

COROMANDEL ECOLOGICAL REGION

Survey Report for the Protected Natural Areas Programme



CONSERVATION
TE PAPA ATAWHAI

Coromandel Ecological Region

**Survey Report for the
Protected Natural Areas Programme**

E.A. Humphreys and A.M. Tyler

**New Zealand Protected Natural Areas Programme
ISSN 0112-9252**

**Published by the Department of Conservation,
Waikato Conservancy, Hamilton
1990**

TABLE OF CONTENTS

	Page
SUMMARY	1
THE SURVEY TEAMS	3
ACKNOWLEDGEMENTS	4
1. INTRODUCTION TO SURVEY	
1.1 Background	7
1.2 Methods	8
2. COROMANDEL ECOLOGICAL REGION	
2.1 Location, Boundaries and Land Tenure	14
2.2 Relief	14
2.3 Geology	14
2.4 Climate	15
2.5 Soils	15
2.6 History	16
2.7 Freshwater Environment	18
2.8 Vegetation	20
2.8.1 Former Vegetation	20
2.8.2 Present Day Vegetation	21
2.9 Fauna	25
3. COLVILLE ECOLOGICAL DISTRICT	
Summary	32
3.1 Ecological Character	35
3.1.1 Relief	35
3.1.2 Geology	35
3.1.3 Climate	35
3.1.4 Soils	36
3.1.5 Vegetation	36
3.1.6 Fauna	38
3.2 Existing Protected Natural Areas	42
3.3 Further Requirements to Provide a Network of Representative Natural Areas	42

	Page
3.4 Recommended Areas for Protection	43
Col 1 Fletcher Bay	46
Col 2 Stony Bay	48
Col 3 Fantail	50
Col 4 Te Moehau	52
Col 5 Ongohi	54
Col 6 Potiki Bay	56
Col 7 Waikawau	58
Col 8 Kennedy Bay	60
Col 9 Okahu	62
Col 10 Hapapawera	64
Col 11 Pungapunga	66
Col 12 Harataunga Tributary	68
Col 13 Whangapoua	70
Col 14 Waingaro Wetland	72
Col 15 Otama	74
Col 16 Ototoro Stream	76
Col 17 Whauwhau and Woodcock Streams, Horseshoe and Sandy Bays	78
Col 18 Whakanekeneke	80
Col 19 Castle Rock	82
Col 20 Manaia Harbour	84
Col 21 Wairotoroto Shingle Beach	86
Col 22 Kirita Bush Remnants	88
 4. THAMES ECOLOGICAL DISTRICT	
Summary	90
4.1 Ecological Character	93
4.1.1 Relief	93
4.1.2 Geology	93
4.1.3 Climate	93
4.1.4 Soils	93
4.1.5 Vegetation	94
4.1.6 Fauna	94
4.2 Existing Protected Natural Areas	98
4.3 Further Requirements to Provide a Network of Representative Natural Areas	98
4.4 Recommended Areas for Protection	98
Tha 1 Mahakirau Catchment	102
Tha 2 Illingsworth's Alluvial Flat	104
Tha 3 Tapu	106
Tha 4 Waiwawa	108
Tha 5 Te Puru	110
Tha 6 Wainora	112
Tha 7 Kauaeranga River Flats	114

	Page
5. TAIRUA ECOLOGICAL DISTRICT	
Summary	116
5.1 Ecological Character	119
5.1.1 Relief	119
5.1.2 Geology	119
5.1.3 Climate	119
5.1.4 Soils	120
5.1.5 Vegetation	120
5.1.6 Fauna	123
5.2 Existing Protected Natural Areas	126
5.3 Further Requirements to Provide a Network of Representative Natural Areas	126
5.4 Recommended Areas for Protection	127
Tai 1 Whitianga Harbour	130
Tai 2 Kaimarama River Flats	132
Tai 3 Whenuakite River Flats	134
Tai 4 Hot Water Beach	136
Tai 5 Parakau	138
Tai 6 Whenuakite-Tapuaetahi	140
Tai 7 Oturu	142
Tai 8 Upper Kauaeranga	144
Tai 9 Upper Hikuai	146
Tai 10 Pauanui Hill	148
Tai 11 Duck Creek	150
Tai 12 Wharekawa Harbour	152
Tai 13 Onemana	154
Tai 14 Paritu Stream	156
Tai 15 Tairua River	158
Tai 16 Puriri SR Extension	160
Tai 17 Upper Wharekawa	162
6. WAIHI ECOLOGICAL DISTRICT	
Summary	164
6.1 Ecological Character	167
6.1.1 Relief	167
6.1.2 Geology	167
6.1.3 Climate	167
6.1.4 Soils	167
6.1.5 Vegetation	168
6.1.6 Fauna	169

	Page
6.2 Existing Protected Natural Areas	173
6.3 Further Requirements to Provide a Network of Representative Natural Areas	173
6.4 Recommended Areas for Protection	173
Wai 1 Otahu Estuary	177
Wai 2 Whiritoa Beach	179
Wai 3 Mataora	181
Wai 4 Maratoto	183
Wai 5 Whiritoa	185
Wai 6 Waiharakeke	187
Wai 7 Waitekauri Valley	189
7. TE AROHA ECOLOGICAL DISTRICT	
Summary	191
7.1 Ecological Character	194
7.1.1 Relief	194
7.1.2 Geology	194
7.1.3 Climate	194
7.1.4 Soils	195
7.1.5 Vegetation	195
7.1.6 Fauna	200
7.2 Existing Protected Natural Areas	200
7.3 Further Requirements to Provide a Network of Representative Natural Areas	201
7.4 Recommended Areas for Protection	203
TeA 1 Wairakau Scenic Reserve Extension	206
TeA 2 Tuahu Lakelets	208
TeA 3 Maurihero SR Extension	210
TeA 4 East Ngatukituki EA Extension	212
TeA 5 Te Rereatukahia	214
TeA 6 Waitekohe Stream	216
TeA 7 Te Hunga EA Extension	218
BIBLIOGRAPHY	220

TABLES

Page

TABLE 1	List of Rare and Endangered Species at their Limits of Distribution and Species Endemic to the Mainland Ecological District of the Coromandel	28

COLVILLE ECOLOGICAL DISTRICT

TABLE 2	Important Plant Species	37
TABLE 3	Important Animal Species	39
TABLE 4	List of Standard Ecological Units and Adequacy of Protection	41

THAMES ECOLOGICAL DISTRICT

TABLE 5	Important Plant Species	96
TABLE 6	Important Animal Species	96
TABLE 7	List of Standard Ecological Units and Adequacy of Protection	97

TAIRUA ECOLOGICAL DISTRICT

TABLE 8	Important Plant Species	124
TABLE 9	Important Animal Species	124
TABLE 10	List of Standard Ecological Units and Adequacy of Protection	125

WAIHI ECOLOGICAL DISTRICT

TABLE 11	Important Plant Species	171
TABLE 12	Important Animal Species	171
TABLE 13	List of Standard Ecological Units and Adequacy of Protection	172

TE AROHA ECOLOGICAL DISTRICT

TABLE 14	Important Plant Species	198
TABLE 15	Important Animal Species	199
TABLE 16	List of Standard Ecological Units and Adequacy of Protection	202

FIGURES

	Page
1. Locality Map of Coromandel Ecological Region	5
2. Map Showing Existing PNAs and RAPS	6
3. Colville Ecological District Locality Map	33
4. Colville Ecological District Showing Bioclimatic Zones	34
5. Colville Ecological District Showing Existing Protected Natural Areas and Recommended Areas for Protection	44
6. Thames Ecological District Locality Map	91
7. Thames Ecological District Showing Bioclimatic Zones	92
8. Thames Ecological District Showing Existing Protected Natural Areas and Recommended Areas for Protection	100
9. Tairua Ecological District Locality Map	117
10. Tairua Ecological District Showing Bioclimatic Zones	118
11. Tairua Ecological District Showing Existing Protected Natural Areas and Recommended Areas for Protection	128
12. Waihi Ecological District Locality Map	165
13. Waihi Ecological District Showing Bioclimatic Zones	166
14. Waihi Ecological District Showing Existing Protected Natural Areas and Recommended Areas for Protection	175
15. Te Aroha Ecological District Locality Map	192
16. Te Aroha Ecological District Showing Bioclimatic Zones	193
17. Te Aroha Ecological District Showing Existing Protected Natural Areas and Recommended Areas for Protection	204

APPENDICES

	Page
I Vegetation Types	233
II Plant Species Checklist for Coromandel Ecological Region	251
III Animal Species Checklist for Coromandel Ecological Region	262
IV Schematic Diagram of Landforms and Landform Definition	266
V Common Plant Names Used in the Text	267
VI Criteria for Ranking Sites of Special Wildlife Interest	269
VII Glossary of PNA Terms	270
VIII List of Abbreviation and Symbols used in Text (incl Atkinson's)	275
IX Stratification of Mainland Districts of Coromandel Ecological Region : Bioclimatic Zones and Land Systems	276
X Freshwater Habitat Survey - Objectives, Methods and Results	278

SUMMARY

Five mainland ecological districts (ED) of the Coromandel Ecological Region (ER) were surveyed over the summers of 1987-88 and 1988-89. Both privately owned land and Department of Conservation administered land was surveyed. The ecological character of the ER and the five EDs and areas recommended for protection (RAPs) are presented in this report.

This report is essentially a summary document. It provides an overview of the Coromandel Ecological Region and outlines the methods employed for vegetation surveys. Each ecological district is considered separately with a series of areas recommended for protection (RAPs). The RAPs, if successfully implemented, will ensure representation of the districts' ecological diversity. Each RAP description in this report has a map of the area, a discussion of its significant features, and the justifications for its protection.

A total of 78 study areas, based largely on catchments and of various sizes were surveyed and in these areas 40 vegetation types were recognised. Bioclimatic zones were found to be significantly reflected in the vegetation of the Coromandel ER and provided the basis for natural area assessment.

Of the 400,000 ha within the Coromandel ER 24,276 ha is reserved for conservation purposes, a further 81,724 ha is also administered by the Department of Conservation.

Key deficiencies in the existing Protected Natural Areas of the Coromandel ER are as follows:

- (i) There is an adequate area of montane vegetation protected in all EDs except Waihi but the diversity of vegetation types is not adequately represented.
- (ii) There is inadequate protection of lowland vegetation types in all ecological districts except Te Aroha ED.

- (iii) There is inadequate protection of the semi-coastal zone in all districts.
- (iv) There is inadequate protection of coastal vegetation in all districts except for coastal forest in Waihi ED. In Te Aroha ED there is no coastal bioclimatic zone.
- (v) There is virtually no protection of duneland in the region.
- (vi) There is no protection of either salt or freshwater wetlands.

The greater number of RAPs lie in the coastal and semi-coastal zone because of these deficiencies.

The RAPs are those areas which include the best examples of ecological units currently under-represented in PNAs. They are an elite set of areas with very high natural values. Exclusion of some natural areas from RAPs does not indicate low natural values. They are important in their own right for contributing to the landscape quality, wildlife habitat, catchment protection and recreation values of the Coromandel ER.

THE SURVEY TEAMS

1987/88

ANDY GARRICK
GRETCHEN RASCH
PAULA BROEKHUIZEN
CATHY JONES
ANNA TYLER
MIKE CANDY

Team Leader
Assistant Team Leader

1988/89

LIZ HUMPHREYS
PAULA BROEKHUIZEN
DAVE KING
CATHY JONES
ANNA TYLER
COLIN MAUNDER

Team Leader

ACKNOWLEDGEMENTS

PNAP surveys depend upon the support, hard work and assistance of a large number of people without whom the survey would not have been possible.

The following people played a major part in the survey and report production.

- * *The landowners who gave permission to survey their land and who often provided interesting and valuable local knowledge.*
- * *CORRY REGNIER for her excellent Phase I report which provided a reliable base from which to carry out survey and a most useful reference document.*
- * *All members of the survey teams in both years for their hard work, energy and enthusiasm; for putting in long hours and to each for the contribution of particular skills and valuable discussion.*
Special thanks go to
ANDY GARRICK, the first year's team leader, for establishing the survey;
CATHY JONES for botanical expertise and enthusiastic herbarium collections made throughout the survey;
ANNA TYLER for her assistance in the compilation of this document;
- * *DIANA GINI, Head Typist, DOC, Hamilton for patient typing and amendment of numerous drafts.*
- * *THEO STEPHENS, Conservancy Advisory Scientist, DOC, Hamilton for editing this report.*
- * *BEV TUNLEY, Draughting Officer, DOC, Hamilton.*
- * *STELLA PENNY for aquatic work and continued advice during analysis and report production.*
- * *Dr B D CLARKSON, Scientific Advisor, Botany Division, DSIR, Rotorua for editing this report and providing advice during analysis.*
- * *The staff of Department of Conservation, Coromandel Peninsula for their logistic support and assistance with landowner liaison.*
- * *The staff of the Department of Conservation, Te Aroha for logistic support and assistance in field survey.*
- * *KEITH OWEN, DOC, Rotorua for assistance in the field and wildlife information for Te Aroha ED.*
- * *JOHN NICHOLLS for useful discussion on Te Aroha ED forests and for much of the resource material for the whole Coromandel ER on which this survey is based.*
- * *Dr WILLEM DE LANGE, Department of Earth Sciences, University of Waikato and Dr PETER BALLANCE, Department of Geology, University of Auckland for geological advice and comment.*

Our thanks go also to other people too numerous to mention, many of whom volunteered their time and assistance.

1. INTRODUCTION

1.1 BACKGROUND

The Protected Natural Areas Programme (PNAP) is a scientifically based programme which aims to preserve the full range of New Zealand's natural character and ecological diversity. It arose from an awareness and concern that many of our indigenous communities, habitats and landscapes were inadequately represented within the existing network of reserves and other protected natural areas and that many of these were under threat of disappearing forever. The Reserves Act, 1977, provided the mandate for the programme and, in Section 3(1)(b), expressed what can be regarded as the programme's principal objective, this being

"... the protection of representative samples of all classes of natural ecosystems and landscape which in the aggregate originally gave New Zealand its own recognisable character."

Ecological districts (ED) provide the framework and reference for the programme. New Zealand is divided into 268 of these districts (Simpson, 1982; McEwen, 1987) each of which is characterised by a unique combination of geology, topography, climate, soils and biological features.

Consideration is also given to other formerly characteristic features such as terrestrial and freshwater fauna and their habitats. The objectives of the PNA Programme necessitate a rapid approach to survey and data compilation. Kelly and Park (1986) provide a detailed discussion of the principles, concepts and approach to the programme and Myers *et al* (1987) expand on survey techniques and data analysis.

This report presents results and recommendations arising from PNAP surveys undertaken in the five mainland districts of the Coromandel Ecological Region (ER). Nationally these districts were seen as having high priority for survey (Myers, 1984) because of actual or potential pressures on natural areas within the region by prospecting, mining, tourism and coastal development and the inadequate representation of the range of Coromandel natural values in the existing PNA network as shown in Regnier 1987.

The districts were surveyed over two consecutive summers; Colville and Thames in 1987/88, and Tairua, Waihi and Te Aroha in 1988/89. Of the many offshore islands, islets and stacks in the ER only a small number are protected. Some islands were surveyed in 1987/88 and 1988/89, those not surveyed warrant attention under the PNA Programme if the opportunity arises so that a full assessment of offshore islands' values can be made.

Abbreviations are used frequently in the text and can be referred to in Appendix VIII. Some terms used in the text have specific definitions in the PNAP, these and other technical terms may be referred to in Appendix VII. A simple landform diagram is also included in Appendix IV. Wherever possible common plant and animal names are used in the text, for Latin equivalents, see Appendix V.

1.2 METHODS

The method used followed the PNAP Guidebook for Rapid Ecological Survey (Myers *et al*, 1987) and is comprised of four stages - reconnaissance, survey, analysis and evaluation and implementation.

(a) RECONNAISSANCE

Regnier (1987) collated existing ecological information for the five ecological districts comprising the Coromandel ER and produced the information as a Phase 1 report. This report identified study areas thus laying the foundation for survey. Sources of information for Phase I included NZFS plot data and file records held by MOF, Rotorua, surveys commissioned by the Department of Lands and Survey, Wildlife Surveys conducted by the Wildlife Service and fisheries data from MAF.

The Phase I survey report identified study areas thus laying the foundation for survey. These study areas were derived through the following process. Each ecological district was divided into bioclimatic zones, using plant species and altitude as indicators. Those identified in Coromandel ER were coastal, semi-coastal, lowland and montane. (See Appendix IX). Vegetation types and landforms were identified and from this checklists of ecological units were made as were plant and animal species' distributions and descriptions of geology, climate and landform.

All natural vegetation outside protected natural areas. In this survey Protected Natural Areas (PNA) were defined as those with secure protection status that is forest sanctuaries, ecological areas, scenic reserves, scientific reserves, wildlife management reserves and QEII open space covenants. All natural vegetation lying outside these PNAs was appraised during reconnaissance. As a result much of the 106,000 ha of land administered by the Department of Conservation (DOC) as Coromandel and Kaimai-Mamaku Forest Park and stewardship land were evaluated alongside natural areas in private ownership. This was the only way a truly comprehensive analysis of natural areas in the ER could be made. A preliminary appraisal of the current level of protection of each bioclimatic zone within existing protected natural areas was made. Existing information pertaining to reserves was found to be variable and sometimes further survey was recommended.

Ecological units which now occur within PNAs at less than 10% of their probable former extent were considered to be inadequately protected. Initial shortfalls in the PNA system were estimated at this stage. From existing information, and field reconnaissance of natural areas, study areas containing the better examples of those under-represented ecological units were selected. Often several study areas with the same units were selected for comparative purposes to ensure the best examples would be identified. Some ecological units are now so rare that all examples were included in study areas.

Selection of study areas followed reserve design principles outlined by Diamond (1975) and Schonewald, Cox and Bayliss (1986) as closely as possible, that is:

- to follow catchment boundaries,
- to develop a series of contiguous reserves rather than a number of smaller, disjunct reserves, and
- the provision of natural corridors to enable recruitment of fauna and flora in case of natural or man-induced catastrophe.

(b) FIELD SURVEY

The Coromandel ER was surveyed using the method outlined by Myers *et al* (1987). Only slight modifications were made to suit specific character and conditions prevailing in the Coromandel ER. The land system approach to classification as defined by Myers was not used. Although Regnier (1987) identified land systems for most ecological districts this classification was not retained during fieldwork as they were not clearly reflected in vegetation types. This was largely due to the high degree of disturbance which has taken place in Coromandel ER. The detail of survey was limited by the extensive natural areas, difficult terrain and sometimes difficult access found in the Coromandel ER, NZFS plots proved useful for providing additional information.

The 32 study areas suggested by Regnier (1987) in Colville and Thames were surveyed in 1987/88. In addition several areas identified during survey were included. Survey teams were denied access to a few privately owned natural areas and these have been omitted from the analysis. (Some of these contain ecological units under-represented in PNAs and would probably have been recommended for protection.) In 1988/89 the 39 study areas identified by Regnier (1987) were surveyed. A freshwater survey was carried out in 1987/88 and this is outlined in the following sections. Offshore islands were surveyed in varying degrees of detail in the two survey periods but information was not adequate to make a full assessment of islands.

Study areas were examined in detail. This involved variable area plot vegetation sampling (see Myers *et al* 1987) vegetation description and mapping. Vegetation lying outside study areas was mapped from canopy observations from vantage points and from aerial photographs. Vegetation was mapped in the field on overlays on 1:25,000 scale aerial photographs (Series SN 5944 and SN 8163). From these vegetation maps of each study area were prepared and large colour-coded vegetation maps (also at 1:25,000) of all natural areas in the ER. These provided the base for analysis.

Guidelines as to the range of vegetation present in the ecological districts had been made by Regnier (1987) (checklists of vegetation types within PNAs). Computer vegetation classification was inappropriate given the small ratio of vegetation plots to the total area surveyed and the degree of modification. A vegetation classification, which distinguished types readily recognisable in the field, was derived by hand-sorting the plot cards.

In 1987/88 water course survey and freshwater fish sampling was carried out in Thames and Colville EDs. (See Appendix X for Results and Section 2.7 for discussion.) The results of this survey and information from previous studies form the basis for recommending measures for preserving aquatic habitats throughout the region.

Objectives of freshwater survey were:

- (i) To identify least modified headwater stream systems in Coromandel Ecological Region
- (ii) To identify least modified coastal stream systems
- (iii) To identify least modified complete catchments (source to sea via estuary) - best native fisheries habitat
- (iv) To obtain an overview of the variety of freshwater stream habitat in the Coromandel Ecological Region.
- (v) To determine whether rocktype and catchment erosion categories produce different stream habitats.
- (vi) To determine whether terrestrial reserves defined by catchment boundaries will adequately protect the range of aquatic habitat types and provide examples of Type A and B catchments. If not to recommend additional aquatic reserves.
- (vii) To determine whether native fisheries values justify protection of an entire catchment from source to sea (Type C catchment) (including exclusion of trout).

Integration of the Freshwater Survey Programme with Terrestrial Programme:

Whereas terrestrial surveys were based around bioclimatic zones determined by indicator plant species - with altitude and drainage characteristics being major determinants of vegetation (Regnier 1987), work by Rounick and Winterbourn (1982) has indicated that forest type is not an important factor in determining stream community type.

Some types of freshwater reserves can be integrated successfully with terrestrial reserves simply by following catchment boundaries. For example headwater forest reserves will preserve habitat for shade tolerant and coolwater communities. All or some of the following criteria are important depending on the species of native fish (McDowall 1984):

- inclusion of entire headwaters
- uninterrupted passage to the sea (no dams, weirs etc)
- unmodified estuary providing spawning habitat
- absence of introduced predators and competitors in particular trout
- absence of water pollution
- maintenance of minimum flows
- absence of flow regulation

There is also a need to retain some stream systems in an unmodified condition from headwaters to coast in order to provide examples of natural ecological succession within the running water habitat.

The area and nature of the terrain and limited resources meant that instream surveys were limited to a number of preselected sites.

A preliminary mapping exercise was carried out to identify sites which fulfilled all of the following criteria:

1. Complete indigenous forest cover
2. A range of rock type
3. Minimum catchment disturbance from roading, excavation, mining and noxious animals
4. A range of altitude
5. Coverage of a range of catchment size

For further details and the criteria for selection of representative stream habitats see Appendix X. Detailed freshwater survey results are in Penny, 1988 (unpub. available at Department of Conservation). The recommendations of the freshwater survey have been integrated with the terrestrial recommendations and are included in the RAPs in the following chapters.

(c) ANALYSIS:

The procedure outlined in the PNAP guidebook (Myers *et al.* 1987) was followed for each of the five ecological districts. This procedure determines which natural areas best represent the former character of each district and fulfil the shortfalls in the existing PNA network. This procedure is outlined in stages below but for more details see Myers *et al.* 1987.

- A summary table of the character of each district was compiled by listing the ecological units and the range of landforms on which they occurred (see Tables 4, 7, 10, 13, 16 and Appendix IV for landform diagram).
- The present extent of each vegetation type was measured using a PLANIX digital planimeter from the 1:25 000 coloured vegetation maps. This was separated into areas within PNAs, within study areas and that lying outside both of these categories.
- The former extent of ecological units could not be measured precisely due to lack of detailed historical information. The past extents of broad ecological classes (see glossary) eg dunelands, semi-coastal wetlands and lowland forest, could be estimated by using a combination of historical accounts, old maps and extrapolation from present extents, topography and bioclimatic zones.¹

¹ Former extent in this survey was taken as that estimated to have existed before human occupation. This baseline was used because there had been considerable modification of vegetation prior to European settlement, particularly in the coastal and semi-coastal zones. An early nineteenth century baseline would have resulted in the past extent of coastal and semi-coastal forest being under- emphasised in favour of secondary communities such as bracken and scrub which were extensive when Europeans arrived.

Probable former extents of ecological classes were mapped and measured. The relative former extents of ecological classes is presented qualitatively in Tables 4, 7, 10, 13, 16.

- The current amount of protection for each ecological class protected within existing PNAs was expressed as a percentage of the estimated former extent. If 10% of the former extent is protected in existing PNAs then representation is considered adequate. (See Tables 4, 7, 10, 13, 16)
- From the exercise above a list was drawn up of those ecological classes for which more protection is required. Selection of study areas which contained the best examples of under-represented ecological classes and those which best represented the natural character of the ecological district the evaluation procedure described in Myers *et al.* (1987) was followed closely and is outlined below.

The representative quality (RQ) of each vegetation type in each study area was assigned a value on a scale of 1-3 based on its area, quality and current level of protection in PNAs. (See Appendix VII for details) The values of each study area gives the initial indication as to which contain the best examples of ecological classes required.

Natural areas and study areas vary in size from small remnants to large tracts of forest. One area may contain several ecological classes. It was therefore necessary to make a subjective assessment of the total conservation value of each area so that the overall best natural areas were those selected as RAPs [using the criteria outlined below (from Myers *et al.* (1987))].

1. "representativeness" - how well the area reflects part/all of the distinctive character of the Ecological District, including freshwater values.
2. "diversity and pattern" - primarily assessed on community diversity but diversity of floristic associations within each community and overall species richness was taken into account.
3. "naturalness" - how closely the vegetation and overall natural character of the area reflects the original pre-human communities and the indigenous content of the vegetation.
4. "special features" - features of particular importance to the area; for example rare or endangered plant species, wildlife habitats of importance, freshwater values, landform features or scenic value.
5. "viability, size and shape" - an indication of the ability of the vegetation to maintain itself in the long term. Regeneration, vigour, size and shape of area are criteria for evaluation.

6. "buffering and surrounding landscape" - protection from outside influences given by natural buffers (catchment boundaries, surrounding vegetation), fences etc.
7. "threat" - immediate or potential threats to future viability; for example burning and damage by stock or vehicles.

Study areas were ranked for each of the above criteria and the overall high quality areas satisfying the shortfalls in the existing reserve system were those selected as RAPs. Study area boundaries were adjusted where necessary to exclude or include adjacent areas. In selection of RAPs the aim was to protect the full range of landforms and vegetation types and the characteristic continual variation of natural vegetation. To this end an altitudinal sequence from sea level to the top of the Coromandel range has been proposed for each ecological district. East to west sequences across the ranges are also recommended. Although the land system approach was not included in the classification of ecological units as mentioned earlier, care was taken to consider the range of vegetation, geology and landform types.

RAPs connecting PNAs were selected wherever possible to form natural corridors for the movement of plant and animal species, to extend important wildlife habitats and to buffer important high quality existing PNAs. When considering long term "viability, fragility and threat" DOC land rates highly under current legislation and management practices. Thus land tenure was a contributing factor in our choice of RAPs.

Scrub tended to receive low RQ values as most scrub types were not considered representative of the original vegetation. Study areas with extensive scrub usually rated low in the evaluation exercise. To acknowledge the intrinsic natural and scientific values of scrub, adequate protection of all scrub types has been accommodated in RAPs. Scrub, as seral vegetation type with the potential to regenerate forest was helped to provide altitudinal sequences, to buffer PNAs and RAPs. In Tairua, where there is not 10% of the original semi-coastal and coastal vegetation remaining, scrub has been included in RAPs for its potential to regenerate to something approaching the former vegetation.

After analysis in each ED had been carried out the ED boundaries were scrutinized to see if they reflected ecological characters found on the ground. The boundaries of Thames and Tairua ecological districts were changed slightly to reflect patterns of vegetation and landform observed during survey.

2. THE COROMANDEL ECOLOGICAL REGION

2.1 LOCATION, BOUNDARIES AND LAND TENURE

The Coromandel Ecological Region includes eight ecological districts from Great and Little Barrier Islands in the north and the length of the Coromandel Range to the end of Te Hunga Ridge in the Kaimai Ranges. This study includes the five mainland ecological districts (Fig. 1) covering nearly 400,000 ha. Approximately 48% of this area is privately owned, 39% is Crown land, 5% is Maori land and the remainder Crown leasehold. The Department of Conservation administers approximately 106,000 ha.

The Region is a peninsula and bounded by sea with the Hauraki Plains (Hauraki ER) to the southwest and the lowlands of Tauranga Harbour (Northern Volcanic Plateau ER) to the southeast. All districts have a coastal zone apart from Te Aroha. The area of study covers nearly 400,000 ha.

2.2 RELIEF

The Coromandel Range is an upland bounded and dissected by a complex system of faults. The Hauraki depression is an elongated trough that lies to the west and is occupied by sea to the north and an accumulation of alluvial and marine sediments, that form the Hauraki Plains, to the south. Tectonic uplifting and folding during the late Tertiary (225-71 million years ago) raised the underlying basement mass of sedimentary rock lying to the east of the Thames fault forming the main Coromandel Range, whilst the Hauraki Gulf area sank.

Intense rainfall and vigorous stream action has deeply dissected the upland. The resulting main range is a chain of peaks with broad ridges and some plateaux remnants. The Karangahake Gorge is the only major break along the main range. The terrain drops steeply and abruptly to the west coast whilst the east coast has a system of larger valleys draining to the sea that now form distinctive estuaries and harbours with large areas of tidal and alluvial flats. There are numerous islands and offshore rock stacks. There is little flat land in the ER, the major areas being on coastal alluvial soils, particularly around Whitianga, Whangamata and Tairua estuaries, the Coromandel harbour and in the Waihi Basin.

2.3 GEOLOGY

The Coromandel Volcanic Zone of the Coromandel and Kaimai Ranges, is part of the Hauraki Volcanic Region and is the largest and oldest area of andesite-dacite volcanism in New Zealand. It includes the early rhyolitic and ignimbrite volcanism, producing a range of igneous rock configurations from basalt, rhyolite and plutonic complexes, that are a feature of the late Cenozoic period in New Zealand. Hydrothermal alteration of the older volcanic rocks is widespread in places forming the gold-silver lodes that have been so significant in the history of the region.

Basement rocks in the Coromandel Volcanic Zone are Jurassic greywackes and argillites (Manaia Hill Group) which are overlain by minor Oligocene and Miocene marine sediments (Torehina Formation - Te Kuiti Group, and Colville Formation - Waitemata Group respectively).

Andesite and dacite eruptions began in the earliest Miocene (ca 22-23 million years ago (mya)) in the north of the peninsula and spread south-eastwards as the Miocene and Pliocene eras progressed with the very youngest being about 2.5 mya. These are collectively called the Coromandel Group. Early Miocene plutonic rocks have intruded the older andesites.

A series of explosive eruptions, associated with the formation of a series of large calderas and ignimbrites, began in eastern Coromandel about 9 mya becoming progressively younger to the south. This series is known as the Whitianga Group and is generally more recent than the andesite-dacite sequence of the Coromandel group.

Dacitic ignimbrites replace rhyolites in the south (Te Aroha district) dating from 1.26 to 0.84 mya. Basaltic eruptions closely associated with the rhyolites in space and time began at about 6-8 mya and lie mostly offshore, small areas occur on the tip of the Kuaotunu Peninsula. The older volcanic rocks, chiefly andesites and dacites have been extensively altered by hydrothermal action during periods of volcanic activity making the rock soft and susceptible to erosion.

2.4 CLIMATE

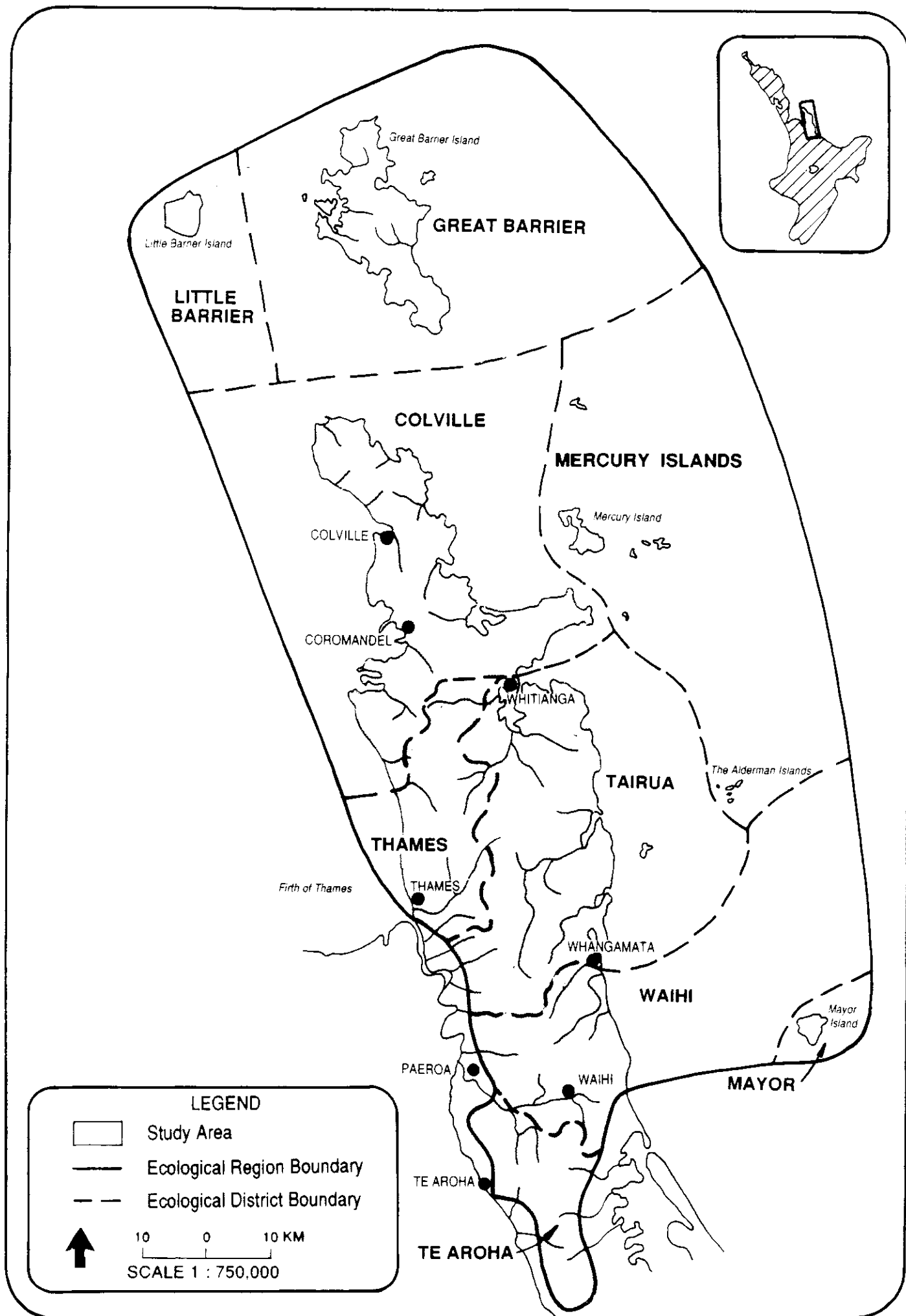
The climate of the Coromandel ER is influenced by several factors. Being a rugged, mountainous peninsula that rises abruptly from the Hauraki Gulf and Plains it is exposed both to the prevalent westerly winds and occasional but intense north-easterly depressions of tropical origin. Local topography is the major influence on weather in many parts, either funnelling or deflecting wind.

The sea has a moderating influence on temperature particularly at low altitudes. The decreases in temperature with altitude which determine bioclimatic zonation are similar throughout the region. Frosts occur infrequently but more often in the Waihi Basin and upland areas. Very rarely snow falls on the high peaks in the southern districts of the region and on Mt Moehau. Winds from the westerly quarter are usually moist on reaching the region and consequently rainfall, fog and cloud are more frequent than in surrounding regions and humidity levels are generally high.

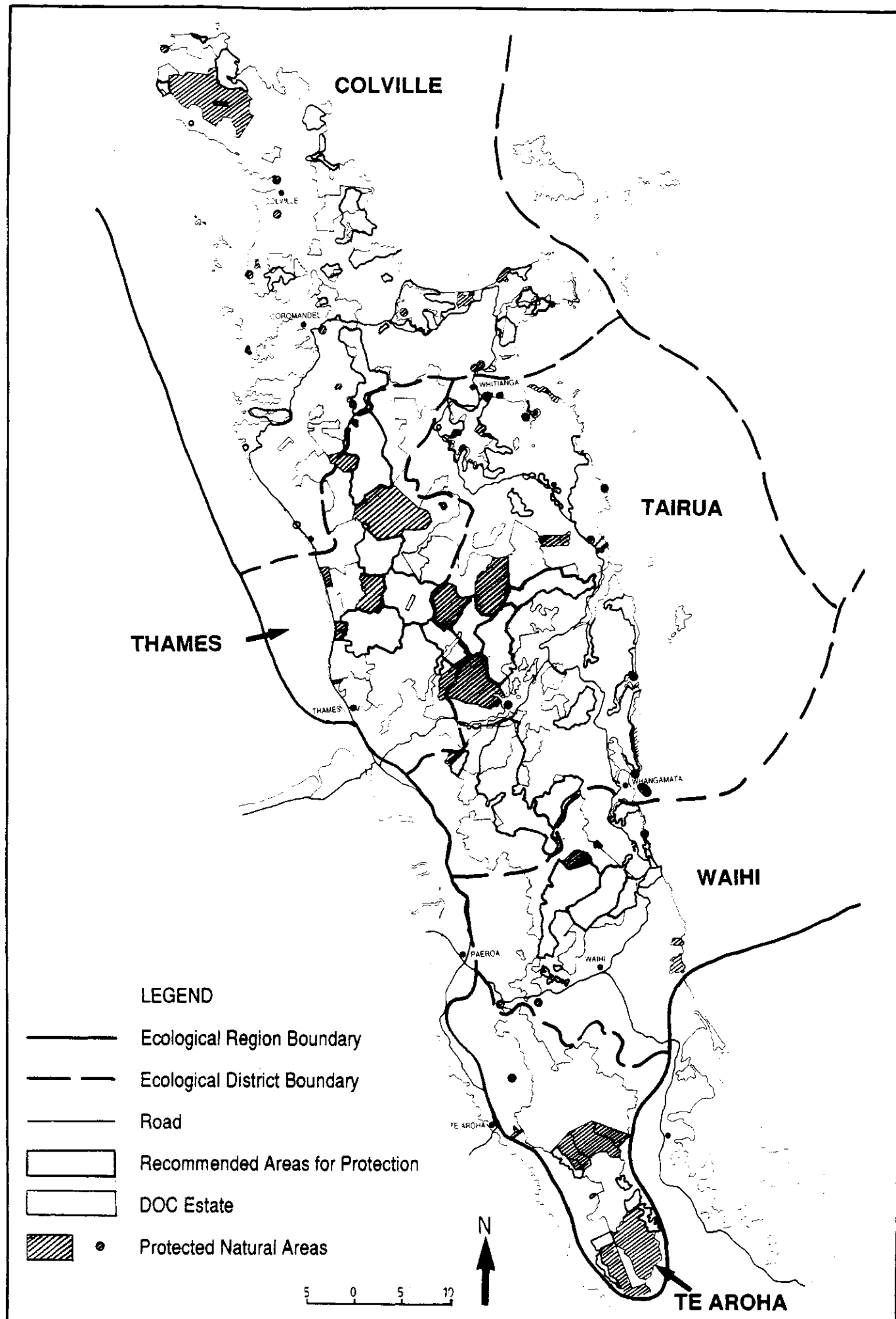
Rainfall ranges between 1275 mm and 2400 mm pa with the central range receiving more than the lowlands. It is distributed fairly evenly through the year with a peak in winter months. Periods of very intense rain can, however, occur at any time of year. Such rainfall is generally of a localised nature and can cause serious erosion.

2.5 SOILS

Soil parent materials in Coromandel ER vary locally and include basement rocks (argillites, sandstones and siltstones), volcanic rocks (andesite, dacite lavas and breccias, rhyolite and ignimbrite domes and flows) volcanic ash beds from a number of showers, alluvium, peat and wind-blown sand. These rocks are deeply weathered, except on steeper slopes where erosion exposes relatively fresh rock. Most of the ash has been eroded from the steeper hill country, though much still remains on the gentler terrain and broader ridge



LOCALITY MAP OF STUDY AREA



**RECOMMENDED AREAS FOR PROTECTION
AND EXISTING PROTECTED NATURAL AREAS
IN THE STUDY AREA**

tops of the southeast of the region. Uneven removal of the ash makes the soil pattern complex, formed from ash, from a mixture of ash and volcanic rock or from volcanic or basement rock without ash.

Alluvial deposits occur along streams, in valley bottoms and form the flats around the harbours and estuaries of the region. Some alluvial fans have formed where streams fall from the western slopes of the Coromandel and Kaimai Ranges. Other recent soils include peat that has accumulated in small areas in poorly drained valleys and along the east coast where stream outlets have been dammed by sand dunes. Areas of consolidated sand occur inland from many of the beaches of the east coast and underlie some of the flat and easy rolling land at Waikawau, Whangapoua, Whitianga, Tairua, Whangamata and the smaller beaches of Waihi ED.

Almost all the region was once covered in dense podocarp-broadleaved species forest with abundant kauri. Soils formed underneath podocarps and especially kauri tend to be impoverished and locally podzolised while those under a broadleaved species canopy are more fertile. High rainfalls of the region in combination with the above factors result in moderately to strongly leached soils with low to moderate fertility.

Steepland clay soils formed from andesite dominate the main Coromandel Range. These tend to be shallow to moderately deep over weathered rock. Associated hill soils are deeper but strongly leached and acid. Soils derived from sandstones occur in the west and north in Colville ED and podzols have developed in Tairua ED where kauri was once extensive. Ash loam and pumice soils occur in the east of Tairua, Waihi and Te Aroha EDs. Gleyed soils are present on the upper slopes of the Kaimai Ranges and a distinctive podzol of that area has formed under some of the beech forest (Jane and Green 1983b).

2.6 HISTORY

In order to appreciate fully the existing vegetation of the Coromandel ER and how well it represents the "original" character of the region a knowledge and understanding of the extent, severity and duration of various modifying influences of humans is essential. The following historical account gives an indication of the drastic and persistent nature of human impact.

The Coromandel ER had been occupied by Maori for centuries when the Endeavour arrived at Mercury Bay in 1769. Middens in the Tairua area have been carbon dated to 800 years BP. Moa bones found in middens at Waikawau Bay and Whaori Bay (near Otama) indicate the first inhabitants were probably moa hunters. Other bones in the middens give us an insight into the mainland fauna and habitat of the region with moas, frequent kokako, kaka, pigeon, tuatara, fur seal, and sea elephant found.

When Europeans began occupying the Peninsula there were, or had been, Maori settlements around the whole coastline (Law 1982) and it is estimated there were about 5000 Maori people inhabiting the peninsula in 1840. This population was halved by tribal warfare soon after Cook's arrival. In Te Aroha ED Maori settlement was on the lower slopes of the Kaimai Ranges and tracks across the Ranges linked the Thames Valley and Bay of Plenty people.

Maori impact on natural ecosystems was mainly in the coastal zone where they cleared forest for cultivation, fortification and living space. It is thought that some large areas were cleared, probably by burning, especially around Whitianga, Tairua and southwards towards Waihi. The Waihi Plain was described by early European travellers as "an extent of bracken and manuka scrub" (MacCaskill 1949). This trend can also be inferred from the decrease in forest birds such as kaka, kokako and pigeon in middens from about the fifteenth century onwards. Maori also brought and released predators namely kuri (dog) and kioi (Polynesian rat) which would have had some impact on native fauna from about 700 years BP.

Changes in the landscape wrought by Maori were slight compared with the depredation caused by the nineteenth century European settlers. It was one of the earliest regions of New Zealand to be settled and its exploitation played an important part in the colony's early economy. Logging, gum-digging, flax-milling and mining were the main industries carried out during the nineteenth and early twentieth centuries. Kauri logging came first, the British Admiralty being the consumer as tall spars were needed for ships. In 1814 a shipment of kauri spars left Kennedy Bay, and in 1821 HMS Coromandel collected 105 spars, leaving its name to the town and the peninsula.

The first sawmill was established at Whitianga in 1838 and by 1875 there were 13 operating throughout the region taking mainly kauri but also some totara, rimu, puriri and tawa. Pohutukawa was used as firewood and for early boat-building. Western catchments were logged first followed by the eastern catchments in the last three decades of the nineteenth century. Logs were moved in huge drives down streams and rivers, with great impacts on the natural character of streams and harbours. Large scale kauri logging was over by about 1914 but selective logging was continued by NZFS until 1972. In Te Aroha ED logging of kauri was more localised and tramways were built to transport timber which were less damaging. Logging here was not followed by burning or gum digging, consequently forests on steeplands retain more of their original character.

Over most of the peninsula loggers were followed by the gum diggers. Fossil kauri resin was dug from the ground after burning of all vegetation. In 1883 Adams wrote that as a result of the annual fires "the east coast (is) the most ruined and disfigured part of New Zealand. Later live kauri trees were bled for gum, damaging them in the long term. The flax milling industry of the late 19th century had severe impacts on east coast wetlands as it was not practised on a sustained yield basis. In 1852 Charles Ring discovered gold near Coromandel township and throughout the late 19th century mines were opened up all over the peninsula and quite large areas of vegetation cleared and burned to make working easier and to provide timber for mine props. Mining continued until 1952 when the Waihi mine closed. Recently there has been renewed interest in gold mining with Martha Hill, Waihi and Golden Cross mines being opened. Numerous prospecting and exploration licences have been issued over much of the ecological region.

As the early industries of logging and mining dwindled settlers moved into the area and converted the less steep land to pasture.

Mechanised drainage methods resulted in the destruction of the large swamps and peatlands of the east coast. Conversion to farmland continues today.

Large areas of previously logged and burnt land has remained in Crown ownership. Much of the lowland has been converted to pine forests whilst the steeplands and montane zones have regenerated to cover the scars in a region where almost every hectare, apart from Te Aroha ED, has been logged, burnt or dug. The natural areas of the ER are reminiscent rather than representative of the original character because of the effects of colonial exploitation and the effects of introduced animals and plants.

Today development pressure is on the coastal and semi-coastal areas. With a shift in the economic base of much of the area towards tourism and leisure activities there has been increased coastal subdivision and the development of camping grounds and tourist facilities.

2.7 FRESHWATER ENVIRONMENT

Following is a summary of the findings and recommendations of survey work carried out in 1987/88 in some Coromandel Streams.

Coromandel freshwater habitat is typically shallow, swift, boulder-strewn streams with frequent waterfalls in the upper catchments. Bedrock is a key feature of the stream bed and banks in steep and eroding stream sections. Streams in Colville, Thames and Te Aroha ecological districts tend to have short courses and steep gradients whereas Tairua and Waihi ecological districts have longer, north-easterly flowing main rivers and generally gentler gradients. Downstream sedimentation, log jams and tailings leachate still persist today many decades after severe disturbance such as mining, vegetation removal and kauri log driving.

FURTHER REQUIREMENTS TO PROVIDE REPRESENTATIVE CATCHMENTS WITHIN PNAs

In the Coromandel ER the steep eroding stream zone is the least modified and it is this zone that is best represented in existing PNAs. Low gradient depositional and estuarine zones occur in country cleared for farming or residential purposes and are not adequately protected. These zones are modified by roading, canalisation, loss of riparian vegetation, bank erosion, sedimentation and nutrient enrichment. In the case of small stream catchments lower reaches may be little modified but upper reaches have been cleared for forestry and farming, (eg Whangapoua Harbour, Otama Beach). The increased sedimentation resulting from catchment erosion causes stream aggradation and increased tendency to flood.

The following recommendations were made and wherever possible were incorporated into the PNA analysis and the selection of RAPs throughout the ER.

(i) Headwater Catchments

Although a representative number of headwater catchments are protected in the PNAs of most EDs it is recommended extensive areas of headwater catchment is reserved

because most catchments sustain storm damage at some time with slipping and scouring and sedimentation of water courses. Slips heal over and sediment is flushed out of high gradient areas in two to four years. Storm damage is often very localised and occurs in different catchments on different occasions. If a large headwater area is reserved this will ensure that some streams are preserved in an undisturbed state for a reasonable period of time and are able to develop representative stream communities. Clearance of vegetation in the vicinity of water courses should be avoided, stock should be excluded and goat and possum numbers reduced as much as possible.

(ii) **Small Coastal Catchments**

There are a very few small coastal catchments which are not modified in the lower reaches by farming, roading and coastal development. The best examples seen so far are the Whauwhau on the eastern side of the Kuaotunu Peninsula and the Fantail draining from Mt Moehau.

All streams with extensive estuarine zones have modified middle or upper reaches. A management plan encompassing the contributing catchment should be sought where natural estuarine values are high and an estuary is an RAP. The headwaters should be included within a PNA with restrictions on activities which have an impact on instream values.

(iii) **Fisheries Corridors**

The fishery status of some Coromandel streams has been assessed by DOC staff and is discussed in the Fauna Section 2.9.

All or some of the following criteria (McDowall 1984) must be met for a native fisheries reserve.

- entire headwaters protected
- uninterrupted passage to the sea (no dams, weirs etc)
- unmodified estuary providing spawning habitat
- absence of introduced predators and competitors, particularly trout
- absence of water pollution
- maintenance of minimum flows
- absence of flow regulation

There are few catchments possessing these qualities. Some approaching it are the Waiharekeke, Te Puru, the Huakitoetoe, Whareroa and the Mataiterangi Streams above Kennedy Bay, streams above Potiki Bay, Whenuakite, Horseshoe and Sandy Bay, Fantail Bay, the Awaroa and Whauwhau Streams. Most of these streams are included within RAPs in the following sections where they lie within areas of natural vegetation. The RAPs do not meet the full requirements to protect native fish habitats. Further definition of the best and most suitable streams for native fish protection in the Coromandel ER is required.

2.8 VEGETATION

The following sections given an outline of firstly former vegetation cover prior to Polynesian and European settlement. This picture is built up from historical accounts, maps, archaeological evidence, soils and remnants of vegetation observed during survey. The section on present day vegetation provides an overview of the key features and major patterns of vegetation in the ER derived from the PNA survey and work of other specialists.

2.8.1 ORIGINAL VEGETATION

Early European settlers remarked on the extensive forests of the Coromandel region which reached almost to the coast in most areas. Since then the forests have been reduced and the composition has changed. Large kauri would have been a striking feature, occurring throughout the forests and in dense stands on ridges below 600m and as stunted montane trees above 600m. The only areas with kauri forest in a condition close to original are Manaia Forest Sanctuary, lower Waiomu, at high altitudes on the slopes of Maumaupaki and Papakai, and on Table Mountain. According to Nicholls (1980), hard beech would have been of local occurrence down the west side of the Coromandel-Kaimai Range, but in the east it was quite common throughout former kauri forests below 300 m from Port Charles to the Katikati hinterland.

Totara and other podocarps would have been more common; Adams noted that rimu was as common as tawa in the head of Te Puru River in 1884. Towai is a common component of the forest canopy today, but would probably have been restricted to the subcanopy before the removal of the kauri and podocarps.

The understorey of the forest would have been more diverse and luxuriant prior to the introduction of goats and pigs, with mangemange, supplejack and many shrubs forming a tangled undergrowth (Kirk, 1869). Birdlife would have been abundant; even in the 1880s hunting expeditions shot tui, parakeet, kaka and pigeons (Simpson, 1955), and kokako were present (Barber, 1985).

At the time of early European settlement some areas of coastal forest had been burnt around sites of Maori occupation. Fernland and scrub occurred for "... four miles between Torehina and Papaaroa ..." [Adams, (1888)], it covered the Waihi Plain and a narrow eastern coastal strip (Barber, 1985), and was found around Coromandel, Whangapoua, Whitianga and Whangamata Harbours and on the coastal hills behind Thames (McCaskill, 1949). Otherwise, regenerating scrub would have been a minor component of the vegetation, occurring after natural disturbances such as wind damage, earth slips and fires caused by lightning strikes.

Wetlands were much larger and more numerous than today, forming large interconnecting systems on the alluvial lowlands of the east coast and must have provided ideal habitat for wetland birds. Adams (1888) described extensive swamps at Colville and Waikawau Bay while Grayland (1969) reported flax mills at Whitianga and on the Waihou River. Originally, freshwater wetlands and swamp forest would have been found on poorly drained alluvial flats and valleys, particularly near estuaries and sand dunes. Small freshwater wetlands were also common on the

flatter valley floors of the eastern low country in Tairua ED and in small basins in coastal catchments. There are no records of the wetland flora of the region either prior to or during early European settlement, other than the mention of large flax swamps at Waikawau and Kennedy Bays, and at Whitianga.

The presence of large, pure flax swamps implies that the swamps were not permanently water logged, as flax tolerates only seasonal inundation (Thompson, 1987). Cabbage trees probably occurred amongst the flax swamps as they do in remnants today. There is little known of the original extent of different types of wetland. We surmise, from remnants today, that kahikatea and swamp maire stands formed marginal zones around flaxlands, reedlands and rushlands but were probably never extensive. Forest on alluvial terraces would have been predominantly of a coastal and semi-coastal type, with only restricted areas of podocarp forest on alluvial terraces in the upper Kauaeranga and Tairua Rivers.

2.8.2 PRESENT DAY VEGETATION

The "types" shown in brackets in the following section refer to detailed vegetation type descriptions in Appendix 1. The vegetation types are discussed under the broader headings of ecological classes.

Dunelands

Most sand dunes and spits have been modified by human activity through the introduction of adventive species, coastal subdivision and grazing or pine planting. Despite this, in some places on foredunes natural communities of spinifex and shorebindweed still occur with scattered pingao growing on the unstable dune front (type 3). On more stable rear dunes, pohuehue, knotted sedge, tauhinu and sand coprosma can be found (type 4). Historical accounts (Adams, 1888) indicate that a fringe of pohutukawa, karo, ngaio and occasionally parapara would have backed the dunes but no examples of this remain today. Parapara is now found only on the offshore islands of the Coromandel ER (Newhook *et al*, 1971).

Natural gravel beach communities are very rare, today they are usually dominated by adventive plants. One type found as a small remnant of *Suaeda novae-zelandiae* (type 8) was found at Wairotoroto River Mouth.

Estuaries

Estuaries and harbours have retained much of their natural character. Zonation of the vegetation communities follows drainage and salinity gradients. Eel grass (type 1) grows on alluvial flats below mean low tide with mangroves (type 2) in the tidal zone around the estuarine margins, especially at stream mouths where nutrient input is high. On the intertidal margins mosaics of sea rush and jointed rush grow with salt tolerant herbs between (type 5). Around the rushland, shrubs such as karamu and marsh ribbonwood grade into a marginal zone of manuka or manuka/sedge-shrubland (type 6).

Wetlands

The following descriptions have been compiled from observations of the remnants in the region. Fertile freshwater wetlands tend to

occur on poorly drained sites such as old river channels, estuary and lake margins and where slumping has blocked streams. They are dominated by varying amounts of raupo and flax, with *Baumea rubiginosa*, swamp millet, and *Blechnum minus*, *Carex geminata*, *Juncus* species, cabbage trees and karamu as frequent associates (type 14). Remnants of cabbage tree forest (type 15c) still occur as stands in or around wetlands on alluvial terraces which are now drained. Swamp maire (type 15a) and kahikatea (type 15b) are found today as scattered trees and very small remnants respectively.

A different type of wetland vegetation occurs on less fertile substrates such as those found at the inland ends of estuary arms. Manuka is a common component, usually found in varying amounts over *Baumea* sedges. In acid conditions umbrella fern, *Blechnum minus*, *B. tenax* and *B. juncea* occur, with the most acid sites having *B. teretifolia*, *Schoenus brevifolius*, umbrella fern and tamingi (type 13). On less acid sites the dominant sedge is *Baumea rubiginosa* with swamp millet, flax, cabbage tree, karamu and *Eleocharis acuta* with *E. sphacelata* as frequent associates.

Streams in the Coromandel ER support a range of aquatic algae, mosses and lichens. Aquatic plant associations are good indicators of stream quality and catchment history and were noted during the freshwater survey. Several catchments in the ER have been noted as of scientific interest due to the presence of certain algae found in upper catchments, elsewhere in the world the algae are almost wholly marine. Sparrow Stream is one such stream.

Coastal forest

There are 13 vegetation types found in the coastal zone. Of these, three are forest types. In the splash zone of exposed coastal cliffs and on small offshore islands and rock stacks New Zealand iceplant grows with other herbaceous and mat-forming species such as sea celery, batchelor's button, glasswort, *Selliera radicans* and *Samolus repens*. (type 7). Where there is sufficient soil, stunted pohutukawa, ngaio, taupata or karo may also be present. Pohutukawa rock treeland (type 10) grows on coastal cliffs and steep hillslopes and is usually modified to varying degrees by grazing. It is characterised by a canopy of large spreading pohutukawa over a sparse understorey and groundcover of flax, kawakawa, rangiora, karo, *Astelia banksii* and shining spleenwort. *Hymenanthera novae-zelandiae* occurs in this type on the offshore islands of the region.

Pohutukawa-broadleaved species forest (type 11) is the coastal type which probably most closely resembling the original coastal forest. The proportion of pohutukawa in the canopy is variable with coastal broadleaved tree species such as puriri, kohekohe, pigeonwood, mahoe, mapou, rewarewa, nikau and silverfern being found in varying proportions. Taraire, kowhai, wharangi, houpara and karaka are locally common in coastal forest, taraire being present only in the forests of Thames and Colville ED (type 17).

Lowland Forest

The lowland bioclimatic zone is the most extensive zone in the Coromandel ER, and there is wide variation in forest composition from the low (200-300 m) to the higher (500-600 m) altitudes. Tawa dominates the canopy with scattered, emergent northern rata, rimu and miro on hillslopes and ridges, and pukatea in the gullies.

Rewarewa, hinau, pigeonwood, mahoe, mamaku and towai are frequent associates. Kohekohe is abundant at lower altitudes and tawari becomes predominant at altitudes over 500m. Mangeao is an associate in Te Aroha ED. The understorey can be diverse and multi-tiered but varies with the history of human disturbance and intensity of goat browse. Common understorey shrubs and trees include kanono, mahoe, rangiora, hangehange, and tree ferns. (type 28).

Where the tawa forest has been modified by relatively recent or intensive logging, the canopy tends to be broken with an abundance of tree ferns such as mamaku and silver fern. (type 29) In places, especially at higher altitudes, towai becomes a significant feature of the canopy, varying in dominance with tawa. Associates are similar to those described above (type 30), but podocarps are usually not frequent if there has been an intensive or recent logging effort (type 31).

Kauri occurs as scattered individual trees throughout logged coastal and lowland forests, and as largely unmodified associations in the montane zone. In the past stands of dense kauri-tanekaha forest (Type 26) would have been very common and extensive, especially on well drained ridges and hillslopes. The tendency of kauri to podzolise the soil under large trees and dense stands results in a kauri association occurring distinct from the rata-podocarp/tawa forest matrix in which it occurs. Hard beech still occurs with kauri (type 27) in scattered locations in Colville and Thames EDs. Tairua up to an altitude of 600m. In the north-east of Te Aroha ED it is a common forest type and is regenerating kauri logging.

Podocarp forest occurs in the lowland zone on alluvial terraces adjacent to rivers. Characteristic species include totara, kahikatea, matai and kanuka in some districts, kanuka and lowland broadleaved species such as kohekohe, puriri and titoki depending upon proximity to the coast.

Montane forest

Montane forest occurs in all five ecological districts above around 600 m. The area varies within each district, as does the maximum altitude attained. Te Aroha has the highest at 952 m. Broadleaved tree species typical of the montane zone include towai (or kamahi in Te Aroha ED), tawari, tawheowheo, broadleaf and southern rata (type 34). Kaikawaka, toatoa, rimu, miro and kauri are frequent components, with kaikawaka and yellow-silver pine becoming locally dominant (type 36). Distinctive sub-canopy species can include horopito, mountain horopito, stinkwood, *Coprosma dodonaeifolia* (endemic to Coromandel ER), korokio and mountain neinei. Silver and red beech with tawari form a montane forest type peculiar to Te Aroha ED (type 37) and a variety of other species distinguish the montane zone in this ecological district.

A number of distinctive plug-like rock outcrops occur, mostly in the montane zone, along the length of the main divide from Moehau and Castle Rock in Colville ED to Wahine Rock in Te Aroha ED. The plant communities growing on them are variable according to exposure, altitude and thickness of soil, but often include *Phormium cookianum*, *Celmisia adamsii* var. *adamsii* and other shrubs and tussocks (type 40). A number of interesting plants, elsewhere uncommon in the Coromandel ER, occur on these including some

sub-alpine herbs such as snow totara x Halls totara, *Chionochloa conspicua*, *Coprosma dodonaefolia* and *Oreobolus pectinatus*.

Seral scrub/forest

The number of seral forest and scrub types identified (types 18-25, 32, 33, 38) reflects the varying degrees of disturbance to which the vegetation has been subjected. They also reflect the range of physical conditions over bioclimatic zones and ecological districts. The different scrub types identified during the survey are recognisable in the field but it should be recognised that they are particularly dynamic, seral communities. Often there is considerable overlap in associated species. The types may represent different stages in the succession to forest.

Coastal headland and hillslopes which have been cleared in the past support a broadleaved scrub (type 19) where kanuka and manuka are not the major canopy species. Common species are mamaku, silver fern, fivefinger, karo, mahoe, kawakawa, *Olearia townsonii*, kanono, karamu, *Hebe pubescens* var. *pubescens* and sapling pohutukawa. Inland broadleaf scrub communities also occur (type 20) but without coastal species. Associates are towai, *Pseudopanax disolour*, five finger, pate, kohuhu, mahoe, wineberry and a range of tree saplings.

Kanuka and manuka stands (types 22, 23, 24) indicate complete clearance of forest cover often where burning has occurred. Manuka is found over a wide altitudinal range on less fertile soils whilst kanuka prefers the more fertile and alluvial sites at lower altitudes; sometimes the canopy is formed from a mixture of both (type 23). Both kanuka and manuka scrub have a dense canopy and sparse ground layer of ferns, mosses, sedges and tree seedlings. Kanuka and manuka do occur with high proportions of broadleaved scrub and tree species (types 22 and 25) in the canopy such as towai, rewarewa, karamu, rangiora, mapou, heketara, tutu and tree saplings. An additional manuka type was recognised where rewarewa regeneration is abundant and emergents overtop the manuka canopy (type 21). Localised kauri-tanekaha and other podocarp regeneration can be found throughout any of the scrub types above. In the case of kauri usually along ridges on infertile soils. Prickly hakea, willow-leaved hakea (in Waihi ED), gorse and pines are common in all the above scrub types.

Towai scrub (type 32) is present over a wide range of altitudes, it is not common in Colville ED but becomes more so further south. Towai reaches its southern limit in Waihi ED. Where it is replaced by kamahi, there is considerable variation in the species forms north and south of Karangahake. At low altitudes associate species include kanono, rewarewa, gully fern, silver tree fern, five finger and tree saplings. At higher altitude montane species begin to appear such as *Coprosma dodonaefolia*, tawheowheo, broadleaf, *Pseudopanax laetus*, *P. colensoii*, yellow silver pine and mairehau. This towai scrub grades into upland rocky bluff vegetation (type 40) and the montane tawari-towai-tawheowheo scrub (type 34) over 550m which has the above associates plus southern rata, snow totara x Halls totara hybrids and *Dracophyllum traversii* among others.

Kamahi scrub (type 33) replaces towai scrub in Te Aroha ED being most common of the eastern side of the Kaimai Range, areas are not extensive due to little vegetation clearance. A number of scrub and

regenerating tree species occur in the kamahi understorey such as rangiora, kohekohe, silver tree fern, pigeonwood, heketara and tawari. An upland scrub type dominated by kanono with mahoe, pigeonwood, pepperwood, *Pseudopanax laetus* and Smith's tree fern (type 38) occurs only in the Te Aroha ED.

2.9 FAUNA

The Coromandel ER is nationally significant as habitat for New Zealand's native fauna with many species present being nationally threatened. Being a mountainous peninsula it has a wide range of habitats from rocky coastline, offshore islands and coastal forest, large estuaries with associated sandy beaches, dune systems and alluvial wetlands to lowland and montane forest and scrub.

As discussed in Section 2.6 and 2.9.1, over centuries wildlife habitats in the Coromandel ER have been modified, destroyed or reduced. Species such as moa, huia, tuatara and fur seals once common on the mainland have become extinct. A number of nationally threatened species inhabit the Coromandel ER many of these are present in low numbers and could be disappearing from the ER; these include the nationally threatened NI kokako, NI kaka, NZ dotterel, brown teal, red-crowned parakeet, NI falcon, lesser short-tailed bat and long-tailed bat (see Table 1). A high proportion of the ER, however, retains a natural or semi-natural vegetation cover and provides habitat for a significant range of wildlife, even if not the original assemblages.

The large forest area of the Coromandel ER which still exists today has been designated as outstanding fauna habitat by the FSU of the Wildlife Service (see Appendix VI). There is an almost continuous tract of forest from Moehau to the Karangahake Gorge where there is a small break, and then southwards through the forests of the Kaimai Range linking up with the Mamaku Plateau. This forest supports a wide range of birds (Appendix III). Scattered populations of the endangered kokako are known but they have not been surveyed recently. Kaka, red-fronted parakeet and falcon are occasionally seen in the Coromandel ER but they are present in low numbers. Threatened NI brown kiwi live in a range of habitats from coastal to lowland forest and scrub, reports of kiwi from the ER are scattered and information is lacking. New Zealand's only native mammals, bats, have been recorded in old mines and in forest. The species most commonly recorded is the threatened long tailed bat.

Large populations of regionally threatened Hochstetter's frogs are found on the margins of streams in some catchments, with stable substrates and banks. This frog is found as disjunct populations in the NI with records from Pureora and East Cape and scattered as far north as Whangarei. At higher altitudes, on the forest floor, Archey's frog is found. It is endemic to the Coromandel ER and is regionally threatened; its southern limit is around the Waitekauri Valley. Archey's frog has not been recorded from Te Aroha ED.

Lizards, geckos and skinks occupy a wide range of habitats from coastal to sub-montane forest with rat-free offshore islands being the best habitat. Records are not comprehensive. Common skinks are found on beaches and in coastal areas around the peninsula. There is a record for the threatened Whittaker's skink in the ER, regionally threatened Duvaucel's gecko has been found in Thames ED and, until recently, tuatara were present on islands off Whangamata.

The large, biologically productive estuaries and their associated lagoons, sand dune systems, salt and freshwater wetlands provide habitat for a range of important wildlife. Many of the estuaries are notable for their large areas of eelgrass and highly productive shellfish beds which provide food for wading birds. Estuaries, mangroves and rushlands provide spawning grounds for fish. Resident and migratory birds use the coastal zone for feeding, breeding and moulting. These include shag, heron, gull, black swan, gannet, South Island pied oyster catcher, wrybill, eastern bar-tailed godwits, turnstones, lesser knots and pied stilts. Nationally important resident and migrant birds include Caspian tern, black fronted tern, variable oystercatcher, banded dotterel, NZ dotterel, sanderling and even occasional endangered black stilt and visiting Royal spoonbill (see Table 1). Small offshore islands support populations of grey-faced petrels which, on some, are still collected but muttonbirders. These birds are no longer present on the mainland but were in the past.

Freshwater wetlands and riverine habitats are probably the most altered and reduced in size but still form an important habitat for a number of species such as the threatened Australasian bittern, banded rail, regionally threatened fernbird and the shy spotless crane. Fernbird are interesting in that they inhabit a range of wetland and shrubland communities, often seral, being found from sea level to about 750 m asl but only as localised populations. Brown teal bred on a few rivers in the Colville ED but breeding has not occurred since 1971, although the birds are still present in low numbers.

Aquatic Invertebrates

The Coromandel freshwater invertebrate fauna does not contain any elements unique to Coromandel. The dominant species are widely distributed elsewhere in New Zealand. The less common species also occur in the Waitakere Ranges but are very sparsely distributed.

Many of these uncommon species are restricted to undisturbed, forested headwaters by requirements for cool, low nutrient conditions - a limited habitat in the North Island today with conversion to pines and the destructive influences of farm stock, feral goats and possums. Destruction of understorey by animals and other clearance of vegetation increases soil erosion during storms and results in sedimentation which reduces the amount of habitat within the stream bed (Penny 1987, 1987b).

The macroinvertebrate community is robust in terms of diversity. No pattern emerged in the distribution of different macroinvertebrate taxa with respect to geology, stream bed gradient, stability or size as a result of survey. The two most frequently collected groups were filter feeders, which feed on suspended particles, whilst the others are generalist, collector gatherers and predators. Specialist detritivore communities were not found. A core group of taxa which are common at forested sites throughout New Zealand were found at over half the sample sites but three other groups were more common (see Appendix X).

Aquatic Vertebrates

The data for freshwater fish within the Coromandel ER are by no means comprehensive. Records for 20 fish species (Appendix III)

have been obtained from site specific surveys over short sections of rivers and streams, seldom more than three sites per stream, but collected over several decades. Habitats surveyed were usually lower catchments where access is easier. Recent surveys in the mid to late 1980s sampled the rugged upper catchments of the major rivers including Coromandel fish populations to conform to the zoogeography of fishes in New Zealand.

Of the species recorded to date, long finned eels were the most common, followed by the red finned and common bullies, banded kokopu, torrent fish and short finned eels. Species only occasionally recorded were smelt, inanga, crans bully and koaro. Those seldom recorded were blue gilled bully, giant bully, giant kokopu and the short jawed kokopu. There is one report for lamprey and black mudfish.

All of the indigenous species recorded except black mudfish, are diadromous, that is they regularly spend a part of their life cycle in the sea. Migratory passage to and from the estuaries and coastal environs is therefore crucial to their existence. Many of the water courses on the Coromandel, particularly those on the west coast, have a steep gradient with numerous natural waterfalls and cascades. Others have been modified by the construction of fords and culverts. Often these become a barrier to upstream migration of fish, however, they can be constructed in such a way as to allow passage of fish. Penetration beyond either natural or artificial barriers is restricted to those species that are adept climbers, like the banded kokopu, koaro and the long finned eel.

The presence of exotic fish influences native fish through competition for food, space and by predation. Trout have been introduced into many of the larger Coromandel rivers and streams from the mid to late 1800s onwards in an attempt to establish self-sustaining populations for recreational angling. Although the practice of haphazard releases has stopped, at least one river system, the Waiwawa, is being stocked on a regular basis. This benefits recreational fishing at the expense of indigenous species.

The Coromandel is noted for its warm summer temperatures and for its intense local downpours. Both geology and climate influence the presence of fish and the various combinations of geology, flows, water depth, air temperature, shading by riparian vegetation and instream organic debris which make up native fish habitat.

Although the naturalness of many of the Coromandel waters has been compromised by historical events, such as mining and logging and current human activities, rivers and streams can rehabilitate themselves given the opportunity. Similarly the more adaptable of our native fish fauna will recolonise suitable habitats as conditions improve. Some species, however, are likely to disappear if their preferred habitat lost. The giant kokopu, a species of the lowland, slow moving streams with stable, vegetated riparian margin is one example. As estuarine margins are developed for agriculture whitebait, the juvenile form of inanga and banded kokopu, lose their spawning habitat.

Table 1 following lists the national conservation status of important plant and animal species occurring within the Coromandel ER.

TABLE 1:

**Rare and Endangered Species, Species at their Limits of
Distribution and Endemic to the Mainland EDs²
of the Coromandel ER**

A. FLORA

1. Unusual Plants and Their Status (Given et al 1987)

	Ecological Districts Known to Occur in				
	Colville	Tairua	Thames	Waihi	Te Aroha
PROBABLY EXTINCT					
<i>Trilepidea adamsii</i>			A		
ENDANGERED					
<i>Celmisia gracilentia</i> var.	CS	D	B,Bu		
<i>Clianthus puniceus</i> (Cheeseman, 1925)			*		
VULNERABLE					
<i>Carmichaelia williamsii</i> (offshore islands)	E				
<i>Dactylanthus taylorii</i>			C		
<i>Lepidium oleraceum</i> (offshore islands)	E		K		
<i>Myriophyllum robustum</i>				Or	Be
<i>Phylloglossum drummondii</i> (Adams 1883)					
<i>Pimelea arenaria</i>		R			
<i>Pittosporum virgatum</i>	Bu	Bu			
<i>Rorippa gigantea</i> (Kirk 1870)					
RARE					
<i>Brachyglottis myrianthos</i>	Ad	PNA	D		
<i>Pisonia brunoniana</i> (offshore islands)	E,N				
<i>Teucrium parvifolium</i>		*?	D		
<i>Marattia salicina</i>	RBS	Bu	A	*	Ni
<i>Desmoschoenus spiralis</i>	D	B,D		BD	
<i>Fuchsia procumbens</i>	M				
<i>Myoporum laetum</i> var. <i>decumbens</i>	PNA				
LOCAL					
<i>Metrosideros carminea</i>	CS	PNA	D	M	PNA
<i>Loxoma cunninghamii</i>	PNA	Bu	A	*	Ni
<i>Pomaderris rugosa</i>		O	D	PNA	
INDETERMINATE (Insufficient information to determine which of the above categories species fall into)					
<i>Calystegia marginata</i> (Cheeseman 1923)			*		
<i>Utricularia monanthos</i>			PNA		

Two further species could be considered rare as they are mainly
or wholly restricted to offshore islands (Atkinson 1968):

Planchonella costata
Streblus banksii

A = Adams (1884; Ad + Adams (1888); Au = Authors observations; B = Bartlett (1978); BD = Botany Division (unpublished); Bu = Burns (1984a, 1984b, 1985a, 1985b); C = Cheeseman (1923); CS = Clarkson and Smale (1987); D = Druce (1983); E = Esler (1978); N = Newhook et al (1971); Ni = Nicholls (pers. comm); O = Ogle (1976); Or = Orchard (1979); * = record from public; M = Miller, RBS = Rotorua Botanical Society; PNA = PNA team, Be = Beadel, S N.

² Mainland Ecological District includes offshore islands that occur within the five mainland EDs.

2. Species Reaching Their Limits of Distribution in Mainland EDs of Coromandel ER

SOUTHERN LIMITS

<i>Halocarpus kirkii</i>	Tairua 37 05' (Druce 1972), found in Kauaeranga Valley (Bartlett 1978 and Druce 1983).
<i>Loxoma cunninghamii</i>	Tairua
<i>Pittosporum umbellatum</i>	Thames, Waihi, north of 37 40' (Druce 1972)
<i>P. virgatum</i>	North of 36 40' (Druce 1972), Tairua
<i>Pseudopanax discolor</i>	Te Aroha/Waihi (Druce 1982)
<i>Sticherus flabellatus</i>	Thames
(North Island limit only)	Tairua
<i>Weinmannia racemosa</i> var.	Te Aroha (Wardle 1966)
(<i>W. silvicola</i>)	[also further south in Raukaumara-East Cape area there are forms keying to this variety (see Wardle 1966)]

NORTHERN LIMITS

Species	District if Known
<i>Aporostylis bifolia</i>	Colville (G) (Te Moehau)
<i>Carpha alpina</i> s.s.	Colville (G) (Te Moehau)
<i>Celmisia incana</i>	Colville (G) (Te Moehau)
<i>Coprosma colensoi</i>	Colville (G) (Te Moehau)
<i>C. foetidissima</i>	Colville (G) (Te Moehau)
<i>Cordyline indivisa</i> (Moore, 1973)	Colville (G) (Te Moehau)
<i>Cyathodes empetrifolia</i>	Colville (G) (Te Moehau)
<i>Epilobium brunnescens</i> s.s.	Colville (G) (Te Moehau)
<i>Gaultheria</i> sp. (<i>G. depressa</i> var.	Colville (G) (Te Moehau)
<i>novae zelandiae</i>)	(G) (?)
	Colville
<i>Hymenophyllum villosum</i>	(G) (Te Moehau)
<i>Juncus novae-zelandiae</i>	(G) (Te Moehau)
<i>Kellaria dieffenbachii</i>	(G) (Te Moehau)
<i>Libocedrus bidwillii</i>	(G) (Te Moehau)
<i>Luzuriaga parviflora</i>	(G) (Te Moehau)
<i>Nothofagus fusca</i> (mainland limit only)	Te Aroha
<i>N. menziesii</i> (mainland limit only)	Te Aroha
<i>Oreobolus pectinatus</i>	(G) (Te Moehau)
<i>Ourisia colensoi</i>	(G) (Te Moehau)
<i>Parahebe catarractae</i> ssp <i>lanceolata</i>	(GJ) Colville
	Colville
<i>Pentachondra pumila</i>	(G) (Te Moehau)
<i>Phyllocladus asplenifolius</i> var. <i>alpinus</i>	(G) (Te Moehau)
<i>Pimelea buxifolia</i>	(Adams, 1883) Tairua
	Colville
<i>Poa colensoi</i>	(G) (Te Moehau)
<i>Podocarpus cunninghamii</i> x	
<i>P. nivalis</i> (Moore)	(G) (Te Moehau)
<i>Rytidosperma setifolium</i>	(G) (Te Moehau)
<i>R. viride</i>	(C) (Tairua)
	(The Pinnacles)
	Colville
<i>Uncinia rupestris</i>	(G) (Te Moehau)
<i>Weinmannia racemosa</i> var. <i>racemosa</i>	(Wardle, 1966)
	Te Aroha

G = Gardner and Smith-Dodsworth, 1985; GJ = Garnock-Jones and Langer, 1980;
C = B D Clarkson, pers comm.

3. Species Endemic to Coromandel ER (from Ecroyd and Nicholls, 1979)

Celmisia gracilentia var.
Coprosma dodonaeifolia (extends
 further south of Te Aroha ED along
 the Kaimai Range)
Dracophyllum patens

Hebe pubescens var. *pubescens*
Pomaderris rugosa
 (rare records are also known from
 just outside the region)

Brachyglottis myrianthos (found in Coromandel Ecological Region, Puketi
 State Forest and in the Maungataniwha Ecological Region.

B. FAUNA

(Information source: Fauna Survey Unit, unpublished,
 unless otherwise referenced)

1. Endangered, Threatened and Rare Fauna in Mainland EDs of Coromandel ER (status from Bell 1986)

ENDANGERED

Invertebrates

Dorcus auriculatus

Birds

NI kokako

Black stilt

White Heron

Brown teal

THREATENED

Mammals

Long-tailed bat

Short-tailed bat (unconfirmed)

Birds

Australasian bittern

NZ dabchick

NZ brown kiwi

Banded dotterel

NZ dotterel

NI kaka

Banded rail

NI falcon

Reef heron

Caspian tern

Royal spoonbill

Black-fronted tern

Reptiles

Whitaker's skink

REGIONALLY THREATENED

Birds

NI fernbird

red-crowned parakeet

NI robin

Amphibians

Archey's frog

Hochstetter's frog

Reptiles

Tuatara (probably extinct)

Duvaucel's gecko

RARE

Birds

Long-tailed cuckoo

Red-necked stint

Sanderling

Variable oystercatcher

INDETERMINATE

Fish

Black mudfish

Giant kokopu

Short-jawed kokopu

2. Distributional Limits in Coromandel Ecological Region

NORTHERN

Birds

NI robin

NI rifleman

Whitehead

Invertebrates

Lissotes reticulatus (flightless stag beetle) (Butcher, 1987)

3. Species Endemic to Coromandel Ecological Region

Amphibians

Archey's frog

Invertebrates

Dorcus sp. (flightless stag beetle) (a new, undescribed species, to date only known from Mt Moehau, Butcher, 1987)

D. auriculatus (flightless stag beetle)

Paracharopa goulstonei (land snail) (Climo, 1983)

3. COLVILLE ECOLOGICAL DISTRICT

S U M M A R Y

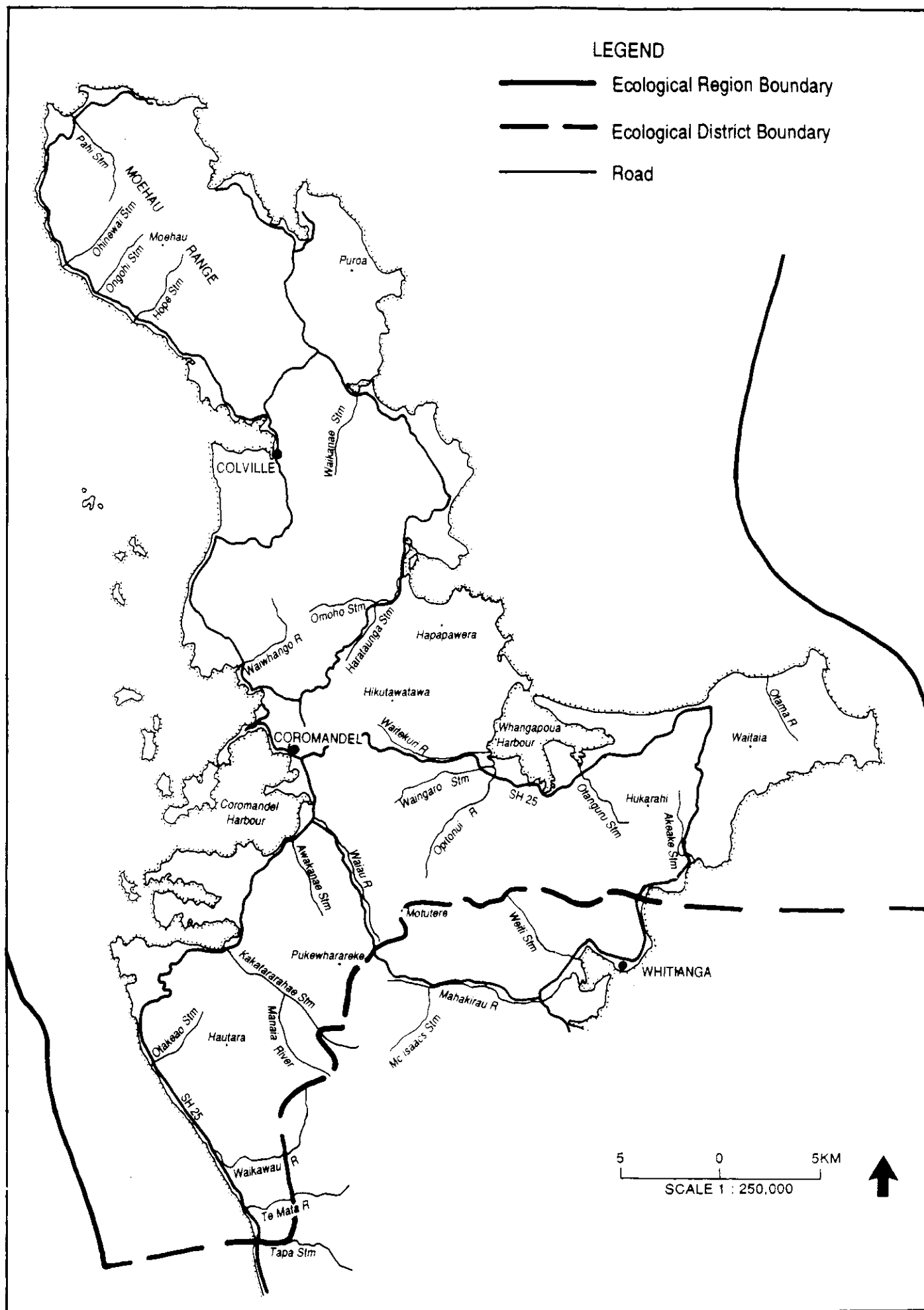
Colville Ecological District (ED) covers the northernmost part of the Coromandel Peninsula from Cape Colville south to Tapu on the west coast and includes Whangapoua Harbour and the Kuaotunu Peninsula on the east coast. The ED includes Te Moehau in the north and a number of other peaks on the main Coromandel Range including Tokatea, Kaipawa, Castle Rock and Motutere (see Fig 3). Underlying geology is complex with basement greywacke and a range of volcanic andesites, basalt and porphyntes.

The natural vegetation of Colville Ed includes remnant coastal forest, dunelands, estuarine wetlands and remnant freshwater wetlands (see Table 4). Lowland forests are still extensive but have mostly been modified by logging. Large mature kauri are no longer common but some scrub areas support good kauri regeneration. Montane areas support a number of notable plant species and communities (see Table 2 and Section 3.1.5). For more information on vegetation change see Table 4.

A high diversity of wildlife is present in the Colville ED despite the degree of modification including a number of threatened species such as NI brown kiwi, NI kaka and NZ dotterel (see Table 3).

4200 ha of land lies within existing Protected Natural Areas (PNAs) and accounts for about 5% of the total ED. Moehau EA is the largest PNA, there are also a small number of scenic reserves (for more details see Regnier 1987 and Table 4). A major deficiency in the reserves of Colville ED is the inadequate representation of coastal ecosystems. Estuarine and freshwater wetlands, sand dunes, offshore islands currently have virtually no protection. Some small coastal reserve protect modified coastal forest but very little of the remaining good pohutukawa forest of the ED. The kauri element in lowland forests and the rocky bluff communities in the district require further protection.

A total of 22 areas have been recommended for protection with most lying in the coastal zone. The greater area recommended for protection is on Crown administered land but some is privately-owned.



COLVILLE ECOLOGICAL DISTRICT



**COLVILLE ECOLOGICAL DISTRICT
BIOCLIMATIC ZONES**

3.1 ECOLOGICAL CHARACTER

3.1.1 RELIEF

Colville ED is the northernmost portion of the Coromandel Peninsula (see Fig 2). The Moehau Range runs in a northwest to southeast direction along the extremity of the peninsula, reaching a height of 892 m. Long ridges and numerous steep streams radiate out to the coast on the northern, eastern and western flanks. The southwards extension of the main range is lower with few points above 430 m, and the terrain is moderately steep.

Harbours and estuaries are a distinctive feature of both the east and west coasts. Sandspits and beaches have formed at the heads of wide bays on the eastern side of the ED, while in the west and north bays are smaller and beaches usually of shingle. Elsewhere the coastline is steep and rocky with offshore islands particularly at the mouth of the Coromandel Harbour.

3.1.2 GEOLOGY

[Source: Skinner, 1986]

At the northern end of the peninsula, tilting to the south has exposed the basement greywacke forming most of the Moehau Range. The oldest volcanic rocks of the Coromandel Group, the Port Charles andesites, overlie this and form the peak of Little Moehau and the lower eastern slopes of the range. A sub-volcanic magma reservoir (Paritu Pluton) intrudes the andesite formation and is exposed between Fantail Bay and Hope Stream on the western flank of Te Moehau. This structure is unique amongst the Tertiary (younger) volcanic regions of New Zealand. Smaller blocks of greywacke are exposed throughout the district amongst the younger andesite and dacite formations of the Kuaotunu sub-group.

3.1.3 CLIMATE

The close proximity of most of the district to the sea results in a mild oceanic climate. The district is relatively narrow and generally lower in relief than elsewhere on the Coromandel Peninsula. The moderating influence of the sea appears to extend further inland than in other districts, resulting in a relatively extensive coastal bioclimatic zone. The winters tend to be mild, the summers warm and humid. Summer droughts can occur. Rainfall is 1250-2800 mm pa and fairly evenly spread through the year.

Te Moehau, the highest peak in Colville ED is subject to different weather conditions. Rapid changes can occur and there is exposure to the full force of the prevailing south-west winds and the less frequent but often more violent north-east storms of tropical origin. The sub alpine character of the vegetation on Te Moehau summit reflects these harsh conditions. Snow has been known to fall on the summit occasionally. Low cloud often lies over Te Moehau making conditions boggy and this cloud effect is reflected in the vegetation (Cranwell and Moore 1936).

3.1.4 SOILS

Various phases of yellow-brown earths and brown granular clays occur on the varied topography of the district ranging from floodplains, to rolling, hilly and steepland country. Further differences arise with the range of parent materials which includes greywacke, andesite of various ages, rhyodacite and granodiorite. On the greywacke blocks, for example, Te Ranga steepland soils (related to yellow-brown earths) occur with Marua and Rangiora hill soils (yellow-brown earths) on less steep slopes. These soils are all of medium to low fertility. Throughout most of the district soils are largely derived from andesitic parent rock giving Waitakere and Rangiora hill soils (brown granular clays) and associated Aroha and Te Kie steepland soils.

3.1.5 VEGETATION

Te Moehau rises steeply through coastal and lowland zones to the montane zone and the 892m summit. The vegetation in the broad coastal zone has been considerably modified. Forest on the coastal flats and hills has been cleared and burnt, leaving only small, isolated forest remnants and large areas of regenerating kanuka and manuka scrub. The best remaining examples of coastal forest include Potiki Bay, Fantail Bay, Stony Bay, Kennedy Bay, the Kuaotunu Peninsula and Papaaroa. The vegetation of the zone occurs only as remnants of tawa with puriri, kohekohe, taraire, rata and local kauri. Around Te Moehau it probably extended up to 300 m, and may once have been more distinctive.

Coastal forest and scrub on offshore islands is similar in composition to the remaining mainland vegetation, but parapara, tawapou, whau and ngaio are still common whereas they are of limited occurrence in mainland forests.

Kauri probably occurred in the coastal forest in Colville ED as shown today by its presence in Stony Bay. At Potiki Bay a "very unusual overlap in the range of kauri, taraire, pohutukawa and hard beech" occurs (Nicholls, 1972). Ngaio was probably once common as indicated by remnants on Maungatawhiri (Wright, 1975) and from Adams' (1888) accounts of coastal forest composition. Hybridisation of northern rata with pohutukawa occurs in the transition zone between the coastal and lowland zones such as can be seen on the upper slopes of the Kuaotunu Peninsula.

The semi-coastal zone distinguished in some other ecological districts in the Coromandel ER was not distinct in terms of vegetation. Due to the more peninsular and steep nature of the Colville ED the coastal influence on vegetation extends some way inland and changes rapidly to lowland vegetation.

Dunelands, estuaries and wetlands have also been modified. The freshwater wetlands remaining today are an estimated 10% of their former extent, the large flax swamps at Waikawau and Colville Bays having long since been milled and drained. Remnants of flax, raupo and sedges do occur behind Kennedy Bay and in the Waingaro Stream, but elsewhere they are small and modified. The fore and rear dune systems at Otama and Waikawau Bays resemble their natural state, but in other places they have been altered and reduced in extent through coastal subdivision, adventive species, pine planting, dune stabilisation and reclamation for grazing, all of which are continuing threats.

TABLE 2:

Important Plants in Colville Ecological District A Provisional List

VULNERABLE

<i>Celmisia adamsii</i> var. <i>adamsii</i> (endemic) <i>Carmichaelia williamsii</i> (offshore islands) <i>Lepidium oleraceum</i> (offshore islands)	<i>Pittosporum virgatum</i>

RARE

<i>Desmoschoenus spiralis</i> <i>Brachyglottis myrianthos</i> <i>Marattia salicina</i>	<i>Myoporum laetum</i> var. <i>decumbens</i> <i>Pisonia brunoniana</i>

LOCAL

<i>Metrosideros carminea</i> <i>Loxoma cunninghamii</i>	<i>Pomaderris rugosa</i> (endemic)

SPECIES ATTAINING THEIR NORTHERN LIMITS OF DISTRIBUTION IN COLVILLE E.D.

<i>Aporostylis bifolia</i> <i>Carpha alpina</i> <i>Celmisia incana</i> <i>Coprosma colensoi</i> <i>C. foetidissima</i> <i>Cordyline indivisa</i> <i>Cyathodes empetrifolia</i> <i>Kelleria dieffenbachii</i> <i>Epilobium brunnescens</i> ssp. <i>brunnescens</i> <i>Gaultheria</i> sp. " <i>novae-zelandiae</i> " <i>Hymenophyllum villosum</i>	<i>Juncus novae-zealandiae</i> <i>Libocedrus bidwillii</i> <i>Luzuriaga parviflora</i> <i>Oreobolus pectinatus</i> <i>Ourisia colensoi</i> <i>Parahebe catarractae</i> ssp. <i>lanceolata</i> <i>Pentachondra pumila</i> <i>Phyllocladus asplenifolius</i> var. <i>alpinus</i> <i>Poa colensoi</i> var. <i>breviligulata</i> <i>Rytidosperma setifolium</i> <i>Uncinia rupestris</i>

The practice of driving kauri logs down rivers into the estuaries and harbours must have altered the original vegetation and the sedimentation patterns and rates. Estuaries and harbours such as Whangapoua, Te Kouma and Manaia have however retained much of their original character and still support mangroves, eel grass and rushlands.

The lowland zone confined to the slopes of the main range is more intact than that of the coastal zone, however most has been logged to some extent and continues to be heavily grazed by feral cattle and goats. On Te Moehau the forest more closely resembles the original and is almost continuous. In places it extends to the coastal zone; for example, Fantail and Stony Bays. The southeastern tract of forest continuing into Thames ED was logged relatively recently, and is generally more highly modified. Kauri would have been locally common (Cranwell and Moore, 1936) with local hard beech in eastern forests below 300 m (Nicholls 1980a). Much of the lowland zone in the southern end of the district is now planted in pine forest.

Montane vegetation occurs above 600 m only on the Moehau Range in Colville ED. The forest around the Te Moehau summit is wind-shorn and stunted, and the soils continually wet and boggy. Rimu, occasional kauri and miro occur in association with the usual montane broadleaved species and kaikawaka above 750 m. A sub-alpine herbfield occurs on the summit (Burns, 1985). Many of the species found here are locally rare and do not occur further north or to the south until Mt Hikurangi, 270 km to the southeast. A list of rare species or species of distributional significance is given in Table 2.

Probably as a result of browsing pressure by goats and cattle (Moore and Cranwell, 1934) the summit vegetation has deteriorated from the dense scrub noted by Adams (1888) to a grassland dominated by bush rice grass.

3.1.6 FAUNA

[Source: Regnier, 1987 unless otherwise stated]

A high diversity of wildlife is still found in Colville ED despite the degree of modification. Throughout the district extensive forested areas, especially in the north and south, provide habitat for common birds such as pigeon, fantail, silvereye, grey warbler, tui, bellbird and pied tit as well as more notable species such as NI brown kiwi and NI kaka. NI kokako and native parakeet no longer occur in Colville ED. Invertebrates such as the flightless stag beetle [*Dorcus* sp; an undescribed species with unknown distribution on the Coromandel (Butcher, 1987)] and land snails are found in forest habitats of Moehau. The long-tailed bat is almost certain to occur but its presence has not yet been confirmed. Of the reptilian fauna, skinks, such as the shore skink, are known from the shingle beaches.

Riverine habitats are particularly important in Colville ED due to the presence of the endangered brown teal. The only known important freshwater fish species in the rivers and streams of the district is the giant kokopu (Fisheries Research Centre, unpublished). A range of more commonly occurring fish species is present (see Appendix VI).

TABLE 3 :**Important Fauna in Colville Ecological District****ENDANGERED****Birds**

White heron

Brown teal

Invertebrates*Dorcus auriculatus* (flightless stag beetle)**THREATENED****Mammals**

Long-tailed bat (unconfirmed)

Birds

Australasian bittern

Banded dotterel

Banded rail

Caspian tern

NI brown kiwi

Royal spoonbill

NI kaka

NZ dotterel

NI falcon

Reef heron

Black-fronted tern

Amphibians

Archey's frog

Hochstetter's frog

REGIONALLY THREATENED**Birds**

Cook's petrel

RARE**Birds**

Variable oystercatcher

NI fernbird

Invertebrates*Geminoropa cf microrhina* (land snail) probably rare*G. huttoni* (land snail) probably rare**LOCALLY RARE****Invertebrates***Loama pirongianensis* (land snail)**RESTRICTED DISTRIBUTION****Birds**

Buller's shearwater

Invertebrates*Mecodema* sp. (carabid beetle) (restricted to Coromandel Ecological Region)**INDETERMINATE****Fish**

Giant kokopu

Estuarine, sand dune and beach habitats are also important wildlife features of Colville ED with large numbers of waders and shore birds (eg NZ dotterel, banded dotterel, reef heron, pied stilt, pied shag, Australasian bittern) using the harbours, bays and river mouths. The few freshwater wetlands that remain around the estuaries provide habitat for NI fernbird, spotless crane, Australasian bittern and grey and mallard duck.

Sea birds, petrels and shearwaters, do not breed on the main land now although they do on the offshore islands [eg whitefaced storm petrels on Cow and Motuokino Islands (Esler, 1977)]. Australasian gannets have bred on islands of the Motukahaua Group for some time (Fleming and Wodzicki, 1952 and Esler, 1977).

Nationally significant wildlife present in Colville ED is given in Table 3.

TABLE 4 : Colville Ecological District - Standard Ecological Units

BIOCLIMATIC ZONE	HYDROLOGIC SYSTEM	VEGETATION TYPE	E C O L O G I C A L U N I T	LANDFORM TYPE	FORMER EXTENT (of veg type)	CHANGE	PRESENT EXTENT	PROTECTION STATUS
coastal	estuarine	eelgrass		tidal flat	common	same	common	1
coastal	estuarine	mangroves		tidal flat	common	same	common	1
coastal	estuarine	<i>Juncus maritimus</i> - <i>Leptocarpus similis</i> rushland		tidal flat	minor	reduced	minor	1
coastal	estuarine	<i>manuka/Leptocarpus similis</i> rush-shrubland		tidal flat	common	reduced	minor	2
coastal	terrestrial	spinifex-shorebindweed sandfield		foredune	minor	reduced	minor	1
coastal	terrestrial	pohuehue-knotted sedge rush-vineland		foredune/rear dune	minor	reduced	minor	1
coastal	terrestrial	iceplant rockfield		cliff/rock stack	common	same	common	1
coastal	terrestrial	coastal flax cliff community		cliff/hillslope	common	reduced	remnant	1
coastal	terrestrial	coastal broadleaved species scrub		hillslope	common	reduced	minor	2
coastal	terrestrial	pohutukawa rock treeland		cliff/hillslope	common	reduced	minor	2
coastal	terrestrial	pohutukawa broadleaved species forest		hillslope/ridge/gully	major	reduced	minor	1
coastal	terrestrial	pohutukawa modified forest		hillslope/ridge/gully	minor	reduced	common	3
coastal-lowland	palustrine	manuka/Baumga species sedge-shrubland		alluvial flat	common	increased	remnant	1
coastal-lowland	palustrine	raupo-flax reedland		basin/alluvial flat & terrace	common	reduced	remnant	1
coastal-lowland	terrestrial	alluvial terrace forest		alluvial terrace	common	reduced	remnant	1
coastal-lowland	terrestrial	taraire-broadleaved species forest		hillslope/ridge/gully	common	reduced	minor	3
coastal-lowland	terrestrial	manuka scrub		hillslope/ridge/gully	minor	increased	major	4
coastal-lowland	terrestrial	manuka-broadleaved species scrub		hillslope/ridge/gully	minor	increased	major	4
coastal-lowland	terrestrial	kanuka-manuka forest		hillslope/ridge/gully	minor	increased	common	4
coastal-lowland	terrestrial	kanuka forest		hillslope/ridge/gully	minor	increased	remnant	3
coastal-lowland	terrestrial	kauri-tanekaha forest		ridge/hillslope	common	reduced	remnant	1
coastal-lowland	terrestrial	hardbeech-kauri forest		ridge/hillslope	common/minor	increased	minor	1
coastal-lowland	terrestrial	rewarewa/manuka scrub		hillslope/ridge/gully	minor	reduced	remnant	1
lowland	terrestrial	lowland swamp forest		basin/alluvial flat & terrace	minor	reduced	remnant	1
lowland	terrestrial	lowland broadleaved species scrub		hillslope/ridge/gully	minor	increased	min/com	2
lowland	terrestrial	(rata-podocarp)/tawa forest		hillslope/ridge/gully	major	reduced	common	3
lowland	terrestrial	(rata-podocarp)/modified forest		hillslope/ridge/gully	minor	increased	major	4
lowland-montane	terrestrial	(rata-podocarp)/towai-tawa forest		hillslope/ridge/gully	common	reduced	minor	5
lowland-montane	terrestrial	towai-tawa forest		hillslope/ridge/gully	common	reduced	minor	5
lowland-montane	terrestrial	towai scrub		hillslope/ridge/gully	minor	reduced	minor	1
lowland-montane	terrestrial	upland rocky bluff community		bluff/pinnacle	minor	same	minor	2
montane	terrestrial	towai-tawari-tawheowheo forest/scrub		hillslope/ridge	common	reduced	minor	5

PROTECTION STATUS: 1 = not represented within existing PNAS 2 = much less than 10% of former extent protected 5 = well represented within existing PNAS
 3 = less than 10% of former extent protected 4 = adequately protected

3.2 EXISTING PROTECTED NATURAL AREAS

Eighteen protected natural areas, totalling 4200 ha, cover approximately 5% of the ecological district. For a breakdown of ecological units protected in PNAs see Table 4 and for a list of the special features of the flora and fauna refer to Regnier (1987). Moehau EA makes up a large proportion (86%) of the total protected land and includes the only example of the montane zone in the district.

Two small reserves occur in lowland zone, one on volcanic rock and the other on greywacke. These, together with Moehau EA protect approximately 7% of the zone, but the full range of volcanic rock types, alluvial flats and lowland areas of relatively easier relief is very poorly represented in the existing PNA network.

Thus a major deficiency in the reserve system is the inadequate representation of vegetation of the coastal zone. This zone, as mentioned in the previous section, accounts for a significant proportion of the total area of the district. Present day total of coastal forest remnants are approximately 8% of their former extent, thus the opportunity for achieving a 10% level of protection has already been lost.

3.3 FURTHER REQUIREMENTS TO PROVIDE A NETWORK OF REPRESENTATIVE NATURAL AREAS

The Moehau EA covers most of the Moehau Range which is a distinctive landform of Colville ED. Most of the parent rock in the EA is greywacke which, in mainland Coromandel ER, is found only in Colville ED.

By virtue of its large size, Moehau EA captures a wide diversity of vegetation types and wildlife. It includes species of particular importance, mentioned in previous sections and some their limits of distribution. It provides adequate protection of the montane zone (and includes a sub-alpine element in the EA) and protects examples of the lowland zone on steep, greywacke country. Although, in terms of area, protection of the summit is not required it is recommended to complete the altitudinal sequence and to increase the protection of important plants and communities. The coastal zone is not represented in the EA and the semi-coastal zone only poorly.

The remaining 13 PNAs protect approximately 1.5% of the coastal zone. The reserves are all small and comprise highly modified vegetation. Papaaroha SR and the Ward OSC are the best examples of protected coastal forest although very small and isolated. Black Jack and Mahurangi Scenic Reserves are somewhat larger and, with time, have the potential to regenerate to coastal forest. Opitonui River Mouth GPR is the only example of an estuarine community that is protected. This reserve includes a very small part of an estuarine ecosystem. Motutapere SR is the only protected offshore island in Colville ED.

3.4 RECOMMENDED AREAS FOR PROTECTION (RAPs)

Each RAP description includes a location map, a checklist of component ecological units, a brief description of landform and vegetation character, and an evaluation/discussion and summary of the priority status of the area.

1. Location Map

Drawn on NZMS1 series maps at 1:50,000, or at reduced scale where necessary.

2. Ecological Unit Checklist

A list of the standard ecological units (see Appendix I for descriptions).

"REL. AREA" - the size of each ecological unit in relation to other examples of that unit in the District; large (L), medium (M) or small (S). For example a large (L) foredune would occupy a much smaller area than a large (L) kanuka forest unit. - 0 indicates no other examples recorded in the district.

3. Landform and Vegetation

Descriptions are given for the entire priority area.

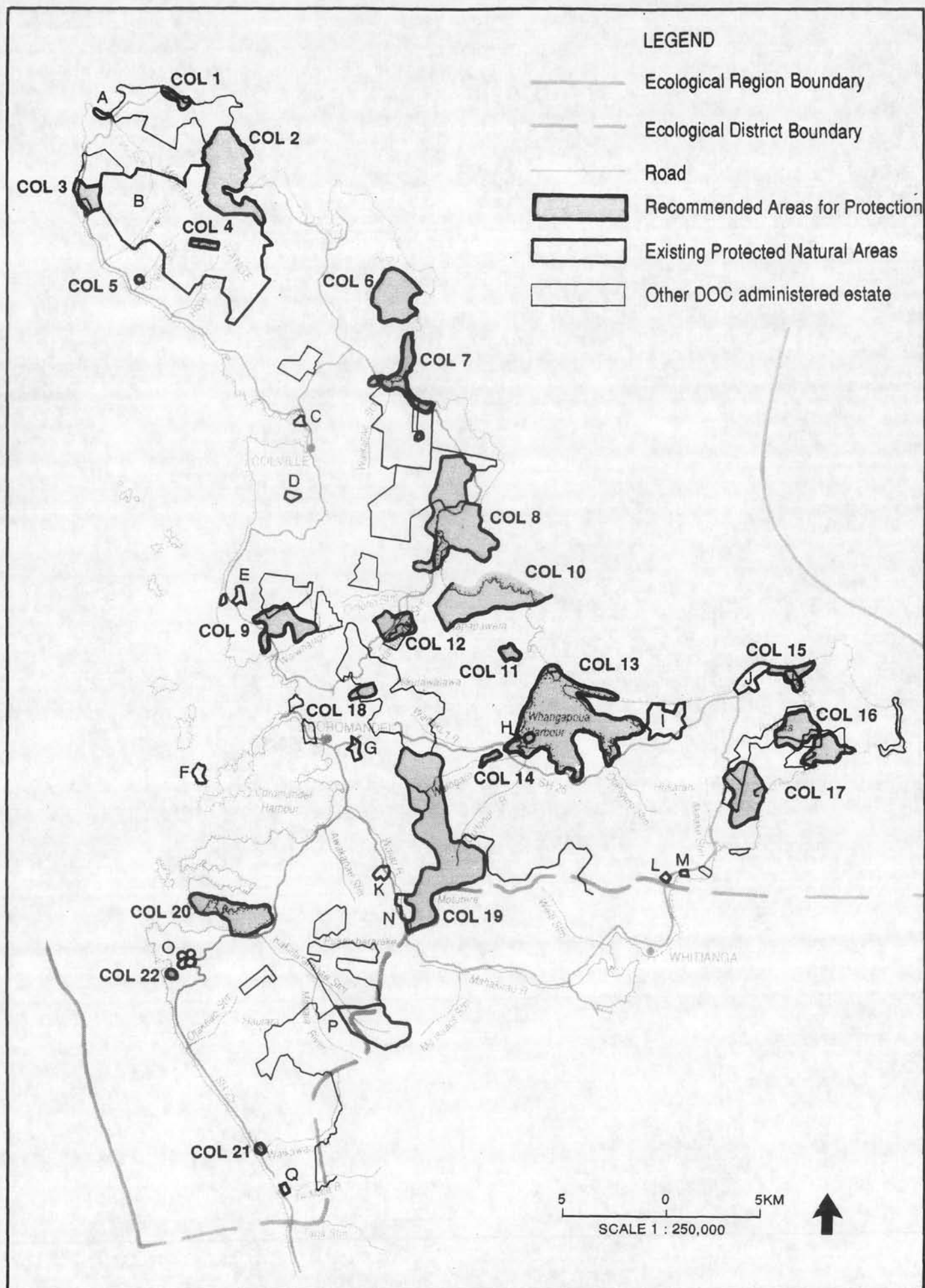
4. Flora

Distinctive or important plant taxa as opposed to vegetation which describes communities of plants.

5. Discussion and Criteria Summary

Outline of the quality of the area and its important features for protection.

Further information, such as distribution of vegetation types within RAPs, may be obtained from the Department of Conservation, Waikato Conservancy, Hamilton.



**COLVILLE ECOLOGICAL AREA
RECOMMENDED AREAS FOR PROTECTION
AND EXISTING PROTECTED NATURAL AREAS**

INDEX TO RAPs

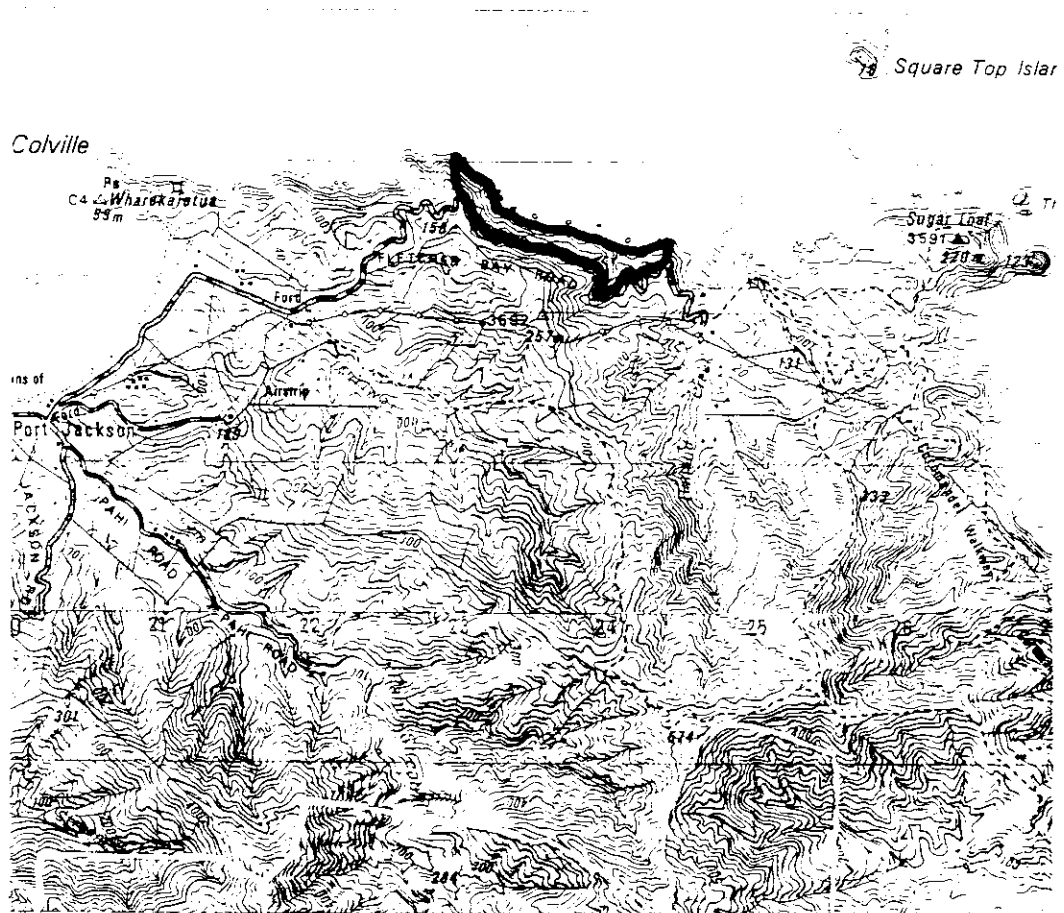
	Page
Col 1 Fletcher Bay	46
Col 2 Stony Bay	48
Col 3 Fantail	50
Col 4 Te Moehau	52
Col 5 Ongohi	54
Col 6 Potiki Bay	56
Col 7 Waikawau	58
Col 8 Kennedy Bay	60
Col 9 Okahu	62
Col 10 Hapapawera	64
Col 11 Pungapunga	66
Col 12 Harataunga Tributary	68
Col 13 Whangapoua	70
Col 14 Waingaro Wetland	72
Col 15 Otama	74
Col 16 Ototoro Stream	76
Col 17 Whauwhau & Woodcock Streams, Horseshoe & Sandy Bays	78
Col 18 Whakanekeneke	80
Col 19 Castle Rock	82
Col 20 Manaia Harbour	84
Col 21 Wairotoroto Shingle Beach	86
Col 22 Kirita Bush Remnants	88

INDEX TO EXISTING PNAS (See Fig 3)

A	Ward QEII Open Space Covenant
B	Moehau Ecological Area
C	Ahirau Scenic Reserve
D	QEII Open Space Covenant
E	Papa Aroha Scenic Reserve
F	Motutapere Island Scenic Reserve
G	Taumatawahine Scenic Reserve
H	Opitonui River Mouth Wildlife Refuge
I	Matarangi Bluff Scenic Reserve
J	Black Jack Scenic Reserve
K	Chiltern Scenic Reserve
L	Buffalo Beach Scenic Reserve
M	Ohuka Beach Scenic Reserve
N	Waiau Falls Scenic Reserve
O	Smuggler's Cave Holdings QEII Open Space Covenant
P	Manaia Forest Sanctuary
Q	Te Mata Scenic Reserve

COLVILLE

Col. 1 FLETCHER BAY



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 S09 235225
AREA	: 30 ha
ALTITUDINAL RANGE	: 20 - 100 m
TENURE	: Crown, DOC (Farm Park)
DATA REFERENCE	: Miller, 1984 (unpubl.) Study Area

Col. 1 : Fletcher Bay

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	coastal flax cliff community	hillslope, cliff	L

Landform:

Exposed north-facing hillslope and coastal cliffs on the northern tip of the Coromandel Peninsula.

Vegetation:

Varies according to exposure. A mixture of low manuka scrub with grasses, cabbage tree and shrubs such as hangehange and koromiko growing amongst a flax-tussockland. Gullies often have a canopy of kanuka, cabbage tree, mamaku and broadleaved shrubs.

Fauna:

Fauna values not assessed.

Flora:

No significant species found during survey.

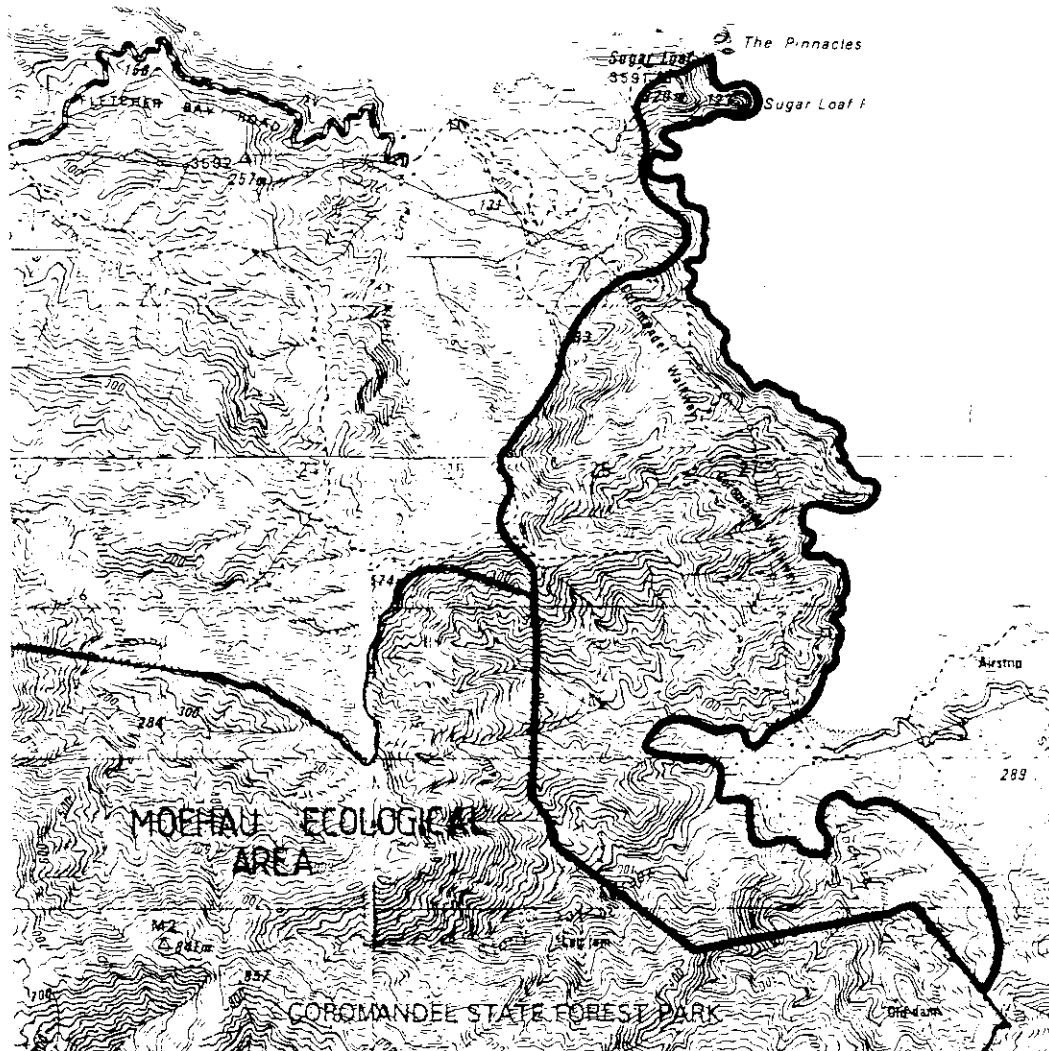
Discussion:

This RAP will contribute to the protection of coastal zone which is currently under-represented in the reserve system of the Colville Ed. This flax-shrubland is a type probably induced by repeated burning even prior to European settlement. The presence of a number of pa sites in the area suggest a sizeable Maori occupation. Early historical records of a flax mill at Port Jackson could indicate that flax was extensive on the coastal hills and cliffs around the tip of the peninsula. The RAP thus has cultural and historical values of the ecological unit also as well as ecological values.

Criteria Summary:

Representativeness	H - This is the best example of this type of coastal flax-shrubland. It resembles other exposed, modified coastal cliff sites in the ED.
Diversity	L - One bioclimatic zone, one vegetation type.
Naturalness	M - It maybe an induced or a naturally occurring community.
Special Features	L - Cultural landscape.
Viability	H - Requires fencing.
Buffering	M - Cliffs below and Fletcher Bay road and pasture, forest and scrub.
Landform	L - Representative of steep exposed coastal hillslopes.
Threat	L - Wild animals, fire, slips.

Col. 2 STONY BAY



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 S10 265190
AREA	: 751 ha
ALTITUDINAL RANGE	: 0 - 520 m
TENURE	: Crown (DOC)
DATA REFERENCE	: Study Area 3

Col. 2 : Stony Bay

Ecological Unit Checklist:

BIOTIC CLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	pohutukawa rock-treeland	cliff	M
coastal	pohutukawa-broadleaved species forest	hillslope, gully	M
coastal	taraire-broadleaved species forest	hillslope, gully	S
lowland	(rata-podocarp)/tawa forest	hillslope, ridge, gully	M
lowland	kauri-tanekaha forest	ridge, hillslope	S
lowland	kanuka scrub/forest	hillslope, ridge, gully	M
lowland	manuka scrub	hillslope, ridge, gully	L

Landform:

Several stream catchments run in an easterly direction to converge on Stony Bay, with others running into Shag and Poley Bays to the north. The coastline is dramatic with high rocky cliffs. The steep valleys are on Manaia Hill Group greywacke.

Vegetation:

This RAP provides a relatively unmodified coastally influenced altitudinal vegetation sequence on the eastern side of the Colville ED continuous with the montane zone of Moehau EA on the hillslopes leading down to Shag and Stony Bays. In places the pattern has been disturbed resulting in a mosaic of coastal and seral scrub types at various stages of regeneration.

A pohutukawa/ flax rock treeland association occurs on the coastal cliffs. Coastal forest is of pohutukawa with species such as kohekohe, puriri, karaka and occasional taraire. Understorey species include mahoe, Rhabdothermus solandri and Coprosma macrocarpa with karaka and titoki regeneration. At higher elevations the forest becomes dominated by tawa and kohekohe with emergent northern rata, miro and totara. Kauri occurs scattered throughout the forest and as dense stands on ridges and spurs with tanekaha, white maire, toro, toru and towai. A number of rare and threatened plants grow in this RAP - see Flora.

Fauna:

Nationally threatened Archey's and Hochstetter's frogs are known to be present. Shag colony on coast, NI kaka recorded.

Flora:

Species of interest occurring in this RAP (including a number of nationally threatened plants) are Fuchsia procumbens, Metrosideros carminea, Adiantum aethiopicum, Sticherus flabellatus, Hymenanthera novae-zelandiae. Whau (Entelia arborescens) is regenerating in kanuka scrub in gullies.

Discussion:

This RAP lies adjacent to Moehau EA. Together with Fantail Bay RAP, it provides the best east to west coast altitudinal sequence in Colville ED. The area includes coastal and lowland forest, remnant mature kauri forest and regenerating stands of kauri; all these vegetation types are currently under-represented in the PNAs of the Colville ED. This RAP would provide increased protection for the very steep catchment of Stony Bay Creek.

Criteria Summary:

Representativeness	H	- Coastal and lowland forest forming the best coast to montane and east to west vegetation sequence in the Colville ED.
Diversity	H	- Seven vegetation types and two bioclimatic zones. Wide altitudinal range, high diversity.
Naturalness	M	- Modification is less marked than in other parts of the district.
Special Features	H	- Nationally threatened fauna - Archey's and Hochstetter's frogs, NI kaka. A number of rare and threatened plants present (see Flora above).
Viability	H	- Management required, mainly fencing and wild animal control.
Buffering	M	- Farmland to north and east, Moehau EA to the west and south.

Col. 3 : Fantail Bay

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	pohutukawa rock-treeland	coastal cliff, river cliff, hillslope	M
coastal	pohutukawa modified forest	hillslope, gully	M
coastal	taraire-broadleaved species forest	hillslope, gully	M
coastal	kanuka forest	hillslope, ridge, gully	S
lowland	(rata-podocarp)/tawa forest	hillslope, gully	S

Landform:

Draining to the west on the flank of Mt Moehau, Fantail Creek is a steep catchment deeply engorged in Manaia Hill Group greywacke and surrounding metamorphosed rocks. Includes the nationally unique landform the Paritu Pluton.

Vegetation:

The area provides an altitudinal sequence from coastal to lowland forest including a small stand of the distinctive northern Coromandel taraire forest. A pohutukawa-flax community grows on coastal cliffs and *Astelia banksii* replaces the flax on inland cliffs above the stream. Inland and at a higher altitude the pohutukawa broadleaved forest gives way to a (rata-rimu)/tawa-kohekohe forest with emergent rimu and rata which continues into Moehau Ecological Area. Away from Fantail Creek itself, the sequence is disrupted by pasture and kanuka scrub, the latter regenerating after burning. Mosses and lichens are abundant near the stream and red aquatic alga (*Hildenbrandia*) associations occur in the stream bed.

Fauna:

NI kaka observed during the survey. Diverse macro-invertebrates in streams. Pied shag colony and Archey's and Hochstetter's frogs recorded by Wildlife Service in 1981.

Flora:

Planchonella costata and whau are present in coastal forest, these trees are not common on the mainland of the Coromandel Peninsula.

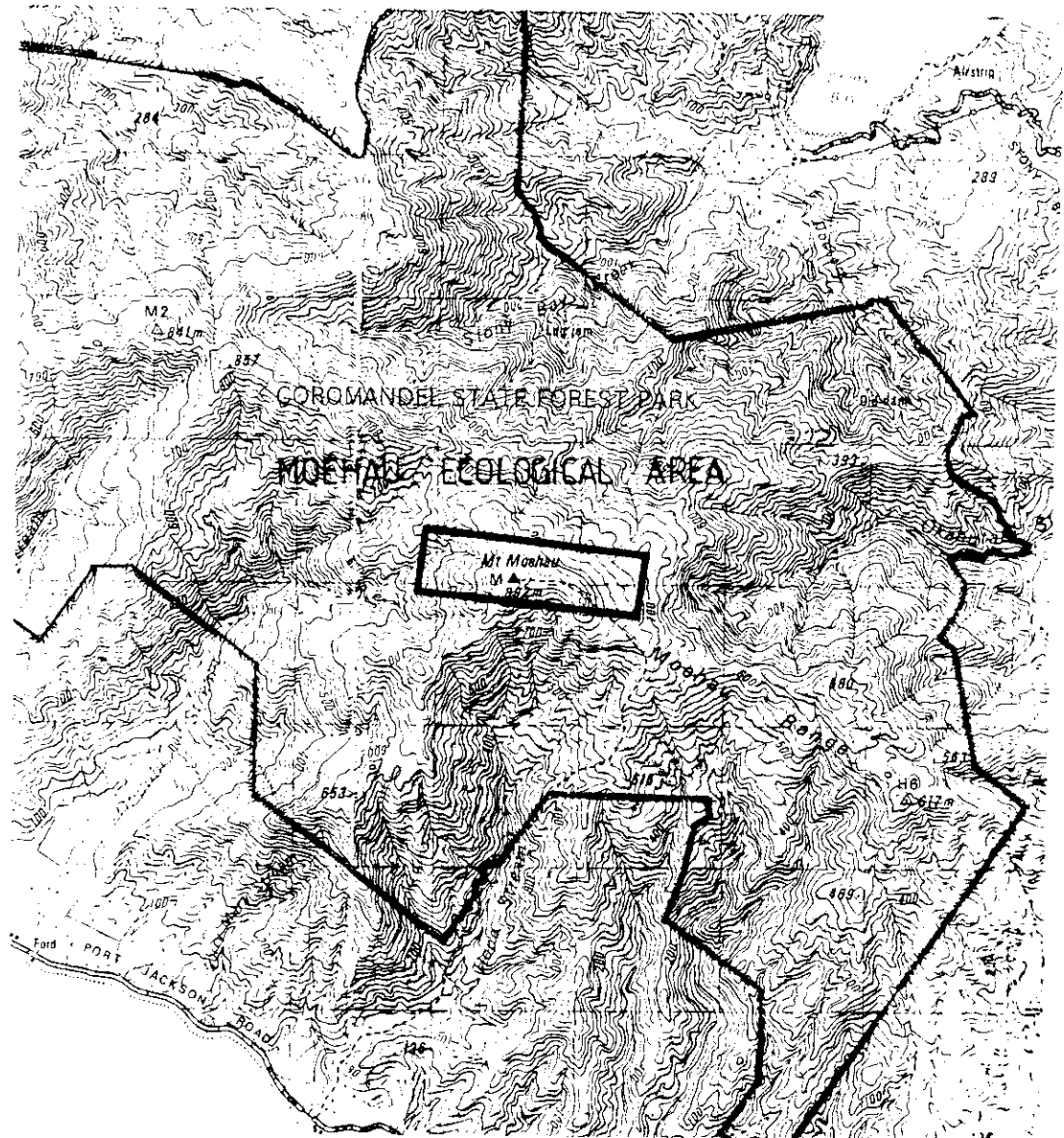
Discussion:

This RAP would contribute to the protection of coastal vegetation which is currently under-represented in the reserves of Colville ED and would provide protection for the whole Fantail Creek catchment. Lying adjacent to Mt Moehau EA this RAP provides the best continuous sequence of representative vegetation communities from coast to the montane zone. Goats, possums and pigs cause some modification. The stream is clean-flowing with a healthy stream community indicating catchment stability, but still require fencing to prevent stock from causing wasting of valley sides. The bay itself is scenic and is well used for recreation.

Criteria Summary:

Representativeness	H - Representative coastal forest including taraire forest.
Diversity	M - Two bioclimatic zones, five vegetation types provide a representative and diverse altitudinal sequence of vegetation communities from the coast to the montane zone.
Naturalness	M - Modified by introduced animals, logging and fire.
Special Features	H - High scenic and recreational value. Healthy freshwater habitat. Nationally threatened Hochstetter's and Archey's frogs, NI kaka recorded. <i>Planchonella costata</i> and whau.
Viability	H - Minimal management needed to protect existing values, though continued wild animal control and fencing in some places will be important to maintain freshwater and flora values.
Buffering	M - Farmland to north and south. Moehau EA to the east.
Landform	H - Paritu Pluton is a nationally unique landform. Very steep terrain typical of the western flank of Mt Moehau.
Threat	M - The beach is intensively used over summer period. Stock and wild animal damage has reduced the understorey and regeneration. Campground.

Col. 4 TE MOEHAU



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 S10 255150
AREA	: 67.5 ha
ALTITUDINAL RANGE	: 650 - 892 m
TENURE	: Maori
DATA REFERENCE	: Burns, B 1985, Dedicated Area Report No. 7. Moore and Cranwell, 1934

Col. 4 : Te Moehau

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
montane	conifer forest	hillslope, ridge	L
montane	towai scrub/forest	hillslope, ridge	S
montane	tussockland	hillslope, ridge	L
montane	rocky bluff	cliff	M

Landform:

The summit and broad ridges of Te Moehau on andesite and quartz and quartz diorite.

Vegetation:

This rectangular block of private land covers the distinctive and unusual summit vegetation of Te Moehau. The whole area lies in the montane zone and consequently the towai scrub and forest around the summit has associated high altitude species such as tawari, tawheowheo, broadleaf, mountain neinei, stinkwood, hutu, korokio. There are occasional stunted, windshorn, prostrate, kauri and rimu. Above 750m there is a montane podocarp forest similar to that found in the Te Aroha ED with towai, tawheowheo and kaikawaka frequent and mountain toatoa, rimu, *Dracophyllum traversii*, southern rata and *Coprosma colensoi*. A number of species in the montane tussockland are considered subalpine and do not occur anywhere north of Moehau eg *Drapetes dieffenbachii*, *Carpina alpina*, *Oreobolus pectinatus*, *Celmisia incana* and *Ourisia colensoi*. Tussockland patches on the summit, believed to have been induced by wild animals, are mostly bush ricegrass with scattered *Dracophyllum traversii* and browsed seedlings of montane trees and shrubs. This habitat is one of the few on Te Moehau which has adventive species.

Fauna:

High densities of threatened Archey's frogs which are endemic to Coromandel ER. Rare land snails, stag beetles: *Dorcus* sp, *Lissoetes planus* and *L. stewartii* plus a range of other unusual invertebrates including an unnamed stick insect.

Flora:

A large number of local and unusual species occur on the summit of Te Moehau including *Cyathodes empetrifolia*, *Drapetes dieffenbachii*, *Pentachondra pumila*, *Celmisia incana*, *Oreobolus pectinatus*, pokaka, *Metrosideros albiflora*, *Podocarpus hallii* x *nivalis*, *Ourisia colensoi*, *Pseudopanax simplex* var. *sinclairii*, *Ascarina lucida*, *Coprosma dodonaefolia* and sub-alpine lichens.

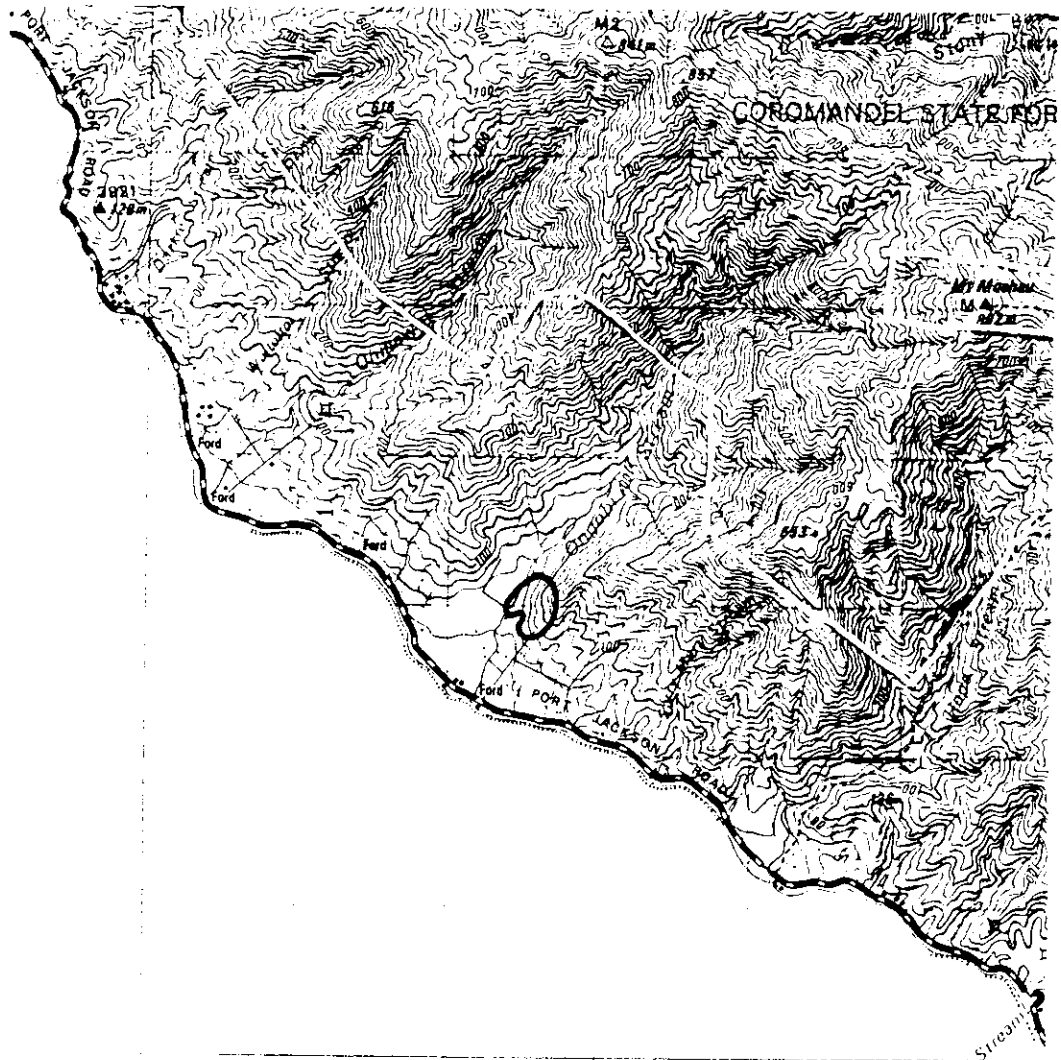
Discussion:

This area is regarded as sacred by the Maori people. Although landlocked by the Te Moehau EA this block is not formally protected. Plant communities on the summit support a number of unusual subalpine plants, many at the northern limit of their range.

Criteria Summary:

Representativeness	H	- The only high altitude forest and tussockland of this type in the Coromandel ER.
Diversity	L	- One bioclimatic zone, four vegetation types.
Naturalness	M	- Has been burnt in the past, modified by pigs and goats.
Special Features	H	- Large number of local, sub-alpine plants, southern species some at their northern limits of distribution. High densities of Archey's frogs and interesting and rare invertebrates.
Viability:	H	- Viable if wild animals controlled.
Buffering:	H	- Surrounded by Moehau EA.
Landform:		- Gently sloping mountain peak on andesite and quartz diorite with some rocky bluffs.
Threat:	M	- Wild animals. Subalpine communities grow slowly and are very susceptible to trampling by people and animals.

Col. 5 ONGOHI BUSH



SCALE	: 1:50,000
GR CENTRE	: NZMS 265 S10 255140
AREA	: 12.5 ha
ALTITUDINAL RANGE	: 25 - 150 m
TENURE	: Private
DATA REFERENCE	: Study area 4

Col. 5 : Ongohi

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal coastal	pohutukawa-broadleaved species forest (rata-podocarp)/tawa forest	alluvial terrace hillslope, gully	L S

Landform:

Coastal hillslope, bouldery alluvial terrace alongside the Ongohi Stream. Bouldery alluvium derived from basement greywacke and overlying Coromandel quartz diorite.

Vegetation:

There is a remnant representative of modified coastal broadleaved forest which has scattered pohutukawa, taraire, puriri, nikau, kohekohe, wharangi grading into more lowland-type forest with frequent tall emergent northern rata. The forest has suffered severely from stock grazing and the understorey is very sparse.

Fauna:

Common forest birds recorded during survey. Brown teal have been recorded in the stream.

Flora:

No species of note found during the survey.

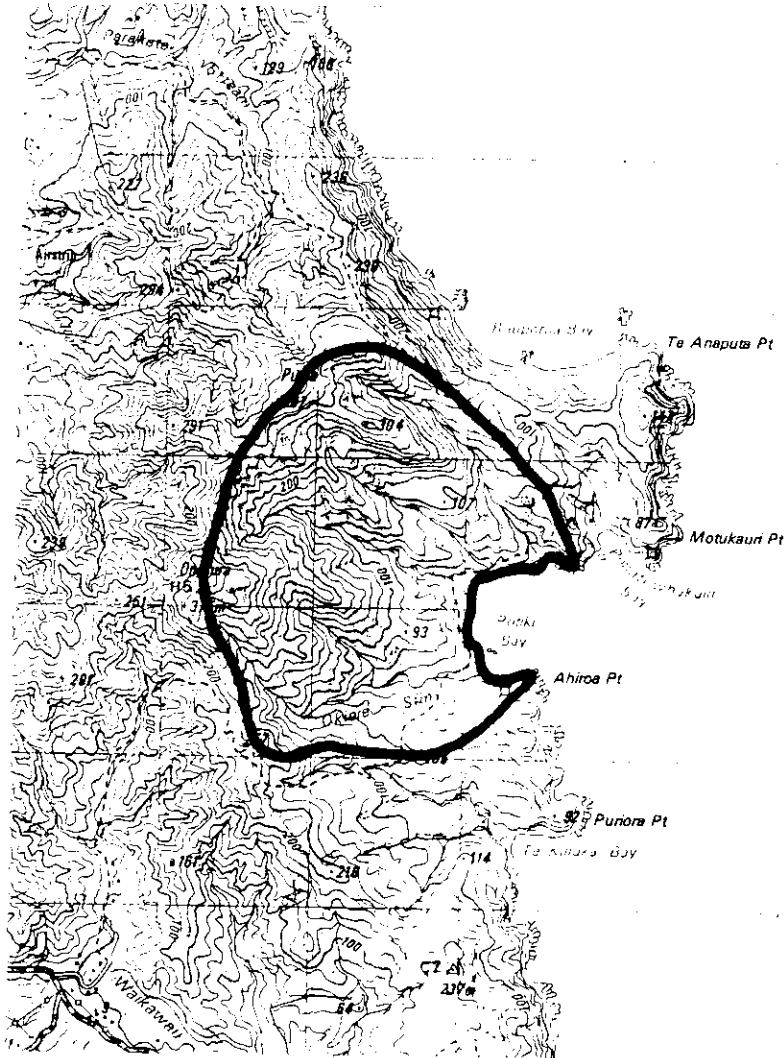
Discussion:

The area of coastal forest in Colville ED is severely depleted and under-represented in PNAs. This small remnant so provides a good example of modified coastal forest, some of which is on typical Colville bouldery alluvial landform and supports a podocarp-broadleaved forest. There are very few other examples of this type of forest. Coastal forest grades into semi-coastal forest with frequent tall northern rata.

Criteria Summary:

Representativeness	M	- Representative coastal forest types on typical and distinctive landform.
Diversity	L	- One bioclimatic zone, two vegetation types.
Naturalness	M	- Canopy composition is good but understorey severely modified by farm stock.
Special Features		- Podocarp-broadleaved forest on alluvial terrace. The area of Ongohi Stream was brown teal habitat until a few years ago.
Viability		- Lower area on all terrace is fenced. Hillslope requires fencing.
Buffering	L	- Surrounding land pasture, some scrub.
Landform	M	- Colluvial toeslope at base of hill. Hillslopes on basement greywacke and alluvial terrace.
Threat	M	- Stock damage preventing regeneration.

Col. 6 POTIKI BAY



SCALE	:	1:50,000
GR CENTRE	:	NZMS 260 T10 355132
AREA	:	455 ha
ALTITUDINAL RANGE	:	0 - 387 m
TENURE	:	Private
DATA REFERENCE	:	Study Area 7

Col. 6 : Potiki Bay

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	pohutukawa rock-treeland	cliff	L
coastal	pohutukawa-broadleaved species forest	hillslope, gully	L
coastal	pohutukawa modified forest	hillslope, gully	M
coastal,	(rata-podocarp)/tawa forest	hillslope, gully	M
semi-coastal			
coastal,	kauri-tanekaha forest	ridge, hillslope	M
semi-coastal			
coastal,	hard beech-kauri forest	ridge, hillslope	L
semi-coastal			
coastal,	kanuka-broadleaved species forest	ridge, hillslope, alluvial flat	L
semi-coastal			
coastal,	manuka-broadleaved species scrub	hillslope, ridge, gully	M
semi-coastal			

Landform:

An east-facing bay sheltered by a large headland to the north. Terrain moderate to steep hill country, much dissected by small streams running into the bay. Occurs on Kuaotunu subgroup of Coromandel Group andesites and dacites from the lower to mid Miocene.

Vegetation:

Pohutukawa rock-treeland occurs on the cliffs around the headland with a mosaic of kanuka and manuka-broadleaved species scrub above. Some unmodified pohutukawa-broadleaved species forest including taraire and large areas of regenerating coastal scrub extend up the slopes behind the bay itself. Mature kauri-hard beech is a feature on the ridges above the bay with semi coastal tawa forest with emergent podocarps and rata in the gullies, some smaller hard beech are found on alluvial boulder terraces near the sea.

Fauna:

Wildlife Service gave the area a preliminary ranking of moderate-high. The streams of Potiki Bay are unstable and flood-prone making them poor to moderate fish habitat.

Flora:

Hard beech.

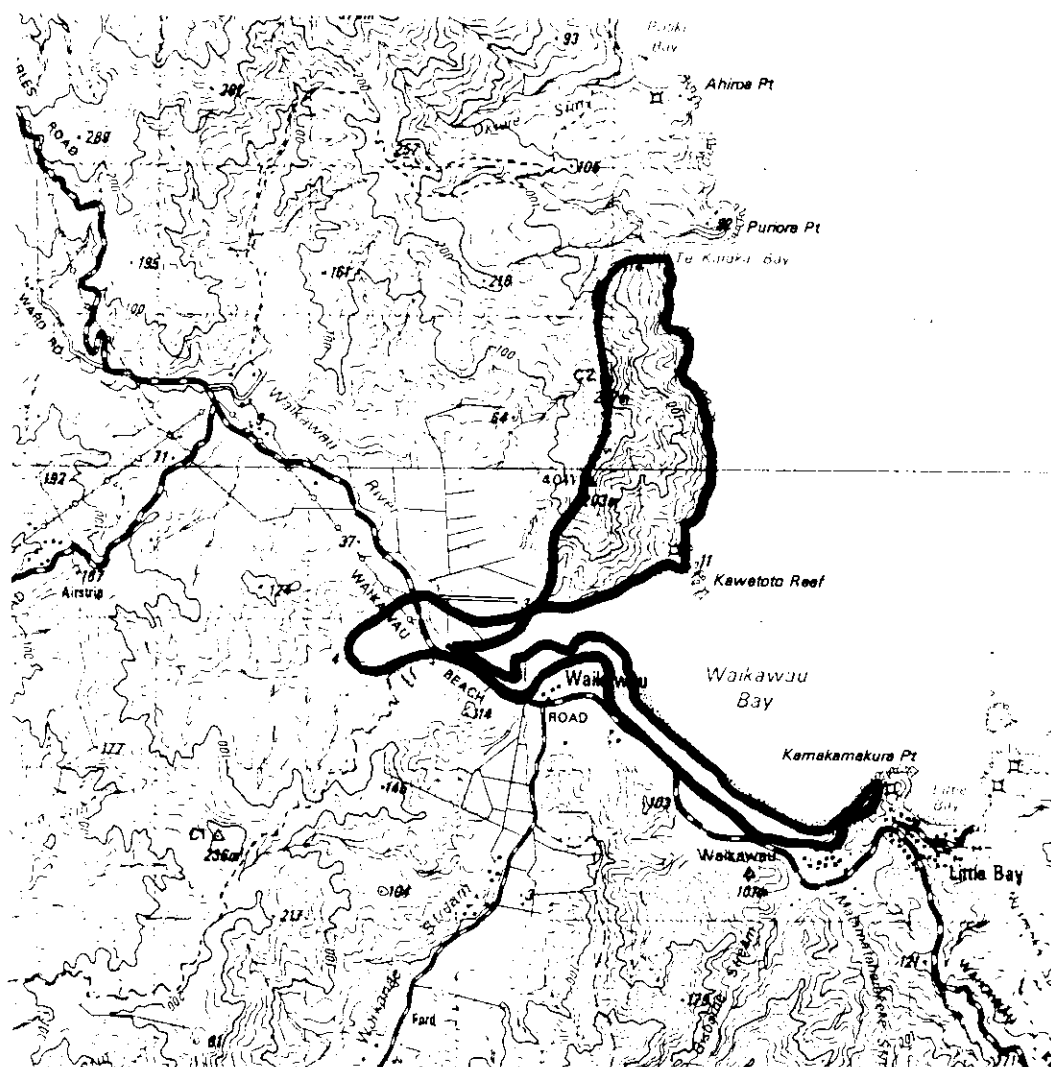
Discussion:

This area is valuable for its relatively large area of coastal forest which is under-represented in the reserves of Colville ED. In 1972, Nicholls recommended it be given top priority for reservation for scientific purposes as "there is no better representation of the unusual overlap in range of kauri, taraire, pohutukawa and hard beech". Inclusion of this area would protect coastal forest on the older andesites and dacites, a volcanic formation that makes up approximately half of the rock type of the Colville ED. Stream quality is healthy and small waterfalls are an attractive features, this RAP includes three small coastal stream catchments.

Criteria Summary:

Representativeness	H	- Good examples of coastal forest types and kauri-hard beech forest on older volcanic rock types.
Diversity	H	- One bioclimatic zone, eight vegetation types. A number of coastal forest and seral associations including an unusual overlap in the range of kauri, taraire, pohutukawa and hard beech.
Naturalness	M	- Patches of pasture, parts heavily grazed. Forests on upper slopes more natural and less disturbed. Some areas recovering from burning.
Special Features	H	- Unusual forest associations. Scenic values. Kiwi have been recorded here.
Viability	H	- Need to exclude stock to allow regeneration of coastal forest. Compact unit suitable for conservation management. New owner, managed by Karuna Falls community largely for conservation.
Buffering	M	- Forest, scrub and pasture on surrounding land. Sea to the east.
Landform	M	- Representative of a steeper eastern bay with coastal cliffs and hillslopes and rocky streams.
Threat	M	- Pigs, goats, feral, cattle.

Col. 7 WAIKAWAU BAY



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T10 355090
AREA	: 227.5 ha
ALTITUDINAL RANGE	: 0 m - 237 m
TENURE	: Crown (DOC)
DATA REFERENCE	: Study Area 8

Col. 7 : Waikawau Bay

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	spinifex-shore bindweed sandfield	foredune	M
coastal	pohuehue-knotted sedge rush-vineland	dune hollow, rear dune	M
coastal	eelgrass	tidal flat	S
coastal	mangroves	tidal flat	S
coastal	<i>Juncus maritimus</i> - <i>Leptocarpus similis</i> rushland	tidal flat	S
coastal	manuka/ <i>Leptocarpus similis</i> rush-shrubland	alluvial flat	M
coastal	manuka/ <i>Baumea</i> species sedge-shrubland	alluvial flat	S
coastal	pohutukawa rock-tree-land	cliff	M
coastal	manuka scrub	hillslope ridge gully	M
coastal	manuka-broadleaved species scrub	hillslope ridge gully	S
coastal	kanuka-manuka forest	hillslope	S

Landform:

A shallow, sandy estuary on Quaternary alluvial deposits derived from volcanic ash and weathered andesite. Moderately steep coastal hills and cliffs on Coromandel Group andesites to the north. A longitudinal dune system extends the length of the bay with parabolic blow outs at the northern end.

Vegetation:

Beach foredunes have a predominantly natural spinifex community including pingao, but the rear dunes are modified by exotics. This RAP has a range of estuarine vegetation communities including eelgrass, mangroves, rushlands and manuka/rushland. A small area of freshwater wetland supports raupo and kahikatea. Wetlands are a scarce habitat in Colville ED.

Fauna:

Breeding populations of Northern Variable Oystercatcher, NZ dotterel on the beach, banded dotterel and NI fernbird are present. Banded rail and Australasian bittern and occasional endangered brown teal have been reported by Wildlife Service. A pied shag colony lives on the coast to the north of the estuary. Forest gecko and green gecko have been recorded here.

Flora:

Korokia, *Streblus banksii* present at northern end of beach, this tree is seldom found on the mainland of Coromandel ER. *Scandia rosaefolia*. Pingao grows on the dunes and enrichment planting has been carried out.

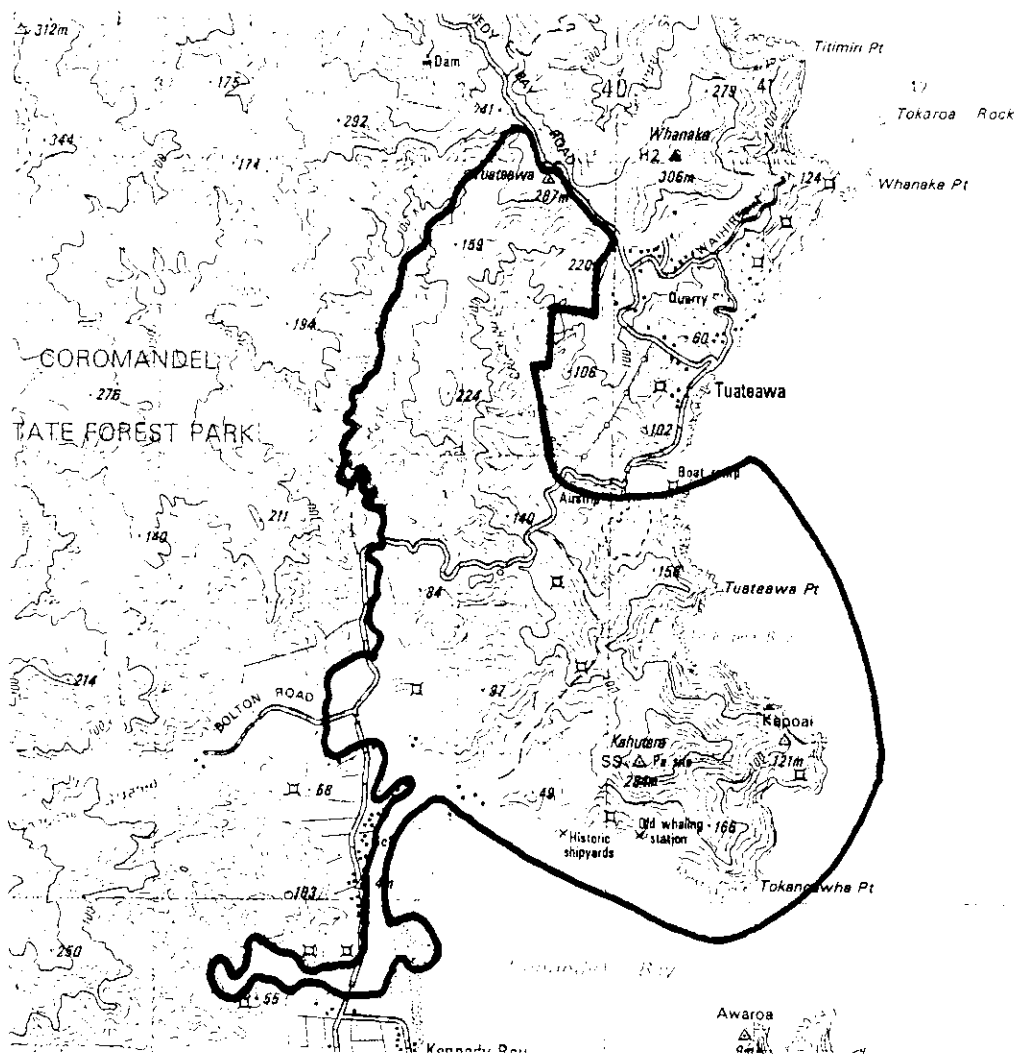
Discussion:

This area contains examples of many of the ecological units which are most under-represented in the PNAs of Colville ED, that is wetland, duneland, and coastal forest together making it a significant natural area. The manuka-rush type and the spinifex are high quality examples of these units. The estuary is an important wildlife habitat - ranked moderate/high by Wildlife Service. This is the only example of parabolic dune blowouts in the Coromandel ER. The beach and dunes are popular for recreation.

Criteria Summary:

Representativeness	H	- Range of representative ecological units present reduced extent in Colville ED.
Diversity	H	- One bioclimatic zone, eleven vegetation types in a small area. A range of vegetation types, landforms and habitats represented.
Naturalness	M	- Dunes modified by introduced species such as marram, pampas, kikuyu and lupin. <i>Spartina</i> present in the estuary.
Special Features	H	- A number of rare plants including <i>Streblus banksii</i> present in coastal forest. <i>Scandia rosaefolia</i> and korokia. Breeding populations of nationally threatened NI fernbird, NZ dotterel, banded rail, Australasian bittern and occasional brown teal, an endangered bird, are seen. Parabolic dune blowouts found here are an unusual landform on Coromandel Peninsula.
Viability	H	- Good sized dune and estuary system but some management needed to prevent further spread of introduced plant species. Goats and sheep are preventing regeneration under the coastal forest and sheep sometimes graze dunes.
Buffering	M	- The dune system and estuary is backed by farmland. The estuary is not adequately fenced to exclude stock. Tributary catchments are largely in scrub with some pasture.
Landform	H	- Only example of parabolic dune blow outs in Coromandel ER.
Threat	M	- Beach and estuary intensively used by tourists over summer period. Subdivision of land at northern end underway. Stock and vehicle access to dunes and estuary. <i>Spartina</i> grass must be removed.

Col. 8
KENNEDY BAY



SCALE : 1:50,000
GR CENTRE : NZMS 260 T10 380030
AREA : 1135 ha
ALTITUDINAL RANGE : 0 - 364 m
TENURE : Private, Crown (DOC) Maori
DATA REFERENCE : Study Areas 11 & 12

Col. 8 : Kennedy Bay

Ecological Unit Checklist

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	mangroves	tidal flat	S
coastal	<i>Juncus maritimus</i> - <i>Leptocarpus similis</i> rushld	tidal flat	M
coastal	Manuka/ <i>Baumea</i> rush-shrubland	alluvial flat	L
coastal	pohutukawa broadleaved species forest	hillslope, ridge, gully	M
coastal	pohutukawa modified forest	hillslope	M
coastal	kauri-tanekaha forest	hillslope, ridge	M
coastal-low	kanuka-manuka scrub	hillslope, ridge, gully	L
lowland	(rata-podocarp)/tawa forest	hillslope, ridge, gully	M

Landform:

This RAP includes the rocky headland north of Kennedy Bay and some of the catchment of the northern estuary of Kennedy Bay. The area includes tidal and alluvial flats, coastal hillslopes rising to a ridge which runs off the main Coromandel range. The coastal headland and coastal area is greywacke while further inland hillslopes are formed on andesites and dacites.

Vegetation:

This RAP covers a wide range of coastal vegetation and a continuous sequence of natural vegetation through to the lowland zone. Coastal vegetation includes a small area of mangroves and tidal rushland and coastal manuka/*Baumea* freshwater wetland. Around the coastline and extending inland are scattered pockets of modified and unmodified pohutukawa forest including an area of kowhai forest which is uncommon in the ED. Much of the coastal zone includes regenerating kanuka and manuka scrub with patches of pohutukawa coastal forest, tawa forest with emergent podocarps and rata and some large areas of kauri regeneration which is unusual occurrence in the coastal zone. Matai is found on alluvial terraces, this tree is not common in Colville ED. The upper catchments are covered in lowland (rata-podocarp)/tawa forest with taraire being frequent in places.

Fauna:

Threatened NI fernbird, Australasian bittern and banded rail and the endangered brown teal have been recorded in the wetland. The forested catchments make this RAP an important native fish habitat.

Flora:

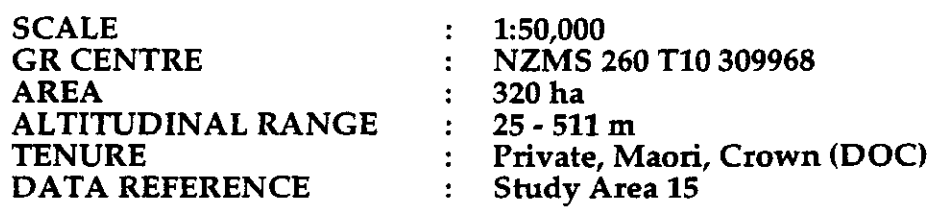
Red-edged (local) and black-edged (Waikato) flax in wetland. Rock fall on north side of the bay has the rare plants *Metrosideros carminea* and *Fuchsia procumbens* growing nearby.

Discussion:

This RAP encompasses a wide diversity of coastal ecological units currently under-represented in the PNAs of the Colville ED and a number of special flora and fauna features. In Colville ED it has been necessary to recommend protection for regenerating coastal forest as there is inadequate unmodified forest. The estuary and forested catchments of Kennedy make this an important native fish habitat. The forested area behind Kennedy Bay is very scenic and a walking track run through the northern end of the RAP.

Criteria Summary:

Representativeness	H	- Representative coastal forest and regenerating coastal forest. Small remnant wetland, lowland forest including kauri regeneration.
Diversity	H	- Two bioclimatic zones, eight vegetation types.
Naturalness	M	- Much of forest has been logged and burnt in the past but is now regenerating. Wetland is in good condition, apart from stock damage. Estuarine vegetation has been modified. The catchment has good freshwater habitat.
Special Features	H	- An opportunity to protect good native fish habitat with an intertidal estuarine area and a stream accessible to fish in a natural condition. A number of threatened birds and plants are found in the area.
Viability	M	- Minimal management needed - formal protection, fencing.
Buffering	H	- Surrounding land predominantly forest and scrub. Pasture and horticultural land adjacent to alluvial flats.
Landform	H	- Good range of landforms included - estuarine, alluvial flats, hillslopes, ridges, gullies and unusual large, blocky boulder fall.
Threat	L	- Wild animals, modification of wetland.



Col. 9 : Okahu

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	pohutukawa modified forest	hillslope, gully	L
coastal	taraire-broadleaved forest	hillslope, gully	L
lowland	broadleaved species scrub	hillslope, ridge, gully	L
lowland	manuka-broadleaved species scrub	hillslope, ridge, gully	L
lowland	kanuka forest	hillslope	S

Landform:

Terrain is steep to very steep hillslopes on Tokatea Hill formation (Manaia Hill Group), also with Coromandel Group Volcanics. The area includes a secondary ridge system extending west from the main Coromandel Range. A tributary of the Waiwhango River drain south-east, it then flows south-west forming the southern boundary of the RAP.

Vegetation:

The lower, southerly slopes are predominantly a mixed scrub and forest of manuka, kanuka, broadleaved species such as rewarewa, mahoe, fivefinger and mamaku and silver tree fern. Remnants of coastal-influenced forest of tawa with scattered emergent rata taraire, kohekohe, puriri and tree fern and unusually frequent hinau in gullies and on upper hillslopes. The central ridge has probably been cleared and now supports a towai-tawari-tawheowheo scrub with occasional pole rimu.

Fauna:

NI brown kiwi reported. Common forest birds recorded during survey.

Flora:

No plants of note recorded during survey. Abundant taraire in forest.

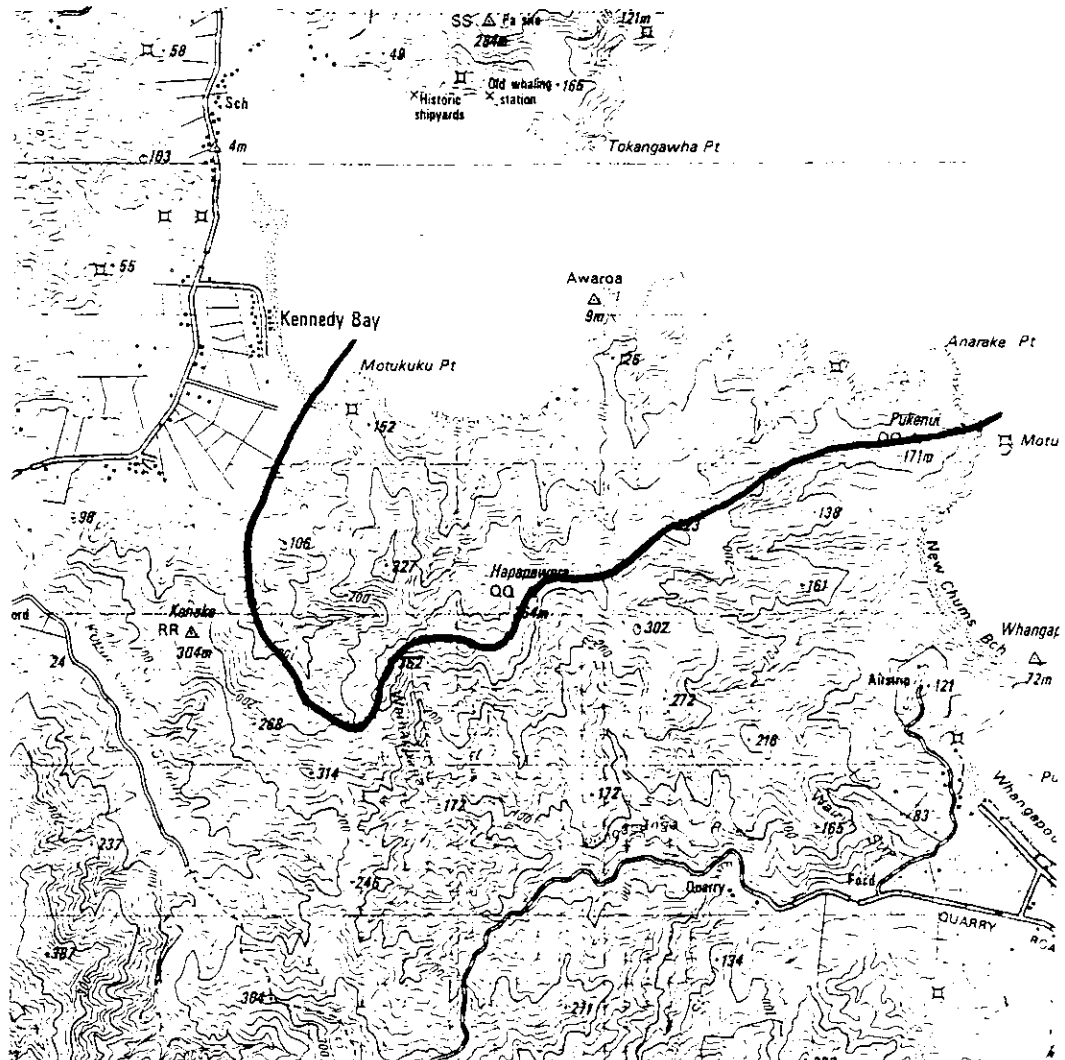
Discussion:

This area if protected would provide additional coastal and semi-coastal forest so under-represented in the reserve system of Colville ED. Taraire occurs more abundantly in this forest, than seen elsewhere in Colville ED. The broadleaved and manuka-broadleaved scrub shows good regeneration and high species diversity. Archey's frogs were found under kanuka broadleaved forest. This RAP is one of a number which include lowland forest additional to the 10% guideline but was selected (part of the Waiwhango River catchment lies within it) for the unusual species composition of the forest and for the altitudinal vegetation sequence and catchment protection.

Criteria Summary:

Representativeness	H	- Best example of forest in which taraire is a major component.
Diversity	H	- Two bioclimatic zones, five vegetation types. Seral and mature forest associations.
Naturalness	M	- Mainly secondary forest types due to logging and burning.
Special Features	H	- Nationally threatened Archey's frogs (endemic to Coromandel ER), threatened NI brown kiwi and abundance of taraire not seen elsewhere in Colville ED.
Viability	H	- Regenerating well, would be assisted by the exclusion of stock.
Buffering	M	- Predominantly surrounded by natural areas (forest and scrub). Block of pines to the south and limited pasture along the Coromandel-Colville Road.
Landform	H	- Steep forested hillslopes are on the uncommon Manaia Hill group, volcanic rocks represented also.

Col. 10 HAPAPAWERA



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T10 400975
AREA	: 580 ha
ALTITUDINAL RANGE	: 0m - 364 m
TENURE	: Maori
DATA REFERENCE	: Study Area 13

Col. 10 : Hapapawera

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	pohutukawa rock-treeland	cliff	M
coastal	pohutukawa-broadleaved species forest	hillslope, gully	L
coastal	pohutukawa modified forest	hillslope, gully	L
coastal	(rata-podocarp)/tawa forest	hillslope, gully	M
coastal	kauri-tanekaha forest	ridge	M
coastal	manuka-broadleaved species scrub	hillslope, ridge, gully	M

Landform:

North facing, coastal hillside occurring on Coromandel Group volcanics. Terrain is moderate to steep and dissected by many small streams. Steep ridges terminate abruptly in rocky headlands and coastal cliffs.

Vegetation:

Unusual pohutukawa-kowhai-puriri forest with a kohekohe, wharangi, kowhai and karaka near the coast grades rapidly into tawa-kohekohe forest with emergent rata and podocarps. The sequence of forest inland is interrupted with regenerating manuka scrub, manuka-treefern-broadleaved species scrub, kauri-tanekaha forest and pohutukawa forest. Taraire is present in the lowland forest.

Fauna:

Variable oystercatcher roost on a rocky point. Nationally threatened reef heron on shore, rookeries of white fronted heron.

Flora:

Kowhai is a major component in the coastal forest canopy here - this is uncommon elsewhere in Coromandel ER where it usually occurs only as scattered trees. Matai and taraire are present in (rata-podocarp)/tawa forest. Whau is present in the understorey near the pa.

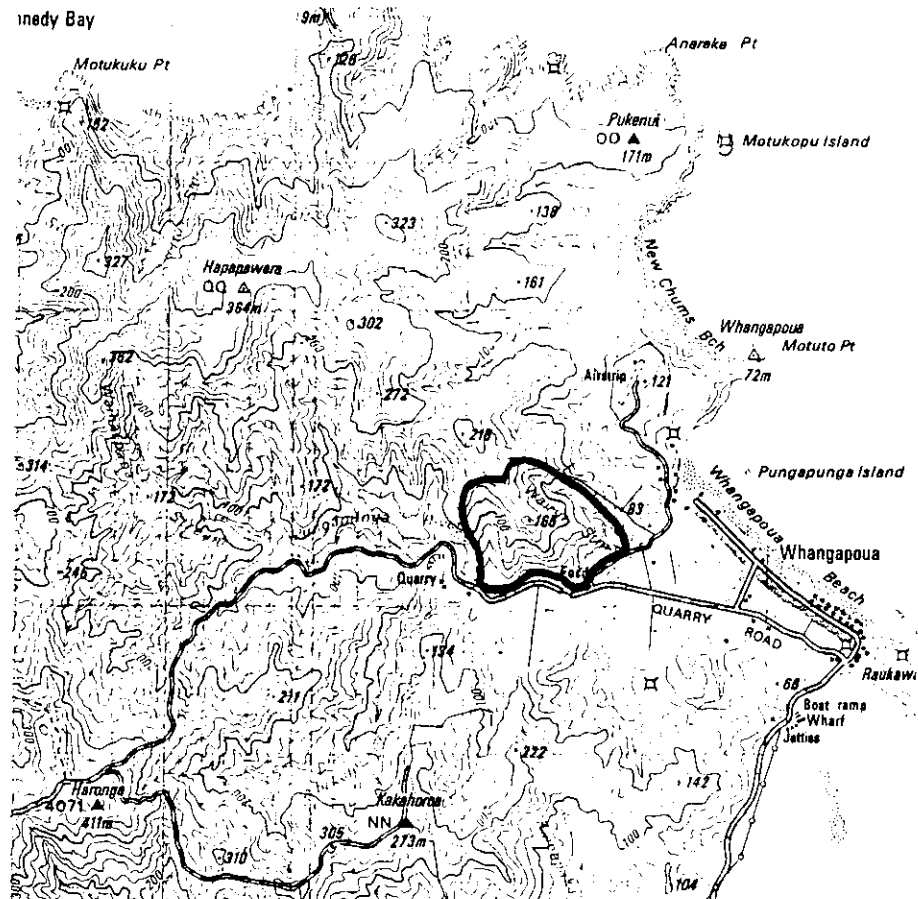
Discussion:

This RAP is primarily selected for the area of coastal forest and scrub currently under-represented in the reserves of Colville ED. Some stands are excellent examples of unmodified pohutukawa forest and include species uncommon in coastal forest remnants today such as kowhai, taraire and kauri. There is a pa site on one headland. Part of the larger, predominantly natural area around Kennedy Bay. Includes several coastal catchments.

Criteria Summary:

Representativeness	H	- Some excellent stands of coastal forest, others somewhat modified. Good manuka-broadleaved species scrub and (rata-podocarp)/tawa-kohekohe forest.
Diversity	M	- One bioclimatic zone, six vegetation types. Coastal and coastal-influenced forest and seral communities represented.
Naturalness	M	- Recovering from relatively recent logging and past burning. Areas of the understorey have been grazed and invaded by pasture grasses.
Special Features	L	- Kowhai component of coastal forest canopy, occasional whau, taraire present in lowland forest. Variable oystercatcher roosts and nationally threatened reef heron recorded during survey.
Viability	H	- Little management needed, requires protection and fencing.
Buffering	H	- Well buffered from ridgeline to sea, pine forest and scrub inland.
Landform	L	- Representative steep coastal hillslopes and rocky shoreline.
Threat	M	- Wild animals.

Col. 11 PUNGAPUNGA



SCALE	:	1:50,000
GR CENTRE	:	NZMS T10 424956
AREA	:	65 ha
ALTITUDINAL RANGE	:	10 - 165 m
TENURE	:	Private
DATA REFERENCE	:	Study Area 14

Col. 11 : Pungapunga

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal, semi-coastal	pohutukawa broadleaved species forest	hillslope, gully	S
coastal, semi-coastal	kauri-tanekaha forest	ridge, hillslope	S
coastal, semi-coastal	kanuka forest	hillslope, alluvial terrace	M
coastal, semi-coastal	manuka scrub	ridge, hillslope	S

Landform:

Coastal alluvial river flats and gentle coastal hillslope and ridges on Coromandel Group volcanics.

Vegetation:

The pattern of vegetation reflects past modification by fire. Pohutukawa-broadleaved species forest lies in gullies and gentle hillslopes giving way to northern rata-broadleaved forest upslope; associated species include puriri, kohekohe, nikau, silver tree fern, white maire and scattered kauri. On ridges there are vigorous secondary stands of kauri and tanekaha with kanuka becoming more frequent downslope. Tall kanuka is found on coastal and semi-coastal hillslopes including the alluvial flats on the lower valley floor where it includes kowhai, kahikatea, kauri, puriri and totara. Manuka scrub dominates on the upper slopes of the catchment.

Fauna:

A good range of native and introduced birds were recorded during the survey. NI kaka was reported by the Wildlife Service.

Flora:

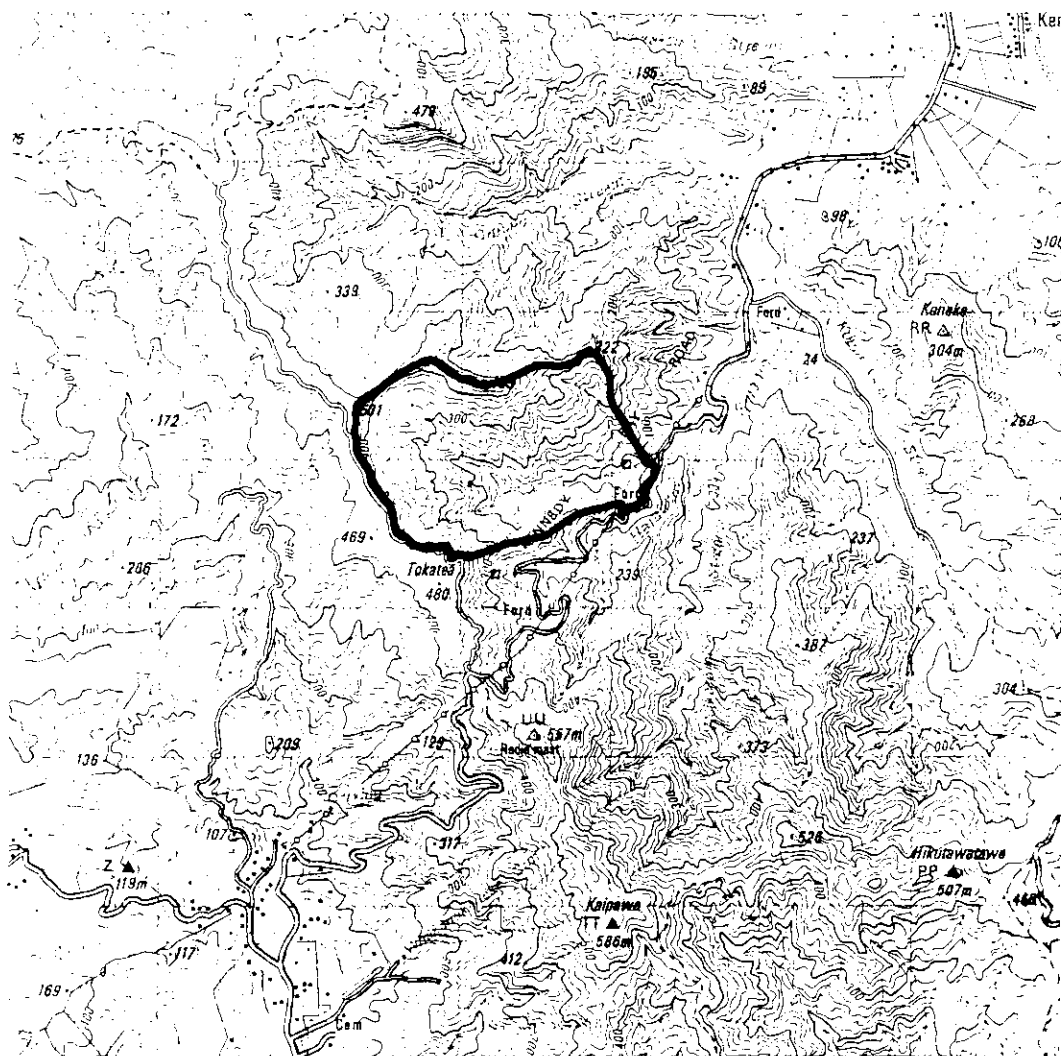
No particular species of note found during survey.

Discussion:

This fairly small hillside includes coastal grading into semi-coastal forest types, both which very under-represented in the PNAs of Colvukke ED. The area includes uncommon regenerating coastal kauri-tanekaha forest on ridges and regenerating coastal alluvial flat forest, of which there is very little remaining in the district.

Criteria Summary:

Representativeness	H	- Coastal forest grading into semi-coastal forest. Several types present including pohutukawa forest, kauri-tanekaha forest, alluvial terrace forest and regenerating scrub communities.
Diversity	M	- Two bioclimatic zones, four vegetation types.
Naturalness	M	- Pohutukawa forest largely unmodified, other communities secondary. Adventive pines and hakea present. Pigs and goats have ongoing impact.
Special Features	-	- Kanuka forest will regenerate to coastal podocarp-broadleaved alluvial terrace which is very rare in this district and the ER.
Viability	H	- Viable if protected. Some electric fencing but goat and pigs need some control.
Buffering	M	- Western side is pine forest the remainder is gorse and pasture.
Landform	-	- Coastal hillslopes and alluvial terrace on
Threat	M	- Damage from pigs and goats.



SCALE	:	1:50,000
GR CENTRE	:	NZMS T10 355960
AREA	:	185 ha
ALTITUDINAL RANGE	:	100 - 500 m
TENURE	:	Private
DATA REFERENCE	:	Freshwater Survey (Penny, 1989)

Col. 12 : Harataunga Tributary

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	manuka-rewarewa scrub	hillslope, ridge, gully	L
lowland-montane	(rata-podocarp)/towai-tawa forest	hillslope, ridge, gully	M
lowland-montane	towai-tawa forest	hillslope, gully, ridge	M
lowland-montane	towai scrub	hillslope, gully, ridge	L

Landform:

Steep, small tributary catchment of the Harataunga river which extends up to the Tokatea ridge and Tokatea Summit on andesite and greywacke.

Vegetation:

Forest types of the upper lowland zone represented with scrub and regenerating forest communities in the lower catchment and tall forest with frequent towai in the upper catchment.

Fauna:

Archey's frogs are probably present in the upper catchment.

Flora:

The unusual alga *Bostrychia scorpiodes* is present in this stream.

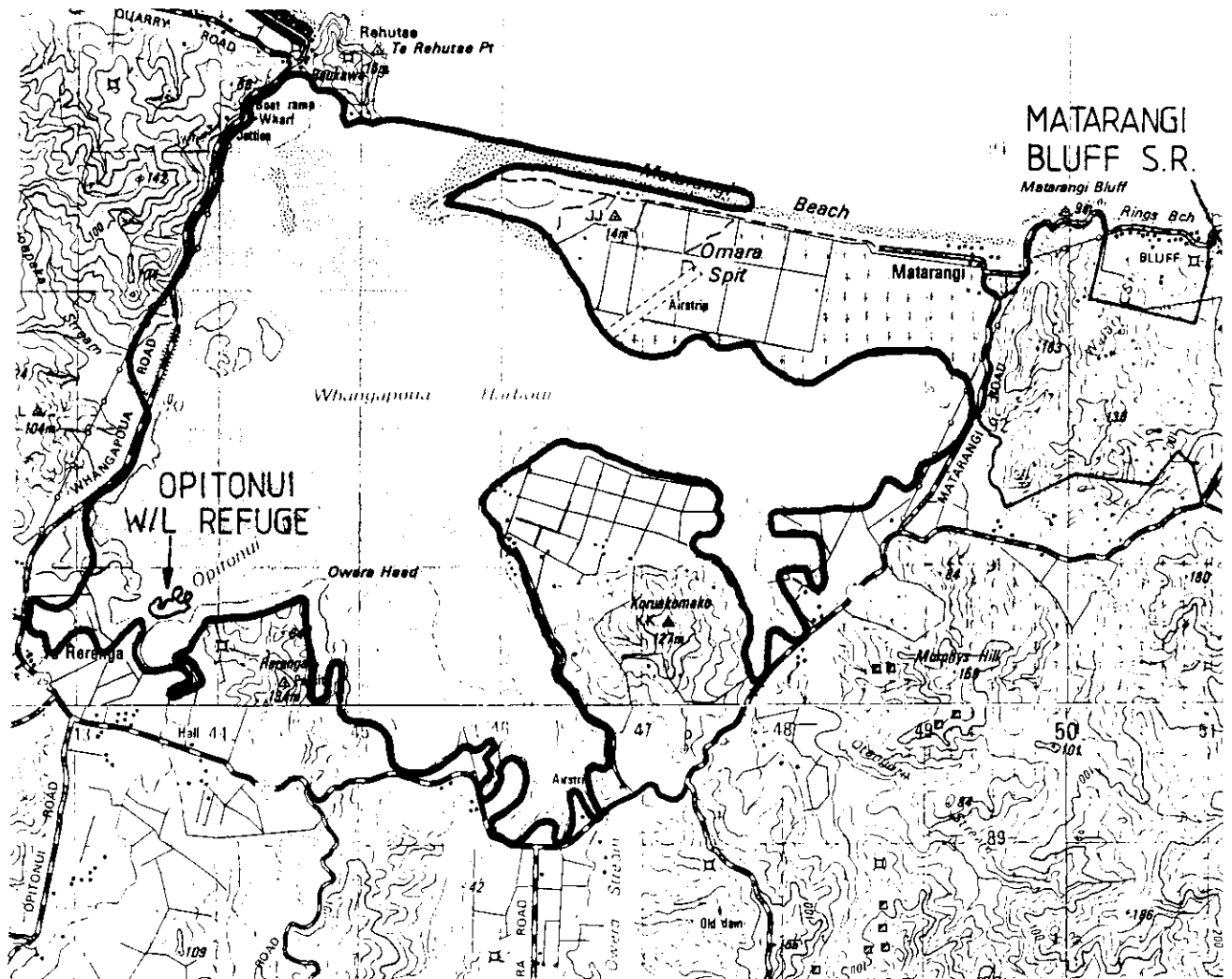
Discussion:

This is recommended predominantly for its catchment values. Lowland to montane forest vegetation represented. This catchment is a fine example of a low-nutrient eroding boulder stream with no fine sediment clogging the substrate or in-filling pools. There is a diverse and abundant invertebrate stream community. Mosses, blue-green algae and *Bostrychia scorpiodes*, which is usually a marine alga, are found in the stream.

Criteria Summary:

Representativeness	M	- Terrestrial vegetation types are quite common in the Coromandel ER but stream communities and configuration are highly representative.
Diversity	M	- Two bioclimatic zones, four vegetation types.
Naturalness	M	- Forest has been disturbed to some extent but stream is very natural. Vehicle track along ridge of main range.
Special Features	M	- <i>Bostrychia scorpiodes</i> (red alga) present in stream.
Viability	M	- Viable, requires protection.
Buffering	H	- Completely surrounded by native forest and scrub apart from vehicle track along top of Tokatea Ridge and Kennedy Bay forms lower catchment boundary.
Landform		- Hillslopes and gullies on andesite and some greywacke.
Threat	M	- Wild animals, mining.

Col. 13 WHANGAPOUA HARBOUR



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T10 450920
AREA	: 1670 ha (this figure is for whole estuary)
ALTITUDINAL RANGE	: 0 - 40 m
TENURE	: Private, Crown
DATA REFERENCE	: Study Area 16, Miller S T; 1987

Col. 13 : Whangapoua

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	eelgrass	tidal flat	L
coastal	mangroves	tidal flat	L
coastal	<i>Juncus maritimus</i> - <i>Leptocarpus similis</i> rushland	tidal flat	L
coastal	manuka/ <i>Leptocarpus similis</i> rushland	tidal flat	L
coastal	raupo flax reedland	alluvial flat	M
coastal	Spinifex-shore bindweed sandfield	foredune	M

Landform:

A large, east coast estuary in a drowned valley complex of Quaternary alluvial deposits derived from Coromandel Group volcanic rock. Includes estuarine sand and mud flats, alluvial flats and a limited dune system (part of large sandspit and dune system now modified by pine plantation and subdivision).

Vegetation:

Complete range of estuarine vegetation associations are found in this harbour. Eelgrass and extensive stands of mangroves occur in the tidal zone in the harbour with manuka-marsh ribbonwood-knotted sedge shrubland and *Juncus maritimus*-*Leptocarpus similis* rushland communities form narrow fringes in the upper harbour. Saltmarsh herbs such as *Sarcocornia quinquefolia*, *Samolus repens* and *Selliera radicans* occur on the sandflats amongst the rushes. Several small islands in the harbour support flax, karamu, pohuehue and shore bindweed. A small freshwater wetland of raupo and flax occurs in one arm of the estuary. What remains of the dune vegetation of Matarangi Spit is largely modified by exotic species (such as haretail, tree lupin, and herbaceous weeds and grasses), though a narrow band of spinifex occurs around its margins with a little pohuehue and shore bindweed and occasional tauhinu and *Coprosma acerosa* present.

Fauna:

The fauna habitat ranking by FSU was high. This estuary is a large, unmodified and relatively undisturbed habitat with a good diversity of bird species (24) present including NZ dotterel, banded rail and NI fern bird. Also diverse estuarine macrofauna; 8 species bivalves including horse mussels, cockles, pipis, native rock oyster and mussels; 6 species of worm; 8 species of Crustacean including mud crab and barnacles; 13 species of snail including mud snail.

Flora:

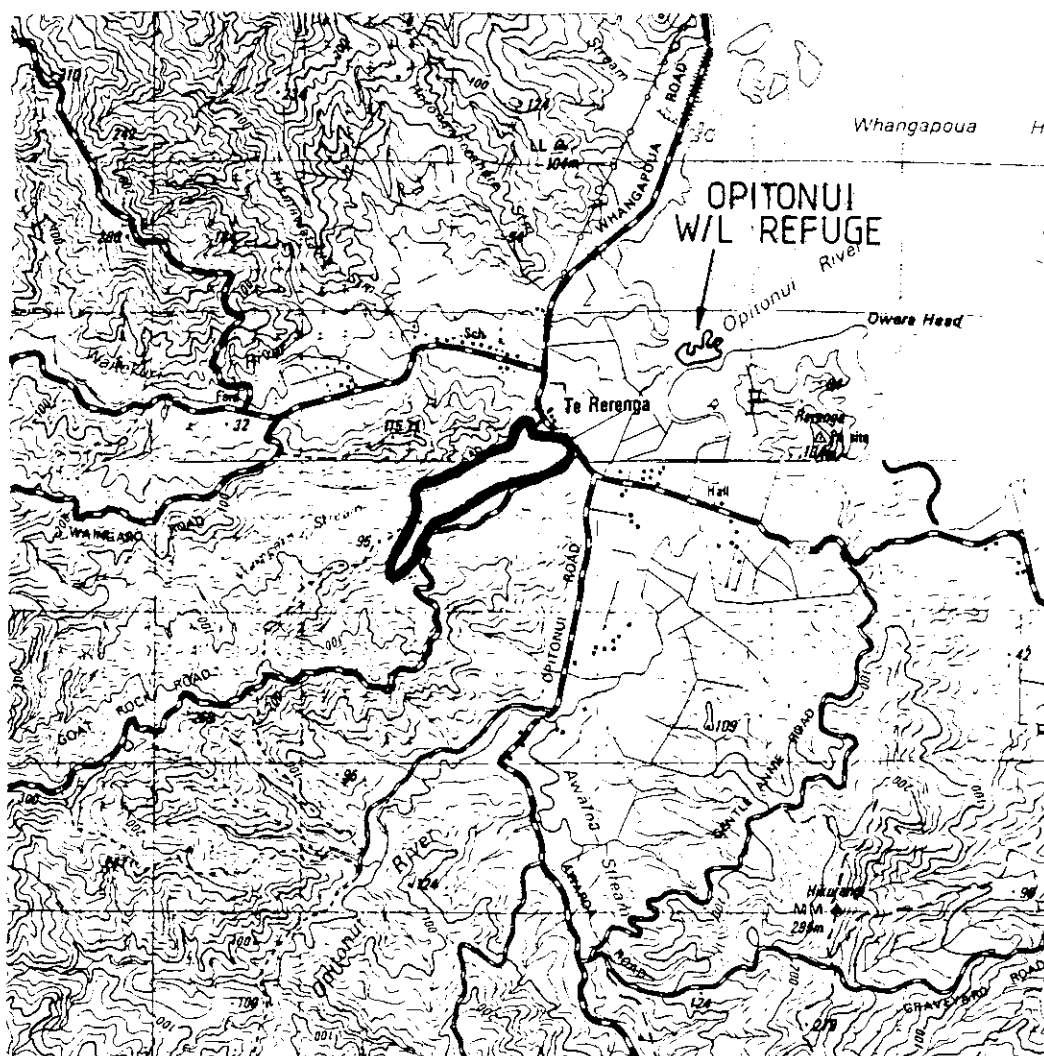
Nationally rare pingao on spit dunes.

Discussion:

Protection of the entire harbour would ensure adequate representation of estuarine wetland communities of an east coast harbour within the Colville ED. The area also rates highly as fauna habitat due to the large number of wading birds (including NZ dotterel, banded rail) which use it. NI fernbirds are found in scrub habitats along the margin. It is a productive estuary for shellfish. The only wetland reserve in the Colville district is very small and is situated on this estuary at the mouth of the Opitonui River. Protection and careful management of catchment required to maintain estuarine values.

Criteria Summary:

Representativeness	H	- The most representative and largest estuarine system in the ecological district.
Diversity	M	- One bioclimatic zone, six vegetation types. Good range of estuarine wetland communities and one dune community.
Naturalness	M	- Harbour vegetation still in predominantly natural condition if not intact. Causeways along western and eastern edges. Sewage settling ponds on former estuarine wetland. Sandspit dunes modified by adventive plant species.
Special Features	H	- Nationally threatened plant pingao on dunes. Diverse and abundant avifauna (including nationally threatened birds - see discussion) and estuarine macrofauna on the estuarine margins.
Viability	M	- Protection of harbour requires co-ordination of a large number of owners and interested parties on the estuarine margins and in the wider catchment area. Complex management.
Buffering	L	- Not well buffered; surrounding flats and low hills are farmed. Tributary catchments are mainly pine forest, a few scrub covered. Matarangi Beach estate development on the sandpit.
Landform	M	- A example of estuarine sandflats, and associated alluvial flats and sandspit.
Threat	H	- Further development of Matarangi Spit Beach Estate, pollution from sewage and increased sediment load during logging of the pine forests in the tributary catchments may threaten the estuarine values.



SCALE	:	1:50,000
GR CENTRE	:	NZMS 260 T11 423900
AREA	:	25 ha
ALTITUDINAL RANGE	:	5 - 15 m
TENURE	:	Crown (SOE)
DATA REFERENCE	:	Study Area 21A

Col. 14 : Waingaro Wetland

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	manuka/Baumea species rush-shrubland	alluvial flat	L
lowland	raupo-flax reedland	alluvial flat	L

Landform:

The wetland is on alluvial flat formed from recent deposits of Coromandel Group andesites and is situated amongst the pine-covered, low hills surrounding Whangapoua Harbour. Originally it would have formed an upper arm of the Whangapoua Harbour.

Vegetation:

In channels where there is open deep water, the rushes *Eleocharis sphacelata* and *Baumea articulata* are found. Elsewhere a mixture of species form a floating mat. Species present include *B.rubiginosa*, swamp millet, kiokio, flax, *Carex geminata*, with manuka, cabbage tree and swamp coprosma. In the upper reaches of the wetland *B.rubiginosa*, kiokio and umbrella fern form a dense cover with manuka as a partial canopy.

Fauna:

Good numbers of nationally threatened NI fernbird and spotless crane present.

Flora:

No notable plants recorded during the survey.

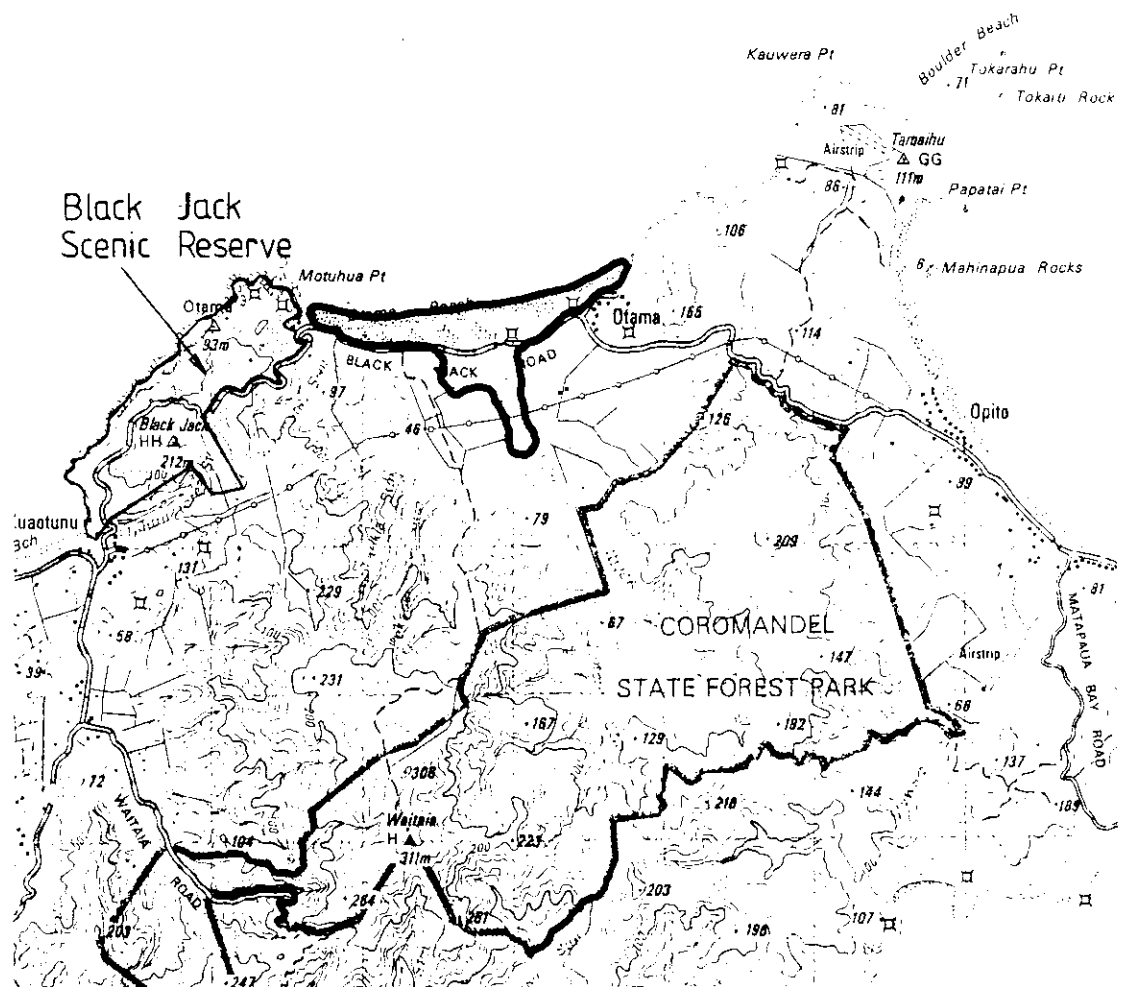
Discussion:

This is the largest remaining example of this type of wetland in Colville ED and one of only a few peatlands in Coromandel ER. It is unmodified by farming practices, and provides important wildlife habitat. Freshwater wetlands were once a feature of the upper reaches of many of the district's harbours and estuaries.

Criteria Summary:

Representativeness	H - Largest remaining freshwater wetland in the Colville ED.
Diversity	M - One bioclimatic zone, two vegetation types. Low community diversity, but only a small RAP.
Naturalness	M - Road across downstream edge. Pussy willow and some other adventive species present.
Special Features	M - Nationally threatened NI fernbird. Spotless crane.
Viability	M - Being a wetland requires careful management especially during logging of the surrounding pine forest.
Buffering	H - Pine and eucalypt plantation.
Landform	M - Representative of alluvial flats in the low foothills.
Threat	M - Alteration of drainage patterns. Increased sediment load with logging.

Col. 15 OTAMA BAY



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T10 568955
AREA	: 42 ha
ALTITUDINAL RANGE	: 0 - 10 m
TENURE	: Crown (lease)
DATA REFERENCE	: Study Area 17

Col. 15 : Otama Bay

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	spinifex-shore bindweed sandfield	foredune	M
coastal	pohuehue-knotted sedge rush-vineland	rear dune	L
coastal	<u>Juncus maritimus-Leptocarpus similis</u> rushland	tidal flat	M
coastal	manuka/ <u>Leptocarpus similis</u> rush-shrubland	tidal flat	M
coastal	pohutukawa rock-treeland	cliff	S
coastal	coastal broadleaved species scrub	hillslope	S

Landform:

A north facing bay on the Kuaotunu Peninsula. Area includes a longitudinal dune barrier system about 400m wide backed by tidal and alluvial flats of the Otama River. The river cuts the dune system at the eastern end. Some of the dunes are of Pleistocene origin.

Vegetation:

Spinifex-shore bindweed sandfield community occurs on fore and mid dunes with a few exotic species such as catsear, hawkbit and sea cakile. Scattered plants of pingao grow on the top and down the front of the foredunes. A dense mat of pohuehue with sand Coprosma covers the rear dunes with knotted sedge and lupin in damp hollows. There is frequent grass in places. Dunes are backed by (manuka-marsh ribbonwood)/Juncus maritimus-Leptocarpus similis rushland on the tidal flats of the estuary. A rocky headland at the west end of the beach supports a pohutukawa/flax rockfield and regenerating coastal broadleaved species scrub with kanuka. Some large, old pohutukawa occur on a low cliff at the east end of the beach.

Fauna:

Nationally threatened NI fernbird inhabits estuarine manuka shrubland and NZ dotterel frequent the beach.

Flora:

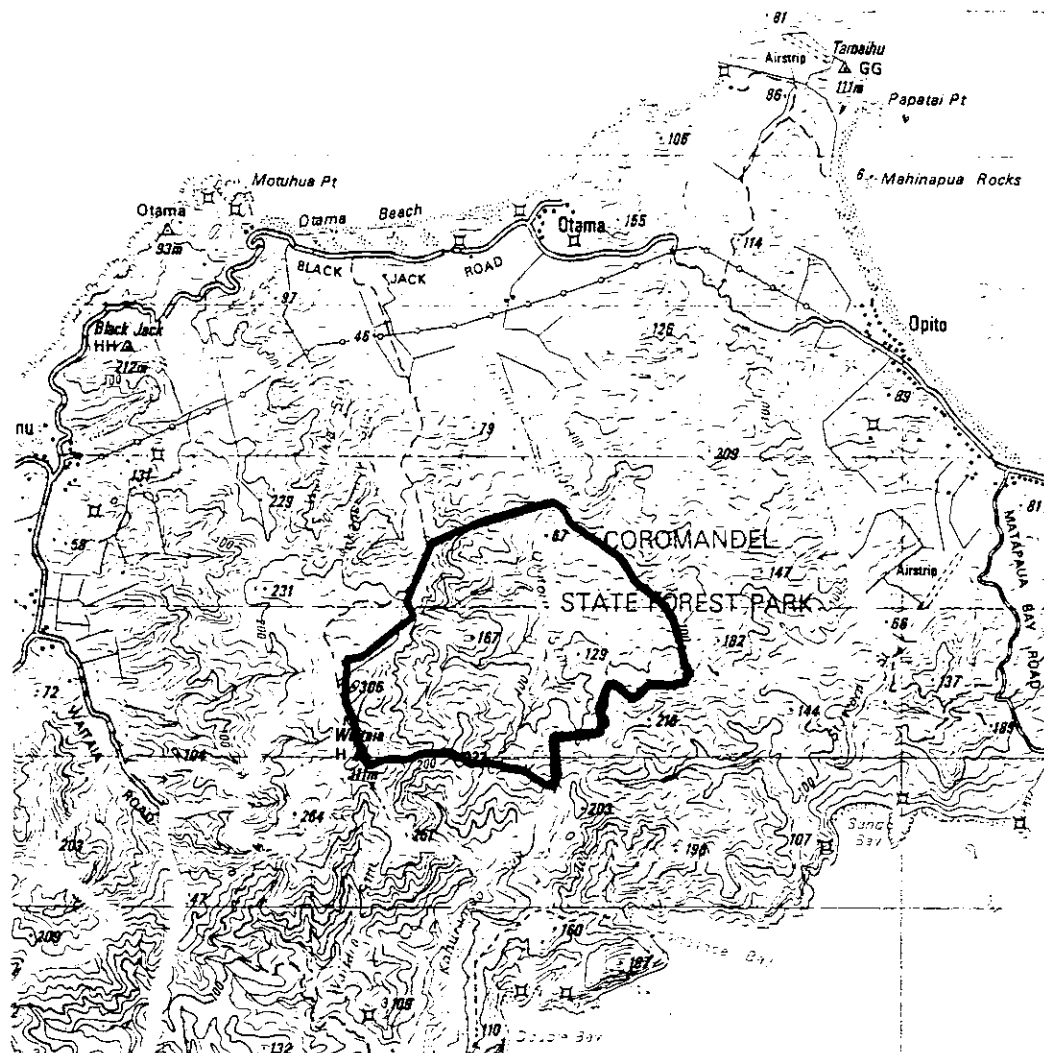
The nationally rare plant pingao occurs on foredunes.

Discussion:

Dune communities in this RAP are the best examples in the ecological district. They are the least modified by adventives and are significant in terms of landform. Examples of complete dune and estuarine systems in predominantly natural condition are rare in the ecological region. The dunes are a well known scenic feature and there is recreational use of the beach. Catchment protection is strongly recommended to maintain the natural values of the estuarine and dune communities.

Criteria Summary:

Representativeness	H	- Best example of contiguous dune and estuarine wetlands in the Colville ED and the best in the Coromandel ER.
Diversity	H	- One bioclimatic zone, six vegetation types. Several of the rare community types and habitats represented; dune, estuarine wetland and coastal forest.
Naturalness	M	- Least modified examples of these communities in district. Some impacts from farming practices and introduced plants.
Special Features	H	- Nationally rare plant pingao. Mimulus repens in estuary. Nationally threatened NI fernbird, NZ dotterel. The whole beach is very scenic.
Viability	M	- Management of dune use and exotic species may be necessary to protect their values and ensure long term viability. Management of Otama watershed is necessary to protect estuarine wetland values.
Buffering	M	- Surrounding flats and low hills developed for farming, but catchment headwaters predominantly natural in forest and scrub with some pines.
Landform	H	- The best example of a Pleistocene dune barrier in the Coromandel ER.
Threat	H	- Beach and dune area intensively used during summer season. Stock access to wetland area and dunes. Mining activities in the catchment. Subdivision in and around RAP.



SCALE	:	1:50,000
GR CENTRE	:	NZMS 260 T10 575925
AREA	:	260 ha
ALTITUDINAL RANGE	:	50 - 300 m
TENURE	:	Crown (DOC)
DATA REFERENCE	:	Surveyed 1989

Col. 16 : Ototoro Stream

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal- semi-coastal	pohutukawa modified forest	hillslope, ridge, gully	L M
coastal- semi-coastal	rata/tawa modified forest	hillslope, ridge, gully	M
coastal- semi-coastal	kanuka forest	hillslope, ridge, gully	L
coastal- semi-coastal	manuka-broadleaved species scrub	hillslope, ridge, gully	

Landform:

Headwaters of the Ototoro Stream on gently sloping Coromandel Group andesites and dacites. This catchment flows off the main ridge of the Kuaotunu Peninsula, near the high point named Waitaia, northwards and into the estuary of the Otama River.

Vegetation:

A large part of the catchment is covered in manuka-broadleaved scrub showing advanced regeneration and frequent presence of young coastal tree species. Ridges on the western side have a mosaic of pohutukawa forest, lowland rata/tawa forest and kanuka scrub; these forest types also show good regeneration after past disturbance.

Fauna:

Common forest birds recorded during survey.

Flora:

No unusual plants recorded during survey. Pohutukawa, northern rata hybrids present.

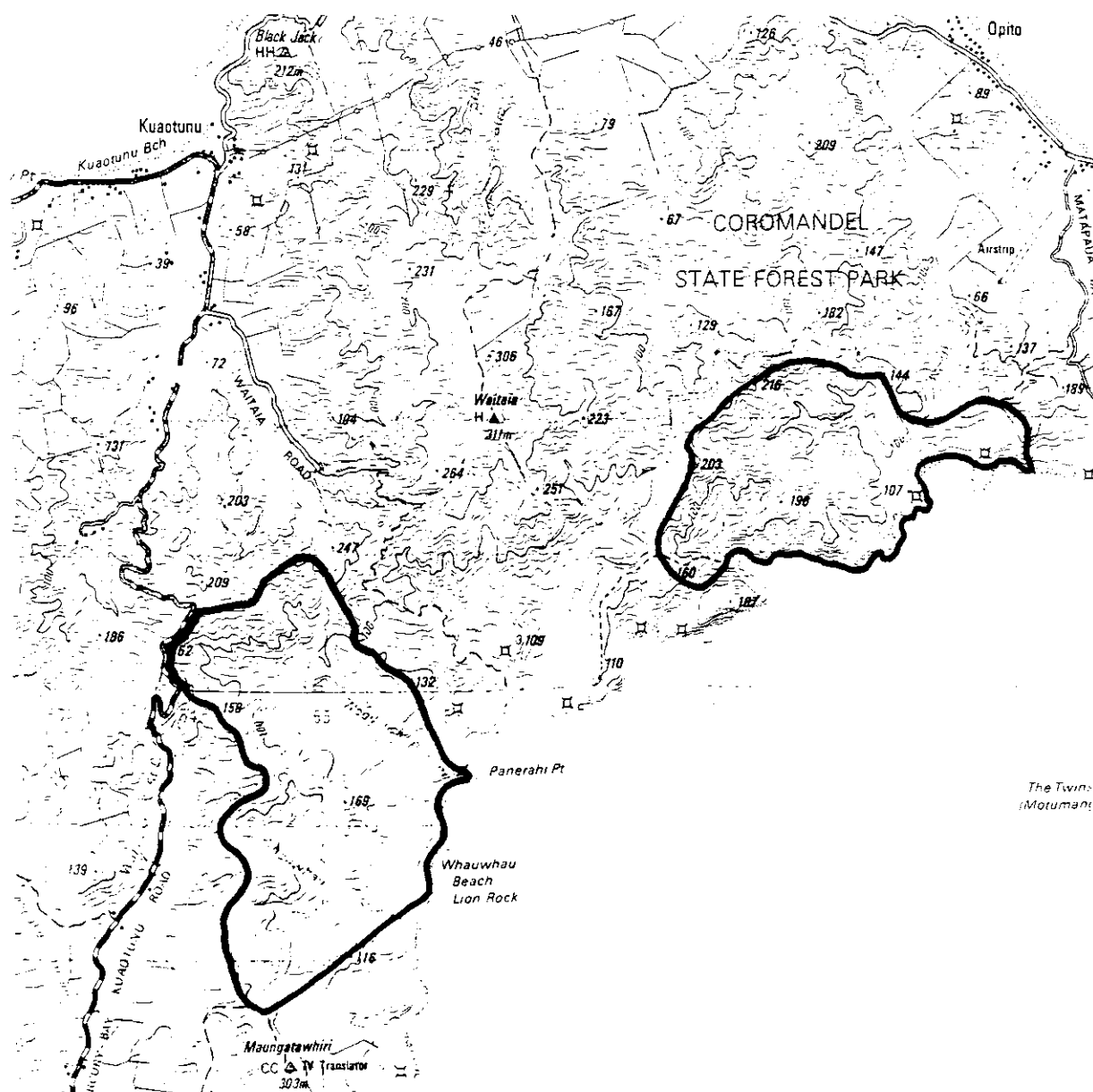
Discussion:

This RAP includes coastal and semi-coastal vegetation types currently underprotected in the existing PNAs of Colville ED. It is important for the protection the vegetation provides for the sensitive Otama Estuary and dune system which is the best remaining in the Coromandel ER. Ototoro is adjacent to Horseshoe Bay etc RAP.

Criteria Summary:

Representativeness	M - Regenerating mosaic of coastal forest and scrub.
Diversity	M - Two bioclimatic zones, four vegetation types.
Naturalness	L - Quite heavily disturbed in the past but regeneration is now proceeding vigorously.
Special Features	M - Scenic backdrop of the Kuaotunu Peninsula, catchment protection for Otama Estuary.
Viability	H - Viable if protected from damaging activities forest will continue to regenerate.
Buffering	M - Surrounded by native forest apart from the northern and eastern boundaries. Horseshoe Bay etc RAP adjoins this RAP to the south.
Landform	- Gentle coastal hillslopes off the main ridge of the Kuaotunu Peninsula on andesite and dacite.
Threat	- Wild animals, mining.

Col. 17
WHAUWHAU & WOODCOCK STREAM
HORSESHOE & SANDY BAYS



SCALE : 1:50,000
GR CENTRE : NZMS 260 T11 550893 & NZMS 260 T10 585917
AREA : 119 ha (242 Woodcock) + 237 ha
ALTITUDINAL RANGE : 0 - 300 m
TENURE : Crown (DOC), private
DATA REFERENCE : Study Area 20

Col. 17 : Whauwhau & Woodcock Streams, etc

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	pohutukawa rock-treeland	cliff, hillslope	M
coastal	pohutukawa-broadleaved forest	cliff, hillslope, ridge, gully	M
coastal	pohutukawa modified forest	hillslope, ridge, gully	L
coastal	kanuka forest	hillslope, ridge, gully	M
coastal	manuka scrub	ridge, hillslope	S
coastal	kauri-tanekaha forest	ridge, hillslope	M
coastal	manuka-broadleaved species scrub	hillslope, ridge, gully	M
lowland	(rata)/tawa modified forest	ridge, hillslope, gully	M

Landform:

This area incorporates a number of forested catchments on the southern side of the Kuaotunu Peninsula, separated by the omission of the Waitaia Stream which has been developed as pasture and pines. The southern section is comprised of two, moderately steep catchments draining to a sandy coastline with rocky outcrops. The eastern section comprises two, small stream catchments and an area of hillside extending down to Matapaua Bay. The coastline here is steep and rocky with a small enclosed sandy bay. Both sections occur on Cormandel Group andesites and dacites.

Vegetation:

Most of the eastern section supports pohutukawa rock-treeland association along the coastal cliffs and hillslopes. A semi-coastal mosaic of modified pohutukawa forest, tawa forest with emergent rata (with pohutukawa x northern rata hybrids) and kanuka scrub is found in the Horseshoe Catchment. Whauwhau and Woodcock Streams have some fairly extensive stands of pohutukawa-broadleaved forest adjacent to the coast giving way to a forest mosaic inland of modified pohutukawa forest, semi-coastal tawa forest with emergent podocarp and rata and kanuka scrub. There are also a few areas of kauri-tanekaha regeneration. The Sandy Bay catchment is predominantly manuka, kanuka and broadleaved scrub species with a relatively large area of pohutukawa modified forest extending towards Matapaua Bay, with some pohutukawa-broadleaved forest and a fringe of pohutukawa rock-treeland.

Fauna:

Common forest bird species were recorded during survey. Diverse invertebrate fauna in Whauwhau Stream as recent modification is minimal. Eastern streams were not assessed. Nationally threatened NI brown kiwi is reported from near Matapaua Bay.

Flora:

Mosses and blue-green algae are present in the Whauwhau Stream (not confined to the bedrock). Pohutukawa x northern rata hybrids.

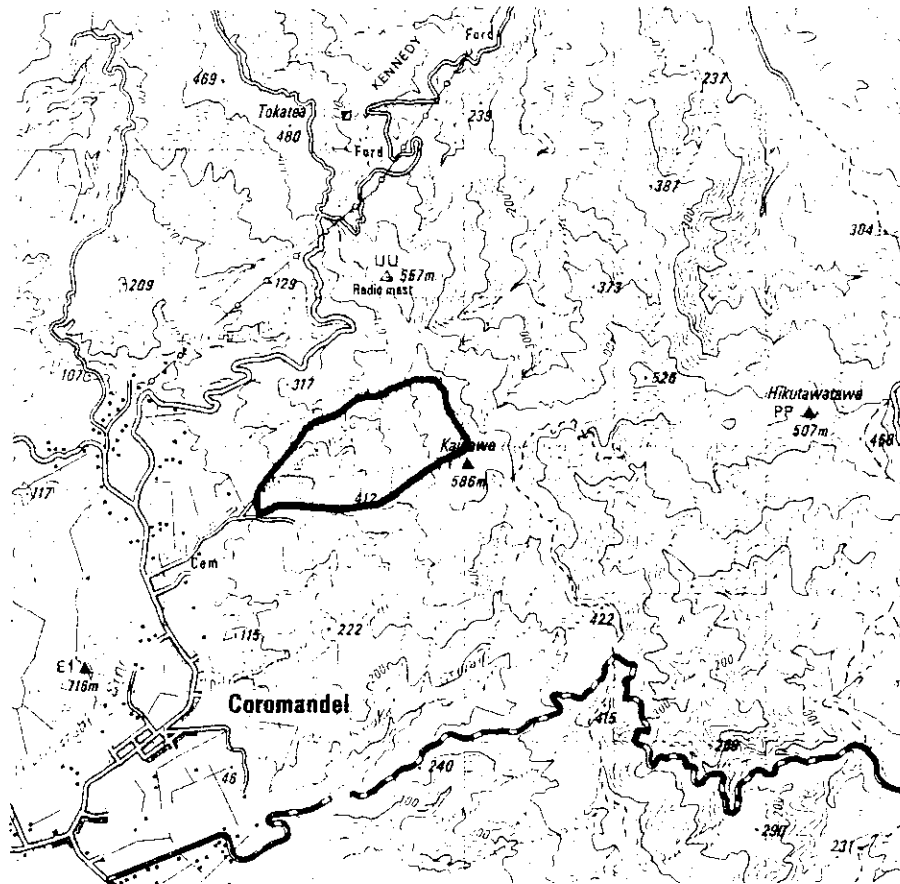
Discussion:

This area supports a large area of coastal forest which is currently under-represented in the reserves of Colville ED. It includes a number of forested catchments (at least one of which is known for good freshwater habitat) and lengths of highly scenic coastline.

Criteria Summary:

Representativeness	H	- Although it is modified in parts, the forest, scrub and regenerating forest complex does have species composition characteristic of coastal forest in Colville ED which is currently under-represented in existing PNAs.
Diversity	M	- Two bioclimatic zones, eight vegetation types. Coastal to lowland forest sequence with a number of successional stages included. Despite past vegetation disturbance the quality of Whauwhau Stream was considered excellent and an example of little modified coastal aquatic environment.
Naturalness	M	- Much of the forest is recovering after significant modification but there is still some relatively unmodified coastal forest.
Special Features	M	- Good stream habitat. Coast has high scenic and recreational value. NI brown kiwi habitat.
Viability	H	- Little management needed.
Buffering	H	- Well buffered - mainly entire catchments included, surrounding land forest and scrub.
Landform	M	- Typical range of landforms associated with coastal hillslopes included.
Threat	L	- Mining activities, wild animals, clearance and coastal subdivision.

Col. 18 WHAKANENEKE



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T10 355930
AREA	: 70 ha
ALTITUDINAL RANGE	: 200 - 586 m
TENURE	: Crown (DOC), Private
DATA REFERENCE	: Freshwater Survey (Penny 1988)

Col. 18 : Whakanekeneke

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	rata/tawa modified forest	hillslope, ridge	S
lowland	manuka scrub	hillslope, ridge, gully	S
lowland	rewarewa/manuka scrub	hillslope, ridge, gully	S
lowland	towai scrub or forest	hillslope, ridge	S

Landform:

Steep, small lowland catchment above Coromandel township on the western side of the Tokatea ridge on weathered andesite.

Vegetation:

Secondary manuka scrub some showing more advanced regeneration. A small amount of modified lowland forest. Some towai scrub on upper ridges.

Fauna:

Not known.

Flora:

Not known.

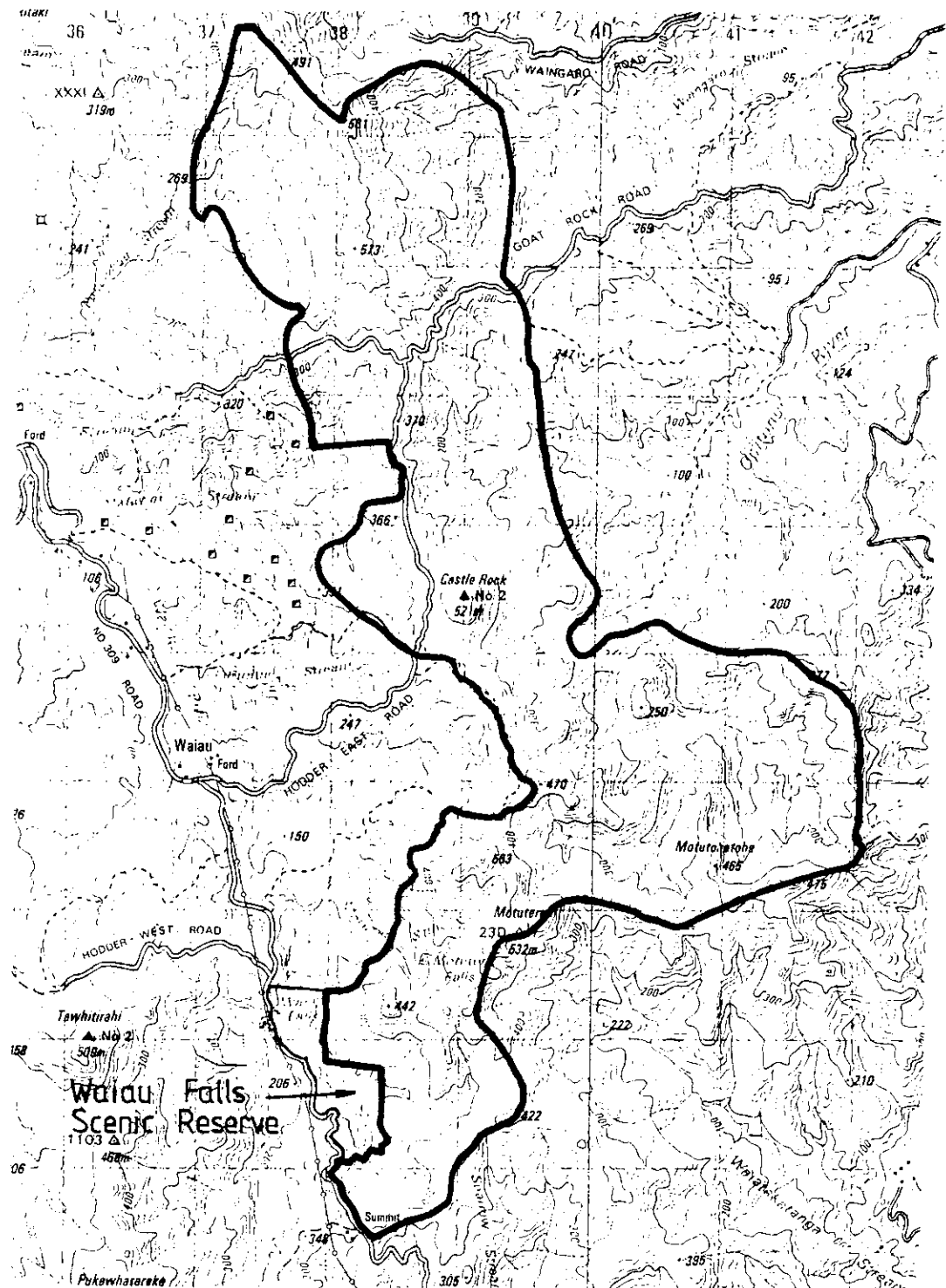
Discussion:

This catchment is comprised of mostly early secondary vegetation types. The area has been recommended mainly for its stream quality which is high. There is little erosion, low sediment loads and slightly mineralised water. There is a high diversity of stream invertebrates indicating stability.

Criteria Summary:

Representativeness	M	- Secondary vegetation common in the ecological region but freshwater values exceptionally good.
Diversity	L	- One bioclimatic zone, four vegetation types.
Naturalness	M	- Terrestrial communities modified but aquatic communities very natural.
Special Features		- Freshwater values.
Viability	M	- Requires protection.
Buffering	H	- Surrounded by natural vegetation.
Landform	M	- Steep catchment on
Threat	M	- Mining activities, wild animals.

Col. 19 CASTLE ROCK



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T11 390855
AREA	: 1571 ha
ALTITUDINAL RANGE	: 100 - 521 m
TENURE	: Crown (DOC), Maori
DATA REFERENCE	: Study Area 21

Col. 19 : Castle Rock

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	(rata podocarp)/tawa forest	hillslopes, gully	L
lowland	(rata)/tawa modified forest	hillslopes, gully	L
lowland	kauri-tanekaha forest	hillslopes, ridges	L
lowland	manuka-rewarewa scrub/forest	hillslopes, ridges, gully	M
lowland	upland rocky bluff community	rock outcrop	L

Landform:

Moderate to steep country of the central Coromandel Range. The area includes the upper reaches of five catchments, lying on both the east and west of the main range. All rock is of the Coromandel Volcanics Group, a feature being the geologically unique dacite plug that forms Castle Rock, which dominates the skyline of the area, and several other lesser peaks along the range.

Vegetation:

A large tract of tawa-broadleaved lowland forest with emergent rata and rimu also being kohekohe, tanekaha, silver tree fern, fivefinger nikau and mahoe and occasional mangeao, pukatea and taraire. The understorey is thick with silver tree-fern, hangehange, kiekie and other shrubs and saplings. Lianes and epiphytes are abundant. In places young kahikatea, miro, rimu and totara are emerging from the canopy. Some areas of forest have few emergents and abundant treeferns indicating logging damage. Associated with Castle Rock is a rocky bluff community with mairehau, *Astelia* sp, *Gahnia* sp, mountain flax, tawari, *Olearia townsonii*, *Pittosporum huttonianum*, hanging spleenwort and *Corokia*.

Fauna:

Regionally threatened (and endemic to Coromandel ER) Archey's frog is present.

Flora:

Extension of southern-most limit of the rare *Pittosporum virgatum*. Nationally vulnerable *Celmisia adamsii* var. *adamsii* found on Castle Rock. *Hymenophyllum armstrongii* grows on Motutere Rock.

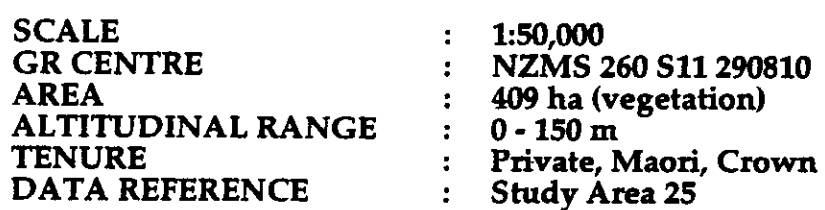
Discussion:

This area contains some of the most extensive and least modified (rata-podocarp)/tawa-kohekohe forest in the district. It also has rock bluff vegetation with nationally rare plants, this vegetation is currently under-represented in the PNAs of Colville ED. The kauri-tanekaha forest in this RAP is some of the most extensive in the district. Streams were not assessed for freshwater values but this site is significant for protection of freshwater values as it encompasses the steep headwaters of five streams the Pukewhau, Matawai, Waiau River flowing west and the Waingaro and Opitonui River flowing east. It provides a narrow corridor of natural vegetation for wildlife through the pines of Whangapoua forest to the northern area of the Colville ED. There are a number of vehicle tracks running through the RAP. The Opitonui kauri is situated in the south of this RAP.

A number of RAPs in the Colville District provide for lowland forest above the 10% objective, Castle Rock is one such RAP but is important for its rock bluff communities, rare plants and catchment protection.

Criteria Summary:

Representativeness	H	- Good example of relatively unmodified lowland forest on volcanic rocks, extensive kauri and rock bluff vegetation.
Diversity	M	- One bioclimatic zone, five vegetation types. Good diversity with several forest types and rock bluff communities.
Naturalness	M	- Less modified than other lowland areas. Forestry roads through area.
Special Features	H	- Several notable plant species. Presence of threatened, endemic Archey's frog. Significant landform and high scenic values, Opitonui kauri.
Viability	H	- Low management effort required, wild animal control.
Buffering	H	- Well buffered naturally. Pine forest in lower catchments to the northeast and southwest. Forest to the south and scrub to the north.
Landform	M	- Dacite plug a feature of the Coromandel Group volcanics of the district. Lowland forest protected on volcanic rock.
Threat	L	- Logging roads opened up again, mining, wild animals.



Col. 20 : Manaia Harbour

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	eelgrass	tidal flat	S
coastal	mangroves	tidal flat	L
coastal	manuka/ <i>Leptocarpus similis</i> rush-shrubland	tidal flat	M
coastal	manuka/ <i>Baumea</i> spp sedge shrubland	alluvial flat	S
coastal	pohutukawa rock-treeland	cliff	L
coastal	broadleaved species scrub	hillslope	L

Landform:

A long, narrow scenic harbour with a westerly aspect. Surrounding landscape is moderate to steep hill country of andesites and greywacke. Typical west coast harbour, with little beach and no dune system.

Vegetation:

Area includes extensive mangroves, some eelgrass and small patches of saltwater rushland with saltmarsh herbs and shrubs around the margins of the harbour. There is a gradation to a narrow fringe of freshwater wetlands of manuka, flax, *Baumea juncea* and *B. rubiginosa* in the upper north-eastern end. There is a narrow band of pohutukawa on cliffs around the north side of the harbour and extensive manuka-Pomaderris rugosa-gorse scrub on headland.

Fauna:

NI fernbird, and nationally threatened banded rail and Australasian bittern reported present in the wetlands. Ranked a moderate to high site of wildlife interest by the Wildlife Service for its importance to wading birds.

Flora:

Small stands of tawapou around the headland. This tree is usually only found as scattered trees on the mainland Coromandel ER today. Pomaderris rugosa (a species endemic to Coromandel ER) is abundant in the coastal scrub.

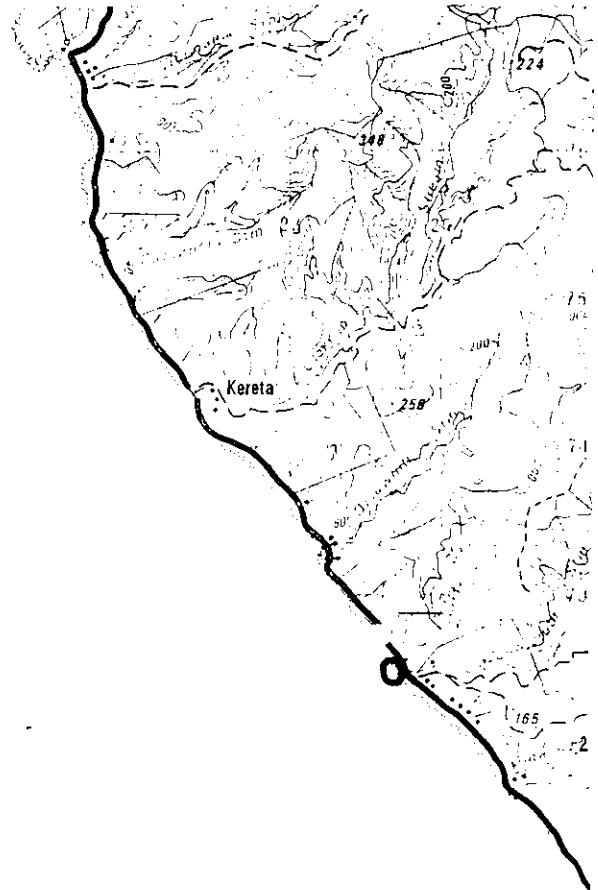
Discussion:

This harbour has been recommended for protection in addition to Whangapoua in Colville ED because of its different physical and hydrologic character and is representative of the West Coast. The upper catchment is largely forested and administered by DOC. The mid catchment and alluvial flats near the harbour have been converted to pasture. Thus compared to some other harbours in the Coromandel ER where upper catchments are modified estuarine values are likely to be retained in the long term, perhaps more so than than Whangapoua Harbour, the other harbour recommended in Colville ED. Inclusion of coastal scrub ensures adequate protection of the endemic shrub Pomaderris rugosa.

Criteria Summary:

Representativeness	H	- Valuable estuarine habitat, estuarine wetland, freshwater wetland and pohutukawa rock-treeland communities included.
Diversity	M	- One bioclimatic zone, six vegetation types. Estuarine wetland and coastal forest scrub communities.
Naturalness	M	- Scrub on the headland is an induced type, the result of clearing and burning. Pohutukawa rock treeland is modified.
Special Features	M	- Tawapou, Coromandel endemic, Pomaderris rugosa, nationally threatened Australasian bittern and banded rail, NI fernbird. Very scenic harbour.
Viability	M	- Being a wetland this area requires careful management. Forested headwaters should protect it from excessive sedimentation.
Buffering	M	- Semi continuous with other scrub around the north side of the harbour, otherwise pasture. Manaia catchment largely in forest and scrub.
Landform	M	- Tidal and alluvial flats and coastal cliffs and hillslopes.
Threat	M	- Infilling and dumping a threat round harbour margins. Grazing of estuarine vegetation.

Col. 21
WAIROTOROTO SHINGLE BEACH



SCALE	:	1:50,000
GR CENTRE	:	NZMS 260 S11 287726
AREA	:	1 ha
ALTITUDINAL RANGE	:	1 m
TENURE	:	Crown
DATA REFERENCE	:	

Col. 21 : Wairotoroto Shingle Beach

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	<i>Suaeda</i> herbfield	shingle beach	L

Landform:

Shingle slack in beach terrace near Wairotoroto Stream.

Vegetation:

An area of brackish water in a hollow of shingle beach supports the native saltmarsh plant *Suaeda novae-zelandiae* which was not found elsewhere in the Coromandel ER and is not a common plant in New Zealand. Other native plants in this natural community include pohuehue, *Cotula coronopifolia*, *Isolepis salcatus*, and *Triglochin striatum*. This area has very few exotic species but is in contrast to much of the surrounding shingle beach which supports blackberry, thornapple and exotic grasses.

Fauna:

Very small habitat, no fauna recorded.

Flora:

Suaeda novae-zelandiae.

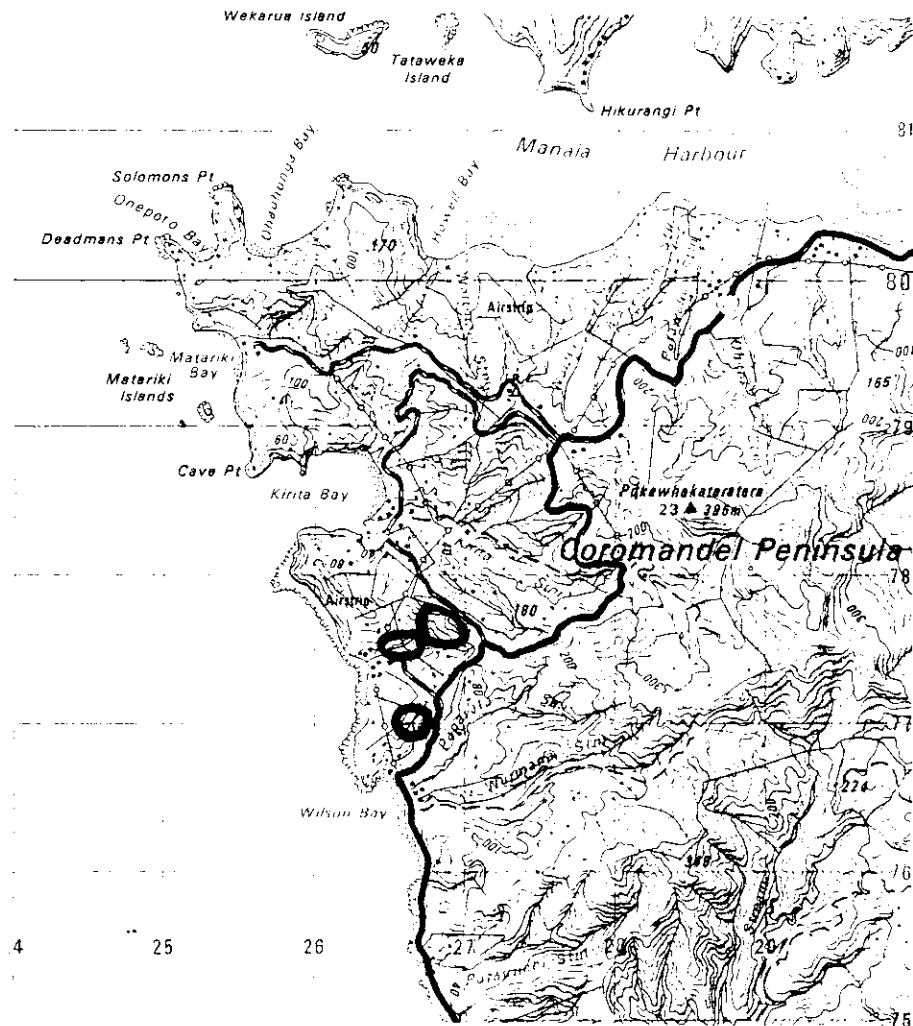
Discussion:

The shingle beaches of the Thames coast have been, in the main, heavily modified by humans through encroachment by roads and settlement and vigorous competition of introduced plant species with native shingle plants. This small area supporting the uncommon plant *Suaeda novae-zelandiae* is the best area of representative shingle vegetation surveyed in the Thames ED.

Criteria Summary:

Representativeness	H	- Best area of native shingle community surveyed in the Thames ED and Coromandel ER.
Diversity	L	- One bioclimatic zone, one vegetation type.
Naturalness	M	- Very few introduced plant species over the small area of this community.
Special Features		- <i>Suaeda novae zelandiae</i> is not common in New Zealand and its habitat is under threat.
Viability	L	- Requires protection and possibly some active management to retain this community.
Buffering	L	- Buffered by communities of adventive plants.
Landform		- Slack in shingle beach.
Threat	H	- Bulldozing, channel modification, invasion by adventive plants.

Col. 22 KIRITA BUSH REMNANTS



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 S11 274786
AREA	: 1 ha
ALTITUDINAL RANGE	: 20 - 260 m
TENURE	: Private
DATA REFERENCE	: Study Area 27

Col. 22 : Kirita Bush Remnants

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal coastal	taraire-broadleaved forest kauri-tanekaha forest	hillslope, gully ridge	M S

Landform:

Coastal hillslopes.

Vegetation:

Several remnants of forest predominantly in the coastal zone. These remnants are of the taraire broadleaved type typical of the Colville and Thames EDs which is currently under-represented in the PNA system. Species associated with taraire include tawa, puriri, karaka, hinau, kanuka, houpara, kowhai, matai, miro, kauri, nikau, totara, pohutukawa and many others. High species diversity is a feature of these forest remnants.

Fauna:

A good range of native and introduced bird species were recorded during the survey.

Flora:

No species of note were recorded during the survey.

Discussion:

Although these forests remnants are dissected, largely unfenced and are grazed by farm stock this coastal forest type is so reduced in extent today and under-represented in the reserve system that they warrant protection.

Criteria Summary:

Representativeness	H - Very few areas of this type of coastal forest remain in Thames ED?
Diversity	L - Two bioclimatic zones, two vegetation types.
Naturalness	L - Unfenced, overgrazed.
Special Features	-
Viability	M - Viable if fenced and protected.
Buffering	L - Surrounded by pasture.
Landform	- Coastal hillslopes.
Threat	- Clearance, stock grazing.

4. THAMES ECOLOGICAL DISTRICT

S U M M A R Y

Thames Ecological District (ED) extends down the eastern coast of the Thames Estuary and across the main range to Whitianga. The country is steep, dissected and comprised of Coromandel Group andesites and includes prominent landforms such as Maunaupaki, Papakai and Kakatarahae. The Thames coastline has boulder, gravel and mud beaches and scenic, rocky headlands.

Natural vegetation of the district is extensive ranging from sparse pohutukawa forest on the coast, through lowland forest and scrub to montane forest and scrub on ridges and cloud or bog forest on plateaus. Both montane and lowland forests are habitat for a number of nationally threatened plants (see Table 5). The vegetation of the Thames ED has been extensively modified by logging and mining activities. Some vegetation types such as forest on alluvial terraces, coastal and freshwater wetland and shingle beach communities have all but disappeared (see Table 7 and Section 4.1.5).

The large tracts of forest found in this district provide habitat for a range of wildlife including some nationally threatened species (Table 5).

Protected Natural Areas in Thames ED cover 9600 ha with four large ecological areas protecting forest lying mainly over 400 m. Coastal reserves are small and protect only 5% of the former extent of coastal vegetation. There is no protection of salt or freshwater wetlands nor of alluvial terrace forest. At least 60% of the total area currently protected is scrub and secondary vegetation.

The seven RAPs proposed in Thames ED seek to protect more representative lowland forest, semi-coastal and coastal forest and some coastal and freshwater wetlands. Some of the RAPs have been proposed largely because of their significant wildlife values and the catchment protection they provide. Almost all the land recommended for protection is Crown administered with a very small proportion privately owned.

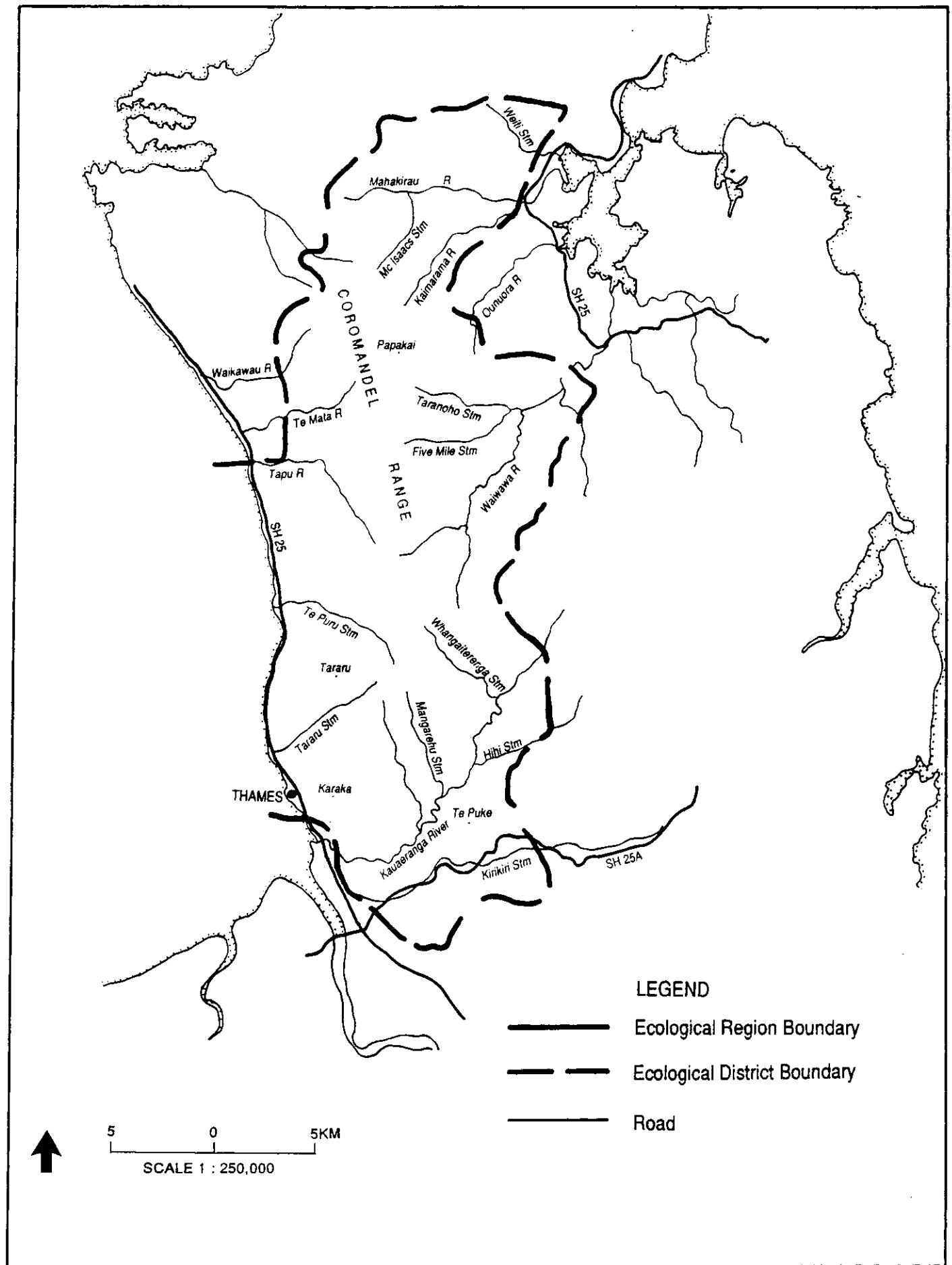
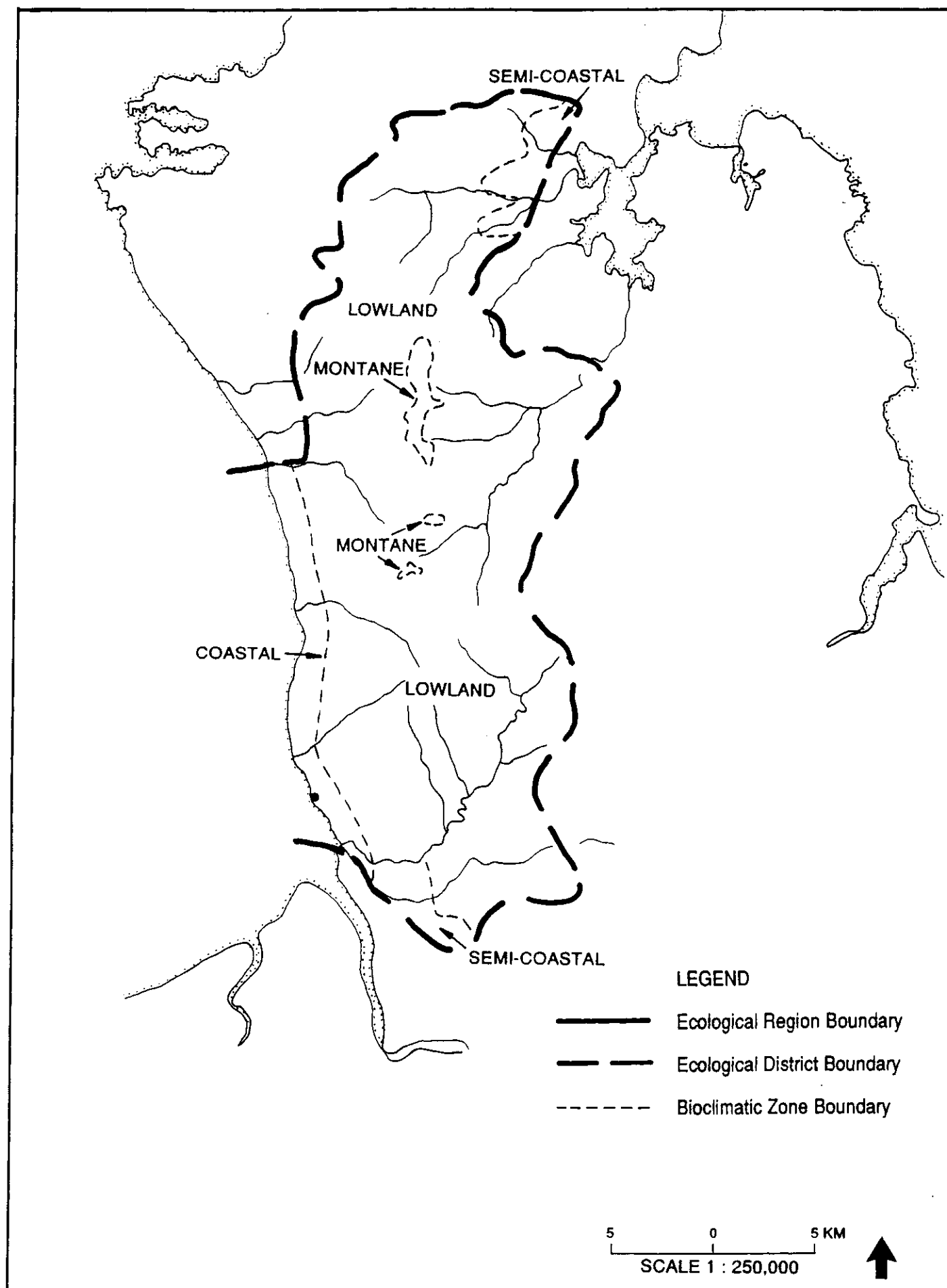


FIG 6



**THAMES ECOLOGICAL DISTRICT
BIOCLIMATIC ZONES**

4.1 ECOLOGICAL CHARACTER

4.1.1 RELIEF

The Thames ED extends down the western Thames coast and across to Whitianga Harbour including a large amount of hill country and areas within the montane zone. The terrain of ED is mainly steep, dissected hill country. Although the maximum altitude attained in Thames ED, as it has stronger affinities with the vegetation and geology of that district is higher than Colville most of the district lies below 600m. Well defined, deep valleys drain to the west via the Kauaeranga, Tapu and other rivers while the Waiwawa drains to the northeast. Small rivers on the west coast have deposited alluvial fans where they emerge from the steep country on to the narrow strip of flatter land between hills and sea. The main range is broad and almost plateau-like while a secondary range between that and the coast terminates in steep spurs and coastal cliffs. River valleys are generally narrow and alluvial flats are limited in extent. The coastline is straight with sandy or shingle beaches. The Kauaeranga River estuary flows into the Firth of Thames and this was originally included in this ED, but subsequent to survey the Thames ED boundary was altered so that this estuarine wetland now lies in the adjacent Hauraki ED.

4.1.2 GEOLOGY

The rocks of the Thames ED are mainly volcanic Coromandel Group andesites and dacites of the older Kuaotunu sub-group that are exposed along the west coast, and the Waiwawa sub-group from the late mid and upper Miocene. Extensive alluvial areas occur as flats around Thames and up the Kauaeranga Valley.

4.1.3 CLIMATE

Thames ED generally has warm humid summers and mild winters. Although summer droughts are frequent, periods of torrential rain and flooding can occur. Temperatures show the same decrease with altitude observed in other ecological districts and thus bioclimatic zonation is similar. Data from the climate station at Thames township indicates a mean daily minimum temperature of 10.6 C, a mean daily maximum of 19.0 C, and a mean annual rainfall of 1278 mm with the most occurring in June. An isohyet map for Coromandel (see Maunder, 1974) shows a great difference in mean annual rainfall between lowland and montane areas. Rainfall increases more rapidly with altitude on the western side of the main divide than the east. Highest rainfall in Thames occurs around Maumaupaki- Papakai-Kakatarahae area, along the main divide in the northern half of the district. The greater exposure and more frequent cloud and mist cover may account for the distinctive vegetation found there.

4.1.4 SOILS

[Information source: McCraw and Bell, 1975]

The geology and pattern of relief are further reflected in a relatively simple soil pattern in the district. On moderately steep land soils are Waitakere hill soils (brown granular clays) of medium to low fertility. On steep and very steep land there are soils related to brown granular clays of Aroha steepland soils (medium to low fertility) and Te Kie steepland soils (medium fertility).

4.1.5 VEGETATION

The steep terrain of the west coast means that most of Thames ED is in the lowland bioclimatic zone, the coastal zone forms a narrow strip extending 1-2 km inland. The crest of the ranges above about 600 m forms the montane zone. The steepness of Thames ED has restricted development for farming leaving vegetation of the lowland and montane zones largely intact. As with other districts in the Coromandel ER, the coastal zone has been highly modified, probably more so than in other districts, so that it is difficult to ascertain past vegetation cover from modified remnants found today. An estimated 43% of the former extent of the coastal zone remains in native vegetation today but is mostly scrub. In places regenerating forest and scrub are contiguous with the coast. Pohutukawa forest would have covered coastal cliffs and hillslopes, rapidly becoming lowland kauri-podocarp tawa forest on steeply rising hillslopes. Guthrie (1948-1951) mentions that kauri once grew on the coast prior to logging in Thames ED.

Sandy beaches and harbours do not occur in Thames ED, although the Waikawau River has mangroves and estuarine vegetation at its mouth. The distinctive gravel beaches of the west coast would have supported little natural vegetation although native herbfields may have grown in wet slacks as indicated by a remnant of *Suaeda* found at the Wairotoroto Stream outlet. (See Appendix I)

The present patterns of vegetation indicate that lowland forest was originally a mosaic of dense kauri, or scattered kauri amongst podocarp-hardwood forest, but with some forest having no kauri at all. An area of dense kauri remains in the Waiomu catchment, and is included in the forest sanctuary. Hard beech would have occurred very locally. (Nicholls, pers. comm) and Adams (1884) mentions it being used for mine props and railway construction. In areas without kauri some podocarp-hardwood forest has remained little affected by logging. Some more recent logging has removed emergent podocarps. Sparse remnants of podocarp forest occur on narrow alluvial flats and terraces in the district such as in the Tapu and Kauaeranga River Valleys. Tanekaha, totara, rimu and titoki occur with kahikatea and swamp maire in wetter places in these situations.

The highest area in Thames ED is along the Maupaupaki-Papakai ridge/plateau. Here Yellow-silver pine, kauri, kaikawaka and southern rata occur in the montane broadleaved species forest and this type has remained largely unmodified by humans. In two places along this broad flat ridge swamp maire occurs as a distinct montane bog association. (See type 35 Appendix I).

4.1.6 FAUNA

The large tract of continuous forest in Thames district provides habitat for a range of wildlife. Common forest birds present include NZ pigeon, tui, bellbird and pied tit. Less common species (see Table 6), of the forest and scrub include NI kokako, NI kaka, NI brown kiwi and NZ falcon. The two native frogs, Archey's and Hochstetter's, are also known from the forest areas. Archey's frog is found in upper catchments, above about 400m, and Hochstetter's from streams below this altitude.

Duvaucel's gecko, New Zealand's largest known living lizard, has a disjunct distribution in New Zealand. In Thames district it has been located in scrub although it can occur in a range of habitats from boulder beaches to scrub and forest (Towns et al, 1985). Sea turtle have been recorded occasionally in the Firth of Thames.

Shore and wader birds are found along the Thames Coast including spotted shag, white fronted tern, pied stilt and Caspian tern. The Firth of Thames is a wetland of international importance under the criteria set down by IUCN and supports significant populations of resident and migratory birds.

TABLE 5 :**Important Plants in Thames Ecological District
A Provisional List****VULNERABLE**

Celmisia adamsii var. *adamsii*
Pittosporum virgatum

LOCAL

Loxoma cunninghamii
Marattia salicina
Metrosideros carminea
Suaeda novae-zelandiae

SPECIES ENDEMIC TO COROMANDEL ER

Brachyglottis myrianthos
Coprosma dodonaeifolia
Dracophyllum patens
Hebe pubescens var. *pubescens*

TABLE 6 :**Important Fauna in Thames Ecological District****ENDANGERED**

Birds
 NI kokako

THREATENED

Mammals
 Long-tailed bat

Birds
 Caspian tern
 NI brown kiwi

NI falcon
 NI kaka

Amphibians
 Archey's frog

Hochstetter's frog

REGIONALLY THREATENED

Reptiles
 Duvaucel's gecko

RARE

Reptiles
Dermachelys coriacea (sea turtle)

TABLE 7 : Thames Ecological District - Standard Ecological Units

BIOCLIMATIC ZONE	HYDROLOGIC SYSTEM	VEGETATION TYPE	E C O L O G I C A L U N I T	LANDFORM TYPE	FORMER EXTENT (of veg type)	CHANGE	PRESENT EXTENT	PROTECTION STATUS
coastal	estuarine	mangroves		tidal flat	minor	same	minor	1
coastal	estuarine	<i>Juncus maritimus</i> - <i>Leptocarpus similis</i> rushland		tidal flat	minor	gone	none	1
coastal	estuarine	<i>manuka/Leptocarpus similis</i> rush-shrubland		tidal flat	minor	gone	none	1
coastal	terrestrial	iceplant rockfield		cliff/rock stack	minor	reduced	remnant	1
coastal	terrestrial	coastal flax cliff community		cliff/hillslope	minor	reduced	remnant	1
coastal	terrestrial	coastal broadleaved species scrub or shrubland		hillslope/gully/ridge	minor	gone	none	1
coastal	terrestrial	pohutukawa rock treeland		cliff/hillslope	minor	reduced	minor	2
coastal	terrestrial	pohutukawa-broadleaved species forest		hillslope/gully/ridge	minor	reduced	remnant	2
coastal	terrestrial	pohutukawa modified forest		hillslope/gully/ridge	minor	increased	common	3
coastal-lowland	palustrine	<i>manuka/Baumga</i> species sedge-shrubland		alluvial terrace/alluvial flat	minor	gone	none	1
coastal-lowland	palustrine	raupo-flax reedland		basin/alluvial flat & terrace	minor	reduced	remnant	1
coastal-lowland	terrestrial	alluvial terrace forest		alluvial terrace	minor	reduced	remnant	1
coastal-lowland	terrestrial	<i>manuka</i> scrub		hillslope/gully/ridge	minor	increased	common	4
coastal-lowland	terrestrial	<i>manuka</i> -broadleaved species scrub or forest		hillslope/gully/ridge	minor	increased	major	5
coastal-lowland	terrestrial	kauri-tanekaha forest		hillslope/ridge	common	reduced	minor	5
coastal-lowland	terrestrial	hardbeech-kauri-tanekaha forest		hillslope/ridge	minor	reduced	remnant	4
coastal-montane	terrestrial	rewarewa/ <i>manuka</i> scrub		hillslope/ridge	minor	increased	common	5
lowland	terrestrial	lowland swamp forest		basin/alluvial flat & terrace	minor	reduced	remnant	1
lowland	terrestrial	lowland broadleaved species scrub		hillslope/gully/ridge	minor	increased	minor	1
lowland	terrestrial	(<i>rata</i> - <i>podocarp</i>)/ <i>tawa</i> -kohekohe forest		hillslope/gully/ridge	major	reduced	major	2
lowland	terrestrial	(<i>rata</i>)/ <i>tawa</i> modified forest		hillslope/gully/ridge	minor	increased	major	4
lowland-montane	terrestrial	(<i>rata</i> - <i>podocarp</i>)/ <i>tawai</i> - <i>tawa</i> forest		hillslope/gully/ridge	major	reduced	major	4
lowland-montane	terrestrial	<i>tawai</i> - <i>tawa</i> forest		hillslope/gully/ridge	common	increased	common	5
lowland-montane	terrestrial	<i>tawai</i> scrub		hillslope/gully/ridge	minor	increased	common	5
lowland-montane	terrestrial	upland rocky bluff community		bluff/pinnacle	minor	same	minor	4
montane	terrestrial	<i>tawai</i> - <i>tawari</i> - <i>tawheowheo</i> forest/scrub		plateau/hillslope/gully/ridge	common	same	common	5
montane	terrestrial	montane swamp forest		basin/plateau	minor	reduced	minor	3

PROTECTION STATUS: 1 = not represented within existing PNAs 2 = much less than 10% of former extent protected 5 = well represented within existing PNAs
 3 = less than 10% of former extent protected 4 = adequately protected

4.2 EXISTING PROTECTED NATURAL AREAS

The PNA system in Thames Ecological District is composed of four lowland and montane ecological areas, a forest sanctuary, and a number of very small, coastal, scenic reserves, totalling 9600 ha altogether and representing approximately a quarter of the ED. The ecological areas account for a large proportion of this figure.

The large reserves in Thames ED lie over several bioclimatic zones resulting in some zones being adequately protected while others are not. The lower lowland, semi-coastal and coastal zones have less than 5% protection, wetlands and mangroves having no protection at all. Scrub and secondary vegetation are disproportionately represented within protected natural areas, making up approximately 60% of their total area. Approximately 20% of the "upland" and montane zone is adequately protected.

4.3 FURTHER REQUIREMENTS TO PROVIDE A NETWORK OF REPRESENTATIVE NATURAL AREAS

The ecological areas (Manaia, Papakai and part of Te Tipi and Motutapere) cover approximately 19% of the montane zone. In the selection of EAs the NZFS placed particular emphasis on protecting kauri forest in the lowland and montane zones. The range of wildlife known to occur in the forests of the district, including threatened species, is represented in the ecological areas. The ecological areas do lie within a much larger tract of forest which contributes to wildlife diversity and especially benefits the populations of wide ranging forest birds.

In contrast, the few very small reserves of the coastal zone are mostly of highly modified vegetation with minor remnants of the original forest. The larger and more representative of these are regenerating well, they are Tapu-Ruamahanga and Thornton Bay Scenic Reserves. Thames ED has a superficially adequate total area reserved within each bioclimatic zone based on the 10% criterion. (See Part 1, section 2.2; in Kelly, 1980). Considering existing PNAs in more detail, there are certain or ecological units which are not represented at all; eg sand/shingle beaches, estuarine communities and the vegetation of alluvial flats and terraces (including forest, sedgeland, and rushland). Although nearly one quarter of the district is included in PNAs, there are none which protect the full range of natural diversity with altitude.

4.4 RECOMMENDED AREAS FOR PROTECTION (RAPs)

Each RAP description includes a location map, a checklist of component ecological units, a brief description of landform and vegetation character, and an evaluation/discussion and summary of the priority status of the area.

1. Location Map

Drawn on NZMS1 series maps at 1:50,000 or at reduced scale where necessary.

2. Ecological Unit Checklist

A list of the standard ecological units (see Appendix I for descriptions).

"REL. AREA" - the size of each ecological unit in relation to other examples of that unit in the District; large (L), medium (M) or small (S). For example a large (L) foredune would occupy a much smaller area than a large (L) kanuka forest unit. - 0 indicates no other examples recorded in the district.

3. Landform and Vegetation

Descriptions are given for the entire priority area.

4. Flora

Distinctive or important plant taxa as opposed to vegetation which describes communities of plants.

5. Discussion and Criteria Summary

Outline of the quality of the area and its important features for protection.

Further information, such as distribution of vegetation types within RAPs, may be obtained from the Department of Conservation, Waikato Conservancy, Hamilton.

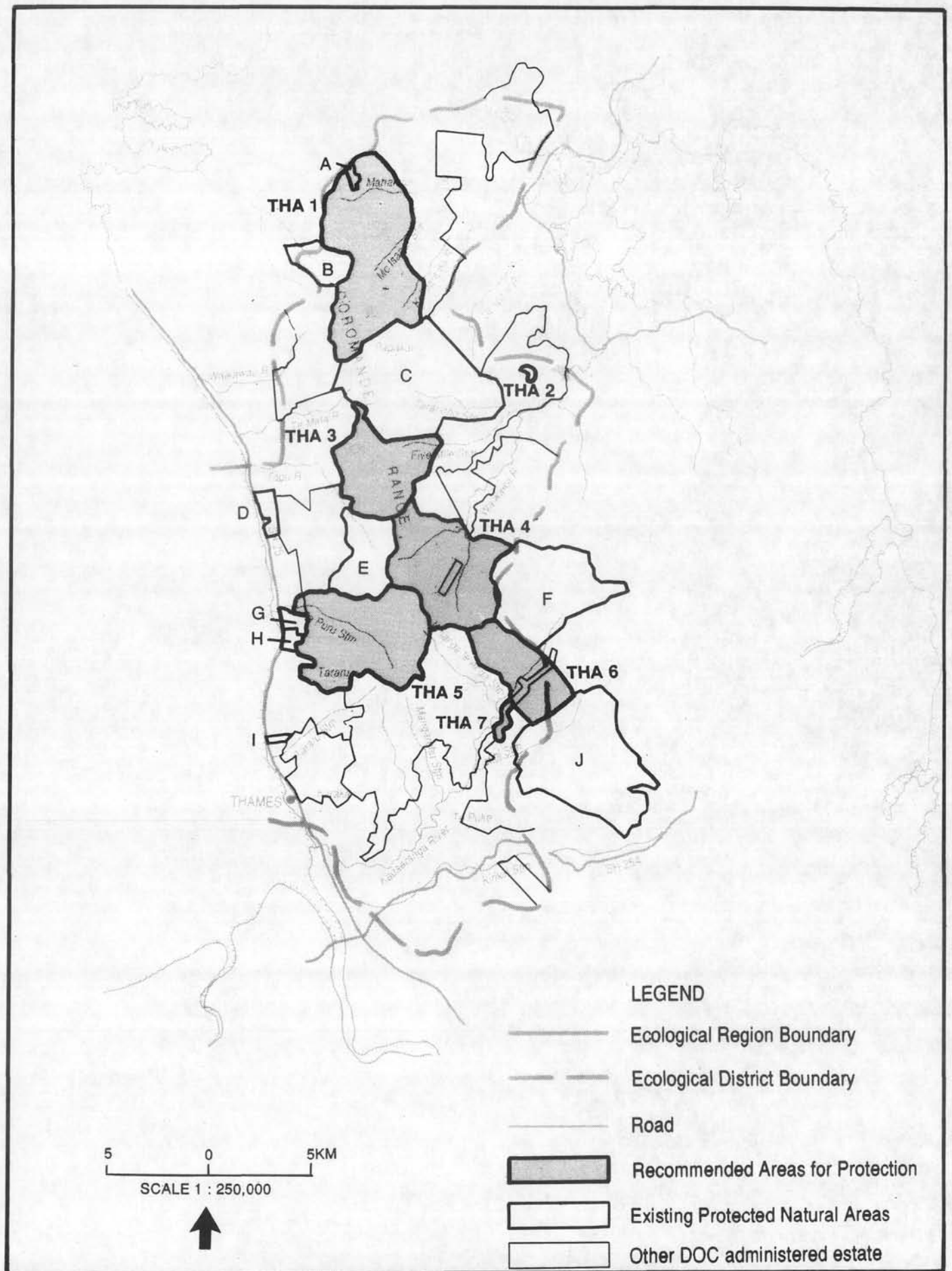


FIG 8

INDEX TO RAPs

		Page
Tha 1	Mahikarau Catchment	102
Tha 2	Illingsworth's Alluvial Flat	104
Tha 3	Tapu	106
Tha 4	Waiwawa	108
Tha 5	Te Puru	110
Tha 6	Wainora	112
Tha 7	Kauaeranga River Flats	114

INDEX TO EXISTING PNAS

(See Fig 4)

- A Waiau Falls Scenic Reserve
- B Manaia Forest Sanctuary
- C Papakai Ecological Area
- D Tapu Scenic Reserve
- E Waiomu Ecological Area
- F Te Tipi Ecological Area
- G Puru Scenic Reserve
- H Thornton Bay Scenic Reserve
- I Waihoanga Private Scenic Reserve
- J Motutapere Ecological Area

THAMES

Tha. 1 : Mahakirau Catchment

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	(rata-podocarp)/tawa forest	hillslope, ridge, gully	L
lowland	(rata)/tawa modified forest	hillslope, ridge, gully	M
lowland	manuka-rewarewa scrub	hillslope, gully	L
lowland	manuka-broadleaved spp scrub	hillslope, ridge, gully	M
lowland-montane	towai-tawa forest	ridge, hillslope	L
montane	tawari-towai-tawheowheo scrub	ridge	S

Landform:

This area incorporates the much dissected headwaters of the Mahakirau and Kaimarama Rivers. Terrain is moderate to steep hill country rising up to the central ridge of the main Coromandel Range and the western boundary.

Vegetation:

A large tract of lowland forest which varies in its species composition with altitude and the degree of disturbance caused by past logging. At low altitudes there is abundant kohekohe, hinau and a diverse understorey. Where disturbed by logging there are few emergent podocarps and a broken tawa canopy. Towai becomes more frequent with altitude and above about 600m ridges are covered in montane scrub, sometimes with kaikawaka. Some lowland ridges and hillslopes support secondary scrub communities.

Fauna:

The Wildlife Service recorded NI brown kiwi, NI kaka, Hochstetter's and Archey's frogs as present and ranked the area of outstanding wildlife value. Sparrow Stream and the Waikawau has a diverse macroinvertebrate fauna including freshwater limpet *Latia*.

Flora:

Loxoma cunninghamii, *McIsaacs* and *Hamon kauri* within this RAP. Sparrow Stream has alga, *Bostrychia scorpioides*, which elsewhere in the world is usually found in the marine environment.

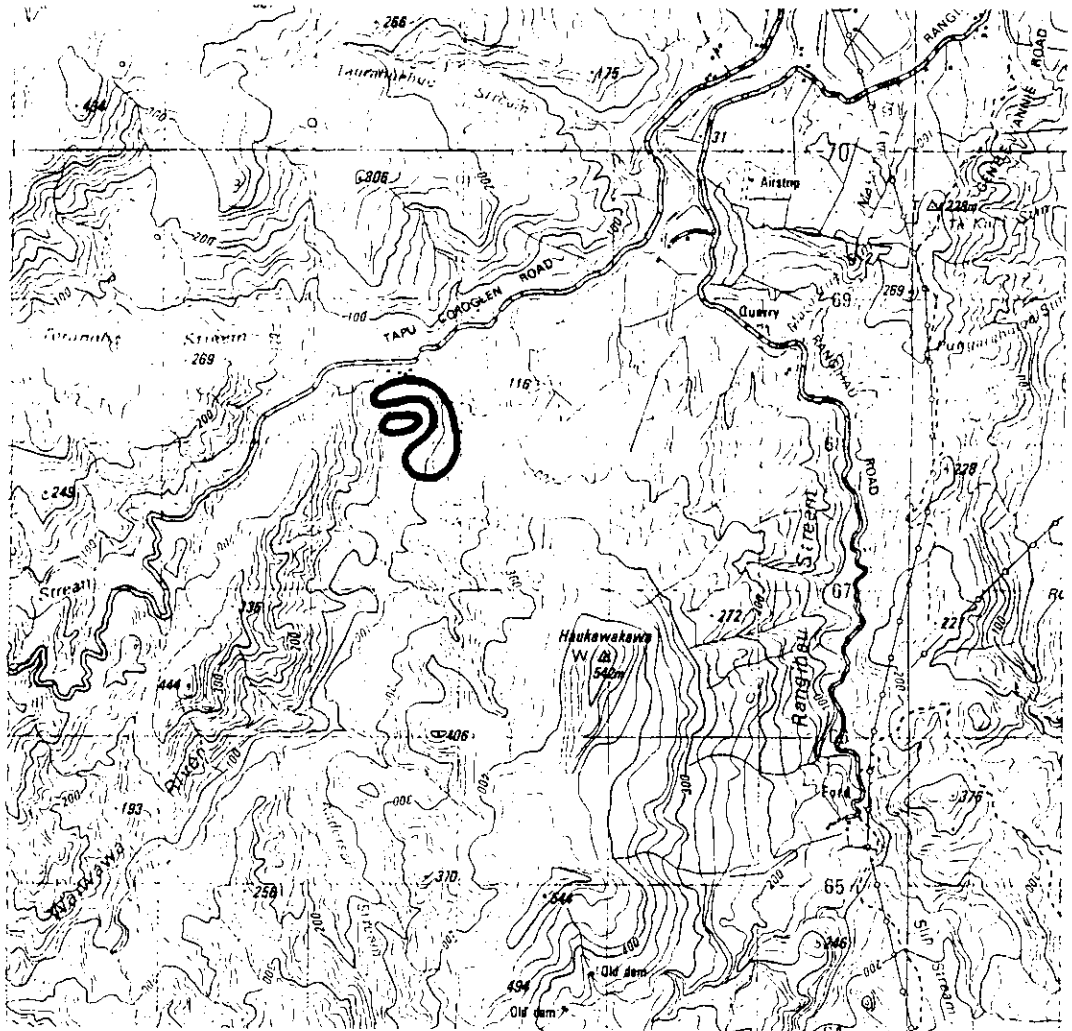
Discussion:

This RAP would provide lowland forest in excess of the representative 10% PNAP guideline but includes so many important natural features that it is being recommended. This area protects the headwaters of the Mahikarau, including Sparrow Stream, and Kaimarama Rivers, which flow into the Whitianga Estuary, also headwater tributaries of the Waikawau River, which flows westwards. Sparrow Stream is a particularly unusual freshwater habitat and includes the unusual alga *Bostrychia scorpioides* which is usually marine. Lying between Papakai EA, Waiomu Forest Sanctuary, Waiau Falls SR and Castle Rock RAP this area is a corridor for wildlife and includes several nationally threatened bird species and both native frogs. Two of the largest Coromandel kauri *McIsaacs* and *Hamon kauri* are located within the RAP. A broad altitudinal range of vegetation from the lower lowland to the montane zone is represented. The area forms part of the scenic backdrop to the 309 Coromandel-Whitianga road and includes a number of distinctive Coromandel Volcanic Peaks - Totokoroa, Pukewhau, Kakatarahae and Pukeotahu. A walking track runs along the western boundary and another through the southeastern corner and into Papakai EA.

Criteria Summary:

Representativeness	M - Large tract of lowland to montane forest over a broad altitudinal range.
Diversity	M - Two bioclimatic zones, six vegetation types.
Naturalness	M - Past logging in much of the area results in the RAP being a mixture of modified tall forest and some secondary communities.
Special Features	- Wide range of threatened fauna. Threatened flora, large kauri, unusual aquatic alga. Catchment protection.
Viability	H - Requires management to protect against damaging activities.
Buffering	H - Completely surrounded by forest and scrub vegetation.
Landform	- Moderate to steep hill country on Coromandel volcanics.
Threat	- Wild animals.

Tha. 2 ILLINGSWORTH'S ALLUVIAL FLAT



SCALE	:	1:50,000
GR CENTRE	:	NZMS 260 T11 466684
AREA	:	20 ha
ALTITUDINAL RANGE	:	40m
TENURE	:	Private
DATA REFERENCE	:	

Tha. 2 : Illingsworth's Alluvial Flat

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
semi-coastal	podocarp alluvial terrace forest	alluvial flat	L

Landform:

Alluvial flats on the Waiwawa River.

Vegetation:

Alluvial terrace forest comprising the podocarps totara, rimu, kauri, kahikatea and tanekaha, up to 25m tall. Some broadleaved tree species including mangeo, kanuka, tawa, rewarewa and treeferns. The understorey and ground layers are very sparse probably due to past heavy grazing.

Fauna:

Fauna not recorded.

Flora:

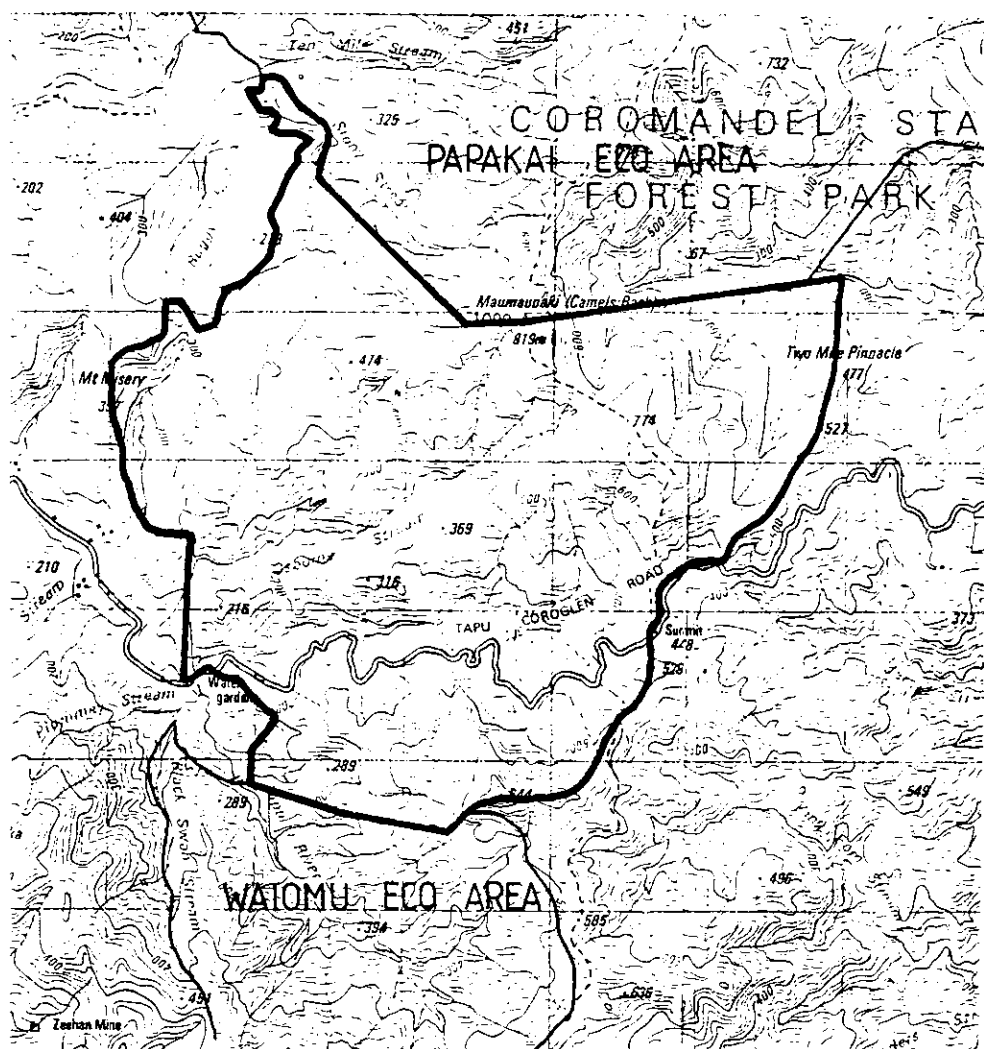
No notable plant species found during the survey.

Discussion:

Podocarp alluvial terrace forest is now uncommon in the Thames ED and the Coromandel ER as a whole mainly due to clearance for agriculture. Although small and grazed in the past this remnant is worthy of protection.

Criteria Summary:

Representativeness	H	- Podocarp alluvial terrace forest is uncommon in Thames ED.
Diversity	L	- One bioclimatic zone, one vegetation type.
Naturalness	M	- Fairly young stand. Very sparse understorey and ground cover probably due to animal browse.
Special Features	-	
Viability	M	- Viable if fenced, podocarps regenerating.
Buffering	L	- Surrounded by pasture and scrub.
Landform	-	- Alluvial terrace.
Threat	M	- Animal browse.



SCALE	:	1:50,000
GR CENTRE	:	NZMS 260 T11 390-660
AREA	:	1420 ha
ALTITUDINAL RANGE	:	120 - 819 m
TENURE	:	Crown (DOC), private
DATA REFERENCE	:	Study Area 32

Tha. 3 : Tapu

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	broadleaved species scrub	hillslope, ridge, gully	L
lowland	manuka-broadleaved species scrub	hillslope, ridge, gully	S
lowland	(rata-podocarp)/tawa forest	hillslope, ridge, gully	L
lowland	(rata-podocarp)/towai-tawa forest	hillslope, ridge, gully	L
montane	towai-tawari-tawheowheo scrub forest	ridge, gully	L
montane	upland rocky bluff	ridge, rock bluff	L

Landform:

Area is steep dissected hill country on Beesons Island Volcanics, and extends across the central ridge of the Coromandel Range. The ridge rises abruptly to the prominent landform Maumaupaki (819m), a rock outcrop surrounded by sheer bluffs on the northern boundary. Two large debris avalanche slips occur on the unstable substrate surrounding the central ridge. The upper reaches of the Tapu River, Osbourne Stream and part of Five Mile Creek are included.

Vegetation:

An uninterrupted altitudinal sequence from lowland to montane vegetation including slip and rock bluff communities, and secondary manuka and broadleaved species scrubs along the western boundary. Forest grades from lowland tawa-kohekohe forest with karaka, nikau, pukatea, kahikatea and emergent podocarps and rata to forest in which towai becomes common with increased altitude to a montane towai-tawari-tawheowheo scrub/forest that is naturally stunted from exposure and altitude. Kauri, kaikawaka, yellow-silver pine and miro are occasionally present in the montane scrub forest. Rocky bluff communities on Maumaupaki and unnamed peak to the south support climbing ratas, mountain flax, kiokio, *Macherina sinclarii*, endemic *Celmisia* and *Chianochloe* *conspicua* var.

Fauna:

Both Archey's and Hochstetter's frogs and kokako recorded. Outstanding wildlife habitat.

Flora:

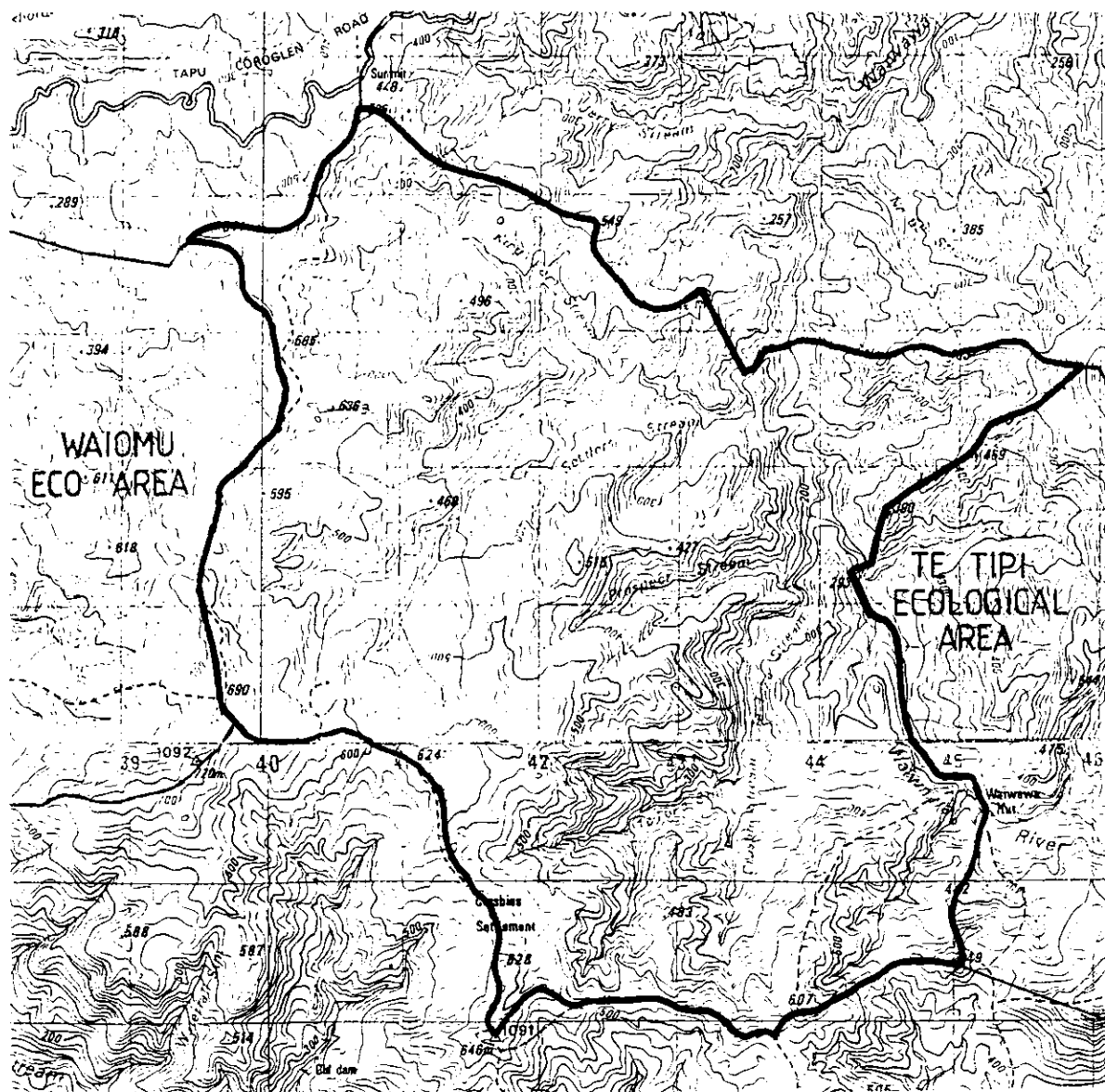
Brachyglottis myrianthos and *Celmisia adamsii* var. *adamsii* are present. A number of other plant species of distributional significance, locally or nationally rare occur in Papakai EA on the northern boundary and are likely to occur in this area.

Discussion:

This area acts both as a buffer for the two adjacent Papakai EA and Waiomu Forest Sanctuary ecological areas and as a wildlife corridor between them. Anderson (1983) proposed the section north of the Tapu-Coroglen road as an extension to Papakai EA. The area was ranked outstanding wildlife habitat by the FSU. Streams were not assessed for freshwater values. The area includes habitat of nationally threatened fauna and flora. A regionally prominent landform is included. The area is viewed from various points on the Tapu-Coroglen Road and a walking track through it runs from the road both north and south.

Criteria Summary:

Representativeness	H	- A good, relatively undisturbed altitudinal sequence of forest types. Good examples of lowland broadleaved scrub and montane towai-tawari-tawheowheo scrub/forest with kauri and kaikawaka also montane rocky bluff community.
Diversity	M	- Two bioclimatic zones, six vegetation types.
Naturalness	M	- Logged for kauri. Tapu-Coroglen road cuts through area in the south. Some wilding pines in manuka-broadleaved species scrub.
Special Features	H	- Valuable wildlife habitat; NI kokako present although not recently confirmed. Two species of native frogs. <i>Brachyglottis myrianthos</i> and <i>Celmisia adamsii</i> var. <i>adamsii</i> . Scenic value includes southern side of Maumaupaki. A walking track runs through the area.
Viability	H	- Minimal management needed - wild animal control to maintain conservation values.
Buffering	H	- Predominantly forest on all sides except the Tapu River flats and Buggy Stream in the west. Papakai EA to the north and Waioumu EA to the south.
Landform	M	- Representative of main Coromandel range including rock outcrops characteristic of Coromandel Group Volcanics.



SCALE : 1:50,000
GR CENTRE : NZMS 260 T12 432595
AREA : 2400 ha
ALTITUDINAL RANGE : 200 - 646 m
TENURE : Crown (DOC), private
DATA REFERENCE : Study Area 34

Tha. 4 : Waiwawa

Ecological Unit Checklist:

BIOTIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	(rata-podocarp)/tawa-towai forest	hillslope	L
lowland-montane	towai scrub/forest	ridge	S
montane	towai-tawari-tawheowheo scrub	ridge	L

Landform:

Mostly moderate to steep hill country on Coromandel Group andesites and dacites rising up to the main Coromandel Range which in this area is broad and flat. Includes a number of the headwater tributaries of the Waiwawa River including Te Toka and Crosbie Streams draining to the north.

Vegetation:

Mainly towai-tawa forest with emergent rata and podocarps. In places on the main ridge the forest becomes montane in character where tawari predominates with some towai and podocarp species. Part of the main ridge where it is broad and flat has been farmed in the past and is now either in a relatively advanced stage of towai-treefern regeneration, a mixed treeland with pasture grasses between, or, where drainage is impeded a manuka/sphagnum type peat bog with rushes.

Fauna:

NI Kaka recorded and NI kokako present immediately to the south. Hochstetter's frogs present.

Flora:

Brachyglottis myrianthos (shrub endemic to Coromandel ER) present.

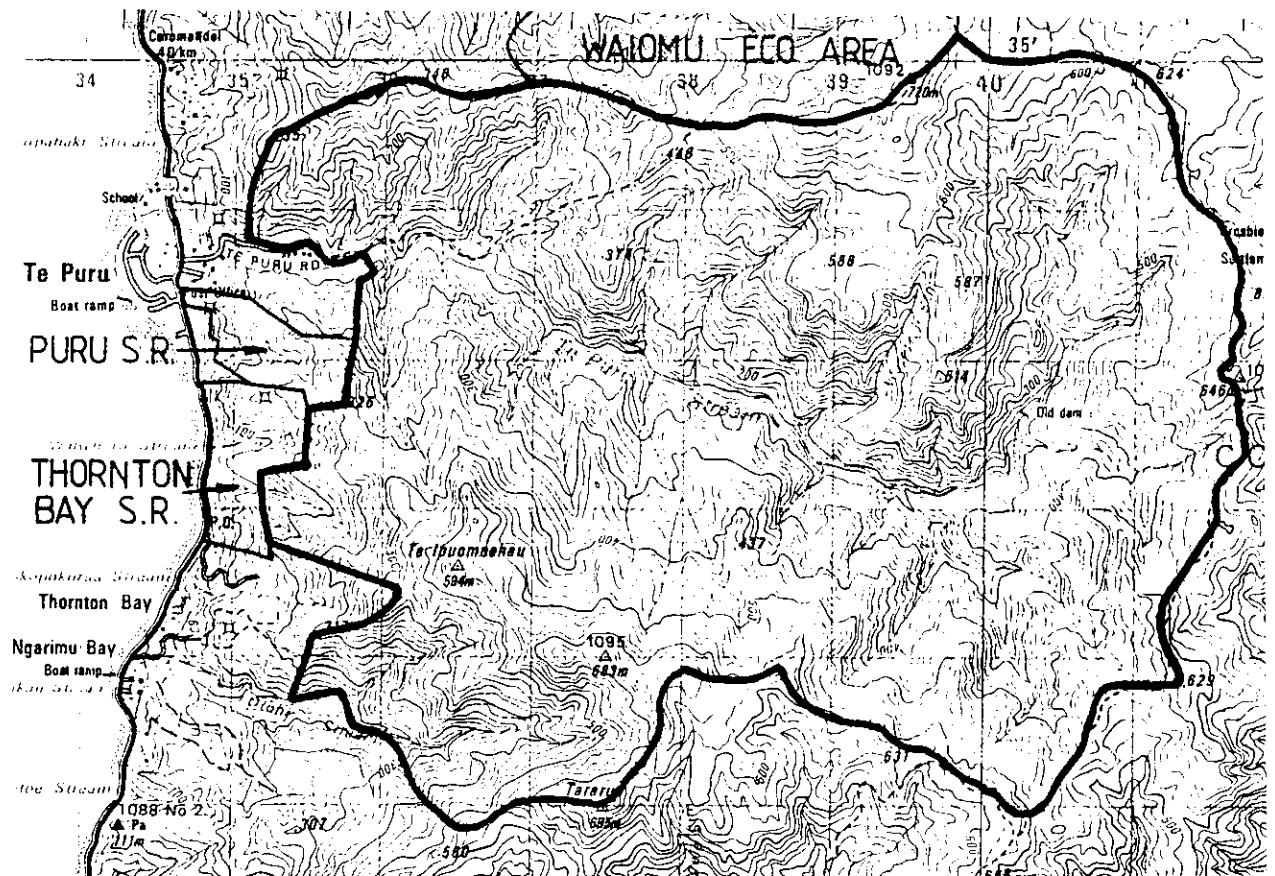
Discussion:

This area is additional to the recommended level of protection of 10% for lowland and upland forest. It forms part of a complete east to west coast sequence of predominantly natural vegetation. The area is also important with a number of notable animal and plant species present. Te Toka Stream was assessed for its freshwater values and was found too unstable to be good habitat, however, the whole area is important for the protection of headwaters of the Waiwawa which runs into Whitianga Estuary. This forest between Waiomu Forest Sanctuary and Te Tipi Ecological Area is an important corridor for wildlife. A walking track runs along the western boundary of this RAP.

Criteria Summary:

Representativeness	M	- Typical of upper lowland forest types grading into montane forest.
Diversity	L	- Two bioclimatic zones, three vegetation types. A limited altitudinal sequence.
Naturalness	M	- Logged for kauri. Tracks on western and southern boundaries. Main ridge vegetation modified by past clearing for farming.
Special Features	H	- NI kokako, NI kaka, frogs, Brachyglottis myrianthos. Part of an east-west vegetation sequence.
Viability	H	- Low management effort required, wild animal control.
Buffering	H	- Entirely surrounded by forest including Te Tipi and Waiomu EAs in the east and west respectively. Also adjacent to Te Puru, Wainora and Tapu RAPs.
Landform	L	- Representative of much of Thames hinterland on Coromandel group volcanics.

Tha. 5 TE PURU



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 385577
AREA	: 2624 ha
ALTITUDINAL RANGE	: 10 - 864 m
TENURE	: Crown (DOC), Private
DATA REFERENCE	: Study Area 35

Tha. 5 : Te Puru

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	broadleaved species scrub	hillslope, ridge, gully	M
lowland	manuka-broadleaved species scrub	hillslope, ridge, gully	S
lowland	manuka-rewarewa scrub	hillslope, ridge, gully	S
lowland	(rata-podocarp)/tawa forest	hillslope, gully	M
lowland	(rata-podocarp)/towai-tawa forest	hillslope, ridge, gully	S
montane	swamp maire-towai montane bog forest	plateau	M
lowland-montane	towai scrub/forest	ridge plateau	M
montane	towai-tawari-tawheowheo forest	ridge	S

Landform:

Area includes the entire Te Puru catchment which drains the broad ridge of the main Coromandel Range in a westerly direction almost to the sea. Terrain is moderate to steep hill country on Coromandel Group andesite and dacite, and volcanic lava and breccias.

Vegetation:

Remnants of pohutukawa/kohekohe-puriri-silverfern forest occur on the coastal hills around Te Puru. Kowhai, karaka, hard beech and kauri are notable occasional species in this forest. Regenerating rewarewa/manuka scrub is a main component of the coastal vegetation, becoming more extensive further up the valley. Pohutukawa and northern rata hybrids mark a transition to lowland tawa forest that has been much modified by logging and burning with only a few rata and podocarps remaining. Towai becomes a common canopy species in the upper half of the catchment. Forest on the high ridges is towai-tawari-tawheowheo forest with some miro and emergent rimu, Hall's totara and broadleaf. On the relatively flat part of the ridge that borders on Waiomu EA, a high altitude rimu-swamp maire-towai-tawari-toro swamp forest occurs, this is a most unusual plant community in the Coromandel ER. Towai scrub is regenerating where the forest has been disturbed at higher altitudes.

Fauna:

Nationally threatened NI Kaka and Hochstetter's frog are present.

Flora:

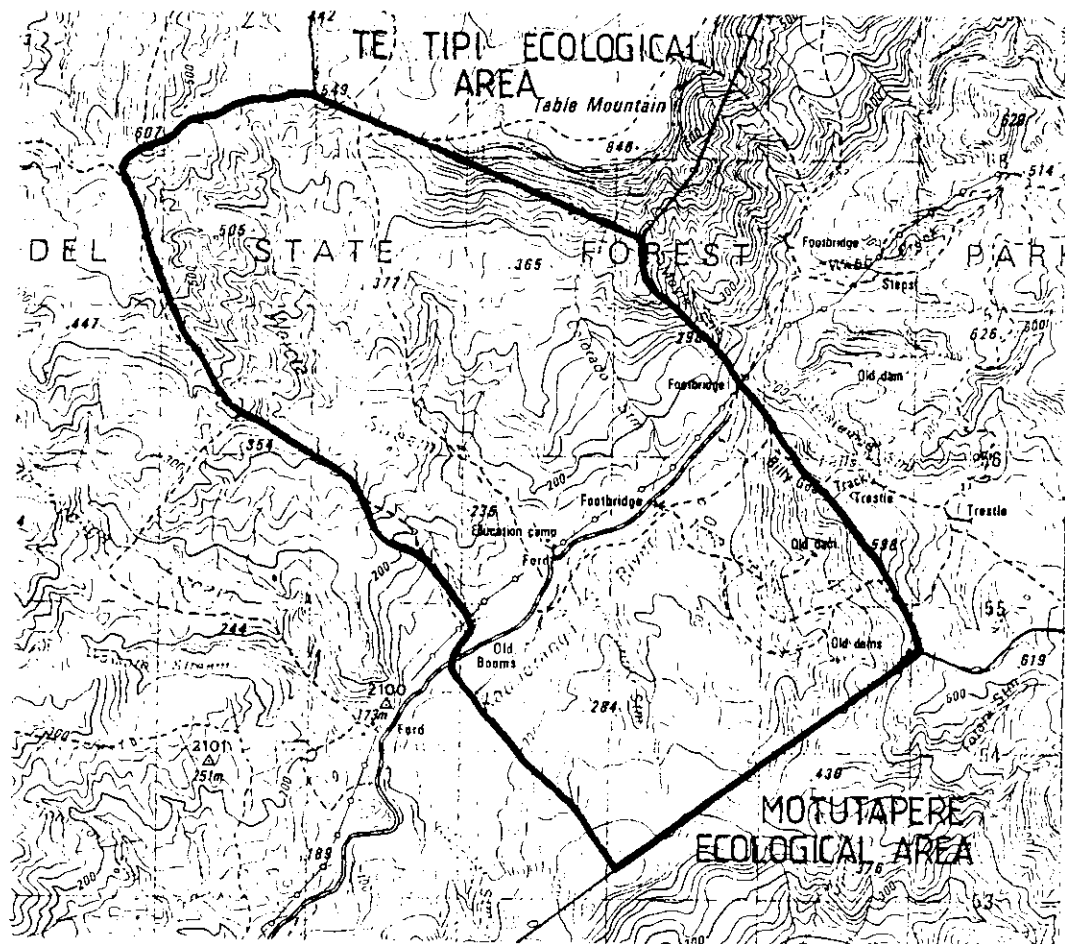
High altitude bog forest with swamp maire is an unusual association in the Thames ED and the Coromandel ER. Hard beech occurs along the stream. Brachyglottis myrianthos and Pohutukawa x northern rata hybrids are present.

Discussion:

Te Puru RAP and the coastal reserves of Puru and Thorntons Bay provide a continuous sequence of natural vegetation from coast to montane zone. This RAP lies in the Kauaeranga Block of the CSFP which has an outstanding wildlife ranking and lies adjacent to Waiomu EA, Te Puru and Thorntons Bay SR and the Waiwawa RAP. This RAP lies over an unstable erodible catchment. Protection and wild animal control will protect soil and water values.

Criteria Summary:

Representativeness	H	- An entire western catchment including a range of forest and seral communities from the lowland to montane zone present.
Diversity	H	- Complete sequence from coastal cliffs to the top of the main range is formed through adjoining Te Puru SR and Waiomu EA.
Naturalness	M	- Recovering from past logging and burning.
Special Features	H	- Unusual high altitude swamp forest, several rare plants and birds. Soil and water protection.
Viability	H	- Minimum long term management necessary.
Buffering	H	- Well buffered. This RAP incorporates an entire catchment. Forest and scrub on surrounding land. Waiomu EA.
Landform	L	- Typical of steep western catchment of Thames ED.
Threat	L	- Mining. Wild animals. Slips.



SCALE	:	1:50,000
GR CENTRE	:	NZMS 260 T12 465565
AREA	:	1320 ha
ALTITUDINAL RANGE	:	100 - 607 m
TENURE	:	Crown (DOC), private
DATA REFERENCE	:	Study Area 36

Tha. 6 : Wainora

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	manuka-broadleaved species scrub	hillslope, ridge, gully	S
lowland	raupo-flax reedland	alluvial terrace	M
lowland	swamp maire swamp forest	alluvial terrace	L
lowland	manuka-rewarewa scrub	hillslope, plateau, gully	M
lowland-montane	towai scrub/forest	hillslope, ridge, plateau	M
lowland	(rata-podocarp)/towai-tawa forest	hillslope, ridge, gully	M
lowland	towai-tawa forest	hillslope, gully	M
montane	tawari-towai-tawheowheo scrub	ridge	M

Landform:

A wide range of rock types are found in this RAP including Whitianga Group ignimbrites and rhyolite, Coromandel Group andesite and dacite in the upper catchment, and Quaternary alluvium in the lower river valley. This RAP spans the lower Kauaeranga River valley including alluvial terraces on the valley floor. The terrain rises steeply to the main ridge adjacent to Table Mountain on the north side, and to a ridge dividing the Kauaeranga Valley from Hihi Stream to the south.

Vegetation:

Forest is mostly upper lowland towai-tawa type with emergent rata and podocarps, also lowland forest with less towai on the southern slopes and along the river. The area was heavily cutover and burnt earlier this century and so includes modified forest and regenerating forest. The vegetation of the flatter areas on the valley floor includes a mosaic of grassed areas used as camping grounds, areas of manuka and bracken with blackberry and manuka-broadleaved species scrub. Regeneration is more advanced in places with totara, rimu, tanekaha and rewarewa. There are two areas of freshwater wetland and swamp forest both very rare vegetation types in Thames ED, one on each side of the river. The wetlands support raupo, kiokio with flax, *Baumea rubiginosa* and bracken. Swamp forest includes swamp maire, pukatea and podocarps.

Fauna:

Nationally endangered NI kokako were found by Wildlife Service in the head of the Wainora catchment in the early 1980s but the birds were not recorded during the survey. NI kaka and Hochstetters frog are present, making the area outstanding fauna habitat. Streams support a diverse freshwater fauna, including limpets (*Latia* sp.) especially in the southern catchments.

Flora:

Swamp maire is present on poorly drained river terraces. This tree and the alluvial terrace forest in which it grows is now uncommon in the Thames ED and the Coromandel ER.

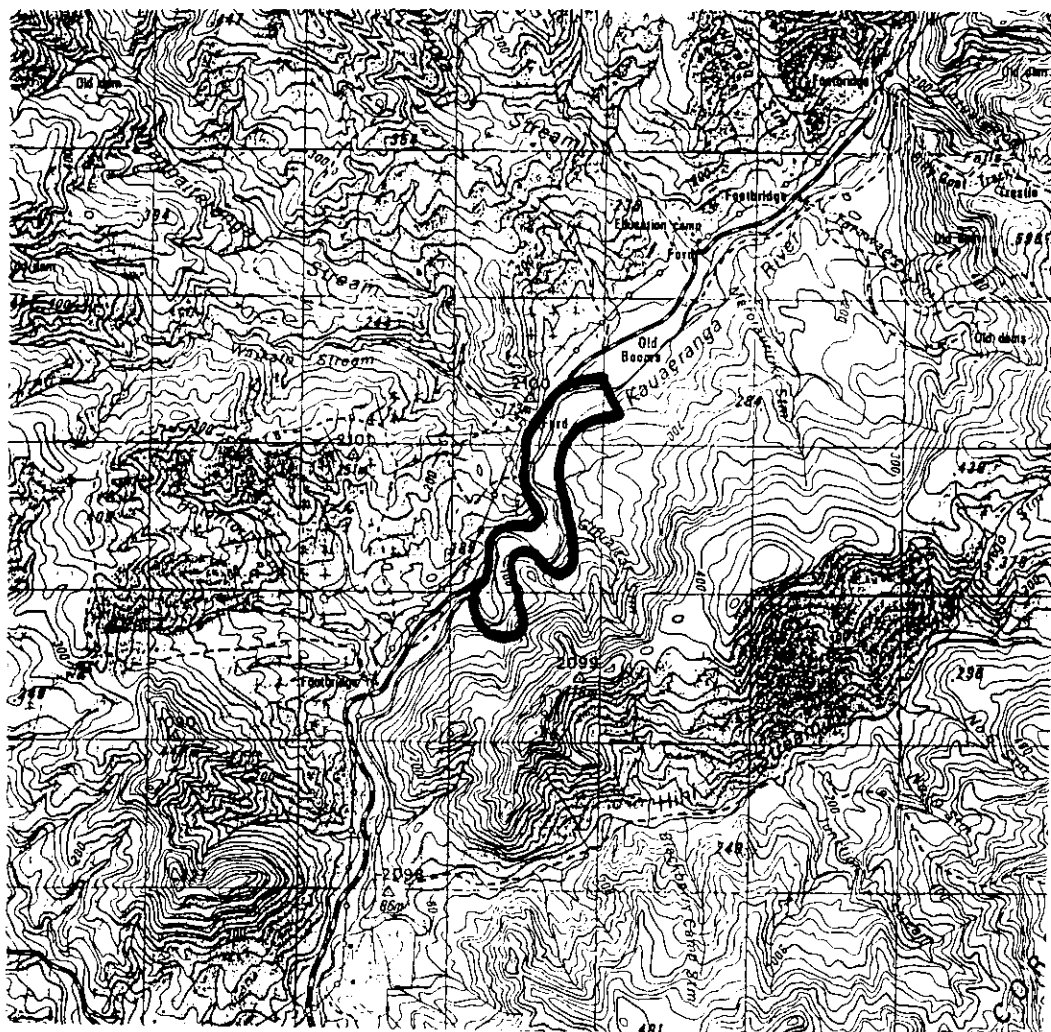
Discussion:

Swamps such as those found on river terraces probably once grew on all river flats where drainage was impeded. The area provides a buffer and corridor between Motutapere and Te Tipi ecological areas and lies adjacent to Waiwawa and Kauaeranga River RAPs and includes the steep slopes of Table Mountain. Wainora Stream catchment has high scenic and recreational value, several popular walking tracks run through the RAP, and provides a good freshwater habitat.

Criteria Summary:

Representativeness	H	- A range of representative vegetation types over three bioclimatic zones is present in this RAP including associations now rare in the ecological district including swamp maire podocarp swamp forest and small areas of raupo-flax wetland vegetation.
Diversity	H	- Two bioclimatic zones, eight vegetation types. Montane, lowland and riverine communities present.
Naturalness	M	- Heavily cutover, last century. There is now advanced regeneration.
Special Features	H	- NI kokako, threatened NI kaka and Hochstetter's frog recorded in this area. Good freshwater habitats. Scenic, high recreational use.
Viability	H	- People management most important.
Buffering	H	- Entirely surrounded by forest and scrub. Te Tipi EA and Waiwawa RAP to the north and Motutapere EA to the south.
Landform	M	- Steep hillslopes typical of southern inland region of Thames ED. Extensive alluvial terraces in the lower Kauaeranga Valley.
Threat	M	- Camping grounds on river flats intensively used over summer period, fire.

Tha. 7 KAUAERANGA RIVER FLATS



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T12 455540
AREA	: 57.5 ha
ALTITUDINAL RANGE	: 100 - 607 m
TENURE	: Crown (DOC), private
DATA REFERENCE	: Study Area 36

Tha. 7 : Kauaeranga River Flats

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	podocarp-broadleaved forest	alluvial terrace	L

Landform:

Recent alluvium derived from Coromandel Group (Waiwawa subgroup) andesites, dacites, volcanic lavas and breccias, and Whitianga Group ignimbrite and rhyolite. Includes the river flats of a section of the lower Kauaeranga River. A number of riverine landforms are included: the river bed itself, a number of terraces of varying ages present, previous islands and ox-bows.

Vegetation:

The vegetation of these alluvial terraces is a mixture of mature kanuka interspersed with variable amounts of podocarps such as totara, tanekaha, rimu and kahikatea with rewarewa, kauri and hard beech. The understorey is commonly mamaku, tutu and Pittosporum colensoi. Younger stands tend to have more manuka with scattered sapling podocarps, rewarewa and lemonwood with kiokio abundant in the understorey. Small areas of raupo, flax and sedge wetland also occur here.

Fauna:

Common forest and field birds recorded during survey. No species of note recorded.

Flora:

Hard beech present, not seen elsewhere on alluvial terraces of the Thames ED.

Discussion:

The kanuka-podocarp river terrace forest remnants of the lower Kauaeranga River are the largest examples of this ecological unit remaining in the Thames Ecological District. Such forest would formerly have been more extensive in this valley and other larger valleys of Thames ED, such as Tapu and in Tairua and Waihi Districts but today only remnants remain. This RAP is contiguous with Wainora RAP.

Criteria Summary:

Representativeness	H - Examples of an ecological unit that is now rare in Coromandel ER.
Diversity	M - One bioclimatic zone, one vegetation type. Different ages of terrace forest included.
Naturalness	H - This is a dynamic system, the river is still mobile, some stands are secondary.
Special Features	M - Hard beech present.
Viability	H - Fencing, wild animal control, people control.
Buffering	H - Bounded by river and forest park.
Landform	H - Range of riverine landforms included.
Threat	L - Human use, wild and feral animals.

5. TAIRUA ECOLOGICAL DISTRICT

S U M M A R Y

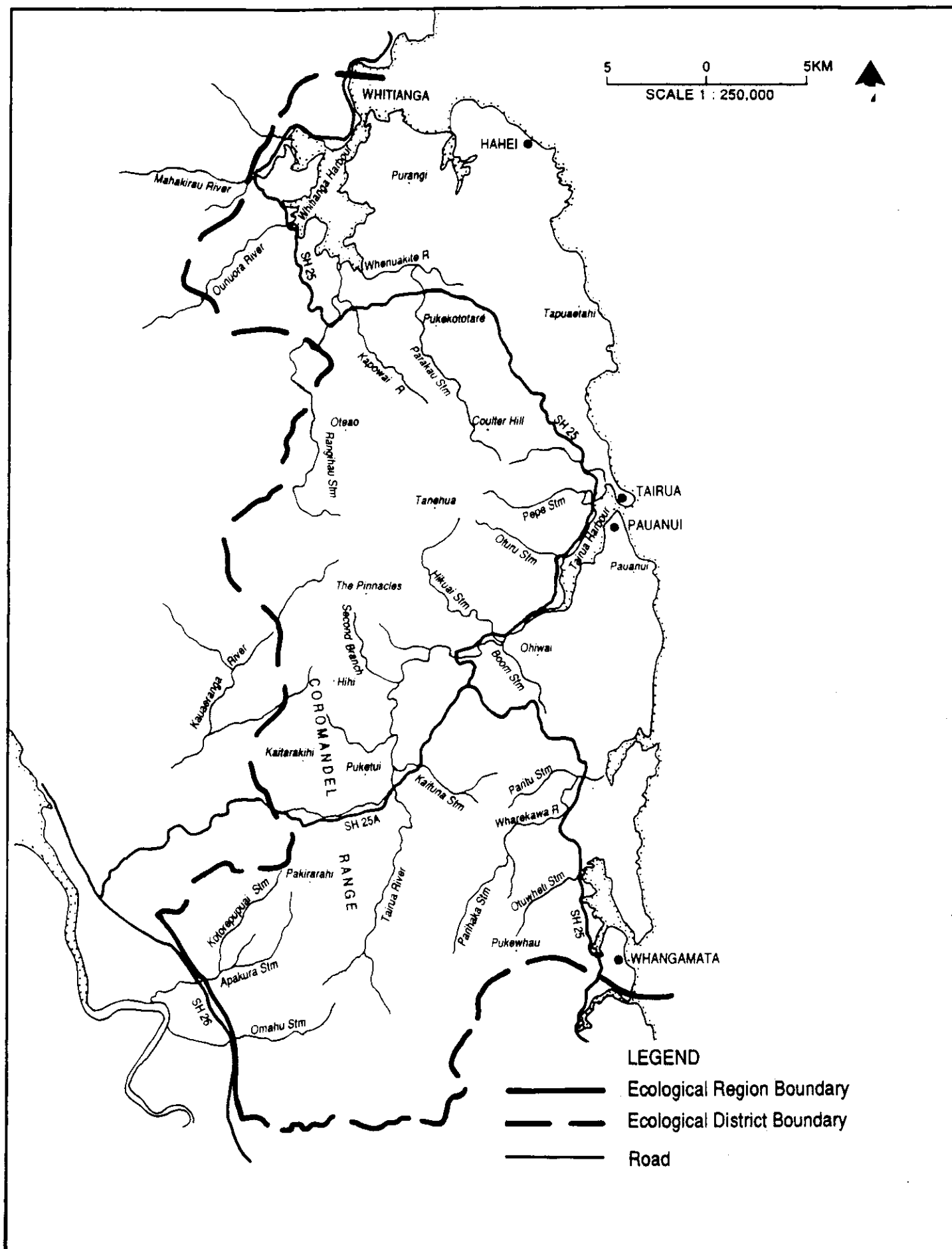
The Tairua Ecological District (ED) is large, extending from Whitianga to Whangamata on the east coast of the Coromandel Peninsula, across the main range to Thames and from there south to Paeroa (see Fig 9). Steep hill country, extensive coastal hills, alluvial plains and large river estuaries are characteristic of the ED. Underlying geology is predominantly ignimbrite sheets, rhyolite breccia, rhyolite and andesite intrusions which form the distinctive pinnacles and bluffs of this district.

Lowland forests are still extensive in this ED, but much modified by logging activities and wild fires so that large areas of scrub and regenerating forest are common. Natural coastal and semi-coastal vegetation, which must previously have been extensive, now only occurs as remnants mainly as narrow strips along the coastal cliffs. Alluvial forest and wetlands have virtually disappeared but the large estuaries still support extensive saltwater wetlands such as eelgrass, mangroves and rushlands (see Table 10).

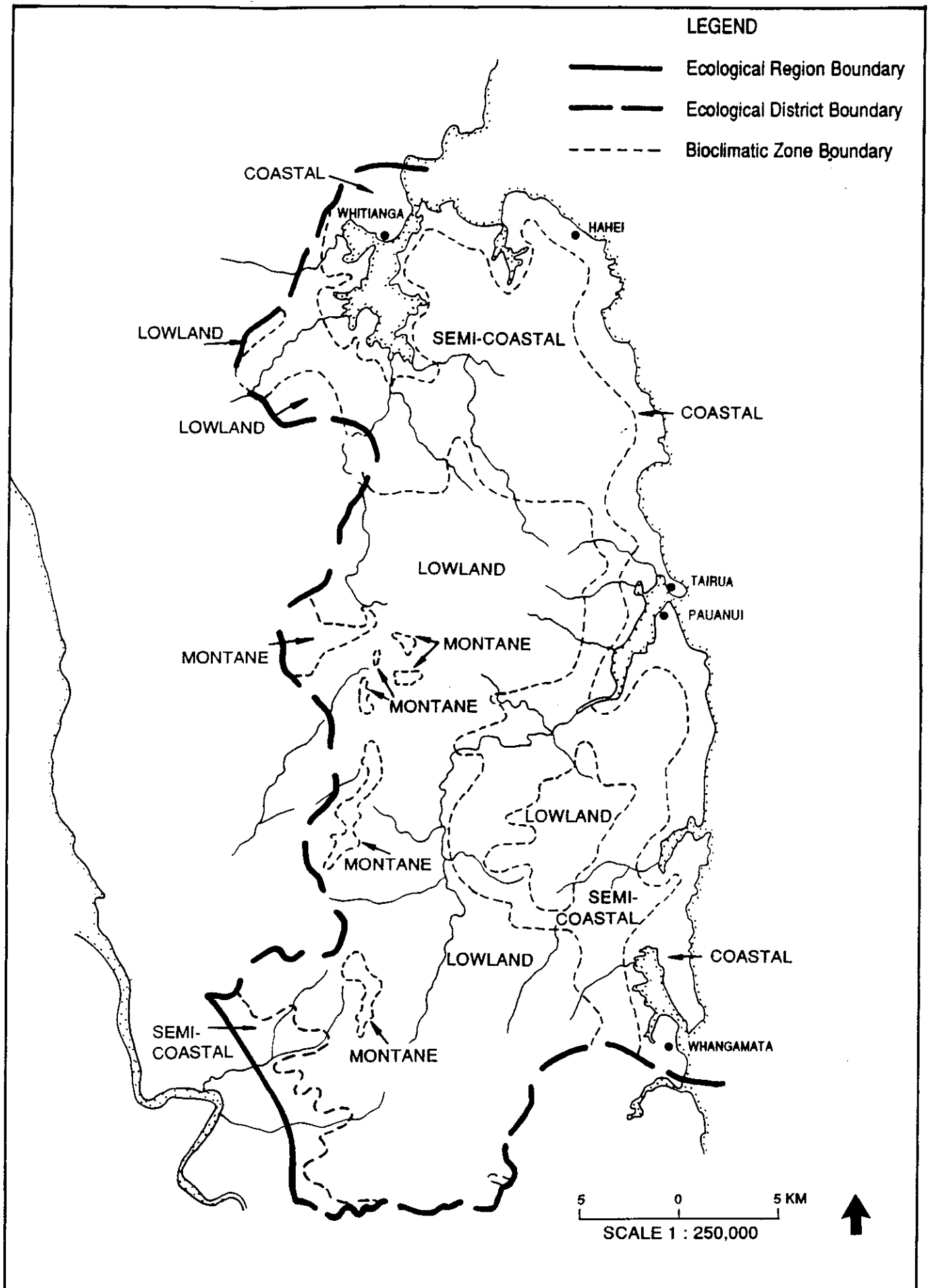
The forests offer habitat for a range of fauna including a number of threatened birds and both species of native frogs. (see Table 9) The estuaries with extensive intertidal mudflats and sandy beaches provide feeding and breeding habitat for a wide range of wetland and sea birds (see Table 9).

Protected Natural Areas (PNAs) in Tairua ED include 4,460 ha, about 5% of the district's area. Three large ecological areas protect a large proportion of the montane and upper lowland vegetation. A large number of small reserves lie at lower altitudes and contain mainly secondary and modified vegetation (see Table 10 and Regnier 1987).

The 17 Recommended Areas for Protection (RAPs) proposed in this ED would provide better protection for the range of ecological units in the coastal and semi-coastal environments. There is not enough of some ecological units to meet the PNAP guidelines for sustainable protection. Large areas of lowland forest have been recommended to provide better protection of altitudinal variation and to encompass high scenic, wildlife, catchment protection and other natural values. Small montane areas are also included for significant landforms and important species communities. The greater area recommended is over Crown administered land but some is on private land, especially in the coastal zone.



TAIRUA ECOLOGICAL DISTRICT



**TAIRUA ECOLOGICAL DISTRICT
BIOCLIMATIC ZONES**

5.1 ECOLOGICAL CHARACTER

5.1.1 RELIEF

The Tairua ED includes the east coast of the Coromandel Peninsula from Whitianga to Whangamata and extends across the main range to Thames and southwards almost to Paeroa. The southwestern boundary of the ecological district has been extended southwards and includes the Te Hue Stream, as a result of survey to include breccia tuff and andesite flows more typical of the Tairua ED than Waihi ED, subsequent to survey. In the east and north of the Tairua ED the terrain is relatively low lying, rolling to hilly with broad river valleys and alluvial flats. Along the central Coromandel Range the country is very steep and dissected in the north. Features include the peaks of the Pinnacles and the high altitude plateau of Table Mountain. The main range is less steep and dissected towards the south in the area of the Tairua River. Rock outcrops such as Little London and Maratoto Rock are andesitic dykes, a distinctive feature of the district. The western side of the range drops steeply to the Hauraki Plains with a narrow alluvial zone at the base of the hills lying within the Tairua ED. Four main rivers flow eastward and terminate in large estuaries on the east coast, their associated barrier dune systems and sandy beaches are frequent along the east coast. A number of small islands lie a short distance offshore, these have typically gently sloping surfaces and often high sea-eroded cliffs.

5.1.2 GEOLOGY

The Tairua ED comprises mainly of sheets of ignimbrite (Coroglen ignimbrite) or rhyolite breccia with extensive intrusions of dome-like rhyolitic lava flows (Minden Rhyolite) of the Whitianga Group from the upper Miocene. The area west and north of Tairua is a large explosive volcanic centre called the Kapowai Caldera. It is clearly defined by a raised andesite rim and a circular pattern of rhyolite domes, plugs and flow complexes. Other probable volcanic centres in the district are south of Whitianga and between Thames-Tairua-Whangamata. Coromandel Group (Waiwawa subgroup) andesites, more common in adjacent ecological districts, occur only in small pockets, one on the coast between Tairua and Hot Water Beach, and patchily in the headwaters of the Tairua River. More recent mid-Pliocene activity produced the Omahine subgroup andesite intrusion and minor extrusion flows of Table Mountain and the Wharekawa Plateau. Islands off the eastern coastline are predominantly rhyolitic on a "basement" of andesite.

5.1.3 CLIMATE

[Information source: Biological Resources Centre, unpublished draft report]

The district generally has warm, dry summers and mild winters. Temperatures within the lowland zone range between -2.0 and 28.5°C. The change in species composition in the bioclimatic zones reflects the change in temperature with increasing altitude. Rainfall is spread throughout the year, although flooding can occur in autumn and there is generally higher rainfall in winter. Records from Tairua Forest Climate Station give a mean annual fall of 1823 mm. Fog is uncommon in the lowlands but is more frequent in the ranges.

5.1.4 SOILS

[Information source: McCraw and Bell, 1975, unless otherwise referenced]

Soils are yellow-brown earths on hill (on ignimbrite flows) and steep land (on rhyolite domes) country (Black, 1980). A deep mantle of volcanic ash has been preserved on large areas of easy terrain of the south-eastern catchments resulting in significantly different soils from those present on the Thames side (Nicholls, 1979).

The main soils on steep and very steep country in the north and east of the district are Tangatara steep land soils (related to yellow-brown earths) of low fertility. On rolling to hilly country the soils are varied but are mainly Puketui and Pukenui hill soils, both low fertility yellow-brown earths. Whangamata sandy loam and hill soils (medium to low fertility) and Whitianga silt loam (medium fertility) are yellow-brown loams which predominate in the south-east of the district. Recent soils from alluvium (Ohinemuri loamy sand to clay loam) are of high fertility and occur mainly around Whitianga Harbour and along the Waiwawa, Whenuakite and Tairua Rivers. Organic soils of Ruakaka peaty loam and loamy peat (low to very low fertility) are relatively more extensive in Tairua ED than elsewhere in the mainland region.

5.1.5 VEGETATION

[For details of present and former extents see Table 10]

Scant documentation of former vegetation in Tairua ED confounds estimation of former vegetation patterns. Present estimates are based on vegetation remnants, photographic collections and records of economic exploitation.

Tairua's distinctive, large estuaries still support wide areas of natural wetland. Tairua and Whangamata harbours are notable for their extensive eelgrass beds and Whitianga harbour for its mangroves and rushlands. During the major kauri logging era, in the late nineteenth century, when huge quantities of water, logs and debris were driven down the river systems of these estuaries there would have been impacts on some communities (Hume & Gibb, 1987). However, in the intervening hundred years nature has healed the scars leaving the harbours today with a predominantly natural appearance.

Estuarine ecosystems in Tairua ED include sandspits and sand dune systems. With the exception of Hot Water Beach these have all been drastically modified. Dune systems at Whitianga, Cooks Beach, Hahei, Tairua, Pauanui and Whangamata all have residential and urban developments while those at Opoutere are planted in pines. Remnant dune vegetation, especially foredune, persists in most places but is considerably modified by adventive plants and heavy human use. Hot Water Beach, for instance, has both foredune and rear dune intact, but, adventive plants are frequent there and sheep graze part of the dunes. The degree of development in the coastal zone in Tairua ED results in natural sand dune and associated wetlands sequences being poorly represented. Today remnants are found at a few places such as Opoutere and Cooks Beach.

Broad alluvial plains and terraces adjacent to, and upstream of, the estuaries would have supported a mosaic of freshwater wetlands from sedge shrublands to flax, raupo, swamp maire, cabbage tree and kahikatea. Old maps (Bell & Fraser, 1912), and the incidence of peat soils show that complex wetland systems extended along stream valleys and between coastal hills (for example between Hot Water Beach and Whenuakite; Wharekawa and Whangamata). There were also numerous small wetlands in basins and stream valleys on coastal slopes.

The large flax swamps around Whitianga provided the raw materials for the flax milling industry operating between 1830 and 1880. This century, wetland drainage right down to tidal margins has reduced natural wetlands to a few areas such as channel margins, as along the Tairua river, and small stream valleys (eg Duck Creek). The gradient from salt to freshwater wetland remains intact in only a few places. Swamp maire and kahikatea forest are virtually non-existent.

Gravel patches in swamps and large alluvial terraces extending from the coastal flats up river valleys, would have supported either a podocarp forest, possibly with kauri, or a podocarp-broadleaved forest, with coastal forest species in the coastal and semi-coastal zones. There may also have been small wetlands on terraces and open water features, such as old river channels. The more freely draining terraces were some of the easiest land to farm and so most of this forest has disappeared except a few remnants, the best examples being found in the mid-Tairua Catchment. Kauri log-driving probably had an impact on alluvial terrace vegetation and some of the remnants seen today are secondary.

The distinctive ignimbrite and andesite coastal cliffs and rock stacks in Tairua ED still have a fringe of pohutukawa rock treeland, often with farm or residential land adjacent. This forest suffers from grazing and invasion by adventive plants such as pines and hakea. The low lying coastal hills of Tairua ED would have been covered in extensive pohutukawa coastal forest. Extant remnants of this forest have suffered modification during the 800 years of human occupation and it is unlikely that any truly represent their original composition. In natural areas coastal forest usually occurs as remnants amongst a mosaic of regenerating coastal scrub and forest, with locally abundant, distinctive elements such as *Pomaderris rugosa*, *Myoporum laetum*, *Pittosporum huttonii*, *Olearia townsonii*, *Hebe pubescens* var *pubescens* and *Loxoma cunninghamii*. Coastal scrub will regenerate with time, to coastal forest depending on the effects of the regenerative process and the common occurrence of wilding pines, hakea and browsing animals.

The islands off the Tairua coast are typically rocky and cliff-bound (eg Castle Rock). They have suffered varying degrees of human use ranging from long term habitation (eg Slipper Island) to seasonal muttonbirding. Regeneration occurs where there have been past attempts to clear and graze land.

Most islands are covered in pohutukawa forest, sometimes as a single species dominant canopy with a sparse understorey

and ground tier, or mixed with other broadleaved coastal tree species often similar to those found on the mainland. Some trees found on islands are now uncommon on the mainland (eg *Hymenanthera novae-zealandiae* large-leaved milk tree and occasional parapara).

Semi coastal forest would also have covered extensive areas in Tairua ED, but following logging, farm development and recent exotic forestry operations only small remnants on steep land persist. This forest is predominantly podocarp and tawa forest with kauri and frequent northern rata as distinctive elements. The best example is at Whenuakite-Tapuaetahi; others exist in the Parakau and Paritu catchments.

The lowland forests in the Tairua ED were noted for their abundant and large kauri and were consequently heavily logged from 1860 until the early nineteenth century. The western catchments rise steeply to the main divide and were also heavily exploited for timber (see historical section). Subsequent wild fires and later logging for podocarps would have further altered lowland forests. More recently pine plantation has further reduced the area. Regeneration has occurred so that the best examples of lowland forest have a tawa or towai-tawa canopy with only very occasional emergent northern rata, rimu, miro and totara. Matai is uncommon in Tairua ED.

Today only scattered groves of large kauri, often on very steep inaccessible terrain, remain and even these trees have sometimes been damaged by gum bleeding. It is not known how much hard beech occurred with the kauri as no mention of it is made in accounts of logging days. Today it is found scattered throughout the district, for example in the Kapowai EA, Tairua River, Apakura and Omahu Valleys. A few occurrences of monoao (*Halocarpus kirkii*) in the upper Kauaeranga Valley are interesting as these are the only records in the Coromandel ER. Kohekohe is frequent in the lower lowland forests whilst those approaching the montane zone at about 500 m have frequent tawari, towai, pigeonwood and tawheowheo in the subcanopy. Towai is found from 250 m upwards in Tairua ED, especially as a scrub component. This could reflect poor soils.

After logging previously forested land was burnt, often annually, over a period of about 40 years by the gum diggers who were very active in Tairua ED. On the resultant, impoverished land which was not suitable for farming has been slow. Kauri regeneration, however, on ridges on poor soils is often vigorous eg a large tract of lowland scrub from the Rangihau, behind Tairua, to Hikuai. Today there are very large areas of scrub in the Tairua ED.

The montane zone of Tairua ED, over 600 m, supports an interesting assemblage of vegetation types and species. Bog forest on Table Mountain in the Te Tipi EA is virtually unmodified by man. Yellow-silver pine, tawari and southern rata occur in the wettest places, with stunted rimu, uncommon silver pine and kauri on more freely draining sites. Remnants of these types of forest indicate it was once more widespread are being scattered on plateau-

like areas from the Upper Rangihau to the Kauaeranga. Large kauri were sought even in the montane zone, as stumps and old heads indicate. Thin barked totara, towai, tawari, tawheowheo, montane species and some tawa grow on ridges and hillslopes but very little of this remains today outside of the EAs. Burning by gum diggers again destroyed most forest remaining after logging and impoverished the soil making regeneration to the present day slow. In some modified, very poorly drained areas on the plateau there is manuka-sedge shrubland with *Baumea* spp, *Gleichenia* fern, tamingi and club mosses. Elsewhere over much of the montane zone there is a scrub forest of towai, tawari, tawheowheo, broadleaf, mountain neinei, toro, southern rata, *Coprosma dodonaefolia*, *C. foetidissima*, *Archeria racemosa* and a host of other montane and southern species.

The rock pinnacles and bluffs so characteristic of Tairua ED occur mainly in the montane zone and are covered in a low scrub of similar composition to the montane scrub but with mairehau, *Olearia townsonii*, *Phormium cookianum*, *Machaerina sinclairi*, *Gaultheria antipoda*. Endangered *Celmisia adamsii* var *adamsii* grows on rock faces with many other interesting plants. Pinnacles at lower altitudes, (eg Puriri SR), are without montane species and instead support frequent *Corokia buddleoides*, toatoa, *Pseudopanax discolor*, totara, kauri and sometimes carmine rata and the endemic *Celmisia*.

5.1.6 FAUNA

The Coromandel Forest Park, which covers most of the forest in Tairua ED, is rated as 'outstanding' wildlife habitat (Anderson, 1983a) due to the presence of endangered NI kokako, threatened NI brown kiwi, NI kaka, NI fernbird, long tailed bat, and Hochstetter's and Archey's frogs (See Table 7 for conservation status). The range of forest birds common in the Coromandel ER (see Section 2.1.7) is present in Tairua ED.

The extensive estuaries and sandy beaches of Tairua provide habitat for shore and wading birds. Notable species include reef heron, Caspian tern, banded rail, NZ dotterel, banded dotterel, pied shag and little black shag. Australasian bittern and NI fernbird inhabit coastal and freshwater wetlands. NI fernbird is found in manuka to altitudes above 600m. Some burrow-nesting seabirds, such as grey-faced petrel, sooty shearwater and fluttering shearwater are present on the offshore islands. Tuatara were recorded from the Whangamata Islands Group but there has been no survey there lately to check their presence.

The only known uncommon fish species occurring in Tairua ED is the giant kokopu (indeterminate status). It is known from two streams in the district, Cook and Waikiekie Streams, both of which are largely surrounded by exotic vegetation.

The range of known wildlife found in Tairua ED, including the common and uncommon species, is listed in Table 9.

TABLE 8 :

**Important Plants in Tairua Ecological District
A Provisional List**

VULNERABLE*Celmisia adamsii* var. *adamsii**Pimelia arenaria***RARE***Desmoschoenus spiralis**Pisonia brunoniana* (offshore island)*Brachyglottis myrianthos**Marattia salicina***LOCAL***Pomaderris rugosa**Loxoma cunninghamii**Metrosideros carminea***INDETERMINATE***Utricularia monanthos**Planchonella costata***SPECIES WITH THEIR LIMITS OF DISTRIBUTION IN TAIRUA E.D.****Southern***Halocarpus kirkii***Northern***Rytidosperma viride***TABLE 9 :**

Important Fauna in Tairua Ecological District

ENDANGERED**Birds**

NI kokako

Black stilt

THREATENED**Mammals**

Long-tailed bat

Birds

NI brown kiwi

Australasian bittern

NI kaka

Reef heron

NZ dotterel

Caspian tern

Banded dotterel

Banded rail

REGIONALLY THREATENED**Birds**

NI fernbird

Amphibians

Hochstetter's frog

Archey's frog

Reptiles

Tuatara

RARE**Birds**

Sanderling

Red-necked stint

INDETERMINATE**Fish**

Giant kokopu

TABLE 10 : Tairua Ecological District - Standard Ecological Units

BIOCLIMATIC ZONE	HYDROLOGIC SYSTEM	VEGETATION TYPE	E C O L O G I C A L U N I T	LANDFORM TYPE	FORMER EXTENT	PRESENT EXTENT	CHANGE	PROTECTION STATUS
C	estuarine	eelgrass		tidal flat	C	Mn	S?	1
C	estuarine	mangroves		tidal flat	Mn	Mn	R	1
C	estuarine	<i>Juncus maritimus</i> - <i>Leptocarpus similis</i> rushland		tidal flat	Mn	Mn	R	1
C	estuarine	<i>manuka/Leptocarpus similis</i> rush shrubland		tidal flat	Mn	Mn	R	1
C, SC	palustrine	<i>manuka/Baumea</i> species sedge shrubland		alluvial flat/gully	Mn C	R	R	1
C, SC	palustrine	raupo-flax reedland		alluvial flat	Mn C	R	R	1
C	terrestrial	spinifex-shorebindweed sandfield		foredune	Mn	R	R	1
C	terrestrial	pohuehue-knotted sedge rush-vineland		reardune	Mn	R	R	1
C	terrestrial	pohutukawa rock treeland		cliff/hillslope/island	Mn	R	R	2
C	terrestrial	pohutukawa broadleaved species forest		hillslope/ridge/gully/island	C	R	R	2
C	terrestrial	pohutukawa modified forest		hillslope/ridge/gully	-	R	R	2
C	terrestrial	coastal broadleaved species scrub		hillslope	-	x	I	2
C, L	terrestrial	kanuka scrub/forest		hillslope/alluvial terrace	x	Mn	I	1
C, L	terrestrial	manuka scrub		hillslope/ridge/gully	x	Mn	I	2
C, SC, L	terrestrial	manuka-broadleaved species scrub		hillslope/ridge/gully	x	Mn	I	2
SC	palustrine	lowland swamp forest		alluvial flat	C?	R	R	1
SC, L	terrestrial	alluvial terrace forest		alluvial terrace	Mn	R	R	1
SC, L	terrestrial	kauri-tanekaha forest		hillslope/ridge	C	R	R	1
SC, L	terrestrial	(rata-podocarp)/tawa forest		hillslope/ridge/gully	Mj	R	R	2
SC, L	terrestrial	(rata)/tawa modified forest		hillslope/ridge/gully	-	Mj	R	1
L	terrestrial	hard beech - kauri forest		hillslope/ridge	-	Mn	I	1
L	terrestrial	(rata-podocarp)/towai-tawa forest		hillslope/ridge	Mn	R	R	4
L	terrestrial	towai-tawa forest		hillslope/ridge/gully	Mn	Mn	R	2
L	terrestrial	kanuka-broadleaved species forest/scrub		hillslope/ridge/gully	-	Mn	I	4
SC, L, M	terrestrial	towai scrub		hillslope/ridge/gully	x	Mj	I	1
L, M	terrestrial	upland rocky bluff		bluff/pinnacle	x	Mn	I	5
M	terrestrial	towai-tawari-tawheowheo forest/scrub		hillslope/ridge/plateau	C	C†	S	3
M	terrestrial	montane conifer forest		hillslope/ridge/plateau	C	Mn	R	5

C = coastal; SC = semi-coastal; L = lowland; M = montane

* = Present; R = remnant; Mn = minor; C = common; Mj = major; I = increased;

PROTECTION STATUS: 1 = not represented within existing PNAS

2 = much less than 10% of former extent provided

3 = less than 10% of former extent protected less

4 = adequately protected; 5 = well represented within existing PNAS

R = reduced; S = static; † more scrub than formerly; - absent or present due to natural disturbances

5.2 EXISTING PROTECTED NATURAL AREAS

Tairua ED has a large number of mainly small PNAs protecting a total of 5% of the ED. For lists of flora and fauna features of PNAs see Regnier 1987 and for adequacy of protection see Table 10. Most of the PNAs are scenic reserves in the coastal zone often protecting highly modified vegetation. A Wildlife Refuge protects a small portion of Opoutere sandspit and a Wildlife Sanctuary one of the islands off Whangamata.

The Kapowai, Motutapere and Te Tipi Ecological Areas almost adequately protect the diversity of montane vegetation, barring some landform features, and well represent the higher altitude lowland forests including hard beech and kauri.

5.3 FURTHER REQUIREMENTS TO PROVIDE A NETWORK OF REPRESENTATIVE NATURAL AREAS

Currently there are no PNAs incorporating estuarine and terrestrial wetlands in Tairua ED. There is an immediate need to protect remaining wetland habitats to reflect the prominence of estuaries in the Tairua ED and the former extent of terrestrial wetlands because both are still threatened.

Mangroves and eelgrass are assumed not to have changed significantly in area. There is only 2% of the previous extent of intertidal and freshwater wetlands in the coastal zone and 3% of semi-coastal wetlands remaining today.

Similarly no duneland communities are adequately protected in Tairua ED. Of the 8% of the former extent of dunelands now remaining much has been fragmented or modified.

Only 2% of the former area of all coastal forests is protected and this includes heavily modified forest included in nine small, coastal scenic reserves. Only 7% of the former area of all coastal forest remains, some has been considerably modified. These areas are small poorly buffered and typically occur amongst larger mosaics.

Semi-coastal forest is not securely protected in existing PNAs. Only 3% of the former area of semi-coastal forest still exists and all of it has been modified. In places it forms a fringe along the lower edges of the larger lowland tracts and elsewhere occurs as remnants in the extensive pine plantations.

Four percent of the former area of lowland forest is currently protected within the three EAs, however, most of this is of the (rata-podocarp)/towai-tawa forest characteristic of the higher altitudes. More of the lower-lowland forests should be protected and preferably as continuous tracts of vegetation. Alluvial terrace forest in the lowland zone is not represented within PNAs.

Most of the montane zone lies within existing PNAs. Diversity in this zone is adequately protected apart from the distinctive pinnacle and rocky bluff communities.

Protection and management of all the aforementioned ecosystems, which are currently insufficiently protected, is imperative to ensure their biological diversity and future existence. The diversity of vegetation across ecological gradients is not well represented in existing PNAs. The exception is the gradient from upper lowland to montane vegetation. Particularly poorly represented are sand dune to estuarine vegetation and coastal to lowland forest.

5.4 RECOMMENDED AREAS FOR PROTECTION (RAPs)

Each proposal includes a location map, a checklist of component ecological units, a brief description of landform and vegetation character, and an evaluation/discussion and summary of the priority status of the area.

1. Location Map

Drawn on NZMS1 series maps 1:50,000 and only reduced where necessary.

2. Ecological Unit Checklist

A list of the standard ecological units (see Appendix I for descriptions).

"REL. AREA" - the size of each ecological unit in relation to other examples of that unit in the District; large (L), medium (M) or small (S). For example a large (L) foredune would occupy a much smaller area than a large (L) kanuka forest unit.
- 0 indicates no other examples recorded in the district.

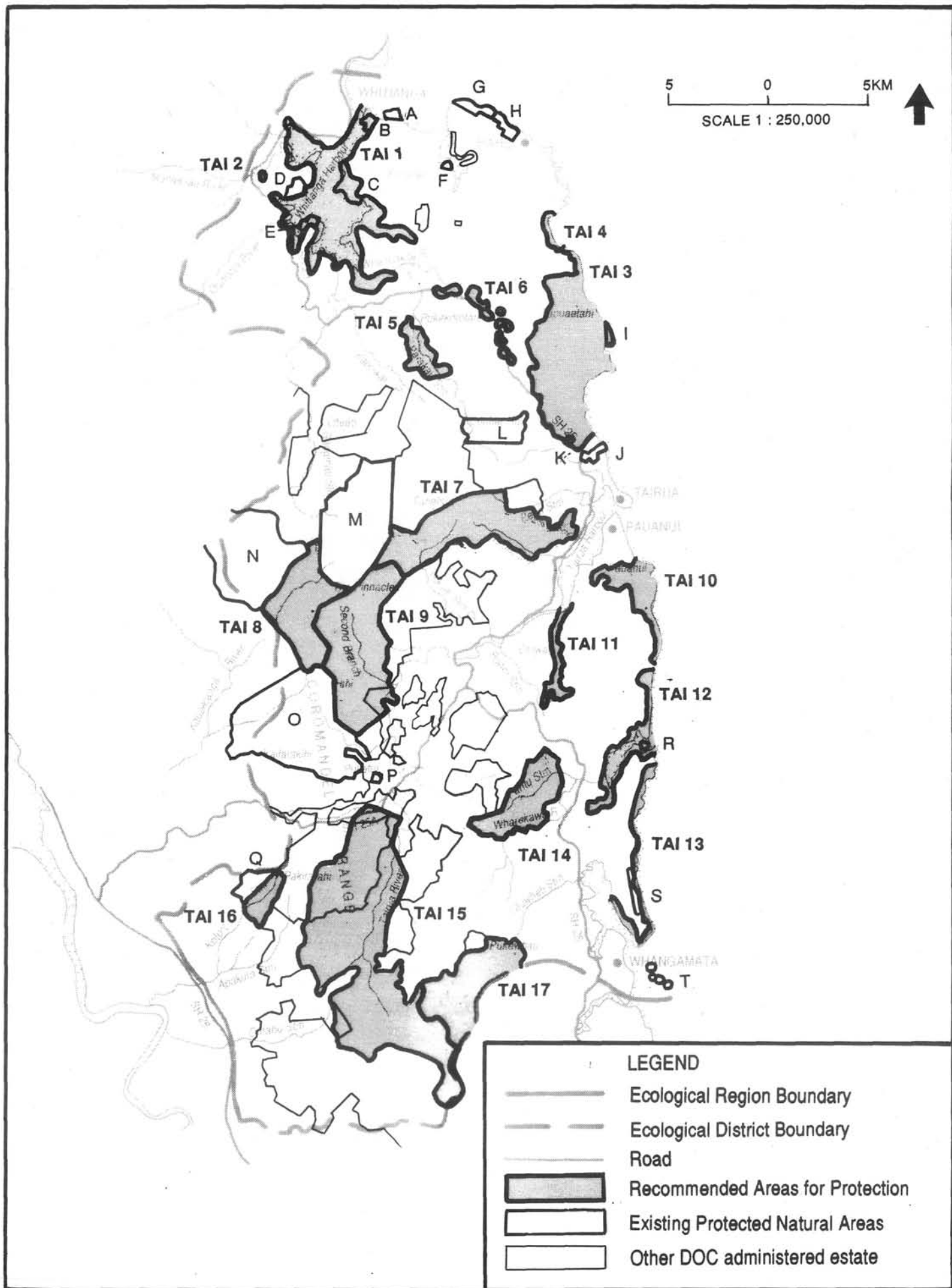
3. Landform and Vegetation

Descriptions are given for the entire priority area.

4. Discussion and Criteria Summary

Outline of the quality of the area and its important features for protection.

Further information, such as distribution of vegetation types within RAPs, may be obtained from the Department of Conservation, Waikato Conservancy, Hamilton.



**TAIRUA ECOLOGICAL AREA
RECOMMENDED AREAS FOR PROTECTION
AND EXISTING PROTECTED NATURAL AREAS**

INDEX TO RAPs

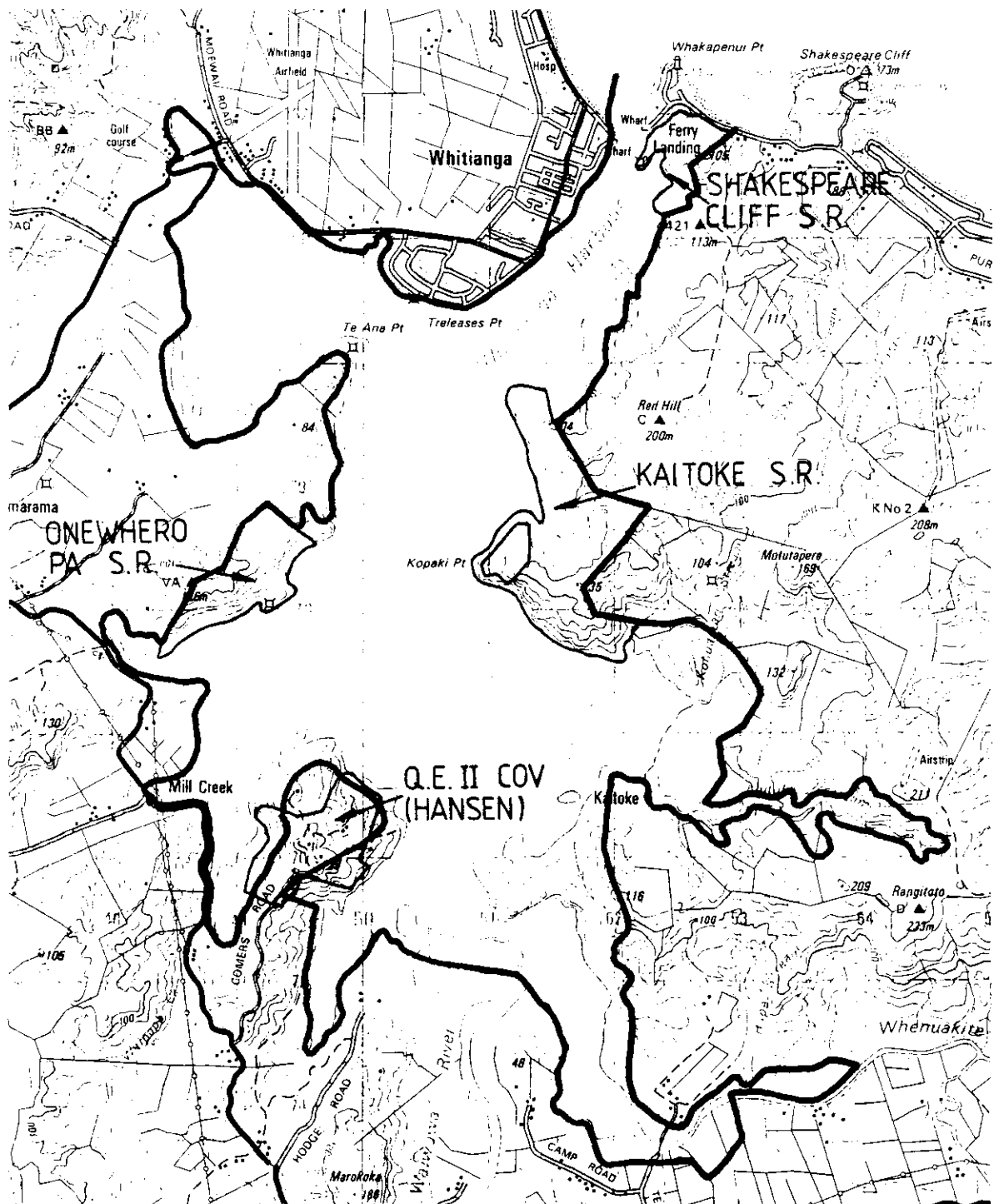
	Page
Tai 1 Whitianga Harbour	130
Tai 2 Kaimarama River Flats	132
Tai 3 Whenuakite-Tapuaetahi	134
Tai 4 Hot Water Beach	136
Tai 5 Parakau	138
Tai 6 Whenuakite River Flats	140
Tai 7 Oturu	142
Tai 8 Upper Kauaeranga	144
Tai 9 Upper Hikuai	146
Tai 10 Pauanui Hill	148
Tai 11 Duck Creek	150
Tai 12 Wharekawa Harbour.. .. .	152
Tai 13 Onemana	154
Tai 14 Paritu Stream	156
Tai 15 Tairua River	158
Tai 16 Puriri SR Extension	160
Tai 17 Upper Wharekawa	162

INDEX TO EXISTING PNAS (See Fig 5)

A Shakespeare Cliff Scenic Reserve
B Whitianga Rock Scenic and Historic Reserve
C Kaitoke Scenic Reserve
D Onewhero Pa Scenic Reserve
E Hansen QEII Open Space Covenant
F Digger's Hill Scenic Reserve
G Cook's Bluff Scenic Reserve
H Cathedral Cove Scenic Reserve
I Tupuaetahi Scenic Reserve
J Twin Kauris Scenic Reserve
K Punaruku Scenic Reserve
L Te Moata QEII Open Space Covenant
M Kopowai Ecological Area
N Te Tipi Ecological Area
O Motutapere Ecological Area
P Fourth Branch Scenic Reserve
Q Puriri Scenic Reserve
R Wharekawa Spit Wildlife Refuge
S Onemana Scenic Reserve
T Whangamata Islands Wildlife Sanctuary

TAIRUA

Tai. 1 WHITIANGA HARBOUR



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T11 505775
AREA	: 2227.5 ha
ALTITUDINAL RANGE	: 0 - 100 m
TENURE	: Crown, Private
DATA REFERENCE	: Study Area 40, Miller, S, 1987

Tai. 1 : Whitianga Harbour

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	zostera (eelgrass)	submerged flat	S
coastal	mangrove forest	tidal flat	L
coastal	<u>Juncus maritimus-Leptocarpus similis</u> rushland	tidal flat	L
coastal	manuka- <u>Leptocarpus similis</u> rush-shrubland	tidal flat	L
coastal	pohutukawa rock treeland	cliff	M
coastal	pohutukawa-broadleaved species forest	cliff, hillslope	M
coastal	pohutukawa modified forest	alluvial flat	M
coastal	kanuka scrub or forest	hillslope	M
coastal	manuka scrub	hillslope	M

Landform:

An estuary with a large area of intertidal flats (74% of estuary area is exposed at low tide) surrounded by extensive alluvial flats, low alluvial terraces and hills of rhyolitic pumice breccia. On the eastern side ignimbrite sheets give rise to cliffs and rocky headlands.

Vegetation:

A gradient from estuarine to terrestrial vegetation is represented in this RAP. The estuarine flats support a small area of eelgrass with extensive mangrove stands (at least 40% of intertidal area). Large areas of rushland and rush-shrublands exist at the heads of inlets, especially the Whenuakite River. Some natural terrestrial vegetation borders the estuary including pohutukawa rock-treeland on ignimbrite cliffs, modified coastal forest and kanuka forest on hillslopes, with varying amounts of adventive species such as hakea and pines.

Fauna:

The estuary was ranked as high wildlife value by the FSU. It supports breeding colonies of pied and little shags, reef heron, fernbird. Banded rail and Australasian bittern are present. The estuary is noted for its rich marine macrofauna and its extensive fish breeding grounds.

Flora:

No significant flora recorded during survey.

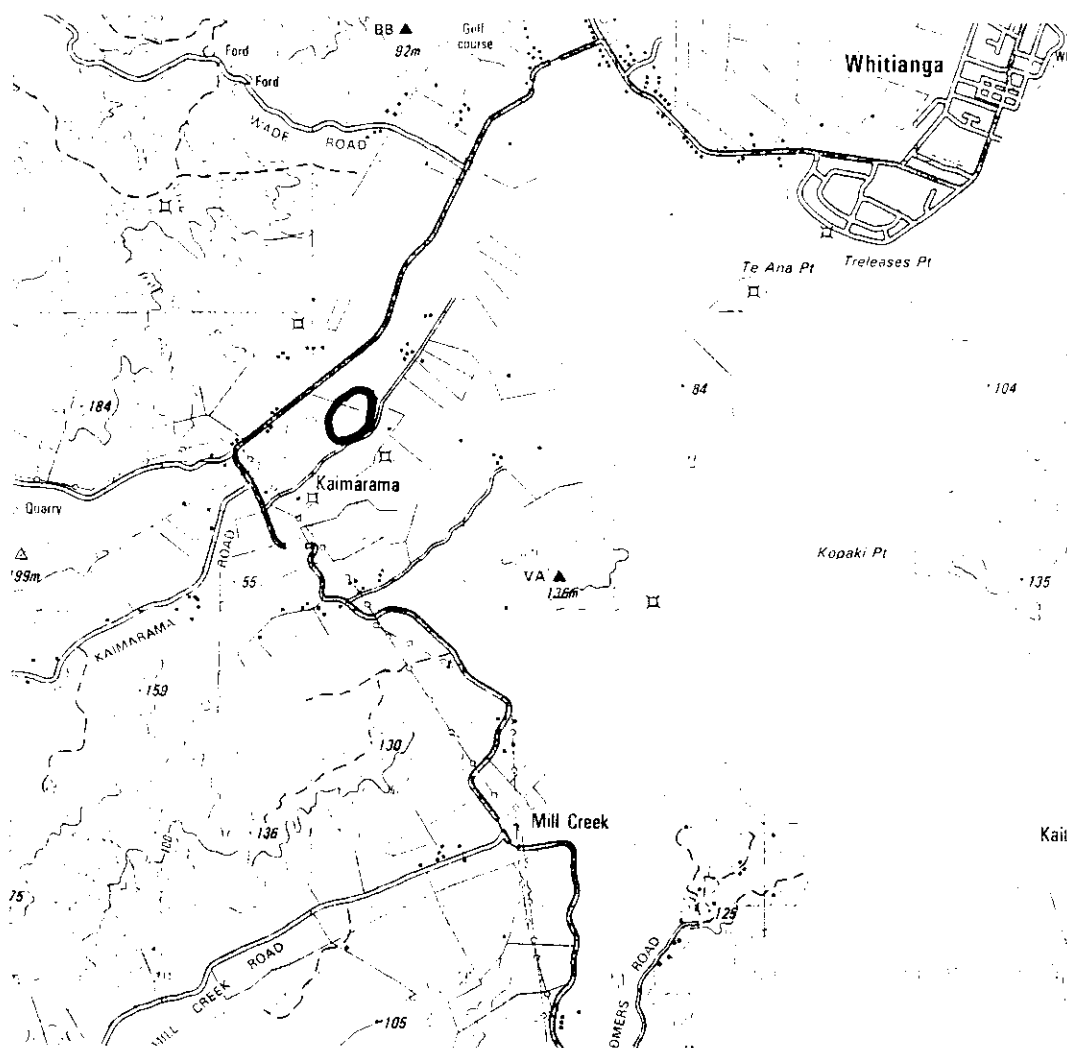
Discussion:

This estuary provides the largest area of intertidal flats in the Tairua ED and represents 2% of the total national population of mangroves. The RAP includes large estuarine wetlands with adjacent coastal forest and scrub. There are several scenic reserves adjacent to the estuary supporting coastal forest and scrub. It is strongly recommended that a management strategy is prepared for the catchment to maintain the high natural values. The estuary supports populations of notable wildlife.

Criteria Summary:

Representativeness	H	- Largest and best example of mangroves and intertidal rushlands in Tairua ED and the Coromandel ER. There is some good pohutukawa coastal forest on headlands.
Diversity	H	- One bioclimatic zone, nine vegetation types.
Naturalness	M	- Mangroves little modified but wetlands and adjacent coastal forest have been reduced in extent. Some adventive species present in coastal scrub, especially prickly hakea. Overall the estuary has retained much of its natural character.
Special Features		- Breeding colonies of pied and little shags. Threatened Australasian Bittern and fernbird, banded rail and reef heron are present. The harbour is a scenic feature and used for recreation.
Viability	M	- Due to the high proportion of developed land, the large catchment of this estuary requires careful management for the long term maintenance of its high natural values.
Buffering	M	- About 25% of the estuarine vegetation is surrounded immediately by natural vegetation but much is in pasture.
Landform		- An example of a large harbour formed by drowned river valleys and surrounded by low coastal hills, alluvial flats and ignimbrite cliffs.
Threat	H	- Siltation from farmland and catchment, coastal development, stock damage to estuarine vegetation. It is important to manage the catchment so as to avoid siltation of the harbour.

Tai. 2 KAIMARAMA RIVER FLATS



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T11 472793
AREA	: 7.5 ha
ALTITUDINAL RANGE	: 5 - 15 m
TENURE	: Private
DATA REFERENCE	: Study Area 39

Tai. 2 : Kaimarama River Flats

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
semi-coastal	podocarp-broadleaved forest	alluvial terrace	S

Landform:

Alluvial river terrace.

Vegetation:

This is a narrow strip of alluvial terrace forest along a tributary of the Whitianga Estuary. The forest is of kahikatea and kauri with coastal broadleaved species such as puriri, karaka, kohekohe. The understorey is sparse due to grazing.

Fauna:

Common forest birds recorded during survey.

Flora:

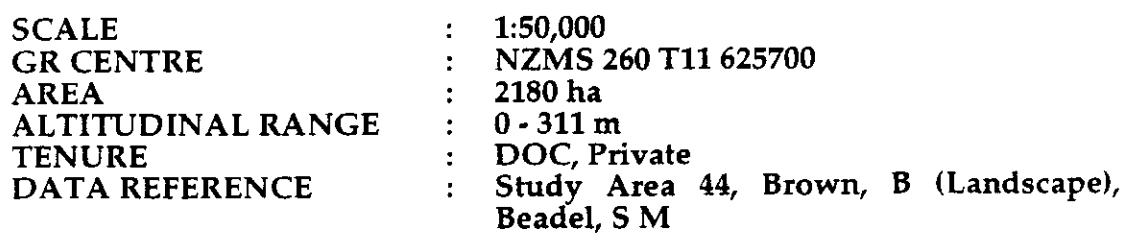
No notable plants recorded during survey.

Discussion:

While not supporting a diversity of vegetation types this forest remnant is representative of a type that has virtually all been removed in Tairua ED. The stands are scattered and stock have access to graze. These trees are a scenic feature on the Tairua-Whitianga road.

Criteria Summary:

Representativeness	H - This is the only area of podocarp-broadleaved, semi-coastal forest on alluvial terrace in the district.
Diversity	L - One bioclimatic zone, one vegetation type.
Naturalness	L - This forest has been modified.
Special Features	-
Viability	M - Fencing, removal of stock is necessary to ensure survival of this forest remnant.
Buffering	L - The river forms a natural buffer. Otherwise surrounded by pasture.
Landform	- - Semi-coastal alluvial terrace.
Threat	M - Stock grazing, topdressing, clearance.



Tai. 3 : Whenuakite - Tapuaetahi

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	pohutukawa rock-treeland	rockstack, cliff	L
coastal	pohutukawa-broadleaved species forest	hillslope, gully	L
coastal	pohutukawa modified forest	hillslope, gully	S
semi-coastal	(rata-podocarp)/tawa forest	hillslope, ridge, gully	L
semi-coastal	kauri-tanekaha forest	hillslope, ridge	L
coastal	raupo-flax reedland	basin	M
semi-coastal		hillslope	
coastal	coastal broadleaved species scrub	hillslope, ridge, gully	M
coastal	manuka-broadleaved species scrub		L
semi-coastal			

Landform:

The area comprises several small coastal catchments flowing eastwards off low coastal hills and the headwaters of streams running westwards into Whitianga Harbour. The coastline is rocky with cliffs, prominent headlands, sheltered bays and small sandy beaches. The RAP lies mainly on andesite with a small area of rhyolite.

Vegetation:

Pohutukawa rock treeland is found on the cliffs along most of the coast. Coastal hillslopes are a covered in mosaic of regenerating coastal forest and scrub, with pockets of pohutukawa forest in gullies and other areas that have escaped burning. A number of mature ngaio are found in this forest in the north of the RAP. Inland, on steeper slopes, coastal forest grades into semi-coastal tawa forest with emergent podocarps and rata including pohutukawa northern rata hybrids. The southern portion of the RAP is predominantly scrub covered while in the north there are more tall forest areas but with some development for farmland. There is a substantial amount of healthy and advanced kauri regeneration in coastal and semi-coastal scrub. Two remnant raupo-flax wetlands are found in small basins and are bordered by swamp maire.

Fauna:

Threatened NI Kaka and NI brown kiwi and the skink *Leiopisma smithii* were recorded by FSU.

Flora:

Loxoma cunninghamii, *Hebe pubescens* var. *pubescens*. Swamp maire in wetland. Greatest number of Ngaio trees in coastal forest seen here. *Sicyos australis* and *Pteris comans* in coastal forest.

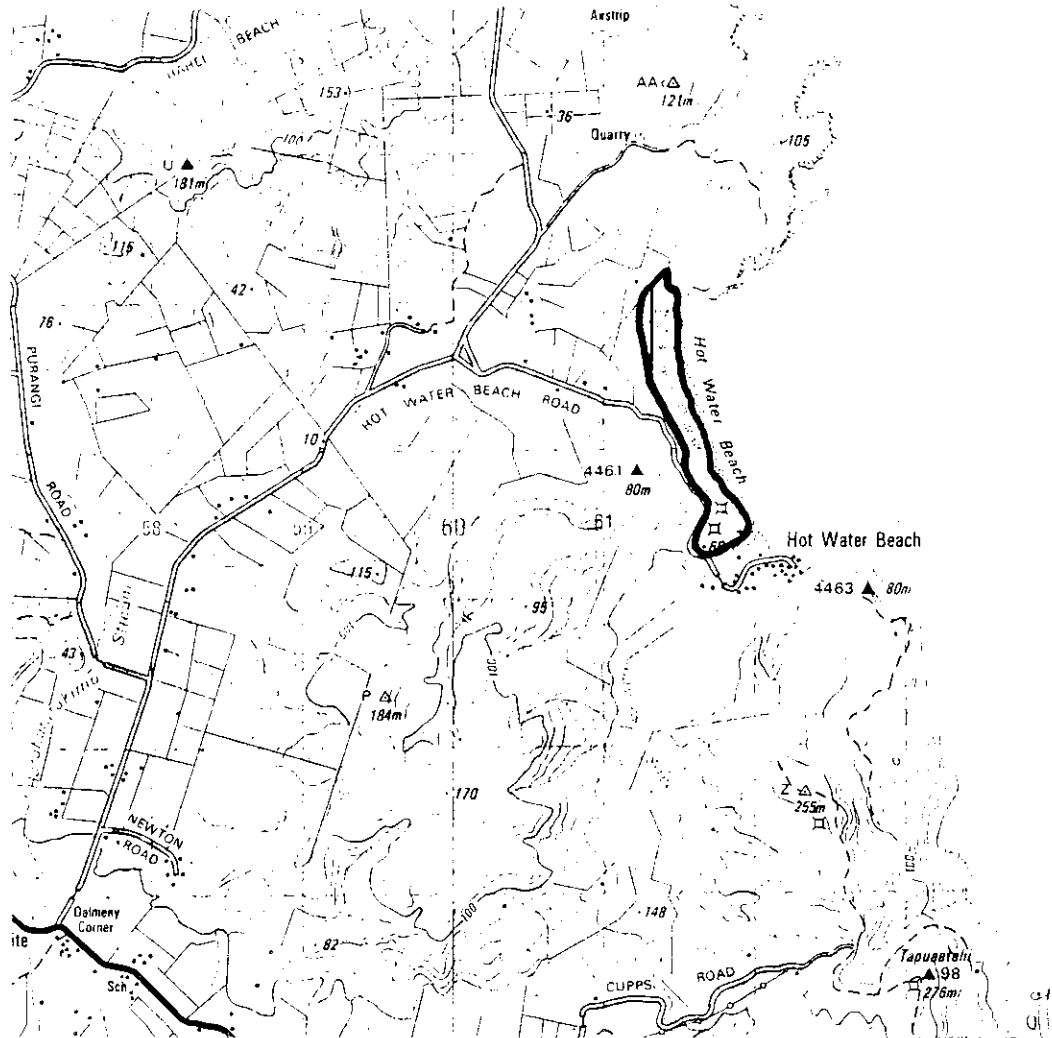
Discussion:

This is the largest, most intact and diverse area of coastal vegetation in the Tairua ED. Modifications, past and present, have had major impacts on this RAP but overall it is still valuable for its representative vegetation, diversity, wildlife, flora and scenic values. Regeneration is proceeding well on DOC land. Private land to the north has some forest fenced to exclude farm stock. Coastal subdivision and development at Sailor's Grave will result in future changes. A small scenic reserve lies on the coast and two others in the south of the RAP.

Criteria Summary:

Representativeness	H	- Contains good examples of representative coastal forest and the largest area of semi-coastal forest with kauri. The small coastal basin wetland represents a once probably more common feature along this coastline.
Diversity	H	- Two bioclimatic zones, nine vegetation types.
Naturalness	M	- Cliff vegetation and (rata-podocarp)/tawa semi-coastal forest is natural. Overall site has a natural scenic appearance. Some wilding pines and hakea. Kauri planting by the Kauri Management Unit of NZFS.
Special Features		- NI Kaka, NI brown kiwi, <i>Loxoma cunninghamii</i> , <i>Hebe pubescens</i> , Swamp maire, <i>Sicyos australis</i> and ngaio present. High scenic values.
Viability	M	- Compact site. Large important vegetation features well buffered. DOC land viable but private land to the north still farmed and coastal subdivision is proceeding near Sailor's Grave Bay. Requires co-ordinated management and attention drawn to the conservation values.
Buffering	M	- Buffered by scrub and partially broken in farmland to the west, scrub to the south, pasture and scrub to the north. Several small scenic reserves adjacent.
Landform		- Coastal hillslopes and cliffs on andesite.
Threat	M	- Wild animals, stock grazing, coastal subdivision, fire. Roothing. Wilding pines and hakea.

Tai. 4 HOT WATER BEACH



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T11 615760
AREA	: 30 ha
ALTITUDINAL RANGE	: 0 - 20 m
TENURE	: Crown (vested in local authority)
DATA REFERENCE	: Study Area 43

Tai. 4 : Hot Water Beach

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	<i>Spinifex</i> -shorebindweed sandfield	foredune	M
coastal	pohuehue-knotted sedge rush-vineland	foredune, reardune	M
coastal	pohutukawa rock-tree land	cliff	S
coastal	pohutukawa-broadleaved species forest	hillslope	S
coastal	pohutukawa modified forest	hillslope	S

Landform:

A low sand dune system situated at the mouth of a small river, includes a small rhyolite knoll and geothermal activity on beach in front of it.

Vegetation:

Good example of *spinifex* foredune to stable reardune vegetation sequence. Extensive rush-vineland on rear dunes with *Coprosma acerosa*. Rocky headland supports representative pohutukawa coastal forest.

Fauna:

NZ dotterel breeding on the beach. Caspian terns and gannets offshore. Pied oystercatchers on beach. Ranked high wildlife value by FSU.

Flora:

Pingao and sand *Coprosma* on dunes.

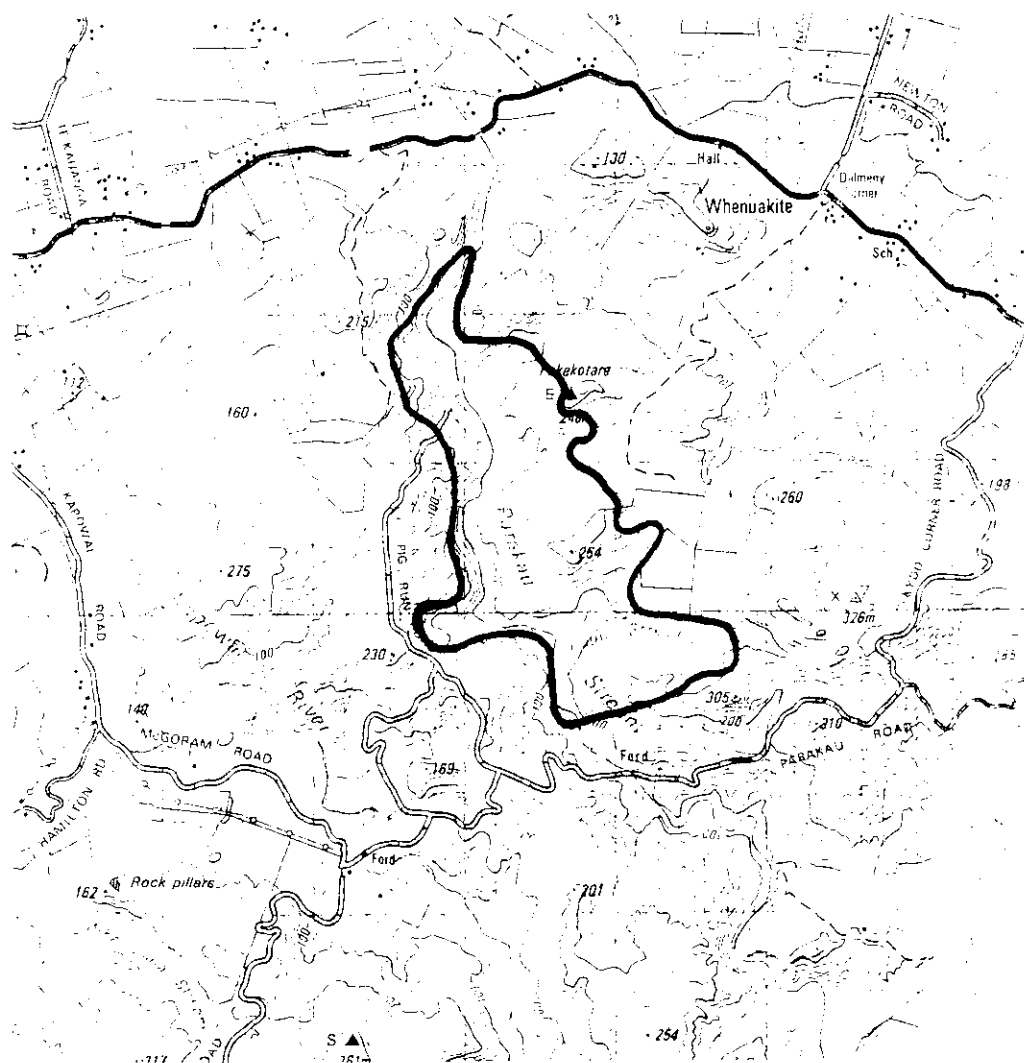
Discussion:

This RAP supports is the most natural least modified sand dune vegetation in the Tairua ED. It has dune vegetation representative of types once far more extensive in Tairua ED. The dunes and foreshore provide an important wildlife habitat, especially for NZ dotterel. There is a regionally threatened important geothermal feature on the beach, Otua hot springs. The beach and hot springs draw a large number of visitors especially during summer. The dunes require careful management so that the natural values are not compromised.

Criteria Summary:

Representativeness	H	- The least modified most representative dune system in the Tairua ED including coastal cliff vegetation.
Diversity	M	- One bioclimatic zone, five vegetation types.
Naturalness	M	- Despite the presence and local abundance of adventive plant species the dunes still retain a predominantly natural character.
Special Features	-	- Breeding pairs of threatened NZ dotterel. Pingao on dunes. Site of regional geopreservation value - water and gas bubble through sand about 2m below tide. Scenic and recreation value high.
Viability	M	- Control of recreational users, removal of weed species and prevention of grazing of rear dunes required.
Buffering	L	- The RAP is bordered by farmland, pine trees and scrub on headlands.
Landform	M	- Low lying sand dune system, includes a rocky knoll and geothermal activity.
Threat	M	- Damage by people. Sheep grazing part of the dune vegetation and coastal forest.

Tai. 5 PARAKAU



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T11 558705
AREA	: 300 ha
ALTITUDINAL RANGE	: 20 - 300 m
TENURE	: Private (Tasman Forestry Ltd)
DATA REFERENCE	: Study Area 46

Tai. 5 : Parakau

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
semi-coastal lowland	(rata)/tawa modified forest	hillslope, ridge, gully	M
semi-coastal	kauri-tanekaha forest	ridge	M S S
semi-coastal	manuka scrub	hillslope, ridge, gully	S
semi-coastal	manuka-broadleaved species scrub	hillslope, ridge, gully	M

Landform:

Steep-sided river valley cut into Coromandel group rhyolites.

Vegetation:

Remnants of semi-coastal and lowland forest with regenerating secondary vegetation including some kauri. Ridges and hillslopes have manuka scrub and kauri regeneration while lower hillslopes and gullies support remnants of taller forest.

Fauna:

Common forest birds recorded during survey.

Flora:

No species of note recorded during survey.

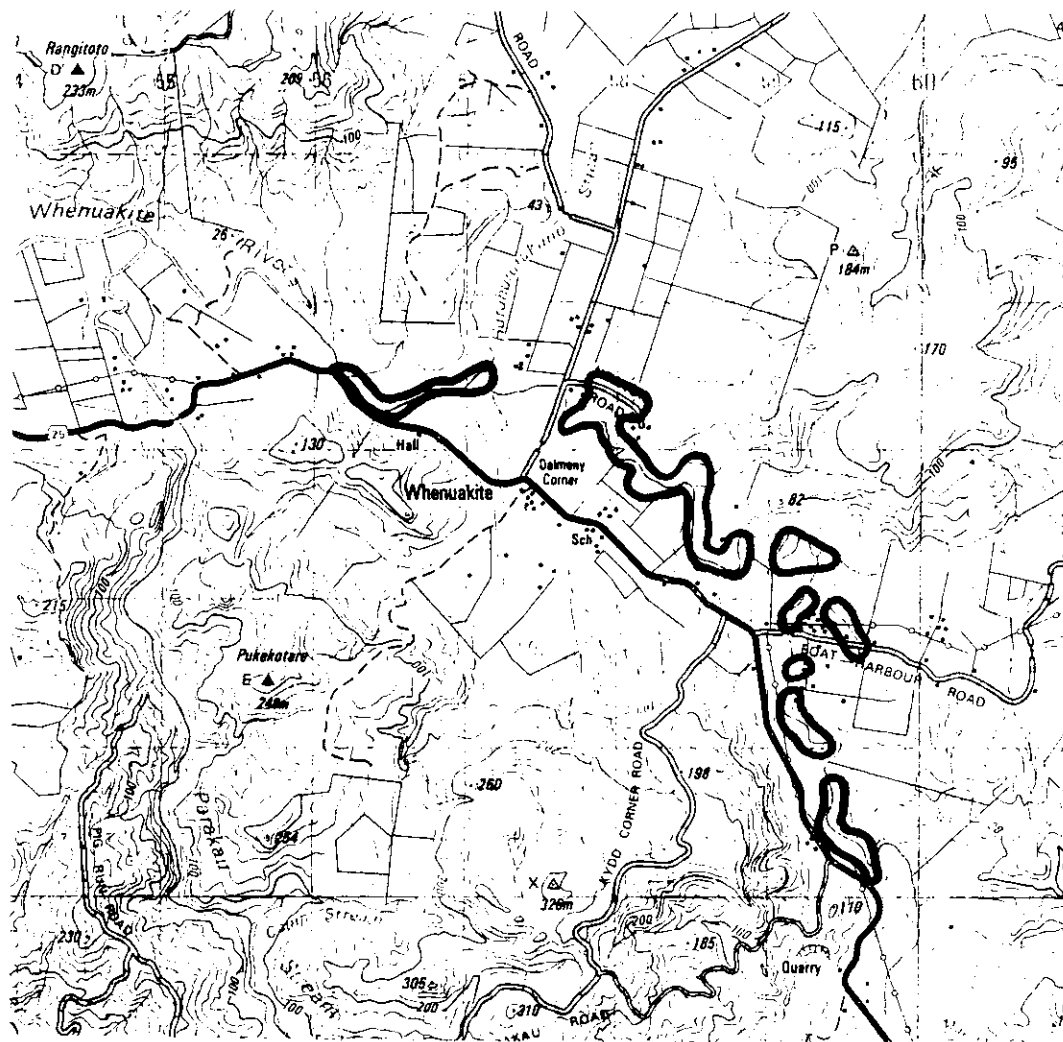
Discussion:

Semi-coastal forest is much reduced in extent in the Tairua ED by human modification. This remnant surrounded by pines is one of the few examples remaining. Although modified, the forest is regenerating to former forest cover and was ranked as a potential wildlife habitat by the FSU.

Criteria Summary:

Representativeness	M	- One of only a few areas supporting semi-coastal forest in Tairua ED.
Diversity	M	- Two bioclimatic zones, four vegetation types.
Naturalness	M	- There has been considerable past modification but regeneration is proceeding. Some wilding pines.
Special Features	L	- No special features recorded during rapid survey.
Viability	M	- Site is reasonably secure but not formally protected.
Buffering	M	- Almost completely surrounded by pine plantation.
Landform		- Steep-sided river valley on rhyolite.
Threat	M	- Topdressing from pines, wilding pines, fire, wild animals.

Tai. 6 WHENUAKITE RIVER FLATS



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T11 585725
AREA	: 102 ha
ALTITUDINAL RANGE	: 0 - 40 m
TENURE	: Private
DATA REFERENCE	: Study Area 45

Tai. 6 : Whenuakite River Flats

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
semi-coastal	podocarp forest	alluvial terrace	M
semi-coastal	manuka-broadleaved species scrub	alluvial terrace	S

Landform:

Alluvial river terrace on the Whenuakite River.

Vegetation:

Several stands of podocarp alluvial terrace forest along the river. Predominantly kahikatea with matai, totara, miro and cabbage tree. Some manuka scrub also.

Fauna:

Common forest birds recorded during survey.

Flora:

No species of note recorded during survey.

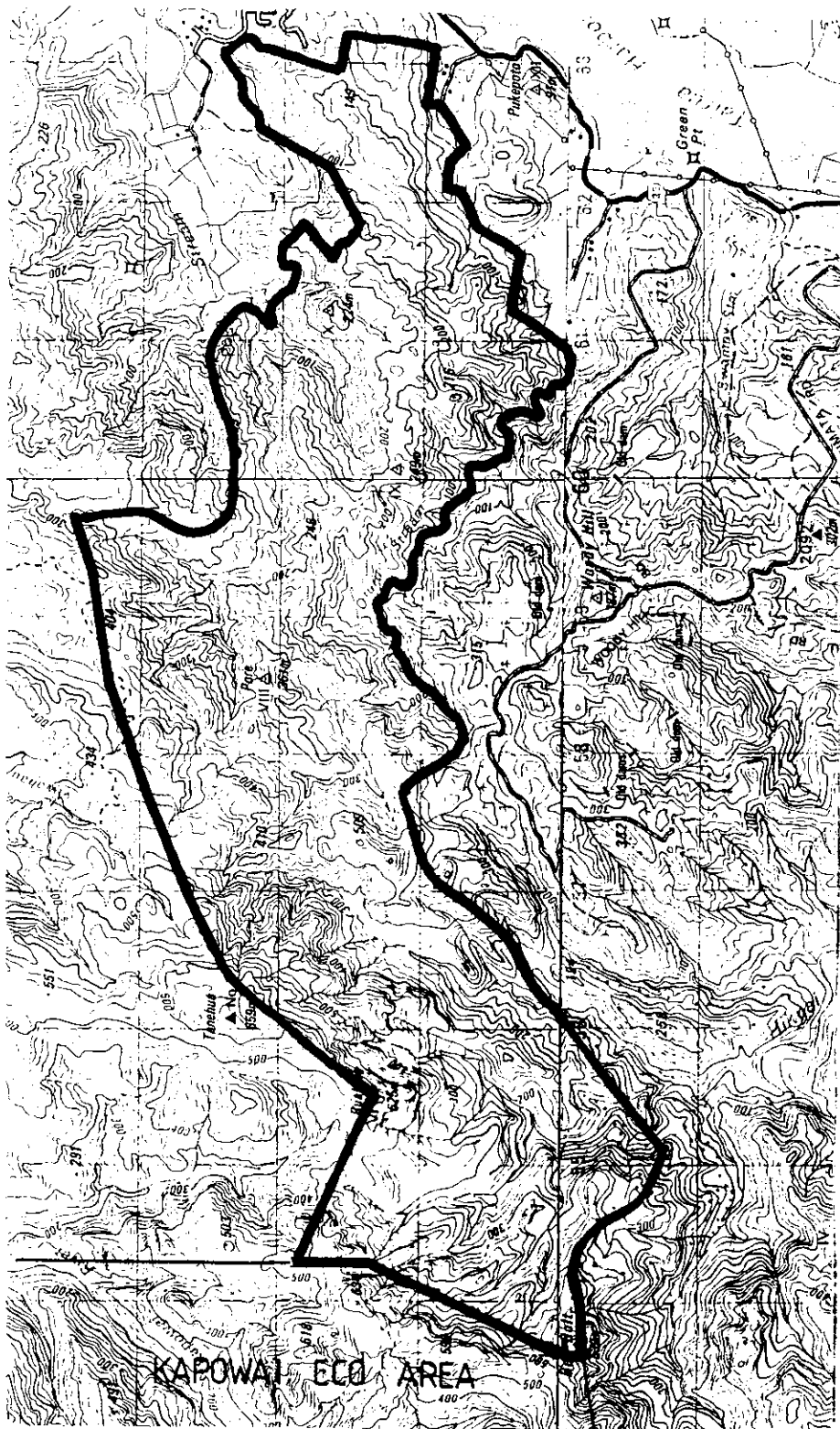
Discussion:

While not supporting a diversity of vegetation types these remnants represent a former semi-coastal vegetation type which would have been far more extensive around Whitianga Harbour but which virtually all been cleared.

Criteria Summary:

Representativeness	H	- The only podocarp alluvial terrace forest in the semi-coastal zone in Tairua ED.
Diversity	L	- One bioclimatic zone, two vegetation types.
Naturalness	M	- Some of the trees are probably secondary but these remnants still retain much of their original character.
Special Features	-	
Viability	M	- Fencing and protection is necessary to ensure the future existence of this forest. Regeneration potential not known.
Buffering	L	- Surrounded by pasture, not fenced.
Landform	-	- Alluvial river terrace in semi-coastal zone.
Threat	M	- Grazing animals, topdressing, clearance.

Tai. 7 OTURU



SCALE	:	1:50,000
GR CENTRE	:	NZMS 260 T12 590610
AREA	:	1707.5 ha
ALTITUDINAL RANGE	:	25 - 659 m
TENURE	:	Crown (DOC)
DATA REFERENCE	:	

Tai. 7 : Oturu

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
semi-coastal	broadleaved species scrub	hillslope, ridge, gully	S
coastal, semi-coastal, lowland	kanuka-broadleaved species forest	hillslope, ridge, gully	L
coastal, semi-coastal, lowland	manuka scrub (incl. <i>Hakea</i> mosaic)	hillslope, ridge, gully	L
lowland, montane	towai scrub	hillslope, ridge, gully	L
lowland	(rata)/tawa modified forest	hillslope, ridge, gully	L
lowland, montane	(rata-podocarp)/towai-tawa	hillslope, gully	S

Landform:

Part of steep hill country rising up to plateau-like high country around Tanehua and Ruahine. Predominantly rhyolite domes but lower hills on rhyolitic pumice breccia, ignimbrite and minor andesite flows.

Vegetation:

An area of predominantly secondary and modified natural vegetation extending from just above sea level to the montane zone. A mosaic of secondary vegetation with the broad pattern being coastal broadleaved and kanuka-broadleaved scrub on lower coastal and semi-coastal slopes, short manuka and manuka-broadleaved scrub, with locally abundant hakea and wilding pines on low hills and upper hillslopes being covered in towai scrub. Kauri regeneration is localised throughout in the scrub communities. Occasional pockets of remnant tall forest can be found in small gullies which have escaped fire, in the upper catchment there are some small areas of tawa and towai-tawa forest, both with some emergent podocarps and northern rata.

Fauna:

Not known but much vegetation is suitable fernbird habitat.

Flora:

Pomaderris rugosa found (endemic to the Coromandel ER) through coastal scrub. Nationally rare *Loxoma cunninghamii*.

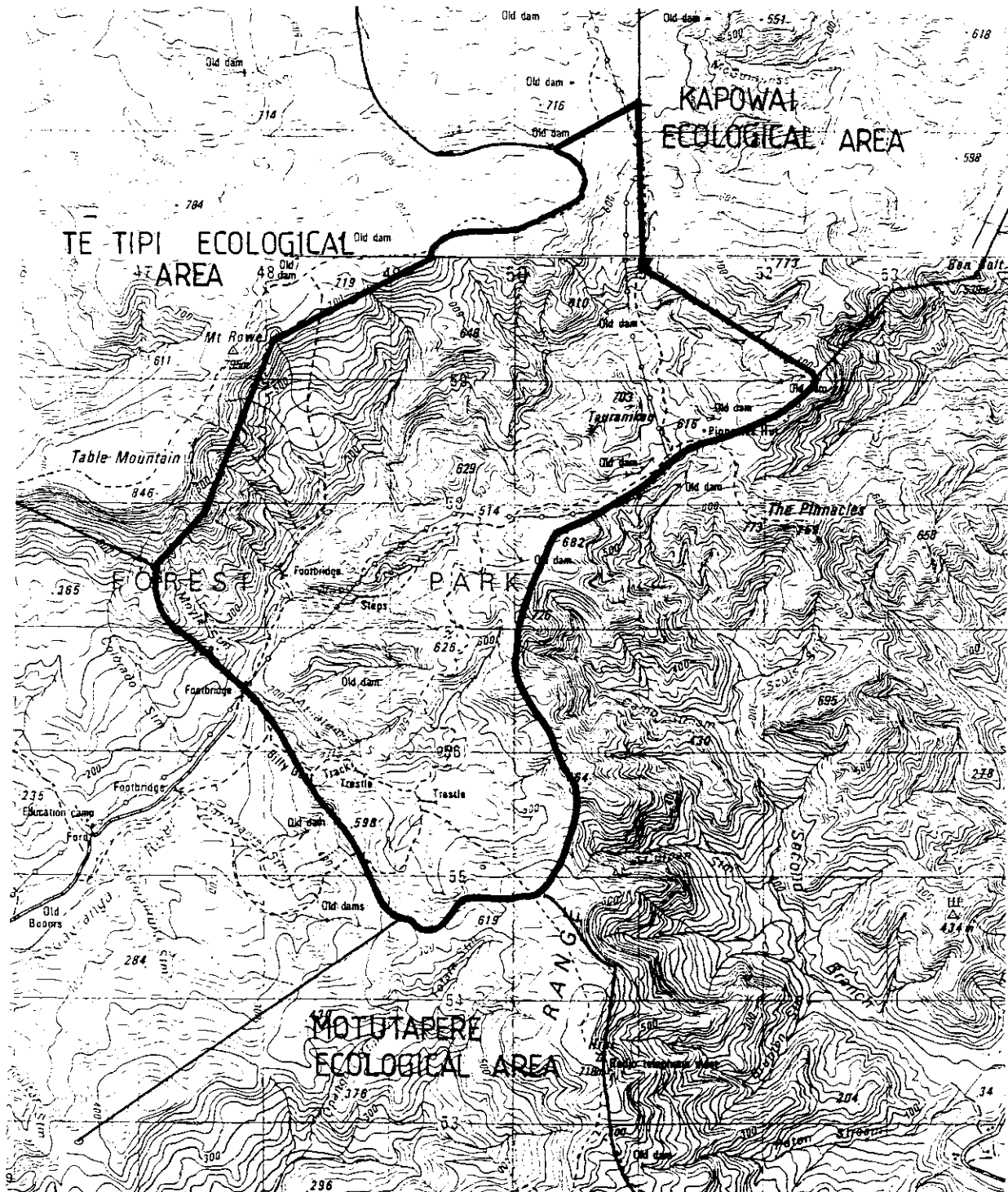
Discussion:

Although comprising predominantly secondary vegetation this area provides the best opportunity to protect an east to west sequence of native vegetation across the main range. The proposed sequence includes this RAP, Upper Hikuai, Kauaeranga and Wainora RAPs. Despite the effects of logging, burning and gum-digging at the beginning of this century forest is regenerating.

Criteria Summary:

Representativeness	M - Predominantly secondary vegetation, including kauri regeneration. Part of a continuous tract of natural vegetation from sea level to the montane zone in Tairua ED. Also provides east-west vegetation sequence across the range.
Diversity	M - Four bioclimatic zones, seven vegetation types.
Naturalness	L - Mainly secondary vegetation, some areas with frequent hakea and wilding pines.
Special Features	- Catchment protection for Tairua estuary and Tairua water supply. Rare plants <i>Loxoma cunninghamii</i> , <i>Pomaderris rugosa</i> present.
Viability	M - This will regenerate to the former forest cover in the long term, requires low-level management to achieve this.
Buffering	H - Mostly surrounded by natural vegetation, some pine forest to the south and farmland to the east. Upper Hikuai RAP and Kapowai EA adjacent.
Landform	M - Steep hills on rhyolite, rhyolite breccia and andesite flows
Threat	M - Fire, wild animals, mining.

Tai. 8 UPPER KAUAERANGA



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T12 495580
AREA	: 1552.5 ha
ALTITUDINAL RANGE	: 150 - 750 m
TENURE	: Crown (DOC)
DATA REFERENCE	: Study Area 48

Tai. 8 : Upper Kauaeranga

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland montane	(rata-podocarp)/tawa forest	hillslope, ridge, gully	M
lowland montane	(rata-podocarp)/towai-tawa forest	hillslope, ridge, gully	S
montane	podocarp forest	hillslope, ridge	L
lowland montane	towai scrub	hillslope, ridge, gully	L

Landform:

The steep and rugged headwaters of the Kauaeranga River. Steep hillslopes in the lower valley lie mainly on andesite, rhyolite pumice breccia and ignimbrites. Steep slopes in the north form the flanks of Table Mountain and Te Tipi EA, those to the south rise to the prominent Coromandel landform known as the Pinnacles. These higher areas lie on Coromandel group rhyolites and are characterised by meso-plateau surfaces with rocky bluffs and pinnacles (remnants of fossil geothermal vents) rising from them.

Vegetation:

There is a broad altitudinal range from lowland to montane vegetation. Secondary towai scrub and forest occupies large areas of this RAP reflecting past intense kauri logging and gum-digging in the catchment especially in the southern portion. These secondary communities support a number of unusual plants outlined below in the flora section. Tawa forest, often with towai and emergent rata and podocarps, remains in less disturbed areas. Steepland adjacent to Te Tipi EA and isolated high altitude areas support stunted forest of kauri, rimu, yellow-silver pine, tawari, southern rata and occasional hard beech which is uncommon in Tairua ED. Steep slopes near the Pinnacles support a diverse montane community of mountain flax, towai, tawheowheo, *Machaerina sinclairii*, broadleaf, mountain neinei and other montane species.

Fauna:

High numbers of fernbird were recorded in lowland and montane scrub.

Flora:

Hard beech found scattered throughout, some reaching to 600 m asl. *Halocarpus kirkii* is present. Coromandel endemic plants *Brachyglottis myrianthos*, *Celmisia adamsii* var. *adamsii*, *Loxoma cunninghamii*, *Coprosma dodonaefolia* are all found in the secondary communities. *Chionochloa conspicua* is found in montane vegetation.

Discussion:

The Upper Kauaeranga Valley has a range of natural values; it provides a wildlife corridor by linking between three important montane EAs, Te Tipi, Motutapere and Kapowai and is adjacent to Wainora and Upper Hikuai RAPs; forest covers a considerable altitudinal range amongst a mosaic of representative secondary communities; is part of an east to west sequence of ecological diversity in the Tairua ED. Secondary forest supports a number of notable plant species. The area is very scenic and is regularly visited by large numbers of people. The Upper Kauaeranga is a proposed "Wild and Scenic River".

Criteria Summary:

Representativeness	M	- Representative forest and scrub communities over a wide altitudinal range. Part of an east to west sequence.
Diversity	H	- Two bioclimatic zones, five vegetation types.
Naturalness	M	- Severe past modification has occurred but regeneration is progressing.
Special Features	-	- High landscape values. Popular recreation area. A number of notable plant species are present. The Coromandel endemics <i>Brachyglottis myrianthos</i> , <i>Celmisia adamsii</i> var. <i>adamsii</i> , <i>Coprosma dodonaefolia</i> . Also <i>Chionochloa conspicua</i> , <i>Loxoma cunninghamii</i> and <i>Dracophyllum patens</i> . Montane vegetation has a distinctive southern element. High numbers of fernbird in montane scrub. Proposed "Wild and Scenic River".
Viability	H	- A compact site worthy of careful management due to its natural values, recreation values and proximity to three EAs.
Buffering	H	- This RAP is buffered completely by natural vegetation.
Landform	-	- Hillslopes, steep and sharp ridges, bluffs and pinnacles on andesites, ignimbrites and rhyolites.
Threat	M	- Wild animals, human damage, fire.

Tai. 9 : Upper Hikuai

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	(rata-podocarp)/tawa forest	ridge, hillslope, gully	L
lowland	hard beech-kauri forest	ridge, hillslope, gully	L
lowland	towai-tawa forest	hillslope, ridge, gully	L
lowland, montane	towai scrub	hillslope, ridge, gully	M
lowland	kanuka-broadleaved species scrub/forest	hillslope, ridge, gully	M
lowland	kanuka forest	alluvial flat	M
montane	tawari-towai-tawheowheo forest	hillslope, ridge	L
montane	upland rocky bluff community	rock bluff, pinnacle	L
montane	montane conifer forest	ridge, hillslope	L

Landform:

A diversity of landforms on rhyolitic pumice breccia and ignimbrites, from alluvial terrace through steep hillslopes to high rock pinnacles and bluffs formed from ignimbrite sheets. The Second Branch River has a bed of massive boulders.

Vegetation:

This RAP includes a diversity of vegetation types over a wide altitudinal range. There is kanuka forest on alluvial flats near the Tairua River and kanuka-broadleaved species scrub on lower hillslopes with locally abundant kauri regeneration. The Second Branch supports a large area of tawa forest with emergent podocarps and northern rata. The First Branch catchment has less towai forest and scrub indicating greater modification. Both catchments have towai-tawa forest in their upper reaches. Hard beech is present, scattered in both catchments. Montane ridges and hillslopes support towai scrub, tawari-towai-tawheowheo forest and scrub and stands of montane conifer forest with yellow-silver pine and hard beech.

Fauna:

This RAP is part of the Hikuai Block which was ranked outstanding wildlife habitat by FSU. Common bush birds were recorded during the survey. Hochstetter's frogs are abundant in side streams of Second Branch Catchment. NI fernbird were recorded in the montane scrub. The FSU also recorded kokako and native, long-tailed bats and NI kiwi here.

Flora:

Loxoma cunninghamii, *Celmisia gracilentia* var. *Brachyglottis myrianthos*, *Dracophyllum patens*, *Coprosma dodoneifolia*, *Hebe pubescens* var. *pubescens*. Northern limit of *Rytidosperma viride*. *Marattia salicina* reported from the area.

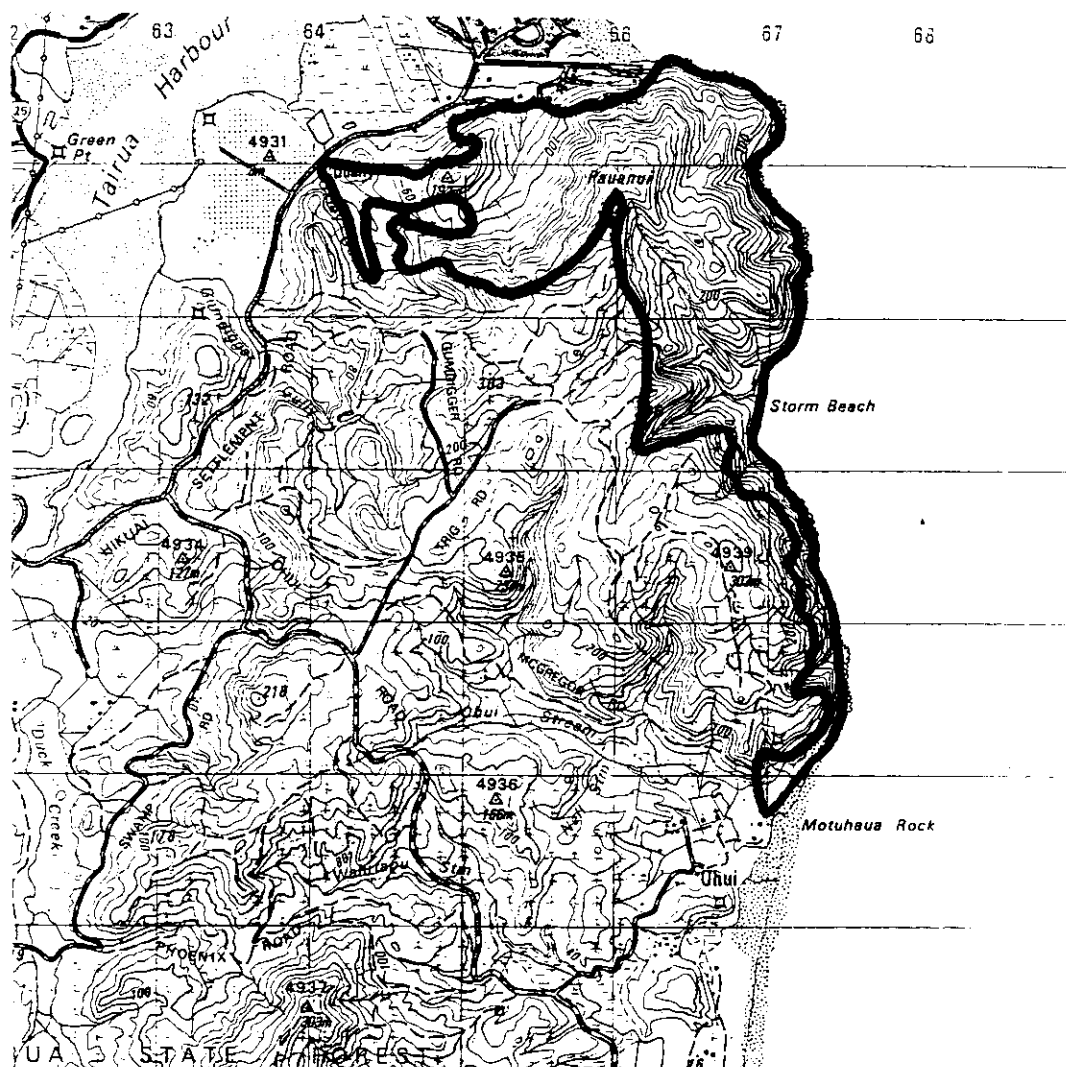
Discussion:

This RAP has a wide range of special features giving it an overall high natural value. It has a diversity of vegetation and landform. There are some localised and unusual plant associations such as yellow-silver pine, hard beech and montane rocky bluff communities currently under-represented in the PNAs in Tairua ED. This RAP is a valuable wildlife habitat and it connects Kapowai and Motutapere EAs. This area is distinctively scenic and includes the Pinnacles and the attractive Second Branch River, which has been proposed "Wild and Scenic Reserve".

Criteria Summary:

Representativeness	H	- Large area of lowland forest, upland rocky bluff and montane conifer forest. Altitudinal sequence from 20 m asl to the montane zone.
Diversity	H	- Two bioclimatic zones, nine vegetation types, including forest and seral scrub.
Naturalness	M	- Much of the area has been logged. First Branch is more heavily modified and was probably burnt.
Special Features	-	- The Second and First Branch Rivers are part of the Tairua "Wild and Scenic River" proposal. Abundance of Hochstetter's frogs reflects good condition of streams in the Second Branch. A large number of threatened plant and animal species have been recorded from this RAP.
Viability	H	- Long term viability is good. A compact RAP comprising almost whole catchments of two tributaries of the Tairua River.
Buffering	H	- Adjoined by Motutapere EA to south, the Upper Kauaeranga RAP to the west, the Kapowai EA and CSFP to the north, some farmland to the east.
Landform	H	- The best example of the prominent rock pinnacles and bluffs characteristic of the Coromandel ER. Very steep hillslopes and gullies on rhyolite pumice breccia and ignimbrite representative of western steep country of Tairua ED and the main Coromandel Range.
Threat	L	- Wild animals, mining activities, fire.

Tai. 10 PAUANUI HILL



SCALE	:	1:50,000
GR CENTRE	:	NZMS 260 T12 660588
AREA	:	415 ha
ALTITUDINAL RANGE	:	0 - 387 m
TENURE	:	Crown, Timberlands
DATA REFERENCE	:	Study area 51, Burns 1984f

Tai. 10 : Pauanui Hill

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	pohutukawa rock-treeland	cliff	M
coastal	pohutukawa-broadleaved species forest	hillslope, gully	S
coastal	manuka-broadleaved species scrub	hillslope, ridge, gully	M
coastal, semi-coastal	manuka/ <u>Baumea</u> sedge-shrubland	alluvial flat	S

Landform:

A prominent and steeply sloping coastal headland with seacliffs on Coromandel group rhyolite. Small alluvial flat formed in a gully bottom.

Vegetation:

Pohutukawa rock-treeland occurs along the coastal cliffs with some remnant pohutukawa-broadleaved forest inland. Much of the coastal hillslopes are covered in coastal manuka-broadleaved species scrub with kanuka, pohutukawa and emergent rewarewa. The endemic Coromandel plant *Pomaderris rugosa* is a frequent scrub species. A small wetland with manuka over *Baumea* spp, umbrella fern and kiokio is situated on the lower, northern slopes, surrounded by pines.

Fauna:

Common bush birds recorded during survey.

Flora:

Pomaderris rugosa.

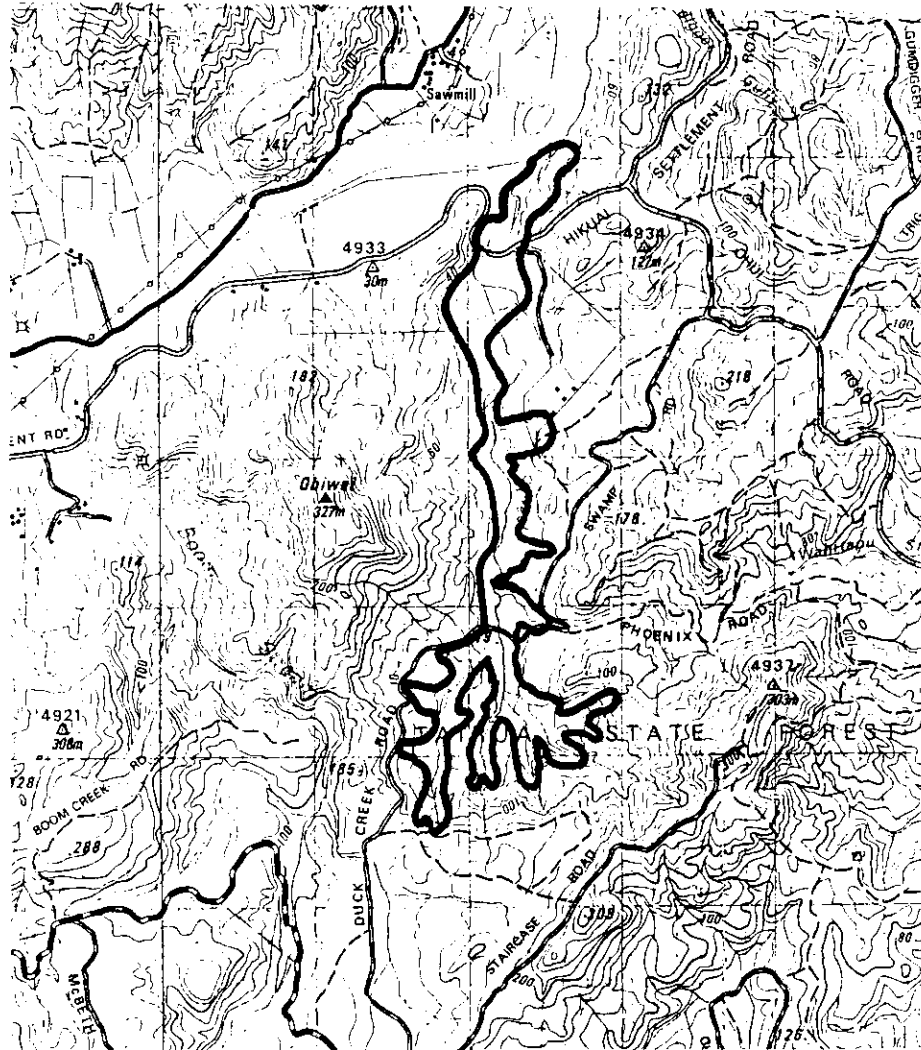
This area includes coastal vegetation types that are considerably reduced from their former extent (see Table 10) and poorly represented in the current reserve system of Tairua ED.

Discussion:

The hill is a prominent local landscape feature and backdrop for Pauanui. It is used for recreation. Steep coastal slopes and cliffs support unmodified pohutukawa forest. The coastal scrub is showing advanced regeneration, although there is evidence of fire having occurred in places in the recent past.

Criteria Summary:

Representativeness	H	- Pohutukawa cliff vegetation well represented and includes regenerating coastal scrub mosaic.
Diversity	L	- Two bioclimatic zones, four vegetation types.
Naturalness	M	- Coastal cliff vegetation is less modified than the rest of the RAP which is secondary.
Special Features		- <i>Pomaderris rugosa</i> in scrub. Scenic values.
Viability	H	- The RAP is a compact area. Coastal scrub is showing good regeneration. Viable with careful management.
Buffering	M	- Buffered to east by sea. Almost completely surrounded by pine forest with some farmland and residential areas to the north.
Landform	M	- Steep, prominent headland on rhyolite.
Threat	M	- Fire risk, topdressing drift from pine forest, wilding pines, drainage of wetland.



SCALE : 1:50,000
GR CENTRE : NZMS 260 T12 623545
AREA : 157.5 ha
ALTITUDINAL RANGE : 0 - 15 m
TENURE : Crown (SOE), Private
DATA REFERENCE : Study area 53

Tai. 11 : Duck Creek

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	<i>Juncus maritimus</i> - <i>Leptocarpus similis</i> rushland	tidal flat	M
coastal	manuka/ <i>Leptocarpus similis</i> sedge-shrubland	tidal flat	M
semi-coastal	manuka/ <i>Baumea</i> spp sedge-shrubland	alluvial flat	L
semi-coastal	raupo-flax reedland	alluvial flat	L
semi-coastal	cabbage tree forest	alluvial flat	L

Landform:

Estuarine intertidal flats and alluvial flats on recent alluvium and peat deposits.

Vegetation:

Sequence from intertidal *Juncus maritimus*-*Leptocarpus similis* rushland to acid peat bog vegetation of manuka/*Baumea* spp sedge-shrubland. Also a more fertile area of cabbage tree swamp forest and raupo-flax reedland adjacent to the main stream with frequent willow and blackberry and small areas of the latter along the wetland margins. The freshwater sedge-shrubland has strong acidic character with *Empodisma minus*, *Gleichenia dicarpa*, *Baumea teretifolia*, and *B. huttonii* being common, narrow arms of peat bog extend up into the catchment.

Fauna:

The FSU of the Wildlife Service ranked this site as moderate to high wildlife value. The regionally threatened fernbird and spotless crane were recorded during the PNAP survey. The nationally threatened bittern reported by farmer. The wetland is a native fish breeding habitat.

Flora:

Utricularia monanthos, (bladderwort), *Empodisma minus* (wire rush) are both uncommon plants in the Coromandel Ecological Region.

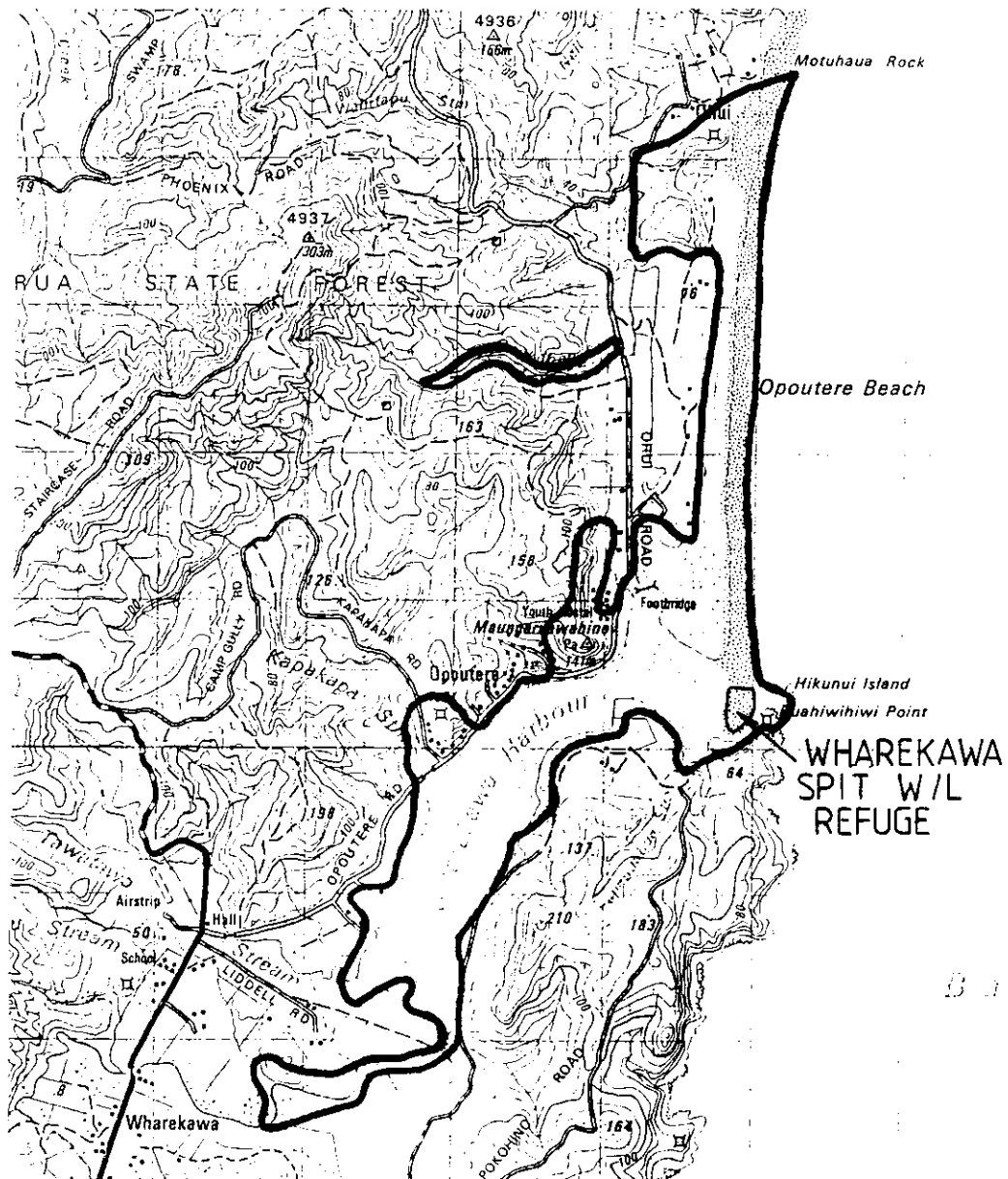
Discussion:

This is the best, relatively intact sequence of estuarine to freshwater wetland vegetation in the Tairua ED and the largest, most representative area of acid peat bog in the Coromandel ER. The area provides habitat for a number of notable wildlife species. Very few other freshwater wetlands of this size exist in the Coromandel Ecological Region. Wetland vegetation protects erosion of the catchment.

Criteria Summary:

Representativeness	H	- Relatively large areas of wetland vegetation including estuarine reedlands and acid peat bog of manuka/ <i>Baumea</i> sedge shrubland, raupo-flax reedland and cabbage tree swamp forest. This is one of the best natural wetlands in the Coromandel ER.
Diversity	M	- Two bioclimatic zones, five vegetation types.
Naturalness	M	- Lower sections modified by farming and exotics. Upper reaches natural despite pine planting adjacent.
Special Features		- <i>Utricularia monanthos</i> . There is only one other wetland on the Coromandel where <i>Empodisma minus</i> is found.
Viability	M	- Viable if protected and managed appropriately.
Buffering	L	- Surrounded by pine forest and farmland.
Landform	L	- Tidal and alluvial flats.
Threat	M	- Farm reclamation, stock grazing, top dressing from farmland and pine forest. Siltation and flooding during future logging operations. Mining activity.

Tai. 12 WHAREKAWA HARBOUR



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T12 665510
AREA	: 550 ha
ALTITUDINAL RANGE	: 0 - 150 m
TENURE	: Crown (DOC, SOE), Private
DATA REFERENCE	: Study Area 52

Tai. 12 : Wharekawa Harbour

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	Zostera (eelgrass)	submerged flat	M
coastal	mangroves	tidal flat	S
coastal	<i>Juncus maritimus</i> - <i>Leptocarpus similis</i> rush-sedgeland	tidal flat	M
coastal	manuka- <i>Leptocarpus similis</i> rush-shrubland	tidal flat	M
coastal, semi-coastal	manuka-Baumea spp sedge-shrubland	alluvial flat	M
coastal	raupo-flax reedland	dune hollow	M
coastal	<i>Spinifex</i> -shorebindweed sandfield	foredune	L
coastal	pohutukawa rock-treeland	cliff	S
coastal	pohutukawa broadleaved species forest	hillslope	M
semi-coastal	swamp maire swamp forest	alluvial flat	O

Landform:

Small harbour with extensive intertidal flats. A large sand dune system and a sandspit lie across the harbour mouth behind which are the remnants of a previously extensive peatland. The estuary is surrounded by steeply rising hills of rhyolite, rhyolitic pumice breccia, ignimbrite and andesite.

Vegetation:

Diverse vegetation including estuarine to freshwater wetland sequences. Mangroves and eelgrass are found on submerged and tidal flats. Estuarine margins support areas of rushland and sedge-shrubland. There is a large, expanse of foredune vegetation with abundant spinifex and pingao. Freshwater wetlands have been reduced to a few remnant areas, one fertile raupo-flax reedland and two small, acid manuka/Baumea sedge-shrublands with occasional swamp maire. An area of pohutukawa-broadleaved coastal forest provides a scenic natural backdrop to part of the harbour.

Fauna:

Part of the sandspit is a wildlife management reserve where several pairs of NZ dotterel and variable oystercatchers. The estuary with its extensive eelgrass and shellfish beds, is an important feeding ground for wading birds and was ranked of high wildlife value by the FSU. Small wetlands provide habitat for a number of birds including threatened Australasian bittern, banded rail and NI fernbird.

Flora:

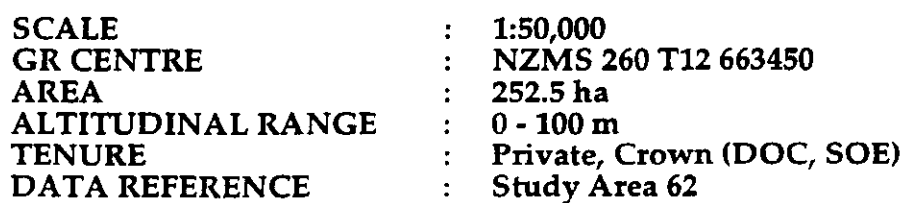
The rare plant pingao is abundant on foredunes. *Pimilea arenaria* has been recorded here.

Discussion:

An area of diverse natural vegetation interrupted by farmland and pines. This small, very scenic estuary, with its sandspit, sand-dunes and brackish and freshwater wetlands is most representative of the range of vegetation associated with estuarine systems in Tairua ED. Larger estuaries in the ED have greater extents of certain vegetation types but not the diversity. The diversity and quality of habitats is reflected in the high wildlife values associated with the estuary and sandspit. Wharekawa Spit Wildlife Refuge is a very small area at the tip of the sandspit.

Criteria Summary:

Representativeness	H	- Good range of coastal ecological units of estuarine ecosystem.
Diversity	H	- Two bioclimatic zones, ten vegetation types.
Naturalness	M	- Estuarine vegetation is the least modified. Farming and forestry has modified rear dunes, wetlands and hillslopes.
Special Features		- Breeding pairs of the NZ dotterel and northern variable oystercatcher. Australasian Bittern, NI fernbird and banded rail present in wetlands. Pingao on sand dunes. Scattered trees of swamp maire.
Viability	M	- The whole harbour area and its catchment requires careful management. Important remnants of natural vegetation require protection. Estuary will be prone to siltation during logging and planting of pines in the catchment. Careful management of these activities is imperative to maintain the natural character of the estuary.
Buffering	M	- Estuary is buffered to some extent by marginal wetlands, surrounding hillslopes are planted in pines. Farmland and forestry adjoin wetlands.
Landform	H	- A comparatively small estuary with intertidal flats, a large sandspit and dune system with remnant peatlands. Surrounded by steep hills on volcanic rocks.
Threat	H	- Natural values of this RAP are under threat from a number of activities; siltation and topdressing associated with pines, conversion to farmland, coastal development, increased human use of a fragile environment (eg vehicles on eelgrass). Catchment also requires careful management.



Tai. 13 : Onemana

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	pohutukawa rock-treeland	cliff	L
coastal	pohutukawa-broadleaved species forest	cliff, hillslope	S
coastal	pohutukawa modified forest	cliff, hillslope	S
coastal	broadleaved species scrub	hillslope	M
coastal	spinifex-shorebindweed sandfield	sand dune	S

Landform:

A long section of coastline with cliffs and small sandy bays on rhyolite.

Vegetation:

This long extent of rugged coastline supports a narrow strip of representative coastal vegetation. Pohutukawa rock-treeland grows on steep hillslopes and cliffs while pohutukawa coastal forest extends inland. Both have been modified to some extent. Some areas have been cleared and support broadleaved species scrub with regenerating coastal species.

Fauna:

Common bush birds recorded in coastal forest and scrub. Two pairs of NZ dotterel nesting on beach south of Onemana and breeding variable oystercatchers. Gannets feeding offshore.

Flora:

Pingao on small dune area at base of cliff. *Planchonella costata* in coastal forest near Whangamata.

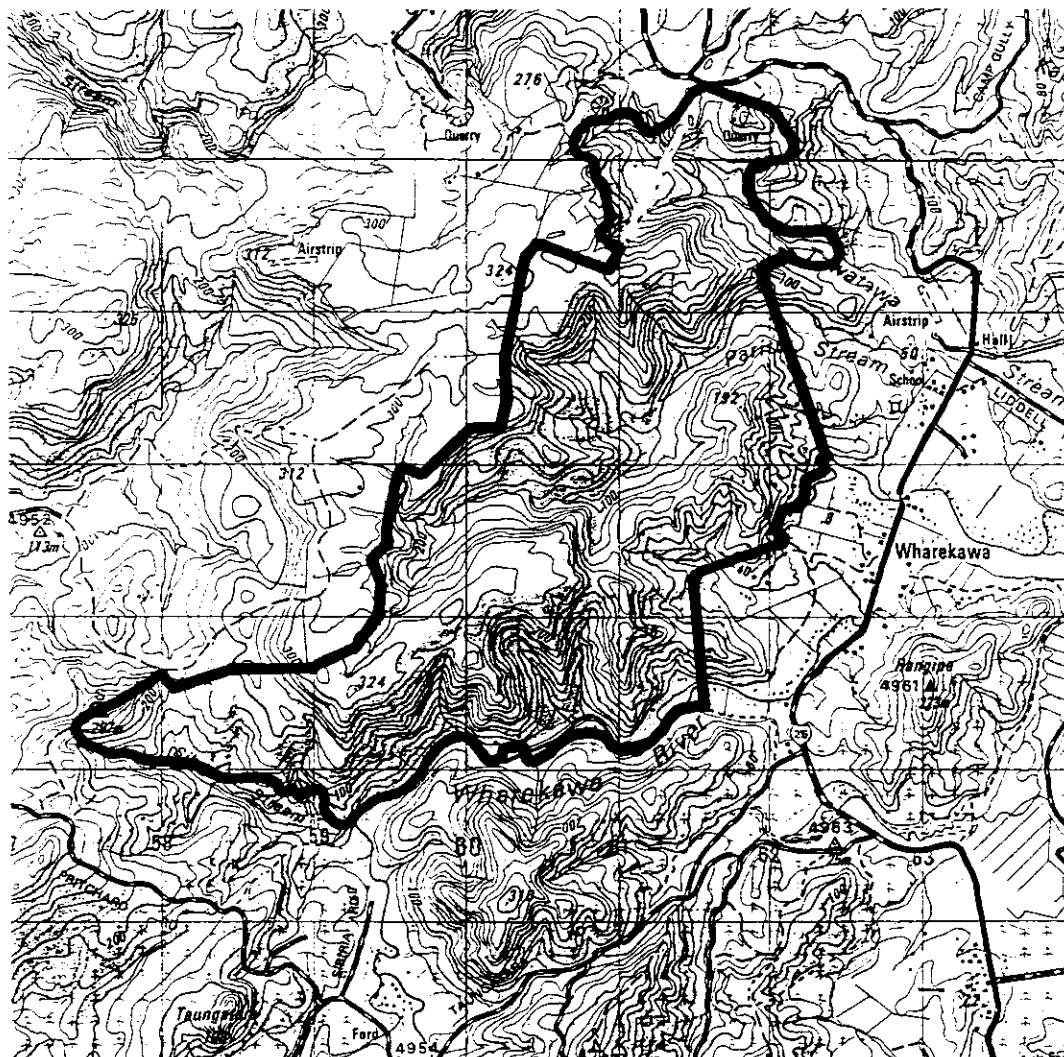
Discussion:

This scenic coastline supports representative remnants of coastal forest which has been replaced elsewhere in Tairua ED by farming and forestry. Includes the particularly scenic bush backdrop of the eastern side of Whangamata Harbour. The fragmented Onemana Scenic Reserve lies within this RAP.

Criteria Summary:

Representativeness	M	- Representative coastal forest and small area of sand dune vegetation.
Diversity	M	- One bioclimatic zone, five vegetation types.
Naturalness	M	- Much of the coastline has a natural appearance but there has been modification.
Special Features	-	- Breeding NZ dotterel. Pingao. Scenic values.
Viability	M	- Sinuous nature of coastal strip makes it vulnerable to damage.
Buffering	L	- Pasture and pine forest. Onemana Scenic Reserve is within the RAP.
Landform	-	- Coastal cliffs and hillslopes. Small sand dune.
Threat	M	- Grazing by goats, sheep and cattle, topdressing from pine forest, logging, burning.

Tai. 14 PARITU STREAM



SCALE	:	1:50,000
GR CENTRE	:	NZMS 260 T12 610480
AREA	:	932.5 ha
ALTITUDINAL RANGE	:	20 - 324 m
TENURE	:	Crown (DOC, SOE)
DATA REFERENCE	:	Study area 56

Tai. 14 : Paritu Stream

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
semi-coastal lowland	kauri-tanekaha forest	hillslope, ridge	M
semi-coastal lowland	(rata-podocarp)/tawa forest	hillslope, ridge, gully	M
semi-coastal lowland	manuka-broadleaved species scrub	hillslope, gully	S
semi-coastal lowland	towai scrub/forest	hillslope, ridge	L

Landform:

River valley, hillslopes and meso-plateau surface above. Underlying rock is andesitic lava flows, rhyolite domes and thick andesitic ash over rhyolite.

Vegetation:

Lower slopes and ridges have been modified in the past and now support manuka-broadleaved species and towai scrub, with abundant kauri regeneration. Upper slopes support tall (rata-podocarp)/tawa forest ranging from a semi-coastal type with puriri and karaka to a lowland type with frequent healthy emergent northern rata and podocarps. On the gentler plateau-like surface there is kauri-tanekaha forest of mixed age, including some large kauri, frequent rimu and northern rata.

Fauna:

Common bush birds recorded during survey. Ranked moderate-high wildlife value by FSU.

Flora:

No plant species of note recorded during survey.

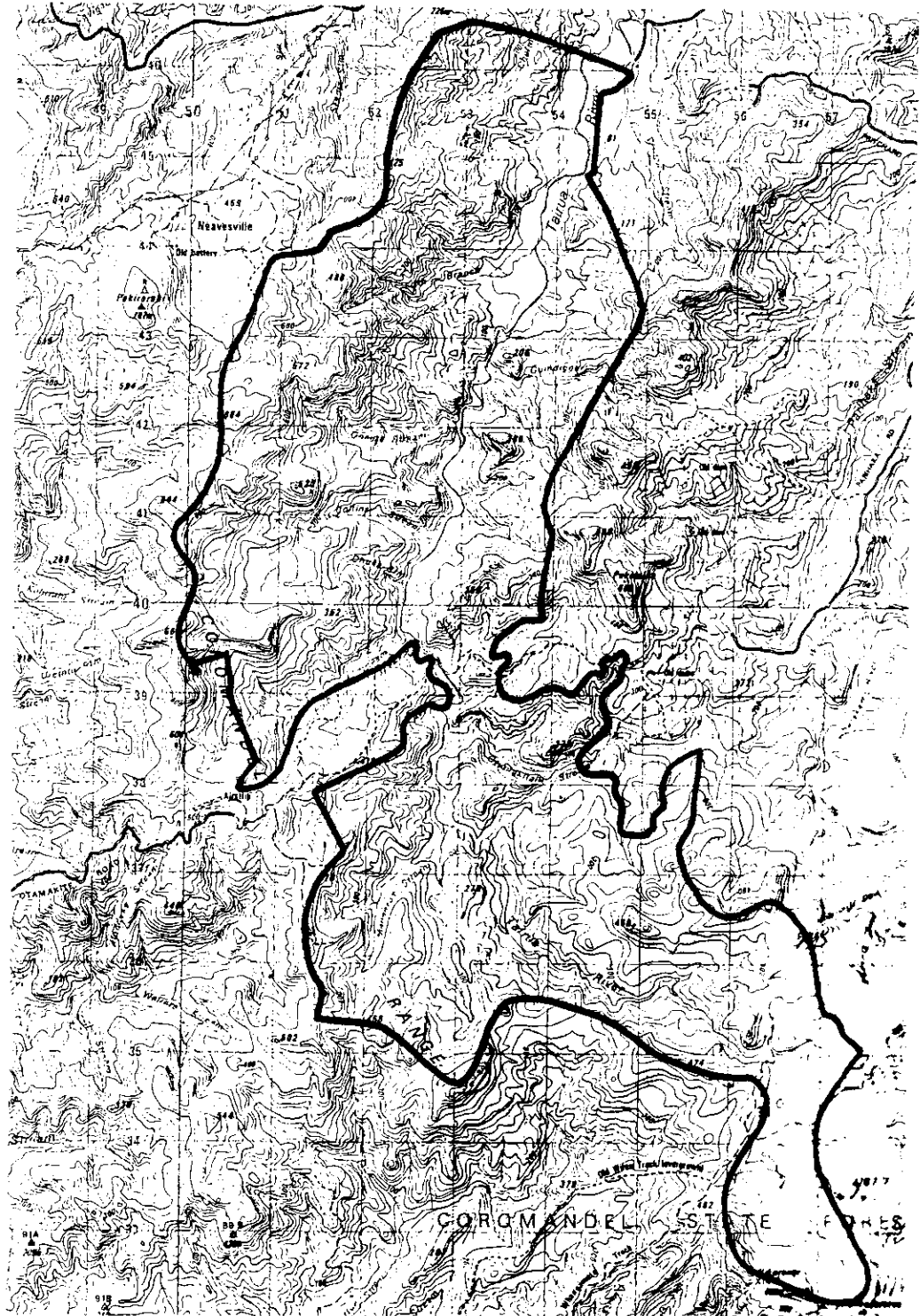
Discussion:

Lowland and semi-coastal forests are much reduced in area today and are barely represented in the existing PNAs of Tairua ED. This RAP includes tall forest with frequent emergent N.rata and large kauri which are now uncommon elements in the forests of this ED.

Criteria Summary:

Representativeness	H	- Representative semi-coastal forest and kauri forest.
Diversity	M	- Two bioclimatic zones, four vegetation types.
Naturalness	M	- Lower hillslopes support secondary vegetation. Upper slopes are predominantly natural.
Special Features		- Part of Wharekawa catchment "Wild and Scenic River" proposal.
Viability	M	- Compact unit, lower catchment is DOC stewardship but Crown land, upper reaches of streams are farm land which has a modifying effect on the catchment.
Buffering	L	- Surrounded by pasture and pine forest.
Landform	-	- Hillslopes on one side of Paritu Stream catchment.
Threat	M	- Topdressing risk from farmland and pine forest. Siltation of catchment from farmland on headwaters.

Tai. 15 TAIRUA RIVER



SCALE	: 1:75,000
GR CENTRE	: NZMS 260 T12 525420
AREA	: 4390 ha
ALTITUDINAL RANGE	: 20 - 700 m
TENURE	: Maori, Private, Crown (DOC)
DATA REFERENCE	: Study Area 59

Tai. 15 : Tairua River

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	podocarp alluvial terrace forest	alluvial terrace	L
lowland	raupo-flax reedland	alluvial terrace	L
lowland	(rata-podocarp)/tawa forest	hillslope, ridge, gully	L
lowland	(rata-podocarp)/towai-tawa forest	hillslope, ridge, gully	L
lowland	kanuka-broadleaved species forest	hillslope, ridge, gully	M
lowland	kanuka forest or scrub	hillslope	M
lowland	manuka scrub	hillslope, ridges, gully, alluvial terrace	M
lowland	kauri-tanekaha forest	hillslope, ridge	M
montane	tawari-towai-tawheowheo scrub or forest	ridge	S

Landform:

The RAP takes in much of the upper catchment of the Tairua River. From extensive alluvial flats on the valley floor, hillslopes rise gently, then more steeply to ignimbrite peaks and bluffs on the western side. The eastern side of the RAP includes only the lower gentle slopes. The headwaters of the Tairua drain from a plateau-like surface of andesitic lava flows with occasional rock outcrops and pinnacles. The river has incised a gorge in its lower reaches.

Vegetation:

This RAP is large in size and contains a diversity of vegetation types over a wide altitudinal range. The alluvial terrace forest varies from podocarp stands with large kahikatea, matai and rimu through a range of secondary stands of tanekaha, matai, kahikatea, cabbage tree with greater or lesser amounts of kanuka and some manuka. There are some small areas of freshwater reedland in old river channels on alluvial terraces. Gentle hillslopes are covered in secondary towai forest often with kauri regeneration on ridges and small pockets of tall forest often with large kauri in gullies. On the steeper upper western slopes and in the headwaters of the Tairua there is more tall (rata-podocarp)/tawa forest than on the eastern slopes with frequent towai, podocarps and rata in the upper catchment and occasional large emergent kauri.

Fauna:

Common bush birds recorded during survey. Hochstetters frogs recorded by FSU.

Flora:

Matai on alluvial flats is not common in Coromandel ER.

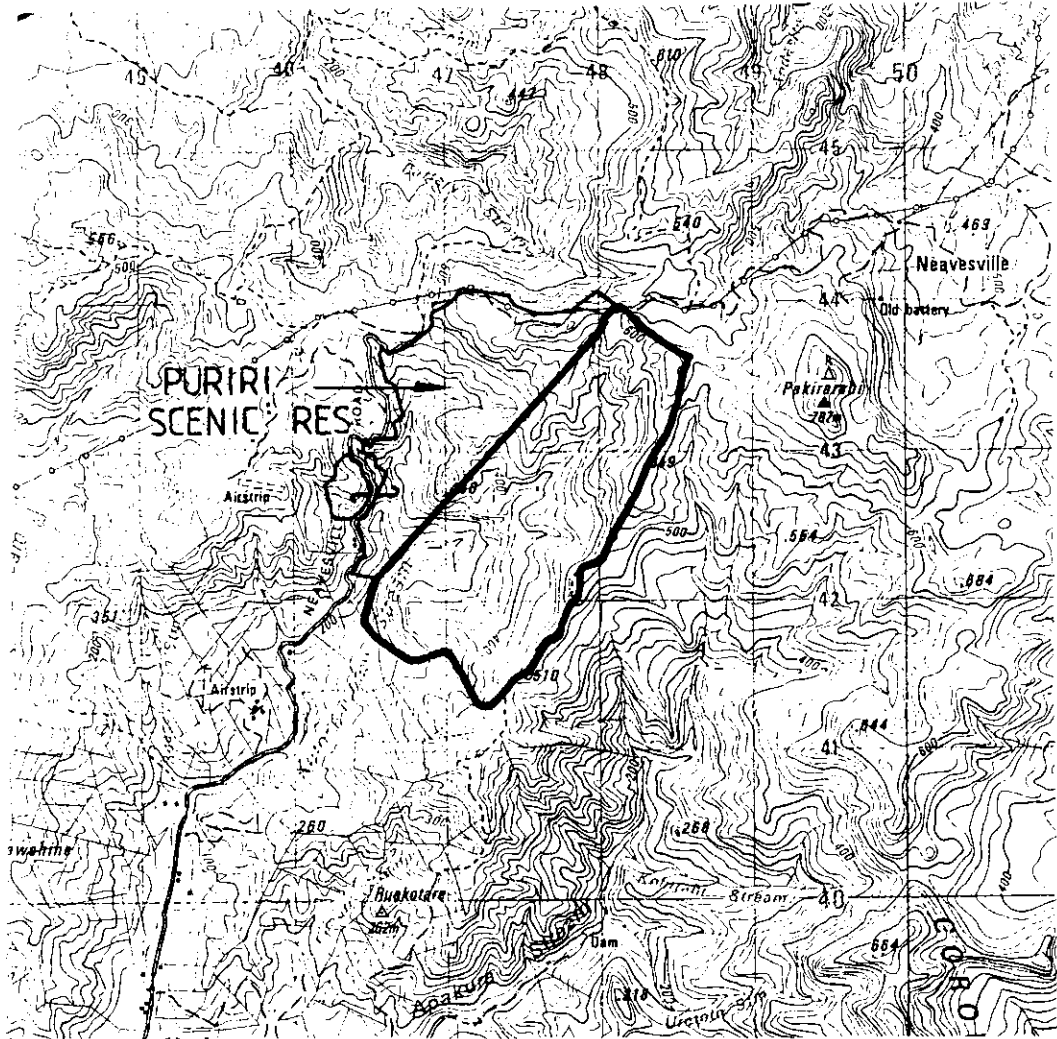
Discussion:

This catchment includes the largest and most intact lowland alluvial terrace vegetation in the Tairua ED and a large continuous tract of lowland forest. Both these types have been significantly reduced from their former extent and are under represented in the existing PNA network. This is the only example of podocarp alluvial terrace forest in the Tairua ED found within a tract of natural forest that remains buffered by forest or scrub. There is good kauri regeneration in scrub communities. The catchment provides an extensive forest wildlife habitat and has a high scenic value. The upper Tairua is a proposed "Wild and Scenic" River and is important for soil and water protection especially as so much of the Tairua Harbour catchment is under pine forest.

Criteria Summary:

Representativeness	H	- Largest area of lowland alluvial terrace forest in the Tairua ED including a number of seral alluvial communities and small freshwater wetlands. Large area of lowland forest.
Diversity	H	- Two bioclimatic zones, nine vegetation types.
Naturalness	M	- Some large areas of forest are little modified but also much secondary vegetation.
Special Features	-	- The whole of this catchment is part of the Tairua "Wild and Scenic River" proposal. High scenic values. Matai found on alluvial terraces here is not common in the Coromandel ER.
Viability	M	- RAP includes most of the catchment but it is interrupted by areas of pines and pasture in the upper catchment.
Buffering	H	- The catchment is buffered by large areas of natural vegetation to the west, south and north, by pines to the east and abuts a small area of pasture.
Landform	M	- Large river catchment with alluvial terraces, bounded by high peaks and bluffs.
Threat	-	- Logging of privately owned forest. Topdressing risk from pines. Stock entering from farmland.

Tai. 16 PURIRI SR EXTENSION



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T12 475425
AREA	: 235 ha
ALTITUDINAL RANGE	: 175 m - 640 m
TENURE	: Private
DATA REFERENCE	: Study Area 58

Tai. 16 : Puriri SR Extension

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	(rata-podocarp)/tawa forest	hillslope, ridge, gully	M
lowland	kanuka-broadleaved species forest	hillslope, ridge	M
montane	towai-tawari-tawheowheo scrub	hillslope, ridge	S

Landform:

Steep lowland and montane hillslopes on ignimbrite and andesite, steep erodible lower slopes on rhyolitic pumice breccia and ignimbrite.

Vegetation:

An area of tall (rata-podocarp)/tawa forest with more frequent emergent podocarps than other forest in the ED occurring from the lower catchment to the montane zone. A small area of montane tawari-towai-tawheowheo scrub is included which has abundant tussock land species such as *Astelia* aff. *nervosa*, *Gahnia pauciflora*, *Baumea rubiginosa* and *Dianella nigra*. There is some kanuka-broadleaved species scrub on the lower slopes.

Fauna:

Common bush birds recorded during survey.

Flora:

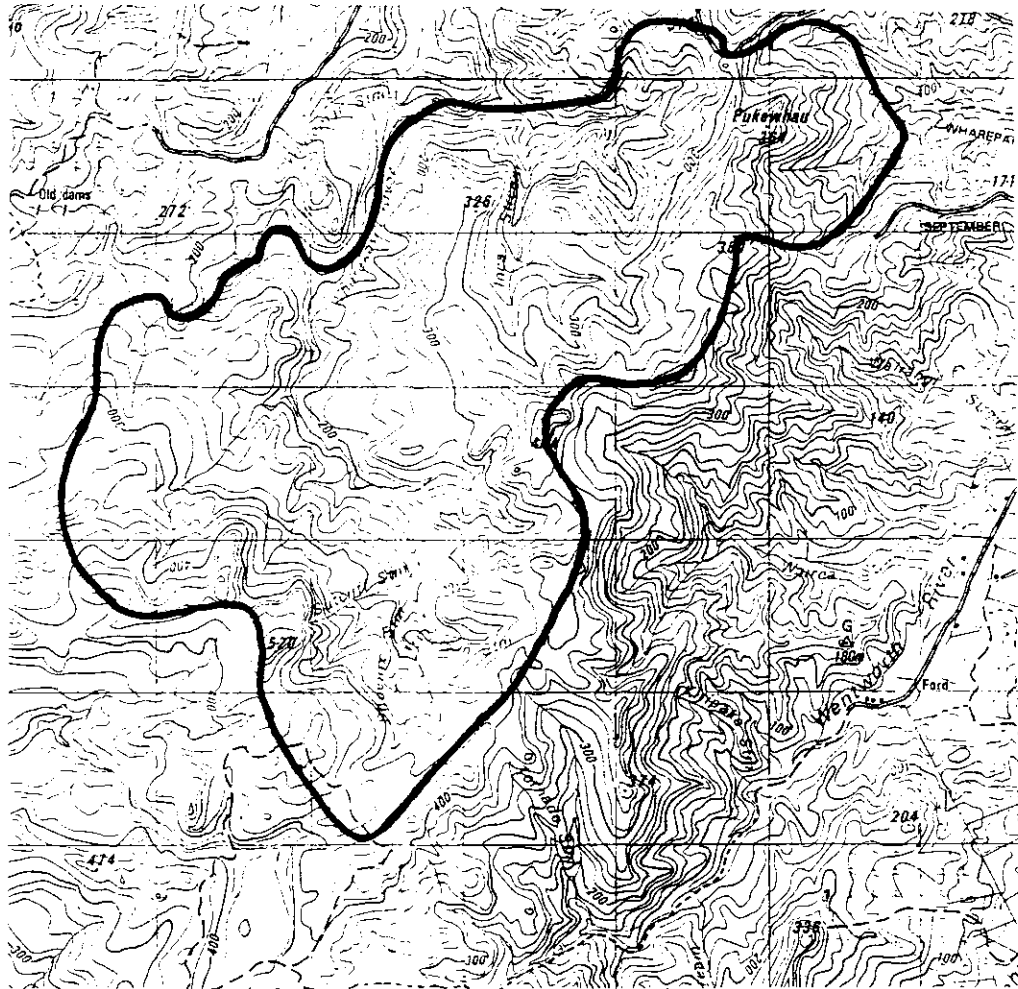
Astelia aff. *nervosa*, *Coprosma dodonaeifolia*, *Ascarina lucida*.

Discussion:

Protection of this area of forest would increase the area of Puriri Scenic Reserve to include a more representative area of lowland forest and some montane vegetation, and alters the boundaries to follow natural features. The area has important soil and water protection values in this steep, unstable catchment.

Criteria Summary:

Representativeness	H	- Good lowland forest.
Diversity	M	- Two bioclimatic zones, three vegetation types.
Naturalness	H	- Some of the catchment logged in the past but is not modified to a great extent.
Special Features		- Scenic value and important for soil and water conservation.
Viability	M	- Viable if protected and managed for conservation.
Buffering	M	- Pines to the west, forest and scrub to the north, south and east.
Landform		- Steep lowland and montane slopes and ridges, typical of the west side of the main range in Tairua ED.
Threat	M	- Logging, burning, conversion to pines, goats, numbers moderate.



SCALE : 1:50,000
GR CENTRE : NZMS 260 T12 575380
AREA : 1365 ha
ALTITUDINAL RANGE : 80 m - 520 m
TENURE : Crown (DOC)
DATA REFERENCE : Study Area 61

Tai. 17 : Upper Wharekawa

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	(rata-podocarp)/tawa forest	hillslope, ridge	M
lowland	(rata-podocarp)/towai-tawa forest	hillslope, ridge	M
lowland	towai scrub	hillslope, ridge	S
lowland	kauri-tanekaha forest	hillslope, ridge	H

Landform:

Headwaters of the Wharekawa River, moderate to steep hillslopes on thick andesitic ash over rhyolite with some rhyolite domes.

Vegetation:

Mostly lowland tawa forest with common emergent rimu, miro, rata and totara and towai-tawa forest with emergent rata and podocarps in the upper catchment. Towai scrub is found on some lower slopes and ridges in the headwaters of the catchment. There are several areas of mature and regenerating kauri-tanekaha forest in the north.

Fauna:

Common forest birds recorded during the survey, kiwi reported.

Flora:

Some large mature kauri.

Discussion:

Probably some of the best and most natural lowland forest remaining in the Tairua Ecological District. Emergent rata and podocarps common with some areas of kauri forest, mature kauri forest is of very limited extent in Tairua ED. The Upper Wharekawa is part of a proposed "Wild and Scenic River". Some recreational development in past tracks.

Criteria Summary:

Representativeness	H	- Representative lowland forest in good condition with some areas of mature kauri.
Diversity	M	- One bioclimatic zone, four vegetation types.
Naturalness		- Upper catchment very natural.
Special Features		- Grove of large kauri developed as recreation feature by Forest Service. The whole upper catchment is part of a proposed "Wild and Scenic River".
Viability	H	- Well buffered and compact area of forest. Viable with good management.
Buffering	H	- Surrounded by natural vegetation to south and east and by pines to north and west.
Landform		- Upper river valley, easy country developed on thick andesitic ash.
Threat		- Topdressing risk from pines, wild animals, mining.

6. WAIHI ECOLOGICAL DISTRICT

S U M M A R Y

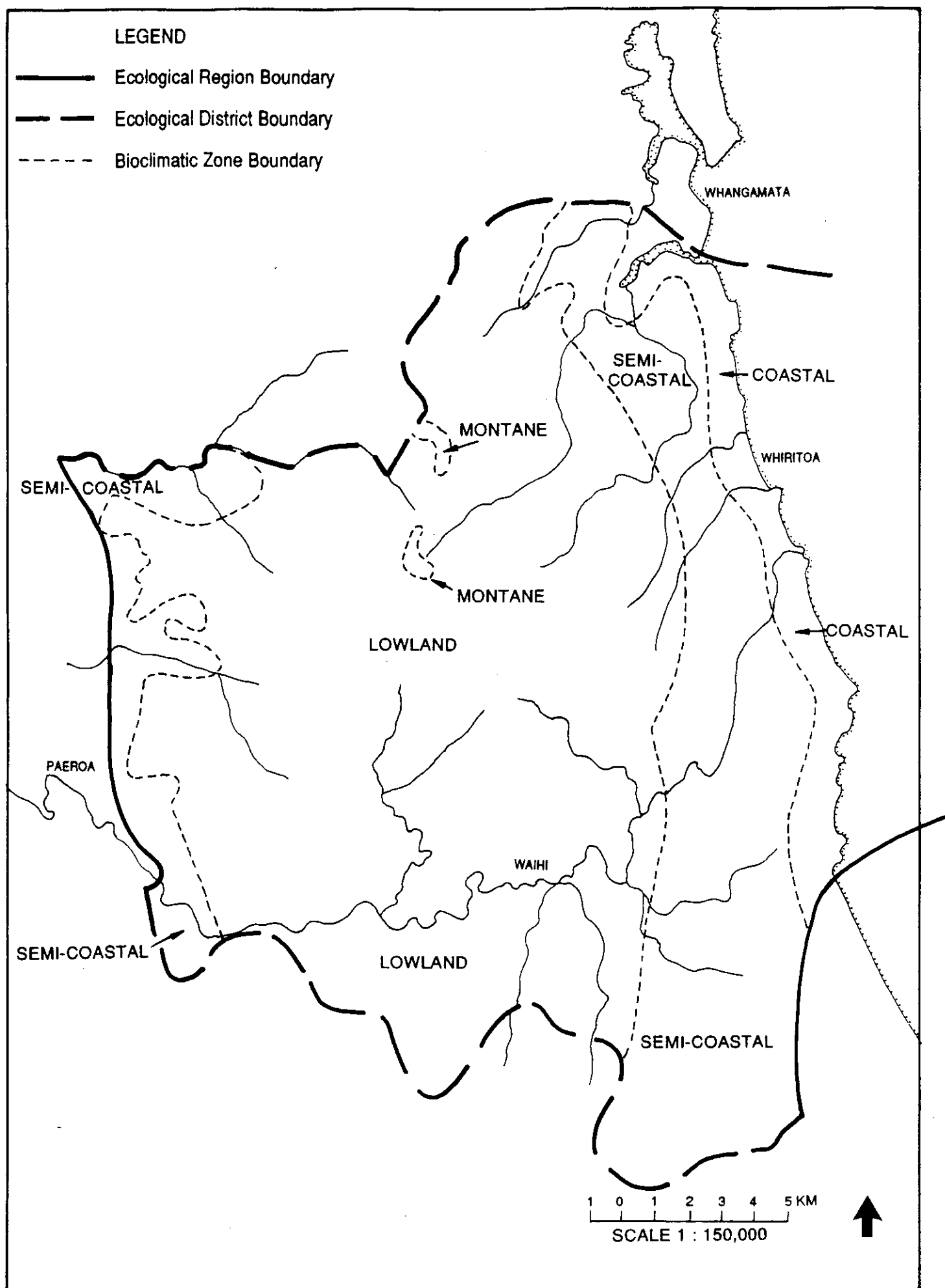
Waihi Ecological District (ED) extends from Whangamata south to Waihi Beach. The southern boundary then runs around the Waihi Basin through the Karangahake Gorge to Paeroa. The western boundary runs from Hikuai to Paeroa. The terrain is generally less steep than other districts with the northern part of the district being Waiwawa subgroup andesites, the southern extension of the Coromandel Range is formed from younger Kaimai subgroup andesites and the Waihi Basin of ignimbrite sheets covered with thick, geologically recent volcanic ash.

A band of hills forms a narrow zone of coastal influence. Steep ignimbrite cliffs are characteristic of Waihi ED with the Otahu estuary being the only large estuary with associated saltwater wetlands into which most of the large eastward flowing rivers run. Consequently coastal wetlands and dunelands are a minor feature of the district. Most coastal hills have been cleared of their former forest cover, Orokawa and Homunga Bay SR is the largest area remaining. This reserve protects about 10% of the former extent of coastal forest in Waihi ED, elsewhere only small remnants remain. Freshwater wetlands and forests in alluvial situations have been cleared for agriculture. Waihi Basin was once covered in infertile scrubland, small wetlands and remnant forest now has very little natural vegetation. Similarly the easy hill country on the western side of the Coromandel Range has been cleared for farming and forestry. Large areas of lowland and montane forest lie over the centre of the district. This forest has been modified through logging but has been left to regenerate. Only remnants of semi-coastal forest remain. Plant species of note are listed in Table 11.

The extensive forests form habitat for diverse fauna including some nationally threatened species (see Table 12). The Wildlife Service recognised this forest as of outstanding wildlife value. Otahu Estuary is the only sizeable area providing wader and wetland bird habitat.

Waihi ED has six Protected Natural Areas totalling 996 ha. There are two small EAs one of which has been gazetted for its geological features. A large SR and several small reserves protect coastal forest but coastal and freshwater wetlands remain unprotected.

The six RAPs proposed in the following section seek to rectify the current shortfalls in the existing reserve system. Several large catchments will provide protection for montane forest, more lowland forest and the important areas of wildlife habitat. Some small areas of semi-coastal forest have been included. Coastal areas recommended for protection include saline and freshwater wetlands and only one area of coastal forest as this is currently adequately protected. Most land recommended for protection is Crown administered but that on the coastal zone is privately owned.



**WAIHI ECOLOGICAL DISTRICT
BIOCLIMATIC ZONES**

6.1 ECOLOGICAL CHARACTER

6.1.1 RELIEF

Waihi ED extends from Whangamata across the Coromandel range to a point just north of Paeroa on the Hauraki Plains. The southern boundary runs from north of Waihi Beach, skirts the Waihi Basin, runs along the Karangahake Gorge to Paeroa. Waihi ED is characterised by a gentler terrain than the other ecological districts with only small areas of the main divide higher than 500m asl. Large river catchments with a predominantly natural vegetation cover flow in a northeasterly direction. Coastal hills of Waihi ED drop steeply to sea cliffs, there are several small, sandy beaches and only one estuary of any size. The extensive Ohinemuri plain in the south of the ED is a distinctive feature.

6.1.2 GEOLOGY

The northern half of the district from Whangamata to Waihi is Coromandel Group-Waiwawa subgroup andesites. The more recent Kaimai subgroup andesites form the southern extension of the main range. The Waihi Basin is Whitianga Group-Coroglen Ignimbrite sheet remnants overlain by thick quaternary ash deposits, and was probably another caldera centre of volcanic activity. Some of the volcanic ash deposits have been derived from explosive eruptions from the Taupo Volcanic Zone (eg Okataina Volcanic Centre) and Mayor Island. Small areas of Minden Rhyolite occur on the coast south of Otahu Estuary and north of Homunga Bay, and along the boundary with Tairua ED. Alluvial material occurs in the lower reaches of the Maratoto Valley and at the head of the Otahu River Estuary.

6.1.3 CLIMATE

[Information source: Biological Resources Centre, unpublished draft report.]

Waihi ecological district generally has warm, moist summers and mild winters. Annual temperatures range between 27 C and -3.5 C with a lower minimum than other districts in the Coromandel region. Waihi has slightly higher rainfall than other monitored areas in Coromandel ER, the Waihi township Climate Station records mean annual falls of 1400 mm - 2800 mm. Seasonal rainfall variation is different too with more rain falling (26%) between November to February than other EDs and 43% from April to July.

6.2.4 SOILS

[Information Source : NZ Soil Bureau, 1954]

On steep to very steep hill country in the district the soil is Aroha sandy loam (medium to low fertility). On lower, rolling to steep slopes there is Waitekauri sandy loam (low fertility). Whangamata gravelly sandy loam (low to very low fertility) and Waitakare clay (medium to low fertility) occur on the flat and gentle hillslopes of the ED.

On most of the flat to easy rolling country of the Ohinemuri catchment Waihi sandy loam (low to very low fertility) occurs with small pockets of Kaipaki peaty loam (low to medium fertility). Peaty soils Piako and Otonga (medium to low fertility) also occur on alluvial flats surrounding the Otahu River estuary and behind the sand dunes at Whiritoa.

6.1.5 VEGETATION

(For details of former and present extents, see Table 13)

River mouths in Waihi ED are small and comparatively narrow. Otahu Estuary is the largest estuary and supports examples of most estuarine vegetation types apart from eelgrass. This includes the only area of mangroves in the Waihi ED, and extensive rushland and rush-shrubland. The transition to freshwater wetlands is represented. Other estuarine vegetation, such as at Ramarama and Whiritoa has been reduced by farming and urban development to very small remnants. In most cases coastal and semi-coastal wetlands have been developed for farmland with only very small remnants of raupo and flax along river channels. Old maps show that the flats south of Otahu were once extensive wetlands.

Dunelands associated with river mouths are not a major feature of Waihi ED. Those at Whiritoa and Mataora have been mined for sand and developed for housing. Most are now heavily modified and support predominantly adventive plants. Only remnant foredunes remain and whilst some still support spinifex and pingao, marram is common and some recreational activity diminishes habitat values. These may still have pingao and *Spinifex* but with marram. They are under pressure from high human recreational use.

It is not certain to what extent Polynesian people had modified the coastal zone in Waihi when Europeans arrived but they had probably burnt some of the coastal hills for cultivation and occupation. The nature of steep coastal slopes makes this zone narrow in Waihi. The cliff and steep slope pohutukawa communities have been reduced in extent and have been modified by burning and grazing animals. Coastal broadleaved forest has almost all been converted to pasture, the most representative example remaining in Orokawa SR. Areas that have been cleared are now regenerating broadleaved scrub with coastal species but very often farm stock have access to browse.

The semi-coastal zone is wide in the Waihi ED extending from the first ridge of the coastal hills back to the foothills of the main Coromandel Range. On the western side of the range the semi-coastal zone extends up some of the large valleys, for example the Hikutaia and Komata.

When Europeans arrived the Ohinemuri Plain was described as being covered in manuka and bracken, probably indicating Polynesian clearance. Old maps show numerous small wetlands along the watercourses on the plain (Bell & Fraser 1912). Very small remnants of natural vegetation over this area give us an indication of the pre-human vegetation cover but many are secondary with abundant pines and hakea. To the north semi-coastal forest is represented in the Whiritoa and Ramarama catchments along with some regenerating scrub. Kauri may have been frequent in

the forests of this zone. On the west side of the range the semi-coastal forest is reduced to remnants which are very dissected. Some of these are still being actively converted to pines and pasture today. Regeneration in this zone is predominantly kanuka and kanuka-broadleaved species scrub and forest.

Alluvial terraces occur in valleys on both the east and west sides of the ranges, but are not as extensive as in Tairua ED. The Ohinemuri and Hikutaia rivers have the largest alluvial terraces but in most areas original vegetation on them has been converted to farmland. The best remaining examples are stands of totara and kanuka with regenerating podocarps in the lower Waiharakeke catchment, stands of mixed podocarps and occasional swamp maire on incised river banks in the Waitekauri valley and podocarp remnants along the Ohinemuri River. Often alluvial terraces which are too bouldery for cultivation have secondary stands of kanuka and under these there is sometimes regeneration of kahikatea, totara and matai, such as in the Waiharakeke Valley.

The lowland zone is extensive and a large area of natural vegetation is within the CSFP; 19% of the bioclimatic zone is still in forest cover. The lowland forests were exploited for timber after those in Tairua ED. Kauri and podocarps were removed and much of the timber was used for props in the nearby gold mines. It is doubtful whether kauri was ever as abundant throughout the lowland zone as it was in the forests of Tairua ED. Today very few large trees remain, with kauri regeneration seen mostly on ridges in the lower lowland and semi-coastal zones indicating that this was probably the area of greatest abundance. Hard beech too probably occurred with the kauri up the eastern side of the Coromandel Peninsula. It is now virtually absent in this ecological district apart from a few scattered trees.

The montane zone is narrow and confined to a few peaks and the ridge of the main range. They are covered mostly in towai-tawari-tawheowheo scrub or forest with locally dominant yellow silver pine on rocky knolls.

6.1.6 FAUNA

The large tracts of forest in the Waihi ED especially the Maratoto Block, lie mainly within the Coromandel SFP and were ranked as having outstanding value for wildlife by FSU.

The range of forest birds common to the Coromandel ER are present in the ED. Notable species present such as native parakeet, NI kaka, NI kokako, NI brown kiwi are present in low numbers. Robins and whiteheads used to be present in Waihi ED last century (Innes 1983) but their northern limit in Coromandel ER is now restricted to Te Aroha ED. Considering the decreased extent of wetland and coastal habitats there is still a good range of wetland and shore birds present with Otahu River estuary being the largest and most diverse habitat. In addition to common birds a number of notable species occur including NZ dotterel, Caspian tern and NI fernbird. Hochstetter's and Archey's frogs, long-tailed bats and Paua slugs occur in this district. Archey's frog is at its southern limit here. These are all nationally threatened wildlife. A number of lizards which are fairly widespread in New Zealand are present in the scrub and forests of Waihi ED, including common gecko, forest gecko and elegant tree gecko. Lizards have not been recorded in the coastal zone.

There is little freshwater fish survey information for Waihi ED but to date black mudfish has been found in a stream near Waihi. This is the only record for the Coromandel ER. The short-jawed kokopu has been found in the Waitekauri River and the giant kokopu in Waihi Beach Stream.

A flightless stag beetle *Dorcus auriculatus* sp. has recently been found in forest near Golden Cross.

TABLE 11 :

**Important Plants in Waihi Ecological District
A Provisional List**

VULNERABLE*Myriophyllum robustum***RARE***Desmoschoenus spiralis***LOCAL***Metrosideros carminea**Pomaderris rugosa***SPECIES ENDEMIC TO COROMANDEL ER***Hebe pubescens* var. *pubescens***TABLE 12 :**

Important Fauna in Waihi Ecological District

ENDANGERED**Birds**

NI kokako

THREATENED**Mammals**

Long-tailed bat

Birds

Banded rail

NZ falcon

Caspian tern

NZ kaka

NI brown kiwi

Reef heron

NZ dotterel

REGIONALLY THREATENED**Birds**

Native parakeet

NI fernbird

Amphibians

Hochstetter's frog

Archey's frog

RARE

Variable Oystercatcher

INDETERMINATE**Fish**

Black mudfish

Short-jawed kokopu

Giant kokopu

TABLE 13 : Waihi Ecological District - Standard Ecological Units

BIOCLIMATIC ZONE	HYDROLOGIC SYSTEM	VEGETATION TYPE	E C O L O G I C A L U N I T	LANDFORM TYPE	FORMER EXTENT	PRESENT EXTENT	CHANGE	PROTECTION STATUS
C	estuarine	mangroves		tidal flat	C * SC L M	C * SC L M	C R	C SC L M
C, SC	estuarine	<i>Juncus maritimus</i> - <i>Leptocarpus similis</i> rushland		tidal flat	Mn Mn	R R	R	1
C	estuarine	<i>manuka</i> / <i>Leptocarpus similis</i> rush shrubland		tidal flat	Mn	R	R	1
C, SC	palustrine	<i>manuka</i> / <i>Baumea</i> species sedge shrubland		alluvial flat/gully	Mn Mn	R *	R R	1
C, SC, L	palustrine	raupo-flax reedland		basin/alluvial terrace	* Mn C?	- -	R R R	1 1 1
SC, L	palustrine	lowland swamp forest		basin/alluvial terrace	M? C?	- -	R R	1 1
C	terrestrial	spinifex-shorebindweed-haretail sandfield		foredune	*	-	R	1
C	terrestrial	pohuehue-knotted sedge rush-vineland		reardune	*	*	R	1
C	terrestrial	pohutukawa rock treeland		cliff/hillslope	Mn	R	R	2
C	terrestrial	pohutukawa-broadleaved species forest		hillslope/ridge/gully	Mn	R	R	2
C, SC	terrestrial	pohutukawa modified forest		hillslope/ridge/gully	-	Mn Mn	R R	5 1
C	terrestrial	coastal broadleaved species scrub		hillslope/ridge/gully	-	Mn	I	3
C, SC, L	terrestrial	manuka scrub		hillslope/ridge/gully	-	Mn *	I S	3 1
C, SC, L	terrestrial	manuka-broadleaved species scrub		hillslope/ridge/gully	-	Mn *	S S	5 1 5
C, SC, L	terrestrial	kanuka scrub		hillslope/ridge/gully	-	Mn Mn *	R R S	5 1 4
C, SC, L	terrestrial	kanuka-broadleaved species scrub		hillslope/ridge/gully	-	Mn Mn	R R R	1 1 4
L	terrestrial	alluvial terrace forest		alluvial terrace	-	Mn	R	1
L	terrestrial	kanuka-broadleaved species forest		alluvial terrace	*	*	I	1
L	terrestrial	kauri-tanekaha forest		hillslope/ridge	Mn?	*	R	2
SC, L	terrestrial	(rata-podocarp)/tawa forest		hillslope/ridge/gully	Mj Mj	R	R	1 2
L	terrestrial	(rata)/tawa modified forest		hillslope/ridge/gully	-	Mn	I	4
L	terrestrial	(rata-podocarp)/towai-tawa forest		hillslope/ridge/gully	Mj	Mn	R	2
L	terrestrial	towai-tawa forest		hillslope/ridge/gully	-	*	I	1
L	terrestrial	broadleaved species scrub		hillslope/ridge/gully	*	Mn	I	1
L	terrestrial	towai scrub		hillslope/ridge/gully	*	*	I	1
L	terrestrial	upland rocky bluff		pinnacle	*	*	S	1
L	terrestrial	towai-tawari-tawheowheo forest/scrub		hillslope/ridge	Mn	Mn+	S+	2
M	terrestrial	montane conifer forest		hillslope/ridge	*	*	S	1

C = coastal; SC = semi-coastal; L = lowland; M = montane

PROTECTION STATUS: 1 = not represented within existing PNAs

2 = much less than 10% of former extent provided

3 = less than 10% of former extent protected less

4 = adequately protected; 5 = well represented within existing PNAs

* = Present; R = remnant; Mn = minor; C = common; Mj = major; I = increased; R = reduced; S = static; + more scrub than formerly; - absent or present due to natural disturbances

6.2 EXISTING PROTECTED NATURAL AREAS

There are a few rather small PNAs in Waihi ED. These include one small lowland ecological area and an EA gazetted for geological preservation. For lists of fauna and flora characteristics of PNAs see Regnier 1987 and for adequacy of protection see Table 13. Four other scenic reserves protect small areas of lowland and coastal forest. The exception in this district is the Orokawa-Homunga SR protects about 10% of the former area of coastal forest in two discontinuous blocks which include modified coastal forest.

6.3 FURTHER REQUIREMENTS TO PROVIDE A NETWORK OF REPRESENTATIVE NATURAL AREAS

The Waihi ED is exceptional because, unlike other Coromandel EDs sufficient coastal forest is protected but montane forests are under-represented. Unfortunately this coastal protection does not extend to other coastal vegetation. However, is not adequately protected. Mangroves and estuarine vegetation have never been extensive due to small size of habitat available. Coastal wetlands are unprotected and they now occupy only 20% of their estimated former range; semi-coastal and lowland freshwater wetlands now only cover 5% of the former area. None of these wetlands are protected.

Semi-coastal forests would once have been extensive on both sides of the ranges in Waihi ED but are now barely protected in the Orokawa-Homunga SR. This forest warrants further protection but only 2% of the previous area is extant and much of it heavily modified. There are no representative areas of semi-coastal forest remaining on the western side of the Coromandel Range in Waihi ED.

Otago EA protects only 1% of the former extent of lowland forests in Waihi ED. Certain forest types within the lowland ecological class (eg alluvial terrace forest) are not represented. Further protection of the diversity of lowland forest is required.

The montane zone is not an extensive feature of Waihi ED and has been little modified by man. Forest and scrub in this zone lacks protection.

The recommended areas proposed for Waihi ED provide a sequence from coastal, through semi-coastal forest and scrub, tracts of lowland forest up to, and including, the montane zone. Protection and ecological management of this area should safeguard a great proportion of the biological diversity of Waihi ED.

6.4 RECOMMENDED AREAS FOR PROTECTION (RAPs)

Each proposal includes a location map, a checklist of component ecological units, a brief description of landform and vegetation character, and an evaluation/discussion and summary of the priority status of the area.

1. **Location Map**

Drawn on NZMS1 series maps 1:50,000 and only reduced where necessary.

2. **Ecological Unit Checklist**

A list of the standard ecological units (see Appendix I for descriptions).

"REL. AREA" - the size of each ecological unit in relation to other examples of that unit in the District; large (L), medium (M) or small (S). For example a large (L) foredune would occupy a much smaller area than a large (L) kanuka forest unit.

- 0 indicates no other examples recorded in the district.

3. **Landform and Vegetation**

Descriptions are given for the entire priority area.

4. **Discussion and Criteria Summary**

Outline of the quality of the area and its important features for protection.

Further information, such as distribution of vegetation types within RAPs, may be obtained from the Department of Conservation, Waikato Conservancy, Hamilton.

INDEX TO RAPs

		Page
Wai 1	Otahu Estuary	177
Wai 2	Whiritoa Beach	179
Wai 3	Mataora	181
Wai 4	Maratoto	183
Wai 5	Whiritoa	185
Wai 6	Waiharakeke	187
Wai 7	Waitekauri Valley	189

INDEX TO EXISTING PNAS

(See Fig 6)

- A Parakawai Quarry EA
- B Te Ramarama SR
- C Otahu EA
- D Orokawa SR
- E Owharoa Falls SR
- F Karangahake SR

Wai. 1 OTAHU ESTUARY



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T12 648368
AREA	: 422.5 ha
ALTITUDINAL RANGE	: 0 - 221 m
TENURE	: Private, Crown, Maori
DATA REFERENCE	: Study area 64

Wai. 1 : Otahu Estuary

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	mangroves	tidal flat	0
coastal	<u>Juncus maritimus</u> - <u>Leptocarpus similis</u> rushland	tidal flat	L
coastal	manuka- <u>Leptocarpus similis</u> rush-shrubland	alluvial flat	L
coastal	manuka- <u>Baumea</u> spp sedge-shrubland	alluvial flat	L
coastal	pohutukawa rock-treeland	cliff	M
coastal	pohutukawa-broadleaved species forest	hillslopes	M
coastal	broadleaved species scrub	hillslope	M
coastal, semi-coastal	manuka scrub	alluvial flat	M
coastal semi-coastal	manuka-broadleaved species scrub	hillslope, ridge	M
coastal, semi-coastal	kanuka scrub/forest	alluvial flat	M

Landform:

Estuary and associated tidal and alluvial flats. Includes a coastal rhyolite headland to the south.

Vegetation:

Vegetation represents the diversity and sequence of coastal to freshwater and terrestrial types, although the individual units are not extensive. Estuarine communities range from mangroves, rushlands and sedge shrublands to raupo-flax freshwater wetland. There are some remnants of coastal forest along the southern coast and regenerating coastal forest and scrub on the flanks of Tunaiti.

Fauna:

This is an important wildlife habitat for wading birds with threatened Australasian bittern, banded rail and NI fernbird recorded. Wildlife Service rated it as of moderate-high wildlife value.

Flora:

Empodisma minus (a plant of acid peat bogs) is present in the sedge-shrubland. This is only the second record of this species from the Coromandel ER and the only record from Waihi ED.

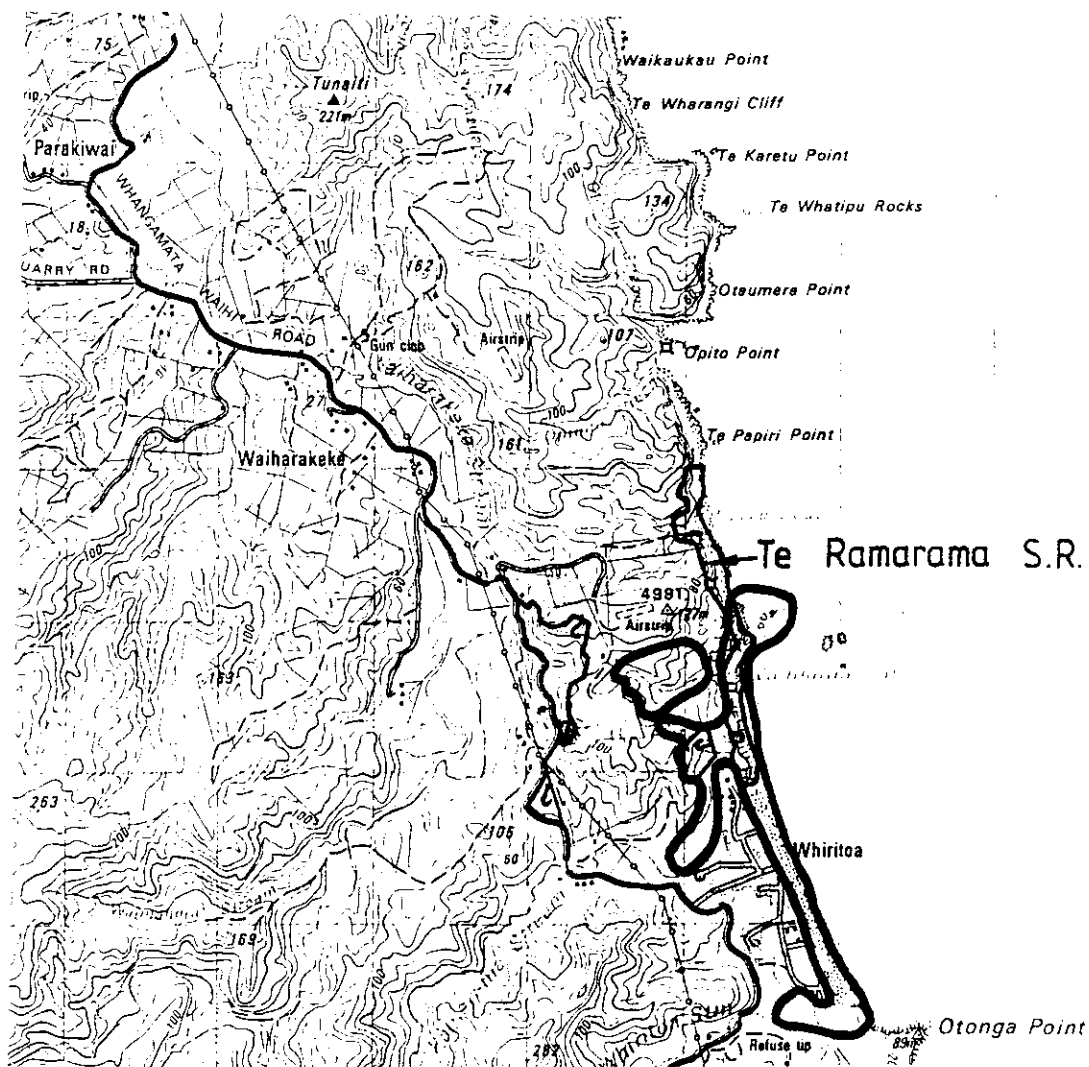
Discussion:

This is the largest, most intact area of estuarine vegetation in the Waihi ED. It supports the diversity of estuarine wetlands and coastal vegetation found in Waihi ED and includes the sequence from estuarine to freshwater wetlands. This estuary is a scenic feature on the Waihi-Whangamata highway. The headwaters and most of the Waiharakeke River lies in the Waiharakeke RAP. This river runs into the Otahu River estuary with only a short distance running through farmland. These two RAPs consequently have a high value for native fish and catchment protection.

Criteria Summary:

Representativeness	H - Representative estuarine and freshwater wetland communities.
Diversity	H - Two bioclimatic zones, eleven vegetation types.
Naturalness	M - Some modification of wetland vegetation but overall natural appearance.
Special Features	M - <i>Empodisma minus</i> , threatened Australasian bittern, banded rail, NI fernbird.
Viability	M - Viable but requires management and protection to control damaging activities.
Buffering	L - Whangamata township to north, pasture and horticultural land adjoins elsewhere. Not well buffered, this needs attention in management considerations.
Landform	- Intertidal flats, alluvial terraces, rhyolite coastal cliffs, hillslopes and ridges.
Threat	H - Expansion of aeroclub along upper estuarine margins, run off from surrounding farmland, topdressing risk. Reclamation for farmland and subdivision.

Wai. 2 WHIRITOA BEACH



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T12 675315
AREA	: 405 ha
ALTITUDINAL RANGE	: 0-100 m
TENURE	: Crown (DOC), Ohinemuri DC, Private
DATA REFERENCE	: Study Area 67

Wai. 2 : Whiritoa Beach

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	<i>Juncus maritimus</i> - <i>Leptocarpus similis</i> rushland	tidal flat	M
coastal	manuka- <i>Leptocarpus similis</i> rush-shrubland	alluvial flat	M
coastal	manuka- <i>Baumea</i> sedge-shrubland	alluvial flat	M
coastal	pohuehue-knotted sedge rush vineland	foredune	L
coastal	pohutukawa rock treeland	seacliffs	M
coastal	pohutukawa-broadleaved species forest	hillslope	M
coastal	coastal broadleaved species scrub	alluvial flat	L

Landform:

Coastal landforms of fossil dunes. A small estuary with tidal flats and coastal hillslopes and cliffs on andesite.

Vegetation:

Remnant sand dune, estuarine and coastal forest vegetation represented in this RAP. A narrow strip of *Spinifex* foredune vegetation is present but marram has been planted and pohuehue vineland covers most of the remaining dunes. Small areas of estuarine and freshwater wetlands exist around the mouths of Whiritoa and Ramarama streams. On cliffs at each end of the beach there is a pohutukawa cliff community. Remnant coastal forest and regenerating forest occurs on hillslopes at the northern end of the beach.

Fauna:

Common coastal birds recorded during the survey include the rare variable oystercatcher. There is a shag roost at Waimana Bay.

Flora:

Pomaderris rugosa in coastal scrub. Pingao scattered along beach.

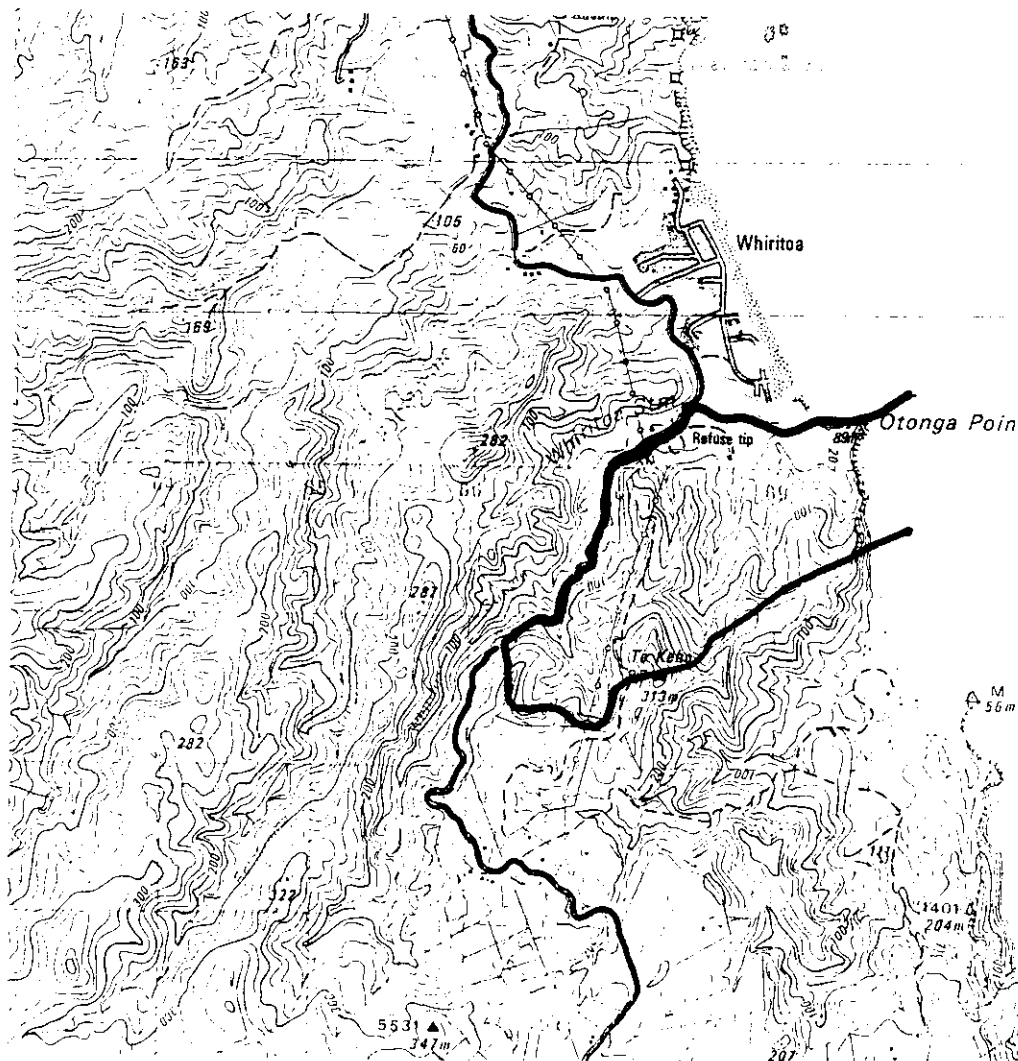
Discussion:

Sand dunes would never have been extensive in Waihi ED but this RAP includes the largest and most natural area of sand dune vegetation in Waihi ED. Scenic remnants of other coastal vegetation types are included such as pohutukawa forest and small, remnant fresh and saltwater wetlands.

Criteria Summary:

Representativeness	H	- Sand dune and remnants of other representative coastal vegetation.
Diveristy	M	- One bioclimatic zone, seven vegetation types.
Naturalness	L	- Coastal vegetation at this site has been and is still being modified considerably.
Special Features		- Pingao on sand dunes.
Viability	L	- Needs immediate protection and careful management to maintain these vegetation communities.
Buffering	L	- Residential, farmland and scrub.
Landform		- Sand dunes, small estuaries with tidal flats, coastal cliff and hillslopes on andesite.
Threat	H	- Vehicles, people, tree and marram planting on dunes. Sand mining may have altered sand system dynamics. Reclamation and dumping of rubbish in wetland at the southern end. Stock grazing in recreation reserve and coastal forest. Casual development for house sites and garden extensions.

Wai. 3 MATAORA



SCALE	:	1:50,000
GR CENTRE	:	NZMS 260 T13 675295
AREA	:	275 ha
ALTITUDINAL RANGE	:	0 - 313m
TENURE	:	Private, Maori
DATA REFERENCE	:	Study Area 68

Wai. 3 : Mataora

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
coastal	pohutukawa rock-tree land	cliffs	M
coastal	coastal broadleaved species scrub	hillslope, ridge, gully	L
coastal, semi-coastal	kanuka-broadleaved species scrub	hillslope, ridge, gully	M
coastal, semi-coastal	manuka-broadleaved scrub	hillslope, ridge, gully	M

Landform:

Coastal cliffs and hillslopes on late Pliocene, early Miocene andesites.

Vegetation:

Coastal-cliff pohutukawa forest and a mosaic of regenerating coastal and semi-coastal forest and scrub communities.

Fauna:

Common scrub and forest birds recorded during survey.

Flora:

Pomaderris rugosa (near southern limit).

Discussion:

This RAP would contribute further to the amount of protected regenerating coastal forest. There is also the sequence from coastal to semi-coastal forest represented. This RAP is adjacent to Whiritoa Beach RAP and Whiritoa RAP.

Criteria Summary:

Representativeness	M	- Small area of representative coastal forest. Larger area of regenerating coastal mosaic.
Diversity	M	- Two bioclimatic zones, three vegetation types.
Naturalness	M	- Although mainly secondary vegetation there is little coastal forest remaining in Waihi ED.
Special Features		- No special features recorded during rapid survey.
Viability	M	- Requires protection and management in order to continue regenerating to natural forest cover.
Buffering	M	- Forest to west, sea to east, farmland and scrub to south and north.
Landform		- Coastal cliffs and hillslopes on andesite and a small area of post-glacial sand deposit.
Threat	H	- Farm development, fire, feral animals.

Wai. 4 : Maratoto

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	(rata-podocarp)/tawa forest	alluvial flat, hillslope, ridge, gully	L
lowland	(rata)/tawa modified forest	hillslope, ridge	L
lowland	kauri-tanekaha forest	hillslope, ridge	S
lowland	towai-tawa forest	alluvial flat, hillslope	S
lowland	manuka scrub	hillslope, ridge	L
lowland	kanuka forest/scrub	hillslope, gully	L
lowland	towai scrub	hillslope, ridge, gully	L
montane	tawari-towai-tawheowheo forest	hillslope, ridge	M
montane	conifer forest	hillslope, ridge	M

Landform:

This RAP encompasses a large area of andesite hill country including the east flowing catchment of the Wharekirauponga and Upper tributaries of the south flowing Waitekauri River. Landforms range from alluvial terraces in the Wharekirauponga river valley through hillslopes and ridges to montane peaks.

Vegetation:

A large tract of lowland tawa forest with emergent podocarps and rata, which is under-represented in the PNAs of Waihi ED, rising through an altitudinal sequence to montane tawari-towai-tawheowheo scrub and forest on the Whakamoehau-Pukehuru ridge, which includes some small patches of montane conifer forest on knolls. Hillslopes, and some alluvial flats, have been modified by mining and attempts to farm. These now support secondary communities of manuka and towai scrub, and kanuka forest. There are some areas of kauri-tanekaha forest on ridges.

Fauna:

Kokako and long-tailed bats reported to inhabit the Golden Cross area. Some high density populations of Archey's and Hochstetter's frogs including the southern limit for Archey's frogs. Lamprey recorded.

Flora:

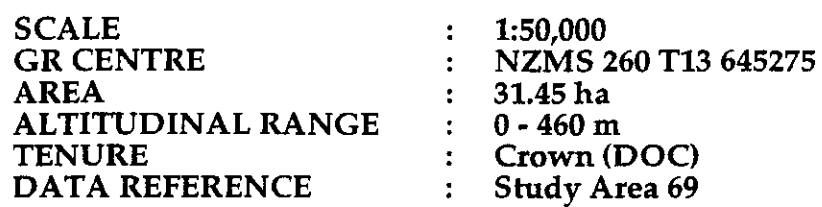
Marattia salicina reported by Waihi tramping club.

Discussion:

This RAP comprises a large tract of lowland forest which is little modified and the only montane vegetation in the ED, both vegetation types currently under-represented in the Waihi reserve system. This area has been recommended in the past by NZFS and Wildlife Service as an extension to the Otahu EA. Wildlife Service rated this area as outstanding wildlife habitat. The RAP is an important habitat for wildlife supporting the largest known kokako population in the Coromandel ER and the southern limit of Archey's frog (which is endemic to the ER). This RAP is adjacent to Waiharakeke RAP.

Criteria Summary:

Representativeness	H	- A complete upper catchment of lowland forest over a large altitudinal range and including forest on alluvial terraces. Includes most of the montane vegetation in the district.
Diversity	H	- Two bioclimatic zones, nine vegetation types.
Naturalness	M	- Predominantly unmodified but past mining, farming attempts and logging have had a minor impact in river valleys.
Special Features		- Largest known population of the endangered kokako in the Coromandel ER. Southern limit of Archey's frogs. Lamprey recorded.
Viability	H	- Viable with low levels of management.
Buffering	H	- Completely surrounded by native forest and scrub apart from the Golden Cross Valley where it adjoins farmland.
Landform		- Several river catchments on andesite. Lowland hillslopes rising to montane ridges and peaks. Some alluvial terrace.
Threat	M	- Mining, wild animals.



Wai. 5 : Whiritoa

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
semi-coastal	(rata-podocarp)/tawa forest	hillslope, ridge, gully	L
lowland			
semi-coastal	kanuka forest	hillslope, ridge, gully	M
lowland			
lowland	(rata)/tawa modified forest	hillslope	M
lowland	kauri-tanekaha forest	hillslope, ridge	L
lowland	manuka-broadleaved species scrub	hillslope, ridge, gully	M
lowland	manuka scrub	hillslope, ridge, gully	M
lowland	broadleaved species scrub	hillslope, gully	M

Landform:

Two small steep catchments, Ramarama and Whiritoa, on andesite, with interfluvium between

Vegetation:

Sequence from under-represented semi-coastal to lowland forest within the Ramarama catchment is the least modified in the Waihi ED. The long ridge between the catchments supports good kauri-tanekaha regeneration. Whiritoa Stream has been more modified especially in the lower valley and as a result of road building. As well as tawa with emergent rata and podocarps there is also kanuka forest, manuka, manuka-broadleaved and broadleaved scrub. Ramarama catchment also has areas of scrub and regenerating forest.

Fauna:

Common forest birds recorded during survey.

Flora:

No species of note recorded during the survey.

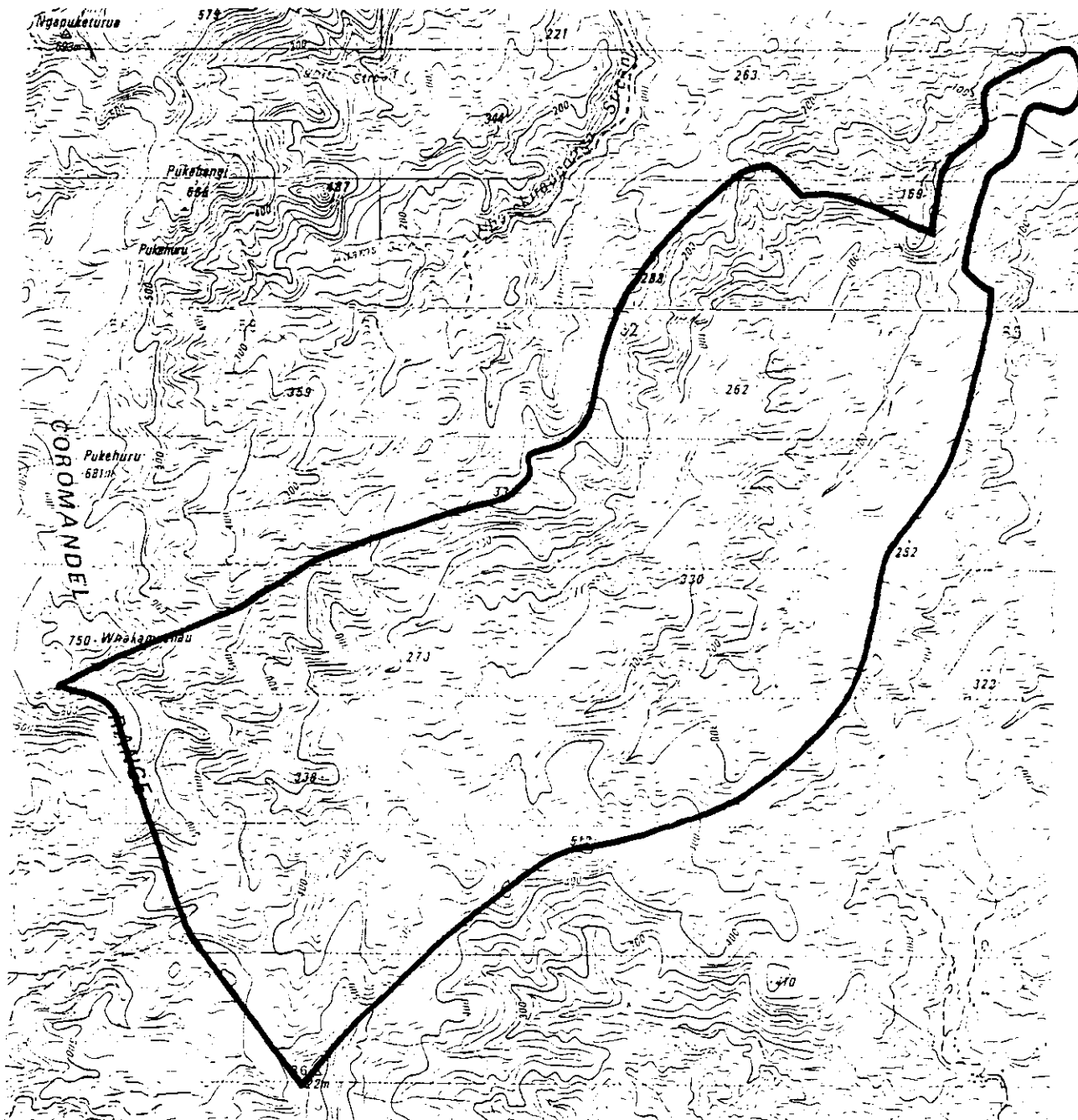
Discussion:

This RAP includes the only opportunity to protect the gradient from semi-coastal to lowland forest in Waihi ED and is part of the proposed coast to montane vegetation sequence. A large area of kauri-tanekaha forest is included which is under represented in the reserves of Waihi ED. The area is scenic and very visible from SH 25 which passes through it. This RAP lies adjacent to and south of the Waiharakeke RAP and inland of Mataora RAP.

Criteria Summary:

Representativeness	H - Representative semi-coastal and lowland forest with kauri-tanekaha regeneration.
Diversity	M - Two bioclimatic zones, seven vegetation types.
Naturalness	M - Most of forested catchment very natural. Some modified areas with secondary vegetation.
Special Features	- Scenic views from SH 25.
Viability	M - Viable with minimum of management, mainly wild animal control and fencing.
Buffering	H - Surrounded by forest and scrub apart from some pasture to the east.
Landform	- Steep hillslopes of two catchments on andesite.
Threat	M - Mining, wild animals, road work on SH 25.

Wai. 6 WAIHAREKEKE



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T13 615275
AREA	: 2300 ha
ALTITUDINAL RANGE	: 30m - 622 m
TENURE	: Crown, (DOC)
DATA REFERENCE	: Study Area 70

Wai. 6 : Waiharekeke

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	(rata-podocarp)/tawa forest	hillslope, ridge, gully	L
lowland	podocarp forest	alluvial terrace	L
montane	tawari-towai-tawheowheo scrub/forest	hillslope, ridge	L
lowland	kanuka forest	hillslope, gully, alluvial terrace	M
lowland	manuka scrub	hillslope, ridge	M

Landform:

This RAP includes two catchments the Waiharekeke and its right branch. The RAP is entirely on andesite and is generally of an easy gradient with hillslopes rising gently to the montane zone on the Whakamoehau ridge.

Vegetation:

This RAP is a substantial area of largely unmodified lowland forest and extends to the montane zone. The lower catchment is modified and supports secondary communities of manuka scrub and kanuka forest on hillslopes (the latter is suffering an unusually dieback), with totara and kanuka forest on alluvial terraces extending eastwards into pasture. There are several small, unusual *Baumea-Gleichenia* wetlands on alluvial terraces also. Rare hard beech along river banks.

Fauna:

Common forest birds recorded during survey. This forest is part of the Maratoto Block of CSFP which was ranked outstanding wildlife habitat by the FSU of the Wildlife Service as it is habitat of NI kokako, NI kaka, Archey's and Hochstetter's frogs and parakeet are recorded in this RAP. Very good quality native fish habitat.

Flora:

Hard beech occasional on river banks.

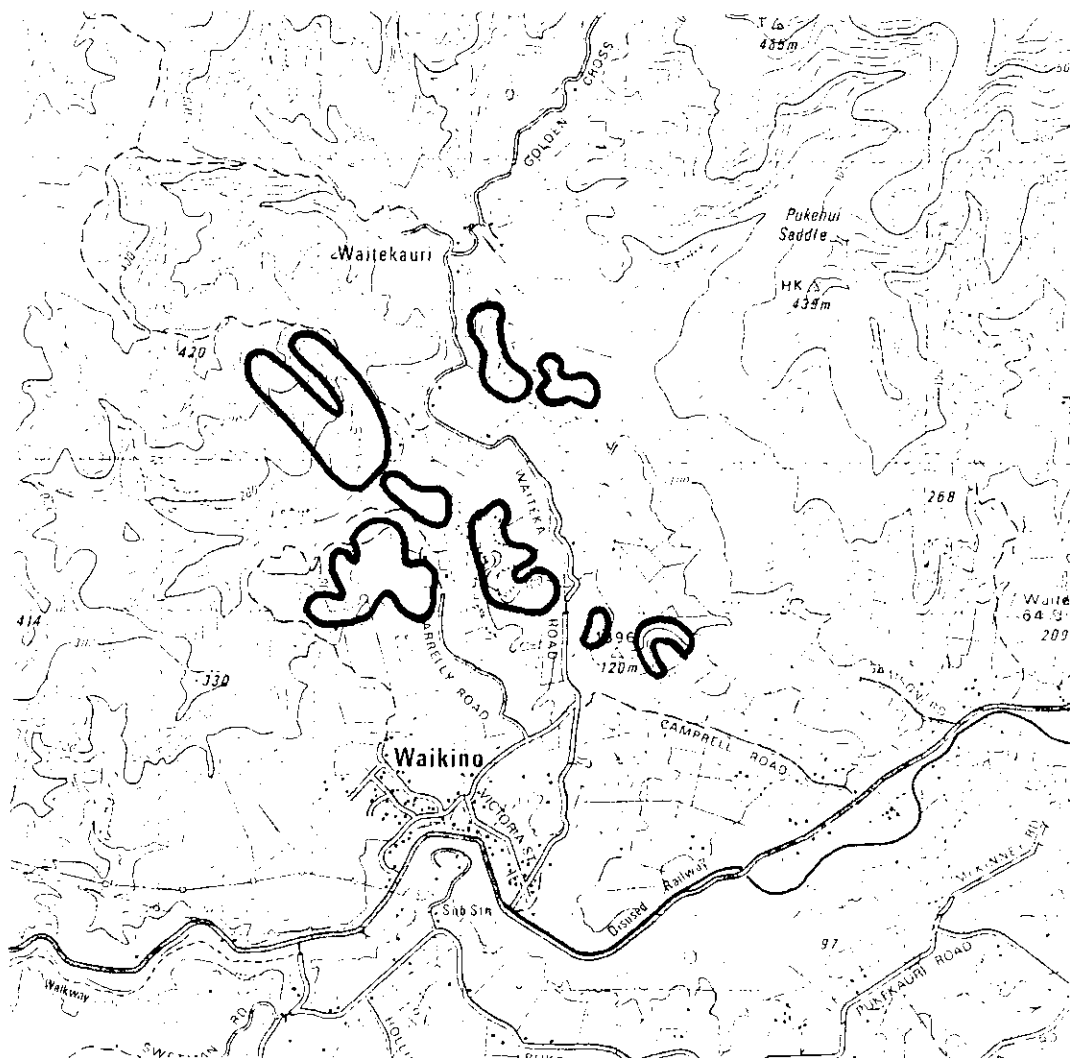
Discussion:

This RAP lies between and adjacent to Maratoto and Whiritoa RAPs and includes a large tract of fairly unmodified lowland forest and includes the gradient from 30m asl to the montane zone. Podocarp and kanuka forest on alluvial terraces and some small freshwater wetlands on alluvial terraces are included in this RAP, they are all currently under-represented in the PNAs of Waihi ED. This catchment is large, most of it is in forest and consequently has very good stream quality and is important for catchment protection.

Criteria Summary:

Representativeness	H	- Lowland and montane forest. Representative alluvial terrace forest and small wetlands.
Diversity	M	- Two bioclimatic zones, five vegetation types.
Naturalness	H	- The vegetation in the lower catchment is modified. <i>Hakea salicifolia</i> in scrub.
Special Features	H	- Scenic. High catchment and in stream values. Threatened Archey's and Hochstetter's frogs present. Endangered kokako, parakeet and NI kaka. Hard beech.
Viability	H	- With low level of management and some protection of private land this catchment should be viable.
Buffering	H	- Buffered by native vegetation apart from pasture to the north east.
Landform		- Alluvial terraces and hillslopes rising to sharp montane ridges on andesite.
Threat	M	- Wild animals, fire in dead kanuka. <i>Hakea salicifolia</i> frequent in scrub on lower slopes.

Wai. 7
WAITEKAURI VALLEY



SCALE	:	1:50,000
GR CENTRE	:	NZMS 260 T13 563195
AREA	:	117.5 ha
ALTITUDINAL RANGE	:	50 - 100 m
TENURE	:	Private
DATA REFERENCE	:	Study area 72

Wai. 7 : Waitekauri Valley

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	podocarp forest	riverbank, hillslope	M

Landform:

The steeply sloping banks of incised streams on ignimbrite in the Waitekauri Valley.

Vegetation:

Scattered remnant of an alluvial-type forest on steeply incised slopes. Most remnants are dense rimu, totara, tanekaha, miro, kahikatea with occasional kauri. Some stands are mixed with tawa, pukatea, rewarewa and tree ferns. There are some small areas of swamp maire in wet flushes and basins.

Fauna:

Common forest birds recorded during survey.

Flora:

Some swamp maire.

Discussion:

Apart from the Waiharekeke this is the only other area in Waihi ED still supporting dense podocarp forest of the type found on alluvial terraces. These forest remnants are on a landform limited to the Waitekauri Valley and Karangahake area.

Criteria Summary:

Representativeness	H	- Only areas of podocarp forest found on this landform.
Diversity	L	- One bioclimatic zone, one vegetation type.
Naturalness	M	- Largely natural appearance but grazing is preventing regeneration.
Special Features		- Swamp maire.
Viability	M	- Require protection and fencing in order to be viable.
Buffering	L	- Almost entirely surrounded by pasture.
Landform		- Incised river banks on ignimbrite.
Threat	H	- Clearance, stock grazing, rubbish dumping.

7. TE AROHA ECOLOGICAL DISTRICT

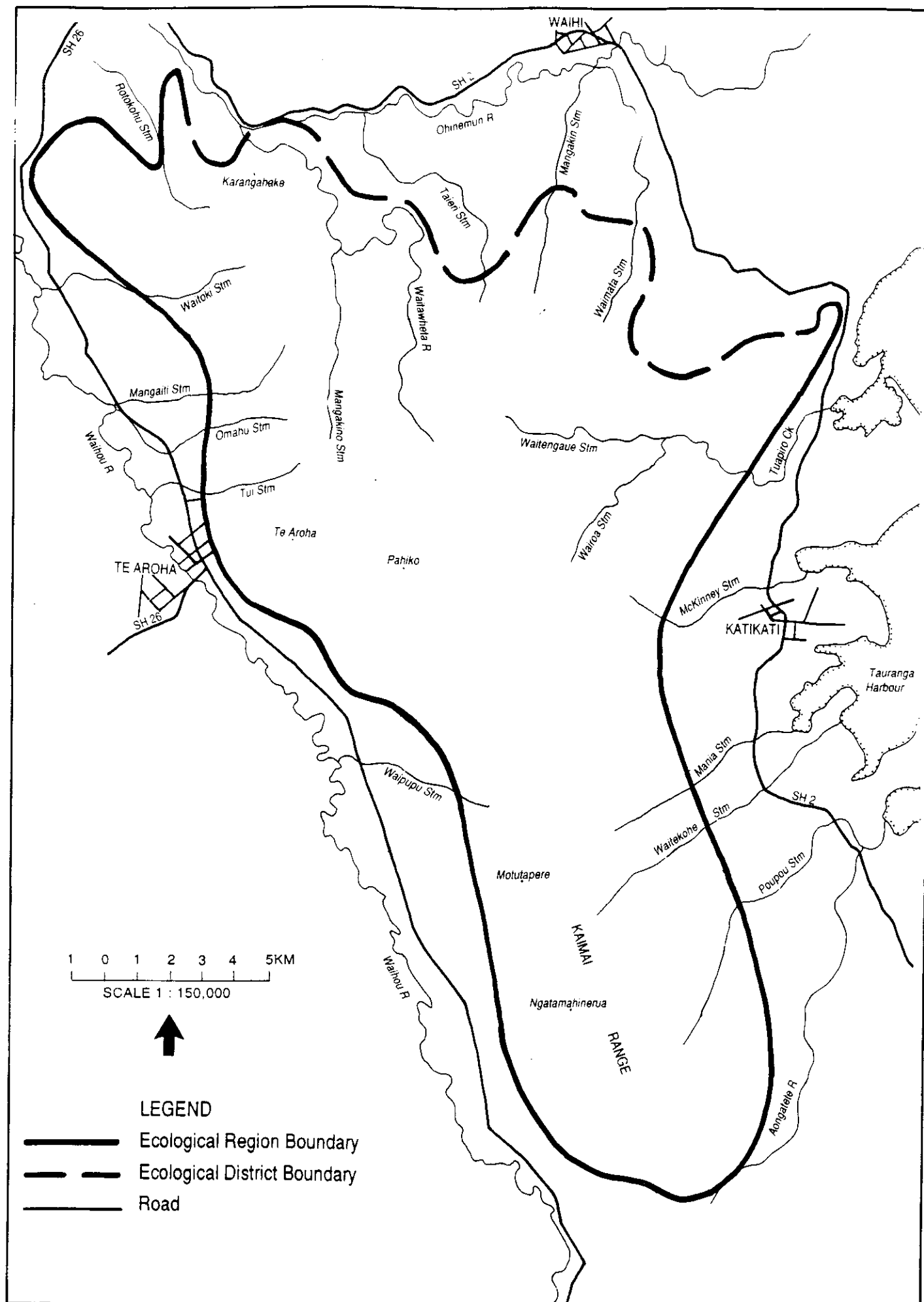
S U M M A R Y

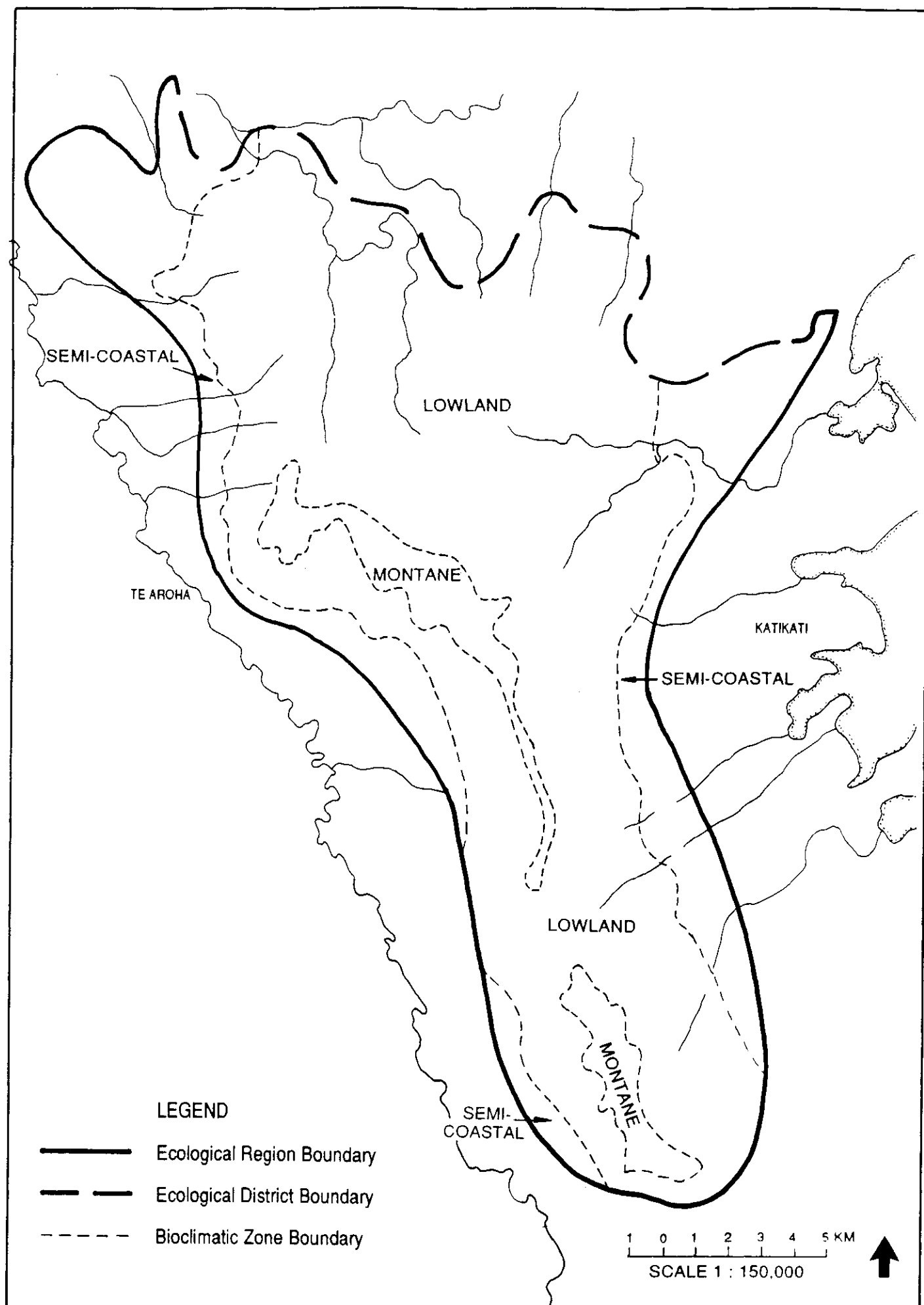
The northern boundary of the Te Aroha Ecological District (ED) runs along the Karangahake Gorge, along the southern side of the Waihi Basin and then south to the Aongatete River. The western boundary runs from Paeroa to the Kaimai Railway tunnel. The Kaimai Range rises steeply on all sides of the district with most of it lying above 200m. Underlying geology is andesite with dacite and ignimbrite. Quaternary volcanic ash overlies lower slopes and some plateau-like surfaces.

The Kaimai Range above 200m is covered by a large tract of forest. Most of the forest below 200m has been cleared for agriculture and forestry. Much of the forest remains unmodified with past disturbance being localised such as mining in the Wairongamai Valley and kauri extraction in the Waitawheta Valley, being of a local nature. There is a great diversity and complexity of forest types with red, silver and hard beech being common. Red and silver beech are not found in the other ecological districts. Montane vegetation communities are also distinctive in this ED. There are large areas of kauri-hardbeech forest which are regenerating after logging. Wetlands would never have been extensive but there would have been some alluvial terrace forest most of which has now been cleared. Forest below about 200m has a distinct semi-coastal character, much of this has now been cleared and modified especially in the north of the district where logging has been recent. Some remnants still exist along stream valleys. It is mainly this type which is currently not adequately protected in reserves of Te Aroha ED. For more details see Section 7.1.5 and Table 16.

A total of 7850 ha, that is 22%, of the Te Aroha ED lie within existing protected areas. Several large Ecological Areas, a Forest Sanctuary and several Scenic Reserves protect adequate areas and the range of diversity in the lowland and montane zone (see Regnier 1987 and Table 16).

The communities not adequately protected in this district are the lower lowland forests and wetlands. It is these types that are proposed in the Recommended Areas for Protection (RAP). RAPs lie mainly on private land.





**TE AROHA ECOLOGICAL DISTRICT
BIOCLIMATIC ZONES**

7.1 ECOLOGICAL CHARACTER

7.1.1 RELIEF

Te Aroha is the southernmost district of the Coromandel Ecological Region. The Kaimai Range makes up most of Te Aroha ED and is geologically part of the Coromandel Range. This range rises steeply from the Hauraki Plains in the west forming a rugged escarpment around 800m in altitude with steep, unstable slopes below.

7.1.2 GEOLOGY

The Kaimai Ranges are predominantly Coromandel Group andesites from the mid Miocene and Pliocene. These are overlain in the south by younger ignimbrites of the Whakamarama Group which bound the southern end of the Te Hunga ridge. The rocks of the northeast area of the district are dacite, and are now treated as two formations (Pukepunga and Uretara) of the Coromandel Group-Kaimai subgroup. An intrusion of Pliocene andesites of the Omahine subgroup form the Waitawheta Plateau around which minor areas of Whitianga group rhyolites and ignimbrites of the Waihi basin occur.

A mantle of Quaternary dacitic and rhyolitic ash remains on the lower, less steep slopes of the range where they have not been eroded away. Colluvial deposits of coarse textured andesitic and dacitic material have collected at the base of the steep slopes of the range.

7.1.3 CLIMATE

[Source: Biological Resources Centre (unpublished)]

Generally, summers are warm and moist and winters mild. Temperatures range between -2.4 C and 29 C and rainfall is spread throughout the year with highest monthly rainfalls occurring in June. Rainfall varies greatly depending upon altitude and aspect. Mean annual rainfall is between 1600 and 2800 mm.

The bioclimatic zones broadly reflect changes in conditions with increasing altitude. A comparison of data recorded at the two climate stations, one at the base of Mt Te Aroha and the other near the summit, shows that rainfall, wind velocity, humidity and occurrence of fog are much higher and annual temperatures much lower on the summit (Stengs, 1978). Rainfall is higher on the eastern side of the range (Dale and James, 1977).

Jane and Green (1983) describe the climate of the upper parts of the range in more detail. Precipitation is high, over 2500 mm/year, and is well dispersed throughout the year and fog occurs frequently. Consequently, precipitation greatly exceeds evapotranspiration in most years and the soils are often waterlogged perhaps for years at a time (Jane and Green, 1983). Temperatures rarely exceed 20 C and winter temperatures are often close to freezing.

Two distinctive plateaux occur at high altitudes along the range, the Ngatukituki and Te Hunga Ridges. Elsewhere ridges are narrow and rugged with rock outcrops. Valleys are deeply incised with numerous steeply graded streams, those in the west have steeper gradients than those in the east. The terrain to the south and east of Te Hunga Ridge changes quickly, becoming undulating and more typical of the Mamaku Plateau in the Northern Volcanic Plateau ER.

The northern third of the district has lower terrain and easier relief with low undulating hills to the north east of the main range. The broad lower catchments of the Waitawheta River and the Mangakino River, that flow almost due north into the Ohinemuri, have alluvial terraces.

The northern boundary of the district is formed, in part, by the distinctive Karangahake Gorge.

7.1.4 SOILS

[Soils information is from Wildon (1980)]

The variation in soils of the district follows changes in slope of the terrain as well as changes in soil parent material. On steep to very steep land the soils are of low fertility. Tangatara steepland soils, related to yellow brown earths and derived from soil parent material of weakly argillised dacite and rhyolite, occur on the very steep upper fault scarp slopes and on the tops of the Range. Aroha steepland soils, related to brown granular clays and derived from weakly argillised andesite and propylised andesite, occur on the steep lower fault scarp slopes.

At lower altitudes on moderately steep to steep slopes, rolling country and alluvial fans, soils are of medium fertility. The moderately steep to steep lower western slopes have a soil of brown granular clay (Komata hill soils) derived from weakly argillised andesite. Isolated pockets of Te Tuhi soils cover more rolling country where the rhyolitic and andesitic ash has not been eroded. At lower altitudes on the western slopes is a band of alluvium (Mangaiti soils) derived from andesite and rhyolite with rewashed volcanic ash.

7.1.5 VEGETATION

Despite its geological affinities with the other districts in the Coromandel ER, the Te Aroha ED has a very diverse flora and vegetation and communities are unlike those of any other district. This can be attributed to the physical location and wide range in geology, landform and altitude as well as overlapping ranges of more northern and southern plant species which occurs in the Kaimai Range.

Another distinguishing feature of the Te Aroha ED is the lesser degree of modification and degradation. The main areas of kauri and podocarps, were removed wholesale at the end of the nineteenth century resulting in areas of secondary vegetation (eg the Upper Waitawheta, Wairoa and Waitengaue). Sometimes dams were used as in the Waitawheta but the gentler gradient

of the catchments of the eastern side of the Kaimai Ranges enabled the loggers to build tramways. Overall this method was probably less destructive to the natural environment, although the former tramlines are easily followed. Repeated burning and gum digging did not occur here as in the northern districts although wild fires have at times spread up through forest on the steeper western side. More recently selective logging was carried out in the forests north of the Waitengaue leaving forest of a disturbed tawa canopy with virtually no emergents, dissected by logging roads. In the forests of the main range it is still possible to find areas which are largely unmodified other than by wild animals. As well as goats, pigs and possums, Te Aroha ED also has red deer which browse forest vegetation.

Forests below about 200m on both sides of the Kaimai Range have a distinctive coastal element with puriri, wharangi, *Astelia banksii* and abundant kohekohe. There are frequent puriri groves in the lower stream valleys on the eastern side of the range. In the survey this zone was called the semi-coastal zone. Although several kilometres from the coast on both sides of the ranges there is no intervening highland and the lower slopes probably experience warmer, salt-laden winds from the sea. The pressure of land development on the lower slopes results in there being little intact semi-coastal forest in a near natural state. Those areas found in the lower Te Rereatukahia Stream in the east and the Stanley Stream in the west being the best examples seen.

The transition between towai and kamahi occurs in Te Aroha ED and intermediate forms are found in the northern part of the district. Kamahi does not appear to attain the prominence in Te Aroha ED that towai does in the northern districts; this could reflect the lower levels of disturbance or different soil types. Kamahi is the predominant secondary tree species on the eastern side of the range whereas on the western side, it is kanuka.

Alluvial terraces in the northern rivers such as the Waitawheta and the Waitengaue have mostly been cleared. There are, however, podocarp remnants in the Waitawheta. There is vigorous hard beech and podocarp regeneration on alluvial flats amongst kanuka, kamahi and pines in the Waitengaue Valley.

Large tracts of tawa forest with occasional emergent northern rata and rimu, kauri and totara occur in the lowland zone. On both sides of the range the altitudinal variation within this type is broadly similar, with abundant kohekohe, mangao and hinau to about 400m. Above 400m tawari, pigeonwood, tawheowheo and kamahi become more frequent. In the upper lowland zone around 550m, and especially on steep unstable slopes, tawari becomes a canopy species with tawa, pigeonwood and tawheowheo. On steep lowland ridges there are frequent miro, thin barked totara, pigeonwood, toatoa and tawa. This grades into the montane ridge and knoll podocarp communities discussed later.

Most of the extensive large kauri forest has been logged but there are still areas of scattered emergents in Maurihoro SR and the Mangakino catchment and elsewhere there are small dense groves

such as that present to the north of the Te Rereatukahia stream. Much of the kauri in Te Aroha ED occurred with extensive hard beech for instance in the Waitawheta, Waitengaue and Wairoa catchments. This forest still remains but is much modified, both kauri and hard beech have regenerated amongst kanuka and kamahi. Nowhere else in the Coromandel ER are there such extensive hard beech and kauri forests. The best remaining areas in the ED today are in the headwaters of the Wairoa where there is regeneration of this forest type not seen elsewhere in the ER.

Silver beech and red beech forests are found in Te Aroha ED. This is the only occurrence of these two species in the Coromandel ER and is the northern and western mainland North Island limit of both species. Silver beech forest is found over 600 m on the most exposed, wettest and steepest areas whereas the taller, red beech forest occurs on hillslopes and ridges especially on the eastern side. Also in the montane zone are various unusual conifer associations, yellow-silver pine, kaikawaka, mountain toatoa and pink pine on rocky knolls and exposed ridges. On wetter plateau areas like Te Hunga ridge there is kaikawaka and yellow silver pine forming a mosaic with silver beech forest. Both montane beech forest and montane conifer communities have similar montane associates such as tawari, stinkwood, *Pseudopanax laetus*, broadleaf, mountain neinei and an abundance of *Gahnia* and *Astelia* spp forming the ground cover. Luxuriant moss and lichen throughout the montane forests indicate the very wet conditions which prevail.

Areas in the montane and upper lowland which have had their forest cover removed by fire and/or browsing animals, support either a tussockland, as near Tangitu, or montane scrub, as near Te Rereatukahia hut. (Type 38 & 39)

In this steep district there is rapid ecological change over small distances on the ground and overlapping of plant communities producing complex and interesting associations. For instance kauri and hard beech overlap with red and silver beech, silver beech occurs with kaikawaka, pink pine and yellow-silver pine, kauri with hard beech and yellow silver pine, hard beech and silver beech. Given the time available for survey and the level of protection already existing in Te Aroha district, we did not distinguish or define these variations in the field as vegetation types.

Wetlands were probably never very extensive in this ecological district. There would have been some along the lower river valleys on alluvial flats (eg Waitawheta River) but only small modified patches remain today. There are some small lakes known as the Tuahu or Killarney Lakes. They support rushland, raupo-flax reedland and some acidic peatland and are the only representatives of wetland and lacustrine vegetation in Te Aroha ED.

TABLE 14 :

Important Plants in Te Aroha Ecological District A Provisional List

VULNERABLE

Myriophyllum robustum

RARE

Marattia salicina

LOCAL

*Loxoma cunninghamii**Metrosideros carminea*

SPECIES WITH THEIR LIMITS OF DISTRIBUTION IN TE AROHA ED

Nationally

Northern

kamahi

red beech (mainland only)

silver beech (mainland only)

Southern

*Coprosma dodonaeifolia**Pseudopanax discolor*

Towai

Regionally

Te Aroha Ecological District is at the boundary of a gap across the Volcanic Plateau in the distribution of some species, eg kaikawaka, yellow-silver pine and pink pine. There is also a wide absence of beech on the Volcanic Plateau (Nicholls, pers comm).

SPECIES ENDEMIC TO COROMANDEL ER

Coprosma dodonaeifolia

TABLE 15 :**Important Fauna in Te Aroha Ecological District****ENDANGERED****Birds**

NI kokako

INSECTS*Dorcus auriculatus* (flightless stag beetle)**THREATENED****Mammals**

Long-tailed bat

Birds

NZ dabchick

NZ kaka

NI brown kiwi

NZ falcon

REGIONALLY THREATENED**Birds**

NI robin

Amphibians

Hochstetter's frog

RARE**Birds**

Long-tailed cuckoo

**SPECIES WITH DISTRIBUTIONAL LIMITS (Northern) in Te Aroha ED
(numbers low throughout region)**

NI robin

NI rifleman

whitehead

7.1.6 FAUNA

Forests of the Te Aroha ED support a diversity of forest birds (see Appendix VI), not only common forest birds but some that are at risk nationally or regionally (see table 11). The Department of Conservation has classified the Kaimai-Mamaku Forest Park and adjoining forests as an area of outstanding wildlife interest (Rasch, 1989).

The common forest birds (eg bellbird, tui and NZ pigeon) are those typically found throughout the Coromandel region. In addition whitehead, NI rifleman and NI robin occur, this is the mainland northern limit for NI robin and NI rifleman is approaching its northern limits. The NI rifleman has only rarely been recorded further north on Little Barrier Island (Bull et al, 1985).

The endangered North Island kokako (Bell, 1986), is present but in very low numbers. (Wallace 1988?) The Fauna Survey Unit (FSU) of the former NZ Wildlife Service located three birds in 1981 in the headwaters of the Tahawai Stream and between the Waitawheta and Waiora Streams (Wallace, 1988). The unit also found NI kokako in 1974 and 1977 in the area between Tuahu track and the Kaimai rail tunnel at a total of 19 localities (Wallace, 1988).

The threatened NI brown kiwi and NZ falcon have been reported from the district, the long-tailed bat is also present. Two were observed near the Waitawheta Hut during the survey in February 1989. The NI kaka is found throughout the district but in low numbers. NZ dabchick has also been recorded.

Hochstetter's frog has been recorded in the past (Bell, 1986) from a number of scattered localities throughout the forested catchments in Te Aroha ED but further information is needed on current distribution. This species is approaching its southern limit in Te Aroha ED, it has a disjunct distribution in the North Island.

The endangered (Bell, 1986) flightless Coromandel stag beetle (*Dorcus auriculatus*) was found on Mount Te Aroha ED by Butcher (1987).

Observations of lizards are limited with only the forest gecko found at one locality in the district (Department of Conservation, unpublished).

7.2 EXISTING PROTECTED NATURAL AREAS

Approximately 22% of the ED lies within PNAs. (For a list of flora and fauna characteristics of PNAs see Regnier 1987.) Most large existing PNAs lie within the Kaimai-Mamaku Forest Park. The East and West Ngatukituki Ecological Areas lie either side of the Ngatukituki Forest Sanctuary together providing a large area of protected forest across the Northern Kaimai Range.

The Te Hunga EA is not adjacent to the PNAs to the north but is linked by continuous forest gazetted as forest park. Te Hunga EA protects a large area of forest on the eastern side of the Kaimai Range from the lowland to the montane zone (Te Hunga Ridge). Wairakau and Maurihiro SRs protect forest on the steep western slopes of the ranges. Mangaiti SR in the north of the district protects an outlier of forest and includes a little of the semi-coastal element, whilst Te Aroha SR protects some of the lower flanks of Te Aroha mountain as does one small QEII Open Space Covenant.

7.3 FURTHER REQUIREMENTS TO PROVIDE A NETWORK OF REPRESENTATIVE NATURAL AREAS

Approximately 15% of the lowland zone and 30% of the montane zone are currently protected within PNAs. As a result of the PNAP analysis it was decided that these, mostly very large, reserves capture most of the diversity and important natural features of the Te Aroha ED.

There is, however, poor representation of the semi-coastal zone found below about 200m. Over much of the district this is the lower, easier country that has been converted to farmland and forestry but small areas of natural vegetation do still exist and proposals to protect these areas make up most of the RAPs in Te Aroha ED.

TABLE 16 : Te Aroha Ecological District - Standard Ecological Units

BIOCLIMATIC ZONE	HYDROLOGIC SYSTEM	VEGETATION TYPE	E C O L O G I C A L U N I T	LANDFORM TYPE	FORMER EXTENT					PRESENT EXTENT					CHANGE					PROTECTION STATUS				
					C	SC	L	M	C	SC	L	M	C	SC	L	M	C	SC	L	M	C	SC	L	M
SC	terrestrial	podocarp alluvial terrace forest		alluvial terrace						R														1
SC, L	terrestrial	kamahi scrub		hillslope/ridge/gully		Mn				Mn														3
SC, L	terrestrial	broadleaved species scrub		hillslope/ridge/gully		-				Mn														4
SC, L	terrestrial	kanuka scrub/forest		hillslope		-				Mn														2
SC	terrestrial	kanuka-broadleaved species scrub/forest		hillslope/ridge/gully		-				Mn														2
L	palustrine	manuka/Baukea species sedge shrubland		basin		-	*			Mn	*													1
L	palustrine	raupo-flax reedland		basin		*				*														5
SC, L	terrestrial	kauri-tanekaha forest		hillslope/ridge		Mn				R														5
SC, L	terrestrial	hard beech-kauri-tanekaha forest		hillslope/ridge		C	C			Mn ⁺														1
SC, L	terrestrial	(rata)/tawa modified forest		hillslope/ridge/gully		-				Mj	Mn													4
SC, L, M	terrestrial	(rata-podocarp)/tawa forest		hillslope/ridge/gully		Mj	Mj	Mn		R	Mj	Mn												2
M	terrestrial	tawai-tawari forest		hillslope/ridge		-				Mn														4
M	terrestrial	beech-tawari forest		hillslope/ridge						Mj														5
L, M	terrestrial	kanono scrub		hillslope/ridge		*	*			*	*													5
L, M	terrestrial	tussockland		hillslope/ridge		-				*	*													5
M	terrestrial	montane conifer forest		hillslope/ridge		-				*	*													2
M	terrestrial	upland rocky bluff community		hillslope/ridge/plateau						C														5
M	terrestrial			rock pinnacle						*	*													1

C = coastal
SC = semi-coastal
L = lowland
M = montane

* = present
R = remnant
Mn = minor
C = common
Mj = major
+ more scrub than formerly
- absent or presence due to natural disturbances

PROTECTION STATUS:

1 = not represented within existing PNA network
2 = much less than 10% of former extent protected
3 = less than 10% of former extent protected
4 = adequately protected
5 = well represented within existing PNA network

7.4 RECOMMENDED AREA FOR PROTECTION (RAPs)

Each proposal includes a location map, a checklist of component ecological units, a brief description of landform and vegetation character, and an evaluation/discussion and summary of the priority status of the area.

1. Location Map

Drawn on NZMS1 series maps 1:50,000 and only reduced where necessary.

2. Ecological Unit Checklist

A list of the standard ecological units (see Appendix I for descriptions).

"REL. AREA" - the size of each ecological unit in relation to other examples of that unit in the District; large (L), medium (M) or small (S). For example a large (L) foredune would occupy a much smaller area than a large (L) kanuka forest unit.
- 0 indicates no other examples recorded in the district.

3. Landform and Vegetation

Descriptions are given for the entire priority area.

4. Discussion and Criteria Summary

Outline of the quality of the area and its important features for protection.

Further information, such as location of vegetation types with RAPs maybe obtained from Department of Conservation, Waikato Conservancy, Hamilton.

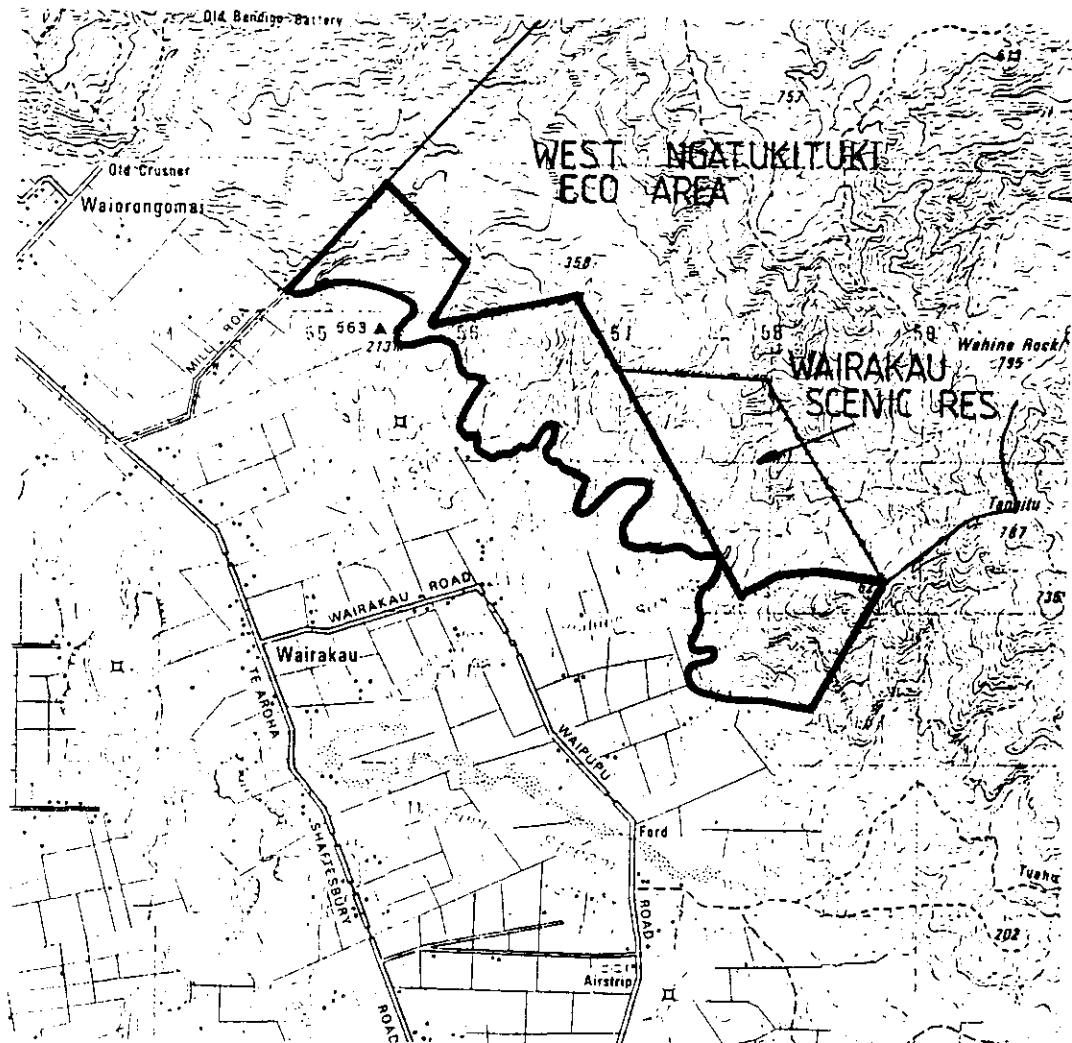
INDEX TO RAPs

	Page
TeA 1 Wairakau Scenic Reserve Extension	206
TeA 2 Tuahu Lakelets	208
TeA 3 Maurihoro SR Extension	210
TeA 4 East Ngatukituki EA Extension	212
TeA 5 Te Rereatukahia	214
TeA 6 Waitekohe Stream	216
TeA 7 Te Hunga EA Extension	218

INDEX TO EXISTING PNAS

(See Fig 7)

- A Mangaiti Scenic Reserve
- B De Jong Open Space Covenant
- C Te Aroha Scenic Reserve
- D Ngatukituki Forest Sanctuary
- E West Ngatukituki Ecological Area
- F Wairakau Scenic Reserve
- G Maurihoro Scenic Reserve
- H Te Hunga Ecological Area
- I East Ngatukituki Ecological Area



SCALE	:	1:50,000
GR CENTRE	:	NZMS 260 T14 567995
AREA	:	275 ha
ALTITUDINAL RANGE	:	75m - 400m
TENURE	:	Private, DOC
DATA REFERENCE	:	Study Area

TeA. 1 : Wairakau Scenic Reserve Extension

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
semi-coastal lowland	(rata-podocarp)/tawa forest	hillslope, ridge, gully	M
semi-coastal lowland	(rata)/tawa modified forest	hillslope, ridge, gully, alluvial fan	M
semi-coastal lowland	kanuka-broadleaved species scrub/forest	hillslope, ridge, gully	M
semi-coastal lowland	broadleaved scrub	hillslope, gully	M

Landform:

Toeslopes of the western Kaimai Range including alluvial fans, where streams emerge from incised valleys on late Pliocene, early Miocene andesite.

Vegetation:

Forest remnants and regenerating forest mainly along streams emerging from the steep western side of the Kaimai Ranges. Most of the (rata)/tawa forest has been modified but still retains much of its forest character and lying mainly below 200m, has semi-coastal characteristics. Broadleaved scrub with abundant mamaku and bracken occupies slopes which have been cleared in the past and are now regenerating. More advanced regeneration is represented by kanuka broadleaved scrub and forest.

Fauna:

Long-tailed bats have been recorded in the area. Common forest birds recorded during the survey.

Flora:

No significant flora recorded during survey.

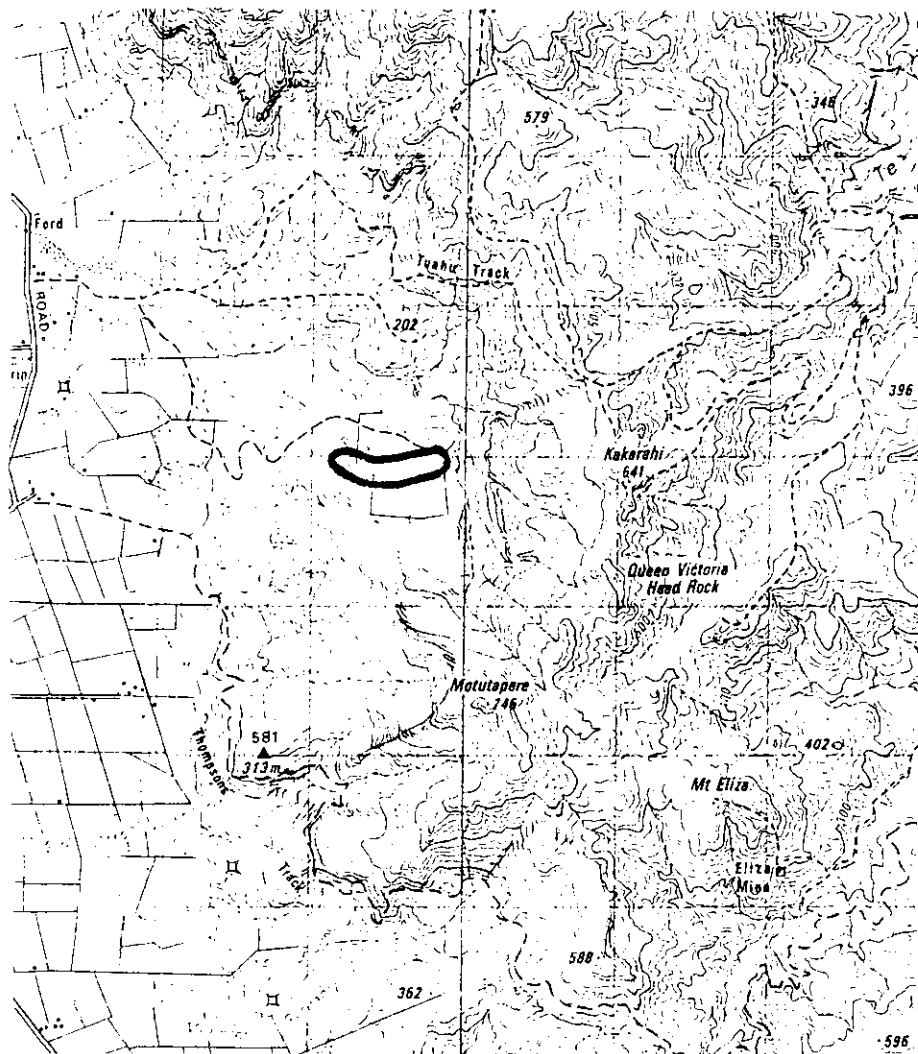
Discussion:

This RAP extends the Wairakau SR to include representative and regenerating semi-coastal forest on lower, gentler slopes of the western Kaimai Range and including some alluvial fan-type landforms. Thus it increases the range of diversity protected in the three existing PNAs which span the ranges from east to west.

Criteria Summary:

Representativeness	M - Representative, semi-coastal vegetation.
Diversity	M - Two bioclimatic zones, four vegetation types.
Naturalness	M - Modified and little modified forest.
Special Features	L - Semi-coastal type forest.
Viability	M - Requires protection and management to maintain this remnant forest. There are already some catchment protection measures through Section 34 of the Soil and Water Conservation Act.
Buffering	M - Natural vegetation to the east otherwise surrounded by farmland.
Landform	- Easy toeslopes of Kaimai Range and some alluvial fans on andesite.
Threat	- Clearance, fire, wild animals.

TeA. 2 TUAHU LAKELETS



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T14 594949
AREA	: 12.5 ha
ALTITUDINAL RANGE	: 250m
TENURE	: (SOE (Timberlands))
DATA REFERENCE	: Study Area 76. Beadel 1988b

TeA. 2 : Tuahu Lakelets

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
lowland	raupo-flax reedland	lake margin	L
lowland	manuka/ <i>Baumea</i> sedge-shrubland	lake margin	L

Landform:

Two small lakelets in a basin on the andesitic, steep western foothills of the Kaimai Ranges.

Vegetation:

These two small lakes are surrounded by quite a range of wetland vegetation types none of which are extensive. Shallow water supports areas of emergent *Eleocharis sphacelata*. Elsewhere margins have a gradient from rush species with abundant *Sphagnum* spp, often forming a floating mat of vegetation, to areas of spike rushes, *Baumea articulata* and flax to raupo in deeper water. On the southern side there are frequent willows. Lying between the two lakes is a patch of acid peat bog with *Baumea rubiginosa*, *B. tenax*, *Gleichenia dicarpa*, manuka and *Epacris pauciflora*.

Fauna:

Pukeko, grey duck, spotless crane and giant kokopu were recorded by FSU.

Flora:

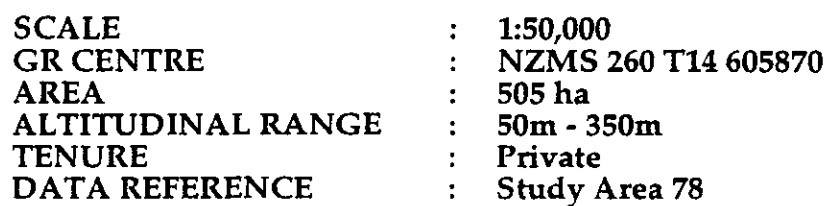
Vulnerable *Myriophyllum robustum* is recorded from the lake. *Epacris pauciflora* - only record from this ecological district.

Discussion:

These small lakes support the largest area of wetland vegetation in the Te Aroha ED. Although not extensive this vegetation is very diverse and supports some interesting assemblages from mesotrophic raupo to acid peat bog vegetation.

Criteria Summary:

Representativeness	H	- The only reasonably sized areas of wetland in Te Aroha ED.
Diversity	M	- One bioclimatic zone, two vegetation types.
Naturalness	M	- Adventive plant species common, peat area natural.
Special Features		- Spotless crane, <i>Myriophyllum robustum</i> . <i>Epacris pauciflora</i> .
Viability	M	- Requires protection and sensitive management.
Buffering	L	- Surrounded by agro-forestry development.
Landform		- Two small basin lakes on andesite
Threat	M	- Cattle grazing, topdressing risk, adventive plants.



TeA. 3 : Maurihiro Scenic Reserve Extension

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
semi-coastal lowland	(rata-podocarp)/tawa forest	hillslope, ridge, gully	M
semi-coastal lowland	kanuka forest	hillslope, ridge, gully, alluvial fan	M
semi-coastal lowland	broadleaved scrub	hillslope, gully	M

Landform:

Steep slopes of the lower Kaimais, toeslopes and alluvial fans where mountain streams emerge from their incised courses on to the flatter Hauraki Plains. Underlying geology is andesite, ignimbrite and undifferentiated alluvium.

Vegetation:

Slopes and stream valleys which have not been disturbed by fire or attempts to clear for farming support (rata-podocarp)/tawa forest. Below about 200m the remnants of this forest type, especially in sheltered stream valleys, have species often found in coastal situations such as wharangi, puriri, *Astelia banksii*, *Phormium cookianum*, nikau and abundant kiekie. Where forest has been cleared in the past and allowed to regenerate there is tall kanuka forest or mamaku-bracken treeland. On some very steep faces there are *Phormium cookianum*, *Astelia banksii*, rata vine communities.

Fauna:

Common lowland forest birds recorded during survey.

Flora:

No species of note recorded during survey.

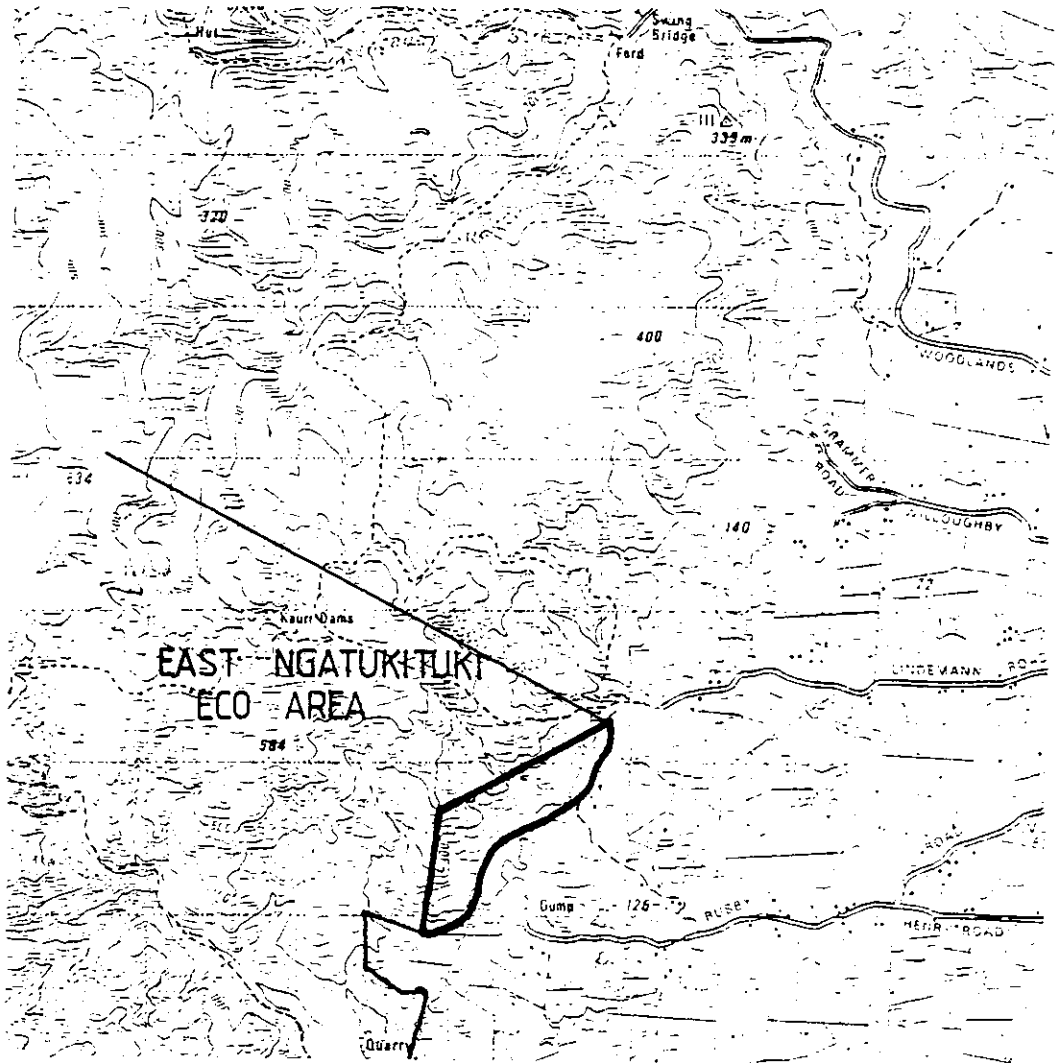
Discussion:

This RAP proposes protection of forest and scrub at altitudes lower than the Maurihiro Scenic Reserve boundary thus providing protection for a wider range of species diversity. Some small remnants of original forest exist while other areas support various regenerating communities.

Criteria Summary:

Representativeness	H	- Semi-coastal type forest of the type found in places along the edge of the Kaimai-Mamaku Forest Park but being mainly on private land. This type probably extended over lowland alluvial slopes of the ranges.
Diversity	M	- Two bioclimatic zones, three vegetation types.
Naturalness	M	- Some original forest remnants other than regenerating vegetation.
Special Features		- Catchment protection, scenic values.
Viability	M	- Some steepland vegetation afforded protection by Section 34 of the Water and Soil Conservation Act. Requires formal protection and some management.
Buffering	M	- Surrounded by forest and scrub on all but west side which is in pasture.
Landform		- Alluvial and colluvial fans, hillslopes, bluff and incised streams on andesite, ignimbrite and alluvium.
Threat	L	- Fire, clearance, grazing animals, erosion

TeA. 4 EAST NGATUKITUKI EA EXTENSION



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T14 635015
AREA	: 57.5 ha
ALTITUDINAL RANGE	: 100m - 350m
TENURE	: Private
DATA REFERENCE	: Study area 75

TeA. 4 : East Ngatukituki EA Extension

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
semi-coastal lowland	(rata-podocarp)/tawa forest	hillslope, ridge, gully	M
semi-coastal lowland	(rata)/tawa modified forest	hillslope, ridge, gully,	M

Landform:

Gentle toeslopes of eastern Kaimai Range on late Pliocene, early Miocene andesite.

Vegetation:

Modified and unmodified tawa forest. The lower slopes support the more semi-coastal type forest with tall kohekohe subcanopy, frequent nikau and kiekie and occasional puriri.

Fauna:

Common forest birds recorded during the survey.

Flora:

No flora of note recorded during survey.

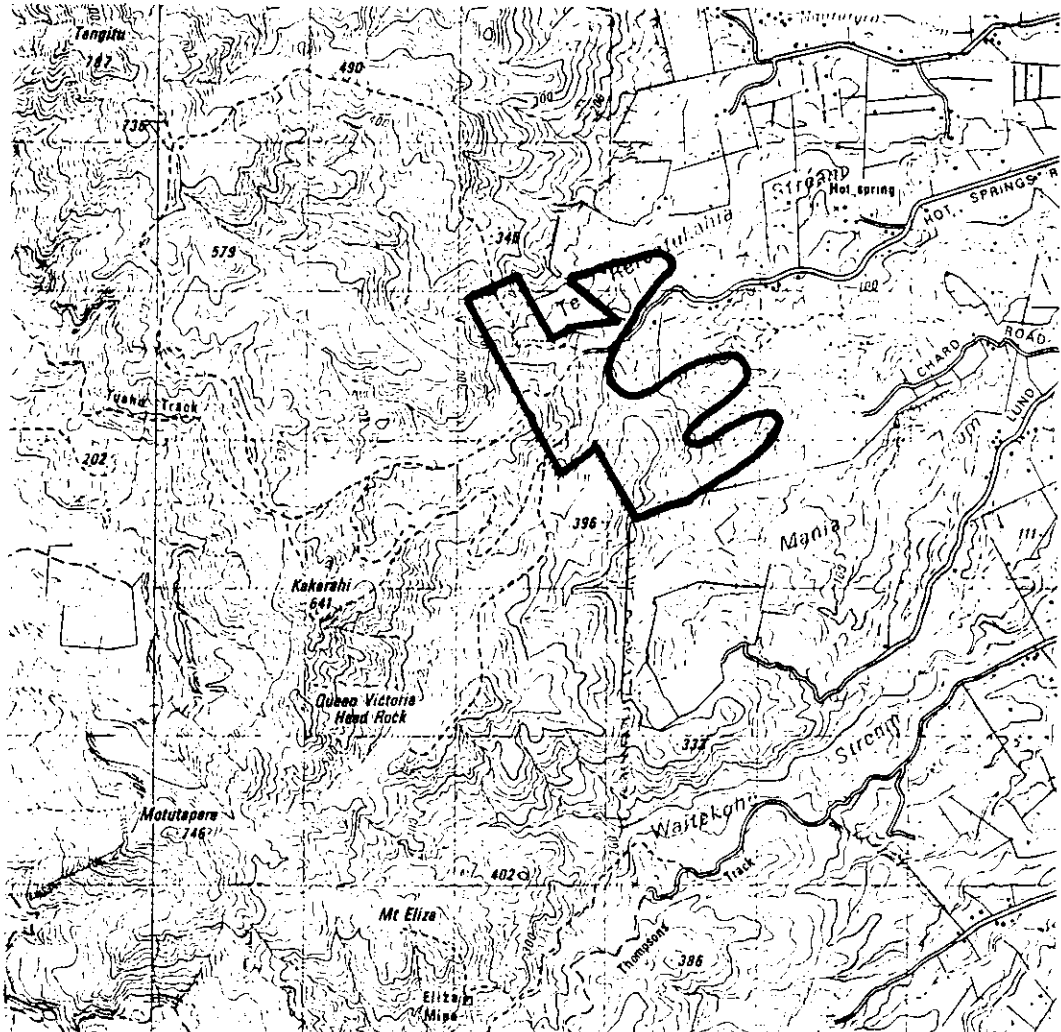
Discussion:

This RAP has semi-coastal forest which is currently under represented in the PNA system in Te Aroha ED. Being adjacent to the East Ngatukituki EA it also would also, if protected, allow representation of the gradient from semi-coastal to montane vegetation.

Criteria Summary:

Representativeness	H - Representative semi-coastal tawa forest.
Diversity	L - Two bioclimatic zones, one vegetation type.
Naturalness	M - Some areas modified, others fairly natural.
Special Features	- None recorded during survey.
Viability	M - Protection and low level management required to maintain this piece of forest.
Buffering	M - Ecological area to the west, otherwise surrounded by farmland.
Landform	- Gentle foothills of the eastern Kaimai Ranges on andesite.
Threat	M - Subdivision for lifestyle blocks, wild animals.

TeA. 5 TE REREATUKAHIA



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T14 630960
AREA	: 152.5 ha
ALTITUDINAL RANGE	: 50m - 325m
TENURE	: Private
DATA REFERENCE	: Study area 77

TeA. 5 : Te Rereatukahia

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
semi-coastal lowland	(rata-podocarp)/tawa forest	hillslope, ridge, gully	M
semi-coastal lowland	kauri-tanekaha forest	hillslope, ridge, gully	M
semi-coastal lowland	kamahi scrub/forest	hillslope, ridge, gully	M

Landform:

Easy hillslopes in the lower Te Rereatukahia catchment on Waiteariki ignimbrite and Huka groups siltstones, sandstones and conglomerates.

Vegetation:

Lowland and semi-coastal type (rata-podocarp)/tawa forest occupies major hillslope and stream valleys with frequent, scattered hardbeech and kauri along streams, especially those to the south. Tall tawa forest in the semi-coastal zone has a dense subcanopy of kohekohe and occasional puriri and karaka. Past kauri logging has resulted in secondary kamahi forest on ridges with kauri and other forest tree regeneration. On the northern side of the catchment is a distinctive and unusual dense kauri grove on a ridge.

Fauna:

Common forest birds recorded during survey.

Flora:

No species of note recorded during survey.

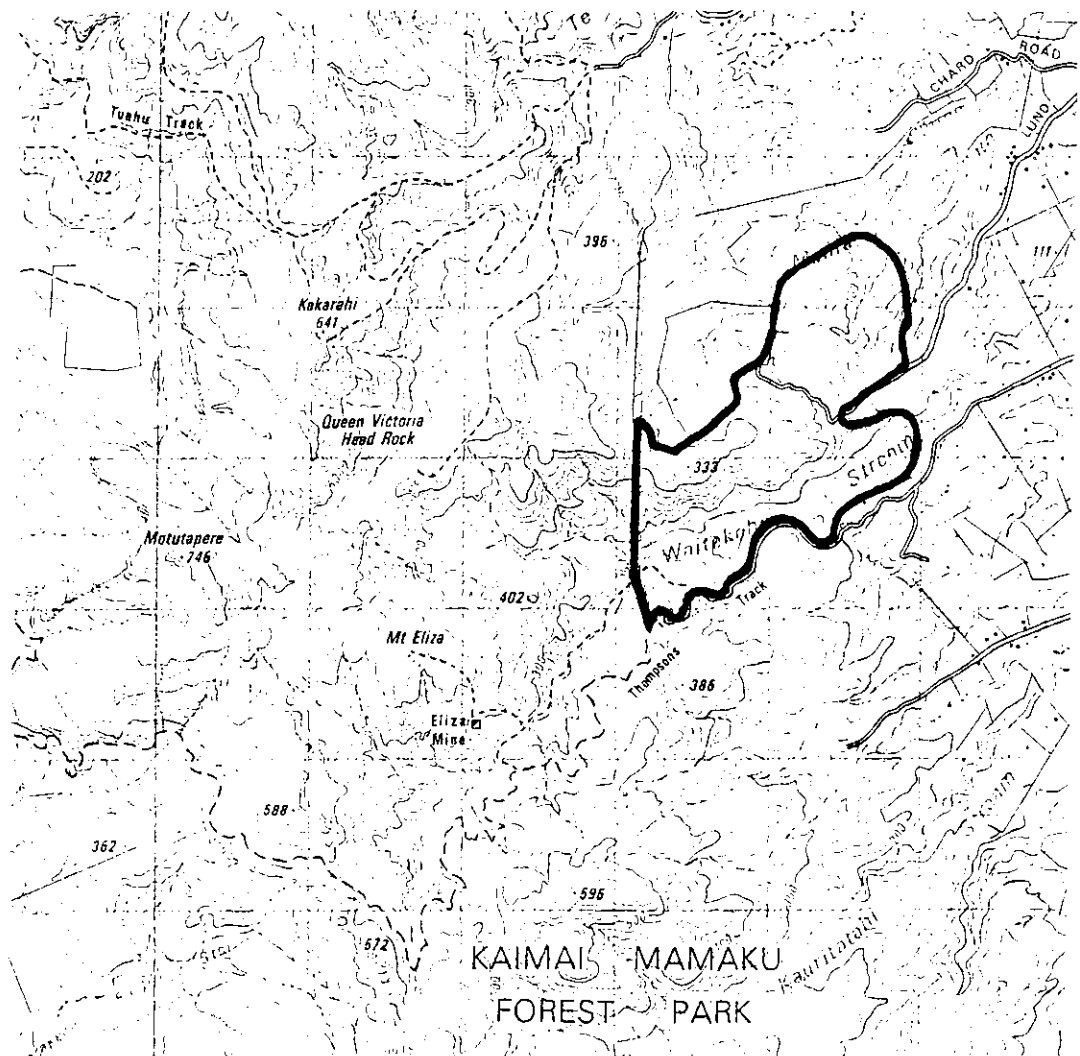
Discussion:

This RAP includes tall, representative, semi-coastal tawa forest with scattered hard beech and large kauri. Hardbeech is approaching its southern limit. Also includes a grove of dense kauri on a hillslope. Popular walking tracks run through this area.

Criteria Summary:

Representativeness	H	- Representative semi-coastal (rata- podocarp)/tawa forest and kamahi scrub. Dense kauri forest.
Diversity	M	- Two bioclimatic zones, three vegetation types.
Naturalness	M	- Some secondary vegetation but much of forest in fairly natural state. Walking track through kauri stands.
Special Features		- One of the southernmost hardbeech kauri forest associations.
Viability	M	- Requires protection and low level of management.
Buffering	H	- Surrounded by forest park apart from pasture to the east.
Landform		- Hillslopes and ridges on ignimbrite and some sedimentary rocks.
Threat	M	- Fire, people damage, wild animals

TeA. 6 WAITEKOHE STREAM



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T14 640940
AREA	: 240 ha
ALTITUDINAL RANGE	: 50m - 330m
TENURE	: Private
DATA REFERENCE	: Study area 77

TeA. 6 : Waitekohe Stream

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
semi-coastal lowland	(rata-podocarp)/modified forest	hillslope, ridge, gully	M

Landform:

Easy low foothills of the eastern Kaimai Range on Waiteariki ignimbrite and Huka group siltstones, sandstones and conglomerates.

Vegetation:

Tawa forest in this area has been modified but still maintains a forest canopy. The valley of the Waitekohe lies below 200m and supports a semi-coastal type of tawa forest which has been mostly cleared for agriculture on the eastern side of the Kaimai-Mamaku Forest Park and is currently under-represented in PNAs in Te Aroha ED.

Fauna:

Common forest birds recorded during survey.

Flora:

No species of note recorded during survey.

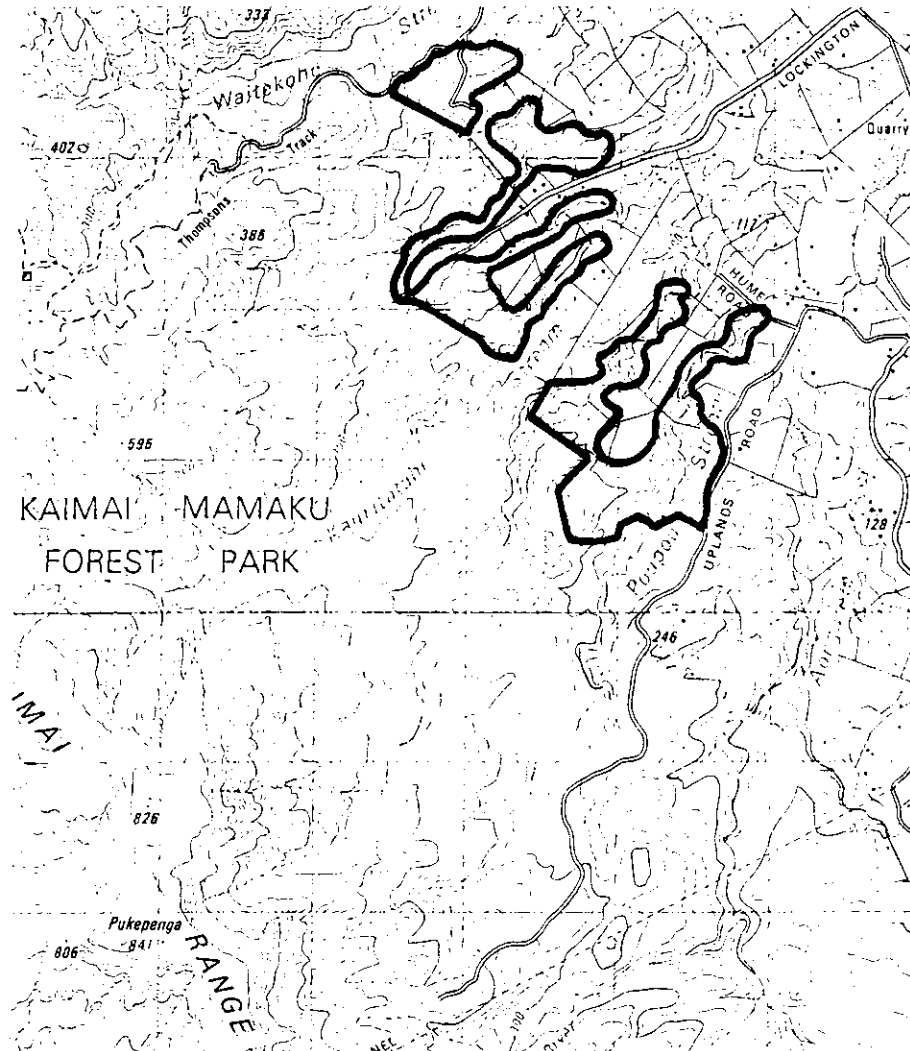
Discussion:

This small forested catchment supports under represented semi-coastal tawa forest.

Criteria Summary:

Representativeness	H - Representative semi-coastal forest.
Diversity	L - One bioclimatic zone, one vegetation type.
Naturalness	M - Some past modification.
Special Features	- None recorded during survey.
Viability	M - Requires protection and some management to maintain natural values.
Buffering	M - Natural vegetation to the west, south and north, elsewhere adjoined by farmland.
Landform	- Gentle hillslopes on lower eastern Kaimai Ranges on ignimbrite and sedimentary rocks.
Threat	M - Subdivision for lifestyle blocks and horticulture, feral animals.

TeA. 7 TE HUNGA ECOLOGICAL AREA EXT.



SCALE	: 1:50,000
GR CENTRE	: NZMS 260 T14 665910
AREA	: 217.5 ha
ALTITUDINAL RANGE	: 50m - 300m
TENURE	: Private, Crown (DOC)
DATA REFERENCE	: Study Area 78

TeA. 7 : Te Hunga Ecological Area Extension

Ecological Unit Checklist:

BIOCLIMATIC ZONE	VEGETATION TYPE	LANDFORM	REL. AREA
semi-coastal lowland	(rata-podocarp)/tawa forest	hillslope, ridge, gully	M
semi-coastal lowland	(rata)/tawa modified forest	hillslope, ridge, gully	M
semi-coastal lowland	kamahi scrub/forest	hillslope, ridge, gully	M

Landform:

Gentle foothills of the eastern Kaimai ranges on Waiteariki ignimbrite.

Vegetation:

Some stream valleys emerging from the Kaimai ranges still support original or slightly modified (rata-podocarp)/tawa forest. Below about 200m in sheltered valleys there is a semi-coastal type of forest with puriri and sometimes a distinctive, tall dense subcanopy of kohekohe. In areas which have been modified there is kamahi scrub or taller kamahi forest with good regeneration of other forest species under main canopy, especially kohekohe.

Fauna:

Common forest birds recorded during survey.

Flora:

No species of note recorded during survey.

Discussion:

This RAP includes several remnants of under-represented lowland and semi-coastal type (rata-podocarp)/tawa and kamahi forest, mainly lying in stream valleys. The PNA survey did not carry out a detailed investigation of condition and composition of each remnant. These forest remnants increase the scenic nature of the area.

Criteria Summary:

Representativeness	M	- Under represented semi-coastal type forest and scrub.
Diversity	M	- Two bioclimatic zones, three vegetation types.
Naturalness	M	- Some remnants have high degree of naturalness, kamahi forest is but secondary. Grazing has reduced naturalness.
Special Features		- None recorded during rapid survey.
Viability	M	- Require protection and management.
Buffering	M	- Forest and scrub to west, otherwise these remnants are surrounded by pasture.
Landform		- Gentle foothills of the eastern Kaimai Ranges on ignimbrite.
Threat	H	- Conversion to farming, forestry, residential subdivision (lifestyle blocks)

BIBLIOGRAPHY

- Adams, J 1884 On the botany of the Thames Goldfields. Transactions and Proceedings of the New Zealand Institute 16 : 385-393.
- Adams, J 1885 On the botany of Te Aroha Mountain - Transactions New Zealand Institute 17 : 275-287.
- Adams, J 1888 On the botany of Te Moehau Mountain, Cape Colville. Transactions and Proceedings of the New Zealand Institute, 21 : 32-41.
- Allan, H H 1961 Flora of New Zealand. Volume 1. Government Printer, New Zealand.
- Anderson, P 1983a Wildlife values - Coromandel Forest Park. Unpublished Wildlife Service Report prepared for District Ranger, NZ Forest Service, Thames.
- Anderson, P 1983b Wildlife values - gazetted and proposed ecological reserves. Unpublished Wildlife Service reports prepared for Conservator of Forests, New Zealand Forest Service, Auckland. Auckland Conservancy file 6/0/19.
- Anderson, P 1983c Kapowai Ecological Area - Wildlife values. Unpublished Wildlife Service Report prepared for District Ranger, NZFS, Thames. Thames file 2/0/149/70/3.
- Atkinson, IAE 1968 An ecological reconnaissance of Coppermine Island, Hen and Chicken Group. NZ Journal of Botany 6: 285-294.
- Atkinson, IAE; Bell, B D 1973 Offshore and Outlying Islands. IN: Williams, G R (ed). The Natural History of New Zealand. A H and A W Reed, Wellington.
- Atkinson, IAE 1985 Derivation of Vegetation Mapping Units for an Ecological Survey of Tongariro National Park. NZJ Bot. Vol 23 : 361-378.
- Auckland Conservancy, NZ Forest Service 1984 A guide to Coromandel State Forest Park (includes mapping of simplified forest classes). NZMS 274/1 Coromandel. Government Printer, Wellington.
- Barber, L 1985 No Easy Riches. A History of the Ohinemuri Company, Paeroa and Waihi 1885-1985.
- Bartlett, J K 1978 Parahebe catarractae (*Scrophulariaceae*) in the Kauaeranga Valley, Coromandel Peninsula, New Zealand. NZ Journal of Botany, 16: 297-80.

- Beadel, S M 1988a Assessment of the Botanical Conservation Values of Forty-Two Exploration, Prospecting and Mining Licence Applications in the Coromandel Ecological Region, Department of Conservation, Hamilton
- Beadel, S M 1988b Assessment of the Botanical Conservation Values of Four Areas in the Bay of Plenty District, Dept of Conservation. Unpub. Dept of Conservation, Rotorua.
- Beadel, S M; Regnier, C; Irving, R; Broekhuizen, P 1989 Vascular Plants of Duck Creek Mire. Tairua Forest, Opoutere.
- Bell, B D 1986 The conservation status of New Zealand wildlife. NZ Wildlife Service, Department of Internal Affairs, Wellington.
- Bell and Fraser, C 1912 Geology of the Whitianga-Tairua Subdivision. Geological Survey Bulletin No 15. New Zealand Dept Mines, Geological Survey Branch.
- Biological Resources Centre, unpublished draft Climate descriptions for Coromandel Region Department of Conservation, Wellington.
- Black, D A 1980 Ecological Areas : Central Coromandel Region. File 31/6, held Forest Research Institute, Ministry of Forestry, Rotorua.
- Black, P M 1972 Hornfelses from Paritu, Coromandel County. Journal of the Royal Society of New Zealand 2 (2) : 211-228.
- Boase, M R; Beadel, S M 1987 Checklist of the vascular plants of Mt Te Aroha, Waikato. Unpublished species list held Rotorua Botanical Society, Rotorua.
- Botany Division, Ecology Section, DSIR 1983 Vegetation of the Kauaeranga Valley. Botany Division, DSIR, Christchurch.
- Botany Division DSIR, unpublished Sand dune survey of New Zealand.
- Bridgewater, G D; Foster, B A 1984 Marine biota of the Whangamata and Tairua estuarine systems, Coromandel Peninsula. A report prepared for the Hauraki Catchment Board, Te Aroha.
- Burns, B R 1983a Ecological areas of Coromandel. Unpublished NZ Forest Service report. Auckland Conservancy file 6/0/19.
- Burns, B 1983b Waingaro Ecological Area. Unpublished, file notes, NZ Forest Service, Auckland Conservancy.

- Burns, B R 1984a Papakai Ecological Area. Auckland Conservancy. Dedicated Areas Report No. 4. Unpublished report, New Zealand Forest Service, Auckland.
- Burns, B R 1984b Kapowai Ecological Area. Auckland Conservancy Dedicated Areas Report No. 3. Unpublished report, New Zealand Forest Service, Auckland.
- Burns, B 1984c Otahu Ecological Area. Auckland Conservancy Dedicated Areas Report No. 1. Unpublished report, NZ Forest Service, Auckland..
- Burns, B 1984d Parakawai Quarry Geological Area. Auckland Conservancy Dedicated Areas Report No. 2. Unpublished report, NZ Forest Service, Auckland.
- Burns, B 1984e Manaia Forest Sanctuary. Auckland Conservancy Dedicated Areas Report No. 5. Unpublished report, NZ Forest Service, Auckland.
- Burns, B 1984f Preliminary report on vegetation of scenic coastline south of Pauanui - Part Tairua State Forest. Unpublished report held Department of Conservation, Thames.
- Burns, B R 1985a Te Tipi Ecological Area. Auckland Conservancy. Dedicated Areas Report No. 6. Unpublished report, New Zealand Forest Service, Auckland.
- Burns, B R 1985b Motutapere Ecological Area. Auckland Conservancy. Dedicated Areas Report No. 9. Unpublished report, New Zealand Forest Service, Auckland.
- Burns, B R 1985c Waiomu Ecological Area. Auckland Conservancy. Dedicated Areas Report No. 8. Unpublished report, New Zealand Forest Service, Auckland.
- Burns, B R 1985d Moehau Ecological Area. Auckland Conservancy. Dedicated Areas Report No. 7. NZ Forest Service, Auckland.
- Butcher, C 1987 A letter to the author of the present report concerning, significant insects in Coromandel; the importance of seral habitats.
- Cheeseman, T F 1925 Manual of the New Zealand Flora. Edition 2. Government Printer, Wellington.
- Clarkson, B D;
Smale, M C 1987 Moehau Range and Castle Rock field trip 28-30 November, 1986. Rotorua Botanical Society Newsletter No. 10.

Climo, F M	1983	Classification of New Zealand Arionacea (Mollusca : Pulmonata). IX. The new Genus <i>Paracharopa</i> (Charopidae). <u>National Museum of New Zealand Records 2</u> (14) : 151-161.
Climo, F M	1985	Classification of New Zealand Arionacea (Mollusca : Pulmonata). XI. The new Genus <i>Chaureopa</i> and description of a new species of <i>Paracharopa</i> Climo (Charopidae). <u>New Zealand Journal of Zoology</u> , 12 : 283-296.
Cockayne, L	1953	The vegetation of New Zealand. 3rd Reprint Edition. H R Engelmann, West Germany.
Cook, V J	1947	Descriptions of new species of <i>Scirpus</i> . <u>Transactions of the Royal Society of New Zealand</u> , 76 : 567:571.
Court, D J	1974	Botany of Shoe Island and the Slipper Island Group - Coromandel Peninsula. <u>Tane</u> 20 : 56-65.
Cranwell, L M;	1936	The occurrence of kauri in montane forest on Te Moeheu. <u>New Zealand Journal of Science and Technology xviii</u> (6): 531-543.
Crookes, M E	1963	New Zealand ferns, Edition 6. Whitcombe and Tombs, Christchurch.
Dale, R W; James, I L	1977	Forest and environment in the Kaimai Ranges. Technical Paper No. 65. Forest Research Institute, New Zealand Forest Service.
Dawson, D G Gaze, P D	1983	Ecology division submission on Kaimai-Mamaku State Forest Park draft management plan revision 1982-1992. Unpublished report, Ecology Division DSIR, Lower Hutt.
Department of Conservation	in prep	Thames Valley Fauna Survey Unit Report. Draft. Department of Conservation, Hamilton.
Department of Conservation	in prep	Wildlife resources, their habitat, status and management - Thames Valley Region. Draft report. Department of Conservation, Hamilton.
Department of Conservation unpublished		Island Survey 1972. Unpublished survey data held Dept of Conservation, Auckland
Department of Conservation unpublished(a)		Amphibian and reptile distribution scheme of New Zealand. Computer file, held Department of Conservation, Wellington.
Dept of Lands and Survey	1975	Kaimai-Mamaku Region - Proposals for a National Park

Douglas, M E; Gubb, D J	1974	The birds of Shoe Island and Slipper Island Group. <u>Tane</u> 20 : 37-41.
Druce, A P	1982	Indigenous higher plants (Gymnosperms, Psilopsids, Lycopods, Ferns, flowering plants) of Kaimai Range, S. Auckland. Unpublished species list, held Botany Division, DSIR, Taita.
Druce, A P	1983	Indigenous vascular plants of Kauaeranga Valley, and in the vicinity of Thames, Coromandel Range, SL to 2745 ft. Unpublished species list, held Botany Division, DSIR, Taita.
Ecroyd, C E; Nicholls, J L	1979	Notes on indigenous flora of Coromandel State Forest Park. Unpublished report. File 31/6 held Forest Research Institute, Rotorua.
Esler, A E	1978	Botanical features of islands near the west coast of the Coromandel Peninsula, New Zealand. <u>New Zealand Journal of Botany</u> 16 : 25-44.
Fauna Survey Unit unpublished data		Fauna Survey of Coromandel and Kaimai-Mamaku Forest Parks. Unpublished survey data, Department of Conservation, Hamilton.
Fisheries Research Centre, unpublished		Fisheries distribution data, Coromandel Ecological Region. Computer printout from Fisheries Research Centre, Ministry of Agriculture and Fisheries, Wellington.
Fleming, C A; Wodzicki, K A	1952	A census of the gannet in NZ. <u>Notornis</u> 5 (2) : 39-78.
Franklin, D A	1962	The Ericaceae in New Zealand (Gaultheria and Pernettya). <u>Transactions of the Royal Society of NZ, Botany</u> 1 : 155-173.
Fraser, C	1910	Geology of the Thames Subdivision. Geological Survey Bulletin NZ Dept of Mines, Geological Survey Branch.
Furey, L	1982	A review of the Coromandel Peninsula excavation literature. <u>NZ Archaeological Association Newsletter</u> 25(1):30-47.
Furey, L	1989	Archaeology of the Kuaotunu Peninsula. Unpublished paper presented at seminar in Whitianga.
Gardner, R O; Smith-Dodsworth, J	1985	Native vascular plants of Moehau. Auckland Botanical Society newsletter 39(1) : 6-9.
Garnock-Jones, P J Langer, H J	1980	Parahebe catarractae (Scrophulariaceae) : infraspecific taxonomy. <u>NZ Journal of Botany</u> 18 : 285-98.

- Geology Division
Dept Scientific
& Industrial Research 1988 Sites of National Geological Significance
Information from computer database.
- Given, D R; Sykes W R 1981 Rare and endangered plants of New
Williams, P A; Zealand. A H and A W Reed Ltd,
Williams, C M Wellington, Auckland.
- Given, D R; 1981 The red data book of New Zealand. Nature
Williams, G R Conservation Council, Wellington.
- Grayland, E & V 1965 Historic Coromandel, A H & A W Reed.
- Green, TGA; Jane G T 1983 Diurnal patterns of water potential in the
evergreen cloud forests of the Kaimai
Ranges, North Island, New Zealand. NZ
Journal of Botany 21: 379-389.
- Gudex, M C 1963 The native flora of Maungatautari and the
Kaimai Range, and the distribution of native
plants in the Waikato. Transactions of the
Royal Society of New Zealand 2: 173-184.
- Guthrie, B 1948- Vegetation survey of the Coromandel.
1951 Unpublished notes and draft maps held at
Thames District Office, Department of
Conservation.
- Hackwell, K R 1980 Letter on Moehau Block from DSIR Ecology
Division. Unpublished, IN: NZ Forest
Service, 1981: Environmental Assessment
Report, Other Minerals Exploration Ltd.
Prospecting Licence Application Nos 31930
and 31931 NZFR report, Auckland
Conservancy.
- Halkett, J; Sale, EV 1986 The World of the Kauri. Published in
Association with the NZ Forest Service.
- Hamlin, B G 1954 Studies in New Zealand Carices, I.
Transactions Royal Society of New Zealand
82: 49-64.
- Hamlin, B G 1957a A revision of the genus *Uncinia*
(Cyperaceae-Caricoideae) in New Zealand.
Dominion Museum Bulletin No. 19.
- Hamlin, B G 1957b Studies in New Zealand Carices 2 and 3.
Transactions Royal Society of New Zealand
84: 681-
- Hayward, B W; 1975 Lichens from the Northern Coromandel
Hayward, GC; Peninsula, New Zealand Tane 21:15-27.
Galloway, D J
- Healy, J; Schofield, 1975 Geological map of New Zealand, Sheet 5 -
J C; Thompson, B N Rotorua. NZ Geological Survey, DSIR,
Wellington.

- Henderson, J; Bartrum, J A 1913 Geology of the Aroha Subdivision. Geological Survey Bulletin No. 16. New Zealand Dept of Mines, Geological Survey Branch.
- Houghton, B F; Lloyd, E F; Keam, R F; Johnston, D M 1989 Inventory of New Zealand Geothermal Fields and Features. First edition. Geological Society of New Zealand Miscellaneous Publication No. 44
- Hume, T M; Gibb, J G 1987 The "Wooden Floor" marker bed - a new method of determining historical sedimentation rates in some New Zealand Estuaries. Journal of the Royal Society of NZ 17(1): 1-7.
- International Water fowl Research Bureau 1980 Conference on the conservation of wetlands of international importance, especially as waterfowl habitat. Cagliari, Italy November 1980.
- Isdale, A M The Tall Trees of Thames. Thames the First 100 Years.
- Isdale, A M Kauaeranga V
- Isdale, A M 1952 Coromandel history sidelights ... Gold Centenary Souvenir, October 1852-1952.
- Jane, G T; Green, TGA 1983a Episodic forest mortality in the Kaimai Ranges, North Island, New Zealand. NZ Journal of Botany 21: 21-23.
- Jane, G T; Green, TGA 1983b Morphology and incidence of landslides in the Kaimai Ranges, North Island, New Zealand. NZ Journal of Geology and Geophysics 26: 71-84.
- Jane, G T; Green, TGA 1983c Biotic influences on landslide occurrence in the Kaimai Range. NZ Journal of Geology and Geophysics Vol 26:381-393.
- Joint Campaign on Native Forests 1983 The inadequacy of the ecological reserves proposed for the Kaimai-Mamaku State Forest Park: The Joint Campaign for Native Forests responds to comments by the Forest Service.
- Kelly, G C 1980 Landscape and nature. IN: Molloy, L F 1980: Land alone endures; land use and the role of research. Discussion Paper No. 3, Soil Bureau, DSIR Wellington.
- Kelly, G C; Park, G N (eds) 1986 The New Zealand Protected Natural Areas Programme. A scientific focus. NZ Biological Resources Centre Publication No. 4. NZ Department of Scientific and Industrial Research, Wellington.
- King, M 1987 Coromandel. Metro March 1987

King, D R	1987	Species List compiled during traverse of Kaitarakihi and Hihi Tracks.
Kirk, T	1870	On the botany of the Thames Goldfields. <u>Transactions and Proceedings of the New Zealand Institute</u> , 2: 89-100.
Law, E; Park, G N; Overmars, F B	1984	Rapid ecological survey of natural areas. Biological Resources Centre for the Technical Advisory Group, Wellington.
Law, G	1982	Coromandel Peninsula and Great Barrier Island in: The First Thousand Years, Ed N Prickett.
Lee, A L	1950	Whitianga ... Auckland Province, New Zealand.
Lissaman, P pers comm		Open space covenant follow-up report. File No. S/3/13 held QEII National Trust Head Office, Wellington.
Lloyd, D G	1972	A revision of the New Zealand, Subantarctic and South American species of <i>Cotula</i> . Section <i>Leptinella</i> . <u>NZ Journal of Botany</u> 10(2): 277-372.
McCaskill, M	1949	The Coromandel Peninsula and Thames Valley.
McCraw, J D; Bell, J L	1975	Soil. IN: Dept of Lands and Survey: Land inventory survey Coromandel-Thames Counties. Includes NZ Soil Bureau Map 109.
McDowall, R M	19	Patterns in the Derivation of a New Zealand Fish Fauna. Fisheries Research Division, Ministry of Agriculture and Fisheries.
McGlone, M S	1985	Plant biogeography and the late Cenozoic history of New Zealand. <u>NZ Journal of Botany</u> 23: 723-749.
Maunder, W J	1974	Climate and climatic resources of the Waikato-Coromandel-King Country region. New Zealand Meteorological Service Miscellaneous Publication 115(7).
Mayhill, P pers comm	1989	Snail species lists for various areas on the Coromandel Peninsula.
Miller, N	1983	Puriri Scenic Reserve provisional plant species list. Unpublished list held Rotorua Botanical Society, Rotorua.
Miller, N	1984a	Cape Colville Farm Park preliminary botanical survey. Unpublished report prepared for the Department of Lands and Survey, Hamilton.

- Miller, N 1984b Orokawa Scenic Reserve botanical survey. Unpublished DSIR report prepared for the Department of Lands and Survey.
- Miller, N 1985a Matarangi Bluff Scenic Reserve and Black Jack Scenic Reserve. A brief botanical survey. Unpublished report prepared for the Department of Lands and Survey, Hamilton.
- Miller, N 1985b Opera Point Historic Reserve: botanical survey. Unpublished report prepared for the Department of Lands and Survey, Hamilton.
- Miller, N 1985c Orokawa Scenic Reserve Field Trip: 14 September 1985. Rotorua Botanical Society Newsletter No. 6.
- Miller, S T 1987 Baseline macrobiotic survey of the Whangapoua and Whitianga estuaries - Coromandel Peninsula. A report prepared for Hauraki Catchment Board, Te Aroha.
- Moore, L B 1967 The New Zealand species of *Libertia* (Iridaceae). NZ Journal of Botany 5(2) : 255-275.
- Moore, L B 1973 Botanical notes on three high peaks overlooking the Hauraki Gulf. Tane 19 : 145-153.
- Moore, L B; Cranwell, L M 1934 Induced dominance of *Microlaena avenacea* (Raoul) Hook f, in New Zealand rain forest area. Recordings Auckland Institute and Museum 1(5) : 219-239.
- Moore, P R 1976 Notes on the Hahei Islands and Adjacent Mainland, Hahei, Coromandel Peninsula, Tane 22 p 148-153.
- Myers, S C 1984 New Zealand Protected Natural Area Programme. Geographic Priorities for future survey. Biological Resources Centre.
- Newhook, F J; Dickson, E M; Bennet, K J 1971 A botanical survey of some offshore islands of the Coromandel Peninsula. Tane 17 : 97-117.
- New Zealand Forest Service 1982 Kaimai-Mamaku Forest Park Draft Management Plan Revision 1982-1992. Rotorua.
- New Zealand Soil Bureau 1954 General survey of the soils of the North Island, New Zealand. New Zealand Soil Bureau Bulletin 5.
- Nicholls, J L 1969 Untitled. Unpublished file 31/6, held Forest Research Institute, Ministry of Forestry, Rotorua.

- Nicholls, J L 1972 Proposed Scenic Reserves: Port Charles-Waikawau Bay. File 31/6, held Forest Research Institute, Ministry of Forestry, Rotorua.
- Nicholls, J L 1977 Existing and proposed Scientific Reserves in the indigenous forests of Coromandel Region. Unpublished report, file 31/6, held Forest Research Institute, Ministry of Forestry, Rotorua.
- Nicholls, J L 1979 Introductory notes on proposed ecological areas in State Forests of the Thames and Tairua ecological districts, Coromandel region. Scientific Co-ordinating Committee for Beech Research. File 31/6, held Forest Research Institute, Ministry of Forestry, Rotorua.
- Nicholls, J L 1980a Kauri-hard beech forests, North and South Auckland Land Districts. A letter to the Managing Director, Henderson and Pollard Ltd, Auckland. Held on file 31/6, Forest Research Institute, Ministry of Forestry, Rotorua.
- Nicholls, J L 1980b Ecological areas: Central Coromandel Region. Unpublished report File 31/6, held Forest Research Institute, Ministry of Forestry, Rotorua.
- Nicholls, J L 1983a Forest Service Scientific Reserves Advisory Committee: "Advance information for Tauranga meeting, November 1983. File 31/6, held Forest Research Institute, Ministry of Forestry, Rotorua.
- Nicholls, J L 1983b Kaimai-Mamaku State Forest Park. Concise rationales of extra scientific reserve proposals. File 31/6, held Forest Research Institute, Ministry of Forestry, Rotorua.
- Nicholls, J L 1985 Forest types of northern half of Kaimai-Mamaku State Forest Park and adjoining or enclosed scenic reserves and Maori land. Descriptions and Map. Unpublished file 31/6 held Forest Research Institute, Ministry of Forestry, Rotorua.
- Ogle, C C 1976 The effect of pines on the diversity of indigenous species. Observations on sand dunes at Opoutere, Coromandel Peninsula. Wellington Botanical Society Bulletin 39.
- Oliver, W R B 1929 A revision of the genus *Dracophyllum*. Transactions of the New Zealand Institute 59: 678-714.

Orchard, A E	1975	Taxonomic revisions in the Family Haloragaceae I. The genus Halorgis, Haloragodendron, Glischrocaryon, Meziella and Gonocarpus. <u>Bulletin of the Auckland Institute and Museum</u> 10: 1-299.
Orchard, A E	1979	Myriophyllum (Haloragaceae) in Australasia, New Zealand: A revision of the genus and a synopsis of the family. <u>Brunonian</u> 2: 248-87.
Parris, B S	1972	The genus Doodia R. Br. (Nechaceae: Filicales) in New Zealand. <u>NZ Journal of Botany</u> 10: 585-604.
Penny, S F	1988	Freshwater Survey of Stream in the Coromandel Ecological Region (unpub) Department of Conservation.
Priestley, R; Squire, R; Vaughan, E Rasch, G;	1989 1989	New Zealand Landform Inventory First Approximation.
Raven, P H; Raven, T E	1976	The genus Epilobium (Onagraceae) in Australasia: A systematic and evolutionary study. New Zealand Department of Scientific and Industrial Research Bulletin 216. Botany Division, DSIR, Christchurch.
Reader's Digest	1985	Reader's Digest complete book of New Zealand birds. Reader's Digest, Sydney.
Reed, A H	1972	The Gumdiggers, A H & A W Reed.
Regnier, C E	1987	Indigenous flora and vegetation survey and assessment. Golden Cross Technical Report No. 11. Prepared on contract to Applied Geology Associates Limited for Cyperus Minerals New Zealand Limited, Waihi.
Regnier, C E	1987	Coromandel Ecological Region (Mainland Ecological Districts) Protected Natural Areas Programme Phase 1. Compilation and Assessment of Ecological Information.
Regnier, C E; Courtney, S P; Wiessing, M I	1988	Pukeamaru Ecological District : Draft survey report for the Protected Natural Areas Programme. Prepared for Department of Lands and Survey, Wellington.
Rowland, M J		Investigations of Two Sites on Slipper Island. Tane.
Schofield, J C	1973	Geological map of New Zealand, Sheet 3, Auckland. New Zealand Geological Survey, Department of Scientific and Industrial Research, 1967, reprinted 1973.
Simpson, R A	1955	This is Kuaotunu, Thames Star Co Ltd.

- Skinner, DNB 1976 Geological map of New Zealand, Sheet N40 and pts N35, N36 and N39: Northern Coromandel. NZ Geological Survey, DSIR, Wellington.
- Skinner, DNB 1981 The geological significance of the Moehau Range. IN: NZ Forest Service (1982): Environmental Assessment Report, Otter Minerals Exploration Ltd, Prospecting Licence Application Nos 31930 and 31931. NZ Forest Service Report, Auckland Conservancy.
- Skinner, DNB 1983 Geological features - Kapowai Ecological Area. Unpublished report NZ Forest Service, Auckland.
- Skinner, DNB 1986 Neogene volcanism in the Hauraki Volcanic Region. Transactions of the Royal Society of NZ (Geology) 23:21-47.
- Smith-Dodsworth, J 1985a Native vascular plants of Pinnacle rock (Motutohetohe), Coromandel Range. Unpublished species list.
- Smith-Dodsworth, J 1985b Vascular plants of Castle Rock track and summit, Coromandel. Unpublished species list.
- Smith-Dodsworth, J 1986 Puriri Reserve Field Trip: 2 November 1986. Rotorua Botanical Society Newsletter No. 9.
- Smith-Dodsworth, J un-dated Native vascular plants of Long Bay Reserve, Coromandel. Unpublished species list.
- Smith-Dodsworth, J un-dated Vascular plants of the Mt Kaipawa track and ridge, Coromandel. Unpublished (b) species list.
- Smith-Dodsworth, J; Gardner, R O 1985 Native vascular flora of the Karangahake Gorge (Waihi). Unpublished species list.
- Speed, H J; Bradfield, PMF; King, D R; Montgomery, P J 1988 Survey for Kokako (*Callecas cinerea wilsonii*) on the Coromandel Peninsula. Dept of Conservation, Maniapoto District.
- Stengs, H M 1978 Vegetation change along an altitudinal gradient Wairakau Ridge, Kaimai Range, New Zealand. Unpublished M.Sc. thesis, University of Waikato, Hamilton.
- Towns, D R 1974 A note on the lizards of the Slipper Island Group. Tane 20: 35-36.

- Towns, D R; Daugherty C H; Newman, D G 1985 An overview of the ecological biogeography of the New Zealand Lizards (Gekkonidae, Scincidae). IN: Biology of Australasian frogs and reptiles. Grigg, G; Shine, R; Ehmann, H (editors). Royal Zoological Society of New South Wales.
- Wallace, S W 1988 Distribution Status of the North Island Kokako in the Eastern Region. Dept of Consdrvation, Eastern Region. Technical Report Series No. 5.
- Wardle, P 1966 Biological flora of New Zealand 1, *Weinmannia racemosa* Linn F (Cunoniaceae). Kamahi. NZ Journal of Botany 4(1): 114-131.
- Wassilieff, M; Timmins, S (compilers) 1984 Register of Protected Natural Areas in New Zealand. Department of Lands and Survey, Wellington.
- Whitton, B A 1987 A letter dated 10 March 1987 to Dr S Penny (Freshwater biologist) concerning the values of the Sparrow Stream, a tributary of the Mahakirau River, Thames Ecological District.
- Wilson, A D 1980 Soils of Piako County, North Island, New Zealand. NZ Soil Survey Report 39, NZ Soil Bureau DSIR, Wellington.
- Wright, A E 1974 Botany of Shoe Island and the Slipper Island Group. Part II : The ferns and fern allies. Tane 20: 66-71.
- Wright, A E 1975 The vegetation of the Mt Maungatawhiri area, Coromandel Peninsula. Tane 21: 3-14.

APPENDIX I

Vegetation Types

1. Eelgrass
2. Mangrove
3. Spinifex - shorebindweed sandfield
4. Pohuehue - knotted sedge rush-vineland
5. *Juncus maritimus* - *Leptocarpus similis* rushland
6. Manuka/*Leptocarpus similis* rush-shrubland
7. Iceplant rockfield (not used 1988/89)
8. *Suaeda* herbfield (not used 1988/89)
9. Coastal flax cliff community (not used 1988/89)
10. Pohutukawa rock-treeland
11. Pohutukawa-broadleaved species forest
12. Pohutukawa modified forest
13. Manuka/*Baumea* species sedge-shrubland
14. Raupo flax reedland
15. Lowland swamp forest
 - (a) Swamp maire
 - (b) Kahikatea
 - (c) Cabbage tree
16. Alluvial terrace forest
 - (a) Podocarp-broadleaved
 - (b) Podocarp
17. Taraire-broadleaved species forest (not used 1988/89)
18. Manuka scrub
19. Coastal broadleaved species scrub
20. Lowland broadleaved species scrub
21. Rewarewa/manuka scrub (Not used 1988/89)
22. Manuka-broadleaved species scrub
23. Kanuka-manuka scrub (Not used 1988/89)
24. Kanuka scrub or forest
25. Kanuka-broadleaved species forest
26. Kauri-tanekaha forest
27. Hardbeech-kauri forest
28. (Rata-podocarp)/tawa forest
29. (Rata)/tawa modified forest
30. (Rata-podocarp)/towai-tawa forest

31. Towai-tawa forest
32. Towai scrub or forest
33. Kamahi scrub or forest (new type 1988/89)
34. Tawari-towai-tawheowheo scrub
35. Swamp maire-towai montane bog forest
36. Montane conifer forest (new type 1988/89)
37. Beech-tawari forest (new type 1988/89)
38. Kanono scrub (new type 1988/89)
39. Tussockland
40. Upland rocky bluff community

VEGETATION TYPES

1. **EELGRASS TIDAL FLAT** Found in Study Areas
SA 16,22,25,40,49,52,63,64,67
[Alt-0m]

Beds consisting solely of *Zostera* (eelgrass) occur on mudflats in the shallower intertidal zone of the major harbours. The beds may be found to the seaward side of mangroves, occasionally growing under shorter mangroves, but also occur as large 'islands' between channels.

Modification of this type must occur from time to time as a result of channel changes. Siltation from human activities inland may be an influence. In Whangapoua Harbour there is evidence of swan grazing.

2. **MANGROVE STAND** SA 6,8,10,11,12,16,22,25,37,40,41,52,63,64
[Alt 0-1m]

Pure stands of mangroves from 1-6m high, often forming a complete canopy over a muddy substrate occur in the upper intertidal zone to seaward of the rush zone. They are found in shallower, more sheltered harbours and estuaries.

The ground tier in this type usually consists solely of mangrove pneumatophores, but does sometimes include eelgrass (*Zostera* sp).

Near the harbour mouth at Whangapoua, there is an 'island' of mangrove on clean sand, with an understorey of *Hormosira banksii* unattached to the substrate. There is also a small area of this type in the Purangi Estuary.

Modifications: In some harbours mangroves are restricted to narrow marginal bands due to reclamation. In other harbours modification by drainage, siltation, weed invasion, fencing, tracking and dumping of rubbish is common.

Dead mangroves were observed in some areas. The cause of their death is unknown.

3. **SPINIFEX-SHOREBINDWEED SANDFIELD**
SA 1,8,12,13,16,17,18,40,41,43,49,52,62,
63, 67
[Alt 0.5-10m]

This is a pioneer Spinifex-dominated community found on exposed and unstable foredunes of east coast beaches in Colville, Tairua and Waihi districts.

Young dunes and foredunes of larger systems often have a sparse covering of Spinifex alone. Other dune areas have the codominants *Calystegia soldanella* and *Lagurus ovatus*. Pingao grows down the faces of the front dunes on some beaches.

Frequent Associates: Catsear, hawkbit, fleabane, *Oxalis corniculata*, *Cakile maritima* and *Lobelia anceps* (along strandline), *Carex testacea*, *Carex pumila*, Buffalo grass, *Paspalum vaginatum*, *Carex geminata*, *C. virgata* (near creek outlets).

Plants of Note: *Pimelea arenaria*, a plant of indeterminate status occurs at Whangamata and Cooks Beach. Pingao (*Desmoschoenus spiralis*), a rare species occurs in a clumped distribution on many beaches. There are reports that this may have been planted over the last 30 years.

Modifications: Marram grass and *Lupinus arboreus* and *Melilotis indica* can form dense invasive patches, causing stabilisation of the dunes, leading to disappearance of the type. Stock and rabbit grazing.

Modification of dunes for farming and residential purposes occurs on every beach except Waikawau, Otama and parts of Hotwater Beach and leads to tracking, erosion, grazing and invasion by exotics eg kikuyu, pasture grasses, *Carpobrotus edulis*.

4. POHUEHUE - KNOTTED SEDGE RUSH-VINELAND

SA 8,12,17,18?,43,67
[Alt 5-10m]

This type is a dense tangle of pohuehue (*Muehlenbeckia complexa*) with various other species occurring on sheltered semi-stabilised sand dunes just inland of exposed beach systems (Type 3) on the East Coast of Colville, Tairua and Waihi districts.

Frequent Associates: *Scirpus nodosus*, *Leptocarpus similis*, Hawkebit, Fleabane, Grasses (all scattered throughout). *Coprosma acerosa* (clumped on relatively unmodified dunes), *Lupinus arboreus*, marram grass (both invasive). The following species are found occasionally: *Spinifex scriceus*, *Calystegia soldanella*, *Cassinia leptophylla*, *Phormium tenax*, Pohutukawa, *Cordyline australis*, *Pinus* spp, Wattle spp.

Modifications: Tends to have a high component of weed species and therefore it is possibly induced over part of the dunes which would normally be Type 3. Human influence is, as in 3, or more extreme and the type has often been effectively removed by flattening, grassing, pine plantations or subdivision.

5. JUNCUS MARITIMUS - LEPTOCARPUS SIMILIS RUSHLAND

SA 6,11,12,16,17,22,25,40,41,49,52,53,63, 64,67,68
[Alt 0-1m]

This is a saltmarsh zone of rush-type species between the sea and the terrestrial or freshwater wetland zone in estuaries and harbours. It is dominated by *Juncus maritimus* and *Leptocarpus similis*, occasionally locally by *Baumea juncea*. It tends to form a mosaic with areas of mat vegetation, commonly *Samolus repens*, *Selliera radicans*, and/or *Sarcocornia quinqueflora*.

Frequent associates: *Apium prostratum* (fineleaved form), *Lobelia anceps*, *Stipa stipoides*, mangrove seedlings, and where freshwater channels enter this type, *Scirpus medianus*, and *Paspalum vaginatum*.

Plants of Note: *Mimulus repens* in the Otama estuary.

Modifications: Invasive and reclaiming species, *Spartina anglica* x *townsendii* and *Paspalum vaginatum*. Cattle pugging and browse are often severe. Manmade drains concentrate freshwater input.

6. MANUKA/LEPTOCARPUS SIMILIS RUSH-SHRUBLAND

SA 8,10,11,12,16,17,22,25,40,41,49,52,53, 63,64,67,68
[Alt 0.5-1m]

These are rush-shrublands occurring just above sea level but still in saline conditions, on landward side of rush zone in estuaries and harbours.

The type varies from shrublands (0.5 to 3m canopy height) dominated by manuka and/or marsh ribbonwood to rushlands of *Leptocarpus similis* with or without *Baumea juncea*, with scattered shrub emergents.

Frequent associates: *Leucopogon fasciculatus*, *Cyathodes juniperina*, *Olearia solandri*, *Coprosma propinqua* x *robusta*, *Scirpus nodosus*, *Juncus maritimus*, *Stipa stipoides*, *Apium prostratum*, *Lobelia anceps*, *Selliera radicans*, *Samolus repens*, *Sarcocornia quinqueflora*, *Cotula coronopifolia*, *Isolepis cernuas*, *Atriplex hastata*, buffalo grass, *Muehlenbeckia complexa*.

Plants of Note: *Empodisma minus* in Otahu estuary - a new Coromandel ER record.

Modifications: Weed species are occasionally a problem (especially grasses). Buffalo grass, *Lotus pedunculatus*, *Gladiolus undulatus* (in Whangapoua and Colville). Cattle pugging and browse frequent. Vehicle tracks, drainage channels.

7. **ICEPLANT ROCKFIELD** SA 3,18,20,16
[Alt 0-6m]

This type occurs in the splash zone of exposed cliffs and offshore rock stacks and islands, as scattered herbaceous and mat-forming plants with occasional stunted pohutukawa, ngaio, *Coprosma repens* and *Pittosporum crassifolium*.

NB: Incorporated into pohutukawa rock treeland in 88/89.

Frequent Associates: On more exposed sites:
Disphyma australe, *Samolus repens*, *Plantago coronopus*,
Senecio lautus, *Sarcocornia quinqueflora*, *Crassula sieberiana*

In less exposed areas there is:
Astelia banksii, *Pseudopanax lessonii*, *Dichondra repens*,
Lagurus ovatus, *Scirpus nodosus*.

Plants of Note: *Asplenium flaccidum* var *haurakiensis*

Modification: Largely unmodified. Subject to severe natural battering by sea and wind.

8. **SUAEDA HERBFIELD** [Alt 1m]

This type is only known to occur in a slack on a shingle beach between SH 25 and the ocean (Hauraki Gulf) at the Waiorotoroto River Mouth. *Suaeda novae zelandiae* constitutes over 50% of the cover. Was probably more common prior to introduction of aggressive adventive plants.

Frequent Associates: *Atriplex hastata*, *Sarcocornia quinqueflora*, *Calystegia soldanella*, *Cotula coronopifolia*, *Apium prostratum*, *Aster subulatus*, grasses

Area Covered: 10m x 35m

Plants of Note: *Suaeda novae-zelandiae* - not recorded on the Coromandel previously.

Modifications: Shingle has been bulldozed from the area - a continued threat. Very small area.

9. **COASTAL FLAX CLIFF COMMUNITY**
SA 1,2,3,17,18,13,11,20
[Alt 6-100m]

This is flaxland on exposed coastal cliffs. The best example of this type occurs at the northern tip of Cape Colville Farm Park to the west of Fletcher Bay.

Frequent Associates: *Leptospermum scoparium* and *Pteridium esculentum*. Grasses with occasional *Cordyline australis* and stunted broadleaved shrubs

In other areas this type tends to be merely flax over grasses as a result of grazing.

Plants of Note:

Modification: Grazing by goats as well as cattle and sheep.

10. **POHUTUKAWA ROCK-TREELAND**
SA 1,2,3,5,6,8,11,13,17,18,20,22,25,33,40
41,42,43,44,49,51,52,63,67,68
[Alt 6-100m]

Pohutukawa forest on coastal cliffs and very steep hillslopes within spray zone. Canopy is usually very open with flax and bare rock a common feature. There are a few epiphytes on the pohutukawa. Flax can be replaced by or be codominant with kawakawa, rangiora or *Astelia banksii*.

Incorporates Iceplant rockfield for 88/89.

Frequent Associates: (On ground - scattered)
Pittosporum crassifolium, *Asplenium flaccidum* ssp *aurakiensis*, *Coprosma repens*, *Apium prostratum*, *Dichondra repens*, *Peperomia urvilleana*, *Asplenium oblongifolium*, *Senecio lautus*, *Doodia media*, *Plantago coronopus*.

Ngaio is recorded on offshore islands in Tairua and Colville ED and a few mainland localities.

Plants of Note: *Hymenanthera novae-zelandiae* on offshore islands in Tairua ED.

Modification: Pasture grasses common.
 Often browsed - goats and stock - possums a future threat.

11. POHUTUKAWA - BROADLEAVED SPECIES FOREST

SA 1,3,6,9,11,12,13,14,20,35,40,43,44,51,
 52,63,64,67
 [Alt 5-280m]

This is pohutukawa forest with a canopy height range of 8-20m occurring on coastal hillslopes. The percentage of pohutukawa varies from dominance in some areas to a forest of mixed canopy species eg puriri, kohekohe, tawa, nikau, silverfern and mamaku.

Frequent Associates: In some areas other species are locally common - white maire, kowhai, wharangi, karaka, titoki, mangaeo.

Pittosporum umbellatum, karo. The understorey usually comprises rangiora, hangehange, kohekohe, silver fern, kawakawa, and saplings of canopy species. *Rhabdothermus solandri* is often present. The ground cover varies, being thick in places and comprising *Gahnia lacera*, ferns (*Adiantum hispidulum*, *A.cunninghamii*, *Asplenium oblongifolium*, *Polystichum richardii*, *Doodia media*, *Anarthropteris tenella*, *Lastreopsis velutina*, *L.microsora*), *Uncinia* species, *Carex* species and seedlings. Epiphytes are present in moderate numbers but there are few lianes. Species include *Collispermum hastatum*, *Pyrrosia eleagnifolia*, *Phymatosorus diversifolius*, *Astelia banksii*, *Pittosporum cornifolium*.

Plants of Note: Tawapou - present in very small numbers at Double Bay (Waitaia), coast near Fantail Bay, Manaia Harbour headland, Opoutere, Motueka Is, Hahei, Cathedral Cove. *Pisonia brunonianam* - present on Motueka Island.

Modification: Severe grazing by goats and stock. Past burning. Introduced trees and weeds. Coastal subdivision. At higher altitudes and lower in sheltered areas, this type grades into the lowland zone forests, the transition zone characterised by northern rata - pohutukawa hybrids and the increasing dominance of tawa.

12. POHUTUKAWA MODIFIED FOREST

SA 1,2,3,4,6,8,11,12,13,20,25,28,33,40,41,
 43,49,51,62,67,68,71,77
 [Alt 5-280m]

This is a secondary coastal and semi-coastal forest more modified than Type 11. Species may be largely the same, but with kanuka and/or manuka and rewarewa common components, sometimes dominant. Silver fern or mamaku are very common canopy and understorey species. The type may be modified and consist of pohutukawa over exotic or coastal species, or pasture grasses, commonly occurring along coastal roadsides and urban estuarine margins. The type includes

- (a) small coastal and semi-coastal forest remnants of species such as puriri, kohekohe, wharangi and tawa, not always including pohutukawa; and

- (b) stands of dense-canopied almost pure pohutukawa as on Penguin and Rabbit Islands and Onemana SA. Canopy height is as for Type 11, but understorey species will grow to a maximum of 15m.

Plants of note and modification as for Type 11.

13. MANUKA/BAUMEA SPP SEDGE-SHRUBLAND

SA 8,11,12,21a,25,51,53,64,65,76
[Alt 0.25-20m]

This is a freshwater wetland vegetation type which may vary from intermediate to high acidity, and ranges from manuka dominated sedge-shrubland or *Baumea rubiginosa* dominated sedgeland to *Baumea teretifolia* - *Schoenus brevifolius* - *Gleichenia dicarpa* sedgeland. It occurs on acid substrate and peatland, often at the inland end of estuary arms which are beyond tidal or saline influence. Small and less diverse pockets occur on alluvial flats inland eg Waiharakeke River.

Frequent Associates:

In slightly more fertile conditions often near edges of streams: *Gleichenia dicarpa*, *Baumea rubiginosa*, *Isachne globosa*, *Phormium tenax*, *Coprosma tenuicaulis*, *C. robusta*, *Cordyline australis*, *Eleocharis acuta*, *E. sphacelata*, *Typha orientalis*, *Carex geminata*, *C. virgata*. In more acidic conditions: *Drosera binata*, *Gleichenia dicarpa*, *Blechnum minus*, *Sphagnum cristatum*, *Baumea teretifolia*, *B. tenax*, *B. juncea*. The most acid conditions have the following species: *Baumea teretifolia*, *Schoenus brevifolius*, *Gleichenia dicarpa*, *Tetraria capillaris*.

Plants of Note:

Utricularia novae-zelandiae, *Schizaea capillaris* and *Schizaea bifida* at Duck Creek along small freshwater stream entering bog. *Empodisma minus* - found at Otahu Estuary and Duck Creek with *Baumea juncea*.

Modifications:

Drainage, channelling leads to breakdown of peat and higher fertility allowing invasion by exotics eg pussy willow and *Lotus pedunculatus*. Many former sites have been drained and are now in pasture. Roothing at Waingaro across wetland in two places has damming effect, helping to maintain water levels.

14. RAUPO-FLAX REEDLAND

SA 8,10,16,18, 21a,29,37,36,44,53,59,64,76
[Alt 0.5 -]

This is a fertile freshwater wetland type dominated by raupo with varying amounts of flax, which occurs in poorly drained areas eg old river channels, streams dammed by roading or natural causes eg slipping, estuary and bog margins. Canopy height is from 1 to 3 metres.

Frequent Associates:

Baumea rubiginosa, *Isachne globosa*, *Blechnum minus*, *Carex geminata*, *Cyperus ustulatus*, *Juncus* spp, *Calystegia sepium*, *Cortaderia fulvida*, *Baumea articulata*, *Cordyline australis*, *Manuka*, *Coprosma robusta*, *C. tenuicaulis*, *Pteridium esculentum*.

Kowhai are found on drier hummocks and river banks. *Syzygium maire* and kahikatea poles are found on forested edges.

Plants of Note:

Syzygium maire

Modifications:

Pussy willow
Lotus pedunculatus
Blackberry
Cattle pugging (SA 18)
Downstream draining, lowering of watertable (SA 10).
Siltation.

15. LOWLAND SWAMP FOREST

Three main types of swamp forest were recognised in the Coromandel Ecological Region.

(a) KAHIKATEA SWAMP FOREST

SA 11,18a,28,36,35
[Alt 5m - 20m]

The only remaining wet kahikatea forest in the Coromandel ER occurs on the river flats behind Kennedy Bay at 10m asl. Kahikatea is dominant with occasional pukatea, puriri, kohekohe, northern rata.

Associates of nikau, *Syzygium maire*, pukatea, karaka and *Cordyline australis* with several other broadleaved species in the understorey. Diverse ground cover up to 1m high includes ferns: *Deparia petersenii*, *Blechnum* species; sedges; *Galinia xanthocarpa* and *Carex* spp; shrubs: *Coprosma rhamnoides* and *C.tenuicaulis*, and herbs. Epiphytes and lianes are diverse and common.

(b) **SYZYGIUM MAIRE SWAMP FOREST**
SA 19a,28,36,52
[Alt 15-160m]

Occurs on alluvial terraces generally at the interface between the hillslope and terrace (Kauaeranga at 160m) at wetland edges (Ohui), and on basin margins (Russeks and Whenuakite). It is a rare type. The canopy is from 10-15 metres high and comprises 50-75% swamp maire. The substrate is wet, unless drained.

Frequent Associates: In the canopy are towai, nikau, pukatea, kahikatea and mamaku. In the understorey there is *Dicksonia squarrosa*, *Coprosma grandifolia*, *C.tenuicaulis*, pigeonwood, mahoe, *Geniostoma rupestris*.

Ground cover includes *Blechnum capense*, *B.chambersii*, *B.minus*, *B.filiforme*, *Pneumatopteris pennigera*, *Uncinia uncinata*, *Coprosma tenuicaulis*, *Pseudopanax arboreus*, mosses and liverworts. Frequent epiphytes and lianes are supplejack, kiekie, *Hymenophyllum* spp, mosses and leafy liverworts

Modifications: Draining, roading, farming, pine forestry

The swamp maire forest in the Kauaeranga should survive as it is still wet, though much smaller in size than previously and there is some regeneration. Ohui has been drained and swamp maire will not regenerate there.

(c) **CABBAGE TREE FOREST**
SA 41,49,53
[Alt 5-15m]

This type is also unusual nowadays but must have been more extensive in the past. It occurs on wet alluvial terraces, for example along the Tairua River next to SH 25. There has been much modification by exotics and draining. It comprises 50-75% *Cordyline australis* with mamaku, mahoe, kanuka, *Salix fragilis* and privet, over silver fern and privet with a ground cover of ferns and blackberry. Flax and manuka are often present for example near Woody Stream.

At Purangi a marginal band of kowhai is included in this type.

Frequent associates: *Phormium tenax*, mahoe, kanuka, *Coprosma robusta*, *Geniostoma rupestris*, *Coprosma robusta* x *propinqua*, *Cyathea dealbata*, *C.medullaris*, *Blechnum capense*, *B.filiforme*, *Phymatosorus diversifolius*, *Myrsine australis*, *Uncinia uncinata*, privet

Plants of Note:

Modifications: Invasion by exotics, drainage, roading, removal of kanuka for firewood and maimais, stock grazing

16. ALLUVIAL TERRACE FOREST

This is an ecological class divided into two types according to landform and compositional differences.

(a) **PODOCARP - BROADLEAVED ALLUVIAL TERRACE FOREST**
SA 1,39,45,59
[Alt 5-100m]

This subtype includes remnant alluvial forests and grazed treelands on terraces adjacent to rivers. Canopy height 10-25m. Species dominance varies, they may be predominantly podocarp (particularly totara, matai and kahikatea).

Frequent Associates: Kanuka and lowland broadleaved species such as kowhai, karaka, puriri, kohekohe, titoki, tawa, taraire with scattered podocarps often influenced by proximity to coast.

Modifications: Pasture grasses and blackberries. All examples of this type surveyed were heavily grazed with no significant understorey or groundcover other than weeds.

- (b) **PODOCARP FOREST** SA 72,73,74
[Alt 20-200m]

This type consists of dense podocarp stands of rimu, kahikatea, totara, miro, tanekaha and kauri in varying proportions. It occurs on steep incised river banks cut in alluvial terraces in the Waitekauri Valley and as remnants along the Taieri Stream, Karangahake and Waitawheta Rivers. The two subtypes occur only as very small areas, but must have been much more widespread in the past.

Frequent associates: Rewarewa, swamp maire at interface between bank and stream bed. Also pukatea, mahoe, mamaku, five finger, *Dicksonia squarrosa*, mapou, putaputaweta, nikau and tawa.

Modifications: Slipping because of grazing and clearing of surrounding areas. Grazing

17. **TARAIRE BROAD-LEAVED SPECIES FOREST**
SA 3,2,15,20,27,26,28,7,8,13
[Alt 50-300m]

Canopy height 10-18m

This is forest in which taraire is common or dominant in the canopy. It occurs on coastal and semicoastal hillslopes in Colville and Thames Ecological Districts but was not seen further south.

Frequent associates: Kohekohe, tawa, silverfern in the canopy, northern rata emergents. Epiphytes are those found in coastal and lowland types. Where taraire is dominant the understorey and ground tier are usually sparse with a thick taraire leaf litter.

Plants of Note: *Yoania australis* (orchid) grows under taraire in Kennedy Bay and probably elsewhere, though none was seen by survey parties.

Modifications: Grazing, human removal of tree ferns in Stony Bay.

18. **MANUKA SCRUB** SA 3,11,14,15,20,26,28,29,33,35,4,7,8,46,
47,48,49,59,63,64,65,66,70
[Alt 20-550m]

This is a secondary vegetation type dominated by manuka, varying in canopy height from 0.5-4m. It occurs on hillslopes and ridges from coastal to montane zones in all ecological districts except in Te Aroha ED where it is scarce.

This type varies from a single tiered (.5-1m) "gumland" type scrub on impoverished soils through successional states to a tall (up to 4m) manuka-dominated canopy with dense undergrowth. This type often shows signs of regeneration to the kauri-tanekaha type on ridges, broadleaved forest or kanuka forest.

Frequent Associates: Bracken, *Coprosma grandifolia*, *C. macrocarpa*, rangiora, hangehange, *Pittosporum tenuifolium*, *Pseudopanax arboreus*, mahoe, *Lycopodium volubile*, *L. deuterodensum*, *Blechnum capense*, *Schoenus tendo*. Frequent are rewarewa, fivefinger, mingimingi, *Pittosporum umbellatum*, *Pseudopanax discolor*, towai, mahoe, silver fern, *Gahnia pauciflora*, *G. setifolia*, *Pomaderris ericifolia*, *Morelotia affinis*, kumeraho, *P. rugosa* (Coromandel and Tairua), *Olearia townsonii*, heketara and toru.

Plants of Note: *Prasophyllum* spp and other orchids
Loxoma cunninghamii
Schizaea spp
Korthalsella sp - Blackjack Scenic Reserve (JSD)

Modification: Invasion by hakea, wattles, pines, gorse. Continued burning usually has led to soil impoverishment and therefore to gumland type. Grazing, pigs and goats

19. COASTAL BROADLEAVED SPECIES SCRUB OR SHRUBLAND

SA 23,3,6,8,10,11,13,15,16,20,22,25,
 33,35,41,64,68
 [Alt 0-50m]

This includes coastal headland and steep hillslope seral vegetation induced by burning or clearing. It is a mixture of broadleaved species where kanuka and manuka are not a major feature. Canopy height 1-8m.

Frequent associates: Fivefinger, *Cyathea dealbata*, *Coprosma macrocarpa*, *C.robusta*, karō, *Olearia rani*, *Pittosporum umbellatum*, *Hebe pubescens*, cabbage tree, hangehange, mapou, mamaku, mingimingi, mahoe, kawakawa and occasional pohutukawa, kanuka and manuka.

Groundcover species are *Gahnia lacera*, *Dianella nigra*, *Lepidosperma laterale*, *Doodia media*, *Blechnum filiforme* and *Adiantum cunninghamii*. A subtype of dense *Pomaderris rugosa* occurs on headlands around Manaia, Te Kouma and Coromandel and Tairua Harbours. Associated species are as above. *Hebe pubescens* is sometimes dominant on dry rocky cliffs just above sea level around Manaia Harbour. *Pittosporum umbellatum* is dominant on dry clay banks on the steep coast north of Thames and localised on the coast in Tairua.

20. BROADLEAVED SPECIES SCRUB

SA 2,3,6,10,8,11,13,15,16,22,25,36,31,35,
 31,32,60,73,74,78
 [Alt 0-350m]

This is a secondary successional type comprising a mixture of broadleaved species with or without high proportions of treefern in the canopy, and where kanuka and/or manuka are not a major feature.

This type occurs mainly in gullies and on hillslopes in regenerating scrub in the lowland zone.

Frequent associates: A large number of species occurs in this type including fivefinger, *Cyathea dealbata*, *C.medullaris*, *Coprosma robusta*, *C.lucida*, *Pittosporum umbellatum*, putaputaweta, *P.huttonianum* (inland Tairua-Waihi), *P.tenuifolium*, *Olearia furfuracea*, *O.townsonii* (east coast from Kuaotunu south), *O.rani*, *H.stricta*, *H.macrocarpa*, hangehange, *Myrsine australis*, mingimingi, rangiora, mahoe, wineberry (on recently disturbed sites), toru, manuka, kanuka and mairehau (may be dominant on slopes - see also towai scrub, kanuka forest, upland rocky bluff communities). May include kauri-tanekaha regeneration on ridges. Rewarewa (may be dominant in Tairua and Waihi districts).

Plants of Note: *Pomaderris rugosa*
Loxoma cunninghamii

21. REWAREWA/MANUKA SCRUB

SA 21,33,35,45 (64)(69)

A manuka-dominant scrub (canopy height 2-7m) with emergent rewarewa (up to 12m) common or occasional. Occurs from 100-400m in Thames District and rarely in Colville District.

Frequent associates: Towai, toru, five finger, kanono, karamu, hinau, *Olearia rani*, tutu, *Cyathea medullaris* and kauri (on ridges in the canopy), *Olearia furfuracea*, mingimingi, *Blechnum capense*, and *Lycopodium deuterodensum*. Because this is a regenerating type more advanced than manuka scrub occasional emergents of future forest type occur eg rimu, kauri, mangao.

Modifications: Gorse and pines in more recently disturbed sites eg SA 33, pigs, prospecting roads

22. MANUKA-BROADLEAVED SPECIES SCRUB OR FOREST

SA 7,8,13,15,21,22,23,26,28,31,32,35,44,
46,47,49,51,56,60,64,69
[Alt 5-400m]

This is a manuka-dominant scrub type with broadleaved species also in the canopy. Rewarewa may or may not be present, being less common in Colville district, and becoming very common in Tairua and Waihi districts. It is generally emergent because of its habit and fast growth. The type occurs from coastal to lowland zones covering ridges and gully systems and there is a great variation in composition.

Frequent associates: Towai, rewarewa, five finger, *Pseudopanax discolor* (Tairua and Waihi EDs), *Coprosma robusta*, mapou, *Cyathea dealbata*, *C. medullaris*, *Dicksonia squarrosa*, *Olearia furfuracea*, *O. townsonii* - from Kuaotunu south, *P. crassifolius*, rangiora, mingimingi, *Olearia rani*, putaputaweta, hinau and tutu. Kauri and tanekaha regeneration common on ridges. Pukatea is found in wetter areas, occasional swamp maire and regenerating podocarps. A diverse understorey of above species with *Lycopodium species*, *Gahnia*, *Blechnum* sp "blackspot" *capense*, kiekie.

Plants of Note: *Olearia albida* - in very small amounts along coast from Wilsons Bay to Tapu.

Modifications: Invasive exotics - gorse, pines etc though the type often presents a continuous canopy which discourages exotics. Pigs, goats, browsing, grazing. Prospecting roads.

23. KANUKA-MANUKA FOREST

SA 3,4,5,6,8,10,11,12,15,28,29
[Alt 5-300 m]

Secondary type where kanuka and manuka occur together in the canopy (3-8.0m) with one or the other being dominant (with treefern and broadleaved species common in the associated gullies). Occurs on lowland ridges and hillslopes.

Frequent associates: Silver fern, hangehange, fivefinger, *Coprosma arborea*, *C. rhamnoides* and rangiora in the understorey in stock-free areas. *Uncinia uncinata*, *Microlaena avenacea*, *Dicksonia squarrosa*, *Dianella nigra*, *Lycopodium volubile*, kiokio are scattered in the ground tier. Lianes are rare, there are no epiphytes. Occurs as an intermediate type in succession from manuka scrub (20) to kanuka forest.

Modifications: Invasive exotics (rare)
Stock and goat browse heavy in some areas restricting regeneration, burning and logging for firewood occasional threat.

24. KANUKA FOREST

SA 2,3,14,15,16,20,28,29,40,54,59,64,65,
66,69,70,73,77,78
[Alt 5-500m]

This is a successional forest type with kanuka dominant in a 10-20m high canopy and treefern and/or scattered emergent rewarewa. It occurs on alluvial terraces and coastal and lowland hillslopes and ridges, less commonly in Thames ED.

Frequent associates:

Nikau, *Cyathea dealbata*, *C.medullaris*, *C.smithii*, *Dicksonia squarrosa*, putaputaweta, fivefinger, rangiora, mahoe, *Coprosma robusta* and *Olearia rani* occasionally in canopy. Kauri and tanekaha regenerating. *Cyathea dealbata*, *Dicksonia squarrosa*, *Coprosma grandifolia*, and rangiora (common in open understorey). Kiokio, *Uncinia* spp, *Microlaena avenacea*, young treeferns, *Astelia trinervia* and seedlings of kauri, rimu, tanekaha are scattered ground cover. Often reverts to kauri-tanekaha type unless browsing prevents regeneration.

Plants of Note:**Modifications:**

Cut for firewood, burning, grazing, pig and goat damage

25. KANUKA-BROADLEAVED SPECIES FOREST

SA 47,54,55,57,58,59,60,63,65,68,73,74,75
[Alt 5-300m]

This type is very similar to manuka-broadleaved species scrub but has kanuka as the dominant species. Again it is a successional type with regenerating forest species eventually taking over kanuka. Has similar associated species as above.

Plants of note:**26. KAURI-TANEKAHA FOREST**

SA 3,6,13,14,20,21,22,28,29,33,44,46,53,55
56,57,59,60,61,65,69,74,77
[Alt 10-400m]

This is a type which varies considerably in age and height and occurs from sea level to montane situations. The original tall forest was more common in the past but has in all but a very few areas been removed by logging. There is, however, considerable regeneration which occurs in most scrub and forest types usually on well-drained ridgelines and creep slopes. Kauri is less frequent in southern Te Aroha ED where rimu and miro associations occur in similar situations.

Frequent associates:

Kanuka, rewarewa, *Cyathea dealbata*, toru, towai, *Pseudopanax discolor* (Tairua and Thames EDs), *Pittosporum tenuifolium*, northern rata, pohutukawa, rimu, mingimingi, rangiora, *Olearia furfuracea*, *Mida salicifolia*, tawheowheo (at higher altitudes), tawari and *Nestegis lanceolata*. Ground cover varies considerably, it may contain *Astelia trinervia*, *Gahnia pauciflora*, *G.lacera*, *G.xanthocarpa*, *Coprosma spathulata*, *C.lucida*, *C.rhamnoides*, hangehange, kiekie, *Pterostylis graminea* var *rubricaulis*, *P. brumalis*, *Brachyglottis kirkii* ss. *angustior* and *Blechnum fraseri*. Epiphytes may occur in older stands including *Metrosideros fulgens*, *M.albiflora*, *M.perforata*, kiekie, *Rubus cissoides*, *Earina mucronata* and *Dendrobium cunninghamii*

Plants of Note:

Pittosporum virgatum (Kennedy Bay and Kuaotunu areas), *Schizaea bifida*, *S.dichotoma*, *Metrosideros albiflora*, *Loxoma cunninghamii*

Modifications:

Logging. Windbreak in exposed areas eg SA 33. Hakea, gorse, pines present in younger stands but kauri, tanekaha etc eventually overtop them. Goat and pig damage to understorey - minimal damage to kauri, burning.

27. HARDBEECH-KAURI FOREST

SA 7,11,33,58,75
[Alt 100-550m]

This forest type may be dominated by hardbeech or occur with equal quantities of kauri and tanekaha (or toatoa at high altitudes). It is often on steep slopes or cliffs off the edge of kauri ridges. The type may be present as clumps too small to map within other types eg 24, 25, 26, 27. The most extensive areas existing today occur in the north eastern catchments in Te Aroha Ecological District. It was once more widespread on the Coromandel Peninsula but was probably never common. It is an unusual association with remnants here, in Northland and in the Waikato.

Frequent associates:

On ridgetops, riverflats and sometimes midslopes it associates with kauri, tanekaha, toatoa, podocarps, rewarewa, towai, or less frequently kohekohe, tawa or hinau. Understorey associates include kohekohe, *Olearia rani*, *Myrsine salicina*, *M. australis*, *Cyathea dealbata*, kiekie and *Nestegis lanceolata*. Ground layer plants include *Blechnum fraseri*, *Alseuosmia macrophylla*, kiekie, *Coprosma rhamnoides*, *Brachyglottis kirkii* ss. *angustior*. Epiphytes and lianes vary from sparse to common and include *Metrosideros perforata*, *M. fulgens*, supplejack, *Lygodium articulatum*, *Phymatosorus diversifolius*, *Collospermum hastatum*, *Freycinetia baueriana* ss. *banksii* and *Asplenium flaccidum*.

Plants of Note:

Pittosporum virgatum) "Penny's Bush"
Corokia buddleioides) Kuaotunu
Schizaea spp

Modifications:

Logging, burning, goat and pig damage

28. (RATA-PODOCARP)/TAWA FOREST

SA 2,3,4,5,6,11,13,36,28,31,33,15,21,26,47
 48,53,54,56,57,58,59,60,61,65,66,69,70,73,
 74,75,76,77,78
 [Alt 100-600]

This type has a canopy of height 11-25 m consisting of tawa, sometimes with kohekohe or other broadleaved species. Scattered emergent northern rata and/or podocarps, particularly, rimu, up to 30 m tall also occur.

The type intergrades from coastal pohutukawa forest through pohutukawa-rata hybrids, rata-tawa on hillslopes and up to submontane forest types where kamahi/towai and tawari are more common or may become codominant with tawa in the canopy. These latter species may even form the canopy over a narrow altitudinal range (conspicuous in Te Aroha ED).

Hinau is sometimes locally more common than tawa; eg Mahakirau Catchment, SA 31, and is possibly a sign of disturbance (John Nicholls, pers comm). Mangeao is a similar indicator in Te Aroha ED. Pukatea and kahikatea are locally common in damp gully heads. Swamp maire occurs rarely in damp basins (eg Russeks, Tararu). Hall's totara and miro are occasionally common on dry ridgelines. Kauri is often present as scattered large emergents. Epiphytes and lianes are diverse and common. The understorey is many tiered with a diversity of species. In Te Aroha the structure is simpler - a tall tawa canopy over one middle tier often with very abundant kanono (may reflect recovery from animal damage). Scattered individuals of red beech occur in this type in Te Aroha district (eg Waiorongomai).

Frequent Associates:

Tawari, hinau, rewarewa, kohekohe, puriri towards coast, *Coprosma arborea*, *Cyathea dealbata*, *C. medullaris*, pigeonwood, mahoe, miro, hard beech (Tairua and Te Aroha ED) and occasionally red beech (Te Aroha ED), nikau, kiekie, hangehange, *Alseuosmia macrophylla* and kanono. Ground tier includes *Asplenium bulbiferum*, *A. oblongifolium*, kohekohe and mahoe seedlings, hangehange, rangiora, *Blechnum filiforme*, *B. discolor* and *B. chambersii*. Bush rice grass and *Uncinia uncinata* are particularly common where heavily animal browsed.

Plants of Note:

Metrosideros albiflora, *Metrosideros carminea* (grows on rocks in this type), *Peperomia tetraphylla* (epiphytic in Kaituna Stream)

Modifications: Adventive herbs in clearings. Goat, pig and possum damage. Possum damage greater to the south. Logging has occurred practically everywhere removing the large kauri and podocarps.

29. (RATA)/TAWA MODIFIED FOREST

SA 21,28,29,31,35,36,44,57,60,65,66,73,75,
77,78
[Alt 100-500 m]

This is a forest type modified from Type 24, generally by logging. There is a "gappy" canopy (6-20 m) of tawa, silver fern or mamaku, rewarewa and kohekohe with rare northern rata emergents. It occurs in the same range of areas as Type 24.

Frequent Associates: Nikau, *Olearia rani*, mahoe, kanuka, towai and pigeonwood. *Coprosma grandiflora*, mangeao, kamahi and *Dicksonia squarrosa* are found more frequently in Te Aroha ED. Ground tier and understorey species are similar to those in Type 24. Epiphytes and lianes as for Type 24 but often reduced in diversity. Regeneration of the species removed by logging is rarely seen.

Modifications: Stock, goat and pig damage common, possums increasing. Past mining and/or logging is heavy or recent with many roads or "bullock tracks" throughout and an open canopy with few emergents. Pampas along logging roads.

Plants of Note:

30. (RATA-PODOCARP)/TOWAI-TAWA FOREST

SA 48,53,55,59,61,65,32,35,36
[Alt 200-650 m]

This is a forest type very similar to type 24 but containing towai as a significant feature of the canopy. Tawa and towai may vary in dominance. Species are the same as in Type 24, though tawheowheo, tawari and *Cyathea smithii* become more common at higher altitudes. Kauri was once common, but has generally been logged out - may be regenerating on ridges.

Modifications: Goat, pig and possum damage. Old logging roads common. Windthrow

31. TOWAI-TAWA FOREST

SA 34,54,36,57,66
[Alt 300-600 m]

This is a secondary forest type with an 8-20 m high canopy of towai and tawa which vary in dominance. It occurs over the same altitudinal range as Type 26 and results from a higher, and possibly more recent, logging effort.

Frequent Associates: *Cyathea smithii*, tawheowheo, *Quintinia serrata*, *Olearia rani*, *O.townsonii* (in Tairua ED), tawari, miro, kauri, mamaku. Understorey species include hard beech (occasional in Tairua ED), *Cyathea smithii*, *C.dealbata*, *Pseudopanax discolor*, kohekohe, towai, rangiora, *Olearia rani*, kiekie, *Alseuosmia macrophylla* and tawari. Ground tier includes sparse bush rice grass, *Uncinia uncinata*, *Blechnum fraseri*, *B.discolor*, kiekie and seedlings. Epiphytes and lianes are moderate in number - kiekie and supplejack common, with filmy ferns, kidney fern, *Asplenium flaccidum*, *A.oblongifolium*, mosses, tawheowheo and puka.

Plants of Note: *Loxoma cunninghamii*, *Brachyglottis myrianthos*.

Modifications: Pampas and gorse are common colonisers of old logging roads. Stock, goat and possum damage. Windfalls. Heavy logging

32. TOWAI SCRUB OR FOREST

SA 31,36,48,54,57,59,60,61,65,66
[Alt 200-600 m]

Two types of towai scrub were distinguished - a high and low altitude type.

- (a) In the low altitude towai is dominant in the 1-10 m high canopy. The type is not common in Colville district but increases in Thames, Tairua and Waihi. There is a lot of variation with altitude and past history. Towai reaches its southern limit around Waihi/north Te Aroha.

Frequent Associates: *Cyathea medullaris*, *Coprosma grandifolia*, *Olearia rani*, *Carpodetus serratus*, rewarewa, fivefinger, *Blechnum capense*, *Pittosporum huttonianum*, *Gahnia* spp, *Machaerina sinclairii*, *Cyathea smithii*, kauri-tanekaha regeneration on ridges. Understorey associates *Cyathea dealbata*, *Dicksonia squarrosa*, mahoe, *Pseudopanax colensoi*, *P. edgerleyi*, rewarewa and hangehange. Ground layer associates are *Schoenus tendo*, *Blechnum capense*, *Uncinia uncinata*, *Microlaena avenacea* and *Asplenium* spp. *Rubus australis* is common in open areas. Epiphytes and lianes are moderate in number.

Plants of Note: *Loxoma cunninghamii*, *Brachyglottis myrianthos*, *Coprosma dodonaeifolia* above 500 m and *Archeria racemosa*.

Modifications: High possum population evident in some areas. Goats and pigs. Type is induced by clearing and burning in the past, and will probably regenerate to Type 27 and 29.

Fernbird present in manuka patches.

- (b) Above 500 m a high altitude towai subtype has distinct montane elements.

Frequent Associates: *Coprosma dodonaeifolia*, *Pseudopanax discolor*, *P. laetus*, *P. colensoi*, *Griselinia littoralis*, tawheowheo, *Metrosideros umbellata*, tawari, yellow silver pine, silver pine and mairehau on dry slopes. Manuka is found locally on plateau-like areas eg Rangihau, where drainage is impeded, with *Schoenus tendo*, *Gleichenia dicarpa*, *Baumea* spp, *Drosera* sp, *Sphagnum* sp and abundant lichens.

33. KAMAHI SCRUB/FOREST

SA 74,75,76,78
[Alt 125-550]

This type is found only in Te Aroha Ecological District, although in the southern parts of Waihi ED and northern part of Te Aroha there is a transition between towai and kamahi. This type is not as widespread as towai scrub and does not extend as high as towai scrub in the other ecological districts.

Frequent Associates: Tawari, rewarewa, fivefinger, kanuka, mahoe, mamaku and *Cyathea dealbata*. In the understorey associated species are *Cyathea dealbata*, mapou, hangehange, kawakawa, kohekohe, rangiora, heketara, pigeonwood, *Coprosma lucida*. Ground cover species include kiokio, hook sedge, silver fern, bracken, *Dianella nigra*, *Hymenophyllum demissum*, *Pneumatopteris pennigera* and seedlings of tree spp.

34. TAWARI-TOWAI-TAWHEOWHEO SCRUB OR FOREST

SA 31,32,57,58,59,66,70
[Alt Moehau above 750 m
elsewhere, above 550 m]

This is a montane forest type occurring on the major ridgelines, peaks and adjacent steep slopes. These areas are high, very exposed, frequently cloud covered and poorly drained. The canopy is often windshorn and varies in height from 2 to 12 m. The main canopy species are tawari and towai, with broadleaf and tawheowheo common.

Frequent Associates: *Pseudopanax colensoi*, *P.laetus*, toro, rimu, miro, southern rata, *Dracophyllum traversii*, tawheowheo and *Griselinia littoralis*. Locally common emergents include kauri, Hall's totara, yellowsilver pine and kaikawaka. Understorey species (if present) include *Cyathea smithii*, *Coprosma grandifolia*, toro, towai, tawheowheo, *Dracophyllum latifolium*, *Dicksonia squarrosa*. Ground tier species comprise *Astelia trinervia*, *A.aff. nervosa*, *A.solandri*, *Gahnia pauciflora*, *G.setifolia*, *Dicksonia squarrosa*, *Cyathea smithii*, *Blechnum discolor*, *B.fraseri*, *B.capense*, *B.procerum*, bush rice grass, *Uncinia* spp, *Rubus australis* and *Libertia pulchella*. Epiphytes and lianes include abundant mosses and filmy ferns, *Astelia solandri*, *Metrosideros* vines, particularly *M.albiflora* and *M.carminaea*

Plants of Note: *Metrosideros albiflora*, *M.carminaea*, *Archeria racemosa* and *Coprosma dodonaeifolia*

Modifications: Moderate browsing - probably goats. Wind and slip damage common. Logging in past has opened up large areas that are slow to regenerate.

35. SWAMP MAIRE-TOWAI MONTANE BOG FOREST

SA 35
[Alt 600-720 m]

A swamp forest dominated by towai (canopy height approx 20 m) with *Syzygium maire* and rimu emergents. This type was found at around 700 m on the slightly sloping boggy plateau between Te Puru and Waiomu catchments, and in the head of the Karaka Stream (Beadel, 1988).

Frequent Associates: Tawari, tawheowheo, toro and rimu in stunted and poor condition. Middle Tier species; *Coprosma grandifolia*, *Dicksonia squarrosa* and towai/kamahi (Te Aroha ED). The ground tier is dominated by litter with some filmy ferns, liverworts, juvenile *Dicksonia squarrosa*, *Cyathea smithii* and kiokio. Epiphytes and lianes are common particularly supplejack and filmy ferns.

Plants of Note: *Syzygium maire*

Modifications: None obvious

36. MONTANE CONIFER FOREST

SA 48,54,77,78
[Altitude 600 m]

This type occurs on a range of landforms from flat, boggy plateau eg top of Table Mountain and Te Hunga Ridge, to exposed ridges and very exposed rocky knolls and bluffs. Canopy composition varies considerably throughout the ecological districts from an even canopy of yellow silver pine and tawari, with admixtures of kauri and rimu (SA 48) to pink pine and kaikawaka in Te Aroha ED.

Frequent Associates: In Tairua and Waihi ED: tawari, toatoa, towai, tawheowheo, *Pseudopanax discolor*, southern rata, *Pseudopanax colensoi*, hinau, *Dracophyllum traversii*, *Corokia buddleioides* and rare kauri. In Te Aroha Ecological Districts there are pink pine, kaikawaka, mountain toatoa and *Coprosma foetidissima*. Understorey species include *Pseudopanax colensoi*, tawheowheo, *Coprosma dodonaeifolia*, *Alseuosmia macrophylla*, towai (not in Te Aroha ED) and *Pseudopanax discolor*. Ground tier species are *Gahnia pauciflora*, *Astelia trinervia*, mosses, *Astelia fragrans* and *A.solandri*. Epiphytes and lianes include mosses and filmy ferns, particularly *Hymenophyllum multifidum*.

Plants of Note: *Coprosma dodonaeifolia*

Modification: Trees twisted and fallen because of unstable substrate and high winds.

37. BEECH-TAWARI FOREST/SCRUB

SA 74,75,77,78
[Alt 550-900 m]

This forest occurs at higher altitudes in the Kaimai Ranges (over 600 m). Within this broad type there is variation from a short cover of scrub dimensions to tall forest.

Silver beech-tawari forest occurs on a range of landforms including hillslopes, ridges and slip faces. Species composition varies with altitude, landform and exposure. Red beech is a significant canopy associate in sheltered positions and usually forms a tall forest. Canopy height 3-15 m tall.

Frequent Associates: *Coprosma foetidissima*, toro and kamahi. In the middle tier there is *Dracophyllum traversii*, broadleaf, tawheowheo, pigeonwood, mahoe, kanono, *Alseuosmia macrophylla*, *Coprosma foetidissima*, *Dicksonia squarrosa*, *Cyathea smithii*, toatoa. The shrub and ground layers comprise *Gahnia pauciflora*, *Astelia solandri*, *Astelia trinervia*, *Coprosma colensoi* (incl. *C.banksii*), *Geniostoma rupestre*, *Pseudopanax colensoi*, horopito, *Libertia pulchella*, *Blechnum discolor*, *Luzuragia parviflora*, *Blechnum procerum*.

Plants of Note: *Coprosma dodonaeifolia*, *Gentiana* sp

Modifications: Some fire, browsing animals (deer and goats), slipping. Suggested dieback.

38. KANONO SCRUB

SA 75,77
[Alt above 500 m]

A broadleaved species scrub found in the montane zone of Te Aroha Ecological District. It is not extensive, existing as small patches or narrow bands on high ridgelines or gently sloping plateau like surfaces eg near Baldy, and in areas of past burning, clearing or on slips.

Canopy height is 2-10 m but usually 2-3 m. Kanono is dominant (over 50%). Generally a very dense scrub type with an unbroken canopy, unless disturbed. Very few ground species or epiphytes and lianes.

Frequent Associates: Include *Olearia rani*, mahoe, tawari, pigeonwood, *Pseudopanax laetus*, *Pseudowintera colorata*, *Cyathea smithii*, broadleaf in the canopy. Occasional tawa, pate and kamahi. Understorey species include bush rice grass, *Blechnum fluviatile*, supplejack, *Asplenium bulbiferum*, *Cyathea smithii*, *Rubus cissoides*, *Melicope simplex*, *Pseudopanax anomolus* and *Gahnia setifolia*.

Species of Note: *Coprosma dodonaeifolia*

Modifications: Slips

39. TUSSOCKLAND

SA 58, 75
[Alt]

A vegetation type found on montane and submontane plateaux and gently sloping areas. Probably induced by logging and burning (some spars sticking out) and maintained by subsequent grazing, burning and the generally exposed nature of sites. Found on a slip near Maumaupaki plateau, near Neavesville, and along the main ridge of Kaimai Range.

Frequent Associates: Flax, *Astelia solandri*, bush rice grass, *Gahnia procera*, *Dracophyllum traversii*, mungimungi, *Coprosma colensoi* (incl *C.banksii*) and broadleaf, Occasional associates include *Hierchloe redolens*, kiokio, *Blechnum procerum*, *Dianella nigra*, *Astelia aff. nervosa*, toatoa, *Coprosma foetidissima*, *Pseudopanax colensoi*, kamahi, *Coprosma dodonaeifolia*, tawari, *Pseudopanax anomolus*, seedlings of yellow silver pine and kaikawaka.

Vegetation cover 0-2.5 m but generally 1 m (bare ground where there are slips). Variable proportion of grasses, sedges and Liliaceae. Often little sign of regeneration of forest tree species.

Plants of Note: *Coprosma dodonaeifolia*

40. UPLAND ROCKY BLUFF COMMUNITY

SA 21,32,48,54,58,65
[Alt 520 m and above]

This is a variable type covering all vegetation on upland rocky bluffs in Colville, Thames and Tairua EDs. It ranges from isolated *Celmisia gracilentia* var on bare rock to faces covered in *Phormium cookianum* and short towai to patches of stunted trees and dense scrub. A number of species unusual in the Coromandel occur in these exposed environments. Mt Moehau has the largest number of montane subalpine species, but some also occur on Castle Rock, the Papakai SR, Maumaupaki, Table Mountain, the Pinnacles, Puriri SR and Omahu Valley. Species are often the same as in towai scrub (higher altitude type) and tawari-tawheowheo-broadleaf scrub, but very stunted (< 1 m).

Frequent Associates: *Celmisia gracilentia* var., *Phormium cookianum*, *Schoenus tendo*, *Chionochloa conspicua* var, *Morelotia affinis*, *Blechnum* sp. "black spot", *Machaerina sinclairii*, *Lycopodium deuterodensum*, *Baumea* spp, *Astelia trinervia*, *Nertera depressa*, *Lindsaea linearis*, *Gonocarpus incanus*, towai, manuka, *Pseudopanax discolor*, *P.colensoi*, *P.laetum*, *Olearia townsonii*, broadleaf, *Pittosporum huttonianum*, *Hebe pubescens*, mingimingi, yellow-silver pine, mairehau, tawheowheo, *Corokia buddleoides*, tawari, hard beech, *Alseuosmia* sp, rimu, kauri, Hall's totara, *Dracophyllum traversii* and orchid species.

Plants of Note: *Celmisia gracilentia* var. *Hebe pubescens*, *Chionochloa conspicua* var. *Dracophyllum patens*, *Podocarpus hallii* x *nivalis*

Modifications: Stunted and windshorn vegetation
Logging in past

APPENDIX II

Species Checklist for Mainland Ecological Districts of
Coromandel Ecological Region (including some islands)CHECKLIST COMPILED FROM PUBLISHED AND UNPUBLISHED SPECIES LISTS AND FIELD
SURVEY

A = Adams, 1884	Hm = Hamlin, 1954 (from Druce, 1982)
Am = Adams, 1885	K = Kirk, 1870
Ad = Adams, 1888	JSD = John Smith Dodsworth 1988,89
Al = Alan, 1961 (from Druce, 1983)	L = Lloyd, 1972 (from Druce, 1983)
An = Anderson, 1983c	M = Moore, 1973 (from Druce, 1983)
Au = author of present report	M1 = Miller, 1984(a)
Ba = Bartlett, 1978	M2 = Miller, 1984(b)
Bb = Boase & Beadel, 1987	M3 = Miller, 1985(a)
B = Burns, 1984(a)	M4 = Miller, 1985(b)
B1 = Burns, 1984(b)	M5 = Miller, 1985(c)
B2 = Burns, 1984(c)	M6 = Miller, 1983
B3 = Burns, 1984(d)	Mo = Moore, 1967 (from Druce, 1983)
B4 = Burns, 1985(a)	N = Newhook et al, 1971
B5 = Burns, 1985(b)	O = Oliver, 1929 (from Druce, 1983)
B6 = Burns, 1985(c)	Og = Ogle, 1976
B7 = Burns, 1985(d)	Or = Orchard, 1975 (from Druce, 1983)
B8 = Burns, 1984(e)	P = Perris, 1972 (from Druce, 1983)
B9 = Burns, 1984(f)	PNA = Protected Natural Areas Programme Survey Team
C = Cheeseman, 1925 (from Druce, 1983)	R = Raven and Raven, 1976 (from Druce, 1983)
C1 = Clarkson, pers. comm	Re = Regnier, 1987
Co = Cook, 1947 (from Druce, 1983)	S = Smith-Dodsworth, 1985(a)
Cr = Crookes, 1963 (from Druce, 1983)	S1 = Smith-Dodsworth, undated (a)
Cs = Clarkson and Smale, 1987	S2 = Smith-Dodsworth, undated (b)
Ct = Court, 1974	S3 = Smith-Dodsworth, 1986
D = Druce, 1983	S4 = Smith-Dodsworth, 1985(b)
Dr = Druce, 1982	SG = Smith-Dodsworth and Gardner, 1985
E = Esler, 1978	SW = Stewart Wallace
G = Gudex, 1963 (from Druce, 1982)	W = Wright, 1975
Ga = Garrick Associates IN: Regnier, 1987	Wa = Wardle, 1966
GJ = Garnock-Jones and Langer, 1980	Sr = Wright, 1971
H = Hamlin, 1957(a) (from Druce, 1983)	
Ha = Hamlin, 1957(b) (from Druce, 1982)	

Ecological Districts Known to Occur in
Colville Tairua Thames Waihi Te Aroha

A. INDIGENOUS FLORA

<i>Acaena anserinifolia</i>	B7	B1	B	M2	Dr
<i>A. sp.</i>				B2	
<i>Acianthus fornicatus</i> var <i>sinclairii</i>	B7	S3	B6		G
<i>A. reniformis</i> agg.	S1		B6		
<i>A. viridis</i>			D		
<i>Adenichilus gracilis</i>			K		
<i>Adiantum aethiopicum</i>	PNA	Wr	JA	SG	
<i>A. cunninghamii</i>	B7	B1	B	B2	Dr
<i>A. diaphanum</i>	B7			SG	
<i>A. fulvum</i>	B7	PNA	B	B2	Am
<i>A. hispidulum</i>	M1	Wr	D	B2	Am
<i>A. viridescens</i>	B7	B5	B	SG	Dr
<i>Agathis australis</i>	B7	B1	B	B2	Dr
<i>Alectryon excelsus</i> var. <i>excelsus</i>	B7	B1	B	B3	Dr
<i>Alseuosmia macrophylla</i>	B7	B1	B	B2	Dr
<i>A. x quercifolia</i>		PNA	K		
<i>Anaphalis keriensis</i>	B7	B1	B	B2	Dr
<i>Anarthropteris lanceolata</i>	B7	B1	D	B2	Dr
<i>Apium prostratum</i>	M1	Ct	K	PNA	
<i>A. sp.</i>			K		
<i>Aporostylis bifolia</i>	B7				

Ecological Districts Known to Occur in
Colville Tairua Thames Waihi Te Aroha

<i>Archeria racemosa</i>		B1	B		
<i>Aristolelia fruticosa</i>			PNA		Dr
<i>A. serrata</i>	B7	B1	B	B3	Dr
<i>Arthropodium candidum</i>			K		Am
<i>A. cirrhatum</i>	M1	Og	K	M2	
<i>Arthropteris tenella</i>	M1	PNA	K	M5	Dr
<i>Ascarina lucida</i> var. <i>lucida</i>	B7	PNA	D		Dr
<i>Asplenium bulbiferum</i> s.s. <i>bulbiferum</i>	B7	B1	B	B2	Dr
<i>A. bulbiferum</i> s.s. <i>gracillimum</i>			PNA		
<i>A. flabellifolium</i> agg.	E		K	SG	
<i>A. flaccidum</i> s.s. <i>flaccidum</i>	B7	B1	B	B2	Dr
<i>A. flaccidum</i> s.s. <i>haurakiense</i>	PNA				
<i>A. hookerianum</i>	E		K	SG	Am
<i>A. lamprophyllum</i>	B7	B4	D	SG	Dr
<i>A. northlandicum</i>		Wr	K		
<i>A. oblongifolium</i>	B7	B1	B	B3	Dr
<i>A. polyodon</i>	B7	B1	B	B2	Dr
<i>A. bulbiferum</i> x <i>A. flaccidum</i>	JSD				Dr
<i>A. bulbiferum</i> x <i>A. lamprophyllum</i>					Dr
<i>A. bulbiferum</i> x <i>A. sp.</i>				M2	
<i>A. oblongifolium</i> x <i>A. flaccidum</i>		Wr			
<i>Astelia banksii</i>	B7	Og	PNA	B3	PNA
<i>A. fragrans</i>		B1	B		Dr
<i>A. grandis</i>	Ad	SW	B		Dr
<i>A. solandri</i>	B7	B1	B		Dr
<i>A. trinervia</i>	B7	B1	B	B2	Dr
<i>A. sp.</i> (unnamed; aff. <i>A. nervosa</i>)	B7	B4	D		Dr
<i>Avicennia resinifera</i>	W	Og	D	PNA	
<i>Azolla filiculoides</i>			A		PNA
<i>Baumea articulata</i>	PNA	Og			Am
<i>B. juncea</i>	M3	Og	K	PNA	Am
<i>B. rubiginosa</i>	PNA	PNA		PNA	
<i>B. tenax</i>	B7	B4		PNA	PNA
<i>B. teretifolia</i>	B7	PNA		PNA	Am
<i>B. sp.</i>				M2	
<i>B. sp.</i>				M2	
<i>Beilschmiedia tarairi</i>	B7	PNA	B8		Am
<i>B. tawa</i> (incl. <i>B. tawaroa</i>)	B7	B4	B	B2	Dr
<i>Blechnum chambersii</i>	B7	B1	B	B2	Dr
<i>B. colensoi</i>	B7	B1	B	PNA	Dr
<i>B. discolor</i>	B7	B4	B	B2	Dr
<i>B. filiforme</i>	B7	B1	B	B2	Dr
<i>B. fluviatile</i> agg.	B7	B1	B	B2	Dr
<i>B. fraseri</i>	B7	B1	B	B2	Dr
<i>B. membranaceum</i>	B7		B	B3	Dr
<i>B. minus</i>	PNA	PNA	D		Dr
<i>B. nigrum</i>	B7	B4	B	B2	Dr
<i>B. procerum</i>	B7	B4	B		Dr
<i>B. vulcanicum</i>	B7		K	SG	Dr
<i>B. sp.</i> ('black spot')	B7	B1	B	B2	Dr
<i>B. chambersii</i> x <i>B. membranaceum</i>			D		
<i>B. procerum</i> x <i>B. sp.</i> ('black spot')					Dr
<i>Bolboschoenus caldwellii</i>		PNA	Co		
<i>B. fluviatilis</i>	M1				
<i>B. medianus</i>	PNA		Co		
<i>Botrychium bifforme</i>			D		Am
<i>Brachyglottis kirkii</i> s.s.	B7	PNA	D		
<i>B. sp.</i> (unnamed; = <i>B. kirkii</i> var. <i>angustior</i>)	B7	B4	D		
<i>B. sp.</i> (<i>B. kirkii</i> ?)				B3	
<i>Brachyglottis myrianthos</i>	Ad	B1	B		
<i>B. repanda</i> s.s.	B7	B1	B	B2	Dr
<i>B. repanda</i> x <i>myrianthos</i>		PNA			
<i>Bulbophyllum pygmaeum</i>	B7	B5	B	B2	Am,G
<i>Caladenia catenata</i>	B7	Og	PNA		Dr
<i>Callitriche muelleri</i>	B7	B1			
<i>Calystegia marginata</i>			K		
<i>C. sepium</i> agg.	M4	Og	K	PNA	Am
<i>C. soldanella</i>	M1	Og	D	M2	
<i>C. tuguriorum</i>	M3		K	M2	G
<i>Cardamine debilis</i> agg.		B1			Dr

Ecological Districts Known to Occur in
Colville Tairua Thames Waihi Te Aroha

<i>Carex breviculmis</i>	E	Og	K		
<i>C. dissita</i>	B7	Og	B	B3	Dr
<i>C. echinata</i> var. (= <i>C. stellulata</i> var. <i>australis</i>)					Dr
<i>C. fascicularis</i>					Ha
<i>C. flagellifera</i>	S1	Og	B		G
<i>C. forsteri</i>		B5	B		Am
<i>C. gaudichaudiana</i>			K		Am
<i>C. geminata</i>	PNA	PNA	PNA	PNA	G
<i>C. inversa</i>	E	Og	D		
<i>C. lambertiana</i>	B7		D		G
<i>C. maorica</i>	PNA	PNA	H		Ha
<i>C. ochrosaccus</i>			B		
<i>C. pumila</i>	M1	Og	K	M2	
<i>C. secta</i> s.s.	PNA	PNA	K	PNA	PNA
<i>C. solandri</i>	S1	B1	D	SG	Dr
<i>C. spinirostris</i>	E	Og	D	SG	Dr
<i>C. subdola</i>			H		Hm
<i>C. testacea</i> s.s.	PNA	Og		PNA	
<i>C. virgata</i>	S1	Og	D	M2	Dr
<i>C. sp.</i> (unnamed; aff. <i>C. geminata</i>)		B5	D	M2	Dr
<i>C. sp.</i>		Ct			
<i>Carmichaelia arborea</i> var. <i>aligera</i> (= <i>C. cunninghamii</i>)	M1	B8	PNA	B3	Dr
<i>C. williamsii</i>	E				
<i>Carpha alpina</i> s.s.	B7				
<i>Carpodetus serratus</i>	B7	B1	B	B3	Dr
<i>Cassinia leptophylla</i> var. <i>leptophylla</i> (incl. <i>C. retorta</i>)	Ad	Og		PNA	
<i>Celmisia gracilentia</i> var. (= <i>C. adamsii</i> var. <i>adamsii</i>)	Cs	Ba	B		Dr
<i>C. incana</i>	B7				
<i>Centella uniflora</i>	B7	B1	B	M2	Dr
<i>Centipeda</i> sp.			K		
<i>Cheilantes distans</i>	M1	Wr	A		
<i>C. sieberi</i> ssp. <i>sieberi</i>	PNA	Wr	K	M5	
<i>Chenopodium glaucum</i> var. <i>ambiguum</i>			K		Am
<i>Chiloglottis cornuta</i>	B7	S3	B		Am, G
<i>Chionochloa conspicua</i> var. <i>cunninghamii</i>	B4	PNA	B	SG	
<i>C. flavicans</i>				SG	
<i>Clematis cunninghamii</i>	S1		K		Dr
<i>C. foetida</i>			K		PNA
<i>C. forsteri</i>		B8	A		Am
<i>C. paniculata</i>	B7	B1	B	B2	Dr
<i>Clanthus puniceus</i>			C		
<i>Collospermum hastatum</i>	B7	B1	B	B2	Dr
<i>C. microspermum</i>	B7	B1	D		Dr
<i>Coprosma acerosa</i>	PNA	Og		PNA	
<i>C. arborea</i>	B7	B5	D	B2	Dr
<i>C. areolata</i>	W	Og		SG	Dr
<i>C. colensoi</i> (incl. <i>C. banksii</i>)	B7	B4	B		Dr
<i>C. dodonaeifolia</i>	B7	B1	B		Dr
<i>C. foetidissima</i>	B7	B5			Dr
<i>C. grandifolia</i>	B7	B1	B	M2	Dr
<i>C. linariifolia</i>					
<i>C. lucida</i>	B7	B1	B	B2	Dr
<i>C. macrocarpa</i> s.s.	S1	PNA	D	M2	
<i>C. propinqua</i>	PNA	Og	K		
<i>C. repens</i>	M1	Og	D	M2	
<i>C. rhamnoides</i>	B7	B5	D	SG	DR
<i>C. robusta</i>	S1	B1	B	B2	Dr
<i>C. rotundifolia</i>			D		Dr
<i>C. spatulata</i>	B7		D	MS	Am
<i>C. tenuicaulis</i>	PNA	Og	D	PNA	PNA
<i>C. sp.</i> (divaricating)				M2	
<i>C. dodonaeifolia</i> x <i>C. lucida</i>			D		PNA
<i>C. macrocarpa</i> x <i>C. propinqua</i>	M1				
<i>C. propinqua</i> x <i>C. robusta</i>	PNA	Og	D		Dr
<i>Cordyline australis</i>	M1	Og	B	M2	Dr
<i>C. banksii</i>	B7	B1	B	B2	Dr
<i>C. indivisa</i>	M		K		Dr
<i>C. pumilio</i>	S1	B1	B	B2	Dr
<i>C. australis</i> x <i>C. banksii</i>	PNA				Dr
<i>Coriaria arborea</i>	B7	B1	B	B3	Dr

	Ecological Districts Known to Occur in				
	Colville	Tairua	Thames	Waihi	Te Aroha
<i>Corokia buddleoides</i> var. <i>linearis</i>	B7	PNA	B	SG	Dr
<i>C. cotoneaster</i>	PNA				
<i>Cortaderia fulvida</i>	PNA	B4	B	SG	PNA
<i>C. toetoe</i>		Ct			
<i>C. sp.</i>		Ct		B3	Dr
<i>Corybas aconitiflorus</i>	B7				
<i>C. acuminatus</i>	S	S3	PNA		
<i>C. macranthus</i>			A	M2	G
<i>C. oblongus</i>	B7	PNA		PNA	Dr
<i>C. orbiculatus</i>	B7	B1	B6		Dr
<i>C. rivularis</i>	B7	B1	B6	PNA	Dr
<i>C. trilobus</i> s.s.	E	S3			PNA
<i>C. sp.</i>				B2	
<i>Corynocarpus laevigatus</i>	M1	Og	B	M2	Dr
<i>Cotula australis</i>	W	Ct	K		
<i>C. coronopifolia</i>	W	Ct	K		Am
<i>C. dioica</i> ssp. <i>dioica</i>	W		L		
<i>C. membranacea</i>			L		
<i>Ctenopteris heterophylla</i>	B7	B1	B	SG	Dr
<i>Crassula seiberiana</i>	E				
<i>Cyathea cunninghamii</i>	B7	B1	B	PNA	Dr
<i>C. dealbata</i>	B7	B1	B	B2	Dr
<i>C. medullaris</i>	B7	B1	B	B2	Dr
<i>C. smithii</i>	B7	B1	B	B2	Dr
<i>Cyathodes empetrifolia</i>	B7				Dr
<i>C. juniperina</i>	B7	B1	B	B2	Dr
<i>Cyperus ustulatus</i>	M1	Ct	D	M2	Dr
<i>Dacrycarpus dacrydioides</i>	B7	B1	B	B2	Dr
<i>Dacrydium cupressinum</i>	B7	B1	B	B2	Dr
<i>Dactylanthus taylorii</i>	C		C		
<i>Daucus glochidiatus</i>	E		K		Am
<i>Dendrobium cunninghamii</i>	B7	B1	B	B2	Dr
<i>Deparia petersenii</i>	M4	PNA		M2	Am
<i>Deschampsia caespitosa</i>					
<i>Desmoschoenus spiralis</i>	W	Og	K	PNA	
<i>Deyeuxia avenoides</i>					
<i>D. billardierei</i>	PNA	PNA			
<i>D. sp. (D. quadriseta</i> agg.)			D		Dr
<i>Dianella nigra</i>	B7	B1	B	B2	Dr
<i>Dichelachne crinita</i>	M4	B5	D		Dr
<i>D. micrantha</i>	Ad		K		Am
<i>D. sp.</i>				SG	
<i>Dichondra repens</i>	B7	Ct	K	PNA	Dr
<i>Dicksonia fibrosa</i>	B7		D		Dr
<i>D. lanata</i> agg.	B7	PNA	K		Dr
<i>D. squarrosa</i>	B7	B1	B	B2	Dr
<i>Disphyma australe</i> ssp. <i>australe</i>	M1	Ct	D	M2	
<i>Diplazium australe</i>		PNA		M2	Dr
<i>Dodonaea viscosa</i> var.	M3	B5	D	B3	Dr
<i>Doodia caudata</i>	PNA		P	PNA	
<i>D. media</i> ssp. <i>australis</i>	B7	Wr	B	B3	Dr
<i>Dracophyllum adamsii</i>	B7				Dr
<i>D. latifolium</i>	B7	B1	B	B2	Dr
<i>D. lessoniaefolium</i>	M3				O
<i>D. patens</i>		B1	B		PNA
<i>D. sinclairii</i> (K,O)					
<i>D. strictum</i> (A,O)					
<i>D. traversii</i>	B7	B4	D	PNA	Dr
<i>Drosera binata</i>		B1	B		Dr
<i>D. peltata</i> ssp. <i>auriculata</i>	B7	B1	D	B2	Dr
<i>D. spathulata</i>		PNA	D		
<i>Drymoanthus adversus</i>	B7	B5	B	B3	Am,G
<i>Dysoxylum spectabile</i>	B7	B1	B	B2	Dr
<i>Earina autumnalis</i>	B7	B1	B	B2	Dr
<i>E. mucronata</i>	B7	B1	B	B2	Dr
<i>Echinopogon ovatus</i>	N	Og	K		Am
<i>Einadia triandra</i>	M1				
<i>Elaeocarpus dentatus</i>	B7	B1	B	B2	Dr
<i>E. hookerianus</i>	B7		B		Dr
<i>Elatostema rugosum</i>	W	B5		B2	Dr

	Ecological Districts Known to Occur in				
	Colville	Tairua	Thames	Waihi	Te Aroha
<i>Eleocharis acuta</i>	PNA	Og	B		Dr
<i>E. gracilis</i>		B1	B		PNA
<i>E. sphacelata</i>	PNA	Og			Am
<i>Elymus multiflorus</i>			K		Am
<i>E. narduroides</i>			K		Am
<i>Empodisma minus</i>		Au		PNA	
<i>Entelea arborescens</i>	M1	Og	K	M2	
<i>Epacris pauciflora</i>		D			Dr
<i>Epilobium alsinoides</i> s.s.	B7		K		Dr
<i>E. billardierianum</i>			K		Am
<i>E. brunnescens</i> s.s.	B7				Dr
<i>E. cinereum</i>			K		R
<i>E. hirtigerum</i>			R		
<i>E. nerteroides</i>		B1	B6		Dr
<i>E. nummulariifolium</i>			B		Dr
<i>E. pallidiflorum</i>	PNA	PNA	D		Dr
<i>E. pedunculare</i>	B7		B		Dr
<i>E. pubens</i>			K		Dr
<i>E. rotundifolium</i>	B7	B1	B	B2	
<i>E. sp.</i>				M2	
<i>Euphorbia glauca</i>		Ct	K		
<i>Euphrasia cuneata</i>					Dr
<i>Freycinetia baueriana</i> s.s. <i>banksii</i>	B7	B1	B	B2	Dr
<i>Fuchsia excorticata</i>	B7	B1	B	SG	Dr
<i>Fuchsia procumbens</i>					
<i>Galinia lacera</i>	B7	B1	B	M2	Dr
<i>G. pauciflora</i>	B7	PNA	B	SG	Dr
<i>G. setifolia</i>	B7	PNA	B	B2	Dr
<i>G. xanthocarpa</i>	B7	B4	B	B2	Dr
<i>Galium propinquum</i>	B7				Dr
<i>G. trilobum</i>			A		Am
<i>Gastrodia cunninghamii</i>		PNA	A		
<i>G. sesamoides</i>	PNA	Og			
<i>Gaultheria antipoda</i>	B7	B5	B	M2	Dr
<i>G. paniculata</i>	S	B5	B	PNA	
<i>G. sp. (unnamed; = G. depressa as var. novae-zelandiae)</i>	B7				Bb
<i>G. sp.</i>				B3	
<i>G. antipoda</i> x <i>G. paniculata</i>			D		
<i>Geniostoma rupestre</i> var. <i>ligustrifolium</i>	B7	B1	B	B2	Dr
<i>Gentiana sp. (unnamed; aff. G. spenceri)</i>					Dr
<i>Geranium microphyllum</i>		PNA	K		Am
<i>G. potentilloides</i> var. <i>potentilloides</i>	B7				
<i>G. solanderi</i>	E		D		
<i>Gleichenia dicarpa</i>	B7	B1	B	B2	Dr
<i>G. microphylla</i>	B7	PNA		SG	Dr
<i>G. sp.</i>		Og			
<i>Gnaphalium audax</i>					Dr
<i>G. gymnocephalum</i>	B7	B1	D	B2	Dr
<i>G. involucreatum</i>	S2		K		Dr
<i>G. limosum</i> s.s.					Dr
<i>G. sphaericum</i>	E	B1	D		Dr
<i>G. sp. (a) (unnamed; aff. G. involucreatum and G. limosum)</i>					Dr
<i>Gonocarpus aggregatus</i>					Am
<i>G. incanus</i> (incl. <i>G. montanus</i>)	B7	B8	Dr	M2	Dr
<i>G. micranthus</i> ssp. <i>micranthus</i>	M3	Ct	D		Dr
<i>Grammitis billardieri</i>	B7	B1	B	B2	Dr
<i>G. ciliata</i>	B7	B4	B	SG	Dr
<i>G. magellanica</i> ssp. <i>nothofageti</i>	B7				Dr
<i>G. pseudociliata</i>	B7		B		Dr
<i>Gratiola sexdentata</i>			A		
<i>Griselinia littoralis</i>	B7	B1	B	B2	Dr
<i>G. lucida</i>	B7	B1	B	B	Dr
<i>Gunnera monoica</i>	PNA		K		
<i>Halocarpus biformis</i>	B7				Dr
<i>H. kirkii</i>	PNA				

Ecological Districts Known to Occur in					
	Colville	Tairua	Thames	Waihi	Te Aroha
<i>Haloragis erecta</i> ssp. <i>erecta</i>	M3	Ct	B	M2	Dr
<i>H. procumbens</i>	E	Ct			
<i>Hebe macrocarpa</i> var. <i>macrocarpa</i>	B7	PNA	B	B2	Dr
<i>H. pubescens</i> var. <i>pubescens</i>	S	Og	B	M2	
<i>H. stricta</i> var. <i>stricta</i>	PNA	Og	B	M2	Dr
<i>H. sp.</i>				B3	
<i>Hedycarya arborea</i>	B7	B1	B	B2	Dr
<i>Helichrysum aggregatum</i> var. <i>aggregatum</i>	M1	Og	M2	Dr	
<i>H. lanceolatum</i>		PNA	Og		Dr
<i>Hierochloa redolens</i>					PNA
<i>Histiopteris incisa</i>	B7	B1	B8	B2	Dr
<i>Hoheria populnea</i> var. <i>populnea</i>	W		K,A		
<i>Hydrocotyle dissecta</i>		PNA	B	B2	Dr
<i>H. elongata</i>			D		G
<i>H. heteromeria</i>	B7	Ct	A		
<i>H. microphylla</i>		Ct		SG	Dr
<i>H. moschata</i>	B7	B1	B		Dr
<i>H. novae-zelandiae</i> s.s.	S2		A		Am
<i>H. pterocarpa</i>			A		Am
<i>Hymenantherna novae-zelandiae</i>		PNA			
<i>Hymenophyllum armstrongii</i>	B7		D		Dr
<i>H. atrovirens</i>					Dr
<i>H. bivalve</i>			K		Dr
<i>H. cupressiforme</i>	PNA			SG	
<i>H. demissum</i>	B7	B1	B	B2	Dr
<i>H. dilatatum</i>	B7	B1	B	B2	Dr
<i>H. ferrugineum</i>	B7	B1	B	PNA	Dr
<i>H. flabellatum</i>	B7	B1	B	B2	Dr
<i>H. flexuosum</i>	B7	B1	D		Dr
<i>H. lyallii</i>	B7	B1	D		Dr
<i>H. malingii</i>					Dr
<i>H. minimum</i>					Dr
<i>H. multifidum</i>	B7	B1	B	B2	Dr
<i>H. peltatum</i>					Cr
<i>H. pulcherrimum</i>					Dr
<i>H. rarum</i>	B7	S3	B	M2	Dr
<i>H. revolutum</i>	B7	B1	B	SG	Dr
<i>H. rufescens</i>					Dr
<i>H. sanguinolentum</i>	PNA	PNA	PNA	PNA	PNA
<i>H. scabrum</i>	B7	B1	B	B2	Dr
<i>H. villosum</i>	B7				C
<i>Hypericum japonicum</i>	B7		D		Am
<i>Hypolepis ambigua</i>	B7	Wr	K		Dr
<i>H. distans</i>	PNA	PNA	B9		G
<i>H. lactea</i>	S2				Dr
<i>H. rufobarbata</i>	B7	B5	B	Re	Dr
<i>Ileostylis micranthus</i>	PNA		D		
<i>Isachne globosa</i>	Ad	PNA	D	PNA	Dr
<i>Isolepis cernuus</i>	W	Og	K	M2	Am
<i>I. distigmatica</i>	PNA	Og	D		
<i>I. habra</i>					Dr
<i>I. inundata</i>	B7	B1	D	SG	Dr
<i>I. nodosa</i>	M1	Og	D	M2	Am
<i>I. pottsii</i>					Dr
<i>I. prolifer</i>	S2	S3	K		Dr
<i>I. reticularis</i>	S2	Og	D		
<i>I. sp.</i>					Am
<i>Ixerba brexioides</i>	B7	B1	B	B2	Dr
<i>Jovellana</i> sp.					Dr
<i>Juncus australis</i>		Og	K,A		Dr
<i>J. gregiflorus</i>	B7	B1	B	SG	Dr
<i>J. holoschoenus</i>					Dr
<i>J. maritimus</i> var. <i>australiensis</i>	W	Og	K	PNA	
<i>J. novae-zelandiae</i>	B7				
<i>J. pallidus</i>	B7	B1	D	PNA	
<i>J. pauciflorus</i>	B7				
<i>J. planifolius</i>	B7	B1	B	B2	Dr
<i>J. prismatocarpus</i>	S2	OG	PNA		Dr
<i>J. sarophorus</i>		PNA			Dr
<i>J. sp.</i>				B2	
<i>J. sp.</i>	W				

Ecological Districts Known to Occur in
Colville Tairua Thames Waihi Te Aroha

<i>Kellaria dieffenbachii</i>	B7				
<i>Knightia excelsa</i>	B7	B1	B	B2	Dr
<i>Korthalsella</i> sp.	PNA				
<i>Kunzea ericoides</i> var.	B7	B1	B	B2	Dr
<i>Lachnagrostis filiformis</i> agg.	Ad	Ct			
<i>L.</i> sp.			K		
<i>Lagarostrobos colensoi</i>		Ba			
<i>Lagenifera pumila</i>	B7	B1	B	B2	Dr
<i>Lagenifera stipitata</i>		Og			
<i>L. strangulata</i>					Am
<i>Lastreopsis glabella</i>	B7	B5	D	B2	Dr
<i>L. hispida</i>	B7	B1	B	B2	Dr
<i>L. microsora</i> s.s. <i>pentangularis</i>	S1	PNA	D	M2	Bb
<i>L. velutina</i>	M1		K	M2	S1
<i>Laurelia novae-zelandiae</i>	B7	B1	B	B2	Dr
<i>Lepidium oleraceum</i>	E		K		
<i>Lepidosperma australe</i>	B2	Og	A	M2	PNA
<i>L. laterale</i>	S1	Og	A	M2	Am
<i>Lepidothamnus intermedius</i>	B7	B1	B	Re	Dr
<i>Leptinella dioica</i> ssp. <i>dioica</i>	W		L		
<i>Leptocarpus similis</i>	M4	Og	K	PNA	
<i>Leptolepia novae-zelandiae</i>	PNA		K		Am,G
<i>Leptopteris hymenophylloides</i>	B7	B1	B	B2	Dr
<i>L. superba</i>					Dr
<i>L. hymenophylloides</i> x <i>L. superba</i>					Dr
<i>Leptospermum scoparium</i>	B7	B1	B	B2	Dr
<i>Leucopogon fasciculatus</i>	B7	Og	B	B2	Dr
<i>L. fraseri</i> s.s.	PNA	B1	K	M2	Dr
<i>Libertia grandifolia</i>	B7	S3	B	SG	Dr
<i>L. ixioides</i>	B7		Mo		Dr
<i>L. pulchella</i>	B7	B1	B		Dr
<i>Libocedrus bidwillii</i>	B7		B	Re	Dr
<i>Lilaeopsis</i> sp.			A		
<i>Lindsaea linearis</i>	S4	Og	D	B2	
<i>L. trichomanoides</i>	B7	B1	B	B2	Dr
<i>L. viridis</i>		B1	A	B2	Dr
<i>Linum monogynum</i>	M1	Ct	K	M2	
<i>Litsea calicaris</i>	B7	B5	B	B3	Dr
<i>Lobelia anceps</i>	C5	B1	B	B2	Am
<i>Lophomyrtus bullata</i>	B7	B1	B	B2	Dr
<i>L. obcordata</i>					Dr
<i>L. bullata</i> x <i>L. obcordata</i>					Am
<i>Loranthus micranthus</i>	PNA				
<i>Loxsuma cunninghamii</i>	PNA	B1	D		
<i>Luzula decipiens</i>	C5				
<i>L. picta</i> s.s.	S2	B1	B		Dr
<i>L. subclavata</i>				SG	
<i>Luzuriaga parviflora</i>	B7	B5	B		Dr
<i>Lycopodium cernuum</i>	PNA	B1	B	B3	Dr
<i>L. deuterodensum</i>	B7	B1	B	B2	Dr
<i>L. fastigiatum</i>					Am,G
<i>L. laterale</i>	B7	B1	B		Dr
<i>L. scariosum</i>	B7	B1	D	B2	Dr
<i>L. varium</i> (incl. <i>L. billardieri</i> & <i>L. novae-zelandicum</i>)	B7	B1	D	Re	Dr
<i>L. volubile</i>	B7	B1	B	B3	Dr
<i>Lygodium articulatum</i>	B7	B1	B	B2	Dr
<i>Machaerina sinclairii</i>		B1	B	B2	Dr
<i>Macropiper excelsum</i> var. <i>excelsum</i>	B7	PNA	B	B2	Dr
<i>Marattia salicina</i>	PNA	An	A		PNA
<i>Melicope simplex</i>		PNA	D		Dr
<i>M. ternata</i>	B7	Ct	K	M2	Dr
<i>M. simplex</i> x <i>M. ternata</i>			A	PNA	Dr
<i>Melicytus lanceolatus</i>		PNA	D		Dr
<i>M. macrophyllus</i>	E				
<i>M. micranthus</i>			B		
<i>M. novae-zealandiae</i>	M1	Ct			
<i>M. ramiflorus</i> s.s. <i>ramiflorus</i>	B7	B1	B	B2	Dr
<i>Metrosideros albiflora</i>	B7	B1	B		

	Ecological Districts Known to Occur in				
	Colville	Tairua	Thames	Waihi	Te Aroha
<i>P. glaucus</i>	B7	B1	B	R	Dr
<i>P. trichomanoides</i>	B7	B1	B	B2	Dr
<i>P. asplenifolius</i> var. <i>alpinus</i> × <i>P. glaucus</i>					Dr
<i>Phylloglossum drummondii</i>			A		
<i>Phymatosorus diversifolius</i>	B7	B1	B	B2	Dr
<i>P. novae-zelandiae</i>		D			Dr
<i>P. scandens</i>	B7	B1	B	B2	Dr
<i>Pimelea arenaria</i>		Og			
<i>P. buxifolia</i>		A			
<i>P. longifolia</i>			D		Dr
<i>P. prostrata</i>	M1	Ct		M2	Dr
<i>P. tomentosa</i>	Ad	Og	K	M2	PNA
<i>Pisonia brunoniana</i>	Ad,E	PNA			
<i>Pittosporum cornifolium</i>	B7	B5	B6	PNA	Dr
<i>P. crassifolium</i>	E	Og	PNA	M2	Am
<i>P. ellipticum</i>		Og			
<i>P. eugenoides</i>	W	B5	D	PNA	Dr
<i>P. huttonianum</i>	S	B1	B	B3	
<i>P. kirkii</i>	B7	B4	B6		Dr
<i>P. tenuifolium</i> ssp. <i>tenuifolium</i>	B7	PNA	B	B2	Dr
<i>P. umbellatum</i>	PNA	PNA	K	M5	Am
<i>P. virgatum</i>	B7,W	B5			
<i>Plagianthus divaricatus</i>	W	Og		PNA	
<i>P. regius</i>					S1
<i>Planchonella costata</i>	E	Ct,Og			
<i>Plantago raoulii</i>	E		K		
<i>Pneumatopteris pennigera</i>	B7	B1	B	B2	Dr
<i>Poa anceps</i> ssp. <i>anceps</i>	B7	B5	B	M2	Dr
<i>P. colensoi</i>	B7				Dr
<i>Podocarpus cunninghamii</i>	B7	B1	B	B2	Dr
<i>P. totara</i> var. <i>totara</i>	PNA	B1	D	SG	Dr
<i>P. cunninghamii</i> × <i>P. nivalis</i>	M				
<i>Polygonum</i> sp. (unnamed; <i>P. decipiens</i> auct.)	E		K		
<i>Polystichum richardii</i>	M1	Wr	D	B2	Dr
<i>P. silvaticum</i>	S2	B4	B		Dr
<i>P. vestitum</i>			D	Re	Dr
<i>Pomaderris ericifolia</i>	M1	Ct	K	B3	Dr
<i>P. hamiltonii</i>	M3				
<i>P. kumeraho</i>	PNA	B5	D	B2	PNA
<i>P. rugosa</i>	S1	Og	A1	PNA	
<i>Potamogeton cheesemanii</i>	PNA	Og			Dr
<i>P. suboblongus</i>			A		Am
<i>Potentilla anserinoides</i>					Am
<i>Prasophyllum colensoi</i>	B7	PNA			
<i>P. nudum</i>	M3				
<i>P. pumilum</i>	PNA		D		
<i>Pratia angulata</i>	PNA	PNA	B	SG	Dr
<i>Prumnopitys ferruginea</i>	B7	B1	B	B2	Dr
<i>P. taxifolia</i>	B7	B1	B	B2	Dr
<i>Pseudognaphalium</i> sp. (<i>P. luteoalbum</i> agg.)	CS	PNA			
<i>Pseudopanax anomalus</i>	B7	B5	B		Dr
<i>P. arboreus</i> var. <i>arboreus</i>	B7	B1	B	B2	Dr
<i>P. colensoi</i> s.s.	B7	B1	B		Dr
<i>P. crassifolius</i>	B7	B1	B	B2	Dr
<i>P. discolor</i>	PNA	B1	B	B2	Dr
<i>P. edgerleyi</i>	B7	B4	B	B2	Dr
<i>P. laetus</i>	B7	B1	PNA	PNA	Dr
<i>P. lessonii</i>	M1	Og	K	M2	
<i>P. simplex</i> (incl. <i>P. simplex</i> var. <i>sinclairii</i>)	B7	B5	B	M2	Dr
<i>P. arboreus</i> var. <i>arboreus</i> × <i>P. crassifolius</i>		D			
<i>P. crassifolius</i> × <i>P. lessonii</i>	M3		D		
<i>Pseudowintera axillaris</i>	B7	B1	B	B2	Dr
<i>P. colorata</i>	B7	B5	B	Re	Dr
<i>Psilotum nudum</i>	E	Wr			
<i>Pteridium esculentum</i>	B7	B1	B	B3	Dr
<i>Pteris comans</i>	PNA	Wr	D	B2	
<i>P. macilenta</i>	S1	S3	B	M2	Dr

Ecological Districts Known to Occur in					
	Colville	Tairua	Thames	Waihi	Te Aroha
<i>P. saxatilis</i>	M4				
<i>P. tremula</i>	S1	Wr	D	B3	Dr
<i>P. comans</i> x <i>P. macilentia</i>	M4	B8		M2	
<i>P. pendula</i> x <i>P. sp.</i>				M2	
<i>Pterostylis alobula</i>	S4				
<i>P. banksii</i>	B7	B4		M2	Am,G
<i>P. barbata</i>			A		
<i>P. brumalis</i>	S1				
<i>P. cardiostigma</i>		PNA			Dr
<i>P. graminea</i>	PNA	PNA	B8		
<i>P. nana</i>			A		
<i>P. trullifolia</i>	B7	B5	B	B2	
<i>P. sp.</i> (cf <i>P. alobula</i> , <i>P. trullifolia</i>)					Dr
<i>P. sp.</i> (unnamed)			D		
<i>P. sp.</i>			B6		
<i>Pyrrosia elaeagnifolia</i>	B7	B1	B	B2	Dr
<i>Quintinia serrata</i> (incl. <i>Q. acutifolia</i> & <i>Q. elliptica</i>)	B7	B1	B	B2	Dr
<i>Ranunculus acaulis</i>	E				
<i>R. amphitrichus</i>	PNA		K		Am
<i>R. reflexus</i>	E	B1	D	B2	Dr
<i>Raoulia glabra</i>					Dr
<i>R. tenuicaulis</i>			K		Am
<i>Rhabdothamnus solandri</i>	B7	B1	B	B2	Dr
<i>Rhagodia triandra</i>	M1				
<i>Rhopalostylis sapida</i>	B7	B1	B	B2	Dr
<i>Ripogonum scandens</i>	B7	B1	B	B2	Dr
<i>Rorippa gigantea</i>			K		Am
<i>R. palustris</i>			K		Am
<i>Rubus australis</i>	B7	B5	B	B2	Dr
<i>R. cissooides</i> var. <i>cissooides</i>	B7	B1	B	B2	Dr
<i>R. schmidelioides</i> var. <i>schmidelioides</i>			K	Re	G
<i>R. sp.</i>				B3	
<i>R. australis</i> x <i>R. cissooides</i> var. <i>cissooides</i>					Dr
<i>Rumex flexuosus</i>			K		
<i>Rumohra adiantiformis</i>	B7	B1	B	SG	Dr
<i>Rytidosperma biannulare</i>				SG	
<i>R. clavatum</i>	B	Og			
<i>R. gracile</i>	B7		D	Sg	Dr
<i>R. setifolium</i>	B7				
<i>R. unarede</i>		Og	D	SG	Dr
<i>R. viride</i>			C1		
<i>Sarcocornia quinqueflora</i>	B1	Og,Ct	D	PNA	
<i>Samolus repens</i> var.	W	Og,Ct	K	PNA	
<i>Scandia rosifolia</i> agg.	M1				
<i>Schefflera digitata</i>	B7	B1	B	B2	Dr
<i>Schizaea bifida</i>	PNA	PNA	D	PNA	Am
<i>S. dichotoma</i>	PNA			B2	
<i>S. sp.</i> (cf <i>S. australis</i> & <i>S. fistulosa</i>)	B7	B1	D	M5	
<i>Schoenoplectus pungens</i>	PNA		K		
<i>S. validus</i>	M1	Og			Am
<i>Schoenus apogon</i>	PNA	PNA	K		Am
<i>S. brevifolius</i>		Og	D	M2	
<i>S. maschalinus</i>	B7	Og	B		Dr
<i>S. tendo</i>	CS	B1	B	PNA	Dr
<i>Scleranthus biflorus</i>	W	Ct			
<i>Selliera radicans</i>	M4	Og	K	PNA	
<i>Senecio glomeratus</i>					Am
<i>S. hispidulus</i>			D	SG	
<i>S. lautus</i> ssp. <i>lautus</i>	E	Ct	K		
<i>S. minimus</i>	B7	B1	B	M2	Dr
<i>S. quadridentatus</i>			K		Am
<i>S. scaberulus</i>	E				
<i>S. sp.</i>	E				
<i>Sicyos australis</i>	Ad	Ct	K		
<i>Solanum aviculare</i>		B5	K	B2	Dr
<i>S. laciniatum</i>	E,W			SG	
<i>Sonchus kirkii</i>	W				
<i>Sophora microphylla</i>	S1	PNA	D	PNA	Am

Ecological Districts Known to Occur in					
Colville	Tairua	Thames	Waihi	Te Aroha	
<i>Sparganium subglobosum</i>	Ad		A		Am
<i>Spinifex sericeus</i>	M1	Og	K	M2	
<i>Stellaria decipiens</i>	E	B1	K		Dr
<i>Sticherus cunninghamii</i>	B7	B1	B	B2	Dr
<i>S. flabellatus</i>	PNA	PNA	Cr	Sm	Am
<i>Stipa stipoides</i>	M4	Ct	K		
<i>Streblus banksii</i>	W				
<i>S. heterophyllus</i>	W		D	M2	Dr
<i>Suaeda novae-zelandiae</i>			PNA		
<i>Syzygium maire</i>	PNA	B5	B8	Re	Dr
<i>Tetragonia trigyna</i>	W	Og,Ct		PNA	
<i>Tetraria capillaris</i>	PNA	PNA	PNA		
<i>Teucrium parvifolium</i>			D		Am
<i>Theylmitra carnea</i>			D		
<i>T. cyanea</i>	B7				
<i>T. decora</i>			PNA		
<i>T. formosa</i>	S1	PNA			
<i>T. ixioideis</i>					G
<i>T. longifolia</i>	B7	Og	PNA	M2	Dr
<i>T. pauciflora</i>	Cs		PNA		Dr
<i>T. pulchella</i>			A		
<i>T. sp.</i>	W	Ct			
<i>Tmesipteris elongata</i> (incl. <i>T. elongata</i> ssp. <i>robusta</i>)	B7	B1	B	B2	Dr
<i>T. lanceolata</i>	B7	PNA		B2	Dr
<i>T. signatifolia</i>	B7	PNA	B6	PNA	PNA
<i>T. tannensis</i>	B7	B4	B		Dr
<i>Townsonia viridis</i>			D		
<i>Toronia toru</i>	B7	B1	B6	B2	Dr
<i>Trichomanes elongatum</i>	B7	B5	B	B2	Dr
<i>T. endlicherianum</i>	B7	S3	D	SG	Dr
<i>T. reniforme</i>	B7	B1	B	B2	Dr
<i>T. strictum</i>	B7	B1	D		Dr
<i>T. venosum</i>	B7	B1	B6	B2	Dr
<i>Triglochin striatum</i>	W	Og	K		
<i>Trilepidea adamsii</i>			A		
<i>Trisetum</i> sp.	Ad				
<i>Tupeia antarctica</i>			K		G
<i>Typha orientalis</i>	M1	Ct	PNA	PNA	Dr
<i>Uncinia banksii</i>	B7	B5		B2	Dr
<i>U. clavata</i>					Dr
<i>U. distans</i>		B1	B		Dr
<i>U. ferruginea</i>					Dr
<i>U. gracilentia</i>			D		Dr
<i>U. rupestris</i>	B7	S3	B		Dr
<i>U. uncinata</i>	B7	B1	B	B2	Dr
<i>U. zotovii</i>	B7		B6		Dr
<i>U. sp.</i>				Re	
<i>Urtica ferox</i>					Dr
<i>U. incisa</i>			D		Dr
<i>Utricularia monanthos</i>		PNA			
<i>Viola filicaulis</i>	B7	B4	B8		Dr
<i>Vitex lucens</i>	B7	Og	Au	B2	Dr
<i>Wahlenbergia gracilis</i> agg.	S	B1	K	B2	
<i>W. sp.</i>	B7				Dr
<i>Weinmannia racemosa</i> var. <i>racemosa</i>		PNA		PNA	Dr
<i>W. racemosa</i> var. (<i>W. silvicola</i>)	B7	B1	B	B2	Wa
<i>Yuania australis</i>	PNA				
<i>Zostera capricorni</i>	PNA	Ct			
<i>Z. muelleri</i>	Ad				
<i>Z. sp.</i>			K		
<i>Zoysia pauciflora</i>		Og			
<i>Z. pungens</i>	Ad				
<i>Z. sp.</i>	W				

APPENDIX III

Animal Species Checklist for Coromandel Ecological Region

INDIGENOUS AND NATURALISED FAUNA

(Information from ecological area report by Burns and Fauna Survey Unit, unpublished, and reptile and amphibian distributions are from Department of Conservation, in prep.)

Ecological Districts Known to Occur in
Colville Tairua Thames Waihi Te Aroha

(i) MAMMALS

Native

Long-tailed bat	<i>Chalinolobus tuberculatus</i>	X	X	X	X	X

Introduced (feral)

cattle	<i>Bos taurus</i>	X			X	
goat	<i>Capra hircus</i>	X	X	X	X	
hares		X		X		X
pig	<i>Sus scrofa</i>	X	X	X	X	X
possum brush-tailed	<i>Trichosurus vulpecula</i>	X	X	X	X	X
rabbit		X		X		X
stoats?	<i>Mustela</i> sp.	X	X	X		X
rats	<i>Rattus</i> spp.	X	X	X	X	X

(ii) BIRDSForest and Field

Native

Australasian harrier	<i>Circus approximans gouldii</i>	X	X	X	X	X
bellbird	<i>Anthornis melanura melanura</i>	X	X	X	X	X
greywarbler	<i>Gerygone igata igata</i>	X	X	X	X	X
long-tailed cuckoo	<i>Eudynamis taitensis</i>		X	X		X
morepork	<i>Ninox novaeseelandiae</i>					
	<i>novaeseelandiae</i>	X	X	X	X	X
NZ falcon	<i>Falco novaeseelandiae</i>	X	X		X	
NZ kingfisher	<i>Halcyon sancta vagans</i>	X	X	X	X	X
NZ pied tit	<i>Petroica macrocephala toitoi</i>	X	X	X	X	X
NZ pigeon	<i>Hemiphaga novaeseelandiae</i>					
	<i>novaeseelandiae</i>	X	X	X	X	X
NZ pipit	<i>Anthus novaeseelandiae</i>					
	<i>novaeseelandiae</i>	X	X	X	X	X
NZ brown kiwi	<i>Apteryx australis mantelli</i>	X	X	X	X	X
NI fantail	<i>Rhipidura guliginosa placabilis</i>	X	X	X	X	X
NI kaka	<i>Mestor meridionalis septentrionalis</i>	X	X	X	X	X
NI kokako	<i>Callae cinerea wilsoni</i>		X	X	X	X
NI rifleman	<i>Acanthisitta chloris granti</i>	X		X		X
NI robin	<i>Petroica australis longipes</i>	X				X
parakeet	<i>Cyanoramphus</i> spp.	X	XDC		X	X
red-crowned parakeet	<i>Cyanoramphus novaeseelandiae</i>					
	<i>chathamensis</i>					
shining cuckoo	<i>Chrysococcyx lucidus lucidus</i>	X	X	X	X	X
silveryeye	<i>Zosterops lateralis lateralis</i>	X	X	X	X	X
spur-winged plover	<i>Vanellus miles novaehollandiae</i>	X				X
tui	<i>Prosthemadera novaeseelandiae</i>					
	<i>novaeseelandiae</i>	X	X	X	X	X
welcome swallow	<i>Hirundo tahitica neoxena</i>	X	X	X	X	X
whitehead	<i>Mohoua albigilla</i>	X				X
yellow-crowned parakeet	<i>Cyanoramphus auriceps</i>			X		

Ecological Districts Known to Occur in
Colville Tairua Thames Waihi Te Aroha

Introduced

blackbird	<i>Turdus merula merula</i>	X	X	X	X	X
brown quail	<i>Synoicus ypsilophorus</i>	X	X	X	X	X
California quail	<i>Lophortyx californica brunnescens</i>	X	X	X	X	X
chaffinch	<i>Frigilla coelebs gengleri</i>	X	X	X	X	X
eastern rosella	<i>Platycercus eximius</i>	X	X	X	X	X
feral pigeon	<i>Columba livia</i>	X				
goldfinch	<i>Carduelis carduelis brittanica</i>	X	X	X	X	X
greenfinch	<i>Carduelis chloris chloris</i>	X	X	X	X	X
hedge sparrow	<i>Prunella modularis occidentalis</i>	X	X	X	X	X
house sparrow	<i>Passer domesticus domesticus</i>	X	X	X	X	X
Indian myna	<i>Acrodothis tristis</i>	X	X	X	X	X
magpie	<i>Gymnorhina sp.</i>	X	X	X	X	
pheasant	<i>Phasianus colchicus</i>	X	X	X	X	X
redpoll	<i>Carduelis flammea cabaret</i>	X	X	X	X	X
skylark	<i>Alauda arvensis arvensis</i>	X	X	X	X	X
song thrush	<i>Turdus philomelos clarkei</i>	X	X	X	X	X
starling	<i>Sturnus vulgaris vulgaris</i>	X	X	X	X	X
turkey	<i>Meleagris gallopavo</i>	X				
white backed magpie	<i>Gymnorhina tibicen hypoleuca</i>	X	X	X	X	X
yellow hammer	<i>Emberiza citrinella caliginosa</i>	X	X	X	X	X

Wetland and ShoreNative

Australasian bittern	<i>Botaurus stellaris poiciloptilus</i>	X	X			
banded dotterel	<i>Charadrius bicinctus bicinctus</i>	X	X		X	
banded rail	<i>Rallus philippensis assimilis</i>	X	X		X	
black-billed gull	<i>Larus bulleri</i>	X	X	X		
black shag	<i>Phalacrocorax carbo novaehollandiae</i>	X	X	X	X	X
black stilt	<i>Himantopus novaeseelandiae</i>		X			
black swan	<i>Cygnus atratus</i>	X	X			X
blue duck (?)	<i>Hymenolaimus malacorhynchus</i>					
brown teal	<i>Anas acuklandica chlorotis</i>	X				
Caspian tern	<i>Hydroprogne caspia</i>	X	X	X	X	X
eastern bar-tailed godwit	<i>Limosa lapponica baueri</i>	X	X	X		
grey duck	<i>Anas superciliosa superciliosa</i>	X	X	X	X	X
grey teal	<i>Anas gibberifrons</i>					X
little black shag	<i>Phalacrocorax sulcirostris</i>	X	X	X	X	
little shag	<i>Phalacrocorax melanoleucos brevirostris</i>	X	X	X	X	X
NZ dabchick	<i>Podiceps rufopectus</i>					X
NZ dotterel	<i>Charadrius obscurus</i>	X	X		X	
NZ scaup	<i>Aythya novaeseelandiae</i>			X		
NZ shoveler	<i>Anas rhynchotis variegata</i>		X			X
northern blue penguin	<i>Eudyptula minor iredalei</i>	X	X	X		
NI fernbird	<i>Bowdleria punctata vealeae</i>	X	X		X	
paradise shelduck	<i>Tadorna variegata</i>	X	X		X	X
pied shag	<i>Phalacrocorax varius varius</i>	X	X	X	X	
pied stilt	<i>Himantopus himantopus leucocephalus</i>	X	X	X	X	X
pukeko	<i>Porphyrio porphyrio melantous</i>	X	X	X	X	X
red-billed gull	<i>Larus novaehollandiae scopulinus</i>	X	X	X	X	
red-necked stint	<i>Calidris ruficollis</i>		X			
reef heron	<i>Egretta sacra sacra</i>	X	X	X	X	
sanderling	<i>Calidris alba</i>		X			
South Island pied oyster catcher	<i>Haemotopus ostralegus finschi</i>	X	X	X	X	
southern black-backed gull	<i>Larus dominicanus</i>	X	X	X	X	X
spotless crake	<i>Porzana tabuensis plumbea</i>	X	X		X	
spotted shag	<i>Stictocaro punctatus punctatus</i>	X		X		
turnstone	<i>Arenaria interpres interpres</i>		X			

Ecological Districts Known to Occur in
Colville Tairua Thames Waihi Te Aroha

variable oyster catcher	<i>Haematopus unicolor</i>	X	X	X	X	
white-faced heron	<i>Ardea novaehollandiae</i>	X	X	X	X	X
white-fronted tern	<i>Sterna striata</i>	X	X	X	X	
wrybill	<i>Anarhynchus frontalis</i>	X				
mallard	<i>anas platyrhynchos platyrhynchos</i>	X	X	X	X	X

Introduced

Seabirds

Arctic skua	<i>Stercorarius parasiticus</i>	X	X			
Australasian gannet	<i>Sula bassana serrator</i>	X	X	X	X	
Bullers shearwater	<i>Puffinus bulleri</i>	X				
Cooks petrel	<i>Pterodroma cookii cookii</i>	X				
fluttering shearwater	<i>Puffinus gavia gavia</i>	X	X			
giant petrel	<i>Macronectes</i> sp.	X				
grey-faxed petrel	<i>Pterodroma macroptera gouldi</i>		X			
northern diving petrel	<i>Pelecanoides urinatrix unrinatrix</i>	XDC				
sooty shearwater	<i>Puffinus griseus</i>	X	X			
white-faced storm petrel	<i>Pelagodroma marina maoriana</i>	XDC				

(iii) REPTILES (tuatara, geckos, skinks, turtles and snakes)

Auckland green gecko	<i>Naufinus elegans elegans</i>	X	X	X	X	
common gecko	<i>Hoplodactylus maculatus</i>	X				X
copper skink	<i>Cyclodina aenea</i>	X				
Duvaucel's gecko	<i>Hoplodactylus duvauceli</i>			X		
forest gecko	<i>Hoplodactylus granulatus</i>	X			X	X
leathery turtle	<i>Dermochelys coriacea</i>			X		
moko skink	<i>Leiopisma moco</i>	XDC	X			
oviparous skink	<i>Leiopisma suteri</i>	X				
Pacific gecko	<i>Hoplodactylus pacificus</i>	X	XDC			
rainbow skink	<i>Lampropholis delicata</i>	X				
shore skink	<i>Leiopisma smithi</i>	X	X	X		
tuatara	<i>Sphenodon punctatus</i>		XDC			
Whitaker's skink	<i>Cyclodina whitakeri</i>		X			
yellow-bellied sea snake	<i>Pelamis platurus</i>	X				

(iv) AMPHIBIANS (frogs)

Native

Archey's frog	<i>Leiopelma archeyi</i>	X		X	X	
Hochstetter's frog	<i>Leiopelma hochstetteri</i>	X	X	X	X	X

Introduced

	<i>Litoria raniformis</i>	X				
whistling frog	<i>Litoria ewingi</i>	X				

FISH (FRESHWATER) (Data from MAF and DOC freshwater fisheries databases)

Native

Lamprey	<i>Geotria australis</i>				F	
Long-finned eel	<i>Anguilla dieffenbachii</i>	F	F	F	F	F
Short-finned eel	<i>A. australis</i>	F	F	F	F	F
Giant kokopu	<i>Galaxias argenteus</i>	F	F		F	
Banded kokopu	<i>G. fasciatus</i>	F	F	F	F	
Koaro	<i>G. brevipinnis</i>	F		F	F	
Inanga	<i>G. maculatus</i>	F	F	F	F	F
Short jawed kokopu	<i>G. postvectis</i>				F	
Torrent fish	<i>Cheimarrichthys forsteri</i>	F	F	F	F	F

Ecological Districts Known to Occur in
Colville Tairua Thames Waihi Te Aroha

Common bully	<i>Gobiomorphus cotidianus</i>	F	F	F	F	F
Cran's bully	<i>G. basalis</i>	F	F	F	F	F
Blue-gilled bully	<i>G. hubbsi</i>	F				
Red-finned bully	<i>G. huttoni</i>		F	F	F	F
Giant bully	<i>G. gobioides</i>	F		F		
Bully	<i>G. sp.</i>		F	F	F	
Common smelt	<i>Retropinna retropinna</i>	F	F	F	F	F
Black mudfish	<i>Neochanna diversus</i>				F	

Introduced

Brown trout	<i>Salmo trutta</i>		F		F	
Rainbow trout	<i>Oncorhynchus mykiss</i>		F	F	F	F
Goldfish	<i>Carassius auratus</i>				F	
Rudd	<i>Scardinius erythrophthalmus</i>				F	

(v) **INVERTEBRATES**

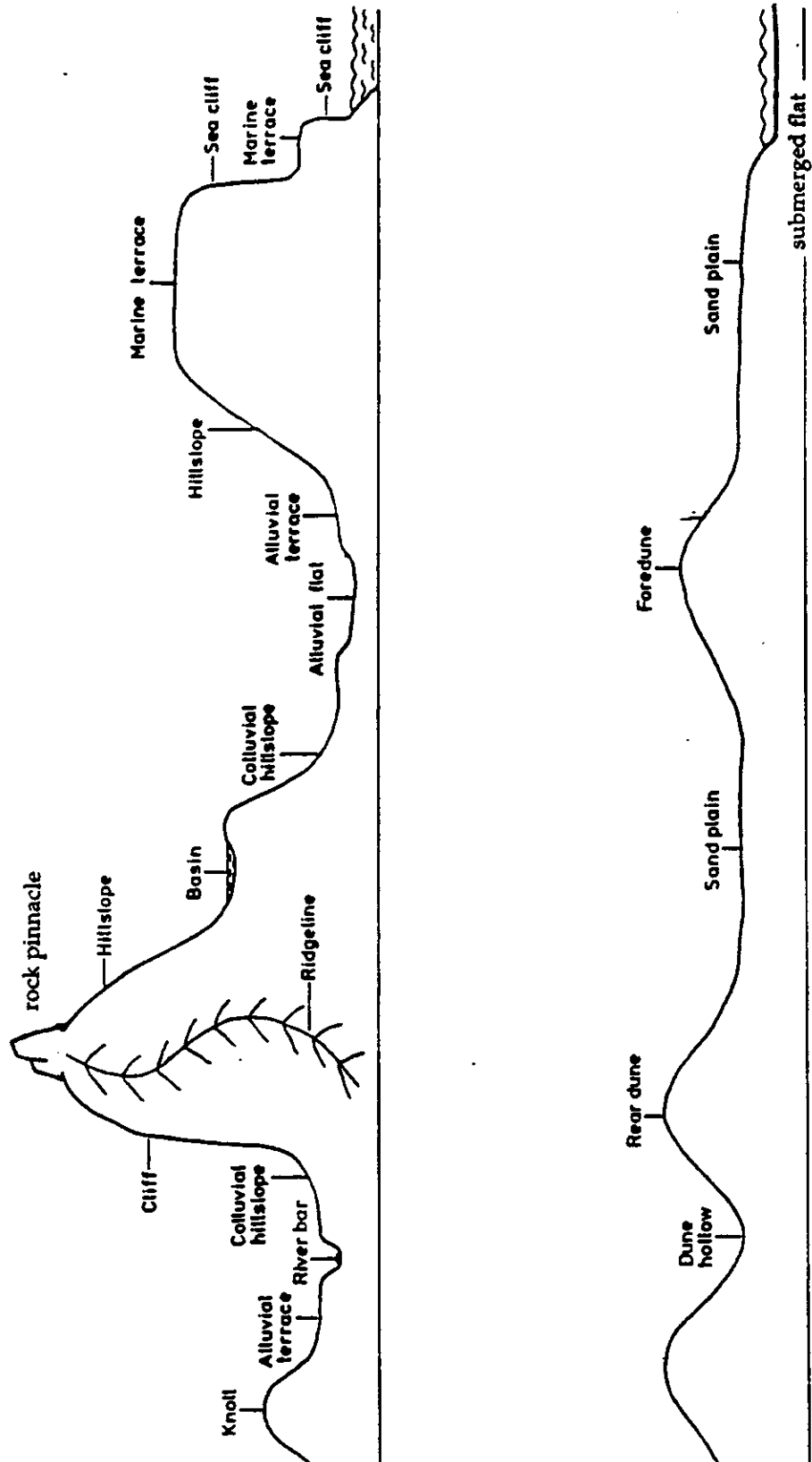
Crustacea

koura	<i>Paranephrops planifrons</i>	F	F	F	F	F
shrimp	<i>Parataya curvirostris</i>					

Molluscs

land snails	<i>Allodiscus dimorphus</i>	<i>Mocella eta</i>
	<i>A. miranda</i>	<i>M. nsp. "northernmaculata"</i>
	<i>A. planulatus</i>	<i>M. nsp. c.f. manatawhia</i>
	<i>A. tessellatus</i>	<i>Paracharopa gerulstonii</i>
	<i>A. urquhartii</i>	<i>P. chrysangeia</i>
	<i>Cavellia buccinella</i>	<i>Phenacohelix giveni</i>
	<i>Cavellia reeftonenensis</i>	<i>P. ponsonbyi</i>
	<i>C. roseveari</i>	<i>Phenocaropa pseudanguiculata</i>
	<i>Chauropa microumbilicata</i>	<i>Phrixgnathus erigone</i>
	<i>Charopa coma</i>	<i>Pulchidromus barbatulus</i>
	<i>C. costullata</i>	<i>Punctum ariel</i>
	<i>C. eta</i>	<i>P. conella</i>
	<i>C. montivaga</i>	<i>P. chryaligeia</i>
	<i>C. nsp. hazelwoodi group</i>	<i>P. crispatum</i>
	<i>C. pilsbryi</i>	<i>P. erigone</i>
	<i>Cytora cytora</i>	<i>P. fulgurata</i>
	<i>C. fasciata</i>	<i>P. lateumbilicata</i>
	<i>C. torquilla</i>	<i>P. mariae</i>
	<i>Delos coresia</i>	<i>P. marina</i>
	<i>D. jeffreysiana</i>	<i>P. ordinarium</i>
	<i>Elasmias subperforata</i>	<i>P. poecilcostata</i>
	<i>Fectoria infecta</i>	<i>P. spp. (unnamed x 3)</i>
	<i>F. mira</i>	<i>Omphalorissa purchasi</i>
	<i>Flammoconcha feredayi</i>	<i>Rhytida greenwoodi</i>
	<i>Flammulini crebriflammis</i>	<i>Serpho kivi</i>
	<i>F. chiron</i>	<i>Thelassohelix zelandiae</i>
	<i>F. perdita</i>	<i>T. zigzag</i>
	<i>Geminoropa huttoni</i>	<i>Therapsia decidua</i>
	<i>G. sp. cf microrhina</i>	<i>T. zelandiae</i>
	<i>G. c.f. cookiana</i>	<i>T. kivi</i>
	<i>Huonodon hectori</i>	<i>Therapsiella neozelanica</i>
	<i>H. pseudoleioda</i>	<i>T. nsp. c.f. neozelanica</i>
	<i>Lamellidea novaseelandica</i>	<i>T. celinde</i>
	<i>Laoma conella</i>	<i>T. serrata</i>
	<i>L. erigone</i>	<i>T. tamora</i>
	<i>L. leimionias</i>	<i>Tornatellides subperforata</i>
	<i>L. marina</i>	<i>Tornatellinops novoseelandica</i>
	<i>L. pirongiaensis</i>	<i>Schizoglossa worthyae</i>
	<i>L. nsp. "tallmarina"</i>	<i>Serpho</i>
	<i>Liarea turriculata waipona</i>	<i>Suteria ide</i>
	<i>L. egea</i>	

APPENDIX IV

Schematic Diagram of Landforms and
Landform Definition

APPENDIX V

Common Plant Names Used in the Text

(INCLUDES INTRODUCED SPECIES)

akeake	<i>Dodonaea viscosa</i>
akepiro	<i>Olearia furfuraceae</i>
batchelor's button	<i>Cotula coronoi</i>
blueberry	<i>Dianella nigra</i>
blackberry	<i>Rubus fruticosus</i>
bracken	<i>Pteridium esculentum</i>
broadleaf	<i>Griselinia littoralis</i>
bush cabbage tree	<i>Cordyline banksii</i>
bush rice grass	<i>Microlaena avenacea</i>
cabbage tree	<i>Cordyline australis</i>
catsear	<i>Hypochoeris radicata*</i>
cocksfoot	<i>Dactylis glomerata*</i>
dracophyllum	<i>Dracophyllum</i> spp.
eel grass	<i>Zostera</i> spp.
flax	<i>Phormium cookianum</i> , <i>Phormium tenax</i>
fleabane	
five finger	<i>Pseudopanax arboreus</i> var. <i>arboreus</i>
fuchsia	<i>Fuchsia excorticata</i>
gahnia	<i>Gahnia</i> sp.
glasswort	<i>Sarcocornia quinqueflora</i>
gorse	<i>Ulex europaeus*</i>
haekaro	<i>Pittosporum umbellatum</i>
hakea	<i>Hakea sericea</i>
Halls totara	<i>Podocarpus cunninghamii</i>
hangehange	<i>Geniostoma rupestre</i> var.
haretail	<i>Lagurus ovatus*</i>
hard beech	<i>Nothofagus truncata</i>
haumakaroa	<i>Pseudopanax edgerleyi</i>
hawkbit	<i>Leontodon taraxacoides*</i>
heketara	<i>Olearia rani</i>
hen and chicken fern	<i>Asplenium bulbiferum</i> s.s. <i>bulbiferum</i>
hinau	<i>Eleaocarpus dentatus</i>
horopito	<i>Pseudowintera axillaris</i>
houpara	<i>Pseudopanax lessonii</i>
Italian ryegrass	<i>Lolium multiflorum*</i>
jointed sedge	<i>Leptocarpus similis</i>
kahikatea	<i>Dacrycarpus dacrydioides</i>
kaikawaka	<i>Libocedrus bidwillii</i>
kamahi	<i>Weinmannia racemosa</i> var. <i>racemosa</i>
kanono	<i>Coprosma grandifolia</i>
kanuka	<i>Kunzea ericoides</i> var.
karaka	<i>Corynocarpus laevigatus</i>
karamu	<i>Coprosma robusta</i>
karo	<i>Pittosporum crassifolium</i>
kauri	<i>Agathis australis</i>
kawakawa	<i>Macropiper excelsum</i> var. <i>excelsum</i>
kiekie	<i>Freycinetia baueriana</i> ssp. <i>banksii</i>
king fern	<i>Marattia salicina</i>
kiokio	<i>Blechnum</i> sp. ('black spot')
knotted sedge	<i>Scirpus nodosus</i>
kohekohe	<i>Dysoxylum spectabile</i>
kohuhu	<i>Pittosporum tenuifolium</i> s.s. <i>tenuifolium</i>
korokia	<i>Corokia buddleioides</i> var. <i>linearis</i>
koromiko	<i>Hebe stricta</i> var. <i>stricta</i>
kowhai	<i>Sophora microphylla</i>
kumarahou	<i>Pomaderris kumeraho</i>
large-leaved milk tree	<i>Paratrophis banksii</i>
mahoe	<i>Melicytus ramiflorus</i> s.s. <i>ramiflorus</i>
mairehau	<i>Phebalium nudum</i>
mamaku	<i>Cyathea medullaris</i>
mamangi	<i>Coprosma arborea</i>
mangaeo	<i>Litsea calicaris</i>
mangemange	<i>Lygodium articulatum</i>
mangrove	<i>Avicennia resinifera</i>
manuka	<i>Leptospermum scoparium</i>
mapou	<i>Myrsine australis</i>
maritime pine	<i>Pinus pinaster*</i>
marsh ribbonwood	<i>Plagianthus divaricatus</i>

matai	<i>Prumnopitys taxifolia</i>
mingimingi	<i>Leucopogon fasciculatus</i>
miro	<i>Prumnopitys ferruginea</i>
monoao	<i>Halocarpus kirkii</i>
mountain horopito	<i>Pseudowintera colorata</i>
mountain neinei	<i>Dracophyllum traversii</i>
mountain toatoa	<i>Phyllocladus aspleniifolius</i> ssp. <i>alpinus</i>
narrow-leaved plantain	<i>Plantago lanceolata</i> *
ngaio	<i>Myoporum laetum</i>
nikau	<i>Rhopalostylis sapida</i>
northern rata	<i>Metrosideros robusta</i>
NZ iceplant	<i>Disphyma australe</i>
parapara	<i>Pisonia brunoniana</i>
paspalum	<i>Paspalum dilatatum</i> *
pate	<i>Schefflera digitata</i>
pigeonwood	<i>Hedycarya arborea</i>
pingao	<i>Desmoschoenus spiralis</i>
pink pine	<i>Halocarpus biformis</i>
pokaka	<i>Eleaocarpus hookerianus</i>
pohuehue	<i>Muehlenbeckia</i> spp.
pohutukawa	<i>Metrosideros excelsa</i>
prickly hakea	<i>Hakea sericifolia</i> *
privet	<i>Ligustrum</i> spp.
pukatea	<i>Laurelia novae-zelandiae</i>
puriri	<i>Vitex lucens</i>
pussy willow	<i>Salix</i> sp.*
putaputaweta	<i>Carpodetus serratus</i>
quintinia	<i>Quintinia serrata</i>
radiata pine	<i>Pinus radiata</i> *
rangiora	<i>Brachyglottis repanda</i>
raupo	<i>Typha orientalis</i>
red beech	<i>Nothofagus fusca</i>
rewarewa	<i>Knightia excelsa</i>
rimu	<i>Dacrydium cupressinum</i>
sand daphne	<i>Pimelia arenaria</i>
sand sedge	<i>Carex pumila</i>
sea cakile	<i>Cakile maritima</i>
sea celery	<i>Apium prostratum</i>
seas rush	<i>Juncus maritimus</i>
silver beech	<i>Nothofagus menziesii</i>
silver fern	<i>Cyathea dealbata</i>
silver pine	<i>Lagarostrobos colensoi</i>
Smith's tree fern	<i>Cyathea smithii</i>
southern rata	<i>Metrosideros umbellata</i>
spinifex	<i>Spinifex sericeus</i>
stinkwood	<i>Coprosma foetidissima</i>
supplejack	<i>Ripogonum scandens</i>
swamp maire	<i>Syzygium maire</i>
sweet vernal	<i>Anthoxanthum odoratum</i> *
tamingi	<i>Epacris pauciflora</i>
tanekaha	<i>Phyllocladus trichomanoides</i>
tarata	<i>Pittosporum eugenioides</i>
taraire	<i>Beilschmiedia tarairi</i>
taupata	<i>Coprosma repens</i>
tawa	<i>Beilschmiedia tawa</i>
tawapou	<i>Planchonella costata</i>
tawari	<i>Ixerba brexoides</i>
tawheowheo	<i>Quintinia serrata</i>
titoki	<i>Alectryon excelsus</i> var. <i>excelsus</i>
toatoa	<i>Phyllocladus glaucus</i>
toro	<i>Myrsine salicina</i>
totara	<i>Podocarpus totara</i>
towai	<i>Weinmannia silvicola</i>
tree fern	<i>Cyathea</i> spp., <i>Dicksonia</i> sp.
tree lupin	<i>Lupinus arboreus</i> *
tutu	<i>Coriaria arborea</i>
wattle	<i>Acacia</i> sp., <i>Albizia</i> sp.*
wharangi	<i>Melicope ternata</i>
whau	<i>Entelea arborescens</i>
wheki	<i>Dicksonia squarrosa</i>
white maire	<i>Nestegis lanceolata</i>
yellow-silver pine	<i>Lepidothamnus intermedius</i>
yorkshire fog	<i>Holcus lanatus</i> *

* adventive

APPENDIX VI

Criteria for Ranking Sites of Special Wildlife Interest

(CRITERIA USED BY FAUNA SURVEY UNIT IN WILDLIFE HABITAT SURVEYS)

A site has to meet only one of the following criterion to gain that status.

1. Outstanding

- (a) Presence of a breeding population of a highly endangered or rare endemic species.
- (b) A population of an endemic species of very restricted distribution and which could become endangered.
- (c) Areas essential to species from (a) and (b) for purposes other than breeding.
- (d) Areas of vital importance to internationally uncommon species (breeding and/or migratory).
- (e) Areas of vital importance to internally migratory species with very limited distribution or abundance.
- (f) Largely unmodified ecosystem or example of original habitat type not represented elsewhere in the country, of large size and containing viable populations of all or almost all species which are typical of the ecosystem of habitat type.

2. High

- (a) Habitat containing an indigenous species which has declined significantly through man's influence.
- (b) One of few or the only breeding area for a non-endemic indigenous species of limited abundance.
- (c) Habitat of an uncommon, discontinuously distributed species not adequately represented in a particular ecological region.
- (d) Example of a largely unmodified habitat which is not represented to the same extent elsewhere in the ecological region and is used by most species which are typical of that habitat type for the region.
- (e) Presence of a species of an endemic family which is of limited abundance throughout the country although adequately represented in one ecological region but whose habitat is at some risk.

3. Moderate - High

- (a) Presence of a species which is still quite widely distributed but whose habitat has been and still is being significantly reduced or modified through man's influence.
- (b) Areas containing high numbers of breeding or moulting birds, or where breeding or moulting areas of inter-regional significance to wildlife.
- (c) A large and fairly unmodified habitat or ecosystem which is represented elsewhere in the ecological region and contains all or almost all species typical of that habitat type for a particular region.
- (d) An area where any particular species is exceptional in terms of, say, abundance or behaviour but which is otherwise widespread.

APPENDIX VII

Glossary of PNA Terms

Source reference:

Law et al (1984)

BIOCLIMATIC ZONE:

Zones delineated subjectively which changes in species and communities reflect altitude and the associated variation in temperature, rainfall, exposure etc. See Appendix IX.

COMMUNITIES:

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

ECOLOGICAL ASSESSMENT CRITERIA:

1. Representativeness (of Ecological Units)

(a) Representative Value

Value assigned on a scale of 1 to 4 to ecological units based on their extent in the District; reduction in area of their former extent; and adequacy of representation in reserves.

	Representative Value
ie Protection adequate	1
Protection inadequate and not a major part of original landscape	2
Protection inadequate, and a major part of original landscape, but not greatly reduced in extent	3
Protection inadequate, major part of original landscape now greatly reduced in extent	4

(b) Representative Quality

Value assigned to each Ecological Unit based on naturalness, size and relationship with surrounding landscape. Classified according to whether the occurrence is:

- (1) a poor example
- (2) typical
- (3) one of better
- (4) exemplary

For ecological units that are unique or rare a scale of 1 to 4 is used by comparing the relative condition of these with related ecological units.

2. Ecological Quality (of Natural Areas)

This is the summation of scores for the following parameters

(a) Diversity and Pattern

Diversity refers to the natural diversity of ecological units within a natural area ie the number of ecological units occurring (scored on a scale of 1-5). Patterns takes into account include successional, drainage, altitudinal, salinity etc gradients (the score is derived from a summation of the ecological patterns recorded).

(b) Rarity and Special Features

Rarity is a measure of the paucity of numbers of occurrences of objects of natural diversity (eg species, communities). Rare and special features are assessed, in increasing order of importance, at the district, region and national levels (includes a summation of rare/special features and a scoring of 1 to 5 of the highest degree of rarity present).

(c) Naturalness

An estimate of how closely an ecosystem approaches the state one might expect in the absence of humans and other introduced animals and plants (scored on a scale 1-3).

(d) Inherent Viability

Long term ecological viability refers to self-regulating capacity and an ability to resist direct and indirect human effects. An important factor is size and sensitivity of ecological units within the Natural Area (scored on a scale 1-4).

(e) Size and Shape

Size and design of a natural area affect the ultimate success of maintaining viability of ecological units within the Natural Area (scored scale on a 104).

(f) Buffering, Surrounding Landscape and Boundaries

The relationship a natural area has with its surrounding landscape, and the extent to which it is buffered, have important consequences for its long-term effective functioning.

Factors to consider are:

- buffering (eg by modified forest or scrub) to reduce external influences on the major natural features.
- continuity with or proximity to other natural habitats.
- spacing of natural areas and networks of natural areas for seed dispersal, migratory animals, etc.

Boundaries should follow natural features eg ridges, streams, etc. Complete catchments are ideal. Buffering is scored in a scale of 1-3 and condition of surrounding landscape on a scale of 1-5.

(g) Fragility and Threat

A measure of the intrinsic sensitivity of ecological units, habitats and species to environmental change, combined with an assessment of exposure to threat which could disturb existing equilibrium (scored on a scale of 1-4).

(h) Management Input

Human input required to retain the inherent viability, eg fencing, animal control, weed control etc (scored on a scale of 1-4).

ECOLOGICAL CHARACTER:

The distinguishing features of a particular place, definable in terms of biotic composition, climatic, edaphic, and topographical information.

ECOLOGICAL CLASS:

A category which describes the broad ecological patterns within an Ecological District in terms of bioclimatic zone, physical environment and natural communities eg lowland forest on plains of low relief.

ECOLOGICAL DISTRICT:

A local part of New Zealand where geological, topographical, climatic and biological features and processes, including the broad cultural pattern, interrelate to produce a characteristic landscape and range of biological communities. New Zealand has been

subdivided into 268 such districts. It represents the level for assessing the representativeness of major ecosystems types in the national network of Protected Natural Areas.

ECOLOGICAL REGION:

A group of adjacent districts with very closely related ecological characteristics, or, in some cases, a single very distinctive Ecological District. New Zealand has been subdivided into 84 such regions.

ECOLOGICAL UNIT:

A category which describes more specifically than the ecological class, the ecological patterns of a district in terms of bioclimatic zones, physical environment (at the level of landform types, soil parent materials) and vegetation types. Vegetation typing follows Atkinson (1983) ie type names are based on species with a cover greater than or equal to 20%. Indicator species with a cover between 5-20% are shown in brackets. Variations on Atkinson's method is the use of double brackets for highly significant indicator species with a cover less than 5%, and underlining of species in the type name, to indicate percentage cover, is not used.

The ecological unit represents the level for rapid PNA field inventory of individual sites and the classification of the natural diversity of a District. An ecological unit may comprise a single homogeneous community with a discrete boundary, or a continuum, mosaic or complex.

HYDROLOGIC CLASS:

One of 6 descriptive categories used in classifying the influence of water on the character of the biotic elements. If water is not a significant influence, a site is considered terrestrial. On sites where water is a major feature the characteristics of the soils and biota will be strongly influenced by the nature of the water body (eg palustrine, lacustrine, riverine, estuarine, marine).

Terrestrial	free water has an insignificant role in the ecological character of these areas.
Palustrine	a wetland community/environment characterised by emergent vegetation which may, or may not, have free standing water present.
Lacustrine	a lake community/environment lacking persistent emergent vegetation.
Riverine	a system of flowing freshwater.
Estuarine	an environment of salt or brackish water, partially enclosed but permanently open to the sea, with diurnal or less frequent inundation.
Marine	wetlands formed as a result of marine deposition or changes in sea level such as the post-glacial rise.

NATURAL AREA:

A tract of land which is:

- (i) real and locatable
- (ii) supports vegetation and landforms considered to be in a predominantly natural state
- (iii) identified as a suitable unit for evaluation of ecological quality and representativeness and has potential to be a priority natural area.

In most instances, a natural area will be coincident with a study area. However, there will be instances where it is decided to incorporate more than one study area into one natural area, or evaluate only part of a study area as a potential priority natural area.

NATURAL DIVERSITY:

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

NATURAL LANDSCAPE:

(re Reserves Act 1977): The term "landscape" is inherently difficult to define, since the character or quality in a landscape is essentially an individual perception, and may embrace wild, rural, or even urban lands, as well as water. In the context of PNAs, therefore, the use of the term "natural ... landscape" is not recommended. In some instances the term "landform" may be more appropriate, eg dunes. If, however, the continued use of the term "natural landscape" appears inescapable, particularly to indicate large scale natural areas, then whenever used in the context of PNAs it must be carefully qualified to differentiate indigenous from developed lands, and "natural landscape" will have the same restricted meaning as adopted herein for natural area. Usage in the Reserves Act embraced both large scale Natural Areas and landforms.

ORIGINAL NATURAL ECOSYSTEM; ORIGINAL NATURAL LANDSCAPE:

(re Reserves Act 1977): The term "original" is inherently difficult to define, but in the context of the objectives of the Reserves Act and the PNA programme, a workable definition is necessary to provide a base on which to assess "naturalness".

The original state of an ecosystem and the landscape is that which prevailed before the arrival of humans in New Zealand with their domesticated and commensal animals and plants. A major objective of most nature conservation strategies in New Zealand is to protect indigenous ecosystems and landscapes that most closely approximate this state.

For the most part, this will be the vegetation that, in all probability, existed prior to widespread European modification beginning about 1840 AD. However there are substantial areas of New Zealand that were extensively modified before European colonisation and for which this datum is not suitable. Where this occurs two other options arise for determining the original natural landscape:

- (a) Where the landscape has remained in, returned to, or is returning to its probable original state (ie mature or steady-state forest), the datum is the mature forest system of the pre-Polynesian period.
- (b) Where this process is not occurring (eg in the extensive shrublands and grasslands that have replaced forest in the drier, eastern South Island) the datum must be the probable state of the shrubland and grasslands at 1840 AD, ie anthropogenic landscape.

Special attention should be paid to the term, "original", where two or three of these options occur in any local or regional PNA study.

PRIORITY NATURAL AREA: (equiv. to Recommended Area for Protection)

An area identified as qualifying for Protected Natural Area status, representing the best example or examples of the natural ecosystems in an Ecological District, and forming part of a national system representing as far as possible the diversity of New Zealand's native flora, fauna, ecosystems, and natural landscapes. Priority Natural Areas will be assessed using the following criteria: diversity and pattern, rarity and special features, naturalness, representativeness, long-term ecological viability, size and shape, and buffering and surrounding landscape.

PROTECTED NATURAL AREA:

A natural area which has a measure of legal protection and is sufficiently secure (Kelly 1980), in which the principal purpose of management is retention of the indigenous character and component elements.

REPRESENTATIVE:

The extent to which an area represents or exemplifies the components of the natural diversity of a larger reference area eg representation in reserves of the current natural diversity of an ecological district, or representation of the primaevial natural landscape.

STUDY AREA:

A tract of land with indigenous vegetation delineated as suitable for survey in rapid field inventory in order to identify the ecological patterns and natural diversity of an Ecological District.

SUCCESSION:

The process of change in the appearance, composition and structure of a community, usually over a number of years. Changes may be due to biotic factors, or abiotic factors, or both.

SURROUNDING LANDSCAPE:

The land which surrounds and influences a particular Natural Area and is influenced by the same set of physical parameters as the Natural Area.

APPENDIX VIII

List of Abbreviations and Symbols Used in Text

ER	Ecological Region
ED	Ecological District
PNAP	Protected Natural Areas Programme
PNA	Protected Natural Area
EA	Ecological Area
SFS	State Forest Sanctuary
WR	Wildlife Refuge
WS	Wildlife Sanctuary
SR	Scenic Reserve
HR	Historic Reserve
SH	State Highway
RAP	Recommended Area for Protection
NZFS	New Zealand Forest Service
FSU	Fauna Survey Unit of New Zealand Wildlife Service
SSWI	Site of Special Wildlife Interest
DOC	Department of Conservation
CSFP	Coromandel State Forest Service
KMU	Kauri Management Unit
MOF	Ministry of Forests
MAF	Ministry of Agriculture and Fisheries
mya	million years ago
QEII	Queen Elizabeth II National Trust
OSC	open space covenant
MHW	Mean High Water
MLW	Mean Low Water
asl	Above Sea Level
bp	Before Present
SA	

Abbreviations Used in Describing Vegetation Structure and Composition (From Atkinson, 1985)

(), []	Where a species is not a common component (20%) of a closed vegetation canopy but is conspicuous then the name is enclosed in brackets: (), used for cover between 10-19%, [], used for cover between 1-9%
	Generally, the compositional name includes the name of the major canopy species with cover 20%. If no species reaches 20% level the two most abundant species 15, 10, 5 or 1% cover provide the compositional name. Where plant cover is less than 1% the 'compositional' name is that of the open ground surface, eg sand is termed a sandfield.
-, /	in addition to structural class names (eg forest, scrub, shrubland (see Atkinson, 1985)), also use hyphen (-) and the diagonal sign (/) to convey height relationships.
-,	links species, not greatly different in height that form part of the same canopy layer, eg tawa-kohekohe forest.
/,	links species that differ significantly in height and that form two or more separate canopy layers, eg rimu/tawa where rimu is taller than tawa.

APPENDIX IX

Stratification of Mainland Districts of Coromandel Ecological Region : Bioclimatic Zones¹ and Land Systems¹

A. BIOCLIMATIC ZONES

Throughout the mainland region five bioclimatic zones have been delineated, although not all five occur in each district. The following lists the indicator species and broad characteristics of each zone. Distinctive features of a zone within an ecological district are highlighted.

The boundaries of each zone are delineated on Overlays 2, 3 and 4 of Figures 2, 3 and 4. These are preliminary boundaries only and changes to them are likely following further fieldwork. It must be emphasised that boundaries are not always as distinctive as a line drawn on a map or a specific altitude suggests. However, the delineation of bioclimatic zones is a useful concept in determining representativeness and the adequacy of the existing PNA network.

Coastal Zone

This zone occurs in Colville, Tairua, Thames and Waihi ED's. Pohutukawa is the indicator species. This zone in all districts has very little original forest cover remaining, it is therefore difficult to determine its extent, particularly in the more northern districts. Generally, it can be regarded as extending 1 km inland. Based on known locations of pohutukawa (see Miller, 1984(a)) the coastal zone in Colville ED appears to extend up to 2 km inland.

Semi-Coastal Zone

Occurs in all five mainland districts. The indicator species is puriri. In Colville ED an abundance of taraire may also be a good indicator. This zone is highly disturbed throughout the region and remnant forests with puriri are sparse. Boundaries are therefore very arbitrary. Semi-coastal zone boundaries have been delineated on Figures 3 and 4 for Tairua, Waihi and Te Aroha ecological districts only. The boundaries have been based on a rapid reconnaissance of semi-coastal remnants by the Regnier 1987. This zone in particular will require refining following further fieldwork.

In Colville ED puriri probably occurred to an altitude of 300 m (eg around Te Moehau Range) and up to 400 m south of Te Moehau to near Castle Rock. South of Castle Rock the district becomes steeper in relief and, as for Thames ED, the semi-coastal zone probably becomes a narrow band extending from 1-2 km inland of the coastal zone boundary.

Lowland Zone

The hill country of the lowland zone is characterised by an abundance of tawa. This zone probably occurs between 300 m and 600-650 m. Kohekohe and towai (replaced by kamahi south of approximately Mt Te Aroha) are also important species, with the former common below about 450 m and the latter increasing in importance with increase in altitude and on steep spurs and ridges throughout the lowland zone.

On alluvial plains of the lowland zone, as for the semi-coastal and coastal zones, kahikatea and other podocarps probably were once common with the indicator species of each zone also present on suitable sites.

¹ For a definition of these terms refer to Law *et al* 1984

Montane Zone

Occurs in all five districts although the extent in each is variable. Species typical of the zone throughout the region, although not necessarily all occurring together at any one site or in any one district, include towai, kamahi (only occurring south of approximately Mt Te Aroha), tawari, tawheowheo, yellow-silver pine, kaikawaka, mountain neinei, kauri and southern rata. The montane zone in Te Aroha ED also includes distinctive vegetation types of silver and red beech forest.

This zone occurs from approximately 600-650 m to the highest altitude in each district, which varies from the highest at 952 m in Te Aroha ED to the lowest at 750 m in Waihi ED.

Within the montane zone of Colville ED, on the summit ridge/plateau of Te Moehau, a distinctive sub-alpine element occurs. Sub-alpine species present include *Celmisia incana*, *Carpha alpina*, *Pentachondra pumila* and three sub-alpine lichens of the genus *Siphula*.

Cockayne (1958) considered the top 100 m of Mt Te Aroha as sub-alpine scrub/forest and the Joint Campaign on Native Forests (1983) mentions the occurrence of a sub-alpine herbfield prior to the establishment of the broadcasting station. Today, however, forests on the summit of Te Aroha are considered montane (Nicholls, 1985).

There is a sub-alpine element in the flora of a number of rock outcrops occurring along the main divide, eg on Wahine Rock (Te Aroha ED), a rock outcrop at an altitude of 795 m, grows *Ourisia colensoi* and *Cyathodes empetrifolia* (Druce, 1982). On Kaitarakihi, Adams (1884) found *Pimelea buxifolia*, a plant now only found from Pukeamaru Range (East Cape) southward in the montane and sub-alpine zones.

APPENDIX X

FRESHWATER SURVEY

METHODS**Preparation:**

MWD Land Use Inventory overlays were prepared which provided broad brush composite information on forest cover, rock type, and erosion category.

Sites in wellgrown indigenous forest and below areas of negligible or slight erosion were chosen. Three categories of rock type were Resistant Volcanic Rocks (RVR), Unstable Volcanic Rocks (UVR) and greywacke (GW). One site in Crustalline Intrusives (CI) was also surveyed.

The two Ecological Districts were divided into catchments and these were grouped for general similarity.

Colville ED

- A. West coast catchments draining to Firth of Thames
- B. East coast catchments draining to estuaries
- C. Small coastal catchments draining foothills

Thames ED

- A. Headwaters of large eastern catchments draining from main range to Whitianga Estuary
- B. Large western catchments draining main range directly into Firth of Thames.
- C. Large western catchments draining from main range to west coast harbours.
- D. Small coastal catchments draining foothills

Helicopter Reconnaissance

Due to the difficult terrain of the Thames ED helicopter reconnaissance was used as an initial screen of catchments preselected by the mapping exercise. Maps had been prepared almost a decade ago and some changes were expected. Any changes in land use and incidence of catchment erosion could be rapidly assessed.

Some suitable preselected sites could not be accessed. Thus the final set of sites surveyed differed somewhat from the initial preselection. The main criteria were however satisfied.

As it turned out the helicopter survey was unavoidably ill-timed two weeks after Cyclone Bola when stream communities had been decimated by flooding.

Instream Survey

A rapid qualitative survey technique was used similar to that used by Rounick and Winterbourn (1982) although stream gradient was determined from topo maps rather than direct measurement in the field. A stream environment survey (Mosely 1979) and Pfankuch streambed stability assessment (Appendix 1) were carried out for each site. Width of active channel and wetted area (average of three measurements each), maximum depth and water temperature were measured. A kick sample of invertebrates was collected from a riffle area using a 200 micron mesh net. Sites were inspected for moss and algae and scrapings taken. Sites were assessed according to a list of stream environment criteria derived for the region.

Invertebrate samples were sorted for taxa and a note made of those which were abundant, however relative abundances were not determined because samples were collected at different times in the year. Budget limitations meant that sorting had to be ruthlessly rapid and any specimens which could not be immediately identified were preserved for future analysis - as and when.

RESULTS

The location of survey sites and a summary of topography, vegetation, geology and stream bed stability are given in Appendix 2.

Stream Size

Streams and rivers surveyed ranged from first to third order with most being second or third. Width of wetted area ranged from 1.0m (Waiona Tributary) to 11m (Te Toka) with most being less than 6m. Maximum depth in runs and riffles was about 50cm.

Altitude and Gradient

Altitude varied from 10 masl (Pahi) to 400 masl (Settlers), Gradient varied from 1:50 (Hihi Main) to 1:4 (Hihi LH). Valley type varied from engorged to open with most streams being confined for some part of their length.

Rock Type

Resistant Volcanic Rocks RVR = 18 Sites
 Greywacke GW = 4 Sites
 Unstable Volcanic Rocks UVR = 6 sites
 Crystalline Intrusives CI - 1 site

The predominant rock type in Thames ED was RVR and most sites which conformed to the slight- negligible erosion and indigenous forest requirements were in this rock type. UVR sites were confined to the Waiatekatanga and Waiora catchments.

Greywacke was found only in Colville ED. Most accessible potential sites were either unsuitable with respect to vegetation or erosion. Coverage of Colville ED is incomplete and further UVR and RVR sites will be surveyed as the opportunity arises.

Water Chemistry

Water chemistry was not surveyed during this study. Previous surveys (NWASCA 1987) of catchments within the two Ecological Districts suggest that water draining forested catchments with minimal ground disturbance is likely to be cool, (9-17 C) soft (17-40 mg/m³ CaCO₃), neutral (ph 6.5 -7.5) low in nutrients (NO₃-N < 70 mg/l, PO₄-P < 20 mg/l) and suspended solids, and well oxygenated.

A frequently seen chemical phenomenon in the Coromandel ranges is iron hydroxide deposition. Oxidation of pyrites (iron sulphide) occurs through weathering processes at the surface and where oxygenated groundwater comes in contact with sulphide bearing rock underground. It may also occur in swamps. The iron hydroxide precipitates as a bright orange floc which may incorporate metals derived from other heavy metal sulphides such as lead, cadmium, copper, lead or zinc.

In some areas vegetation clearance and excavation associated with mining, forestry and construction have caused some or all of the following effects depending on the availability of pyrites and other metal sulphides in the rock:
Elevations in sulphate, destruction of alkalinity and/or reduction in pH, formation of bright orange iron floc over the surface of the stream bed and elevation of heavy metals in water and sediments.

Instances of these effects in association with past mining are described in more detail in NWASCA (1987).

Iron flocculation has also been observed in association with forestry and sewage lagoon construction in the Waikiekie catchment (Whangamata) (Penny, 1987b) and in association with past forestry in the Tairua water supply catchment (unpublished data).

Naturally occurring examples of iron flocculation were observed in the Whauwhau, Waitaia and Te Wawawahi catchments during this survey. These occurrences were small and localised compared with those caused by human disturbance.

Water samples collected from the Sparrow Stream by Whitton and Penny in September 1987 (unpublished data) and analysed for trace elements by Whitton showed a slight maritime influence (Appendix 5).

Stream Bed Stability Assessment

A composite description has been obtained from Pfankuch assessments. Individual assessments are available on request for site specific use but have not been written up here.

Upper banks:

In the immediate vicinity of the reach stream banks were generally found to be in good condition with vigorous plant growth, infrequent raw spots and very limited amounts of potential debris jam material (eg fallen logs, branches etc)

Lower banks:

These were relatively stable - mostly composed of large boulders in a gravel sand matrix although some rivers featured substantial areas of bedrock. In general large rocks and old logs were firmly embedded and the flow pattern showed little cutting and deposition. The exceptions were larger rivers draining large catchments eg Hihi where some erosive crosscurrents and pool filling was evident.

Some cutting was evident but in most cases raw banks were limited in extent. On the other hand most channel point bars showed some recent increase due to gravel and sand indicating that erosion material carried by stream originates more from slips than stream bank erosion and that slips are relatively frequent.

Stream bottom:

In most streams there was evidence of some mobility of larger substrate elements during high flows, and encrusting vegetation (moss, bluegreen algae) was restricted to areas of submerged bed rock except in small stable catchments eg Sparrow and Whauwhau. Some streams showed a high tendency to scour eg Te Toka. In a few low gradient streams tight packing was seen due to silt retention having a cementing effect. In these streams moss was found growing over boulders and cobbles.

Most streams showed some infilling of pools but only in four was this excessive. In one of these (Woodcock) eroding zones of exposed bedrock supported vigorous and various bluegreen algal community whereas depositional zones were knee deep in catchment derived sand both in pools and at point bars. In streams below roadcuttings significant sedimentation has been observed often caused by side casting of slip material originating above the road bench, however these sites were deliberately excluded from the survey.

Streams with a fair to poor stability assessment had all suffered from recent impacts viz slipping caused by Cyclone Bola (Waiomu, Te Toka, Manaia) stock intrusion (Fantail, Ongohi) and goat infestation (Kakatarake and Manaia). Woodcock was the only stream in which there was no evidence of recent impacts but in which large deposits of sand had accumulated in low gradient areas. The conclusion here was that the small size of the catchment and long depositional zone had prevented flushing of sediment derived from logging earlier this century.

Effect of rock type on stability assessment

Sites were not selected in areas with erosion factor >1 . Many potential UVR sites were excluded as a result.

There was no apparent difference between surveyed UVR and RVR sites with respect to stream bed stability.

All four GW sites exhibited animal grazing impacts so it is not possible to determine the extent to which this rock type contributes to stream bed instability.

Macroinvertebrates

The occurrence of macroinvertebrates in Colville and Thames EDs is tabulated in Appendix 3. These are presence/absence data but taxa which were common in a sample are denoted with a C. A compilation of genera from the Thames ED is given in Table 1. The results are compared with results obtained for a quantitative study of three Coromandel catchments in 1982-3 by Penny (1987), with an extensive NZ wide study by Rounick and Winterbourn (1982) and two intensive studies one of a stream system in the Waitakere Ranges (Towns 1978, 1979) and the other of a South Island montane stream near Reefton (Cowie 1983, 1985).

As a general comment no one Coromandel stream was like any other. Differing combinations of rock type, aspect, gradient and size produced a unique set of physical circumstances at each site and it was not possible to group streams according to physical characteristics.

Similarly no pattern emerged from the macroinvertebrate presence/absence data with respect to geology, stream bed gradient, stability or size. The two most frequently collected groups were filter feeders feeding on suspended particles while the others were generalist collector - gatherers and predators.

The community was robust in terms of diversity but productivity was likely to be limited by the frequency of nonseasonal flood events and related bedload movement. Specialist detritivore communities were not found although the two generalist detritivore species Olinga (caddis) and Austroperla cyrene (stonefly) occurred at several sites and the caddis Triplectides occurred at three sites.

Rounick and Winterbourn (1982) identified a core group of taxa which were common at forested sites throughout New Zealand. These core groups were represented at over half the sites, but three other groups were equally or more common (Table 2).

River Environment Survey Questionnaire

RIVER ENVIRONMENT SURVEY

ENV. RYR. Q.P.1 CASE 4

River name: _____ at: _____ (grid ref: _____) River Reach Code _____
 Date: _____ Observer: _____ Refer to Reach Sketch attached.

Note: Complete codes by circling number(s).

A. SURVEY REACH SKETCHING

General description of the landscape in the vicinity of the survey reach

Terrain type		Vegetation/land use	Lithology (specify rock type)
1 mountains	1 1 1	Bare ground	
2 foothills	2 2 2	Native grassland	
3 uplands (plateau)	3 3 3	Shrub/scrubland	
4 hills	4 4 4	0-25% forest (native)	
5 lowlands or plain	5 5 5	25-75% forest (native)	
	6 6 6	75-100% forest (native)	
	7 7 7	Developed pasture	
	8 8 8	Arable	
	9 9 9	Exotic forest plantations	
	0 0 0	Urban	

Comments: _____

B. FLORIC QUALITY

Diversity of flora along banks	Condition of flora along banks	Litter on bank (paper, cans, etc.)
1 Great	1 Excellent	1 < 1 per 30 m
2	2	2 2-5 per 30 m
3	3	3 5-10 per 30 m
4	4	4 10-50 per 30 m
5 Limited	5 Poor	5 > 50 per 30 m

Diversity of local fauna	Confinement of stream	Presence of vistas
1 Great	1 Open	1 Far vistas
2	2	2
3	3	3
4	4	4
5 Limited	5 Confined	5 No vistas

Accessibility/level of use

- 1 Wilderness
- 2
- 3
- 4
- 5 Paved access/mass use

Comments: _____

C. GEOMORPHOLOGY

Valley Characteristics in the vicinity of the survey reach. Do not include artificial changes such as stopbanks; refer to diagram sheet.

Valley type	If no valley:-	Valley measurements
0 Not applicable	0 Not applicable	Depth from surrounding hills _____ m
1 Stream cut valley	1 Alluvial fan	Top width _____ m
2 Glacial trough	2 Alluvial or outwash plain	Bottom width _____ m
3 Rock gorge	3 Delta	
4 Wide lowland valley	4 _____ (specify)	
5 _____ (specify)		

Terraces

- 0 None
- 1 Indefinite
- 2 Fragmentary
- 3 Continuous

Number of terrace levels: _____

Active undercutting of valley walls by stream

- 0 No undercutting
- 1 Occasional minor undercutting
- 2 Occasional major undercutting
- 3 Frequent major undercutting

Length of valley wall undercut by stream on left bank _____ m
 right bank _____ m

Lithology of valley sides

(specify rock type)

Land susceptibility class of valley sides

(specify)

Valley flat/floodplain in the vicinity of the survey reach: Refer to diagram sheet

Presence

- 0 Absent
- 1 Indefinite
- 2 Fragmentary
- 3 Continuous

Extent: incl. floodplain outside stopbanks

- 0 Absent
- 1 Narrow (<1 active channel width)
- 2 Moderate (1-5 active chl. widths)
- 3 Wide (>5 active chl. widths)

Average active channel width

width _____ m
 Average distance between stopbanks (if present) _____ m

Channel constriction by valley walls or terraces

- 0 No constriction
- 1 Occasional con.
- 2 Frequent constr.
- 3 Confined
- 4 Entrenched

Vegetation/land use of valley sides

- 1 1 1 Bare ground
 2 2 2 Native grassland
 3 3 3 Shrub/scrubland
 4 4 4 0-25% native forest
 5 5 5 25-75% native forest
 6 6 6 75-100% native forest
 7 7 7 Developed pasture
 8 8 8 Arable
 9 9 9 Exotic forest plantations
 0 0 0 Urban

Floodplain vegetation/land use

- 1 1 1 Bare ground
 2 2 2 Native grassland
 3 3 3 Shrub/scrubland
 4 4 4 0-25% native forest
 5 5 5 25-75% native forest
 6 6 6 75-100% native forest
 7 7 7 Developed pasture or parkland
 8 8 8 Arable
 9 9 9 Exotic forest plantation
 0 0 0 Urban
 . . . Marsh

Bank vegetation type (Species)

- 00 None
 11 Grass, weeds
 22 Bushes (incl. gorse and broom)
 33 Trees - scattered
 44 Trees - dense
 55 Vegetative protection work: dense, layered

2. CHANNEL PATTERN FOR SURVEY REACH (at low flow unless otherwise specified).

<u>Bankfull</u>	<u>Low Flow</u>	<u>Chl Pattern</u>
1	1	Straight
2	2	Sinuuous
3	3	Irregular
4	4	Regular meanders
5	5	Irregular meanders
6	6	Tortuous meanders
7	7	Braided

- Islands
 0 None
 1 Occasional
 2 Frequent
 3 Braided

Bar types

- 0 None
 1 Alternate bars
 2 Meander point bars
 3 Mid-channel bars
 4 Diagonal bars ("riffles, boulder")
 5 Sand waves or large dunes

3. CHANNEL BOUNDARY CONDITIONS AND MATERIALSObstructions in channel

- 0 0 None
 1 1 Logs, debris, stumps in mid-channel
 2 2 Growing vegetation in mid-channel (specify _____)
 3 3 Boulders in mid-channel
 4 4 Overhanging trees at edge of channel
 5 5 Slumped banks
 6 6 Artificial constriction (specify _____)

Degree of obstruction of channel

- 0 None
 1 Occasional minor
 2 Occasional major
 3 Frequent minor
 4 Frequent major

Channel bed material

- 1 1 Sand-silt
 2 2 Sand-gravel (<64 mm)
 3 3 Gravel
 4 4 Cobbles
 5 5 Boulders
 6 6 Bedrock

Bedrock in channel

- 0 None
 1 One occurrence
 2 Two occurrences
 - occurrences
 per _____ a length of reach

Bedrock lithology (specify)

percent of channel bed composed of bedrock _____%

Channel bank material: alluvial

- 0 0 0 No alluvial banks
 1 1 1 Clay and silt (cohesive)
 2 2 2 Silt and sand (non-cohesive)
 3 3 3 Sand and gravel (<64 mm)
 4 4 4 Sand to cobbles
 5 5 5 Sand overlain by silts
 6 6 6 Gravel overlain by silt
 7 7 7 Cobbles overlain by silt
 8 8 8 Boulders

Channel bank material: non alluvial

- 0 0 0 All alluvial bank material
 1 1 1 Glacial deposits
 2 2 2 Bedrock (specify lithology _____)
 3 3 3 Protection work (specify _____)

Floodplain surficial material

- 0 0 No floodplain
 1 1 Silt/clay
 2 2 Sand/silt
 3 3 Gravel (<64 mm)
 4 4 Cobbles

Percentage of bank in alluvium on:
 left bank _____%
 right bank _____%

Floodplain land capability class (specify class outside and inside stopbanks, if applicable)

Percentage of bank being actively eroded on:
 left bank _____%
 right bank _____%

4. WATER QUALITYWater Colour

- 1 Colourless
 2 Pale green
 3 Green
 4 Light brown
 5 Brown

Turbidity - degree

- 1 Clear
 2
 3
 4
 5 Very turbid
 Depth at which bottom visible: _____m

Turbidity - cause

- 1 Algae
 2 Dissolved (brown humic) matter
 3 Rock (glacial) flour
 4 Other sediment load
 5 (Specify) _____

Evidence of pollution (specify)

- 1 None
 2
 3
 4
 5 Severe

River fauna (specify species)

- 1 Large variety
 2
 3
 4
 5 None

Attached/weed growth (% cover)

- 1 0-20%
 2 20-40%
 3 40-60%
 4 60-80%
 5 80-100%

Slimes/algal growth (% cover)

- 1 0-20%
 2 20-40%
 3 40-60%
 4 60-80%
 5 80-100%

Appendix 1 Stream channel stability evaluation form (from Rounick and Winterbourn 1982, after Pfankuch 1975).

Item Rated		Stability Indicators by Classes							
UPPER BANKS		EXCELLENT		GOOD		FAIR		POOR	
Landform slope		Bank slope gradient <30% (20)		Bank slope gradient 30-40% (4)		Bank slope gradient 40-60% (6)		Bank slope gradient >60% (5)	
Mass-wasting (existing or potential)		No evidence of past or any potential for future mass-wasting into channel. (3)		Infrequent and/or very small. Mostly healed over. Low future potential. (6)		Moderate frequency and size, with some raw spots eroded by water during high flows. (9)		Frequent or large, causing sediment nearly year-long OR imminent danger of same. (12)	
Debris jam potential (floatable objects)		Essentially absent from immediate channel area. (2)		Present but mostly small twigs and limbs. (4)		Present, volume and size are both increasing. (6)		Moderate to heavy amounts, predominantly larger sizes. (8)	
Vegetative bank protection		90% plant density. Vigor and variety suggests a deep, dense, soil binding root mass. (3)		70-90% density. Fewer plant species or lower vigor suggests a less dense or deep root mass. (6)		50-70% density. Lower vigor and still fewer species form a somewhat shallow and discontinuous root mass. (9)		<50% density plus fewer species and less vigor indicate poor, discontinuous and shallow root mass. (12)	
Channel capacity		Ample for present plus some increases. Peak flows contained. W/D ratio <7. (1)		Adequate. Overbank flows rare. Width to Depth (W/D) ratio 8 to 15. (2)		Rarely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25. (3)		Inadequate. Overbank flows common. W/D ratio >25. (4)	
LOWER BANKS									
Bank rock content		65% with large, angular boulders 12" numerous. (2)		40 to 65%, mostly small boulders to cobbles 6-12". (4)		20 to 40%, with most in the 3-6" diameter class. (6)		<20% rock fragments of gravel sizes, 1-3" or less. (8)	
Obstructions Flow deflectors Sediment traps		Rocks and old logs firmly embedded. Flow pattern without cutting or deposition. Pools and riffles stable. (2)		Some present, causing erosive cross currents and minor pool filling. Obstructions and deflectors newer and less firm. (4)		Moderately frequent, moderately unstable obstructions and deflectors move with high water causing bank cutting and filling of pools. (6)		Frequent obstructions and deflectors cause bank erosion year-long. Sediment traps full, channel migration occurring. (8)	
Cutting		Little or none evident. Infrequent raw banks less than 6" high generally. (4)		Some, intermittently at outcrops and constrictions. Raw banks may be up to 12". (6)		Significant. Cuts 12-24" high. Root mat overhangs and sloughing evident. (12)		Almost continuous cuts, some over 24" high. Failure of overhangs frequent. (16)	
Deposition		Little or no enlargement of channel or point bars. (4)		Some new increase in bar formation, mostly from coarse gravels. (8)		Moderate deposition of new gravel and coarse sand on old and some new bars. (12)		Extensive deposits of predominantly fine particles. Accelerated bar development. (16)	
BOTTOM									
Rock angularity		Sharp edges and corners, plane surfaces roughened. (1)		Rounded corners and edges, surfaces smooth and flat. (2)		Corners and edges well rounded in two dimensions. (3)		Well rounded in all dimensions, surfaces smooth. (4)	
Brightness		Surfaces dull, darkened or stained. Gen. not "bright". (1)		Mostly dull, but may have up to 35% bright surfaces. (2)		Mixture, 50-50% dull and bright, i.e. 35-65%. (3)		Predominantly bright, 65%, exposed or scoured surfaces. (4)	
Consolidation or particle packing		Assorted sizes tightly packed and/or overlapping. (2)		Moderately packed with some overlapping. (4)		Mostly a loose assortment with no apparent overlap. (6)		No packing evident. Loose assortment, easily moved. (8)	
Bottom size distribution and percent stable materials		No change in sizes evident. Stable materials 80-100%. (4)		Distribution shift slight. Stable materials 50-80%. (8)		Moderate change in sizes. Stable materials 20-50%. (12)		Marked distribution change. Stable materials 0-20%. (16)	
Scouring and deposition		Less than 5% of the bottom affected by scouring and deposition. (6)		5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools. (12)		30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools. (18)		More than 50% of the bottom in a state of flux or change nearly year-long. (24)	
Clinging aquatic vegetation (moss and algae)		Abundant. Growth largely moss-like, dark green, perennial. In swift water too. (1)		Common. Algal forms in low velocity and pool areas. Moss here too and swifter waters. (2)		Present but spotty, mostly in backwater areas. Seasonal blooms make rocks slick. (3)		Perennial types scarce or absent. Yellow-green, short term bloom may be present. (4)	
COLUMN TOTALS									

Add the values in each column for a total reach score here (E + G + F + P =).

Reach score of: <38 = Excellent, 39-76 = Good, 77-114 = Fair, 115+ = Poor.

SUMMARY OF SURVEY

THAMES ECOLOGICAL DISTRICT

Headwaters of large eastern catchments draining from main range to Whitianga Estuary (Type A)

CATCHMENT	STREAM	MAP REF	ALTITUDE m.a.s.l.	ORDER	WIDTH m	ROCK TYPE	VEG	STREAM BED ASSESS

Maikato- Katanga Mahakirau Trib Sparrow	T11	420808	60	3	4	UVR	scrub/	good
		421808	60	2	2-3	UVR	forest	good
		395796	120	3	2.5	RVR	forest	good

Kaimarama Trib Toronoho Waiwawa Te Toka Settlers LH RH	T11	424753	40	2	3.5	RVR	forest	good
		459689	60	3	4	RVR	forest	good
		434608	240	2	11	RVR	forest	fair
		413616	400	2	4	RVR	forest	good
		414615	400	2	3	RVR	forest	good

Headwaters of large western catchments draining main range to the Firth of Thames (Type A)

CATCHMENT	STREAM	MAP REF	ALTITUDE m.a.s.l.	ORDER	WIDTH m	ROCK TYPE	VEG	STREAM BED ASSESS

Waikawau Waikawau	T11	379721	160	2	5.5	RVR	scrub/	fair
							forest	

Te Mata Trib	T11	391687	240	2	8+	RVR	forest	good
		392687	240	1	<2	RVR	forest	good

Waiomu Comstock	T11	366607	80	3	5	RVR	scrub/	fair
		370607	100	1	2.5	RVR	forest	fair

Kaueranga Trib 2 Mihini LH trib RH trib Junction	T12	463557	140	2	5	UVR	forest	good
		460561	200	1	1	UVR	forest	good
		457564	220	1	1.3	UVR	forest	good
		459512	100	3	7	RVR	forest	good
		471516	140	1	2.4	RVR	forest	fair
		463515	120	1	2	RVR	forest	good
		472517	140	2	3.5	RVR	forest	good

Large western catchments draining main range to west coast harbours

CATCHMENT	STREAM	MAP REF	ALTITUDE m.a.s.l.	ORDER	WIDTH m	ROCK TYPE	VEG	STREAM BED ASSESS

Manaiakopaka	T11	363760	260	2	3	RVR	forest	fair
		336761	100	2	2	GM	forest	poor

Colville ED

COLVILLE ECOLOGICAL DISTRICT

West coast streams draining Mount Meehan to Firth of Thames

CATCHMENT	STREAM	MAP REF	ALTITUDE m.a.s.l.	ORDER	WIDTH m	ROCK TYPE	VEG	STREAM BED ASSESS

Pahi Fantail	S10	253211	10	3	7.7	GM	Pasture/	forest/
		194172	60	2	4.4	GM	scrub	good

Ongohi Fantail	S10	225133	40	3	10	CI	scrub/	forest
							forest	fair

East coast streams draining Kusotunu Peninsula to Pacific Ocean

CATCHMENT	STREAM	MAP REF	ALTITUDE m.a.s.l.	ORDER	WIDTH m	ROCK TYPE	VEG	STREAM BED ASSESS

Woodcock Whauwhau	T11	556894	<20	1	2	RVR	forest	fair
		554885	20	2	2	RVR	forest	good

Kusotunu Waitata	T10	546915	20	2	2	UVR/	pasture/	forest
						GM	forest	fair

UVR = unstable volcanic rocks

RVR = resistant volcanic rocks

Stream bed assessment = measure of stability

APPENDIX 3 PMA SURVEY THAMES ECOLOGICAL DISTRICT MACROINVERTEBRATES
TABLE 1 x = present, C = common

Stream	TE TOKA Main 1 18/3/88	TE TOKA Main 2 18/3/88	Settlers Rt Fork 18/3/88	Settlers Lt Fork 18/3/88
Date				
Taxonomic group				
MOLLUSCA				
Hydrobiidae				
Potamopyrgus antipodarum				
Latiidae				
Latia neritoides				
CRUSTACEA				
Paratya curvirostris		x		
INSECTA				
MEGALOPTERA				
Corydallidae				
Archichauliodes diversus	x			x
EPHEMEROPTERA				
Ephemeridae				
Ichthybotis hudsoni		x		
Oligoneuridae				
Coloburiscus humeralis	x		x	
Leptophlebiidae				
Deleatidium	x		x	
Austroclima				
Mauilulus luma				
Zephlebia cruentata				
Zephlebia versicolor				
Siphonuridae				
Nesameletus		x		
Rallidens				
PLECOPTERA				
Eusthenidae				
Stenoperla prasina	x		x	
Austroperlidae				
Austroperlidae	x			
Gryopterygidae				
Megaleptoperla diminuta				
Megaleptoperla fenestrata	x		x	
Zelandoperla fenestrata				
Zelandobius fuscillatus				
Zelandobius confusus				
Acroperla trivacuata			x	
TRICHOPTERA				
Hydroptilidae				
Oxethira albiceps				
Hydrobiosidae				
Hydrobiosis umbripennis				?
Hydrobiosis parumbripennis				
Hydrobiosis clavifera				
Neurochoroma				
Hydrochoroma crassicaudatum				
Polycentropidae				
Polyplectropus pueriles				
Philopotamidae				
Hydrobiosella				
Hydropsychidae				
Aoteapsyche colonica	x			
Aoteapsyche raruraru				
Orthopsycha fimbriata				
Orthopsycha thomasi				
Helicopsychidae				
Helicopsycha zealandica				
Leptoceridae				
Calocidae				
Pycnocentrella eruenis				
Helicophidae				
Zetolessica				
Conoesucidae				
Pycnocentrodus				
Beraeoptera roria				
Olinga feredayi				
COLEOPTERA				
Ptylodactylidae				
Elmidae				
Hydora nitida				
Hydraenidae				
DIPTERA				
Tipulidae				
Aphrophila neozealandica				
Eriopterini				
Tanyderidae				
Muscidae				

APPENDIX 3
TABLE 2: PNA SURVEY THAMES ECOLOGICAL DISTRICT MACROINVERTEBRATES

Stream	HIHI 7/4/88	HIHI LH TRIB 7/4/88	HIHI RH TRIB 7/4/88	Junction 7/4/88
Date				
Taxonomic group				
MOLLUSCA				
Hydrobiidae				
Potamopyrgus antipodarum				
Latiidae				
Latic neritoides				
CRUSTACEA				
Paratya curvirostris				
INSECTA				
MEGALOPTERA				
Corydalidae				
Archichauliodes diversus				
EPHEMEROPTERA				
Ephemeridae				
Ichthybotis hudsoni				
Oligoneuridae				
Coloburiscus humeralis				
Leptophlebiidae				
Deleatidium				
Austroclima				
Masuiulus luma				
Zephlebia cruentata				
Zephlebia versicolor				
Zephlebia				
Siphonuridae				
Nesameletus				
Rallidens				
PLECOPTERA				
Eusthenidae				
Stenoperla prasina				
Austroperlidae				
Austroperlidae				
Grypopterygidae				
Megalopteria diminuta				
Zelandoperla agnetis				
Zelandoperla fenestrata				
Zelandobius furcillatus				
Zelandobius confusus				
Acroperla trivacuata				
TRICHOPTERA				
Hydroptilidae				
Oxyethira albiceps				
Hydrobiidae				
Hydrobiidae				
Hydrobiidae umbripennis				
Hydrobiidae parumbripennis				
Hydrobiidae clavigera				
Pelochorema				
Neurochorema				
Hydrochorema crassicaudatum				
Tiphobiosis montana				
Polycentropidae				
Polyelectropus pueriles				
Philopotamidae				
Hydrobiosella				
Hydropsychidae				
Aoteapsyche colonica				
Aoteapsyche raruraru				
Orthopsycha fimbriata				
Orthopsycha thomasi				
Helicopsychidae				
Helicopsycha zealandica				
Leptoceridae				
Calocidae				
Pycnocentrella eruenis				
Helicophidae				
Zelotesia				
Conoesucidae				
Pycnocentrodus				
Beraeoptera roria				
Olinga feredayi				
COLEOPTERA				
Ptylodactylidae				
Elmidae				
Hydora nitida				
Hydraenidae				
DIPTERA				
Tipulidae				
Zelandotipula				
Aphrophila neozelandica				
Eriopterini				
Tanyderidae				
Tabanidae				
Muscidae				
Chironomidae				
Maoridiamasa				

APPENDIX 3

TABLE 3: PNA SURVEY THAMES ECOLOGICAL DISTRICT MACROINVERTEBRATES

x = present, C = common

Stream	Walora River	Walora Trib 1	Walora Trib 2
Date	6/4/88	4/4/88	4/4/88
Taxonomic group			
MOLLUSCA			
Hydrobiidae			
Potamopyrgus antipodum			
Latidae			
Latia neritoides			
CRUSTACEA			
Paratya curvirostris			
INSECTA			
MEGALOPTERA			
Corydalidae			
Archichauliodes diversus			
EPHEMEROPTERA			
Ephemeridae			
Ichthybotis hudsoni			
Oligoneuridae			
Coloburiscus humeralis			
Leptophlebiidae			
Deleatidium			
Austroclima			
Maululus luma			
Zephlebia cruentata			
Zephlebia versicolor			
Siphonuridae			
Nesameletus			
Rallidens			
Amelotopsis			
PLECOPTERA			
Eusthenidae			
Stenoperla prasina			
Austroperlidae			
Austroperlidae			
Gryopterixgidae			
Megaleptoperla diminuta			
Zelandoperla agnetis			
Zelandoperla fenestrata			
Zelandobius furcillatus			
Zelandobius confusus			
Acroperla trivacuata			
TRICHOPTERA			
Hydroptilidae			
Oxyethira albiceps			
Hydrobiosidae			
Hydrobiopsis umbripennis			
Hydrobiopsis parumbripennis			
Hydrobiopsis clavigera			
Peltochorema			
Neurochorema			
Hydrochorema crassicaudatum			
Tipobiosia montana			
Polycentropidae			
Polyplectropus puerilis			
Philopotamidae			
Hydrobiosella			
Hydropsychidae			
Aoteapsyche colonica			
Aoteapsyche raruraru			
Orthopsycha fimbriata			
Orthopsycha thomasi			
Helicopsychidae			
Helicopsycha zealandica			
Leptoceridae			
Triplectides obsoletus			
Calocidae			
Pycnocentrella eruenis			
Helicophidae			
Zelotesica			
Conoesucidae			
Pycnocentrodus			
Beraeoptera roria			
Olinga feredayi			
COLEOPTERA			
Ptylodactylidae			
Elmidae			
Hydora nitida			
Hydraenidae			
Hydrophilidae			
DIPTERA			
Chironomidae			
Tipulidae			
Aphrophila neozealandica			
Eriopterini			
Tanyderidae			
Tabanidae			
Muscidae			

APPENDIX 3
TABLE 4: PNA SURVEY THAMES ECOLOGICAL DISTRICT MACROINVERTEBRATES

Stream	KAIMARAMA TRIB 1 18/3/88	KAIMARAMA TRIB 2 18/3/88	TORRANHO
Date	18/3/88	18/3/88	18/3/88
Taxonomic group			
MOLLUSCA			
Hydrobiidae			
Potamopyrgus antipodarum	x	x	
Latidae			
Latia neritoides	x		
CRUSTACEA			
Paratya curvirostris	x		
INSECTA			
MEGALOPTERA			
Corydalidae			
Archichauliodes diversus	x	x	x
EPHEMEROPTERA			
Ephemeridae			
Ichthybotis hudsoni			
Oligoneuridae			
Coloburiscus humeralis	x	x	x
Leptophlebiidae			
Deleatidium			
Austroclima			
Mauitulus luma			
Zephlebia cruentata			
Zephlebia versicolor			
Siphonuridae			
Nesameletus	x		
Rallidens			
Ameletopsis			
PLECOPTERA			
Eusthenidae			
Stenoperla prasina			x
Austroperlidae			
Austroperla cyrene			
Grypoterygidae			
Megaleptoperla dimidiata			
Zelandoperla agnetis			
Zelandoperla fenestrata	x		?
Zelandobius furcillatus			
Zelandobius confusus			
Acroperla trivacuata	?		
TRICHOPTERA			
Hydropsilidae			
Oxyethira albiceps			

TABLE 5: PNA SURVEY THAMES ECOLOGICAL DISTRICT MACROINVERTEBRATES

Stream	TEN MILE	TEN MILE	WAIKAMAU	WAIKAMAU
Date	17/3/88	RT FORK	UPPER	TR18
Taxonomic group	17/3/88	17/3/88	18/3/88	18/3/88
MOLLUSCA				
Hydrobiidae				
Potamopyrgus antipodarum	x			
Latidae				
Latia neritoides				
CRUSTACEA				
Paratya curvirostris			x	
INSECTA				
MEGALOPTERA				
Corydalidae				
Archichauliodes diversus	x		x	
EPHEMEROPTERA				
Ephemeridae				
Ichthybotis hudsoni				
Oligoneuridae				
Coloburiscus humeralis	C	x	C	x
Leptophlebiidae				
Deleatidium	C	C	x	
Austroclima				
Mauvulus luma				
Zephlebia cruentata				
Zephlebia nodularis		x		
Zephlebia versicolor				
Siphonuridae				
Nesameletus	x	x	x	
Rallidens				
Ameletopsis		x	x	
PLECOPTERA				
Euthenidae				
Stenoperla prasina				
Austroperlidae				
Austroperla cyrene				
Gryopterygidae				
Megaleptoperla diminuta				
Zelandoperla agnetis		x	x	
Zelandoperla fenestrata				
Zelandobius furcillatus		x		
Zelandobius confusus				
Acroperla trivacuata	x			
TRICHOPTERA				
Hydroptilidae				

Stream	KAKATARAHAE	TE WAIKAWAHU	nzus outcrops
Date	17/3/88	18/3/888	
Taxonomic group			
MOLLUSCA			
Hydrobiidae			Hydrobiopsis
Potamopyrgus antipodarum			Hydrobiopsis umbripennis
Latiidae			Hydrobiopsis parumbripennis
Latia neritoides			Hydrobiopsis clavigera
CRUSTACEA			Peltochorema
Amphipoda	x		Costachorema
Paratya curvirostris	x		Neurochorema
			Hydrochorema crassicaudatum
			Tiphobiosis montana
INSECTA			Polycentropidae
MEGALOPTERA			Polyplectropus pueriles
Corydalidae			Philopotamidae
Archichauliodes diversus			Hydrobiosella
EPHEMEROPTERA			
Ephemeridae			Hydropsychidae
Ichthybotis hudsoni			Aoteapsyche colonica
Oligoneuridae			Aoteapsyche raruraru
Coloburiscus humeralis			Orthopsyche fimbriata
Leptophlebiidae			Orthopsyche thomasi
Deiletidium			Helicopsychidae
Austroclima			Helicopsyche zealandica
Hauulius luma			Leptoceridae
Zephlebia cruentata			Triplectides obsoletus
Zephlebia nodularis			Hudsonema amabilis
Zephlebia versicolor			Calocidae
Zephlebia			Pycnocentrella eruenis
Siphonuridae			Helicophidae
Nesameletus			Zetollessica
Rallidens			Conoesucidae
Ameletopsis			Pycnocentrodus
PLECOPTERA			Beraeoptera roria
Eusthenidae			Olinga feredayi
Stenoperla prasina			COLEOPTERA
Austroperlidae			Ptylodactylidae
Austroperla cyrene			Elmidae
Gryptopterygidae			Hydora nitida
Megaleptoperla diminuta			Hydraenidae
Zelandoperla agnetis			Hydrophilidae
Zelandoperla fenestrata			DIPTERA
Zelandobius fuscillatus			Simuliidae
Zelandobius confusus			Austrosimulium
Acroperla trivacuata			Chironomidae
TRICHOPTERA			Maoridiamesa
			Tanypodinae
			Tipulidae
			Aphrophila neozelandica
			Eriopterini
			Paralimnophora
			Empididae
			Tanyderidae

TABLE 7: PNA SURVEY COLVILLE ECOLOGICAL DISTRICT MACROINVERTEBRATES
x = present, C = common

Stream	FANTAIL	PAHI	ONGOH
Date	10/7/88	10/7/88	10/7/88
Taxonomic group			
MOLLUSCA			
Hydrobiidae			
Potamopyrgus antipodarum	x		
Latiidae			
Latic neritoides			
CRUSTACEA			
Amphipoda			
Paratya curvirostris			
INSECTA			
MEGALOPTERA			
Corydalidae			
Archichauliodes diversus	C	x	
EPHEMEROPTERA			
Ephemeridae			
Ichthybotis hudsoni			
Oligoneuridae			
Coloburiscus humeralis	C	x	x
Leptophlebiidae			
Deleatidium	C	C	C
Austroclima sepia	x		x
Mauitulus luma			
Zephlebia cruentata			
Zephlebia nodularis			
Zephlebia versicolor			
Zephlebia			
Siphonuridae			
Nesameletus	x		x
Rallidens			
Ameletopsis			
PLECOPTERA			
Euthenidae			
Stenoperla prasina			
Austroperlidae	C		
Austroperlidae			
Gryopterygidae			
Megaleptoperla diminuta			
Zelandoperla agnetis			
Zelandoperla fenestrata			
Zelandoperla decorata			
Zelandobius fuscillatus	x		x
Zelandobius confusus	x		x
Acroperla trivacuata			
IRIDIUMPHIDIA			
Hydroptilidae			
Oxyethira albiceps			
Paroxyethira			
Hydrobiosidae			
Hydrobiosis			
Hydrobiosis umbripennis	x		
Hydrobiosis parumbripennis			
Hydrobiosis clavigera			
Psilochorema			
Costachorema			
Neurochorema			
Hydrochorema crassicaudatum			
Tiphobiosis montana			
Polycentropidae			
Polyplectropus pueriles			
Philopotamidae			
Hydrobiosella	x		x
Hydropsychidae			
Aoteapsyche colonica			
Aoteapsyche rarururu			
Orthopsyche fimbriata			
Orthopsyche thomasi	C		x
Helicopsychidae			
Helicopsyche zealandica	x		
Leptoceridae			
Tripletides obsoletus			
Hudsonema anabilis			
Calocidae			
Pycnocentrella eruenis			
Helicophidae			
Zetolessica			
Conoesucidae			
Pycnocentrodus			
Beraeoptera foria			
Olinga feredayi			
COLEOPTERA			
Ptylodactylidae			
Elmidae			
Hydora nitida			
Hydraenidae			
Hydrophilidae			
DIPTERA			
Simuliidae			
Austrosimulium			
Chironomidae			
Maoridianesa			
Tanypodinae			
Tipulidae			
Aphrophila neozelandica			
Eriopterini			
Paralimnophora			
Empididae			
Ceratopogonidae			

APPENDIX 3

TABLE B: PNA SURVEY COLVILLE ECOLOGICAL DISTRICT MACROINVERTEBRATES

Taxonomic Group	Stream	Whauwhau 1st Branch 13/9/88	3rd Branch 13/9/88	Main Control 5/9/88	Woodcock
MOLLUSCA					
Melaniidae					
Melanopsis trifasciata			x		
Hydrobiidae					
Potamopyrgus antipodarum	x		x	x	
Latiidae					
Laticia neritoides					
CRUSTACEA					
Amphipoda					
Paratya curvirostris					
INSECTA					
MEGALOPTERA					
Corydalidae					
Archichauliodes diversus	x				
EPHEMEROPTERA					
Ephemeridae					
Ichthybotis hudsoni					
Oligoneuridae					
Coloburiscus humeralis	x		x	x	
Leptophlebiidae					
Deleatidium					
Austroclima sepia					
Mauitulus luma					
Acanthophlebia cruentata					
Zephlebia cruentata					
Zephlebia nodularis					
Zephlebia versicolor	x		x	x	
Zephlebia					
Siphonuridae					
Nesameletus					
Rallidens					
Ameletopsis					
PLECOPTERA					
Euthenidae					
Stenoperla prasina					
Austroperlidae					
Austroperla cyrene					
Gryllopterygidae					
Megaleptoperla diminuta			x		
Zelandoperla					
Zelandoperla fenestrata			x		
Zelandoperla decorata					
Zelandoperla turcillatus					x
Zelandoperla confusus					x
Acroperla trivacuata					x
TRICHOPTERA					
Hydroptilidae					
Oxyethira albiceps					
Paroxyethira					
Hydrobiosidae					
Hydrobiosis					
Hydrobiosis umbripennis					
Hydrobiosis parumbripennis					
Hydrobiosis clavigera					
Hydrobiosis spatulata					x
Palaichorema					
Costachorema					
Neurochorema					
Hydrochorema crassicaudatum					
Tiphobiosis montana					
Polycentropidae					
Polyelectropus puerilis					
Philopotamidae					
Hydrobiosella					x
Hydropsychidae					
Aoteapsyche colonica					
Aoteapsyche raruraru					
Orthopsycha fimbriata					x
Orthopsycha thomasi					
Helicopsychidae					
Helicopsycha zealandica					x
Leptoceridae					
Triplectides obsoletus					
Hudsonema anabilis					x
Calocidae					
Pycnocentrella eruenis					
Helicophidae					
Zelotesia					
Conoesucidae					
Pycnocentrodus					
Beraeoptera roria					
Olinga feredayi					x
COLEOPTERA					
Ptylodactylidae					
Elmidae					
Hydra nitida					
Hydraenidae					
Hydrophilidae					
DIPTERA					
Simuliidae					
Austrosimulium					
Chironomidae					
Maoridiamesa					
Tanypodinae					
Tipulidae					
Aphrophila neozealandica					
Eriopterini					
Paralimnophora skusei					x
Empididae					

