeast. There is a rapid drop in rainfall on the eastern side of the range. The highest monthly rainfalls occur from May to August inclusive.

Snow falls, some moderate to heavy, occur occasionally in winter on the higher slopes of the main range. Frosts occur occasionally at Opotiki between May and September, but increase in frequency and severity with increasing altitude and distance from the coast. Frosts are rare in some coastal areas, such as Te Kaha and Whanarua Bay.

The predominant wind direction at Opotiki is from the south to west quarter. Wind speeds are not recorded. Total average annual sunshine is a comparatively high 2169 hours. Average daily maximum temperatures range between 14.3° C in July and 23.1° C in February. Wind speed increases and sunshine hours and temperature decrease in the hill and mountain parts of the District.

Average relative humidity at Opotiki ranges from a very high 88% in June and July, down to 75-76% in October through to January. Fog, thunder and hail are infrequent, occurring on an average of 7.0, 3.3 and 0.4 days per year respectively.

An exceptionally violent cyclone (Cyclone Bernie) at Easter 1982 caused major windthrow in the forests of the District especially beech forest below 900m. It is apparent that although such extreme climatic events occur infrequently, they must have a major impact on the forest patterns.

A notable climatic feature is the lack of coastal winds. Compared with the North Island west coast, there is very little observable wind impact on the structure of the coastal forests, and many coastal species extend to higher altitudes.

2.7 Vegetation and flora

From the extant native vegetation it can be assumed that, prior to Maori occupation beginning about 1000 A.D. or earlier (Wellman, 1962), the steep rugged landscape of the Motu Ecological District was characterised by a dense forest cover. Non-forest vegetation was restricted to coastal scrub, small wetlands, open riverbeds, and substantial subalpine scrub and alpine grassland zones. The vegetation was in a dynamic relationship with a landscape being moulded by rapid geological uplift and erosion, periodic volcanic deposition, and climatic and associated sea-level changes.

The warm coastal climate supported a narrow belt up to two or three kilometres wide of luxuriant vegetation dominated by pohutukawa (Metrosideros excelsa), tawa (Beilschmiedia tawa s.l.), puriri (Vitex lucens), kohekohe (Dysoxylum spectabile) and taraire (B. tarairi). Elsewhere in New Zealand this species assemblage occurs only in eastern Northland and Coromandel.

On lowland hills were mosaic forest patterns in which hard beech (Nothofagus truncata), tanekaha (Phyllocladus trichomanoides), rewarewa

(Knightsia excelsa), hinau (Elaeocarpus dentatus) and northern rata (M. robusta) predominated on ridges and spurs, with tawa, puriri, kohekohe and pukatea (Laurelia novae-zelandiae) predominant on the lower slopes and in gullies. There was a scattering of podocarps, principally rimu (Dacrydium cupressinum). In high altitude forests these species were progressively displaced by cooler climate trees including tawari (Ixerba brexioides), toatoa (Phyllocladus glaucus), kamahi (Weinmannia racemosa), quintinia (Quintinia serrata) and in the uppermost forests, red beech (N. fusca) and silver beech (N. menziesii).

The impact of human settlement has been confined mainly to flat and moderately sloping land on the coast, and hill country of the immediate hinterland. During Maori times much of this was cleared by fire, for cultivation of taro (Calocasia esculenta) and kumara (Ipomoea batatas), and inducing bracken (Pteridium esculentum) fernland, a staple crop (Nicholls, 1980). The East Cape region was historically a major centre of Maori population, (Wellman, 1962).

This pattern was consolidated during the European period when these lands were used for new crops (such as potato (Solanum tuberosum)); sheep farming and dairying, and, in the last decade, horticulture. Considerable areas of steeper hill country abandoned by European sheep farmers in the 1930's and 1950's subsequently reverted to scrub and young forest, and have recently been widely planted in exotic pines.

Today about 70% of the ecological district is covered by indigenous forest (Nicholls, 1983a). Human occupation is concentrated on the coastal flats and forest occurs there as small remnants or secondary stands. Forest elsewhere in the coastal zone has also been modified. Reverting communities range from bracken and manuka (Leptospermum scoparium) to tall secondary forest which shows imbalances in age structure and species composition compared to primary forest. The lower altitude hills have a mixture of reverting scrub dominated by manuka, kanuka (L. ericoides), tree ferns and young broadleaved trees, and of secondary forest and small areas of primary forest. The remaining higher altitude forest communities, above about 400 m a.s.l., are largely unmodified, except for the depredations of introduced browsing animals, widespread windthrow caused by Cyclone Bernie, clearing in some river valleys, and past logging of an area downstream of Motu township.

The native vascular flora of the Motu Ecological District comprises more than 630 species (Druce, 1978, 1980; Heginbotham, 1979; B.D. Clarkson and B.R. Clarkson herbarium records; PNA survey herbarium records) and the adventive vascular flora exceeds 460 species (Heginbotham, 1979). The extent of the non-vascular flora is unknown. The areas of subalpine scrub and shrubland, and alpine tussockland, herbfield and fellfield are the most northern substantial occurrences of such vegetation in the North Island. Other notable features of the District are: the hard beech dominated forest on the Bay of Plenty side, which is the largest tract in New Zealand and reaches exceptionally high altitudes; the common occurrence in upper forests of kaikawaka (Libocedrus bidwillii); local occurrence of mountain beech (Nothofagus solandri var. cliffortioides), at its northern limit in the normally silver beech dominated uppermost forest; and an anomalous absence of beeches at the northernmost end of the Raukumara Range (Nicholls, 1983a).

Two species, taraire, and Carmichaelia williamsii, reach their southern limits in the District. Many species, predominantly alpine and subalpine, reach their northern limits.

Rare and endangered species of the District include: Olearia pachyphylla, which is almost wholly restricted to the District; Carmichaelia williamsii, at two of its four known mainland sites; Metrosideros carminea, which is sporadically distributed; and Coriaria pottsiana, a scree-slope shrub on Mt Hikurangi and Mt Arowhana.

2.8 Wildlife

The diversity of wildlife in the Motu Ecological District as elsewhere, is related to the range of wildlife habitats present. Forest was historically the predominant habitat and remains so except in the coastal zone. Apart from the substantial induced scrub areas, other wildlife habitats are of comparatively small area and are all wetland types: freshwater swamps, rivers and riverbeds; and coastal lagoons, rivermouths and rockstacks. The vertebrate wildlife species in the District are listed in Appendix IV, together with an indication of their habitat and distribution. The fauna has not been extensively documented.

All indigenous forest bird species extant in the North Island except red-crowned parakeet (Cyanoramphus novae zelandiae) are present, including kaka (Nestor meridionalis), yellow-crowned parakeet (C. auriceps) N.Z. falcon (Falco novae seelandiae) and N.I. kokako (Callaeas cinerea), which are mostly confined to large forest tracts. Generally, forest bird species richness is highest in the large forest tracts and is diminished in more isolated and smaller forest and scrub remnants. Patterns in seasonal migration and habitat usage may be expected.

Many other North Island forest bird species, now presumed extinct on the mainland, probably once occurred in the Motu District, including little spotted kiwi (Apteryx owenif), N.I. saddleback (Philesturnus carunculatus), piopio (Turnagra capensis), stitchbird (Notiomystis cincta), moas, kakapo (Strigops habroptilus), and N.I. bush wren (Xenicus longipes) (Buller, 1882). Nesting colonies of many coastal and oceanic seabird species (e.g. mottled petrel (Pterodroma inexpectata) and black petrel (Procellaria parkinsoni) (Roxburgh, 1977)) once occurred on small offshore islands, headlands and inland valleys. Only unused burrows remain in a few sites.

Wetland habitats each support their own assemblage of avian wildlife. There is a concentration of birdlife on lower braided portions and mouths of rivers. A colony of 500-600 white fronted terns (Sterna striata) has bred in several past seasons at the Motu River mouth (G.A. Taylor, pers. comm.), and they possibly breed also at the Raukokore River mouth, Tokaroa Rock and other offshore islands¹. Small breeding colonies of

1. N.Z. Wildlife Service F.S.U. Survey

red-billed gull (Larus novae hollandiae) occur at the Motu and Haparapara River mouths, and one of southern black-backed gulls at the Raukokore River mouth. Breeding of the uncommon N.Z. Dottered (Charadrius obscurus) has been reported from the Haparapara river mouth (G.A. Taylor, pers. comm.). The Motu River and its tributaries have a comparatively large population of whio (Hymenolaimus malacorhynchos) conservatively counted at 86 birds (Roxburgh, 1982). They also occur in small numbers in the Waikakariki (G.A. Taylor, pers. comm.) and Hawai Riversf.

The widespread native long-tailed bat (Chalinolobus tuberculatus) is known to occur in some forest habitats². The short-tailed bat (Mystacina tuberculata) is likely to be present also (M.J. Daniel, pers. comm.). The lizard fauna is poorly known. Common gecko (Hoplodactylus maculatus) and shore skink (Leiolopisma smithii) occur in beach driftwood habitatsf. Other species likely to be present include Cyclodina aenea, C. ornata, Loatriatum, Naultinus elegans and H. granulatus (B.W. Thomas, pers. comm.).

The most common of the three New Zealand native frogs, Hochstetter's frog (Leiopelma hochstetteri), is widely distributed in suitable habitats from near sea-level to the high hills². Habitats include edges of small first and second order forest streams (Saunders, 1982), and stable, dark and moist, moss-covered gravel or rock substrates enclosed under over-hanging forest vegetation. Some habitats show a surprising degree of disturbance caused by upstream modification.

Knowledge of the freshwater fisheries is largely limited to the Motu and Haparapara Rivers. Both rivers have comparatively large catchments mostly still in native forest cover. The Motu supports whitebait (Galaxias spp.), kahawai (Ariippis trutta) and eel (Anguilla spp.) fisheries; provides habitat for about half of New Zealand's indigenous fish species, and may be an important recruitment source for freshwater fisheries in other rivers of the region (Rowe, 1981). The river is characterised by four native fish species: long-finned eel (Anguilla dieffenbachii), koaro (Galaxias brevipinnis), blue-gilled bully (Gobiomorphus hubbsi) and torrentfish (Cheimarrichthys fosteri). The rarely reported shortjawed kokopu (Galaxias postvectis) has been found in two headwater tributaries of the Motu (Rowe, 1981).

The Haparapara River also has high density and species richness of native fish (C.J. Richmond, pers. comm.). Shortjawed kokopu and giant kokopu (G. argenteus) are present, and the invertebrate fauna is generally species rich and abundant in comparison with other stream systems in the region. The river is unusual in that it lacks introduced fish species and its aquatic ecology is likely to be in a near-pristine state.

The terrestrial invertebrate fauna is virtually unknown (e.g. see Watt, 1976). High forest invertebrate species richness is indicated by a small litter sample from near Opape containing 36 mollusc species (D.J. Roscoe, cited in Daniel, 1983), and the presence in other northern North Island of high numbers of small mollusc species (Solem, Climo and Roscoe, 1981) and Coleoptera (Watt, 1979).

Fauna introduced to New Zealand and occurring in the wild in the District include birds, fish, frogs, weasel, stoat, rats, mice, hare, rabbit, deer, goat, pig, possum, cat and hedgehog (Appendix IV). These have had considerable impact on the native fauna (e.g. see Williams, 1973; Dingwall, Atkinson and Hay, 1978; Diamond and Veitch, 1981) and flora (e.g. see Atkinson, 1972; Jane, 1979, cited in N.Z. Forest Service, 1983). Possums have yet to colonise some areas, including that between the Maungatutara River and the sea (Jane, ibid.) and parts of Houpoto forest (N. D'Anvers, pers. comm.). Feral goats are widely, patchily distributed. They are in high numbers in the Takaputahi catchment where they have heavily browsed understorey vegetation. Rooting by wild pigs is widespread in low altitude forests. Red deer, which colonised the Raukumara Range between 1950 and 1970 (Gibb and Flux, 1973), are present in low numbers only, and wild cattle are common in some high altitude forests.

3. SURVEY METHODOLOGY

The methodology used in this survey is described fully in Rapid Ecological Survey of Natural Areas (Park, 1983), including the December 1983 amendments. In this section key features of the standard methodology are outlined and adaptations based on the experience of this survey are noted.

3.1 Determination of Priority Ecological Classes for survey

The ecological classes chosen as priorities for survey in the Motu Ecological District were all those in the coastal and lowland zones. These were selected by the scientific leaders before the survey began, on the basis of the rapidly changing land use patterns in the coastal and lowland zones, their very inadequate representation in protected natural areas, and the lack of information on the distribution of key coastal species. Furthermore the montane and subalpine zones have already been subject to a broad ecological survey, and they are well represented in proposed ecological areas and an approved-in-principle wilderness area in Raukumara S.F.P. The procedures for determining survey priorities outlined by Park (*ibid.*) were thus greatly shortened.

The targeted priority areas of the District were surveyed from the southwest to the northeast. There was some variation, resulting from the inadequate time available before survey to gain permission for access from landowners.

3.2 Delineation of Survey Areas

An area was surveyed if it was characterised by indigenous species, and/or dominated by natural processes.

A total of 47 survey areas were defined; 18 large forest blocks and 29 other vegetation remnants (see Figure 4).

The large forest blocks mostly adjoin or are connected to the Raukumara S.F.P., and account for the bulk of the area surveyed. Natural boundaries such as rivers or catchments were inadequate to subdivide these blocks into manageable survey areas. The approach taken instead was to

use the legal boundaries of the large Maori land blocks as the basis on which to subdivide the District for survey purposes. Such an approach had the particular advantage of being able to relate the survey results back to local land tenure patterns. Some legal boundaries were modified to nearby catchment or ridge boundaries where this was feasible, and some blocks were subdivided or combined if appropriate. The size of these survey areas ranged between 60 and 7000 hectares. To survey and report on such areas took two or three person teams from several days to a few weeks.

The remaining areas surveyed were the numerous forest and scrub remnants, and the relatively few wetlands, islands and riverbeds. These had discrete boundaries defined by the edge of the remnant or ecological unit. All the larger forest remnants, wetlands, islands and riverbeds, were treated as separate survey areas. The more than 70 small forest remnants (less than 5 ha and predominantly coastal scrub communities or pohutukawa forest) were incorporated within the nearest large forest block, which was usually under the same legal title.

3.3 Rapid ecological survey

Areas were surveyed using the rapid ecological survey technique (Park, 1983). This method is similar in essence to a N.Z. Forest Service reconnaissance survey technique described by Wardle (1971) as "non-area plots chosen to represent average stands ... located throughout the forests and shrublands".

Rapid ecological survey consisted of:

- (a) Viewing and reconnaissance of the area and use of aerial photographs to identify ecological units or patterns of ecological units. Ecological units represent the level for rapid field inventory of individual sites to determine their biological and physical content, and for vegetation and landform typing. Ecological units were defined in the field primarily on vegetation characteristics, and secondarily on landform. The scale of ecological unit definition was related to the scale of aerial photographs used (c. 1:28 000). Particular attention was paid to small remnants of communities of high conservation significance such as the very rare kahikatea forest on alluvial terraces.

- (b) Selection of a sample stand (or releve) of no fixed dimensions, representative of the range of variation in an ecological unit. This non-area plot was required to be reasonably homogenous in character and to contain the characteristic canopy species belonging to the plant community. Its boundaries were determined by the homogeneity of the vegetation and the need to obtain an adequate representation of the relative importance of the leading canopy dominants. Although the plot was unbounded, in tall forest an area approximating 20 x 20 m was used as a guideline. (Justification for the use of non-area plot design is outlined by Wardle, 1970).
- (c) Estimating and recording semi-quantitative cover classes of all common species in the vegetation tiers, and a range of other information specified on the recording cards: locational and landform data, community class, condition of vegetation, extent of litter and dead stems, and tier heights. Geological information was added later.
- (d) Occasionally, replication of samples where an ecological unit did not appear reasonably homogenous.
- (e) Selecting one or more plots to represent each element in mosaic units - intricate mosaic forest patterns are a feature of the Motu District.

3.4 Modifications to survey card

A number of changes arising from very early field experience with the ecological unit field card were made, in addition to the amendments recorded by Park (1983). These were:

- (i) Successional Status.
The successional status concept was clarified into two components:
 - (a) type of succession: (1) primary (2) secondary
 - (b) stage of succession: (1) pioneer (2) seral
 - (3) mature (= climax)
 - (4) degenerating

These concepts were readily understood in the field by team members, except for 'degenerating'. This was occasionally ascribed on field cards to windthrown forest (which is deteriorating condition) rather than in the successional sense of a post-climax ecosystem, characterised by reduced productivity, stature and available nutrients. Degenerating communities in this sense were not noted by the present survey.

(ii) Quality, Trend and Modifiers

Interpretation of these factors was restricted to what was observable rather than inferrable. This was essential to prevent confusion resulting from past history of ecological units, especially in secondary stands which had been induced by modifying agents such as fire at some time in the past.

Trend was interpreted in terms of changes in plant abundance, species richness, and vegetation structure.

In the case of modifiers, the modifying factor (eg possum, Lotus pedunculatus, fire) was noted on the card.

(iii) Not Known Category

An additional category, not known, was used for occasions where survey members were unable to determine an appropriate category. It was felt this option would greatly reduce the frequency of inappropriate selections.

(iv) Canopy Definition

The definition of canopy by Atkinson in Owen and Park (1983) was used. Some interpretation difficulty arose in "treeland" and "shrubland" where the middle and ground tier cover classes could be interpreted in relation to percentage cover under the emergent trees and shrubs only, or over the whole non-area plot. The latter was chosen in this survey.

(v) Tier Heights

The estimated average height of each tier was recorded on the ecological unit card. The estimated average height of the leading dominant(s) in each tier, and emergent(s) if present, was recorded in the extended notes section (see vii).

(vi) Listing of Species Names

On the reverse side of the ecological unit card, the species were listed by their common or scientific names rather than the computer or six-letter codes listed on the card. This enabled direct use of the card by any person involved in analysis, and easy checking of team member's species identifications both as they were being recorded and subsequently. It will also enable subsequent easy reference to the ecological unit data by any person requesting such data.

(vii) Extended Notes

The blank reverse side of the blue fauna card was used as an extended notes section to cater for information not listed on the ecological unit card (eg emergent species in the canopy, and past successional history), and to summarise the key vegetation, landform and other features of the unit. This summary provided a useful, readily understood description of the unit, which was frequently used to resolve questions of interpretation subsequently arising from the field card data.

The space was also used to note any fauna observations, especially the native Hochstetter's frog and other features useful for conservation evaluation.

(viii) Other Information

For easy subsequent reference, team members were encouraged to write an appropriate Atkinson - type ecological unit name, site locality, observers' names or initials, and date on the top right-hand corner of each ecological unit card.

3.5 Definition of Bioclimatic Zones

Bioclimatic zones were not precisely defined prior to the survey. With the survey data in hand it was decided to use certain indicator species

or assemblages of species to define bioclimatic zone boundaries, and so merge the bioclimatic zone concept with the vegetation classification. The upper limits of the bioclimatic zones thus selected are:

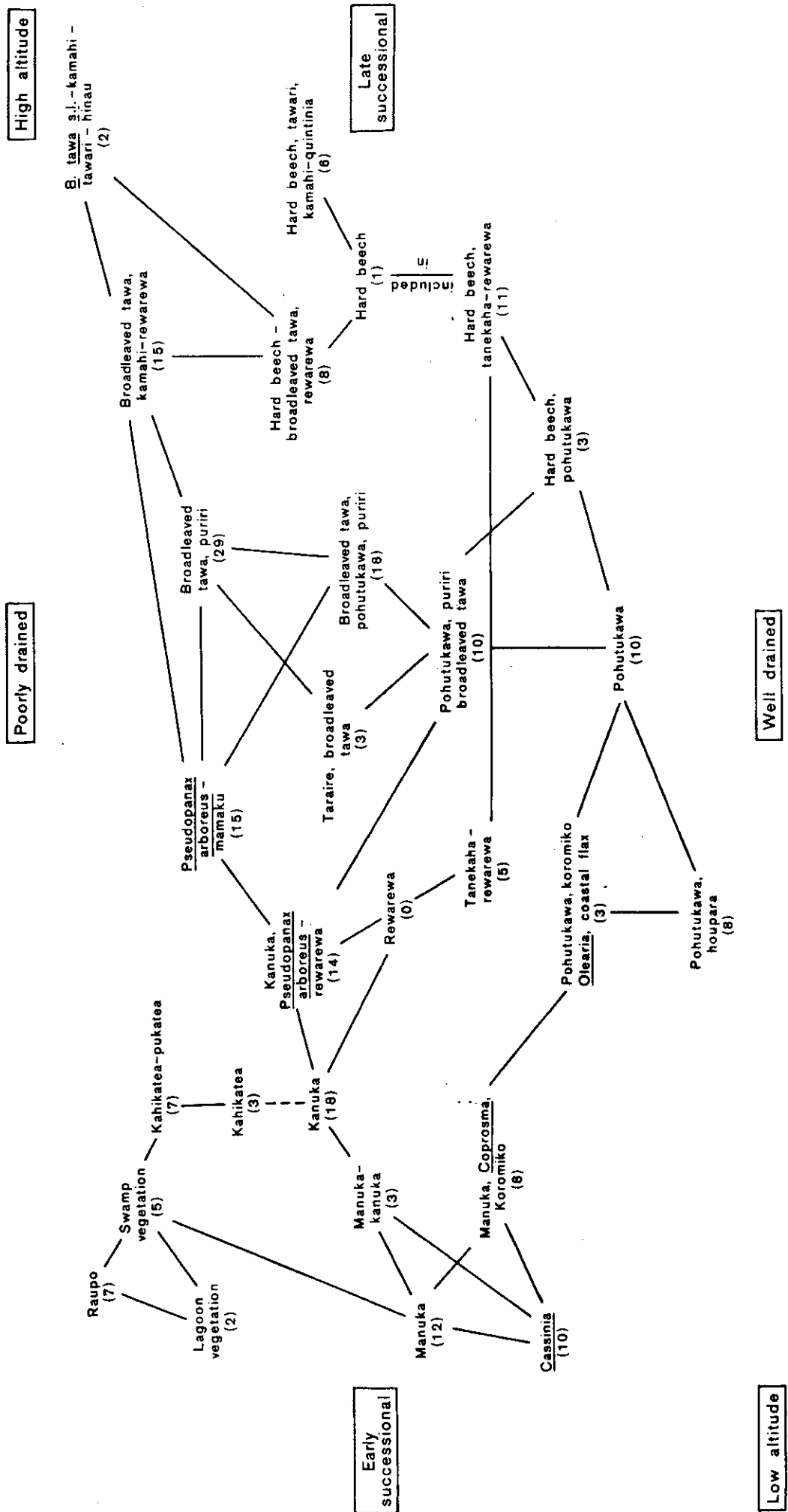
- (i) coastal: the upper limit of pohutukawa as a physiognomically prominent forest canopy species. Generally the coastal zone extends to the ridge of the frontal seaward-facing hill slopes of the District, up to 250-300 m a.s.l. and 2-3 km from the coast.
- (ii) lowland: the transition to forest with an abundance of montane species such as tawari, quintinia, kamahi, raukawa, broadleaf, and toatoa. The upper limit is at about 600 m a.s.l. on coastal hills, and falls to about 400-500 m a.s.l. inland.
- (iii) montane: the upper limit of forest vegetation (treeline) at about 1370 m a.s.l. Dwarfed forms of mountain and silver beech are included in the subalpine zone.
- (iv) subalpine: the upper limit of erect woody vegetation (scrubline), principally the upper limit of Olearia colensoi, at about 1520 m a.s.l. Includes herb dominated communities edaphically controlled or induced by fire.
- (v) alpine: includes alpine tussockland, herbfield and fellfield on the summits of Mt Hikurangi and Whanokao.

3.6 Landform

Because of the lack of adequate large-scale resource data, and insufficient pre-survey time to develop a full understanding of landform and geomorphic processes in the District, landform has not been integrated into the present survey as fully as it might have been.

The Ministry of Works and Development Land Resource Information (L.R.I.) 1:63360 worksheets were found not to represent adequately the landform character of the Motu Ecological District. For instance, the coastal headlands were not separated from the hinterland, riverbeds were not mapped, and some boundaries followed vegetation rather than landform.

Figure 2 - Vegetation Types of the Coastal and Lowland Zones



NB the number in brackets indicates the number of ecological unit cards assigned to each type the lines link types with the most similar composition

features. The terrain classification maps prepared by the Department of Lands and Survey to accompany Crozier and Owen (1983) were based on the L.R.1. maps. They were not substantially used for the same reason although the terrain units were recorded on the field card. Other available landform data (in a broad sense) were restricted to the 1:250 000 general North Island soil reconnaissance survey (D.S.I.R., 1954), the 1:250 000 geological survey (Kingma, 1965), and a near full set of 1980-81 black and white aerial photographs of approximately 1:28 000 scale.

Data were collected for the full set of landform variables specified on the field card and as well brief descriptions were made of ecological unit landforms. Of this data use was later made mainly of altitude, slope, landform assemblage and catenary position.

3.7 Analysis

The 236 ecological unit cards were hand-ordered into types, on the basis of the top tier cover class data and field knowledge of the vegetation types in the District (see Figure 2). Twenty-seven types were identified. They reflect gradients of altitude, soil drainage, and successional stage. Landform has been used as a secondary criterion to differentiate within these vegetation types where they cover more than one distinct landform unit.

3.8 New Zealand Forest Service survey data

New Zealand Forest Service National Forest Survey and Ecological Survey plot data were used to delineate the vegetation types present in the middle and upper altitude zones of the District not covered by the present survey. More than 500 plots between 450 m and 1420 m were measured by the National Forest Survey and Ecological Survey. These plots were hand-ordered in the manner already outlined in section 3.7 and the types thus defined were integrated with those of the present survey. This ordination produced types more or less identical with those described by Nicholls (1971), and the descriptions presented in Appendix II are expanded versions of those in Nicholls (1971).

3.9 Other survey data

The vegetation types described for the subalpine and alpine zones follow those of Druce (1961) and Mt Hikurangi and Mt Arowhena field notes of B.D. Clarkson. These types are broad in comparison to the others described but, as nearly all the subalpine and alpine zones are already protected, they are considered adequate for the purposes of this account.

The data for the proposed Opape Lands reserve ("Nukutere Scenic Reserve") are taken from Daniel (1983).

The vegetation types outlined by Clarkson and Regnier (1983, 1984) for the scenic reserves in the study area have also been used.

A wildlife survey of the District was carried out by the N.Z. Wildlife Service Fauna Survey Unit in October–November 1983, as part of a survey of the East Cape region. The data collected have been used in this study.

4. VEGETATION AND LANDFORM

4.1 Description of vegetation types

The vegetation types of the District identified (see 3.7, 3.8 and 3.9) are listed and described in Appendix I.

Each type is named according to the leading dominants in the top tier, and the structural class follows Atkinson (1983). For wetlands, where possible, national wetland classification terms (proposed in Environmental Council of New Zealand, 1983) are incorporated into the type name or description. This facilitates direct comparison of the types of wetland present in the District with those elsewhere in New Zealand. For convenience, seven wetland types, each represented by a single occurrence, have been grouped into two blanket types. Similarly a blanket type has also been used to describe the many subalpine scrub and shrubland types.

Each description includes, as appropriate: successional status; emergent and canopy dominants in order of decreasing frequency, canopy height range, landform(s) and altitude; middle and ground tier dominants, epiphytes and lianes; and extent and type of modification in each tier, including browsing, trampling and flooding. The successional status of a type in relation to others is also noted where known, as are any other features of note such as rarely occurring canopy species.

Checklists of indigenous and adventive vascular plants recorded by the present survey are included as Appendices II and III respectively.

4.2 Checklist of Ecological Super-Units

As noted in section 3.7, some of the vegetation types identified occur on more than one landform. The vegetation - landform combination has therefore been chosen as the basis of the subsequent assessment of representativeness in the coastal and lowland zones of Motu Ecological District (see chapter 6). The vegetation-landform units so formed have been termed Ecological Super-Units (ESU's), to distinguish them from the ecological class concept of Park (1983). These Ecological Super-Units are listed in Table 1 along with information on the extent and conservation status of each.

4.3 Vegetation map

A vegetation map of the coastal and lowland zones was also produced from the data collected. However only the portions covering the Priority Natural Areas are given in this report. Copies of the complete vegetation map are available for purchase at the Gisborne office of the Department of Lands and Survey. In order to map at a 1:50,000 scale the 39 ESU's were reduced to 27 mapping units. The concordance between the ESU's and the mapping units is given on the map legends (Figure 5).

4.4 Rare and endangered plants

Four rare and endangered species (Given, 1981), Carmichaelia williamsii, Olearia pachyphylla, Metrosideros carminea and Coriaria pottsiana, occur in the District.

Carmichaelia williamsii is found in the north of the District at two coastal localities, both on the edge of open pohutukawa canopies. One site has eight robust juveniles growing amongst Libertia grandiflora on skeletal soils below the ridge of a rocky coastal hillside. A narrow walking track runs beside the population and track users have caused minor damage to some plants. There is no stock access and no evidence of browsing.

The other site is near the type locality for the species. There are only two mature individuals, growing with hangehange, tutu, kanuka, Corokia cotoneaster and Leucopogon fasciculatus, on a steep unstable hillside in dry compacted soil. Both plants are unhealthy and perhaps senescent. Die-back along stem margins, and black manuka blight is evident on both plants. A stock track runs through this site and stock have damaged the base of one plant and broken branches on the other.

At least two other populations occur on the mainland. Both are north of the District. Other populations occur on Alderman, Great Barrier, Little Barrier and Poor Knights Islands.

Olearia pachyphylla is found on the coastal margins of Opape and Haurere headlands. Mature plants and seedlings are abundant on disturbed sites

(e.g. the old military track) and are a major canopy or understorey component in some areas. Associated species here include hangehange, Phormium cookianum and manuka. There is no evidence of browsing and the locations are not of easy access. The only other location from which this species has been recently recorded is in a similar habitat on the east coast of Coromandel Peninsula where only a few plants exist (Heginbotham, 1979).

Metrosideros carminea is found in several localities in the District, mainly confined to riparian forest along the lower reaches of the Raukokore and Kereu Rivers, and along the Manuriki and Otangihia Streams. The plants are either rupestral or arboreal lianes on a wide range of tree species, and often growing with M. perforata and M. diffusa. Mature plants were rarely found, and less than 50 plants were found in total. Due to the nature of the survey the search was not comprehensive and it is likely that many more plants remain undiscovered. M. carminea is found outside the District at several sites in Northland, Coromandel Peninsula, Waikato, Kaimai Range and Taranaki, as well as on Great Mercury and Great Barrier Islands.

Coriaria pottsiana is common on the subalpine scree slopes of Mt Hikurangi. It is also recorded from Mts Arowhana and Parikanapa (Druce, 1980), the latter being outside the District. The species is regarded as rare because of its restricted distribution. On Mt Hikurangi plant numbers appear to be stable despite disturbance by stock trampling.

4.5 Limits of distribution

The known southern limit of taraire (Beilschmiedia tarairi) was extended six small trees being noted on a hillslope in broadleaved tawa-pohutukawa-puriri forest, lat. 37°57', Torere. Libocedrus plumosa reaches its southern limit in the North Island at lat. 38°15', Whinray Scenic Reserve, (Clarkson and Regnier, 1984); Archeria racemosa is approaching its southern limit at 38°10' (Druce, 1980), and Carmichaelia williamsii reaches its southern limit at 37° 45' (Druce, 1980).

More than 40 species, mainly alpine and subalpine, reach their northern limit in the District on Mts Hikurangi, Whanokao and Raukumara (Appendix II). These include Cassinia vauvilliersii, Coprosma pseudocuneata,

Euphrasia zelandica, Forstera tenella, Hebe odora, Hymenanthera alpina, mountain beech, Olearia colensoi and Peraxilla colensoi, (Druce, 1980). Coprosma rubra reaches its northern limit near Toatoa Scenic Reserve (Clarkson and Regnier, 1983).

4.6 Tawa or tawaroa?

It has long been known that a broadleaved form of Beilschmiedia tawa sensu lato exists (Allan, 1961; Knowles and Beveridge, 1982). Wright (1984) recently described this form as a new species, B. tawaroa (tawaroa). He states that B. tawaroa differs from B. tawa sensu stricto in its dense spreading crown, larger width-length leaf ratio, dark green leaf colouration, and drip tip. The high width-length leaf ratio is the critical diagnostic feature (A.E. Wright, pers. comm.).

On the basis of herbarium specimen data and field work in the northern North Island, B. tawaroa is described by Wright (1984) as being coastally distributed (near sea-level to 250 m a.s.l.), along the east coast of the North Island, including offshore islands, from Mangonui in Northland to Raukokore in the eastern Bay of Plenty. It exceeds 250 m a.s.l. only on Little Barrier Island where it occurs up to 600 m a.s.l.

As a result of the present survey, it was found that B. tawa s.s., and a range of broadleaved forms approaching and including B. tawaroa occur as a major canopy tree in the District. The latter tawaroa-like forms do not always reach the leaf width-length ratios determined by Wright for B. tawaroa. On some individual trees a wide range of leaf width-length ratios is present. Wright (1984) has collected B. tawaroa from Raukokore in the far north of the District, and has other records from the East Cape vicinity.

On the basis of accumulated field observations over the summer and a wide-ranging collection¹ of the different B. tawa s.l. forms, it is now considered that tawaroa-like forms are predominant in the coastal and lowland zones. They were also found in the Waioeka valley south of the District, on low altitude alluvium on the Motu River 22 km inland, and in the montane zone up to 800 m a.s.l. and 15 km inland.

1. Specimens have been lodged with the Auckland Institute and Museum.

B. tawa s.s. forms the montane component of B. tawa s.l., and also occurs occasionally in the coastal and lowland zones. At the lower part of its altitudinal range, B. tawa s.s. occurs in association with tawaroa-like forms. The relationships between the different forms here are not well understood.

The taxonomic status of the broadleaved B. tawa s.l. forms in the District is unresolved. Although forms keying to B. tawa s.s. and B. tawaroa both occur in the District, many tawaroa-like forms could not be attributed confidently to either taxon. As well, clear differences in habitat preference were not distinguished by the survey. As the District

and adjacent areas appears to be the only place in New Zealand where the distribution of these forms substantially overlaps, further work is required here to resolve these problems. At present we remain unconvinced that the taxonomic differences are inter-specific.

Problems have arisen in the survey in recognising and interpreting the different forms. In the field there were differences in taxon recognition amongst individual team members, and at different times of the survey. Consequently, field card records alone were not sufficient to distinguish relative proportions of B. tawa s.s. and tawaroa-like forms and so derive vegetation types and ecological units.

In this report, where tawaroa and tawaroa-like forms predominate the name broadleaved tawa is used. B. tawa s.s. forms are referred to as tawa. Where both broadleaved tawa and tawa are present the name B. tawa s.l is used.

5. WILDLIFE

This preliminary account¹ of wildlife values identifies the key features to be considered in wildlife conservation and the definition of priority natural areas in the District (Chapter 6). Wildlife data at the detailed level of the vegetation and landform components of the present survey are not available.

5.1 Assemblages of species

A rich species assemblage is one indicator of good wildlife habitat² (Thomas, 1979). Such assemblages distinctive in the District are:

- the full range of extant North Island forest bird species, except red-crowned parakeet, in the large forest blocks and Raukumara S.F.P.;
- breeding and feeding concentrations of coastal and river bird species at mouths and on lower braided portions of rivers.
- high densities and species richness of native fish and invertebrates in the comparatively unmodified Haparapara River (C.J. Richmond, pers. comm.).

5.2 Rare, endangered and uncommon species

Five rare and endangered species listed in The Red Data Book of New Zealand (Williams and Given, 1981) occur in the District, and several other uncommon species are of concern. Habitats supporting these species are of high or outstanding wildlife value.

N.I. kokako is described as vulnerable, declining in numbers and threatened by habitat modification and food competition with possums. It is now exceedingly rare in the District.

Hochstetter's frog is described as a rare species. The N.Z. Wildlife Service survey, Daniel (1983) and the present survey have shown Hochstetter's frog is

1. The N.Z. Wildlife Service is preparing a report on the wildlife and wildlife habitats of the Bay of Plenty region.
2. Others are the number of individuals present (i.e. density), and demographic health of population.

widely distributed in suitable habitats and the District may be one of the species' strongholds in New Zealand. The species generally is concentrated in a narrow habitat along sheltered forest first and second order streams and is vulnerable to disturbance locally and higher up in its catchments (Bell, 1982).

Short jawed kokopu and giant kokopu are listed as of indeterminate status, and the short-tailed bat as vulnerable. Their distribution in the District is poorly known.

Though not listed in Williams and Given (1981), who are regarded as a rare and threatened species by the N.Z. Wildlife Service (Williams, 1981). They are one of the very ancient members of the New Zealand avifauna. They are poor colonisers, are unable to cope with significant habitat alteration, and their riverine habitats are vulnerable to change. The District has a substantial population primarily on the Motu River and its tributaries (Roxburgh, 1982).

The status of N.Z. dotterel, which has a small breeding population at the Haparapara river mouth, has been evaluated recently by Reed (1981) who considered it could be classed as an endangered species.

N.I. kaka, parakeet and N.Z. falcon occur in fairly low numbers in the large forest tracts of the District. N.I. kaka is a declining species on the North Island mainland (Ogle, 1981), as is parakeet (Saunders, 1984). The North Island race of the N.Z. falcon may have its distribution centred on the East Cape region (Saunders, 1984).

5.3 Endemism

Fauna whose distribution is restricted to New Zealand (i.e. endemic) are of scientific and conservation significance, and the level of significance increases at higher levels of classification. Most vertebrate species occurring in the District are endemic to New Zealand. At higher classification levels, kiwis belong to an endemic order of birds, kokako and short-tailed bat to endemic families, and Hochstetter's frog, weka, bellbird, tui and the geckos Hoplodactylus and Naultinus to endemic genera. Hochstetter's frog is described as a very primitive and valuable part of the New Zealand biota (McLennan and MacMillan, 1982). Endemism is high at the specific and generic levels among New Zealand insects (Watt, 1975) and land snails (Climo, 1975).

6. NATURE CONSERVATION EVALUATION AND PROPOSALS

6.1 Objectives and methods

The primary objective of the Protected Natural Areas Programme is expressed in the Reserves Act 1977 (Section 3(1)(b)):

"Ensuring, as far as possible, the survival of all indigenous species of flora and fauna, both rare and common-place, in their natural communities and habitats, and the preservation of representative samples of all classes of natural ecosystem, and landscape which in the aggregate originally gave New Zealand its own recognisable character".

In the Motu Ecological District, the procedure for defining priority natural areas to achieve the primary objective has been as follows:

- (a) description and listing of ecological values of the District (Chapters 4, 5 and 6.2);
- (b) listing of ecological resources in existing and proposed protected natural areas (section 6.3);
- (c) listing of ecological resources not in existing and proposed protected natural areas (section 6.4).
- (d) definition of priority natural areas which would achieve this objective (section 6.5).

6.2 Checklist of Survey Areas

Appendix V is a checklist of the Survey Areas of the Motu Ecological District. The Survey Area name, code number, Ecological Super-Units and units present, and special features are listed.

6.3 Checklist of ecological resources in existing and proposed Protected Natural Areas

Protected Natural Areas (PNAs) are areas whose tenure and administration are reasonable guarantees of the preservation of the indigenous landscape,

fauna and flora they contain (Kelly, 1980). Within the Motu Ecological District, current PNAs are gazetted Scenic Reserves (Reserves Act 1977) and the Motu River (Water and Soil Conservation Act 1967). Proposed PNAs include State Forest ecological and wilderness areas (Forests Act 1949) and a scenic reserve (Reserves Act 1977).

There are also a number of existing reserves containing indigenous vegetation which have been established for specific purposes other than nature conservation.

There are no covenanted areas in the District.

(i) Gazetted Protected Natural Areas (see Appendix VI, Part A)

There are seven gazetted scenic reserves in the Motu Ecological District: Two are very small (less than 20 ha) both in the coastal zone. The others are all in the lowland and montane zones. Two, Meremere Hill and Toatoa, are only partly in the District. In total these reserves cover 6286 ha; excluding those portions of Meremere Hill and Toatoa Reserves not in the District the total is approximately 4500 ha.

In February 1984, a National Water Conservation Order (under section 20b of the Water and Soil Conservation Order) was declared on the Motu River and its major tributaries (except the upper Takaputahi) between Motu Falls and the State Highway 35 Bridge. The Order specifies that the river shall be preserved as far as possible in its natural state. The Order recognises the outstanding wilderness scenic, natural and recreational values of these parts of the river. It applies only to the river and not to the surrounding land (Planning Tribunal, 1984).

(ii) Proposed Protected Natural Areas (see Appendix VI, Part B)

There are seven Ecological Areas totalling about 20 550 ha, one Wilderness Area of 39 000 ha, and one Scenic Reserve (only partly in district) of 3950 ha, proposed in the Motu Ecological District.

The seven Ecological Areas and the Wilderness Area are all contained within Raukumara State Forest Park. The Ecological Areas were recommended by the State Forest Scientific Reserves Advisory Committee (SFSRAC) in May 1983 and await approval. The Wilderness Area has been approved in principle by the Minister of Forests, and an appraisal is now underway.

The proposed "Nukutere Scenic Reserve" (Daniel, 1983) has been approved in principle both by the Minister of Lands and the Whakatohea Trust Board.

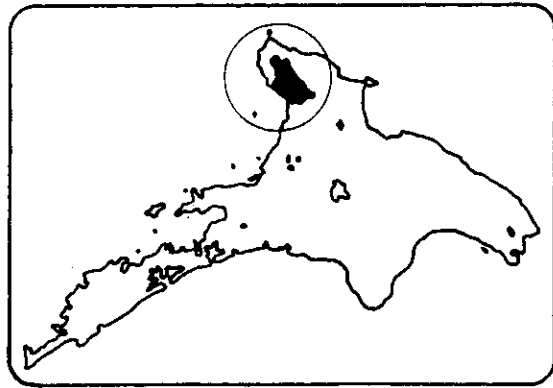
(iii) Other gazetted "reserves"

These "reserves" are ones which have been established for reasons other than nature conservation, and they fall below the base line where preservation of indigenous landscape, fauna and flora is reasonably guaranteed (Kelly 1980). They contain many of the vegetation types of the District. They include Raukumara State Forest Park (Forests Act 1949), Whitianga Recreation Reserve (Reserves Act 1977), Te Kaha Local Purpose Waterworks Reserve (Reserves Act 1977), and seven Maori Reserves (Maori Affairs Act 1953.)

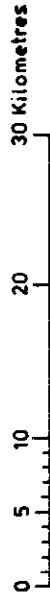
6.4 Ecological resources not in existing or proposed PNAs

The scenic reserves, together with the proposed scenic reserve and ecological areas and approved-in-principle wilderness area, are fully representative of the montane, subalpine and alpine vegetation and landform types of the Motu Ecological District (see Figure 3). This survey has proceeded on this assessment. It is very important that the proposed and approved-in-principle PNAs are gazetted.

The extent of representation of all coastal and lowland ecological super-units in existing and proposed PNAs is shown in Table 1. The majority of these E.S.U.s are not represented. Eight are represented to a limited extent in the two coastal scenic reserves, the proposed "Nukutere Scenic Reserve" and the proposed Paraumu and Puketoetoe ecological areas. Two lowland and montane E.S.U.s are well represented



Scale 1:500000



Cape Runaway

Hicks Bay

PUKEAMARU
ECOLOGICAL
DISTRICT

Raukokore River

MOTU
ECOLOGICAL
DISTRICT

Mangaporo River

Tapuaeora River

Waipū River

WAIAPU
ECOLOGICAL
DISTRICT

Bay of Plenty

Motu River

WAIOTEKA
ECOLOGICAL
DISTRICT

Motu River

KEY TO SCENIC RESERVES

- ① Tokata
- ② Oroī
- ③ "Nukutere"
- ④ Meremere Hill
- ⑤ Taatōa
- ⑥ Whitikau
- ⑦ Whinray
- ⑧ Aorangiawai

KEY TO PROPOSED ECOLOGICAL AREAS

- Ⓐ Kopuapounamu
- Ⓑ Raukokore
- Ⓒ Whanokao
- Ⓓ Hikurangi
- Ⓔ Maungawaru
- Ⓕ Puketotē
- Ⓖ Paraumu

KEY TO PRIORITY NATURAL AREA CORRIDORS

- ⓓ Whanarua-Kereu Corridor
- ⓓ Motu Corridor
- ⓓ Torere Corridor

Raukumara State
Forest Park Bdy.

Proposed
Raukumara
Wilderness Area

LOCALITY MAP OF MOTU ECOLOGICAL DISTRICT SHOWING SCENIC RESERVES, PROPOSED ECOLOGICAL AREAS, PRIORITY NATURAL AREA CORRIDORS

in the wilderness area, and proposed ecological areas and "Nukutere Scenic Reserve".

Of the rare and endangered plant species (see Table 2), Olearia pachyphylla, Carmichaelia williamsii, and Metrosideros carminea are not included in PNAs; the plant species at their distribution limits in the coastal and lowland zones are not included either (see Tables 2).

Conservation of wildlife requires protection of their habitats, which may be extensive for wide-ranging species. Of the key wildlife values and habitats in the District (Chapter 5), the following are not protected:

- coastal and riverbed bird species on the rivermouths and lower braided portions of rivers;
- fish and invertebrate species assemblages in Haparapara River, including the rare giant kokopu;
- N.Z. dotterel breeding habitat on Haparapara River estuary.

The following key wildlife values and habitats are partly protected:

- the North Island forest bird species assemblage, for which the wilderness area and proposed ecological areas would provide a core reserve;
- shortjawed kokopu (Motu River only);
- Hochstetter's frog ("Nukutere Scenic Reserve", wilderness area, some proposed ecological areas).

Insufficient is known of the distribution of the short tailed bat to determine how much of its habitat is protected.

Knowledge of invertebrate populations in New Zealand is currently such that the best strategy for invertebrate conservation is protection of representative samples of vegetation and landform (Watt, 1979). Full representation of the ecological super-units in the coastal and lowland zones is therefore required.

TABLE 1 CHECKLIST OF ECOLOGICAL SUPER-UNITS OF THE
COASTAL AND LOWLAND ZONES

Abbreviations and explanatory notes

- / Demarcates tiers.
- Links species of approximately equal cover class.
- , Separates species in order of decreasing cover class.
- n.v. Not vegetated or not vegetation type described.
- a Because of exotic species present, cannot be considered to be part of 1840 vegetation datum. Both instances however are the only semi-natural remnant of their vegetation - landform type.
- b Recent induced successional units which in the past may have been major units after natural disturbances such as windthrow, lightning, fires, volcanic eruption, or slipping.
- c Induced successional units which have increased in relation to their former extent.
- d Former major ecological super-unit ("major ecological unit" in Park, 1983) has been interpreted as one which was formerly a significant component of the landscape at about 1840 A.D. The 1840 datum was selected in order that the present study be comparable with representativeness assessments carried out by the Biological Survey of Reserves. As well, the long history of Polynesian modification in the coastal zone of the district makes it difficult to assess the pre-Polynesian vegetation.
- e All non-major ecological units however would have contributed to the recognisable original character of the landscape, except for two with a substantial adventive plant component.
- f Although there are still numerous areas of greatly modified pohutukawa forest and treeland, intact pohutukawa coastal cliff forest is very rare.
- g In cases where the Olearia present is O. pachyphylla, this unit is practically confined to the district.
- h Number of extent in district refers to the number of plots measured in each super-unit. This gives only an approximate indication of the extent of the super-unit in the lowland and coastal zones.
- i Protection is considered adequate where approximately 10% or more of E.S.U.'s original extent is protected, and poor for between 0 and 10%.
- j Proposed Protected Natural Area only.
- k The length of river protected under the Motu River National Water Conservation Order.

TABLE 1
CHECKLIST OF ECOLOGICAL SUPER-UNITS OF THE COASTAL AND LOWLAND ZONES

Unit no. (veg) (type)	Bioclimatic zone	Natural community type and class	Landform	Number or extent in district ^h	Former ecological super-unit ^d	Greatly reduced from former extent	Confined to district	Protected Area Status	
								Total area (ha)	No. of areas of adequacy of protection ⁽ⁱ⁾
A HYDROECOLOGICAL CLASSES									
1 (1)	coastal	<u>Ruppia polycarpa</u> , <u>Limosella lineata</u> aquatic herbfield	lagoon mudflat	1	No	Yes	No	0	0 Nil
2 (1)	coastal	<u>Juncus microcephalus</u> , <u>Aster subulata</u> rushland	lagoon mudflat	1	No ^a	No	No	0	0 Nil
3 (1)	coastal	<u>Plagianthus divaricatus</u> - <u>Cyperus ustulatus</u> shrubland	old lagoon	1	No	Yes	No	0	0 Nil
4 (2)	coastal	cabbage tree tree-land swamp	alluvial terrace	1	No	No	No	0	0 Nil
5 (2)	coastal	<u>Phormium tenax</u> flax swamp	dried stream course	1	No	No	No	0	0 Nil
6 (3)	lowland coastal	raupo reedland	infilled gullies, poorly drained terrace sites, beach strand depressions	7	No	No	No	0	0 Nil
7 (n.v.)	lowland coastal	bare riverbeds and flowing waters	major river valleys	-	Yes	Yes	No	95 km ^k	1 Adequate
8 (2)	lowland	<u>Carex geminata</u> sedge swamp	peaty infilled gully impeded drainage	1	No	No	No	0	0 Nil
9 (2)	lowland	<u>Isachne globosa</u> grass swamp	peaty infilled gully	1	No	No	No	0	0 Nil
10 (4)	lowland	manuka scrub bog	poorly drained peat in valley bottoms	2	No	No	No	0	0 Nil
11 (5)	lowland	kahikatea swamp forest and tree-land and kahikatea forest	alluvial valleys	3	No	Yes	No	69 ha	1 Poor

12 (6)	lowland	pukatea, kahikatea swamp forest	alluvial terrace, impeded drainage	1	No	No	1 ha	1	Poor
B TERRESTRIAL CLASSES									
13 (n.v.)	coastal	bare rock and ice plant herbland	rock stack	1	No	No	0	0	Nil
14 (27)	coastal	tauhinu-lupin shrubland	marine beach	1	No ^a	No	0	0	Nil
15 (7)	coastal	taraire, broad- leaved tawa forest	valley bottoms in low hills	3	No	Yes	0	0	Nil
16 (8)	coastal	pohutukawa forest and treeland	on and above coastal cliffs within spray and subaerial zones	10	Yes	Yes ^f	2 ha	1	Poor
17 (34)	coastal	pohutukawa/koromiko <u>Olearia</u> , flax scrub	steep hill slopes in spray and subaerial zones	3	No	No	0	0	Nil
18 (9)	coastal	pohutukawa, houpara forest	offshore stacks and islands	7	No	No	0	0	Nil
19 (10)	coastal	pohutukawa, puriri forest	marine terraces, colluvium	5	Yes	Yes	0	0	Nil
20 (10)	coastal	pohutukawa, broad- leaved tawa, puriri forest	lower and mid hillslopes	7	Yes	Yes	40 ha j	1	Poor
21 (11)	coastal	broadleaved tawa, pohutukawa, puriri forest	basal to upper coastal hillslopes	17	Yes	No	27 ha j	1	Poor
22 (15)	coastal	hard beech, pohutu- kawa forest	high seaward facing ridges	3	No	No	0	0	Nil
23 (30)	coastal	manuka-kanuka scrub	mid and basal hillslopes	3	No ^b	No ^c	0	0	Nil
24 (31)	coastal, lowland	kanuka scrub and forest	fresh alluvial terrace sites	4	No	No	0	0	Nil
25 (29)	coastal, lowland	manuka, Coprosma, koromiko scrub	low altitude mid and upper hillslopes	11	No ^b	No ^c	0	0	Nil

26 (27)	lowland, coastal	tauhinu shrubland and scrub	alluvial floodplains	7	No	No	No	0	0	Nil
27 (31)	lowland, coastal	kanuka forest and scrub	low altitude hill- slope bases to crests	14	No ^b	No ^c	No	0	0	Nil
28 (32)	lowland, coastal	kanuka, <u>Pseudopanax arborescens</u> - rewarewa forest and scrub	low altitude basal to upper hillslopes	14	No ^b	No ^c	No	0	0	Nil
29 (28)	lowland, coastal	manuka scrub	mid to crest hillslopes	11	No	No	No	14 ha	1	Poor
30 (33)	lowland, coastal	<u>Pseudopanax arborescens</u> - mamaku forest and scrub	mid and upper hillslopes	19	No	No	No	0	0	Nil
31 (6)	lowland, coastal	kahikatea, pukatea forest	alluvial terraces	6	No	Yes	No	0	0	Nil
32 (12)	lowland, coastal	broadleaved tawa, puriri forest	colluvium, basal and mid hillslopes, mid hillslope gullies	19	Yes	No	No	0	0	Nil
33 (12)	lowland	broadleaved tawa, puriri or pukatea forest	low altitude alluvial terraces and gullies	8	No	Yes	No	0	0	Nil
34 (16)	lowland	hard beech - broadleaved tawa, rewarewa forest	lower and mid zone mid and upper hillslopes	8	Yes	No	No	1450 ha j	1	Poor
35 (17)	lowland	hard beech, tanekaha - rewarewa forest	low and mid zone ridges, knolls and spurs	11	Yes	No	No	750 ha j	1	Poor
36 (13)	lowland	broadleaved tawa, kamahi, rewarewa forest	mid and upper zone, mid and upper hillslopes	16	Yes	No	No	300 ha j	1	Poor
37 (33)	lowland	tanekaha - rewarewa forest	low and mid zone, mid and upper hillslopes	7	No ^b	No ^c	No	0	0	Nil
38 (14)	lowland, montane	<u>B. tawa s.l.</u> - kamahi-tawari	ridge summits and upper hillslopes	2	Yes	No	No	(c2583 ha) (c14316ha) j	(5) (6)	Adequate
39 (18)	lowland	hard beech, tawari kamahi-quintinia forest	ridge crests and upper hillslopes	6	Yes	No	No	(c2150 ha) (c9716 ha) j	(3) (4)	Adequate

TABLE 2: Special features of high conservation priority

(i)	Rare and endangered species^a <u>Carmichaelia williamsii</u> <u>Olearia pachyphylla</u> <u>Metrosideros</u> <u>carminea</u>	Survey Areas or Habitats Raukokore River, Motuaruhe Haurere and Opape Headlands Raukokore Reserve, Pohueroro Maungaroa North, Houputo A, Houputo D.
	Giant kokopu N.Z. dotterel Shortjawed kokopu Hochstetter's frog	Haparapara River Haparapara River mouth Haparapara River Torere 64/65, Torere Stm, Manuriki Stm, Orini Stm, Waipore Stm, Whanarua Stm, Te Aruhe Ahika, Mangahatoto Stm, Waihueroro Stm, Mangaikakorea Stm, Raukokore R tributary (GR N62: 298559); probably other streams.
(ii)	Limits of distribution <u>Beilschmiedia tarairi</u> southern limit <u>Carmichaelia williamsii</u> " " <u>Coprosma rubra</u> northern limit	Torere Bush^b Whanarua Toatoa
(iii)	Special habitats Haparapara/Waikakariki Rivers^c	
a.	Advice on protection of specific sites of rare and endangered species may be sought from Department of Lands and Survey Gisborne, N.Z. Wildlife Service Wellington, and Botany Division D.S.I.R. Lincoln.	
b.	The gully behind Hawai Marae is the next taraire site north of the southern limit.	
c.	These rivers are some of the largest lacking introduced salmonids. It is the policy of the N.Z. wildlife Service to retain these rivers in their natural state as far as possible and to exclude introduced fish species (C.J. Richmond, pers. comm.).	

6.5 Selection of Priority Natural Areas

Having carried out the steps listed at the outset of this chapter, priority natural areas were selected. The aim was to achieve, where possible, large viable corridors from sea coast to mountain top, with a complete altitudinal sequence of ecological super-units and incorporating as many special features (Table 2) as possible.

Only three localities exist where it is still possible to achieve such large representative reserves: Whanarua-Kereu, Motu and Torere.

Ecological super-units which were under-represented or unrepresented in these corridors, because they are generally outliers surrounded by highly modified vegetation or developed land (e.g. kahikatea-pukatea forest), were then considered. The best three examples (if three existed) of each, based on size and condition, were selected as outlier Priority Natural Areas.

The Priority Natural Areas so determined are listed and their values briefly described below (section 6.6.). They are shown on Figures 3 and Figures 4 to 10.

To summarise, three corridors and associated outliers have been selected and a priority order indicated. Two of the proposed corridors (Whanarua-Kereu and Motu) contain a representative sample of most of the ecological super-units of the district and the third (Torere) has an incomplete sample of ecological super-units.

In the second and third priority corridors, the core areas of importance are indicated by a first priority rating so that should negotiation for protection of a complete corridor fail the area of greatest importance might still be sought. However, in this event, it would be essential that those associated with the original survey be involved in any re-assessment of priorities.

Although the corridors have been listed in a priority order it should be noted that the reservation of at least the two best corridors (Whanarua-Kereu and Motu) and all the first priority outliers would be necessary to represent adequately the latitudinal variation of vegetation and associated biological and landscape features of the district.

This conclusion rests on the proviso that the already proposed Opape Lands corridor (Daniel, 1983) comes to fruition. If the Opape Lands corridor does not eventuate the Torere corridor would assume much greater importance.

6.6 Priority Natural Areas

Brief descriptions of the Priority Natural Areas are given below. More complete information on the survey areas in each Priority Natural Area can be found in Appendix V and the survey area numbers cited can also be used to refer to the survey area cards which are held at the Gisborne office of the Department of the Lands and Survey. The area (ha) given for each Priority Natural Area is approximate only. The grid reference indicates the approximate centre of the Priority Natural Area. The location of each of the Priority Natural Areas is shown on Figures 4 to 10.

PRIORITY ONE AREAS

1:1 Whanarua-Kereu corridor (Figure 8)

Area: 9552ha

Altitude: 0-883m

Grid reference: N62 280510

Survey Areas: 5355-0001 Puhoeroro block, 5155-0005 Maungaroa North and part Waikawa (access not granted), 5255-0001 part Motuaruhe, 5204-0001 Kereu River, 5155-0002 part Te Kaha.

Description: A complete altitudinal sequence from coastal pohutukawa forest to montane hard beech, tawari, kamahi, quintinia forest. The great majority of the corridor comprises a mosaic of lowland (steep-land) broadleaved tawa, kamahi, rewarewa forest-hard beech, broadleaved tawa, rewarewa forest-hard beech, tanekaha, rewarewa forest. Links with the proposed Raukumara Wilderness Area and the proposed Raukokore Ecological Area. Includes the greatest range of ESU's and most of the best examples in the District. "These blocks are of outstanding wildlife value... including animals with limited distributions such as Hochstetter's frog and kaka" (Saunders, 1984).

Other special features include the presence of the threatened native broom, Carmichaelia williamsii, and the threatened carmine rata, Metrosideros carminea, (in substantial numbers), pockets of taraire and the only kahikatea-matai forest in the District.

1:2 Raukokore River kahikatea-pukatea forest (Figure 10)

Area: 12.5ha

Altitude: 75-120m

Grid reference: N62 373519

Survey area: 5355-0001 Puhoeroro block

Descriptions: An unmodified kahikatea-pukatea forest on an alluvial terrace beside the Raukokore River. Surrounded by tawa forest, on the hillslopes, and black beech-rimu forest, on the ridges. This area will be discussed more fully by the forthcoming Pukeamaru PNA Survey report.

1:3 Raukokore (Figure 9)

Area: 115ha

Altitude: 15m

Grid reference: N62 280595

Survey areas: 5255-0007 Raukokore Beach, 5255-0008 Kapongaro, 5255-0004 lower Raukokore River.

Description: Tauhinu scrub and shrubland, raupo reedland, lagoon vegetation (Plagianthus divaricatus, Juncus microcephalus, Ruppia polycarpa), cabbage tree swamp and remnant taraire forest at Raukokore Beach, rivermouth and vicinity. The only example of lagoon vegetation in the District and the only intact landform of its type. A special feature is the presence of the threatened shrub, Carmichaelia williamsii.

The taraire forest is all that remains of what was presumably a more widespread type in this locality. Broadleaved tawa (in this instance a form which keys to tawaroa) occurs with the taraire. A breeding colony of southern black backed gulls is present at the Raukokore River mouth.

1:4 Haparapara and Waikakariki Rivers (Figure 7)

Area: 187.5ha

Altitude: 0-610m

Grid reference: N70 123425

Survey area: 5054-0003 Haparapara and Waikakariki Rivers

Description: An area of special wildlife interest (C.J.Richmond pers. comm.); the only salmonid free river in the District and one of the few such rivers in New Zealand (D.Rowe pers. comm.). Supports populations of two threatened fish species, short jawed kokopu and giant kokopu. Includes small areas of manuka scrub, pohutukawa, houpapa forest, kanuka scrub and forest and broadleaved tawa, puriri forest.

1:5 Opape Headland (Figure 5)

Area: 25ha

Altitude: 0-45m

Grid reference: N70 850230

Survey area: 4852-0001 Opape Headland

Description: Pohutukawa, koromiko, olearia, wharariki scrub on coastal cliffs with large numbers of the threatened shrub, Olearia pachyphylla. This is probably the most substantial population of the species in New Zealand.

1:6 Torere 64 kahikatea forest (Figure 4)

Area: 20ha

Altitude: 335m

Grid reference: N79 955155

Survey area: 4951-0002 Torere 64/65 Lands

Description: A remnant of now uncommon kahikatea forest and associated wetland. Modified by cattle browsing and trampling but with the potential to recover if managed appropriately.

1:7 Te Uritukituki (Figure 6)

Area: 12.5ha

Altitude: 0-120-m

Grid reference: N70 982333

Survey area: 4953-0001 Te Uritukituki

Description: One of the three best examples of pohutukawa, puriri forest, a type much reduced from its former extent. Occurs on a low marine terrace above Te Uritukituki Beach.

1:8 Houpoto Swamp (Figure 6)

Area: 177.5ha

Altitude: 30m

Grid reference: N 70 005325

Survey area: 4953-0003 Houpoto Swamp E

Description: The largest intact fertile palustrine wetland in the District. Occurs in a valley floor of the Houpoto Stream. Vegetation types represented include raupo reedland, Isachne globosa swamp and Carex geminata swamp. A belt of manuka grows on some peaty mariginal sites. Several wetland species found here are unknown

elsewhere in the District including the nationally uncommon monocotyledonous herb, Sparganium subglobosum. Spotless crake are found here.

1:9 Torere Bush (Figure 6)

Area: 32.5ha

Altitude: 60-213m

Grid reference: N70 935258

Survey area: 4952-0008 Torere Bush

Description: A first priority core area in the Torere corridor. Here taraire occurs at its known southern limit. The forest is broadleaved tawa, pohutukawa, puriri.

1:10 Whitianga (Figure 7a)

Area: 102.5

Altitude: 30-275m

Grid reference: N70 035385

Survey area: 5053-0002 part Whitianga block

Description: A first priority core area in the Motu corridor. One of the three best examples of coastal pohutukawa, puriri, broadleaved tawa and broadleaved tawa, pohutukawa, puriri forest in the District. Occurs on marine terrace and low hills above Whitianga Bay.

1:11 Motu Kaimeanuī Island (Figure 8a)

Area: 1.5ha

Altitude: 0-15m

Grid reference: N61 218587

Survey area: 5255-0006 Motu Kaimeanui Island

Description: One of the three best examples of an island in the District. The vegetation is mainly pohutukawa-Pseudopanax lessonii and Pseudopanax lessonii-Pittosporum tenuifolium forest. Exhibits the complete zonation from Leptocarpus and sea rush to coastal scrub and forest. A nesting colony of black backed gulls is present and white fronted terns roost here.

1:12 Motu Papuku Islands (Figure 8a)

Area: 2ha

Altitude: 0-15m

Grid reference: N61 213580

Survey area: 5255-0005 Motu Papaku Island

Description: Two of the best three examples of islands in the District. Covered with Pseudopanax lessonii-rewarewa-mangeao-puriri forest.

1:13 Kereu River pukatea-kahikatea forest (Figure 8a)

Area: 12ha

Altitude: 120m

Grid reference: N70 212487

Survey area: 5254-0001 Maungaroa South

Description: A modified remnant of pukatea-kahikatea forest on an alluvial terrace of the Kereu River. Has the potential to recover if managed appropriately.

PRIORITY TWO AREAS

2:1 Motu corridor (Figure 7)

Area: 5463ha

Altitude: 0-870m

Grid reference: N70 120340

Survey areas: 5053-0002 Whitianga block, 5053-0003 Omaio block, 5054-0001 part Wharawhara block, Mangaroa (access not granted), Ohutu (access not granted)

Description: A complete altitudinal sequence from coastal pohutukawa forest and treeland, and pohutukawa, puriri, broadleaved tawa forest to montane hard beech, tawari, kamahi, quintinia forest. The great majority of the corridor comprises a mosaic of lowland (steep-land) broadleaved tawa, kamahi, rewarewa and hard beech, tanekaha, rewarewa forest. Also included are minor areas of cassinia shrubland, cassinia-kanuka scrub and kahikatea-pukatea forest with kowhai. Links with the proposed Raukumara Wilderness Area and incorporates the lower reaches of the Motu River and Tokata Scenic Reserve. An area of special wildlife interest (C.J.Richmond pers. comm.); and a roosting site for gulls and white fronted terns (Motu River mouth).

2:2 Tokaroa Rock (Figure 6)

Area: 0.3ha

Altitude: 0-30m

Grid reference: N70 967316

Description: A rock stack, near Te Uritukituki Beach, which supports breeding colonies of white fronted terns and red billed gulls.

2:3 Torere kahikatea forest and manuka scrub swamp (Figure 4)

Area: 3.7ha

Altitude: 213m

Grid reference: N79 974145

Survey area: 4951-0002 part Torere 64/65 Lands

Description: A very small remnant of now uncommon kahikatea swamp forest and adjoining manuka scrub swamp.

PRIORITY THREE AREAS

3:1	Torere corridor (Figure 6)
-----	----------------------------

Area: 1095ha

Altitude: 0-579m

Grid reference: N70 912202

Survey areas: 4952-0001 Pehitairi Headland, 4952-0002 part Te Waiti, 4952-0008 Torere Bush

Description: A sequence from coastal pohutukawa forest and treeland and induced scrub to moderately and highly modified lowland (steep) forest. Provides the shortest link to a proposed Ecological Area (Paraumu), and buffers the pohutukawa, puriri, broadleaved tawa forest containing the southernmost known taraire.

3:2	Awanui Pied Shag Colony (Figure 7a)
-----	-------------------------------------

Area: 17.5ha

Altitude: 0-20m

Grid reference: N70 074443

Survey area: 5054-0002 part Awanui-Haparapara

Description: Pohutukawa forest and treeland with a pied shag colony. An area of special wildlife interest (C.J.Richmond pers. comm.)

3:3 Opape Headland (Figure 5)

Area: 139ha

Altitude: 0-161m

Grid reference: N70 845225

Survey area: 4852-0001 Opape Headland

Description: Broadleaved tawa, pohutukawa, puriri forest; manuka, *Coprosma* spp., koromiko scrub, and *Pseudopanax arboreus*-mamaku scrub and forest which forms the buffer to a first priority area containing the threatened shrub, *Olearia pachyphylla*. Also includes the best example of raupo reedland in the District. Links with Oroi Scenic Reserve and the Opape Lands proposed reserve (Daniel, 1983).

3:4 Haurere Headland (Figure 5)

Area: 50ha

Altitude: 0-167m

Grid reference: N70 867237

Survey area: 4852-0002 Haurere Headland

Description: Manuka scrub, broadleaved tawa-puriri-karaka forest, and pohutukawa treeland. The threatened shrub, *Olearia pachyphylla*, is common on the steep coastal cliffs and there is a gannet colony near the bay on the headland.

PRIORITY NATURAL AREA MAPS

KEY :



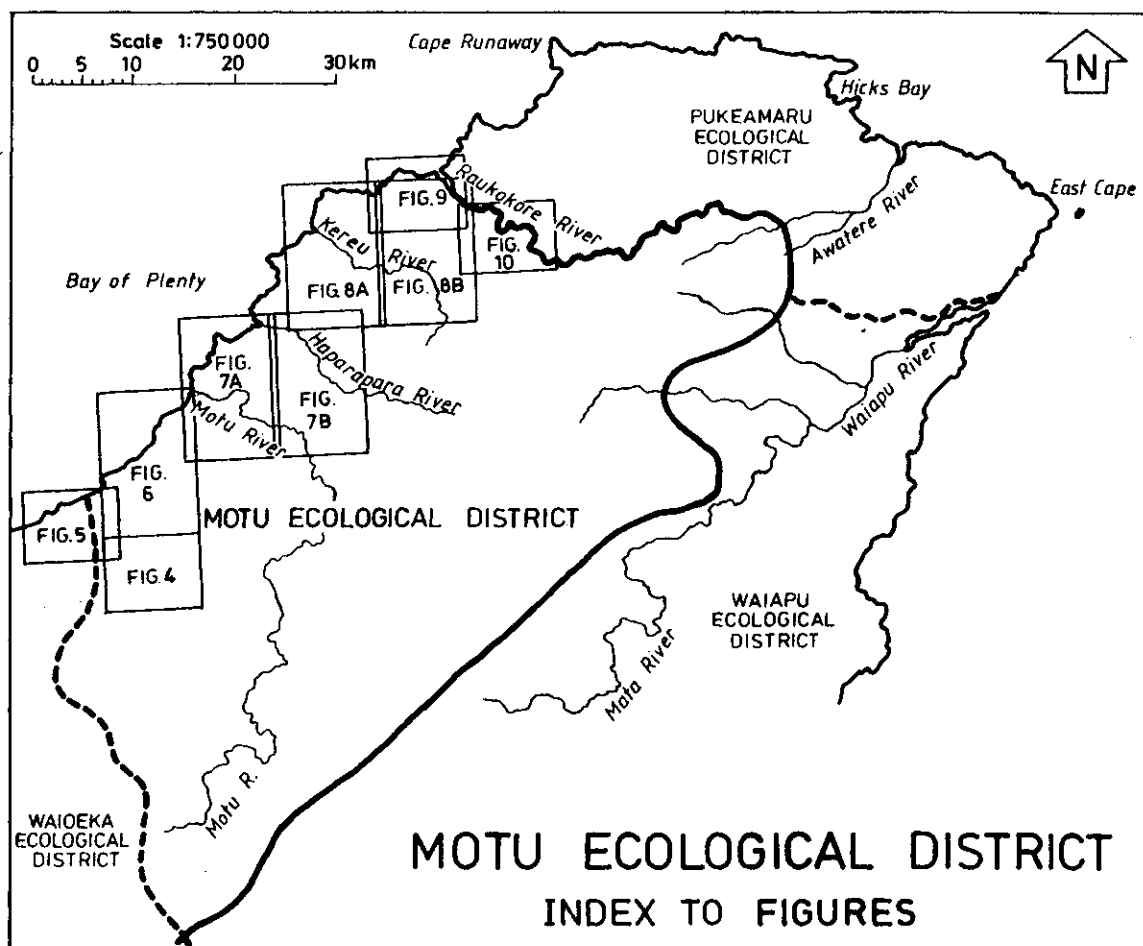
PRIORITY 1



PRIORITY 2

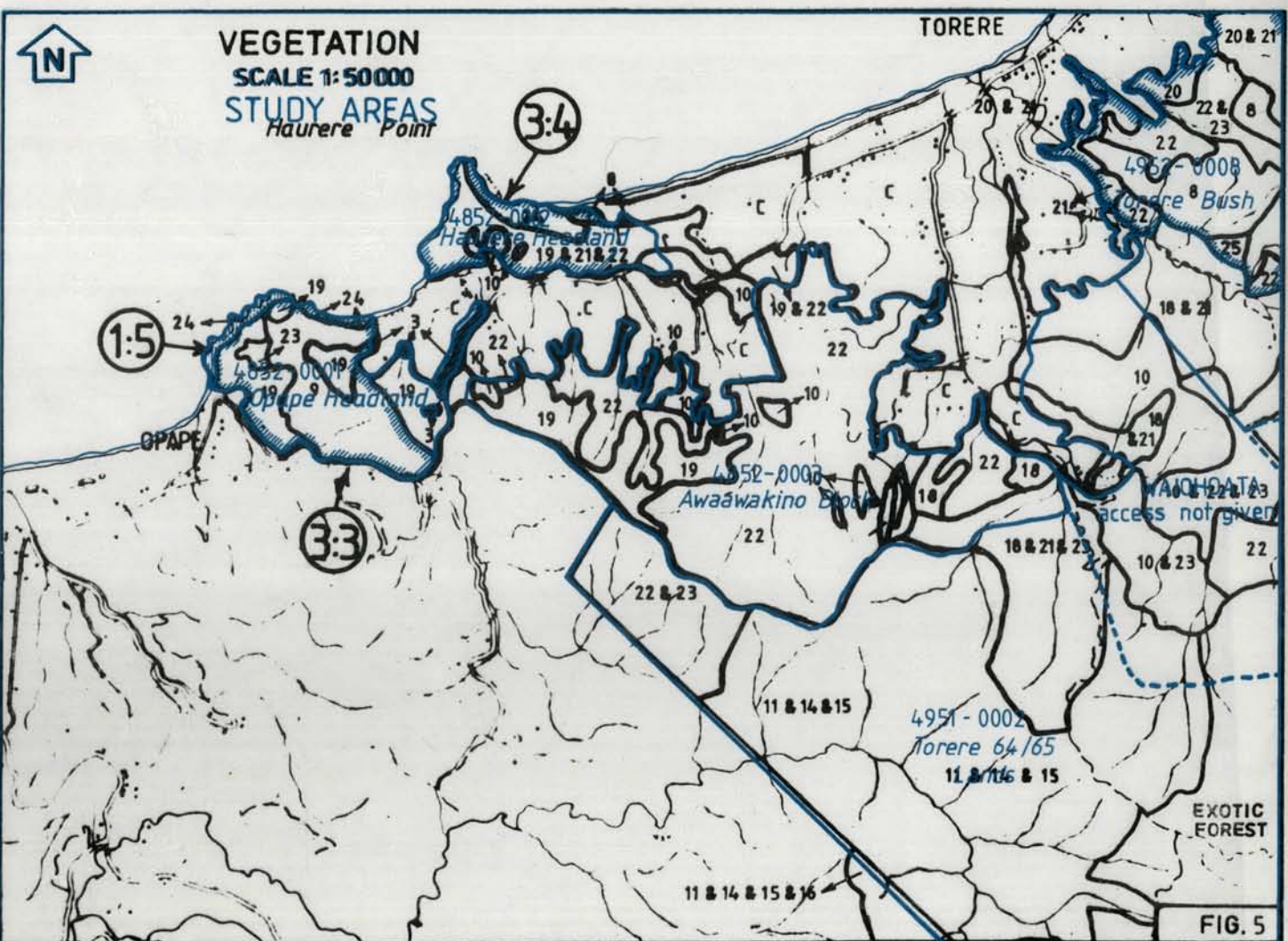
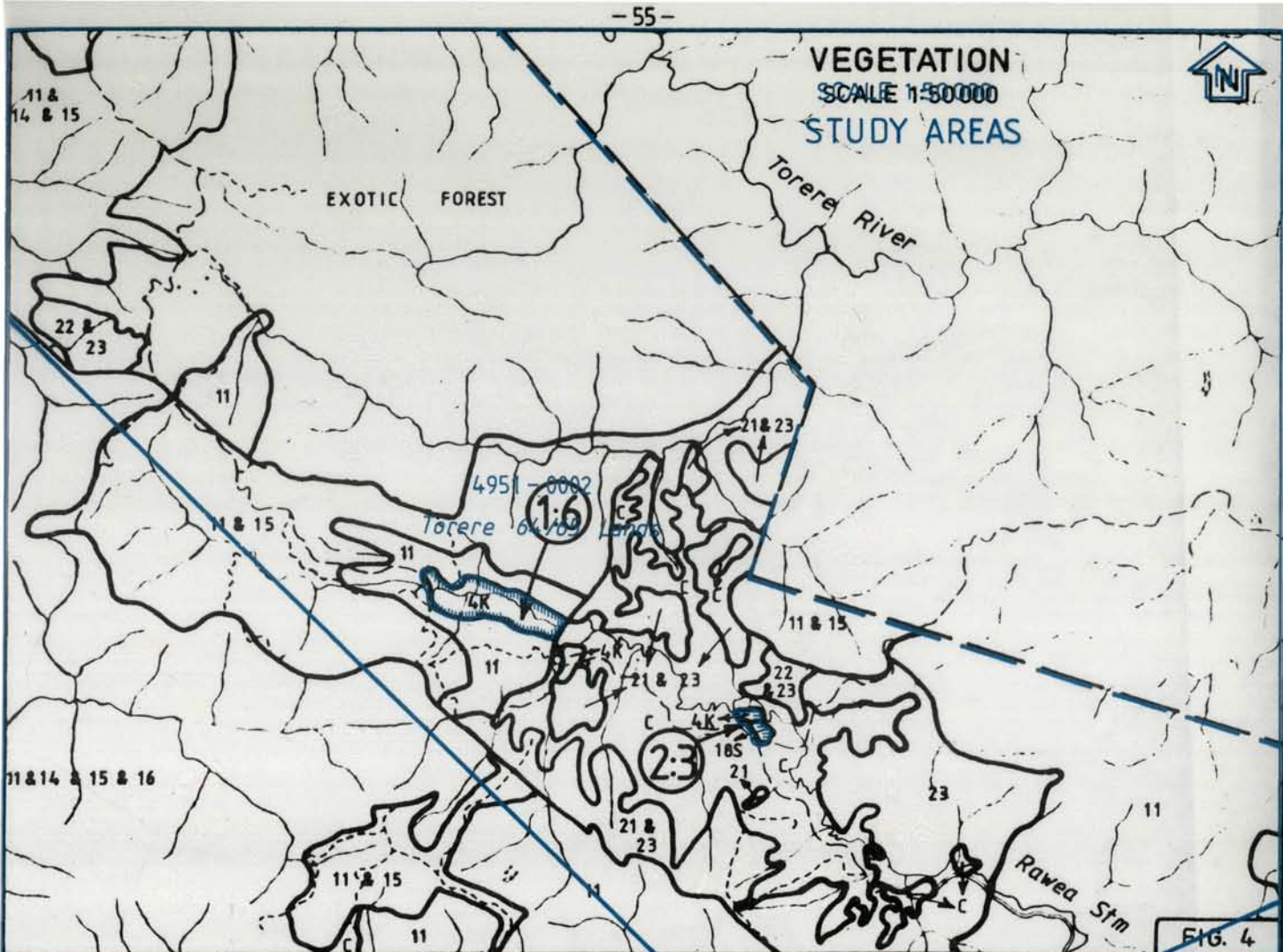


PRIORITY 3



VEGETATION LEGEND

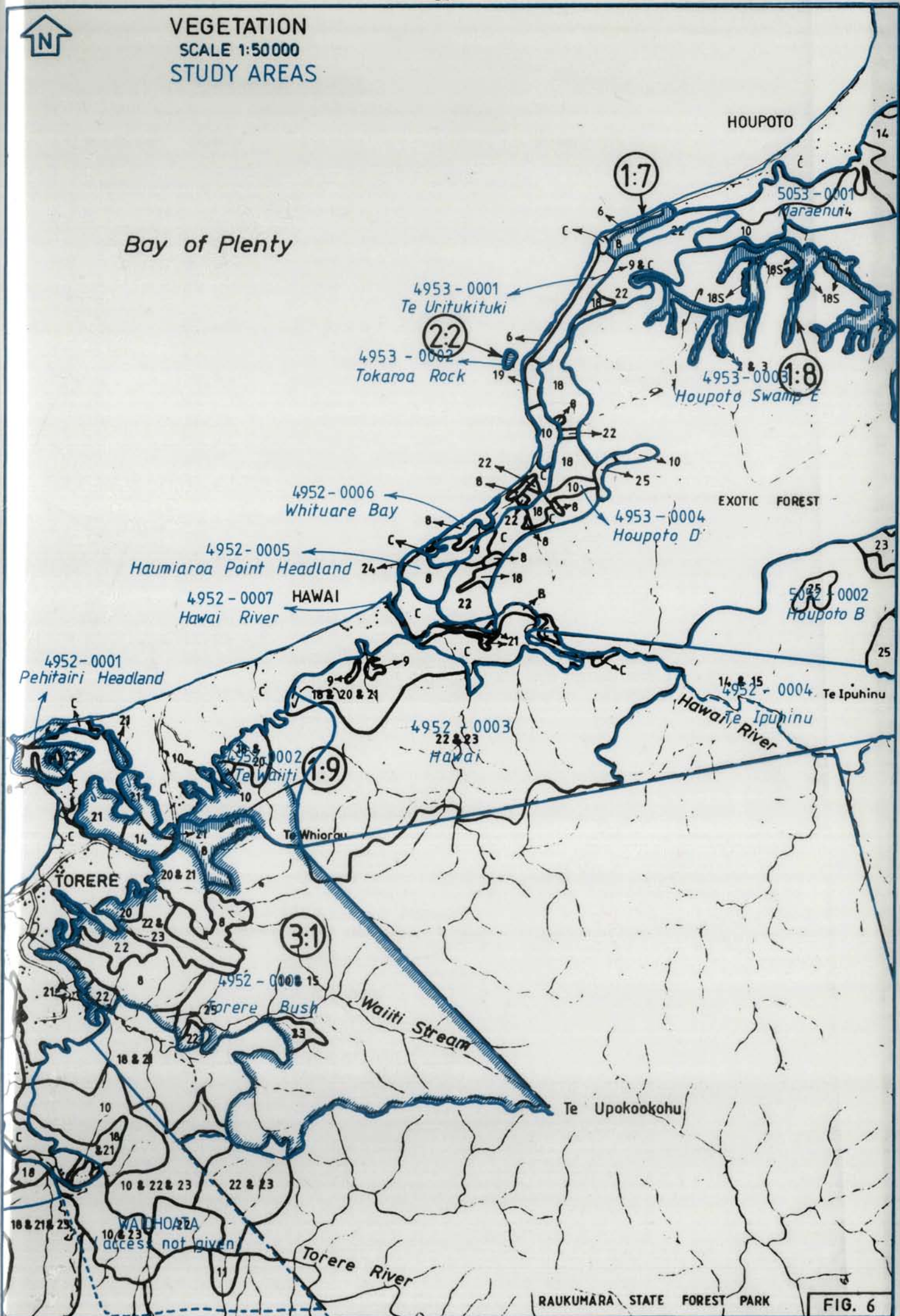
Mapping unit number	ESU's	Name
1	1,2,3	lagoon vegetation
2	4,5,8,9	swamp vegetation
3	6	raupo reedland
4	11,12,31	kahikatea-pukatea forest and treeland
5	15	taraire, broadleaved tawa forest
6	16	pohutukawa forest and treeland
7	18	pohutukawa, houpara forest
8	19,20	pohutukawa, puriri, broadleaved tawa forest
9	21	broadleaved tawa, pohutukawa, puriri forest
10	32,33	broadleaved tawa, puriri forest
11	36	broadleaved tawa, kamahi, rewarewa forest
12	38	<u>B. tawa s.l.</u> kamahi, tawari, hinau forest
13	22	hard beech, pohutukawa forest
14	34	hard beech, broadleaved tawa, rewarewa forest
15	35	hard beech, tanekaha, rewarewa forest
16	39	hard beech, tawari, kamahi, quintinia forest
17	14,26	tauhinu scrub and shrubland
18	10,29	manuka scrub
19	25	manuka, <u>Coprosma</u> spp., koromiko scrub
20	23	manuka-kanuka scrub
21	24,27	kanuka scrub and forest
22	28	kanuka- <u>Pseudopanax arboreus</u> -rewarewa scrub and forest
23	30	<u>Pseudopanax arboreus</u> -mamaku scrub and forest
24	17	pohutukawa, koromiko, olearia, wharariki scrub
25	37	rewarewa-tanekaha forest
Code		
B	7,13	bare riverbed (includes water)
C		farmland
Ca		<u>Carex geminata</u>
Cb		cabbage tree (<u>Cordyline australis</u>)
E		exotic forest (in some places includes small pockets of indigenous forest)
F		flax (<u>Phormium tenax</u>)
I		<u>Isachne globosa</u>
J		<u>Juncus microcephalus</u>
K		kahikatea
M		matai
P		pukatea
PL		<u>Plagianthus divaricatus</u>
R		<u>Ruppia polycarpa</u>
S		swamp





VEGETATION
SCALE 1:50000
STUDY AREAS

Bay of Plenty

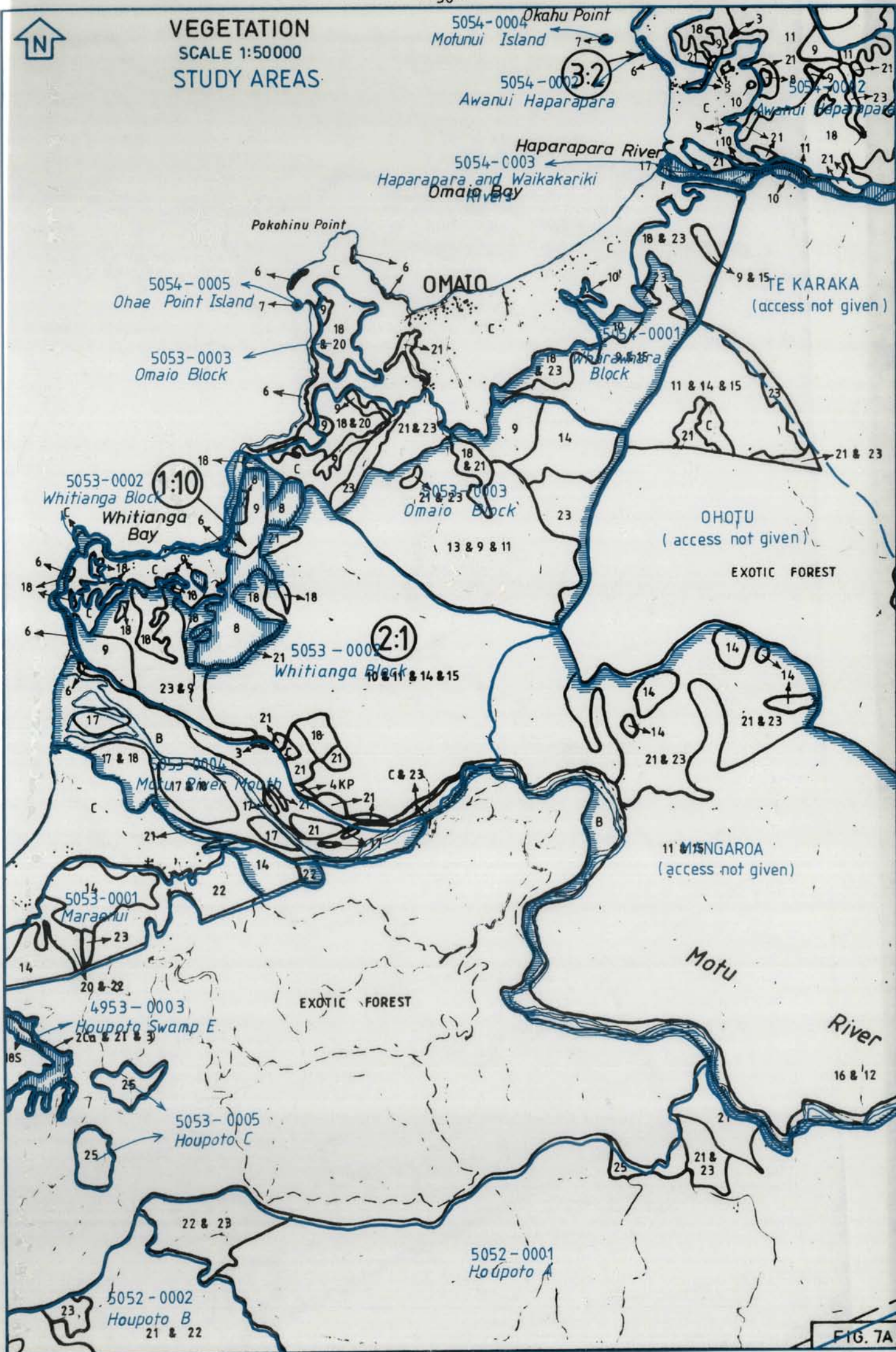


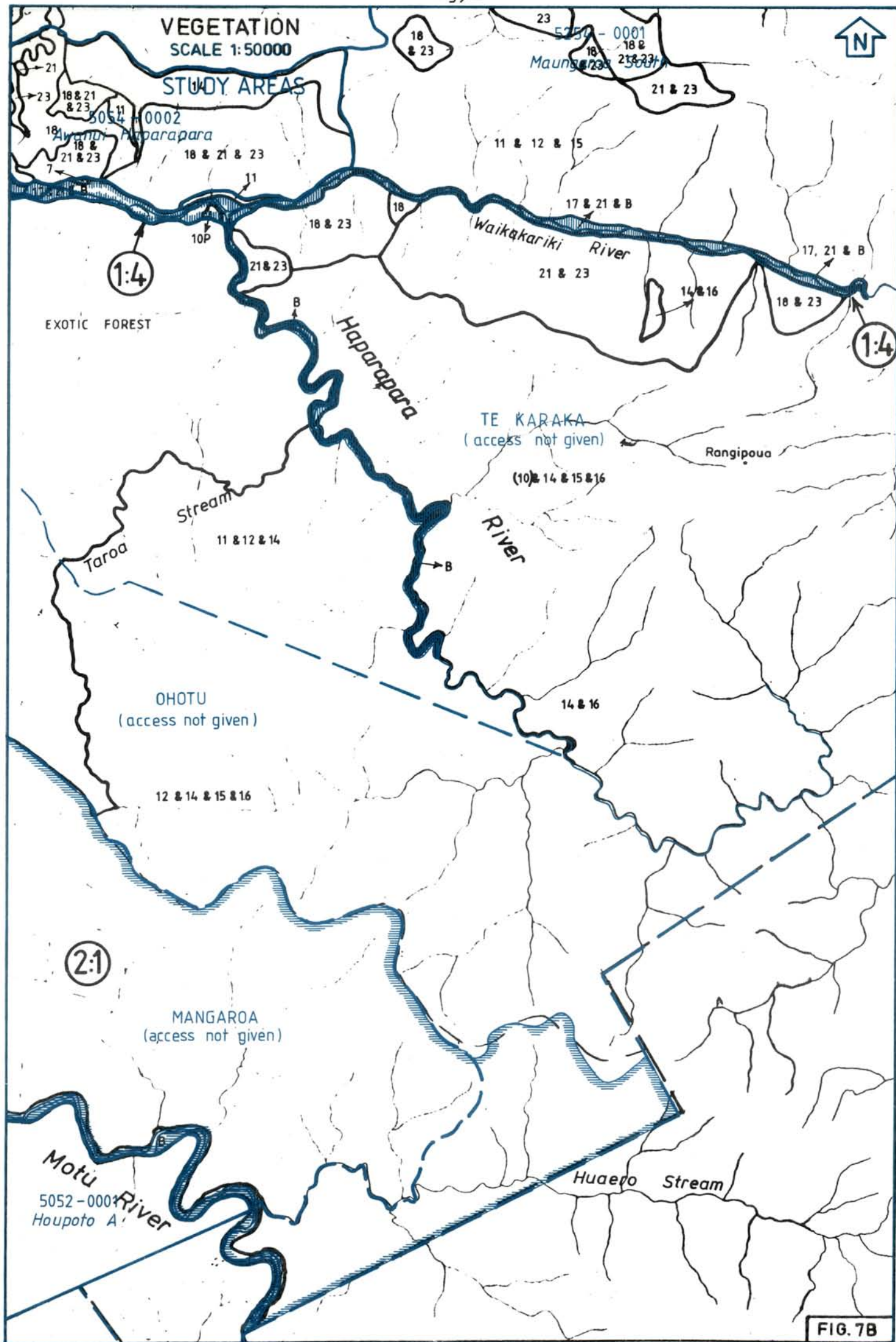
VEGETATION LEGEND

Mapping unit number	ESU's	Name
1	1,2,3	lagoon vegetation
2	4,5,8,9	swamp vegetation
3	6	raupo reedland
4	11,12,31	kahikatea-pukatea forest and treeland
5	15	taraire, broadleaved tawa forest
6	16	pohutukawa forest and treeland
7	18	pohutukawa, houpara forest
8	19,20	pohutukawa, puriri, broadleaved tawa forest
9	21	broadleaved tawa, pohutukawa, puriri forest
10	32,33	broadleaved tawa, puriri forest
11	36	broadleaved tawa, kamahi, rewarewa forest
12	38	<u>B. tawa s.l.</u> kamahi, tawari, hinau forest
13	22	hard beech, pohutukawa forest
14	34	hard beech, broadleaved tawa, rewarewa forest
15	35	hard beech, tanekaha, rewarewa forest
16	39	hard beech, tawari, kamahi, quintinia forest
17	14,26	tauhinu scrub and shrubland
18	10,29	manuka scrub
19	25	manuka, <u>Coprosma</u> spp., koromiko scrub
20	23	manuka-kanuka scrub
21	24,27	kanuka scrub and forest
22	28	kanuka- <u>Pseudopanax arboreus</u> -rewarewa scrub and forest
23	30	<u>Pseudopanax arboreus</u> -mamaku scrub and forest
24	17	pohutukawa, koromiko, olearia, wharariki scrub
25	37	rewarewa-tanekaha forest
Code		
B	7,13	bare riverbed (includes water)
C		farmland
Ca		<u>Carex geminata</u>
Cb		cabbage tree (<u>Cordyline australis</u>)
E		exotic forest (in some places includes small pockets of indigenous forest)
F		flax (<u>Phormium tenax</u>)
I		<u>Isachne globosa</u>
J		<u>Juncus microcephalus</u>
K		kahikatea
M		matai
P		pukatea
PL		<u>Plagianthus divaricatus</u>
R		<u>Ruppia polycarpa</u>
S		swamp



VEGETATION
SCALE 1:50000
STUDY AREAS







VEGETATION
SCALE 1:50000
STUDY AREAS

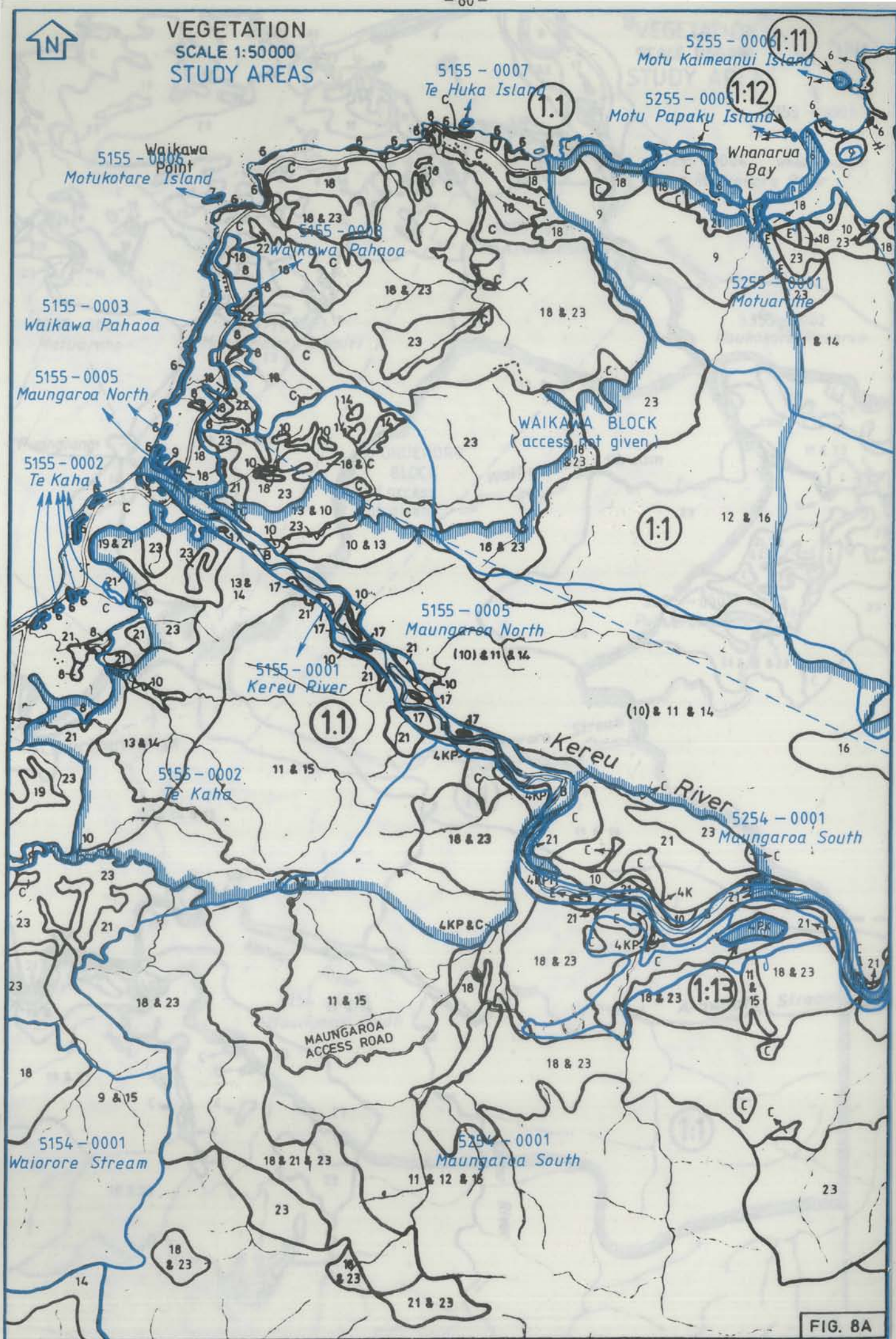


FIG. 8A

VEGETATION
SCALE 1:50 000
STUDY AREAS



5355 - 0003
Tawaroa Topu

5255 - 0004 Whakaahuru
Lower Raukokore River

5255 - 0009
Te Aruhe Ahika

5355 - 0002
Raukokore Reserve

5255 - 0001
Motuaruhe

5255 - 0003
Maraehako Te Waiti

POHUERORO
BLOCK
(access
not given)

Waihueroro Stream

5355 - 0001
Pohueroro Block

Pohueroro Stream

Hereheretunga

1:1

11 & 16

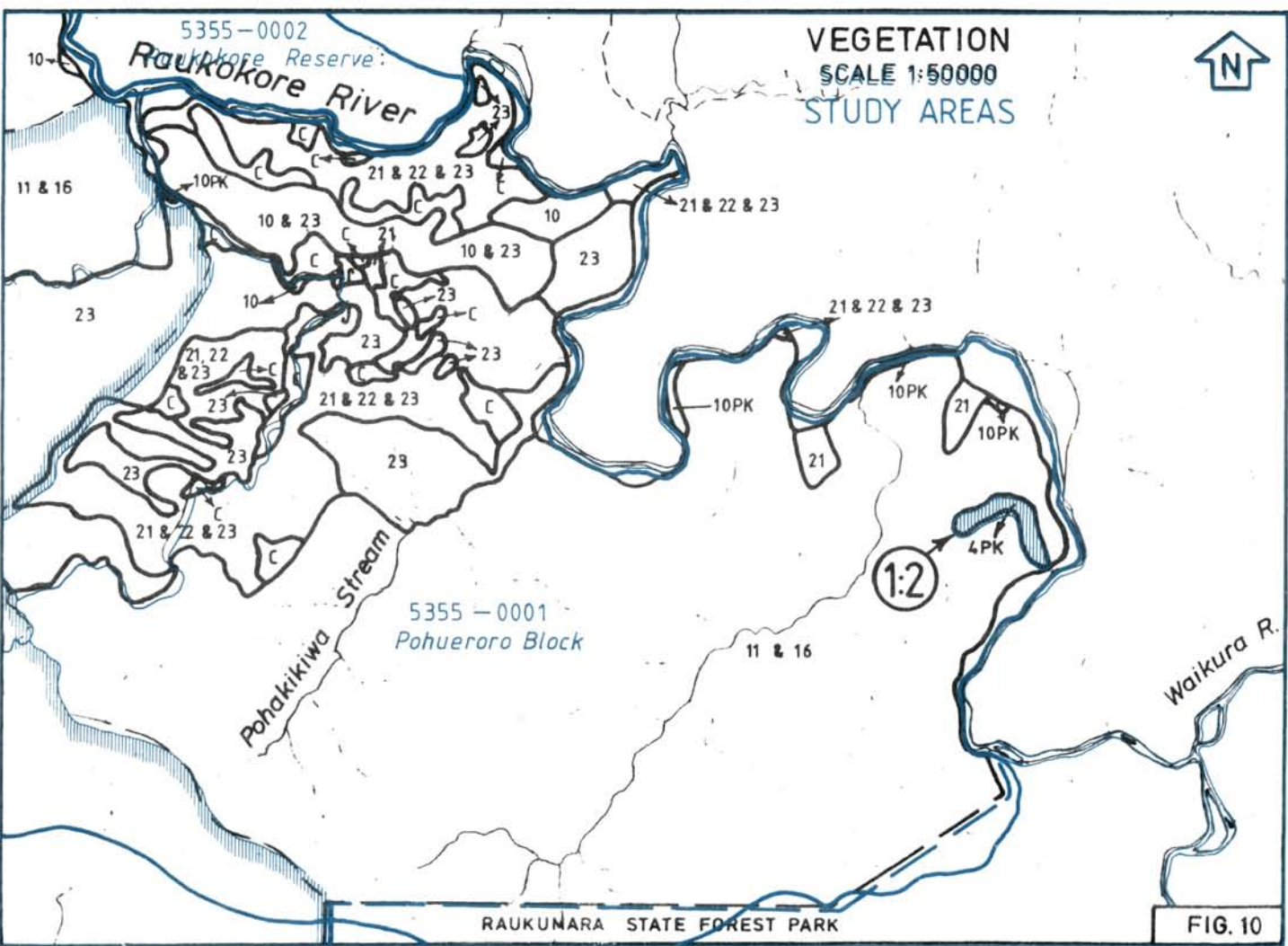
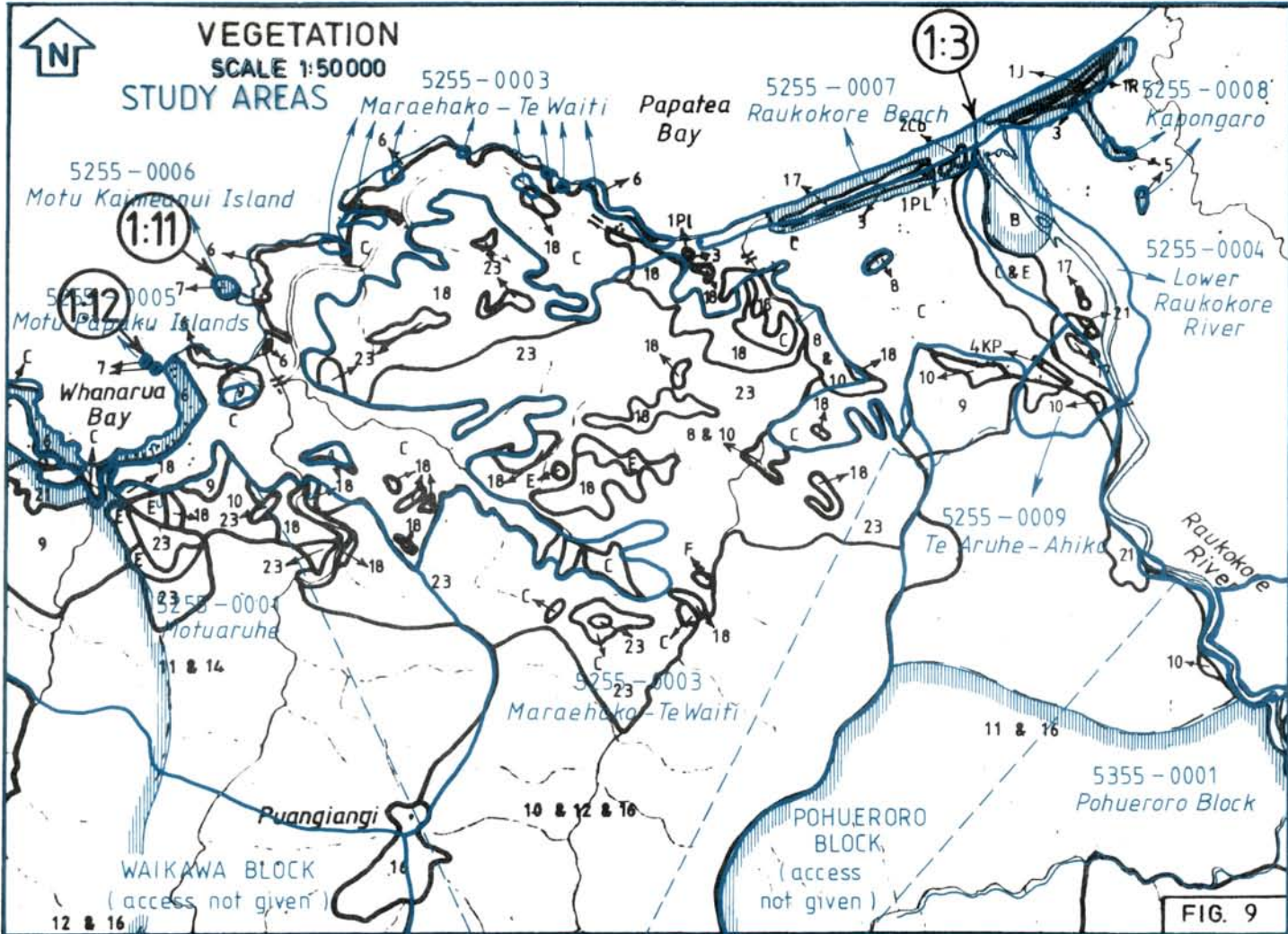
5254 - 0001
Maungaroa South

Kereu River

Arawhata Stream

1:1

FIG. 8B



ACKNOWLEDGEMENTS

Our special thanks go to Harold Helmbright, who acted as our Maori liaison officer. He imparted generously of his time, knowledge and energy, visiting landowners throughout the District and securing permission to survey the land. A comprehensive survey would have been impossible but for his contribution and commitment.

Our sincere thanks to all landowners for allowing us free access onto their land. To these people we are grateful for their co-operation, and interest in the protected natural area survey.

Caxton Paper Mills Ltd and Tasman Pulp and Paper Co. Ltd are acknowledged for allowing access onto their leasehold land. Our thanks to Neil D'Anvers of Caxton Ltd, and Barry Osborne and Frank Akurangi of Tasman Ltd for their assistance.

Thanks also to the Department of Maori Affairs for their helpful advice and assistance.

We thank the Gisborne office of the Department of Lands and Survey, especially Mr Graeme Boggs (Assistant Commissioner of Crown Lands) for administrative support and supervision, and Tony Bartlett and colleagues for mapping.

Thanks to John Herbert (FRI) and John Leathwick (FRI) for advice, John Innes (FRI) for critically reading the wildlife section and to Mark Smale (FRI) for his constructive criticism of parts of the text.

We thank Alan Saunders, Chris Richmond and Noel Hellyer of the N.Z. Wildlife Service, Department of Internal Affairs for information, advice, and for freely making available the data collected by the Fauna Survey Unit during their 1983-1984 East Cape survey.

Thanks to David Rowe (Fisheries Research Division, Ministry of Agriculture and Fisheries, Rotorua), Bruce Thomas (D.S.I.R., Nelson) and Mike Daniel (D.S.I.R., Lower Hutt) for information and advice, and to Ian Speden (N.Z. Geological Survey, Lower Hutt) and Bill Cotching (Soil Bureau, Rotorua) for critically reading parts of the text.

Anthony Wright of the Auckland Institute and Museum generously assisted in identifying numerous specimens of broadleaved forms of tawa.

The assistance and encouragement from Geoff Park (Biological Resources Centre, D.S.I.R., Wellington) and Janet Owen (Department of Lands and Survey, Head Office, Wellington) is much appreciated.

Many thanks to Alison Davis and Willie Shaw who gave assistance in the field; also to Bev Clarkson (Botany Division, D.S.I.R.) and Corry Regnier (Dept. Lands and Survey, Gisborne) for their advice and support.

We thank Marc Heginbotham for making available his treatise, Wild Plants from Ohope to East Cape, which proved to be a valuable reference.

Warm thanks also to Maxine and Gordon McRobbie of Thornton Park Motels for making our stay at 'The Cottage' comfortable. We are also indebted to Kiri Hata, the field survey cook, for her invaluable culinary contributions to the survey.

Ngahiwi Meroiti and Joanne Ekers of Alpha Word Processing Centre, Rotorua had the task of typing early versions, Maria Manukau of Tass Print, Te Atatu typed the final manuscript. Their efforts are gratefully acknowledged.

REFERENCES CITED

- ALLAN, H.H. 1961: Flora of New Zealand. Vol.1. Government Printer, Wellington.
- ATKINSON, I.A.E. 1972: Notes on vegetation and effects of animals in the central Raukumara Range. Unpublished report, Botany Division, D.S.I.R., Lower Hutt.
- ATKINSON, I.A.E. 1983: Vegetation structural classes for rapid inventory. Botany Division report series. D.S.I.R., Lower Hutt.
- BELL, B.D. 1982: New Zealand frogs. Herpetofauna 14(1): 1-21.
- BERRYMAN, K.R. 1982: Seismotectonic assessment of the Motu River Catchment. p.26 in: Motu River National Water Conservation Order application: submissions and evidence. Ministry of Works and Development, Wellington.
- BULL, P.C.; GAZE, P.D.; ROBERTSON, C.J.R. 1978: Bird distribution in New Zealand: a provisional atlas 1969-1976. Ornithological Society of New Zealand, Wellington.
- BULLER, W.L. 1982: Manual of the birds of New Zealand. Government Printer, Wellington.
- CLARKSON, B.R.; REGNIER, C.E. 1983-1984: Scenic reserves of west Gisborne. Draft reports. Botany Division, D.S.I.R., Rotorua.
- CLIMO, F.M. 1975: The land snail fauna; P. 459-492 in: Kuschel, G. (Ed) Biogeography and Ecology in New Zealand. Dr W. Junk, The Hague.
- CROZIER, M.J.; OWEN, R.C. 1983: Terrain evaluation for rapid ecological survey. Unpublished report to Biological Resources Centre, Wellington.
- DANIEL, L.J. 1983: Opape Lands, Eastern Bay of Plenty - A proposal for reservation under the Reserves Act 1977. Department of Lands and Survey, Gisborne.
- D.S.I.R. 1954: General survey of the soils of the North Island, New Zealand. Soil Bureau, D.S.I.R. Wellington.

DIAMOND, J.M.; VEITCH, C.R. 1981: Extinctions and introductions in the New Zealand avifauna: cause and effect? Science 211 (4481): 499-501.

DINGWALL, P.R.; ATKINSON, I.A.E.; HAY, C. 1978: The ecology and control of rodents in New Zealand Nature Reserves. Department of Lands and Survey, Wellington.

DRUCE, A.P. 1961: Mountain vegetation of the North Island. N.Z. Soil News. 3:95-107.

DRUCE, A.P. 1980: Trees, shrubs, and lianes of New Zealand (including wild hybrids). Unpublished report. Botany Division, D.S.I.R., Lower Hutt.

DRUCE, A.P. 1983: Indigenous higher plants of New Zealand (including wild hybrids). Unpublished report. Botany Division, D.S.I.R., Lower Hutt.

EAST COAST REGIONAL DEVELOPMENT COUNCIL, 1979: East Coast regional resources assessment. East Coast Regional Development Council, Gisborne

ENVIRONMENTAL COUNCIL OF NEW ZEALAND, 1983: Wetlands: a diminishing resource. Report to the Minister for the Environment.

GIBB, J.A.; FLUX, J.E.C. Mammals; P.334-371 in: Williams G.R. (Ed.) The Natural History of New Zealand. A.H. & A.W. Reed, Wellington.

GIBBS, H.S.; PULLAR, W.A. 1961: Soils of the Bay of Plenty. Proceedings 23rd conference New Zealand Grasslands Association: 12-25.

HEALY, J.; VUCETICH, G.C.; PULLAR, W.A. 1964: Stratigraphy and chronology of late quarternary volcanic ash in Taupo, Rotorua and Gisborne districts. Part 1. N.Z. Geological Survey Bulletin n.s.73.

HEALY, T. 1983: Inter-dependence of the channel and landscape topography of the Motu River system. Statement to Planning Tribunal Hearing on application for National Water Conservation Order for Motu River.

HEGINBOTHAM, M. 1979: Wild Plants of Ohope to East Cape. Private report to Botany Division, D.S.I.R., Lincoln.

INNES, J. 1983: Visit to Waingakia catchment, Raukumara State Forest Park. Unpublished file note. Forest Research Institute, Rotorua.

KELLY, G.C. 1980: Landscape and nature conservation. p. 63-87 in: Land alone endures. D.S.I.R., Wellington.

KINGMA, J.T. 1965: Geological map of New Zealand 1:250 000. Sheet 6 East Cape. D.S.I.R., Wellington.

KNOWLES, B., BEVERIDGE A.E. 1982: Biological flora of New Zealand. 9 Beilschmiedia tawa. N.Z. Journal of Botany 20: 37-54.

LAVERS, R.B. 1978: Distribution of the North Island Kokako. Notornis 25(3): 165-185.

MCCASKILL, L.W. 1981: Scenic reserves of Gisborne. Department of Lands and Survey, Wellington.

MCLENNAN, J.A.; MAC MILLAN, B.W.H. 1982: Ecological investigations of the Takaputahi dam site. Unpublished file report, Ecology Division, D.S.I.R., Lower Hutt.

N.Z. FOREST SERVICE, 1983: Raukumara State Forest Park management plan 1983-1993. N.Z. Forest Service, Rotorua.

NICHOLLS, J.L. 1968: Joint survey of scenic reserves. Unpublished report, Forest Research Institute, Rotorua.

NICHOLLS, J.L. 1971: Raukumara forest class map. N.Z. Forest Service mapping series 6, Sheet No. 6.

NICHOLLS, J.L. 1980: The past and present extent of New Zealand's indigenous forests. Environmental conservation 7(4): 309-310.

NICHOLLS, J.L. 1983a: Proposed Ecological Areas in Raukumara State Forest Park. Unpublished report to N.Z. Forest Service Scientific Reserves Advisory Committee.

NICHOLLS, J.L. 1983b: Raukumara Wilderness and recommended Ecological Areas. Unpublished note. Forest Research Institute, Rotorua.

OGLE, C.C. 1981: Great Barrier Island wildlife survey. Tane 27: 177-200.

OWEN, J.M.; Park, G.N. 1983: A classification of natural ecosystems in New Zealand. New Zealand Biological Resources Centre Publication No. 4, Wellington.

PARK, G.N. 1983: Rapid ecological survey of natural areas. N.Z. Biological Resources Centre, Wellington.

PLANNING TRIBUNAL, 1984: Report and recommendation in respect of submissions and objections received pursuant to S.206(1) of the Water and Soil Conservation Act 1967 in respect of a report and recommendation of the National Water and Soil Conservation Authority in relation to the Motu River. Report of Number Two Division to Minister of Works and Development, Wellington.

PULLAR, W.A. 1973: Isopachs of tephra, central North Island, New Zealand. 1:1,000,000. D.S.I.R., Wellington.

PULLAR, W.A., BIRRELL, K.S. 1973: Age and distribution of late quaternary pyroclastic and associated cover deposits of the Rotorua and Taupo area, North Island, New Zealand. N.Z. Soil Survey Report 1, N.Z. Soil Bureau, Wellington.

REED, S.M. 1981: New Zealand Dotterel (Charadrius obscurus) - an endangered species? Notornis 28(2); 129-132.

ROWE, D.K. 1981: Fisheries investigations in the Motu River. N.Z. Ministry of Agriculture and Fisheries, Rotorua.

ROXBURGH, A.J. 1977: The Wildlife resources of the Gisborne East Cape Region. Unpublished report. N.Z. Wildlife Service, Rotorua.

ROXBURGH, A.J. 1982: Wildlife values and investigations. p. 40-49 in: Motu River National Water Conservation Order application: submissions and evidence. Ministry of Works and Development, Wellington.

SAUNDERS, A. 1982: A brief habitat assessment of the Torere/Opape Block, Opotiki District. Unpublished report, N.Z. Wildlife Service, Tauranga.

SAUNDERS, A.J. 1983: Wildlife and wildlife habitat values of the Mamaku Plateau - an overview. N.Z. Wildlife Service FSU Report 37. Wellington

SAUNDERS, A.J. 1984: Wildlife and wildlife habitat values of the proposed Raukumara Wilderness Area. Unpublished report. N.Z. Wildlife Service, Taurangi.

SIMPSON, P.(comp.) 1982: Ecological regions and districts of New Zealand. Biological Resources Centre, Wellington.

SMITH, W.D.; BERRYMAN K.R. 1983: Revised estimates of earthquake hazard in New Zealand. Bulletin N.Z. National Society for Earthquake Engineering 86(4).

SOLEM, A; CLIMO, F.M.; ROSCOE, D.J. 1981: Sympatric species diversity of New Zealand land snails. New Zealand journal of zoology 8(4): 453-485.

SPEDEEN, I.G. 1972: New fossil localities in the Torlesse Supergroup, Western Raukumara Peninsula, New Zealand. N.Z. journal of geology and geophysics 15(3). 433-445.

SPEDEEN, I.G. 1973: Distribution, stratigraphy and stratigraphic relationships of Cretaceous sediments, Western Raukumara Peninsula, New Zealand. N.Z. journal of geology and geophysics 16(2): 243-268.

THOMAS, J.W.(Ed.) 1979: Wildlife habitats in managed forests - the Blue Mountains of Oregon and Washington. Agricultural handbook No. 553. U.S. Forest Service, Washington.

TIMMINS, S. 1983: Register of Protected Natural Areas in New Zealand. Department of Lands and Survey, Wellington.

TORTELL, P. (Ed.) 1981: New Zealand atlas of coastal resources. Government Printer, Wellington.

VUCETICH, C.G.; PULLAR, W.A. 1969: Stratigraphy and chronology of Late Pleistocene volcanic ash beds in central North Island, New Zealand. N.Z. journal of geology and geophysics 12: 784-837.

WARDLE, J.A. 1970: The ecology of Nothofagus solandri. N.Z. journal of botany 8(4): 494-646.

WARDLE, J.A. 1971: The forests and shrublands of the Seaward Kaikoura Range. New Zealand journal of botany 9:269-292

WATT, J.C. 1976: Coleoptera and type localities of New Zealand Coleoptera, and notes of collectors 1770-1920. Journal of the Royal Society of New Zealand 7(1): 79-91.

WATT, J.C., 1979: New Zealand invertebrates. p. 140-146 in: A Coastal Reconnaissance. Transactions of the Royal Society of New Zealand Geology 1(5): 29-99.

WILDLIFE SERVICE, DEPT. INTERNAL AFFAIRS: 1984: Draft East Cape wildlife habitat inventory. Unpublished draft report to the Conservator of Wildlife, Dept. Internal Affairs, Rotorua.

WILLIAMS, G.R. (Ed.) 1973: The natural history of New Zealand, A.H. & A.W. Reed, Wellington.

WILLIAMS, G.R.; Given, D.R. 1981: The red data book of New Zealand. Nature Conservation Council, Wellington.

WILLIAMS, M.J. 1982: Blue Ducks on the Motu River. p. 35-39 in: Motu River National Water Conservation Order application: submissions - and evidence. Ministry of Works and Development, Wellington.

WRIGHT, A.J. 1984: Beilschmiedia Nees (Lauraceae) in New Zealand. New Zealand journal of botany 22(1):109-125.

APPENDIX I Descriptions of the Vegetation Types of the District

Abbreviations

- , separates species listed in order of decreasing class cover and
- links species of approximately equal cover

1. Lagoon and Estuary vegetation

A blanket type for three vegetation types recorded on or near the small lagoon at the Raukokore River mouth respectively dominated by Juncus microcephalus, Ruppia polycarpa and coastal ribbonwood/Cyperus ustulatus. Other species present include Limosella lineata, Triglochin striatum, Scirpus fluviatilis, Cotula coronopifolia, Aster subulata, Eleocharis acuta, and Carex virgata.

Under the proposed national wetlands classification, the Juncus microcephalus and Ruppia polycarpa types correspond to salt rush and reed swamp, and mudflat respectively. The coastal ribbonwood/Cyperus ustulatus type corresponds to non-tidal shrub-swamp.

2. Swamp vegetation

A blanket type, distinct from raupo reedland, incorporating four freshwater wetland communities dominated by cabbage tree, Isachne globosa, Phormium tenax and Carex geminata respectively. Occurs between 5 and 300 ft (1.5-90 m) a.s.l. in flood channels and at stream sides scattered through the District. All of this vegetation is characteristic of relatively fertile swamps. It is probable that some was induced following stream siltation or clearance of swamp forest.

The communities correspond respectively to Cabbage tree swamp, Grass swamp, Flax swamp and Sedge swamp, under the proposed national wetlands classification.

3. Raupo reedland

Reedland swamp dominated by raupo up to 3 m tall. Occurs from 6-350 ft (2-110 m) a.s.l. on infilled gullies (e.g. Houpoto Swamp), poorly drained

terraces (near mouths of the Motu and Kereu Rivers), and behind Papatea Bay gravel beach. Frequent canopy associates, when raupo is not an exclusive dominant, are Carex virgata, Isachne globosa, Scirpus lacustris, Carex geminata and Baumea rubiginosa. A variety of exotic and native species is represented in the ground layer including Ranunculus repens, Myosotis caespitosa, Lotus pedunculatus, Polygonum spp., Isachne globosa and Juncus articulatus. In most cases this vegetation was induced after clearance of swamp forest but at a few sites it is probably primary vegetation. Cattle browsing and trampling was evident at most sites.

4. Manuka bog scrub

Mature, two-tiered, manuka dominant scrub 2-3 m tall found in the Houputo and Rawea valleys, 200 and 1100 ft (60-335 m) a.s.l. respectively, on wet, infertile, peaty soils. Ground layer dominants are Gleichenia dicarpa and bracken in the lowland stand, and Sphagnum cristatum, Eleocharis gracilis and Blechnum minus in the upland stand.

5. Kahikatea swamp forest and treeland and kahikatea forest

Primary and secondary swamp forest, forest and treeland in which kahikatea, 5-25 m tall, is the leading dominant. Where the canopy is not predominantly kahikatea, rimu, kamahi, wheki, tawari, and hinau are canopy associates. Occurs in poorly drained valley bottoms and river terraces between 1000-1700 ft (300-510 m) a.s.l. Present in Whinray SR and as small remnants of second growth forest along Rawea Stream. Understorey dominants are kahikatea, lacebark, wheki and Metrosideros diffusa. Ground layer variable, with Metrosideros diffusa, Uncinia spp., wheki, sphagnum and other assorted mosses as the leading dominants. Blechnum minus, Pseudopanax anomalus and Lophomyrtus bullata are nearly always present. Whinray SR excepted, trampling and grazing by stock common.

6. Kahikatea - pukatea forest and swamp forest

Seral and mature kahikatea and pukatea forest, 8-30 m tall. Found on mid and lower valley alluvial terraces along the Kereu, Raukokore and Motu Rivers, between 60 and 150 ft (18-45 m) a.s.l. Kahikatea, and occasionally rimu, is most common on well drained alluvium closest to the river

while pukatea occurs on wetter sites usually where the terrace adjoins surrounding hillslopes. Other common canopy associates are kanuka, broadleaved tawa, and, in lower valley sites, puriri. Matai is present at one site on the Kereu River. Middle tier dominants are mahoe, kahikatea, supplejack, pukatea and broadleaved tawa. The ground tier is usually sparse and variously dominated by kahikatea seedlings, Blechnum filiforme, Oplismenus imbecillus, Carex virgata, C. dissita, C. solandri and numerous exotic grasses and herbs. Puka and Collospermum hastatum are common epiphytes. In most areas the understorey is severely modified by cattle browsing and trampling. Silt deposition from river flooding is also evident in some areas.

7. Taraire, broadleaved tawa forest

Mature secondary forest dominated by taraire and broadleaved tawa, 12-15 m tall, found on coastal valley bottoms between 150 and 350 ft (50-110 m) a.s.l. Occurs only in three localities: Orini Stream, Kereu River and north of the Raukokore River. Other major canopy components are puriri, pohutukawa and kohekohe, and there are many minor species. Middle tier dominants are taraire, hangehange, broadleaved tawa and ponga. The ground layer is dominated by Coprosma rhamnoides, hangehange, ferns and sedges in some areas, litter and tree seedlings in others. The main lianes and epiphytes are supplejack, Collospermum hastatum, Blechnum filiforme and Phymatosorus scandens. The understorey in all of these remnants is modified by stock browsing.

8. Pohutukawa forest and treeland

Remnant mature secondary pohutukawa dominant forest and treeland, 10-18 m tall, restricted to a narrow strip on and above coastal cliffs within the coastal spray and subaerial zones between 5 and 50 ft (1.5-15 m) a.s.l. The major canopy subdominant is karaka. Taupata, karo, houpara, pohutukawa, karaka and kawakawa are the middle tier dominants. In most cases the ground layer vegetation is highly modified as a result of past clearance and grazing. Where ground vegetation exists the main species are taupata, Arthropodium cirratum, introduced pasture grasses (cocksfoot, Yorkshire fog), kawakawa, houpara, Scirpus nodosus and Asplenium oblongifolium.

Forests on coastal rocky cliffs at Maraenui, Tokata, Whitianga Bay and Whanarua are relatively unmodified and support, beneath the forest canopy, a wide range of coastal, mostly herbaceous ground plants, including (though not always together): Apium prostratum, Arthropodium cirratum, Asplenium flaccidum ssp. haurakiense, Dichondra repens, Disphyma australe, Lagenifera pumila, Lobelia anceps, Oxalis exilis, Peperomia urvilleana, Plantago raoulii, Poa anceps, Sarcocornia quinqueflora, Samolus repens, Scirpus cernuus, S. nodosus, Selliera radicans and Senecio lautus.

9. Pohutukawa, houpapa forest

Secondary seral pohutukawa dominant forest, 5-15 m tall, in the coastal subaerial zone, on inshore stacks and islands, from 8-50 ft (2.5-15 m) a.s.l. Houpapa is commonly the canopy subdominant and occasionally is dominant. Common middle tier species are houpapa, hangehange and kawakawa. Ground tier dominants include Uncinia uncinata, Oplismenus imbecillus, Asplenium oblongifolium and kawakawa. Older forest has a mangeao, tawaroa, puriri and rewarewa component. Little modification by browsers (usually possums only). Evidence of past Maori occupation on most islands.

10. Pohutukawa, puriri, broadleaved tawa forest

Mature secondary pohutukawa dominant forest, 12-20 m tall, with subdominant (or occasionally dominant) puriri, and broadleaved tawa, kohekohe, rewarewa and karaka. Two landform variants may be distinguished: one primarily on mid and upper coastal hillslopes between 100 and 700 ft (30-210 m) a.s.l.; the other, in which puriri is often dominant and broadleaved tawa not as common, on marine terraces and colluvial basal hillslopes between 20 and 150 ft (6-50 m) a.s.l. The middle tier dominants include ponga, kohekohe, karaka, broadleaved tawa, mahoe and supplejack. The ground layer dominants are Coprosma rhannoides, kawakawa, Blechnum filiforme, Gahnia lacera, Oplismenus imbecillus and Asplenium oblongifolium. The understorey is sparse in many areas due to stock browsing.

11. Broadleaved tawa, pohutukawa, puriri forest

Mature secondary broadleaved tawa dominant forest, with subdominant pohutukawa (occasionally dominant) and puriri, 11-17 m tall, widespread on basal to upper coastal hillslopes, 20-600 ft (6-180 m) a.s.l. Other important canopy associates are rewarewa, kohekohe and karaka. Pohutukawa are usually very large and scattered, and puriri tend to be in gullies. Mangeao is a rare component. The middle tier is characteristically diverse. Dominants include ponga, kohekohe, supplejack, rangiora, broadleaved tawa, raurekau, mahoe and heketara. Ground layer dominants are Blechnum filiforme, Adiantum cunninghamii, Gahnia lacera, hangehange, and a wide variety of broadleaved seedlings. Evidence of possum browsing in most plots, and the understorey of some areas is highly modified by stock browsing.

12. Broadleaved tawa, puriri forest

Mature secondary broadleaved tawa dominant forest, usually with associated and occasionally dominant puriri, 12-22 m tall. Occurs as remnant pockets on coastal colluvial basal hillslopes; and it is widespread up to 8 km inland in gullies and on alluvial flats and basal - mid hillslopes, between 20 and 850 ft (6-260 m) a.s.l. The alluvial terraces form a distinct landform variant, in which puriri is sometimes absent and is replaced by pukatea. Puriri is also absent from better drained hillslopes. Other important canopy associates are kohekohe, rewarewa and karaka. Taraire and mangeao are rare coastal components. Middle tier dominants are kohekohe, ponga, mahoe, broadleaved tawa, kawakawa, supplejack and hangehange. The ground layer vegetation is sparse. Dominants include Blechnum filiforme, hangehange, Blechnum chambersii and Oplismenus imbecillus. Many species of broadleaved tree seedlings and ferns occur in low numbers. Collospermum hastatum is a common epiphyte. Most of the remnants have a highly modified understorey because of stock browsing.

13. Broadleaved tawa, kamahi-rewarewa forest

Mainly mature largely unmodified broadleaved tawa forest with subdominant kamahi, between 12 and 20 m tall. Found between 150 and 2250 ft (45-690 m) a.s.l. but mostly between 800 and 1500 ft (245-460 m). Occurs throughout the District mainly on mid and upper hillslopes. Other commonly occurring

canopy associates are rewarewa, northern rata, hinau, rimu, mamaku and mahoe. Broadleaved tawa, mahoe, kamahi, wheki, rangiora and heketara are prominent in the diverse understorey. Crown fern, kiokio, hen and chicken fern, Blechnum chambersii, Leptopteris hymenophylloides and Hymenophyllum demissum were each noted as ground layer dominants. The lianes, supplejack and kiekie, and the perching lilies, Collospermum hastatum and Astelia solandri are nearly always present.

14. B. tawa s.l. - kamahi - tawari - hinau forest

Mature primary forest on broad ridges and upper hillslopes between 1450 and 2000 ft (440-610 m) a.s.l. Dominant canopy species are B. tawa s.l., kamahi, tawari and hinau. The main subdominant associates are rewarewa, miro, rimu, toro and quintinia. B. tawa s.l., raukawa, mapou, pigeonwood and heketara are the middle tier dominants and the main ground layer species are Blechnum discolor and Uncinia uncinata. Windthrow common.

15. Hard beech, pohutukawa forest

Secondary forest dominated by hard beech, 15-18 m tall, with a subdominant pohutukawa component. Other important canopy associates are broadleaved tawa and rewarewa. Occurs scattered through the district on coastal ridges between 250 and 750 ft (75-230 m) a.s.l. The understorey comprises a variable, diverse mixture of species including hard beech, broadleaved tawa, heketara, ponga, Cyathodes juniperina, Coprosma spathulata, Pseudopanax arboreus, Olearia furfuracea and Nestegis lanceolata. Gahnia lacera, G. pauciflora, kiokio and Coprosma spathulata are the ground layer dominants.

A transitional type at the upper limit of the coastal zone.

16. Hard beech - broadleaved tawa, rewarewa forest

Primary and secondary hard beech and broadleaved tawa forest, one or other dominant, 12-20 m tall, found mostly on mid and upper hillslopes, between 200 and 1500 ft (60-460 m) a.s.l. Rewarewa is the most frequent canopy associate, and kamahi and northern rata occur occasionally. Middle tier dominants are hard beech, ponga, broadleaved tawa, heketara, Pseudopanax arboreus, supplejack and putaputaweta. Kiokio, rangiora,

hangehange, kiekie and Asplenium oblongifolium are the main ground layer species. Windthrow is common, and in some areas the understorey is modified by stock.

17. Hard beech, tanekaha-rewarewa forest

Mostly unmodified forest dominated by hard beech, 14-25 m tall, on ridges, knolls and spurs between 750 and 1600 ft (230-490 m) a.s.l. Occasionally the canopy is exclusively hard beech. Usually tanekaha and rewarewa are minor canopy associates. Dominants in the fairly diverse middle tier are hard beech, heketara, kamahi, Dracophyllum latifolium and tanekaha. Umbrella fern, Gahnia pauciflora, Leucopogon fasciculatus, Astelia solandri and Uncinia uncinata are the most common ground layer plants. Lianes present are Metrosideros fulgens and M. diffusa. Goat browse damage and windthrow were noted in several areas.

18. Hard beech, tawari, kamahi-quintinia forest

Mature primary forest dominated by hard beech, 14 - 20 m tall. It is widespread on ridges, knolls spurs and upper hillslopes between 1000 and 2700 ft (300-820 m) a.s.l., mostly from 1500-1800 ft (460-550 m) a.s.l. The most frequent canopy subdominants are tawari, quintinia and kamahi. The main middle tier dominants are quintinia, kamahi, hard beech, Dracophyllum latifolium, Archeria racemosa and heketara. Ground layer dominants are Astelia solandri, kidney fern, umbrella fern and filmy ferns (Hymenophyllum spp.). The perching lily Collospermum microspermum and the shrub epiphyte Pittosporum cornifolium were commonly noted. Other species which characterise the montane nature of this vegetation type and which are common at higher altitudes include toatoa, Hall's totara, toro and raukawa. Large miro and rimu are scattered throughout. Windthrow common.

19. Kamahi - tawari forest

Primary, stunted, dense kamahi and tawari dominant forest between 1500 and 3200 ft (460-975 m) a.s.l., mainly confined to hillslopes of the Raukumara Range north of Mt Raukumara. Other canopy associates are tawa, red beech, Alsophila smithii, rimu, miro and Hall's totara. Kamahi,

tawari and toro constitute the main middle tier species. Pseudowintera axillaris, Blechnum discolor, kamahi and mosses are the dominant ground cover species.

20. Hard beech - silver beech forest

Primary hard and silver beech dominant forest confined mainly to hillslopes about Mt Puketoetoe, 2500-3000 ft (760-915 m) a.s.l., with subdominants of tawari, kamahi and rimu. Kaikawaka, Hall's totara and toatoa are locally common. Dominant middle tier species include hard beech, toatoa and tawari. Pseudopanax colensoi, Astelia spp., Gahnia spp. and mosses are the main ground layer plants.

21. Red beech - silver beech forest

Primary red and silver beech forest in the vicinity of Mts Maungihaumi, Ahiapurua and Raukumara, between 2000 and 3700 ft (610-1130 m) a.s.l. Main subcanopy dominants are kamahi, tawari, Griselinia littoralis and Pseudopanax colensoi, with locally frequent miro, Hall's totara and kaikawaka. Middle tier dominants are tawari, kamahi and silver beech. Common ground layer species are mosses, Microlaena avenacea, Pseudowintera colorata, Blechnum discolor, B. fluviatile, Coprosma foetidissima and Polystichum vestitum. Much cattle trampling and browsing on rdiges south of Mt. Hikurangi.

Between 2100 and 2800 ft (640-850 m) a.s.l. on Te Pakera No. 1 Trig and Te Pakera No. 2 Trig is forest containing frequent hard beech, red and silver beech with frequent emergent rimu over a dense understorey of kamahi, tawari and scattered rimu, miro and Hall's totara.

22. Silver beech, kaikawaka forest

Primary silver beech dominant forest with a subdominant kaikawaka component, limited to a few areas between 3100 and 4000 ft (950-1220 m) a.s.l. in the vicinity of Mts Whanokao, Hikurangi, Maungawaru and Rangipoua. Other common associates are toatoa, pink pine, red beech and tawari. Very locally mountain beech is also present. Silver beech, tawari and mountain toatoa are middle tier dominants. Pseudopanax

colensoi, Gahnia spp., mosses and kidney fern are the major ground layer species. Much cattle damage in the vicinity of Mt Hikurangi.

23. Subalpine scrub and shrubland

A blanket type incorporating many different scrub and shrubland types. The main type, Olearia colensoi scrub, occurs on all the high peaks of the Raukumara Range between 4500 and 5000 ft (1370-1525 m) especially on moderate slopes. Canopy associates include Brachyglottis rotundifolia, pink pine, Coprosma pseudocuneata, mountain toatoa, Pseudopanax simplex and P. colensoi.

Other types represented are pink pine scrub, particularly on rocky ridges and knolls, and shrubland dominated by mountain toatoa, pink pine and the yellow-silver pine X pygmy pine hybrid, on poorly drained areas such as Maungawaru Plateau and the summit of Mt Arowhana. In this latter type mid-ribbed snow tussock and many different small shrubs (e.g. Dracophyllum adamsii, Pimelea buxifolia, Myrsine divaricata, Cyathodes empetrifolia, pygmy pine and Coprosma depressa) are also present.

Substantial areas dominated by herbs occur within this blanket type. For example, on Mt Arowhana seral herbfield dominated by Celmisia spectabilis covers burnt-off land formerly occupied by Olearia colensoi, and on the Maungawaru Plateau and Mt Arowhana very poorly drained sites have cushion bogs dominated by Oreobolus pectinatus.

24. Alpine tussockland

Occurs on Mts Hikurangi and Whanokao between 5000 ft and 5500 ft (1525-1675 m) a.s.l. Mid-ribbed snow tussock almost completely dominates the canopy in places, and the herbs Ranunculus insignis and Aciphylla colensoi are prominent between the tussocks. Shrubs represented in the canopy include Hebe odora, H. venustula and H. sp. unnamed (H. stricta var. lata).

25. Alpine herbfield

Occurs on Mt Hikurangi above 5500 ft (1675 m). Mid-ribbed snow tussock gives way to herbfield dominated by Celmisia spectabilis, C. incana and

Ranunculus insignis. Also present are North Island edelweiss, Hebe tetragona, Brachyglottis bidwillii and Coriaria plumosa. The scree slopes within this zone support scattered colonies of plants such as Epilobium astonii, Helichrysum "alpinum", Parahebe olsenii and Coriaria pottsiana. Cattle browsing and trampling common.

26. Alpine fellfield

Occurs on Mt Hikurangi above 5600 ft (1710 m). The plant cover is very patchy. Species present include Pentachondra pumila, Geum sp. (G. parvifolium agg.), Coprosma pumila, Parahebe olsenii, Epilobium glabellum, Lycopodium fastigiatum, L. australicum, Podocarpus nivalis, Oreomyrrhis colensoi, Gaultheria "novae-zelandiae", Dracophyllum adamsii, D. recurvum, North Island edelweiss, Poa novae-zelandiae, P. colensoi, Myosotis amabilis, Anisotome aromatica and Racomitrium lanuginosum.

27. Tauhinu shrubland and scrub

Primary, pioneer and seral, tauhinu dominant shrubland and scrub, 0.5-4 m high, on low alluvial terraces and floodplains of the Motu, Haparapara-Waikakariki, Kereu and Raukokore Rivers, between 0 and 150 ft (0-45 m) a.s.l. Also occurs on narrow gravel beach at the Raukokore River mouth. The main canopy associates are manuka, tutu, buddleia (in Haparapara-Waikakariki), tree lupin and kanuka. The common ground cover plants include many exotic grasses (especially Agrostis stolonifera and Yorkshire fog) and herbs (ragwort, Lotus spp.). Usnea sp. is epiphytic on tauhinu, manuka and kanuka. Young tauhinu stands are characterised by few other canopy species, considerable bare ground, smaller stature and greater spacing of individual shrubs, and the presence of scabweed (Raoulia tenuicaulis).

28. Manuka scrub

Dense seral scrub vegetation found on coastal and lowland hillslopes throughout the District between 40 and 1200 ft (12-365 m) a.s.l., following burning and forest clearance. Generally occurs on mid to crest catenary positions in seral vegetation complexes. Mostly a two-tiered structure 1.5-4 m tall, with almost complete manuka dominance of the

canopy. The most common canopy associates are bracken fern, kamahi, kanuka, kohuhu, and pohutukawa. The ground layer is a variable, often sparse mixture of exotic grasses and herbs, especially Lotus pedunculatus, catsear, and browntop, and usually there are few tree seedlings. Some taller manuka scrub has secondary broadleaved shrubs and trees (rewarewa, kohuhu, Olearia furfuracea, Pseudopanax arboreus, tutu and hangehange) becoming established which will replace the manuka in time.

29. Manuka, coprosma, koromiko scrub

Seral, generally two-tiered scrub nearly always dominated by manuka 2-8 m high, and rarely by gorse. It has a substantial canopy component of broadleaved shrubs especially karamu (Coprosma robusta and C. macrocarpa), koromiko (Hebe stricta var. stricta or var. macroura), hangehange and emerging pohutukawa. Occurs on coastal hillslopes and headlands between 150 and 400 ft (45-120 m) a.s.l. Has developed following clearing or burning. Ground layer dominance varies considerably from stand to stand with Coprosma rhamnoides, Gaultheria antipoda, bracken fern, Gahnia lacera, Lepidosperma australe and Lycopodium deuterodensum each noted as leading dominants and associates. In some taller, older scrub the broadleaved shrubs are beginning to overtop the manuka.

30. Manuka-kanuka scrub

Seral scrub characterised by the co-dominance of manuka and kanuka, 1.5-8 m tall. Found on mid and basal hillslopes between 100 and 350 ft (30-110 m) a.s.l., and has developed following forest clearance or as a result of burning. The understorey, where present, is dominated by manuka, kanuka, broadleaved shrubs and tree ferns (mamaku and ponga). Ground cover dominants vary considerably from area to area and include exotic grasses and herbs, bracken, Morelotia affinis and Carex longibrachiata.

31. Kanuka forest and scrub

Seral kanuka, 4-12 m tall, almost completely dominates. There are two landform variants: one, resulting from primary succession, on fresh alluvial terraces between 10 and 150 ft (3-45 m) a.s.l. and usually

having manuka or tauhinu as occasional canopy associates; the other, resulting usually from secondary succession, on hillslope bases to crests between 100 and 800 ft (30-240 m) a.s.l., and having broadleaved trees and shrubs and treeferns as occasional canopy associates (kohuhu, kamahi and wheki, and pohutukawa on crests and upper hillslopes). The latter variant has developed following burning and forest clearance and, in several instances, hillside slipping. The middle tier and ground layers are highly variable, with treeferns (ponga and wheki), broadleaved shrubs (hangehange, Pseudopanax arboreus, Coprosma rhamnoides, karamu, putaputaweta, rangiora), and needle-leaved shrubs (Leucopogon fasciculatus) in some areas, and in others a dominance of exotic herbs and grasses because of animal browsing or flooding.

32. Kanuka, Pseudopanax arboreus - rewarewa forest and scrub

Seral forest and scrub of mature kanuka, 7-15 m tall, being replaced by broadleaved tree and treefern species such as Pseudopanax arboreus, rewarewa, kohuhu, mahoe and mamaku. Found mainly on mid to upper hillslopes between 200 and 650 ft (60-200 m) a.s.l. The most frequent species in the diverse middle tier are Leucopogon fasciculatus, hangehange, rangiora, ponga, kamahi, heketara and Pseudopanax arboreus. Ground layer dominants are hangehange, Gahnia lacera, Uncinia uncinata, bracken fern, Coprosma rhamnoides and kiokio. Stock browsing in some areas.

33. Pseudopanax arboreus - mamaku forest and scrub

Seral forest and scrub, 4-10 m tall, dominated by Pseudopanax arboreus, mamaku, and occasionally kamahi, Coprosma robusta or ponga. There is a wide range of other broadleaved tree species in the canopy including putaputaweta, mahoe, kamahi, karamu, broadleaved tawa and kohuhu. Occurs frequently throughout the District mainly on mid to crest hillslopes, 100-1300 ft (30-400 m) a.s.l. Has developed following forest clearance or burning. Understorey dominants are rangiora, hangehange, mahoe, kawakawa, ponga and Leucopogon fasciculatus. Kiokio, Uncinia uncinata, Pneumatopteris pennigera, rangiora, kawakawa and hangehange are the ground layer dominants.

34. Pohutukawa, koromiko, olearia, flax scrub

Secondary scrub of scattered pohutukawa, 8-12 m tall, emergent over a coastal scrub canopy dominated by Hebe stricta var macroura, manuka, Olearia pachyphylla (where present), houpara and Phormium cookianum. Occurs within the spray and subaerial zones between 35 and 50 ft (10-15 m) a.s.l. on coastal cliffs and headlands. Ground layer dominants are Phormium cookianum, hangehange, rengarenga and taupata. Pyrrosia serpens is present both as a rupestral and an epiphyte.

35. Tanekaha - rewarewa forest

Seral forest, developed after clearing and burning, generally dominated by tanekaha or rewarewa, 8-18 m tall. Found on mid and upper hillslopes in the Houpoto and Torere blocks between 100 and 1000 ft (30-300 m) a.s.l. The most frequent canopy associates are kanuka and kamahi. Middle tier dominants are rewarewa, kamahi, tanekaha and Leucopogon fasciculatus. Ground layer dominants are kiokio, Lycopodium volubile, tanekaha, Uncinia uncinata, heketara and Coprosma spathulata.

APPENDIX II

CHECKLIST OF INDIGENOUS VASCULAR PLANTS

Below is a checklist of indigenous vascular plants recorded, collected or observed during the present survey of the Motu Ecological District.

Nomenclature follows that of Druce (1978, 1980, 1983). Common names used on the field cards or in the text are also given.

Abbreviations and symbols 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
spp.	:	more than one species
ssp.	:	subspecies
s.s.	:	sensu stricto, in the narrow sense
X	:	hybrid
var.	:	variety
H	:	found in Houpoto Swamp
S	:	southern limit in district
N	:	northern limit in district
*	:	rare in district
**	:	rare or endangered nationally (see Given, 1981)
o	:	previously not recorded from district

<i>Acaena anserinifolia</i>	bidibidi
<i>A. novae-zelandiae</i>	bidibidi
<i>A. sp.</i> (cf. <i>A. hirsutula</i> and <i>A. anserinifolia</i> var. <i>paucidens</i>)	
<i>Aciphylla colensoi</i>	
<i>A. squarrosa</i> var.*	
<i>Adiantum cunninghamii</i>	
<i>A. fulvum</i>	
<i>A. hispidulum</i>	
<i>Alectryon excelsus</i> var. <i>excelsus</i>	titoki
<i>Alseuosmia macrophylla</i>	
<i>A. pusilla</i>	
<i>Alsophila colensoi</i> ^N	
<i>A. cunninghamii</i>	
<i>A. smithii</i>	
<i>A. tricolor</i>	ponga, silver fern
<i>Anarthropteris lanceolata</i>	
<i>Anisotome aromatica</i>	
<i>Apium prostratum</i> ssp. <i>prostratum</i>	native celery
<i>Archeria racemosa</i>	
<i>Aristotelia fruticosa</i> var. <i>microphylla</i> ^N	
<i>A. serrata</i>	makomako, wineberry
<i>Arthropodium cirratum</i>	rengarenga lily
<i>Arthropteris tenella</i>	
<i>Ascarina lucida</i> var. <i>lucida</i>	hutu
<i>Asplenium bulbiferum</i> s.s.	hen and chicken fern
<i>A. flaccidum</i> ssp. <i>flaccidum</i>	
<i>A. flaccidum</i> ssp. <i>haurakiense</i>	

<i>A. hookerianum</i>	
<i>A. oblongifolium</i>	
<i>A. polyodon</i>	
<i>A. richardii</i> ^{N*}	
<i>Astelia fragrans</i>	
<i>A. linearis</i> var. <i>novae-zelandiae</i> ^N	
<i>A. solandri</i>	
<i>Athyrium australe</i>	
<i>A. japonicum</i>	
<i>Baumea rubiginosa</i> ^{*H}	
<i>B. tenax</i> ^{*H}	
<i>Beilschmiedia tarairi</i> ^{S*}	taraire
<i>B. tawa</i> s.l. (incl. broadleaved tawa)	see Section 4.6
<i>B. tawaroa</i>	tawaroa
<i>Blechnum chambersii</i>	
<i>B. discolor</i>	crown fern
<i>B. filiforme</i>	
<i>B. fluviatile</i>	
<i>B. membranaceum</i>	
<i>B. minus</i>	blechnum "swamp"
<i>B. penna-marina</i>	
<i>B. sp.</i> (<i>Lomaria latifolia</i>)	
<i>B. sp.</i> (<i>B. capense</i> agg., "reduced pinnae")	kiokio, blechnum "reduced pinnae"
<i>Brachyglottis bidwillii</i> var.	
<i>bidwillii</i> ^{N*}	
<i>B. repanda</i> var. <i>repanda</i>	rangiora

B. rotundifolia var.

(*B. elaeagnifolia*)^N

Bulbophyllum pygmaeum

Callitriche muelleri

Calystegia sepium agg.^H

C. soldanella

C. tuguriorum

Cardamine debilis agg.

Cardiomanes reniforme

kidney fern

Carex breviculmis

C. dissita

C. flagellifera

C. geminata agg.^H

C. lessoniana

C. maorica

C. pumila

C. secta^H

C. solandri

C. virgata^H

Carmichaelia arborea var.

(= *C. flagelliformis*)

*C. williamsii***^S

Carpodetus serratus

putaputaweta, marbleleaf

Cassinia leptophylla var. *leptophylla*

tauhinu

C. vauvilliersii^N

Celmisia incana

C. spectabilis var. *spectabilis*^N

Centella uniflora

<i>Cheilanthes sieberi</i>	
<i>Chionochloa conspicua</i> ssp. <i>cunninghamii</i>	
<i>C. flavicans</i> *	
<i>C. pallens</i> var. (broad leaves) ^N	mid-ribbed snow tussock
<i>Clematis foetida</i>	
<i>C. forsteri</i> ^H	
<i>C. paniculata</i>	
<i>C. parviflora</i>	
<i>Collospermum hastatum</i>	
<i>C. micropermum</i>	
<i>Coprosma areolata</i>	
<i>C. colensoi</i> (incl. <i>C. banksii</i>)	
<i>C. crassifolia</i> ^{O*}	
<i>C. depressa</i>	
<i>C. foetidissima</i>	
<i>C. grandifolia</i>	raurekau
<i>C. lucida</i>	
<i>C. macrocarpa</i> ssp. "minor"	
<i>C. "oreophila"</i> (aff. <i>C. cheesemanii</i>) ^N	
<i>C. pseudocuneata</i> ^N	
<i>C. pumila</i> ^N	
<i>C. repens</i>	taupata
<i>C. rhamnoides</i> ssp. <i>rhamnoides</i>	
<i>C. robusta</i> ^H	karamu
<i>C. rubra</i> ^N	
<i>C. rugosa</i> ssp. <i>rugosa</i> ^N	
<i>C. spathulata</i>	

<i>C. "taylorae"</i> (= <i>C. parviflora</i> var. <i>dumosa</i> Cheeseman 1906) ^N	
<i>C. tenuifolia</i> ^N	
<i>Cordyline australis</i>	cabbage tree
<i>C. australis</i> x <i>banksii</i>	
<i>C. banksii</i>	
<i>C. indivisa</i>	
<i>Coriaria arborea</i>	tutu
<i>C. plumosa</i> ^N	
<i>C. pottsiana</i> ^{N**}	
<i>Corokia cotoneaster</i> var. (larger leaves)*	
<i>Cortaderia fulvida</i> ^H	toetoe
<i>C. toetoe</i>	
<i>Corynocarpus laevigatus</i>	karaka
<i>Cotula australis</i>	
<i>C. coronopifolia</i> *	
<i>Craspedia "Hikurangi"</i> (incl. in <i>C. uniflora</i>)	
<i>Crassula sieberiana</i>	
<i>Ctenopteris heterophylla</i>	
<i>Cyathodes juniperina</i>	narrow-leaved mingimingi
<i>Cyperus ustulatus</i>	
<i>Dacrycarpus dacrydioides</i>	kahikatea
<i>Dacrydium cupressinum</i>	rimu
<i>Dendrobium cunninghamii</i>	
<i>Deyeuxia billardieri</i>	
<i>Dianella nigra</i>	
<i>Dichelachne crinita</i>	plume grass

<i>Dichondra repens</i>	
<i>Dicksonia squarrosa</i>	wheki
<i>Disphyma australe</i>	New Zealand ice plant
<i>Dodonaea viscosa</i> var.	akeake
<i>Doodia media</i>	
<i>Dracophyllum adamsii</i>	
<i>D. latifolium</i>	neinei
<i>D. recurvum</i> ^N	
<i>D. sinclairii</i> ^S *	
<i>D. strictum</i>	
<i>D. traversii</i>	
<i>Drapetes dieffenbachii</i>	
<i>Drosera arcturi</i> ^N *	
<i>D. binata</i> ^H	
<i>Drymoanthus adversus</i>	
<i>Dysoxylum spectabile</i>	kohekohe
<i>Earina autumnalis</i>	
<i>E. mucronata</i>	
<i>Elaeocarpus dentatus</i>	hinau
<i>E. hookerianus</i>	pokaka
<i>Eleocharis acuta</i> ^H	
<i>E. gracilis</i> ^H	
<i>E. sphacelata</i>	
<i>Entelea arborescens</i>	whau
<i>Epilobium astonii</i> ^N *	
<i>E. brunnescens</i> s.s.	
<i>E. nerteroides</i>	
<i>E. nummularifolium</i>	

<i>E. pallidiflorum</i> ^{O*H}	
<i>E. pedunculare</i>	
<i>E. rotundifolium</i>	
<i>Euphrasia cuneata</i>	
<i>E. zelandica</i> ^N	
<i>Freycinetia baueriana</i> ssp. <i>banksii</i>	kieke
<i>Fuchsia excorticata</i>	fuchsia
<i>Gahnia lacera</i>	
<i>G. pauciflora</i>	
<i>G. procera</i>	
<i>G. setifolia</i>	
<i>Galium perpusillum</i>	
<i>G. propinquum</i>	
<i>Gaultheria antipoda</i>	
<i>G. sp. (G. depressa</i> var. <i>novae-zelandiae)</i>	<i>G. "novae-zelandiae"</i>
<i>Geniostoma ligustrifolium</i> var.	
<i>ligustrifolium</i>	hangehange
<i>Gentiana sp. (cf. G. montana</i> and	
<i>G. patula)</i>	
<i>Geranium microphyllum</i>	
<i>G. potentilloides</i> var. <i>potentilloides</i>	
<i>Gleichenia dicarpa</i> ^H	
<i>G. microphylla</i>	
<i>Gnaphalium audax</i> s.s.	
<i>G. gymnocephalum</i>	
<i>G. keriense</i>	
<i>G. luteo-album</i> agg.	
<i>G. sphaericum</i>	

Gonocarpus micranthus ssp. micranthus	
G. sp. (cf. G. incanus and G. montanus)	
Grammitis billardieri	
G. magellanica ssp. nothofageti	
Griselinia littoralis	broadleaf
G. lucida	puka
Gunnera monoica	
Halocarpus biformis	pink pine
Haloragis erecta ssp. erecta	
Hebe odora s.s. ^N	
H. stricta var. stricta ^H	
H. s. var. macroura	
H. tetragona var. tetragona ^N	
H. venustula ^N	
H. sp. (Veronica arborea) ^N	Hebe parviflora var. arborea
H. sp. (Hebe stricta var. lata)	
H. sp. "Motu" (Veronica salicifolia var. angustissima) ^N	
H. sp. "Wairoa" ^N	
Hedycarya arborea	pigeonwood
Helichrysum aggregatum	
H. sp. unnamed aff. H. bellidioides	H. "alpinum"
H. lanceolatum	
Histiopteris incisa	
Hoheria populnea var. lanceolata	lacebark
Hydrocotyle americana	
H. elongata	
H. microphylla	

H. moschata

H. novae-zelandiae agg.

Hymenophyllum bivalve

H. demissum

H. dilatatum

H. flabellatum

H. flexuosum

H. malingii

H. multifidum

H. rarum

H. revolutum

H. sanguinolentum

H. scabrum

Hypericum japonicum

Hypolepis ambigua

*H. millefolium**

H. rufobarbata

H. tenuifolia

Isachne globosa^H

Ixerba brexioides

tawari

Jovellana repens

J. sinclairii

Juncus gregiflorus

J. maritimus var. *australiensis*

sea rush

J. planifolius^H

J. prismatocarpus^{O*H}

J. sarophorus

Knightia excelsa

rewarewa

<i>Lachnagrostis filiformis</i> agg.	
<i>Lagenifera pumila</i>	
<i>Lastreopsis glabella</i>	
<i>L. hispida</i>	
<i>L. microsora</i> ssp. <i>pentangularis</i>	
<i>Laurelia novae-zelandiae</i>	pukatea
<i>Lemna minor</i>	
<i>Lepidosperma australe</i>	
<i>Leptocarpus similis</i>	oioi, jointed rush
<i>Leptopteris hymenophylloides</i>	
<i>L. superba</i>	
<i>Leptospermum ericoides</i> var. <i>ericoides</i>	kanuka
<i>L. scoparium</i> ^H	manuka
<i>Leucogenes leontopodium</i> ^{N*}	N.I. edelweiss
<i>Leucopogon fasciculatus</i>	mingimingi
<i>L. fraseri</i>	patotara
<i>Libertia grandiflora</i>	
<i>L. pulchella</i>	
<i>Libocedrus bidwillii</i>	kaikawaka
<i>L. plumosa</i> ^{S*}	kawaka
<i>Limosella lineata</i> *	
<i>Lindsaea trichomanoides</i>	
<i>Litsea calicaris</i> *	mangeao
<i>Lobelia anceps</i>	
<i>Lophomyrtus bullata</i>	ramarama
<i>Luzula picta</i> s.s.	
<i>Luzuriaga parviflora</i>	
<i>Lycopodium australianum</i>	

<i>L. cernuum</i>	
<i>L. deuterodensum</i>	
<i>L. fastigiatum</i>	
<i>L. scariosum</i>	
<i>L. varium</i>	
<i>L. volubile</i>	
<i>Lygodium articulatum</i> *	mangemange
<i>Machaerina sinclairii</i>	
<i>Macropiper excelsum</i> var. <i>excelsum</i>	kawakawa
<i>Melicope simplex</i>	poataniwha
<i>M. ternata</i>	wharangi
<i>Melicytus lanceolatus</i>	mahoe-wao
<i>M. ramiflorus</i> ssp. <i>ramiflorus</i>	mahoe
<i>Mentha cunninghamii</i> *	
<i>Metrosideros carminea</i> **	
<i>M. colensoi</i> *	
<i>M. diffusa</i>	
<i>M. excelsa</i>	pohutukawa
<i>M. excelsa</i> x <i>robusta</i>	
<i>M. fulgens</i>	
<i>M. perforata</i>	
<i>M. robusta</i>	northern rata
<i>Muehlenbeckia australis</i>	
<i>M. australis</i> x <i>complexa</i>	
<i>M. complexa</i>	
<i>Microlaena avenacea</i>	
<i>M. stipoides</i>	
<i>Microtis unifolia</i>	

<i>Mida salicifolia</i>	
<i>Montia fontana</i>	
<i>Morelotia affinis</i>	
<i>Myoporum laetum</i>	ngaio
<i>Myosotis saxosa</i> (incl. <i>M. amabilis</i>) ^{N*}	
<i>Myriophyllum propinquum</i>	
<i>Myrsine australis</i>	mapou
<i>M. divaricata</i>	
<i>M. nummularia</i> ^N	
<i>M. salicina</i>	toro
<i>Neomyrtus pedunculata</i>	
<i>Nertera depressa</i>	
<i>N. sp. unnamed aff. N. dichondraefolia</i>	
<i>Nestegis lanceolata</i>	white maire
<i>Nothofagus fusca</i>	red beech
<i>N. menziesii</i>	silver beech
<i>N. solandri</i> var. <i>cliffortioides</i> ^N	mountain beech
<i>N. s. var. solandri</i> *	black beech
<i>N. truncata</i>	hard beech
<i>Olearia albida</i>	
<i>O. arborescens</i> ^N	
<i>O. colensoi</i> ^N	
<i>O. furfuracea</i>	
<i>O. ilicifolia</i> ^N	
<i>O. nummularifolia</i> var. <i>nummularifolia</i> ^N	
<i>O. pachyphylla</i> **	
<i>O. rani</i>	heketara
<i>Oplismenus imbecillus</i>	bamboo grass

<i>Oreobolus pectinatus</i>	
<i>Oreomyrrhis colensoi</i> s.s.	
<i>Orthoceras strictum</i>	
<i>Ourisia caespitosa</i> ^N	
<i>O. macrophylla</i> var.	
<i>Oxalis exilis</i>	
<i>O. lactea</i>	
<i>Paesia scaberula</i>	
<i>Parahebe catarractae</i> ssp. <i>diffusa</i>	
<i>P. olsenii</i> ^N	
<i>Paratrophis microphylla</i>	
<i>Parsonsia capsularis</i> var. <i>capsularis</i>	
<i>P. heterophylla</i>	
<i>Passiflora tetrandra</i>	
<i>Pellaea rotundifolia</i>	
<i>Pennantia corymbosa</i>	kaikomako
<i>Pentachondra pumila</i> *	
<i>Peperomia tetraphylla</i>	
<i>P. urvilleana</i>	
<i>Phormium cookianum</i>	coastal flax, wharariki
<i>P. tenax</i> ^H	swamp flax
<i>Phyllachne colensoi</i> ^{N*}	
<i>Phyllocladus aspleniifolius</i> var. <i>alpinus</i>	mountain toatoa
<i>P. glaucus</i>	toatoa
<i>P. trichomanoides</i>	tanekaha
<i>Phymatosorus diversifolius</i>	houndstongue
<i>P. novae-zelandiae</i>	
<i>P. scandens</i>	fragrant fern

<i>Pimelea buxifolia</i> ^N *	
<i>P. longifolia</i> *	
<i>P. oreophila</i> ^N *	
<i>P. prostrata</i> var. <i>quadrifaria</i> *	
<i>P. tomentosa</i> *	
<i>Pittosporum cornifolium</i>	
<i>P. crassifolium</i> var. <i>crassifolium</i>	karo
<i>P. eugenioides</i>	lemonwood
<i>P. rigidum</i> var. <i>rigidum</i> ^N	
<i>P. tenuifolium</i> ssp. <i>tenuifolium</i>	kohuhu
<i>P. sp.</i> (<i>P. ellipticum</i> ?)	
<i>P. sp.</i> (<i>P. huttonianum</i> ?)	
<i>Plagianthus divaricatus</i> *	coastal ribbonwood
<i>Plantago novae-zelandiae</i> *	
<i>P. raoulii</i>	
<i>Pneumatopteris pennigera</i>	<i>Thelypteris pennigera</i>
<i>Poa anceps</i> agg.	
<i>Podocarpus hallii</i>	Hall's totara
<i>P. hallii</i> x <i>nivalis</i>	
<i>P. nivalis</i> ^N	snow totara
<i>P. totara</i> var. <i>totara</i> *	totara
<i>Polystichum richardii</i>	
<i>P. vestitum</i>	
<i>Pomaderris ericifolia</i>	
<i>P. kumeraho</i> *	
<i>Potamogeton cheesemanii</i>	
<i>P. suboblongus</i> ^{O₂H} *	
<i>Prasophyllum colensoi</i>	

<i>Pratia angulata</i>	
<i>Prumnopitys ferruginea</i>	miro
<i>P. taxifolia</i>	matai
<i>Pseudopanax anomalus</i>	
<i>P. arboreus</i> var. <i>arboreus</i>	five finger
<i>P. colensoi</i>	
<i>P. crassifolius</i>	lancewood
<i>P. crassifolius</i> x <i>lessonii</i> var. <i>lessonii</i>	
<i>P. edgerleyi</i>	raukawa
<i>P. laetus</i>	
<i>P. lessonii</i> var. <i>lessonii</i>	houpara, coastal five finger
<i>P. simplex</i>	
<i>Pseudowintera axillaris</i>	lowland pepperwood
<i>P. colorata</i>	
<i>Pteridium esculentum</i>	bracken
<i>Pteris macilenta</i>	
<i>P. saxatilis</i>	
<i>P. tremula</i>	
<i>Pterostylis banksii</i>	
<i>Pyrrosia serpens</i>	
<i>Quintinia serrata</i> (incl. <i>Q. acutifolia</i> and <i>Q. elliptica</i>)	quintinia
<i>Ranunculus hirtus</i> s.s.	
<i>R. insignis</i>	
<i>R. macropus</i>	
<i>Raoulia glabra</i>	
<i>R. grandiflora</i> ^N *	
<i>R. tenuicaulis</i>	

<i>Rhabdothamnus solandri</i>	
<i>Rhopalostylis sapida</i>	nikau
<i>Ripogonum scandens</i>	supplejack
<i>Rubus australis</i>	
<i>R. cissoides</i> var. <i>cissoides</i>	bush lawyer
<i>R. schmidelioides</i> var. <i>schmidelioides</i>	
<i>Rumohra adiantiformis</i>	
<i>Ruppia polycarpa</i>	
<i>Rytidosperma gracile</i>	
<i>R. racemosum</i>	
<i>R. unarede</i>	
<i>Samolus repens</i>	sea primrose
<i>Sarcocornia quinqueflora</i> ssp. <i>quinqueflora</i>	<i>Salicornia australis</i> , glasswort
<i>Scandia rosaefolia</i> var. "coastal"	
<i>S. r.</i> var. "inland"	
<i>Schefflera digitata</i>	pate
<i>Schizeilema allanii</i>	
<i>Schoenus maschalinus</i>	
<i>S. nitens</i> var. <i>concinus</i> *	
<i>S. tendo</i>	
<i>Scirpus cernuus</i>	
<i>S. chlorostachyus</i> ^H	
<i>S. fluviatilis</i>	
<i>S. lacustris</i> ^H	
<i>S. nodosus</i>	knotted sedge
<i>S. reticularis</i> * ^H	
<i>S. subtilissimus</i> ^{O*} ^H	

<i>Selliera radicans</i>	
<i>Senecio lautus</i>	
<i>S. minimus</i>	
<i>S. quadridentatus</i>	
<i>S. wairauensis</i>	
<i>Solanum aviculare</i> var. <i>aviculare</i>	
<i>S. nodiflorum</i>	
<i>Sophora tetraptera</i>	kowhai
<i>Sparganium subglobosum</i> ^{O*H}	
<i>Sphaeropteris medullaris</i>	mamaku
<i>Stellaria parviflora</i>	N.Z. chickweed
<i>Sticherus cunninghamii</i>	<i>Gleichenia cunninghamii</i> , umbrella fern
<i>Tetragonia tetragonioides</i> *	
<i>Thelymitra longifolia</i>	
<i>Tmesipteris elongata</i>	
<i>T. lanceolata</i>	
<i>T. tannensis</i>	
<i>Triglochin striatum</i>	
<i>Toronia toru</i>	toru
<i>Trichomanes elongatum</i>	
<i>T. venosum</i>	
<i>Typha orientalis</i> ^H	raupo
<i>Uncinia banksii</i>	
<i>U. scabra</i>	
<i>U. uncinata</i>	hooked sedge
<i>U. zotovii</i>	
<i>Urostemon kirkii</i>	<i>Senecio kirkii</i> , kohurangi

Urtica incisa

Viola cunninghamii

V. filicaulis

Vitex lucens

puriri

Wahlenbergia gracilis agg.

Weinmannia racemosa

kamahi

Zoysia sp.*

APPENDIX III

CHECKLIST OF ADVENTIVE VASCULAR PLANTS

Below is a checklist of adventive vascular plants recorded, collected or observed during the present survey of the Motu Ecological District.

Common names used on the field cards or in the text are also given. See Appendix II for a key to abbreviations and symbols used.

<i>Acacia mearnsii</i>	black wattle
<i>Achillea millefolium</i>	yarrow
<i>Agrostis stolonifera</i>	
<i>A. tenuis</i>	browntop
<i>Aira caryophyllea</i>	
<i>Anagallis arvensis</i>	scarlet pimpernel
<i>Anthemis cotula</i>	
<i>Anthoxanthum odoratum</i>	sweet vernal.
<i>Aster subulatus</i>	
<i>Atriplex hastata</i>	
<i>Bellis perennis</i>	daisy
<i>Berberis</i> sp.	
<i>Briza maxima</i>	
<i>B. minor</i>	
<i>Bromus diandrus</i>	
<i>B. mollis</i>	
<i>B. uniolodes</i>	
<i>Buddleia davidii</i>	buddleia
<i>Cakile edentula</i>	

<i>Callitriche stagnalis</i>	
<i>Calystegia silvatica</i>	bindweed
<i>Campsia</i> sp.	
<i>Canna indica</i>	
<i>Cannabis sativa</i>	Indian hemp
<i>Capsella bursa-pastoris</i>	shepherd's purse
<i>Carduus pycnocephalus</i>	
<i>C. tenuiflorus</i>	
<i>Carex divulsa</i>	
<i>C. longebrachiata</i>	
<i>Centaureum erythraea</i>	
<i>Cerastium fontanum</i> ssp. <i>triviale</i>	mouse-ear chickweed
<i>C. glomeratum</i>	annual mouse-ear chickweed
<i>Chamaecyparis lawsoniana</i>	Lawson's cypress
<i>Chenopodium album</i>	fathen
<i>Chrysanthemum leucanthemum</i>	
<i>Cichorium intybus</i>	chicory
<i>Cirsium arvense</i>	Californian thistle
<i>C. vulgare</i>	Scotch thistle
<i>Colocassia esculenta</i>	taro
<i>Conyza floribunda</i>	fleabane
<i>Cordyline terminalis</i>	
<i>Coronopus didymus</i>	
<i>Cortaderia selloana</i>	
<i>Crataegus monogyna</i>	hawthorn
<i>Crepis capillaris</i>	hawksbeard
<i>Crocasmia x crocosmiiflora</i>	crocasmia
<i>Cupressus macrocarpa</i>	macrocarpa

<i>Cynodon dactylon</i>	
<i>Cyperus congestus</i>	
<i>C. eragrostis</i>	
<i>Cytisus scoparius</i>	broom
<i>Dactylis glomerata</i>	cocksfoot
<i>Datura stramonium</i>	
<i>Daucus carota</i>	wild carrot
<i>Dipsacus fullonum</i>	teasel
<i>Digitalis purpurea</i>	foxglove
<i>Epilobium ciliatum</i>	
<i>Eucalyptus</i> spp.	
<i>Euphorbia peplus</i>	
<i>Festuca arundinacea</i>	
<i>Foeniculum vulgare</i>	fennel
<i>Fumaria muralis</i>	
<i>Galium aparine</i>	
<i>G. divaricatum</i>	
<i>Geranium molle</i>	
<i>G. robertianum</i>	
<i>Gnaphalium spicatum</i>	
<i>Hedychium gardnerianum</i>	wild ginger
<i>Holcus lanatus</i>	Yorkshire fog
<i>Hordeum murinum</i>	
<i>Hypericum androsaemum</i>	tutsan
<i>Hypochoeris radicata</i>	catsear
<i>Ipomoea congesta</i>	blue morning glory
<i>Juncus articulatus</i>	
<i>J. bufonius</i>	

J. effusus

J. microcephalus

J. tenuis

Lapsana communis

nipplewort

Lagurus ovatus

haretail

Leontodon taraxacoides

hawkbit

Leycesteria formosa

Himalayan honeysuckle

Ligustrum lucidum

privet

Linum bienne

Lolium perenne

Perennial ryegrass

Lonicera japonica

Japanese honeysuckle

Lotus angustissimus

L. pedunculatus

L. subbiflorus

Ludwigia palustris

Lupinus arboreus

lupin

Lycium ferocissimum

African boxthorn

Lythrum hyssopifolia

Malva neglecta

Matricaria maritima

Medicago lupulina

M. sativa^o

lucerne

Mentha pulegium

pennyroyal

M. spicata

Miscanthus nepalensis

Himalayan fairygrass

Mycelis muralis

wall lettuce

Myosotis caespitosa

Nasturtium officinale

watercress

<i>Opuntia vulgaris</i>	
<i>Orobanche minor</i>	
<i>Oxalis latifolia</i>	
<i>Parentucellia viscosa</i>	tarweed
<i>Paspalum dilatatum</i>	paspalum
<i>Phleum pratense</i>	timothy
<i>Phytolacca octandra</i>	inkweed
<i>Plantago coronopus</i>	
<i>P. lanceolata</i>	
<i>P. major</i>	
<i>Pinus radiata</i>	
<i>Poa annua</i>	
<i>Polycarpon tetraphyllum</i>	
<i>Polygonum aviculare</i>	
<i>P. convolvulus</i>	
<i>P. hydropiper</i>	
<i>P. persicaria</i>	
<i>Populus alba</i>	silver poplar
<i>Prunella vulgaris</i>	selfheal
<i>Prunus persicus</i>	peach
<i>Ranunculus repens</i>	buttercup
<i>Rosa chinensis</i>	
<i>R. rubiginosa</i>	sweet briar
<i>Rubus fruticosus</i> agg.	blackberry
<i>R. phoenicolasius</i>	Japanese wineberry
<i>Rumex acetosella</i>	sheep's sorrel
<i>R. crispus</i>	
<i>R. obtusifolius</i>	

<i>Sagina procumbens</i>	
<i>Salix babylonica</i>	weeping willow
<i>S. caprea</i>	goat willow
<i>S. cinerea</i>	pussy willow
<i>S. fragilis</i>	crack willow
<i>Sambucus nigra</i>	elder
<i>Scrophularia auriculata</i>	
<i>Senecio bipinnatisectus</i>	fireweed
<i>S. jacobaea</i>	ragwort
<i>S. vulgaris</i>	
<i>Silene gallica</i>	
<i>Sison amomum</i>	stone parsley
<i>Sisymbrium officinale</i>	
<i>Sisyrinchium iridifolium</i>	blue-eyed grass
<i>Solanum nigrum</i>	
<i>Sonchus asper</i>	prickly sow thistle
<i>S. oleraceus</i>	
<i>Spergula arvensis</i>	
<i>Spergularia rubra</i>	
<i>Sporobolus africanus</i>	ratstail
<i>Stachys arvensis</i>	
<i>Stellaria alsine</i>	
<i>S. graminea</i>	
<i>S. media</i>	chickweed
<i>Taraxacum officinale</i>	dandelion
<i>Trifolium arvense</i>	
<i>T. dubium</i>	
<i>T. glomeratum</i>	

T. pratense

T. repens

Ulex europaeus

gorse

Verbascum thapsus

V. virgatum

Verbena bonariensis

verbena

V. officinalis

Veronica anagallis-aquatica

V. plebeja

V. serpyllifolia

Vicia sativa

Vulpia bromoides

Wahlenbergia marginata

Yucca aloifolia

APPENDIX IV: Checklist of Vertebrate Wildlife Habitats and Distribution

Abbreviations and Notes

a. Distribution refers to population distribution in the habitat in the District.

b. L.J. Daniel, pers. comm.

c. M.J. Daniel, pers. comm.

d. A.M. Davis, pers. comm.

e. C. Richmond, pers. comm.

f. G.A. Taylor, pers. comm.

g. Atkinson (1972)

h. Bull, Gaze and Robertson (1978)

i. Rowe (1981)

j. Roxburgh (1982)

k. Innes (1983)

l. The most recent known kokako records are from Meremere Hill Scenic Reserve in 1978 and (L.J. Daniel, pers. comm.). None were recorded in the 1983-84 Fauna Survey Unit survey nor the present survey.

m. Species for which there is a stated concern, principally listing in Williams and Given (1981).

n. All species records other than cited above, based on N.Z. Wildlife Service Fauna Survey Unit survey (September-November, 1983) and present survey.

o. Only confirmed habitat; probably more widespread.

APPENDIX IV: Checklist of Vertebrate Wildlife Habitats and Distribution

<u>Scientific Name</u>	<u>Maori Name</u>	<u>European Name</u>	<u>Habitat</u>	<u>Distribution^a</u>
A. INDIGENOUS				
<u>Mystacina tuberculata</u>		Short-tailed bat	Forest	Probably present ^{c,m}
<u>Chalinolobus tuberculatus</u>		Long-tailed bat	Forest	Present
<u>Apteryx australis mantelli</u>	Kiwi	N.I. brown kiwi	Forest and scrub (lowland, montane)	Widespread
<u>Eudyptula minor iredali</u>		Northern blue penguin	Coastal waters; islets and coastal cliffs	Present
<u>Puffinus carneipes hullianus</u>		Flesh-footed shearwater	Coastal offshore waters	Locally common case ^f
<u>P. bulleri</u>		Buller's shearwater	Coastal offshore waters	Locally common ^f
<u>P. gavia gavia</u>	Pakaha	Fluttering shearwater	Coastal offshore waters	Locally common ^f
<u>Sula bassana serrator</u>	Takapu	Australasian gannet	Coastal headlands, offshore waters	Colony on Haurere headland
<u>Phalacrocorax carbo novaeollandiae</u>	Kawau	Black shag	Rivers and river-mouths, coastal headlands	Locally common
<u>P. varius varius</u>	Kahuriruhi	Pied shag	Rivermouths and coastal headlands	Locally common
<u>P. sulcirostris</u>		Little black shag	Rivermouths	Uncommon ^h
<u>P. melanoleucos brevirostris</u>	Kawaupaka	Little shag	Rivers and river-mouths	Locally common

<u>Scientific Name</u>	<u>Maori Name</u>	<u>European Name</u>	<u>Habitat</u>	<u>Distribution^a</u>
<u>Ardea novaehollandiae</u>		White-faced heron	Rivers and river-mouths	Locally common
<u>Ardea novaehollandiae</u>				
<u>Egretta sacra sacra</u>	Matuku-moana	Reef heron	Rivermouths	Uncommon
<u>Tadorna variegata</u>	Putangitangi	Paradise shelduck	River valleys	Locally common
<u>Anas superciliosa superciliosa</u>	Parera	Grey duck	Rivers and streams	Locally common
<u>Hymenolaimus malacorhynchos</u>	Whio	Blue duck	Rivers	Uncommon ^{j,m}
<u>Circus approximans gouldi</u>	Kahu	Australasian harrier	River valleys, forest, shrubland, grassland	Widespread
<u>Falco novaeseelandiae</u>	Karearea	N.Z. falcon	Forest	Uncommon
<u>Gallirallus australis greyi</u>	Weka	N.I. weka	Forest, scrub	Present (Motu and Toatoa)
<u>Porzana tabuensis plumbea</u>	Puweto	Spotless crane	Freshwater swamp	Rare ^d
<u>Porphyrio porphyrio melanotus</u>	Pukeko	Swamp-hen	Freshwater swamp	Uncommon
<u>Haematopus unicolor</u>	Torea	Variable oyster-catcher	Rivermouths, beaches	Uncommon
<u>Charadrius obscurus</u>		N.Z. dotterel	Haparapara River mouth	Rare ^{f,m}
<u>C. bicinctus bicinctus</u>	Tuturiwhatu	Banded dotterel	Lower braided rivers and rivermouths	Uncommon
<u>Himantopus himantopus leucocephalus</u>	Poaka	Pied stilt	Rivermouths	Uncommon
<u>Larus dominicanus</u>	Karoro	Southern black-backed gull	Rivers, rivermouths, offshore	Locally common
<u>L. novaehollandiae</u>	Tarapunga	Red-billed gull	River deltas and	Locally common

<u>Scientific Name</u>	<u>Maori Name</u>	<u>European Name</u>	<u>Habitat</u>	<u>Distribution^a</u>
<u>L. bulleri</u>		Black-billed gull	River deltas	Rare ^f
<u>Sterna striata</u>	Tara	White-fronted tern	Rivermouths, offshore	Locally common
<u>Hydroprogne caspia</u>	Taranui	Caspian Tern	Rivermouths	Uncommon
<u>Hemiphaga novaeseelandiae</u>	Kereru	N.Z. pigeon	Forest (coastal, lowland)	Widespread
<u>Nestor meridionalis</u>	Kaka	N.I. kaka	Forest (lowland, montane)	Uncommon ^m
<u>Cyanoramphus auriceps</u>	Kakariki	Yellow-crowned parakeet	Forest (lowland, montane)	Uncommon ^m
<u>Chrysococcyx lucidus</u>	Pipiharauroa	Shining cuckoo	Forest and scrub	Widespread
<u>Eudynamis taitensis</u>	Koekoea	Long-tailed cuckoo	Forest	Widespread
<u>Ninox novaeseelandiae</u>	Ruru	Morepork	Forest	Widespread
<u>Halcyon sanita vagans</u>	Kotare	N.Z. kingfisher	Forest; streams (lowland)	Widespread
<u>Acanthisitta chloris granti</u>	Titipounamu	N.I. rifleman	Forest (montane)	Locally common
<u>Hirundo tahitica neoxena</u>		Welcome swallow	Ponds, rivers	Uncommon
<u>Anthus novaeseelandiae</u>	Pihoihoi	N.Z. pipit	Riverbeds and river-mouths, roadsides, alpine	Locally common
<u>Mohoua albicilla</u>	Popokatea	Whitehead	Forest (lowland, montane)	Widespread
<u>Gerygone igata</u>	Riroriro	Grey warbler	Forest and scrub	Widespread

<u>Scientific Name</u>	<u>Maori Name</u>	<u>European Name</u>	<u>Habitat</u>	<u>Distribution^a</u>
<u>Rhipidura fuliginosa placabilis</u>		Piwakawaka	N.I. fantail	Forest and scrub Widespread
<u>Petrocca macrocephala toitoi</u>		Miro-miro	Pied tit montane)	Forest (lowland, Locally Common
<u>P. australis longipes</u>		Toutouwai	N.I. robin	Forest Rare ^{b,j}
<u>Zosterops lateralis lateralis</u>		Tauhou	Silvereye	Forest and scrub Widespread
<u>Anthornis melanura melanura</u>		Korimako	Bellbird	Forest Widespread
<u>Prothemadera novaeseelandiae novaeseelandiae</u>		Tui	Tui	Forest Widespread
<u>Callaeas cinerea wilsoni</u>		Kokako	N.I. kokako	Forest Very rare ^{l,m}
<u>Hoplodactylus maculatus</u>			Common gecko	Beaches ^o Uncommon
<u>Leiopelisma smithi</u>			Shore skink	Beaches Uncommon
<u>Leiopelma hochstetteri</u>			Hochstetter's frog	Forested first and Widespread ^m
			second order streams	
<u>Ariippis trutta</u>	Kahawai	Kahawai	Rivermouths	Locally common ⁱ
<u>Anguilla dieffenbachii</u>	Tuna	Tuna	Longfinned eel	Rivers and streams Widespread ⁱ
<u>A. australis schmidti</u>	Tuna	Tuna	Shortfinned eel	Lowland rivers Locally common ⁱ
<u>Galaxias brevipinnis</u>	Kokopu	Kokopu	Koaro	Streams Widespread ⁱ
<u>G. fasciatus</u>	Kokopu	Banded kokopu	Lowland rivers and streams	Locally common? ⁱ
<u>G. maculatus</u>	Inanga	Inanga	Lowland rivers	Probably present ⁱ
<u>G. argenteus</u>	Kokopu	Giant kokopu	Lowland rivers, swamps	Present ^e

<u>Scientific Name</u>	<u>Maori Name</u>	<u>European Name</u>	<u>Habitat</u>	<u>Distribution^a</u>
<u>Gobiomorphus hubbsi</u>			Bluegilled bully	Rivers and streams Widespread ⁱ
<u>G. luttoni</u>	Toitoi	Redfinned bully	Lowland rivers	Uncommon ⁱ
<u>G. cotidianus</u>	Toitoi	Common bully	Lowland rivers	Widespread ⁱ
<u>G. gobioides</u>		Giant bully	Lowland rivers	Probably present ⁱ
<u>Cheimarrichthys fosteri</u>			Torrentfish	Rivers and streams Widespread ⁱ
<u>Retropinna retropinna</u>		Paraki, porohe	Common smelt	Lowland rivers Probably present ⁱ
B. ADVENTIVE				
<u>Mus musculus</u>		Mouse	Forest, habitations	Widespread? ^{g,k}
<u>Rattus rattus</u>		Ship rat	Forest	Widespread? ^{g,k}
<u>R. norvegicus</u>		Norway rat		Present ^g
<u>Mustela nivalis</u>		Weasel	Beach ⁿ	Uncommon?
<u>M. erminea</u>		Stoat	Forest	Widespread?
<u>M. putorius</u>		Ferret		Present
<u>Erinaceus europaeus</u>			Hedgehog	Present
<u>Felis catus</u>		Cat		Present
<u>Sus scrofa</u>		Pig	Lowland and montane forest	Widespread
<u>Trichosorus vulpecula</u>			Possum	Forest Widespread
<u>Oryctolagus cuniculus</u>			Rabbit	Grassland Widespread
<u>Lepus europaeus</u>		Hare	Grassland, alpine	Widespread?

<u>Scientific Name</u>	<u>Maori Name</u>	<u>European Name</u>	<u>Habitat</u>	<u>Distribution</u> ^a
<u>Cervus elaphus</u>		Red deer	Forest	Widespread
<u>Capra hircus</u>		Goat	Forest	Locally common
<u>Anas platyrhynchos</u> <u>platyrhynchos</u>			Mallard	Ponds and rivers
<u>Synois ypsilophorus</u>			Brown quail	Locally common
<u>Lophortyx californica</u> <u>brunnesiens</u>			California quail	Scrub
<u>Phasianus colchicus</u>			Pheasant	Scrub, grassland
<u>Alauda arvensis arvensis</u>			Skylark	Locally common
<u>Prunella modularis</u> <u>occidentalis</u>			Hedgesparrow	Grassland, scrub
<u>Turdus philomelos clarkei</u>			Song thrush	Forest, scrub
<u>T. merula merula</u>		Blackbird	Forest, scrub	Widespread
<u>Emberiza citrinella</u> <u>caliginosa</u>			Yellowhammer	Widespread
<u>Fringilla coelebs gengleri</u>			Chaffinch	Scrub, grassland
<u>Carduelis chloris chloris</u>			Greenfinch	Widespread
<u>C. carduelis britannica</u>			Goldfinch	Widespread?
<u>Carduelis flammea cabaret</u>			Redpoll	Widespread?
<u>Passer domesticus domesticus</u>			House Sparrow habitations	Widespread
<u>Sturnus vulgaris vulgaris</u>			Starling	Grassland, scrub, Grassland

<u>Scientific Name</u>	<u>Maori Name</u>	<u>European Name</u>	<u>Habitat</u>	<u>Abundance</u>
<u>Acridotheres tristis</u>			Indian Myna forest	Grassland, scrub, Widespread
<u>Gymnorhina tibicen hypoleuca</u>		magpie	White-backed	Grassland Widespread
<u>Salmo trutta</u>		Brown trout	Rivers and streams	Uncommon ^g
<u>Litoria aurea</u>		Golden bell frog	Wetlands	Present
<u>L. raniformis</u>		Golden bell frog	Wetlands	Present

APPENDIX V: Checklist of survey areas of coastal and lowland zones

Abbreviations and explanatory notes

- / indicates emergent species
- links species of approximately equal cover classes
- , separates species in order of decreasing cover class
- + links ecological units occurring in mosaic patterns
- F.S.U. Fauna Survey Unit (N.Z. Wildlife Service) survey results
- a Names are derived from Maori legal block names or local topographical features, combined with the most prominent natural characteristic.
- () no plot

APPENDIX V: Checklist of Survey Areas of Coastal and Lowland Zones

Name	Ecological Super-Unit and Ecological Units; Special Features
Torere 64/65 Lands 4951-0002	10. (Manuka scrub bog on peaty, poorly drained alluvium.) 11. Kahikatea-rimu-kamahi-wheki-hinau forest on valley bottom alluvium. 11. Kahikatea forest on poorly drained alluvium. 11. Kahikatea, <u>rimu-Juncus articulatus-Lotus pedunculatus-wheki</u> - <u>Agrostis tenuis</u> treeland on poorly drained alluvium. 28. Kanuka-tutu-hangehange- <u>Pseudopanax arboreus</u> - mahoe scrub on hillslopes. 30. Kamahi, <u>P. arboreus</u> - wheki forest and scrub on inland hillslopes. 34. Hard beech, broadleaved tawa-rewarewa-tanekaha forest on upper hillslopes. + 35 Hard beech, broad leaved tawa-rewarewa-tanekaha forest on upper hillslopes. + 36. Broadleaved tawa, silver fern, pukatea forest on hillslopes. 36. <u>B. tawa s.l.</u>, rewarewa-mahoe forest on lower hillslopes. + 36. <u>B. tawa s.l.</u>, mahoe-rewarewa-raukawa-kamahi forest on upper hillslopes. Hochstetter's frog in first and second order streams of Rawea valley; brown kiwi (F.S.U.)

Name	Ecological Super-Unit and Ecological Units; Special Features
Opape headland 4852-0001	6. Raupo, <u>Cyperus ustulatus</u> - <u>Juncus effusus</u> - <u>Carex geminata</u> reedland in small valley bottoms. 17. Pohutukawa/<u>Phormium cookianum</u>, <u>Olearia pachyphylla</u>-hangehange-manuka scrub on and above coastal cliffs, stacks and marine terrace edge. 21. Broadleaved tawa, pohutukawa-puriri forest on coastal lower valleys to upper slopes. 25. Manuka, <u>Myrsine australis</u>-kohuhu-<u>Hebe stricta</u>-<u>Coprosma robusta</u> scrub on coastal hillslopes. 25. Gorse, <u>Hebe stricta</u>, manuka-<u>Coprosma macrocarpa</u> scrub on seaward facing hillslopes. 30. Kamahi-kohuhu, rewarewa-manuka-<u>Myrsine australis</u> forest below coastal headland <u>Olearia pachyphylla</u> abundant in 17, less so in 30; gannet roost on rocky cliffs; spotless crane in 6.
Haurere Pt headland 4852- 0002	17. Rock, pohutukawa, <u>Olearia pachyphylla</u> treeland on steep coastal cliffs. 19. Pohutukawa, puriri-karaka-rewarewa treeland on low, gently sloping coastal terrace. 25. Manuka, <u>Coprosma macrocarpa</u> - rangiora scrub on low and high hillslopes. + 25. Gorse, <u>Hebe stricta</u>, manuka-<u>Coprosma macrocarpa</u> scrub on seaward facing hillslopes. + 27. (Kanuka forest on lower hillslopes).

Name	Ecological Super-Unit and Ecological Units; Special Features
Awaawakino Block 4852-0003	32. Broadleaved tawa, puriri-karaka forest on inland-facing gullies. <u>O. pachyphylla</u> common in 17; gannet colony on headland.
	25. Manuka, <u>Hebe stricta</u> - <u>Coprosma robusta</u> scrub on low and high hills.
	+ 25. (<u>H. stricta</u> , gorse, <u>C. macrocarpa</u> scrub on north facing slopes).
	28. Kanuka, kohuhu forest and scrub on mid and lower hillslopes.
	32. Broadleaved tawa, puriri, kohekohe forest in small gullies and on low hills and marine terrace.
	32. Broadleaved tawa-puriri-kohekohe, pohutukawa-kanuka forest in small gullies and on low hills and marine terrace.
Torere Bush 4952-0008	32. Broadleaved tawa, pukatea-rewarewa-rimu-mamaku-puriri forest on dissected marine terrace.
	20. Pohutukawa-broadleaved tawa-puriri forest on coastal mid and lower hillslopes.
	23. Kanuka, manuka, mamaku scrub on low hills.
	28. Kanuka, rewarewa, pohutukawa-kohuhu-mamaku forest on low-lying ridges.
	32. Broadleaved tawa, kohekohe, puriri-heketara forest in inland gullies and lower gully slopes.
	+ 35. Hard beech, tanekaha forest on inland ridges and spurs.

Name	Ecological Super-Unit and Ecological Unit; Special Features
	37. Rewarewa, kanuka-supplejack-putaputaweta-mahoe forest on knoll and mid slopes. Southern limit of taraire (6 small trees); Hochstetter's frog in Waititi Stream (F.S.U.); N.Z. falcon.
Pehitairi headland 4952-0001	20. Puriri, pohutukawa-broadleaved tawa-kamahi forest in gullies and on marine terrace edge. 25. Manuka, bracken- <u>Phormium cookianum</u> , <u>Coprosma robusta</u> , - <u>Hebe stricta</u> var, <u>macroura</u> scrub on exposed steep coastal slope. 16. Pohutukawa/ngaio/pasture grasses, rock, <u>P. cookianum</u> treeland on exposed steep coastal headland. 27. Kanuka forest on hillslopes; some <u>Pinus radiata</u> underplanting. 28. Kanuka, kamahi, broadleaved tawa-houpara-rewarewa forest on low, sheltered coastal hills. 34. Broadleaved tawa, hard beech-puriri-kamahi forest on hillslopes and gullies.
Te Waititi 4952-0002	6. (Raupo, <u>Cyperus ustulatus</u> , manuka reedland). 25. Manuka, tutu, scrub on exposed mid and upper hillslopes. + 27. Kanuka, bracken- <u>Coprosma robusta</u> -hangehange scrub on hillslopes. 32. Puriri, broadleaved tawa-kohekohe forest on colluvial hillslopes.
Hawai 4952-0003	21. Broadleaved tawa, karaka-puriri-miro, pohutukawa forest in small coastal gullies. 23. Manuka-kanuka scrub on exposed coastal lower hillslopes.

Name	Ecological Super-Unit and Ecological Units; Special Features
	28. Kanuka, rewarewa-kohuhu forest and scrub on hillslopes. Taraire present near its southern limit; whau plentiful in gully bottom; 23 and 28 being partly cleared.
Te Ipuhinu 4952-0004	34. Broadleaved tawa, hard beech-rewarewa-wheki-tanekaha on forest mid and lower slopes. + 34. Hard beech, broadleaved tawa-tanekaha-rewarewa forest on ridges and spurs.
Hawai River 4952-0007	7. (Bare gravel and flowing water). + 24. (Kanuka scrub on riverbanks). Pair blue ducks; no lagoon.
Haumiaroa Pt headland 4952-0005	17. Pohutukawa-houpara/ <u>Hebe stricta</u> var. <u>macroura</u> , manuka- <u>Coprosma macrocarpa</u> scrub on exposed coastal rockface. 20. Pohutukawa-karaka, kohekohe-puriri-wheki-putaputaweta forest on low coastal hill. 28. Kanuka-kohekohe, <u>Olearia albida</u> -whau-puriri forest on Polynesian pa site atop hill. 29. Manuka scrub on exposed coastal hillslopes.
Whituare Bay 4952-0006	19. Pohutukawa-kohekohe, kanuka, puriri-manuka-mamaku forest on marine terrace scarp. Shore skink and weasel

Name	Ecological Super-Unit and Ecological Units; Special Features
Tokaroa Rock 4953-0002	13. Rock, ice plant herbfield on offshore rockstack. White fronted tern and red billed gull breeding colony (F.S.U.)
Te Uritukituki 4953-0001	16. Pohutukawa, karaka forest on very steep rock faces. 19. Pohutukawa, puriri-kohekohe forest on undulating marine terrace. 21. Kohekohe, pohutukawa-broadleaved tawa-houpara- <u>Olearia albida</u> forest on very steep coastal face. 25. Manuka-blackberry- <u>Coprosma robusta</u> scrub on fairly steep coastal hillslopes. 28. (Kanuka, rewarewa-pohutukawa forest on moderately steep hillslopes). 32. Broadleaved tawa, puriri-mamaku-kohekohe-pukatea- <u>Pseudopanax arboreus</u> -mahoe forest on fairly steep coastal hillslopes. Mangeao in 32.
Maraenui forest 5053-0001	28. Kanuka, rewarewa forest on lowland hillslopes and gullies. 28. Kanuka, kohuhu- <u>Pseudopanax arboreus</u> scrub on low hillslopes. 30. (Rewarewa-broadleaved tawa-mamaku forest in gully head). 32. Broadleaved tawa, kamahi-kohekohe forest on mid to upper hillslopes and gullies. 34. Hard beech, broadleaved tawa, rewarewa forest on upper hillslopes.
Houpoto Swamp E 4953-0003	6. Raupo- <u>Baumea rubiginosa</u> , <u>Cortaderia fulvida</u> - <u>Carex virgata</u> - <u>Isachne globosa</u> reedland on infilled valley bottom.

Name	Ecological Super-Unit and Ecological Units; Special Features
Houpoto A forest 5052-0001	6. Raupo, <u>Isachne globosa</u>, <u>Scirpus lacustris</u> reedland on infilled valley bottom. 8. <u>Carex geminata</u> swamp on peaty, infilled valley bottom above small dam. 9. <u>Isachne globosa</u> <u>Baumea rubiginosa</u>-Yorkshire fog grass swamp on peaty, infilled valley bottom. 10. Manuka-<u>Gleichenia dicarpa</u> scrub bog on peaty infilled valley bottom margins. Many swamp plants, including <u>Sparganium subglobosum</u>; spotless crane.
	35. Hard beech, tanekaha-rewarewa-miro forest on low altitude ridges and spurs.
	+
	36. Broadleaved tawa, northern rata-rewarewa-putaputaweta-silver fern-mahoe forest on lower hillslopes.
	+
	36. Broadleaved tawa, rimu-rewarewa-kohuhu-tanekaha-northern rata-kamahi forest on mid hillslopes.
	+
	37. Rewarewa-kanuka-kamahi, tanekaha forest on hillslopes.
	+
	39. Hard beech, miro, Hall's totara-tawari-rimu forest on higher altitude ridges and upper slopes.
Single <u>Metrosideros carminea</u> ; Hochstetter's frog in Manuriki Stm.	

Name	Ecological Super-Unit and Ecological Units; Special Features
Houpoto B 5052-0002	24. (Kanuka scrub and forest on narrow alluvial terrace) 27. Kanuka forest on lower hillslopes. 30. Kamahi/silver fern, tanekaha forest on moderate hillslopes. 35. Hard beech, tanekaha, rewarewa forest on moderate upper hillslopes. 37. Tanekaha, manuka, hard beech-rewarewa forest and scrub on low and mid hillslopes.
Houpoto C 5053-0005	37. Tanekaha, kanuka forest on lower valley hillslopes and knobs. Bats reported (F.S.U.)
Houpoto D 4953-0004	20. (Pohutukawa forest in small gullies on steep coastal hill). 20. (Puriri-Pohutukawa forest remnant on steep coastal hill). 28. (Kanuka, broadleaved shrubs on steep coastal hills). 29. (Bracken and manuka fernland on steep coastal hills). 29. Manuka scrub on steep coastal hills. 32. Broadleaved tawa forest in steep coastal hill gully and on upper hillslope. 37. Tanekaha-rewarewa forest on upper hillslopes. <u>Metrosideros carminea</u> in coastal gully.
Motu River Mouth 5053-0004	6. Raupo, <u>Veronica anagallis-aquatica-Rumex crispus-Juncus articulatus-Prunella vulgaris-Polygonum hydropiper</u> reedland on swampy alluvial terrace edge.

Name	Ecological Super-Unit and Ecological Units; Special Features
Whitianga block 5053-0002	7. (Bare ground and flowing water).
	24. Kanuka/ <u>Muehlenbeckia australis</u> forest on alluvial terrace.
	26. Gravel, tauhinu, <u>Raoulia tenuicaulis</u> -tutu-grasses shrubland on gravel alluvial floodplain.
	26. Tauhinu-kanuka, bare ground-lupin-grasses scrub on silty alluvial floodplain.
	White-fronted tern and red-billed gull breeding colonies at mouth; three black beech trees on true left river bank above SH35 bridge.
	16. Pohutukawa forest on steep coastal faces.
	16. Pohutukawa, houpara, karo-karaka forest on coastal cliffs.
	19. Puriri, pohutukawa-putaputaweta forest on coastal marine terrace.
	20. Pohutukawa, broadleaved tawa, rewarewa forest on low coastal hills.
	+
	27. Kamahi-kanuka forest and scrub.
	21. Broadleaved tawa-puriri, pohutukawa-rewarewa-mamaku forest on low coastal hills.
	27. Kanuka, <u>Cordyline australis</u> , lacebark-kowhai forest on colluvial basal hillslope.
	27. Kanuka-kamahi, rewarewa-kohuhu- <u>Pseudopanax arboreus</u> -heketara-pohutukawa forest and scrub on low hillslopes.
	29. Manuka scrub on low hill ridges.
	30. Kiokio-rangiora- <u>Gahnia setifolia</u> scrub and fernland on low hills.

Name	Ecological Super-Unit and Ecological Units; Special Features
Omaio Block 5053-0003	+ 30. <u>Pseudopanax arboreus</u>-putaputaweta, mahoe-fuchsia-<u>Coprosma robusta</u>-rangiora-mamaku scrub on low hills. + 30. Mamaku, kamahi-pohutukawa-<u>Metrosideros perforata</u> forest on low hills. 31. Kahikatea, puriri-pukatea-kanuka forest on alluvial terrace. 32. Broadleaved tawa forest on higher altitude gullies and hillslopes. + 34. Hard beech, broadleaved tawa-northern rata forest on upper slopes. + 35. Hard beech, rewarewa forest on low altitude ridges and spurs. + 36. Broadleaved tawa, kamahi forest on lower hillslopes and gullies.
	Intact coastal cliff vegetation; bats reported (F.S.U.).
	16. Pohutukawa, houpara-<u>Phormium cookianum</u>-<u>Olearia albida</u> forest on coastal margins.
	21. Broadleaved tawa, pohutukawa-karaka-kohekohe-puriri forest on basal hillslopes and gullies.
	21. Pohutukawa-broadleaved tawa, puriri forest on mid hillslope.

Name	Ecological Super-Unit and Ecological Units; Special Features
	21. Broadleaved tawa, pohutukawa forest on midslopes and gully heads.
	+
	22. Hard beech-pohutukawa, rimu, broadleaved tawa forest on low coastal ridges and upper hillslopes.
	+
	36. Broadleaved tawa, northern rata, kohekohe-hinau forest on upper hillslopes.
	23. Manuka, kanuka scrub on low coastal hillslopes.
Ohae Point Island 5054-0005	30. <u>Pseudopanax arboreus</u> , manuka-kamahi scrub on upper hillslopes.
	34. Hard beech, broadleaved <u>tawa-Pseudopanax arboreus</u> forest on hillslopes.
Wharawhara Block 5054-0001	18. Houpara, pohutukawa forest on islet.
	21. Broadleaved tawa, pohutukawa, puriri forest on coastal hillslopes.
	+
	35. Hard beech, rewarewa, tanekaha-kamahi-toru forest on coastal ridge tops.
	29. Manuka, <u>Pseudopanax arboreus</u> , kanuka-rewarewa-toru- <u>Leucopogon fasciculatus</u> -kohuhu scrub on lower coastal hillslopes.
	30. Mamaku, <u>P. arboreus</u> -kamahi, broadleaved tawa forest on upper catchment slopes and gullies.

Name	Ecological Super-Unit and Ecological Units; Special Features
Haparapara/ Waikakariki rivers 5054-0003	32. Broadleaved tawa, puriri, putaputaweta-karaka-rewarewa-hinau rimu-kohekohe forest on marine terrace and basal colluvial hillslopes. 7. (Bare ground and flowing water) 24. Kanuka-manuka, tauhinu-tutu scrub and shrubland on alluvial floodplain. 26. Tauhinu-tutu-buddleia scrub and shrubland on braid islands. + 26. Buddleia, tutu-manuka-tauhinu scrub on braid islands. N.Z. Dotterel breeding at rivermouth; introduced fish absent.
Motunui Island 5054-0004	18. Pohutukawa, karo forest on small offshore island.
Awanui Hapara- para 5054-0002	6. Raupo, <u>Phormium tenax</u>-Hebe <u>stricta</u> reedland along stream course. 15. Taraire-broadleaved tawa-putaputaweta forest on valley stream banks and lower slopes (Orini Stm). 16. Pohutukawa treeland on coastal cliffs. 20. Pohutukawa, broadleaved tawa, rewarewa forest on coastal mid hillslope. 21. Broadleaved tawa, mamaku-rangiora, puriri-pohutukawa forest on low and high hills. 21. Broadleaved tawa-puriri, pohutukawa forest on colluvial hillslopes. 21. Broadleaved tawa, pohutukawa-rewarewa forest on low hills.

Name	Ecological Super-Unit and Ecological Units; Special Features
	27. Kanuka forest on coastal mid and lower hillslopes. 29. Manuka, <u>Coprosma robusta</u>-kanuka scrub on low hills. 28. Kanuka-manuka-rangiora-putaputaweta-mahoe-mamaku-<u>Pseudopanax arboreus</u>-tutu forest on low hills. + 30. Mamaku, <u>Pseudopanax arboreus</u>-broadleaved tawa-mahoe fernland on steep low hillslopes. 32. Broadleaved tawa, kamahi forest on basal hillslopes. 33. Puriri, broadleaved tawa-rewarewa forest on alluvial terraces and colluvial hillslopes. 33. Broadleaved tawa-<u>Paesia scaberula</u>, <u>Hoheria populnea</u>-kohekohe-kawakawa-<u>Lotus pedunculatus</u>-<u>Ranunculus repens</u> - <u>Sison amomum</u> forest and treeland on alluvial plain. 34. Broadleaved tawa, hard beech forest on high hill ridges and upper slopes. Hochstetter's frog in upper reaches of Orini Stm, and Waikakariki River in tributaries (F.S.U.); extensive windthrow.
Waiorore Stream 5154-0001	16. Pohutukawa, karaka forest on coastal cliffs. 21. Broadleaved tawa, pohutukawa, kamahi-rewarewa-<u>Pseudopanax arboreus</u> forest on midslopes and gullies. + 35. Hard beech, kamahi-rewarewa-<u>Pseudopanax arboreus</u> forest on ridges and knolls. 28. Kanuka, <u>Pseudopanax arboreus</u>-toru-rewarewa-ponga-<u>Leucopogon fasciculatus</u> forest on hillslopes.

Name	Ecological Super-Unit and Ecological Units; Special Features
Maungaroa South 5254-0001	29. <u>Manuka, Coprosma lucida-kamahi-toru-Pseudopanax arboreus-tutu-rewarewa-kohuhu-Olearia furfuracea</u> scrub on upper hillslopes and ridges.
	Hochstetter's frog Waiorore Stm tributary; N.Z. falcon (F.S.U.).
	12. Pukatea-kahikatea swamp forest on poorly drained alluvial terrace edge.
	29. Manuka scrub on steep hillslopes.
	29. (Manuka scrub on steep hillslopes).
	+
	30. <u>Pseudopanax arboreus, manuka, rewarewa-kamahi-tutu-Coprosma robusta-mamaku</u> scrub on steep hillslopes.
	31. Kahikatea, pukatea-kanuka forest on alluvial terraces.
	31. <u>Cyperus ustulatus-blackberry, kanuka-kahikatea-pukatea</u> treeland on valley alluvium.
	35. Hard beech, toro forest on lower ridges.
	+
	36. Broadleaved tawa, rewarewa-kamahi-hinau forest on steep lower slopes.
	+
	36. Broadleaved tawa, rewarewa-kamahi forest on steep lower slopes.

Name

Ecological Super-Unit and Ecological Units; Special Features

- +
36. Broadleaved tawa, hinau-kamahi-rewarewa forest on steep mid altitude hillslopes.
- +
36. B. tawa s.l., northern rata-kamahi forest on upper hillslopes.
- +
36. Broadleaved tawa, heketara-kamahi windthrown forest on mid altitude plateau and gully heads.
- +
38. Rimu-tawari-hinau-kamahi-wheki-Pseudowintera axillaris windthrown forest on upper hillslopes.
- +
39. Hard beech, tawari-northern rata-B. tawa s.l. - rewarewa forest on mid altitude ridges.
- +
39. Hard beech, tawari-toatoa-northern rata forest on high altitude ridges.

Bat; N.Z. falcon parakeet kaka and rifleman (F.S.U.); extensive windthrow on south to southeast aspects.

Te Kaha
5155-0002

16. Pohutukawa-houpara-taupata-Hypochoeris radicata-Holcus lanatus treeland on and above coastal cliffs.
15. Taraire - broadleaved tawa - pohutukawa, mamaku-puriri forest on lower valley slopes (Pakaranui Stm).

Name	Ecological Super-Unit and Ecological Units; Special Features
+	22. Pohutukawa-hard beech, broadleaved tawa-kamahī- <u>Myrsine australis</u> - northern rata - rewarewa forest on coastal ridges and upper slopes.
+	34. Hard beech, broadleaved tawa, heketara-kohuhu forest on coastal ridges and spurs.
	19. Puriri, pohutukawa-pigeonwood forest on colluvial basal hillslope.
	25. Manuka, kohuhu, bracken - toru - <u>Leucopogon fasciculatus</u> - <u>Cordyline banksii</u> - <u>Coprosma robusta</u> scrub on low coastal upper hillslopes.
+	27. Kanuka forest on steep coastal mid and basal hillslopes.
+	27. Kanuka, pohutukawa - kohuhu forest on coastal upper hillslopes.
+	30. Mahoe - kawakawa - houpara, mamaku - tutu - putaputaweta <u>Cordyline banksii</u> forest on steep lower slopes and gullies.
	33. Broadleaved tawa, mahoe, karaka - taraire - ponga-puriri forest on alluvial stream terrace.
	33. Pukatea, nikau, broadleaved tawa - mahoe forest on alluvial flood plain.
	34. Broadleaved tawa, hard beech - rewarewa - kohekohe forest in gullies and on lower hillslopes.
+	35. Hard beech, tanekaha - rewarewa forest on ridges.
	36. Broadleaved tawa, northern rata - <u>Pseudopanax arboreus</u> - kohekohe - tawari - ponga - <u>Metrosideros perforata</u> forest on plateau.

Name	Ecological Super-Unit and Ecological Units; Special Features
Kereu River 5155-0001	6. Raupo - blackberry - <u>Juncus effusus</u> reedland on poorly drained alluvial terrace near river mouth. 7. (Bare gravel and flowing water) 26. Tauhinu, manuka scrub on alluvial flood plain 26. Tauhinu, <u>Lotus subbiflorus</u> - <u>Trifolium repens</u> - <u>Plantago lanceolata</u> shrubland on alluvial flood plain
Maungaroa North 5155-0005	16. (Pohutukawa forest on coastal cliffs) 21. Puriri - pohutukawa - karaka - kohekohe - broadleaved tawa forest on marine and alluvial terraces. 22. Hard beech, pohutukawa, broadleaved tawa - rewarewa - puriri - kamahi forest on coastal ridges. + 32. (Broadleaved tawa, puriri - kamahi forest on lower hill slopes and gullies). 32. Broadleaved tawa, puriri-kamahi forest on lower hill slopes and gullies. + 38. Hard beech, tawari - kamahi, rimu - Hall's totara - quintinia - rewarewa forest on ridges and upper hill slopes. 24. Kanuka, mosses, <u>Salix incana</u> - manuka - blackberry - <u>Plantago lanceolata</u> - <u>Lotus subbiflorus</u> on alluvial terraces. 27. Kanuka forest and scrub on steep basal hillslopes. 27. Kanuka, kohuhu scrub and forest on steep coastal and hillslopes. 29. Manuka scrub on marine terrace and hillslopes.

Name	Ecological Super-Unit and Ecological Units; Special Features
	30. <u>Coprosma robusta</u> - <u>Pseudopanax arboreus</u>, mamaku forest on low and mid hillslopes. 31. Kahikatea, matai-pukatea forest on alluvial terrace. 31. Kahikatea, rimu-broadleaved tawa forest on alluvial terraces. 33. Broadleaved tawa, puriri, rewarewa forest on alluvial fans 33. Pukatea - broadleaved tawa, rewarewa - northern rata - supplejack - mahoe forest on poorly drained alluvial terrace. <u>Metrosideros carminea</u> at four sites along Kereu River; <u>Lygodium articulatum</u> near Hereheretaunga summit; brown kiwi (F.S.U.); extensive windthrow.
Waikawa Pahaoa 5155-0003	5. <u>Phormium tenax</u>, <u>Prunus persica</u> swamp of old stream course. 16. Pohutukawa forest on and above coastal cliff faces. 20. Pohutukawa - puriri - kanuka, broadleaved tawa forest on basal hillslopes and marine terrace. 28. <u>Pseudopanax arboreus</u>, kanuka, putaputaweta - mamaku - kohuhu scrub and forest on hillslopes and marine terrace. 29. Manuka scrub on hillslopes, colluvium and marine terrace.
Motukotare Island 5155-0006	18. (Pohutukawa forest on old wave cut platform on small offshore island).
Te Huka Island 5155-0007	18. Pohutukawa - manuka scrub on small offshore island summit and upper slopes.
Motuaruhe forest 5255-0001	16. Pohutukawa, houpara, karaka forest on and above steep coastal cliffs.

Name	Ecological Super-Unit and Ecological Units; Special Features
	21. Broadleaved tawa, pohutukawa - puriri forest on steep coastal hillslopes. 21. Broadleaved tawa - pohutukawa - puriri forest on colluvial slopes and marine terrace. 27. Kanuka, <u>Cordyline australis</u> - <u>Coprosma robusta</u> scrub on low coastal hillslopes. 29. Manuka, tauhinu, bracken - <u>Pseudopanax arboreus</u> scrub on high hills and colluvial slopes. 30. <u>Pseudopanax arboreus</u>, heketara - wheki, kamahi - broadleaved tawa - miro forest on hillslopes and gullies. 32. Broadleaved tawa, puriri, karaka - kohekohe - rewarewa forest on steep coastal hillslopes. 35. Hard beech, rewarewa forest on ridges and spurs. + 36. Broadleaved tawa, kohekohe - kamahi forest on mid and lower slopes and in gullies. 38. (<u>B. tawa</u> s. l. - tawari - kamahi - northern rata forest on upper hillslopes). Black beech on ridge above Whanarua Stream (N61: 198565); <u>Carmichaelia williamsii</u>; Hochstetter's frog in Whanarua stream tributaries. (F.S.U.)
Maraehako- Te Waiti 5255-0003	18. <u>Poa anceps</u>, <u>Coprosma repens</u>-<u>Scirpus nodosus</u> - <u>Apium prostratum</u>-<u>Samolus repens</u> - houpara grassland and herbfield on coastal stack.

Name	Ecological Super-Unit and Ecological Units; Special Features
	18. Pohutukawa, houpara - <u>Cyathodes juniperina</u> forest on coastal stack. 21. Broadleaved tawa, puriri-pohutukawa-karaka forest on steep valley slopes. 29. Manuka, kamahi-<u>Leucopogon fasciculatus</u>-kohuhu-pohutukawa scrub on coastal crests and upper hillslopes. 30. Mamaku, <u>Pseudopanax arboreus</u>-mahoe, putaputaweta - fuchsia forest on hillslopes. 32. Broadleaved tawa, karaka-puriri forest in stream gully. 32. Broadleaved tawa, rewarewa, <u>Myrsine australis</u> - hinau - puka - lancewood - putaputaweta - kohuhu forest on lower slopes and gullies. + 38. <u>B. tawa s.l.</u>, tawari-kamahi forest on broad upper ridges. + 39. Hard beech, toru - tanekaha - quintinia - kamahi - tawari - hinau forest on ridges and spurs.
Motu Papaku Island 5255-0005	18. Houpara, mangeao-rewarewa, puriri-<u>Myrsine australis</u>, <u>Cordyline australis</u> forest on small offshore islands. Successional forest developed in absence of grazing animals; northern blue penguin.
Motu Kaimeanui Island 5255-0006	18. Pohutukawa, houpara - mangeao, puriri forest on small offshore island.

Name	Ecological Super-Unit and Ecological Units; Special Features
Te Aruhe Ahika 5255-0009	18. Houpara, kohuhu, <u>Myrsine australis</u> -pohutukawa forest on small offshore island.
	Successional forest developed in absence of grazing animals.
	21. Broadleaved tawa, puriri, rewarewa-pohutukawa-karaka-pukatea forest on colluvial basal hillslope.
	21. Broadleaved tawa, pohutukawa, rewarewa forest on hillslopes.
Pohueroro Block (no survey area card)	31. Pukatea-kahikatea, puriri forest on alluvial terrace.
	Hochstetter's frog in unnamed creek (F.S.U.).
	27. Kanuka forest on slip sites.
	27. Kanuka scrub on low hillslopes.
	+
	28. Kanuka, <u>Pseudopanax arboreus</u> -mahoe-mamaku forest on moderate and steep hillslopes.
	+
	28. Kanuka- <u>Ranunculus repens</u> , mamaku - mahoe - putaputaweta - manuka - bracken - <u>Agrostis tenuis</u> -paspalum treeland and shrubland on hillslopes.
	30. Mahoe, broadleaved tawa, wineberry - kamahi - putaputaweta - mamaku - pigeonwood - <u>Coprosma robusta</u> forest on hillslopes and gullies.
	+
	30. Mamaku, <u>Pseudopanax arboreus</u> -kamahi, heketara-mahoe - putaputaweta forest and scrub on hillslopes.

Name	Ecological Super-Unit and Ecological Units; Special Features
Lower Raukokore River 5255-0004	32. Broadleaved tawa, titoki-mahoe-pigeonwood forest on lower hillslopes in gullies.
	+
	36. <u>B. tawa s.l.</u> - kamahi, hinau, rewarewa-rimu on high steep hillslopes.
	+
	39. Hard beech, tawari-broadleaved tawa-kamahi-tanekaha-miro forest on ridges and spurs.
	33. Broadleaved tawa, pukatea-ponga forest on alluvial terrace (partly windthrown).
	33. Broadleaved tawa, rewarewa-puriri-pukatea-kohekohe forest on alluvial terrace.
	<u>Metrosideros carminea</u> at two sites along Raukokore River; Hochstetter's frog on unnamed tributary of Raukokore River (N62:295562); also Waihueroro, Mangaikakorea and Mangahatoto Stms (F.S.U.); kaka, N.Z. falcon and rifleman (F.S.U.); extensive cattle grazing.
	7. (Bare gravel and flowing water).
	24. Kanuka, tauhinu scrub on alluvial floodplain.
	26. Tauhinu-bare ground, lupin, <u>Sporobolus africanus</u> - <u>Agrostis stolonifera</u> shrubland on alluvial floodplain.
	27. (Kanuka scrub on hillslope).
	30. (Rangiora, hangehange, <u>Leucopogon fasciculatus</u> on steep hillslopes).

Name	Ecological Super-Unit and Ecological Units; Special Features
Raukokore Beach 5255-0007	<u>Carmichaelia williamsii</u>; banded dotterels, and roost of <u>c.</u> 500 white fronted terns near river mouth. 1. Mud, <u>Ruppia megacarpa</u>, <u>Spirogyra</u> (algae), <u>Limosella lineata</u> on lagoonal mudflat. 2. <u>Juncus microcephalus</u> - <u>Aster subulata</u> - <u>Scirpus cernuus</u>, <u>Eleocharis acuta</u> rushland on lagoonal mudflat edge. 3. <u>Plagianthus divaricatus</u> - <u>Cyperus ustulatus</u>, <u>Eleocharis acuta</u> shrubland on coastal flats. 4. <u>Cordyline australis</u> - blackberry treeland on alluvial floodplain. 6. Raupo reedland on old marine strand depression. 14. Gravel, tauhinu - lupin, blackberry shrubland on gravel beach. Common gecko and shore skink on beach (F.S.U).
Raukokore Reserve 5355-0002	32. Broadleaved tawa, puriri-rewarewa forest on lower hillslopes. + 34. (Hard beech, rewarewa, broadleaved tawa forest on upper hillslopes) 33. Broadleaved tawa, pukatea-kohekohe-karaka-kawakawa-mahoe forest on alluvial terrace. <u>Metrosideros carminea</u>, extending down Raukokore River to S.H. 35 bridge; extensive windthrow.
Kapongaro forest 5255-0008	15. Taraire, broadleaved tawa, puriri-kohekohe-rewarewa forest in gully system on raised marine terrace.
Tawaroa Topu 5355-0003	32. Broadleaved tawa, puriri-karaka forest on moderate hillslope.

APPENDIX VI

Checklist of ecological resources in existing and proposed PNAs of the district

PART A EXISTING (GAZETTED) PNAS¹

Whinray Scenic Reserve
 Oroī Scenic Reserve
 Tokata Scenic Reserve
 Aorangiwaī Scenic Reserve
 Part Meremere Hill Scenic Reserve
 Part Toatoa Scenic Reserve
 Part Whitikau Scenic Reserve
 Motu River National Water Conservation Order

PART B PROPOSED PNAS¹

Raukumara Wilderness Area
 Maungawaru Ecological Area
 Whanokao Ecological Area
 Hikurangi Ecological Area
 Raukokore Ecological Area
 Kopuapounamu Ecological Area
 Puketoetoe Ecological Area
 Paraumu Ecological Area
 Part "Nukutere Scenic Reserve"

1. Preservation of indigenous landscape, fauna and flora reasonably guaranteed
 (Kelly, 1980)

TABLE A
EXISTING GAZETTED PNAS
Scenic Reserves

Whinray Scenic Reserve (Clarkson and Regnier, 1984)	397 ha	River terraces and gentle lower slopes	1. <u>Kahikatea-rimu/kamahih-tawa-tawari</u> forest
		Steeper slopes and ridges	2. <u>Rimu/tawa</u> forest
		High ridges	3. <u>Tawari-kamahih</u> forest
		Valley bottom with impeded drainage	4. <u>Kahikatea/Carex-raupo-toetoe</u> shrub-sedgeland.
			5. Shrubland and scrub. Includes all secondary successions ranging from minor patches of recently retired pasture, now dominated by bracken fernland, to five finger-mahoe-tawa scrub.
			6. Pasture
Whitika Scenic Reserve (Clarkson and Regnier, 1984)	872 ha (approx. 140 ha in Motu E.D.)	Hillslopes below 670m Hillslopes above 670m	1. <u>Rimu/tawa</u> forest 2. <u>Tawa/tawari-kamahih</u> forests 3. <u>Bracken fernland</u> - scrub 4. <u>Pasture</u>
Part Toatoa Scenic Reserve (Clarkson and Regnier, 1983)	2849 ha (approx. 2350 ha in Motu E.D.)	Steep lower hillslopes from 360 m up to 600-700 m	1. <u>Rimu/tawa/tawari</u> forest with kamahih, hinau, rewarewa and emergent miro.
		Upper hillslopes between about 600-760 m, extending to below 450 m on ridge tops	2(a) <u>Hard beech/tawari</u> forest. Hard beech, and locally dominant toatoa and occasional Hall's totara over tawari. Scattered red beech.
			2(b) <u>Tawari</u> - kamahih forest. <u>Tawari-kamahih</u> with emergent Hall's totara, toatoa, scattered rimu and occasional northern rata.
		Upper hillslopes above 760 m	3. Red beech/ <u>tawari</u> forest, with Hall's totara.

Knoll around Ngateretere
Trig (840-985 m)

4. Silver beech/tawari forest.

5. Scrub dominated by bracken and/or manuka with Coprosma robusta, C. lucida, Pseudopanax arboreus, kohuhu and other broad-leaved shrubs

6. Pasture

Coprosma rubra is at its northern limit just outside the reserve.

Part Meremere Hill Scenic Reserve
(Clarkson and Regnier, 1983)
1368 ha (approx. 80 ha in Motu E.D.)

Between 100-450 m. Sheltered gullies and ridge sides

1. Tawa forest with pukatea, hinau, rewarewa and scattered emergent rimu and northern rata.

Ridges below 500m

2. Hard beech forest, with tanekaha, kamahi, lancewood and rewarewa.

Between 450-500 m and 700m. Upper slopes and ridges.

3(a) Tawa/tawari forest.

Tawa canopy (as in 1) becomes discontinuous, particularly on ridgetops, and there is a lower tier of abundant tawari, occasional kamahi and a few emergent rimu and miro. Tawari dominant canopy, with tawa Hall's totara and miro. Alsophila smithii dominates recent slip faces.

As above

(b) Hard beech/tawari forest.

Hard beech and occasional toatoa over tawari and kamahi with scattered miro, Hall's totara and rimu.

Above 700 m

As for 3(b), with some red beech also present.

As for 1 and 2

4. Scrub dominated by any of manuka, bracken, tutu, kiokio, mingimingi, Pseudopanax arboreus, kohuhu, mamaku, rangiora, Coprosma robusta, kamahi, mahoe and rewarewa.

Vegetation types 1 and 3 are represented in Motu E.D.

Lower ridges and slopes

2. Manuka scrub succeeding to
pohutukawa/kamahih-kohuhu treeland.

Banks of Opape Stream

3. Willow - black wattle-manuka/bracken
treeland.

1.77 ha

Coastal slopes at Motu
River mouth between 0-30 m

4. Pasture.

1. Pohutukawa-puriri/kohekohe-Olearia forest,
with Coprosma macrocarpa.

Rocky coastline,
within spray and sub-
aerial zone

2. Rockfield, with scattered sea primrose,
primrose, glasswort, NZ iceplant,
taupata, Scirpus nodosus, Rytidosperma spp.
coastal flax and rengarenga.

3. Sandfield.

Aorangiwai Scenic Reserve
(Nicholls, 1968)

751 ha

Steep slopes rising to
Mt Aorangi. Steep slopes
and bluffs. Between
180-1260m.

Vegetation:

1. Occasional large rimu and rata and (local)
kahikatea, over abundant tawa and kamahi,
frequent pukatea and occasional hinau and
rewarewa.
2. Occasional large rimu and rata, over abundant
tawa, kamahi and tawari and occasional miro,
hinau and rewarewa.
3. In the gullies, frequent rimu, miro and matai
and (local) totara and kahikatea over maire and
kamahi.
4. Upper ridges, occasional rimu, miro and other
softwoods and abundant red and silver beech,
over kamahi and tawari.
5. Subalpine scrub, shrubland and grassland.

Other Reserves

Motu River National
Conservation Order

c. 95 km
on main
river

Motu River and some
tributaries

Bare gravel and flowing water. Large population
of blue ducks.

PART B: PROPOSED P.N.As.

1. Proposed Wilderness Area in Raukumara Forest Park
(approved in principle)

Proposed Raukumara Wilderness 39 000 ha
Area
(Nicholls, 1983b)

Mostly very steep and
broken land, between
100-1486 m

Hard beech predominates up to 600 m a.s.l., with understorey kamahi and quintinia and scattered rimu, miro, tanekaha, toatoa, northern rata, rewarewa, and B. tawa s.l. Between 600-850 m, red and silver beech mix with or replace hard beech, and tanekaha, northern rata, rewarewa, and tawa disappear. Montane forest on the high divides is generally composed of red and silver beech, Hall's totara, toatoa, kamahi, tawari, and local kaikawaka, up to about 1150 m. Silver beech then predominates to the tree-line, with locally abundant kaikawaka, mountain toatoa and pink pine, and very localised mountain beech.

A major belt of rimu-rata/tawa forest, with some pukatea, hinau, rewarewa, kamahi, and mahoe, covers relatively easy terrain in the upper Mangatutara and Te Kahika catchments, and occurs elsewhere as pockets in gully bottoms and on terraces. In the total absence of hard beech in the upper Mangatutara Valley, this podocarp hardwood type reaches 800m, and matai, kahikatea and maire are locally common.

Few lowland or coastal plant species are present despite the low altitude along the Motu River.

2. Proposed Ecological Areas in Raukumara Forest Park

(Recommended by SFSRAC 5/83. Not yet approved in principle 2/84)

Proposed Maungawaru Ecological Area (Nicholls, 1983b) c. 2250 ha Subalpine Maungawaru Plateau, and adjacent steep land, between 600-1450 m

Includes the sub-alpine vegetation of the Area Maungawaru Plateau, 1350-1450m a.s.l., and surrounding forest in the headwaters of major tributaries of the Mangaotane Stream, down to 600m. The area of the Plateau, mainly above tree-line, is about 450 ha.

Vegetation on the Plateau is montane shrubland or dwarfed forest in shallow gullies, with more open patches on broad ridges where there are scattered Olearia colensoi in grassland, herbfields or mires. Pink pine and very stunted mountain beech are common, and the pygmy pine x yellow-silver pine hybrid is locally abundant.

Montane forest on rocky spurs and steep gully sides leading from the plateau is dominated by silver and mountain beech, with kaikawaka, mountain toatoa and pink pine throughout and forming discrete stands in places. With decreasing altitude, this type grades into red beech-silver beech-kamahi-tawari forest with occasional to locally frequent Hall's totara and kaikawaka. Wide ridges with little rocky or poorly-drained ground carry nearly pure red and silver beech forest down to approx 850 m. Below this, rimu and miro appear.

Proposed Whanokao Ecological Area (Nicholls, 1983b) c. 4500 ha Upper catchment of Tapuaeroa River, between 400-1618 m

Covers the stunted forest and sub-alpine vegetation of the precipitous Mt Whanokao (Honokawa on maps), and contrasting montane forest types on the northern and southern sides of the upper Tapuaeroa catchment, podocarp-hardwood forest and shrub-hardwood forest on very steep terrain bordering the river in the east of the area, and podocarp-hardwood forest with unusually high numbers of rimu, matai, and kahikatea on

relatively easy terrain upstream. Boundaries follow the Tapuaeroa catchment boundary except for two minor exceptions.

Some noteworthy species above tree-line on Mt Whanokao are pygmy pine, snow totara, Olearia colensoi and Brachyglottis rotundifolia. The surrounding montane beech forest above 850 m is similar to that along the Mt Raukumura ridge, except for the addition of mountain beech. In contrast, the montane forest on the south side of the catchment is almost purely silver beech, with an understorey of broadleaf, fuchsia, Pseudopanax spp., Dracophyllum spp., and Olearia colensoi.

Forest between 750-850m a.s.l. all round the catchment comprises red and silver beech, kamahi, tawari, and quintinia, with occasional rimu, miro, Hall's totara, and toatoa. Podocarp-hardwood forest similar to that in the proposed Kopuapounamu EA covers very steep ridges in the lower catchment, where abundant tutu, wineberry, pate, manuka and other shrubs densely cover frequent old slip faces above the deeply entrenched river and its tributaries. The main area of rimu-rata/tawa forest with above-average numbers of rimu and locally frequent matai and kahikatea occurs up to 750m a.s.l. in the Mangamuku sub-catchment.

Proposed Hikurangi Ecological c. 6500 ha Area
(Nicholls, 1983a) Upper catchment of Waingakia Stream, and part of Mt Hikurangi, between 450-1764 m

Covers Mt Hikurangi open tops within State Forest, and catchment of Waingakia tributary of the Mata River. The summit of the mountain at 176 m a.s.l. is the highest point on the North Island axial ranges.

The peaks of Mt Hikurangi have a very similar flora to those of Mt Whanokao. Coriaria pottsiana is an East Cape endemic. (Druce 1980). A belt of stunted silver beech with kaikawaka, mountain

toatoa, pink pine, and patches of mountain beech covers the steep, rocky ridges and faces immediately below the scrub and herbfield, with red beech-silver beech-kamahitawari forest containing miro and Hall's totara and rare kaikawaka below this down to about 900 m.

The forest pattern in the rest of Waingakia catchment is typical of the whole south-east face of the Raukumara Range. Below 750 m, there is tawa-kamahitawari forest with scattered podocarps (mainly rimu) in the lowest, widest, section of the valley, and forest below that altitude upstream as the valley closes in upstream has a consistent admixture of red and silver beech. Above this, tawa and other lowland hardwoods disappear; red and silver beech dominated forest with the kamahitawari understorey continues up to about 1200m. Rimu and miro are scattered throughout up to 900m, but above that the only softwoods are very rare Hall's totara and kaikawaka.

The uppermost montane forest is composed of abundant stunted silver beech, over a dense underwood in which broadleaf, fuchsia, Dracophyllum spp., Pseudopanax spp., and Olearia colensoi are prominent. Kaikawaka, mountain toatoa, and pink pine occur very locally, on occasional rocky outcrops along the leading spurs and fringing the scrub patches on the main range.

Along the highest ridges on the west side of the Raukokore catchment, there is rimu-tawa forest with strong admixtures of red and silver beech, and this gives way towards the river to purely podocarp-hardwood forest. Matai and kahikatea occur on small riparian flats or low terraces. Stands of kanuka with regenerating podocarps, including tanekaha, occur where mixed podocarp-

Part mid-catchment
of Raukokore River,
and adjacent minor area,
between 175-1618 m

Proposed Raukokore Ecological c. 3300 ha
Area
(Nicholls, 198 a and 1983b)

dominant forest probably once occurred on the only sizable area of flat ground at the northern boundary of this proposed reserve. Although the altitude along the river inside the proposed reserve is nearly all below 300m, no kohekohe or other coastal species occur, which is typical of all the narrow interior river valleys in the ecological district.

Podocarp-hardwood forest persists on relatively easy terrain close to the west side of the river, but an association of abundant hard beech, kamahi, tawari, and quintinia, with scattered to locally frequent rimu, miro, Hall's totara, toatoa, B. tawa s.l., hinau, and rewarewa predominates on the broken country leading to Wharehina Trig and upriver to the wilderness area boundary. Tanekaha also occurs frequently on the lower ridges. Above 750m round Wharehina, there is an incoming of silver beech and occasional kaikawaka. Only a fragment of this type of forest is in the proposed reserve, but it is amply represented in the proposed Puketoetoe ecological area.

Proposed Kopuapounamu
Ecological Area
(Nicholls, 1983a)

c. 1000 ha

Upper catchment of
Kopuapounamu tributary
of Awatere River,
between 450-1414 m

Represents the remaining indigenous forest at the north-east extremity of the Motu Ecological District, where the underlying rock is grossly deformed and the land notoriously unstable. Hard beech is absent eastwards from the middle Raukokore River valley, and so podocarp-hardwood forest here gives way quite abruptly at about 800m a.s.l. to montane red and silver beech forest (i.e. there are no definite belts of the rimu-tawa-beech and rimu-beech types so characteristic of the rest of the main forest tract). Also included is the part of the portion of the main Raukumara divide where beeches are anomalous and very rare.

The main trees in the podocarp-hardwood forest are B. tawa s. l., kamahi, tawari, and mahoe, and pukatea up to 600m; rimu, miro, Hall's totara, rata, hinau, and rewarewa are scattered throughout; matai, kahikatea, and maire occur very locally, and kohekohe only appears rarely along the lowest forest fringe.

Between 800-900m, red beech appears in the podocarp-hardwood forest; above this is red beech-silver beech-kamahi-tawari-quintinia forest with occasional miro and Hall's totara, grading into a stunted forest along the Mt Raukumara ridge of silver beech-kaikawaka-pink pine-mountain toatoa. This gives way at 1,200m to stunted scrub which includes snow totara.

In marked contrast, the narrow main divide and its western spurs, from only 750 m to about 1100 m, have a stunted forest of dense kamahi, tawari, toro, quintinia, and tree ferns. Miro and Hall's totara are locally frequent about the lower margins, and extremely scattered along the exposed ridge-tops. Rare clumps of red and silver beech and rare kaikawaka occur on the highest ground.

Catchment of Ngarere Stream, a tributary of the lower Motu River, and minor adjacent catchments, between 80-1,120 m

c. 1750 ha

Proposed Puketoetoe Ecological Area (Nicholls, 1983a)

Contains a representative example of the hard beech dominated forest of the moderately high, very steep and rugged country typical of the north-western quarter of the Raukumara S.F.P., between the Hawai-Motu divide and the headwaters of the Raukokore River. Also includes exceptional mixtures, (for North Island indigenous forest), of hard beech, silver beech, rimu and kaikawaka.

Near the Motu River, relatively minor areas of podocarp-hardwood forest occur on high river terrace remnants and adjacent hillsides. Rimu, miro, northern rata and occasional matai are

emergent above B. tawa s. l., pukatea and a dense understorey of kamahi, mahoe, pigeonwood, and tree ferns. As along the Raukokore River at the same low altitude, any element of coastal plants appears to be lacking.

Up to about 750 m, some pockets of rimu-B. tawa s.l. forest occur in gullies. Hard beech predominates, over abundant kamahi and tawari and various admixtures of small rimu, miro, toatoa, northern rata, B. tawa s.l., hinau, rewarewa and quintinia, with Dracophyllum latifolium and Archieria racemosa in the understorey.

Between 750-1100 m, the forest along the high ridges and in the broad, basin-like valleys at the head of the catchment is a complex of varying associations. The main species are hard beech, silver beech, rimu, miro, Hall's totara, kaikawaka, tawari, kamahi and quintinia. Red beech does occur but is comparatively rare. On the higher ground about Puketoetoe Trig is a dense low forest of silver beech, mountain toatoa, pink pine, tawari, kamahi, quintinia, and occasional kaikawaka.

Proposed Paraumu Ecological Area (Nicholls, 1983a) c. 1250 ha Catchment of tributaries of Hawai River, between 30-630 m. Mostly finely dissected, moderately steep hill country below 300 m

This ecological area is the only part of the Raukumara S.F.P. containing the typical hard beech dominated lowland forest of the Eastern Bay of Plenty. Hard beech is dominant along the ridges spurs and upper valley sides with pockets of purely podocarp-hardwood forest in gully bottoms. Associated with the hard beech are frequent to locally abundant tanekaha and kamahi and varying admixtures of small northern rata of terrestrial origin, rimu, miro, tawa, hinau, rewarewa, kohekohe, and nikau. Puriri occurs near the northern boundary; pohutukawa, karaka, ngaio, and mangeao occur not far outside it but are not certainly known inside the proposed ecological

secondary forest of hard beech, northern rata, tanekaha, rewarewa, kamahi, kanuka, and toru.

In the relatively small area above 300 m, the hard beech forest composition changes a little with toatoa tending to replace tanekaha, a disappearance of kohekohe and nikau and concomitant incoming of tawari and quintinia. Broad, undulating, ridges about Paraumu and Te Upokookohu Trigs, have appreciable areas of podocarp-hardwood forest with scattered rimu and northern rata over B. tawa s.l. kamahi, tawari, hinau, rewarewa, and pukatea. Some kohekohe and nikau persist in this type up to about 450 m.

3. Proposed scenic reserve

Part proposed Opape Scenic Reserve ("Nukutere Scenic Reserve")
(Daniel, 1983)

- | | | |
|---|--------------------------------|--|
| <p>Semi-coastal lower hill-slopes, between 60-250 m</p> | <p>(approved in principle)</p> | <p>1. Kohekohe and puriri forest with some large pohutukawa on ridge tops.</p> |
| <p>Ridges and valleys, steep slopes, colluvium and lower altitude gullies between 150-660 m</p> | | <p>2. Hard beech forest, with rimu and tawa, with tawa kohekohe and pukatea, white maire and tanekaha.</p> |
| <p>Upper hillslopes and ridges around Te Pakera Trigs between 660-850 m</p> | | <p>3. Rimu-beech forest
Hard beech, red beech, silver beech, kamahi, tawari and scattered Rimu miro and Hall's totara.</p> |
| <p>Mid and upper hillslopes, between 520-645 m (small area only)</p> | | <p>4. Rimu and tawa forest, with kamahi, tawari, and occasional miro, hinau and rewarewa.</p> |
| <p>Moderate valley slopes between 380-540 m</p> | | <p>5. Rimu-beech forest (as for 3) with more tawa, no red or silver beech and occasional huge emergent rata and rimu. Has been logged.</p> |
| <p>Basal to ridge steep slopes between 100-420 m</p> | | <p>6. Fire induced secondary mosaic of broadleaved shrubs and podocarps, in which rewarewa predominates. Occasional kohekohe and puriri.</p> |