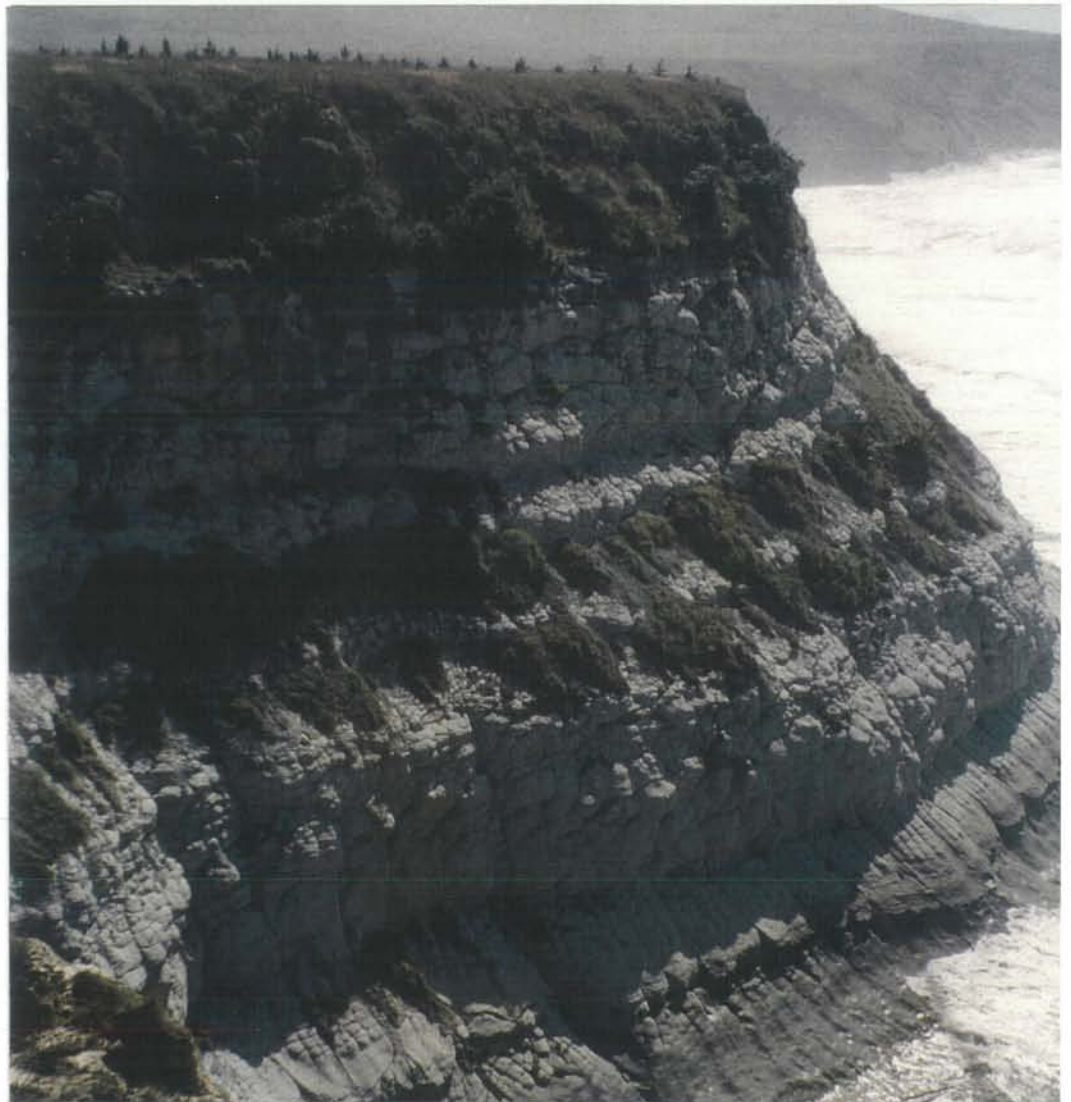




Hundalee Ecological District

APRIL 1999

Survey Report
for the
Protected
Natural Areas
Programme



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Department of Conservation
Te Papa Atawhai

Hundalee Ecological District

Survey Report for the Protected Natural Areas Programme

Simon Moore

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Foreword

The Hundalee Ecological District was surveyed by the Nelson-Marlborough Conservancy of the Department of Conservation as part of the Protected Natural Areas Programme (PNAP) over the summer of 1996/97.

The recommended areas for protection (RAPs), in tandem with the existing protected natural areas (PNAs), are intended to represent the best range of natural diversity within the ecological district from those areas to which access was granted for surveying, and landowner approval given for inclusion in the report.

RAPs are the starting point for the implementation phase of the PNAP. This will involve discussion and consultation, primarily with the respective landowners, aimed at securing protective management. Changes may occur following the consultation process, or after consideration of other values an area and its vicinity may possess.

It is recognised that effective conservation is often a partnership between the Department of Conservation, and landowners and local communities. With this in mind the Department promotes a range of mechanisms for achieving protection and conservation management including reservation, conservation covenants, management agreements and protected private land agreements.

The report also outlines the natural character of the ecological district and describes additional unprotected natural areas surveyed within the district which do not meet the RAP criteria. As such it is a substantial reference work as well as a guide to conservation priorities. It will be of interest to landowners, conservation managers and organisations, scientists and the general public.



Neil Clifton
Conservator
Nelson/Marlborough Conservancy
Department of Conservation

Summary

Hundalee Ecological District, in Lowry Ecological Region, was surveyed during the summer of 1996/97 as part of the Protected Natural Areas Programme (PNAP). The district covers 86 030ha of mostly hill country between the Kaikoura coastline and the Hope Fault which marks the foothills of the Seaward Kaikoura Range and Amuri Range. The majority of this land is freehold.

Greywacke hill country accounts for 60% of the district. The remainder comprises either “soft rock” hill country (eg. sandstone, siltstone, mudstone, limestone), glacial outwash or local alluvium. The district is divided into 5 land systems on the basis of geology, landforms, soils, climate and vegetation. Four bioclimatic zones are present, including coastal, semi-coastal, lowland and montane, with the majority of the district lying within the lowland zone.

The principal natural vegetation types are forest, scrub and shrubland with minor areas of rockland and wetland vegetation. Human disturbance, particularly over the last 200 years has greatly influenced the pattern of vegetation through logging, fire, grazing, oversowing, topdressing and the introduction of noxious plants and animals. Vegetation types were sorted with the assistance of PC-RECCE vegetation inventory data analysis programmes (Hall, 1992) and TWINSpan multivariate analysis programme (Hill, 1979).

Some areas within the district were not surveyed as access was denied by landowners. Other areas which were surveyed are not included in the report as permission to publish was withdrawn.

Both unprotected and protected natural areas were surveyed. Recommended areas for protection (RAPs) were selected to complement existing protected natural areas and thereby represent more fully the natural diversity of the ecological district. Existing protected areas including formal reserves, private protected land agreements and Queen Elizabeth II covenants, total 2 358ha (2.7% of the total area) while 32 RAPs total 6 883ha (8% of the total area). Additional sites within the district visited during the survey, which did not meet the RAP criteria, are also described within the report.

1. Introduction

1.1 THE PROTECTED NATURAL AREAS PROGRAMME

Many of New Zealand's natural ecosystems are poorly represented in the network of national parks and reserves. The vast majority of protected land comprises of steepland forest and mountain communities that are exposed to comparatively little threat. More accessible coastal, lowland and montane areas which have traditionally been attractive for logging and rural development remain highly under-represented and at risk of further depletion.

The Reserves Act of 1977 recognised and set out to remedy this imbalance. It provided the stimulus for the development of a nation-wide ecological survey to identify areas of significant conservation value which should be given legal protection. More specifically the Act acknowledged the need to ensure:

“...as far as possible, the survival of all indigenous species of flora and fauna, both rare and commonplace, in their natural communities and habitats, and the preservation of representative samples of all classes of natural ecosystems and landscape which in the aggregate originally gave New Zealand its own recognisable character.” (Section 3 (1)(b))

The result was the Protected Natural Areas Programme (PNAP) which was instigated by the National Parks and Reserves Authority in 1983. To begin the survey process, New Zealand was divided into 85 ecological regions, and these further divided into 269 ecological districts. An ecological district is defined as a local part of New Zealand where the topographical, geological, climatic, soil and biological features, including the broad cultural pattern, produce a characteristic landscape and range of biological communities (Park et al., 1983).

1.2 SELECTION OF THE HUNDALEE ECOLOGICAL DISTRICT FOR SURVEY

The Hundalee Ecological District was identified as a high priority for survey for several reasons:

- The few protected areas within the district did not cover the range of communities present.
- Much of the natural cover of the district had been removed and what remained was the last vestige of natural character within the area.
- The continued removal or modification of natural vegetation for farm development.
- Little information existed on the natural history of the area (fauna, flora, geology, landforms, etc.).

1.3 CHARACTER OF THE LOWRY ECOLOGICAL REGION

(Ref. McEwan, 1987)

1.3.1 *Location*

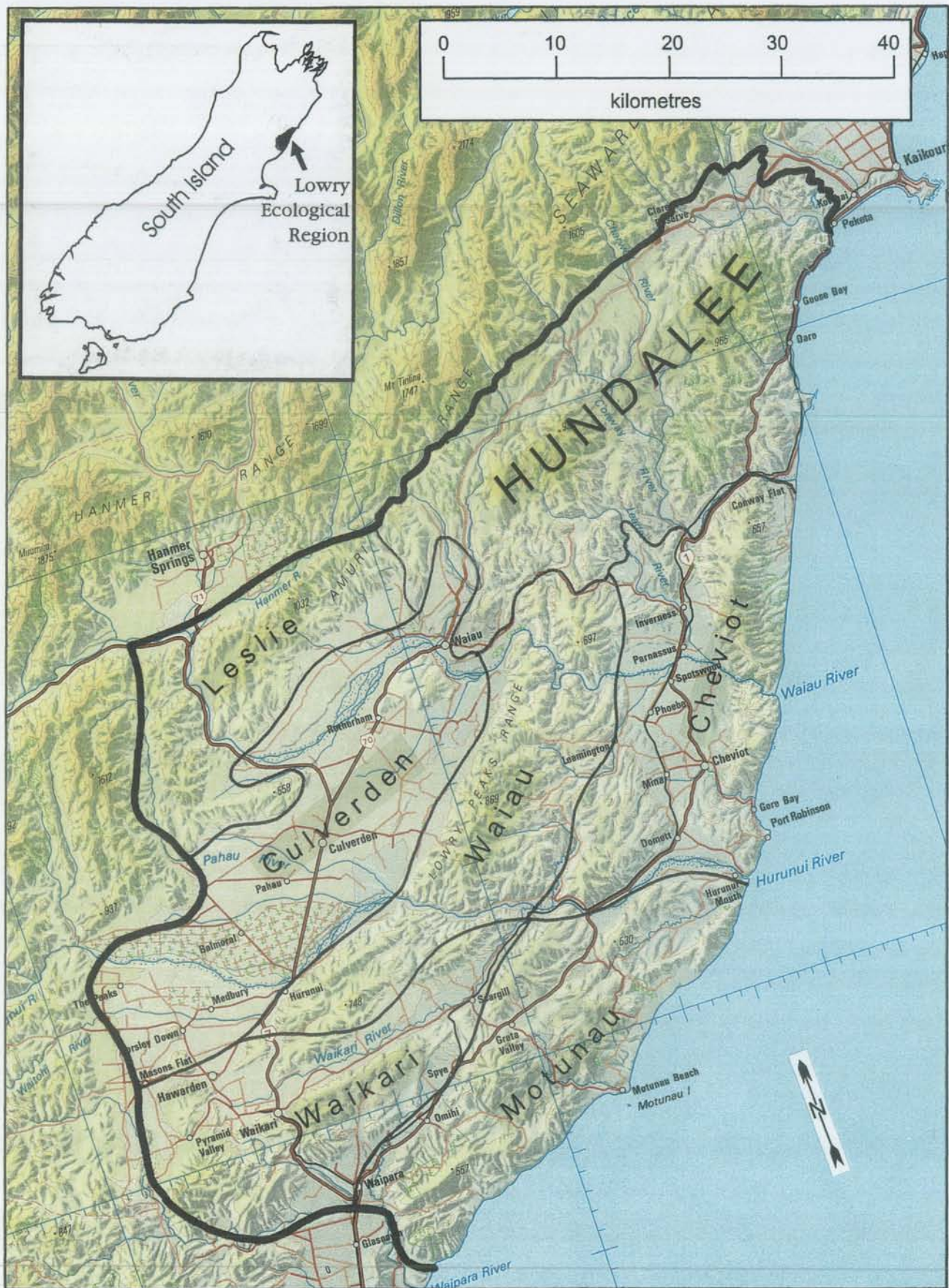
The northern coastal boundary of the Lowry Ecological Region (Map 1) marks the change from low greywacke coastal hills to the alluvial plains of Kowhai Ecological District, part of Kaikoura Ecological Region. Manakau Ecological District and a small section of Dillon Ecological District, in the southern portion of Clarence Ecological Region, form the north-eastern boundary along the Hope Fault where the east-facing slopes of the Seaward Kaikoura Range merge into lowland foothills. The eastern extremity of the ecological region borders Miromiro Ecological District (Molesworth Ecological Region) along Hanmer River, separating the lowland-montane greywacke hill country of Leslie Ecological District from the Hanmer Basin and the taller peaks of the Hanmer Range. Leslie Ecological District similarly borders the moderately glaciated, broken and jagged mountains and intermontane basins and valleys of Sumner Ecological District (Puketeraki Ecological Region) south of Hanmer. The south-western section of the district adjoins the low hills of Ashley Ecological District which mark the western-most point of Canterbury Foothills Ecological Region. The coastal hills of Motunau Ecological District give way to the northern-most point of Low Plains Ecological District, part of Canterbury Plains Ecological Region, near Waipara River.

1.3.2 *Landforms and Ecological Districts*

Lowry Ecological Region covers approximately 377 000 ha and is made up of non-glaciated coastal and inland hills and basins bounded by the Kowhai alluvial plains to the north, the Pacific Ocean to the east, the Hope Fault and Canterbury foothills to the west, and the Canterbury plains to the south. The typically steep-sided coastal and inland hills of Hundalee Ecological District form the northern portion of the region. Like Leslie Ecological District to the southwest it is bordered by the Hope Fault and the two districts contain the highest peaks in the region although most are below 900m. The remaining coastline of the ecological region between Hundalee Ecological District and the Canterbury Plains lies within Cheviot and Motunau Ecological Districts. They consist of coastal hills (mostly below 600m) valleys and plains. Waiau Ecological District lies between Cheviot Ecological District and the inland basin which makes up Culverden Ecological District. It includes the Lowry Range and consists of east-draining hills, mostly below 600m. Waikari Ecological District forms part of the southern boundary of the region to the west of Motunau Ecological District and incorporates dry hills mostly below 600m, and flat-bottomed valleys.

The Conway, Waiau and Hurunui Rivers, and to a lesser extent the Kahutara and Waipara Rivers drain the coastal and inland hills, although the headwaters lie in the high-relief mountains further inland.

Map 1 Lowry Ecological Region



1.3.3 Geology

The geology within the region is dominated by moderately to strongly indurated Mesozoic Torlesse Supergroup greywacke and argillite with lesser amounts of Quaternary glacial outwash and Tertiary calcareous siltstone, sandstone and limestone. Minor components include basal coal measures, volcanics, quartz sands, crystalline sandstone and alluvium.

1.3.4 Climate

A subhumid climate prevails in most areas with mean daily summer temperatures of approximately 16°C during summer, featuring dry föhn north-westerly winds, contrasting with cool winters averaging approximately 6°C (New Zealand Meteorological Service, 1983). Precipitation varies between 600 and 1600mm per annum.

1.3.5 Soils

Most soils in the ecological region are moderately fertile although prone to drying out in summer. Yellow-grey earths and lowland yellow-brown earths are the dominant soil types, covering much of the greywacke, outwash and Tertiary soft rock hill country and basins. Steepland greywacke soils tend to be stony, while rolling land from loess and Tertiary sedimentary rocks have more compact subsoils. Rendzinas tend to follow the distribution of basaltic rock and limestone, while recent soils from alluvia appear locally on river flats.

1.3.6 Vegetation

Beech and podocarp-mixed hardwood forest vegetation dominated the pre-Polynesian Canterbury landscape in lowland, montane and subalpine zones (Molloy, 1969). The arrival of Polynesians signalled drastic changes through frequent fires, so that by the time Europeans arrived secondary forest, scrub, shrubland and grassland were widespread with a few pockets of original forest which escaped burning. Logging and conversion to pasture coupled with the introduction of exotic plant and animal species has led to a further reduction in the condition and extent of prevailing forest. Fire-induced short tussock grasslands and shrublands are now the most common vegetation types, with forest confined largely to coastal areas and inland valleys and gullies. The most intensive agricultural development has occurred in basins, terraces and fans while most of the hill country is semi-intensively managed. Exotic forestry plantations cover a significant portion of the Culverden basin while smaller woodlots are scattered elsewhere throughout the ecological region.

1.4 REPORT FORMAT

Although report formats have, in the past, varied according to the nature of an ecological district and at the discretion of the author(s), most have followed the outline set down by Myers, Park and Overmars (1987). The main departure in this report is the inclusion of natural area descriptions additional to those recommended for protection. Limited allocated survey time meant that not all natural areas could be visited although all of those that were, are included in this report.

2. Methods

2.1 PREPARATION AND RECONNAISSANCE

Survey preparation involved a variety of tasks including researching existing literature, sending letters to landowners, consulting with local Iwi, and contacting others with local knowledge of the area. This was carried out during November 1996 from Nelson/Marlborough Conservancy office.

The reconnaissance phase of the survey was used to delimit the ecological district boundary and the land systems within it, familiarise the team with the natural ecosystems, and identify study areas. An aerial photograph desktop study, coupled with a limited ground survey, was undertaken earlier in 1996 as part of a report on areas of significant conservation value within the Kaikoura District (Moore and Grove, 1997). This served as a reconnaissance for the northern portion of the ecological district. A ground reconnaissance of both the southern part of Hundalee Ecological District situated within Canterbury, and the neighbouring Manakau Ecological District was conducted in December 1996.

2.2 FIELD SURVEY AND PERSONNEL

2.2.1 *Personnel*

The field survey team at any given time involved a minimum of two people with PNAP experience and a maximum of four. The team of two comprised the leader (Simon Moore) and one of two others (Philip Grove and James Bibby). Periodic assistance was provided in pairs by other Department of Conservation staff, (Faith Barber, Tim Shaw, Simon Walls, Graeme Ure, Greg Bettjeman, Nick Head and Joseph Arand) and a volunteer (Susan King, Marlborough Conservation Board). This assistance allowed two survey groups to operate with at least one experienced member in each, usually for one week at a time.

2.2.2 *Study Area Selection and Data Collection*

The field survey took place between January and April, 1997. Study areas were selected as a result of literature searches, ground reconnaissance, and examination of aerial photographs and topographical maps. A study area is defined as:

“...a tract of land with indigenous vegetation delineated as suitable for survey in rapid field inventory in order to identify the ecological patterns and the natural diversity of an ecological district. It is an arbitrary unit, defined as appropriate to circumstances - it may be defined by the boundary of a remnant forest stand; a catchment; a legal title; or in largely undifferentiated environments by grid squares or other manageable, arbitrarily bound areas.”

(Myers, Park and Overmars, 1987)

In addition to the information recorded on site cards and in notebooks, photographs were taken at each study area and at all representative ecological unit sites sampled within. Logistically it was not possible to sample every ecological unit within each

study area. Those with low natural values were usually excluded and some were described from a distance. Plot size was limitless to allow flexibility when sampling different vegetation types. For example forested areas generally required a larger plot size than sedgelands, proportional to their scale of uniformity. Plot size also varied between forest types and depended ultimately on the survey teams' satisfaction that the character of the vegetation type was adequately represented. Many other areas not formally described on plot sheets were summarised in varying detail in notebooks. 196 plots were incorporated into 60 study areas, although some of these were later withdrawn from the publication at the landowners request. Site cards and field notebooks are filed within the Departments' Nelson/Marlborough Conservancy Office.

2.2.3 Landform features

A general landform type was noted on each ecological unit card. Comments were made, where appropriate, on the extent of erosion. Study area cards were used to record rock type(s) and soil type(s). Each landform type associated with an ecological unit was listed, whether sampled or not. Outstanding landscape values could be described in detail on the study area card along with other abiotic or intangible attributes such as historical, economic, recreational and spiritual values.

2.2.4 Vegetation

A general vegetation type was noted for each ecological unit within a study area following the notation of Atkinson (1985). At each sample site a list of vascular plants was made over a range of tiers, and each assigned a broad cover class. The seven tiers used were: 0-0.1m, 0.1-0.3m, 0.3-2m, 2-5m, 5-12m and 12-40m. Each tier was assigned a percentage cover rating. The mean canopy height and height range within the top tier were recorded. Comments were made at each study site on the pattern of the ecological unit within the study area, the sample site relationship to the rest of the ecological unit, the dynamics and naturalness of the vegetation, and modifying factors such as weed infestation.

A vascular plant species list is given in Appendix I. Although this list is intended to be comprehensive, exotic species present in the district may not appear unless they occurred in and around the natural areas surveyed.

2.2.5 Fauna

Bird species, reptiles and frogs were noted where sighted. Specific identification was, in some cases, restricted with a lack of zoological expertise within the survey team. No information was gathered for fresh-water fish, although access to the NIWA freshwater data base offset this shortcoming somewhat. Invertebrate species were noted where obvious eg the proliferation of German wasps on black and mountain beech.

2.3 ECOLOGICAL DISTRICT BOUNDARY

The ecological district (Map 1) follows those defined in McEwen (1987) with one exception. The southwestern boundary was extended to include the lowland hills bounded by Little Lottery River, Counting Stream and Dog Brook. This area was

formerly included in Leslie Ecological District but the geological pattern of calcareous siltstone, sandstone and basaltic pyroplastics and pillow lavas is continuous with that found on the eastern side of the Lottery River within the Hundalee Ecological District.

2.4 DATA ANALYSIS

A package of computer programs, PC-RECCE Vegetation Inventory Data Analysis (Hall, 1992), was applied to check, summarise, and analyse vegetation description data. Programs for clustering, ordination and classification of data were run on a MS-DOS compatible computer.

The data file comprised a 'header record' and at least one 'tier record' for each sample plot. The 'header record' included a plot name code, locality, grid reference, and date as well as abbreviated data on altitude, aspect, slope, physiography, parent material, drainage, cultural factors, ground cover (% vegetation, moss, litter, exposed soil, bare rock), and mean canopy height. The 'tier record' contained the plot name code, tier number, upper and lower height limit, tier total cover class, and species name (6 character code) and cover class.

The 196 plots were divided into 33 broad groups of similar vegetation type using the multivariate analysis programme TWINSpan (Hill, 1979). TWINSpan provided a list of indicator species, which represent those that most differentiate one vegetation group from another, at each level of division. Some vegetation groups were clearly correlated with environmental factors while others were grouped because they contained widespread common adventive species.

2.5 LAND SYSTEMS

Land systems are used to subdivide the ecological district into physical units for the purpose of understanding its ecological character. A land system may comprise a discrete or spatially disjunct areas (Whitehouse, Basher and Tonkin, 1992) in which the topography, soils and vegetation form a recurring pattern, recognisably distinct from that of adjacent land systems (Christian, 1957 cited in Myers, Park and Overmars, 1987). Five land systems were identified on this basis and, where possible, the best examples of the range of ecological units in each have been recommended for protection.

2.6 BIOCLIMATIC ZONES

Coastal, semi-coastal, lowland and montane bioclimatic zones are all represented within the ecological district, although the majority fall into the lowland category. The boundaries of these zones were broadly delineated with the aid of indicator species derived from the TWINSpan results. Although sparsely sampled because of the amount of existing information, true coastal forest contained at least one of the following indicator species: wharangi (*Melicope ternata*), ngiao (*Myoporum laetum*), *Griselinia lucida*, *Coprosma repens* and/or *Asplenium oblongifolium*. The semi-

coastal zone was deemed to correspond with the presence of kawakawa and pigeonwood which were generally restricted to east-draining, coastal hill country. The lowland-montane boundary was demarked by the disappearance of pokaka around 600m and the appearance of such species as *Gaultheria crassa* and *Wahlenbergia albomarginata*. The tops of the tallest peaks contain some species such as *Dracophyllum uniflorum* which are most commonly found in subalpine areas. However the character of the vegetation was not deemed to be sufficiently different to montane areas to warrant a separate zone.

2.7 ECOLOGICAL EVALUATION OF NATURAL AREAS

2.7.1 Primary Criteria

The following primary criteria are based on those described by Myers, Park and Overmars (1987) and were used to assess natural areas for their suitability as recommended areas for protection (RAPs):

- Representativeness. The extent to which an area represents or exemplifies the components of the natural diversity of a land system or ecological district.
- Diversity and Pattern. Natural diversity refers to the range of the natural physical and biotic components in the landscape including species, plant and animal communities, ecosystems, landforms, soil sequences and dynamic systems and processes. Pattern describes the arrangement of species, communities and habitats according to spatial and environmental gradients.
- Rarity and Special Features. Rarity is a measure of the paucity of numbers or occurrences of elements of natural diversity (eg species, communities). The categories of threatened plant and animal species used in this report are those found in Cameron et al (1995) and Molloy and Davis (1994). Special features include additional biotic and abiotic features of significance such as species with limited distributions, spectacular unusual landform features, geological reference, or type localities.
- Naturalness. The degree to which an area has been free from human disturbance and intervention, including the scale of exotic plant invasion.
- Long-term Viability. The degree to which an area is able to retain its inherent natural values over time. This includes its autonomy and self-regulating capacity, and an ability to resist direct and indirect human effects.
- Size and Shape. The size and design of a protected natural area may affect the ultimate success of maintaining viable community samples. Generally large areas are more viable than small ones and the best shape is that with the smallest perimeter. These considerations need to be weighed up against the provision of natural barriers present in the area such as waterways and ridges, and the requirement of buffering or edge species.
- Fragility and Threat. An assessment of the vulnerability of, and threats to, the significant features of an area. Fragile ecosystems in New Zealand include wetlands and sand dune systems.

- Buffering. The inclusion of perimeter buffers such as modified forest or scrub, may be beneficial for the long-term effective functioning of a natural area by reducing external influences.

2.7.2 Secondary Criteria

Occasionally other criteria may be taken into account when choosing between two areas which are similar in terms of their primary criteria. These include historical, spiritual, educational, recreational, economic and/or aesthetic landscape value.

2.8 LANDOWNER CONSULTATION

Preliminary discussions regarding landowner consultation with Federated Farmers and interested groups within the district, resulted in a decision to provide draft descriptions of RAPs and other natural areas to landowners. An option to withdraw the descriptions of these areas from the final published document was provided at this stage.

3. Natural Character

3.1 LOCATION, BOUNDARIES AND TENURE

Hundalee Ecological District, part of Lowry Ecological Region (Map 1), is comprised of hill country lying between the Pacific Ocean and the Seaward Kaikoura and Amuri Ranges. It is bound by the Kowhai River alluvial plains in the north, and Conway River, Counting Stream and the township of Waiau to the south. It straddles the Canterbury-Marlborough border with its centre located some 35km southwest of Kaikoura. The district covers an area of approximately 86 030 ha.

The majority of the area is privately owned. Blocks of Crown land under the administration of the Department of Conservation, Land Information New Zealand and Te Runanga O Ngāi Tahu are scattered throughout the district, most commonly in the form of reserves, marginal strips, beaches and riverbeds. Te Runanga O Ngāi Tahu owns several former Crown reserves as a result of the Ngāi Tahu settlement. Tranz Rail Limited and Transit New Zealand administer the railway line and roads respectively.

3.2 RELIEF AND DRAINAGE

Much of the district is composed of lowland youthful, steep-sided hills with sharp ridges and peaks dropping to narrow valley floors. The majority of these hills lie below 900m asl with the highest point, Mt. Peter, at 993m asl. Low-relief hill country lies in the south and west, in the form of glacial outwash and low hills on soft rock. Coastal terraces are a feature of the landscape between the Conway River mouth and Haumuri Bluffs while alluvial terraces occur locally on riversides throughout the district. The average base elevation is approximately 450m asl.

The Conway and Kahutara Rivers and their tributaries drain much of the northern and inland central parts of the district although their headwaters lie further west in the Seaward Kaikoura Range. Streams to the south generally flow into the Waiau River while a series of smaller waterways drain the steep-sided catchments of the coastal hills to the east.

3.3 GEOLOGY, LANDFORMS AND SOILS

3.3.1 *Geology*

(Ref. Lensen, 1962; Gregg, 1964; and Warren, 1995)

The dominant rock type, occurring over approximately two-thirds of the district, is grey indurated sandstone and mudstone (greywacke and argillite) of the Mesozoic Torlesse Supergroup. Much of the remainder of the district lies on various types of Quaternary and Tertiary soft rock which have been folded and truncated on and around the Hope, Woodchester and Hundalee faultlines and the Ngaroma syncline.

The most common soft rock comprises marine siltstone and sandstone with conglomerate bands. The southwestern portion of the district between Mt. Cookson and Counting Stream is made up of a combination of Tertiary basaltic pyroclastics and pillow lavas, limestone, and marine blue-grey calcareous siltstone and sandstone with smaller segments of Quaternary glacial outwash gravels, loess-covered in places, and Mesozoic yellow-grey soft silty interbedded fine and medium sandstones. A similar geological composition, with the exclusion of volcanic rock types, exists in the Limestone Hill-Ferniehurst area in the southeast. Two bands dominated by Tertiary marine siltstone and sandstone stretch between Waiau and the Gelt River in the south, and Hundalee and Oaro in the southeast of the district. The northeastern margin is composed largely of Quaternary glacial outwash gravels, loess-covered in places, flanked to the east by seams of Tertiary limestone and Mesozoic yellow-grey soft silty interbedded fine and medium sandstones. The southeastern coastline between Tarapuhi and the Conway River mouth contains nearshore marine and estuarine gravel and sand on uplifted marine-cut terrace surfaces of Quaternary age. The marine deposits are commonly overlain by thicker beds of loess and/or colluvial or alluvial gravel and sand. Terraces and flats along the main river systems and many of the smaller streams which are networked throughout the district are comprised of recent alluvium.

The Hope Fault is a major active transcurrent fault and as such poses a high earthquake risk for the district. Late Quaternary fault traces, particularly those associated with the Hundalee fault zone, indicate continuing fault activity of sufficient intensity to disrupt surface features.

3.3.2 Accelerated Erosion

Although having a relatively low mean annual rainfall, the Hundalee Ecological District is occasionally subject to large-scale storm events. Intense rainfall during these storms can result in shallow earth flows and localised gully erosion, particularly steep soft rock whose bush or scrub cover has been removed for pastoral development.

The steep greywacke terrain is prone to slips and rockfall following heavy rain. Valleys are non-glaciated and therefore V-shaped rather than U-shaped. Soft rock hill country to the south and west is also prone to slips and slumping, particularly following the removal of vegetation on steep hill slopes and terrace risers.

3.3.3 Landforms

Lake Rotorua (73ha), Lake Rotoiti (5ha) and Lake Kowhai (3ha) lie at the northern end of the district at the base of low relief greywacke hills between Kahutara River and Kowhai River floodplain. They were formed by the buildup of alluvial deposits on the adjacent plains and terraces which eventually impeded the runoff from these hills (M. Johnston, pers. comm.).

The marine terraces between the Conway River mouth and Tarapuhi (including those on the southern side of the river mouth in Cheviot Ecological District) were formed during interglacial-glacial cycles of marine cliffing, marine aggradation, and regression of the sea, followed by erosion and fan accumulation (Warren and Speden, 1977; Ota et al., 1984). This process also gave rise to the spectacular Haumuri Bluffs which are a prominent coastal landscape feature within the district.

The entire coastline of the ecological district has been classified as having either significant or outstanding regional natural features and landscapes (Boffa Miskell and Lucas Associates, 1993).

3.3.4 Geopreservation Sites

There are 10 sites (see Appendix VI) within the district which are classified as having geopreservation value (Kenny and Hayward, 1993a; Kenny and Hayward, 1993b). The five of national importance are Annandale (Mt. Cookson) karst, Glenstrae Pleistocene fauna, Kaikoura coastal features, Haumuri Bluff Upper Cretaceous sediments and fossils, and Hundalee Hills deep sea canyon. The five of regional importance are Haumuri Bluff sea arch, Mikonui earth flow, Oaro shore platform, Conway coastal mouth marine terraces, and Lower Conway railway cutting Cretaceous-Tertiary boundary.

3.3.5 Soils

(Ref. New Zealand Soil Bureau (1953, 1968))

The steepland soils on greywacke in moderate rainfall areas are generally lowland yellow-brown earths of the Hurunui soil set and, bordering the coast, the Patutu set. These soils are typically sandy and stony loams of poor to moderate fertility. On hilly and rolling land with lower rainfall, soils are yellow-grey to yellow-brown earths intergrades of very low, low and moderate fertility (Kahutara, Wandle and Hundalee soil sets, respectively). Soft rock hills to the south of the district are dominated by yellow-grey earths on rolling lands and hills (Leader and Lottery soil sets) and to a lesser extent terrace lands and fans (Glasnevin set). Medium to high fertility brown granular heavy silt loams to clay loams of the Cookson-Waikari set have formed on basic volcanic rocks. Other soil groups of limited distribution in the district include recent soils from alluvium on flood plains (Waimakariri, Waimakariri Shallow and Waimangarara soil sets), rendzinas and related soils (Waikari and Amuri sets), and the droughty yellow-brown sands (Taumutu set) near the Conway River mouth.

Four sites (see Appendix VII) have been classified as significant (Arand et al., 1991) because of their soils. Of national importance is Lottery Bush Scenic Reserve which contains both the Lottery and Wandle soil sets. Of regional importance are Goose Bay-Omihi Scenic Reserve (Patutu set), Limestone Creek Scenic Reserve (Hurunui set), Hyde Open Space Covenant (Hundalee set).

3.3.6 Climate

Climatological stations are located at Kaikoura, situated approximately 6km outside the ecological district on the coast to the northeast, and the township of Waiau which lies 33km inland on the southern border. The following information is based on summaries of climatological observations for these two stations (New Zealand Meteorological Service, 1983) as well as general weather patterns of Marlborough (Pascoe, 1983), Canterbury (Ryan, 1987) and those summarised for the Hundalee Ecological District (McEwen, 1987).

The climate of the Hundalee Ecological District is generally subhumid with mild summers and cool winters. Day temperatures occasionally exceed 32°C in summer although this is more common in inland areas which are exposed to hot, dry northwesterly föhn winds. Coastal temperatures are moderated by a cool persistent

Map 2
Land Systems

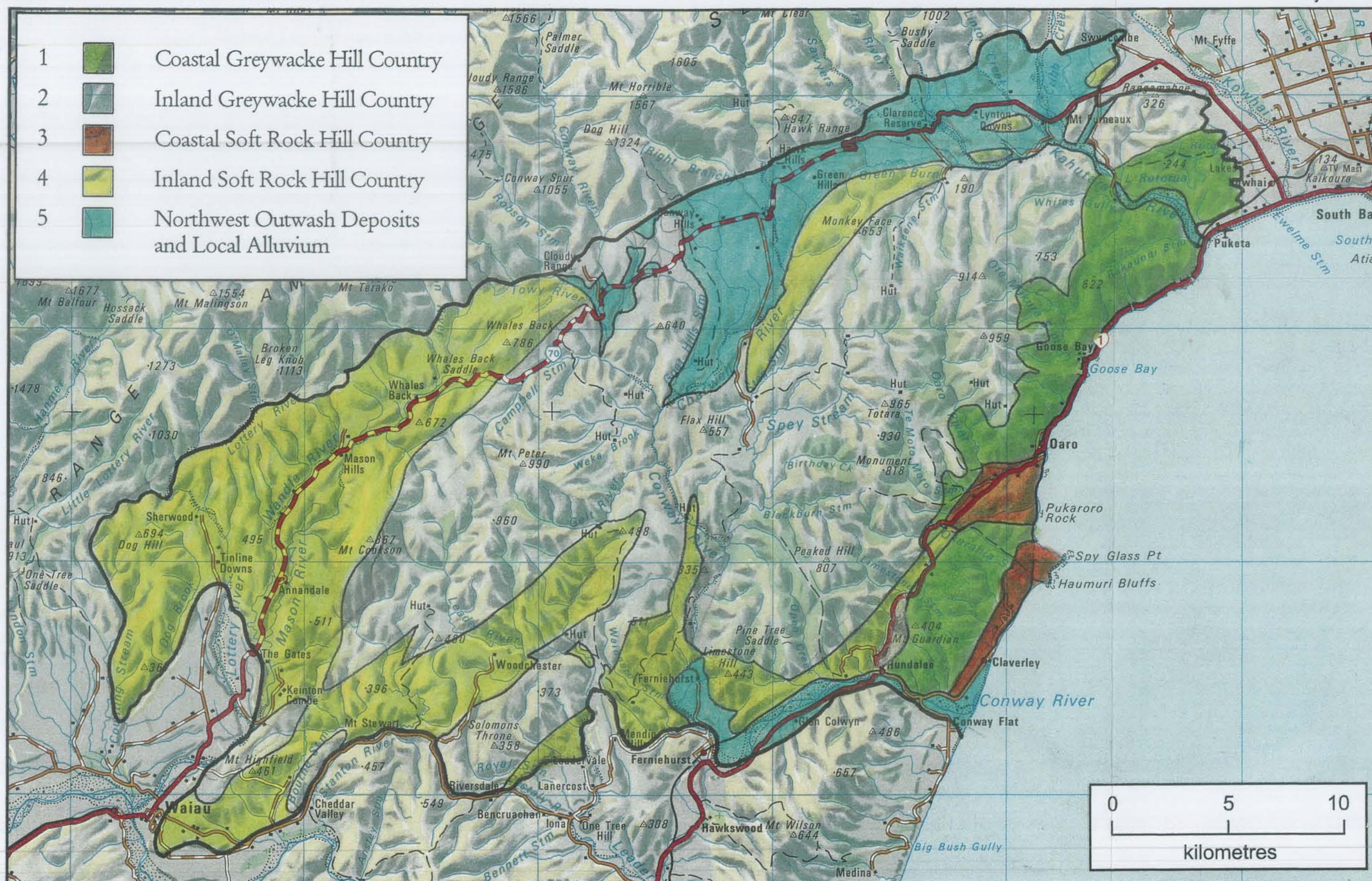
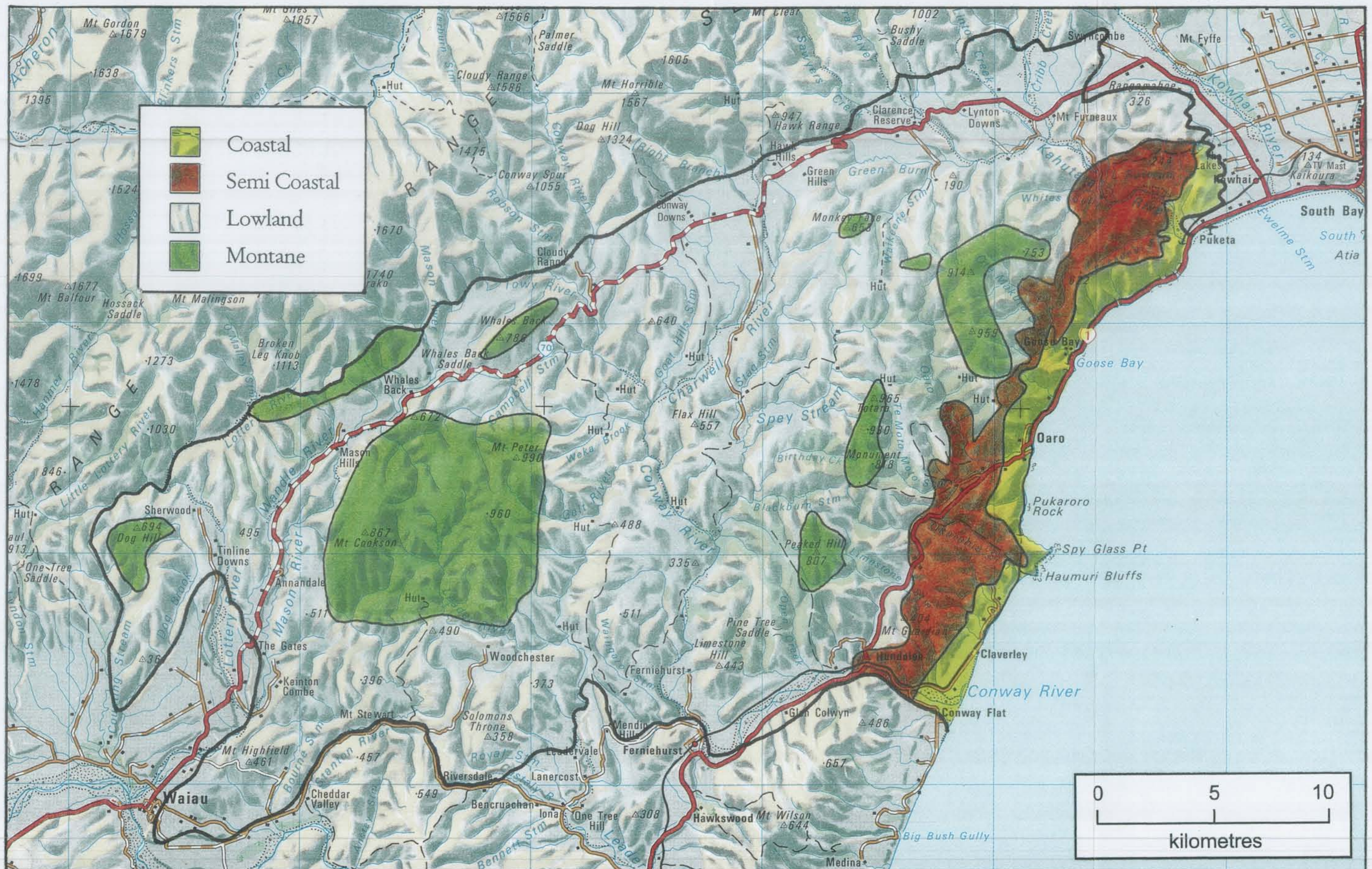


Table 1
Land Systems

	LANDFORMS	GEOLOGY	SOILS	CLIMATE	BIOTIMATIC ZONE	VEGETATION
1	Steep sided coastal hills with V-shaped valleys and both sharp and rounded ridges and crests, draining to the east and southeast. Coastal platform. Coastal bluffs and sheer rockland. Disturbed roadsides. Coastal gravelfields, stonefields and boulderfields near splash zone. 7 360 ha – 9% of the ecological district.	Mesozoic greywacke.	Patutu lowland yellow-brown earths, shallow and poorly developed on many colluvial slopes. Little soil formation on other landforms.	Annual rainfall of 800-1000mm, mostly from the south. Persistent on-shore easterly wind moderates temperatures. Sunshine hours lowered by shade of coastal hills, particularly in winter. Salt-laden coastal mist often apparent.	Coastal. Sea level to approximately 500m asl.	Coastal broadleaved low forest covers most hill slopes and coastal platform with mahoe, fivefinger, ngaio, titoki, hinau and pigeonwood prominent canopy species. Kanuka scrub and low forest on ridges and crests. Coprosma shrubland, silver tussock and pasture grassland, and bracken fernland on more recently burned hill slopes and toeslopes. Scattered shrubs, ferns, herbs and grasses on steep rocklands and bluffs with Marlborough rock daisy common.
2	Steep-sided hills with V-shaped valleys and sharp to rounded crests and ridges in the headwaters of the main coastal catchments and the Black Hills area. Moderately steep sided to rolling hills with V-shaped valleys. Bare rock and talus around parts of the highest peaks. Series of three small lakes at the base of greywacke hills in the north of the district formed by adjacent alluvial aggradation. 43 610 ha – 51% of the ecological district.	Mesozoic greywacke.	Hurunui lowland yellow-brown earths. Minor Kahutara yellow-grey to yellow-brown earths intergrade.	Annual rainfall of 1000-1200mm. Dry föhn winds from the northwest cause summer temperatures to occasionally exceed 32 °C. Winter frosts common. Limited winter snowlie on the tallest peaks and occasional snowlie below this.	Lowland, montane. 30-993m (Mt. Peter).	Black beech-broadleaved forest covers much of the lowland forested riparian strips and streamsides, often with scattered red beech and/or matai. Regenerating broadleaved forest, often dominated by mahoe, common in lowland gullies and wetter hill slopes. Regenerating kanuka scrub and low forest on ridges and drier hill slopes. Silver tussock-pasture grassland dominates the lowland crests and ridges with areas of bracken fernland, manuka shrubland and mixed shrubland. Fescue becomes a grassland component in montane areas. Montane mixed shrubland with Halls totara and broadleaf on slopes of taller peaks, often on colluvium and talus. Mountain beech forest in some catchment heads of taller peaks. Scattered shrubs, ferns, herbs and grasses on steep rocklands and bluffs with Marlborough rock daisy common. Lake margins characterised by raupo, and a mix of sedge and rush species. Carex secta sedgeland dominates seepage areas and remains on some modified wetlands.
3	Rolling hill country near the coast between Oaro and Conway River mouth. Includes a series of interglacial coastal marine terraces and platforms between Tarapuhi and the Conway River mouth. The sequence continues to the south of the Conway River in Cheviot Ecological District. The older raised platform at Haumuri gives way to sheer coastal bluffs. Prominent landform features include the sea arch at the base of the Haumuri Bluffs and Oaro shore platform. 1 490 ha – 2% of the ecological district.	Mesozoic sandstone and siltstone with calcareous bands, pods and concretions. Tertiary argillaceous limestone, calcareous silty mudstone, and calcareous sandstone. Tertiary marine mudstone and siltstone. Quaternary nearshore marine and estuarine gravels and sand on uplifted marine-cut terrace surfaces. Commonly overlain by thicker beds of loess and/or colluvial or alluvial gravel and sand.	Hundalee yellow-grey to yellow-brown earths intergrade. Wharanui yellow-grey earths. Medina yellow-grey to yellow-brown earths intergrade. Taumutu yellow-brown sands. Minor Amuri rendzina and related soils.	Annual rainfall of 800-1000mm, mostly from the south. Persistent on-shore easterly wind moderates temperatures. Salt-laden coastal mist sometimes apparent.	Coastal. Sea level to 324m.	Much of the rolling hill country has been cleared for pasture. Manuka scrub is regenerating in places. Broadleaved low forest with scattered black beech occurs mostly in riparian zones along Mikonui Stream and Okarahia tributaries. Coastal broadleaved scrub and shrubland occupies much of the scarp and near-shore area south of Mikonui Stream. Cliffs and steeper colluvial hill slopes are generally sparsely vegetated with rockland communities. Vegetation on coastal terraces is almost completely exotic pasture grassland. Haumuri Bluff faces have a mixture of coastal broadleaved scrub, exotic grassland, native ice plant herbfield, and bare rock.
4	Low rolling hills with incised watercourses. Grading into a terraces in places around the Lottery-Wandle area. Slips and slumping apparent in places, and accelerated with the removal of natural vegetation cover, particularly on streamsides. Mt. Cookson area features limestone cliffs and a karst system with a field of dolines/tomos including Hazey Hole Cave (c.400m long). Contains Quaternary fossil faunas. Areas of limestone talus on razorback ridge of Whalesback. Abuts Hope Fault on the southwest border of the district. 24 690 ha – 29% of the ecological district.	Mostly Tertiary marine sandstone and siltstone, some blue grey and calcareous. Tertiary limestone overlying and passing into basaltic pyroclastics and pillow lavas. Tertiary and Mesozoic basal coal measures and calcareous sandstone with concretionary layers. Minor Quaternary glacial outwash gravel, overlain in places by dune sand.	Leader yellow-grey earths. Wandle and Hundalee yellow-grey to yellow-brown earths intergrade. Cookson-Waikari and Middlehurst brown granular loams and clays. Minor Waikari rendzinas and related soils; Lottery yellow-grey earths; Hurunui lowland yellow-brown earths.	Annual rainfall of 900-1100mm. Dry föhn winds from the northwest cause summer temperatures to occasionally exceed 32 °C. Winter frosts common.	Lowland, montane. Near sea level to 867m (Mt. Cookson).	Low relief has meant that much of this area has been converted to pasture. Extensive pasture grassland (with varying amounts of silver tussock) intergrades with bracken fernland, manuka shrubland and scrub, mixed Coprosma-matagouri shrubland. Older kanuka or broadleaved low forest in places. Occasional black and/or mountain beech forest stands scattered on dry lower hill slopes, gullies and streamsides. Black beech-podocarp forest on undulating hills and terraces in the Lottery-Wandle area. Minor rockland and gravelfield communities. Minor modified seepages with Carex secta and mixed Juncus species.
5	Low gently rolling hill country, downland, and terraces including the glacial outwash apron bordering the Hope Fault on the northwest margin of the district. Locally occurring alluvial terraces and flats by watercourses scattered throughout the district. Includes terrace risers and braided river floodplains. River mouths and developed beaches scattered along the coastline, sandspits, gravelspits, and the coastal lagoon at the Conway river mouth. 8 880 ha – 10% of the ecological district.	Quaternary glacial outwash gravel, local fan gravel and silt. Quaternary alluvial sand, silt and gravel. Modern river estuarine deposits and coastal gravel and sand.	Hundalee and Jordan yellow-grey to yellow-brown earths intergrade with associated Hororata yellow-brown shallow and stony soils. Charwell lowland yellow-brown earths. Waimangarara and Waimakariri Shallow recent soils. Minor Waikari rendzina and related soils; Kahutara yellow-grey to yellow-brown earths intergrade; Hurunui lowland yellow-brown earths. Some Taumutu yellow-brown sands around beach and rivermouth areas although little soil development in most places.	Annual rainfall of 800-1200mm. Dry föhn winds from the northwest cause summer temperatures to occasionally exceed 32 °C particularly in inland areas. Winter frosts common in inland areas. Coastal areas are characterised by a persistent on-shore easterly wind which moderates temperatures. Salt-laden coastal mist often apparent.	Coastal, semi-coastal and lowland. Sea level to 570m.	Vast majority of the glacial outwash apron has been converted to pasture grassland. Minor elements of bracken fernland, manuka shrubland and mixed broadleaved shrubland and scrub. Pockets of mixed podocarp and podocarp-broadleaved forest in the Sawyers Creek and Ferniehurst areas. Kanuka low forest and scrub and manuka scrub and shrubland on alluvial terraces and flats. Modified mixed shrubland on terrace risers. Gravelfields on floodplains contain few native species. Margins dominated by willow species. Exotic pine plantations dominate the area between Linton Creek and Little Linton Creek. Little native vegetation on beaches other than scattered shore bindweed herbfields. Inland Conway lagoon margins have a mixture of reedland, rushland, flaxland and shrubland.

Bioclimatic Zones



easterly sea breeze. Winter temperatures are more moderate near the coast with frosts and snow more likely to occur inland. Mean daily temperature range is higher inland (12.1 °C at Waiau) than on the coast (6.9°C at Kaikoura).

A moderate rainfall of 850-1200mm pa is evident with an autumn-winter maximum. The majority of rain comes from the southerly quarter. Records show that the area is prone to episodes of heavy rain intensity eg 205mm were recorded in Kaikoura in 24 hours as a result of Cyclone Alison in 1975. Rainfall also increases over an altitudinal gradient, although this is not marked since most of the hill country lies below 900m. Misty sea spray is often associated with the lower coastal slopes between Oaro and Peketa.

3.4 LAND SYSTEMS

Hundalee Ecological District has been divided into five land systems, described in Table 1 and demarked in Map 2. Each is distinguished by a combination of landforms, geology, soils, climate and vegetation. Due to the fragmented nature of some characteristic landforms and geology patterns, not all of the land systems are contained in discrete areas.

The pattern of the land systems adopted closely follows that of the land types identified by Boffa Miskell and Lucas Associates (1993) which were adopted in the Cheviot-Motunau PNA survey.

3.5 BIOCLIMATIC ZONES

Four bioclimatic zones are demarked on Map 3 - coastal, semi-coastal, lowland and montane.

3.6 VEGETATION

3.6.1 *Vegetation History*

(Ref. Molloy, 1969; Harris, 1969; Wardle, 1970, 1973, 1991; and Stevens, McGlone and McCulloch, 1988).

Coal, pollen and spore analyses have provided a broad view of forest types in North Canterbury over several epochs. The Late Cretaceous-Early Tertiary vegetation was predominantly coniferous forest. In the Mid-Tertiary pollen assemblages of Myrtaceae and extinct beeches were found to be dominant. Modern beeches (*Nothofagus* spp.) have thrived since the Pleistocene epoch.

The Kaikoura District, like most of the South Island, was heavily forested before the arrival of humans. From the coastal hills to the mountains of the main divide the landscape was covered in beech in steeper dry areas and podocarp (members of the *Podocarpaceae* family) forest on poorly drained terrain. Above the tree line, on scree slopes, and on young alluvium low forest, shrubs and grasses dominated. The vegetation had evolved without humans and grazing animals and, in the absence of

large scale ecological events such as fire, was not well suited to disturbance and rapid regeneration.

Fires became frequent, prolonged, and expansive with the arrival of the first Polynesian settlers about 1000 years ago. Areas which had formerly contained beech, podocarp, and mixed broadleaved forest gave way to more fire-tolerant species such as matagouri (*Discaria toumatou*) and kanuka (*Kunzea ericoides*) in dry areas, and manuka (*Leptospermum scoparium*) in moist areas. Plants characteristic of open areas such as rocky outcrops, scree, and riverbeds became much more widespread as forested areas were cleared. Coupled with the frequent fires was a change to a cooler, drier climate. The combination of these factors resulted in both a reduction and a change in vegetation, the podocarp forest giving way to beech forest.

A thousand years of ecological upheaval meant that the European settlers arriving in the 1800's were greeted by a very different landscape than had awaited Polynesian settlers. Forests which had previously blanketed the district were much reduced and low forests, shrub, and tussock grasslands had become relatively widespread. On a much smaller scale, vegetation had been altered more directly. The local Māori cultivated kumara, ideally suited to the warm climate of the Kaikoura District.

European settlers quickly and dramatically altered the landscape, burning and logging to clear land for sowing with pasture. It has been almost 150 years since the first farms were established in the Kaikoura District. Since then most of the native forests have been logged, shrublands and grasslands burned, and wetlands drained to make way for farmland. Introduced species have become widespread.

In the light of this history it is extremely difficult to distinguish between seral and induced forest and scrub, and patterns originally resulting from the intrinsic physical site characteristics such as altitude and slope.

3.6.2 Vegetation Pattern and Types

The following broad vegetation types are distinguished according to predominant canopy species. The TWINSpan analysis has not necessarily determined the same vegetation grouping since the predominant canopy species may not always be the determinant species or species mix for group selection in multivariate analysis. For example, vascular species associated with beech forests may be the same as those found in mixed forests on comparable sites (Wardle, 1991). Some vegetation types are included to highlight their unusual nature and are therefore narrowly defined, while the more common types may encompass a range of similar vegetation.

The principal species which typify a vegetation type are described below within broad tiers to give an indication of the characteristic structure. The ground tier is comprised of species occurring below 30cm while the shrub tier lies between 30cm and 2m. The understorey may be of variable height between the canopy and shrub tier. Minor species include those whose mean cover is 5-10% of the whole vegetation group. Infrequent associated species have a mean cover of 1-5% while species whose cover is less than 1% are excluded from the descriptions.

In some cases, particularly with orchids such as *Thelymitra*, identification could not be made beyond genus unless the plant was flowering and is thus referred to as *Thelymitra* sp.

Type 1: Mountain beech forest

Periodic burning of mountain beech (*Nothofagus solandri* var. *cliffortioides*) forest has meant that remaining fragments are generally secondary forest confined to the south and east-facing slopes of upper lowland and montane catchment heads. The canopy comprises uniform mountain beech with occasional minor black beech (*N. solandri* var. *solandri*). The moderately sparse understorey commonly contains broadleaf (*Griselinia littoralis*), marbleleaf (*Carpodetus serratus*), fivefinger (*Pseudopanax arboreus*), lancewood (*P. crassifolius*) and kanuka. *Cyathodes juniperina*, *Leucopogon fasciculatus*, *Coprosma linariifolia*, *C. rhamnoides* and *C. aff. parviflora* dominate the shrub tier while *Blechnum procerum* and *B. chambersii* are common in the ground tier. Other infrequent associated species include Hall's totara (*Podocarpus hallii*), *Gaultheria antipoda*, *Rubus schmidelioides*, *Coprosma propinqua* ssp. *propinqua*, *C. microcarpa*, *Hebe venustula*, wharariki, hound's tongue fern, *Asplenium terrestre* ssp. *terrestre*, *Paesia scaberula*, *Uncinia fuscovaginata*, *Deyeuxia avenoides*, *Lagenifera strangulata*, *Brachyglottis lagopus* and introduced species such as cocksfoot (*Dactylis glomerata*), browntop (*Agrostis capillaris*), and *Hieracium lepidulum*.

Type 2: Montane mixed beech forest

This forest type occurs on dry northeast to southwest-facing greywacke slopes and ridges. Mountain beech, black beech and, to a lesser extent, red beech (*Nothofagus fusca*) form the principal canopy components. The dominant understorey species are Hall's totara and marbleleaf. *Pseudopanax colensoi* and *Coprosma rhamnoides* are the prominent shrub tier species. *Blechnum discolor*, *Polystichum vestitum*, *Microlaena avenacea* and *Uncinia uncinata* dominate the ground tier. Other infrequent associated species include broadleaf, lancewood, *Coprosma crassifolia*, *Blechnum chambersii*, *B. procerum*, *B. montanum*, *Hypolepis millefolium*, *Asplenium terrestre* ssp. *terrestre*, *Gahnia procera*, sweet vernal (*Anthoxanthum odoratum*) and wall lettuce (*Mycelis muralis*).

Type 3: Semi-coastal and lowland black beech forest associations

Type 3a. Black beech forest and black beech-mountain beech forest

East- and south-facing greywacke faces and gullies up to 600m may have a minor red beech canopy component in mature stands. The typical understorey and shrub species, which are generally sparse, are mahoe (*Melicytus ramiflorus*), marbleleaf, fivefinger, kanuka and *Coprosma rhamnoides*. Infrequent associated species include pokaka (*Elaeocarpus hookerianus*), wheki-ponga (*Dicksonia fibrosa*), *Coprosma robusta*, red mapou (*Myrsine australis*), wineberry (*Aristotelia serrata*), lemonwood (*Pittosporum eugenoides*), broadleaf, kohuhu (*Pittosporum tenuifolium*) and *Coprosma propinqua* ssp. *propinqua* in the understorey and shrub tiers. Bracken fern (*Pteridium esculentum*), *Blechnum minus*, *Polystichum richardii*, *Uncinia scabra*, *U. uncinata*, and wall lettuce dominate the ground tiers. Younger stands may contain lancewood and kanuka as minor canopy elements. While there is little understorey a moderately dense shrub layer of regenerating black beech, *Coprosma linariifolia*, *C. propinqua* ssp. *propinqua*, *C. rhamnoides*, *Helichrysum lanceolatum*, *Leucopogon fasciculatus* and *Cyathodes juniperina* is present. The ground layer is sparse with *Polystichum vestitum* and *Uncinia uncinata* the most common species. Infrequent

associated species are hound's tongue fern, *Deyeuxia avenoides*, *Lagenifera strangulata* and *Ranunculus reflexus*.

West to northwest-facing slopes between 100 and 500m elevation generally have a sparse understorey containing lancewood, marbleleaf, broadleaf, *Rubus cissoides*, *Coprosma robusta*, *C. rhamnoides*, *C. microcarpa*, *Leucopogon fasciculatus*, *Cyathodes juniperina*, *Microlaena avenacea* and *Uncinia uncinata*. Infrequent associated species include, mahoe, fivefinger, kanuka, *Coprosma lucida*, *C. linariifolia*, *C. propinqua* ssp. *propinqua*, *Hebe stricta*, *H. rakaiensis*, *Corokia cotoneaster*, *Carex geminata*, *Histiopteris incisa*, *Polystichum richardii*, *Blechnum discolor*, *B. fluviatile*, *Urtica incisa*, *Pratia angulata*, *Nertera depressa*, *Thelymitra* sp., *Hieracium pilosella* and wall lettuce.

Black beech forest on gently sloping soft rock hill country and alluvial terraces up to 600m may contain matai (*Prumnopitys taxifolia*), red beech and/or pokaka as minor canopy associates. The understorey and shrub tiers typically contain marbleleaf, lancewood, *Coprosma rhamnoides*, *C. aff. parviflora*, *C. propinqua* ssp. *propinqua*, *Neomyrtus pedunculata*, *Lophomyrtus obcordata*, with *Uncinia uncinata*, *Microlaena avenacea* and regenerating tree and shrub species in the ground tier. Infrequent associates include kahikatea (*Dacrycarpus dacrydioides*), rimu (*Dacrydium cupressinum*), kanuka, broadleaf, fivefinger, *Pseudopanax colensoi*, *Rubus schmidelioides*, *R. cissoides*, *Leucopogon fasciculatus*, *Pittosporum divaricatum*, *Helichrysum lanceolatum*, *Corokia cotoneaster*, *Coprosma microcarpa*, *Blechnum discolor*, *B. novae-zelandiae*, *Polystichum vestitum* and self heal (*Prunella vulgaris*).

Type 3b. Black beech-red beech forest

Mixed black beech-red beech forest is infrequent, generally occurring in lowland and occasionally semi-coastal greywacke riparian zones between 100 and 300m elevation. The understorey is characterised by marbleleaf, mahoe, wineberry, tree fuchsia (*Fuchsia excorticata*), *Coprosma rhamnoides*, *Rubus cissoides*, *Polystichum richardii*, *Hypolepis millefolium*, *Pneumatopteris pennigera*, *Microlaena avenacea*, *Uncinia uncinata* and wall lettuce. Infrequent associates include matai, miro (*Prumnopitys ferruginea*), hinau (*Elaeocarpus dentatus*), lemonwood, fivefinger, *Calystegia tuguriorum*, manuka, kaikomako (*Pennantia corymbosa*), *Coprosma crassifolia*, *Urtica ferox*, wheki-ponga, mamaku (*Cyathea medullaris*), *Blechnum minus*, *B. discolor*, *B. chambersii*, *Asplenium bulbiferum*, *A. flaccidum*, *A. gracillimum*, *Adiantum cunninghamii*, *Nertera* sp., European broom (*Cytisus scoparius*), foxglove (*Digitalis purpurea*), and wall lettuce.

Type 3c. Black beech-mixed broadleaved forest

Semi-coastal and lowland riparian zones up to 500m elevation often contain a black beech-broadleaved forest mix with black beech and hinau (semi-coastal) emergent over mahoe. Pigeonwood (*Hedycarya arborea*) (semi-coastal) and marbleleaf form minor canopy components. The rich understorey is largely a mix of mahoe, pate (*Schefflera digitata*), red mapou, *Coprosma grandifolia*, kawakawa (*Macropiper excelsum*) (semi-coastal), mamaku and *C. dealbata*, *Metrosideros diffusa*, hound's tongue fern, *Histiopteris incisa*, *Hymenophyllum scabrum*, *Uncinia uncinata*, *U. scabra* and *Microlaena avenacea*. Infrequent associate species include lemonwood, broadleaf, *Lophomyrtus obcordata*, *Coprosma lucida*, *C. rhamnoides*, *Corokia cotoneaster*, *Urtica ferox*, kiekie (*Freycinetia baueriana* ssp. *banksii*), *Asplenium*

bulbiferum, *A. flaccidum*, *A. flabellifolium*, *Leptopteris hymenophylloides*, *Lastreopsis glabella*, *Adiantum cunninghamii*, *Blechnum chambersii*, *B. fluviatile*, silver tussock (*Poa cita*), *Ranunculus reflexus*, and *Oxalis exilis*.

Type 3d. Black beech-podocarp forest

Mixed black beech-podocarp forest occupies drier alluvial terraces between 100 and 400m elevation. Matai is typically the major podocarp canopy associate while kahikatea is often a minor component. The principle subcanopy species are marbleleaf, tree fuchsia and *Lophomyrtus obcordata*. A dense shrub tier is dominated by *Lophomyrtus obcordata*, *Coprosma rotundifolia*, *C. rhamnoides*, *Myrsine divaricata*, *Corokia cotoneaster* and *Neomyrtus pedunculata*. Blackberry (*Rubus fruticosus* agg.) and *Parsonsia capsularis* scramble among most tiers while *Microlaena avenacea*, *Uncinia uncinata*, *Polystichum vestitum* and *Blechnum penna-marina* dominate the ground tier with regenerating tree and shrub species. Less frequently occurring associates include pokaka, kowhai (*Sophora microphylla*), lancewood, wineberry, *Pseudopanax colensoi*, *Muehlenbeckia australis*, *Parsonsia heterophylla*, *Coprosma linariifolia*, *Coprosma* aff. *parviflora*, *Coprosma propinqua* ssp. *propinqua*, *Carex* sp., *Hypolepis millefolium*, *Blechnum minus*, *B. fluviatile*, *Uncinia scabra*, wall lettuce and self heal.

Black beech-podocarp forest on gently sloping soft rock hill country and alluvial terraces up to 600m elevation contains matai as major a canopy associate and red beech and/or pokaka as minor associates. It is otherwise very similar to Type 3a. The understorey and shrub tiers typically contain marbleleaf, lancewood, *Coprosma rhamnoides*, *C. aff. parviflora*, *C. propinqua* ssp. *propinqua*, *Neomyrtus pedunculata*, *Lophomyrtus obcordata*, with *Uncinia uncinata*, *Microlaena avenacea* and regenerating tree and shrub species in the ground tier. Infrequent associates include kahikatea, rimu, kanuka, broadleaf, fivefinger, *Pseudopanax colensoi*, *Rubus schmidelioides*, *R. cissoides*, *Leucopogon fasciculatus*, *Pittosporum divaricatum*, *Helichrysum lanceolatum*, *Corokia cotoneaster*, *Coprosma microcarpa*, *Blechnum discolor*, *B. novae-zelandiae*, *Polystichum vestitum* and self heal.

Type 4: Podocarp forest

Lowland and semi-coastal podocarp-broadleaved associations up to 500m elevation are generally confined to alluvial terraces, toe slopes, and gently rolling hill country. Matai is usually emergent over mahoe. Other emergent/canopy species in semi-coastal areas are black beech, miro, titoki (*Alectryon excelsus*), marbleleaf, kaikomako and kanuka with supplejack (*Ripogonum scandens*) a common climber. The shrub tier contains kawakawa (semi-coastal areas), kaikomako, *Lophomyrtus obcordata* and *Coprosma rhamnoides* while regeneration of broadleaved and podocarp species may be a feature of the ground tier where grazing pressure is light. Infrequent associates include kowhai, pigeonwood, fivefinger, *Streblus heterophyllus*, *Olearia paniculata*, *Helichrysum lanceolatum*, *Muehlenbeckia axillaris*, *Pneumatopteris pennigera*, *Asplenium gracillimum*, *Blechnum fluviatile*, *Paesia scaberula*, *Uncinia scabra*, *Pellaea rotundifolia*, and wall lettuce.

Further inland, emergent matai and mahoe also form the basic canopy structure in lowland (some tending to semi-coastal) podocarp-broadleaved communities up to 500m elevation. The only other emergent species of significance is kahikatea, while marbleleaf is a minor canopy component. There is generally no clearly defined shrub tier while the lower tiers contain *Asplenium bulbiferum*, hound's tongue fern,

and *Uncinia uncinata*. Infrequent associates include narrow-leaved lacebark (*Hoheria angustifolia*), black beech, miro, hinau, kowhai, lemonwood, broadleaf, red mapou, supplejack, kaikomako, *Melicope simplex*, *Coprosma rhamnoides*, *Lophomyrtus obcordata*, *Asplenium gracillimum*, and *Polystichum vestitum*.

Type 5: Broadleaved associations

Some of the rarer vegetation types, found only in a few localities are included within this grouping.

Type 5a. Mahoe-mixed broadleaved forest

On coastal soft rock hill country the canopy of mahoe-mixed broadleaved forest and scrub contains minor kaikomako, pigeonwood, ngaio, tree fuchsia, kowhai and supplejack. *Coprosma robusta* and kawakawa feature in a sparse understorey. *Hypolepis millefolium*, *Histiopteris incisa* and *Blechnum novae-zelandiae* are important in the ground tier. Infrequent associates include fivefinger, *Coprosma rotundifolia*, *Pneumatopteris pennigera*, *Asplenium bulbiferum*, *Polystichum richardii*, *Blechnum fluviatile*, *B. chambersii*, *Adiantum cunninghamii*, *Uncinia uncinata*, cocksfoot and sweet vernal.

Coastal and semi-coastal mahoe forest and mahoe-mixed broadleaved forest are typical of greywacke gullies and valley sides near the coastline and up coastal valleys, often in association with supplejack. Pigeonwood, titoki, marbleleaf, kaikomako and *Metrosideros diffusa* are minor canopy elements. The shrub layer is dominated by kawakawa while *Blechnum chambersii*, *Asplenium gracillimum*, *Polystichum richardii* and *Uncinia uncinata* dominate the lower tiers. Species occurring infrequently include hinau, broadleaf, kowhai, red mapou, fivefinger, *Coprosma grandifolia*, *C. rotundifolia*, pate, *Lophomyrtus obcordata*, wineberry, wheki-ponga, *Pneumatopteris pennigera*, *Lastreopsis glabella*, *Adiantum cunninghamii*, *Blechnum fluviatile*, and hound's tongue fern.

Lowland mahoe-mixed broadleaved forest on inland greywacke hill country is very similar to the broadleaved component found in podocarp-broadleaved forest (Type 4a) and is found on concave hill slopes and gullies. Marbleleaf is a minor canopy component. There is often no clearly defined shrub tier while the lower tiers contain *Asplenium bulbiferum*, hound's tongue fern, and *Uncinia uncinata*. Infrequent associates include narrow-leaved lacebark, black beech, miro, hinau, kowhai, lemonwood, broadleaf, red mapou, supplejack, kaikomako, *Melicope simplex*, *Coprosma rhamnoides*, *Lophomyrtus obcordata*, *Asplenium gracillimum*, and *Polystichum vestitum*.

Type 5b. Mahoe-fivefinger forest

Steeper coastal greywacke faces, often colluvial, contain mahoe and fivefinger as the principle canopy species with minor ngaio and *Olearia paniculata*. The shrub layer is dominated by kawakawa and *Coprosma robusta*. A typically sparse ground layer contains scattered ferns including *Adiantum cunninghamii*, hound's tongue fern and *Polystichum richardii*. Other less frequent associates include tree tutu, karaka (*Corynocarpus laevigatus*), pigeonwood, red mapou, kaikomako, kohuhu, *Hebe salicifolia*, wharariki, and *Uncinia uncinata*.

Type 5c. Mixed broadleaved forest and scrub

Lowland broadleaved forest is characteristically confined to gullies, riparian zones and terraces, often in association with black beech and podocarp species. At altitudes of up to 500m broadleaved low forest and scrub commonly contains lemonwood, marbleleaf, mahoe, tree fuchsia, broadleaf, tree tutu (*Coriaria arborea*), pate, *Coprosma grandifolia* and *C. robusta*, with occasional red beech. *Metrosideros diffusa* is a common climber. The shrub layer is usually sparse with some scattered wineberry. *Polystichum richardii* is abundant in the ground tier, with hound's tongue fern, *Blechnum minus*, *B. chambersii*, *Adiantum cunninghamii*, *Uncinia uncinata*, ragwort (*Senecio jacobaea*) and wall lettuce. Infrequent species include black beech, kohuhu, fivefinger, Hall's totara, *Coprosma robusta*, *Cordyline banksii*, *Cyathea smithii*, mamaku, *Asplenium bulbiferum*, *Polystichum vestitum*, *P. richardii*, *Microlaena avenacea*, *Acaena anserinifolia* and *Cerastium fontanum*.

Type 5d. Mahoe-kanuka forest, treeland and scrub

Mahoe and kanuka form regenerating scrub and low forest, sometimes in association with other broadleaved species, sometimes with each other, on dry, coastal, semi-coastal and lowland east- to south-facing slopes. Marbleleaf may also be a minor canopy component. The understorey is generally dominated by *Coprosma rhamnoides* with lesser amounts of kawakawa and *Helichrysum lanceolatum*. *Uncinia uncinata* and sweet vernal are prominent in a sparse ground tier. Infrequent associates include pigeonwood, kowhai, *Coprosma rotundifolia*, *C. crassifolia*, *Adiantum cunninghamii*, *Blechnum fluviatile*, *Paesia scaberula*, *Uncinia leptostachya*, *U. scabra*, cocksfoot and self heal.

On southeast- to west-facing slopes marbleleaf is generally more common within the canopy. Other minor canopy elements may also be present such as red mapou, titoki, kowhai and hinau. The shrub layer is again dominated by *Coprosma rhamnoides* with *Olearia paniculata*, kawakawa and regenerating mahoe. *Uncinia uncinata* is the prominent ground tier species with hound's tongue fern. Infrequent species include broadleaf, *Coprosma robusta*, akeake (*Dodonaea viscosa*), *Astelia fragrans*, *Polystichum richardii*, *Echinopogon ovatus* and sweet vernal.

Type 5e. Ngaio treeland

Ngaio treeland forms an unusual and rare community type on the coastal north-facing slopes on calcareous sandstone, west of Piripaua. *Coprosma robusta*, kaikomako and mahoe are also prominent. Dense pasture grasses and weeds dominate the vegetation below this - cocksfoot, *Festuca arundinacea*, Yorkshire fog (*Holcus lanatus*), vipers bugloss (*Echium vulgare*), ragwort and Scotch thistle (*Cirsium vulgare*). Infrequent species include manuka, tree tutu, *Coprosma propinqua* ssp. *propinqua*, *C. rigida*, *Polystichum richardii*, and *Oreomyrrhis ramosa*.

Type 5f. Kowhai forest and treeland

This is a rare and unusual vegetation type within the ecological district. Only one stand of significant size was observed, on marine siltstone and sandstone at the southern end of the district. *Cordyline australis* is a minor canopy component along with scrambling *Muehlenbeckia australis*. Where the canopy is open the shrub tier contains such species as tauhinu (*Ozothamnus leptophyllus*), *Coprosma propinqua* ssp. *propinqua*, matagouri, *Carmichaelia australis*, *Rubus squarrosus*, blackberry, bracken

fern and young kowhai. Introduced pasture grasses dominate the modified ground tiers with a few minor native species such as *Polystichum richardii*, *Acaena anserinifolia* and *Rytidosperma unarede*. Vegetation under the dense canopy is very species-poor, at least partly due to a history of damage by animals, particularly pigs.

Type 5g. Mountain ribbonwood treeland, scrub and shrubland.

A small stand of mountain ribbonwood (*Hoheria lyallii*) present towards the head of an east-facing gully to the north of Mt. Peter represents a rare and unusual vegetation type within the ecological district. The most common associated species amongst an open canopy are tree fuchsia, kanuka, manuka, *Cordyline australis*, *Cortaderia richardii* and *Carex secta*.

Type 6: Kanuka and manuka associations

Type 6a. Manuka scrub

Induced coastal manuka scrub on poorly-drained calcareous sandstone and siltstone occurs at Mikonui Stream and, in a sparse understorey, contains a variety of broadleaved seedlings of species found further upstream in coastal broadleaved low forest. These include marbleleaf, kawakawa, kaikomako, pigeonwood, *Coprosma lucida*, *C. robusta*, ngaio, mahoe, tree fuchsia and fivefinger, and occur predominantly in canopy gaps with *Carex geminata*, *Histiopteris incisa* and *Hypolepis millefolium*.

Further inland, also on poorly-drained sandstone and siltstone, manuka scrub may contain minor kanuka where the canopy is relatively open. *Coprosma rhamnoides* and *Leucopogon fasciculatus* dominate the shrub tier with minor bracken fern and kanuka. Sweet vernal and cocksfoot are the most common ground tier species with minor *C. rhamnoides* and *L. fasciculatus* seedlings. Broadleaved seedlings present include marbleleaf, broadleaf and *Coprosma robusta*.

Manuka often colonises pasture grassland, particularly on forest margins on a variety of substrates. This vegetation type is typically highly modified with a predominantly exotic ground tier.

Type 6b. Kanuka forest and scrub

Semi-coastal to lowland kanuka forest and scrub (50-400m in altitude, mostly around 200m) occurring on a variety of substrates and aspects, is typically species-poor with a dense kanuka canopy over a shrub tier dominated by *Coprosma rhamnoides* with minor *Helichrysum lanceolatum* and, in more open areas, European broom. Exotic pasture grasses are common in the ground tiers with *Brachypodium sylvaticum* (on alluvium), sweet vernal, and browntop prominent. Infrequent associated species include marbleleaf, kowhai, manuka, tree tutu, *Cyathodes juniperina*, *Corokia cotoneaster*, *Coprosma crassifolia*, *Dichelachne crinita*, *Haloragis erecta*, hound's tongue fern, *Asplenium gracillimum*, *Polystichum richardii*, *Uncinia fuscovaginata*, *Stellaria decipiens*, *Leptinella serrulata* (on alluvium), and introduced cocksfoot, Yorkshire fog, ragwort, *Hieracium pilosella*, and catsear (*Hypochoeris radicata*).

Kanuka forest and scrub on lowland-montane greywacke faces (200-700m altitude, mostly around 450m) may contain minor manuka, marbleleaf and black beech as canopy and sub-canopy components. The vegetation is also relatively species-poor

with *Coprosma rhamnoides* again dominating the shrub layer, and *Polystichum vestitum* and *Uncinia uncinata* the ground tiers. Species occurring infrequently include Hall's totara, lancewood, *Corokia cotoneaster*, *Coprosma* aff. *parviflora*, *Leucopogon fasciculatus*, *Blechnum minus*, *B. vulcanicum* and wall lettuce.

Type 6c. Kanuka-manuka scrub and forest

Manuka forms a sometimes dominant canopy association with kanuka in damper areas, often on alluvial flats prone to periodic flooding. Kowhai may also be a minor component of what is often a relatively open canopy. *Coprosma rhamnoides* is the dominant shrub tier species with a ground tier made up principally of introduced pasture species: *Brachypodium sylvaticum*, browntop, sweet vernal, cocksfoot and white clover (*Trifolium repens*). Infrequently occurring species include *Leucopogon fasciculatus*, *Coprosma propinqua* ssp. *propinqua*, tauhinu, fescue tussock (*Festuca novae-zelandiae*), silver tussock, *Carex secta*, *Blechnum penna-marina*, *Polystichum vestitum*, *Muehlenbeckia axillaris*, *M. complexa*, *Nertera setulosa*, European broom, *Juncus articularis*, *Lotus pedunculatus*, *Agrostis stolonifera*, Yorkshire fog, Californian thistle, ragwort, and *Hieracium pilosella*.

Type 6d. Kanuka-manuka-black beech forest, scrub and shrubland

Kanuka and/or manuka often invades sites previously occupied by black beech forest or mountain beech forest which have been burned or cleared. If a seed source is still present in relatively close proximity these beech species will recolonise. Consequently beech-kanuka-manuka associations are transitional phases towards mature beech forest. The proportions of each species in the canopy varies according to the age of the stand. Common shrub species are *Coprosma rhamnoides*, *Leucopogon fasciculatus*, *Cyathodes juniperina*, and *Helichrysum lanceolatum* with *Uncinia uncinata* prominent in the ground tier. Infrequent species include lancewood, marbleleaf, fivefinger, *Gaultheria antipoda*, *Coprosma* aff. *parviflora*, *Rubus cissoides*, bracken fern, *Polystichum vestitum*, *Microlaena avenacea*, blackberry, cocksfoot, sweet vernal, browntop, catsear, and *Hieracium pilosella*.

Type 6e. Manuka-kanuka-marbleleaf scrub

This is an induced vegetation type generally restricted to inland soft rock and glacial outwash gravels. Marbleleaf is typically the dominant broadleaved species with minor fivefinger, mahoe, lancewood, kohuhu, wineberry and *Cordyline australis*. Kanuka may become a minor canopy species where drainage is poor. *Rubus australis* is the most profuse scrambler, occurring in all tiers. Shrub tier species include *Coprosma propinqua* ssp. *propinqua*, *C. robusta*, *C.* aff. *parviflora*, *Leucopogon fasciculatus* and minor scrambling *Clematis forsteri* agg. The ground tier is largely modified with pasture species and weeds dominating, particularly where the canopy is very open. *Polystichum vestitum* and *Uncinia uncinata* are common with minor *Blechnum chambersii*, *B. fluviatile*, *B. procerum*, *Pellaea rotundifolia*, bracken fern, *Rubus cissoides*, *Acaena anserinifolia* and *Ranunculus reflexus*.

Type 7: Exotic forest, treeland, scrub and shrubland

Crack willow (*Salix fragilis*), pussy willow (*S. xreichardtii*), silver poplar (*Populus alba*), lombardy poplar (*Populus nigra*), hawthorn (*Crataegus monogyna*), European broom, gorse (*Ulex europaeus*), *Buddleja davidii* are common in wetland areas, particularly braided river systems.

European broom and gorse are scattered throughout the district on hill country. European broom poses the largest weed threat and has infested parts of south-east portion of the district. A newer arrival to the district, Spanish heath (*Erica lusitanica*) and radiata pine (*Pinus radiata*) are also taking hold in places.

Type 8: Mixed scrub, shrubland and grassland

Type 8a. Mixed scrub and shrubland

Montane mixed scrub and shrublands growing primarily on greywacke and limestone colluvial and talus slopes above 600m elevation are characterised by mountain beech, Hall's totara and *Olearia paniculata* associations either forming a loose canopy or emergent over a shrub canopy. Common shrub tier species are kanuka, mountain beech, manuka, Hall's totara, broadleaf, wharariki, *Olearia paniculata*, *Coprosma propinqua* ssp. *propinqua* and matagouri (*Discaria toumatou*). The ground tier cover is typically sparse. Other species occurring infrequently include *Cyathodes juniperina*, *Coprosma rigida*, *Aristotelia fruticosa*, *Corokia cotoneaster*, tauhinu, *Coriaria plumosa*, *Olearia cymbifolia*, *Gaultheria depressa* var. *novaezelandiae*, *Brachyglottis monroi*, *Hebe traversii*, *H. venustula*, *Muehlenbeckia complexa*, *Aciphylla glaucescens*, *A. aurea*, *Blechnum montanum*, *Polystichum vestitum*, bracken fern, fescue tussock, silver tussock, *Deyeuxia avenoides*, browntop and catsear.

Mixed shrubland at lower altitudes contains a higher proportion of shrub species to those found in either broadleaved scrub (Type 5), shrub-grassland (Type 8c), or shrub-rockland (Type 9).

Type 8b. Saltmarsh ribbonwood shrubland

Saltmarsh ribbonwood (*Plagianthus divaricatus*) forms a regionally rare coastal marine wetland community occurring on the lagoon margin at the Conway River mouth. Common associated species are *Juncus kraussii* var. *australiensis*, *Schoenoplectus pungens*, *Carex littorosa*, *Isolepis nodosa*, glaucous goosefoot (*Chenopodium glaucum* ssp. *ambiguum*), *Cotula coronopifolia* and *Sellieria radicans* plus a host of exotic grasses and herbs.

Type 8c. Shrub-grassland and grassland

These communities exist mostly on Mesozoic greywacke, on a variety of aspects and slopes. Broadleaf (at higher altitudes on talus), matagouri, *Coprosma propinqua* ssp. *propinqua* and scrambling *Muehlenbeckia australis* are the most common shrub and climber species. An often open canopy below this is composed of varying amounts of bracken fern, silver tussock, fescue tussock, browntop, Yorkshire fog, sweet vernal and white clover. Infrequent associates include mountain ribbonwood, tree fuchsia, kanuka, *Coprosma rhamnoides*, *C. aff. parviflora*, *Brachyglottis monroi*, Marlborough rock daisy (*Pachystegia* sp. 'A'), wharariki, *Rubus australis*, *R. cissoides*, *Polystichum vestitum*, *Hypolepis millefolium*, *Bulbinella angustifolia*, *Rytidosperma gracile*, *Elymus solandri*, *Deyeuxia avenoides*, *Acaena anserinifolia*, *Raoulia subsericea*, cocksfoot, catsear, and sheeps sorrel (*Rumex acetosella*).

Montane areas, most notably around the highest peaks in the district, contain the most intact induced short tussock grasslands and shrub-grasslands, although they still tend to have a high proportion of introduced species. Fescue tussock and silver

tussock in variable proportions form a relatively open canopy in places, with few shrubs. The intertussock species are primarily the same as in the shrub-grassland above.

Type 8d. Mixed pasture grassland

The vast majority of grassland in the ecological district, particularly in coastal, semi-coastal and lowland zones, is dominated by pasture grasses.

Type 9: Mixed shrub-rockland and rockland

Marlborough rock daisy (*Pachystegia insignis* and *P. sp. 'A'*) and a wide variety of shrub, fern, herb, and grass species form a scattered cover on bluffs and rock outcrops from near sea level to the tops of some of the highest peaks in the district.

Coastal bluffs lying in the splash zone near sea level contain scattered shrubland, shrub rockland and rockland communities providing habitat for a variety of species such as *Griselinia lucida*, tree tutu, fivefinger, red mapou, akeake, ngaio, *Hebe stricta*, *Coprosma repens*, *C. robusta*, karaka, harakeke, *Einadia triandra*, *Pachystegia sp. 'A'*, Marlborough lilac (*Heliohebe hulkeana* ssp. *hulkeana*), *Collospermum hastatum*, *Arthropodium cirratum*, *Asplenium terrestre* var. *maritimum*, *Muehlenbeckia complexa*, *Pyrrosia eleagnifolia*, hound's tongue fern, *Asplenium richardii*, *A. oblongifolium*, silver tussock, New Zealand ice plant (*Disphyma australe*), *Dichondra repens*, *Apium prostratum*, *Linum monogynum*, *Senecio lautus*, *Luzula banksiana* and a host of exotic grasses and herbs, the most common being Yorkshire fog, cocksfoot, *Festuca arundinacea*, *Bromus catharticus*, *Plantago lanceolatum*, ragwort, *Chrysanthemoides monilifera*, catsear, white clover, yarrow (*Achillea millefolium*) and fennel (*Foeniculum vulgare*). Many of these species and the communities they exist in are now uncommon in the district and/or the region.

At higher altitudes (up to 500m) on east-facing semi-coastal greywacke bluffs, occurring up to the ridgeline of coastal hills, the more prominent species are fivefinger, broadleaf, manuka, *Coprosma propinqua* ssp. *propinqua*, *C. crassifolia*, *Melicytus alpinus*, *Helichrysum lanceolatum*, European broom, Marlborough lilac, Marlborough rock daisy (*Pachystegia insignis* ss. or *P. sp. 'A'*), *Sophora prostrata*, *Celmisia monroi*, wharariki, hound's tongue fern, *Blechnum procerum*, *Pyrrosia eleagnifolia*, bracken fern, fescue tussock, silver tussock, *Rytidosperma unarede*, *Elymus rectisetus*, *Linum monogynum*, *Ranunculus reflexus*, *Wahlenbergia albomarginata*, *Brachyglottis lagopus*, *Hydrocotyle moschata*, *Festuca rubra*, cocksfoot and sweet vernal.

Inland lowland to montane bluff vegetation on greywacke typically contains a mix of matagouri, manuka, kanuka, broadleaf, *Coprosma robusta*, kohuhu, *Helichrysum lanceolatum*, *Coprosma propinqua* ssp. *propinqua*, *Corokia cotoneaster*, Marlborough rock daisy (either *Pachystegia sp. 'A'* or *P. insignis* ss.), *Brachyglottis monroi*, Marlborough lilac, *Olearia paniculata*, European broom, *Muehlenbeckia complexa*, *Clematis afoliata*, *Carmichealia australis*, *Pellaea rotundifolia*, *Polystichum richardii*, silver tussock, *Deyeuxia avenoides* and a multitude of introduced grasses and herbs such as sweet vernal, Yorkshire fog, cocksfoot, browntop, sheeps sorrel, *Hieracium pilosella*, *Cerastium fontanum*, white clover and Californian thistle. As altitudes reach 800m species such as *Hebe venustula* may become apparent. Species found more often on limestone outcrops and fissures include *Cystopteris tasmanica*, *Asplenium lyallii* and *Asplenium* aff. *trichomanes*.

Type 10: Fernland

Type 10a. Bracken fernland and fern-grassland

Bracken fern often is often dominant or co-dominant over a grassland typically consisting of such species as silver tussock, fescue tussock, browntop, Yorkshire fog, sweet vernal and white clover. Associated minor species include *Bulbinella angustifolia*, *Rytidosperma gracile*, *Elymus solandri*, *Deyeuxia avenoides*, *Acaena anserinifolia*, *Raoulia subsericea* and introduced cocksfoot, catsear, and sheeps sorrel.

Type 10b. Wheki scrub

Oaro Private Protected Land (PNA12) was the only locality in the district where a dense stand of wheki was encountered. It contains a few scattered silver fern in the canopy (6-8m tall) and epiphytic *Rumohra adiantiformis* and *Tmesipteris elongata*. A dense cover of leaf litter excludes the growth of ground tier species.

Type 11: Carex sedgeland

Carex sedgelands are a community type confined to flush areas, hollows, streamsides and lake margins. As a component of freshwater wetlands, they were much more widespread before human arrival, and most of those remaining are now highly modified.

Carex secta is the common canopy species and may reach 2m or more where disturbance is limited, occasionally forming a dense canopy, but more often a shorter open canopy. Where the canopy is relatively closed it commonly occurs with *Cordyline australis*, harakeke, *Juncus sarophorus*, *Galium trilobum*, plus exotics such as *Agrostis stolonifera*, Yorkshire fog, and beggars tick (*Bidens frondosa*). An open canopy often means a drier area with a significant degree of grazing pressure, and associated grass and turf species are typically exotic. Natives include manuka, *Cordyline australis*, *Coprosma propinqua* ssp. *propinqua*, *C. aff. parviflora*, *Juncus gregiflorus*, *J. articularis*, *Carex geminata*, *C. virgata*, *Acaena anserinifolia*, *Hydrocotyle novae-zelandiae*, and *Blechnum penna-marina*. Common exotics are blackberry, sweet vernal, cocksfoot, sheeps sorrel, white clover, scotch thistle, and *Ranunculus repens*. This community often merges with *Juncus* rushland, raupo reedland and harakeke flaxland.

Type 12: Raupo reedland

Raupo (*Typha orientalis*) reedland occurs on the fertile fringes of lakes, the lagoon margin at the Conway River mouth, and in areas where free-standing water is common (swamps, seepages and ponds). It may be a much-reduced vestige of a once larger wetland, or it may be induced in areas through damming and drainage alteration. It has few native associates where water is free-standing and relatively deep, tending to merge on its periphery with stands of *Carex secta*, harakeke, crack willow or pussy willow.

Type 13: Flaxland

Montane fire-induced wharariki flaxland occurs in areas towards the summits of Mt. Stewart and Peaked Hill. Common associates are fescue tussock, *Aciphylla glaucescens*, *A. aurea*, *Gaultheria depressa* var. *novaezelandiae*, matagouri and *Gingidia montana*.

Coastal and lowland harakeke (and less frequently wharariki) flaxland is present on cliffs, scarps, lake margins, seepages and the lagoon perimeter at the Conway River mouth. Common associates on the margins of lakes are manuka, crack willow, pussy willow, European broom, gorse, *Carex virgata*, *C. secta*, raupo, and *Gonocarpus aggregatus*, yarrow, cocksfoot and Yorkshire fog.

The intertidal lagoon at the Conway River mouth has a small area of modified harakeke flaxland with the most prevalent species being saltmarsh ribbonwood, *Muehlenbeckia complexa*, gorse, *Isolepis nodosa*, *Juncus kraussii* var. *australiensis*, raupo, *Cotula coronopifolia*, and a suite of exotic herbs and grasses.

Type 14: *Juncus* rushland

This vegetation type is commonly modified, occurring in a mosaic with communities of harakeke flaxland, *Carex* sedgeland, raupo reedland and willow forest and treeland. The canopy is usually open and tends toward a reed-pasture grassland association in many places. Where partially closed the canopy consists primarily of *Juncus gregiflorus*, with minor *J. pallidus*, *J. australis*, *Carex secta*, *C. geminata* and *C. virgata*. *Senecio minimus* and *Hypolepis ambigua* are notable natives among a mostly exotic understorey of *Stellaria graminea*, *Ranunculus repens*, cocksfoot, white clover and Yorkshire fog.

Type 15: River Gravelfield

The collection of plant communities present on floodplains and islands of braided rivers is generally dominated by introduced species. A description is included here as these areas often have significant habitat value for birdlife.

Crack willow, pussy willow, silver poplar, lombardy poplar, hawthorn, European broom, gorse, woolly mullein (*Verbascum thapsus*), Californian thistle, *Hieracium pilosella*, white clover, suckling clover (*Trifolium dubium*), hare's-foot trefoil (*T. arvense*), catsear, common storksbill (*Erodium cicutarium*), borage (*Borago officinalis*), sheeps sorrel, ragwort, smooth hawksbeard (*Crepis capillaris*), perennial ryegrass (*Lolium perenne*), browntop and Yorkshire fog are present in varying densities on islands and floodplains along the Conway River. A few native species are present - *Raoulia tenuicaulis*, *Epilobium melanocaulon*, *Muehlenbeckia axillaris* and young manuka.

Close to the river mouth the floodplain and island vegetation is also of highly modified and of variable density with silver wattle (*Acacia dealbata*), crack willow, pussy willow, European broom, tree lupin (*Lupinus arboreus*), gorse, *Buddleja davidii*, Californian thistle, scotch thistle, common sow thistle (*Sonchus oleraceus*), viper's bugloss, sweet clover (*Melilotus albus*), slender birdsfoot trefoil (*Lotus angustissimus*), woolly mullein, catsear, common groundsel (*Senecio vulgaris*), allseed (*Polycarpon tetraphyllum*), monkey musk (*Mimulus moschatus*), spreading pearlwort (*Sagina procumbens*), sea primrose (*Samolus repens*), sheep's sorrel, common storksbill, stonecrop (*Sedum acre*), Yorkshire fog, browntop, and cocksfoot. Native species include ngaio, *Hebe salicifolia*, *Pseudognaphalium luteoalbum* agg., *Senecio lautus*, *Epilobium microphyllum*, and *Hierochloa redolens*.

Type 16: Sandfield/gravelfield on beaches

A semi-native association exists beyond the high tide mark on some sandy beaches. *Carex pumila* and *Calystegia soldanella* may occur separately or together with a host of exotic species, most commonly marram grass (*Ammophila arenaria*), cocksfoot, *Festuca arundinacea*, and American sea rocket (*Cakile edentula*).

A very sparse collection of plants inhabit the shoreline gravelfields beyond the high tide mark and the sandspit at the Conway River mouth. Native species include *Isolepis nodosa*, shore bindweed, and glaucous goosefoot. Gorse, scotch thistle and scarlet pimpernel (*Anagallis arvensis*) are commonly present.

Type 17: New Zealand iceplant rockland

An unusual rockland community occurs in patches towards the tops of the Haumuri Bluffs. The dominant species is New Zealand iceplant (*Disphyma australe*) with other native associates, *Sonchus kirkii*, *Spergularia media*, silver tussock, *Linum monogynum*, *Senecio lautus*, and New Zealand climbing spinach (*Tetragonia trigyna*). Introduced *Lepidium pseudotasmanicum* is also present.

Type 18: Aquatic herbfield

Deeper parts of pond and lake margins which are permanently immersed may contain stands of common water milfoil (*Myriophyllum propinquum*) and introduced willow weed (*Polygonum persicaria*). Both Pacific azolla (*Azolla filiculoides*) and common duckweed (*Lemna minor*) occur free-floating on lake surfaces. The Conway River mouth lagoon contains considerable beds of *Gracilaria* sp. (Davidson, Paton and Cash, 1993)

3.7 THREATENED AND NOTABLE PLANT SPECIES

3.7.1 Threatened Plants

(Ref. Allan, 1961; Moore and Edgar, 1970; Healy and Edgar, 1980; Webb, Sykes and Garnock-Jones, 1988; Brownsey and Smith-Dodsworth, 1989; Wilson and Galloway, 1993; St. George, Irwin and Hatch, 1996.)

Categories given in the 'Status' column refer to threatened species priorities as determined by Molloy and Davis (1994) where Category A is the highest priority, Category B is the second priority and Category C the third. The seventeen criteria used to determine threatened species priorities assess five different factors: taxonomic distinctiveness, status of the species, threats facing the species, vulnerability of the species, and human values. Category I refers to species about which little information exists, but based upon existing evidence, are considered to be threatened. Terms used in the 'Status' column in Table 2 are those used by Cameron et al (1995) (see Appendix III for definitions).

TABLE 2: THREATENED PLANT SPECIES

SPECIES	COMMON NAME	STATUS	HABITAT	THREATS/COMMENTS
<i>Alepis flavida</i>	yellow mistletoe	Category B vulnerable	Usually hosted by black or mountain beech.	Possum palatability makes it susceptible to browsing.
<i>Urtica linariifolia</i>	swamp nettle	Category B vulnerable	Lowland swamps, especially amongst flax, raupo and willow.	Decline in habitat has contributed to rarity.
<i>Coprosma wallii</i> + (Jane, 1987)		Category B vulnerable	Lowland and montane shrubland, scrub and open forest.	
<i>Tupeia antarctica</i>	white mistletoe	Category B rare	Hosted by a wide variety of species, both native and introduced.	Browsing, especially by possums, but also goats and stock.
<i>Teucrium parvifolium</i> + (Lincoln Herbarium collection from 1963)		Category C vulnerable	Coastal to lowland forests and shrublands, especially marginal terraces, hillsides and dry creek beds.	Threats are land development, browsing, especially by goats and an introduced boring beetle.
<i>Senecio dunedinensis</i>	fireweed	Category I rare	Shrubland, grassland and rocky places.	

+ denotes not seen during the survey, but recorded from the district.

3.7.2 Rare and Notable Species

TABLE 3: NATIONALLY RARE AND LOCAL PLANT SPECIES, SPECIES AT THE EDGE OF THEIR RANGE AND REGIONALLY ENDEMIC SPECIES

SPECIES	COMMON NAME	STATUS	HABITAT	THREATS/COMMENTS
<i>Austrofestuca littoralis</i> + (Davidson et al, 1993)	sand tussock	rare	Coastal rocky and sandy places.	Browsing by stock, goats, hares and rabbits; lupin and marram grass invasion.
<i>Coprosma obconica</i> ssp. <i>obconica</i>		rare	Forest, scrub and shrubland on poorly drained and sharply drained sites.	
<i>Notospartium torulosum</i>	Canterbury pink broom	rare	Lowland to montane streamsides and scrub.	Susceptible to grazing and fire.
<i>Anamanthele lessoniana</i> + (Stevens, 1996)	a bamboo grass	local	Podocarp and Broadleaved forest.	
<i>Illeostyus micranthus</i>	small-leaved mistletoe	local	Hosted by a wide variety of species, both native and introduced in forest, treeland and shrubland.	Susceptible to fire and browsing by possums, goats and stock.

SPECIES	COMMON NAME	STATUS	HABITAT	THREATS/COMMENTS
<i>Pseudopanax ferox</i>	fierce lancewood	local	Lowland forest and scrub.	Prone to grazing from rabbits and goats.
<i>Arthropodium cirratum</i>	rengarenga or rock lily	at its southern limit	Usually coastal cliffs and rockland.	Often grows in colonies.
<i>Collospermum hastatum</i>	kahakaha or perching lily	at its southern limit	Epiphytic, rupestral and terrestrial in coastal and lowland forest.	
<i>Coprosma grandifolia</i>	raurekau	at its southern limit	Lowland to lower montane forest.	
<i>Gentiana astonii</i>	a gentian	at its southern limit, regionally rare	Usually a calcicole, often on talus or colluvium.	Formerly known only from Ure River, Benmore and the Chalk Range.
<i>Hebe stricta</i>	koromiko	at its southern limit	Coastal, lowland and montane usually on banks.	
<i>Melicope ternata</i>	wharangi	at its southern limit.	Coastal forest.	
<i>Olearia bullata</i>		probably at its northern limit	Montane shrubland and scrub.	Dubious record from near Havelock (K. Ford, pers. comm.).
<i>Freycinetia baueriana</i> ssp. <i>banksii</i>	kiekie	southern limit on east coast of South Island. Uncommon within the ecological district.	Coastal to montane forest.	
<i>Brachyglottis monroi</i>		South Marlborough regional endemic	Coastal to montane rocky bluffs.	
<i>Epilobium brevipes</i>		South Marlborough/Canterbury endemic	Shady rock bluffs and outcrops 300-1200m asl.	
<i>Heliohebe hulkeana</i> ssp. <i>hulkeana</i>	Marlborough lilac	South Marlborough regional endemic	Coastal to montane steep rockland and bluffs.	
<i>Heliohebe raoulia</i> ssp. <i>raoulia</i> + (Brian Molloy, pers. comm.)		Marlborough/Canterbury endemic, uncommon within the ecological district	Dry mountains and hill.	

SPECIES	COMMON NAME	STATUS	HABITAT	THREATS/COMMENTS
<i>Pachystegia insignis</i> ssp.	Marlborough rock daisy	South Marlborough regional endemic	Coastal to montane steep rockland and bluffs.	Mainly between the Wairau and Clarence Rivers but disjunct populations south to Waiau River, Taxonomy under review.
<i>Pachystegia</i> sp. 'A'	Marlborough rock daisy	South Marlborough regional endemic	Coastal to montane steep rockland and bluffs.	Irongate Stream to South of Conway River. Taxonomy under review.

3.7.3 Uncommon Species

The following species comprise indigenous vascular plant species which are uncommon within the ecological district. They were found in no more than two locations during the course of the survey:

Aciphylla aura, *A. glaucescens*, *Apium prostratum*, *Asplenium* aff. *trichomanes*, *A. lyallii*, *A. terrestre* ssp. *maritimum*, *Australina pusilla*, *Blechnum triangularifolium*, *Callitriche petrei*, *Calystegia sepium*, *Carex litorosa*, *C. moarica*, *C. pumila*, glaucous goosefoot, *Chiloglottis cornuta*, broadleaved snow tussock (*Chionochloa flavescens* agg.), mid-ribbed snow tussock (*C. pallens* var.), *Clematis marata*, *Coprosma acerosa*, *C. cheesmanii*, *C. ciliata*, *C. repens*, *Coriaria kingiana*, *Crassula moschata*, *Cyperus ustulatus*, *Cystopteris tasmanica*, *Deyeuxia aucklandica*, *Dracophyllum uniflorum*, *Earina autumnalis*, *Einadia allanii*, *E. triandra*, *Epilobium glabellum*, *E. nerterioides*, *E. pallidiflorum*, *Gahnia pauciflora*, *Gahnia procerum*, *Gentiana tenuifolia*, *Geum leiospermum*, *Grammitis ciliata*, *G. magellanica* ssp. *nothofagei*, *G. poeppigiana*, *Hebe venustula*, *Helichrysum intermedium*, *H. parvifolium*, mountain ribbonwood, *Hydrocotyle pterocarpa*, *Hymenophyllum demissum*, *H. villosum*, *Isolepis reticularis*, *Leptinella dioica*, *Lycopodium scariosum*, *Melicytus* 'brockiei', *M. crassifolius* var. 'inland erect', *M. micranthus* (and *M. micranthus* x *M. ramiflorus*), *Muehlenbeckia axillaris*, *Myosotis* 'australis white', *Olearia avicenniifolia*, *O. nummularifolia*, *Passiflora tetrandra*, *Pimelia traversii*, saltmarsh ribbonwood, lowland ribbonwood (*Plagianthus regius*), *Poa anceps*, *Pterostylis alobula*, *P. areolata*, *Rumohra adiantiformis*, *Rytidosperma nigricans*, *R. pumilum*, *Samolus littoralis*, *Schoenoplectus pungens*, *Scleranthus biflorus*, *Selliera radicans*, *Sonchus kirkii*, *Spergularia media*, *Thelymitra hatchii*, *Tmesipteris elongata*, *Uncinia angustifolia*.

3.8 FAUNA

A fauna species list is given in Appendix II.

3.8.1 Marine Mammals

Offshore waters of the Kaikoura Canyon are of international significance (Davidson and Paton, 1993) as habitat for marine mammals such as sperm whale (*Physeter macrocephalus*), humpback whale (*Megaptera novaeangliae*), minke whale (*Balaenoptera acutorostrata*), orca (*Orcinus orca*), pilot whale (*Globicephala melaena*), southern right whale dolphin (*Lissodelphis peronii*), dusky dolphin (*Lagenorhynchus obscurus*) and Hector's dolphin (*Cephalorhynchus hectori*) (Category B). Elephant

seal (*Mirounga leonina*) (Category O), leopard seal (*Hydrurga leptonyx*) and most commonly, New Zealand fur seal (*Arctocephalus forsteri*) come ashore and may be seen basking on coastal rocks and beaches.

3.8.2 Introduced Mammals

The ship rat (*Rattus rattus*), Norway rat (*Rattus norvegicus*) and house mouse (*Mus musculus*) are all present within the district. Both rat species pose a threat as predators of native wildlife and have been linked with the decline and in some cases extinction, of bird, insect and bat species (Innes, 1990; Moors, 1990). A lack of information exists on the impact of mice on local flora and fauna (Murphy and Pickard, 1990). The numbers and distribution of these rodents is unknown within the district.

Hedgehogs (*Erinaceus europaeus*) are abundant in coastal and lowland farmland where frosts are few and mild. They are nocturnal insectivores with limited range. Their main significance to the environment is their capacity for carrying and spreading human and stock infections (Brockie, 1990).

Rabbits (*Oryctolagus cuniculus cuniculus*) are evident in relatively low densities in the district (pers. obs.; Gibb and Williams, 1990) and appear to be most numerous along developed valley floors. Hares are generally seen at higher altitude grassland, also in comparatively small numbers.

Coastal broadleaved forest along the Kaikoura Coast has been recognised as being highly susceptible to possum (*Trichosurus vulpecula*) browsing (Rose, 1994). However recent survey evidence (Napp, 1995) suggests that dieback in mahoe, the most common canopy species, is a result of environmental effects such as salt and wind as little sign of possum browse could be found. Dieback in a more prone species, titoki, was also attributed to environmental factors as similar dieback was seen with or without possum browse and, like mahoe, the worst affected areas were those in exposed localities. This suggests that possum numbers were not high at the time of the survey. Poisoning programmes are carried out by the Canterbury Regional Council to ensure possum populations are kept in check. However another adverse effect of possums within the district has been as a reservoir for bovine tuberculosis, and even low numbers may pose a threat to cattle.

Feral cats (*Felis catus*) were seen on two occasions although their numbers and impact on local bird populations remain unknown.

The three mustelids, stoats (*Mustela ermina*), ferrets (*Mustela furo*) and weasels (*Mustela nivalis vulgaris*) are present within the district (King, 1990(a); King 1990(b); Lavers and Clapperton, 1990). Mustelids will prey on bird fauna although again, the extent of predation within the district remains unknown.

Pigs (*Sus scrofa*) were seen in the Open Creek catchment where European broom infestation has made the forest in the valley difficult to access for hunters. In forest elsewhere, rooting was evident in many locations, although most was old. Localised damage to the understorey was significant in places, although the lack of consistent sightings of fresh sign indicated that numbers were not high within the district.

Goat (*Capra hircus*) farming, concentrated in the northeastern part of the district, has invariably led to escapes and damage to forest and wetland vegetation nearby. Small populations have become feral and infiltrated coastal reserves further south causing significant damage and, in isolated instances, danger to the public by grazing

close to cliff edges and knocking rocks down onto Highway 1. Feral goats exist in small numbers elsewhere in the district in forest and scrub remnants causing localised damage to the vegetation.

Sheep (*Ovis aries*) and, more significantly, cattle (*Bos taurus*) have impacted through browsing and trampling on unfenced forested areas and protected areas where fencing has lapsed. Cattle lay bare the forest floor and eliminate nearly all young trees, shrubs and ferns while trampling is most damaging in localities where drainage is poor.

According to local landowners red deer (*Cervus elephus scoticus*) still remain in well forested catchments but none were seen during the survey.

3.8.3 Birds

(Ref. Kelly, 1972; Jowett, 1979; O'Donnell and Moore, 1983; New Zealand Wildlife Service, 1983; Ellis, 1987; Kinsky and Robertson, 1987; Marchant and Higgins, 1990 and 1993; Higgins and Davies, 1996.)

Sixty-four bird species have been recorded from the district since the 1970's, 16 of which are introduced. Eleven of the native species are listed as being threatened (Molloy and Davis, 1994). Categories given in the 'Status' column of Table 4 refer to threatened species priorities as determined by Molloy and Davis (1994) where Category A is the highest priority, Category B is the second priority and Category C the third. The seventeen criteria used to determine threatened species priorities assess five different factors: taxonomic distinctiveness, status of the species, threats facing the species, vulnerability of the species, and human values. Category I refers to species about which little information exists, but based upon existing evidence, are considered to be threatened. Category O describes species which are threatened in New Zealand but which are known to be secure in other parts of their range outside of New Zealand.

TABLE 4: THREATENED BIRD SPECIES

SPECIES	COMMON NAME	STATUS	HABITAT	THREATS/COMMENTS
<i>Eudyptula minor albosignata</i>	white-flippered penguin	Category B	Banks Peninsula and Canterbury coast.	Habitat alteration by human settlement, grazing, trampling, invasion of weeds, increased erosion and water run-off.
<i>Falco novaeseelandiae</i>	New Zealand falcon	Category B	Native bush and isolated high high back-country valleys.	Range more limited - avoids cultivated and settled areas. Selective logging of mature podocarp and tawa may have reduced potential nesting sites. Intense pastoral land use may affect breeding habitat.
<i>Hemiphaga novaeseelandiae</i>	New Zealand pigeon	Category B	Mainly restricted to native bush, although can occur in towns.	Formerly hunted; clearance and modification of habitat.
<i>Sterna albobriata</i>	black-fronted tern	Category B	Inland on shingle riverbeds, moving to the coast in winter.	Subject to human disturbance at coastal sites. Activities of shingle-plant operations may disturb breeding colonies.

SPECIES	COMMON NAME	STATUS	HABITAT	THREATS/COMMENTS
<i>Charadrius bicinctus bicinctus</i>	banded dotterel	Category C	Coast, riverbeds and lake shores.	Flood mitigation and planting of willows and other trees have decreased the amount of available nesting habitat.
<i>Egretta sacra sacra</i>	reef heron	Category C	Sheltered rocky coastline.	Dismantling of wooden wharves used for roosting and nesting, reclamation of tidal land, deepening of channels and disturbance by power-boats.
<i>Haematopus unicolor</i>	variable oystercatcher	Category C	Beaches and coast, particularly where sandy.	Large parts of favoured habitat, especially near small estuaries, lost because beaches developed for housing.
<i>Sterna striata</i>	white-fronted tern	Category C	Coastal areas.	Human disturbance and predation by cats, dogs, stoats, rats and mustelids.
<i>Botaurus stellaris poiciloptilus</i>	Australasian bittern	Category O	Swamps, lakes, salt marshes and boggy areas with cover.	Habitat destruction of dense wetland vegetation.
<i>Hydroprogne caspia</i>	Caspian tern	Category O	Coastal estuaries and inland along rivers to major lakes.	Human disturbance and habitat destruction and modification.
<i>Podiceps cristatus australis</i>	Southern crested grebe	Category O	Lakes in the foothills of the main mountain chain of the South Island.	Disturbance of nesting birds by campers, anglers etc., eutrophication of lakes; removal of shoreline vegetation; lake level fluctuation by hydro-manipulation.

Other species not included in the threatened list have been noted as occurring in the district since the 1970's but were seen rarely or not at all during the survey. Included in this group are the tui (*Prosthemadera novaeseelandiae*), long-tailed cuckoo (*Eudynamis taitensis*), South Island robin (*Petroica australis australis*), marsh crake (*Porzana pusilla affinis*) and spotless crake (*Porzana tabuensis plumbea*). The nocturnal habits of others such as the morepork (*Ninox novaeseelandiae*) and the Southern blue penguin (*Eudyptula minor minor*) may have precluded observation.

The Kaikoura coastline between Kahutara River mouth and Haumuri Bluffs, including offshore rocks, provides habitat and breeding areas for a variety of coastal bird species, reflected in the two nature reserves at Pinnacle Rock and Rileys Lookout and the wildlife reserve at Otumatau Rock.

Many freshwater wetland bird species are found in Lake Rotorua Wildlife Management Reserve. Braided river systems and coastal river mouths, in particular the Conway River, are other important habitats. A pair of blue ducks (*Hymenolaimus malacorhynchos*) had been observed from the Stag and Spey Stream near Birthday Creek in 1992 although there have been no reports since (Paton, 1994).

The removal of forest and modification and predation resulting from the introduction of wild animals has had a profound effect on the numbers and composition of native bush species. Kaka (*Nestor meridionalis*) were quite common thirty years ago while the laughing owl (*Sceloglaux albifacies*) was thought to be plentiful along the coast at the turn of the century (Jowett, 1979).

3.8.4 Reptiles and Frogs

The common gecko (*Hoplodactylus maculatus*), green gecko (*Naultinus rudis*) and common skink (*Oligosoma nigriplantare*) were all seen in scattered localities during the survey. The green-spotted skink (*Oligosoma lineoocellatum*) may also occur as its distribution includes much of the eastern South Island (Gill, 1986), but none were sighted.

Frogs were heard in wetland areas and around stock ponds, although none was identified. It is likely, however, that two introduced species, the golden bell frog (*Litoria raniformis*) and whistling frog (*L. ewingii*) are present as the range of both includes the Hundalee Ecological District (Gill, 1986).

3.8.5 Fish

Koaro (*Galaxias brevipinnis*), a Category C threatened species, has been found in both Ote Makura Stream and Omihi Stream (Allibone, 1995). Its preferred habitat is rapidly-flowing, tumbling bouldery streams, most often those flowing through forests.

3.8.6 Snails

Shells of the carnivorous snail *Wainuia edwardii* were found in a few scattered forest localities. Other sightings of the species have been made within the district (K. Walker, pers. comm.). Recent research has indicated that this species should be treated as a threatened Category C species (Efford, 1997).

3.8.7 Insects

A list of common insects found in various habitats around the Oaro area (Jowett, 1979) is given in Appendix III and includes the insects most often encountered during the survey, although it is by no means comprehensive.

Of concern is the presence of the introduced German wasp (*Vespula germanica*) in nearly all stands of black and mountain beech forest visited.

3.9 CULTURAL INFLUENCES

(Ref. Elvy, 1949; Sherrard, 1966)

Maori valued the Kaikoura coastline above any other district in the South Island. As a result there was always a large Maori population in residence, and many bloody battles over territory. The district was prized so highly because it fulfilled all of their needs. The coastline supplied plenty of seafood in the form of paua (*Haliotis* spp.), pipi (*Phaphies australis*), various genera of cockles, whelks and mussels, crayfish (*Jasus* spp.), kahawai (*Arripis trutta*), butterfish (*Odax* spp.), rock cod (*Lotella rhacinus*), conger eel (*Conger vereauxi*), and hapuku (*Polyprion*

oxygeneios). There was abundant birdlife; New Zealand pigeon, kaka, blue ducks, and gulls, and there was timber for building villages, fortifications, and for making canoes. There was flax (*harakeke* and *wharariki*) for weaving and the mild climate suited the cultivation of kumara (*Ipomoea batatas*). In addition to this there were plenty of good defensive positions on bluffs and headlands for building pas. No tribe ever lived peacefully here for very long since there was always another tribe that coveted the territory.

The first inhabitants are thought to have been pit-dwelling Moa Hunters, who probably lived about a thousand years ago. They may have existed as late as the 15th century, when they were defeated by the Waitaha. Ngati Mamoe, from the east coast of the North Island, invaded and conquered Waitaha during the 16th century and went on to live in relative peace for the next 100 years. The Ngai Tahu, also from the North Island, were the next to conquer the territory in the middle of the 17th century, and they reigned until the raids of Te Rauparaha in the late 1820s. In 1827, the Maori population on the Kaikoura coast was estimated at 3000-4000. Te Rauparaha's raids resulted in the deaths of at least 1400, while many more were taken as wives or slaves back to his stronghold on Kapiti Island. European diseases also took their toll and by 1857 there were only 78 Maori (Ngai Tahu) left in the area from the Clarence to the Conway Rivers.

Whaling began in the area as early as the 1830's, with ships anchoring off the coast while they processed their catches. A whaling station was established on shore at Cloudy Bay to the north of the district by 1842, and several more sprang up along the coast soon after.

Farming was the next, and is still, the major land use in the Kaikoura area. To begin with, the land was farmed by squatters until the land ownership and sales had been concluded. This was no easy matter, since both Ngati Toa, by virtue of Te Rauparaha's conquest and Ngai Tahu, by virtue of their continued residence, felt that they had the right of sale over the same territories. Eventually this was resolved and much of the district has been farmed ever since.

4. Existing Protected Areas

4.1 INTRODUCTION

Existing scenic reserves, nature reserves, wildlife management reserves, scientific reserves and Crown-owned biologically important areas currently leased to Transrail, coupled with protected private land and QEII covenants total approximately 2400ha or 2.7% of the total land area of the Hundalee Ecological District. These are individually detailed below and shown on Map 4).

Several reserves formerly administered by the Department of Conservation are now to be managed by Te Runanga o Ngāi Tahu under the Reserves Act, 1977, as a result of the Treaty of Waitangi settlement in 1998.

The vegetation types are classified according to Ch 3.5.2. Principal species which typify a vegetation type are described (where possible) within broad tiers to give an indication of the characteristic structure. The ground tier is comprised of species occurring below 30cm while the shrub tier lies between 30cm and 2m. The understorey may be of variable height between the canopy and shrub tier. Minor species are those with a mean cover of 1-5% within a given tier. Species with cover of less than 1% are excluded from the descriptions unless notable.

Categories of threatened species are described in Chapter 3.7.1.

Ecological units highlighted in bold font indicate the principal vegetation type(s) within the area.

4.2 PROTECTED NATURAL AREAS

PNA 1 - Clarence Reserve

Grid Reference Centre:	NZMS 260 O31 448690; O31 464691
Area:	60 ha
Altitudinal Range:	200-340 m
Tenure:	Crown land administered by DOC
Vegetation Types:	4a, 6c, 9, 15
Study Area Number:	See K11 and K12

Land System(s)

Northwest outwash deposits and local alluvium.

Bioclimatic Zone(s)

Lowland.

Ecological Units

- Mixed podocarp-broadleaved forest and treeland on terrace riser, alluvial flat and low terrace.

- Matai-mahoe-kanuka forest and treeland on terrace riser.
- Sparsely-vegetated gravelfield and stonefield on floodplain.
- Manuka shrubland on alluvial flat and floodplain.
- Kanuka scrub on alluvial flat and floodplain.
- Mixed shrub-grassland on terrace riser.

Landforms

Two small sections of Clarence Reserve extend into the ecological district along Sawyers Creek and Kahutara River. Much of these areas comprise recent floodplain gravels with terraces, flats and terrace risers. A thin layer of loess covers older terraces while younger low terraces are prone to periodic flooding.

Vegetation and Flora

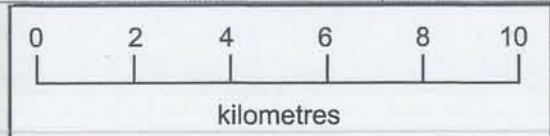
The forest vegetation includes mixed podocarp-broadleaved forest on the terrace risers of Sawyers Creek and mixed shrub-grassland on the terrace risers of Kahutara River. Kanuka and manuka scrub occupies alluvial terraces while unconsolidated river gravelfield dominates the floodplain.

Secondary matai-mahoe-kanuka forest generally inhabits the terrace riser on the true right of Sawyers Creek. The tallest kanuka seen in the ecological district occurs here (up to 15m) forming a canopy with mahoe, matai and minor fivefinger and marbleleaf. The most common subcanopy species is mahoe with minor matai, *Olearia paniculata*, *Cordyline banksii* and fivefinger. *Coprosma rhamnoides* and *Helichrysum lanceolatum* are the most frequent shrub species, with minor mahoe, matai, kaikomako and *Coprosma crassifolia*. The ground tier is typically species-rich, yet relatively sparse, the most common species being seedlings of *Coprosma rhamnoides*, kaikomako, kowhai and mahoe, with *Uncinia uncinata*, *Brachypodium sylvaticum*, *Polystichum richardii*, *Pellaea rotundifolia*, bracken fern and *Asplenium hookerianum*.

The terrace riser on the true left (south-facing) side of Sawyers Creek contains older mixed podocarp-broadleaved forest with emergent matai, miro and to a lesser extent titoki and pokaka. The canopy contains mahoe and titoki with minor matai, miro, and marbleleaf. Matai and mahoe are the predominant understorey species with minor miro, titoki, supplejack and red mapou. The most common species in the shrub tier are matai, miro, mahoe, kaikomako, red mapou and *Coprosma rhamnoides*. Ground tier species include seedlings of mahoe, titoki, kaikomako, supplejack and *Coprosma rhamnoides* with *Microlaena avenacea*, *Asplenium gracillimum*, *A. hookerianum*, *Polystichum richardii*, *Paesia scaberula*, *Leptopteris hymenophylloides* and wall lettuce.

The alluvial kanuka scrub canopy reaches 10m in places and generally contains no other associates. The understorey contains kanuka and manuka, with minor kowhai and European broom. A moderately dense shrub tier contains largely European broom with *Coprosma rhamnoides*, kanuka and minor *Corokia cotoneaster*, *Cyathodes juniperina*, manuka and kowhai. *Brachypodium sylvaticum* dominates a ground tier which is largely comprised of a variety of introduced seedlings, grasses and herbs. The most prominent native species are seedlings of *C. rhamnoides* and kanuka, and *Stellaria decipiens*.

Map 4



Manuka scrub and shrubland is dense and contains minor kanuka while the shrub tier also contains young kanuka and minor tree tutu. Seedlings of these two species are also frequent in the ground tier with minor *Muehlenbeckia complexa*, *Epilobium nummulariifolium*, wall lettuce, catsear, ragwort and *Hieracium pilosella*.

Fauna

Bellbirds (*Anthornis melanura*), New Zealand pigeon (threatened - Category B), South Island robin, South Island fantail (*Rhipidura fuliginosa fuliginosa*), South Island tomtit (*Petroica macrocephala macrocephala*) were observed, as were tree wetas (Family *Stenopelmaticidae*) and cicadas (*Amphisalta* spp.).

Selection Criteria

- Natural riverine processes which characterise these communities such as flooding, silt deposition and active channelisation, are still operating within the area.
- Podocarp forest, particularly on alluvium is regionally rare in both Canterbury and South Marlborough.
- Some of the best stands of mixed podocarp-broadleaved forest and matai-mahoe-kanuka forest in the ecological district occur here.
- Alluvial forest is rare within the Canterbury/South Marlborough region.

PNA 2 - Kahutara Private Protected Land

Grid Reference Centre:	NZMS 260 O31 525680
Area:	7 ha
Altitudinal Range:	90-100 m
Tenure:	Private protected land
Vegetation Types:	6c, 7
Study Area Number:	See notes (N20)

Land System(s)

Northwest outwash deposits and local alluvium.

Bioclimatic Zone(s)

Lowland.

Ecological Units

- Kanuka-manuka low forest and scrub on alluvial floodplain and terrace flat.
- Willow treeland on alluvial floodplain and terrace flat.

Landforms

The PPL is situated at the base of Mt. Furneaux between the junctions of Kahutara River and Bellbird Stream, and Kahutara River and Cribb Creek. Like the Kahutara Scientific Reserve further downstream it is comprised of recent alluvial gravels with a thin covering of loess on a terrace flat and is prone to periodic flooding.

Vegetation and Flora

The vegetation pattern is also similar to that found in the Kahutara Scientific Reserve. Kanuka provides a thick canopy 5-6m tall with scattered manuka (particularly near margins), scrambling *Muehlenbeckia australis* and occasional kowhai. *Coprosma propinqua* ssp. *propinqua*, *C. rhamnoides* and *C. propinqua* ssp. *propinqua* x *C. robusta* are thinly spread in the shrub tier while *Brachypodium sylvaticum* dominates the lower tiers with scattered *Polystichum vestitum*.

Willows dominate the margins, typically with lupin, gorse, tauhinu, manuka and bracken fern over a sward of cocksfoot. Although most common near the margins and open areas, other weedy species are present in the interior including Himalayan honeysuckle (*Leycesteria formosa*), European broom, old man's beard (*Clematis vitalba*) and *Buddleja davidii*. These species pose a threat to the protected land, particularly in light of its small size, periodic flooding disturbances, lack of buffering, and readily available seed source close by.

Fauna

Both New Zealand kingfisher (*Halcyon sancta vagans*) and bellbird were seen during the survey. Cicadas were plentiful.

The area has been fenced since 1984 but is dilapidated in places, and would be difficult to maintain due to periodic flooding. Stock, and sheep in particular, which roam the floodplain therefore have ready access to the area and grazing damage was observed. Rabbits were also seen on the floodplain and presumably browse vegetation within the reserve.

Secondary Criteria

One of the reasons for creating the protected land initially was to provide river protection through the regeneration of the undercanopy (ie. ground, shrub and understorey tiers). This purpose is being served although to a large extent through adventive weeds rather than regenerating native species.

Selection Criteria

- Natural riverine processes which characterise these communities such as flooding, silt deposition and active channelisation, are still operating within the area.
- Alluvial forest and scrub are rare within the Canterbury/South Marlborough region.

PNA 3 - Lake Rotorua Wildlife Management Reserve

Grid Reference Centre:	NZMS 260 O31 579665
Area:	73 ha
Altitudinal Range:	30-110 m
Tenure:	Crown land administered by DOC. Statutory acknowledgement applies to Te Runanga o Ngai Tahu
Vegetation Types:	5a, 5d, 6b, 7, 11, 12, 13, 18
Study Area Number:	K28

Land System(s)

Coastal greywacke hill country; northwest outwash deposits and local alluvium.

Bioclimatic Zone(s)

Semi-coastal.

Ecological Units

- Crack willow forest on lake margin.
- Mahoe-mixed broadleaved forest on hill slope.
- Kanuka low forest on lower hill slopes and toe slopes.
- Kanuka-mixed broadleaved low forest on hill slope.
- European broom-manuka-mixed pasture shrub-grassland on lower hill slopes and toe slopes.
- Harakeke-*Juncus-Carex* flax-rush-sedgeland on lake margin.
- *Carex secta* sedgeland on lake margin and poorly drained flats.
- Raupo reedland on lake margin.
- Aquatic herbfield on lake bed under open water.

Landforms

Lake Rotorua was formed by the build-up of alluvial deposits on the neighbouring plains and terraces which eventually impeded the runoff from the adjacent hill country (M. Johnston pers. comm.). It is considered to have natural features and landscapes of regional significance (Boffa Miskell and Lucas Associates, 1993).

The toe slopes and lower hill slopes included in the reserve are loess-covered Mesozoic greywacke.

Vegetation and Flora

The best examples of freshwater wetland vegetation in the district occur here on the lake margins. Intact wetlands are now rare on both a district and regional level. A mosaic of raupo reedland, *Carex secta* sedgeland, crack willow forest and treeland, and harakeke-*Juncus-Carex* associations dominate the margins with varying amounts of gorse, broom, pasture grasses and herbaceous weeds. Some fire-induced kanuka, kanuka-mixed broadleaved, and mahoe-mixed broadleaved forest extends to near the lake edge.

Kanuka forest towards the western lake margins contains a dense shrub layer of *Coprosma rhamnoides* but is otherwise relatively species-poor.

Broadleaved species include some of those associated with coastal and semi-coastal habitats including ngaio, titoki and kawakawa. Mahoe is the dominant species, with lesser amounts of fivefinger, kaikomako, tree fuchsia, cabbage tree, marbleleaf and kowhai. The understorey, shrub and ground tiers in mahoe-mixed broadleaved forest are generally sparse with scattered ferns, particularly *Polystichum richardii*, broadleaved seedlings and exotic pasture grasses and weeds.

Harakeke-*Carex-Juncus* associations contain variable amounts of each component. The most common sedge species are *Carex secta* and *C. virgata*. The common rushes are *Juncus sarophorus* and the introduced *J. effusus*, while a variety of exotic shrub, herb and grass species dominate the remainder of the vegetation. This vegetation type commonly occurs around the mouths of lake tributaries.

Tall *Carex secta* tussocks may occur as individuals or in clumps in open water near the lake margin. Raupo similarly forms stands in shallow areas.

The threatened swamp nettle, *Urtica linearifolia*, is present both inside and outside the fenced reserve. This is one of two localities where the orchid, *Pterostylis alobula*, was found, previously thought only to occur in Banks Peninsula on the east coast of the South Island (St George, Irwin and Hatch, 1996), although now also known from the neighbouring Cheviot Ecological District (Stevens, 1996). This species may be more common since several observations of *Pterostylis* were unable to be identified further as they were not flowering. This was the only location within the ecological district where *Hydrocotyle pterocarpa* was found during the survey.

Fauna

The lake and surrounding margins provide habitat for a variety of native bird species including threatened Southern crested grebe (Category O), pied shag (*Phalacrocorax varius varius*), little shag (*P. melanoleucos brevirostris*), white-faced heron (*Haematopus unicolor*), paradise shelduck (*Tadorna variegata*), grey duck (*Anas superciliosa superciliosa*), grey teal (*A. gibberifrons gracilis*), New Zealand shoveler (*A. rhynchotis variegata*), Australasian harrier (*Circus approximans gouldi*), pukeko (*Porphyrio porphyrio melanotus*), threatened New Zealand pigeon (Category B), New Zealand kingfisher, grey warbler (*Gerygone igata igata*), South Island fantail and bellbird. Introduced species include black swan (*Cygnus atratus*), mallard (*Anas platyrhynchos platyrhynchos*), Canada geese (*Branta canadensis maxima*) and Californian quail (*Lophortyx californica*).

Southern crested grebe is rare on the east coast of the South Island (Bull et al., 1985) and this was the only location in the district where it was found. White-faced heron, little shag, grey duck, grey teal and New Zealand shoveler are either absent or uncommon within the rest of the ecological district. Pied shags roost in kanuka-broadleaved forest near the lake edge, the only inland site known in the ecological district. The number and combination of species is regionally rare and was not seen elsewhere in the ecological district.

Fish species to inhabit the lake include shortfinned eel (*Anguilla australis*), longfinned eel (*A. dieffenbachii*) and common bully (*Gobiomorphus cotidianus*) (NIWA, 1997).

Secondary Criteria

A commercial bird-watching venture is run by an adjacent landowner.

The lake has importance to local Iwi.

Selection Criteria

- Contains the largest, most intact freshwater wetland in the district and one of the few remaining in the region with the best examples of *Carex secta*, raupo and mixed harakeke-*Juncus-Carex* associations in the ecological district.

- The most important link in the network of wetlands in the ecological district.
- Contains a diverse range of wetland and terrestrial plant and animal communities.
- The threatened (Category B) swamp nettle occurs here in one of only two known localities in the district. The orchid *Pterostylis alobula* is uncommon on the east coast of the South Island. This was the only location within the ecological district where *Hydrocotyle pterocarpa* was found during the survey.
- The lake and surrounding margins provides important habitat for a variety of bird species including the threatened New Zealand pigeon (Category B). It is the only location in the district where threatened Southern crested grebe (Category O) may be found, and white-faced heron, little shag, grey duck, grey teal and New Zealand shoveler are either absent or uncommon within the rest of the ecological district. Pied shags roost in kanuka-broadleaved forest near the lake edge, the only inland site known in the ecological district. The number and combination of species is regionally rare and was not seen elsewhere in the ecological district.
- Intrinsic landscape value is of regional significance.

Notes

The relatively narrow protected zone between the lake edge and the boundary has meant the area is prone to weed infestation. Much of the surrounding farmland is grazed by goats which are continually testing the reserve boundary fencing.

PNA 4 - Kahutara Scientific Reserve

Grid Reference Centre:	NZMS 260 O31 567661
Area:	18 ha
Altitudinal Range:	25-30 m
Tenure:	Crown land administered by DOC
Vegetation Type:	6c
Study Area Number:	K27

Land System(s)

Northwest outwash deposits and local alluvium.

Bioclimatic Zone(s)

Semi-coastal.

Ecological Units

- Kanuka low forest and scrub on alluvial floodplain and terrace flat.

Landforms

The scientific reserve forms part of a block of 65ha, the remainder of which is conservation land spanning a section of floodplain and channels of the Kahutara River. It is situated on the true right and is comprised of recent alluvial gravels with a thin covering of loess on a terrace flat bounded by active and inactive river channels, and is prone to periodic flooding.

Vegetation and Flora

The kanuka canopy is generally even-aged and dense, overlying a sparse understorey and mainly exotic grass sward. Periodic floods not only contribute to the modification of vegetation but also make fencing maintenance difficult, allowing sheep to browse throughout. Where flooding has been most severe the ground is practically denuded below the canopy. Combined with a readily available seed source of pasture species and weeds close by, it is little wonder that the understorey does not contain many native species. *Coprosma rhamnoides*, *C. crassifolia*, *C. propinqua* ssp. *propinqua*, *Muehlenbeckia australis* and kowhai are thinly scattered as shrubs and small trees. An introduced grass *Brachypodium sylvaticum* dominates the ground tier with *Agrostis stolonifera*, white clover and lotus.

This is one of two localities where an orchid, *Pterostylis alobula*, was found. It was previously thought only to occur in Banks Peninsula on the east coast of the South Island (St George, Irwin and Hatch, 1996), although now also known from the neighbouring Cheviot Ecological District (Stevens, 1996). This species may be more common since several observations of *Pterostylis* were unable to be identified further as they were not flowering.

Fauna

South Island fantail, bellbird and grey warbler were found within the reserve.

Both rabbits and sheep graze the area.

Secondary Criteria

The vegetation provides stabilisation to the floodplain.

Selection Criteria

- Natural riverine processes which characterise these communities such as flooding, silt deposition and active channelisation, are still operating within the area.
- Native vegetation cover on alluvium, and forest in particular, is now regionally rare within Canterbury and South Marlborough and this stand represents one of the largest in the ecological district.
- *Pterostylis alobula* is uncommon on the east coast of the South Island.

PNA 5 - Scenic Reserve - unnamed (Kabutara-Rosy Morn)

Grid Reference Centre:	NZMS 260 O31 546606; O31 580626
Area:	74 ha
Altitudinal Range:	2-380 m
Tenure:	Crown land administered by DOC
Vegetation Types:	5a, 5b, 6a, 6b, 7, 8c, 8d, 9, 10a
Study Area Number:	K31

Land System(s)

Coastal greywacke hill country.

Bioclimatic Zone(s)

Coastal.

Ecological Units

- Mahoe-fivefinger scrub on colluvial hill slopes.
- Mahoe-mixed broadleaved scrub on colluvial hill slopes.
- Marlborough rock daisy rockland on bedrock hill slopes and bluffs.
- *Coprosma* shrub-grassland on hill slopes.
- Manuka scrub and shrubland on hill slopes.
- Kanuka scrub on hill slopes and ridges.
- Bracken fernland on hill slopes.
- European broom shrubland on hill slopes and spur side slopes.
- Silver tussock-rough pasture on hill slopes and spur side slopes.

Landforms

Two disjunct areas of steep south- and east-facing coastal Mesozoic greywacke slopes extending from the ridgeline to SH 1, close to the shoreline. The reserves form part of the Kaikoura coastline and as such have outstanding landscape value which is of national importance (Boffa Miskell and Lucas Associates, 1993). The coastal features between the Kahutara River mouth and Oaro are also listed in the geopreservation inventory as having national significance (Kenny and Hayward, 1993b) as a good example of steeply cliffed coast, rocky headlands and stacks.

Vegetation and Flora

The forest and scrub vegetation is secondary, reflecting the human disturbance during the relatively long settlement period along the coastal areas within the district. Coastal broadleaved communities are now regionally uncommon while the rockland communities mentioned here are dominated by regionally endemic species.

Mahoe is the dominant broadleaved species, sharing the dense scrub canopy equally with fivefinger on steep, colluvial slopes. In these areas common associates include *Olearia paniculata*, *Hebe salicifolia*, and *Coprosma lucida*, with little understorey, shrub or ground tier vegetation other than hound's tongue fern due to the unstable nature of the substrate. Elsewhere the canopy is dominated by mahoe with varying amounts of titoki, pigeonwood, ngaio, marbleleaf, red mapou, kohuhu, wharangi and *Coprosma lucida*. Closer to the shoreline karaka, *Coprosma repens*, *Griselinia lucida*, and akeake may become more frequent. Kawakawa and supplejack dominate the understorey where stable enough, with hound's tongue, *Asplenium oblongifolium* and *Adiantum cunninghamii* prominent at ground level.

Steep rocky faces and bluff ends contain sparse communities of Marlborough rock daisy (*Pachystegia* sp. 'A'), Marlborough lilac, elements of coastal forest and scrub, and pasture grasses and weeds.

Kanuka scrub occurs on drier spurs and ridges while the remaining communities are at less-advanced stages of regeneration following burning.

Fauna

The reserve provides habitat for bush birds, most commonly bellbird and South Island fantail.

Secondary Criteria

Well defined landforms along the coast between Kahutara River mouth and Oaro are of scientific and educational value as well as scenic interest.

The area has importance for local iwi.

Selection Criteria

- The two segments of the reserve form part of a network of coastal broadleaved communities between Kahutara River mouth and Oaro.
- The area contains notable plant species *Hebe salicifolia*, close to or at its northern limit, and South Marlborough endemic species including Marlborough rock daisy and Marlborough lilac.
- Forms part of the Kaikoura coastline which has been identified as an outstanding landscape feature of national importance.

PNA 6 - Pinnacle Rock Nature Reserve

Grid Reference Centre:	NZMS 260 O31 581620
Area:	0.1 ha
Altitudinal Range:	0-8 m
Tenure:	Crown land administered by DOC
Vegetation Types:	9
Study Area:	K31

Land System(s)

Coastal greywacke hill country.

Bioclimatic Zone(s)

Coastal.

Ecological Units

- Bare and sparsely-vegetated rockland.

Landforms

The reserve is composed of a Mesozoic greywacke bedrock outcrop only partly isolated from the mainland, depending on tide conditions. It is integral with the Kaikoura coastline and as such shares its outstanding landscape value which is of national importance (Boffa Miskell and Lucas Associates, 1993).

Vegetation and Flora

Not inspected during the survey but vegetation appears minimal.

Fauna

The reserve has significant habitat value as a breeding site for red-billed gull (*Larus novaehollandiae*), spotted shag (*Stictocarbo punctatus punctatus*) and the threatened white-fronted tern (Category C).

Selection Criteria

- A breeding site for red-billed gull, spotted shag, and threatened white-fronted tern.
- Part of the Kaikoura coastline which has been identified as an outstanding landscape feature of national importance.

PNA 7 - Railway Lease (Kabutara-Rosy Morn)

Grid Reference Centre:	NZMS 260 O31 560613; O31 570619
Area:	31 ha
Altitudinal Range:	2-270 m
Tenure:	Crown land leased to Transrail
Vegetation Types:	5a, 5b, 6b, 7, 8c, 8d, 9, 10a
Study Area Number:	K31

Land System(s)

Coastal greywacke hill country.

Bioclimatic Zone(s)

Coastal.

Ecological Units

- Mahoe-fivefinger scrub on colluvial hill slopes.
- Mahoe-mixed broadleaved scrub on colluvial hill slopes.
- Marlborough rock daisy rockland on bedrock hill slopes and bluffs.
- Kanuka scrub on hill slopes and ridges.
- Bracken fernland on hill slopes.
- European broom shrubland on hill slopes and spur side slopes.
- Silver tussock-rough pasture on hill slopes and spur side slopes.

Landforms

Two disjunct areas of steep, south- and east-facing coastal Mesozoic greywacke slopes between and above the Raramai and Paratitahi train tunnels. The reserves form part of the Kaikoura coastline and as such have outstanding landscape value which is of national importance (Boffa Miskell and Lucas Associates, 1993). The coastal features between the Kahutara River mouth and Oaro are also listed in the geopreservation inventory as having national significance (Kenny and Hayward, 1993b) as a good example of steeply cliffed coast, rocky headlands and stacks.

Vegetation and Flora

The vegetation pattern is similar to that found in PNA 5 although there is a larger proportion of mahoe-broadleaved scrub and less regenerating shrubland and pasture.

Fauna

The reserve provides habitat for bush birds, most commonly bellbird and South Island fantail.

Secondary Criteria

Well defined landforms along the coast between Kahutara River mouth and Oaro are of scientific and educational value as well as scenic interest.

The area has importance for local iwi.

Selection Criteria

- The two segments of the reserve form part of a network of coastal broadleaved communities between Kahutara River mouth and Oaro.
- The area contains *Hebe salicifolia* close to or at its northern limit, and South Marlborough endemic species including Marlborough rock daisy and Marlborough lilac.
- Forms part of the Kaikoura coastline which has been identified as an outstanding landscape feature of national importance.

PNA 8 - Riley's Lookout (Panau Island) Nature Reserve

Grid Reference Centre:	NZMS 260 O31 559606
Area:	0.1 ha
Altitudinal Range:	0-5 m
Tenure:	Crown land administered by DOC
Vegetation Types:	9
Study Area Number:	K31

Land System(s)

Coastal greywacke hill country.

Bioclimatic Zone(s)

Coastal.

Landforms

The reserve is a small offshore Mesozoic greywacke bedrock islet situated 250m southeast of the mainland. It is integral with the Kaikoura coastline and as such shares its outstanding landscape value which is of national importance (Boffa Miskell and Lucas Associates, 1993).

Ecological Units

- Bare or sparsely vegetated rockland.

Vegetation and Flora

Not inspected during the survey but vegetation appears to be minimal.

Fauna

This reserve has significant faunal habitat value. It is one of the few known breeding sites along the Kaikoura Coast for the threatened (Category O) reef heron (Davidson, Paton and Cash, 1993). It is also a breeding site for large numbers of red-billed gull, Southern black-backed gull (*Larus dominicanus*), spotted shag and the threatened (Category C) white-fronted tern.

New Zealand fur seal haul-out here and have been observed breeding (Brian Paton, pers. obs.)

Secondary Criteria

The reserve is regularly visited by commercial whale-watching operations to observe seal and birdlife (Davidson, Paton and Cash, 1993).

An historic landmark as the place where Barney Riley reputedly stood to look for whales. He was a notorious local personality who whaled in the area between 1850 and the early 1870's (Elvy, 1949).

Selection Criteria

- One of the few known breeding sites along the Kaikoura Coast for the threatened reef heron. Also a breeding site for large numbers of red-billed gull, Southern black-backed gull, spotted shag and threatened white-fronted tern.
- A haul-out and occasional breeding site for New Zealand fur seals.
- Part of the Kaikoura coastline which has been identified as an outstanding landscape feature of national importance.

PNA 9 - Scenic Reserve - unnamed (Ote Makura Stream)

Grid Reference Centre:	NZMS 260 O31 495615; O31 502604; O31 522601
Area:	681 ha
Altitudinal Range:	20-920 m
Tenure:	Crown land administered by DOC
Vegetation Types:	1, 2, 3a, 3b, 3c, 5a, 5d, 6a, 6b, 8a, 8c, 8d, 9, 10a
Study Area Number:	K1, K3, K5

Land System(s)

Coastal greywacke hill country; Inland greywacke hill country.

Bioclimatic Zone(s)

Coastal; semi-coastal; lowland; montane.

Ecological Units

- Black beech-mountain beech forest and mountain beech forest on hill and spur side slopes.
- Black beech-hinau-mahoe forest on lower hill slopes and toe slopes.

- Black beech-red beech-mixed broadleaved forest along riparian zone.
- Black beech-mountain beech-red beech forest on debris mantled lower hill slope.
- Hinau-mahoe-mixed broadleaved forest along riparian zone.
- **Mahoe-mixed broadleaved forest on coastal and semi-coastal colluvial hill slopes, gullies, toe slopes, alluvial terrace and flat.**
- **Mahoe-mixed broadleaved forest on lowland-montane hill slopes.**
- Hall's totara/fescue tussock shrub-grassland on colluvial hill slopes.
- **Kanuka scrub and low forest on hill slopes and ridges.**
- Kanuka-mixed broadleaved treeland and shrubland on hill slopes.
- Manuka scrub and shrubland on ridges and hill slopes.
- Rockland communities on bluffs.
- *Coprosma*-tauhinu-matagouri shrubland on hill slopes.
- Bracken fernland on hill slopes.
- Silver tussock-mixed pasture grassland on ridges and upper hill slopes.
- Fescue tussock-mixed pasture grassland on ridges and crests.

Landforms

The reserve is composed of three discrete areas on Mesozoic greywacke hills and spurs inland from Goose Bay. It includes the majority of forested east- and south-facing slopes of the Ote Makura Stream catchment, including the upper tributaries and headwaters. Valleys are V-shaped and steep-sided with soil development often limited.

Combined, the three segments cover the range of bioclimatic zones from coastal to montane within 6 km of the coastline.

The coastal portion of the reserve forms part of the Kaikoura coastline and as such has outstanding landscape value which is of national importance (Boffa Miskell and Lucas Associates, 1993).

Vegetation and Flora

There is little evidence of any primary forest in the reserve, most having been logged or burned in the past.

Black-red beech forest is generally confined to riparian zones, often associated with broadleaved species, and rarely forms a closed canopy. A few scattered emergent matai, lowland totara, rimu, miro and kahikatea remain in places. A dense understorey and shrub tier contains mahoe, *Coprosma grandifolia*, lemonwood, marbleleaf and pate with minor mamaku, *Cyathea smithii*, *Coprosma robusta* and *Metrosideros diffusa*. The ground tier commonly contains *Blechnum fluviatile*, *B. chambersii* and hound's tongue fern with minor *Polystichum richardii*, *P. vestitum*, *Microlaena avenacea*, wall lettuce and a host of tree and shrub seedlings.

Black beech forest is found in patches on lower hill slopes and riparian zones, and merges with mountain beech forest towards the catchment head. Black beech and/or mountain beech forest covers most of the slopes in the reserve segment at Ote

Makura Stream headwaters. Minor lancewood and marbleleaf are present in the understorey. The shrub and ground tiers are dominated by *Microlaena avenacea* and *Blechnum discolor* with minor pepper tree (*Pseudowintera colorata*), silver fern, *Coprosma rhamnoides*, *C. propinqua* ssp. *propinqua*, *Uncinia uncinata*, *Gahnia procera*, *Blechnum procerum* and *Lycopodium volubile*.

Broadleaved forest throughout the altitudinal zones is dominated by mahoe. On coastal steep, colluvial south-facing slopes the canopy is often uneven and associated species include hinau, titoki, kanuka, kowhai and red mapou. Kawakawa, *Olearia paniculata*, *Coprosma rhamnoides* and regenerating mahoe dominate the shrub tier. The ground tier is generally sparse with hound's tongue fern prominent.

Small semi-coastal streamside flats contain mahoe with an equal proportion of pigeonwood and supplejack. Kawakawa, *Metrosideros diffusa* and supplejack are prevalent within both the understorey and shrub tiers while the most common ground tier species are *Metrosideros diffusa* and kawakawa seedlings.

East- and northeast-facing semi-coastal slopes mahoe forms a dense canopy with pigeonwood and marbleleaf. The understorey contains mahoe and minor pigeonwood and kawakawa. Kawakawa also dominates a sparse shrub tier, while the ground tier is typically denuded.

Upstream, towards the headwaters on east-facing slopes over 400m elevation, mahoe, marbleleaf and lemonwood are the dominant canopy species, with mahoe and marbleleaf also prominent in the understorey. *Coprosma rhamnoides* is the major component of a sparse shrub tier while the ground tier is largely comprised of *Uncinia uncinata* with minor *Polystichum richardii*, *Pellaea rotundifolia* and wall lettuce.

Hall's totara forms patches of shrub-grassland with fescue tussock, usually on high altitude colluvial slopes and old slip sites near mountain beech margins. Minor components include bracken fern, tauhinu, *Melicytus alpinus*, *Hypolepis millefolium*, silver tussock, *Muehlenbeckia complexa* and a host of introduced grasses and herbs.

Kanuka scrub and low forest on steep montane faces typically contains a dense canopy. Few associates exist in either the canopy or understorey, while *Coprosma rhamnoides* dominates the shrub tier. The ground tier is typically sparse with minor silver tussock and *Coprosma rhamnoides* seedlings.

Small areas of rockland on outcrops contain Marlborough rock daisy and Marlborough lilac.

The remaining vegetation types have been induced by more recent fires and tend to occupy forest margins, upper slopes, ridges and crests. Montane grasslands, although modified and seral, contain many native intertussock species confined to the higher peaks in the district. Little of this vegetation type falls within the reserve, however.

The orchid *Earina autumnalis* is regionally rare and was found only in one other locality (Oaro River catchment). *Epilobium nerterioides* was not sighted elsewhere in the district. *Gahnia procera*, *Hymenophyllum villosum* and *Coprosma repens* are uncommon within the district.

Fauna

The area is recognised as having significant faunal habitat value (New Zealand Wildlife Service, 1983).

South Island fantail and bellbird were the most common bush birds to be seen and heard here. The threatened New Zealand wood pigeon (Category B) and South Island robin were seen in forest in several locations within the reserve. Other native species reported from here include the threatened New Zealand falcon (Category B), silveryeye (*Zosterops lateralis*), South Island tomtit (*Petroica macrocephala macrocephala*), South Island rifleman (*Acanthisitta chloris chloris*) and New Zealand kingfisher, as well as a host of introduced species.

Ote Makura Stream provides habitat for native fish including the threatened (Category C) koaro, long-finned eel, inanga (*Galaxias maculatus*) and blue-gilled bully (*Gobiomorphus hubbsi*) (NIWA, 1997).

German wasps were seen to be numerous on black and mountain beech.

Secondary Criteria

The area has importance for local iwi.

Coastal parts of the reserve are integral with the Kaikoura coastal landform features which are recognised as having scientific and educational qualities (Kenny and Hayward, 1993b).

Selection Criteria

- The reserve includes one of the few remaining forest tracts in the region which span coastal to montane bioclimatic zones and does so within 6 km of the coastline. As such it has high values for its biological pattern.
- The reserve contains examples of black-red beech forest along riparian zones which are some of the best within the ecological district. There is little of this vegetation type left within the ecological district.
- A range of vegetation types and habitat are present according to aspect, substrate, drainage, burning history and proximity to the coastline, giving the area high diversity value.
- Notable flora found within the reserve includes *Earina autumnalis* which is regionally rare and was found only in one other locality in the ecological district. *Epilobium nerterioides* was not sighted elsewhere in the district. *Gahnia procera*, *Coprosma repens* and *Hymenophyllum villosum* are uncommon within the district. Marlborough rock daisy and Marlborough lilac are endemic to South Marlborough.
- The area has significant faunal habitat value for a variety of fauna including threatened New Zealand pigeon (Category B) and New Zealand falcon (Category B). Ote Makura Stream provides habitat for native fish including the threatened koaro and long-finned eel.
- Coastal parts of the area form part of the Kaikoura coastal features and as such have significant landscape value.

Notes

The present fragmented nature of the reserve means that perimeter fencing is hard to maintain, particularly with electric fencing, which was found to be broken and ineffective in many places, allowing stock to wander freely through much of the reserve.

PNA 10 - Goose Bay-Omibi Scenic Reserve

Grid Reference Centre:	NZMS 260 O32 515560; O32 515577; O32 530577; O32 537588; O32 540 596
Aaea:	441 ha
Altitudinal Range:	1-700 m
Tenure:	Partly Crown land administered by DOC; partly reserve managed by Te Runanga o Ngai Tahu
Vegetation Types:	1, 5a, 5d, 6a, 6b, 8a, 8c, 8d, 9, 10a
Study Area Number:	K7, K31

Land System(s)

Coastal greywacke hill country; Inland greywacke hill country.

Bioclimatic Zone(s)

Coastal; semi-coastal; lowland; montane.

Ecological Units

- Mountain beech and black beech-mountain beech forest on colluvial spur side slopes.
- Mountain beech-Hall's totara forest and treeland on colluvial spur side slopes.
- Mahoe-mixed broadleaved forest and scrub on coastal colluvial hill slopes.
- Mahoe-mixed broadleaved forest and scrub on inland colluvial hill slopes and spur side slopes.
- Mahoe-supplejack-mixed broadleaved forest along on coastal gully and riparian zone.
- Mahoe-ngaio-kowhai treeland and scrub on hill slopes.
- Kanuka scrub on shoulder slope.
- Kanuka low forest on steep colluvial hill slopes.
- Kanuka-manuka scrub on bedrock hill slopes.
- Manuka scrub on hill slopes and spur side slopes.
- Rockland communities on bluffs.
- *Coprosma* shrubland on hill slopes and spur side slopes.
- Bracken fernland on hill slopes and spur side slopes.
- Silver tussock-pasture grassland on ridges, hill slopes and spur side slopes.
- Mixed pasture grassland on ridges and crests and gently-sloping hill slopes and spur side slopes.

Landforms

The reserve is comprised of several discrete segments among Mesozoic greywacke hill country, including fragmented coastal forest and scrub blocks on steep slopes and cliffs adjacent to the main highway between Kie Kie Creek mouth and Oaro; much of the forested slopes of the Omihi Stream catchment and its tributary, extending inland for approximately 3km to an altitude of 700m and composed of steep-sided V-shaped valleys, spurs and hills; the forested slopes of two unnamed streams extending approximately 1.5km inland to an altitude of 500m situated to the north of Oaro. Many of the steeper slopes, both coastal and inland, are colluvial.

The coastal slopes form a major stretch of the Kaikoura coastline which has been recognised as nationally important for its landscape value (Boffa Miskell and Lucas Associates, 1993).

The reserve is regionally significant for its soils (Arand et al., 1991) because it occurs over a range of habitats, and since coastal soil-vegetation associations are now nationally uncommon.

Vegetation and Flora

Much of the mahoe-mixed broadleaved forest, beech forest and older bluff vegetation has not been subjected to burning or clearing for many decades. It has been suggested that the even-aged nature of much of the coastal mahoe forest along the Kaikoura Coast could be attributed to a lack of burning activity during the second world war (Jane, 1985). Most of the remaining plant communities are in various stages of regeneration, depending on burning history, drainage, aspect, altitude and proximity to the shoreline.

The reserve contains a continuous sequence of native vegetation along Omihi Stream, from shore platform to montane mountain beech forest.

Mountain and black-mountain beech forest cloaks some of the upland south-facing slopes, often on colluvium. The forest is secondary and generally forms a closed canopy with few associates, with kanuka, broadleaf, and fivefinger minor understorey components with younger beech poles. A moderate well-developed shrub layer is largely comprised of *Cyathodes juniperina*, *Leucopogon fasciculatus*, *Coprosma rhamnoides*, wharariki and *Hebe venustula*. A sparse ground tier contains scattered shrub and tree seedlings, hound's tongue fern, *Brachyglottis lagopus*, *Asplenium terrestre* ssp. *terrestre* and *Paesia scaberula*.

Small areas of mountain beech-Hall's totara forest, scrub and treeland occur on colluvium at the head of the catchment. The most common associated species are broadleaf, lancewood, marbleleaf, kanuka, *Coprosma lucida*, *C. rhamnoides*, *Rubus schmidelioides*, *Polystichum vestitum*, *Blechnum procerum*, and *B. penna-marina*.

The coastal mahoe-broadleaved forest on colluvial hill slopes typically contains minor canopy associates of titoki, pigeonwood with lesser amounts of wharangi, marbleleaf, karaka, akeake and ngaio. Common understorey and shrub species include kawakawa, supplejack, kaikomako, *Coprosma crassifolia* and *Melicope simplex*, while hound's tongue fern, *Adiantum cunninghamii*, *Polystichum richardii*, *Asplenium oblongifolium*, *Uncinia uncinata*, and *Metrosideros diffusa* occur frequently below 0.5m.

Further inland broadleaf, hinau, lemonwood, marbleleaf and red mapou are prominent canopy components in mahoe-mixed broadleaved forest, with scattered emergent black beech on drier sites. This is by far the most common vegetation type in the reserve. A few scattered emergent matai and occasional rimu occur near wetter valley bottoms. Understorey density is variable and dependent upon grazing pressure, slope, aspect and degree of soil development.

Along riparian zones and in gullies where grazing pressure is light, understorey and shrub associates of mahoe-supplejack-mixed broadleaved forest include pate, *Coprosma robusta*, *C. grandifolia*, silver fern, mamaku, *Metrosideros diffusa*. The most common ferns are *Blechnum chambersii*, hound's tongue fern, *Polystichum richardii*, *Asplenium flaccidum*, *A. gracilimum*, *Adiantum cunninghamii* and *Pneumatopteris pennigera*, while other ground layer species are broadleaved seedlings, *Microlaena avenacea*, supplejack, *Metrosideros diffusa* and *Libertia ixioides*.

Mahoe-ngaio-kowhai treeland and open scrub has a moderately sparse shrub layer of *Coprosma rhamnoides* with a large variety of minor species such as mahoe, kawakawa, kanuka, marbleleaf, *Olearia paniculata*, *Coprosma robusta*, *C. crassifolia*, *C. propinqua* ssp. *propinqua*, red mapou, kowhai, *Helichrysum aggregatum*, and *Muehlenbeckia australis*. The ground layer contains mostly pasture species and weeds with scattered ferns such as *Paesia scaberula*, *Blechnum fluviatile*, *Polystichum richardii*, and *Adiantum cunninghamii*, and other species such as *Uncinia uncinata* and *Clematis paniculata*.

Kanuka low forest generally contains a dense canopy and poor understorey, particularly where accessible to stock. The most frequent species in a sparse shrub tier are *Coprosma rhamnoides*, *C. propinqua* ssp. *propinqua* and *Leucopogon fasciculatus* while the ground tier is largely denuded. Larger canopy gaps commonly contain wharariki.

Fire induced manuka-kanuka shrubland, scrub and forest is generally found on drier forest margins and slopes while silver tussock-pasture grassland occurs towards the ridges and may contain a shrub component including species such as *Coprosma propinqua* ssp. *propinqua*, matagouri, tauhinu, manuka and Hall's totara in varying densities. Fescue tussock becomes more common at higher altitudes while *Rytidosperma* species are more conspicuous near the coast. Steep rockland and bluffs contain a mosaic of introduced and native grasses, herbs and shrubs.

Marlborough lilac and Marlborough rock daisy are common species on greywacke outcrops and are associated at higher altitudes towards Poho-o-te-atua with wharariki, *Aciphylla glaucescens*, *Celmisia monroi*, *Gingidia montana*, *Poa colensoi*, and *Chionochloa flavescens*, forming communities which are rare within the ecological district.

Pseudopanax ferox is locally distributed on a national level and is uncommon within the district. *Coprosma grandifolia* is at or near their southern limit. *Geum leiospermum* was not seen elsewhere in the district, while *Hymenophyllum villosum*, *Chionochloa* aff. *flavescens*, and *Aciphylla glaucescens* are uncommon within the district. The nationally local mistletoe, *Ileostylus micranthus*, has been recorded from here previously, as have species seen rarely or not at all within the rest of the ecological district including *Collospermum hastatum*, *Asplenium polyodon*, *Hymenophyllum demissum* and *H. sanguinolentum* (Williams, 1982). Marlborough rock daisy and Marlborough lilac are endemic to South Marlborough.

Fauna

The area is recognised as having significant faunal habitat value (New Zealand Wildlife Service, 1983).

The South Island fantail, bellbird and silvereye were seen and heard commonly throughout the area. A South Island robin was seen on one occasion in mahoe-mixed broadleaved forest. Other native species reported from the area include grey warbler, Australasian harrier, New Zealand pigeon (threatened - Category B), and South Island tomtit (New Zealand Wildlife Service, 1983).

Common gecko were observed basking on rockland. The sound of cicadas was prominent throughout much of the lowland forest. German wasp populations have established in mountain and black beech forest.

Omihi Stream has been found to contain native fish species including the threatened inanga (Category C), koaro and long-finned eel (NIWA, 1987).

The sizes and shapes of the components of the reserve have made effective fencing very difficult by not always following natural contours or boundaries. This, coupled with a lack of resources to regularly check and maintain the fencing has contributed to stock infiltrating several parts of the reserve. Possum browse was observed on both mahoe and titoki.

Secondary Criteria

The Omihi Stream segment in particular is of educational and scientific value (Kenny and Hayward, 1993b) as the only discrete reserve in the district marking the changes between coastal and montane forest.

The aesthetic or scenic value of the reserve is high as it is the first stretch of forested coastline to be seen along the main highway north of Christchurch.

The area has importance for local iwi.

Selection Criteria

- The reserve includes one of the few remaining forest tracts in the region which span coastal to montane bioclimatic zones and the only one to be reserved as a discrete entity. As such it has high biological pattern values.
- A range of vegetation types and habitat are present according to aspect, substrate, drainage, burning history and proximity to the coastline giving the area high diversity value.
- The components of this reserve form the bulk of the network of coastal broadleaved communities between Kahutara River mouth and Oaro.
- A number of rare or unusual species are present within the area (see above).
- Montane rockland communities have, in some cases, escaped devastating fires and contain a combination of species which is rare within the ecological district.
- The area has significant habitat value for a variety of fauna including the threatened New Zealand pigeon (Category B). Omihi Stream is known to contain threatened koaro.
- Soil associations present are of regional significance.

- Part of the Kaikoura coastline which has been identified as an outstanding landscape feature of national importance.

PNA 11 - Otumatau Rock Wildlife Reserve

Grid Reference Centre:	NZMS 260 O32 536580
Area:	0.1 ha
Altitudinal Range:	0-6 m
Tenure:	Crown land administered by DOC
Vegetation Types:	9
Study Area Number:	K31

Land System(s)

Coastal greywacke hill country.

Bioclimatic Zone(s)

Coastal.

Ecological Units

- Mixed shrub-rockland on coastal spur toe slope.
- Bare rockland on coastal spur toe slope.

Landforms

The reserve consists of a coastal Mesozoic greywacke rock outcrop at the base of a spur lying in the splash zone. As part of the Kaikoura coastline it shares outstanding landscape value which is of national importance (Boffa Miskell, 1993).

Vegetation and Flora

The vegetation consists of scattered coastal broadleaved scrub and shrubland, probably at least partially planted. Karaka, *Coprosma repens*, *Griselinia lucida*, ngaio and akeake comprise the shrub species while *Asplenium oblongifolium*, *A. terrestre* ssp. *terrestre* and *Pyrrosia eleagnifolia* grow in rock cracks. New Zealand ice plant scrambles over the rock surface in places, while *Chrysanthemum monilifera* is the most common exotic species present.

Human disturbance has meant that much of this vegetation type has been lost and is now uncommon in the district and region.

Fauna

The reserve is an important nesting area for red-billed gulls and the threatened (Category C) white-fronted tern.

Secondary Criteria

The area has importance for local iwi.

Scenic value is significant as the reserve is positioned adjacent to SH 1.

Selection Criteria

- Coastal broadleaved communities occurring in the splash zone are much reduced from their original extent.
- A breeding site for red-billed gull, and threatened white-fronted tern.
- Part of the Kaikoura coastline which has been identified as an outstanding landscape feature of national importance.

PNA 12 - Oaro River Private Protected Land

Grid Reference Centre:	NZMS 260 O32 485565
Area:	296 ha
Altitudinal Range:	50-750
Tenure:	Private protected land
Vegetation Types:	3a, 3c, 4a, 5a, 5c, 5g, 6b, 8c, 8d, 9, 10a
Study Area Number:	K9

Land System(s)

Coastal greywacke hill country; Inland greywacke hill country.

Bioclimatic Zone(s)

Semi-coastal; lowland; montane.

Ecological Units

- Mountain-black beech forest on hill slopes and gullies.
- Black beech-mixed broadleaved forest on alluvial terraces.
- Matai-mahoe forest in gullies.
- **Mahoe-supplejack-mixed broadleaved forest on hill slopes, spur side slopes and gullies.**
- Hall's totara-broadleaf-kanuka scrub and shrubland on upper hill slopes and crest.
- Wheki scrub on hill slope.
- **Kanuka low forest on hill slopes, spur side slopes and ridges.**
- Mixed shrub-rockland on steep bedrock slopes and bluffs.
- *Coprosma*-tauhinu-matagouri/silver tussock-mixed pasture shrub-grassland on spur slopes, ridges and crests.
- Bracken fernland on spur side slopes and ridges.
- Silver tussock-mixed pasture grassland.

Landforms

The private protected land (PPL) includes much of the south- and west-facing mid to lower slopes of Poho-o-te-atua. These steep Mesozoic greywacke spur and hill slopes drain into the mid section of Oaro River and are largely shielded from coastal mists by Poho-o-te-atua and its associated ridgeline.

Vegetation and Flora

Black beech forest merging upslope into mountain beech forest exists in a few dry gully sides with sparse understorey associates of Hall's totara, broadleaf, lancewood, marbleleaf and *Coprosma lucida*. The shrub tier is moderately dense in places with *Cyathodes juniperina*, *Coprosma rhamnoides* and scrambling *Rubus schmidelioides*. A sparse ground tier contains scattered ferns: *Polystichum vestitum*, *Blechnum procerum*, and *B. penna-marina*.

Black beech-mixed broadleaved forest exists in a few scattered strips along the riparian zone on the true left bank of Oaro River. Black beech is emergent over mahoe, marbleleaf, broadleaf and kaikomako with a shrub layer of *Coprosma rhamnoides*, *C. rigida* and *Melicope simplex*. *Uncinia uncinata* is the dominant species in the ground tier which is otherwise sparse.

Small, scattered stands of remnant matai-mahoe forest occur in narrow strips by watercourses in mid to upper slopes, surrounded by secondary beech and broadleaved forest. This forest type is now rare within both the district and the region. Vegetation below the canopy is sparse with red mapou, kaikomako and wheki scattered in the understorey. There is no prominent shrub tier while the ground tier is comprised of scattered broadleaved seedlings, *Metrosideros diffusa*, *Uncinia uncinata* and ferns such as *Polystichum richardii*, *Pellaea rotundifolia* and *Asplenium hookerianum*.

Mahoe-supplejack-mixed broadleaved forest contains occasional emergent hinau and infrequent canopy associates such as pigeonwood and lemonwood. Scattered understorey species include wheki, silver fern and marbleleaf. The shrub tier is usually not present while the moderately sparse ground tier species most commonly includes *Uncinia uncinata* with scattered broadleaved seedlings and ferns (*Pellaea rotundifolia*, *Blechnum fluviatile*, and *Polystichum richardii*).

Kanuka low forest generally contains a dense kanuka canopy approximately 8m high with few canopy or understorey associates other than scattered mahoe, red mapou and *Leucopogon fasciculatus*. There is usually a thick shrub tier, mostly of *Coprosma rhamnoides*, with minor *C. propinqua* ssp. *propinqua* and *Helichrysum lanceolatum*. *Uncinia scabra*, seedling *C. rhamnoides*, and *Dichondra brevifolia* are the most common species in the ground tier.

The PPL was the only locality in the district where a dense stand of wheki was encountered. It contained a few scattered silver fern in the canopy (6-8m tall) and epiphytic *Tmesipteris elongata* and *Rumohra adiantiformis*. Dense leaf litter meant that the growth of any other species was limited.

On sheer bedrock faces and bluffs the vegetation contains a mix of common broadleaved species such as red mapou, mahoe, broadleaf and *Metrosideros diffusa* as well as Hall's totara, kanuka, *Cyathodes juniperina*; regional endemics such as Marlborough rock daisy and *Brachyglottis monroi*; and a regionally uncommon orchid, *Earina autumnalis* (seen in only two locations in the district).

The upper slopes, crests and many ridges, most of which fall outside of the reserve, have sustained more intensive burning and grazing regimes. Hall's totara-broadleaf-kanuka shrublands are present on upper slopes, often on colluvium and often merging with mountain beech forest.

The remaining communities accommodate a significant pasture grass component and are at various initial stages of regeneration following burning. They include shrub-grassland communities, bracken fernland and silver tussock-mixed pasture grasslands but are minor components of the reserve.

The epiphytic fern ally *Tmesipteris elongata* was previously thought to be confined to Banks Peninsula on the East Coast of the South Island (Brownsey and Smith-Dodsworth, 1989) and was not found elsewhere in the district. An epiphytic fern, *Rumohra adiantiformis*, was not found elsewhere during the survey and is regionally rare. The orchid *Earina autumnalis* is also regionally rare. Species endemic to South Marlborough include Marlborough rock daisy and *Brachyglottis monroi*.

Fauna

The area is recognised as having faunal habitat value (New Zealand Wildlife Service, 1983).

South Island fantail, South Island tomtit, bellbird, the threatened New Zealand pigeon (Category B), grey warbler and silvereye were seen during the survey. Additional native species reported from the Oaro catchment as a whole include the threatened New Zealand falcon (Category B), Australasian harrier, brown creeper (*Mohoua novaeseelandiae*), South Island rifleman and several introduced species (New Zealand Wildlife Service, 1983).

Wainuia edwardii snail shells were found in streamside black beech-broadleaved forest. Recent research has indicated that this species should be treated as a threatened Category C species (Efford, 1997). Live *Rytida* snails and carabid beetles were present in matai forest.

Tree wetas (Family *Stenopelmatidae*) were found among the bluff vegetation.

An old (1944) record of lamprey (*Geotria australis*) exists for the Oaro River (NIWA, 1997), although it may not still persist. There are no other records for this species in the district.

Secondary Criteria

The whole Oaro area is of importance to local iwi.

Much of the catchment is visible from the main highway approaching Oaro township and as such maintains an aesthetic value enjoyed by many travellers.

Selection Criteria

- Some of the best examples of matai forest remnants on greywacke hill country seen in the district. This is a regionally rare ecological unit now confined to small scattered stands.
- The only example of wheki scrub seen in the district.
- A diverse range of greywacke semi-coastal and lowland secondary and fire-induced communities are present.
- A number of rare or notable plant species occur within the PPL (see above).
- The area has significant faunal habitat value (see above).

Notes

The naturalness of this area, like many others in the vicinity, is variable with stock browsing usually localised rather than widespread. Deer farming in adjacent paddocks has led to their infiltration into the protected land, presumably through damaged or ineffectual fencing. Possums, goats and sheep were also noted. Damage could become much more evident if the influx of stock is left unchecked.

The shape of the protected area is not ideal, encompassing, as it does, only a portion of hill country on one side of the valley without following any natural contours other than Oaro River. This is at least partially due to the pattern of ownership in the vicinity.

PNA 13 - Terako Downs Scenic Reserve

Grid Reference Centre:	NZMS 260 N32 201551
Area:	192 ha
Altitudinal Range:	380-650 m
Tenure:	Crown land administered by DOC
Vegetation Types:	1, 3a, 3d, 6a, 6c, 8c
Study Area Number:	H17

Land System(s)

Inland soft rock hill country; Northwest outwash deposits and local alluvium (minor).

Bioclimatic Zone(s)

Lowland; montane.

Ecological Units

- Black beech and black-mountain beech forest on hill slopes, spur side slopes and gullies.
- Black beech-mixed podocarp-broadleaved forest on hill and spur side slopes and in gullies.
- Kanuka-manuka scrub on hill and spur side slopes and crests.
- Manuka shrubland on hill and spur side slopes and crests.
- Fescue tussock-pasture grassland on hill and spur side slopes, crests and ridges.

Landforms

The reserve incorporates the gently rolling to moderately steep hill slopes and old terraces around two tributaries draining southeastwards into the Wandle River. Tertiary calcareous siltstone and sandstone are the major underlying rock types, with a small area of Quaternary glacial outwash gravel by Wandle River. Variable amounts of loess cover these sediments.

Soils under forest in drier parts of the South Island are now uncommon (Arand et al., 1991).

Vegetation and Flora

The forests of Terako Downs, together with those nearby on similar terrain, represent the most northern and most extensive examples of black and/or mountain beech, with emergent podocarps, remaining in Canterbury. The podocarp representation is especially significant as all three canopy species found here are now comparatively rare in Canterbury (Molloy, 1987).

The vegetation pattern in this reserve is similar to that found in the nearby Wandle Scenic Reserve with a primary and/or older secondary mixed-age black beech-podocarp-broadleaved mix along the riparian zones and much of the lower hill and spur side slopes where poorly drained, with younger secondary or tertiary even-aged black beech and black-mountain beech forest above this. Fire induced kanuka-manuka scrub and manuka shrubland occur on forest margins and merge into fescue tussock-pasture grassland on upper slopes, ridges and crests.

The principal emergent and canopy podocarp species in the beech-podocarp-broadleaved forest are kahikatea, matai and rimu. Prominent associated broadleaved species found in the canopy and understorey include pokaka, broadleaf, lancewood and marbleleaf. The dense shrub layer is dominated by beech regeneration and *Coprosma rhamnoides*, with *Microlaena avenacea* and *Uncinia uncinata* conspicuous up to 0.5m. Seedlings of black beech, mountain beech, kahikatea, matai and broadleaved species were found at ground level although rimu was notably absent.

Secondary black beech forest close to Wandle River on a section of glacial outwash terrace is older, of mixed age and has a relatively open canopy. Other canopy and understorey components are sparse with only a few scattered pokaka, Hall's totara and lancewood in evidence. The shrub tier is thick with regenerating black beech, *Coprosma* aff. *parviflora*, *C. propinqua* ssp. *propinqua*, *C. rhamnoides*, and *Neomyrtus pedunculata*. A few matai and kahikatea seedlings occur at ground level but the general lack of podocarps of any age suggests this section of the reserve has been logged in the past and grazed until recently.

The majority of the manuka-kanuka scrub is young (below 5m) with an even mix of the two species evident in the canopy. *Coprosma rhamnoides*, *C. aff. parviflora*, *Leucopogon fasciculatus* and *Cyathodes juniperina* are becoming established in the shrub tier, although a pasture grass sward still dominates the vegetation below this.

Approximately 15% of the reserve remains in fescue tussock-pasture grassland with scattered tauhinu and matagouri. Native grasses, *Elymus solandri* and *Rytidosperma gracile* are present between tussocks along with *Wahlenbergia albomarginata*, and clumps of *Bulbinella angustifolia* and bracken fern. Browntop, Yorkshire fog and sweet vernal are the most common pasture grasses.

Many orchids seen in the reserve were not in flower at the time of the survey and consequently were not identified beyond the genus level. However a previous study (Molloy, 1987) has identified *Thelymitria longifolia*, *Microtis unifolia*, *Pterostylis banksii* and *P. graminea*, all of which are generally widespread but outside their described range on the east coast of the South Island (St. George, Irwin and Hatch, 1996). The threatened (Category B) mistletoe *Alepis flavida* was found growing on black beech very close to the boundary and is likely to be present within the reserve, although not seen during the survey.

Fauna

Bellbird, South Island fantail, South Island robin and South Island rifleman were found while South Island tomtit, New Zealand pigeon (threatened - Category B), and New Zealand kingfisher have been recorded (New Zealand Wildlife Service, 1983).

The area reportedly supports populations of the carnivorous snail *Wainuia edwardii* (New Zealand Wildlife Survey, 1983) although none were seen during the survey. Recent research has indicated that this species should be treated as a threatened Category C species (Efford, 1997).

German wasps populate much of the black and mountain beech forest.

Possum and sheep sign were present, although the sheep sign was old and confined to margins and easily accessible areas.

Secondary Criteria

Although the reserve lies adjacent to the Kaikoura-Waiau Inland Road much of it is obscured from view, limiting the scenic value. However this accessibility makes it attractive for recreational pursuits and enhances its potential for educational and scientific purposes. This reserve and those nearby at Lottery and Wandle are valuable for scientific and educational purposes as examples of a forest type now rare within Canterbury and South Marlborough.

The forested streams have important catchment values, serving as water storage areas and regulating stream flows.

Selection Criteria

- One of the few beech-podocarp stands left in either the Canterbury or South Marlborough regions.
- Mature forest cover is now rare within the Inland Soft Rock Hill Country land system.
- Intactness values are relatively high, particularly in black (and/or mountain) beech-mixed podocarp-pokaka forest where regeneration is vigorous.
- Several rare or notable species are known to occur either nearby or within the reserve (see above).
- The forest has significant faunal habitat value (see above).

Notes

This reserve was purchased in 1991 after previous moves to have at least some of the area logged. A sheep grazing permit was granted for 30ha of fescue tussock-pasture grassland within the reserve as part of the purchase agreement.

PNA 14 - Wandle Bush Reserve

Grid Reference Centre:	NZMS 260 N32 169538; 176533; 174537
Area:	Approximately 80 ha
Altitudinal Range:	440-560 m
Tenure:	Crown land administered by DOC
Vegetation Types:	3a, 3d, 6b, 8d
Study Area Number:	H18

Land System(s)

Inland soft rock hill country.

Bioclimatic Zone(s)

Lowland.

Ecological Units

- Black beech-rimu forest in gullies and along watercourses.
- Black beech-matai forest on hill side slopes.
- Black beech and black beech-mountain beech forest on spur slopes and ridges.
- Kanuka-manuka low forest on spur slopes and ridges.
- Pasture grassland on ridges and crests.

Landforms

The reserve is composed of three disjunct areas, the largest of which is situated at the head of a tributary to Lottery River and includes the northeast- and southwest-facing forested slopes and valley. The slopes from ridge to valley are generally convex, becoming steep where the stream is incised. Two smaller blocks lie over the ridgeline to the southeast of the larger block in a tributary catchment which flows into the Wandle River. They are part of a substantial forest remnant locally known as Wandle Bush. The terrain is mostly gently rolling hill and spur slopes and gullies.

The geology is Tertiary calcareous siltstone, with much of the area overlain with loess. The reserve is one of few sites where forest-covered soil of the Wandle Group are protected (Arand *et al.*, 1991).

Vegetation and Flora

The values of this reserve are similar to those found at the nearby Lottery Scenic Reserve and Terako Downs Reserve. Kahikatea, matai and, in particular, rimu are scattered throughout the canopy, often emergent in densities which generally increase as drainage becomes poorer. Red beech and, more commonly, pokaka are also canopy components. Secondary even-aged black (and/or mountain) beech forms a closed canopy on steeper mid to upper spur side slopes, associated with a sparse understorey. Older secondary growth and/or primary podocarp-beech forest is typically mixed age with a more open canopy and a prominent understorey containing regenerating canopy species and scattered broadleaved species such as kohuhu, broadleaf and lancewood. The thick shrub layer is dominated by regenerating pokaka, *Coprosma microcarpa*, *C. rhamnoides* and *Neomyrtus pedunculata*. *Microlaena avenacea* is common in the ground tier with scattered seedlings of broadleaved, beech and podocarp species although rimu was notably absent.

Fire-induced manuka-kanuka low forest and scrub borders the beech and beech-podocarp forest on upper spur slopes and ridges. The dense shrub layer contains *Coprosma rhamnoides*, *Leucopogon fasciculatus*, *Cyathodes juniperina* and *Coprosma* aff. *parviflora*. *Uncinia uncinata*, seedling *Coprosma rhamnoides* and pasture grasses dominate below this. More recently burned pasture grassland is present on ridges and crests.

The proportion of pokaka, both regenerating and as a canopy component, is higher in this reserve than was observed at any other locality in the ecological district and the beech-podocarp-pokaka stand was similarly the best seen.

The threatened broom *Notospartium torulosum* (Category B) has been previously recorded (New Zealand Wildlife Service, 1983) but was not seen during the survey. *Thelymitra hatchii* was not found elsewhere in the district although this may be due to a lack of flowering material for positive identification of other *Thelymitra* sightings. *Coprosma ciliata* is uncommon within the district.

Fauna

South Island rifleman, South Island fantail, South Island tomtit, South Island robin and, most commonly, bellbird were seen and/or heard in forested areas. An Australasian harrier was seen in pasture on the reserve boundary. New Zealand pigeon (threatened - Category B) has also been recorded from Wandle Bush and a sighting of tui has been reported (New Zealand Wildlife Service, 1983).

Wasp populations were typically high among black and mountain beech.

Red deer were heard within the reserve and evidence of browsing of both deer and possums was observed.

Secondary Criteria

The fragmented nature of the reserve with small blocks of forest lying within larger tracts means the reserve itself has limited appeal for recreation, particularly as access involves travelling through private farmland.

This reserve and those nearby at Lottery and Terako Downs are valuable for scientific and educational purposes as examples of a forest type now rare within Canterbury and South Marlborough.

The forested catchments have important hydrological values, serving as water storage areas and regulating stream flows.

Selection Criteria

- One of the few beech-podocarp forest stands, protected or otherwise, left in either the Canterbury or South Marlborough regions.
- Mature forest cover is now rare within the Inland Soft Rock Hill Country land system.
- The black (and/or mountain) beech-mixed podocarp-pokaka forest was the best and most intact example observed during the survey with vigorous beech, pokaka, kahikatea and matai regeneration.
- The threatened broom *Notospartium torulosum* (Category B) has been recorded from the reserve in the past. *Coprosma ciliata* is uncommon within the district.
- The forest, both inside and outside the reserve, provides important faunal habitat. The threatened New Zealand pigeon (Category B) occurs here.
- Soils beneath these forest stands have significant value.

Notes

The piecemeal pattern of the reserve is far from an ideal layout, which would include an entire forested catchment, but is a result of historic ownership patterns and land trade-offs.

PNA 15 - Lottery Scenic Reserve

Grid Reference Centre:	NZMS 260 174505; 183503
Area:	109 ha
Altitudinal Range:	280-450 m
Tenure:	Crown land administered by DOC
Vegetation Types:	3a, 3d, 6c, 8c, 8d
Study Area Number:	H16

Land System(s)

Inland soft rock hill country.

Bioclimatic Zone(s)

Lowland.

Ecological Units

- Black beech-mixed podocarp forest on gently rolling hill slopes.
- Mixed podocarp-pokaka-black beech forest on terrace.
- Black-mountain beech forest on dry convex ground on terrace and gently rolling hill slopes.
- Black beech-kahikatea forest in valley head.
- Kanuka-manuka scrub and low forest on gently rolling hill slopes and terraces on tall forest margins.
- Manuka scrub on hill side slope, shoulder slope.
- Mixed shrub-grassland on terrace riser.
- Pasture grassland on terraces and flats.

Landforms

The reserve is essentially comprised of two blocks with the larger block to the west further subdivided into four sections by paper roads. It lies on low rolling hill country and old terraces underlain by calcareous silts and sandstones of Miocene age, and forms part of a Canterbury sequence of sediments including limestone and some volcanics, ranging from Eocene to Pliocene in age (Kelly, 1972). Some old terraces cut in the sediments include a capping of Quaternary glacial outwash debris, and loess is widely distributed.

The reserve has been recognised as having regional significance for its soils (Arand *et al.*, 1991) as it is one of the few sites where Wandle and Lottery soils are protected, and soils under forest in dry parts of the South Island are uncommon.

Vegetation and Flora

Black beech forest merges into and becomes mountain beech forest over an altitudinal gradient. Scattered matai, kahikatea, rimu and pokaka are often associated with the beech to varying degrees on gently sloping ground and terraces where drainage is poor. Some of this forest is either primary or older secondary growth, unquestionably pre-dating European settlement. Along with the nearby Wandle and Terako Downs reserves this is one of the few beech-podocarp stands, protected or otherwise, left in the Canterbury-South Marlborough regions. Primary and/or older secondary growth forest is similarly rare, particularly on lowland terraces and rolling hill country.

Podocarp regeneration, particularly kahikatea and matai, is vigorous in places and, although stock have infiltrated the reserve in places, the naturalness values and condition of the stand is generally high relative to forest remnants in the remainder of the district. The reserve has been fenced since the early 1970's.

Black (and/or mountain) beech-mixed podocarp forest contains kahikatea, matai and rimu, both emergent and combined with beech and pokaka in the canopy. Pokaka forms a significant component on terraces. Marbleleaf and younger kahikatea, matai and beech are prominent in a well-developed understorey. The moderately dense shrub tier contains *Lophomyrtus obcordata*, *Neomyrtus pedunculata*, *Coprosma rhamnoides* and regenerating matai with minor beech, kahikatea and pokaka regeneration. *Microlaena avenacea*, *Uncinia uncinata* and *U. scabra* are prominent in the ground tier with seedlings of matai, kahikatea, *Coprosma propinqua* ssp. *propinqua*, *C. rhamnoides*, *C. aff. parviflora*, *Neomyrtus pedunculata* and *Lophomyrtus obcordata*.

The northern-most corner of the larger block contains a small stand of black beech-kahikatea forest in a basin at the valley head. This is the only location of such a forest type in the district and it is now rare within both Canterbury and South Marlborough.

Forest margins on hill slopes are generally occupied by younger secondary/tertiary black (and/or mountain) beech forest and beyond this, manuka-kanuka scrub and low forest. The beech forest here is generally drier, containing only a minor element of matai and kahikatea in all tiers. Younger beech poles, lancewood, kanuka and *Rubus squarrosus* are the most common understorey species. *Helichrysum lanceolatum*, *Coprosma propinqua* ssp. *propinqua*, *C. rhamnoides*, *Cyathodes juniperina*, and beech regeneration are prominent in the rich shrub tier with minor lancewood, *Leucopogon fasciculatus*, pepper tree, *Corokia cotoneaster*, marbleleaf, kohuhu, *Coprosma* aff. *parviflora* and *C. microcarpa*. The ground tier includes seedlings of canopy, understorey and shrub tier species as well as a variety of other species such as *Asplenium bulbiferum*, *Grammitis magellanica* ssp. *nothofageti*, bracken fern, *Clematis forsteri*, *Uncinia uncinata*, *Microlaena avenacea* and herbaceous weeds such as wall lettuce and catsear.

Kanuka-manuka scrub and low forest are of variable age. Younger stands are dominated by manuka up to 5m tall with occasional kanuka and lancewood in the canopy. A shrub tier of *Leucopogon fasciculatus*, *Coriaria sarmentosa* and *Coprosma rhamnoides* has established, with the ground tier dominated by exotic grasses and weeds.

Some pasture grassland persists in places, most commonly on the terraces, and contains scattered tauhinu, bracken fern, *Juncus gregiflorus*, *J. australis*, and various *Carex* spp.

The filmy fern *Hymenophyllum bivalve* has been recorded from the reserve (Kelly, 1972) but was not found here or elsewhere in the district during the survey. *Coprosma cheesmanii*, and a hybrid between mahoe and swamp mahoe (*Melicytus ramiflorus* x *M. micranthus*) were not recorded elsewhere in the district. *Grammitis magellanica* ssp. *nothofageti* and *Coprosma ciliata* are uncommon within the district.

Fauna

Native bird species recorded here include South Island robin, bellbird, South Island fantail, South Island rifleman, New Zealand pigeon (threatened - Category B), South Island tomtit, and grey warbler. Other native species to be recorded from here previously include shining cuckoo and silvereye (Kelly, 1972), Australasian harrier and paradise shelduck (New Zealand Wildlife Service, 1983).

The carnivorous snail *Wainuia edwardii* has been recorded here (New Zealand Wildlife Service, 1983) although it was not seen during the survey. Recent research has indicated that this species should be treated as a threatened Category C species (Efford, 1997).

Upland bully (*Gobiomorphus breviceps*) has been recorded in the tributary stream within the reserve (Kelly, 1972).

The density of black and mountain beech has meant that German wasp populations are high.

Secondary Criteria

Scenic values are more evident for the eastern block of the reserve which is visible from the Waiau-Kaikoura Inland Road.

This reserve and those nearby at Wandle and Terako Downs are valuable for scientific and educational purposes as examples of a forest type now rare within Canterbury and South Marlborough.

The forested streams have important catchment values, serving as water storage areas and regulating stream flows.

Selection Criteria

- One of the few beech-podocarp stands left in either the Canterbury or South Marlborough regions.
- Primary and/or older secondary growth forest is similarly rare, particularly on lowland terraces and rolling hill country.
- The small stand of black beech-kahikatea forest is the only location of such a forest type in the district and it is now very rare within both Canterbury and South Marlborough.
- Intactness values are relatively high and matai and kahikatea regeneration strong with the reserve having been fenced since the early 1970's.
- A number of rare or notable plants occur within the reserve (see above).

- The area has significant faunal habitat value (see above).
- Soils have been recognised as having regional importance (see above).

Notes

Fencing does not always correspond to ownership, instead tending to follow forest margins.

PNA 16 - Ngaroma Scenic Reserve

Grid Reference Centre:	NZMS 260 O32 370510
Area:	89 ha
Altitudinal Range:	170-300 m
Tenure:	Crown land administered by DOC
Vegetation Types:	3a, 3d, 5c, 6a, 6b, 7, 8d, 10a, 13
Study Area Number:	H9, H33

Land System(s)

Inland greywacke hill country; Northwest outwash deposits and local alluvium (minor).

Bioclimatic Zone(s)

Lowland.

Ecological Units

- **Black beech-mixed podocarp forest on terraces and gently rolling toe slopes.**
- **Black beech forest on lower hill slopes, gullies, terrace risers and valleys.**
- Mixed broadleaved shrubland on cliff toe slope.
- Willow scrub on river banks.
- Kanuka low forest and scrub on toe slopes and river margins.
- Manuka shrubland and scrub on hill slopes, toe slopes and terrace.
- Mixed shrub-rockland and rockland on cliffs and bluffs.
- Bracken fernland on hill slopes, cliff faces and alluvial flats.
- European broom-mixed pasture grass shrub-grassland on hill slopes, cliff faces and alluvial flats.
- Harakeke-mixed pasture grass flax-grassland on cliff faces.

Landforms

Landforms are comprised of Mesozoic greywacke hill slopes, incised V-shaped valleys, toe slopes and the terrace bordering the banks of the Conway River. A small section of riverside alluvial terrace is present in the northern portion of the reserve. Moderately thick layers of loess cover much of the area, particularly where slopes are gentle.

This reserve has been identified as having regional importance for soil values as possibly the only remaining example of Hundalee soils under native vegetation (Arand et al., 1991).

Vegetation and Flora

Most of the forest on the terrace and gently rolling toe slopes comprises older secondary growth of mixed age. The area has been logged for totara and rimu in the 1900's (Jane, 1987). A relatively open canopy contains kahikatea (particularly in poorly drained areas), matai and over-mature black beech (tending to mountain beech in places) emergent over mature beech and pokaka. The most common understorey and shrub species are marbleleaf, *Lophomyrtus obcordata*, lancewood, *Coprosma linariifolia*, *C. rhamnoides* and regenerating black beech, pokaka, and matai. *Microlaena avenacea* and *Uncinia uncinata* are frequent in the ground tier with seedlings of the common tree and shrub species. Mixed-age black beech forest (primary or older secondary) occurs on southeast-facing terrace risers in the downstream portion of the reserve. A relatively open black beech canopy includes minor kohuhu, marbleleaf and lancewood. *Corokia cotoneaster*, *Coprosma rhamnoides* and *C. propinqua* ssp. *propinqua* are common in the shrub tier with minor *Cyathodes juniperina* and scrambling *Rubus cissoides*. A relatively barren ground tier most frequently contains seedlings of lancewood, *Corokia cotoneaster* and *Coprosma rhamnoides* with *Polystichum richardii*, *Asplenium terrestre* ssp. *terrestre* and *Ranunculus reflexus*.

Younger secondary or tertiary black beech forest (tending to mountain beech in places) is apparent on the toe slopes and terrace surrounded by and close to the margins of older beech-podocarp-pokaka forest. The dense canopy overlays a moderately sparse understorey of kanuka, lancewood and marbleleaf; a similarly sparse shrub layer of *Cyathodes juniperina*, *Coprosma rhamnoides* and lancewood; and a fairly barren ground tier notable for the presence of matai seedlings in good numbers.

Black beech forest (tending to mountain beech in places) on upper valley sides appears to be of an age intermediate of those above, suggesting a history of patchwork logging and burning within the area. The canopy is relatively even-aged although not closed, allowing the formation of a well-defined shrub tier featuring *Coprosma rhamnoides*, *C. linariifolia*, *Cyathodes juniperina*, *Corokia cotoneaster*, *Melicope simplex* and regenerating beech. Seedlings of the common tree and shrub species are present in a typically sparse ground tier.

Kanuka scrub along river margins contains a shrub tier of *Coprosma rhamnoides*, *Cyathodes juniperina* and *Corokia cotoneaster*, with *Olearia paniculata*, *Hebe traversii*, *Helichrysum lanceolatum* and scrambling *Rubus cissoides*. The sparse ground cover includes *Polystichum richardii* and *Asplenium flabellifolium*.

A mixed shrubland is present on cliff toe slopes and gentler, stable cliff faces. Kohuhu and kanuka are common species with lesser amounts of *Cordyline australis*, *Coriaria sarmentosa* and kowhai. A mosaic of bracken fernland, European broom-mixed pasture grass shrub-grassland, and harakeke-mixed pasture grass flax-grassland are present on more recently disturbed hill slopes, cliff faces and alluvial flats.

Most of the manuka shrubland and scrub which exist on forest fringes is relatively young (3-4m tall) and contains a thick sward of exotic grass.

Mixed shrub-rockland and rockland on cliffs and bluffs commonly contains a combination of manuka, kanuka, kowhai, *Olearia paniculata*, *Cordyline australis*, *Coprosma robusta*, *C. rhamnoides*, *C. propinqua* ssp. *propinqua*, *C. rigida*, *C. crassifolium*, *Helichrysum lanceolatum*, *Corokia cotoneaster*, *Coriaria sarmentosa*, *C.*

arborea, European broom, *Pachystegia* sp. 'A', *Brachyglottis monroi*, Marlborough lilac, browntop, sweet vernal, and Yorkshire fog.

The presence of the locally occurring fierce lancewood in kanuka scrub, and the threatened *Coprosma wallii* (Category B) amongst mixed shrub-rockland on cliffs and bluffs are noted from a previous report (Jane, 1987). Neither species was detected from this area during the survey. Fierce lancewood was seen in a few scattered localities throughout the district. *C. wallii* was not seen elsewhere in the district. *Carex lambertiana* and *Grammitis ciliata* were not seen in the ecological district while *Uncinia angustifolia* was only found in one other locality (the nearby Waingaro QEII covenant). Sightings of these three species possibly represents a new northern and eastern limit on the east coast of the South Island. Species endemic to the South Marlborough area which occur here include *Pachystegia* sp. 'A', Marlborough lilac and *Brachyglottis monroi*.

The reserve has been fenced since 1992.

Fauna

South Island fantail, South Island robin, South Island tomtit, bellbird and New Zealand pigeon (threatened - Category B) were seen in the forest while a New Zealand falcon (threatened - Category B) was observed close by. Other species recorded from the vicinity include brown creeper, South Island rifleman, and Australasian harrier (New Zealand Wildlife Service, 1983).

Wasps were commonly found on black beech.

Secondary Criteria

Isolation and the relatively small size makes the reserve unattractive for recreation. Potentially the area has educational and scientific value as one of the few beech-podocarp stands remaining in either Canterbury or South Marlborough.

Selection Value

- One of the best black beech-mixed podocarp-pokaka stands in the district and the only one to occur largely on the Inland Greywacke Hill Country land system.
- Beech-podocarp forest is now rare in both Canterbury and South Marlborough.
- The reserve contains a number of rare or notable plant species (see above).
- The reserve provides valuable habitat for a variety of fauna (see above).
- Soils have been recognised as having regional importance (see above).

PNA 17 - Limestone Creek Scenic Reserve

Grid Reference Centre:	NZMS 260 O32 462488
Area:	4 ha
Altitudinal Range:	100-122 m
Tenure:	Crown land administered by DOC
Vegetation Types:	3a, 5c, 10a
Study Area Number:	H4

Land System(s)

Inland greywacke hill country.

Bioclimatic Zone(s)

Lowland.

Ecological Units

- Black beech forest on hill slope and terrace.
- Fivefinger-*Coprosma* low forest on steep valley sides.
- Bracken fern-mixed pasture grassland on toe slopes.

Landforms

The area is comprised of Mesozoic greywacke lower hill slopes, a small area of terrace, and the banks of a steeply incised stream. It is one of the few remnants of Hurunui soils under beech forest in Southern Marlborough and as such is recognised as significant (Arand et al., 1991).

Vegetation and Flora

Once common, lowland black beech forest is now sparsely distributed in the district and not well represented within the existing reserve network. The forest in the reserve is secondary and of mixed age with the canopy averaging 20m. Vigorous regeneration, particularly of fivefinger at sub-canopy and shrub level, has proven the effectiveness of the fencing. Minor understorey species include young black beech poles, marbleleaf, broadleaf and scrambling *Rubus cissoides*. *Coprosma robusta*, *C. crassifolia* and *Cyathodes juniperina* are present with fivefinger and regenerating black beech in the dense shrub tier while *Uncinia fuscovaginata*, *Blechnum minus* and seedling shrub and tree species are conspicuous in a sparse ground tier.

Coprosma grandifolia occurs close to its southern limits in the reserve. The threatened (Category B) yellow mistletoe, *Alepis flavida*, has been reported from here (Williams, 1982), but was not seen during the survey.

Fauna

Native bird species recorded in the Limestone Creek-Peaked Hill area include grey warbler, bellbird, South Island tomtit, silvereye and the threatened New Zealand pigeon (Category B) (New Zealand Wildlife Service, 1983).

Secondary Criteria

The scenic value is significant as it is the first area of native forest by State Highway No.1 travelling north from Christchurch.

Selection Criteria

- One of the most intact stands of beech forest seen in the ecological district, doubtless as a result of fencing.
- The vegetation here is representative of a forest type once common within the district but which is now much reduced in extent.

- *Coprosma grandifolia* is at or close to its southern limit here.
- As part of the Limestone Creek-Peaked Hill forest remnant it provides faunal habitat to a variety of species including the threatened New Zealand pigeon (Category B).

Notes

The viability of this reserve is affected by its small size which makes it vulnerable to weed infestation and edge effects.

PNA 18 - Hopefield QEII Covenant

Grid Reference Centre:	NZMS 260 N32 239451
Area:	20 ha
Altitudinal Range:	200-300 m
Tenure:	QEII Covenant on private land
Vegetation Types:	5f, 6a, 8d, 10a
Study Area Number:	H26

Land System(s)

Inland soft rock hill country.

Bioclimatic Zone(s)

Lowland.

Ecological Units

- Kowhai forest and treeland on hill slope.
- Manuka scrub on hill slope and ridge.
- Mixed shrub-bracken fern-pasture grassland on hill slope and gullies.
- Pasture grassland on ridge.
- Sparsely vegetated loamfield on recent slip sites.

Landforms

The covenant lies on a west- to north-facing, moderate to steep hill slope from ridgeline to gully bottom beside a tributary to Stanton River. The substrate is Early Tertiary marine sandstone and siltstone with conglomerate bands.

Vegetation and Flora

This is the best stand of kowhai seen in the ecological district. Little of this vegetation type remains regionally in either Canterbury or South Marlborough, as it occurs largely as induced forest on rolling hill country of sandstone and siltstone, most of which has been converted to pasture.

Cabbage tree, manuka, tauhinu, matagouri and *Coprosma propinqua* ssp. *propinqua* are the principal tree and shrub species associated with kowhai where the canopy is open. A thick pasture grassland sward dominates the ground tiers. Vegetation under a closed canopy is sparse and has been adversely affected by stock grazing and pigs in the past. However the covenant has been formalised only recently and recovery time

has thus far been short. A few scattered black beech are emergent on upper hill slopes.

Mixed shrub-bracken fern-pasture grassland contains scattered native shrub and tree species such as *Coprosma robusta*, cabbage tree, manuka, *Olearia paniculata* and *O. avicenniifolia*. Broom, briar and blackberry are also common throughout this ecological unit.

Olearia avicenniifolia is uncommon in the ecological district.

Fauna

Paradise shelduck and South Island fantail were seen in and around the covenant along with chaffinch (*Fringilla coelebs gingleri*), magpie (*Gymnorhina tibicen hypoleuco*) and Californian quail.

Pig rooting and browsing was commonly seen under the closed kowhai canopy and, along with stock browsing, has caused extensive damage. Animal control measures coupled with fencing, however, will alleviate this problem and allow the understorey to recover in due course.

Secondary Criteria

Scientific and educational value must be attached to the area as it is one of the few kowhai forest stands in either Canterbury or South Marlborough.

Selection Criteria

- This was the best stand of kowhai seen in the ecological district and the only one of significant size.
- Little of this vegetation type remains regionally in either Canterbury or South Marlborough.
- *Olearia avicenniifolia* is uncommon in the ecological district.

PNA 19 - Waingaro QE II Covenant

Grid Reference Centre:	NZMS 260 032 345445
Area:	20 ha
Altitudinal Range:	120-180 m
Tenure:	QEII Covenant on private land
Vegetation Type:	3a, 3d, 8c, 8d, 11
Study Area Number:	H10

Land System(s)

Inland soft rock hill country.

Bioclimatic Zone(s)

Lowland.

Ecological Units

- Black beech-matai-kahikatea forest on alluvial terrace and toe slope.
- Black beech forest on hill slopes.

- *Carex secta* sedgeland on seepage.
- Mixed shrub-grassland on hill slopes.
- Pasture grassland on stream bed and alluvial terrace.

Landforms

The covenant includes a section of Waingaro Stream and the northeast- and southwest-facing lower hill slopes either side of it. Recent streamside alluvial flats toe slopes and terraces are overlain by loess where slopes are gentle. Massive to laminated Tertiary grey marine siltstone underlies the hill slopes.

Vegetation and Flora

The concentration of podocarp species is highest on the small areas of unlogged alluvial terraces and toe slopes. Here primary or older secondary growth forest is dominated by emergent kahikatea and matai with an open canopy of mixed-age black beech. Understorey species include marbleleaf and lancewood with younger kahikatea and matai, and climbers such as supplejack and *Rubus schmidelioides*. Kowhai is prominent towards the margins. A moderately dense shrub tier contains *Corokia cotoneaster* and *Coprosma rotundifolia* with minor *Coprosma rhamnoides* and *C. crassifolia*. *Polystichum vestitum* and *P. richardii* are the most common ferns while a wide variety of seedlings may be found at ground level.

A few scattered podocarp species, including matai, kahikatea and lowland totara occur in black beech forest on steeper hill slopes. The forest is of mixed age, either older secondary or primary. The understorey is sparse while the shrub layer is moderately dense, the most common species being *Corokia cotoneaster*, *Pittosporum divaricatum*, *Lophomyrtus obcordata*, *Cyathodes juniperina* and *Coprosma rhamnoides*. A variety of seedlings, including matai, are scattered amongst a fairly sparse ground tier.

A small stand of modified *Carex secta* sedgeland occurs on a seepage, bordered either side and downhill by black beech forest, and uphill by mixed shrub-pasture grassland. Past grazing along with weed and pasture infiltration have meant that the inter-tussock spaces are largely exotic.

Mixed shrub-pasture grassland on hill slopes contains, in various combinations, tauhinu, *Carmichaelia australis*, kanuka, manuka, *Coprosma propinqua* ssp. *propinqua*, briar, bracken fern, *Juncus effusus*, and a mixture of introduced pasture grasses such as cocksfoot, Yorkshire fog, browntop and sweet vernal.

Seedlings and young shrubs of *Coprosma obconica* ssp. *obconica* are present and this was the only location where it was seen during the survey. This is a nationally rare species, although not listed as threatened. Swamp mahoe is rare in both South Marlborough and Canterbury, and was found in only one other locality (Ferniehurst Bush). *Unicinia angustifolia* was found from only one other location within the ecological district (Ngaroma Scenic Reserve).

Fauna

South Island fantail and bellbird were present.

German wasps were prolific on black beech.

Sheep were seen roaming through the covenant, doubtless gaining access through the weak points in the fencing system, over and around the stream, which are washed out periodically. Cattle are grazed in adjacent areas and would be very damaging if they gained entrance, particularly in the accessible alluvial podocarp forest areas.

Secondary Criteria

Easy access would make the area ideal for scientific and educational purposes with black beech-podocarp forest now regionally rare in both Canterbury and South Marlborough.

Selection Criteria

- Black beech-podocarp forest is now regionally rare in both Canterbury and South Marlborough.
- One of the best stands of older secondary/primary black beech forest seen during the survey.
- Natural forest cover is now rare within the Inland Soft Rock Hill Country land system.
- Rare and notable plant species occur within the covenant (see above).

PNA 20 - Le Cren QE II Covenant

Grid Reference:	NZMS 260 N32 275442
Area:	22 ha
Altitudinal Range:	240-310 m
Tenure:	QEII Covenant on private land
Vegetation Type:	6c, 11
Study Area Number:	H22

Land System(s)

Inland greywacke hill country; Inland soft rock hill country.

Bioclimatic Zone(s)

Lowland.

Ecological Units

- Manuka scrub on hill slope.
- *Carex secta* sedgeland on seepages.

Landforms

The covenant is situated on an east-facing slope on gently rolling hill country. It straddles rock types of Mesozoic greywacke and Mesozoic calcareous siltstone and sandstone which are overlain with loess.

Vegetation and Flora

The area contains fire-induced manuka-kanuka scrub which has been fenced since 1984 and provides a useful yardstick with which to compare unfenced scrub of similar age present throughout the district.

The exclusion of stock has meant that pasture grasses and weeds have become common, particularly as the manuka-kanuka canopy has not yet closed. Some canopy damage appears to have occurred as a result of snow lie. Blackberry, Himalayan honeysuckle, briar and a variety of exotic herbs and grasses are present. Native shrub species competing with weeds include *Coprosma rhamnoides*, *C. 'tayloriae'*, *C. propinqua* ssp. *propinqua*, *Cyathodes juniperina*, *Gaultheria antipoda* and *Leucopogon fasciculatus* while bracken fern and tall pasture grasses and herbs dominate the lower tiers.

Small seepage areas contain *Carex secta* sedgeland, although much of this ecological unit occurs outside the covenant. The sedgeland is highly modified with extensive weed and pasture grass infestation.

Olearia avicenniifolia is uncommon in the ecological district.

Fauna

Bellbird, South Island fantail, and paradise shelduck were seen and heard in the area during the survey.

Fencing appears to be effective with no sign of stock grazing.

Secondary Criteria

The covenant has scientific and educational values as a yardstick for manuka-kanuka regeneration with the exclusion of stock.

Selection Criteria

- The fire-induced manuka-kanuka scrub which occurs within the covenant, has been fenced since 1984 and as such provides a representative yardstick with which to compare unfenced scrub of similar age which occurs throughout the district.
- Native vegetation cover within the Inland Soft Rock Hill Country is now uncommon.
- *Olearia avicenniifolia* is uncommon in the ecological district.

PNA 21 - Conway River Scenic Reserve

Grid Reference Centre:	NZMS 260 032 482440
Area:	7 ha
Altitudinal Range:	0.5-5 m
Tenure:	Crown land administered by DOC
Vegetation Types:	5a, 7, 8d, 14
Study Area Number:	H14

Land System(s)

Northwest outwash deposits and local alluvium.

Bioclimatic Zone(s)

Coastal.

Ecological Units

- Mixed broadleaved scrub and treeland on coastal alluvial terrace and scarp.
- *Acacia dealbata* forest and treeland on coastal alluvial terrace.
- **Mixed grass-rushland on coastal alluvial terrace.**
- **Pasture grassland on coastal alluvial terrace.**

Landforms

A recent alluvial terrace at the mouth of the Conway River bordering the lagoon on the landward side. The reserve includes part of a scarp separating this terrace from one of a series of coastal marine terraces which extend north to the Haumuri Bluffs.

Vegetation and Flora

The broadleaved scrub and treeland is dominated by ngaio on the terrace and mahoe on the scarp. The most common associate species include tree fuchsia, broadleaf, red mapou, kowhai, cabbage tree, and manuka with much of the vegetation cloaked in *Muehlenbeckia australis*. Indigenous coastal alluvial vegetation is now rare both on a district and regional basis. Because the area is leased for grazing there is virtually no regeneration.

The grass-rushland contains a largely introduced mix of *Festuca arundinacea*, *Juncus articulatus*, *J. filicaulis* and the native *Isolepis nodosa*. The remaining communities are dominated by introduced trees and grasses.

Fauna

The reserve may be used by some of the numerous bird species which inhabit the lagoon and river mouth, otherwise its value appears limited.

Secondary Criteria

There is currently an economic value attached to the reserve as it is leased for grazing to an adjacent landowner.

Selection Criteria

- The only representation of coastal alluvial scrub in the district
- The reserve could potentially be linked with the lagoon and its associated communities providing a buffer to this regionally important wetland.

Notes

The degenerated state of the remaining scrub and treeland, coupled with the current grazing lease, means that the remaining native scrub and treeland won't last beyond the life of the existing mature trees.

OTHER RESERVES AND PROTECTED LAND

Other areas present within the ecological district are protected or administered by the Department of Conservation but do not have intrinsic ecological values. These are listed below:

- Stream draining Lake Rotorua (NZMS 260 O31 578653).
- Crown Land (passing through - Parititahi) (NZMS 260 O31 575622).
- Goose Bay-Omihi Recreation Reserve (leased) (NZMS 260 O32 533585).
- Goose Bay-Omihi caretakers house (leased) (NZMS 260 O32 534587).
- Crown Land (Omihi) (NZMS 260 O32 527566).
- Historic Reserve (Omihi) (NZMS 260 O32 526565).
- Crown Land (Oaro Beach) (NZMS 260 O32 518552).
- Oaro River Scenic Reserve. (NZMS 260 O32 506541). 32 ha
- Oaro Recreation Reserve (NZMS 260 O32 513544).
- Conservation Land - Oaro River (NZMS 260 O32 513544).
- Lyford Recreation Reserve. (NZMS 260 N32 222581). 1.9 ha.
- Hundalee Recreation Reserve. (NZMS 260 O32 385552). 1.7 ha.
- Claverley Conservation Land. (NZMS 260 O32 497472). 3.2 ha.
- Lake Rotoiti Marginal Strip. (NZMS 260 O31 589676)
- Kahutara River Marginal Strip. In three parts. (NZMS 260 O31 543687). 46 ha.
- Kahutara River tributary Marginal Strip. (NZMS 260 O32 466700). 15 ha.
- Sawyers Creek Marginal Strip. (NZMS 260 O31 459699). 24 ha
- Greenburn River Marginal Strip. (NZMS 260 O31 455672). 9 ha.
- Charwell River Marginal Strip. (NZMS 260 O31 398650). 1 ha.
- Conway River Marginal Strip. (NZMS 260 O32 320588).
- Hundalee Stream Marginal Strip (NZMS 260 O32 447463).
- Bourne Stream Marginal Strip. (NZMS 260 N32 197411).
- Stanton River Marginal Strip. (NZMS 260 N32 224424).
- Pariwhakatau Pa (NZMS 260 O32 495464).

5. Recommended Areas for Protection

5.1 INTRODUCTION

Descriptions of recommended areas for protection are given below. Note that the vegetation types given in each ecological units section in this chapter may be narrower and more closely defined than the broader vegetation types described in Chapter 3.5.2, and given in the summary heading for each RAP. Some types may represent an intergrade of two others. Where this occurs, both have been included in the summary heading.

The principal species which typify a vegetation type are described below within broad tiers to give an indication of the characteristic structure. The ground tier is comprised of species occurring below 30cm while the shrub tier lies between 30cm and 2m. The understorey may be of variable height between the canopy and shrub tier. Minor species are those whose mean cover is 1-5% within a given tier. Species whose cover is less than 1% are excluded from the descriptions.

The categories used for threatened species are described in Chapter 3.7.1.

Ecological units highlighted in bold font indicate the principal vegetation type(s) within the area.

5.2 RECOMMENDED AREAS FOR PROTECTION

RAP 1 - Linton Creek

Grid Reference Centre:	NZMS 260 O31 499700
Area:	5 ha
Altitudinal Range:	150-170 m
Tenure:	Private
Vegetation Type:	6b, 6c
Study Area Number:	K14

Land System(s)

Northwest outwash deposits and local alluvium.

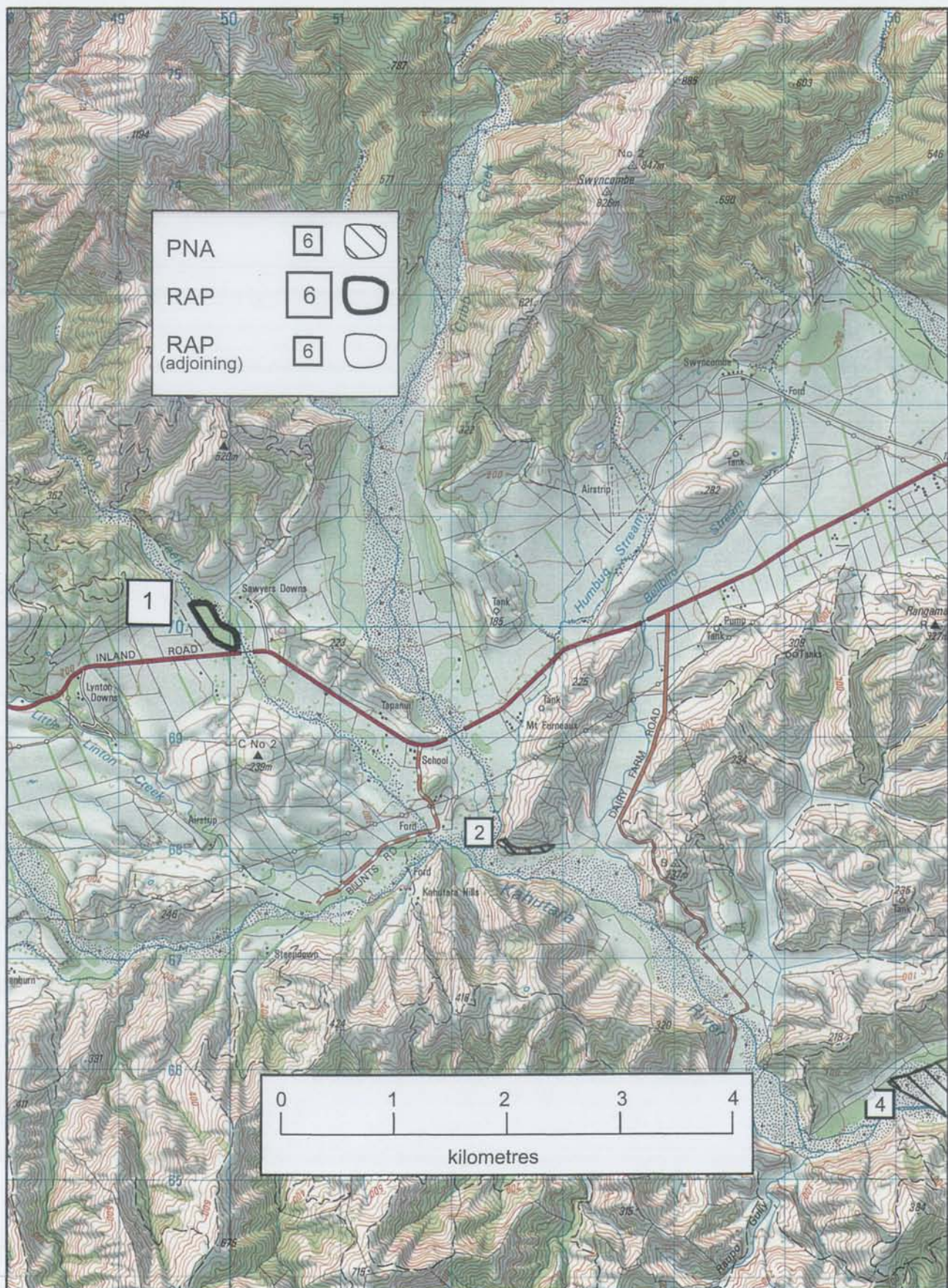
Bioclimatic Zone(s)

Lowland.

Ecological Units

- **Kanuka low forest on low terrace.**
- Kanuka-manuka low forest on low terrace.

Map 5 Recommended Areas for Protection - 1



Landforms

The area forms part of a low alluvial terrace on the true right of Linton Creek. It is prone to flooding, and erosion of the terrace margin occurs where the terrace forms the river bank adjacent to one of the principal active river channels.

Vegetation and Flora

Induced kanuka low forest forms a dense even-aged canopy with few other species in abundance above the moderately sparse shrub tier. *Coprosma propinqua* ssp. *propinqua* and *C. rhamnoides* with younger kanuka are prominent here, while the largely exotic ground tier is relatively dense with *Brachypodium sylvaticum* the dominant species. White clover is also common with minor sweet vernal, Yorkshire fog, browntop, wall lettuce, catsear, *Hieracium pilosella* and seedlings of *Coprosma propinqua* ssp. *propinqua*, *C. rhamnoides*, and kanuka. Manuka becomes a component in all tiers near margins.

Threats include the common shrub and herb species populating the river plain, particularly European broom and *Buddleja davidii*, which become established in canopy gaps and on margins. Introduced pasture grasses, in particular *Brachypodium sylvaticum*, are widespread on the forest floor.

Fauna

South Island fantail and bellbird were observed within the kanuka forest.

The area is partially fenced but still accessible to stock. However, the most severe browsing appears to come from rabbits which were common at the time of survey.

Secondary Criteria

The native vegetation cover provides stabilisation for the portion of terrace on which it occurs, particularly where it forms the river bank.

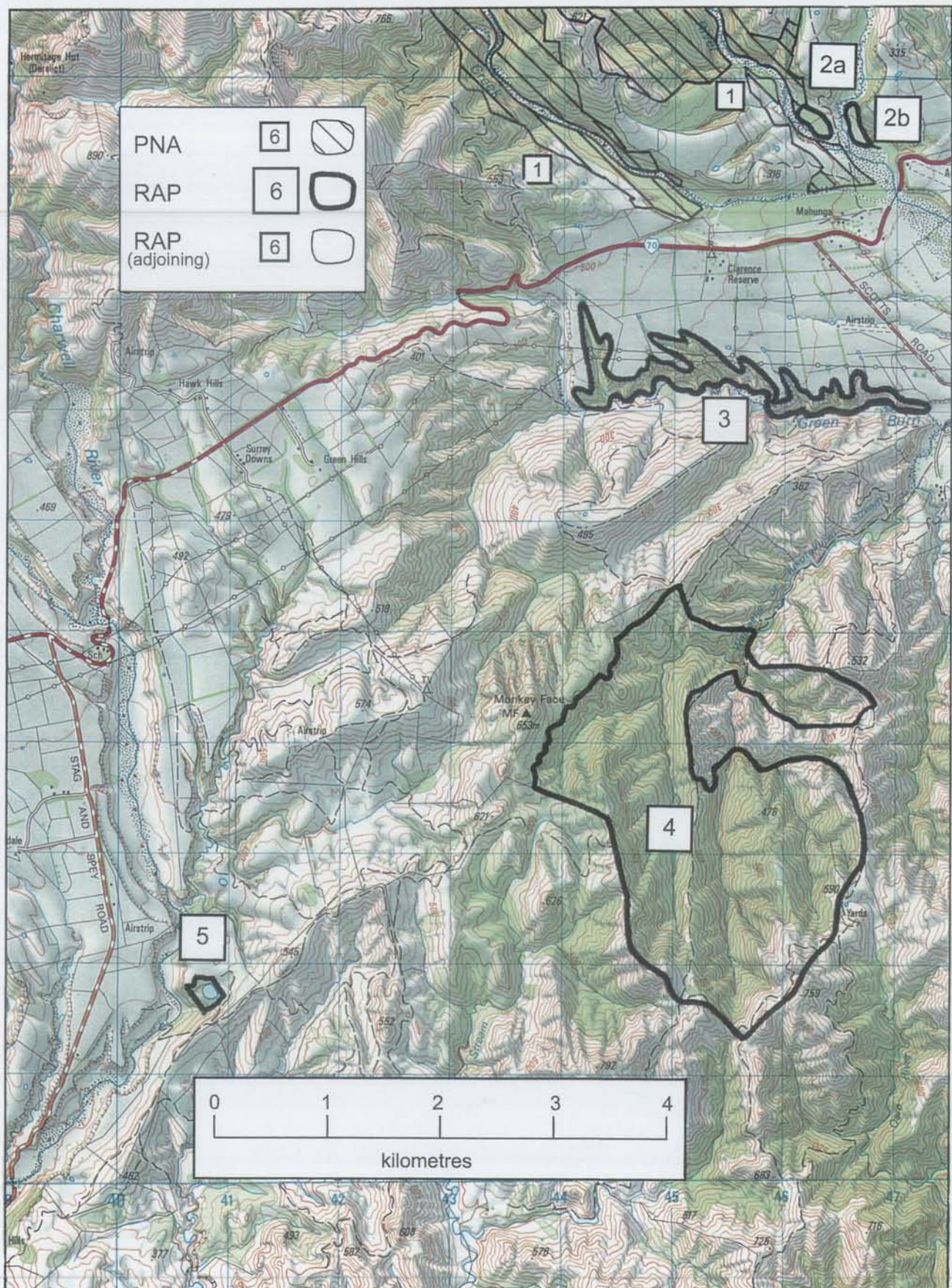
Selection Criteria

- Natural riverine processes which characterise these communities such as flooding, silt deposition and active channelisation, are still operating within the area.
- Native forest cover on alluvium is now regionally rare in both Canterbury and South Marlborough, and this area represents one of the few stands remaining within the ecological district.

Notes

In the absence of grazing and an anticipated drop in rabbit numbers as a result of the RCD virus, and given a sufficient seed source to allow recruitment from nearby podocarp-broadleaved forest, the area should be able to regenerate by itself.

Map 6 Recommended Areas for Protection - 2a, 2b, 3, 4, 5



RAP 2 - Kahutara River

Grid Reference Centre:	NZMS 260 O31 467696
Area:	4.5 ha (a = 1.5, b = 3)
Altitudinal Range:	180-210 m
Tenure:	Private
Vegetation Type:	6a, 6b, 6c, 8d, 15
Study Area Number:	K12

Land System(s)

Northwest outwash deposits and local alluvium.

Bioclimatic Zone(s)

Lowland.

Ecological Units

- Kanuka low forest and scrub on low terraces and flats.
- Kanuka-manuka low forest and scrub on low terraces and flats.
- Manuka scrub and shrubland on floodplain, flats and low terraces.
- Mixed pasture grassland on low terrace.
- Gravelfield on river channels.

Landforms

Two discrete segments of low terraces, flats and floodplain of the Kahutara River near the confluence with Sawyers Creek. A thin layer of loess covers the slightly older terraces, less prone to flooding events.

Vegetation and Flora

The low terrace at section (a) contains kanuka low forest up to 9m, tending to scrub in places, which contains a moderately dense canopy with minor kowhai, kohuhu, and *Cordyline banksii*. A moderately sparse understorey is comprised of scattered kanuka, kohuhu, kowhai and *Clematis forsteri*. The shrub tier is slightly more developed, containing *Coprosma rhamnoides* with minor *C. propinqua* ssp. *propinqua*, *Corokia cotoneaster*, matagouri, young kowhai and blackberry. *Brachypodium sylvaticum* dominates a dense, largely exotic ground tier in association with sweet vernal, ragwort, and *Muehlenbeckia axillaris* with minor Yorkshire fog, catsear and *C. rhamnoides* seedlings.

The kanuka canopy at section (b) reaches 10m in places and generally contains no other associates. The understorey contains kanuka and manuka, with minor kowhai and European broom. The shrub tier is moderately dense, containing largely European broom with *Coprosma rhamnoides*, kanuka and minor *Corokia cotoneaster*, *Cyathodes juniperina*, manuka and kowhai. *Brachypodium sylvaticum* dominates a ground tier which is largely comprised of a variety of introduced seedlings, grasses and herbs. The most prominent native species are *Stellaria decipiens* and seedlings of *C. rhamnoides* and kanuka.

The manuka scrub and shrubland canopy is dense and contains minor kanuka while the shrub tier also contains young kanuka and minor tree tutu. Seedlings of these two species are also frequent in the ground tier with minor *Muehlenbeckia axillaris*, *Epilobium numulariifolium*, wall lettuce, catsear, ragwort and *Hieracium pilosella*.

Two mature individuals of the nationally local *Pseudopanax ferox* were found among the kanuka understorey in section (b)

Weeds along with cattle grazing pose the most serious risk to regeneration, particularly in section (b) where the open nature of the canopy allows an influx of European broom and pasture grasses.

Fauna

The forest and scrub provides habitat for a multitude of bellbirds.

Cattle graze on the floodplain, although damage appears to be restricted to forest and scrub margins. Rabbits were bountiful at the time of survey and provided the main browsing threat to the vegetation.

Secondary Criteria

The native vegetation cover provides stabilisation for the portion of terrace on which it occurs, particularly where it forms the river bank.

Selection Criteria

- Natural riverine processes which characterise these communities such as flooding, silt deposition and active channelisation, are still operating within the area.
- Native forest and scrub cover on alluvium is now regionally rare in both Canterbury and South Marlborough, and this represents one of the few remaining areas in the ecological district.
- *Pseudopanax ferox* occurs locally on a national level and is uncommon in the ecological district.

Notes

Over time, with the removal of stock and an anticipated drop in rabbit numbers as a result of the RCD virus, all areas have the potential to regenerate given the immediate proximity to a podocarp-broadleaved seed source. Although small and fragmented, both of the component stands are adjacent to, and would enhance existing alluvial forest in the Clarence Reserve.

RAP 3 - Green Burn

Grid Reference:	NZMS 260 O31 455673
Area:	65 ha
Altitudinal Range:	160-260 m
Tenure:	Private
Vegetation Types:	3a, 5c, 6a, 6b, 7, 8d, 9, 10
Study Area Number:	N16

Land System(s)

Northwest outwash deposits and local alluvium; Inland soft rock hill country.

Bioclimatic Zone(s)

Lowland.

Ecological Units

- **Black beech-mixed broadleaved forest and scrub on terrace riser, gullies and riparian zone.**
- **Fivefinger-mixed broadleaved low forest and scrub on terrace riser, gullies and riparian zone.**
- Mixed broadleaved low forest and scrub on scarp, gullies and terrace riser.
- Kanuka low forest and scrub in gullies, on terrace riser, shoulder slopes and convex slopes.
- Manuka shrubland on scarp and terrace riser.
- Marlborough rock daisy rockland on bluff and terrace riser.
- Gorse shrubland on scarp.
- European broom on scarp and terrace riser.
- Bracken fernland on scarp and terrace riser.
- Mixed pasture grassland in gullies, scarp, on terrace riser and floodplain.

Landforms

The area is comprised of the terrace riser, gullies, scarps and bluffs along a section of the true right of Green Burn, near its confluence with Kahutara River.

Geological composition comprises a seam of Tertiary limestone which runs through the centre of the area, separating Mesozoic flint beds and argillite to the east, and Quaternary undifferentiated glacial outwash gravels to the west.

Vegetation and Flora

A mosaic of natural, semi-natural and exotic vegetation types occur within the area and are dependent upon the geology, aspect, slope, and historical disturbance pattern.

Black beech-mixed broadleaved forest of varying age is present on the drier slopes of the flint and argillite substrate in the east of the area. Fivefinger, tree fuchsia and mahoe are the most common broadleaved associates. Species richness is at a maximum in the riparian zone where other canopy and understorey species include *Cordyline australis*, *Coprosma robusta*, marbleleaf, kohuhu, *Olearia paniculata*, kanuka, red mapou, kowhai and *Rubus cissoides*. The shrub tier contains *Helichrysum lanceolatum*, *Hebe stricta*, *H. traversii*, *Cyathodes juniperina* and *Coprosma rhamnoides*. *Astelia fragrans* and *Polystichum richardii* are the most common ground tier species where the canopy is closed. Fivefinger-mixed broadleaved low forest and scrub tend to occupy concave slopes and forest margins. Kanuka forms stands at gully heads and on convex slopes and shoulder slopes. Canopy gaps and more recently disturbed areas may contain European broom

shrubland, gorse shrubland, mixed pasture grassland, bracken fernland or regenerating broadleaved scrub, typically dominated by fivefinger, *Coprosma robusta*, tree fuchsia and *Muehlenbeckia australis*.

Marlborough rock daisy (*Pachystegia* sp. 'A') rockland occurs on dry limestone bluffs and rocky faces. Other species include *Olearia paniculata*, *Coprosma propinqua* ssp. *propinqua*, *C. robusta*, *C. robusta* x *C. propinqua* ssp. *propinqua*, matagouri, manuka, gorse, hawthorn, *Coriaria sarmentosa*, Marlborough lilac, *Brachyglottis monroi*, wharariki, *Clematis forsteri* agg., *Muehlenbeckia complexa*, *Linum monogynum*, *Gingidia montana*, *Epilobium glabellum*, self heal, oxeye daisy and *Clinopodium vulgare*.

Mixed broadleaved forest on glacial outwash gravel faces contains mostly fivefinger, tree fuchsia, mahoe, *Olearia paniculata* and marbleleaf as canopy species with minor broadleaf and lemonwood. Kanuka low forest dominates knolls, ridges, shoulder slopes and, commonly, north-facing slopes. Intactness is variable, with forest being interspersed with patches of gorse, bracken fernland and manuka shrubland.

Weeds provide a threat, particularly given the narrow meandering shape of the area. European broom, gorse, old man's beard, hawthorn, Himalayan honeysuckle, blackberry and pasture grasses are already established.

The threatened mistletoe *Tupeia antarctica* (Category B) was found growing on fivefinger. This was the only location in the ecological district where *Epilobium glabellum* was found, a species very rare in Marlborough (Raven and Raven, 1976). Regionally endemic species include Marlborough rock daisy, Marlborough lilac and *Brachyglottis monroi*.

Fauna

South Island fantail and bellbird are present within the forest and scrub, with paradise shelduck using the streambed as habitat.

Stock, possums and rabbits pose the most obvious threats to the vegetation in association with weed infestation.

Secondary Criteria

The forest and scrub vegetation provides stabilisation to the slopes. The soft rock, in particular, is vulnerable to accelerated erosion.

Selection Criteria

- Native vegetation occurs over a sequence of three geological types in a relatively short distance. This type of sequence is rare within the ecological district.
- Native vegetation cover on the Northwest Outwash Deposits and Local Alluvium land system is now rare, this being the best example of native forest left on Quaternary glacial outwash gravels.
- Native vegetation on the Inland Soft Rock Hill Country land system is now rare, particularly limestone communities.
- The forest and scrub provide habitat for threatened, regionally rare and regionally endemic plant species (see above).

RAP 4 - Waikeene Stream

Grid Reference Centre:	NZMS 260 O31 450635
Area:	640 ha
Altitudinal Range:	200-700 m
Tenure:	Private
Vegetation Types:	3a, 5c, 6b, 8c, 8d, 10a
Study Area Number:	K21

Land System(s)

Inland greywacke hill country.

Bioclimatic Zone(s)

Lowland; montane.

Ecological Units

- Black beech forest on steep lower spur side slopes and gullies.
- Black beech-kanuka forest on lower hill slopes, spur side slopes and gullies.
- Kanuka low forest hill slopes, spur side slopes and ridges.
- Mixed broadleaved scrub in gullies.
- Tauhinu-silver tussock-fescue tussock shrub-grassland on hill slopes and spur side slopes and ridges.
- Bracken fernland on spur side slopes.
- Mixed pasture grassland on spur side slopes.

Landforms

The area comprises steep Mesozoic greywacke spur slopes, hill slopes, ridges and gullies of the mid to upper reaches of Waikeene Stream and its tributaries, east of and bordering Tuku Tuku Iwi (NAT 6).

Vegetation and Flora

Some snow-damaged primary or older secondary black beech forest remains on steep southeast-facing lower spur side slopes and gullies adjacent to Tuku Tuku Iwi. The canopy is in poor condition with a large proportion of dead spars. Black beech is of mixed age and some emergent trees are present with minor kanuka and climbing *Rubus cissoides*. The understorey is dominated by black beech poles, with marbleleaf and minor broadleaf, lancewood, mahoe and *Rubus cissoides*. A rich and dense shrub tier contains *Leucopogon fasciculatus* and *Coprosma microcarpa* with minor *C. robusta*, *C. rhamnoides*, *C. linariifolia*, *Corokia cotoneaster*, *Cyathodes juniperina*, *Rubus cissoides* and younger mahoe, black beech and lancewood. The dense ground tier is largely composed of *Microlaena avenacea* with *Uncinia uncinata* and minor *Blechnum discolor*, *Urtica incisa*, *Nertera depressa*, *Pratia angulata*, *Thelymitra* sp., *Hieracium pilosella*, wall lettuce and seedlings of broadleaf. *arex geminata* is present near gully bottoms with ferns such as *Blechnum fluviatile*, *Histiopteris incisa* and *Pneumatopteris pennigera*.

In gullies near catchment heads the beech generally drops out leaving small strips of streamside mixed broadleaved forest containing mahoe, marbleleaf, lancewood and minor *Cordyline banksii*.

Secondary black beech-kanuka forest covers much of the dry lower hill slopes and spur side slopes. A relatively open canopy also contains minor marbleleaf and lancewood. The dense shrub tier largely consists of *Helichrysum lanceolatum*, *Leucopogon fasciculatus*, *Coprosma linariifolia* and *C. rhamnoides*. The ground tier is sparse containing only scattered hound's tongue fern, *Lagenifera strangulata*, *Ranunculus reflexus* and seedlings of *C. rhamnoides* and *L. fasciculatus*.

Kanuka low forest covers most of the mid to upper hill slopes and spur side slopes, and some ridges. It contains a dense kanuka canopy with minor lancewood. The understorey is well-developed, consisting primarily of *Leucopogon fasciculatus* and kanuka, with marbleleaf and lancewood, and minor *Rubus cissoides*. The principal species in a moderately dense shrub tier are *Leucopogon fasciculatus*, *Coprosma rhamnoides*, and younger kanuka with minor *Helichrysum lanceolatum*, *Cyathodes juniperina*, *Coprosma microcarpa*, *C. robusta*, lancewood, kohuhu and *Rubus cissoides*. A rich, dense ground layer contains abundant *Microlaena avenacea*, *Uncinia uncinata* and *U. fuscovaginata*. *Coprosma rhamnoides* seedlings and sweet vernal are moderately common with minor *Dianella nigra*, *Asplenium gracillimum*, *Ranunculus multiscapus*, wall lettuce, *Hieracium pilosella*, catsear and seedlings of other principal tree and shrub species.

Tauhinu-silver tussock-fescue tussock shrub-grasslands are present on more recently burned upper slopes and ridges. Minor shrub species include manuka, kanuka, *Coprosma propinqua* ssp. *propinqua* and matagouri. Bracken fern and *Polystichum vestitum* may also form minor canopy components. The intertussock ground tier contains younger fescue tussock and bracken fern, *Elymus solandri*, sweet vernal, browntop and mats of *Raoulia subsericea* with minor seedlings of kanuka, tauhinu, matagouri, *Polystichum vestitum*, bracken fern and silver tussock, and *Deyeuxia avenoides*, *Dichelachne crinita*, *Rytidosperma gracile*, *Bulbinella angustifolia*, *Helichrysum filicaule* and catsear.

The locally occurring mistletoe, *Ileostylis micranthus*, occurs within the forested area.

Fauna

Species seen and/or heard within the forested area include South Island robin, South Island tomtit, brown creeper, bellbird while species seen in the shrub-grassland include New Zealand pipit (*Anthus novaeseelandiae*), white-fronted magpie and threatened New Zealand falcon (Category B). Other species which have been observed in a previous survey (New Zealand Wildlife Service, 1983) include threatened New Zealand pigeon (Category B), silvereye and South Island fantail with yellowhammer (*Emberiza citrinella*), hedge sparrow (*Prunella modularis*), chaffinch, goldfinch (*Carduelis carduelis*), blackbird (*Turdus merula merula*) and Californian quail. The area has been recognised as having good potential for bird habitat (New Zealand Wildlife Service, 1983).

Cattle and sheep graze the shrub-tussockland. The forested areas, however, are partially fenced and in combination with a generally dense understorey and often steep gradients stock access is limited. Evidence of possums, rabbits and pigs were observed.

Secondary Criteria

The area is adjacent to and continuous with forest in Tuku Tuku Iwi, an area of importance for local Iwi.

Selection Criteria

- Excellent examples of black beech-kanuka forest and kanuka low forest on the Inland Greywacke Hill Country land system.
- Intact kanuka forest on ridges is rare within the ecological district.
- The locally occurring mistletoe, *Ileostylis micranthus*, occurs within the forested area.
- Habitat is provided for a range of bird species including the threatened New Zealand falcon and possibly the threatened New Zealand pigeon.

RAP 5 - Flax Hills Lake

Grid Reference Centre:	NZMS 260 O31 408617
Area:	7 ha
Altitudinal Range:	380-410 m
Tenure:	Private
Vegetation Types:	5c, 6a, 7, 11, 12
Study Area Number:	N14

Land System(s)

Inland soft rock hill country.

Bioclimatic Zone(s)

Lowland.

Ecological Units

- Black Italian poplar treeland on lake margins and hill slope.
- Fivefinger-lancewood-kohuhu low forest on lake margin and hill slope.
- Manuka shrubland on lake margin and hill slope.
- Raupo-mixed *Carex* reed-sedgeland on lake margins.
- Raupo reedland on lake margins.
- Open water on lake.

Landforms

The area consists of a small lake situated close to Charwell River formed on a Mesozoic sandy mudstone hillside hollow.

Vegetation and Flora

The eastern bank contains several large black Italian poplars (*Populus x euramericana*) forming a treeland over an understorey comprised predominantly of pasture grasses. *Pseudognaphalium luteoalbum* agg. and *Gnaphalium audax* are present although native species are few.

Broadleaved low forest is present on the northwest lake margin and is dominated by fivefinger, lancewood and kohuhu. Minor canopy associates include *Coprosma lucida* and *C. robusta*. *Rubus schmidelioides* is the main climber. *Leucopogon fasciculatus* dominates the understorey and shrub tier. *Blechnum procerum* and *Pellaea rotundifolia* are prominent in a depleted ground tier.

Manuka shrubland is regenerating, particularly towards the southern and western margins. Minor associates include *Coprosma rhamnoides* and gorse, with a mainly pasture grass ground tier.

Raupo reedland is present from the lake edge to open water and mixes with *Carex secta* and *Carex maorica* on drier margins. These margins also contain *Isolepis reticularis*, *Callitriche petrei*, *Blechnum minus*, *Epilobium pallidiflorum*, *Ranunculus amphitrichus*, and *Hydrocotyle novae-zelandiae*.

Fauna

The lake and lake edge provide habitat for an abundance of ducks. Approximately 150 were seen, mostly paradise shelduck and mallard. A welcome swallow (*Hirundo tahitica neoxena*) was seen diving for insects.

Stock graze the lake margins and drink from the lake, causing deterioration of the vegetation.

Secondary Criteria

The lake is used for recreational duck hunting in season.

Selection Criteria

Wetland habitats are now rare in the ecological district and regionally in both Canterbury and South Marlborough.

- This is the only lacustrine wetland of any size, containing natural and semi-natural communities outside the network of lakes in the northeast of the ecological district and the only one to occur on the Inland Soft Rock Hill Country land system.
- Species found here which are uncommon within the ecological district include *Carex maorica*, *Isolepis reticularis*, *Callitriche petrei* and *Epilobium pallidiflorum*.
- The lake and margins are of habitat value, particularly for waterfowl.

RAP 6 - Right Branch Ote Makura Stream Catchment

Grid Reference Centre:	NZMS 260 O32 510589
Area:	355 ha
Altitudinal Range:	70-940 m
Tenure:	Private
Vegetation Types:	1, 2, 3c, 3d, 4a, 5a, 6a, 6b, 8a, 8c, 8d
Study Area Number:	K2

Land System(s)

Coastal greywacke hill country; Inland greywacke hill country.



Plate 1. RAP 5 - Flax Hills Lake. Raupo reedland on lake margin.



Plate 2. RAP 6 - Right Branch Ote Makura Stream Catchment.

Map 7 Recommended Areas for Protection - 6, 7a, 7b, 8, 9, 10



Bioclimatic Zone(s)

Coastal; semi-coastal; lowland; montane.

Ecological Units

- Mountain beech forest on colluvial upper hill slopes.
- **Black beech-mountain beech forest on colluvial hill slopes and spur side slopes.**
- Black beech-matai forest on hill and spur side slopes and gullies.
- Black beech-hinau-mahoe forest along riparian zone and gullies.
- **Mahoe-mixed broadleaved forest along riparian zone and gullies.**
- Hall's totara-*Cyathodes juniperina*-tauhinu shrubland on colluvial upper spur side slopes.
- Kanuka scrub on hill slopes and spur side slopes.
- Manuka shrubland on hill slopes.
- Mixed shrub-rockland and rockland on outcrops and bluffs.
- Silver tussock-fescue tussock-pasture grassland on mid to upper hill slopes, crests and ridges.
- Bare loamfield on hill slopes and spur side slopes.

Landforms

The area is comprised of steep, dissected Mesozoic greywacke hill country with V-shaped valleys, hills and spurs draining eastward into Ote Makura Stream. Bedrock outcrops and bluffs are most common on upper hill slopes, crests and ridges. Soil cover is generally thin and most of the steeper slopes are colluvial.

Small scale accelerated erosion is evident on steep faces where vegetation cover is sparse. In these locations recent slips have left bare loamfield.

Coastal parts of the area are integral with the Kaikoura coastal landform features which are recognised as having regional landscape significance (Boffa Miskell, 1993)

Vegetation and Flora

Old growth secondary black beech-mixed podocarp forest is present on a moderately steep south-facing concave spur side slope. It is well buffered by surrounding black beech, mountain beech and broadleaved forest. Black beech is emergent with matai and a few scattered rimu. Mahoe and marbleleaf are prominent with minor red mapou, broadleaf and lancewood. *Coprosma rhamnoides* is prominent among a relatively sparse shrub tier. The ground layer is also moderately sparse and largely composed of seedlings of *Coprosma rhamnoides*, and *Uncinia uncinata*, *Polystichum richardii* and *Asplenium hookerianum*.

Black beech forest becomes mountain beech forest with increasing altitude although the pattern remains very similar throughout. Secondary mixed-age beech forest contains emergents over a canopy of younger beech with minor broadleaved species, most notably marbleleaf, lancewood and broadleaf. Beech regeneration is apparent in the shrub tier with *Coprosma rhamnoides* and minor regenerating *Coprosma*

linariifolia and lancewood. Seedlings of *Coprosma rhamnoides* plus *Uncinia uncinata*, *Blechnum discolor*, *B. procerum*, *Polystichum vestitum* are the most common species in a moderately sparse ground tier.

Secondary mahoe-mixed broadleaved forest covers approximately 40% of the area on colluvial slopes on both sides of the catchment. Hinau is occasionally emergent over a thick canopy of mahoe, and to a lesser extent, red mapou. Below the canopy, the vegetation is typically very sparse and the few species that are present show signs of grazing where accessible to stock.

Semi-coastal to lowland riparian mixed broadleaved forest contains a diverse range of species. Variable amounts of emergent black beech, and to a lesser extent, hinau, occur over a canopy of mahoe and pigeonwood with minor lemonwood, hinau and climbing *Metrosideros diffusa*. The subcanopy contains mamaku, pate, kawakawa and younger mahoe and marbleleaf. The most numerous species in the shrub tier include younger pate, kawakawa, marbleleaf and *Coprosma grandifolia*. Climbing kiekie is present in the subcanopy and shrub tiers. A rich array of ferns is present, the most common of which are *Histiopteris incisa*, *Lastreopsis glabella*, *Leptopteris hymenophylloides*, *Blechnum chambersii*, *B. fluviatile* and *Asplenium bulbiferum*. Other common ground tier species include *Uncinia uncinata*, *Microlaena avenacea*, *Urtica ferox*, seedlings of pate and marbleleaf, and scrambling *Metrosideros diffusa*. Riparian forest near the stream branch, approximately 1km inland from Goose Bay is similar to that described above, although it contains more supplejack throughout all tiers. Titoki and *Lophomyrtus obcordata* are common canopy and shrub species while coastal species such as *Griselinia lucida* appear.

Montane Hall's totara-*Cyathodes juniperina*-tauhinu shrubland is present on unstable colluvial southeast facing slopes near the ridgeline at approximately 900m. Manuka, matagouri and *Coprosma parviflora* are minor shrub species. The ground tier contains, most frequently, scrambling *Gaultheria depressa* var. *novaezelandiae*, *Poa colensoi*, *Deyeuxia avenoides* and *Gentiana tenuifolia* with foxglove, catsear and *Hieracium pilosella*.

Bluffs and outcrops typically contain sparsely scattered broadleaved species such as mahoe, broadleaf, red mapou, *Olearia paniculata* or *Melicope simplex* emergent over a denser subshrub and ground tier comprised of *Sophora prostrata*, *Pachystegia* sp. 'A', sweet vernal, and *Rytidosperma racemosa* with minor *Clematis afoliata*, *Muehlenbeckia complexa*, *Pyrrosia eleagnifolia*, *Asplenium flabellifolium*, *Cotula serrulata*, woolly mullein and *Aira caryophyllea*.

Fire-induced manuka shrubland and kanuka scrub are generally found on forest margins which have escaped the most recent burning. They form a relatively small proportion of the total vegetation and are generally highly modified.

Montane silver tussock-fescue tussock-pasture grassland contains a mostly scattered emergent shrub component of matagouri, tauhinu and *Melicytus alpinus*. Silver tussock and fescue tussock occupy approximately half of the ground cover with intertussock spaces occupied primarily by sweet vernal and browntop, and minor *Elymus solandri*, *Rytidosperma gracile* and *Polystichum vestitum*. The ground tier is composed of younger browntop and sweet vernal with white clover and minor Yorkshire fog, *Geranium microphyllum*, *Wahlenbergia albomarginata*, *Helichrysum filicaule* and catsear.

Kiekie was once much more widespread in the ecological district but is now uncommon, and this locality represents the southern limit for the species on the east coast of the South Island. *Helichrysum parvifolium* is endemic to montane, subalpine and alpine areas of east Nelson, south and east Marlborough and North Canterbury, this being one of two localities in the district where it was found. *Gentiana tenuifolia* is known from the northern half of the South Island and is uncommon in the Kaikoura District (David Glenney, pers. comm.). It was seen from only two localities in the ecological district. *Einadia allanii*, generally a coastal herb, was found on dry north-facing rock outcrops, the only time it was observed in the district. *Melicactus* 'brockiei' and *Hymenophyllum demissum* are uncommon within the ecological district. Other species more commonly found in the subalpine areas of the Seaward Kaikoura Range but which occur here within 4km of the coast include *Dracophyllum uniflorum* (one of two localities in the district) and *Hebe venustula*.

Fauna

The catchment is part of a larger area recognised as having significant fauna habitat value (New Zealand Wildlife Service, 1983).

South Island fantail and bellbird were the most common bush birds to be seen and heard. An Australasian harrier was observed, while other native species reported from here include the threatened New Zealand falcon, silvereye, South Island tomtit, South Island rifleman and New Zealand kingfisher, as well as a host of introduced species (New Zealand Wildlife Service, 1983).

German wasps were seen to be numerous on black and mountain beech.

Secondary Criteria

The area is of importance to local iwi.

The catchment contributes to the water supply for the Goose Bay settlement.

Coastal parts of the area are integral with the Kaikoura coastal landform features which have recognised scientific and educational qualities (Kenny and Hayward, 1993b).

Selection Criteria

- Excellent examples of a range of vegetation types present over semi-coastal, lowland and montane bioclimatic zones give the area high values in both biological diversity and representativeness.
- Intact natural montane communities are generally confined to the higher peaks within the ecological district.
- Black beech-mixed podocarp forest is a regionally rare vegetation type, and this stand represents the most extensive stand in the Coastal Greywacke Hill Country land system.
- The area would link existing scenic reserves at Ote Makura Stream and Omihi Stream.
- The less accessible and well-buffered forest on steep slopes towards the interior of the area is very intact with negligible sign of animal damage.

- A range of rare or unusual plants are present (see above).
- The catchment is part of a larger area identified as having significant faunal habitat value (see above).

RAP 7 - Omihi Stream

Grid Reference Centre:	(a) NZMS 260 O32 514574; (b) O32 497585
Area:	(a) 140 ha; (b) 25 ha
Altitudinal Range:	(a) 20-740 m; (b) 640-900 m
Tenure:	Private
Vegetation Types:	1, 3a, 5a, 5c, 6a, 8a, 8c, 8d, 9, 10a
Study Area Number:	K7

Land System(s)

Coastal greywacke hill country; Inland greywacke hill country.

Bioclimatic Zone(s)

(a) Coastal; semi-coastal; lowland; montane (b) Montane.

Ecological Units

- (a) Mahoe-mixed broadleaved low forest, treeland and scrub on coastal colluvial hill slopes and gullies.
- (a) Mahoe-mixed broadleaved low forest, treeland and scrub on inland colluvial hill slopes and spur side slopes and gullies.
- (a) Bracken fernland on hill slopes and spur side slopes.
- (a) and (b) Silver tussock-mixed pasture grassland on upper hill slopes, spur side slopes and ridges.
- (a) and (b) Mixed pasture grassland on ridges and crests and gently-sloping hill slopes and spur side slopes.
- (b) Mountain beech-Hall's totara low forest and treeland on hill slopes.
- (b) Manuka-kanuka scrub and shrubland on hill slopes.
- (b) Mixed shrub-rockland and rockland on bluffs and outcrops.

Landforms

The two discrete areas adjoin, and are continuous with, the Omihi Stream segment of the Goose Bay-Omihi Scenic Reserve (PNA 10). Part (a) encompasses much of the north-facing slopes of the lower reaches of Omihi Stream, and the predominantly north-facing slopes of the right branch to its headwaters. Part (b) is comprised of the headwaters of Omihi Stream at its northernmost reaches. The landscape is dominated by steep-sided, V-shaped Mesozoic greywacke valleys and associated hill slopes and gullies. Soil cover is often thin and some slopes are colluvial.

The coastal slopes present in part (a) form part of the Kaikoura coastline which has been recognised as nationally important for its landscape value (Boffa Miskell, 1993).

Vegetation and Flora

The broadleaved forest and scrub in section (a) undergoes a transition from being coastal in nature at the lower reaches through to montane towards the headwaters, although mahoe is the dominant species at most altitudes. Coastal mahoe-broadleaved low forest, treeland and scrub typically contains minor canopy associates of pigeonwood, red mapou, *Coprosma robusta*, supplejack and kowhai with lesser amounts of karaka, and ngaio. Common understorey and shrub species include kawakawa, supplejack, *Coprosma rhamnoides*, *C. propinqua* ssp. *propinqua* and *C. rotundifolia*, while *Paesia scaberula*, *Uncinia uncinata*, *Blechnum procerum*, *Polystichum richardii*, *Urtica ferox* and kowhai seedlings comprise the major components of a sparse ground cover.

Further inland broadleaf, hinau, lemonwood, marbleleaf and red mapou are canopy components in mahoe-mixed broadleaved low forest, treeland and scrub with scattered emergent black beech. A few scattered emergent matai and occasional rimu occur near valley bottoms. Understorey density is variable and dependent upon grazing pressure, slope, aspect and degree of soil development. In riparian zones where grazing pressure is light, understorey and shrub associates include pate, *Coprosma robusta*, *C. grandifolia*, supplejack, silver fern, mamaku, *Metrosideros diffusa*. The most common ferns are *Blechnum chambersii*, hound's tongue fern, *Polystichum richardii*, *Asplenium flaccidum*, *A. gracillimum*, *Adiantum cunninghamii* and *Pneumatopteris pennigera*, while other ground tier species include broadleaved seedlings, *Microlaena avenacea*, supplejack, *Metrosideros diffusa* and *Libertia ixioides*.

Mountain and black-mountain beech forest is present on upland slopes of both areas, often on colluvium. The forest is secondary and generally forms a closed canopy with few associates. Kanuka, broadleaf, and fivefinger are minor understorey components with younger beech poles. A moderate well-developed shrub layer is largely comprised of *Cyathodes juniperina*, *Leucopogon fasciculatus*, *Coprosma rhamnoides*, wharariki and *Hebe venustula*. The sparse ground tier contains scattered shrub and tree seedlings, hound's tongue fern, *Brachyglottis lagopus*, *Asplenium terrestre* ssp. *terrestre* and *Paesia scaberula*.

Fire-induced manuka-kanuka shrubland, scrub and forest is generally found on drier forest margins and slopes while silver tussock-pasture grassland occurs towards the ridges and may contain a shrub component including *Coprosma propinqua* ssp. *propinqua*, matagouri, tauhinu, manuka and Hall's totara in varying densities. Fescue tussock becomes more common at higher altitudes while *Rytidosperma* species are more conspicuous near the coast.

Marlborough lilac and Marlborough rock daisy (*Pachystegia* sp. 'A') are common on greywacke outcrops and are associated at higher altitudes towards Poho-o-te-atua with wharariki, *Aciphylla glaucescens*, *Celmisia monroi*, *Gingidia montana*, *Poa colensoi*, and *Chionochloa flavescens* agg., forming communities which are rare within the ecological district.

Marlborough rock daisy and Marlborough lilac are regionally endemic. *Chionochloa flavescens* agg. is uncommon in the district, confined to rocky areas of the highest peaks.

Fauna

The area is recognised as having significant fauna habitat value (New Zealand Wildlife Service, 1983).

South Island fantail, bellbird and silvereye were seen and heard commonly throughout the area. A South Island robin was seen on one occasion in mahoe-mixed broadleaved forest. Other native species reported from the area include grey warbler, Australasian harrier, New Zealand pigeon (threatened - Category B), and South Island tomtit (New Zealand Wildlife Service, 1983).

Common gecko are present. The sound of cicadas was prominent throughout much of the lowland forest. German wasp populations have established in mountain and black beech forest.

Omihi Stream has been found to contain native fish species including the threatened inanga (Category C), koaro and long-finned eel (NIWA, 1987).

Secondary Criteria

The coastal slopes present in part (a) form part of the Kaikoura coastline which has been recognised as having scientific and educational qualities (Kenny and Hayward, 1993b).

The area has importance for local iwi.

Selection Criteria

- Both areas contain vegetation types continuous with those in the Omihi Stream section of the Goose Bay-Omihi Scenic Reserve. Their addition would not only provide protection to those vegetation types, but would serve to create a more manageable reserve boundary which would include the entire catchment and would not bisect a stream as is currently the case.
- Both sections would combine with the reserve to enhance one of the few remaining forest tracts within either Canterbury or South Marlborough which span coastal to montane bioclimatic zones.
- Excellent examples of montane shrubland and shrub-rockland communities within the Coastal Greywacke Hill Country land system.
- Intact natural montane communities present are generally confined to the higher peaks within the ecological district.
- Uncommon and notable plant species occur within the area (see above).
- The area has significant habitat value for a variety of fauna (see above).
- Forming part of the Kaikoura coastline it is integral with an area which has been identified as an outstanding landscape feature of national importance.

RAP 8 - Poho-o-te-atua

Grid Reference Centre:	NZMS 260 O32 496574
Area:	80 ha
Altitudinal Range:	500-875 m
Tenure:	Private
Vegetation Types:	1, 6b, 8a, 8c, 8d, 9
Study Area Number:	K10

Land System(s)

Inland greywacke hill country.

Bioclimatic Zone(s)

Lowland; montane.

Ecological Units

- Mountain beech forest and treeland on upper mountain slope.
- **Hall's totara-kanuka-broadleaf scrub and shrubland on upper mountain slopes, crests and ridges.**
- Kanuka low forest on upper mountain slope.
- Mixed shrub-rockland, herb-rockland and rockland on outcrops.
- **Mixed shrub-silver tussock-pasture grass shrub-grassland on mountain slopes, crest and ridges.**
- Silver tussock-pasture grassland on upper mountain slopes, crest and ridges.

Landforms

The area is comprised of the summit and surrounding ridges and slopes of Poho-o-te-atua (845m). Soil cover is thin in places leaving exposed bedrock outcrops and semi-colluvial slopes, particularly on steep slopes close to the mountain crest.

Vegetation and Flora

Mountain beech forest is generally confined to gully heads or small discrete patches on and around the summit and ridgeline. It is characteristically secondary even-aged forest, commonly containing subcanopy and shrub components of Hall's totara, marbleleaf, broadleaf, lancewood, *Coprosma lucida*, *C. rhamnoides* and *Cyathodes juniperina* with scrambling *Rubus schmidelioides*. The most common ground tier species are ferns: *Blechnum procerum*, *B. penna-marina* and *Polystichum vestitum*.

The Hall's totara-kanuka-broadleaf scrub and shrubland contains emergent Hall's totara up to 8m in some places. The canopy is comprised of the three principal species with minor *Olearia paniculata*, *Coprosma propinqua* ssp. *propinqua*, *C. aff. parviflora*, *Cyathodes juniperina*, *Hebe venustula* and wharariki. *Polystichum vestitum* and *Blechnum penna-marina* are the most frequent ground tier species.

Kanuka low forest is the same vegetation type as that in the nearby Oaro PPL (PNA 12), which is comprised of a dense kanuka canopy approximately 8m high with few canopy or understorey associates other than scattered mahoe, red mapou and *Leucopogon fasciculatus*. There is usually a thick shrub layer, mostly of *Coprosma rhamnoides* with minor *C. propinqua* ssp. *propinqua* and *Helichrysum lanceolatum*. *Uncinia scabra*, seedling *Coprosma rhamnoides* and *Dichondra brevifolia* are the most common species in the ground tier.

Mixed shrub-silver tussock-pasture grass shrub-grassland contains scattered emergent *Melicetus alpinus*, matagouri, tauhinu, *Coprosma propinqua* ssp. *propinqua* and *C. aff. parviflora* with minor *Coriaria sarmentosa*. Other prominent species aside from silver tussock and pasture grasses include *Polystichum vestitum*, *Aciphylla glaucescens* and *A. aurea*.

The shrub component becomes minor in more exposed areas leaving a grassland community.

Outcrop communities are typified by a sparse collection of flax, subshrubs, ferns, grasses and herbs including wharariki, Marlborough lilac, *Gingidia montana*, hound's tongue fern, *Grammitis poeppigiana*, *Lycopodium varium*, *Chionochloa flavescens* agg., *Poa colensoi*, *Celmisia monroi*, *Aciphylla glaucescens*, *Epilobium atriplicifolium*, *Myosotis australis* agg. 'white flower', *Brachyglottis lagopus* and *Wahlenbergia gracilis*.

Coriaria kingiana was not observed elsewhere in the district - it is rare in the South Island. Other species found only at this location include *Myosotis australis* 'white flower' and *Grammitis poeppigiana*. Regionally endemic species to occur from this area include *Pachystegia* sp. 'A' and Marlborough lilac. *Chionochloa flavescens* agg., *Olearia nummularifolia* are uncommon in the district, confined to the highest peaks.

Fauna

New Zealand pipit was seen from the area. Common gecko was observed on rock outcrops.

Secondary Criteria

The mountain has importance for local iwi.

Selection Criteria

- Provides a link between two existing protected areas at Omihi Stream (PNA 10) and Oaro River (PNA 12).
- Excellent examples of montane scrub, shrubland, shrub-grassland and grassland within the Coastal Greywacke Hill Country land system.
- Intact natural montane communities are generally confined to the few higher peaks within the ecological district.
- Rare, uncommon and regionally endemic plant species are present (see above).

RAP 9 - Oaro-Tarapuhi Coastline

Grid Reference:	NZMS 260 O32 511517
Area:	95 ha
Altitudinal Range:	sea level to 210 m
Tenure:	Private
Vegetation Types:	5b, 5e, 6c, 8c, 8d, 9, 16
Study Area Number:	K15

Land System(s)

Coastal greywacke hill country; Coastal soft rock hill country.

Bioclimatic Zone(s)

Coastal.

Ecological Units

- Ngaio treeland and shrubland on coastal scarp.
- Manuka scrub on coastal scarp.

- Mahoe-fivefinger scrub on coastal scarp and hill slopes.
- Silver tussock-mixed pasture grassland on coastal scarp and hill slopes.
- Karaka treeland (planted) on coastal terrace and toe slopes.
- Mixed broadleaved-*Isolepis nodosa* shrub-rushland on coastal rocks in splash zone.
- *Carex pumila*-*Calystegia soldanella* sedge-herbfield on sandy beech.
- Rockland on coastal bluffs, cliffs and offshore islets.
- Bracken fern-mixed pasture fern-grassland on coastal scarp, hill slope, cliff face and terrace.
- Mixed pasture grassland on coastal terrace, scarp, hill slope and cliff face.

Landforms

The area consists of a geologically diverse section of coastline between Oaro and Tarapuhi, just west of Piripaua. It excludes the section of main trunk railway-line. Coastal cliffs between Oaro and Mikonui beech are chiefly comprised of Tertiary argillaceous limestone (Amuri) overlain in places by Tertiary calcareous sandstone and sandy limestone. A coastal terrace extends from these cliffs to Mikonui Stream mouth. The coastline south of this point to the train tunnel is predominantly comprised of Mesozoic greywacke coastal hill slopes, cliffs and toe slopes. A soft rock scarp east of the tunnel contains a mix of Cretaceous sandstones and siltstones with locally occurring coastal sand flats. Offshore islets are comprised of those parts of shore platforms permanently above the high tide mark.

Two geopreservation points occur within the area (Kenny and Hayward, 1993b). They are the Oaro shore platform and Mikonui earthflow.

Oaro shore platform is partially exposed at high tide. It is considered to be of regional importance and is one of several coastal platforms between Oaro and Haumuri Bluffs, most of which are subtidal.

The earth flow south of Mikonui Stream is a well-defined landform of regional significance. It is comprised of a creeping mass of colluvial debris with 2-3m blocks of sandstone, sulphurous and pyritic mudstones, and organic material such as logs, in a bentonitic clay matrix (Jowett, 1979). This mass movement provides maintenance problems for the railway line which passes over it.

The cliffs form part of the coastline extending north to the Kahutara River mouth which has been identified as having outstanding landscape value which is of national importance (Boffa Miskell, 1993).

Vegetation and Flora

A mosaic of vegetation types are present along this stretch of coastline, varying with substrate, slope, aspect, altitude, proximity to the high-tide mark, and history of human disturbance.

Ngaio treeland and scrub is present on the northeast-facing calcareous sandstone and siltstone scarp. Emergent ngaio up to 9m are present as treeland. Beneath this the vegetation is patchy with ngaio, and to a lesser degree mahoe, *Coprosma robusta* and kaikomako in clumps or as individuals, tending to shrubland in places. Minor associates include manuka, *Coprosma rigida*, *C. propinqua* ssp. *propinqua* and tree

tutu. The ground tier is most dense where canopy cover is sparse and is dominated by cocksfoot with *Polystichum richardii*, *Oreomyrrhis ramosa*, Yorkshire fog, *Festuca arundinacea*, Scotch thistle, vipers bugloss and ragwort. Manuka-kanuka scrub is present in patches on drier convex slopes nearby and contains little else other than a ground tier composed of pasture grasses.

Coastal mixed broadleaved-mixed pasture grass shrub-grassland and scrub are present on coastal hill slopes, cliffs, scarps, toe slopes and terraces. Ngaio, fivefinger, mahoe, karaka, *Hebe stricta*, marbleleaf, tree fuchsia, manuka, tree tutu, *Coprosma robusta* and kawakawa are the major canopy species on east-facing greywacke faces south of Mikonui Stream. Minor components include akeake, kaikomako, red mapou, kohuhu and *Cordyline australis*. Old mans beard and banana passionfruit vine are present in places and pose a potential weed threat. Where the canopy is dense the understorey, shrub and ground tiers are generally sparse with scattered seedlings of the canopy species, ferns and herbs such as *Adiantum cunninghamii*, *Polystichum richardii*, *Pellaea rotundifolia*, *Asplenium oblongifolium*, *A. terrestre* ssp. *terrestre*, *A. flaccidum*, *A. hookerianum*, *Apium prostratum* and *Haloragis erecta*. Canopy gaps contain a predominantly exotic mix of cocksfoot, sweet vernal, catsear and *Hieracium pilosella*.

Steep, rocky, east-facing cliff and scarp faces, where vegetated, typically contain a low shrub-grassland mix of *Coprosma robusta*, *C. crassifolia*, Marlborough rock daisy, Marlborough lilac, flax (both wharariki and harakeke), rengarenga (*Arthropodium cirratum*), *Muehlenbeckia complexa*, *Polystichum richardii*, *Linum monogynum* and exotic species such as cocksfoot, sweet vernal, *Rytidosperma racemosa*, catsear and *Hieracium pilosella*.

The rocky coastline between Mikonui Stream and the train tunnel contains several examples of vegetation succession with mixed broadleaved-mixed pasture grass shrub-grassland giving way to mixed broadleaved-*Isolepis nodosa* shrub-rushland towards the intertidal zone on the seaward side of the railway tracks. The dominant broadleaved species are ngaio, titoki, karaka, kawakawa, *Coprosma robusta* and *Hebe salicifolia*. They are often stunted in their growth form. *Isolepis nodosa* is present where the broadleaved canopy is sparse, often with *Asplenium oblongifolium*, *Senecio lautus* and New Zealand iceplant. To the seaward side of this vegetation type, and lying just above the high tide mark is a community of Marlborough rock daisy, Marlborough lilac, *Apium prostratum*, *Linum monogynum* and *Pyrrosia eleagnifolia*. Minor species which may also occur in this zone, often on rock outcrops, include stunted mahoe, akeake, *Asplenium terrestre* ssp. *maritimum*, *Polystichum richardii*, hound's tongue fern, *Pellaea rotundifolia*, *Crassula moschata*, *Dichondra brevifolia*, *Rhagodia triandra*. Eelgrass (*Zostera novaezelandica*) is present on intertidal sandflats.

A few small groves of planted karaka are present along the coastal terraces and toe slopes and are regenerating. Most of the coastal terraces and much of the scarp, hill and cliff faces are occupied by pasture grassland, often in association with bracken fern or silver tussock. Other remnants of human occupation in the vicinity include the presence of elderberry (*Sambucus nigra*), walnut (*Juglans* spp.) and, more recently, radiata pine.

On the northern side of Mikonui Stream mixed pasture grassland on the coastal terrace gives way to *Carex pumila*-*Calystegia soldanella* sedge-herbfield on the sandy beech. This is a sparse community tending to sandfield in places. Scattered marram

grass and cocksfoot are emergent over a low cover of *Carex pumila* and *Calystegia soldanella* with minor *Festuca arundinacea* and *Cakile edentula*.

Rengarenga was not seen elsewhere in the district and is at or close to its southern limit at this position. Regionally endemic species include Marlborough rock daisy and Marlborough lilac. This is the only location in the district where *Hebe stricta* and *H. salicifolia* were found together. It is also the only location where *Poa anceps* was found in the district. *Apium prostratum*, *Crassula moschata*, *Sonchus littoralis*, *Samolus repens*, *Einadia triandra* are uncommon within the ecological district, being confined to coastal rocky areas. *Isolepis nodosa*, *Calystegia soldanella* and *Carex pumila* are uncommon in the ecological district, confined to scattered localities along the coastline.

Fauna

New Zealand fur seal were observed hauling out on offshore islets.

Pied shags nest along this stretch of coast. Spotted shags were seen on the offshore islets. South Island pied oystercatchers (*Haematopus ostralegus finschi*) were observed feeding in rockpools. Other bird species seen within the treeland, scrub and shrubland include threatened New Zealand pigeon (Category B), grey warbler, bellbird, silvereye, South Island fantail plus white-backed magpie, blackbird, chaffinch, hedge sparrow and yellowhammer. Records exist of blue penguin (*Eudyptula minor*) using "the Oaro coastline" (Jowett, 1979) although no evidence was found to suggest that this still occurs.

The cliffs and rockland provide habitat to common gecko.

Secondary Criteria

This stretch of coastline has a long history of settlement, by both Maori and, more recently, early European. It is of major significance to local Iwi (Martin Solomon - Ngai Tahu o Kaikoura, pers. comm.).

The area commands commercial value as part of the main truck railway line between Christchurch and Picton. A maintenance road follows the railway between Oaro and the tunnel.

Intertidal shore platforms are used for recreational shellfish collection.

Selection Criteria

- A diverse range of plant communities is present over the varied and complex geology and landform patterns present.
- Native vegetation is uncommon on the Coastal Soft Rock Hill Country land system.
- The coastal rockland communities beyond the high tide mark are the most representative and intact within the ecological district.
- The *Carex pumila*-*Calystegia soldanella* sedge-herbfield on Mikonui Beach is the best representation of a sandy shoreline native community in the ecological district. Both species are uncommon within the district.
- This is the only location in the district where ngaio-dominated broadleaved treeland and scrub was seen.

- Uncommon and notable plant species occur within the area (see above).
- The treeland, scrub, shrubland, grassland, rockland, beeches, intertidal pools and offshore islets provide important habitat for a diverse range wildlife including the threatened New Zealand pigeon.
- As the area forms part of the Kaikoura coastline it is of outstanding landscape value which is of national importance.
- Regionally important geological and landscape features include Mikonui earth flow and Oaro shore platform.

Notes

Limited public activity in this area is due partly to restricted vehicle access and partly to a lack of knowledge of its existence by those other than locals. This has doubtless contributed to the coastal scrub and splash zone vegetation regenerating well after a long history of human occupation and associated disturbance. Isolation coupled with the unique geology and landform patterns distinguish this stretch of coastline from that found north of Oaro.

RAP 10 - Mikonui Stream

Grid Reference Centre:	NZMS 260 O32 505523
Area:	180 ha
Altitudinal Range:	near sea level to 324 m
Tenure:	Private
Vegetation Types:	5a, 5d, 6a, 6c, 8d
Study Area Number:	K15

Land System(s)

Coastal soft rock hill country; Coastal greywacke hill country.

Bioclimatic Zone(s)

Coastal; semi-coastal.

Ecological Units

- Mixed broadleaved-kanuka treeland, low forest and scrub on upper hill slope.
- Mahoe forest and scrub on hill slopes and riparian zone.
- **Manuka scrub and shrubland on hill slopes and flats.**
- Manuka-kanuka scrub and low forest on hill slopes.
- Silver tussock-mixed pasture grassland on hill slopes.

Landforms

The mid to lower reaches of Mikonui Stream catchment comprise gently rolling to steep hill slopes and steep-sided, incised stream channels. A flat is present on the south bank near the river mouth.

Accelerated erosion is a common feature of the area, and is characteristic of the soft substrate. The area contains a succession of rock types. From north to south (and oldest to youngest rock types) the catchment passes through bands of Tertiary marine mudstone; Tertiary calcareous silty mudstone; Tertiary calcareous sandstone and sandy limestone; argillaceous limestone; Mesozoic sandstone with calcareous pods and bands; Mesozoic jarositic siltstone with large calcareous concretions; Mesozoic soft, silty interbedded fine and medium sandstone with calcareous bands; and Mesozoic greywacke.

A regionally important (Kenny and Hayward, 1993b) landform feature, the Mikonui earthflow, is present in both this area and the Oaro-Tarapuhi Coastline (RAP 9). It comprises a creeping mass of colluvial debris with 2-3m blocks of sandstone, sulphurous and pyritic mudstones, and organic material such as logs, in a bentonitic clay matrix (Jowett, 1979).

Vegetation and Flora

Mahoe is the dominant canopy species in broadleaved low forest on lower hill slopes and riparian zones. Other prominent species include ngaio, tree fuchsia, kanuka and supplejack. Common understorey species include younger mahoe, kaikomako, wineberry and kawakawa with minor *Coprosma robusta*, supplejack and young tree fuchsia. The shrub tier generally contains young kaikomako, mahoe and kawakawa. A variety of ferns is present, most commonly *Blechnum novae-zelandiae*, *Hypolepis millefolium* and *Asplenium bulbiferum* with minor *Asplenium oblongifolium*, *A. terrestre* ssp. *terrestre*, *Adiantum cunninghamii*, *Polystichum richardii*, *Blechnum fluviatile* and *B. chambersii*. Other ground tier species include *Uncinia uncinata*, supplejack and regenerating kawakawa with cocksfoot, sweet vernal, white clover and yarrow.

South-facing upper hill slopes contain much the same species as mentioned above with scattered black beech and a higher kanuka component. Kowhai is present in areas where the canopy is relatively open.

Manuka scrub and shrubland is widespread on the poorly-drained southern bank of the catchment and extends nearer to the coastline than anywhere else in the ecological district. A few stands are present in drier areas with a kanuka component. Manuka scrub and shrubland contains minor broadleaved species such as tree tutu, fivefinger, tree fuchsia and *Hebe stricta* in the canopy and understorey. The shrub tier is generally sparse, although in wetter open areas *Carex geminata* is present with *Histiopteris incisa*. Seedlings of broadleaved species occupy much of the sparse ground tier and include mahoe, pigeonwood, marbleleaf, *Coprosma lucida*, *C. robusta*, kawakawa and kaikomako. *Uncinia uncinata* is the only other species present in any quantity. Pasture species become more prevalent towards margins.

The remaining vegetation cover is largely a highly modified silver tussock-pasture grass mix.

Fauna

South Island fantail, bellbird, threatened New Zealand pigeon, silvereye, grey warbler and blackbird were seen and/or heard.

Sheep and possums contribute the greatest amount of browsing damage.

Secondary Criteria

A Maori village was located at Mikonui beach until 1870 when it shifted to Oaro. This area is of major significance to local Iwi (Martin Solomon - Ngai Tahu o Kaikoura, pers. comm.).

The vegetation provides stabilisation to the stream banks which are particularly susceptible to accelerated erosion.

Selection Criteria

- Native vegetation is uncommon on the Coastal Soft Rock Hill Country land system.
- The area includes the Mikonui earthflow, a regionally important landscape feature.
- Coastal manuka scrub and shrubland is rare within the ecological district, particularly on flat and rolling hill country.

Notes

Adjoins Oaro-Tarapuhi Coastline (RAP 9).

RAP 11 - Okarahia Tributary

Grid Reference Centre:	NZMS 260 O32 510501
Area:	50 ha
Altitudinal Range:	20-180 m
Tenure:	Private and Tranzrail
Vegetation Types:	3c, 5a, 5d, 6a, 6b, 8d, 9, 10a
Study Area Number:	K16

Land System(s)

Coastal soft rock hill country.

Bioclimatic Zone(s)

Coastal; semi-coastal.

Ecological Units

- Black beech-mixed broadleaved forest along riparian zone, lower hill slopes and gullies.
- Mahoe-mixed broadleaved low forest and scrub along riparian zones concave hill slopes and gullies.
- Mahoe-kanuka low forest and scrub on hill slopes.
- Kanuka low forest and scrub on hill slopes.
- Manuka shrubland on hill slopes and forest margins.
- Rockland on shoulder slope.
- Bracken fernland on hill slopes.
- Mixed pasture grass-silver tussock grassland on upper hill slopes.

Landforms

The area is comprised of a south-facing tributary catchment of Okarahia Stream very close to the stream mouth at the southern end of Haumuri Bluffs. The main trunk railway line (excluded from the RAP) runs along the lower half of the valley before entering a tunnel and re-emerging to the north on the stretch of coastline leading to Oaro. This tunnel runs underneath much of the RAP.

The geology is a mix of (from east to west) Late Tertiary argillaceous limestone (Amuri), Mesozoic massive glauconitic sandstone, Mesozoic jarositic siltstone, Mesozoic soft silty interbedded fine and medium sandstone with a section of Mesozoic greywacke towards the catchment head.

Vegetation and Flora

Remnant mixed-age riparian mahoe-mixed broadleaved forest contains emergent black beech and hinau in the mid to upper reaches of the catchment and is generally isolated from grazing pressure. The canopy consists of younger black beech, mahoe, kowhai, red mapou and marbleleaf. Principal canopy species are also present in the understorey with minor kaikomako, kanuka, mamaku, lancewood and kohuhu. *Coprosma rhamnoides* dominates the shrub tier with minor *C. rotundifolia*, supplejack and younger tree and shrub species. The ground tier contains a good representation of tree and shrub seedlings and minor amounts of *Paesia scaberula*, *Haloragis erecta*, catsear, wall lettuce and Californian thistle.

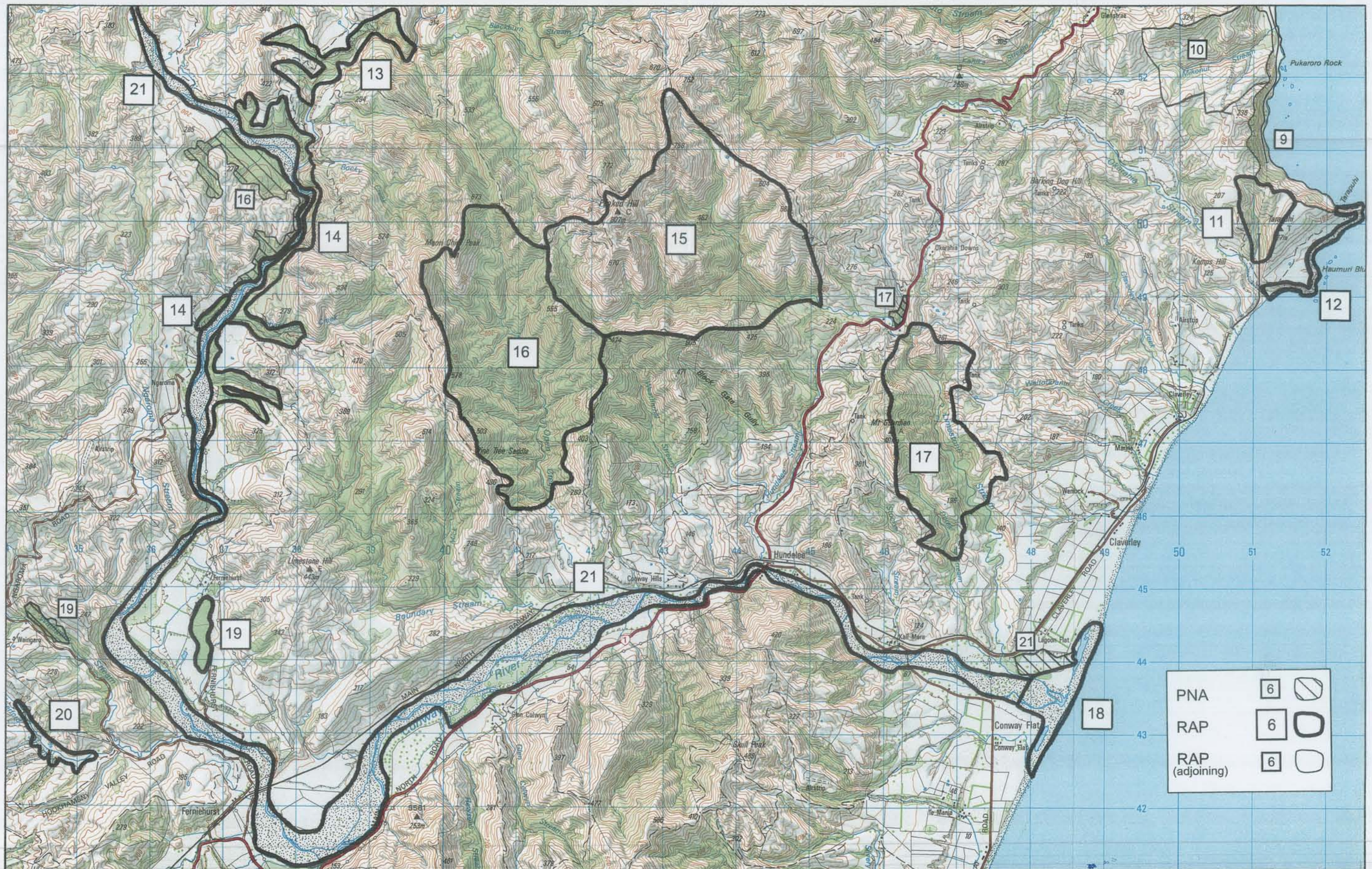
On hill faces mahoe-mixed broadleaved low forest and scrub generally occupies shady aspects and concave slopes, merging into kanuka on drier convex slopes. Where mahoe dominates the canopy it is characteristically associated with ngaio, pigeonwood, kaikomako, kowhai and marbleleaf. On well-buffered and/or steeper slopes which have not been exposed to severe grazing pressure, the understorey contains younger mahoe with minor elements of wineberry, supplejack, wheki, kaikomako and kowhai. Kawakawa and *Coprosma rotundifolia* dominate the shrub tier with regenerating tree species. *Asplenium gracillimum*, *Pneumatopteris pennigera* and *Blechnum chambersii* are prominent in the ground tier with good numbers of tree and shrub seedlings.

Kanuka generally forms a dense canopy with minor amounts of kowhai. *Coprosma rhamnoides* forms a dense shrub tier with minor *Helichrysum lanceolatum*, *Muehlenbeckia australis* and young kanuka. Where well-buffered, the relatively dense ground tier is largely composed of hound's tongue fern, *C. rhamnoides* seedlings, plume grass, sweet vernal, *Hieracium pilosella* and catsear, with minor *Coprosma robusta* seedlings, *Muehlenbeckia australis*, *Asplenium gracillimum*, *A. terrestre* ssp. *terrestre*, *Geranium microphyllum*, *Ranunculus multiscapus*, blackberry, cocksfoot, browntop and ragwort.

Sparsely-vegetated rockland occurs in places on the northwest-facing limestone colluvial shoulder slopes of Tarapuhi Peak close to the ridgeline. Scattered shrubs such as prostrate kowhai, *Melicytus alpinus*, fivefinger, red mapou, matagouri, *Olearia paniculata*, Marlborough rock daisy, Marlborough lilac, *Coprosma rigida* (seen hosting *Ileostylus micranthus* mistletoe), *C. robusta* and briar are present along with wharariki. Grasses and herbs include *Haloragis erecta*, *Linum monogynum*, silver tussock, *Dichondra brevifolia*, cocksfoot, *Festuca arundinacea*, viper's bugloss, white clover, catsear and *Hieracium pilosella*.

Map 8

Recommended Areas for Protection - 11 to 21



The nationally local mistletoe, *Ileostylus micranthus* occurs on limestone rockland with the regionally endemic shrubs Marlborough lilac and Marlborough rock daisy.

Fauna

South Island fantail, South Island robin, bellbird (plentiful), brown creeper, silvereye and grey warbler were witnessed in and around the forest and scrub along with redpoll (*Carduelis flammea caberet*), goldfinch (*C. carduelis*), chaffinch and yellowhammer.

Secondary Criteria

Native forest cover provides slope stabilisation within the catchment. Soft rock hill country is prone to accelerated erosion.

Scenic values are high; the main trunk railway line passes through the area.

Selection Criteria

- The most extensive native forest and scrub cover left on the Coastal Soft Rock Hill Country land system.
- Native forest cover on the Coastal Soft Rock Hill Country land system is rare within the ecological district.
- The black beech-mixed broadleaved forest remnants are the only stands of any size left on the Coastal Soft Rock Hill Country land system and occur closer to the coast than any other in the ecological district.
- Local and regionally endemic species are present (see above).

RAP 12 - Haumuri Bluffs

Grid Reference Centre:	NZMS 260 O32 520498
Area:	13 ha
Altitudinal Range:	Sea level to 50 m
Tenure:	Private
Vegetation Type:	5b, 5e, 8d, 9, 17
Study Area Number:	K30

Land System(s)

Coastal soft rock hill country.

Bioclimatic Zone(s)

Coastal.

Ecological Units

- Ngaio-fivefinger shrubland on cliff faces.
- Silver tussock-mixed pasture grassland on bluffs and cliff faces.
- New Zealand iceplant herbfield on bluffs and cliff faces.
- Rockland on bluffs and cliff faces.

Landforms

The south-, east-, and north-facing coastal cliffs from Okarahia Stream mouth to Tarapuhi are composed of sedimentary rock types and have been identified as having national importance for their geology (Kenny and Hayward, 1993b). It is a classic locality exposing the late Cretaceous sequence of Marlborough and is the holostratotype of Haumurian and Piripauan Stages. It is also the type locality for many late Cretaceous molluscs and vertebrates and contains well-preserved macro- and microfaunal remains.

Four late Cretaceous rock formations are established. At the base, 120m of Okarahia Sandstone (yellow grey quartzose sandstone with a few lensoid "Piripauan" shellbeds near the base) unconformably overlies folded Torlesse rocks (greywacke), and passes upwards into 15m of yellowish coarse sandstone and sandy granule conglomerate, Tarapuhi Grit, containing the lowest known appearance of "Haumurian" fauna. Overlying are 240m of massive dark grey Conway Siltstone with scattered large spherical calcareous concretions, a unit recognisable throughout much of the northeastern coastal area of the South Island. This underlies 32m of glauconitic and locally calcareous yellow or grey Claverley Sandstone, whose uppermost unit, the distinctive Terado Limestone Member, conformably underlies the widespread early Tertiary Amuri Limestone (Warren and Speden, 1978). Shore platforms lie partially exposed to the east of the cliffs.

Another extremely well defined landform of regional importance (Kenny and Hayward, 1993b) is the Haumuri Bluff sea arch situated at the northeast cape.

The cliffs form part of the coastline extending north to the Kahutara River mouth which has been identified as having outstanding landscape value of national importance (Boffa Miskell, 1993).

Vegetation and Flora

Vegetation tends to be confined to faces or parts of faces with gentler gradients or rock fissures. Sheer cliffs are sparsely vegetated.

The ngaio-fivefinger shrubland is largely restricted to the southern end of the area, near the Okarahia Stream mouth. Other prominent species include tree tutu, *Coprosma robusta*, *Hebe stricta*, *Cortaderia richardii*, wharariki, harakeke, *Festuca arundinacea*, Yorkshire fog, cocksfoot, browntop, silver tussock and dandelion (*Taraxacum officinale*).

New Zealand iceplant herbfield generally occurs on east-facing and north-facing upper cliff faces. Associated native species include *Sonchus kirkii*, *Spergularia media*, silver tussock, *Linum monogynum*, *Senecio lautus*, and New Zealand climbing spinach (*Tetragonia trigyna*). Introduced *Lepidium pseudotasmanicum* is also present.

Silver tussock-mixed pasture grassland occurs on gentler cliff faces and cliff tops, particularly in the northern half of the area. Scattered broadleaved species and flax may occur, such as those found in the shrubland to the south, although the principal components are silver tussock, cocksfoot, browntop and Yorkshire fog.

Sonchus kirkii, *Spergularia media*, *Senecio lautus* and New Zealand climbing spinach are uncommon in the ecological district.

Fauna

The cliff bases, narrow beaches and exposed shore platforms extending around the coastline from Okarahia Stream to the train tunnel entrance east of Piripaua are known haul-out areas for threatened elephant seal (*Mirounga leonina*) (Category O), leopard seal (*Hydrurga leptonyx*) and are regionally important for large numbers of New Zealand fur seal (Davidson, Paton and Cash, 1993).

Silvereye was noted from the vicinity, as was chaffinch, greenfinch and white-backed magpie. A spotted shag roost was observed close to Piripaua.

Secondary Criteria

The cliffs containing Upper Cretaceous sediments and fossils, and the sea arch are of scientific and educational importance as well as having scenic value.

The area is important to local Iwi.

Selection Criteria

- The area forms part of a regionally important haul-out zone for New Zealand fur seals. It is also one of the sites in the region used by threatened elephant seals (Category O) and leopard seals.
- Native plant communities are uncommon on the Coastal Soft Rock Hill Country land system.
- The New Zealand iceplant communities of these coastal cliffs are an unusual and rare vegetation type within the district.
- The cliffs provide habitat for several plant species which are uncommon within the ecological district (see above).
- Geological values of the Upper Cretaceous sediments and fossils of the cliffs and bluffs are of national importance.
- The Haumuri sea arch is a regionally important landscape feature.
- As the area forms part of the Kaikoura coastline it is of outstanding landscape value which is of national importance.

Notes

The area appears to be under little threat other than gradual and sporadic colonisation by introduced pasture grasses and weeds. Public access is restricted and so human interference with wildlife is currently minimal.

RAP 13 - Spey Stream

Grid Reference Centre:	NZMS 260 O32 385522
Area:	75 ha
Altitudinal Range:	160-280 m
Tenure:	Private
Vegetation Types:	3a, 3d, 6b, 7, 8a, 8d, 9
Study Area Number:	H31

Land System(s)

Inland greywacke hill country; Northwest outwash deposits and local alluvium.

Bioclimatic Zone(s)

Lowland.

Ecological Units

- Black beech-matai-marbleleaf forest on alluvial terrace.
- Black beech forest on terrace risers, lower hill slopes and gullies.
- Kanuka low forest and scrub on lower hill slopes.
- Fivefinger-broadleaf-*Olearia paniculata* scrub and shrubland on steep colluvial hill slopes and terrace risers.
- Mixed shrub-rockland on cliffs, bluffs and outcrops.
- Mixed willow-kanuka-European broom scrub on alluvial flats, stream bed and banks.
- European broom shrubland on streambed and banks.
- Mixed pasture grassland on terrace risers, hill slopes and terraces.

Landforms

The area is comprised of small alluvial terraces, terrace risers, bluffs, cliffs, outcrops and hill slopes along the true right of Spey Stream and its tributaries, between the confluences with Conway River and Blackburn Stream. Small terraces are composed of recent alluvium, while the rest of the area is underlain by Mesozoic greywacke.

Vegetation and Flora

Black beech forest is the predominant vegetation type, much of it occurring on steep terrace risers and incised gullies. The mixed-age forest contains a moderately dense canopy up to 20m. The understorey is comprised of younger black beech and marbleleaf with minor lancewood, broadleaf, kanuka, *Coprosma robusta*, *Olearia paniculata* and scrambling *Rubus squarrosus*. Young black beech shares the shrub tier with *Corokia cotoneaster* and *Coprosma rhamnoides*, with minor *Coprosma linariifolia*, *Hebe traversii*, *Cyathodes juniperina*, European broom, young marbleleaf and lancewood, and *Rubus squarrosus*. The moderately sparse ground tier contains seedlings of the tree and shrub species mentioned above, with *Astelia fragrans*, *Microlaena avenacea*, *Polystichum richardii*, *P. vestitum*, *Asplenium gracillimum*, *A. hookerianum*, *Blechnum penna-marina*, sweet vernal and wall lettuce.

Two small streamside alluvial terraces contain mixed-age forest. The principal canopy species is black beech with minor matai and marbleleaf. Other canopy species present, but contributing > 1% of the canopy cover, include lowland totara, kahikatea, miro and pokaka. Marbleleaf is the most common understorey species with minor black beech, matai, kahikatea and climbing *Parsonsia capsularis*. The shrub tier is dominated by *Coprosma rhamnoides* and *Neomyrtus pedunculata* with minor *Coprosma rigida* and young black beech, marbleleaf and matai. The species-rich, moderately dense ground tier contains *Microlaena avenacea*, *Polystichum*

vestitum, *Blechnum penna-marina*, and *Coprosma rhamnoides* seedlings, with minor *Blechnum fluviale*, *Hypolepis millefolium*, *Uncinia fuscovaginata*, *Parsonsia capsularis*, wall lettuce and seedlings of the tree and shrub species mentioned above.

Fivefinger-broadleaf-*Olearia paniculata* scrub and shrubland is present on steep, shady, southwest-facing colluvial slopes. Much of this shrubland is remnant and has survived fires and grazing damage through its inaccessible and sheltered location. A poorly defined shrub tier includes younger fivefinger with minor broadleaf, *Olearia paniculata*, *Coprosma crassifolia*, *C. propinqua* ssp. *propinqua* and *Hebe traversii*. The sparse ground tier most commonly contains fivefinger seedlings and *Polystichum richardii* with minor *C. propinqua* ssp. *propinqua* seedlings, *Asplenium terrestre* ssp. *terrestre*, *A. hookerianum* and wall lettuce.

Sheer greywacke cliff faces contain patchy communities of shrub-rockland and rockland. Taller shrub species include *Olearia paniculata*, broadleaf, red mapou, marbleleaf, tree tutu, kanuka and European broom. The most common subshrub species is Marlborough rock daisy (*Pachystegia* sp. 'A'), with minor *Hebe traversii*, *Brachyglottis monroi*, Marlborough lilac, wharariki, *Corokia cotoneaster*, *Coprosma propinqua* ssp. *propinqua* and *Melicytus crassifolius* var. 'inland erect'. *Linum catharticum* is also present with exotic grasses such as Yorkshire fog, sweet vernal, browntop and cocksfoot.

Induced kanuka low forest occurs in a few small stands on beech forest margins.

European broom has become established along much of the watercourse and forest margins, and poses the greatest weed threat.

Melicytus crassifolius var. 'inland erect' and *Pterostylis areolata* were not seen elsewhere in the ecological district. Regionally endemic species include Marlborough rock daisy, Marlborough lilac and *Brachyglottis monroi*.

Fauna

Paradise shelduck use the stream as habitat. South Island fantail, bellbird and South Island robin were seen and/or heard within the forest.

Brown trout (*Salmo trutta*) were observed within Spey Stream.

Secondary Criteria

The riparian vegetation has stream bank stabilization values.

Trout fishing offers recreational value.

Selection Criteria

- Excellent example of alluvial black beech-matai-marbleleaf forest with plenty of podocarp regeneration. Black beech-podocarp forest is now rare within South Marlborough and Canterbury.
- Excellent examples of riparian black beech forest on the Inland Greywacke Hill Country land system.
- Remnant lowland mixed shrublands were the best seen within the Inland Greywacke Hill Country land system, and the combination of species was not seen elsewhere within the ecological district.
- Rare and regionally endemic plant species are present (see above).

Notes

The true left of the stream lies on property where access was denied.

RAP 14 - Conway Riparian Zone

Grid Reference Centre:	NZMS 260 O32 376494
Area:	130 ha
Altitudinal Range:	120-280 m
Tenure:	Private
Vegetation Types:	3a, 3c, 3d, 6b, 7, 8d, 9, 10a
Study Area Number:	H6, H33

Land System(s)

Inland greywacke hill country; Northwest outwash deposits and local alluvium.

Bioclimatic Zone(s)

Lowland.

Ecological Units

- Black beech-matai forest on alluvial terraces and toe slopes.
- **Black beech forest on terrace risers and lower hill slopes.**
- Black beech-mixed broadleaved forest along riparian zones.
- **Kanuka low forest and scrub on terrace risers and lower hill slopes.**
- **Mixed shrub-rockland and rockland on bluffs and cliffs.**
- Mixed scrub and shrubland on alluvial flats, terraces, terrace risers and hill slopes.
- Mixed pasture grassland and bracken fern-pasture grassland on terrace risers and hill slopes.

Landforms

The area consists of riparian zones, largely on the true left of the Conway River, and some of the lower portion of its tributaries, between Ngaroma Stream confluence and Spey Stream confluence. Small alluvial terraces and toe slopes are present at the base of steep Mesozoic greywacke terrace risers and lower hill slopes. Sheer west- to south-facing greywacke bluffs and cliffs occur in the northern half of the area.

Vegetation and Flora

Some small alluvial terraces and toe slopes still contain natural forest cover, although most have been cleared. Black beech dominates the canopy with scattered emergent matai. The understorey consists of younger black beech with kanuka on drier convex areas. The shrub tier is moderately dense containing *Lophomyrtus obcordata*, with minor *Cyathodes juniperina*, *Coprosma propinqua* ssp. *propinqua* and younger kanuka, matai and black beech. The dense ground tier is dominated by *Microlaena avenacea* and *Uncinia uncinata*, with *U. fuscovaginata*, *Histiopteris incisa* and *Hydrocotyle novae-zelandiae* in wetter hollows. Minor species include *Asplenium gracillimum*, *Polystichum richardii*, *P. vestitum*, wall lettuce, ragwort, self heal and

seedlings of black beech, matai, *Lophomyrtus obcordata*, *Corokia cotoneaster* and *Coprosma rhamnoides*.

Secondary black beech forest along the terrace risers of this section of Conway River and the lower reaches of smaller tributaries typically contains few other associates in a moderately dense canopy. A sparse understorey contains black beech with minor marbleleaf, lancewood and kohuhu. The shrub tier is moderately dense with *Coprosma propinqua* ssp. *propinqua*, *C. rhamnoides*, *Corokia cotoneaster*, *Helichrysum lanceolatum* and *Gaultheria antipoda* with minor black beech and scrambling *Rubus cissoides*. The ground tier is typically sparse, containing scattered tree and shrub seedlings with *Uncinia uncinata*, *Microlaena avenacea*, *Polystichum richardii*, *Asplenium terrestre* ssp. *terrestre*, *Ranunculus reflexus* and *Hieracium pilosella*.

Mixed-age riparian beech forest along the lower reaches of Sebastopol Creek contains few other canopy or understorey species. A moderately dense shrub tier primarily consists of regenerating black beech and *Coprosma crassifolia* with minor *Coprosma lucida*, *C. rhamnoides* and marbleleaf. The ground tier is generally somewhat sparse with minor *Polystichum richardii*, *Asplenium flaccidum*, *Blechnum fluviatile*, *B. novae-zelandiae* and wall lettuce.

Induced kanuka low forest and scrub on dry faces typically has a dense canopy containing minor kowhai, broadleaf and scrambling *Rubus cissoides*. The dense understorey merges with the shrub tier and primarily contains kanuka and *Corokia cotoneaster* with minor manuka, *Cyathodes juniperina*, *Coprosma crassifolia*, tree tutu and *Rubus cissoides*. The moderately dense ground tier contains, most commonly, *Polystichum richardii* and browntop with minor amounts of tree and shrub seedlings, *Pellaea rotundifolia*, *Asplenium terrestre* ssp. *terrestre*, *A. gracillimum*, *Lagenifera strangulata*, cocksfoot, ragwort, wall lettuce and *Torilis arvensis*.

Shrub-rockland and rockland on south- to west-facing bluffs and cliffs contain scattered small trees and shrubs such as manuka, kanuka, kowhai, broadleaf, *Coprosma robusta*, kohuhu, *Cordyline australis*, European broom, tree tutu, *Helichrysum lanceolatum*, *Coprosma propinqua* ssp. *propinqua* and *Corokia cotoneaster*. Subshrubs and scramblers include Marlborough rock daisy (*Pachystegia* sp. 'A'), Marlborough lilac, *Brachyglottis monroi* var. *monroi*, *Muehlenbeckia australis*, *Carmichaelia australis* and less commonly *Clematis afoliata*. The ground tier often merges with these smaller shrubs and includes species such as *Polystichum richardii*, *Pellaea rotundifolia*, *Asplenium flabellifolium*, *Dichelachne crinita*, and a variety of exotic grasses and herbs.

The river banks are often very weedy, with willows, European broom, gorse, pasture grasses and a variety of herbs present. These species pose some threat to the rockland communities, although their spread is likely to continue primarily along the floodplain.

Fauna

The Conway River as a whole has been rated as having moderate-high wildlife value (O'Donnell, 1982, cited in O'Donnell and Moore, 1983), providing habitat for a variety of wetland and terrestrial birdlife. Bellbirds, South Island fantail and grey warbler were seen and/or heard in the forest.

Evidence of browsing by stock was variable. Some areas have been fenced and others are on a steep gradient which makes them inaccessible. Possum and rabbit sign was found. German wasps are present in the beech forest.

Secondary Criteria

The vegetation has importance for bank stabilisation, preventing sedimentation of the river.

Selection Criteria

- A variety of riparian vegetation types includes alluvial black beech-matai forest, a vegetation type now rare in both South Marlborough and Canterbury.
- Excellent examples of black beech riparian forest both within the Inland Greywacke Hill Country land system and within the ecological district.
- Greywacke cliff and bluff communities were some of the best seen on the Inland Greywacke Hill Country land system and some of the best in the ecological district.
- Regionally endemic species present include Marlborough rock daisy, *Brachyglottis monroi* var. *monroi*, and Marlborough lilac.

Notes

Adjoins The Conway River Floodplain (RAP 21), Spey Stream (RAP 13) and Ngaroma Scenic Reserve (PNA 16).

RAP 15 - Peaked Hill

Grid Reference Centre:	NZMS 260 O32 438495
Area:	725 ha
Altitudinal Range:	140-807 m
Tenure:	Private
Vegetation Types:	3a, 3b, 3c, 4a, 5a, 5c, 6b, 8a, 8c, 8d, 9, 10a, 13
Study Area Number:	H4

Land System(s)

Inland greywacke hill country; Northwest outwash deposits and local alluvium.

Bioclimatic Zone(s)

Lowland; montane.

Ecological Units

- Mixed beech-podocarp-broadleaved forest along riparian zone, including stream gullies and small alluvial terraces.
- **Black beech forest in riparian zone and gullies.**
- Black beech-mixed broadleaved forest in riparian zone and gullies.
- Red beech-black beech-broadleaved forest in stream gullies.
- **Mixed broadleaved low forest on hill slopes and gullies.**



Plate 3. RAP 14 - Conway Riparian Zone. Black beech forest on the terrace rivers and gully tributaries of the true left of Conway River.



Plate 4. RAP 15 - Peaked Hill. Mixed broadleaved low forest and kanuka low forest.

- Mixed broadleaved low forest on alluvial terrace.
- **Kanuka scrub on hill slopes.**
- Mixed scrub, shrubland and shrub-rockland on rock bluffs and steep bedrock and colluvial hill slopes.
- Wharariki flaxland on steep colluvial hill slopes.
- Marlborough rock daisy rockland on sheer bluff faces.
- European broom shrubland on hill slopes and ridges.
- Bracken fernland on hill slopes.
- Fescue tussock-silver tussock-mixed pasture grassland and shrub-grassland hill slopes, crests and ridges.
- Mixed pasture grassland on hill slopes, ridges and crests.

Landforms

The area encompasses the upper reaches and headwaters of Limestone Creek, including Peaked Hill (807m). The hill country contains steep-sided V-shaped valleys, hill slopes (colluvial in many cases), crests, ridges and bedrock outcrops and bluffs. The principal rock type is Mesozoic greywacke. A few small, localised pockets of streamside alluvium are also present.

Vegetation and Flora

An intact stand of primary (or older secondary) mixed beech-podocarp-broadleaved forest occurs towards the eastern, low-altitude end of the area. Black beech and hinau are the most prominent canopy species, with minor black beech, matai, miro and lemonwood. The principal understorey species are mahoe and marbleleaf, with minor red beech, black beech, pokaka, lemonwood, miro, fivefinger, wheki, kaikomako and lancewood, with scrambling *Rubus cissoides* and epiphytic *Asplenium flaccidum*. The shrub tier is moderately dense, containing *Coprosma rhamnoides* and minor regenerating red beech, black beech, matai, miro, kowhai, marbleleaf, tree fuchsia, mahoe, kaikomako, *Pseudopanax colensoi* and *Rubus cissoides*. *Polystichum richardii* is the most frequent ground tier species with minor *Pneumatopteris pennigera*, *Asplenium bulbiferum*, *Adiantum cunninghamii*, *Blechnum discolor* and good numbers of tree and shrub seedlings.

Secondary even-aged black beech forest and black beech-mixed broadleaved forest is generally confined to gullies and riparian zones. The canopy contains varying amounts of broadleaved species which are also prominent in the understorey, particularly marbleleaf and tree fuchsia. Other prominent species are mahoe, fivefinger and wineberry, with minor *Rubus cissoides* and pate. The shrub and ground tiers tend to merge and are dominated by *Blechnum procerum*, *Uncinia uncinata* and *Urtica ferox* with minor *Coriaria plumosa*, *Coprosma rhamnoides*, *Rubus cissoides*, *Pneumatopteris pennigera*, *Hypolepis millefolium*, *Polystichum richardii*, *Blechnum chambersii*, *B. discolor*, *B. procerum*, hound's tongue fern, *Adiantum cunninghamii*, seedlings of the principal tree and shrub species, and cocksfoot, wall lettuce and foxglove.

Lowland-montane mixed broadleaved forest in gullies is dominated by broadleaf, lemonwood and mahoe with minor kohuhu and occasional tall kanuka. Tree fuchsia dominates the forest margins. The understorey and shrub tier are typically sparse with minor mahoe, Halls totara, wineberry, fivefinger, wheki, marbleleaf, *Coprosma robusta*, *C. crassifolia*, *C. rhamnoides*, and *Cordyline banksii*. *Polystichum richardii* is prominent in the ground tier, with minor *Blechnum procerum*, *Asplenium bulbiferum*, *Uncinia uncinata*, *Acaena anserinifolia*, *Urtica ferox*, catsear, foxglove, wall lettuce and ragwort. Weed content varies with grazing pressure and buffering.

Small stands of broadleaved forest are present on alluvium. Mahoe drops out and lemonwood, marbleleaf and broadleaf dominate the thick canopy with minor *Cordyline australis*. A sparse understorey contains minor amounts of canopy species along with wheki. The dense shrub and ground tier tend to merge, with *Polystichum richardii* the dominant species. *Uncinia uncinata* and wall lettuce are also prominent with minor amounts of *Coprosma rhamnoides*, *C. aff. parviflora*, *Urtica ferox*, *Blechnum discolor*, *Oreomyrrhis ramosa*, *Acaena anserinifolia*, *Senecio minimus*, cocksfoot, Yorkshire fog and white clover.

Mixed montane shrubland and scrub on bedrock bluff and steep colluvial south-facing hill slopes contain scattered emergent mountain beech, broadleaf, *Cordyline australis*, manuka and Hall's totara over a shrub tier of dense matagouri with tree fuchsia, *Coprosma rhamnoides*, *C. aff. parviflora* and *Muehlenbeckia australis*. Minor species include wharariki, tauhinu, bracken fern, *Coprosma propinqua* ssp. *propinqua* and *Rubus cissoides*. The ground tier is dominated by silver tussock, *Polystichum vestitum*, browntop, sweet vernal and seedlings of *C. aff. parviflora* and matagouri, with minor *Coriaria plumosa*, Marlborough rock daisy (*Pachystegia* sp. 'A'), *Hypolepis millefolium*, fescue tussock, *Linum monogynum*, *Acaena anserinifolia*, sheep's sorrel, white clover, *Trifolium dubium*, catsear and foxglove.

Small areas of wharariki flaxland are present on steep colluvial south-facing slopes burned within the last five years. Where bluff faces are sheer there is little vegetation other than scattered Marlborough rock daisy.

The grassland and shrub-grassland areas are most natural on the slopes surrounding Peaked Hill. Scattered tauhinu, *Coprosma propinqua* ssp. *propinqua*, matagouri and *Melicytus alpinus* are emergent over moderately dense silver tussock and fescue tussock. The intertussock spaces are dominated by dense pasture grasses, particularly browntop, sweet vernal, cocksfoot and Yorkshire fog. Minor species include catsear and white clover.

European broom shrubland is present to the north of Peaked Hill summit as well as infesting the neighbouring Boundary Stream catchment to the south. This represents the biggest weed threat to the area.

Fauna

Habitat value for wildlife has been assessed as "moderate" (New Zealand Wildlife Service, 1983) with a variety of birdlife present including the threatened New Zealand pigeon (Category B), grey warbler, bellbird, South Island tomtit, brown creeper, silvereye and hedge sparrow.

Stock damage appears to be confined to forest margins and the most accessible areas. The presence of palatable species such as wineberry suggest that possum numbers are not currently high.

Secondary Criteria

Forested areas, particularly on steep valley sides, perform an important role in erosion prevention.

Selection Criteria

- Excellent sequence of vegetation types, from lowland to montane, on the Inland Greywacke Hill Country land system.
- The stand of riparian mixed beech-podocarp-broadleaved forest is rare within the ecological district and regionally within Canterbury and South Marlborough. It has high intactness values with profuse regeneration of the major canopy and understorey species.
- One of the best stands of red beech-black beech-broadleaved forest seen in the ecological district. This is now a rare vegetation type both within the ecological district and regionally in Canterbury and South Marlborough.
- Mixed broadleaved forest contains a high proportion of lemonwood and broadleaf, and fewer mahoe which is unusual within the Inland Greywacke Hill Country land system.
- Few examples of alluvial broadleaved forest are present within the ecological district.
- Excellent examples of montane shrubland and shrub-grassland within the land system.
- Intact natural montane communities are generally confined to the higher peaks within the ecological district.
- Bluff vegetation contains the regionally endemic Marlborough rock daisy.
- Wildlife habitat is provided for a number of terrestrial bird species including the threatened New Zealand pigeon.

RAP 16 - Open Creek

Grid Reference Centre:	NZMS 260 O32 412480
Area:	600 ha
Altitudinal Range:	80-680 m
Tenure:	Private
Vegetation Types:	3a, 3b, 3d, 5a, 5d, 6a, 6b, 6c, 6d, 7, 8c, 8d, 10a
Study Area Number:	H7

Land System(s)

Inland greywacke hill country; Northwest outwash deposits and local alluvium.

Bioclimatic Zone(s)

Lowland; montane.

Ecological Units

- Mixed beech-podocarp-broadleaved forest along riparian zone and on alluvial terrace.

- Black beech-red beech forest along riparian zone, lower spur side slopes and hill slopes.
- **Black beech forest on hill side slope, spur side slope, riparian zone, gully and gully head.**
- Black beech-kanuka low forest on hill crest, hill slope and spur side slope.
- **Mahoe-mixed broadleaved forest in gullies and concave hill slopes and spur side slopes.**
- Mahoe-mixed broadleaved-kanuka forest in gullies.
- Kanuka low forest and scrub on (often colluvial) convex hill slopes, ridges, spur side slopes and spur crests.
- **Kanuka-manuka low forest and scrub on (often colluvial) hill slopes, spur side slopes and spur crests.**
- Manuka shrubland and scrub on hill slopes, spur side slopes and spur crests.
- Mixed shrub-grassland on hill crests, spur crests, spur side slopes and hill slopes.
- European broom shrubland on hill crests, spur crests, spur side slopes and hill slopes.
- Bracken fernland on hill slopes and spur side slopes.
- Mixed pasture grassland on hill crests, spur crests, spur side slopes and hill slopes.

Landforms

The area comprises the Open Creek catchment extending from approximately one quarter of the way upstream from the Conway River confluence, to the headwaters.

The steep-sided V-shaped valley and associated tributaries, gullies, hill slopes, spur slopes, crests and ridges are composed of Mesozoic greywacke. A few small, localised alluvial terraces are scattered along the creek. Many of the steeper slopes are colluvial.

Vegetation and Flora

The native forest vegetation extends from valley bottom to ridge crest in much of the catchment. Black beech-red beech forest, mahoe-mixed broadleaved forest, and kanuka and kanuka-manuka low forest and scrub comprise most of the area with associated intergrades.

Small, poorly-drained alluvial terraces typically contain black beech forest with minor red beech and scattered emergent matai and lowland totara. The remaining canopy and understorey species consists of mahoe, with minor broadleaf, lemonwood, marbleleaf, tree fuchsia, manuka, wineberry, mamaku, *Parsonsia capsularis* and *Calystegia tuguriorum* are also present in the understorey. The shrub tier contains *Coprosma rhamnoides* with minor manuka, *Rubus cissoides* and *Calystegia tuguriorum*. *Microlaena avenacea*, *Polystichum richardii* and *Hypolepis millefolium* are prominent in the ground tier with minor *Blechnum fluviatile*, *B. chambersii*, *Pneumatopteris pennigera*, *Urtica ferox*, *Oreomyrrhis ramosa*, *Uncinia uncinata*, *Acaena anserinifolia*, *Ranunculus reflexus* and wall lettuce. Canopy gaps and margins may contain exotic species such as gorse, European broom, Yorkshire fog, foxglove and white clover.

Tall mixed-age black beech-red beech forest occupies much of the riparian zone and lower faces. There are typically few other canopy or understorey species on steep slopes other than minor amounts of marbleleaf. Juvenile beech shares the shrub tier with *Coprosma rhamnoides* and minor *Cyathodes juniperina*, *Coprosma propinqua* ssp. *propinqua*, wineberry, broadleaf, and *Rubus cissoides*. *Blechnum procerum* and *Microlaena avenacea* are prominent in the ground tier with minor *Hypolepis millefolium*, hound's tongue fern, *Polystichum richardii* and *Uncinia uncinata*.

Secondary gully and concave hill slope vegetation is typically dominated by a canopy of mahoe. Emergent species may include scattered podocarp species such as lowland totara and matai. Kanuka may be present either as an emergent species or a canopy associate. Kowhai, lemonwood and red mapou are minor canopy associates. The shrub tier contains *Coprosma rhamnoides* and *Helichrysum lanceolatum*. *Uncinia uncinata*, *U. fuscovaginata*, *Blechnum fluviatile* and wall lettuce comprise the ground tier with minor *Asplenium hookerianum* and *Acaena anserinifolia*.

Kanuka scrub and low forest generally forms a dense canopy with minor manuka. *Coprosma rhamnoides* dominates the shrub tier in association with *Helichrysum lanceolatum* and *Leucopogon fasciculatus*. The ground tier typically contains seedlings of both *C. rhamnoides* and *H. lanceolatum* with *Uncinia uncinata*, *Polystichum vestitum* and minor kanuka, *Blechnum fluviatile*, *Asplenium flabellifolium*, *Dichondra repens*, *Lagenifera strangulata*, *Acaena anserinifolia*, *Ranunculus foliosus* and *Agrostis capillaris*. Older stands may contain more broadleaved seedlings and juveniles such as marbleleaf, kohuhu and broadleaf. Kanuka low forest and scrub may contain regenerating black beech close to beech forest margins.

Fauna

Bellbird, South Island rifleman, silveryeye, South Island fantail, South Island tomtit, Australasian harrier, grey warbler, brown creeper, and threatened New Zealand pigeon (Category B) are known from the area (New Zealand Wildlife Service, 1983) along with introduced species such as chaffinch, goldfinch, greenfinch, redpoll, yellowhammer, hedge sparrow and white-backed magpie.

The carnivorous snail *Wainuia edwardii* has been observed in the past (New Zealand Wildlife Service, 1983). Recent research has indicated that this species should be treated as a threatened Category C species (Efford, 1997).

Deer and pigs are present in the valley. Stock numbers are not high within the interior as the steep slopes and dense vegetation on the perimeter makes access difficult.

Secondary Criteria

The area provides recreational value for deer and pig hunting.

Selection Criteria

- One of the most expansive areas of native forest remaining in the ecological district, extending from valley floor to ridge in most places.
- Mixed beech-podocarp-broadleaved forest on alluvial terraces is a rare vegetation type within both South Marlborough and Canterbury.

- One of the best stands of red beech-black beech-broadleaved forest seen in the ecological district. This is now a rare vegetation type both within the ecological district and regionally in Canterbury and South Marlborough.
- Excellent examples of black beech forest, kanuka low forest and mixed broadleaved low forest on the Inland Greywacke Hill Country land system.
- Wildlife habitat is provided for a number of terrestrial bird species including the threatened New Zealand pigeon.

RAP 17 - Limestone and Derek Streams

Grid Reference Centre:	NZMS 260 O32 465469
Area:	295 ha
Altitudinal Range:	40-404 m
Tenure:	Private
Vegetation Types:	3a, 3c, 4a, 5a, 5c, 5d, 6b, 6c, 8c, 8d, 9, 10a
Study Area Number:	H11

Descriptions include information gathered by Stevens (1996) as part of the Cheviot/Motunau PNA survey.

Land System(s)

Coastal greywacke hill country; Inland greywacke hill country; Northwest outwash deposits and local alluvium.

Bioclimatic Zone(s)

Semi-coastal.

Ecological Units

- Black beech forest on hill slope.
- Black beech-mixed broadleaved forest along riparian zone.
- Matai-mahoe forest on alluvial terrace.
- Mixed broadleaved forest along riparian zone.
- Mahoe-mixed broadleaved forest on hill slopes.
- Kanuka-mixed broadleaved low forest, scrub and shrubland on colluvial hill slopes, crests and ridges.
- Kanuka-manuka low forest on hill slopes.
- Kanuka scrub, shrubland and shrub-pasture grassland on colluvial hill slopes and ridges.
- Mixed shrub-rockland and rockland on bluffs, outcrops and gorge sides.
- Bracken fernland on hill slopes.
- Mixed pasture grassland on hill slopes, crests and ridges.



Plate 5. RAP 16 - Open Creek. Kanuka forest on ridges and convex slopes, broadleaved forest on concave slopes, and black beech forest in gullies, riparian zones and lower hill slopes.



Plate 6. RAP 17 - Limestone and Derek Streams. Mixed broadleaved low forest and scrub, and kanuka low forest and scrub.

Landforms

The area comprises the midstream portion of Limestone Stream and the mid to upper portion of Derek Stream including its headwaters. A few small streamside alluvial terraces are present along Limestone Stream. Most hill slopes are steep, particularly the eastern flank of Mt. Guardian. Limestone Stream forms a gorge towards the northern end of the area. There are only two gorges within the ecological district (the other is in the Leader River-Black Hills area) and they represent a change from the V-shaped valley systems typical of most greywacke hill country. Bluffs and outcrops are scattered throughout, generally on steep land. Greywacke hill country to the south of Oaro and east of SH1 is of much lower relief than that situated north of Oaro. The highest point is Mt. Guardian at 404m.

The geology is dominated by Mesozoic greywacke other than small and localised areas of alluvium.

Vegetation and Flora

The most common vegetation types, cloaking most of the steep slopes, are kanuka, kanuka-manuka and kanuka-mixed broadleaved low forest, scrub and shrubland.

Kanuka-mixed broadleaved low forest, scrub and shrubland on drier east-facing steep slopes (often colluvial) is often sparse and patchy, with an open canopy consisting primarily of kanuka, kowhai and mahoe. *Helichrysum lanceolatum* dominates the shrub tier with bracken fern common in open areas. Pasture grasses such as sweet vernal and cocksfoot dominate the ground tier.

Mahoe-mixed broadleaved low forest and scrub on steep, shady east-facing slopes and gully risers (often colluvial), where grazing pressure is low, contain a canopy dominated by mahoe, with variable amounts of kanuka, red mapou, broadleaf and marbleleaf. Understorey and shrub tiers are often sparse, with minor fivefinger and *Helichrysum lanceolatum* the only prominent species. The ground tier, however, is typically species-rich with *Adiantum cunninghamii*, *Asplenium bulbiferum*, hound's tongue fern, *Polystichum richardii* and *Uncinia uncinata* prominent along with the threatened *Anemanthele lessoniana*.

Kanuka extends to the valley bottom in many cases, particularly downstream. Where broadleaved species dominate riparian forest and scrub a richer mix of species occurs including tree tutu, tree fuchsia, kawakawa, fivefinger, supplejack, mahoe, marbleleaf, broadleaf, red mapou, black beech, kowhai, *Coprosma robusta*, *C. rotundifolia*, kaikomako, *Helichrysum lanceolatum*, *Lophomyrtus obcordata*, *Hebe stricta*, silver fern, wheki, kanuka, *Cordyline banksii*, *Metrosideros diffusa* and an array of ferns including *Asplenium bulbiferum*, *A. terrestre* ssp. *terrestre*, *Polystichum richardii*, *Blechnum fluviatile* and *B. chambersii*.

Kanuka-manuka scrub and low forest are present on west-facing hill slopes of moderate gradients. A dense canopy overlies a moderately sparse shrub tier dominated by *Coprosma rhamnoides*. The ground tier is sparse and heavily grazed in places. Canopy gaps tend to be dominated by bracken fernland.

Small alluvial terraces contain a canopy dominated by emergent matai and minor kanuka over mahoe, kanuka and kaikomako with scrambling *Muehlenbeckia australis* and supplejack. The shrub tier tends to merge with a low understorey with *Lophomyrtus obcordata* the most frequent species along with minor kaikomako, kanuka, *Coprosma rhamnoides*, *Streblus heterophyllus*, supplejack and *Parsonsia*

capsularis. The most common species amongst a moderately dense ground tier is *Hypolepis ambigua* with minor *Microlaena stipoides*, *Hydrocotyle heteromeria* and seedlings of *Lophomyrtus obcordata*, *Coprosma rhamnoides*, kaikomako and matai.

Secondary mixed-age black beech forest is present on steep south-facing gully risers at the northern end of the area around a tributary confluence upstream from the gorge. The dense beech canopy overlies a moderately dense understorey of fivefinger with minor black beech and *Leucopogon fasciculatus*. A moderately dense shrub tier contains regenerating beech, fivefinger and minor *Leucopogon fasciculatus*, *Helichrysum lanceolatum*, *Coprosma rhamnoides*, *C. robusta* and *Cyathodes juniperina*. *Astelia fragrans* and seedlings of fivefinger, black beech, *Coprosma rhamnoides* and *C. juniperina* are conspicuous among a sparse ground tier.

Vegetation on bluffs and outcrops include a mix of shrub species forming a canopy of variable density and height. Manuka, *Coprosma crassifolia*, *Helichrysum lanceolatum*, Marlborough rock daisy (*Pachystegia insignis* ss.), *Muehlenbeckia complexa* and prostrate kowhai are prominent. The ground tier is commonly comprised of pasture grasses, silver tussock, European broom, Marlborough lilac, *Cheilanthes humilis* and *Polystichum richardii*. Drier sites in the gorge typically contain a mix of *Helichrysum lanceolatum*, *Corokia cotoneaster*, *Carmichaelia australis*, *Olearia paniculata*, *Brachyglottis monroi*, Marlborough rock daisy, Marlborough lilac, *Linum monogynum*, *Anaphalis keriense* and introduced grasses.

Characteristic species in shady gorge sites include fivefinger, tree tutu, *Leucopogon fasciculatus*, *Cyathodes juniperina*, tree fuchsia, *Hebe salicifolia*, *Gingidium montana*, *Ourisia lactea* ssp. *lactea*, *Astelia fragrans*, *Libertia ixioides*, hound's tongue fern, *Blechnum triangularifolium*, *Adiantum cunninghamii*, *Pyrrosia eleagnifolia*, silver tussock, and introduced grasses.

Weed species become more frequent in the downstream areas, particularly in canopy gaps and where grazing prevents the re-establishment of native riparian species. Wattle, hawthorn, briar, European broom, gorse and blackberry are the most apparent.

A threatened shrub, *Teucrium parvifolium* (Category C), and a nationally local bush grass, *Anemathele lessoniana*, were both found within the area on a previous study (Stevens, 1996). Neither species was seen in the ecological district during the survey. The nationally local mistletoe, *Ileostylus micranthus*, was observed growing on prostrate kowhai, *Coprosma propinqua* ssp. *propinqua* and *Melicytus alpinus*. Several plants occurring within the RAP were not found elsewhere, including *Calystegia sepium*, *Clematis marata*, *Blechnum triangularifolium* and *Arthropodium candidum*.

Fauna

The forest, scrub and rockland provides habitat for a variety of bird including threatened New Zealand pigeon (Category B) and New Zealand falcon (Category B). Other species seen and/or heard include Australasian harrier, South Island fantail, bellbird, shining cuckoo (*Chrysococcyx lucidus*), New Zealand kingfisher, South Island rifleman, silvereye, brown creeper, chaffinch and white-backed magpie.

Deer and possums are present, although the principal cause of damage to forested areas appears to be via stock. German wasps are present on black beech.

Selection Criteria

- The Limestone Stream gorge is an unusual landscape feature within the ecological district and the only one to occur within the Coastal Greywacke Hill Country land system.
- The area is the largest remaining forest remnant lying solely within the semi-coastal bioclimatic zone.
- A diverse variety of vegetation types are present within the area and are the best on low-relief semi-coastal greywacke hill country.
- Relatively unmodified shrubland and shrub-rockland are present on gorge faces.
- Small areas of matai-kanuka-mixed broadleaved forest occur on localised alluvial terraces. This forest type is now rare in both Canterbury and South Marlborough.
- A variety of rare and unusual plants are present (see above).
- Habitat is provided for a variety of terrestrial bird species including threatened species (see above).

Notes

Lies close to and could link with Limestone Creek Scenic Reserve (PNA 17). Peaked Hill (RAP 15) lies further upstream and includes the headwaters of Limestone Stream.

RAP 18 - Conway River Mouth

Grid Reference Centre:	NZMS 260 O32 483436
Area:	75 ha
Altitudinal Range:	sea level - 3 m
Tenure:	Crown land administered by LINZ
Vegetation Types:	7, 8b, 8d, 11, 12, 13, 14, 15, 16, 18
Study Area Number:	H14

Land System(s)

Northwest outwash deposits and local alluvium.

Bioclimatic Zone(s)

Coastal.

Ecological Units

- Willow-*Acacia* treeland and scrub on braided river islands and banks.
- Saltmarsh ribbonwood shrubland at lagoon margin on low coastal terrace.
- Harakeke flaxland at lagoon margin on low coastal terrace.
- Mixed sedge-rushland at lagoon margin on low coastal terrace.
- Pasture grassland on low coastal terrace.
- Raupo reedland in standing water in lagoon.
- Gravelfield on braided river bed.

- Gravelfield on beach and spit.
- *Gracilaria* aquatic herbfield under open water in lagoon.

Landforms

The area contains a section of braided riverbed containing active and inactive channels, backwashes and holes, with varying amounts of silt deposits. Semi-consolidated, vegetated islands are present, particularly close to the banks. The river mouth is a wide braided delta. Active channels flow into a lagoon which, depending on river flows and gravel aggregation, may be split into two smaller lagoons to the south and north of the primary outlet. The lagoon is flanked to the seaward side by a spit comprised largely of gravel with some sand, the extent and nature of which is also in a constant state of flux. It may disappear when a breach occurs across the shingle barrier during high river discharge (O'Donnell and Moore, 1983).

A low coastal terrace is present on the landward side at the northern end of the lagoon. It is bounded by the braided river system, a terrace riser at the margin of an adjacent older terrace, and the lagoon itself. A section of the terrace closest to the lagoon margin is intertidal.

Vegetation and Flora

Little native vegetation is present in the braided riverbed. Adventive weeds dominate the floodplain and repeatedly become established after flooding events. The most common of these are gorse, European broom, tree lupin, Scotch thistle, vipers bugloss, lilac (*Syringa vulgaris*), woolly mullein, sweet clover, common storksbill, spreading pearlwort, stonecrop, allseed and cocksfoot. Scattered among this usually sparse vegetation are a scant number of native species: *Raoulia tenuicaulis*, *Gnaphalium audax* and toetoe (*Cortaderia richardii*). Silver wattle (*Acacia dealbata*), crack willow and pussy willow dominate the treeland and scrub on river banks and islands.

The densest vegetation on the sandspit occurs near the intertidal lagoon margin where *Isolepis nodosa* is most apparent. Other species present here and scattered over other parts of the sandspit include *Calystegia soldanella*, *Carex pumila*, scarlet pimpernel, gorse and Scotch thistle.

Saltmarsh ribbonwood (*Plagianthus divaricatus*) shrubland, harakeke (harakeke) flaxland and mixed sedge-rushland form a mosaic of communities on the low coastal terrace near the lagoon margin. These vegetation types are confined to a small proportion of the total area. Common associated species with coastal saltmarsh ribbonwood shrubland are *Juncus kraussii* var. *australiensis*, *Schoenoplectus pungens*, *Carex littoralis*, *Isolepis nodosa*, glaucous goosefoot and *Sellieria radicans* plus a host of exotic grasses and herbs.

Harakeke flaxland contains, as the most common species, saltmarsh ribbonwood, *Muehlenbeckia complexa*, gorse, *Isolepis nodosa*, *Juncus kraussii* var. *australiensis*, raupo, *Cotula coronopifolia*, and a suite of exotic herbs and grasses.

A mix of *Isolepis nodosa*, *Carex littoralis*, *Schoenoplectus pungens* and *Juncus kraussii* var. *australiensis* form areas of open sedge-rushland. They contain a host of exotic grass species, most commonly browntop and cocksfoot, and merge with pasture grassland in places.

Selliera radicans becomes frequent in the intertidal zone, beyond which lie patches of raupo reedland and aquatic herbfield dominated by *Gracilaria* sp.

This is the only location in the district and one of few in either South Marlborough or Canterbury where many of these species such as saltmarsh ribbonwood, *Schoenoplectus pungens*, *Selliera radicans* and *Carex litorosa* are to be found. The nationally rare sand tussock (*Austrofestuca littoralis*) has been reported from the area (Davidson, Paton and Cash, 1993) but was not observed during the survey. *Calystegia soldanella*, glaucous goosefoot, *Isolepis nodosa*, *Leptinella dioica*, and *Carex pumila* are uncommon in the ecological district, confined to scattered localities along the coastline.

Fauna

The lagoon and river bed host a rich variety of birdlife including the threatened black-fronted tern (Category B), white-fronted tern (Category C), banded dotterel (Category C) and Caspian tern (Category O). Other native species present include black shag (*Phalacrocorax carbo novaehollandiae*), little shag, white-faced heron, paradise shelduck, grey duck, South Island pied oystercatcher, spur-winged plover (*Vanellus miles novaehollandiae*), pied stilt (*Himantopus himantopus leucocephalus*), Southern black-backed gull, red-billed gull and black-billed gull (*Larus bulleri*) (O'Donnell and Moore, 1983). Introduced species include the mallard and black swan.

Black flounder (*Rhombosolea ritiaria*) and common bully are known to occur from the river mouth and lagoon (NIWA, 1997).

Cattle from the adjacent farm are periodically allowed onto the lagoon margin and have caused localised damage to the flaxland vegetation in and around the track that runs between the gate and the lagoon edge.

Secondary Criteria

The river mouth is of importance to local iwi.

Selection Criteria

- The largest lagoon and gravelspit landforms within the ecological district.
- The only rivermouth wetland system to feature natural plant communities within the ecological district and one of the few in either Canterbury or South Marlborough.
- Saltmarsh ribbonwood shrubland is not found elsewhere in the district and rarely in the South Marlborough or Canterbury regions.
- Mixed sedge-rushland and harakeke flaxlands seen here represent rare communities within the ecological district.
- Several plant species found here are either rare or uncommon within the district and/or region (see above).
- This is the only known location of black flounder within the ecological district.
- A rich variety of birdlife uses the lagoon, and adjacent riverbed and spit as habitat, including four threatened species (see above).

Notes

The area borders a scenic reserve (PNA 21) which contains a highly modified coastal bush remnant and is presently leased for grazing. This area could potentially be used as a buffer.

The option of restoring it to its original cover, and making it an integral part of the existing native vegetation would be a major undertaking.

RAP 19 - Ferniehurst Bush

Grid Reference Centre:	NZMS 260 O32 367445
Area:	20 ha
Altitudinal Range:	135-145 m
Tenure:	Private
Vegetation Types:	4a, 7
Study Area Number:	H5

Land System(s)

Northwest outwash deposits and local alluvium.

Bioclimatic Zone(s)

Lowland.

Ecological Units

- Mixed podocarp-broadleaved forest on terrace.
- European ash-mixed podocarp-broadleaved forest on terrace.

Landforms

A fluvial terrace which is little dissected and negligibly weathered. It is likely to be of the last glacial age (Warren, 1995), now overlain with alluvium and loess.

Vegetation and Flora

This is the oldest stand of mixed podocarp-broadleaved forest in the district. Kahikatea, with lesser amounts of matai and miro are emergent over mahoe and, to a lesser degree, lemonwood. A rich array of minor species in the canopy includes rimu, lowland totara, black beech, hinau, pokaka (all of which may occur as emergents), narrow-leaved lacebark, kohuhu, red mapou, marbleleaf, tree fuchsia, broadleaf, *Cordyline banksii* and lancewood. Smaller tree and shrub species include swamp mahoe (*Melicytus micranthus*), fivefinger, kaikomako, pepperwood (*Pseudowintera colorata*), *Lophomyrtus obcordata*, wineberry, *Streblus heterophylla*, pate, kowhai, silver fern, wheki-ponga, *Melicope simplex*, *Coprosma grandifolia*, *C. lucida*, *C. robusta*, *C. rotundifolia*, *C. linariifolia*, *C. crassifolia*, *C. areolata*, *C. rhamnoides*, *C. propinqua* ssp. *propinqua* and *Hebe salicifolia*. *Metrosideros diffusa*, *Ripogonum scandens*, *Parsonsia capsularis*, *P. heterophylla* and *Calystegia tuguriorum* are common climbers. The ground tier contains a variety of tree and shrub seedlings, herbs and most commonly ferns, of which *Asplenium bulbiferum* and hound's tongue fern occur frequently. European ash (*Fraxinus excelsior*) is prominent in the margins, particularly at the southern end, and a variety of

introduced species and garden escapes are present on margins, by the track and in canopy gaps.

Notable species include swamp mahoe which is rare in both South Marlborough and Canterbury and was seen from only one other location in the ecological district (Waingaro QEII covenant). Lowland ribbonwood is uncommon in the ecological district. The mistletoes *Tupeia antarctica* (threatened - category B) and *Ileostylus micranthus* (locally occurring) are both reported from here (Molloy, date unknown) although were not seen during the survey.

Fauna

Bellbird, South Island rifleman, South Island fantail and threatened New Zealand woodpigeon (Category B) were observed during the survey. Brown creeper, grey warbler, shining cuckoo and morepork have been previously recorded (Molloy, date unknown).

Secondary Criteria

The area has scientific and educational value as one of the oldest podocarp-broadleaved forest remnants remaining in either Canterbury or South Marlborough.

Selection Criteria

- This is the oldest and largest podocarp-broadleaved forest remnant in the ecological district and one of few of this age in either Canterbury or South Marlborough.
- Native vegetation cover (and mature forest in particular) on fluvial terrace landforms is now very rare within both Canterbury and South Marlborough.
- The area has been fenced since the 1930's and is quite intact apart from introduced species concentrated around the perimeter.
- The forest stand is one of the most species-rich within the ecological district to occur outside a riparian zone.
- Several threatened and notable plant species occur here (see above).
- The area provides habitat for fauna including the threatened New Zealand pigeon.

RAP 20 - Rutherford Stream

Grid Reference Centre:	NZMS 260 O32 344429
Area:	20 ha
Altitudinal Range:	100-120 m
Tenure:	Private
Vegetation Types:	7, 8d, 11, 12, 14
Study Area Number:	H34

Land System(s)

Inland soft rock hill country.



Plate 7. RAP 19 - Ferniehurst Bush.



Plate 8. RAP 20 - Rutherford Stream. *Carex secta* sedgeland in the foreground merging into raupo reedland.

Bioclimatic Zone(s)

Lowland.

Ecological Units

- *Carex secta* sedgeland on poorly drained stream flat.
- *Carex secta*-raupo sedge-rushland on poorly drained stream flat.
- *Carex secta-juncus australis*-*J. gregiflorus* sedge-reedland on poorly drained stream flat.
- Raupo rushland on poorly drained stream flat.
- Mixed pasture grassland on wetland margins and toe slopes.
- Willow treeland on wetland margins.

Landforms

Rutherford Stream is a minor tributary of Conway River. The RAP is composed of a section of the stream where there is no clearly defined channel. The soil is deep and poorly drained on the stream flat, forming a swamp.

The underlying geology is Tertiary marine siltstone and sandstone.

Vegetation and Flora

Carex secta dominates the vegetation within the wetland. Raupo is present in the wettest areas either as pure stands or in association with *Carex secta*. In drier parts of the wetland *Carex secta* shares the canopy with *Juncus australis* and *J. gregiflorus*, forming sedge-reedland.

Pasture grasses and introduced herbs dominate the ground tier and scramble on and around the canopy species in all of these vegetation types, merging into pasture grassland on the margins. Sweet vernal, cocksfoot, Yorkshire fog and *Arenatherum elatius* are the most common grasses. The common herbs are *Stellaria graminea*, *Ranunculus repens*, self heal, *Rumex crispus*, *Veronica serpyllifolia*, Californian thistle, white clover and watercress (*Rorippa microphylla*). Seedlings of a species of *Carex* (probably *Carex coriacea*) are present near margins, although browsing damage is evident.

Fauna

Paradise duck and mallard use the wetland for habitat.

Stock graze within the wetland, most prominently near margins. Soil compaction and trampling damage pose the biggest threat, preventing the canopy from closing in many places.

Selection Criteria

- Wetland habitats are now rare within the ecological district (particularly within the Inland Soft Rock Hill Country land system) and regionally in both Canterbury and South Marlborough.
- This is the only intact wetland seen within the southern half of the ecological district.

- Intact communities of *Carex secta* sedgeland, *Carex-juncus* sedge-rushland, and raupo reedland and sedge-reedland are rare within the district.

Notes

In time, and with the exclusion of stock, the canopy will become more closed, excluding many of the introduced grasses and herbs which are currently present. The re-introduction of native wetland associate species may be somewhat hindered by a lack of a nearby seed source.

RAP 21 - Conway River Floodplain

Grid Reference Centre:	NZMS 260 O32 367475
Area:	740 ha
Altitudinal Range:	Near sea level - 400 m
Tenure:	Crown land. AMF rights apply to >50%. Statutory acknowledgement applies to Te Runanga o Ngai Tahu
Vegetation Types:	7, 15
Study Area Number:	H33

Land System(s)

Northwest outwash deposits and local alluvium.

Bioclimatic Zone(s)

Coastal; semi-coastal; lowland.

Ecological Units

- Willow forest, treeland and scrub on braided river islands.
- Wattle forest, treeland and scrub on braided river islands.
- Mixed shrubland and shrub-herbfield on riverplain and braided river islands.
- Mixed herbfield and herb-stonefield on riverplain and braided river islands.
- **Boulderfield, stonefield, gravelfield and sandfield on floodplain and in river channels.**

Landforms

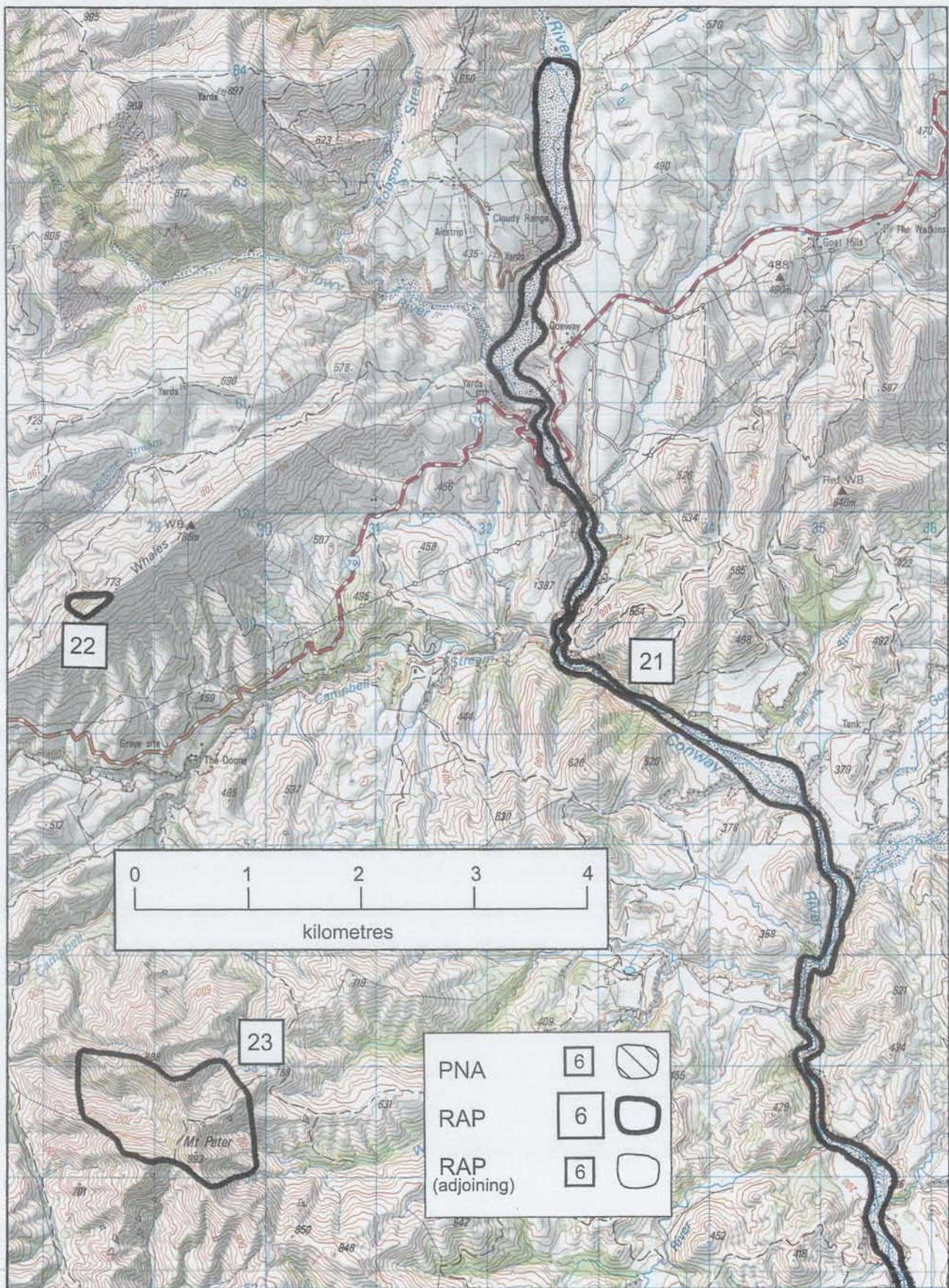
Conway River is relatively short and rain-fed. The area contains the floodplain including islands, and active and inactive channels. Its most seaward point is where it borders RAP 18 (Conway River Mouth), 0.5km from the coastline, and it extends inland to the edge of the ecological district, approximately 2.5km north of the confluence with Towey River.

The floodplain contains recent unconsolidated silt, sand, gravel, stone and boulder deposits. Where exotic tree species have become established on islands a thin soil layer may develop, although these areas are still subject to periodic flooding.

Vegetation and Flora

The vegetation on the riverbed is generally highly modified and dominated by weeds and introduced species. Silver wattle dominates the vegetation on some of the larger islands in the lower reaches. Crack willow and pussy willow are scattered

Map 9 Recommended Areas for Protection - 21, 22, 23



largely on islands and near banks. Shrublands are often dominated by European broom. Other prominent species include gorse, hawthorn, lupin and manuka. A variety of introduced herbs and grasses are present, and become dense on sand and silt deposits close to the banks. Woolly mullein, Californian thistle, vipers bugloss, sheeps sorrel, ragwort, white clover, *Trifolium arvense*, *Hieracium pilosella*, smooth hawksbeard, common storksbill, browntop, sweet vernal, Yorkshire fog and perennial ryegrass are all prominent. *Raoulia tenuicaulis*, *Epilobium melanocaulon*, *Scleranthus uniflorus* and, least commonly *Muehlenbeckia axillaris*, comprise the native species which were found. They tend to be confined to riverbeds throughout the district.

European broom, in particular, and weed infestation in general, pose the most serious threats to the riverbed environment.

Fauna

(Ref. O'Donnell and Moore (1983).)

The river has been rated as having moderate-high wildlife value. Two features of the wildlife are the high numbers of paradise shelduck and black-billed gulls which breed on the riverbed. Numbers of the latter species vary from year to year and in some years breeding may not occur at all. Other native wetland species present include black shag, little shag, white-faced heron, grey duck, South Island pied oystercatcher, spur-winged plover, banded dotterel (threatened - Category C), pied stilt, red-billed gull, black-billed gull and black-fronted tern (threatened - Category B). Introduced wetland species include Canada goose and mallard. Terrestrial bird species using the braided riverbed as habitat include Australasian harrier, welcome swallow, brown creeper, grey warbler, South Island fantail, silvereye and bellbird as well as introduced species such as rock pigeon (*Columba livia*), hedge sparrow, song thrush (*Turdus philomelos*), blackbird, yellowhammer, ciril bunting (*Emberiza cirrus*), chaffinch, greenfinch, goldfinch, redpoll, house sparrow (*Passer domesticus*), starling (*Sturnus vulgaris*) and white-backed magpie.

Native fish species known to use the Conway River (NIWA, 1997) include common river galaxias (*Galaxias vulgaris*) and upland bully. Brown trout were observed in pools.

Selection Criteria

- Natural riverine processes which characterise these communities such as flooding, silt deposition and active channelisation, are still operating within the area.
- Conway River is the largest braided riverbed system in the ecological district and has been classified as having moderate-high wildlife habitat value. It hosts breeding populations of paradise shelduck and black-billed gull. A variety of other wetland and terrestrial bird species use the riverbed as habitat, including threatened banded dotterel and black-fronted tern.
- Native fish inhabiting the river include common river galaxias and upland bully.
- Habitat is provided for several plant species which are generally confined to riverbeds in the district such as *Raoulia tenuicaulis*, *Epilobium melanocaulon*, *Scleranthus uniflorus*, and *Muehlenbeckia axillaris*.

Notes

The riverbed adjoins protected natural areas (Ngaroma Scenic Reserve (PNA 16), Conway River Scenic Reserve (PNA 21)), and recommended areas for protection (Conway River mouth (RAP 18) and Conway Riparian Zone (RAP 14)).

RAP 22 - Whale's Back Ridge

Grid Reference Centre:	NZMS 260 N32 283592
Area:	3 ha
Altitudinal Range:	650-770 m
Tenure:	Private
Vegetation Types:	8a, 9
Study Area Number:	N47

Land System(s)

Inland soft rock hill country.

Bioclimatic Zone(s)

Montane.

Ecological Units

- Mixed shrubland on colluvial spur side slope.
- Hall's totara-broadleaf treeland and tree-shrubland on colluvial spur side slope.
- Mixed shrub-rockland on bluffs.
- Rockland on bluff and colluvial spur side slope.

Landforms

An area of Tertiary limestone (Amuri) on the northwest-facing slopes of Whales Back ridge. Limestone colluvium (tending to talus in places) covers the lower portion of the area. Limestone bluffs extend up to the Whale's Back ridgeline above the colluvial slopes.

Vegetation and Flora

The mixed shrubland lies at the base of the colluvial rockland on a more moderate gradient. The principal species are *Coprosma propinqua* ssp. *propinqua*, *C. aff. parviflora*, *Melicytus alpinus* and matagouri.

Hall's totara-broadleaf treeland and tree-shrubland contains matagouri, *Melicytus alpinus*, *Coprosma propinqua* ssp. *propinqua*, *C. 'tayloriae'*, *Corokia cotoneaster*, *Lophomyrtus obcordata* and *Sophora prostrata* with scrambling *Muehlenbeckia complexa*, *Rubus schmidelioides* and *Clematis forsteri* agg. The ground layer contains scattered *Gentiana astonii* and silver tussock.

The shrub-rockland on the bluffs contains scattered Marlborough rock daisy (*Pachystegia* sp. 'A'), *Brachyglottis monroi*, Marlborough lilac, *Clematis afoliata*, *Haloragis erecta*, *Pimelia traversii*, *Asplenium lyallii*, *A. trichomanes*, *Brachyglottis bellidioides* and a host of exotic herbs and grasses such as wall lettuce, oxeye daisy (*Leucanthemum vulgare*) and sandwort.

The largely bare limestone colluvial rockland contains a scattering of the shrubs, herbs and grasses mentioned above, particularly *Gentiana astonii*.

This location of *Gentiana astonii* represents a new southern limit for the species which is a localised regional endemic. Marlborough lilac, Marlborough rock daisy and *Brachyglottis monroi* are all regionally endemic species. *Pimelia traversii* was not seen elsewhere in the ecological district. Other species such as *Asplenium lyallii* and *A. trichomanes* are uncommon within the ecological district and are generally confined to rocky areas, usually on limestone.

Fauna

Common gecko is numerous amongst the bluffs and colluvium.

The inaccessible nature of the cliffs and unstable and difficult terrain of the talus and colluvium means that grazing pressure is comparatively low.

Selection Criteria

Natural communities on limestone are now rare within the ecological district and regionally in Canterbury and South Marlborough.

Intact natural montane communities are generally confined to the higher peaks within the ecological district.

The area contains several plant species which are either restricted in distribution, uncommon in the district or largely confined to areas of limestone (see above).

Excellent habitat is provided for a population of common gecko.

RAP 23 - Mount Peter

Grid Reference Centre:	NZMS 260 N32 291544
Area:	125 ha
Altitudinal Range:	550-993 m
Tenure:	Private
Vegetation Types:	1, 5g, 8a, 8c, 9, 11
Study Area Number:	H15

Land System(s)

Inland greywacke hill country.

Bioclimatic Zone(s)

Montane.

Ecological Units

- Mountain beech forest, treeland and scrub on hill slope and ridge crest.
- **Mixed broadleaved scrub and shrubland on talus hill slope.**
- Hall's totara-broadleaf-*Olearia paniculata* scrub and shrubland on talus hill slopes.
- Mountain ribbonwood treeland, scrub and shrubland on hill slope at gully head.
- Mixed shrub-rockland and rockland on outcrops and bluffs.



Plate 9. RAP 22 - Whales Back Ridge. Montane mixed shrubland on limestone colluvium.

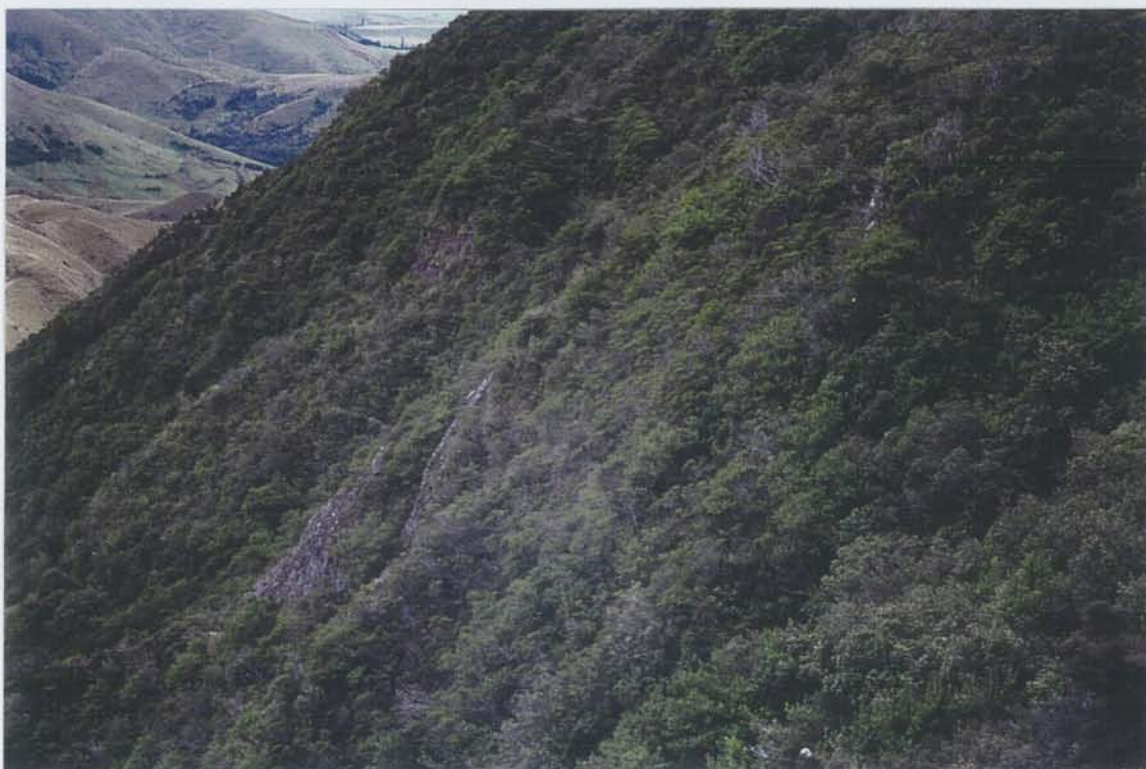


Plate 10. RAP 23 - Mount Peter. Montane mixed shrubland on greywacke talus slope.

- *Carex secta* sedgeland on gully bottom.
- Fescue tussock-silver tussock-pasture grassland on hill slopes, ridges and crests.
- Fescue tussock grassland on hill slopes.

Landforms

Steep Mesozoic greywacke hill slopes and gully heads characterise the area on and around the highest peak in the ecological district, Mt. Peter. Many of these slopes are overlain with talus. Soil development is generally weak, particularly on the steepest faces. Bluffs and rock outcrops are scattered throughout.

Vegetation and Flora

A small stand of mountain beech low forest is situated close to the summit of Mt. Peter. It tends to scrub and treeland in places, particularly towards its margins. Some canopy damage can be attributed to prolonged snow lie. The only other species to feature in the somewhat open canopy is broadleaf. The most common shrub tier species are young mountain beech and tauhinu. The ground tier contains a variety of seedlings, subshrubs, grasses and herbs, the most common of which are mountain beech, *Gaultheria crassa*, *Hebe venustula*, *Olearia cymbifolia*, fescue tussock, *Poa colensoi*, *Rytidosperma gracile*, *Deyeuxia avenoides*, sweet vernal and catsear. This is the highest altitude in which beech exists in the district and a few species found beneath the somewhat open canopy are more typical of the subalpine areas to be found in the nearby Seaward Kaikoura Range e.g. *Dracophyllum uniflorum*, *Olearia cymbifolia* and *Hebe venustula*.

Fragmented stands of mixed shrubland on south-facing talus slopes contain a dense canopy approximately 1m high. Broadleaf is the most common species and shares the canopy with tauhinu, matagouri, *Olearia cymbifolia*, *Aristotelia fruticosa*, *Coprosma propinqua* ssp. *propinqua*, *C. rigida* and *Olearia paniculata*. The most common species in lower tiers, usually in canopy gaps, are *Hypolepis millefolium*, *Polystichum vestitum*, *Aciphylla glaucescens*, *A. aurea* and *Anisotome aromatica*.

Hall's totara-broadleaf-*Olearia paniculata* scrub and shrubland occurs on south- and west-facing talus hill slopes, tending to screes in places. Taller scrub tends to be present at the base of outcrops and bluffs which offer shade and some protection from fire. The three principal species form a canopy which exceeds 5m in these places but is generally 0.5-2m. Common associated species in the canopy include *Coprosma propinqua* ssp. *propinqua*, *C. rigida*, *Brachyglottis monroi*, *Cyathodes juniperina*, *Hebe rakaiensis*, *Coriaria plumosa*, matagouri, *Rubus squarrosus*, *Olearia cymbifolia*, bracken fern and wharariki. Ground tier species and those found in canopy gaps include seedlings of canopy species, *Polystichum vestitum*, fescue tussock, silver tussock, *Deyeuxia avenoides*, *Elymus solandri*, *Gingidia montana*, *Asplenium flabellifolium*, *Blechnum penna-marina* and *Wahlenbergia albomarginata* along with introduced pasture grasses and weeds such as cocksfoot, browntop, sweet vernal, and catsear.

A small stand of mountain ribbonwood is present towards the head of an east facing gully to the north of Mt. Peter. The most common associated species amongst an open canopy are tree fuchsia, kanuka, manuka, *Cordyline australis*, toetoe and *Carex secta*.

Common bluff and outcrop species include *Pachystegia* sp 'A', *Helichrysum intermedium*, wharariki, broadleaf, *Cyathodes juniperina*, Marlborough lilac, *Hebe cheesemanii*, *H. anomala*, *Asplenium richardii*, *Chionochloa pallens* agg., *Rytidosperma setifolium*, *Celmisia monroi* and *Brachyglottis bellidioides*.

A small stand of *Carex secta* lies by the tributary to Campbell Stream to the west of Mt. Peter. Toetoe and *Olearia bullata* occur on the margins.

A small stand of fescue tussock grassland is present on southwest facing slopes of Mt. Peter. The canopy contains minor silver tussock and *Chionochloa pallens* agg. with a few scattered shrubs such as tauhinu, matagouri and *Coprosma rigida*. The most frequent intertussock species are *Rytidosperma gracile*, *Elymus solandri*, *Bulbinella angustifolia*, *Deyeuxia avenoides*, *Viola cunninghamii*, *Helichrysum filicaule*, *H. bellidioides*, *Geranium microphyllum* and *Anisotome aromatica* as well as introduced pasture grasses and weeds including Yorkshire fog, sweet vernal, browntop, white clover and catsear. This was the most intact fescue tussock grassland seen in the district.

65-70% of the area is composed of fescue tussock-silver tussock-pasture grassland with variable amounts of bracken fern, matagouri, tauhinu and exotic grasses and weeds.

Gentiana tenuifolia is known from the northern half of the South Island and is uncommon in the Kaikoura District (David Glenney, pers. comm.). It was seen from only two localities in the ecological district. *Chionochloa pallens* agg. is uncommon in the district and this was the only location where it was seen with any frequency. *Aciphylla aura* and *Helichrysum intermedium* were only seen on the highest points within the ecological district. *Dracophyllum uniflorum* was similarly seen from one other high-altitude locality within the district. Mountain ribbonwood and *Olearia nummularifolia* are uncommon within the ecological district.

Fauna

Bellbird, brown creeper, South Island fantail, South Island tomtit, New Zealand pipit, silvereye, blackbird and chaffinch were seen and/or heard.

The outcrops, bluffs and talus provide excellent habitat for skinks and geckos. However bad weather during the survey precluded any observations.

Sheep grazing pressure is generally low although palatable species such as *Chionochloa pallens* agg. have been targeted where accessible. Possum browse was observed on some shrub species. Rabbits and hares are present.

Selection Criteria

- A range of montane vegetation types gives the area excellent diversity.
- Intact natural montane communities are generally confined to the higher peaks within the ecological district.
- Mountain beech forest is present at the highest altitude within the ecological district.
- Excellent examples of short tussock grassland and montane shrubland within both the Inland Greywacke Hill Country Hill Country land system and the ecological district.

- Mountain ribbonwood forms a community which is rare within the district.
- The area contains several rare, uncommon or notable plant species (see above).

RAP 24 - Mount Stewart

Grid Reference Centre:	NZMS 260 N32 282510
Area:	255 ha
Altitudinal Range:	480-956 m
Tenure:	Private
Vegetation Types:	1, 8a, 8c, 9, 13
Study Area Number:	H32

Land system(s)

Inland greywacke hill country.

Bioclimatic Zone(s)

Lowland; montane.

Ecological Units

- Mountain beech forest on mountain side slopes and gullies.
- Mixed shrubland on colluvial mountain side slopes.
- Mixed shrub-rockland and rockland on outcrops and bluffs.
- *Olearia nummularifolia* shrubland on gully head.
- Wharariki flaxland on colluvial mountain slopes.
- Fescue tussock-silver tussock-pasture grassland on upper mountain slopes, crests and ridges.
- Loamfield on steep mountain slopes.
- Stonefield and gravelfield on steep mountain slopes.

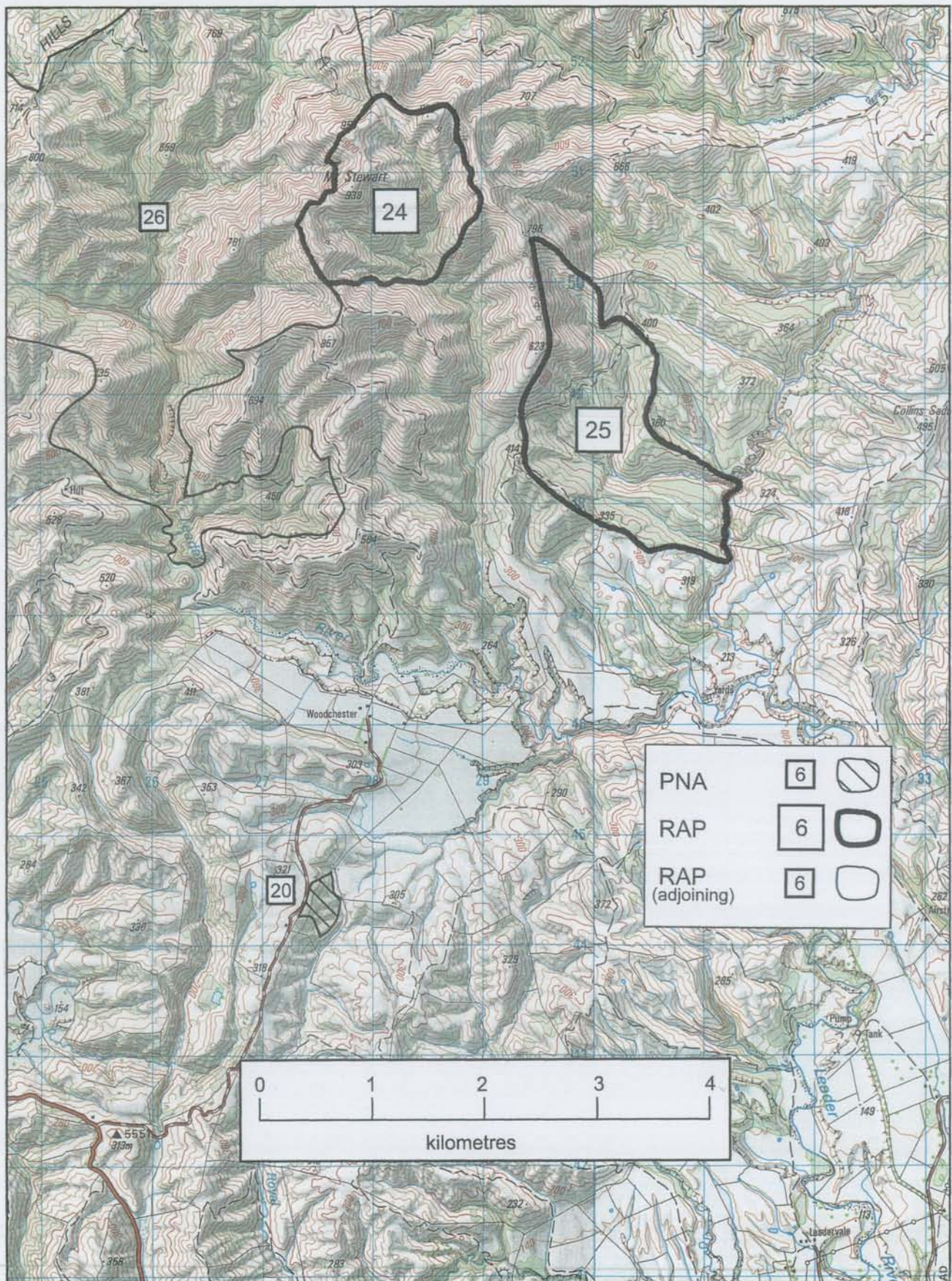
Landforms

Mt. Stewart is the second highest peak in the ecological district and forms part of a series of peaks along a ridgeline between the headwaters of Limestone Stream (Woodchester) and tributary headwaters of Leader River and Gelt River. The area comprises steep greywacke hill country which is often highly-eroded, particularly around ridges and crests, the steepest areas of which are screes and loamfields. Bluffs and rock outcrops are present on colluvial slopes which are often unstable. Soil cover is thin or absent in many places.

Vegetation and Flora

Mountain beech forest is generally confined to gullies and south- and east-facing slopes. The pattern is the same as that found in the nearby Gelt Stream (NAT 23) and Black Hills (RAP 26). Older secondary forest (>20m tall) along streamsides may contain canopy components of red beech and *Rubus cissoides*. The most common subcanopy and shrub species are regenerating beech, broadleaf, lancewood, marbleleaf and *Coprosma rhamnoides*. A sparse ground tier contains seedlings, particularly beech, with *Polystichum vestitum*, *Asplenium terrestre* ssp.

Map 10 Recommended Areas for Protection - 24, 25



terrestre, *Blechnum montanum* and wall lettuce. In younger mountain beech forest on drier hill slopes there are few associates in the dense canopy aside from scattered marbleleaf and broadleaf. *Cyathodes juniperina* dominates the thick shrub tier with minor regenerating mountain beech, *Leucopogon fasciculatus* and *Coprosma rhamnoides*. The ground tier is sparse, the most common species being seedlings of mountain beech and *Cyathodes juniperina*.

Fire-induced montane mixed shrublands are typically species-rich and are similar to those found on nearby Mt. Peter. The most common species are broadleaf, manuka, tauhinu, *Cordyline australis*, tree fuchsia, matagouri, *Olearia paniculata*, *Coriaria sarmentosa*, *Coprosma* aff. *parviflora*, *C. propinqua* ssp. *propinqua*, *Melicytus alpinus*, *Aristotelia fruticosa*, *Gaultheria antipoda*, wharariki, with scrambling *Muehlenbeckia complexa*, *Rubus australis* and *R. schmidelioides*. The most common subshrub and ground tier species are *Brachyglottis monroi*, *Gingidia montana*, bracken fern, *Carex breviculmis*, fescue tussock, silver tussock, *Poa colensoi*, *Deyeuxia avenoides*, *Aciphylla glaucescens*, *Leucopogon fraseri*, *Luzula rufa*, *Anaphalioides bellidioides*, *Celmisia monroi*, *Brachyglottis bellidioides*, *Wahlenbergia albomarginata*, *Gnaphalium audax* with browntop, sweet vernal, Yorkshire fog, cocksfoot, white clover, sheep's sorrel, catsear, viper's bugloss, smooth hawksbeard and *Hieracium pilosella*.

More recently burned faces (five years prior to visit) support a montane flaxland community with wharariki forming an open canopy at approximately 1m. Canopy associates include *Aciphylla glaucescens*, *A. aurea*, fescue tussock, matagouri and *Hierochloa redolens* with a few scattered broadleaf, tauhinu, *Gaultheria depressa* var. *novaezealandiae* and *Olearia cymbifolia*. Vegetation in the ground tier is moderately sparse, the most common species being young fescue tussock, *Deyeuxia avenoides*, *Aciphylla aurea*, *Gingidia montana*, catsear, *Hieracium pilosella* and smooth hawksbeard.

Rock outcrops and bluffs contain sparse communities usually dominated by Marlborough rock daisy (*Pachystegia* 'A'), Marlborough lilac, *Brachyglottis monroi*, wharariki and *Hebe venustula*.

A population of *Olearia nummularifolia* exists at a gully head of Limestone Stream. This species is uncommon elsewhere in the district, occurring as a minor component of montane mixed shrublands on the highest peaks.

Modified grassland covers approximately 40% of the area, and is comprised of a few scattered shrubs (*Melicytus alpinus*, matagouri, tauhinu, with scrambling *Muehlenbeckia australis*) over a canopy of silver tussock and fescue tussock. Intertussock areas are dominated by pasture grasses such as perennial ryegrass, *Bromus mollis* and browntop with *Deyeuxia avenoides*, *Wahlenbergia albomarginata*, white clover, sheep's sorrel, catsear and *Cerastium fontanum*.

Unstable screes and loamfields contain little vegetation. One specialised species which is found here is a scree type of *Viola* aff. *cunninghamii* which is likely to be a distinct species (Peter Heenan, pers. comm.).

Senecio dunedinensis (threatened Category I) was found in low abundance among the flaxland and grassland. Several South Marlborough endemic species occur in the area, generally on rock bluffs and outcrops, including Marlborough rock daisy, Marlborough lilac and *Brachyglottis monroi*. *Helichrysum parvifolium* is endemic to montane, subalpine and alpine areas of east Nelson, south and east Marlborough and North Canterbury, this being one of the two localities in the district where it

was found. *Aciphylla aurea* and *Helichrysum intermedium* were only seen on the highest points within the ecological district. *Rubus australis* and *Brachyglottis bellidioides* are uncommon in the ecological district.

Fauna

Australasian harrier and silvereye were observed in shrubland areas. Mountain beech forest is likely to contain the same forest birds as those found in nearby Black Hills such as South Island tomtit, bellbird, South Island rifleman and South Island fantail.

The outcrops, bluffs and talus provide excellent habitat for skinks and geckos. However bad weather during the survey precluded any observations.

Sheep graze the area over the summer months.

Selection Criteria

- A wide range of montane vegetation types gives the area excellent diversity.
- Intact natural montane communities are present. These communities are generally confined to the higher peaks within the ecological district.
- Extensive and excellent examples of mountain beech forest and montane shrubland, shrub-rockland, rockland, flaxland and grassland are present on the Inland Greywacke Hill Country land system.
- A community of *Olearia nummularifolia* shrubland is present. This species is uncommon in the district and elsewhere was only seen as a minor shrubland component on the highest peaks.
- Several rare, uncommon and regionally endemic plant species are present (see above).

Notes

Adjoins RAP 26 (Black Hills) to the west.

RAP 25 - Leader Tributary

Grid Reference Centre:	NZMS 260 O32 302482
Area:	285 ha
Altitudinal Range:	200-796 m
Tenure:	Private
Vegetation Types:	5a, 5c, 5f, 6a, 6e, 8c, 8d, 10a
Study Area Number:	H35

Land System(s)

Inland soft rock hill country; Inland greywacke hill country.

Bioclimatic Zone(s)

Lowland; montane.



Plate 11. RAP 24 - Mount Stewart. Fire-induced mountain flaxland.



Plate 12. RAP 25 - Leader Tributary.

Ecological Units

- Black beech forest in riparian zone and on lower hill slope.
- Mixed broadleaved low forest in riparian zone.
- Mahoe-mixed broadleaved low forest in riparian zone and gully heads.
- Kowhai treeland on hill slopes.
- Manuka-marbleleaf scrub on hill slopes.
- Manuka scrub in riparian zone, on hill slopes, crests and ridges.
- Bracken fern-mixed pasture grass fern-grassland on hill slopes.
- Mixed shrub-pasture grass shrub-grassland on hill slopes, crests and ridges.
- Mixed pasture grassland in riparian zone, on hill slopes, crests and ridges.
- Bare loamfield on slip sites.

Landforms

The catchment comprises a secondary tributary to Leader River, lying between Limestone Stream and Collins Saddle.

Quaternary and Tertiary siltstone and sandstone (Inland Soft Rock Hill Country land system) comprises the geology of the rolling hill country which occupies the majority of the area. Steeper Mesozoic greywacke gullies and slopes (Inland Greywacke Hill Country land system) form the upper 30% of the catchment.

A thin layer of loess covers much of the area, particularly on undulating terrain.

Vegetation and Flora

The majority of the catchment contains induced manuka scrub. Pasture grassland, mixed shrub-pasture grassland and bracken fern-pasture grassland are present in more recently disturbed areas along riparian zones and ridges on soft rock hill country, and on hill slopes and ridges within the greywacke hill country. Broadleaved forest dominates the upstream riparian zones and gullies. Minor vegetation types include black beech forest and kowhai treeland.

The manuka scrub canopy density is variable, even though it appears to be of the same age throughout (3-4m tall). Where it is at its most dense and exposed to grazing pressure (e.g. on southwest-facing shoulder slopes) there is little vegetation in either shrub or ground tiers. The canopy on drier northeast-facing slopes is generally more open, accommodating minor kanuka. The shrub tier is dominated by *Leucopogon fasciculatus* and *Coprosma rhamnoides* with minor kanuka and bracken fern. Sweet vernal and cocksfoot are the most common ground tier species with minor *C. rhamnoides* and *L. fasciculatus* regeneration. Larger canopy gaps typically contain a weedy shrubland mix of tree tutu, blackberry, Himalayan honeysuckle, bracken fern and *Muehlenbeckia australis*.

Broadleaved species dominate the forested riparian zones and gullies of both soft rock and greywacke hill country, although the species composition varies. Mixed broadleaved riparian low forest and scrub on soft rock is typically composed of a canopy of broadleaf, marbleleaf, tree fuchsia and mahoe with minor manuka, wineberry, Himalayan honeysuckle and lancewood. There is little shrub tier other than younger canopy species. The ground tier is often sparse with minor

Pneumatopteris pennigera, *Polystichum richardii*, *P. vestitum*, *Blechnum chambersii*, *B. fluviatile*, *Pellaea rotundifolia*, *Asplenium hookerianum*, *Urtica ferox*, *Uncinia* sp., and ragwort. The species mix is similar in soft rock gully heads. Mahoe is dominant with marbleleaf, tree fuchsia and minor climbers of *Muehlenbeckia australis*, *Rubus australis* and *Clematis paniculata*. A sparse shrub tier is composed of *Coprosma* aff. *parviflora*, *C. rhamnoides* and regenerating canopy species. The typically sparse ground tier is comprised of *Asplenium gracillimum* and *Polystichum richardii* with lesser amounts of *Pellaea rotundifolia*, *Blechnum chambersii*, *B. fluviatile*, *B. procerum*, sweet vernal, ragwort, and seedling mahoe and *Coprosma propinqua* ssp. *propinqua*.

Mahoe-mixed broadleaved low forest on greywacke riparian zones and gullies contains scattered emergent black beech individuals. Canopy associates include *Olearia paniculata*, fivefinger, *Coprosma robusta* and marbleleaf. The shrub tier includes wineberry, *Hebe traversii* and younger canopy species. *Polystichum richardii*, *Uncinia* sp. and pasture grasses dominate the ground tier with minor *Blechnum chambersii*, *B. procerum*, hound's tongue fern, *Asplenium gracillimum*, *A. flaccidum* and ragwort.

Manuka-marbleleaf scrub is present on some areas of soft rock lower hill slopes and is an intermediate vegetation type between manuka scrub and mixed broadleaved low forest.

Black beech forest is confined to a small stand in the southeastern corner of the catchment. There are few canopy associates and a scattered broadleaved understorey containing minor black beech, marbleleaf, *Coprosma robusta*, broadleaf, lancewood and *Rubus australis*. The shrub tier is of variable density with *Cyathodes juniperina*, *Coprosma rhamnoides* and *Helichrysum lanceolatum* prominent. Ground tier cover is also variable, tending to be thicker on steep, inaccessible faces where seedlings of the major tree and shrub species are dense.

Kowhai treeland is confined to a few small scattered localities on disturbed soft rock slopes. There is generally little vegetation beneath the open canopy besides a pasture grassland sward.

The mistletoe *Tupeia antarctica*, a threatened species (Category B) was found growing on a marbleleaf host.

Fauna

Habitat is provided for the threatened New Zealand pigeon (Category B), Australasian harrier, South Island tomtit and other common bush birds.

Stock, particularly cattle, have caused damage to the lower tiers of forest and scrub, especially on margins and easily accessible areas.

Selection Criteria

- The area contains native vegetation cover over a gradient of altitude and geology.
- Native forest and scrub vegetation on the Inland Soft Rock Hill Country land system is now rare within the ecological district.
- One of the most extensive examples of manuka scrub on the Inland Soft Rock Hill Country land system within the ecological district.

- Kowhai forest is a rare vegetation type within the ecological district.
- Contains habitat for threatened plant and bird species (see above).

RAP 26 - Black Hills

Grid Reference Centre:	NZMS 260 N32 259499
Area:	1450 ha
Altitudinal Range:	250-900 m
Tenure:	Private
Vegetation Types:	1, 2, 3a, 5a, 5c, 6b, 6c, 7, 8a, 8c, 8d, 9, 11, 13, 15
Study Area Number:	H28

Land System(s)

Inland greywacke hill country.

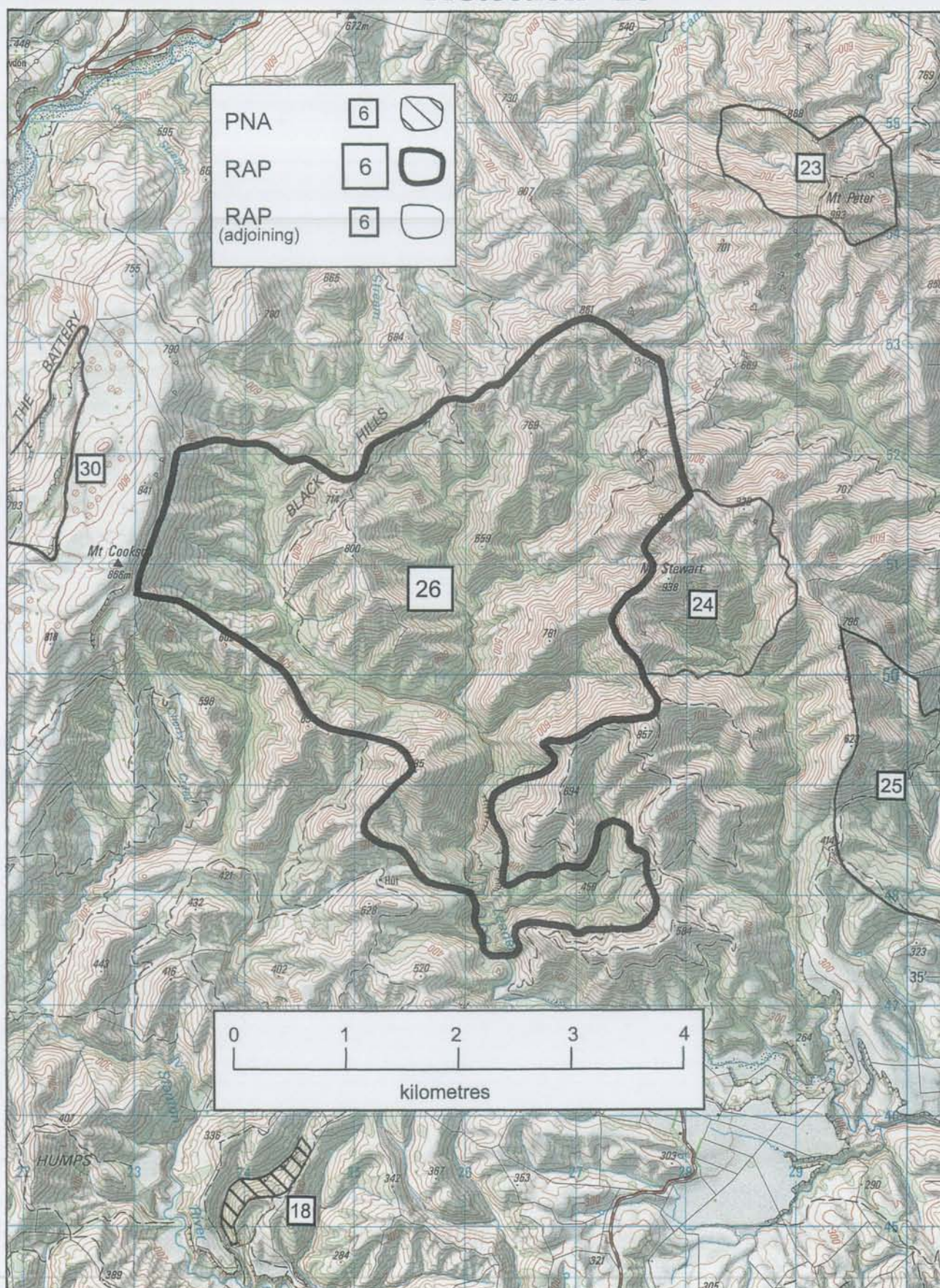
Bioclimatic Zone(s)

Lowland; montane.

Ecological Units

- **Black beech forest on hill slopes and mountain slopes.**
- Black beech forest along riparian zones.
- Mountain beech forest on hill slopes and mountain slopes, and along riparian zones.
- **Black beech-mountain beech forest on hill slopes and mountain slopes, and along riparian zones.**
- Black beech-mountain beech-red beech forest along riparian zones.
- **Mixed broadleaved low forest, scrub and shrubland on hill slopes, mountain slopes, gullies.**
- Mixed broadleaved forest and scrub along riparian zones.
- **Kanuka-manuka low forest and scrub on hill slopes and mountain slopes.**
- Wharariki-*Aciphylla glaucescens* flaxland on colluvial mountain slopes.
- Mixed shrub-wharariki shrub-flaxland on colluvial mountain slopes.
- Marlborough rock daisy-*Brachyglottis monroi* shrub-rockland and rockland on sheer gorge faces and rock outcrops.
- *Carex secta* sedgeland on seepages.
- **Mixed shrub-fescue tussock-pasture grass shrub-grassland on mountain and hill slopes, ridges and crests.**
- Fescue tussock-pasture grassland on mountain and hill slopes, ridges and crests.
- Silver tussock-mixed pasture grassland on hill slopes, ridges and crests.
- Shrubland, shrub-rockland, herb-rockland and rockland on river bed and small alluvial flats.

Map 11 Recommended Areas for Protection - 26



Landforms

The area consists of steep dissected Mesozoic greywacke hill and mountain slopes, gullies, crests and ridges which encompass the headwaters and upper tributary headwaters of Leader River. The southern lowland portion of the area includes the sheer faces of the Leader River gorge. There are only two gorges within the ecological district (the other is at Limestone Creek) and they represent a change from the V-shaped valley systems typical of most greywacke hill country. Localised areas of bedrock outcrops and bluffs are present, particularly on steep montane mountain slopes. Steeper slopes are often colluvial, while a thin layer of loess covers some crests and gentler slopes.

Vegetation and Flora

Beech forest is generally confined to riparian strips and lower hill slopes, frequently buffered on the uphill side by kanuka-manuka low forest in montane areas, and broadleaved low forest and scrub at lower altitudes. Black beech and mountain beech frequently merge from 400-700m.

Secondary mixed-aged black beech stands on south-facing slopes at approximately 400m contain scattered emergent trees over a relatively low open canopy. The understorey is poorly developed consisting largely of beech poles. A moderately dense shrub tier contains black beech regeneration with minor *Coprosma rhamnoides* and young lancewood and marbleleaf. *Polystichum vestitum* dominates much of the ground tier with minor black beech seedlings, *Hypolepis millifolium*, *Blechnum penna-marina*, *Acaena anserinifolia*, *Ranunculus reflexus*, *Oxalis exilis*, cocksfoot, Yorkshire fog, sweet vernal, browntop, white clover, ragwort and wall lettuce.

Black beech-mountain beech-red beech forest is present as small stands adjacent to streams on more fertile parts of the upper catchment area. At 600m on east-facing streamside slopes the principal understorey species are similar to those found in the black beech forest described above with beech regeneration of all species in all tiers. *Coprosma rhamnoides* is again the dominant shrub tier species, and *Polystichum vestitum* is prominent in the ground tier. *Uncinia uncinata*, *Asplenium terrestre* ssp. *terrestre* and *Blechnum montanum* are minor additional ground tier components although the total cover is typically sparse. This site is well buffered by kanuka-manuka scrub and therefore less exposed to grazing than black beech forest.

Black beech-mountain beech forest on less fertile, dry, west-facing slopes around 600m contain minor kanuka in the understorey. *Cyathodes juniperina*, *Coprosma rhamnoides*, *C. aff. parviflora*, and younger black beech and mountain beech are prominent in a relatively dense shrub tier, with minor *C. linariifolia*, lancewood, broadleaf and marbleleaf. Tree and shrub seedlings dominate the ground tier, particularly *Coprosma rhamnoides* and black beech with minor mountain beech, *Cyathodes juniperina*, broadleaf and *C. linariifolia*. *Deyeuxia aucklandica*, cocksfoot, browntop, wall lettuce, catsear and *Hieracium lepidulum* are also minor ground tier associates.

Black beech forest is present in places along riparian zones and lower hill slopes at the lowland southern end of the area. Red beech is a minor canopy component. The understorey typically contains scattered broadleaved species, most notably marbleleaf with minor lemonwood. A sparse shrub tier contains minor *Coprosma rhamnoides*, *C. propinqua* ssp. *propinqua*, *C. rigida*, and scrambling *Rubus cissoides*.

The ground tier is also sparse and heavily grazed where accessible to stock. Wall lettuce is the most common species with minor seedlings of *Coprosma rhamnoides* and *C. rigida*, *Uncinia uncinata*, *Libertia ixioides*, *Polystichum vestitum*, *P. richardii* and *Asplenium bulbiferum*.

Mixed broadleaved shrubland on steep lower valley sides near the Leader River gorge contain a canopy mix, at approximately 4m, of marbleleaf, broadleaf, *Coprosma robusta*, and tree tutu, with minor mahoe, fivefinger and *Olearia paniculata*. A low shrub tier contains seedlings of canopy species with *Helichrysum lanceolatum*, *Hebe traversii*, *Aristotelia fruticosa* and *Astelia fragrans*. The moderately dense ground tier contains *Adiantum cunninghamii* and hound's tongue fern with minor seedlings of *Coprosma robusta* and broadleaf, *Blechnum fluviatile*, *Asplenium bulbiferum*, *Ctenopteris heterophylla*, *Ranunculus reflexus*, Yorkshire fog, cocksfoot and wall lettuce.

Kanuka-manuka low forest and scrub on dry sites of varying altitudes typically contain fluctuating proportions of the two species in the canopy, with increasing amounts of kanuka in older stands on the driest sites. Other minor canopy associates include marbleleaf, black beech, mountain beech (at higher altitudes) and climbing *Rubus cissoides*. The most common understorey and shrub species are manuka, kanuka, *Cyathodes juniperina* and *Coprosma rhamnoides* with minor *C. propinqua* ssp. *propinqua*, *C. aff. parviflora*, *Leucopogon fasciculata*, *Gaultheria antipoda*, *Helichrysum lanceolatum* and *Rubus cissoides*. The ground tier commonly contains seedlings of *Coprosma rhamnoides*, with *Polystichum vestitum*, cocksfoot, and catsear. Minor associates include seedlings of marbleleaf, *Cyathodes juniperina*, *Coprosma propinqua* ssp. *propinqua*, manuka and broadleaf, *Rubus cissoides*, *Uncinia uncinata*, *Blechnum procerum*, *B. discolor*, *Lycopodium scariosum*, *Pratia angulata*, *Wahlenbergia albomarginata*, browntop, sweet vernal, self heal, *Plantago lanceolatum*, *Hieracium pilosella* and wall lettuce.

Recently-burned montane colluvial slopes above 700m commonly support a flaxland community dominated by wharariki and, to a lesser degree, *Aciphylla glaucescens*. Older stands have a significant shrub component containing a broad mix of species such as matagouri, *Aristotelia fruticosa*, *Melicytus alpinus*, *Myrsine divaricata*, *Coprosma rhamnoides*, *C. propinqua* ssp. *propinqua*, *C. aff. parviflora*, tauhinu, *Coriaria sarmentosa*, *Hebe venustula*, *Olearia paniculata*, briar, young mountain beech, *Cordyline australis*, manuka, kowhai, broadleaf, scrambling *Muehlenbeckia complexa* and *Clematis forsteri* agg. Ground tier species include *Brachyglottis monroi*, *Gingidia montana*, bracken fern, *Asplenium terrestre* ssp. *terrestre*, *A. flabellifolium*, *A. richardii*, *Polystichum richardii*, *P. vestitum*, *Acaena anserinifolia*, *Leucopogon fraseri*, *Orobancha minor* and *Poa colensoi*.

Small areas of modified *Carex secta* sedgeland occur in seepages and contain minor scattered emergent manuka. The most frequent canopy associates are *Juncus articularis* and minor *J. effusus*, *Carex ovalis* and *Coprosma propinqua* ssp. *propinqua*. Ground species commonly occur between tussocks and include *Polystichum vestitum*, sweet vernal and *Blechnum penna-marina*, with minor *Hierochloa redolens*, *Oreomyrrhis ramosa*, Yorkshire fog, cocksfoot, browntop, ragwort, wall lettuce, catsear, self heal and *Parentucellia viscosa*.

Sheer greywacke valley and gorge faces and rock outcrops contain communities of Marlborough rock daisy and *Brachyglottis monroi*. The inaccessible nature of the faces mean that further details are not available.

The shrubland, shrub-rockland, herb-rockland and rockland on river beds and small alluvial flats are commonly modified, particularly where access for stock is easy. Species such as tree tutu, *Hebe traversii*, toetoe, *Juncus articulatus*, cocksfoot, Yorkshire fog, *Plantago lanceolatum*, ragwort, *Sagina procumbens*, smooth hawksbeard, *Acaena anserinifolia*, *Lotus pedunculatus*, *Hydrocotyle novae-zelandiae*, *Ranunculus repens*, self heal, *Cerastium fontanum*, *Hieracium pilosella*, *Cardamine corymbosa* and catsear are typical of communities at the bottoms of shady, steep-sided valleys. Sunnier areas at lower altitudes accessible to stock are typified by shrublands containing European broom, gorse, manuka and briar.

Induced and modified fescue tussock-mixed pasture grasslands dominate the upper hill and mountain slopes, crests and ridges in montane areas, while silver tussock-mixed pasture grassland is common at lower altitudes. Scattered shrub species are present, most commonly tauhinu, manuka and matagouri, forming shrub-grassland in places. The most frequent intertussock species in montane grasslands include browntop and sweet vernal with minor *Rytidosperma gracile* and *Elymus solandri*. Ground tier species typically include *Hieracium pilosella* with minor *Wahlenbergia albomarginata*, *Helichrysum filicaule*, catsear and white clover.

Regionally endemic plant species occur within the area such as Marlborough rock daisy and *Brachyglottis monroi*. *Coprosma ciliata* and *Gahnia procera* are uncommon within the district. *Deyeuxia aucklandica* is usually found in subalpine and alpine areas, and was not seen elsewhere in the district. The clubmoss *Lycopodium scariosum* is rare on the east coast of the South Island (Brownsey and Smith-Dodsworth, 1989) and was not seen elsewhere in the district.

Fauna

Bird species seen in forest and scrub include paradise shelduck, South Island robin, South Island tomtit, South Island fantail, bellbird, South Island rifleman, chaffinch and blackbird. Threatened New Zealand pigeon (Category B) has been noted from the area, as has the carnivorous snail, *Wainuia edwardii* (New Zealand Wildlife Service, 1983). Recent research has indicated that this snail species should be treated as a threatened Category C species (Efford, 1997).

Deer, sheep, cattle, pigs, rabbits, hares and possums are present. German wasp populations are present throughout the black beech and mountain beech forest.

Secondary Criteria

The area potentially has recreational value for hunting.

Selection Criteria

- The Leader River gorge is an unusual landscape feature within the ecological district and the only one to occur on the Inland Greywacke Hill Country land system.
- Some of the most extensive beech forest remnants left in the ecological district occur within the area.
- Excellent examples of mountain beech forest, montane mixed beech forest, black-mountain beech forest, black beech forest and mixed broadleaved riparian forest within both the Inland Greywacke Hill Country land system and the ecological district as a whole.

- The best representation of beech forest spanning an altitudinal gradient in the ecological district.
- Intactness of vegetation is very good in beech forest where well buffered by surrounding kanuka-manuka scrub, and in much of the broadleaved shrubland and rockland vegetation in the gorge area.
- The forest, rockland, scrub and grassland provide habitat to a variety of wildlife (see above).
- Rare and regionally endemic plant species are present (see above).

RAP 27 - Whale's Back Stream

Grid Reference Centre:	NZMS 260 N32 245577
Area:	30 ha
Altitudinal Range:	450-620 m
Tenure:	Private
Vegetation Types:	1, 3a, 6d, 7, 8d, 10a
Study Area Number:	N48

Land System(s)

Inland soft rock hill country; Northwest outwash deposits and local alluvium.

Bioclimatic Zone(s)

Lowland; montane.

Ecological Units

- Mountain beech forest on hill slope and scarp.
- **Black beech-mountain beech on hill slope and scarp.**
- Kanuka-manuka low forest and scrub on hill slope and scarp.
- Bracken fernland on hill slope, scarp and alluvial flats.
- Mixed pasture grassland on hill slope, scarp and alluvial flats.
- Willow forest and treeland on scarp and alluvial toe slope and flat.

Landforms

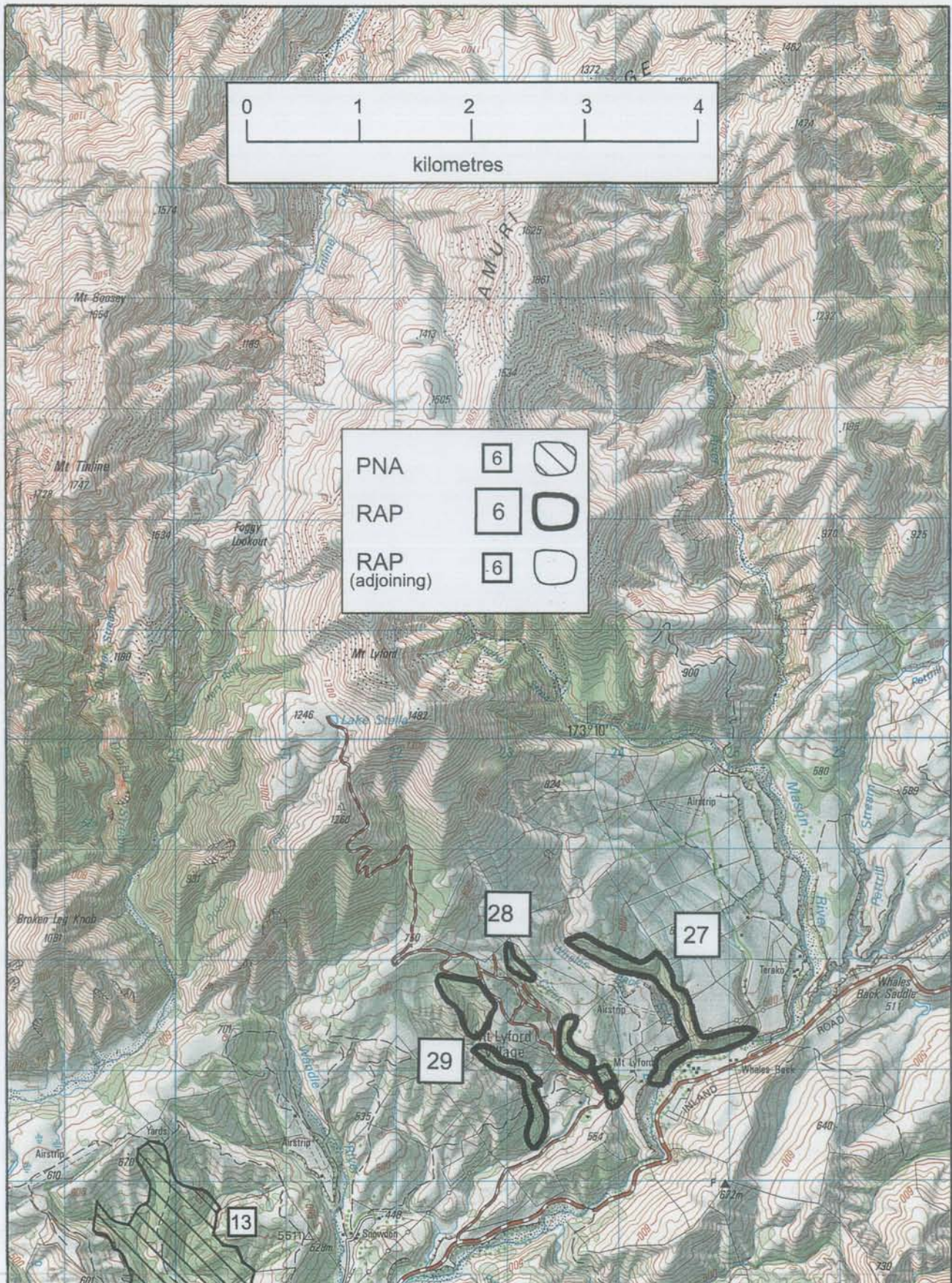
The area includes the lower hill slopes and scarps of the true left of Whales Back Stream extending from near its halfway point to its confluence with Mason River. It follows the vegetation pattern both to the east and the west to include south-facing scarps of Mason River on either side of the confluence.

The geology includes Tertiary massive mudstone, mudstone with sandstone bands and basal conglomerate and grit in the upper third of the area, with Quaternary moraine deposits terminating at the Mason River scarps.

Vegetation and Flora

Black beech-mountain beech forest and mountain beech forest are the most common vegetation types. The proportion of black beech within the canopy

Map 12 Recommended Areas for Protection - 27, 28, 29



declines with increasing altitude. The forest is of varying ages with some younger even-aged stands in a mosaic with older mixed-age stands.

Dense young stands are often sparse beneath the canopy with kowhai and kohuhu the most common associates. Several species are present towards the forest margins of these stands including *Olearia arborescens*, broadleaf, marbleleaf, tree tutu, *Cordyline australis*, wineberry, *Hebe venustula* and wharariki.

The older stands tend to occur nearer the riparian zone and contain a larger element of broadleaved species within the understorey including fivefinger, Hall's totara, tree fuchsia, lancewood, *Coprosma robusta*, red mapou and scrambling *Rubus cissoides*. The shrub tier contains *Coprosma linariifolia*, *C. aff. parviflora*, *C. propinqua* ssp. *propinqua*, *C. rhamnoides*, *Leucopogon fasciculatus*, *Cyathodes juniperina*, *Hebe salicifolia*, and *Helichrysum lanceolatum*. Ground tier species include *Microlaena avenacea*, *Astelia fragrans*, *Polystichum vestitum*, *Blechnum procerum*, *B. fluviatile*, *Pellaea rotundifolia*, *Lagenifera strangulata* and *Acaena novae-zelandiae*.

Many streamside flats and toe slopes, particularly in the lower half of the stream, are highly modified and principally comprised of pasture grass species and weeds. The native clubrush *Isolepis pottsii* is present in moist, shady places.

Weed infestation occurs in places on forest margins and in canopy gaps. European broom, willows, blackberry and rowan (*Sorbus aucuparia*) are particularly common around the confluence with Mason River. Much of the northeast-facing bank of Whales Back Stream has been planted in Douglas fir which may prove to be an invasive seed source for canopy gaps and margins in the future.

Fauna

Bellbird and South Island fantail were observed regularly.

Shells of the native carnivorous snail *Wainuia edwardii* were present among the forest and scrub. Recent research has indicated that this snail species should be treated as a threatened Category C species (Efford, 1997).

European wasp numbers are high where beech is dense.

Some grazing damage is evident within the lower reaches of Whales Back Stream. However fencing along the western forest margin prevents excessive damage.

Secondary Criteria

Native vegetation stabilizes the section of streamside scarp. The mudstone and sandstone substrate is particularly vulnerable to accelerated erosion.

Selection Criteria

- Native forest on both Inland Soft Rock Hill Country, and Northwest Outwash and Local Alluvium land systems is now rare within the ecological district.
- The area provides habitat for a threatened snail species (see above).

RAP 28 - Lulus Creek

Grid Reference Centre:	NZMS 260 N32 235572
Area:	20 ha
Altitudinal Range:	490-660 m
Tenure:	Private
Vegetation Types:	1, 3a, 3d, 6a, 6d, 10a
Study Area Number:	H23

Land System(s)

Inland soft rock hill country; Northwest outwash deposits and local alluvium.

Bioclimatic Zone(s)

Lowland; montane.

Ecological Units

- Mountain beech forest on lower hill slope and riparian zone.
- **Black beech-mountain beech-mixed broadleaved forest on lower hill slopes and riparian zone.**
- **Black beech-mountain beech forest on lower hill slopes.**
- Black beech-mixed podocarp-mixed broadleaved forest on streamside terrace.
- **Manuka-kanuka scrub on hill slopes and spur side slopes.**
- Manuka scrub and shrubland on hill slopes.
- Bracken fernland on hill slopes.

Landforms

A small portion of the lower reaches of this tributary to Mason River lies on Quaternary outwash deposits. The remainder of the geology is Tertiary massive mudstone, mudstone with sandstone bands, and sandstone grading into basal conglomerate and grit.

The terrain is generally rolling with few steep slopes.

Vegetation and Flora

Younger black beech-mountain beech and mountain beech forest occurs further upstream on hill slopes and riparian zones. A mixed broadleaved component generally becomes more significant in riparian areas.

Remnant black beech-mixed podocarp-mixed broadleaved forest is present on a small streamside terrace towards the southern segment of the area. Matai is the most common podocarp species with kahikatea and lowland totara present as scattered individuals. Broadleaved species in the canopy and understorey include marbleleaf, pokaka and lancewood with scrambling *Rubus cissoides*. *Coprosma* aff. *parviflora* is the most common species in a dense shrub tier. Other species to occur in minor amounts include *C. rhamnoides*, *C. propinqua* ssp. *propinqua*, *Neomyrtus pedunculatus*, *Astelia fragrans*, with young black beech, pokaka, pepper tree, broadleaf, marbleleaf and *Rubus cissoides*. The ground tier is also dense, comprised

of *Uncinia uncinata*, *Polystichum vestitum*, *Blechnum novae-zelandiae*, and tree and shrub seedlings with minor amounts of *Microlaena avenacea*, *Uncinia scabra*, *Blechnum procerum*, *B. discolor* and *B. chambersii*.

Secondary beech forest typically contains a dense mountain beech canopy (black beech becomes a component at lower altitudes). Scattered rimu are present on south-facing slopes on soft rock in the upper half of the area. Minor broadleaved understorey associates include lancewood, broadleaf, pokaka, marbleleaf, *Coprosma linariifolia*, fivefinger, and *Rubus cissoides*. The shrub tier is dominated by *Neomyrtus pedunculatus*, *Coprosma* aff. *parviflora*, *C. rhamnoides* and *Pittosporum divaricatum* with minor *Coprosma microcarpa*, *C. propinqua* ssp. *propinqua*, *Cyathodes juniperina* and younger canopy and understorey species. The ground tier is generally well stocked with regenerating tree and shrub species as well as *Uncinia uncinata* and minor *Blechnum novae-zelandiae*, *B. discolor*, *Lagenifera strangulata*, wall lettuce and catsear.

Older manuka-kanuka stands, lying uphill from beech forest on south-facing soft rock slopes are reverting to beech forest, and contain dense shrub and ground tiers largely composed of mountain beech (with some black beech) and broadleaved species including *Pseudopanax colensoi*, marbleleaf, broadleaf, *Coprosma robusta* and *Rubus cissoides*. Other species present in minor amounts include *Cyathodes juniperina*, *Gaultheria antipoda*, *Cordyline australis*, *Myrsine divaricata*, *Coprosma* aff. *parviflora*, *C. rhamnoides*, *C. robusta* x *C. propinqua* ssp. *propinqua*, lowland totara, bracken fern, *Blechnum procerum* and *B. penna-marina*.

Younger manuka scrub and shrubland contain scattered tauhinu and *Carmichaelia australis*, and a ground tier dominated by pasture grass.

Douglas fir has been planted close to the forest margin in the downstream portion of the area.

This location was one of only two within the ecological district where the small strap fern, *Grammitis magellanica* ssp. *nothofagei* was found.

Fauna

Bellbird and South Island fantail were seen and heard in forested areas, while an Australasian harrier was observed in the vicinity.

Shells of the native carnivorous snail *Wainuia edwardii* were present among the forest and scrub. Recent research has indicated that this snail species should be treated as a threatened Category C species (Efford, 1997).

European wasp numbers are high where beech is dense. and there was evidence of possums.

Stock damage appears minimal as much of the area adjacent to grazing land on the northern margin is fenced.

Secondary Criteria

Scenic and recreational values for inhabitants of Lyford Village.

Native vegetation stabilises the streamside slopes. The mudstone and sandstone substrate is particularly vulnerable to accelerated erosion.

Selection Criteria

- Native forest on both Inland Soft Rock Hill Country, and Northwest Outwash and Local Alluvium land systems is now rare within the ecological district.
- Black beech-mountain beech-podocarp-broadleaved forest is now uncommon within both Canterbury and South Marlborough.
- The area provides habitat for rare or uncommon plant and faunal species (see above).

Notes

The RAP adjoins, and the vegetation is continuous with, forest and scrub within subdivided sections of Lyford Village.

RAP 29 - West Lyford

Grid Reference Centre:	NZMS 260 N32 227572
Area:	60 ha
Altitudinal Range:	430-680 m
Tenure:	Private
Vegetation Types:	1, 3a, 6a, 6d, 8d, 10a
Study Area Number:	H20

Land System(s)

Inland soft rock hill country.

Bioclimatic Zone(s)

Lowland; montane

Ecological Units

- Mountain beech forest on hill slopes, spur side slopes and riparian zone.
- Black beech-mountain beech-kanuka forest on hill slopes and riparian zone.
- Black beech forest along riparian zone.
- Manuka scrub on hill slopes, spur side slopes and riparian zone.
- Bracken fernland on hill slopes.
- Mixed pasture grassland on hill slopes, ridges and riparian zone.

Landforms

The area is situated in the upper reaches of a tributary to Mason River, lying to the west of, and bordering, Lyford Village near the base of the steeper high-relief greywacke slopes of the Seaward Kaikoura Range. The generally rolling hill country is comprised of Tertiary massive mudstone, mudstone with sandstone bands, and sandstone grading into basal conglomerate and grit. These rock types are prone to accelerated erosion, particularly along steep streamside banks.

Vegetation and Flora

Secondary mountain beech and black beech-mountain beech forest are present towards the tributary headwaters along riparian zones and on south-facing hill slopes and spur side slopes. Black beech-mountain beech-kanuka forest occupies places where the beech canopy is more open, as a result of snow damage. The presence of mountain beech is diminished at lower altitudes downstream where black beech forest is largely confined to the riparian zone.

The mountain beech and black beech-mountain beech forest understorey towards the headwaters typically contains younger beech with minor lancewood, marbleleaf, Hall's totara, broadleaf, *Coprosma linariifolia*, *Rubus cissoides* and *R. schmidelioides*. A shrub tier is comprised of *Cyathodes juniperina*, *Leucopogon fasciculatus*, *Coprosma* aff. *parviflora*, *C. rhamnoides*, *C. propinqua* ssp. *propinqua*, *C. linariifolia* and *Gaultheria antipoda*. The ground tier is dominated by *Blechnum chambersii*, *B. procerum* and tree and shrub seedlings with minor *Uncinia uncinata* and *U. scabra*. Near streamsides fern species are more plentiful with the addition of *Polystichum richardii*, *P. vestitum*, *Blechnum fluviatile* and *Hypolepis millefolium*. However, pasture grasses and weeds are common where the canopy is open.

Black beech riparian forest further downstream characteristically contains a canopy of variable density. Understorey and shrub tier species include broadleaf, fivefinger, *Sophora microphylla*, *Cordyline australis*, red mapou, marbleleaf, kanuka, kohuhu, *Olearia arborescens*, tree tutu, *Coprosma robusta*, *C. rhamnoides*, *C. aff. parviflora*, *C. propinqua* ssp. *propinqua*, *C. robusta* x *C. propinqua* ssp. *propinqua*, *Leucopogon fasciculatus*, *Corokia cotoneaster*, *Gaultheria antipoda*, *Hebe traversii*, *Carmichaelia australis*, *Rubus cissoides*, *R. schmidelioides* and *Clematis forsteri* agg. Scattered individuals of matai, kahikatea and rimu were observed. The ground tier is dominated by pasture grasses and weeds in open streamside localities. Where the forest cover is dense this tier contains species such as *Uncinia uncinata*, *Polystichum richardii*, *Blechnum penna-marina*, *B. procerum*, *B. chambersii*, *Lagenifera strangulata*, *Pratia angulata*, *Ranunculus reflexus*, *Hieracium pilosella*, white clover, ragwort, sweet vernal and wall lettuce.

Induced dense manuka scrub contains scattered *Coprosma propinqua* ssp. *propinqua*, *C. aff. parviflora*, tauhinu and *Rubus cissoides* in the shrub tier. The ground tier contains *Polystichum vestitum* and *Bulbinella angustifolia* in association with a thick pasture grass sward.

The threatened mistletoe *Alepis flavida* (Category B) is present on black beech and mountain beech hosts in the upper reaches of the tributary. The orchid *Chiloglottis cornuta* was seldom seen in the ecological district, although this may be at least partially due to the difficulty in identification when it is not in flower.

Fauna

Bellbird, grey warbler, South Island fantail and South Island robin were heard and/or seen in the forest. This was the only location where the threatened (Category B) kea (*Nestor notabilis*) was observed during the survey. Their presence may be linked to the close proximity of Lyford Village.

Shells of the carnivorous snail *Wainuia edwardii* were observed on the floor of riparian black beech forest. Recent research has indicated that this snail species should be treated as a threatened Category C species (Efford, 1997).

Inanga whitebait were observed in pools along the stream.

Deer, possum and pigs are present, although at the time of survey there was no evidence to suggest that numbers are great.

Secondary Criteria

Scenic and recreational values for inhabitants of Lyford Village.

Native vegetation stabilises the riverside slopes. The mudstone substrate is particularly vulnerable to accelerated erosion.

Selection Criteria

- Natural forest cover on the Inland Soft Rock Hill Country land system is now uncommon.
- Threatened and uncommon plants are present (see above).
- The only location during the survey where the threatened kea was seen. The threatened carnivorous snail species *Wainuia edwardii* is present.

Notes

The RAP adjoins, and the vegetation is continuous with, forest and scrub within subdivided sections of Lyford Village.

RAP 30 - The Battery

Grid Reference Centre:	NZMS 260 N32 222520
Area:	90 ha
Altitudinal Range:	600-800 m
Tenure:	Private
Vegetation Types:	1, 8a, 8c, 8d, 9, 10a
Study Area Number:	H3

Land System(s)

Inland soft rock hill country.

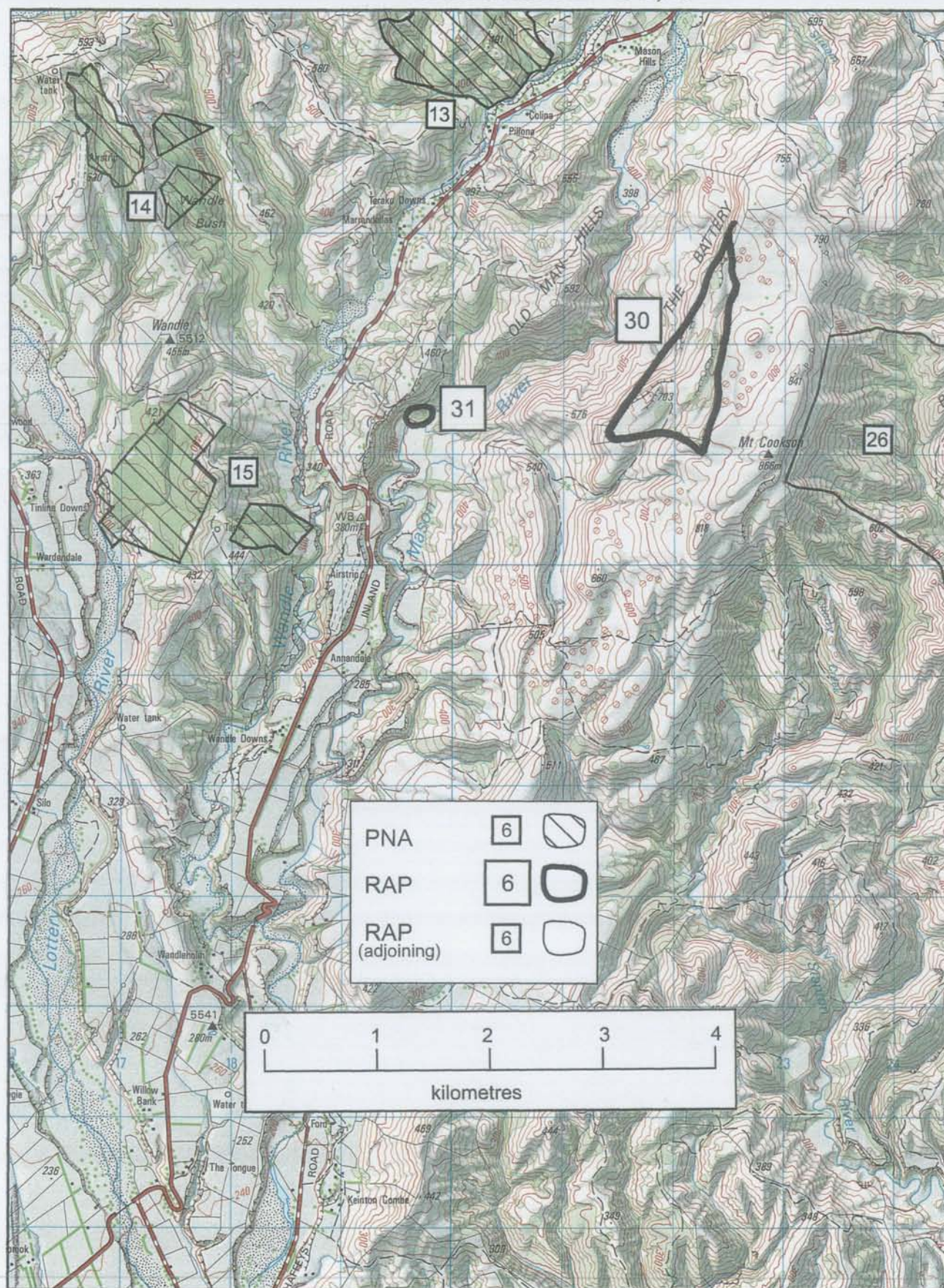
Bioclimatic Zone(s)

Montane.

Ecological Units

- Mountain beech forest and scrub on colluvial slopes, flats and fissures.
- Mixed shrubland on colluvial slopes, flats and fissures.
- Mixed shrub-rockland and rockland on outcrops and cliffs.
- Talus rockland at cliff bases.
- Bracken fernland on colluvial slopes and flats.
- Fescue tussock grassland on flats.
- Pasture grassland on flats.

Map 13 Recommended Areas for Protection - 30, 31



Landforms

The unique landforms found here include spectacular cliffs and fields of dolines, tomos and fissures which are a part of the Mt. Cookson cave and karst network. This network has been recognised as having national importance while the vulnerability has been classified as “unlikely to be damaged by humans” (Kenny and Hayward, 1993a).

The geology of the area is predominantly Tertiary limestone overlying and passing into basaltic pyroclastics and pillow lavas. There is little soil development, even on flats, and colluvium and bedrock covers much of the area. Limestone talus occupies the base of the cliffs.

Vegetation and Flora

A few small stands of young, even-aged mountain beech forest and scrub occur on colluvium around fissures. The most prominent species in a fairly sparse understorey are broadleaf, *Coprosma robusta*, *C. linariifolia*, fivefinger, lancewood, Hall's totara and marbleleaf.

Much of the shrubland is confined to areas in and around fissures which offer more moisture and protection from fires. Hall's totara, *Olearia paniculata*, broadleaf, *Coprosma robusta* x *C. propinqua* ssp. *propinqua*, *Corokia cotoneaster*, matagouri, *Brachyglottis monroi*, wharariki, and *Hebe traversii* form a canopy of variable density. Much of the ground layer is comprised of introduced species, most notably browntop, *Arenaria serpyllifolia*, *Medicago lupulina*, *Linum catharticum*, wall lettuce and *Hieracium pilosella*. The most common native species are the ferns *Blechnum penna-marina* and *Asplenium lyallii*. Some manuka occurs on the fringes of this vegetation type.

Sparse rockland communities containing many of the shrub species found in fissures occur on dry outcrops. Other species seen here include *Cordyline australis*, *Rubus squarrosus* and occasional *Pseudopanax ferox*.

Scattered shrubs, grasses and herbs occupy the talus rockland at the base of the cliffs. Broadleaf, kohuhu, *Coprosma propinqua* ssp. *propinqua*, *Melicytus alpinus*, *Brachyglottis monroi*, *Muehlenbeckia complexa* and matagouri are the principal shrubs and subshrubs. Silver tussock and *Elymus solandri* are the most frequent grasses among the lower tiers, although sweet vernal is prominent where pockets of fine gravel or soil have developed. *Trifolium dubium* and *Hieracium pilosella* are the most abundant herbs.

Above the talus, on cliff faces there is a sparse rockland community containing several species found amongst the talus as well as *Pachystegia insignis* ss., *Coprosma acerosa*, and *Epilobium brevipes*.

Fescue tussock grassland occupies the flats and those areas more recently burned accounting for approximately 80% of the area. A few scattered shrubs of matagouri, *Melicytus alpinus* and tauhinu are present. Fescue tussock generally shares the canopy with pasture grasses such as cocksfoot, sweet vernal, browntop and *Elymus solandri*. The most frequent herbs are white clover and *Hieracium pilosella*. *Bulbinella angustifolia* occurs in moister locations.

There are several rare or threatened plants present within the area. This was the only locality in the district where *Cystopteris tasmanica* was found - this fern is generally confined to montane and subalpine rock crevices and overhangs, most frequently on

calcareous soils. Other species which favour limestone habitats and are uncommon within the district include *Asplenium lyallii* and *A. aff. trichomanes*. This was one of two locations where *Coprosma acerosa* was found. This species indicates long-standing, remnant open habitats. *Pseudopanax ferox* occurs locally on a national level and is uncommon within the district. *Heliohebe raoulii* ssp. *raoulii* has been recorded from here (B. Molloy, pers. comm.), although it was not seen within the district during the survey. *Rytidosperma pumilum* was not seen elsewhere in the ecological district. Species endemic to South Marlborough or South Marlborough and Canterbury include *Epilobium brevipes* (not seen elsewhere in the district), *Brachyglottis monroi* and *Pachystegia insignis* ss.

Fauna

Colluvium, talus, fissures, cliffs and rock outcrops provide ideal habitat for common skinks, which are plentiful. An Australasian harrier was seen in the vicinity.

Stock do not graze the area intensively due to the difficult and, in places, dangerous nature of the terrain. Goats have penetrated in some parts, despite the efforts of the landowners to eradicate them.

Secondary Criteria

Sinkholes, caves and cliffs in the Mt. Cookson area contain the late Quaternary fossil remains of moas and other vertebrate faunas and are consequently of scientific interest paleontologists (Worthy and Holdaway, 1995).

Selection Criteria

- The landforms found here include spectacular cliffs and fields of dolines, tomos and fissures which are a part of a cave and karst network of national significance and are unique within the district.
- Sections containing deep bedrock fissures and cliffs have largely escaped historic burning and grazing so that the shrubland and rockland vegetation is predominantly long-standing.
- The most substantial and intact examples of montane grassland, rockland, shrubland, scrub and forest on the Inland Soft Rock Hill Country land system within the district.
- Native vegetation cover in montane areas on limestone and volcanic substrates is rare within the ecological district.
- Intact natural montane communities are generally confined to the higher peaks within the ecological district.
- A number of rare or unusual plant species occur in the area (see above).
- A high proportion of rockland provides ideal habitat for large numbers of common skink.

RAP 31 - Mason River Alluvial Remnant

Grid Reference Centre:	NZMS 260 N32 197513
Area:	1.5 ha
Altitudinal Range:	300-320 m
Tenure:	Private
Vegetation Types:	3d, 7, 10a
Study Area Number:	H21

Land System(s)

Northwest outwash deposits and local alluvium; Inland soft rock hill country.

Bioclimatic Zone(s)

Lowland.

Ecological Units

- Matai-kahikatea-black beech forest on terrace and toe slope.
- Mixed pine-manuka scrub on toe slope margins.
- Mixed shrubland on terrace.
- Bracken fernland on toe slope margins.

Landforms

The small riverside terrace is composed of recent alluvium and grades into a toe slope of Tertiary marine blue-grey calcareous siltstone and sandstone with concretionary bands at the base of a scarp.

Vegetation and Flora

This tall, mixed-age remnant forest stand is dense and largely natural in all tiers. Matai dominates the canopy and is emergent in places. Kahikatea and black beech are also prominent with minor climbing *Muehlenbeckia australis*. The understorey primarily contains marbleleaf, *Lophomyrtus obcordata*, tree fuchsia and younger matai and kahikatea, with minor black beech, pokaka, kowhai, *Muehlenbeckia australis*. The shrub tier is species-rich with *Lophomyrtus obcordata* common. *Corokia cotoneaster*, *Coprosma rigida*, *C. rhamnoides* and blackberry are also conspicuous with minor *C. propinqua* ssp. *propinqua*, *C. aff. parviflora*, *C. linariifolia*, *C. robusta*, *Neomyrtus pedunculatus*, pepper tree, wineberry, *Microlaena avenacea*, juvenile canopy and understorey species and scrambling *Parsonsia capsularis*. The most common species in the ground tier are *Polystichum vestitum*, *Uncinia uncinata*, *Microlaena avenacea*, *Blechnum penna-marina* and seedlings of *Coprosma rhamnoides*, *C. rigida*, *Corokia cotoneaster*, *Myrsine divaricata* and *Lophomyrtus obcordata*. Minor species include seedlings of remaining tree and shrub species (black beech is notably absent), *Asplenium terrestre* ssp. *terrestre*, *A. bulbiferum*, *A. gracillimum*, *Blechnum procerum*, *B. novae-zelandiae*, *B. chambersii*, *B. fluviatile*, *Histiopteris incisa*, *Hypolepis ambigua*, *Uncinia scabra*, self heal, catsear and wall lettuce.



Plate 13. RAP 30 - The Battery.



Plate 14. RAP 31 - Mason River Alluvial Remnant.

A barrier of weedy shrub species, particularly blackberry, has formed on the terrace perimeter while the northwestern portion of the stand, above the toe slope, merges into pine-manuka scrub and bracken fernland. These vegetation types have provided a buffer and prevented major stock damage within the stand, although they have also become established in canopy gaps.

Fauna

Bellbird and South Island fantail are present within the forest stand.

German wasps occur locally around black beech trees.

Stock have infiltrated the area in places although damage does not appear to be severe.

Selection Criteria

- Intact mixed podocarp-black beech forest is now rare within both Canterbury and South Marlborough.
- Native vegetation cover, and forest in particular, is now rare on alluvium within both Canterbury and South Marlborough.

RAP 32 - Little Lottery

Grid Reference Centre:	NZMS 260 N32 120519; N32 127522
Area:	85 ha in total
Altitudinal Range:	450-640 m
Tenure:	Private
Vegetation Types:	6a, 6b, 6c, 6d, 8c, 8d
Study Area Number:	N49

Land System(s)

Inland soft rock hill country.

Bioclimatic Zone(s)

Lowland; montane.

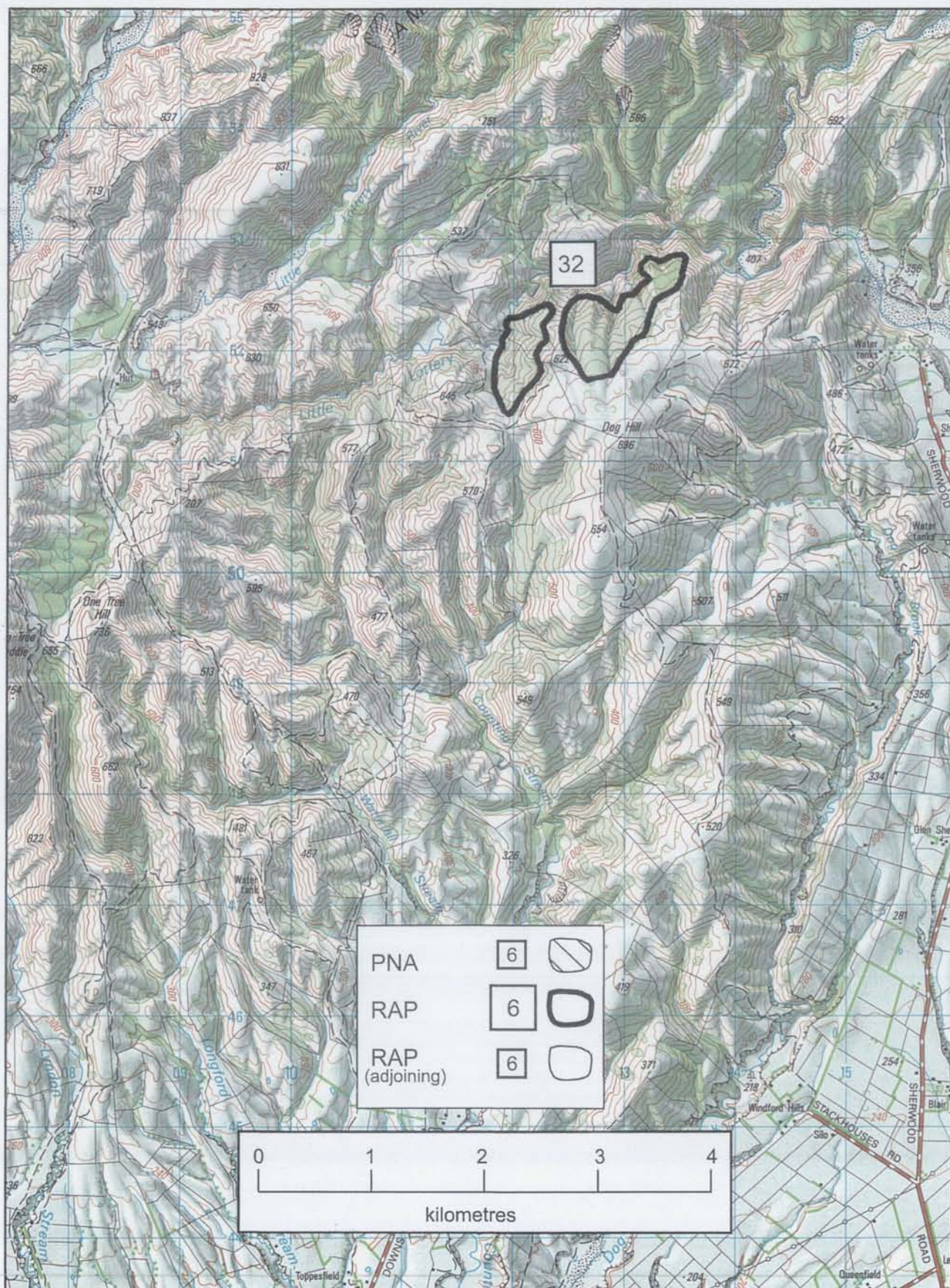
Ecological Units

- Black beech-kanuka forest along gullies and riparian zone.
- Kanuka low forest and scrub on hill slope.
- **Kanuka-manuka low forest and scrub on hill slope.**
- Manuka shrubland on hill slope.
- Mixed shrub-grassland on hill slope.
- Pasture grassland on hill slope.

Landforms

The area consists of two discrete segments of the west- and north-facing hill slopes of Dog Hill, by the Little Lottery River. Gradients range from gentle and undulating on the shoulder, to steep towards the mid and lower portions of the slope.

Map 14 Recommended Areas for Protection - 32



The geology is composed of basaltic pyroclastics and pillow lavas. A layer of loess is generally deeper where the terrain is gentle and thin or absent on steeper faces.

Vegetation and Flora

Kanuka and kanuka-manuka scrub and low forest cover the majority of the area. Gullies and riparian areas contain ribbons of black beech-kanuka forest (black beech tends to mountain beech with increasing altitude).

The tiers below the canopy are generally modified. Scattered *Coprosma rhamnoides* and *C. propinqua* ssp. *propinqua* are present under the dense canopy with matagouri and *Muehlenbeckia australis* where the canopy is more open. The ground tier is dominated by introduced pasture grasses and weeds, most commonly sweet vernal, browntop, ragwort, wall lettuce and *Hieracium pilosella*. Bare ground is common.

Fauna

Bellbird and South Island fantail were observed within the scrub.

Cattle have primarily contributed to a large amount of damage beneath the canopy, through trampling, soil compaction and grazing.

Selection Criteria

- Native vegetation cover is now rare on the Inland Soft Rock Hill Country land system, and particularly so on volcanic substrates.
- The most extensive native forest or scrub vegetation on volcanic substrate within the ecological district.

6. Additional Natural Areas

6.1 INTRODUCTION

The following list of natural areas is not intended to be comprehensive. Limited time and resources did not allow for all natural areas within the ecological district to be described. Access was denied to several, while descriptions of others were subsequently withdrawn at the request of landowners. Of those included, some were seen potentially as RAP's but the ecological units present were deemed to be better represented elsewhere. Typically these areas are comprised of larger forested catchments, usually on greywacke, and were described through survey plots and detailed notes. Other areas, particularly small wetland remnants and manuka and kanuka scrub, are significantly modified and/or induced. Inclusion of these is aimed to typify the character of much of that ecological unit remaining within the ecological district. In many cases this description is brief, particularly where a site was viewed only through binoculars. Their selection was generally based on ready accessibility and convenience.

General descriptions of vegetation only include the principal canopy species and those within each tier which have a % cover of >5% (i.e. excludes "present" and "minor" species) unless they are rare or notable.

The categories used for threatened species are described in Chapter 3.7.1.

6.2 ADDITIONAL NATURAL AREAS VISITED DURING THE COURSE OF THE SURVEY

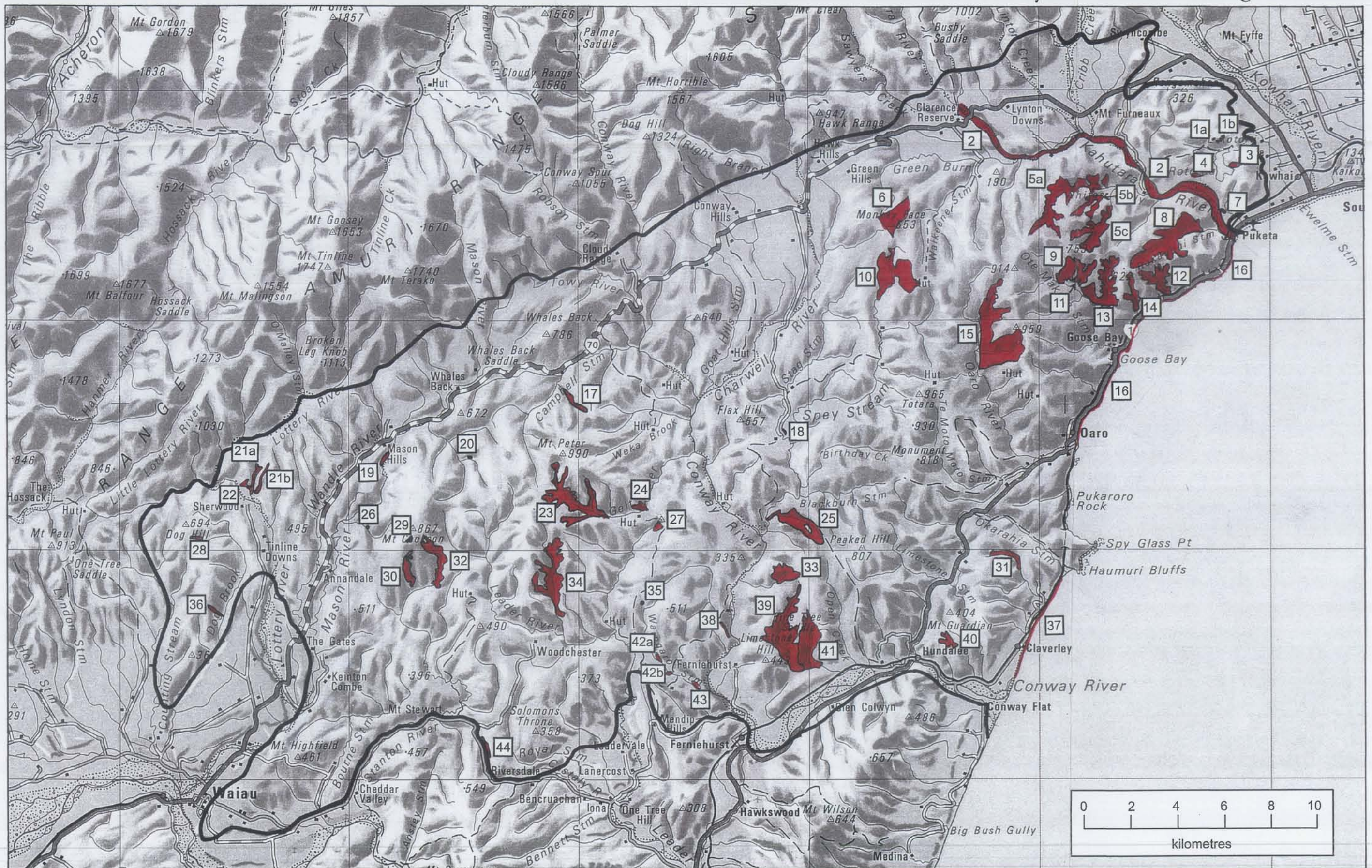
NAT 1 - Lake Rotorua Surrounds (1)

Grid Reference Centre:	NZMS 260 (a) O31 578678; (b) O31 579679
Area:	(a) 0.5 ha; (b) 0.5 ha
Altitudinal Range:	60-120 m
Tenure:	Private
Vegetation Types:	5a, 6a
Study Area Number:	N25

The two disjunct areas are situated on a low-relief southwest-facing lower hill slope (Coastal Greywacke Hill Country land system) beside the Lake Rotorua Wildlife Management Reserve.

The bulk of the area is composed of semi-coastal mahoe-mixed broadleaved low forest. Canopy associates include marbleleaf, kaikomako, supplejack, *Parsonsia capsularis* and *Rubus cissoides*. The shrub and ground tiers have been heavily grazed by goats and contain only scattered ferns such as *Polystichum richardii*, *Asplenium hookerianum*, *Blechnum fluviatile*, *Histiopteris incisa* and *Adiantum cunninghamii* with pasture grasses. The manuka shrubland surrounding the broadleaved forest contains *Coprosma rhamnoides* with scattered broadleaved species (kawakawa, red mapou and tree fuchsia).

Map 15
Additional natural areas surveyed within the Ecological District



South Island fantail, grey warbler and the threatened New Zealand pigeon (Category B) were detected within the area.

NAT 2 - Kahutara River Floodplain

Grid Reference Centre:	NZMS 260 O31 540669
Area:	365 ha
Altitudinal Range:	sea level - 210 m
Tenure:	Crown land (includes marginal strips and conservation area administered by DOC). AMF rights apply to some parts of the true left.
Vegetation Types:	7, 15
Study Area Number:	N21

The area is comprised of the section of braided riverbed between the Kahutara River mouth and the point where it adjoins the Clarence Reserve, near the Sawyers Creek confluence. It is the second largest braided river system in the ecological district behind Conway River. The majority of the river floodplain is composed of unconsolidated gravels and sand (Northwest Outwash Deposits and Local Alluvium land system). Scattered isolated islands have formed, although these are prone to flooding events. A network of both active and inactive channels are present throughout the floodplain. Natural riverine processes which characterise these communities such as flooding, silt deposition and active channelisation, are still operating within the area.

Larger willows occur on banks and islands, while the majority of the floodplain contains either a sparsely vegetated gravelfield or shrubland dominated by adventive species. Gravelfield contains scattered native species such as *Raoulia tenuicaulis*, *Pseudognaphalium luteoalbum* agg., *Epilobium microphyllum*, *E. brunnescens* ssp. *brunnescens*. Tree tutu may occur within the shrubland, although these areas are usually composed chiefly of lupin, gorse, European broom and *Buddleja davidii* in association with a swathe of adventive grasses and herbs.

A number of wetland bird species use the river plain as habitat. The list given here is not comprehensive as the whole river system was not surveyed and existing published information is scant. Red-billed gull, black-billed gull, paradise shelduck, Australasian harrier, New Zealand kingfisher, and threatened banded dotterel (Category C) and black-fronted tern (Category B) were noted during the course of the survey.

Active river channels and pools provide habitat for common river galaxias, inanga and upland bully (NIWA, 1997).

NAT 3 - Lake Rotorua Surrounds (2)

Grid Reference Centre:	NZMS 260 O31 584667
Area:	5 ha
Altitudinal Range:	30-140 m
Tenure:	Private
Vegetation Types:	5a, 6b
Study Area Number:	N25

The area is situated on a low-relief south-facing hill slope (Coastal Greywacke Hill Country land system) adjoining the Lake Rotorua Wildlife Management Reserve.

The vegetation is comprised of a combination of semi-coastal mahoe-mixed broadleaved low forest on concave slopes, and kanuka low forest and scrub on drier convex slopes. The mahoe-mixed broadleaved forest contains fivefinger, ngaio, kowhai and *Cordyline australis* with *Coprosma rhamnoides* dominating the sparse shrub tier. The ground tier is also sparse and predominantly occupied by *Polystichum richardii*, pasture grasses and weeds.

Kanuka low forest and scrub is characterised by a dense canopy with few associates. *Coprosma rhamnoides* is the most frequent shrub tier species while the ground tier is generally in poor condition, comprising pasture grasses and a few scattered ferns and broadleaved seedlings which have escaped grazing.

NAT 4 - Kahutara River Bank (1)

Grid Reference Centre:	NZMS 260 031 568663
Area:	3 ha
Altitudinal Range:	40-110 m
Tenure:	Private
Vegetation Types:	5a, 6a, 7
Study Area Number:	N22

This area is composed of semi-coastal manuka scrub and mahoe-mixed broadleaved scrub on the low-relief south-facing lower hill slope and toe slope adjacent to Kahutara Scientific Reserve (PNA 4). It lies within the Coastal Greywacke Hill Country land system on the true left of the Kahutara River approximately 3km from the coast. Mahoe forms the canopy with ngaio and scattered matai, kowhai and *Cordyline australis*. Recently disturbed parts of the area contain manuka shrubland and scrub. The area is modified, grazed and prone to infestation from European broom.

NAT 5 Whites Gully

Grid Reference Centre:	NZMS 260 518648
Area:	(a) 210 ha; (b) 45 ha; (c) 115 ha
Altitudinal Range:	70-680 m
Tenure:	Private
Vegetation Types:	1, 2, 4a, 5a, 5d, 6b, 8c, 8d, 10a
Study Area Number:	K18

The three disjunct areas occur within the Whites Gully catchment and its tributaries on both Coastal and Inland Greywacke Hill Country land systems with small localised pockets of streamside alluvium, covering semi-coastal, lowland and montane bioclimatic zones. Whites Gully itself is a tributary to Kahutara River, the confluence lying some 5km upstream from the river mouth. The forest is generally confined to riparian areas, lower hill slopes (colluvial in places), and gullies. Mahoe-mixed broadleaved forest dominates gullies, south-facing lower hill slopes and riparian zones in semi-coastal and lowland areas, with scattered remnant patches of riparian podocarp-mixed broadleaved forest. Upper lowland and montane gullies and headwaters contain mountain beech and black beech-mountain beech forest. Kanuka low forest occupies much of the drier faces, usually giving way to pasture

grassland, bracken fernland and mixed shrub-pasture grassland on lower to mid hill slopes.

Matai-mixed broadleaved forest contains emergent matai and isolated miro and lowland totara. Mahoe, kaikomako and supplejack comprise the remainder of the canopy. Understorey and shrub tiers comprise kaikomako, *Lophomyrtus obcordata*, supplejack and kawakawa. Tree and shrub seedlings dominate the ground tier in association with *Blechnum fluviatile*.

Semi-coastal mahoe-mixed broadleaved forest contains canopy and understorey associates of supplejack, *Olearia paniculata*, kanuka and fivefinger. Kawakawa is common in the shrub tier while *Blechnum chambersii*, *Asplenium hookerianum*, *Polystichum richardii* and kawakawa seedlings typify a relatively dense ground tier in areas where stock access is limited.

Montane mountain beech forest and black beech-mountain beech forest may contain scattered red beech in riparian zones towards the headwaters. The understorey and shrub tiers are typically sparse. *Blechnum discolor* and *Microlaena avenacea* dominate the lowest tier.

Kanuka forest contains a dense canopy with little understorey. The shrub tier is also dense, composed primarily of *Coprosma rhamnoides* and *Helichrysum lanceolatum*. *Polystichum richardii*, seedlings of *C. rhamnoides*, sweet vernal and browntop are common in the ground tier.

The oldest lowland totara known within the ecological occurs within segment (b). Five trees occur together, the largest of which has a breast-height diameter of 5m (Paton, 1991).

Common forest birds are present, including the threatened New Zealand pigeon (Category B).

NAT 6 - Tuku Tuku Iwi

Grid Reference Centre:	NZMS 260 O31 440647
Area:	134 ha
Altitudinal Range:	380-653 m
Tenure:	Privately owned by Te Runanga o Ngai Tahu (formerly a Scenic Reserve administered by DOC)
Vegetation Types:	1, 6a, 6b, 7, 8d, 9, 11
Study Area Number:	See notes (N41)

The area is chiefly composed of lowland steep, dissected hill country containing numerous well-weathered bedrock outcrops. The geology is mainly Mesozoic calcareous and glauconitic sandstone with some Mesozoic greywacke. Most of the area drains northwards into Green Burn with the remainder draining southeastwards into Waikeene Stream. Several large caves are present and are an unusual feature of the area.

Repeated burning, both deliberate and more recently, accidental, combined with the exposed nature of the faces have rendered much of the reserve susceptible to pine infestation with the rugged terrain making eradication extremely difficult. This situation is not set to improve within the immediate future, particularly in the northern part of the reserve where mature pines have become well-established among rock outcrops and manuka regeneration is still young. Spanish heath has also

become established on scrub margins and open areas and would undoubtedly spread further in the event of another fire.

Older kanuka occupies much of the southeast-facing upper slopes with mountain beech forest in gully heads. These slopes are sheltered from the prevailing westerly wind and the seed source of pine woodlots and shelterbelts lying inland from the reserve, and have escaped the brunt of the most recent fires. This vegetation type typically contains minor lancewood among a thick kanuka canopy, with lancewood, marbleleaf and younger kanuka in the understorey. A dense shrub tier commonly consist of *Leucopogon fasciculatus*, *Coprosma rhamnoides* with lesser amounts of kanuka, lancewood, *Helichrysum lanceolatum*, *Coprosma microcarpa* and *Cyathodes juniperina*. The ground tier is dominated by young *Coprosma rhamnoides*, *Uncinia fuscovaginata*, *U. uncinata* and *Microlaena avenacea*.

Carex secta-Hypolepis millifolium sedge-fernland occurs locally in seepages, while rock bluffs and outcrops contain a sparse vegetation cover of silver tussock, *Hebe salicifolia*, *Asplenium* spp. and *Celmisia monroi*.

Gentle slopes, crests and ridges are generally occupied by pasture grassland maintained by fire and grazing from stock and wild animals.

A New Zealand falcon (threatened - Category B) was seen perching on top of a rock outcrop. The reserve appears to be only partially fenced allowing access for stock sheep and cattle from neighbouring farms. Wild animals noted in the past include deer, pigs and mice (Williams, 1982).

This reserve has importance for local iwi.

NAT 7 - Kahutara River Bank (2)

Grid Reference Centre:	NZMS 260 O31 579647
Area:	3 ha
Altitudinal Range:	10-80 m
Tenure:	Private
Vegetation Types:	5b, 5d
Study Area Number:	N19

The area is composed of a low-relief south-facing hill slope adjacent to, and on the true left of, the Kahutara River floodplain within 1 km of the coastline. It lies within the Coastal Greywacke Hill Country land system. The vegetation is largely coastal mahoe-fivefinger scrub and mahoe-kanuka scrub. Other species to feature sporadically in the canopy include red mapou, *Olearia paniculata*, kohuhu, kawakawa, manuka and European broom. The ground tier is chiefly composed of *Polystichum richardii* and pasture grasses.

NAT 8 - Rakaunui Stream

Grid Reference Centre:	NZMS 260 O31 554633
Area:	250 ha
Altitudinal Range:	30-500 m
Tenure:	Private
Vegetation Types:	5a, 6b, 8a, 8c, 8d, 9, 10a
Study Area Number:	K25

Rakaunui Stream catchment drains to the northeast into the true right of Kahutara River, close to the river mouth. It lies within the Coastal Greywacke Hill Country land system with small localised areas of streamside alluvium. The steep-sided V-shaped valley and associated gullies and hill slopes are typically colluvial. Scattered bluffs and rock outcrops occur more often on north-facing slopes.

The natural vegetation is primarily semi-coastal. Mahoe-mixed broadleaved forest covers the riparian zone, gullies and concave hill slopes while kanuka dominates the convex hill slopes and shoulder slopes. These two vegetation types cover the majority of the area. Small stands of highly modified mixed broadleaved treeland occur on alluvial terraces. Marlborough rock daisy rockland is present on bluffs and rock outcrops, while forest margins on slopes are occupied by mixed shrubland and shrub-pasture grassland (most notably near the catchment head), mixed pasture grassland, or bracken fernland.

Mahoe dominates vegetation in riparian areas sharing the canopy with pigeonwood, kanuka, supplejack and marbleleaf. Kawakawa and mamaku are the most common shrub tier species, while the ground tier is generally sparse.

Concave colluvial hill slopes typically contain a dense canopy of mahoe. Supplejack is the only other species present in any significant quantity within any tier. The ground tier is almost completely denuded in many places.

Kowhai, mahoe, kaikomako and kanuka dominate the modified treeland on alluvial terraces. Pasture grasses generally comprise the dense ground tier.

Tall kanuka forest, particularly on shoulder slopes, contain a dense canopy with few other associates, and little understorey. *Coprosma rhamnoides* dominates a dense shrub tier with *Helichrysum lanceolatum*. *Uncinia uncinata* is common in the ground tier.

The dominant canopy species within mixed shrubland towards the catchment head are *Coprosma propinqua* ssp. *propinqua*, manuka, matagouri and tauhinu.

Notable plant species include *Asplenium* aff. *trichomanes* which is uncommon within the ecological district, while Marlborough rock daisy is regionally endemic.

Common bush birds are present including South Island fantail, bellbird, grey warbler and silvereye.

Goats and sheep are present and have caused substantial damage to the shrub and ground tier of mahoe-broadleaved forest, particularly in easily accessible areas and near margins.

NAT 9 - Ote Makura Tributary (1)

Grid Reference Centre:	NZMS 260 O31 514623
Area:	55 ha
Altitudinal Range:	240-700 m
Tenure:	Private
Vegetation Types:	5a, 6b
Study Area Number:	K6

This area contains largely semi-coastal and lowland mahoe-mixed broadleaved forest and scrub on the Coastal Greywacke Hill Country Land System. A small segment of the tributary riparian zone features scattered emergent matai, lowland totara,

rimu and hinau, while isolated black beech and red beech individuals are present in the small portion of riparian forest along Ote Makura Stream. Mahoe dominates the canopy with lemonwood and kaikomako. Tiers below the canopy are typically denuded, particularly on accessible hill slopes prone to grazing. Kanuka low forest and scrub is present on some forest margins and on drier slopes.

This area lies between two sections of the scenic reserve (PNA 9) which are separated by a track allowing for the movement of stock from one side of the valley to the other.

NAT 10 - Spey Stream Headwaters

Grid Reference Centre:	NZMS 260 O31 435621
Area:	195 ha
Altitudinal Range:	400-620 m
Tenure:	Private
Vegetation Types:	3a, 3b, 6a, 6b, 6e, 9, 11
Study Area Number:	H30

The headwaters of Spey Stream lie south of Tuku Tuku Iwi Reserve (NAT 6). Hill slopes, gullies and stream valleys range in gradient from steep (on greywacke) to undulating (on soft rock). Rock outcrops and bluffs are largely scattered on steep upper hill slopes. The underlying geology spans Mesozoic greywacke (Inland Greywacke Hill Country land system) to the east and Mesozoic flint beds, argillite, mudstone and sandstone (Inland Soft Rock Hill Country land system) to the west.

The dominant ecological units are: lowland black beech forest and black beech-red beech forest along riparian zones, in gullies and on lower hill slopes; lowland kanuka low forest and scrub on hill slopes and ridges; lowland manuka scrub and shrubland on hill slopes, ridges and crests; and lowland marbleleaf-manuka scrub on colluvial hill slopes. *Carex secta* sedgeland is present along a low-gradient soft rock stream flat. Lowland and montane mixed shrubland, shrub-rockland and rockland occurs on outcrops and bluffs.

Black beech-red beech forest on gentle soft rock lower hill slopes and riparian zones contains an open canopy with dead spars. There are few other canopy species and little understorey. *Coprosma propinqua* ssp. *propinqua* dominates a sparse shrub tier while the ground tier is also relatively barren due to easy access of stock.

Black beech forest on greywacke is of mixed age. The canopy is often in poor condition with a large proportion of dead spars (presumably a combination of snow damage and senescence). The understorey is dominated by black beech and marbleleaf. A dense shrub tier contains *Leucopogon fasciculatus* and *Coprosma microcarpa*. The ground tier is largely composed of *Microlaena avenacea* with *Uncinia uncinata*.

Marbleleaf-manuka scrub on colluvial greywacke slopes has resulted from severe snow damage. Other associates within a low open canopy include kanuka, Hall's totara and lancewood. *Coprosma rhamnoides* and *Corokia cotoneaster* dominate the shrub tier while a dense ground tier consists primarily of *Uncinia uncinata*, *Polystichum vestitum* and *Blechnum procerum*.

Kanuka low forest is typified by a dense canopy. The shrub tier is composed mainly of *Coprosma rhamnoides* and *Leucopogon fasciculatus*, with little ground tier.

Carex secta sedgeland contains scattered manuka, wharariki and *Juncus gregiflorus*. The ground tier, where present, is largely composed of adventive grasses and herbs. Rock outcrops and bluffs commonly contain a mix of matagouri, Marlborough rock daisy (*Pachystegia* sp. 'A'), fescue tussock, silver tussock, sweet vernal, browntop, Yorkshire fog and white clover.

European broom and Spanish heath are established in some areas, notably open forest and scrub margins, and pose a potential threat.

South Island tomtit and bellbirds were seen. German wasp populations were high within black beech forest.

Sheep and cattle have caused the most damage to shrub and ground tier cover, largely on margins and easily accessible areas.

NAT 11 - Ote Makura Tributary (2)

Grid Reference Centre:	NZMS 260 031 520619
Area:	50 ha
Altitudinal Range:	200-580 m
Tenure:	Private
Vegetation Types:	4a, 5a, 6a
Study Area Number:	K4

This area largely comprises semi-coastal to lowland broadleaved forest on the Coastal Greywacke Hill Country land system. Forest is generally confined to riparian areas and often colluvial lower hill slopes. Scattered emergent matai, and to a lesser extent, lowland totara, rimu and black beech are present in riparian zones over a mixed broadleaved canopy. Mahoe dominates this canopy with narrow-leaved lacebark, marbleleaf, broadleaf and kowhai. The tiers below the canopy are generally very sparse and in poor condition having been exposed to stock trampling and browsing. Canopy gaps generally contain pasture grasses and weeds. Small amounts of manuka scrub may be present on drier margins, although much of the forest grades into pasture grassland.

Threatened (Category B) wood pigeon was seen within the forest along with other forest birds including high numbers of South Island fantail.

The area adjoins the headwaters portion of the unnamed scenic reserve at Ote Makura Stream (PNA 9).

NAT 12 - Rosie Morn

Grid Reference Centre:	NZMS 260 552616
Area:	90 ha
Altitudinal Range:	10-460 m
Tenure:	Private
Vegetation Types:	5a, 5c, 6b, 8d, 10a
Study Area Number:	K23

Rosy Morn Stream is one of a series of small, coastal, sea-draining streams lying between Goose Bay and Kahutara River mouth. The catchment consists of a steep-sided V-shaped valley, branching at the headwaters. The geology is Mesozoic greywacke and is included in the Coastal Greywacke Hill Country land system.

Mahoe-mixed broadleaved forest and mixed broadleaved scrub and forest dominate the remaining tall vegetation along the riparian zone and on lower hill slopes and gullies, with kanuka low forest on convex slopes and drier faces. Bracken fernland and silver tussock-mixed pasture grassland occupies much of the upper slopes, ridges and gently sloping terrain.

Riparian mahoe-mixed broadleaved forest contains infrequent, scattered emergent individuals of kahikatea, matai and pokaka. Mahoe dominates the canopy and understorey with pate and supplejack. Kawakawa is prominent in the shrub tier while *Asplenium gracillimum* and *Lastreopsis glabella* are common in the ground tier.

Mixed broadleaved forest and scrub on south-facing hill slopes and gullies typically contain a mix of mahoe, fivefinger, broadleaf, marbleleaf and red mapou within the dense canopy. The shrub tier and ground tiers are generally sparse having been damaged in many cases by goats. *Polystichum richardii* is the only species to exist with any degree of frequency.

Kanuka low forest is of variable condition. Where intact, it contains a dense kanuka canopy with little understorey. *Coprosma rhamnoides* and, on steep southeast-facing slopes, *C. crassifolia*, dominate the shrub tier, while the ground tier commonly contains sweet vernal and *Leptinella serrulata*.

Kie kie occurs within the catchment and is now rare within the ecological district. The nationally local mistletoe, *Ileostylus micranthus*, was found on a kanuka host.

The catchment forms part of the Kaikoura coastline and as such has outstanding landscape value which is of national importance (Boffa Miskell and Lucas Associates, 1993). The coastal features between the Kahutara River mouth and Oaro are also listed in the geopreservation inventory as having national significance (Kenny and Hayward, 1993b) as a good example of steeply cliffed coast, rocky headlands and stacks.

NAT 13 - Ote Makura Stream + Tributary (3)

Grid Reference Centre:	NZMS 260 O31 530610
Area:	145 ha
Altitudinal Range:	100-640 m
Tenure:	Private
Vegetation Types:	5a, 6b
Study Area Number:	N37

The area consists largely of semi-coastal and lowland mahoe-mixed broadleaved forest and scrub on the Coastal Greywacke Hill Country land system. The riparian zone contains scattered emergent matai, lowland totara, rimu, hinau, black beech and red beech individuals. Mahoe dominates the canopy with lemonwood and kaikomako. Tiers below the canopy are typically denuded, particularly on accessible hill slopes prone to grazing. Kanuka low forest and scrub is present on some forest margins and on drier slopes. The pattern of vegetation mirrors that of the nearby scenic reserve (PNA 9) which comprises much of the Ote Makura Stream catchment. However the condition of the forest vegetation is generally much poorer.

NAT 14 - Kie Kie

Grid Reference Centre:	NZMS 260 O31 540610
Area:	50 ha
Altitudinal Range:	40-540 m
Tenure:	Private
Vegetation Types:	5a, 6b, 8a, 8c, 8d, 9, 10a
Study Area Number:	K24

Kie Kie Creek is one of a series of small, coastal, sea-draining streams lying between Goose Bay and Kahutara River mouth, lying within the Coastal Greywacke Hill Country land system. The mouth and lowest reaches of the creek lie within an unnamed scenic reserve (PNA 5). The catchment consists of a steep-sided V-shaped valley and associated steep hill slopes (including bedrock and colluvial slopes), and scattered rock outcrops and bluffs.

Natural vegetation cover consists largely of secondary mahoe-mixed broadleaved forest in riparian zones and gullies and mixed shrubland towards the headwaters. Kanuka scrub is present on drier hill slopes. Bluffs and outcrops contain mixed shrubland, shrub-rockland and rockland. The remainder of the catchment is composed of induced silver tussock-mixed pasture grassland and bracken fernland.

In riparian zones and gullies mahoe dominates the canopy and understorey with fivefinger, pate and supplejack. Kawakawa is prominent in the shrub tier

Mixed shrubland towards the headwaters is an intermediary vegetation type between the mahoe-mixed broadleaved low forest in gullies and the shrub-tussockland and bracken fernland on more recently disturbed slopes. Matagouri, *Coprosma propinqua* ssp. *propinqua*, bracken fern, silver tussock and sweet vernal share a low canopy with scattered emergent kanuka, fivefinger and *Cordyline australis*.

Shrubland and shrub-rockland on southeast-facing rock outcrops contains emergent fivefinger. The canopy, where it exists, consists largely of *Helichrysum lanceolatum* and *Coprosma propinqua* ssp. *propinqua*. Hound's tongue fern dominates the ground tier. North-facing bluffs and outcrops contain larger proportions of Marlborough rock daisy while small patches of mixed broadleaved remnant shrubland and scrub persist in shady areas beyond the reach of stock. Mahoe, fivefinger, ngaio, hinau, wineberry, marbleleaf, *Hebe stricta*, tree fuchsia, *Coprosma grandifolia*, *Clematis foetida* and *Urtica ferox* are prominent.

The catchment forms part of the Kaikoura coastline and as such has outstanding landscape value which is of national importance (Boffa Miskell and Lucas Associates, 1993). The coastal features between the Kahutara River mouth and Oaro are also listed in the geopreservation inventory as having national significance (Kenny and Hayward, 1993b) as a good example of steeply cliffed coast, rocky headlands and stacks.

The nationally local mistletoe, *Ileostylus micranthus*, was found on a *Coprosma propinqua* ssp. *propinqua* host. Marlborough rock daisy is regionally endemic, while *Rytidosperma nigricans* and *Scleranthus biflorus* are uncommon within the ecological district.

Kie Kie Stream provides habitat for native fish species including inanga, long-finned eel and red-finned bully (NIWA, 1997).

Goats have caused much of the browsing damage within the catchment.

NAT 15 - True Left: Upper Oaro River

Grid Reference Centre:	NZMS 260 O32 477595
Area:	370 ha
Altitudinal Range:	320-940 m
Tenure:	Private
Vegetation Types:	1, 3a, 3c, 5a, 6b, 8a, 8c, 9
Study Area Number:	N35

The area covers the naturally vegetated parts of the upper reaches and tributaries of the true left of Oaro River, excluding the headwaters. It adjoins the Oaro River Private Protected Land (PNA 12) on its southern (downstream) border. The underlying geology is Mesozoic greywacke and the area lies within the Inland Greywacke Hill Country land system. The terrain is dominated by steep-sided V-shaped valleys, gullies, hill slopes and spur side slopes.

The broad vegetation pattern consists of: black beech forest and black beech-mixed broadleaved forest in lowland riparian area, gullies and south-facing lower hill and spur slopes; black beech-mountain beech forest and mountain beech forest on upper lowland and montane riparian zones, gullies and south-facing slopes; mahoe-mixed broadleaved forest on more recently disturbed gullies and concave hill slopes; kanuka low forest and scrub on more recently disturbed convex slopes and ridges; Hall's totara shrubland and scrub on montane colluvial slopes; mixed shrubland and shrub-grassland on recently disturbed slopes on easier gradient; shrub-rockland and rockland on outcrops and bluffs.

Black beech forest on dry slopes contains few canopy and understorey associates. The shrub tier is moderately dense in places with *Cyathodes juniperina*, *Coprosma rhamnoides* and scrambling *Rubus schmidelioides*. A sparse ground tier contains scattered ferns such as *Polystichum vestitum*, *Blechnum procerum*, and *B. pennamarina*.

Black beech-broadleaved forest along the riparian zone contains emergent black beech and occasional podocarp individuals (most frequently matai) over mahoe, marbleleaf, broadleaf and kaikomako with a shrub layer of *Coprosma rhamnoides*, *C. rigida* and *Melicope simplex*. *Uncinia uncinata* is the dominant species in the ground tier, which is otherwise sparse.

Mahoe-mixed broadleaved forest contains occasional emergent hinau. Understorey species include scattered wheki, silver fern and marbleleaf. The shrub tier is not prominent while the moderately sparse ground tier most commonly includes *Uncinia uncinata*, with scattered broadleaved seedlings and ferns (*Pellaea rotundifolia*, *Blechnum fluviatile*, and *Polystichum richardii*).

Kanuka low forest generally includes a dense canopy with few associates. There is usually little understorey and a thick shrub layer of *Coprosma rhamnoides*. *Uncinia scabra* and *C. rhamnoides* seedlings are the most common species in the ground tier.

Montane Hall's totara shrubland and scrub commonly consists of canopy associates of *Cyathodes juniperina* and tauhinu. The ground tier contains, most frequently, scrambling *Gaultheria depressa* var. *novaezelandiae*, *Poa colensoi*, *Deyeuxia avenoides* and *Gentiana tenuifolia* with foxglove, catsear and *Hieracium pilosella*.

On sheer bedrock faces and bluffs the vegetation consists of a mix of common broadleaved species such as red mapou, mahoe, broadleaf and *Metrosideros diffusa*, with Hall's totara, kanuka, *Cyathodes juniperina*. Regionally endemic species including Marlborough rock daisy and *Brachyglottis monroi* are present.

Mixed shrubland and shrub-grassland typically contains tauhinu, matagouri and manuka, with silver tussock, fescue tussock and various pasture grasses forming the ground tier.

The area provides habitat for South Island fantail, South Island tomtit, bellbird, Australasian harrier, brown creeper, South Island rifleman, grey warbler, silveryeye and the threatened New Zealand pigeon (Category B) and New Zealand falcon (Category B) (New Zealand Wildlife Service, 1983). *Wainuia edwardii* snail shells were found in the adjacent Oaro River PPL (PNA 12). Recent research has indicated that this species should be treated as a threatened Category C species (Efford, 1997). An old (1944) record of lamprey exists for the Oaro River (NIWA, 1997). There are no other records for this species in the district.

NAT 16 - Kaikoura Coastline: Oaro to Kahutara River Mouth

Grid Reference Centre:	NZMS 260 O32 539590
Area:	20 ha
Altitudinal Range:	Sea level to 10 m
Tenure:	Combination of Transit New Zealand (legal road), Ngai Tahu (formerly fragments of Goose Bay-Omihi Scenic Reserve) and conservation land administered by DOC. Excludes private land and camping grounds.
Vegetation Types:	7, 9, 16
Study Area Number:	K31

The area is composed of the coastal rockland, boulderfield, stonefield and sandfield lying between the shoreline and State Highway No. 1 between the Kahutara River mouth and Oaro. Coastal rockland is present on spur ends, the best remaining examples of which occur above and on the seaward side of the Raramai and Parititahi tunnels. The area falls within the Coastal Greywacke Hill Country land system, although locally the substrate varies from sand to greywacke boulders and mudstone/sandstone on some spur ends. There is little soil development. Kaikoura coastline as a whole has been identified as an outstanding landscape feature of national importance (Boffa Miskell Ltd, 1993). The steeply cliffed coast, rocky headlands and stacks have nationally significant geopreservation value (Kenny and Hayward, 1993b).

The stretch of coastline has historical significance both to Māori and non-Māori with several archaeological sites present.

Mixed coastal shrubland, shrub-rockland and rockland on spur ends contain a mix of species associated with coastal broadleaved low forest and scrub, rockland species such as Marlborough rock daisy, and species associated with rocky coastlines, commonly in the splash zone. Canopy or emergent species commonly consist of ngaio, tree tutu, *Hebe stricta*, mahoe, kawakawa, red mapou, fivefinger, *Coprosma robusta*, *C. repens*, *Griselinia lucida*, akeake, Marlborough rock daisy, Marlborough lilac, wharariki and *Muehlenbeckia australis*. The ground tier contains a number of adventive herb, grass and shrub species as well as hound's tongue fern, *Polystichum richardii*, *Asplenium terrestre* ssp. *maritimum*, *A. oblongifolium*, *Pyrrosia eleagnifolia*,

silver tussock, *Senecio lautus*, New Zealand iceplant, *Isolepis nodosa*, *Einadia triandra*, *Luzula banksiana*, *Linum monogynum* and *Acaena anserinifolia*.

Vegetation commonly growing in stonefields and the fissures of boulderfields close to the splash zone include many species that are present on spur ends. Ngaio is common with *Griselinia littoralis*, *Coprosma repens*, akeake, karaka, kawakawa, *Clematis forsteri* agg., *Cyperus ustulatus*, *Isolepis nodosa*, *Asplenium oblongifolium*, *Pyrrosia eleagnifolia*, *Senecio lautus* and New Zealand ice plant in addition to several introduced species. However it is unclear in many instances whether or not the presence of such species as karaka and *Coprosma repens* is natural, or if they represent traditional cultivation by local Māori. The presence of pohutukawa in and around such vegetation suggests the latter.

Common adventive species growing within shrubland and on rockland, boulderfields and stonefields include European broom, banana passionfruit vine, localised garden nastertium (*Tropaeolum majus*), *Festuca rubra*, perennial ryegrass, Yorkshire fog, cocksfoot, prairie grass (*Bromus catharticus*), ragwort, catsear, stonecrop, *Chenopodium album*, white clover, *Trifolium pratense*, vipers bugloss, plantain (*Plantago australis*), woolly mullein, Scotch thistle, *Chrysanthemoides monilifera*, and yarrow.

A few small, sandy beaches are present along the coastline, most notably at Oaro and Goose Bay. The vegetation is typically semi-natural shrub-herbfield and grass-herbfield and as such does not score highly (4 out of 20) within a national context of sand dune and beach vegetation (Johnson, 1992). Scattered ngaio, *Hierochloa redolens*, *Haloragis erecta*, *Carex pumila*, *Senecio lautus* and *Calystegia soldanella*, may be found among lupin, European broom, gorse, marram grass, cocksfoot, vipers bugloss, Californian thistle, *Atriplex prostrata*, white clover, *Anagallis arvensis*, yarrow, catsear and *Rumex crispus*.

Notable plant species include *Asplenium terrestre* ssp. *maritimum* and *Cyperus ustulatus* which are rare within the ecological district.

Red-billed gull, Southern black-backed gull, white-fronted tern, spotted shag, South Island pied oystercatcher and the threatened reef heron (Category O) are present. New Zealand fur seal haul out along the coastline.

The coastline serves as an ecological link between terrestrial and marine environments. Stream mouths, particularly larger ones such as Ote Makura Stream, Omihi Stream and Kie Kie Stream provide unrestricted passage for native fish species such as inanga, koaro, long-finned eel, red-finned bully and blue-gilled bully (NIWA, 1997).

NAT 17 - Campbell Stream Tributary

Grid Reference Centre:	NZMS 260 N32 297564
Area:	13 ha
Altitudinal Range:	400-560 m
Tenure:	Private
Vegetation Types:	3a, 6c
Study Area Number:	H19

The area is composed of a steep-sided Mesozoic greywacke riparian zone and lower hill slopes along a tributary to Campbell Stream, north of Mt. Peter. It lies within the Inland Greywacke Hill Country land system.

Lowland mixed-age black beech forest dominates the natural vegetation with manuka-kanuka scrub on some margins.

Black beech dominates the canopy and understorey with marbleleaf and lancewood. The shrub tier most frequently contains *Leucopogon fasciculatus* and *Cyathodes juniperina* on drier hill slopes, and *Coprosma robusta* along the streamside. *Astelia fragrans* is the most common species in a relatively sparse ground tier on dry slopes, while ferns such as *Blechnum fluviatile*, *B. chambersii*, *B. vulcanicum*, *Histiopteris incisa*, *Pneumatopteris pennigera* are concentrated on stream banks.

The steepness of the banks has meant that, although cattle and sheep are not excluded, grazing pressure is light.

NAT 18 - Stag and Spey Wetland

Grid Reference Centre:	NZMS 260 O32 389552
Area:	0.5 ha
Altitudinal Range:	170-175 m
Tenure:	Private
Vegetation Types:	11, 12
Study Area Number:	N39

This wetland remnant occurs beside Stag and Spey Road, north of, and very close to, the Spey Stream-Stag Stream confluence. The underlying geology is a small localised pocket of Quaternary glacial outwash gravel (Northwest Glacial Outwash and Local Alluvium land system). The wetland occupies part of an old stream channel.

The vegetation is composed largely of raupo reedland with minor *Carex coriacea*. Willow and silver poplar have infested the southern portion of the wetland and pasture grasses impact on the margins. The 1997/98 drought saw a combination of die-off from the effects of the drought coupled with an increase in grazing pressure and consequently a deterioration of an already highly modified area.

NAT 19 - Mason River Escarpment

Grid Reference Centre:	NZMS 260 N32 214539
Area:	8 ha
Altitudinal Range:	390-420 m
Tenure:	Private
Vegetation Types:	3d, 6b, 7, 8d
Study Area Number:	H27

This area is composed of a southeast-facing scarp beside Mason River within the Inland Soft Rock Hill Country land system. The geology is composed of Tertiary marine blue-grey calcareous siltstone and sandstone with concretionary bands.

Black beech-matai remnant forest is present on the scarp with an area of kanuka low forest and scrub, interspersed with exotic and semi-natural shrub-grassland and pasture grassland.

Lowland black beech forms a moderately open canopy with emergent matai. Minor emergent kahikatea is present while other minor canopy associates include pokaka and *Rubus schmidelioides*. The sparse understorey is comprised of minor black beech, pokaka, marbleleaf and *R. schmidelioides*. The shrub tier is dominated by

Coprosma aff. *parviflora*, *C. rhamnoides*, *Neomyrtus pedunculatus* and *R. schmidelioides* with minor *C. propinqua* ssp. *propinqua*, *Myrsine divaricata* and regenerating pokaka. *Uncinia uncinata* is prominent in the ground tier with minor tree and shrub seedlings. Blackberry and pines are present throughout.

Kanuka low forest and scrub contains minor broadleaved species in the canopy and understorey including kowhai, kohuhu, lancewood and broadleaf. *Coprosma rhamnoides*, *Cyathodes juniperina*, *Corokia cotoneaster*, *Helichrysum lanceolatum* and *Hebe traversii* comprise the shrub tier. Blackberry dominates areas where the canopy is open. The ground tier is generally very sparse.

Bluffs contain a largely exotic mix of pines, shrubs, pasture grasses and weeds with scattered manuka.

Weed infestation has occurred throughout the area with pines, Douglas fir, European larch (*Larix decidua*), silver birch (*Betula pendula*), briar, blackberry and pasture grasses present in varying amounts, primarily on margins and in canopy gaps.

Cattle trampling and browsing has damaged the shrub and ground tiers, particularly on parts of the scarp which have gentler gradients and little buffering.

NAT 20 - Lagoon Stream

Grid Reference Centre:	NZMS 260 N32 252541
Area:	0.5 ha
Altitudinal Range:	480-540 m
Tenure:	Private
Vegetation Types:	9
Study Area Number:	H29

Lagoon Stream feeds south-westwards into Mason River. The area is comprised of Mesozoic greywacke rock bluffs beside a tributary to Lagoon Stream and lies within the Inland Greywacke Hill Country land system.

The mixed shrub-rockland and rockland is principally composed of matagouri, *Coprosma propinqua* ssp. *propinqua*, *Brachyglottis monroi*, *Pachystegia* sp. 'A' and cocksfoot.

Notable species include the regionally endemic *Brachyglottis monroi*, *Pachystegia* sp. 'A' and Marlborough lilac.

NAT 21 - Lottery River Tributaries

Grid Reference Centre:	NZMS 260 (a) N32 159533; (b) N32 163534
Area:	(a) 17 ha; (b) 10 ha
Altitudinal Range:	(a) 320-480 m; (b) 340-540 m
Tenure:	Private
Vegetation Types:	3a, 6a, 6b
Study Area Number:	N29

The area is composed of two adjacent disjunct tributary gullies on low-relief, undulating hill country feeding southwards into the true left of Lottery River and underlain with Tertiary blue-grey calcareous siltstone (Inland Soft Rock Hill Country). The vegetation is largely composed of lowland black beech forest

(tending to mountain beech at higher altitudes) with scattered individuals of matai and rimu along the riparian zone. Kanuka, broadleaf, marbleleaf and *Cordyline australis* are common associates. Manuka scrub and manuka-kanuka low forest and scrub dominate the remaining vegetation on slopes above the beech forest. The vegetation is somewhat modified through grazing and the influx of gorse, European broom and pasture grasses.

NAT 22 - Lottery River Beech Remnant

Grid Reference Centre:	NZMS 260 N32 155529
Area:	6 ha
Altitudinal Range:	340-400 m
Tenure:	Private
Vegetation Types:	3a, 6b
Study Area Number:	N38

This gully and toe slope is adjacent to Lottery River, approximately 1.5 km east of the confluence with Little Lottery River. Tertiary blue-grey siltstone and sandstone comprise the geology, and the area lies within the Inland Soft Rock Hill Country land system.

Lowland black beech forest occupies the gully and is flanked by kanuka/manuka scrub. The pattern is similar to that found within Lottery Scenic Reserve, though much more degraded.

NAT 23 - Gelt River Headwaters

Grid Reference Centre:	NZMS 260 N32 295523
Area:	175 ha
Altitudinal Range:	360-900 m
Tenure:	Private
Vegetation Types:	1, 2, 3a, 5c, 5g, 6b, 8a, 8c
Study Area Number:	H24

Gelt River drains eastwards into the true right of Conway River. The upper reaches and headwaters are composed of a steep-sided V-shaped valley with associated steep spur and hill slopes (often colluvial) and gullies. Rock outcrops and bluffs are scattered on steeper faces. The underlying geology is Mesozoic greywacke and the area lies within the Inland Greywacke Hill Country land system.

Mountain beech forest and black beech-mountain beech forest cover most of the area on lower hill slopes, gullies and the riparian zone. The remaining vegetation is a combination of: mixed broadleaved forest on lowland colluvial spur and hill slopes; small amounts of kanuka low forest on spur and hill slopes; mixed shrubland on montane south-facing colluvial slopes; and manuka-mixed shrubland on spur and hill slopes and forest margins. A small patch of mountain ribbonwood scrub and treeland lies at the head of a tributary.

Lowland black beech-mountain beech forest on hill slopes contains few canopy or understorey associates. Red beech may be present on more fertile knolls. A relatively dense shrub tier is typically comprised of *Cyathodes juniperina* and beech regeneration. The ground tier is characteristically sparse.

Lowland riparian black beech-mountain beech forest contains a larger proportion of broadleaved species including broadleaf, lancewood, tree fuchsia, marbleleaf, kohuhu and mahoe, largely in the understorey and shrub tiers. Other prominent shrub tier species include *Helichrysum lanceolatum* and *Corokia cotoneaster*. The ground tier contains *Astelia fragrans*, *Polystichum richardii*, *Blechnum vulcanicum*, *B. procerum*, *B. penna-marina*, *Asplenium richardii* and wall lettuce.

Lowland mixed broadleaved forest is comprised of marbleleaf, mahoe and broadleaf. Younger mahoe is common amongst a sparse understorey and shrub tier while the ground tier is dominated by hound's tongue fern.

The most notable species within the area is mountain ribbonwood which is uncommon within the ecological district.

Common bush birds are present including large numbers of bellbird.

Stock damage appears to be confined largely to the peripheral areas. Pig, deer and possum sign was noted, while German wasps are plentiful within the beech forest.

NAT 24 - Gelt Tributary Gully

Grid Reference Centre:	NZMS 260 O32 324520
Area:	15 ha
Altitudinal Range:	300-440 m
Tenure:	Private
Vegetation Types:	3a, 8a
Study Area Number:	N32

The area is made up of the forested lower reaches of two small gullies draining southeastwards into the true left of Gelt River, approximately 3km from the confluence with Conway River. The geology is composed of Mesozoic greywacke and the area lies within the Inland Greywacke Hill Country land system.

The vegetation is primarily lowland black beech forest tending to black beech-mixed broadleaved forest where the beech canopy is more open. The most common broadleaved species within both canopy and understorey include tree fuchsia, broadleaf, kohuhu, mahoe, lancewood, *Olearia paniculata* and climbing *Clematis forsteri* agg. and *Rubus cissoides*. The shrub tier contains *Corokia cotoneaster*, *Helichrysum lanceolatum*, *Raukaua anomala*, *Cyathodes juniperina*, *Coprosma rhamnoides*, *C. robusta*, *C. propinqua* ssp. *propinqua* and *C. robusta* x *C. propinqua* ssp. *propinqua*. Ground tier species include *Polystichum richardii*, *P. vestitum*, *Blechnum vulcanicum*, *B. procerum*, *B. penna-marina*, *Asplenium richardii*, *Urtica incisa* and *Astelia fragrans*. Margins contain a shrubland mix of *Coprosma propinqua* ssp. *propinqua*, *C. aff. parviflora*, *C. rhamnoides*, tree tutu, *Pittosporum divaricatum*, *Melicytus alpinus*, *Cordyline australis*, *Rubus cissoides*, *R. schmidelioides* and *Muehlenbeckia australis* with a ground tier comprised mainly of pasture grasses and adventive herbs.

NAT 25 - Spey Stream Tributary

Grid Reference Centre:	NZMS 260 O32 395514
Area:	130 ha
Altitudinal Range:	160-670 m
Tenure:	Private
Vegetation Types:	3a, 5d, 6b, 6d, 7
Study Area Number:	N12

The area is composed of a Mesozoic greywacke valley and associated gullies, hill slopes, spur slopes, ridges and crests within the Inland Greywacke Hill Country land system.

Riparian vegetation and south-facing lower hill slopes and spur side slopes are largely occupied by black beech forest. The remainder of the area contains lowland to montane kanuka low forest and scrub. Minor vegetation types include beech-kanuka intergrades and kanuka-mahoe low forest and scrub in gullies and south-facing slopes. Some patches of European broom have infiltrated recently disturbed areas.

NAT 26 - Annandale Wetland Remnant

Grid Reference Centre:	NZMS 260 N32 209511
Area:	<0.5 ha
Altitudinal Range:	480-500 m
Tenure:	Private
Vegetation Types:	11
Study Area Number:	N2

This small, highly modified lowland seepage wetland remnant contains *Carex secta*, *Eleocharis acuta*, *Juncus articulatus* and *Carex coriacea*. The inter-sedge vegetation is composed largely of pasture grasses and weeds, with some *Epilobium brunescens* and *E. komarovianum*. *Herpolirion novae-zelandiae* is present on margins. Grazing damage, particularly from cattle, is evident throughout.

NAT 27 - The Gelt

Grid Reference Centre:	NZMS 260 O32 332511
Area:	15 ha
Altitudinal Range:	320-480 m
Tenure:	Private
Vegetation Types:	6a, 8c
Study Area Number:	N30

The head of the tributary to Leader River lies southwest of the hill known as The Gelt. The south-facing hill slope and gully is underlain with Tertiary white muddy limestone and falls within the Inland Soft Rock Hill Country land system.

Lowland manuka shrubland and manuka-mixed shrubland and scrub dominates the vegetation with broadleaved species present in greater numbers along drainage lines. Fivefinger, tree fuchsia and marbleleaf are present with a number of small-leaved shrub species including *Coprosma propinqua* ssp. *propinqua*, *C. aff. parviflora*, *Cyathodes juniperina* and matagouri. *Rubus cissoides* and *Muehlenbeckia complexa* scramble throughout. The ground tier is dominated by pasture grasses, adventive

herbs and scattered ferns such as bracken fern, *Hypolepis millefolium*, *Pellaea rotundifolia*, *Polystichum vestitum*, *P. richardii*, *Blechnum procerum*, and *B. pennamarina*. Grazing and trampling damage, particularly by cattle, occurs throughout the area.

NAT 28 - Dog Hill

Grid Reference Centre:	NZMS 260 N32 132507
Area:	3 ha
Altitudinal Range:	460-580 m
Tenure:	Private
Vegetation Types:	3a, 6b
Study Area Number:	N38

The area comprises a gully at the headwaters of Dog Brook, approximately 0.5 km southeast of Dog Hill. It is underlain with basaltic flows and pyroclastics (Inland Soft Rock Hill Country land system). A ribbon of upper lowland black beech forest is present along the watercourse, flanked by kanuka low forest and scrub.

NAT 29 - Mount Cookson

Grid Reference Centre:	NZMS 260 N32 227505
Area:	4 ha
Altitudinal Range:	740-820 m
Tenure:	Private
Vegetation Types:	8, 9
Study Area Number:	H2

The area is comprised of the montane southeast-facing bluffs and boulderfields situated within 0.5km of Mount Cookson's crest. The geology is predominantly limestone overlying and passing into basaltic pyroclastics and pillow lavas within the Inland Soft Rock Hill Country land system. Annandale (Mt. Cookson) karst lies adjacent to the bluffs and boulder field. It is a geopreservation area of national importance composed of a field of dolines/tomos (Kenny and Hayward, 1993a).

Remnant shrubland is scattered in patches over the bluffs and boulderfield. Broadleaf and Hall's totara are the dominant species over *Coprosma propinqua* ssp. *propinqua*, *C. rigida*, *Aristotelia fruticosa* and matagouri. A sparse ground tier is largely composed of *Clematis foetida*, *Muehlenbeckia complexa* and introduced pasture grasses and weeds. This type of community is now uncommon within the ecological district, being confined to localised areas on the highest peaks.

Notable plant species include *Brachyglottis monroi* which is regionally endemic. *Asplenium* aff. *trichomanes* is uncommon within the ecological district and is confined rockland, usually on limestone.

NAT 30 - Stanton River Tributary

Grid Reference Centre:	NZMS 260 N32 228499
Area:	45 ha
Altitudinal Range:	280-670 m
Tenure:	Private
Vegetation Types:	1, 2, 3a, 6a, 6b, 8c, 8d
Study Area Number:	N1

The tributary to Stanton River lies South of Mt. Cookson, running adjacent to and west of Cherry Creek. Underlying geology is primarily Mesozoic greywacke (Inland Greywacke Hill Country) with minor basal coal measures and glauconitic sandstone (Inland Soft Rock Hill Country) towards the head of the valley. Landforms are comprised of the valley, associated gullies and mostly east-facing hill slopes on the true right of the stream.

Black beech forest grading into black beech-mountain beech forest with increasing altitude, occupies the lowland riparian zone and gullies, while mountain beech forest is present on montane gullies and faces. Mountain beech-black beech-red beech forest is present within the montane riparian zone. The pattern of beech forest is fractured and interspersed with manuka scrub, kanuka scrub and mixed shrub-pasture grass shrub-grassland.

The canopy cover in mixed-age mountain beech-black beech-red beech riparian beech forest is often open and fragmented. The most frequent understorey associates are Hall's totara, marbleleaf, tree fuchsia, *Olearia paniculata*, wineberry, *Coprosma propinqua* ssp. *propinqua*, *Cyathodes juniperina* and kanuka. Cattle have grazed much of the shrub and ground tiers which are commonly dominated by pasture grasses.

Mixed-age black beech forest and black beech-mountain beech forest contain a relatively open canopy with a sparse understorey. The shrub tier is often quite dense, composed of beech regeneration, *Coprosma rhamnoides* and *Leucopogon fasciculatus* while the ground tier is typically sparse.

NAT 31 - Old Claverley Creek

Grid Reference Centre:	NZMS 260 O32 481498
Area:	30 ha
Altitudinal Range:	40-240 m
Tenure:	Private
Vegetation Types:	3a, 4a, 5a, 6b, 8d
Study Area Types:	H12

Old Claverley Creek lies south of Okarahia Stream and north of Limestone Stream, draining eastwards into the Pacific Ocean. The upper half of the catchment is comprised of a riparian zone, gullies and moderately steep (and frequently colluvial) to rolling hill slopes of low relief, approximately 2km from the coast. Mesozoic greywacke is the major rock type and the area lies within the Coastal Greywacke Hill Country land system. Small localised pockets of streamside alluvium are also present.

The semi-coastal vegetation comprises: black beech forest on hill slopes and riparian areas; mahoe low forest in riparian areas, gullies and colluvial convex slopes; and kanuka low forest and scrub on convex slopes. Small stands of podocarp-mixed broadleaved forest are present on alluvial terraces and toe slopes. The valley floor is largely modified and dominated by pasture grasses and weeds.

Alluvial pockets typically contain emergent matai. The canopy and understorey consists largely of mahoe with *Streblus heterophyllus*, pigeonwood and supplejack. Shrub and ground tiers are sparse. A small stand of lowland totara-lemonwood-mahoe-kanuka low forest is present within the riparian zone close to the major stream fork. Marbleleaf, wheki and fivefinger dominate the understorey and shrub tiers, while hound's tongue fern, *Asplenium terrestre* ssp. *terrestre* and *Pellaea rotundifolia* are the most frequent ground tier species.

Black beech forest typically contains few canopy or understorey associates. *Helichrysum lanceolatum* dominates a dense shrub tier with *Leucopogon fasciculatus*. The ground tier is generally sparse.

Kanuka low forest is in a transitional phase towards mahoe-mixed broadleaved forest. The dense even-aged kanuka canopy contains few associates. Mahoe is prominent in the understorey, while a dense shrub tier contains *Coprosma rhamnoides*, *C. rotundifolia* and young mahoe. Other broadleaved species present (but in low density) within the shrub tier include marbleleaf, kawakawa and kohuhu. *Uncinia leptostachya* is the most frequent ground tier species.

Mahoe-mixed broadleaved forest contains a canopy of mahoe, and to a lesser extent marbleleaf, with a dense understorey of kawakawa. The ground tier is characteristically sparse.

Rare or unusual plant species to occur within the area include *Coprosma grandifolia*, at or near its southern limit at this location. *Grammitis ciliata* is uncommon within the ecological district.

South Island fantail, New Zealand kingfisher and the threatened New Zealand pigeon (Category B) were noted within the forest.

Possums and stock pose threats via grazing, trampling and browsing.

NAT 32 - Stanton River Headwaters

Grid Reference Centre:	NZMS 260 N32 240493
Area:	80 ha
Altitudinal Range:	380-700 m
Tenure:	Private
Vegetation Types:	3a, 5c, 6c
Study Area Number:	H25

This area includes the upper reaches and headwaters of Stanton River. It lies upstream from the Cherry Creek confluence and extends to the east-facing flanks of Mt. Cookson. The steep-sided incised valley, hill slopes and gullies are composed of Mesozoic greywacke and lie within the Inland Greywacke Hill Country land system.

The majority of the area contains lowland black beech forest and lowland to montane black-mountain beech forest within the riparian zone and on lower hill slopes. Mixed broadleaved low forest and scrub is present in gullies and on steep, shady valley sides within the riparian zone. Kanuka-manuka low forest and scrub occupies drier mid to lower hill slopes.

Mixed-age black beech forest and black beech-mountain beech forest on dry, steep slopes contain a relatively open canopy with a sparse understorey. The shrub tier is often dense, composed of beech regeneration, *Coprosma rhamnoides* and *Leucopogon fasciculatus* while the ground tier is typically sparse.

Broadleaved scrub on steep valley sides is characterised by a low canopy of fivefinger, tree fuchsia, kowhai, *Coprosma robusta*, marbleleaf, kanuka, and broadleaf.

Kanuka-manuka scrub typically contains few canopy or understorey associates. The shrub tier is characterised by young kanuka, *Leucopogon fasciculatus* and *Coprosma rhamnoides*. Browntop is the most common species within a sparse and modified ground tier.

Grazing damage appears to be restricted to areas of gentler gradient. German wasps are plentiful within the beech forest.

NAT 33 - Upper Sebastopol Creek

Grid Reference Centre:	NZMS 260 O32 389490
Area:	60 ha
Altitudinal Range:	240-480 m
Tenure:	Private
Vegetation Types:	3a, 3c, 6b, 6d
Study Area Number:	H6

Sebastopol Creek is a tributary draining into the true left of Conway River between Spey Stream and Ferniehurst. The lowland steep-sided V-shaped valley, hill slopes and gullies are composed of Mesozoic greywacke and fall within the boundaries of the Inland Greywacke Hill Country land system.

Lowland black beech forest covers the majority of the gullies and mid to lower hill slopes. Lowland black beech-mixed broadleaved forest is present within riparian zones, while black beech forest margins, upper hill slopes, crests and ridges typically contain kanuka and kanuka-manuka forest and scrub. The natural forest cover does not extend over the whole catchment. The headwaters and upper hill slopes of Māori Chief Peak are excluded as they are infested with European broom.

Riparian forest contains emergent black beech over a canopy dominated by marbleleaf and wheki. Wheki, wineberry and *Coprosma crassifolia* are prominent in a dense shrub tier while the ground tier characteristically contains *Microlaena avenacea*, *Uncinia uncinata*, wall lettuce and wineberry seedlings.

Mixed-age black beech forest on drier hill slopes and gullies is typified by a dense canopy and sparse understorey. The shrub tier is dense in places, composed of black beech regeneration, *Coprosma rhamnoides* and *C. crassifolia*, overlying a sparse ground tier.

Kanuka-manuka scrub occupying upper slopes, ridges and crests may be highly modified depending on stock access, density of the canopy and subsequent presence of European broom. Kanuka forms the bulk of the canopy, growing through and overtopping an understorey of manuka. *Coprosma rhamnoides* and European broom form the shrub tier where the canopy is not tight. Few native species are present in a fairly barren ground tier.

Bellbird, South Island rifleman, silvereye, South Island fantail South Island tomtit, Australasian harrier, grey warbler, brown creeper and the threatened New Zealand pigeon (Category B) have been observed within the vicinity (New Zealand Wildlife Service, 1983).

Stock have access to the area but tend to browse and graze within the forest margins rather than the interior. Deer and pig sign were observed.

NAT 34 - Limestone Creek: Woodchester

Grid Reference Centre:	NZMS 260 N32 289479
Area:	205 ha
Altitudinal Range:	210-740 ha
Tenure:	Private
Vegetation Types:	3a, 3b, 4a, 5c, 6a, 6b, 8a, 8d, 9
Study Area Number:	N26

Limestone Creek catchment drains southwards into the true left of the Leader River, its headwaters lying on the southern and eastern flanks of Mt. Stewart. The lower 10% of the stream catchment is composed of stream flats, scarps, terrace risers, gullies and lower hill slopes underlain with Tertiary marine siltstone and sandstone (Inland Soft Rock Hill Country land system). The remainder of the area comprises a steep-sided, V-shaped valley and associated gullies, hill slopes, scarps, rock outcrops and bluffs on Mesozoic greywacke (Inland Greywacke Hill Country land system). Small streamside alluvial terraces and flats are localised along the riparian zone.

Black beech-red beech forest and black beech forest dominate the lowland riparian areas with black beech forest extending up south-facing lower hill slopes in many cases. Black beech may tend to mountain beech at higher altitudes. Mixed broadleaved low forest and scrub occupies much of the scarp, terrace riser, north-facing lower hill slopes, and remainder of the south-facing hill slopes and riparian zone where beech forest is absent. Induced kanuka low forest and scrub and manuka scrub tend to be situated on mid to upper hill slopes and shoulder slopes, bordering beech and broadleaved forest, or on drier convex faces. Rockland and shrub-rockland is present on steep streamside faces, bluffs and recent slip sites within the Soft Rock Hill Country land system. Pasture grasses and weeds occupy much of the valley floor in the lower reaches of the catchment.

Mixed-age black beech-red beech riparian forest on soft rock contains occasional emergent podocarp individuals, most commonly matai and kahikatea, among a typically open canopy. Common understorey and shrub species include marbleleaf, lancewood, *Helichrysum lanceolatum*, mahoe, tree fuchsia, fivefinger, *Coprosma propinqua* ssp. *propinqua*, *C. robusta*, wineberry, broadleaf and black beech regeneration. The ground tier contains *Blechnum fluviatile*, *B. penna-marina*, *Polystichum richardii*, *Asplenium bulbiferum*, *Uncinia uncinata*, *Astelia fragrans*, broadleaved seedlings and pasture grasses and weeds.

Older secondary riparian black beech and black beech-mountain beech forest on greywacke may contain canopy components of red beech and *Rubus cissoides*. The most common understorey and shrub species are regenerating beech, broadleaf, lancewood, marbleleaf and *Coprosma rhamnoides*. A sparse ground tier contains tree and shrub seedlings, particularly beech, *Polystichum vestitum*, *Asplenium terrestre* ssp. *terrestre*, *Blechnum montanum* and wall lettuce. In younger beech forest on drier hill slopes there are few associates in the dense canopy aside from scattered marbleleaf and broadleaf. *Cyathodes juniperina* dominates the thick shrub tier. The ground tier is sparse with the most common species mountain beech and *Cyathodes juniperina* seedlings.

Mixed broadleaved low forest on lowland mudstone is commonly composed of tree fuchsia, kohuhu, *Olearia paniculata*, broadleaf, fivefinger, *Coprosma robusta*, tree tutu and manuka. Fire-induced montane mixed shrublands are typically species-rich

with broadleaf, manuka, tauhinu, cabbage tree, tree fuchsia, matagouri, *Olearia paniculata*, *Coriaria sarmentosa*, *Coprosma* aff. *parviflora*, *C. propinqua* ssp. *propinqua*, *Melicytus alpinus*, *Aristotelia fruticosa*, *Gaultheria antipoda*, wharariki, with scrambling *Muehlenbeckia complexa*, *Rubus australis* and *R. schmidelioides*.

Generally the valley floor and alluvial flats and terraces are highly modified and at best semi-natural, particularly in the lower reaches of the catchment. One small terrace, approximately halfway up the catchment contains mature and regenerating matai and kahikatea in good numbers (M. Giller, pers. comm.).

Rock bluff vegetation on soft rock contains a variety of adventive herbs and pasture grasses in addition to scattered native species such as *Coprosma robusta*, *Coriaria sarmentosa*, *Hebe traversii*, manuka, *Muehlenbeckia complexa*, wharariki, silver tussock, bracken fern, *Gnaphalium audax*, *Acaena anserinifolia* and *Linum monogynum*. On montane greywacke rock outcrops and bluffs sparse communities are usually dominated by Marlborough rock daisy (*Pachystegia* sp. 'A'), Marlborough lilac, *Brachyglottis monroi*, wharariki and *Hebe venustula*.

Much of the catchment is now fenced and consequently free from grazing pressure.

Common bush birds, particularly South Island fantail and bellbird are present within the area as are paradise shelduck.

NAT 35 - Collins Saddle

Grid Reference Centre:	NZMS 260 O32 325479
Area:	<0.5 ha
Altitudinal Range:	300-310 m
Tenure:	Private
Vegetation Types:	11, 12
Study Area Numer:	N33

A small lowland wetland remnant lies on an old slip site downstream from a stock pond, south of Collins Saddle at the headwaters of Ngaroma Stream. The vegetation consists of a modified stand of *Carex secta* and raupo within the Inland Soft Rock Hill Country land system. Pasture grasses and adventive herbs occupy much of the inter-sedge spaces, while the area is subject to trampling and grazing by stock.

NAT 36 - Dog Brook Gully Tributary

Grid Reference Centre:	NZMS 260 N32 142472
Area:	9 ha
Altitudinal Range:	260-460 m
Tenure:	Private
Vegetation Types:	3a
Study Area Number:	N38

The gully tributary to Dog Brook lies approximately 4km south of Dog Hill. It is underlain with Tertiary marine blue-grey calcareous siltstone and sandstone with concretionary bands (Inland Soft Rock Hill Country land system). The ribbon of lowland black beech forest within the gully contains minor canopy and understorey associates such as fivefinger, kanuka, broadleaf, *Olearia paniculata* and *Cordyline australis*. The shrub tier contains *Cyathodes juniperina*, *Helichrysum lanceolatum*, *Coprosma rhamnoides*, *Coprosma propinqua* ssp. *propinqua*, and *Hebe traversii* while the ground tier is typically sparse.

NAT 37 - Claverley Beach

Grid Reference Centre:	NZMS 260 O32 500471
Area:	30 ha
Altitudinal Range:	Near sea level
Tenure:	Crown land administered by LINZ
Vegetation Types:	16, 7
Study Area Number:	N7

Few native plant species remain within the coastal sandfields and gravelfields of the beach that runs between the Conway River lagoon and Okarahia Stream mouth. The vegetation above the high-tide mark generally consists of either sparsely-vegetated sandfield or gravelfield, or shrubland, shrub-grassland and herbfield dominated by adventive species such as lupin and European broom, marram grass, cocksfoot, ryegrass, Yorkshire fog, Scotch thistle, Californian thistle, scarlet pimpernel and catsear. As such it contains a low ranking (1 out of 20) within a national context of sand dune and beach vegetation (Johnson, 1992). Native species to occur include ngaio, harakeke, *Isolepis nodosa*, *Calystegia soldanella* and *Epilobium cinereum*.

The beach provides habitat for bird species including red-billed gull, black-billed gull and South Island pied oystercatcher.

NAT 38 - Waingaro Limestone Bluffs

Grid Reference Centre:	NZMS 260 O32 363465
Area:	1.5 ha
Altitudinal Range:	200-300 m
Tenue:	Private
Vegetation Types:	8a, 9
Study Area Number:	N43

The east-facing Tertiary muddy limestone bluffs within the Inland Soft Rock Hill Country land system contains lowland mixed shrubland, shrub-rockland and rockland. The most common species are Marlborough rock daisy (*Pachystegia* sp. 'A') (regionally endemic), *Sophora prostrata*, matagouri, *Carmichaelia australis*, Marlborough lilac (regionally endemic), wharariki, *Rubus squarrosus*, *R. cissoides*, *Clematis afoliata*, *Muehlenbeckia australis* and *M. complexa*. Much of the ground tier consists of pasture grasses and adventive herbs.

The inaccessibility of the bluff vegetation means that threats from stock grazing and browsing are minimal.

NAT 39 - Boundary Stream

Grid Reference Centre:	NZMS 260 O32 385462
Area:	245 ha
Altitudinal Range:	100-480 m
Tenure:	Private
Vegetation Types:	3a, 3b, 6b
Study Area Number:	H13

Boundary Stream is a tributary to Conway River draining into the true left approximately 7km inland from the river mouth. The upper catchment is comprised of a steep-sided V-shaped valley with associated steep hill slopes and gullies. The underlying rock type is Mesozoic greywacke and the area falls within the Inland Greywacke Hill Country land system.

Lowland black beech-red beech forest occurs along riparian zones. Lowland black beech forest is present in gullies and hill slopes while kanuka low forest occupies hill slopes and ridges, usually uphill from beech forest margins. A large proportion of the upper catchment slopes to the ridgeline, outside the boundaries of the area described, is infested with European broom.

Black beech-red beech forest is generally of mixed age and contains few canopy associates. The understorey is comprised of both beech species, wineberry, mahoe and marbleleaf. Wineberry and *Coprosma rhamnoides* dominate the shrub tier. The ground tier is largely comprised of *Pneumatopteris pennigera* and *C. rhamnoides* seedlings.

Black beech forest of mixed age contains few other frequent canopy or understorey species. The shrub tier is characterised by *Leucopogon fasciculatus* and black beech regeneration while *C. rhamnoides* and black beech seedlings dominate the ground tier.

Kanuka forest occupies much of the upper catchment and maintains a dense canopy. The understorey contains both kanuka, and, to lesser extent, manuka. *Coprosma rhamnoides*, younger kanuka and *Coprosma* aff. *parviflora* dominate the shrub tier while the ground tier is relatively sparse.

Melicytus 'brockiei', found within the catchment, was only recorded from one other locality in the ecological district (within the nearby Spey Stream area).

Bellbird, South Island rifleman, silvereye, South Island fantail, South Island tomtit, Australasian harrier, grey warbler, brown creeper and the threatened New Zealand pigeon (Category B) have been observed within the vicinity (New Zealand Wildlife Service, 1983).

European broom has invaded canopy gaps within the forest and poses a continual threat. However the dense European broom shrubland in association with kanuka forest and scrub on beech forest margins also acts as a barrier to stock infiltration. Regeneration under a moderate to dense beech canopy is generally very good.

NAT 40 - Stocker Stream Headwaters

Grid Reference Centre:	NZMS 260 O32 460461
Area:	25 ha
Altitudinal Range:	60-200 m
Tenure:	Private
Vegetation Types:	5d, 6b
Study Area Number:	H8

Stocker Stream is a small tributary of the Conway River. The headwaters lie some 3.5 km from the coast on Mesozoic greywacke (within the Coastal Greywacke Hill Country land system). Landforms are comprised of a steep-sided riparian zone, gullies and moderately steep to rolling hill slopes of low relief.

The semi-coastal vegetation is dominated by mahoe-kanuka forest and kanuka scrub. Scattered emergent matai and kanuka is present over a broadleaved canopy dominated by mahoe along riparian zones and in gullies. Canopy associates include kowhai, marbleleaf, lemonwood and supplejack. Shrub and ground tier vegetation is typically sparse. On drier hill slopes kanuka forms a low open scrub canopy over a shrub tier of tauhinu and bracken fern. Pasture grasses form the bulk of the vegetation within the ground tier. *Carex secta* is present on some gully bottoms. The locally occurring native mistletoe, *Ileostylus micranthus*, was observed, growing on kowhai.

The threatened New Zealand pigeon (Category B) was heard within the area.

Grazing and browsing pressure from stock provide the biggest threat to regeneration.

NAT 41 - Mick Stream

Grid Reference Centre:	NZMS 260 O32 400456
Area:	160 ha
Altitudinal Range:	50-460 m
Tenure:	Private
Vegetation Types:	3a, 3b, 6b
Study Area Number:	H13

Mick Stream catchment is a secondary tributary of Conway River, draining southwards into Boundary Stream, which in turn feeds into the true left of the Conway River, approximately 7km from the coast. The catchment is comprised of a steep sided V-shaped valley with associated steep hill slopes and gullies. The underlying rock type is Mesozoic greywacke and the area falls within the Inland Greywacke Hill Country land system. Small, localised areas of alluvium are also present.

Lowland black beech-red beech forest occurs in riparian zones and fertile gullies, while lowland black beech forest occupies gullies and lower to mid hill slopes. Stands of matai-kahikatea forest and treeland are present on small alluvial terraces. Kanuka forest is present on mid to upper hill slopes and ridges. A large proportion of the catchment, outside the boundaries of the area described, is infested with dense European broom shrubland.

Black beech-red beech riparian forest typically contains a dense understorey of wheki. The shrub tier contains mahoe and an assortment of minor broadleaved species while the ground tier is principally comprised of *Uncinia uncinata*.

Black beech forest contains few canopy associates other than scattered red beech on more fertile sites. Mahoe and black beech are prominent within the understorey, while the shrub tier is dominated by *Coprosma rhamnoides* and black beech regeneration. The ground tier is characteristically sparse.

Matai-kahikatea forest and treeland occur on two small modified stream terraces beside Boundary Stream, close to the Mick Stream confluence. Canopy and understorey associates include hinau, red mapou and *Neomyrtus pedunculatus*. Both areas border pasture grassland and native vegetation has generally been eaten out in the shrub and ground tiers.

Kanuka forest contains a dense canopy with no frequent associates. Mahoe and marbleleaf are prominent in the understorey while *Coprosma rhamnoides* dominates the dense shrub tier with younger marbleleaf. The ground tier is generally sparse.

Rare or notable species include the nationally local mistletoe, *Ileostylus micranthus*. *Gahnia pauciflora* and *Australina pusilla* were not recorded elsewhere in the ecological district.

Bellbird, South Island rifleman, silvereye, South Island fantail, South Island tomtit, Australasian harrier, grey warbler, brown creeper and the threatened New Zealand pigeon (Category B) have been observed within the vicinity (New Zealand Wildlife Service, 1983).

European broom has invaded canopy gaps within the forest and poses a continual threat. However the dense European broom shrubland in association with kanuka forest and scrub on beech forest margins also acts as a barrier to stock infiltration.

NAT 42 - Upper Waingaro Stream

Grid Reference Centre:	NZMS 260 (a) N32 332454; (b) N32 339447
Area:	(a) 3 ha; (b) 1.5 ha
Altitudinal Range:	(a) 160-220 m; (b) 120-160 m
Tenure:	Private
Vegetation Types:	3a, 8a
Study Area Number:	N42

Two small disjunct forest stands lie upstream from the Waingaro QE II Covenant in gullies and on lower hill slopes and scarps, mostly within the riparian zone. Part (a) lies on the border between Mesozoic greywacke (Inland Greywacke Hill Country land system) and Mesozoic basal coal measures and sandstone (Inland Soft Rock Hill Country land system). Part (b) lies within the Inland Soft Rock Hill Country land system on Tertiary marine blue grey calcareous siltstone and sandstone.

The pattern of vegetation is largely typical of remnant soft rock forest stands, with secondary lowland black beech forest prominent. Scattered individuals of kahikatea and matai remain. The shrub and ground tiers are generally in poor condition. Forest margins contain shrubland which features kowhai, manuka, *Coprosma robusta*, cabbage trees and weeds such as blackberry, briar and Himalayan honeysuckle. Pasture grasses and adventive herbs dominate the ground tier.

NAT 43 - Waingaro Stream

Grid Reference Centre:	NZMS 260 350441
Area:	5 ha
Altitudinal Range:	120-160 m
Tenure:	Private
Vegetation Types:	3a, 3d
Study Area Number:	H10

The area lies adjacent to, and the forest tract is continuous with, that of the Waingaro Stream QEII Covenant (PNA 19). Underlying geology consists of massive to laminated Tertiary grey marine siltstone. The low relief southwest-facing lower hill slope and toe slope lie within the Inland Soft Rock Hill Country land system while small localised areas of alluvial flats are present by the stream channel.

The concentration of podocarp species is highest on the small areas of unlogged alluvial terraces and toe slopes. Here primary or older secondary growth forest is dominated by emergent kahikatea and matai with an open canopy of mixed age black beech. Understorey species include marbleleaf and lancewood with younger kahikatea and matai, and climbers such as supplejack and *Rubus schmidelioides*. Kowhai is prominent towards the margins. A moderately dense shrub tier contains *Corokia cotoneaster* and *Coprosma rotundifolia* with minor *Coprosma rhamnoides* and *C. crassifolia*. *Polystichum vestitum* and *P. richardii* are the most common ferns while a wide variety of seedlings may be found at ground level.

A few scattered podocarp individuals, including matai, kahikatea and lowland totara occur in lowland mixed-age black beech forest on steeper hill slopes. The understorey is sparse while the shrub layer is moderately dense, the most common species being *Corokia cotoneaster*, *Pittosporum divaricatum*, *Lophomyrtus obcordata*, *Cyathodes juniperina* and *Coprosma rhamnoides*. A variety of seedlings, including matai, are scattered amongst a fairly sparse ground tier.

Several rare and uncommon species are known to occur within the adjoining QEII Covenant area and may occur here, although grazing pressure, particularly from cattle, has meant that the understorey is in much poorer condition, most noticeably on alluvial areas.

NAT 44 - Castaly River

Grid Reference Centre:	NZMS 260 N32 259413
Area:	1 ha
Altitudinal Range:	220-240 m
Tenure:	Private
Vegetation Types:	11
Study Area Number:	N4

The area consists of modified lowland *Carex secta* sedgeland along the upper reaches of Castaly River beside the Leader-Waiiau Road. *Juncus effusus* is a minor canopy component while *Coprosma propinqua* ssp. *propinqua* and *Cordyline australis* are scattered, largely on margins. The *Carex secta* canopy is generally open, with inter-sedge areas dominated by pasture grasses. Grazing occurs throughout the area, particularly by cattle.

7. Discussion

7.1 COMPARATIVE EVALUATION OF PROTECTED AREAS AND RECOMMENDED AREAS FOR PROTECTION WITHIN EACH LAND SYSTEM

TABLE 5: EXISTING PROTECTED AREAS AND RAPS WITHIN EACH LAND SYSTEM

LAND SYSTEM	EXISTING PNA'S (HA) AND % OF EACH LAND SYSTEM	RAPS (HA) AND % OF EACH LAND SYSTEM	TOTAL
Coastal Greywacke Hill Country	645 8.8%	504 6.8%	1149 15.6%
Inland Greywacke Hill Country	1033 2.4%	4425 10.1%	5458 12.5%
Coastal Soft Rock Hill Country	0 0%	243 16.3%	243 16.3%
Inland Soft Rock Hill Country	536 2.2%	638 2.6%	1174 4.8%
Northwest Outwash Deposits and Local Alluvium	144 1.6%	1073 12.1%	1217 13.7%
Total	2358 2.7%	6883 8.0%	9241 10.7%

While the total proportion of the ecological district covered by existing PNAs and RAPS exceeds the 10% of the land area recommended as a minimum, it was not possible to achieve this in each land system (Table 7). Much of the Inland Soft Rock Hill Country and the Northwest Outwash and Local Alluvium land systems are now largely farmland and the remaining vestiges of natural vegetation are small and fragmented. The proportion of the latter was boosted by the inclusion of the Conway River Floodplain which is predominantly comprised of unconsolidated river gravels. Furthermore, several sites which were deemed potentially suitable as RAPS were either not surveyed, as access by landowners was denied, or surveyed and the permission to publish the results subsequently withdrawn.

The other two land systems which are under-represented in the existing reserve network (Coastal Soft Rock Hill Country and Inland Greywacke Hill Country) now have a combined PNA-RAP proportion exceeding 12%.

The remaining land system (Coastal Greywacke Hill Country) is the only one to contain existing protected natural areas approaching 10%. The addition of RAPS would enhance this beyond 15%.

7.2 COMPARATIVE EVALUATION OF BIODIVERSITY WITHIN PROTECTED NATURAL AREAS AND RECOMMENDED AREAS FOR PROTECTION

Vegetation types which were once widespread and are now rare within the district are generally those most prone to human disturbance. The podocarp forests of alluvial and glacial outwash terraces and flats have almost disappeared as they were affected by Polynesian fires, followed by logging and a desire by European settlers to use these fertile areas for farming. Mixed beech-podocarp forests on poorly-drained undulating soft-rock hill country also suffered through logging and conversion to pasture. Wetlands have been drained to create farmland and few examples remain within the district of a once-widespread ecosystem. The best examples of podocarp forest and wetlands represented within the RAPs are therefore typically smaller and more degraded than the more common native vegetation types such as black beech forest and kanuka forest on steep, dry greywacke hill country.

Black beech forest dominates much of the indigenous forest cover of Inland Greywacke Hill Country lowland zones, mixing with red beech on more fertile sites. Mountain beech merges with these vegetation types in montane areas, becoming pure mountain beech forest towards the highest peaks. These vegetation types are highly under-represented within the existing reserve network despite the fact that many steep-sided catchments still maintain beech forest cover, although rarely primary and seldom continuous up to the ridgeline. Black beech forest, black-mountain beech forest and mountain beech forest are represented (often as small fragments) within PNAs 9, 10, 12 and 17 on greywacke and 13, 14, 15, 16 on soft rock. Catchments recommended for protection primarily as the best examples of these beech forest types include RAPs 13, 14, 15, 16, 26 on greywacke, and RAPs 27, 28, 29 on soft rock. Other RAPs may contain examples *Nothofagus solandri* forest within them e.g. RAP 4, 6, 7, 17, 23, 24 (greywacke), 30 (soft rock), and 4 (glacial outwash deposits).

Mixed podocarp forest and mixed podocarp-broadleaved forest are now restricted to a handful of small stands on alluvium with little formal protection (PNA 1). RAPs 19 and 31 have been selected solely as representatives of podocarp forest remnants although some larger PNAs and RAPs, include small stands on streamside alluvium (e.g. PNA 12 and RAP 17).

Mixed beech-podocarp forest is largely confined to undulating poorly-drained soft rock hill country, and riparian areas on greywacke. The proportion and composition of podocarp species is variable and dependent upon drainage and fertility. Matai is the most common species. Existing scenic reserves have afforded protection to the majority of remaining forest in the southwest soft rock hill country portion of the district (PNAs 13, 14, 15, 16). Riparian mixed beech-podocarp forest and mixed beech-podocarp-broadleaved forest are scattered throughout the district in less-modified catchments with examples in both protected areas (PNAs 9, 19) and RAPs (6, 13, 15, 16).

Mixed beech forest containing red beech in combination with black beech and/or mountain beech, is generally confined to riparian zones on greywacke, and is poorly represented within the existing reserve network (PNA 9). These forest types may be found within RAPs 15, 16 and 26.

Coastal and semi-coastal broadleaved forest and scrub on greywacke are relatively well represented within the existing reserve network (PNAs 5, 7, 9, 10). However there is no protection for broadleaved forest, scrub or shrubland on soft rock between Oaro and Okarahia Stream. RAPs 9, 10, 11 and 12 have been selected to balance this.

Lowland mixed broadleaved forest occurs largely in gullies and concave hill slopes throughout forested greywacke catchments. Examples are found within the reserve network although they are generally clustered towards the east of the district (PNAs 9, 10, 12) in narrow bands between semi-coastal and montane broadleaved forest. Further representative examples of lowland broadleaved forest on greywacke are found within RAPs 6, 13, 15, 16 and 26; on soft rock within RAP 5 and 25; and on glacial outwash and alluvium within RAP 3 and 15.

Montane forest, scrub, shrubland, shrub-rockland and rockland are largely confined to the higher peaks of the district and are afforded little protection under the current reserve network. The exceptions are the upland ridges and headwaters within PNA 9, 10 and 12 concentrated on greywacke in the eastern part of the district. RAP's 8, 23, 24 (on greywacke), and 22 and 30 (on soft rock) have been selected to offset this.

Fire-induced manuka and kanuka low forest and scrub occurs throughout the district. Kanuka generally occurs on drier greywacke hill slopes, ridges and alluvial terraces while manuka is more common on poorly-drained soft rock hill country. The two species often occur together. Kanuka forest and scrub on alluvium is now rare within the district. Protected stands are to be found within PNAs 1, 2 and 4. RAPs 1 and 2 have been selected solely as examples of alluvial kanuka forest. Kanuka forest on greywacke hill country may be found in many PNAs and RAPs. However the best examples occur within RAP 4, 15, 16 and 26. Manuka scrub and manuka kanuka scrub on soft rock are represented in RAP 10 (coastal), RAP 11 (semi-coastal), PNA 20, and RAP 25 and 32 (lowland).

Lake Rotorua Wildlife Management Reserve (PNA 3) is the largest and most intact wetland remaining within the district. Other lacustrine and swamp wetlands may be found over both lowland greywacke and soft rock hill country, usually on a small scale and generally modified to varying degrees. RAPs 5 and 19 have been selected as wetland remnants while other larger RAPs and PNAs contain small localised seepages and swamps (e.g. RAP 26). RAP 21 was selected in recognition of its riverine wetland wildlife habitat value. RAP 18 is selected as the only example of a coastal lagoon wetland system within the district, important for both its botanical and wildlife habitat values. Beach vegetation and coastal splash zone shrub-rockland are found within RAP 9. Examples of sedgeland, rushland, reedland, flaxland and aquatic herbfield are contained within these wetland ecosystems in addition to peripheral forest and scrub vegetation.

Shrub-rockland and rockland on bluffs and outcrops are a feature of the district on hill country. Localised examples are to be found throughout the larger catchments and highest peaks e.g. PNA 12 and RAPs 6, 13, 15, 17, 24 on greywacke, and RAPs 3, 22 and 30 on soft rock.

A variety of uncommon vegetation types within the ecological district are to be found within the ecological district including wheki scrub (PNA 12), kowhai forest and treeland (PNA 18; RAP 25), mountain ribbonwood treeland and shrubland (RAP 23) and saltmarsh ribbonwood shrubland (RAP 18).

Fescue tussock and silver tussock become dominant in some montane grassland areas, although these are induced vegetation types which will revert to shrubland over time. Examples of these are present within RAPs on the highest peaks (23 and 24).

Intergrades of many of these vegetation types are present.

Several areas containing significant and potentially significant examples of many of the vegetation types listed above were either not visited, as access was denied by the landowner, or surveyed and permission for inclusion within the report later withdrawn by the landowner.

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VASCULAR PLANTS RECORDED IN HUNDALEE
ECOLOGICAL DISTRICT

#	=	introduced species
aff.	=	has affinities to
agg.	=	an aggregate of species
ss.	=	in the strict sense
ssp.	=	subspecies
var.	=	variety
'	=	tag name
x	=	hybrid between two species
1	=	M. Giller, pers. com (1997)
2	=	Stevens, 1996
3	=	Williams, 1983
4	=	Purdie, 1983
5	=	Kelly, 1972
6	=	Molloy, 1987
7	=	Jane, 1987
8	=	Davidson, Paton, Cash, 1993

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<i>Coriaria kingiana</i>	small-leaved tutu
<i>Coriaria plumosa</i>	feathery tutu/mountain tutu/tutu heuheu
<i>Coriaria sarmentosa</i>	shrub tutu
<i>Corokia cotoneaster</i>	korokio/wire-netting bush
<i>Corynocarpus laevigatus</i>	karaka/karaka nut
<i>Crataegus monogyna</i> *	hawthorn
<i>Cupressus macrocarpa</i> *	macrocarpa
<i>Cyathodes juniperina</i>	prickly mingimingi
<i>Cytisus scoparius</i> *	broom/European broom
<i>Dacrycarpus dacrydioides</i>	kahikatea
<i>Dacrydium cupressinum</i>	rimu
<i>Discaria toumatou</i>	matagouri
<i>Dodonaea viscosa</i>	akeake/sticky hop-bush
<i>Dracophyllum uniflorum</i>	mountain inaka/turpentine scrub
<i>Elaeocarpus dentatus</i>	hinau
<i>Elaeocarpus hookerianus</i>	pokaka
<i>Erica lusitanica</i> *	Spanish heath
<i>Fraxinus excelsior</i> *	European ash
<i>Fuchsia xcolensoi</i>	
<i>Fuchsia excorticata</i>	tree fuchsia/kotukutuku
<i>Fuchsia perscandens</i>	
<i>Gaultheria antipoda</i>	bush snowberry/fool's beech/tawiniwini
<i>Gaultheria crassa</i>	
<i>Gaultheria depressa</i> var. <i>novaezelandiae</i>	snowberry/koropuka
<i>Griselinia littoralis</i>	broadleaf/papauma
<i>Griselinia lucida</i>	puka/shining broadleaf
<i>Hebe anomala</i>	
<i>Hebe canterburiensis</i>	
<i>Hebe gracillima</i> ³	
<i>Hebe rakaiensis</i>	
<i>Hebe salicifolia</i>	koromiko
<i>Hebe stricta</i>	koromiko
<i>Hebe traversii</i>	
<i>Hebe venustula</i>	
<i>Hebe vermicosa</i> ³	
<i>Hedycarya arborea</i>	pigeonwood/porokaiwhiro
<i>Helichrysum intermedium</i>	
<i>Helichrysum lanceolatum</i>	niniao
<i>Heliohebe hulkeana</i> ssp. <i>hulkeana</i>	Marlborough lilac
<i>Heliohebe raoulii</i> ssp. <i>raoulii</i>	
<i>Helichrysum parvifolium</i>	a coral daisy
<i>Heliohebe raoulii</i> ssp. <i>raoulii</i>	
<i>Hoheria angustifolia</i>	narrow-leaved lace bark/narrow-leaved houhere
<i>Hoheria lyallii</i> var. <i>lyallii</i>	mountain ribbonwood/mountain lacebark
<i>Hydrangea macrophylla</i> *	mophead hydrangea
<i>Ileostylus micranthus</i>	small-flowered mistletoe
<i>Ilex aquifolium</i> *	common holly/English holly
<i>Kunzea ericoide</i>	kanuka
<i>Larix decidua</i> *	deciduous larch/European larch
<i>Leptospermum scoparium</i>	manuka
<i>Leucopogon fasciculatus</i>	tall mingimingi/soft mingimingi
<i>Lophomyrtus obcordata</i>	rohutu/New Zealand myrtle
<i>Lupinus arboreus</i> *	tree lupin
<i>Macropiper excelsum</i>	kawakawa
<i>Melicope simplex</i>	poataniwha
<i>Melicope ternata</i>	wharangi
<i>Melicytus alpinus</i>	porcupine shrub
<i>Melicytus 'brockiei'</i>	
<i>Melicytus crassifolius</i> var. 'inland erect'	
<i>Melicytus micranthus</i>	swamp mahoe
<i>Melicytus micranthus</i> x <i>M. ramiflorus</i>	
<i>Melicytus ramiflorus</i>	mahoe/whiteywood
<i>Metrosideros excelsa</i> *	pohutukawa
<i>Myoporum laetum</i>	ngaio
<i>Myrsine australis</i>	mapou/red matipo
<i>Myrsine divaricata</i>	weeping mapou/weeping matipo
<i>Neomyrtus pedunculata</i>	myrtle
<i>Nothofagus fusca</i>	red beech

Nothofagus solandri var. *cliffortioides*
Nothofagus solandri var. *solandri*
Nothofagus fusca x *solandri* var. *solandri*
Notospartium torulosum
Olearia arborescens
Olearia avicenniifolia
Olearia bullata
*Olearia coriacea*¹
Olearia cymbifolia
Olearia nummularifolia
Olearia odorata
Olearia paniculata
Ozothamnus leptophyllus
Pachystegia insignis ss.
Pachystegia sp. 'A'
Pennantia corymbosa
Pimelea traversii
*Pinus nigra**
*Pinus radiata**
Pittosporum divaricatum
Pittosporum eugenoides
Pittosporum tenuifolium
Plagianthus divaricatus
Plagianthus regius
Podocarpus hallii
Podocarpus totara
*Populus alba**
Populus nigra var. *italica**
Prumnopitys ferruginea
Prumnopitys taxifolia
Pseudopanax arboreu
Pseudopanax colensoi
Pseudopanax crassifolius
Pseudopanax ferox
*Pseudotsuga menziesii**
Pseudowintera colorata
Raukaua anomala
*Rosa rubiginosa**
*Salix fragilis**
*Salix xreichardtii**
*Sambucus nigra**
Schefflera digitata
Solanum aviculare
*Solanum nigrum**
Sophora microphylla
Sophora prostrata
Streblus heterophyllus
*Tenckidium parvifolium*²
Tupeia antarctica
*Ulex europaeus**

Lianes and Trailing Plants

Calystegia sepium
Calystegia soldanella
Calystegia tuguriorum

Clematis afoliata
Clematis foetida
Clematis forsteri agg.
Clematis marata
Clematis paniculata
*Clematis vitalba**
*Lycycteria formosa**
Metrosideros diffusa
Metrosideros perforata
Muehlenbeckia australis
Muehlenbeckia axillaris
Muehlenbeckia complexa
Parsonsia capsularis
Parsonsia heterophylla

mountain beech
 black beech

 Canterbury pink broom
 common tree daisy/glossy tree daisy
 mountain akeake

scented shrub daisy/scented tree daisy
 akriahe/golden akeake
 tauhinu/cottonwood
 Marlborough rock daisy
 Marlborough rock daisy
 kaikomako

radiata pine

lemonwood/ tarata
 kohuhu/kohukohu/black matipo
 saltmarsh ribbonwood
 lowland ribbonwood/imanatu
 Hall's totara/thin-barked totara
 lowland totara/ totara
 silver poplar
 Lombardy poplar
 miro/brown pine
 matai/black pine
 fivefinger/whauwhaupaku
 three-finger/mountain five-finger/orihau
 lancewood/horoeka
 fierce lancewood
 Douglas fir/Oregon pine
 pepper tree/red horopito/mountain horopito

sweet briar/eglantine/mihinare
 crack willow
 pussy willow
 elderberry
 sevenfinger/pate
 poroporo/bullibulli
 black nightshade/garden huckleberry
 kowhai
 prostrate kowhai
 turepo/milk tree/small-leaved milk tree

pirita/white mistletoe
 gorse

greater bindweed/pink bindweed
 sand convulvulus/shore bindweed
 climbing convulvulus/New Zealand
 bindweed
 leafless clematis

pataua small white clematis

puawananga/white clematis
 old man's beard
 Himalayan honeysuckle
 akatea/white climbing rata
 aka/ clinging rata/small white rata
 pohuehue/large-leaved muehlenbeckia
 creeping pohuehue/creepingmuehlenbeckia
 shrub pohuehue/wire vine
 New Zealand jasmine/aka kiore
 New Zealand jasmine

<i>Passiflora mixta</i> *	northern banana passionfruit
<i>Passiflora mollissima</i> *	banana passionfruit
<i>Passiflora tetrandra</i>	kohia/ New Zealand passionfruit
<i>Ripogonum scandens</i>	supplejack/kareao
<i>Rubus australis</i>	tataramoa/swamp lawyer/bush lawyer
<i>Rubus cissoides</i>	bush lawyer/tataramoa
<i>Rubus cissoides</i> x <i>schmidelioides</i> *	
<i>Rubus fruticosus</i> agg*	blackberry
<i>Rubus schmidelioides</i>	white-leaved lawyer/tataramoa
<i>Rubus squarrosus</i>	leafless lawyer/yellow-prickled lawyer
<i>Tradescantia fluminensis</i> *	wandering Jew/wandering Willie
Dicot Herbs	
<i>Acaena agnipila</i> *	Australian sheep's bur
<i>Acaena anserinifolia</i>	bidibid/piripiri/hutiwai
<i>Acaena caesiiglaucia</i>	glaucus bidibid
<i>Acaena novae-zelandiae</i>	red bidibid
<i>Acaena profundeincisa</i>	
<i>Achillea millefolium</i> *	common yarrow
<i>Aciphylla aurea</i>	golden speargrass/golden spaniard
<i>Aciphylla glaucescens</i>	giant speargrass
<i>Anagallis arvensis</i> *	scarlet pimpernel
<i>Anaphaloides bellidioides</i>	hell's bells/ everlasting daisy
<i>Anaphalis keriensis</i>	
<i>Anisotome aromatica</i>	common aniseed/aromatic aniseed
<i>Anisotome filifolia</i>	
<i>Anthriscus caucalis</i> *	beaked parsley
<i>Apium prostratum</i>	shore celery
<i>Arctium lappa</i> *	great burdock
<i>Arenaria serpyllifolia</i> *	sandwort
<i>Armeria maritima</i> *	thrift/sea pink
<i>Atriplex prostrata</i> *	orache
<i>Australina pusilla</i>	
<i>Bellis perennis</i> *	English daisy/double daisy/lawn daisy
<i>Bidens frondosa</i> *	beggars' ticks
<i>Borago officinalis</i> *	borage
<i>Brachyglottis bellidioides</i> ss.	
<i>Brachyglottis lagopus</i> ss.	
<i>Cakile edentula</i> *	sea rocket
<i>Callitriche petriei</i>	starwort
<i>Callitriche stagnalis</i> *	starwort
<i>Cardamine corymbosa</i>	
<i>Cardamine debilis</i> 'narrow petal'	New Zealand bitter cress/panapana
<i>Cardamine debilis</i> agg.	New Zealand bitter cress/panapana
<i>Cardamine hirsuta</i> *	common bitter cress/hairy bitter cress
<i>Carduus nutans</i> *	nodding thistle/musk thistle
<i>Celmisia gracilentia</i> var.	pekapeka/common mountain daisy
<i>Celmisia monroi</i> var.	rock cotton plant
<i>Celmisia spectabilis</i>	common mountain daisy/puwharetaiko
<i>Centaureum erythraea</i> *	centaury
<i>Centranthus ruber</i> ¹³	spur valerian
<i>Cerastium arvense</i> ¹³	field chickweed
<i>Cerastium fontanum</i> *	mouse-ear chickweed
<i>Cerastium glomeratum</i> *	annual mouse-ear chickweed
<i>Chenopodium album</i> ¹³	fathen
<i>Chenopodium glaucum</i> ssp <i>ambiguum</i>	glaucus goosefoot
<i>Chrysanthemoides monilifera</i> *	boneseed
<i>Cirsium arvense</i> *	Californian thistle
<i>Cirsium vulgare</i> *	Scotch thistle/spear thistle
<i>Clinopodium vulgare</i> *	wild basil
<i>Conium maculatum</i> *	hemlock/poison parsley
<i>Cotula coronopifolia</i> *	bachelor's button/waterbuttons
<i>Crassula moschata</i>	shore stonecrop
<i>Crassula sieberiana</i> ³	
<i>Crepis capillaris</i> *	smooth hawksbeard
<i>Daucus glochidiatus</i>	New Zealand carrot/pinaki
<i>Dianthus armeria</i> *	Deptford pink
<i>Dichondra brevifolia</i>	dichondra
<i>Dichondra repens</i>	kidney weed/Mercury Bay weed/dichondra
<i>Digitalis purpurea</i> *	foxglove

<i>Disphyma australe</i>	New Zealand ice plant/Maori ice plant
<i>Echium vulgare</i> *	viper's bugloss
<i>Einadia allanii</i>	poipapa
<i>Einadia triandra</i>	berry saltbush
<i>Epilobium alsinoides</i> ssp. <i>alsinoides</i>	
<i>Epilobium alsinoides</i> ssp. <i>atriplicifolium</i>	
<i>Epilobium billardierianum</i> ssp. <i>cinereum</i>	
<i>Epilobium brevipes</i>	
<i>Epilobium brunnescens</i>	creeping willowherb
<i>Epilobium glabellum</i>	
<i>Epilobium komarovianum</i>	creeping willowherb
<i>Epilobium melanocaulon</i>	
<i>Epilobium microphyllum</i>	papakoura
<i>Epilobium nerterioides</i>	
<i>Epilobium nummulariifolium</i>	creeping willowherb
<i>Epilobium pallidiflorum</i>	swamp willowherb/tarawera
<i>Epilobium pedunculare</i>	long-stalked willowherb
<i>Epilobium pubens</i>	
<i>Epilobium rotundifolium</i>	round-leaved willowherb
<i>Erodium cicutarium</i> *	common storksbill/common crowfoot
<i>Euphorbia peplus</i> *	milkweed/petty spurge
<i>Foeniculum vulgare</i> *	fennel/sweet fennel
<i>Galium aparine</i> *	cleavers/goosegrass
<i>Galium divaricatum</i> ⁵⁷	slender bedstraw
<i>Galium palustre</i> *	marsh bedstraw
<i>Galium perpusillum</i>	dwarf bedstraw
<i>Galium propinquum</i>	mawe
<i>Galium trilobum</i>	
<i>Gentiana astonii</i>	
<i>Gentiana tenuifolia</i>	
<i>Geranium microphyllum</i>	namunamu/small-leaved cranesbill
<i>Geranium molle</i> *	dove's-foot cranesbill
<i>Geranium sessiliflorum</i>	short-flowered cranesbill
<i>Geum leiospermum</i>	
<i>Gingidia montana</i>	mountain aniseed/naupiro
<i>Gnaphalium audax</i> ssp. <i>audax</i>	cudweed
<i>Gnaphalium gymnocephalum</i>	creeping cudweed
<i>Gnaphalium limosum</i>	creeping cudweed
<i>Gonocarpus aggregatus</i>	
<i>Gonocarpus micranthus</i>	piripiri
<i>Haloragis erecta</i>	toatoa/shrubby haloragis
<i>Helichrysum filicaule</i>	creeping everlasting daisy
<i>Hieracium lepidulum</i> *	tussock hawkweed
<i>Hieracium pilosella</i> *	mouse-ear hawkweed
<i>Hieracium praealtum</i> *	king devil
<i>Hydrocotyle elongata</i>	
<i>Hydrocotyle heteromeria</i>	waxweed
<i>Hydrocotyle microphylla</i>	
<i>Hydrocotyle moschata</i>	hairy pennywort
<i>Hydrocotyle novae-zelandiae</i>	
<i>Hydrocotyle pterocarpa</i>	
<i>Hypericum perforatum</i> *	Saint John's wort/goatweed
<i>Hypochoeris radicata</i> *	catsear/flatweed
<i>Lagenifera cuneata</i> ⁶	slender New Zealand daisy
<i>Lagenifera petiolata</i>	papataniwhaniwha
<i>Lagenifera pumila</i>	papataniwhaniwha
<i>Lagenifera strangulata</i>	parani
<i>Lapsana comitum</i> *	nipplewort
<i>Lathyrus odoratus</i> *	sweet pea
<i>Lathyrus latifolius</i> *	everlasting pea
<i>Lemma minor</i>	common duckweed
<i>Leontodon taraxacoides</i> *	hawkbit
<i>Lepidium pseudotasmaticum</i> *	narrow-leaved cress
<i>Leptinella dioica</i>	shore cotula
<i>Leptinella serrulata</i>	
<i>Leptinella squalida</i>	
<i>Leucanthemum vulgare</i> *	oxeye daisy
<i>Leucopogon fraseri</i>	patotara/dwarf mingimingi
<i>Linum catharticum</i> *	purging flax/fairy flax
<i>Linum monogynum</i>	rauhui/New Zealand true flax

<i>Lotus angustissimus</i> *	slender birdsfoot trefoil
<i>Lotus pedunculatus</i> *	lotus/birdsfoot trefoil
<i>Malva neglecta</i> *	dwarf mallow
<i>Marrubium vulgare</i> ^{ns}	horehound
<i>Medicago arabica</i> ^{ns}	spotted bur medick
<i>Medicago lupulina</i> *	black medick
<i>Melilotus alba</i> *	sweet clover
<i>Melissa officinalis</i> *	lemon balm/tea balm
<i>Mentha australis</i> *	
<i>Mimulus moschatatus</i> *	musk/monkey musk
<i>Mycelis muralis</i> *	wall lettuce
<i>Myosotis australis</i> agg. 'white flower'	
<i>Myosotis arvensis</i> *	field forget-me-not
<i>Myosotis laxa</i> *	water forget-me-not
<i>Myriophyllum propinquum</i>	common water milfoil
<i>Nertera ciliata</i> ¹	
<i>Nertera depressa</i>	fruiting duckweed/bead plant/nertera
<i>Nertera villosa</i>	
<i>Nertera setulosa</i>	nertera
<i>Oreomyrrhis colensoi</i>	mountain myrrh
<i>Oreomyrrhis ramosa</i>	
<i>Orobancheminor</i> *	broomrape
<i>Oxalis lactea</i> ssp. <i>lactea</i>	
<i>Oxalis corniculata</i> *	yellow wood sorrel/horned oxalis
<i>Oxalis exilis</i>	yellow oxalis
<i>Oxalis lactea</i>	
<i>Oxalis magellanica</i> agg.	tutaekahu/white oxalis
<i>Parentucellia viscosa</i> *	tarweed/yellow bartsia/sticky bartsia
<i>Parietaria debilis</i>	New Zealand pellitory
<i>Pastinaca sativa</i> ^{ns}	wild parsnip
<i>Physalis peruviana</i> *	cape gooseberry
<i>Phytolacca octandra</i> ^{ns}	inkweed
<i>Plantago australis</i> *	swamp plantain
<i>Plantago lanceolata</i> *	narrow-leaved plantain
<i>Plantago lanigera</i>	
<i>Plantago major</i> *	broad-leaved plantain
<i>Plantago raoulii</i> var.	kopa kopa
<i>Polycarpon tetraphyllum</i> *	allseed
<i>Polygonum aviculare</i> ^{ns}	wireweed
<i>Polygonum salicifolia</i>	swamp willow weed
<i>Pratia angulata</i>	panakenake
<i>Prunella vulgaris</i> *	selfheal
<i>Prunus laurocerasus</i> *	cherry laurel
<i>Pseudognaphalium luteoalbum</i> agg.	jersey cudweed
<i>Ranunculus acris</i> *	giant buttercup
<i>Ranunculus foliosus</i>	grassland buttercup
<i>Ranunculus multiscapus</i>	grassland buttercup
<i>Ranunculus reflexus</i>	hairy buttercup/maruru
<i>Ranunculus repens</i> *	creeping buttercup
<i>Ranunculus sceleratus</i> *	celery-leaved buttercup/poison buttercup
<i>Raoulia glabra</i>	mat daisy
<i>Raoulia subulata</i>	
<i>Raoulia tenuicaulis</i>	scabweed/mat daisy/tutahuna
<i>Reseda lutea</i> ^{ns}	cut-leaved mignonette
<i>Rorippa microphylla</i> *	one-rowed watercress
<i>Rorippa sylvestris</i> *	creeping yellow watercress
<i>Rumex acetosella</i> *	sheep's sorrel
<i>Rumex crispus</i> *	curled dock
<i>Rumex obtusifolius</i> *	broadleaved dock/paewhenua
<i>Sagina procumbens</i> *	procumbent pearlwort/spreading pearlwort
<i>Samolus repens</i>	sea primrose/shore pimpernel/water pimpernel
	Canberra grass
<i>Scleranthus biflorus</i>	
<i>Scleranthus brockiei</i>	
<i>Scleranthus uniflorus</i>	
<i>Sedum acre</i> *	kohukohu
<i>Selliera radicans</i>	stonecrop/gold moss
<i>Senecio dunedinensis</i>	selliera
<i>Senecio jacobaea</i> *	fireweed
<i>Senecio lautus</i>	ragwort/Saint James wort
	shore groundsel/variable groundsel

<i>Senecio mikanioides</i> ⁴³	German ivy
<i>Senecio minimus</i>	fireweed
<i>Senecio quadridentatus</i>	pahohoraka/white fireweed
<i>Senecio vulgaris</i> *	common groundsel
<i>Sherardia arvensis</i> *	field madder
<i>Silene gallica</i> ⁴³	catchfly
<i>Silybum marianum</i> ⁴³	variegated thistle
<i>Sisymbrium officinale</i> ⁴³	hedge mustard
<i>Sonchus asper</i> *	prickly sow thistle/puha
<i>Sonchus kirkii</i>	puha/New Zealand sow thistle
<i>Sonchus oleraceus</i> *	sow thistle
<i>Spergula arvensis</i> *	corn spurrey
<i>Spergularia media</i>	native sea spurrey
<i>Stellaria decipiens</i>	
<i>Stellaria gracilentia</i>	slender chickweed
<i>Stellaria graminea</i> *	stitchwort
<i>Stellaria media</i> *	chickweed
<i>Stellaria parviflora</i>	New Zealand chickweed
<i>Syringa vulgaris</i> *	lilac
<i>Taraxacum officinale</i> *	dandelion
<i>Tetragonia trigyna</i>	New Zealand climbing spinach
<i>Torilis arvensis</i> *	spreading hedge-parsley
<i>Torilis nodosa</i> ⁴³	hedgehog parsley
<i>Trifolium arvense</i> *	hare's-foot trefoil
<i>Trifolium dubium</i> *	suckling clover
<i>Trifolium micranthum</i> *	lesser suckling clover
<i>Trifolium pratense</i> *	red clover
<i>Trifolium repens</i> *	white clover
<i>Trifolium subterraneum</i> *	subclover/subterranean clover
<i>Urtica dioica</i> ⁴⁹	perennial nettle/tall nettle/slender nettle
<i>Urtica ferox</i>	ongaonga/tree nettle
<i>Urtica incisa</i>	scrub nettle
<i>Urtica linearifolia</i>	swamp nettle
<i>Verbascum thapsus</i> *	woolly mullein
<i>Verbascum virgatum</i> ⁴³	moth mullein
<i>Veronica serpyllifolia</i> *	thyme speedwell/turf speedwell
<i>Vicia hirsuta</i> *	hairy vetch
<i>Vicia sativa</i> *	vetch/narrow-leaved vetch/tare
<i>Vicia tetrasperma</i> *	four-seeded vetch/smooth tare
<i>Viola cunninghamii</i>	mountain violet/white violet/haka
<i>Vittadinia australis</i>	white fuzzweed
<i>Wahlenbergia albomarginata</i>	New Zealand harebell
<i>Wahlenbergia gracilis</i>	New Zealand harebell/ slender harebell
Orchids	
<i>Caladenia lyallii</i> ⁵	white fingers/white orchid
<i>Chiloglottis cornuta</i>	green bird orchid
<i>Corybas orbiculatus</i> ⁵	
<i>Corybas trilobus</i>	
<i>Earina autumnalis</i>	Easter orchid
<i>Gastrodia cunninghamii</i> ⁵	huperei/black orchid/potato orchid
<i>Microtis unifolia</i>	onion orchid
<i>Prasophyllum colensoi</i>	leek orchid
<i>Pterostylis alobula</i>	
<i>Pterostylis areolata</i>	
<i>Pterostylis banksii</i>	tutukiwi
<i>Pterostylis graminea</i>	
<i>Thelymitra hatchii</i>	
<i>Thelymitra longifolia</i>	white sun orchid/maikuku
Grasses	
<i>Agrostis capillaris</i> *	browntop/bent grass/browntop bent
<i>Agrostis personata</i>	
<i>Agrostis stolonifera</i> *	creeping bent
<i>Aira caryophyllica</i> *	silvery hair grass
<i>Ammophila arenaria</i> *	marram grass
<i>Anemathele lessoniana</i> ²	a bamboo grass
<i>Anthoxanthum odoratum</i> *	sweet vernal
<i>Arrhenatherum elatius</i> *	tall oat grass
<i>Austrofestuca littoralis</i> ³	sand tussock

<i>Avena sativa</i> *	oatgrass
<i>Brachypodium sylvaticum</i> *	
<i>Bromus catharticus</i> *	prairie grass
<i>Bromus diandrus</i> ^{ns}	rippgut brome/great brome
<i>Bromus mollis</i> ^{ns}	soft brome
<i>Chionochloa</i> aff. <i>flavescens</i>	broadleaved snow tussock/haumata
<i>Chionochloa pallens</i> var.	mid-ribbed snow tussock
<i>Cortaderia richardii</i>	toetoe
<i>Cynosurus cristatus</i> *	crested dogtail
<i>Dactylis glomerata</i> *	cocksfoot
<i>Deschampsia chapmanii</i> ⁷	
<i>Deyeuxia aucklandica</i>	
<i>Deyeuxia avenoides</i>	mountain oat grass
<i>Dichelachne crinita</i>	long-hair plume grass/patiti
<i>Echinopogon ovatus</i>	hedgehog grass/forest hedgehog grass
<i>Elymus rectisetus</i> *	blue wheat grass/tutaekuri
<i>Elymus solandri</i>	
<i>Festuca arundinacea</i> *	tall fescue
<i>Festuca novae-zelandiae</i>	fescue tussock/hard tussock
<i>Festuca rubra</i> *	chewing's fescue/red fescue
<i>Hierochloa radolens</i>	holly grass/karatu
<i>Holcus lanatus</i> *	Yorkshire fog
<i>Hordeum murinum</i> *	barley grass
<i>Lachnagrostis lyallii</i>	
<i>Lolium perenne</i> *	perennial ryegrass
<i>Microlaena avenacea</i>	bush rice grass/oat grass
<i>Microlaena polymoda</i> ³	
<i>Microlaena stipoides</i>	slender rice grass/meadow rice grass
<i>Poa anceps</i>	broad-leaved poa
<i>Poa breviglumis</i>	
<i>Poa cita</i>	silver tussock/wi
<i>Poa colensoi</i>	blue tussock
<i>Poa imbecilla</i>	weak poa
<i>Rytidosperma caespitosum</i> *	
<i>Rytidosperma clavatum</i>	
<i>Rytidosperma gracile</i>	
<i>Rytidosperma nigricans</i>	
<i>Rytidosperma pilosum</i> *	
<i>Rytidosperma pumilum</i>	
<i>Rytidosperma racemosum</i>	
<i>Rytidosperma setifolia</i>	bristle tussock/mountain danthonia
<i>Rytidosperma unarode</i>	
<i>Stenostachys gracilis</i>	
<i>Stenostachys laevis</i> ⁷	
Sedges	
<i>Carex breviculmis</i>	grassland sedge
<i>Carex coriacea</i>	cutty grass/toetoe rautahi
<i>Carex dipsacea</i>	
<i>Carex flagellifera</i>	manaia/Glen Murray tussock
<i>Carex forsteri</i> ³	
<i>Carex geminata</i>	cutty grass
<i>Carex lambertiana</i>	
<i>Carex litorosa</i>	sea sedge
<i>Carex maorica</i>	
<i>Carex ovalis</i> *	oval sedge
<i>Carex pumila</i>	sand sedge
<i>Carex raoultii</i> ³	
<i>Carex secta</i>	pukio
<i>Carex solandri</i> ⁷	
<i>Carex virgata</i>	swamp sedge
<i>Cyperus ustulatus</i>	giant umbrella sedge/cyperus
<i>Eleocharis acuta</i>	sharp spike sedge
<i>Gahnia pauciflora</i>	cutting sedge
<i>Gahnia procera</i>	giant sedge
<i>Scirpus cernua</i>	
<i>Scirpus habra</i> ⁷	
<i>Isolepis nodosa</i>	knobby clubrush/turf rush/knotted sedge
<i>Isolepis reticularis</i>	
<i>Schoenoplectus pungens</i>	three-square

<i>Uncinia affinis</i>	matau
<i>Uncinia angustifolia</i>	
<i>Uncinia banksii</i>	
<i>Uncinia clavata</i> ³	fish-hooks
<i>Uncinia ferruginea</i>	
<i>Uncinia fuscovaginata</i>	
<i>Uncinia leptostachya</i>	
<i>Uncinia rubra</i>	
<i>Uncinia rupestris</i> ⁷	
<i>Uncinia scabra</i>	
<i>Uncinia uncinata</i>	hook grass
Rushes and Allied Plants	
<i>Juncus articulatus</i> [*]	jointed rush/dwarf rush
<i>Juncus australis</i>	leafless rush
<i>Juncus bufonius</i> ⁴³	toad rush
<i>Juncus effusus</i> [*]	soft rush/leafless rush
<i>Juncus gregiflorus</i>	leafless rush
<i>Juncus inflexus</i> ¹	hard rush
<i>Juncus kraussii</i> var. <i>australiensis</i>	sea rush
<i>Juncus pallidus</i>	leafless rush
<i>Juncus sarophorus</i>	leafless rush
<i>Juncus tenuis</i> [*]	track rush
<i>Luzula banksiana</i> agg.	coastal woodrush
<i>Luzula congesta</i> [*]	
<i>Luzula picta</i>	wood rush
<i>Luzula rufa</i> var. <i>rufa</i>	red woodrush
Other Monocot Herbs	
<i>Arthropodium candidum</i>	small renga lily
<i>Arthropodium cirratum</i>	renga lily/rengarenga/rock lily
<i>Astelia fragrans</i>	kakaha/bush lily/bush flax
<i>Bulbinella angustifolia</i>	Maori onion/swamp lily/golden star lily
<i>Bulbinella hookeri</i> ³	
<i>Collospermum hastatum</i>	kahakaha/perching lily
<i>Dianella nigra</i>	ink berry/New Zealand blueberry
<i>Freylinetia baueriana</i> ssp. <i>banksii</i>	kiekie
<i>Herpolirion novae-zelandiae</i>	grass lily/sky lily
<i>Libertia ixioides</i>	mikoikoi/native iris
<i>Phormium cookianum</i>	wharariki/mountain flax
<i>Phormium tenax</i>	harakeke/New Zealand flax
<i>Typha orientalis</i>	raupo/bulrush/broadleaf cumbungi
Ferns and Clubmosses	
<i>Adiantum cunninghamii</i>	common maidenhair
<i>Asplenium bulbiferum</i>	hen and chickens fern/mother spleenwort
<i>Asplenium flabellifolium</i>	necklace fern/walking fern/butterfly fern
<i>Asplenium flaccidum</i>	hanging spleenwort/makawe o raukatauri
<i>Asplenium gracillimum</i>	
<i>Asplenium hookerianum</i>	Hooker's spleenwort/perching spleenwort
<i>Asplenium lyallii</i>	Lyall's spleenwort
<i>Asplenium oblongifolium</i>	shining spleenwort/huruhuruwhenua
<i>Asplenium polyodon</i> ³	sickle spleenwort/petako
<i>Asplenium richardii</i>	Richard's spleenwort/matuakaponga
<i>Asplenium terrestre</i> ssp. <i>terrestre</i>	ground spleenwort
<i>Asplenium terrestre</i> ssp. <i>maritima</i>	
<i>Asplenium</i> aff. <i>trichomanes</i>	maidenhair spleenwort
<i>Azolla filiculoides</i>	Strasburger/Pacific azolla
<i>Blechnum chambersii</i>	lancefern/rereti
<i>Blechnum discolor</i>	piupiu/crown fern
<i>Blechnum durum</i>	
<i>Blechnum fluviatile</i>	kiwakiwa/ray water fern
<i>Blechnum minus</i>	swamp kiokio
<i>Blechnum montanum</i>	mountain kiokio
<i>Blechnum novae-zelandiae</i>	kiokio
<i>Blechnum penina-marina</i>	little hard fern/alpine water fern
<i>Blechnum procerrum</i>	small kiokio
<i>Blechnum triangularifolium</i>	
<i>Blechnum vulcanicum</i>	mountain hard fern/triangular kiokio
<i>Cheilanthes humilis</i>	rock fern
<i>Ctenopteris heterophylla</i>	comb fern

<i>Cyathea dealbata</i>	silver fern/ponga
<i>Cyathea medullaris</i>	mamaku/black tree fern
<i>Cyathea smithii</i>	soft tree fern/ Smith's tree fern/ponga
<i>Cystopteris tasmanicum</i>	bladder fern
<i>Dicksonia fibrosa</i>	wheki-ponga/fibrous tree fern
<i>Dicksonia squarrosa</i>	wheki/rough tree fern
<i>Dryopteris filix-mas</i> *	male fern
<i>Grammitis billardieri</i>	
<i>Grammitis ciliata</i>	
<i>Grammitis magellanica subsp. nothofagei</i>	
<i>Grammitis poeppigiana</i>	dwarf strap fern
<i>Histiopteris incisa</i>	mata/water fern
<i>Hymenophyllum bivalve</i> ⁵	
<i>Hymenophyllum demissum</i>	drooping filmy fern
<i>Hymenophyllum dilatatum</i> ³	
<i>Hymenophyllum sanguinolentum</i> ¹	
<i>Hymenophyllum scabrum</i>	rough filmy fern
<i>Hymenophyllum villosum</i>	hairy filmy fern
<i>Hypolepis ambigua</i>	
<i>Hypolepis millefolium</i>	thousand-leaved fern
<i>Hypolepis nifolobarbata</i>	sticky pig fern
<i>Lastreopsis glabella</i>	smooth shield fern
<i>Lastreopsis velutina</i>	velvet fern
<i>Leptolepis novae-zelandiae</i> ³	lace fern
<i>Leptopteris hymenophylloides</i>	heruheru/crepe fern
<i>Lycopodium fastigiatum</i>	alpine clubmoss/mountain clubmoss
<i>Lycopodium scariosum</i>	creeping clubmoss
<i>Lycopodium varium</i>	tassel fern/hanging clubmoss/iwituna
<i>Lycopodium volubile</i>	climbing clubmoss
<i>Paesia scaberula</i>	matata/hard fern/scented fern/lace fern
<i>Pellaea rotundifolia</i>	tarawera/New Zealand cliff brake
<i>Phymatosorus pustulatus</i>	hound's tongue fern
<i>Pneumatopteris pennigera</i>	gully fern/pakaurohāroha/feather fern
<i>Polystichum richardii</i>	common shield fern/black shield fern
<i>Polystichum vestitum</i>	prickly shield fern/puniu
<i>Pteridium esculentum</i>	bracken fern/rahurahu/rarauhe/austral brake
<i>Pteris tremula</i>	shaking brake/turawera/tender brake
<i>Pyrrosia cleagnifolia</i>	leather-leaf fern
<i>Rumohra adiantiformis</i>	leathery shield fern
<i>Tmesipteris elongata</i>	

Appendix II

Fauna list recorded in the Hundalee Ecological District

- * = introduced
 1 = References: Kelly, 1972; Jowett, 1979; O'Donnell and Moore, 1983; New Zealand Wildlife Service, 1983.
 2 = Reference: Jowett, 1979.
 3 = Reference: Todd, 1991.
 4 = Reference: NIWA, 1997.

Common Name	Scientific Name
Terrestrial Birds ¹	
blue penguin	<i>Eudyptula minor</i>
Southern crested grebe	<i>Podiceps cristatus australis</i>
black shag	<i>Phalacrocorax carbo novaehollandiae</i>
pied shag	<i>Phalacrocorax varius varius</i>
little black shag	<i>Phalacrocorax sulcirostris</i>
little shag	<i>Phalacrocorax melanoleucos brevirostris</i>
spotted shag	<i>Stictocorbo punctatus punctatus</i>
white-faced heron	<i>Haematopus unicolor</i>
reef heron	<i>Egretta sacra sacra</i>
Australasian bittern	<i>Botaurus stellaris poeciloptilus</i>
black swan*	<i>Cygnus atratus</i>
Canada goose*	<i>Branta canadensis maxima</i>
paradise shelduck	<i>Tadorna variegata</i>
mallard*	<i>Anas platyrhynchos platyrhynchos</i>
grey duck	<i>Anas superciliosa superciliosa</i>
grey teal	<i>Anas gibberifrons gracilis</i>
New Zealand shoveler	<i>Anas rhynchotis variegata</i>
New Zealand scaup	<i>Aythya novaeseelandiae</i>
Australasian harrier	<i>Circus approximans gouldi</i>
New Zealand falcon	<i>Falco novaeseelandiae</i>
Californian quail*	<i>Lophortyx californica</i>
marsh crake	<i>Porzana pusilla affinis</i>
spotless crake	<i>Porzana tabuensis plumbea</i>
pukeko	<i>Porphyrio porphyrio melanotus</i>
South Island pied oystercatcher	<i>Haematopus ostralegus finschi</i>
variable oystercatcher	<i>Haematopus unicolor</i>
spur-winged plover	<i>Vanellus miles novaehollandiae</i>
banded dotterel	<i>Charadrius bicinctus bicinctus</i>
pied stilt	<i>Himantopus himantopus leucocephalus</i>
Southern black-backed gull	<i>Larus dominicanus</i>
red-billed gull	<i>Larus novaehollandiae</i>
black-billed gull	<i>Larus bulleri</i>
Caspian tern	<i>Hydroprogne caspia</i>
black-fronted tern	<i>Sterna albobriata</i>
white-fronted tern	<i>Sterna striata</i>
New Zealand pigeon	<i>Hemiphaga novaeseelandiae</i>
rock pigeon*	<i>Columba livia</i>
kea	<i>Nestor notabilis</i>
shining cuckoo	<i>Chrysococcyx lucidus</i>
long-tailed cuckoo	<i>Eudynamis taitensis</i>
morepork	<i>Ninox novaeseelandiae</i>
little owl*	<i>Athene noctua</i>
New Zealand kingfisher	<i>Halcyon sancta vagans</i>
South Island rifleman	<i>Acanthisitta chloris chloris</i>
welcome swallow	<i>Hirundo tahitica neoxena</i>
New Zealand pipit	<i>Anthus novaeseelandiae</i>
hedge sparrow*	<i>Prunella modularis</i>
brown creeper	<i>Mohoua novaeseelandiae</i>
grey warbler	<i>Gerygone igata igata</i>
South Island fantail	<i>Rhipidura fuliginosa fuliginosa</i>
South Island tomtit	<i>Petroica macrocephala macrocephala</i>
South Island robin	<i>Petroica australis australis</i>
song thrush*	<i>Turdus philomelos</i>
blackbird*	<i>Turdus merula merula</i>

silveryeye
 bellbird
 tui
 yellowhammer*
 ciril bunting*
 chaffinch*
 greenfinch*
 goldfinch*
 redpoll*
 house sparrow*
 starling*
 white-backed magpie*

Zosterops lateralis
Anthornis melanura
Prosthemadera novaeseelandiae
Emberiza citrinella
Emberiza cirius
Fringilla coelebs gingleri
Carduelis chloris chloris
Carduelis carduelis
Carduelis flammea cabaret
Passer domesticus
Sturnus vulgaris
Gymnorhina tibicen hypoleuco

Sea Birds - seen offshore from Kaikoura Coast²

wandering albatross
 royal albatross
 N.Z. black-browed mollymawk
 grey-headed mollymawk
 Salvin's mollymawk
 white-capped mollymawk
 giant petrel
 Cape pigeon
 Westland black petrel
 flesh-footed shearwater
 Buller's shearwater
 sooty shearwater
 Hutton's shearwater
 white-faced stormpetrel
 Australasian gannet
 Arctic skua

Diomedea exulans exulans
Diomedea epomophora
Diomedea melanophrys unpavida
Diomedea chrysostoma
Diomedea cauta salvini
Diomedea cauta steadi
Macronectes giganteus giganteus
Caption capense capense
Procellaria westlandica
Puffinus carneipes bullinus
Diomedea bulleri
Puffinus griseus
Puffinus huttoni
Pelagodroma marina maoriana
Sula bassana serrator
Stercorarius parasiticus

Marine Mammals³

dusky dolphin
 elephant seal
 Hector's dolphin
 humpback whale
 leopard seal
 minke whale
 New Zealand fur seal
 orca
 pilot whale
 Southern right whale dolphin
 sperm whale

Lagenorhynchus obscurus
Mirounga leonina
Cephalorhynchus hectori
Megaptera novaeangliae
Hydrurga leptonyx
Balaenoptera acutorostrata
Arctocephalus forsteri
Orcinus orca
Globicephala melaena
Lisodelphis peronii
Physeter macrocephalus

Introduced Animals

brown hare*
 brush-tailed possum*
 cat*
 cattle*
 dog*
 European hedgehog*
 ferret*
 goat*
 horse*
 house mouse*
 Norway rat*
 pig*
 rabbit*
 red deer*
 sheep*
 ship rat*
 stoat*
 weasel*

Lepus europaeus occidentalis
Trichosurus vulpecula
Felis catus
Bos taurus
Canis familiaris
Erinaceus europaeus occidentalis
Mustela furo
Capra hircus
Equus caballus
Mus musculus
Rattus norvegicus
Sus scrofa
Oryctolagus cuniculus cuniculus
Cervus elephus scoticus
Ovis aries
Rattus rattus
Mustela erminea
Mustela nivalis vulgaris

Frogs

Southern bell frog*
 whistling frog*

Litoria raniformis
Litoria ewingii

Geckos

Common gecko
 Green gecko

Hoplodactylus maculatus
Naultinus rudis

Skinks

Green-spotted skink
Common skink

Oligosoma lineoocellatum
Oligosoma nigriplantare

Fish⁴

lamprey
short-finned eel
long-finned eel
inanga
koaro
common river galaxias
common bully
upland bully
blue-gilled bully
red-finned bully
black flounder
brown trout⁴

Geotria australis
Anguilla australis
Anguilla dieffenbachii
Galaxias maculatus
Galaxias brevipinnis
Galaxias vulgaris
Gobiomorphus cotidianus
Gobiomorphus breviceps
Gobiomorphus hubbsi
Gobiomorphus buttoni
Rhombosolea retiaria
Salmo trutta

Snails

Wainuia edwardii
Rytida spp.

Insects²

Seashore - beach and rocks
kelpfly
kelpfly
rove beetles

Chaetocoelopa littoralis
Maorimyia bipunctata
unidentified spp. of *Coleoptera*, Family
Staphylinidae
Opifex fuscus
Anisolabis littorea

Grassland - between beech and bush
butterflies

various spp. of *Lepidoptera*, Families
Lycaenidae, *Pieridae*, *Nymphalidae*
Odontria spp.
Vespula germanica
unidentified spp. of *Orthoptera*, Family
Gryllidae
Apis mellifera
unidentified spp. of *Diptera*, Family *Syrphidae*
Pteronemobius spp.

chafers
German wasp⁴
grasshoppers

honey bee
hoverflies
small field cricket

Forest margin
boulder copper butterfly
cicada
common copper butterfly
monarch butterfly
red admiral butterfly (kahukura)
yellow admiral butterfly

Lycaena boldenarum
Amphisalta spp.
Lycaena salustius
Danaus plexippus
Bassaris gonerilla
Bassaris itea

Forest
carabid beetles
longhorn beetles

unidentified spp. of *Coleoptera*, Family *Carabidae*
unidentified spp. of *Coleoptera*, Family
Cerambycidae
Celatoblatta spp.
Lissotes reticulatus
unidentified spp. of *Orthoptera*, Families
Stenopelmatidae (tree weta), and *Rhaphidophoridae*
(cave weta)

Tussock grassland and scrubland
boulder copper
common copper
migrating locust (kapakapa)
New Zealand grasshoppers
praying mantis (whe)
stick insects

Lycaena boldenarum
Helleia sallustius
Locusta migratoria
Phaulacridium marginale
Orthodera ministralis
unidentified spp. of *Phasmatodea*, Family
Phasmidae

Freshwater - stream

common netbuilding caddis
Dobsonfly
doublegilled mayflies
hornycased caddis
large green stonefly
longtailed stoneflies
net-winged midges

sandflies
spinygilled mayfly
spiral caddises
suckergilled mayfly

Freshwater - pond

common backswimmer
common pond skater
common water boatman
cosmopolitan diving beetle
dixa midges
red damselfly (kihitarā)
water measurer

Aoteapsyche colonica
Archichauliodes diversus
Zephlebia spp.
Olinga feredayi
Stenoperla prasina
Zealandoperla spp.
unidentified spp. of *Diptera*, Family
Blepharoceridae
Austrosimulium spp.
Coloburiscus humeralis
Helicopsyche spp.
Deleatidium myzobranchia

Anisops assimilis
Microvelia macgregori
Sigara arguta
Rhantus pulverosus
unidentified spp. of *Diptera*, Family *Dixidae*
Xanthocnemis zealandica
Hydrometra riskei

Appendix III

GLOSSARY

alluvial fan: fan formed from accumulation of alluvium.

alluvial terrace: terrace formed from accumulation of alluvium. An alluvial terrace is a portion of the former floodplain of a river, now abandoned and left at a higher level as the river downcuts through it.

alluvium: rock or soil material that has been transported primarily by flowing water.

argillite: a hard, dark grey to black mudstone which, in New Zealand, is commonly associated with greywacke.

bluff: a precipitous bedrock outcrop which is at least 15m high, and usually has a broad face.

boulderfield: land in which the area of unconsolidated bare stones (> 200mm diameter) exceeds the area covered by any one class of plant growth form (Atkinson, 1985).

buffering: protection of an area from the introduction of exotic plant and animal species and human activities provided by natural features (e.g. rock barriers, catchment boundaries and surrounding vegetation) or artificial structures (e.g. fences).

colluvial slope: a slope that has a debris mantle (soil or scree) to a depth of at least 0.3m and few bedrock outcrops.

colluvium: rock or soil material that has been transported downslope primarily by gravity.

conservation: the preservation and protection of natural and historic resources for the purpose of maintaining their intrinsic values, providing for their appreciation and recreational enjoyment by the public, and safeguarding the options of future generations (*Conservation Act 1987*, Section 2 (1)).

diversity: the range of natural physical and biotic components in an area (land systems, landforms, soils, plant and animal communities, ecological units and ecosystems).

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 divided into 268 ecological districts (Myers *et al*, 1987).

ecological region: a group of adjacent ecological districts with closely related ecological characteristics or, in some cases, a single very distinctive ecological district. New Zealand has been divided into 85 ecological regions (Myers *et al*, 1987).

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

endangered conservation status: a plant or animal species in danger of extinction and whose survival is unlikely if causal factors continue to operate (Wilson and Given, 1989).

endemic: a native plant or animal species which is confined to an area (e.g. Marlborough or New Zealand).

exotic: introduced; a plant or animal species which has been brought to New Zealand by humans, either by accident or by design (*c.f.* native).

fan: a landform composed of sedimentary deposits with an approximately half-cone shaped form which is generally fan-shaped in plan view, formed at a valley or gully mouth.

fernland: vegetation in which the cover of ferns in the canopy is 20-100% and in which the fern cover exceeds that of any other growth form or bare ground. Tree ferns > 10cm dbh are excluded as trees (Atkinson, 1985).

flaxland: see tussockland.

floodplain: flat or gently sloping surface of alluvium, adjacent to a river or stream channel and covered by water during floods when flow is no longer confined to channels.

foot slope: the gentle, concave slope at the base of the side slope and above the toe slope and valley floor. This is where colluvial material is redeposited after having been moved downslope.

forest: Woody vegetation in which the cover of trees and shrubs in the canopy is > 80% and in which tree cover exceeds that of shrubs (Atkinson, 1985).

gorge: a relatively deep and narrow valley passage with steep, often with rocky sides.

grassland: vegetation in which the cover of grass in the canopy is 20-100% and in which the grass cover exceeds that of any other growth form or bare ground. Tussock grasses are excluded from the grass growth form (Atkinson, 1985).

greywacke: an indurated grey sandstone, mostly comprising quartz and feldspar, which is the most abundant rock in New Zealand.

herb: all herbaceous and low-growing semi-wood plants that are not separated as ferns, tussocks, grasses, sedges, rushes, reeds, cushion plants, mosses or lichens.

herbfield: vegetation in which the cover of herbs in the canopy is 20-100% and in which the herb cover exceeds that of any other growth form or bare ground. Tussock grasses are excluded from the grass growth form (Atkinson, 1985).

indeterminate conservation species: a plant or animal species thought to be extinct, endangered, vulnerable or rare, but for which there is insufficient information to allow an allocation one of these categories (Wilson and Given, 1989).

indigenous: native; a plant or animal species which occurs naturally in New Zealand (*c.f.* introduced).

indurated: hardened by the action of heat and pressure (as in the case of greywacke and argillite), or the introduction of some cementing material not commonly contained in the original mass.

introduced: exotic; a plant or animal which has been brought to New Zealand by humans, either by accident or by design (*c.f.* indigenous).

Jurassic: the period 190 to 135 million years ago on the geological time scale.

Kaikoura Orogeny: the second mountain building period in New Zealand, which began approximately ten million years ago and is continuing today. The present shape and topography of New Zealand has been formed over this period (Stevens *et al.* 1988).

lacustrine: pertaining to lakes.

land system: an area throughout which there is a general coherence and unity of physical and biological attributes.

levee: a linear accumulation of debris on the margins of a stream, debris flow or landslide track.

local conservation status: a plant or animal species not presently at risk but potentially so, and hence deserving some level of monitoring and possibly protection (Wilson and Given, 1989).

loess: buff to light-yellowish or yellowish-brown coloured, unstratified deposits of loosely arranged angular grains of silt carried from riverbeds and deposited by winds.

mass movement: gravity-induced downslope movement of soil and/or rock material through falling, toppling, flowing or sliding motions (e.g. rock avalanche and debris flow).

mudstone: a sedimentary rock composed of mud-sized particles (e.g. argillite).

native: indigenous; a plant or animal species which occurs naturally in New Zealand (c.f. exotic).

naturalised: applied to a species that originally was imported from another country but now behaves like a native in that it maintains itself without further human intervention and has invaded native populations.

naturalness: an assessment of how closely the physical and biotic components of an area reflect the condition before human occupation (in New Zealand, approximately pre-AD 700).

outwash: stratified rock material, boulder to sand-sized, deposited by meltwater streams in front of a glacier's snout.

plot: a sample site from which vegetation and landform data have been recorded.

Protected Natural Area (PNA): a legally protected area, characterised by indigenous species or ecosystems, in which the principal purpose of management is retention of the indigenous state (Department of Lands and Survey, 1984). The term may also be applied to areas legally protected for their soil, geological and/or landform values.

Quaternary: the period 2 000 000 years ago to the present day on the geological time scale.

rare conservation status: a plant or animal species with small world populations that are not presently endangered or vulnerable but are at risk (Wilson and Given, 1989).

Recent: the 12 000 year period between the end of the Pleistocene glaciations and the present day; the Holocene period.

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

reed: herbaceous plants growing in standing or slowly-flowing water that have tall, slender, erect, unbranched leaves or culms that are either hollow or have a very spongy pith.

reedland: vegetation in which the cover of reeds in the canopy is 20-100% and in which the reed cover exceeds that of any other growth form or open water. Tussock grasses are excluded from the grass growth form (Atkinson, 1985).

representativeness: an assessment of how well an area (e.g. a RAP) shows the overall characteristics of a larger area (e.g. a land system or ecological district).

riparian: of or on a riverbank or stream bank.

riser: the steep slope below the edge of a terrace tread.

rockland: land in which the area of residual bare rock exceeds the area covered by any one class of plant growth form. Cliff vegetation often includes rockland (Atkinson, 1985).

rock outcrop: an exposure of bedrock that is less than approximately 3m high.

rupestral: of rocks; a species which inhabits rocky places.

rushland: vegetation in which the cover of rushes in the canopy is 20-100% and in which the rush cover exceeds that of any other growth form or bare ground. Tussock-rushes are excluded (Atkinson, 1985).

sandfield: land in which the area of bare sand(0.02-2mm diameter) exceeds the area covered by any one class of plant growth form (Atkinson, 1985).

sandstone: a sedimentary rock composed of sand-sized particles (e.g. greywacke).

scree: a sloping pile of angular rock fragments, with little or no surface soil, at the foot of a cliff (*i.e.* talus), mantling a hill/mountain slope (*i.e.* sheet scree), confined to a narrow channel or gully (*i.e.* scree chute or gully scree) or forming a steep, cone-shaped accumulation of colluvium below a chute/gully (*i.e.* cone scree).

scrub: woody vegetation in which the cover of shrubs and trees in the canopy is > 89% and in which shrub cover exceeds that of trees (Atkinson, 1985).

sedgeland: vegetation in which the cover of sedges in the canopy is 20-100% and in which the sedge cover exceeds that of any other growth form or bare ground. Tussock sedges and reed-forming sedges are excluded (Atkinson, 1985).

senescent: growing old.

shrubs: woody plants < 10cm dbh (Atkinson, 1985).

side slope: the midslope part of hill and mountain slopes between the summit/shoulder and foot slope. It may be linear or concave throughout its length.

stonefield/gravelfield: land in which the area of unconsolidated bare stones (20-200mm diameter) exceeds the area covered any one class of plant growth form. The appropriate name is given depending on whether stones or gravel form the greater area of ground surface (Atkinson, 1985).

summit/shoulder slope: the slope above a side slope, comprising ridge tops and convex slopes leading up to them.

survey area: the total area surveyed, using Protected Natural Areas Programme methodology, within the Hundalee Ecological District.

tephra: solid matter, including ash, ejected during a volcanic eruption.

terrace: a flat or gently sloping surface (*i.e.* the tread), generally composed of alluvial deposits, bounded on one side by a steeper descending slope (*i.e.* the riser) and, on the other, by a steeper ascending slope.

Tertiary: the period 65 to 2 million years ago on the geological time scale. The Tertiary period was marked initially by sea transgression until, about 25 million years ago, renewed uplift caused the seas to retreat.

toe slope: the gentle, evenly sloped, downslope portion of the footslope; usually adjoins an alluvial terrace or floodplain.

Torlesse Supergroup: a group of mostly greywacke and argillite rocks which form most of the basement rocks of large parts of the North and South Islands. The remaining rock includes conglomerate, red and green mudstone, and meta-volcanics with associated limestone and chert.

tree: woody plants > 19cm dbh. Tree ferns > 10cm are treated as trees (Atkinson, 1985).

treeland: Vegetation in which the cover of trees in the canopy is 20-80%, with tree cover exceeding that of any other growth form, and in which the trees form a discontinuous canopy above either a lower canopy of predominantly non-woody vegetation or bare ground (Atkinson, 1985).

tussockland (including flaxland): vegetation in which the cover of tussocks in the canopy is 20-100% and in which the tussock cover exceeds that of any other growth form or bare ground. Tussocks include all grasses, sedges, rushes, and other herbaceous plants with linear leaves (or linear non-woody stems) that are densely clumped and > 10cm in height. It is sometimes useful to separate **flaxland** as a subclass for areas where species of *Phormium* are dominant (Atkinson, 1985).

viability: the ability of an area's plant and animal communities (or, in some cases, individual species) to maintain themselves in the long term without any special effort to perpetuate them.

vineland: vegetation in which the cover of unsupported (or artificially supported) woody vines in the canopy is 20-100% and in which the cover of these vines exceeds that of any other growth form or bare ground. Vegetation containing woody vines that are supported by trees and shrubs is classified as forest, scrub or shrubland (Atkinson, 1985).

vulnerable conservation status: a plant or animal species believed likely to become endangered in the near future if the causal factors continue to operate (Wilson and Given, 1989).

Appendix IV

ECOLOGICAL UNITS

BIOCLIMATIC ZONE	LAND SYSTEM	VEGETATION AND TYPE CODE	LANDFORM TYPE(S)	RAP AND PNA	PLOT NO.'S
Coastal	Coastal greywacke hill country	Mahoe-supplejack forest (5a)	Colluvial hill side slope, gully, V-shaped valley streamside.	PNA5, PNA7, PNA9, PNA10, RAP7	K1/4, K7/4, K23/1, K23/3, K31/1
Coastal	Coastal greywacke hill country	Mahoe-(ngaio)-(kowhai) scrub and treeland (5a)	Hill side slope	PNA10	K7 description
Coastal	Coastal greywacke hill country	Mahoe-mixed broadleaved forest (5a)	Riparian zone, gully		K24 description
Coastal	Coastal greywacke hill country	Mahoe-fivefinger forest (5b)	Colluvial hill side slope	PNA5, PNA7	K24 description, K31/2
Coastal	Coastal greywacke hill country	Mixed broadleaved forest and scrub (5d)	Hill side slope, gully		K23 description
Coastal	Coastal greywacke hill country	Manuka scrub and shrubland (6a)	Hill side slope, ridge	PNA5	K31 description
Coastal	Coastal greywacke hill country	Kanuka forest and scrub (6b)	Hill side slope	PNA5, PNA7	K23/2, K31 description
Coastal	Coastal greywacke hill country	Manuka-kanuka low forest and scrub (6c)	Hill side slope	RAP10	K15 description
Coastal	Coastal greywacke hill country	Coprosma-mixed grass shrub-grassland (8c)	Hill side slope	PNA5	K31 description
Coastal	Coastal greywacke hill country	Mixed shrubland, shrub-rockland and rockland (9)	Bluff, cliff, steep bedrock faces, rocky coastline in splash zone, offshore islets	PNA5, PNA6, PNA7, PNA8, PNA10, PNA11, RAP9	K15/4 + description, K24/1, K24/2, K31 description
Coastal	Coastal soft rock hill country	Mahoe-mixed broadleaved low forest and scrub (5a)	Hill side slope, gully, riparian zone	RAP9, RAP10	K15/6
Coastal	Coastal soft rock hill country	Mahoe-fivefinger scrub (5b)	Coastal scarp	RAP9	K15/7

BIOCLIMATIC ZONE	LAND SYSTEM	VEGETATION AND TYPE CODE	LANDFORM TYPE(S)	RAP AND PNA	PLOT NO.'S
Coastal	Coastal soft rock hill country	Ngaio treeland (5e)	Hill side slope	RAP9	K15/5
Coastal	Coastal soft rock hill country	Ngaio-fivefinger shrubland (5e)	Cliff faces	RAP12	K30 description
Coastal	Coastal soft rock hill country	Manuka scrub and shrubland (6a)	Coastal flat, coastal scarp, hill slopes and forest margins	RAP9, RAP10	K15/2
Coastal	Coastal soft rock hill country	Mixed shrubland, shrub-rockland and rockland (9)	Coastal cliff faces, bluffs	RAP9, RAP12	K15/4, K30/1, K30 description
Coastal	Coastal soft rock hill country	New Zealand iceplant rockland (17)	Coastal cliff faces, bluffs	RAP12	K30/2
Coastal	Northwest outwash deposits and local alluvium	Mahoe-supplejack forest (5a)	Alluvial terrace	PNA9	K1/2
Coastal	Northwest outwash deposits and local alluvium	Ngaio treeland (5e)	Low coastal alluvial terrace	PNA21	H14/4
Coastal	Northwest outwash deposits and local alluvium	Saltmarsh ribbonwood shrubland (8b)	Lagoon margin	RAP18	H14/2
Coastal	Northwest outwash deposits and local alluvium	Mixed sedge-rushland (11, 14)	Lagoon margin	RAP18	H14 description
Coastal	Northwest outwash deposits and local alluvium	Raupo reedland (12)	Lagoon margin	RAP18	H14 description
Coastal	Northwest outwash deposits and local alluvium	Harakeke flaxland (13)	Lagoon margin	RAP18	H14 description
Coastal	Northwest outwash deposits and local alluvium	Sandfield/ gravelfield on beaches (16)	Foredune, sandspit, beaches, lagoon margins	RAP9, RAP18	K15/3, H14/3, K31 description
Coastal	Northwest outwash deposits and local alluvium	<i>Gracilaria</i> aquatic herbfield (18)	Lagoon	RAP18	H14 description
Coastal-semi-coastal-lowland	Northwest outwash deposits and local alluvium	River gravelfield (15)	Braided river floodplain	RAP18, RAP21	H14/1, H33 description, notes (N21)
Semi-coastal	Coastal greywacke hill country	Black beech forest (3a)	Hill side slope, gully		K16/4, H12/4

BIOCLIMATIC ZONE	LAND SYSTEM	VEGETATION AND TYPE CODE	LANDFORM TYPE(S)	RAP AND PNA	PLOT NO.'S
Semi-coastal	Coastal greywacke hill country	(Black beech)-[hinau]/mahoe forest (3c)	Streamside knoll, bedrock toe slope, gully, riparian zone	PNA9, RAP6	K1/3, K1/5, K2/2
Semi-coastal	Coastal greywacke hill country	(Matai)/mahoe forest (4a)	Hill side slope, toe slope	PNA12	K4/1, K9/5, K18/1, H12/3
Semi-coastal	Coastal greywacke hill country	Mahoe-mixed broadleaved forest and scrub (5a)	Hill side slope, toe slope and colluvial hill side slope, gully, riparian zone	PNA9, PNA10, PNA12, RAP6, RAP7, RAP17	K1/1, K1/6, K2/1, K4 description, K6/1, K7/1, K7/2, K7/7, K9/1, K16/2, K18/2, K25/2, K25/3, H8/1, H11/6, H12/2 + notes (N22, N25, N37)
Semi-coastal	Coastal greywacke hill country	Kanuka-mixed broadleaved low forest, scrub and shrubland (5d)	Colluvial hill side slope, crest, ridge	RAP17	H11 description, H12/1
Semi-coastal	Coastal greywacke hill country	Manuka scrub and shrubland (6a)	Hill side slope		K4 description, notes (N22, N25)
Semi-coastal	Coastal greywacke hill country	Kanuka forest and scrub (6b)	Hill side slope, spur side slope and ridge, gully riser	PNA10, PNA12, RAP6, RAP7, RAP17	K2 description, K7/3, K9/2, K25/1, K16/1, K18/3, H11/5, notes (N25, N37)
Semi-coastal	Coastal greywacke hill country	Kanuka forest and scrub (6b)	, hill side slope	RAP6,	K2 description
Semi-coastal	Coastal greywacke hill country	Kanuka-manuka forest and scrub (6c)	Hill side slope	RAP17	H11/2
Semi-coastal	Coastal greywacke hill country	Mixed shrubland, shrub-rockland and rockland (9)	Bluffs, sheer bedrock face	RAP6, RAP17	K2/3, H11/4
Semi-coastal	Coastal greywacke hill country	Wheki scrub (10b)	Hill side slope	PNA12	K9 description
Semi-coastal	Coastal greywacke hill country	<i>Carex</i> sedgeland (11)	Lake margins and swamp	PNA3	K28 description + notes
Semi-coastal	Coastal greywacke hill country	Raupo reedland (12)	Lake margins	PNA3	K28 description
Semi-coastal	Coastal greywacke hill country	Harakeke flaxland (13)	Lake margins and swamp	PNA3	K28 description

BIOCLIMATIC ZONE	LAND SYSTEM	VEGETATION AND TYPE CODE	LANDFORM TYPE(S)	RAP AND PNA	PLOT NO.'S
Semi-coastal	Coastal greywacke hill country	<i>Juncus</i> rushland (14)	Lake margins and swamp	PNA3	K28 description
Semi-coastal	Coastal greywacke hill country	Aquatic herbfield (18)	Lake bed	PNA3	K28 description
Semi-coastal	Coastal soft rock hill country	Black beech-mixed broadleaved forest (3c)	Lower hill side slope, gully, riparian zone	RAP11	K16 description
Semi-coastal	Coastal soft rock hill country	Mahoe-mixed broadleaved low forest and scrub (5a)	Riparian zone, concave hill side slope, gully	RAP11	K16 description, K26/1
Semi-coastal	Coastal soft rock hill country	Mahoe-kanuka low forest (5d)	Hill side slope	RAP11	K16 description
Semi-coastal	Coastal soft rock hill country	Manuka shrubland (6a)	Hill side slopes and forest margins	RAP11	K16 description
Semi-coastal	Coastal soft rock hill country	Kanuka forest and scrub (6b)	Toe slope by lake margin, hill side slope	PNA3, RAP11	K16 description, K28/1 + notes
Semi-coastal	Coastal soft rock hill country	Mixed shrubland, shrub-rockland and rockland (9)	Bluffs and outcrops	RAP11	K16/3
Semi-coastal	Northwest outwash deposits and local alluvium	Black beech/mixed broadleaved forest (3c)	Alluvial terrace	RAP12	K9/5
Semi-coastal	Northwest outwash deposits and local alluvium	(Matai)/mahoe forest (4a)	Alluvial terrace, flat	RAP17	H11/1
Semi-coastal	Northwest outwash deposits and local alluvium	Kanuka forest and scrub (6b)	Alluvial terrace and flat	PNA4	K27/1
Lowland	Inland greywacke hill country	Black beech forest (3a)	Gully, steep lower spur side slope, hill side slope, terrace, terrace riser, riparian zone	PNA16, PNA17, RAP4, RAP13, RAP14, RAP15, RAP16, RAP17, RAP26	K21/4, H4/8, H6/1, H6/3, H7 description, H9/1, H9/3, H11/3, H13/1, H13/2, H13/4/3, H19/1, H25/1, H30 description, H31/4, H33/1, H33/4, H35 description, notes (N1, N12, N26, N32)
Lowland	Inland greywacke hill country	Black beech-mountain beech forest (3a)	Colluvial hill side slope, spur side slope	RAP6, RAP12	K2 description, K9 description, H24/2, H25 description, notes (N1)

BIOCLIMATIC ZONE	LAND SYSTEM	VEGETATION AND TYPE CODE	LANDFORM TYPE(S)	RAP AND PNA	PLOT NO.'S
Lowland	Inland greywacke hill country	Black beech-red beech forest (3b)	Hill side slope, toe slope, lower spur side slope, riparian zone	PNA9, RAP16	K3/3, H7/4, H13/5, H13/8, H13/9, H30/3, notes (N26)
Lowland	Inland greywacke hill country	Black beech-red beech/mixed broadleaved forest (3b)	Gully, riparian zone	PNA9	K3/5
Lowland	Inland greywacke hill country	[Mixed podocarp]/(Red beech)-[black beech]/mixed broadleaved forest (3b)	Gully, riparian zone	RAP15, RAP16	H4/7, H7/6
Lowland	Inland greywacke hill country	Black beech/mixed broadleaved forest (3c)	Gully, riparian zone	RAP14, RAP15, RAP17	H4/6, H6/2, H11 description, H13/6, notes (N35)
Lowland	Inland greywacke hill country	(Black beech)-(matai)/broadleaved forest (3c)	Gully, hill side slope, spur side slope	RAP6	K2/4
Lowland	Inland greywacke hill country	(Mixed podocarp)/black beech forest (3d)	Terrace, gently rolling toe slope	PNA16	H9/2
Lowland	Inland greywacke hill country	Mahoe-mixed broadleaved forest (5a)	Colluvial hill side slope, spur side slope	PNA10	K7 description
Lowland	Inland greywacke hill country	Fivefinger-broadleaf scrub (5c)	Colluvial hill side slope and gorge	RAP13	H31/2
Lowland	Inland greywacke hill country	Fivefinger-coprosma low forest (5c)	Steep valley side	PNA17	H4 description
Lowland	Inland greywacke hill country	Mixed broadleaved forest and scrub (5c)	Spur side slope (+/- colluvial), hill side slope, gully, riparian zone	RAP4, RAP6, RAP15, RAP25	K2 description, K14 description, H4/4, H24/1, H25 description, H28/8
Lowland	Inland greywacke hill country	Mixed broadleaved shrubland (5c)	Cliff toe slope	PNA16	H9 description, H33 description
Lowland	Inland greywacke hill country	[Lowland totara]-(kanuka)/mahoe-mixed broadleaved low forest (5d)	Gully	RAP16	H7/2
Lowland	Inland greywacke hill country	Kanuka-mixed broadleaved forest (5d)	Colluvial hill side slope	RAP16	H7/5, notes (N12)

BIOCLIMATIC ZONE	LAND SYSTEM	VEGETATION AND TYPE CODE	LANDFORM TYPE(S)	RAP AND PNA	PLOT NO.'S
Lowland	Inland greywacke hill country	Manuka shrubland (6a)	Hill side slope, spur side slope, spur crest	RAP16	H7 description
Lowland	Inland greywacke hill country	Kanuka low forest and scrub (6b)	Hill side slope, spur side slope, ridge, toe slope	PNA16, RAP4, RAP13, RAP14, RAP16	K21/2, H7/1, H9 description, H13/4, H13/7, H30/2, H31 description, H33/2
Lowland	Inland greywacke hill country	Kanuka-manuka forest, scrub and shrubland (6c)	Spur side slope, hill side slope, toe slope, bedrock hill side slope, colluvial hill side slope, crest	PNA10, PNA13, PNA14, RAP16, RAP25	K7/8, H6/4, H7 description, H17/1, H18/1, H19 description, H25/2, H28/3
Lowland	Inland greywacke hill country	Manuka scrub (6c)	Terrace	PNA16	H9/4
Lowland	Inland greywacke hill country	Black beech-kanuka forest (6d)	Hill side slope, hill crest, spur side slope, gully	RAP4, RAP16	K21/2, H7/3, notes (N12)
Lowland	Inland greywacke hill country	Manuka-marbleleaf scrub (6e)	Colluvial hill slope		H30/1
Lowland	Inland greywacke hill country	Mixed shrubland (8a)	Forest margins in gully		Notes (N32)
Lowland	Inland greywacke hill country	Mixed shrub-tussockland (8c)	Spur side slope, hill side slope, spur crest, hill crest	PNA9, RAP16	K3/1, H7 description
Lowland	Inland greywacke hill country	Mixed shrub-rockland and rockland (9)	Bluff, cliff, rock outcrop, steep bedrock hill slopes	PNA9, PNA12, PNA16, RAP13, RAP14	K1 description, K9/4, H9 description, H29/1, H30 description, H31 description, H33 description, notes (N29)
Lowland	Inland greywacke hill country	<i>Carex</i> sedgeland (11)	Stream flat		Notes (N4)
Lowland	Inland greywacke hill country	Harakeke-mixed pasture flax-grassland (13)	Cliff face	PNA16	H9 description
Lowland	Inland soft rock hill country	Black beech forest (3a)	Riparian zone, hill side slope, spur side slope, gully	PNA13, PNA14, PNA15, PNA19, RAP29	H10/2, H16/6, H17/2, H18 description, H20 description, notes (N29, N35, N38, N42)
Lowland	Inland soft rock hill country	Mountain beech-black beech	Hill side slope, scarp	RAP27, RAP28	H23/1, Notes (N26,

BIOCLIMATIC ZONE	LAND SYSTEM	VEGETATION AND TYPE CODE	LANDFORM TYPE(S)	RAP AND PNA	PLOT NO.'S
		forest (3a)			N29, N35, N48)
Lowland	Inland soft rock hill country	Mountain beech-black beech/mixed broadleaved forest (3a)	Riparian zone	RAP28	H23 description
Lowland	Inland soft rock hill country	Black beech-(mixed podocarp) forest (3d)	Gently rolling hill side slopes and terraces	PNA13, PNA15, RAP28	H16/2, H23/2
Lowland	Inland soft rock hill country	Mixed podocarp-black beech-(pokaka) forest (3d)	Terrace	PNA15	H16/4
Lowland	Inland soft rock hill country	(Kahikatea)/black beech forest	Valley head	PNA15	H16 description
Lowland	Inland soft rock hill country	Black beech-(matai) forest (3d)	Hill side slope	PNA14	H18/2
Lowland	Inland soft rock hill country	Black beech-(rimu) forest (3d)	Gully, riparian zone	PNA14	H18/3
Lowland	Inland soft rock hill country	Black beech-(mixed podocarp)/mixed broadleaved forest (3d)	Hill side slope, spur side slope, gully	PNA13	H17/3
Lowland	Inland soft rock hill country	Mahoe-mixed broadleaved forest and scrub (5a)	Hill side slope, riparian zone, gully head	RAP26	K26/1, H35/1, (notes (N26, N35)
Lowland	Inland soft rock hill country	Mixed broadleaved low forest (5c)	Lake margin, hill slope, riparian zone	RAP5, RAP26	H35 description, Notes (N14)
Lowland	Inland soft rock hill country	Kowhai forest and treeland (5f)	Hill side slope	PNA18, RAP26	H26/1, H35 description
Lowland	Inland soft rock hill country	Manuka scrub and shrubland (6a)	Hill side slope, shoulder slope, crest, ridge, riparian zone	PNA13, PNA15, PNA18, PNA20, RAP5, RAP26, RAP28, RAP29	H16/3, H17 description, H20 description, H22/1, H23 description, H26 description, H35/2, notes (N14, N29, N30)
Lowland	Inland soft rock hill country	Kanuka low forest and scrub (6b)	Hill side slope	RAP32	Notes (N49)
Lowland	Inland soft rock hill country	Kanuka-manuka low forest and scrub (6c)	Hill side slope, spur side slope	PNA15, RAP28, RAP32	H16 description, H23 description, Notes (N29, N38, N48, N49)

BIOCLIMATIC ZONE	LAND SYSTEM	VEGETATION AND TYPE CODE	LANDFORM TYPE(S)	RAP AND PNA	PLOT NO.'S
Lowland	Inland soft rock hill country	Black beech-mountain beech-kanuka forest (6d)	Hill side slope, riparian zone	RAP29	H20 description
Lowland	Inland soft rock hill country	Black beech/kanuka forest (6d)	Toe slope	PNA15	H16/5
Lowland	Inland soft rock hill country	Black beech-kanuka-manuka forest and scrub (6d)	Gully and riparian zone	RAP32	Notes (N49)
Lowland	Inland soft rock hill country	Manuka-marbleleaf scrub (6e)	Hill side slope	RAP26	H35 description
Lowland	Inland soft rock hill country	Mixed shrub-grassland (8c)	Terrace riser	PNA15	H16 description
Lowland	Inland soft rock hill country	Marlborough rock daisy shrub rockland and rockland (9)	Bluff, terrace riser	RAP3	Notes (N16)
Lowland	Inland soft rock hill country	Mixed shrub rockland and rockland (9)	Bluffs, recent slip sites		Notes (N26, N43)
Lowland	Inland soft rock hill country	<i>Carex</i> sedgeland (11)	Lake margin, stream flat, seepage	PNA19, PNA20, RAP5, RAP20	H10 description, H22 description, H30 description, H34/1, notes (N2, N14, N33)
Lowland	Inland soft rock hill country	Raupo reedland (12)	Lake margin, stream flat	RAP5, RAP20	H34 description, notes (N14, N33)
Lowland	Inland soft rock hill country	<i>Juncus</i> rushland (14)	Stream flat	RAP20	H34 description
Lowland	Northwest outwash and local alluvium	Black beech forest (3a)	Terrace riser	RAP13	H31/1
Lowland	Northwest outwash and local alluvium	(Black beech)/mixed broadleaved forest and scrub (3a)	Terrace riser, gully, riparian zone	RAP3	Notes (N16)
Lowland	Northwest outwash and local alluvium	(Mixed podocarp)/black beech/mixed broadleaved forest (3d)	Alluvial terrace and toe slope	RAP13, RAP14, RAP31	H21/1, H31/3, H33/3
Lowland	Northwest outwash and local alluvium	Matai-kahikatea/black beech forest (3d)	Alluvial terrace	PNA19	H10/1

BIOTIC ZONE	LAND SYSTEM	VEGETATION AND TYPE CODE	LANDFORM TYPE(S)	RAP AND PNA	PLOT NO. S
Lowland	Northwest outwash and local alluvium	(Mixed podocarp)/mixed broadleaved forest (4a)	Alluvial terrace, terrace riser	PNA1, RAP19	K11 description, H5/1, H5/2, H5/3
Lowland	Northwest outwash and local alluvium	Matai/(kanuka)/mahoe forest (4a)	Terrace riser	PNA1	K11 description
Lowland	Northwest outwash and local alluvium	Fivefinger-mixed broadleaved low forest and scrub (5c)	Terrace riser, gully, riparian zone	RAP3	Notes (N16)
Lowland	Northwest outwash and local alluvium	Mixed broadleaved forest and scrub (5c)	Alluvial terrace, scarp, gully, riparian zone	RAP3, RAP15	H4/5, notes (N16)
Lowland	Northwest outwash and local alluvium	Kanuka low forest and scrub (6b)	Alluvial terrace, gully, terrace riser, shoulder slopes	PNA1, RAP1, RAP3	K12/1, K14/1, notes (N16)
Lowland	Northwest outwash and local alluvium	Kanuka-manuka low forest and scrub (6c)	Alluvial terrace, alluvial flat	PNA2, RAP1, RAP2	K12/3, K14 description, notes (N20)
Lowland	Northwest outwash and local alluvium	Manuka scrub (6c)	Flood plain, scarp, terrace riser	PNA1, RAP2, RAP3	K12/2, notes (N16)
Lowland	Northwest outwash and local alluvium	Raupo reedland (12)	Old stream channel		Notes (N39)
Montane	Inland greywacke hill country	Mountain beech forest, scrub and treeland (1)	Colluvial hill side slope, crest, flat, fissure	PNA9, PNA10, RAP6, RAP7, RAP8, RAP23, RAP24, RAP29, RAP30	K2/5, K5/1, K7/6, K10 description, K18 description, H15/1, H24 description, H32 description, notes (N35)
Montane	Inland greywacke hill country	Mountain beech-Hall's totara forest and treeland (1)	Colluvial hill side slopes	PNA10	K7 description
Montane	Inland greywacke hill country	Mountain beech-black beech-red beech forest (2)	Hill side slope, toe slope	RAP26	H28/5, notes (N1)
Montane	Inland greywacke hill country	Mountain lacebark shrubland (5g)	Hill side slope	RAP23	H15/5, H24 description
Montane	Inland greywacke hill country	Manuka scrub and shrubland (6a)	Hill side slope	PNA9, RAP7	K3 description, K7 description

BIOCLIMATIC ZONE	LAND SYSTEM	VEGETATION AND TYPE CODE	LANDFORM TYPE(S)	RAP AND PNA	PLOT NO.'S
Montane	Inland greywacke hill country	Kanuka forest and scrub (6b)	Colluvial hill side slope	PNA9, RAP8	K3/4, K10 description, H4 description, H24 description
Montane	Inland greywacke hill country	Kanuka-manuka forest and scrub (6c)	Spur side slope, hill side slope	PNA10, RAP7	K7/5
Montane	Inland greywacke hill country	Mixed scrub and shrubland (8a)	Talus hill side slope, colluvial hill and mountain side slope, knoll, bluff	PNA9, PNA10, RAP6, RAP8, RAP12, RAP15, RAP23, RAP24	K2/6, K9 description, K10/1, H4/1, H4/2, H15/2, H15/4, H32/1, notes (N35)
Montane	Inland greywacke hill country	<i>Olearia nummularifolia</i> shrubland (8a)	Gully head	RAP24	H32 description
Montane	Inland greywacke hill country	Mixed shrub-grassland and short tussockland (8c)	Hill side slope, mountain side slope, crest, ridge	PNA9, PNA10, RAP6, RAP12, RAP15, RAP23, RAP24	K2/7, K3/6, K9 description, K17/1, H4/1, H15/3, H28/7, H32 description, notes (N35)
Montane	Inland greywacke hill country	Mixed shrub-rockland and rockland (9)	Rock outcrop, bluff	PNA10, PNA8, RAP15, RAP24	K7 description, K10 description, H4 description, H32 description, notes (N26, N35)
Montane	Inland greywacke hill country	<i>Carex secta</i> sedgeland (11)	Gully bottom	RAP23	H15 description
Montane	Inland greywacke hill country	Wharariki flaxland (13)	Mountain side slope, ridge, colluvial hill side slope	RAP15	H32/2, H4 description
Montane	Inland soft rock hill country	Mountain beech forest (1)	Hill side slope, scarp, gully, riparian zone	RAP27, RAP28, RAP29	H20/1, H23 description, Notes (N48)
Montane	Inland soft rock hill country	Mixed scrub and shrubland (8a)	Talus on hill side slope, boulderfield at cliff base, bedrock crevices, colluvial hill side slope	RAP22, RAP30	H2/2, H3/2, H24 description, notes (N47)
Montane	Inland soft rock hill country	Mixed shrub-tussockland (8c)	Hill crest, colluvial side slope	RAP4, RAP8	K3/7, K10 description, K17/2, H2/1

BIOCLIMATIC ZONE	LAND SYSTEM	VEGETATION AND TYPE CODE	LANDFORM TYPE(S)	RAP AND PNA	PLOT NO.'S
Montane	Inland soft rock hill country	Short tussockland (8c)	talus flat, mountain side slope and crest	RAP6, RAP8, RAP30	K2/7, H3/3, H24 description, K10 description
Montane	Inland soft rock hill country	Mixed shrub-rockland and rockland (9)	Bluff, rock outcrop, talus at cliff base	RAP22, RAP23, RAP30	H3/1, H15 description, Notes (N47)

Appendix V

THREATENED, RARE OR LOCALLY- OCCURRING PLANTS WITHIN HUNDALEE ECOLOGICAL DISTRICT OBSERVED OUTSIDE NATURAL AREAS

SPECIES	THREATENED CATEGORY/ STATUS	CONSERVANCY	GRID REFERENCE	HABITAT
<i>Alepis flavida</i>	B. Vulnerable	Canterbury	NZMS 260 N32 210543	Hosted by black beech individuals on roadside verge.
<i>Urtica linearifolia</i>	B, Vulnerable	Nelson/Marlborough	NZMS 260 O31 595661	Beside ditch and among fenceline.
<i>Notospartium torulosum</i>	Rare	Canterbury	NZMS 260 N31 219606	Scattered individuals among pasture.
<i>Notospartium torulosum</i>	Rare	Canterbury	NZMS 260 N32 283581	Among manuka scrub, recently planted in pines.
<i>Ileostylus micranthus</i>	Local	Nelson/Marlborough	NZMS 260 O31 443683	Hosted by scattered individuals of kanuka in paddock.

Appendix VI

GEOPRESERVATION SITES

(From Kenny and Hayward (1993a and 1993b))

NAME	IMPORTANCE	VULNERABILITY	CONSERVANCY	GRID REFERENCE	TYPE	DESCRIPTION/SIGNIFICANCE
Anandale (Mt. Cookson) karst	National	Unlikely to be damaged by humans.	Canterbury	NZMS 260 N32 226517	Karst system	Field of dolines/tomos. Hazy Hole Cave (approx. 400m long).
Glenstrae Pleistocene fauna	National	Unlikely to be damaged by humans.	Nelson/Marlborough	NZMS 260 O32 491526	Fossils - Quaternary	Most diverse bathyal Pleistocene fauna in New Zealand.
Haumuri Bluff sea arch	Regional	Unlikely to be damaged by humans.	Nelson/Marlborough	NZMS 260 O32 519491	Sea arch	A prominent and attractive feature. Classified as an extremely well defined landform of scientific/ educational and scenic value.
Kaikoura coastal features	National	Unlikely to be damaged by humans.	Nelson/Marlborough	NZMS 260 O31 558610	Sea cliff - coastal stack	Good example of steeply cliffed coast, rocky headlands and stacks. Classified as extremely well defined landforms of scientific/educational and scenic value.
Mikonui earth flow	Regional	Unlikely to be damaged by humans.	Nelson/Marlborough	NZMS 260 O32 510536	Earth flow	A good example of an earth flow. Classified as an extremely well defined landform of scientific/ educational value.
Oaro shore platform	Regional	Unlikely to be damaged by humans.	Nelson/Marlborough	NZMS 260 O32 515539	Shore platform	

NAME	IMPORTANCE	VULNERABILITY	CONSERVANCY	GRID REFERENCE	TYPE	DESCRIPTION/SIGNIFICANCE
Conway coastal mouth marine terraces	Regional	Unlikely to be damaged by humans	Nelson/Marlborough	NZMS 260 O32 515503 (centred at northern end of site)	Uplifted terraces, marine terraces.	Sequence of six marine terraces of Waioheran-Holocene age uplifted up to 300m (Tarapuhi Terrace) and tilted to the north. Terraces also show uplift rate was higher in the early Holocene than in the late Pleistocene.
Haumuri Bluff Upper Cretaceous sediments and fossils	National	Moderately vulnerable to modification by humans.	Nelson/Marlborough	NZMS 260 O32 522501	Strata - type/reference section. Biostratigraphic section. Fossils - Mesozoic.	A classic locality exposing the late Cretaceous sequence of Marlborough. Holostratotype of Haumuri and Piripauan Stages. Type locality for many late Cretaceous molluscs and vertebrates. Well preserved macro and microfaunal remains.
Hundalee Hills deep sea canyon	National	Could be improved by human activity.	Nelson/Marlborough	NZMS 260 O32 451474	Strata - basal	Preserved wall of late Pliocene deep sea canyon.
Lower Conway railway cutting Cretaceous Tertiary boundary	Regional	Unlikely to be damaged by humans.	Nelson/Marlborough	NZMS 260 O32 473443	Cretaceous/Tertiary boundary	Phosphatised pebbles in quartz sandstone. Good section through upper Cretaceous and Paleocene, including unconformity of Paleocene age.

Appendix VII

SOIL SITES OF IMPORTANCE WITHIN THE HUNDALEE ECOLOGICAL DISTRICT

(From Arand et al., 1991)

NAME	IMPORTANCE	VULNERABILITY	CONSERVANCY	GRID REFERENCE	SOIL TYPE	DESCRIPTION/SIGNIFICANCE
Goose Bay - Omihia Scenic Reserve	Regional	Site is formally protected; no foreseeable threat to soil and/or vegetation.	Nelson/Marlborough	NZMS 260 O32 534586	Lowland yellow-brown earths (Patutu)	(i) Moderate variety of habitats from sunny faces to deep shady gullies (ii) Coastal soil-vegetation associations are nationally uncommon.
Hyde Open Space Covenant (now Ngaroma Scenic Reserve)	Regional	Site is formally protected; no foreseeable threat to soil and/or vegetation.	Nelson/Marlborough	NZMS 260 O32 372510	Yellow-grey to yellow-brown earths intergrade (Hundalee)	Possibly the only remaining example of Hundalee soils under native vegetation.
Limestone Creek Scenic Reserve	Regional	Site is formally protected; no foreseeable threat to soil and/or vegetation.	Nelson/Marlborough	NZMS 260 O32 461485	Lowland yellow-brown earths (Hurunui)	This is one of the few remnants of Hurunui soils under beech forest in southern Marlborough (this association was formerly much more extensive).
Lottery Bush Scenic Reserve	National	Site is formally protected; no foreseeable threat to soil and/or vegetation.	Canterbury	NZMS 260 N32 175506	Yellow grey to yellow-brown earths intergrade (Wandle); Yellow-grey earths (Lottery)	(i) Few soils derived from Tertiary sandstone remain under native forest in New Zealand. (ii) This is the only site where Wandle and Lottery soils are protected together. (iii) Soils under forest on terraces in dry parts of the South Island are uncommon.

