CLASSIFICATION SYSTEM

FOR

PRODUCTIVE LAND

IN THE

TASMAN DISTRICT

Report prepared for : Tasman District Council

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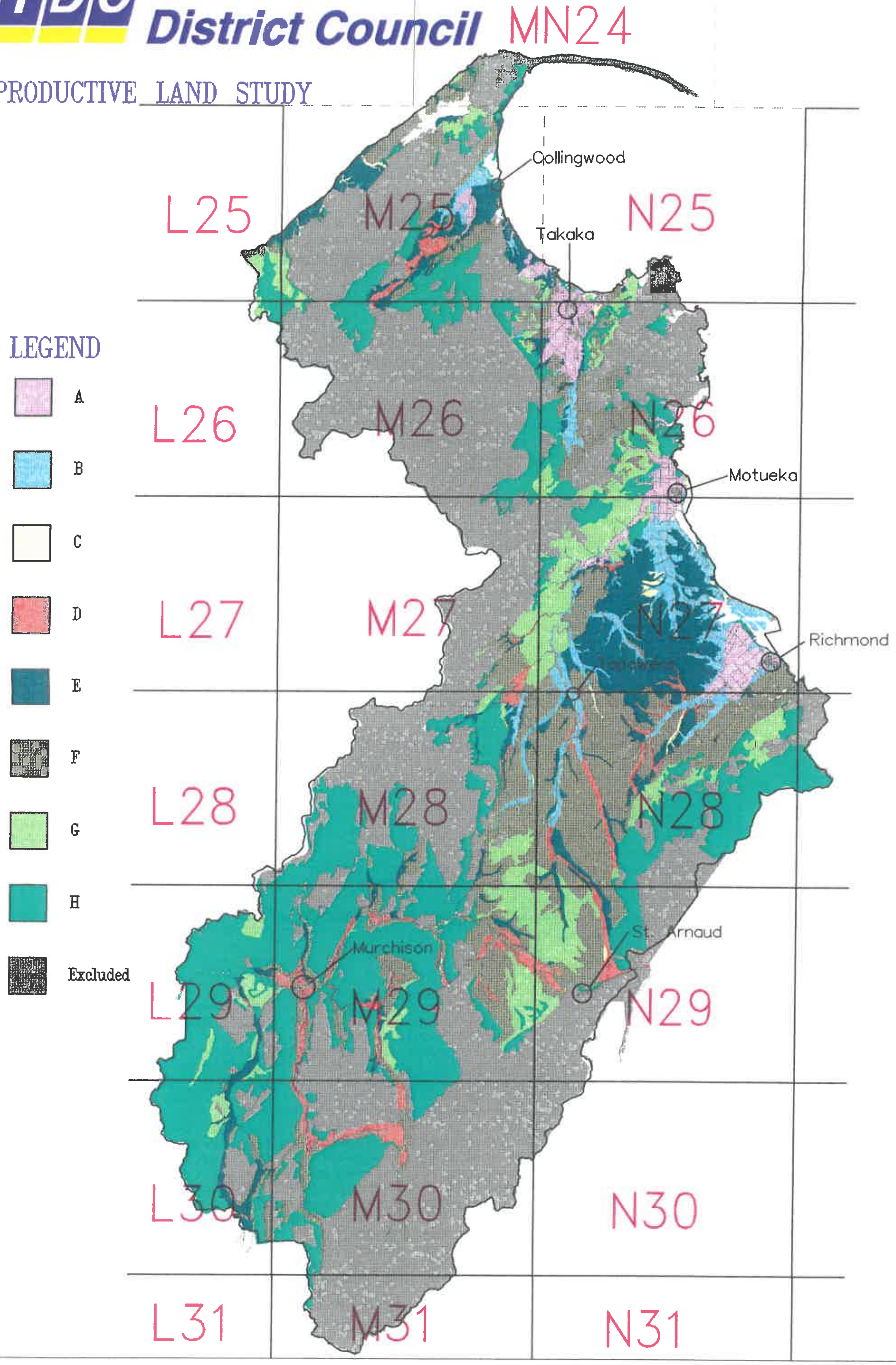


SUMMARY

Agriculture New Zealand was commissioned by Tasman District Council to class productive land in the Tasman District into similar groups. The focus of the project is to group land units with similar flexibility in terms of the activities that could be sustained by that land unit. The project was constrained to inherent physical characteristics of the land. The outcome of the project is a report detailing the classification system used and a series of maps at scales suited for planning purposes (mainly 1:50,000, with some 1:25,000)

Land units were grouped into similar classes using a range of topographical, soil, climate and past use criteria. No field visits were made for this project. It was a desk top study using published information and knowledge obtained in past field work for other purposes.

The groupings differ to those suggested by the Land Use Capability system prepared by NWASCO, particularly in the highly flexible land units. The LUC system consistently undervalued some types of soils and climatic areas.

Land was grouped into 8 classes. The classes were mainly based on a hierarchy of suitability to a range of enterprises. The key criteria used was the suitability of a land unit for a range of activities. The most flexible land units were those that had a wide range of activities that it could sustain. The least flexible units were those that could only sustain a few productive activities or none at all.

The land classes are summarised in figure 1. This shows that there is a significant area of very flexible land, in the coastal area in the North of Tasman District. Most of the district is non productive through being excluded as national parks etc.

	TDC Land Class		Area	
			(ha)	(%)
Very Flexible	A	Very Intensive Horticulture	22,223	2.3
	B	Semi-Intensive Horticulture	29,958	3.1
	C	Intensive Cropping	2,521	0.3
	D	Cropping	21,847	2.2
	E	Intensive Pastoral	64,439	6.6
	F	Extensive Pastoral	136,305	14.0
	G	Production Forestry	53,403	5.5
Inflexible	H	Non Productive	223,519	23.0
	Exc	Excluded	416,403	42.9
		Total	970,618	100.0

NB: Minor revisions to area in each class may made due to final map checking.

ACKNOWLEDGEMENTS

This project was greatly assisted by the efforts of Alex Shearer and Les Beecher of the Graphics Information System (GIS) section of the Tasman District Council. Their efforts in drawing source maps at the correct scale greatly increased the productivity of the mapping process. Inputting the finished maps into the GIS will increase the usefulness and ease of use of the system.

Feedback from Mary-Anne Baker and Geoff Markham of the TDC was appreciated.

We would also like to thank Ministry of Forestry (MoF) and Les Molloy for allowing parts of their publications to be reproduced in this report.

PROJECT TEAM

This project was a team effort. The team members and their areas of contribution were:

Mike Kearney, Agriculture New Zealand, Richmond
- project coordinator, report writing and climate data

John Bealing, Agriculture New Zealand, Richmond
- mapping, soils and water

Iain Campbell, Land and Soil Consultancy Services, Nelson
- soil science and mapping

Elton Merrin, Agriculture New Zealand, Richmond
- district knowledge of climate and soils relating to agriculture in the Tasman District

Dennis Crone, Agriculture New Zealand, Motueka
- district knowledge of climate and soils relating to agriculture in the Tasman District

Clive Cook, Agriculture New Zealand, Richmond
- district knowledge of climate and soils relating to horticulture, particularly in Richmond and Tapawera

Steven Spark, Agriculture New Zealand, Motueka
- district knowledge of climate and soils relating to horticulture, particularly in Golden Bay and Motueka.

1.0 INTRODUCTION

1.1 The issue

Tasman District Council needs information on productive quality of lands to assess :

- conflicting benefits to parties regarding land use
- restrictions necessary to prevent adverse effects on the
  - productive quality of land
  - other resources or users
- identify values to protect (eg high value land)

Examples of planning needs are:

- Gravel plan
- Subdivision, especially for Rural Residential
- Resource consents for - discharges
  - mining
  - building
  - land disturbance

To date, land use has been classified using Land Use Capability (LUC) maps and soil surveys. There are a number of factors that suggest a classification system should be revised:

- better knowledge of soil resources
- experience with new technologies
- advances in classification systems
- concept of sustainable management embodied in the Resource Management Act (RMA)
- scale of maps is often to broad for planning needs

1.2 Purpose

The purpose of this report is to set out the criteria and parameters of a land classification system to be used to map the productive values of the land in Tasman District. The objective is to give a quantifiable structure to the land classification system such that other people can interpret and understand why a particular area of land is given a certain class.

1.3 Scope

The area considered is the area administered by the Tasman District Council, excluding land reserved for non productive use such as Conservation areas, reserves and National Parks.

This report aims to provide information on the potential use for land. Existing use may provide information about the capability of land but the project is not restricted to existing use.

The focus of the report is on land used for productive purposes. It is recognised that there are other viewpoints regarding land (eg Conservation, Bio-diversity) but these are not considered in this report.

1.4 Outcome

The end point of this project is to provide a land resource classification system that may be used in developing district planning policies on land management. It is not intended to develop plans or give policy advice as part of this project.

The classification system will consist of this report which outlines the factors considered in giving rankings to individual areas. A series of maps will be drawn that show the classification given to all productive land areas in the Tasman District. Appendices to the report will provide additional information that will assist in the interpretation of the maps.

1.5 Focus

The focus of this classification system is on the **existing inherent characteristics** of land in the Tasman District. Inherent is defined to mean a permanent attribute of the land.

Attributes can be modified - for example, slope can be improved through terracing, soil structure can be improved through the addition of organic matter. Major alterations to the characteristics of an area that would require significant capital or ongoing expenditure are not considered.

Modifications that would improve existing characteristics rather than change them significantly were considered. For example, wet soils can be improved through the addition of drainage. If the inherent characteristics of the land (eg soil structure) allow the soil to drain freely if the water table is lowered, then drainage is not taken as a limiting factor. If however, the structure of the soil is the cause of the wetness (eg heavy clay), then the land would receive a lower classification than a silt for example.

Existing characteristics are in some cases treated as inherent. Fertility levels are the main characteristic that there may be a difference in the present levels compared to the inherent levels. It is not considered realistic for planning purposes to ignore 50 to 100 years of fertiliser use when assessing land. For example, the Moutere hills had severe fertiliser limitations 50 years ago for pipfruit orchards. As a result of years of research work and fertiliser inputs, fertility levels are not a limitation for pipfruit orchards currently.

Drought susceptibility was not given a strong weighting in this classification system (as per brief). It was felt that drought could be ameliorated through irrigation. Although some areas are short of water, it is physically feasible to amend this short coming. Most other characteristics can not be amended completely. For example, excess rain is practically impossible to prevent - it is not feasible to stop rain from falling.

Flexibility of land is used as a proxy for value. Very flexible land is ranked higher than less flexible areas. Areas that have a high flexibility rating can grow a large range of crops or sustain a diverse range of enterprises. Areas that have a lower flexibility rating can usually grow fewer crops.

It may be possible to grow high value crops in areas ranked as less flexible. However, there may only be one or two high value crops that can be grown compared to a range of crops in another area. An example would be Tadmor compared to Riwaka. Tadmor can grow raspberries and hops. Both these crops can be grown in Riwaka but a range of other crops can also be grown such as kiwifruit and apples.

Current profitability levels of crops can change quickly - eg Kiwifruit. If a classification system is based on current profitability levels, there may need to be frequent changes of priorities to reflect changing enterprise profitability. For example, a classification based on temperate crops might downgrade an area such as Takaka which is more suited to subtropical crops. An area that can grow a wider range of crops or production enterprises should be able to sustain a high level of output over the long term rather than an area that is only suitable to a few activities.

2.0 SUSTAINABLE MANAGEMENT AND RESOURCE MANAGEMENT ACT (RMA)

Sustainable management is a very difficult concept to define. The general thrust of the RMA appears to be to provide future generations with (at least) the same potential as the present generation enjoy.

Issues that could impinge on productive land use include :

- erosion
- chemical pollution
- soil fertility
- urban spread on to high quality land.

Erosion and soil fertility are considered within this report. Chemical pollution is not as it is a result of land use whether for productive or other uses.

Urban spread is a planning issue beyond the scope of this report. One of the factors to consider is the productive value of the soils as well as other factors such as population growth etc.

Soil fertility is an example of sustainable management having an effect on the land classification. Some land has reverted in the last 10 years since fertiliser and other subsidies were removed in the mid 1980's. It appears the level of fertiliser that can be put on in the current economics of land activities means that some land activities are not sustainable. The concept of what is sustainable from a financial viewpoint can change over time. When considering soil fertility, the difference in reversion from high levels of fertiliser inputs in the mid 1980's to the situation in the early 1990's can give some guide as to the extent current production activities are sustainable with levels of inputs affected by financial considerations

Soil erosion and sustainable management is a characteristic which can be measured more objectively relating to physical factors only. If land is eroding due to land activities, then the physical potential of the soil is decreasing.

3.0 CLASSIFICATION SYSTEMS CONSIDERED

3.1 Land Use Capability (LUC) Assessment , National Water And Soil Conservation Organisation (NWASCO)

Widespread soil erosion lead to land use capability mapping starting in the 1940's. It was based on successful methods developed in the USA. The mapping started at the farm and individual run plans. Next catchments were mapped, then regions and finally the entire country was assessed in the early to mid 1970's[3].

The emphasis in the LUC system was conservation rather than production. An extended legend which gave more information about actual and potential production was added to the mapping system but this was a secondary use.

The classification system had two parts[3]. Firstly, land was broken up into small units that had similar physical properties (Land Inventory). The characteristics used to assess this inventory were:

Primary Characteristics
- rock type
- soil type
- slope

Secondary Characteristics
- vegetation
- erosion

Secondly, individual inventory units were grouped together into Land Use Capability classes based on needing similar - management levels
- intensity of conservation treatment

There are a number of areas that have meant the LUC classification system itself is not ideal for planning uses.

Firstly, the emphasis of the LUC was in conservation, particularly related to soil erosion. The system was based on a USDA method of classification related to soil erosion. As a consequence most of the emphasis tended to be on classes of land that were prone to erosion. Production was a secondary use. For example, the LUC classification system has 11 classes of vegetation related to scrubland but lumped all orchards into one class[2].

Secondly, the focus of the classification system was on forestry to pastoral agriculture to arable cropping. This is perhaps as a result of the emphasis on conservation. The effect is that the LUC system is not reliable in ranking land types for horticulture (see table 5). This limits the value of the LUC system in the Tasman District as horticulture is a significant land use in the district. Also, as horticulture is close to urban areas, it is often in conflict with other uses of land.

Thirdly, the LUC uses a national system of classes. While this does mean that the local land can be compared to other districts in New Zealand, it does limit the value for use within the region.

The LUC showed a minimal area of class I, with the next most common class being class IV. At a district level the difference between adjacent land units is often not that large.

Fourthly, there have been some significant changes in technology in the 20 years since the LUC was applied to the Tasman District. The main changes have been in irrigation systems. Low cost permanent irrigation systems such as trickle irrigation were only in a development stage in New Zealand in the 1970's. With the advent if these systems, stony soils such as the Ranzau and Hau soils were reassessed as being as good as river silts. The LUC system had assessed these soils as being difficult to crop as focus of the LUC was extensive agriculture rather than intensive. (In terms of the LUC classification systems, many land units graded as 'S' for soil limitations - due to the volume of stones - are no longer seen as limiting).

Finally, economic assumptions underlying the LUC meant that some soil types were down graded unnecessarily. Intensive land units, such as orchards, can afford to put more resources into land modifications than extensive units. For example, many soils classed as having wetness limitations ('W') in the LUC system, would not be considered as limiting for Orchards. Orchards can afford to spend more on drainage to remove excess water. Provided the physical characteristics allow free drainage once the water table has been lowered, much land classed as wet by the LUC system would now be classed as suitable for intensive use.

It is difficult to completely separate the maps from the classification system as one influences the other. In the case of the LUC maps there are number of reasons why they are no longer adequate for planning purposes:

(a) Scale - the existing LUC maps were prepared at 1:63,650 (1 inch to the mile) which is out of date with the current metric scale commonly used of 1:50,000. Also for planning purposes, it would be ideal to have larger scale maps at 1:25,000.

(b) Existing use often had a significant influence on where boundaries were drawn in the LUC's Examples are

- boundaries between soil classes following property boundaries rather than contours
- Forestry block East of Kina Golf Course following property boundaries and roads rather than topography.

(c) With more data available some changes have been made to the LUC classes. The LUC sheets were based on soil maps prepared in the 1950's. Contour data was not available for some parts of the district. With additional information on contours, some areas are being reclassed, with boundaries of others adjusted. There is also some more detailed information available on soil types, especially in Golden Bay. More experience with a range of crops is highlighting potential areas unforeseen in the mid 1970's.

3.2 Existing and past use

Existing use can be a guide to the potential flexibility but other factors need to be considered. For example, pines are grown in the Moutere hills beside apple orchards on the same soil type.

Existing use also ignores past success and failures on a type of land. For example, the cropping potential of the Motupiko and Pigeon Valleys could be ignored if the past history of tobacco growing was overlooked.

3.3 Molloy[13]

Molloy[13] summarises the land use challenge as matching a crop to suitable climate and soil. The key requirements were given as:
- appropriate temperatures
- adequate and well distributed rainfall
- soils capable of storing - rainfall
  - nutrients

Guidelines given by Molloy for a flexible soil assessment system are incorporated into the soil criteria aspects of the classification system developed.

Molloy also outlines a system of assessing climatic factors. Although the focus is mainly on soils it does provide some information that helps identify and narrow the focus on which climate criteria are important and which aspects to measure. In particular, the map of soil temperatures (reproduced in appendix C.1) suggest that there is little difference climatically over the Tasman District for pastoral agriculture and production forestry. This suggests that any further data collection should be focused on the criteria for other productive uses such as horticulture.

3.4 Beck[8]

Beck[8] reports on a number of systems used by different countries for development purposes. Although his work is directed more at international institutions such as FAO rather than at a national level, there are a number of valuable points raised about a land classification system.

A key point that he makes is that it is very difficult to separate physical from economic or social issues. Land Inventory Units can be separated purely on physical characteristics. However, where small Land Inventory Units are grouped together, there is usually a bias towards some activities that appear more profitable than others. There is also usually an "ideal" land unit that others are compared to and ranked from. Often these two points are not given explicitly and therefore the bias of the study can be difficult to determine.

In the case of the LUC system, the bias was towards soil conservation, with productive aspects secondary. The crops that were considered were generally productive forestry, pastoral agriculture or arable cropping. Horticulture was not as important on the national scene 20 years ago as it is now.

Beck also suggests that the preferred way to amalgamate smaller land units into larger classes is to compare individual land units suitability to grow a range of crops.

3.5 Soil Bureau classifications

Various DSIR Soil Bureau publications give detailed classification systems. Most focus on classing the soils only and are very detailed. They are useful to distinguish land units between classes but not to determine the classification system itself.

Wilson and Giltrap[17], however, neatly summarises the relative importance of climate and soil types as :

Climate largely determines the type of crops that can be grown in a district
Soil types show the relative range of crops and land use systems that are feasible within the climatic limits

4.0 OVERVIEW OF CLASSIFICATION SYSTEM CHOSEN

The key measure of flexibility in this project was taken as suitability of land units to a range of crops.

Soil, climate and topographical criteria were itemised and ranked. These were then applied to individual land units. In some cases, a land unit could be ranked purely on its physical characteristics. However, in most cases, the range of crops that could be grown was the final determinant of the ranking of a land unit.

The key question that was often posed was "Does this soil/climate/topographical attribute mean that this land unit is less flexible than its neighbours? Can it grow a wider or narrower range or crops or land use activities?"

4.1 Ideal Land Unit

As Beck[8] mentioned, there is often an "Ideal" land unit that is used as the best land unit in the district. In this project the ideal land unit would be something like a Riwaka Silt. Riwaka has a warm relatively frost-free climate, that can grow a range of crops from vegetables to hops to citrus. The silt soil types found near Riwaka are deep free draining soils, as good as any silts in Hawkes Bay or Gisborne.

4.2 Ideal Crops

It is difficult to separate out the current profitability of crops or activities when assessing suitability of a land unit for a crop. The list below gives the broad economic ranking of current land use activities in the Tasman District. It is not necessarily based on profit but on total output per hectare, including on and off farm sectors.

1) Glasshouse and protected cropping

2) Nursery, floriculture

3) Fruit Crops
   - Pipfruit
   - Hops
   - Kiwifruit
   - Berryfruit

- Citrus
- Subtropicals
- Grapes

4) Market gardening/tobacco

5) Process vegetables

6) Arable cropping

7) Dairy

8) Other Intensive pastoral

9) Extensive pastoral

10) Production forestry

4.3 Number and type of classes

The classification system was broken into 8 classes. This gave sufficient range to distinguish between major flexibility groupings without needing to many classes.

It is coincidental that there are 8 TDC classes - the same number of classes as in the LUC system. We did consider changing the number of classes to avoid this comparison. However, 8 classes gives a good balance for a classification system of flexibility compared to simplicity.

The classes are ranked from A to H with A being the most flexible. The system is shown below in figure 2.

More flexible classes can sustain a wider range of enterprises than less flexible classes. For example, class A can sustain enterprises ranging from Very Intensive to Non Productive. Class B can not sustain Very Intensive enterprises but can sustain Semi-intensive to Non Productive.

A land unit that is rated as highly flexible can sustain enterprises that are currently very profitable through to unprofitable. It is doubtful if, for example, pine trees would be planted instead of apples on the Waimea plains. However, the flexibility is there. Less flexible land units, such as G, may only be able to sustain plantation forestry, recreation or conservation.

Range of enterprises that could be sustained on a land unit	TDC Class							
	Very Flexible —— Inflexible							
	A	B	C	D	E	F	G	H
Very Intensive Horticulture	■							
Semi-IntensiveHorticulture	■	■						
Intensive Cropping	■	■	■					
Cropping	■	■	■	■				
Intensive Pastoral	■	■	■	■	■			
Extensive Pastoral	■	■	■	■	■	■		
Production Forestry	■	■	■	■	■	■	■	
Non Productive	■	■	■	■	■	■	■	■

Figure 2: **Land Class and Suitability to types of enterprises**
(Shaded areas show uses for which classes are suitable)
Adapted from Buckman et al[9]

The main crop or land use activities in each group are listed below. More detail is given in section 7.0

Potential Use - examples

A - nursery, floriculture, orchards, market garden, cropping, pastoral, production forestry

B - nursery, floriculture, orchards, market garden, cropping, pastoral, production forestry

C - nursery, vineyards, market garden, cropping, pastoral, production forestry

D - cropping, pastoral, production forestry

E - Dairy, other intensive and extensive pastoral and production forestry

F - Extensive Sheep and beef, production forestry

G - Production forestry

H - Non productive - Recreation, Conservation

5.0 DETAILS OF CLASSIFICATION SYSTEM

5.1 Overview of Criteria chosen

The four groups of criteria chosen were :
- Climate
- Topography
- Soils
- Existing and Past land use

Climate is the most important criteria to consider at this stage as it sets the overall limits on what crops can be grown in a location. The other 3 criteria can be considered in detail at each land unit.

Climate

The main climatic feature affecting land suitability appears to be temperature. Rainfall is generally adequate throughout the region. The driest part is the Moutere depression, which can be irrigated in some cases.

Pastoral and Forestry

Temperature generally does not limit pastoral or forest industries for most of the district. The soil temperature classification in Molloy[13] (reproduced in appendix C1) shows most of the district classed as mild to cool. The frigid zones are either too high for productive use and/or are parts of areas excluded from this study due to being in a National Park for example.

There are variations due to site specific factors such as soil type and orientation. However, climate on its own does not appear to limit either of these enterprises from any parts of the district.

In general, dairy farms seem to be limited to the mild or warmer districts. Pasture growth on dairy farms does not vary significantly between Murchison or Takaka. Pasture growth monitoring by Tasman Milk over the last 4 years shows very similar pasture production levels between Takaka and Murchison[12]. The growth may occur over different time periods but the total is similar.

Average annual pasture production over the last 4 years on a number of sites show a range of :

Murchison	- 12.5 to 14 tonnes of Dry Matter/ha/year
Collingwood	- 12 to 14
Takaka	- 12 to 13.8
Motueka (unirrigated)	- 9.5
Nelson (irrigated)	- 13

Regions classed as cool by Molloy[13], are generally those areas that are currently predominantly used in Extensive sheep and beef or Forestry. This classification is spread evenly over the district. Specific limitations will be more important than climatic zones.

Forestry appears to grow in all parts of the district provided altitude is less than 600m and rainfall is greater than 600 mm pa[5,6]. Trees will grow between 600 and 1200 metres, but the growth rate is much slower. The tree rotation increases from 25-30 towards 50-60 years at these higher altitudes which often means that altitudes above 600m are not suitable for practical commercial use.

Areas that are potentially suitable for forestry are spread throughout the district. (see appendix D.1). Although there is some upwards variation in site index ranking near the coast (see appendix D.2), for most of the district climate should not limit production forestry. Specific limitations are likely to be more important to assess suitability for forestry, than climate.

Horticulture and Cropping

The key issue is this report are those areas that are classed as warm under Molloys[13] system. These areas would be suitable for more intensive land uses such as horticulture. Much of the coastal areas are classed as warm However, there are differences in microclimate as distance from the coast increases.

Detailed climate criteria should therefore concentrate on suitability for horticultural crops.

Table 2 : **Summary of Land Classification Criteria**

	Land Class	Criteria														
		Climate					Topography		Soil							Past Use
		Altitude	Length of growing season	Heat over summer	Rainfall	Wind	Slope (Degs)	Orientation (North/ South)	Fertility	Water Holding Capacity	Rooting depth (m)	Erosion	Structure/ Texture	Drainage & Permeability		
Very Flexible	A	<50m	1-4	1-5	4-6	1-5	<= 3	n/a	1-5	1-5	>=1.0	0	3-6	1-3		
	B	<50	1-9	1-7	3-6	1-5	<=15	N	1-5	1-5	>=0.8	0-1	2-6	1-3		
	C	<300	1-9	1-8	2-6	1-5	<=15	N/S	1-5	1-4	>=0.6	0-1	2-6	1-3		
	D	<300	1-11	1-8	2-5	1-5	<=18	N/S	1-4	1-3	>=0.6	0-1	2-6	1-3		
	E	<300	1-11	1-8	2-5	1-5	<=28	N	1-4	1-3	>=0.6	0-2	2-5	1-4		
	F	<1200	1-12	1-10	1-6	1-6	<=35	N/S	1-4	1-3	>=0.2	0-3	2-4	1-4		
	G	<600	1-12	1-10	1-5	1-6	<=35	N/S	1-5	1-3	>=0.8	0-4	2-4	1-4		
Inflexible	H		1-12	1-10	1-6	1-6		N/S	1-5	1-5		0-6	1-6	1-5		

NB: No single factor can be taken in isolation. A number of factors are considered when deciding on the classification of a particular land unit. The final assessment is made using professional judgement.

5.2 Climate

Although climate does not vary as much across a district as soil characteristics, evidence of climatic variation is less obvious than different soil types. Proof of variation is also more difficult with climate as climate varies from day to day in the same spot whereas soil characteristics do not.

Areas in the Tasman District were ranked using mainly expert opinion. Climate data from weather stations was used where it was available. However, there are only a few weather stations in the district with observation over a long period. These stations do not provide enough detail for the scale required for this project. A summary of key weather parameters is given in table 3.

Altitude

Permanent snowline from 2000 metres up.
Treeline from 1200 to 1300 metres
Production forestry up to 600 metres

Heat over summer (hot to cool)

The heat units given in table 2, show that Riwaka and Appleby are the warmest areas that records are available for. Next warmest areas are Kotinga, Tapawera and Lake Rotoiti. There are a number of microclimates around the region as listed below.

1 = Dovedale
2 = Clifton/Motueka Valley/Upper Moutere
3 = Riwaka/Motueka/Waimea/Golden Bay Plains
4 = Golden Bay foothills/Aorere Plains
5 = Brightwater/Wakefield/Tadmor/Upper Takaka
6 = Puponga
7 = Wakefield to foot of Spooners
8 = Murchison
9 = West Whanganui
10 = Lake districts

Rainfall

High rainfall levels in Takaka places some limits on the range of crops that can be grown. For example, apples are not suited to commercial production for existing commercial varieties as high rainfall leads to high disease pressure.

The Aorere Valley is the only area where high rainfall is a major limiting factor. The annual rainfall south of Bainham is too high for existing commercial horticulture crops.

Rainfall groupings :

1. Extremely high	>3,200 mm	unsuitable for horticulture
2. Very High	2400 - 3200	some depressing effect on quality and yield
3. High	1600 - 2400	irrigation only needed for limited periods
4. Moderate	800 - 1600	irrigation essential for most soil types
5. Low	600 - 800	irrigation essential for most soil types
6. Very Low	<600	irrigation essential

See also the rainfall map in appendix C.3

Length of growing season (long to short)

The length of a growing season is often measured by the time between the last spring and first autumn frost of a season. This frost free period is quite closely related to the average seasonal temperature[9].

Table 2 shows that Kotinga, Riwaka and Appleby have similar mean temperatures. Tapawera and Lake Rotoiti have significantly lower average temperatures. These latter two areas also have significantly more frosts.

Taking microclimates into account, the district was split up into the following groups:

1 = Clifton
2 = Motueka/Aorere plains, Puponga, West Whanganui
3 = Waimea plains
4 = Riwaka/Takaka Plains
5 = Golden Bay foothills
6 = Spring Grove to foot of Spooners, Upper Takaka
7 = Motueka Valley
8 = Tadmor and Upper Moutere
9 = Dovedale
10 = Murchison
11 = Lake districts

See also appendices C.1, C.4, C.5 and C.6 for more information.

Wind over growing season (least to highest)

The windiest part of the district is the West Coast areas

1 = Dovedale
2 = Motueka Valley/Tadmor/Upper Moutere
3 = Clifton/Motueka and Riwaka plains/Coastal Foothills (Mariri to Appleby)
4 = Takaka
5 = Aorere/Waimea/Puramahoi plains, Puponga
6 = West Coast, Pakawau

Table 3: **Summary of climate data from available weather stations in the Tasman District**

Location	Period	Average Annual Temperature (°C)	Ground Frost (number of days)	Heat Units (Degree Days base 10°C)	Average Annual Rainfall (mm)	Sunshine hours (annual total)	Wind (Mean daily windrun km)
Kotinga	1986-94	12.3	59	981	2,201	2,243	180
Riwaka	1986-94	12.3	88	1,060	1,437	2,354	118
Appleby	1986-94	12.8	60	1,149	1,013	n/a	179
Nelson Airport	1941-80	12.1	89.7	1,038	986	2,397	264
Appleby	1932-80	12.5	70.3	1,060	955	n/a	174 (1971-80)
Riwaka	1956-80	12.5	82.0	1,151	1,381	2,418	136
Tapawera	1930-80	10.5	117.6	723	1,307	n/a	146 (1971-80)
Lake Rotoiti	1965-80	9.1	127.1	493	1,562 (1958-80)	n/a	n/a
Source : NZ Met Service[4], NIWA[7]							

Summary of Suitability of Climate for Horticultural Crops

Climate factors have been grouped together based on the above climate criteria. The localities in each area are listed below and shown on appendix C.2

The areas are defined conservatively. Therefore there may be locations inside an area where there is a better microclimate due to say shelter. There may also be areas where climate can be improved, particularly as a result of better shelter.

The basis of grouping areas together is the effect it would have on changing a land class. Climate can vary from one location to the next. The concern in this paper is not to highlight the variation from location to location but show the area within which climate is believed to be similar from its effect on land use and the range of crops that can be grown in an area.

The table below shows only distinctions relating to horticulture. As previously mentioned, the Tasman district is generally suitable throughout the region for pastoral or forestry uses, from a climatic point of view.

The groupings are :

1(a) Coastal area from Motueka township to Riwaka Valley
- little frost or wind
- can grow a wide range of temperate and subtropical crops, from tobacco though apples to avocados

1(a) Clifton
- can grow a wide range of subtropical crops but not temperate as it is too wet and not enough winter chilling for flower set.

1(b) Waimea/Riwaka/Motueka plains and Coastal Moutere foothills
- can grow a similar range of temperate crops as 1) but not warm subtropical plants as it is too cold and frosty

1(b) Lower Takaka, Puramahoi
- suitable for subtropical crops with some limitations due to wind and frost risk

2(a) Wakefield, Motueka Valley, Upper Moutere
- hot, dry climate suitable for temperate crops with some limitations due to a shorter growing season, drought over summer and frost

2(a) Central Takaka
- higher rainfall, greater frost risk and shorter season than Lower Takaka zone

2(a) Collingwood
- higher rainfall than Lower Takaka or Puramahoi

2(b) Dovedale, Tadmor
- shorter season and greater frost risk than Wakefield

2 (b) Golden Bay foothills
- more wind than plains

3(a) Puponga, Rockville
- high rainfall and wind

3(a) Murchison, Rosedale/Dovedale Hills
- cold with a short growing season and frequent frosts

4) Aorere(south of Bainham) - very high rainfall
Canaan - risk of snow and frost during the season

5) West Coast - extreme wind and rain
Lake districts - very cold with a short growing season

It should be emphasised that the above classification is based on flexibility rather than temperature. A warmer climate is not necessarily better. An area may be cool but dry and be able to grow a wider range of crops than another area that is hotter but wetter. For example, Rockville is ranked lower than Tadmor. Although Rockville is considerably warmer, its high rainfall restricts the number of crops that can be grown there, more so than Tadmor does. While the climate is warmer in Takaka than some other parts of the Tasman district, the range of horticultural crops that can be grown is restricted to subtropical rather than deciduous.

The climate grouping and map is based on observations of a number of crops over a number of years. There is only a limited number of weather stations to provide any quantitative backup. The map is deliberately drawn at 1:250,000 as there is not enough detail to overlay at 1:50,000 level. However, this has led to some uncertainty about boundary lines in many inland boundaries. Therefore the map is only indicative of the general areas.

5.3 Topography

The criteria assessed were slope and Orientation

Slope

	Degrees	Limiting factor
1 = Flat	0 - 3 degrees	Irrigation
2 = Mild slope	4 - 15	Cultivating row crops
3 = Moderately Steep	16 - 18	Cereal harvesters
4 = Steep	19 - 28	Vehicle access without tracks
5 = Very steep	29 - 35	Vehicles restricted to tracks
	> 35	Prone to erosion

Orientation

Suitability of North or South orientation depends on other factors such as climate. For example, in warmer areas South facing slopes may be better for pasture or forestry, whereas in colder areas, North facing slopes may be preferred.

Generally, North facing slopes would be required for a land unit to be classed as very flexible. Valleys running East/West would usually be assessed as colder than other areas in the same locality, particularly if the valley was narrow (eg <100m with high valley walls).

5.4 Soil

Soil Structure and Texture

Soil structure and texture affect root penetration, plant stability, nutrition and moisture extraction. Plants have different tolerances to different characteristics relating to soil structure and texture. The most important characteristic affecting suitability for different enterprises is often drainage.

1. Rock - strong structure, low Organic Matter (OM) and fertility , poor drainage
2. Clay - weak structure, high OM and fertility, poor drainage
3. Peat - weak structure, high OM and fertility, good drainage
4. Silt - medium structure and OM, high fertility, good drainage
5. Sand - strong structure, low OM and fertility, good drainage
6. Stony - strong structure, low OM and fertility, excessive drainage

Drainage and Permeability

Drainage may be limiting due to
- high water table
- pans
- global warming
- soil structure and texture

1 = Well drained
2 = Well drained to moderately drained
3 = Imperfectly drained
4 = Poorly drained
5 = Very poorly drained to very excessively drained

Rooting Depth

Rooting depth is the distance from the soil surface to inhibiting factors such as depth to factors inhibiting root growth eg
- pans
- water table
- abrupt changes in soil structure or texture (eg clay to coarse gravel)

	Rooting depth	Suitable for
1.	>= 1.0 metres	wide range of crops from shallow rooting grasses to perennial crops such as apples and pears
2.	>= 0.8	limitations may be overcome by additional drainage
3.	>= 0.6	unsuited to deep rooting crops such as apples and pears. Some crops such as grapes may tolerate the shallow rooting depth.
4.	>=0.3	suitable only for shallow rooting crops

Erosion

Erosion may be caused by unstable soil type, degree of slope or flooding potential. There are a number of different types - eg wind, sheet and scree creep. The classification used in the LUC system is given below.

	Area of Land affected
0 = Negligible	not significant
1 = Slight	1-10%
2 = Moderate	11-20%
3 = Severe	21-40%
4 = Very severe	41-60%
5 = Extreme	>60%

Natural Fertility

It is difficult to give one single element relating to natural fertility as plants need a range of elements such as Phosphorus, Potassium etc. The reaction of soils to added fertiliser is often as important as the natural level of fertility.

1 = Very high	Minimal additional fertiliser needed
2 = High	Moderate additional fertiliser needed
3 = Medium	Normal fertiliser program
4 = Low	Some elements deficient and need ongoing correction
5 = Very Low	Stopping the fertiliser program leads to reversion

Water holding capacity

Soils with high water holding capacity can tolerate lack of rain better than other soils. In the Tasman District, evapotranspiration levels are often 5 mm/day in summer, peaking in strong winds at 7 to 8 mm/day. Soils with low water holding capacity would need more irrigation or rainfall to grow a wide range of crops.

1 = Very high	> 130 mm water	eg Mapua Clay loam
2 = High	75 - 130	Waimea Silt
3 = Medium	50 - 75	Ranzau Stony Clay loam
4 = Low	25 - 50	Ranzau Gravelly Silt loam
5 = Very Low	<25	Tahunanui Sands

5.5 Past and Current use

Past and current use was mainly gauged from the experience of the people involved in the project. Current topographical maps and aerial photographs gave some indication of current land use. Relevant reports[18,20,21,22] and maps[19] were also used to assess known problem areas in the district eg Separation Point Granites[20] and Waimea-Lee-Roding Catchment Control Scheme[18,19].

6.0 APPLICATION OF CLASSIFICATION SYSTEM

6.1 The Process

This project is intended to group together individual land units with similar flexibility in terms of activities that can be sustained by those land units. The process involves grouping individual land units with varying characteristics based on the suitability of that land unit to grow a range of enterprises.

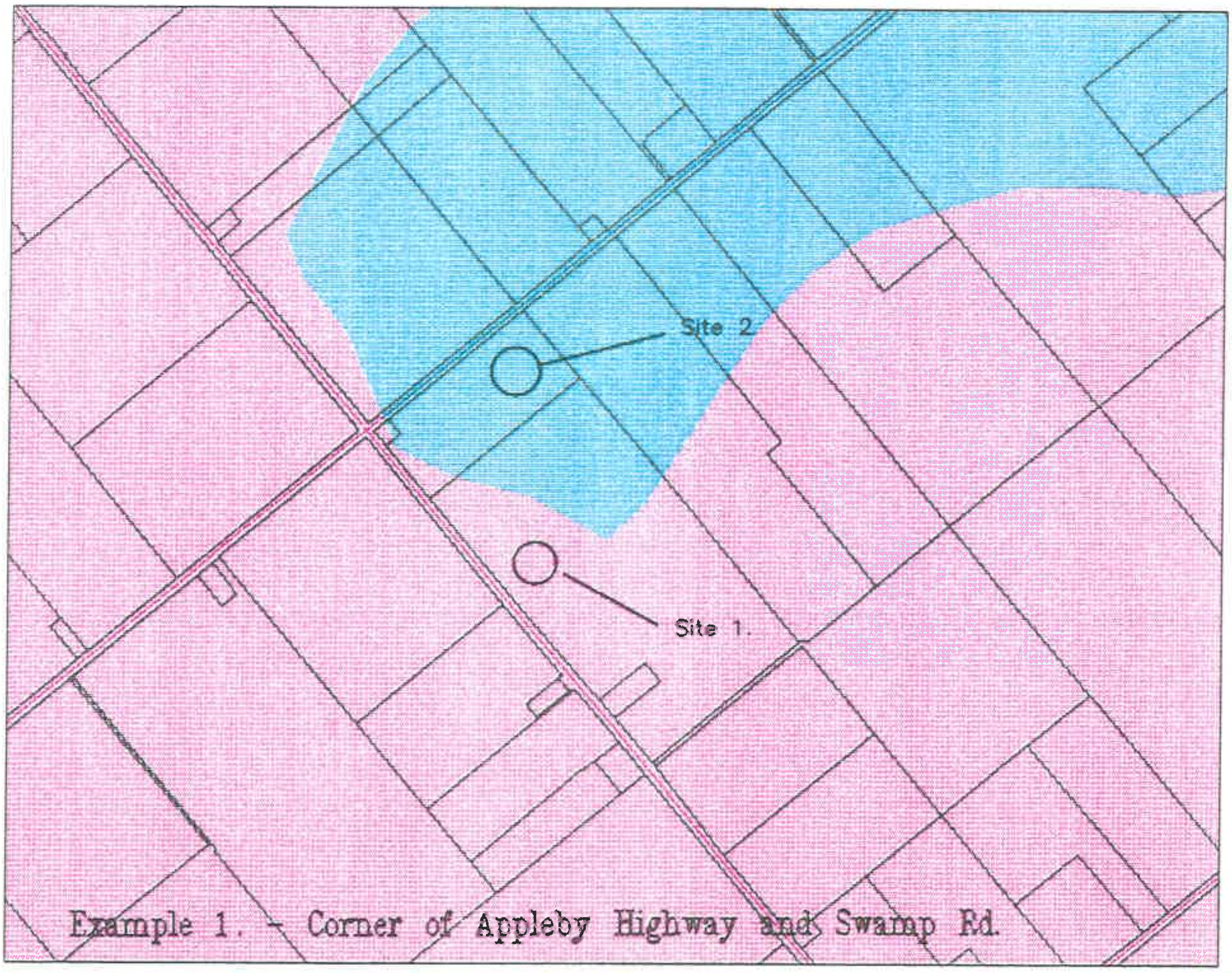
Individual criteria can not be considered in isolation. It is a balancing act. For example, in some circumstances, stony soils might be a limiting factor - eg in a cold climate, with shallow soils. In other circumstances, such as a warmer climate with greater rooting depth, stony soils may not be limiting.

It would be difficult, and time consuming, to give the ranking under this system of each characteristic for each individual land unit. Instead, the main themes running through a group are outlined in section 7.0. To help users understand how different characteristics were balanced in classing an individual land unit, the process of assessing an individual land unit is outlined in the examples below.

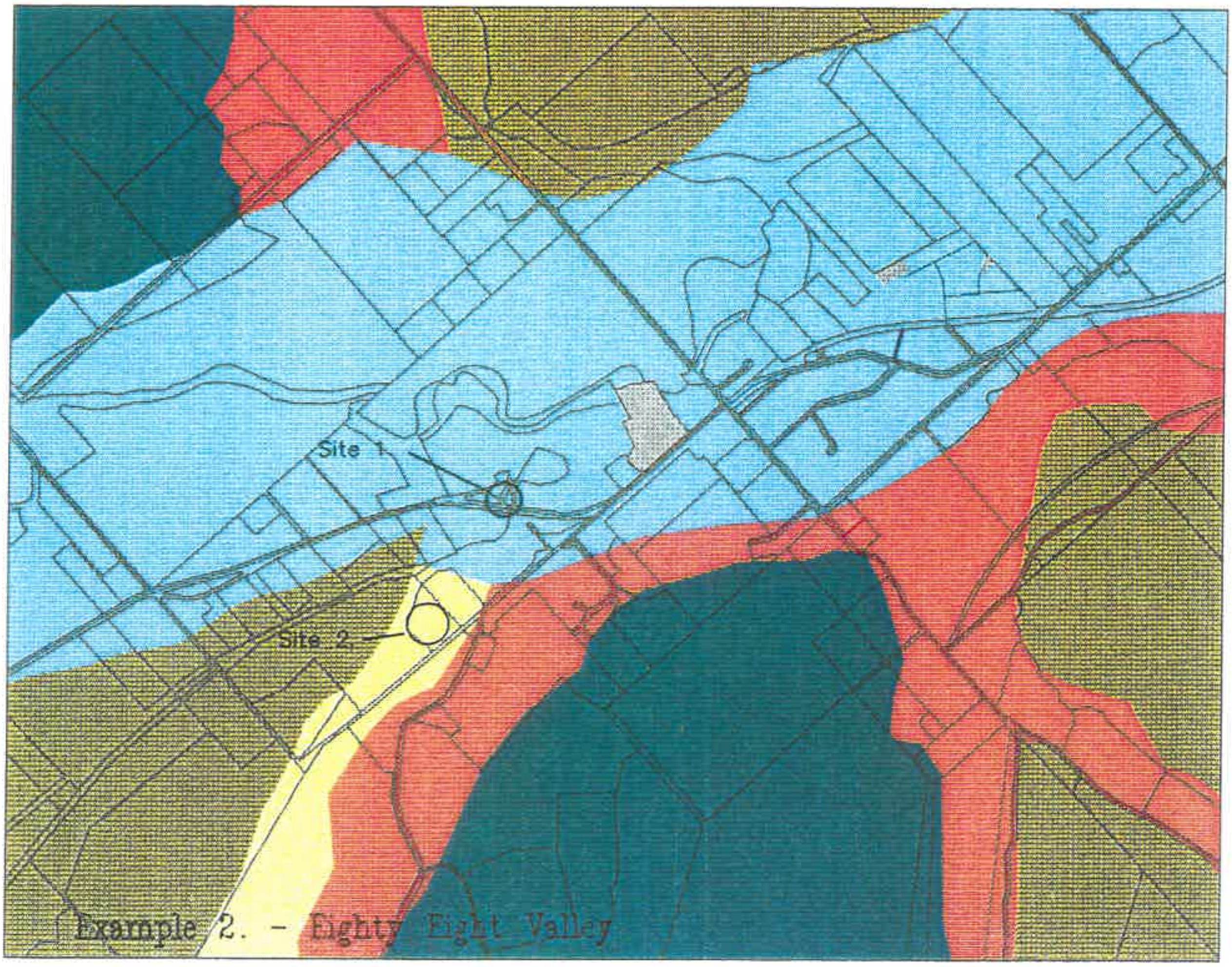
Example 1: Corner of Swamp Rd and Richmond to Motueka highway

Site 1: Climate - classed as 1(b) in appendix C.2
Topography - flat
Soil type - Ranzau stony clay loam from soil map. Classed as a grade A soil in appendix B. Fertility and waterholding capacity low but can be corrected. Erosion potential is low. Structure is stony, drainage verges on excessively drained, but has a good rooting depth (>1.0 metres) which compensates for the above.
Past History- wide range of crops can be grown provided irrigation is available.
Overall, there are no limitations that cannot be overcome by technology.

Site 2: Climate - as for site 1
Topography - as for site 1
Soil - soil type is Richmond Clay loam, which is classed as grade B in appendix B. Fertility and soil waterholding capacity are high, erosion is negligible. Structure is a heavy clay. Drainage is slow due to the slow permeability of the soil. Rooting depth is limited by a high water table. Drainage would lower the water table provided there is adequate fall to remove the water. However, the permeability of the soil is low due to the clay content. This



Example 1. - Corner of Appleby Highway and Swamp Rd.



Example 2. - Eighty Eight Valley

would mean that some sensitive crops would not be able to grow there.

Past History - mainly dairy farming. Some apples are grown in this soil type, although poorly drained blocks have been removed.

Overall, there are some limitations that would restrict the range of crops that could be grown.

Example 2: Intersection of 88 Valley with Main Highway South

Site 1: Climate- classed as 2(a) in appendix C.2 so there are some limitations due principally to the shorter growing season than class 1 climate groups

Topography- flat, valley running North/South

Soil - soil type is Motupiko loam. Moderate fertility and water holding capacity with deep root zone available. Erosion is negligible. Structure is silt. Soil type is free draining as a result of its open soil structure.

Past history- frost risk restricts some horticultural crops such as most apple varieties.

Overall, climate restrictions mean this land is less flexible than example 1.

Site 2: Climate- same as site 1

Topography- flat, but facing East/West

Soil- as for site 1, but tending to be shallower soils

Past History - mainly pastoral with very little horticulture

Overall, orientation and depth of soil mean this site is less flexible than site 1.

6.2 Comparison to LUC maps

It is useful to compare the results of this system with the LUC maps. Differences should be explainable.

It is difficult to compare the systems on past use and climate as the LUC system did not list these explicitly for the Tasman District. Topography is generally the same, although some improvements were made to Land Units as a result of better topographical maps available since the 1970's.

The main difference is in the assessment of soil types and their suitability for a range of enterprises. The comparison in table 4 shows that the two systems are comparable in the less flexible classes but markedly different in the flexible classes. As mentioned previously in section 3.1, changes in technology and differing economic assumptions mean that the system derived for the Tasman District places less emphasis on drought susceptibility and drainage aspects of soils than the LUC system did.

Table 4: **Comparison of Agriculture NZ and LUC classes based on soil types**

Agriculture NZ classes	LUC classes	
	Range	Most Common
A	I-IV	variable
B	II-VI	variable
C	III - V	variable
D	III - IV	variable
E	III - VII	VI
F	IV - VIII	VI
G	VI - VIII	VII
H	VII - VIII	VIII

(See appendix B for source of table 4)

The difference over the district is shown in table 5.

Table 5 : **Area of each class in the Tasman District**

Agriculture New Zealand system		LUC system	
Class	Area (ha)	Class	Area (ha)
A	22,223	I	4,715
B	29,958	II	4,965
C	2,521	III	46,658
D	21,847	IV	52,027
E	64,439	V	1,052
F	136,305	VI	111,851
G	53,403	VII	267,251
H	223,519	VIII	469,114
Total Productive Area	554,215		957,627

NB : There may be minor changes to the areas as a result of final map checking.

6.3 Reliability

The maps that classed productive land in the Tasman District have been drawn based on published information, such as soil maps and climate data. The people involved in the project were able to bring years of experience from their work in the district. However, there were no specific field visits made in relation to this project.

In some cases, an individual had first hand knowledge of the soil types and locations. Generally this level of knowledge has been sufficient for the scale of the maps used in this project.

Field Visits

Boundary lines are only as accurate as the underlying soil and topographical maps. In some cases, boundaries shown on the district maps will be accurate. However, in many cases the boundary may not be determined accurately until a field inspection is made

Scale

There may also be small areas contained in a larger grouping that, on closer inspection, warrant a different class. This may be due to small microclimates due to specific topographical features or small areas of soils that differ to that shown on soil maps.

6.4 Conservative approach to grading

With a desk top study such as this, it is not possible to be 100% certain about all boundary lines. Where there was some uncertainty that could not be resolved under the brief of this project, the approach taken has been to apply the criteria conservatively. If in doubt an area would be taken down a grade. The intention is to allow crops from a higher class in a lower class, provided certain conditions are meet. An example would be Kaiteriteri Hill Soils. In some areas, production forestry could be grown provided some conditions are meet.

The other side of this approach is that there may be some flexible areas that been given a lower rating.

7.0 WEIGHTING OF CRITERIA

The key criteria was suitability of a land unit to grow a range of crops or activities. There are a number of criteria that have been taken into account.

The following paragraphs give a general description of the criteria levels considered for each class. In some cases, climate might over ride soil type considerations, or slope might over ride soil type qualities. For more details, readers are referred to the detailed soil type groupings in appendix B and climate groupings in appendix C

Class A

Crop range -nursery, floriculture, orchards, market garden, cropping, pastoral, production forestry
- no physical restrictions on the range of temperate horticultural crops that could be grown outdoors.

Soils - free draining, deep (>1.2m), with no major fertility requirements that cannot be fixed easily

Topography - flat (slope <3 degrees)

Climate - rainfall less than 1600 mm pa
- heat units greater than 1000 Growing degree days at 10 degree base
- soil temperatures mild to warm

Class B

Crop range - nursery, floriculture, orchards, market garden, cropping, pastoral, production forestry
- some restrictions on the types of individual crops that could be grown. For example, it may be possible to grow some orchard crops (eg apples) but not others (eg kiwifruit) due to limitations such as soil structure.

Soils - some restrictions but still relatively deep soils (> 0.8m)

Topography - rolling up to 15 degrees. Still able to use a full range of orchard equipment and ladders

Climate - rainfall and heat units similar to class A
- may be a shorter growing season and/or higher rainfall
- soil temperatures mild to warm

Class C

Crop range - nursery, vineyards, market garden, cropping, pastoral, production forestry
- severe restrictions on range of horticultural crops that could be grown. Only a few of each type could be grown in these areas. For example, raspberry gardens but not apple orchards

Soils - sometimes shallow soils but generally with a strong structure capable of taking intensive cultivation

Topography - flat to steep

Climate - often the main limiting factor
- soil temperatures mild
- rainfall up to 2400 mm pa
- short growing season although hot over the summer

Class D

Crop Range - cropping, pastoral, production forestry
- extensive arable cropping as the highest land use.

Soil type - shallow soils, often infertile or poor structure

Topography - flate to steep

Climate - colder with soil temperatures cool to mild
- rainfall up to 3200 mm pa
- shorter growing season than Class C

Class E
Crop range- Dairy and other intensive pastoral, Extensive pastoral and production forestry
Soil type - often shallow, usually wet
Topography - generally flat to rolling, with maximum slope being 28 degrees
Climate - rainfall up to 4800 mm pa
- soil temperatures cool to warm
- average annual air temperature greater than 10 to 11 degrees
- usually lower altitudes (ie <400m)

Class F
Crop range- Extensive Pastoral, production forestry
Soil type - low fertility, often shallow, can be prone to erosion
Topography - steep
Climate - soil temperatures cold to cool
- often high altitude so having a short growing season

Class G
Crop range - Production forestry
Topography - steep
Climate - altitude less than 600m
- rainfall greater than 600mm

Class H
Activities - Non productive - Recreation, Conservation

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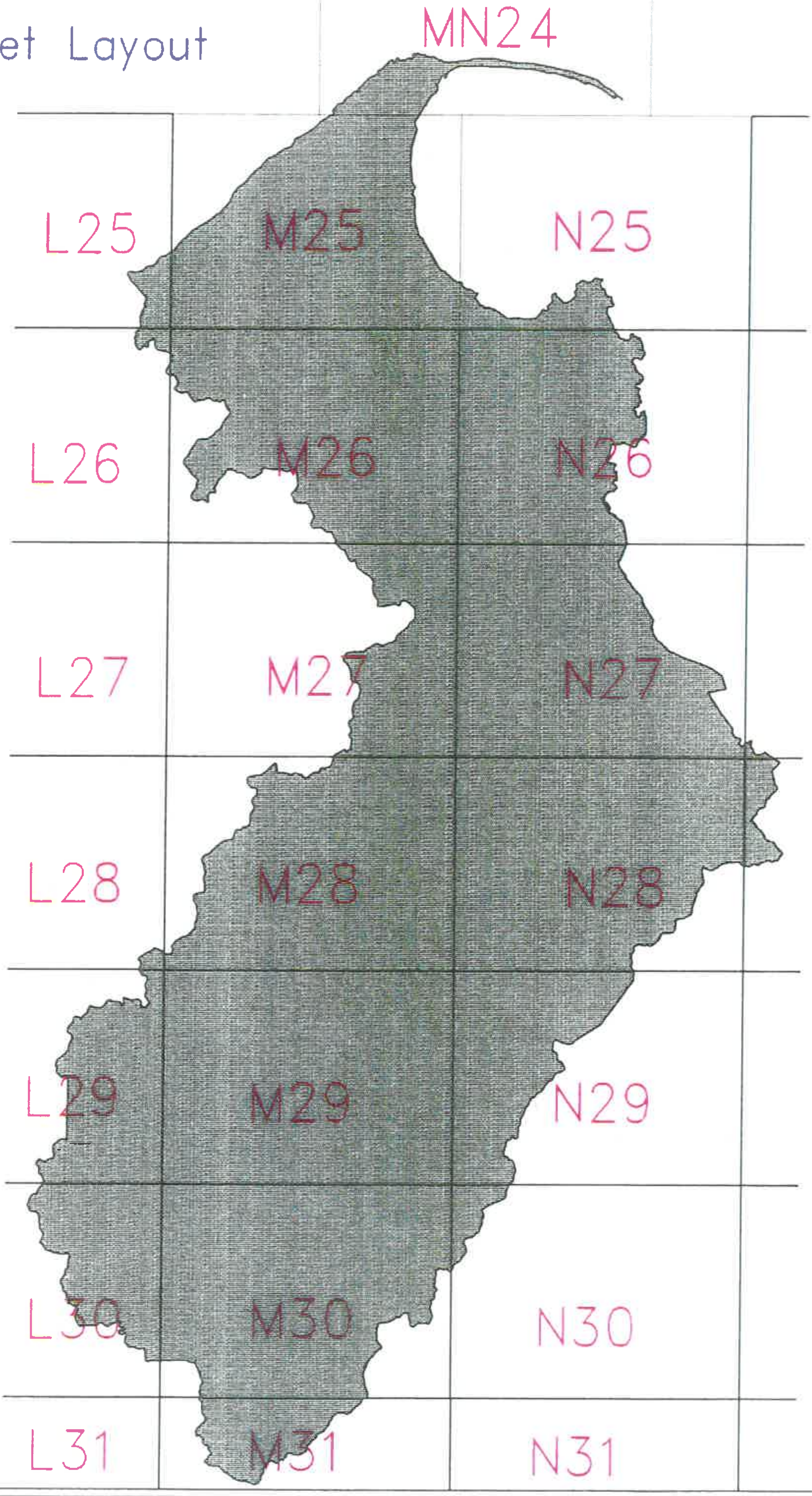
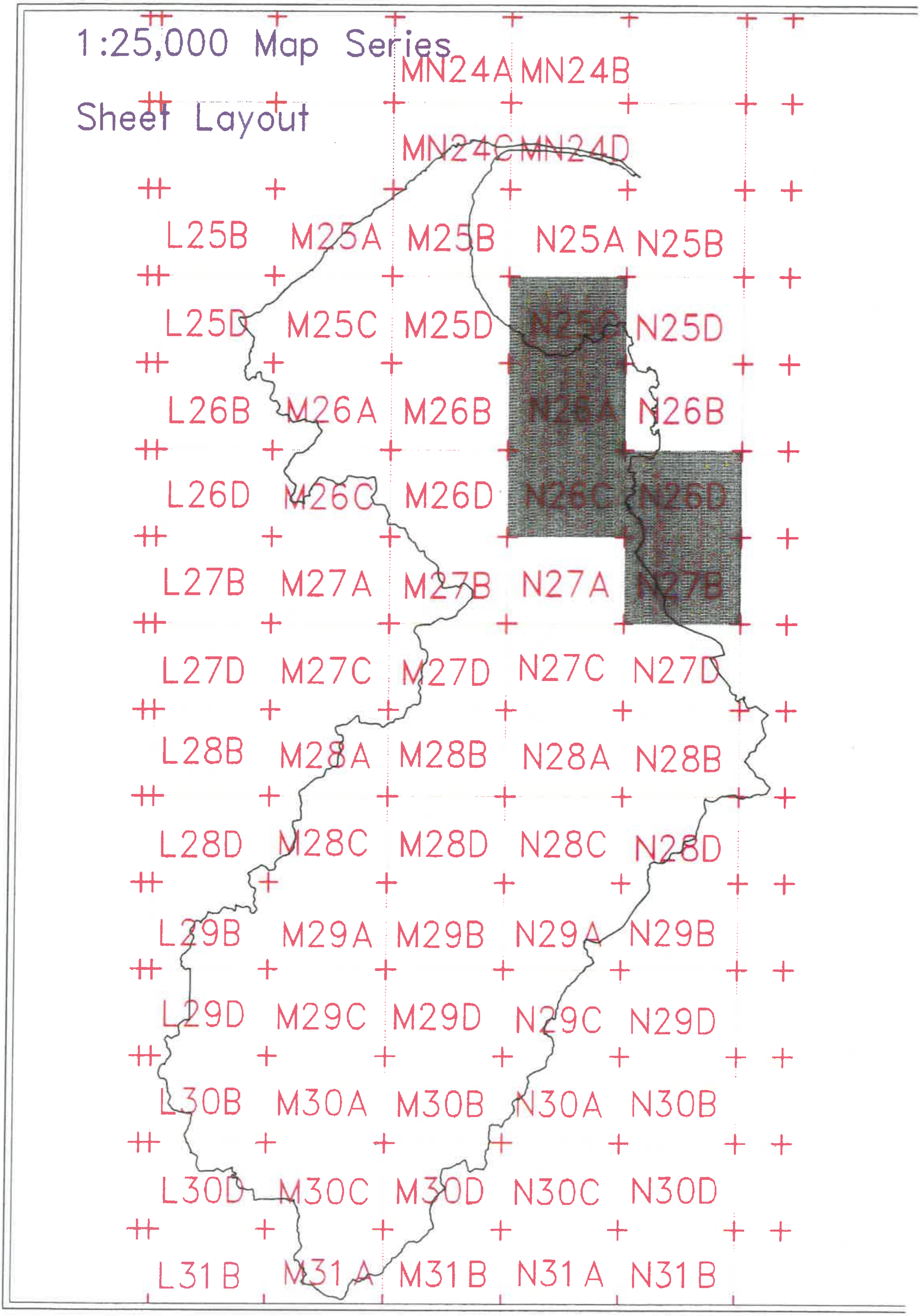
1:50,000 Map Series

Sheet Layout

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L30D M30C M30D N30C N30D
L31B M31A M31B N31A N31B

Appendix B: **Soil Types and LUC classes for each TDC class**

There are occasions where one soil type is in more than one TDC class. This is a reflection of the coarseness of the original soil maps.

The base documents for soil information were soil maps at 1:253,440 (4 miles to the inch). There is one soil map which covers the Moutere depression in more detail at 1:126,720 (2 miles to the inch). Better information about climate, slope and aspect suggests in some cases that a soil type should be split up into different classes. In effect some soil types should be reclassified. For example, the Motupiko silt is in four classes from A to D.

There are a number of ways of looking at the information.

(a) Sorted alphabetically by soil type **name** -eg Waimea Silt Loam

(b) **TDC class** - eg all soil type in Class A, B etc

(c) Sorted by soil type **number** - eg 33b, 33g

Each system is listed below in the above order.

Each separate soil type in a TDC class has comments which explain exceptions from the norm. For example, there are comments on why the same soil type has been split over more than one class.

Also listed is the LUC class for each soil type. Originally it was hoped that once a trend between TDC and LUC classes became evident, the LUC could be sorted into TDC classes and therefore reduce the time spent on the project. Unfortunately the LUC classification was unreliable, particularly relating to more flexible land units (Class A to D). They were used as a secondary check in the mapping process.

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
2&Waimea	A	Clifton		n/a		
2&Waimea	A	Graham Silt Loam	G	n/a	3s2	
2	A	Hamama		43a	4e5,4s5,4c3,3s10	High rainfall
2&Waimea	A	Hau	Hu	27c		
2	A	Karamea Silt		99c	3w3,4s10,3s8,4c3,4s2,3s2	
2&Waimea	A	Maori Gravel	M	n/a		
2&Waimea	A	Motupiko	Mo	33g	3w1,3s3	Brightwater to Wakefield
2	A	Okari		70b	4sh	Same as Tu but higher rainfall
2	A	Puramahoi		43b	4c3,3s10,3c2,4s5	
2&Waimea	A	Ranzau	Rz/Rzg	27d	3s1	
2&Waimea	A	Richmond Silt	Rms	89c	3w1	
2&Waimea	A	Riwaka	R & Rw	98a	1s2+2s2	
2&Waimea	A	Rosedale Silt	Rd	37	4e5	
2&Waimea	A	Sherry	Sy	98c	3s2,2s2,3e2	Riwaka Plain only
2&Waimea	A	Takaka Silt		n/a		
2	A	Tarakohe Silt		73b		
2&Waimea	A	Waimea	Y/Ym/Yg	98	1s2,2s2,2w1	
2&Waimea	B	Bishopdale clay	B	n/a		
2&Waimea	B	Braebum	B/Bn	89d	2w1,3w1	
2&Waimea	B	Dovedale gravels	D	33g	3s3	Pans
2&Waimea	B	Graham Silt Loam	G	n/a	3e6	Colder up narrow valleys
2	B	Hokitika		99b	4s2	
2	B	Ikamatua		43c	3s10	Rooting Depth Limitation - D,E,F
2&Waimea	B	Mapua Sandy	Mp	32	3e6,4e5,4e5+6e16	
2&Waimea	B	Motupiko	Mo	33g	3s3+4s4,4s3,3s3	Wakefield to Spooners & Inland - climate
2	B	Rameka		80b		Depth limiting in some cases.Some A, steep = C
2&Waimea	B	Ranzau	Rz/Rzg	27d		Wet phase
2&Waimea	B	Richmond Clay	Rm/Rmp	89c		Wetter than silt
2&Waimea	B	Sherry Sand	Sy	98c		East/West orientation
2&Waimea	B	Tahanunui Sand	Tu	68c	6s10,6e24,4s11	Stable. High Organic matter

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
2&Waimea	B	Tahanunui Sandy Grave	TuG	68c	4e11,7e9	
2&Waimea	B	Tapawera Sandy Loam	Tw	n/a	4s3+6s4	
2&Waimea	B	Wakatu Silt	Wa	30a	3e6	
2&Waimea	B	Wantwood Silt	Wd	71e	2s2,4e1	
2&Waimea	C	Dovedale gravels	D	33g		Colder
2&Waimea	C	Kikiwa Silt	Ka	34b	3s3,3s16	
2&Waimea	C	Mapua Sandy	Mp	32		Inland north facing slopes
2&Waimea	C	Motupiko	Mo	33g	4s3	High Inland Valleys - cold plus thin soils
2&Waimea	C	Ranzau	Rz/Rzg	27d		Wetter phase
2&Waimea	C	Ronga	Ro	98b		
2&Waimea	C	Sherry Sand	Sy	98c	3s2	Valley - often sloping
2&Waimea	C	Tapawera Sandy Loam	Tw	n/a	4s3+5s4	
2&Waimea	C	Waimea	Y/Ym/Yg	98		Cold, narrow valleys
3	D	Ahaura		43	4c3,3s10	
2&Waimea	D	Atapo Stony	Ap	n/a	3s3	Drainage
2&Waimea	D	Braeburn	B/Bn	89d	3w1	Climate
3	D	Craigeburn		52	4c1	
2&Waimea	D	Dovedale gravels	D	33g		Colder and shallow soils
3	D	Howard		45a	4c1	)
2	D	Ikamatua		43c	4s5,3s10	) Short growing season as a result of
2&Waimea	D	Kaiteriteri Sandy Loam	K	37c	4s1	
2&Waimea	D	Matariki	Mar	n/a	4s3	
2&Waimea	D	Motupiko	Mo	33g	3s3,4s3	Head of Inland Valleys - colder and thinner soils
2&Waimea	D	Orinoco	O	37b	3e6	
2&Waimea	D	Sherry Sand	Sy	98c	4s3	Climate
2&Waimea	D	Sunnybank	SH	n/a		
3	D	Tasman		99	4c1	
2&Waimea	D	Tophouse Stony Silt	Tp	52a		Provided adequate depth
2&Waimea	D	Wangapeka	Wp	n/a		
2&Waimea	D	Wantwood Hill	WdH	71e	4e1	

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
3	E	Ahaura		43	3s10,4s5	
2&Waimea	E	Brooklyn Hill	BrH/BrS	77dH	6e5	
2	E	Hamama		43a		
3	E	Hokitika		99b	4s2,6s12	
3	E	Howard		45a	4c1	) Grading difference due to increaseing slope
2	E	Ikamatua		43c	3s10,3c2	) altitude, valley aspect and valley width
2	E	Karangarua		91a	7w2+6e3,6s5,4s11	
2&Waimea	E	Kikiwa rolling	Kar	34b	4e6,3e6,3s3,3e3,4e5	Gentle slopes
2&Waimea	E	Korere Hill	KeH	45H	6e16	
2	E	Kotinga		59a	4s10,6s6	
2	E	Mahinapua		70c		Same as Tu but wind blow
2&Waimea	E	Mapua Hill	MpH	32	6e16	B if slope not too steep
2&Waimea	E	Matariki	Mar	n/a	3w3,3e6	
2&Waimea	E	Motupiko	Mo	33g		High plateaus
2&Waimea	E	Orinoco Hill	OH	37bH	4e5,6e11	
2	E	Otere		44	6e3,3e9,3c2	
2	E	Pikikiruna Hill		74cH	6e4	
2&Waimea	E	Richmond Clay	Rm/Rmp	89c	2w1	Wetter and low lying
2&Waimea	E	Rosedale Hill	RdH	37H	6e16,4s4,4e5	
2&Waimea	E	Rosedale Silt	Rd	37	6e16	
2&Waimea	E	Sherry Sand	Sy	98c	3s2,4s12	Altitude. Valley width
2&Waimea	E	Spooner Hill	SoH	37aH	4e5	
2&Waimea	E	Stanley Hill	StH	35cH	6e16	
2&Waimea	E	Stanley Silt	St	35c(?)		
2&Waimea	E	Sunnybank Hill	SyH	n/a		
2&Waimea	E	Tadmor	T/TsH	44cH	4e6,4s7	
2	E	Tahanunui Sand	Tu	68c		Climate, especially wind
2	E	Tarakohe Hill		73bH	6e3	
2&Waimea	E	Wangapeka	Wp	n/a	4s3	Too bouldery for Cropping + climate
2&Waimea	E	Wantwood Hill	WdH	71e	7e8,4s1+6e5	Mixed with Hs

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
3	F	Arahura		46H	6e25,7e13+6e25	
2&Waimea	F	Atawhai Steepland	AxS/As	77c	8e1	
3	F	Blackball		46aH	6e25	
2&Waimea	F	Brooklyn Hill	BrH/BrS	77dH	6e18,7e1	Slope
2	F	Denniston Tableland		64f	7s7+7e25,7c6	
2&Waimea	F	Heslington Steepland	Hs	74b	4s1+6e5,6e5	
3	F	Hokitika		99b	4s2	Flooding
2&Waimea	F	Hope Hill	HeH	45bH	7e11,6e16	Provided not too steep
3	F	Howard		45a	4c1,7c6	)
3	F	Howard Hill		45aH	7e13,6e25,7e11	
2	F	Ikamatua		43c	4s5,4c3,3s10	)
2&Waimea	F	Kairuru Complex	Kx/KxH	44d	5s2,6e4	
2&Waimea	F	Kaiteriteri Sandy Loam	K	37c	4s13	
2&Waimea	F	Katrine Hill	KnH	53bH	4e16,6s12	
2&Waimea	F	Ketu Steepland	KuS	42		
2&Waimea	F	Kikiwa rolling	Kar	34b	6e16	Steeper slopes
2&Waimea	F	Korere Hill	KeH	45H	7e11,6e16	
2	F	Kotinga		59a	7s7	
2&Waimea	F	Lee Steepland	Les	n/a	7e3	
2	F	Ligar		81eH	4e2	H on steep slopes
2	F	Matiri Hill		65fH	7e22	
2&Waimea	F	Matiri Steepland	MtS	65f	8e3,7e22,8e5,6e25	Maybe H, depending on slope
2&Waimea	F	Ngamoti Steepland	NS	n/a	7e9,6e11	
2	F	Onahau		59	4s10,6s6	E if sloping or humping/hollowing
2	F	Onekaka Hill		47d	4e10+7e9,7e25	)
2	F	Onekaka Rolling		47dH	6e21,7e25,7e9	
2	F	Otere Hill		44H	6e3	
2&Waimea	F	Otu Steepland	OtS	n/a		
2	F	Pakawau		62bH	7e8,7e22	
2	F	Patarua		38bH	6e3,7e8	

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
2	F	Pikikiruna Hill		74cH	6e4,5s2,5e2	
2	F	Pikikiruna Steep	PkS	74c	6e3,6e4,7e8	Steep but fertile
2&Waimea	F	Ronga	Ro	98b	4s2	
2&Waimea	F	Rosedale Hill	RdH	37H	4s3	
2&Waimea	F	Spooner Hill	SoH	37aH	7e11,6e16	
2&Waimea	F	Stanley Hill	StH	35cH	7e11,7e9	
2&Waimea	F	Tadmor	T/TsH	44cH	4e1,6e18,3e3,7e11,7	E or F depending on slope
2	F	Tarakohe Hill		73bH	6e3,6e5,5s2	
2	F	Tarakohe Rolling		73bH + 44H		B if little slope
3	F	Tasman		99	6e3,4s12	Flooding
2&Waimea	F	Tophouse Hill	TpH	52aH		
3	F	Tutaki Rolling		42cH	6e18	Check for existing S&B
2	F	Wakamarama		65d	7e25	
2&Waimea	F	Whangamoa Steepland	WgS	42b	7e3	
3	G	Blackball		46aH	7e13	
2&Waimea	G	Brooklyn Hill	BrH/BrS	77dH	7e1	
2&Waimea	G	Brooklyn Steepland	BrS	77d	6e5,7e1	Majority
2&Waimea	G	Hope Hill	HeH	45bH	7e11	
2&Waimea	G	Kaiteriteri Hill	KH	37cH	6e21,6e11	
2&Waimea	G	Kaiteriteri Hill/Sandy L	KH+K	37cH+37c	7e9	
2&Waimea	G	Kaiteriteri Sandy Loam	K	37c	6e21	Steep slope - erosion prone
2	G	Kanieri Hill		66H	7e9,7e25	
3	G	Kawateri Hill		47eH	6e21	Reversion due to fertility
2&Waimea	G	Kawatiri Steepland	KwS	47e	8e3	
2&Waimea	G	Matiri Steepland	MtS	65f	7e22	
2	G	Onekaka Hill		47d	8e3,7e9,7e25	) Grading difference due to increaseing slope
2	G	Pakawau		62bH	6e21,7e22	Also F or H depending on slope and aspect
2&Waimea	G	Pelorus Steepland	PS	65c	6e21	
2	G	Pikikiruna Steep	PkS	74c	8e1,7e8	Steeper slopes
2&Waimea	G	Pokororo Steepland	PoS	41e	7e9,6e21	Watch Slope

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
3	G	Punakaiki		47fH	6e+bedrock	
2&Waimea	G	Sherry Sand	Sy	98c		Very narrow valley
2&Waimea	G	Tadmor	T/TsH	44cH	6e18	
2&Waimea	G	Tahanunui Sand	Tu	68c	6s10	Raw Sand. Low Organic matter
3	G	Tutaki Rolling		42cH	7e4	
3	G	Tutaki Steep		42c	7e4	
3	H	Alpine		100		
3	H	Blackball		46aH	7s7	
2&Waimea	H	Brooklyn Steepland	BrS	77d	7e1	Higher altitude
2	H	Bryneira		83a		
2	H	Denniston Rolling		64fH	7s7	
2	H	Denniston Tableland		64f	7c6	
2&Waimea	H	Dun Steepland	DuS	79	8e5	
2&Waimea	H	Glenhope Steepland	GpS	66a	8e5,6e21,7e25	
3	H	Haast+Lewis		65e+65	8e5	
2&Waimea	H	Haupiri Steepland	HrS	65b	7e25,7e9,8e5	
2	H	Hohounu	HoS	67bH(?)	8c1	
2	H	Hohounu	HoS	67b	8e7	
3	H	Howard Hill		45aH	7e13	Over 700 m
2&Waimea	H	Kaiteriteri Hill	KH	37cH	7e9	Production forestry with conditions
2&Waimea	H	Kaiteriteri Sandy Loam	K	37c	6e21	- severe erosion potential
2	H	Kanieri		66	8e5,8e3	Shallow
2	H	Kanieri Hill		66H	7e25	
2&Waimea	H	Katrine	KnH	53b	4s14+6w2	
3	H	Kawateri Hill		47eH	7e25,8e3,8e5	
2&Waimea	H	Kawatiri Steepland	KwS	47e	7e25,8e3,8e5	
	H	Kenepuru Steepland		47a	7c6	above 800m
2	H	Kini		87a	6w2,7w2,8w1	C if drained
2&Waimea	H	Lewis Steepland	LS	65	8e5	
2	H	Ligar		81eH	7e9	

B1: Sort by TDC Class

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
2	H	Matiri Hill		65fH		
2&Waimea	H	Matiri Steepland	MtS	65f	8e5,8e3,7e22	
3	H	McKerrow		67a	8e5,8e7	
3	H	Motukarara		92	7w3,6s10	
3	H	Okarito		60	7s7	
2	H	Onekaka Hill		47d	8e3	
2	H	Pakawau		62bH	7e22,8e3	
2&Waimea	H	Patriarch Steepland	PcS	57g		
2&Waimea	H	Pelorus Hill	PH	65cH	8e5	
2&Waimea	H	Pelorus Steepland	PS	65c	8e5	
2	H	Pikikiruna Steep	PkS	74c	8e1,7e8	Longer, steeper slopes
2&Waimea	H	Pokororo Steepland	PoS	41e	7e9	
3	H	Punakaiki Steepland		47f	8e11	
2	H	Puponga Rolling		62aH		Severe Erosion
2	H	Puponga Steep		62a		Severe Erosion
2&Waimea	H	Spencer Mountain	SnS	58	8e8,8e9	
3	H	Tutaki Steep		42c	8e3,7e4	
2&Waimea	H	Waimea	Y/Ym/Yg	98	4s1	Low lying, high water table
3	H	Waiuta		62	7s7	
2	H	Wakamarama		65d	8e5,8e3	
2	H	Whitcombe		67	8e7	

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
3	D	Ahaura		43	4c3,3s10	
3	E	Ahaura		43	3s10,4s5	
3	H	Alpine		100		
3	F	Arahura		46H	6e25,7e13+6e25	
2&Waimea	D	Atapo Stony	Ap	n/a	3s3	Drainage
2&Waimea	F	Atawhai Steepland	AxS/As	77c	8e1	
2&Waimea	B	Bishopdale clay	B	n/a		
3	F	Blackball		46aH	6e25	
3	G	Blackball		46aH	7e13	
3	H	Blackball		46aH	7s7	
2&Waimea	B	Braeburn	B/Bn	89d	2w1,3w1	
2&Waimea	D	Braeburn	B/Bn	89d	3w1	Climate
2&Waimea	E	Brooklyn Hill	BrH/BrS	77dH	6e5	
2&Waimea	F	Brooklyn Hill	BrH/BrS	77dH	6e18,7e1	Slope
2&Waimea	G	Brooklyn Hill	BrH/BrS	77dH	7e1	
2&Waimea	G	Brooklyn Steepland	BrS	77d	6e5,7e1	Majority
2&Waimea	H	Brooklyn Steepland	BrS	77d	7e1	Higher altitude
2	H	Bryneira		83a		
2&Waimea	A	Clifton		n/a		
3	D	Craigeburn		52	4c1	
2	H	Denniston Rolling		64fH	7s7	
2	F	Denniston Tableland		64f	7s7+7e25,7c6	
2	H	Denniston Tableland		64f	7c6	
2&Waimea	B	Dovedale gravels	D	33g	3s3	Pans
2&Waimea	C	Dovedale gravels	D	33g		Colder
2&Waimea	D	Dovedale gravels	D	33g		Colder and shallow soils
2&Waimea	H	Dun Steepland	DuS	79	8e5	
2&Waimea	H	Glenhope Steepland	GpS	66a	8e5,6e21,7e25	
2&Waimea	A	Graham Silt Loam	G	n/a	3s2	
2&Waimea	B	Graham Silt Loam	G	n/a	3e6	Colder up narrow valleys

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
3	H	Haast+Lewis		65e+65	8e5	
2	A	Hamama		43a	4e5,4s5,4c3,3s10	High rainfall
2	E	Hamama		43a		
2&Waimea	A	Hau	Hu	27c		
2&Waimea	H	Haupiri Steepland	HrS	65b	7e25,7e9,8e5	
2&Waimea	F	Heslington Steepland	Hs	74b	4s1+6e5,6e5	
2	H	Hohounu	HoS	67b	8e7	
2	H	Hohounu	HoS	67bH(?)	8c1	
2	B	Hokitika		99b	4s2	
3	E	Hokitika		99b	4s2,6s12	
3	F	Hokitika		99b	4s2	Flooding
2&Waimea	F	Hope Hill	HeH	45bH	7e11,6e16	Provided not too steep
2&Waimea	G	Hope Hill	HeH	45bH	7e11	
3	D	Howard		45a	4c1	)
3	E	Howard		45a	4c1	) Grading difference due to increaseing slope
3	F	Howard		45a	4c1,7c6	)
3	F	Howard Hill		45aH	7e13,6e25,7e11	
3	H	Howard Hill		45aH	7e13	Over 700 m
2	B	Ikamatua		43c	3s10	Rooting Depth Limitation - D,E,F
2	D	Ikamatua		43c	4s5,3s10	) Short growing season as a result of
2	E	Ikamatua		43c	3s10,3c2	) altitude, valley aspect and valley width
2	F	Ikamatua		43c	4s5,4c3,3s10	)
2&Waimea	F	Kairuru Complex	Kx/KxH	44d	5s2,6e4	
2&Waimea	G	Kaiteriteri Hill	KH	37cH	6e21,6e11	
2&Waimea	H	Kaiteriteri Hill	KH	37cH	7e9	Production forestry with conditions
2&Waimea	G	Kaiteriteri Hill/Sandy L	KH+K	37cH+37c	7e9	
2&Waimea	D	Kaiteriteri Sandy Loam	K	37c	4s1	
2&Waimea	F	Kaiteriteri Sandy Loam	K	37c	4s13	
2&Waimea	G	Kaiteriteri Sandy Loam	K	37c	6e21	Steep slope - erosion prone
2&Waimea	H	Kaiteriteri Sandy Loam	K	37c	6e21	- severe erosion potential

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
2	H	Kanieri		66	8e5,8e3	Shallow
2	G	Kanieri Hill		66H	7e9,7e25	
2	H	Kanieri Hill		66H	7e25	
2	A	Karamea Silt		99c	3w3,4s10,3s8,4c3,4s2,3s2	
2	E	Karangarua		91a	7w2+6e3,6s5,4s11	
2&Waimea	H	Katrine	KnH	53b	4s14+6w2	
2&Waimea	F	Katrine Hill	KnH	53bH	4e16,6s12	
3	G	Kawateri Hill		47eH	6e21	Reversion due to fertility
3	H	Kawateri Hill		47eH	7e25,8e3,8e5	
2&Waimea	G	Kawatiri Steepland	KwS	47e	8e3	
2&Waimea	H	Kawatiri Steepland	KwS	47e	7e25,8e3,8e5	
	H	Kenepuru Steepland		47a	7c6	above 800m
2&Waimea	F	Ketu Steepland	KuS	42		
2&Waimea	C	Kikiwa Silt	Ka	34b	3s3,3s16	
2&Waimea	E	Kikiwa rolling	Kar	34b	4e6,3e6,3s3,3e3,4e5	Gentle slopes
2&Waimea	F	Kikiwa rolling	Kar	34b	6e16	Steeper slopes
2	H	Kini		87a	6w2,7w2,8w1	C if drained
2&Waimea	E	Korere Hill	KeH	45H	6e16	
2&Waimea	F	Korere Hill	KeH	45H	7e11,6e16	
2	E	Kotinga		59a	4s10,6s6	
2	F	Kotinga		59a	7s7	
2&Waimea	F	Lee Steepland	Les	n/a	7e3	
2&Waimea	H	Lewis Steepland	LS	65	8e5	
2	F	Ligar		81eH	4e2	H on steep slopes
2	H	Ligar		81eH	7e9	
2	E	Mahinapua		70c		Same as Tu but wind blow
2&Waimea	A	Maori Gravel	M	n/a		
2&Waimea	B	Mapua Sandy	Mp	32	3e6,4e5,4e5+6e16	
2&Waimea	C	Mapua Sandy	Mp	32		Inland north facing slopes
2&Waimea	E	Mapua Hill	MpH	32	6e16	B if slope not too steep

B2: Sort by Soil Type Name

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
2&Waimea	D	Matariki	Mar	n/a	4s3	
2&Waimea	E	Matariki	Mar	n/a	3w3,3e6	
2	F	Matiri Hill		65fH	7e22	
2	H	Matiri Hill		65fH		
2&Waimea	F	Matiri Steepland	MtS	65f	8e3,7e22,8e5,6e25	Maybe H, depending on slope
2&Waimea	G	Matiri Steepland	MtS	65f	7e22	
2&Waimea	H	Matiri Steepland	MtS	65f	8e5,8e3,7e22	
3	H	McKerrow		67a	8e5,8e7	
3	H	Motukarara		92	7w3,6s10	
2&Waimea	A	Motupiko	Mo	33g	3w1,3s3	Brightwater to Wakefield
2&Waimea	B	Motupiko	Mo	33g	3s3+4s4,4s3,3s3	Wakefield to Spooners & Inland - climate
2&Waimea	C	Motupiko	Mo	33g	4s3	High Inland Valleys - cold plus thin soils
2&Waimea	D	Motupiko	Mo	33g	3s3,4s3	Head of Inland Valleys - colder and thinner soils
2&Waimea	E	Motupiko	Mo	33g		High plateaus
2&Waimea	F	Ngamoti Steepland	NS	n/a	7e9,6e11	
2	A	Okari		70b	4sh	Same as Tu but higher rainfall
3	H	Okarito		60	7s7	
2	F	Onahau		59	4s10,6s6	E if sloping or humping/hollowing
2	F	Onekaka Hill		47d	4e10+7e9,7e25	)
2	G	Onekaka Hill		47d	8e3,7e9,7e25	) Grading difference due to increaseing slope
2	H	Onekaka Hill		47d	8e3	)
2	F	Onekaka Rolling		47dH	6e21,7e25,7e9	
2&Waimea	D	Orinoco	O	37b	3e6	
2&Waimea	E	Orinoco Hill	OH	37bH	4e5,6e11	
2	E	Otere		44	6e3,3e9,3c2	
2	F	Otere Hill		44H	6e3	
2&Waimea	F	Otu Steepland	OtS	n/a		
2	F	Pakawau		62bH	7e8,7e22	
2	G	Pakawau		62bH	6e21,7e22	Also F or H depending on slope and aspect
2	H	Pakawau		62bH	7e22,8e3	

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
2	F	Patarua		38bH	6e3,7e8	
2&Waimea	H	Patriarch Steepland	PcS	57g		
2&Waimea	H	Pelorus Hill	PH	65cH	8e5	
2&Waimea	G	Pelorus Steepland	PS	65c	6e21	
2&Waimea	H	Pelorus Steepland	PS	65c	8e5	
2	E	Pikikiruna Hill		74cH	6e4	
2	F	Pikikiruna Hill		74cH	6e4,5s2,5e2	
2	F	Pikikiruna Steep	PkS	74c	6e3,6e4,7e8	Steep but fertile
2	G	Pikikiruna Steep	PkS	74c	8e1,7e8	Steeper slopes
2	H	Pikikiruna Steep	PkS	74c	8e1,7e8	Longer, steeper slopes
2&Waimea	G	Pokororo Steepland	PoS	41e	7e9,6e21	Watch Slope
2&Waimea	H	Pokororo Steepland	PoS	41e	7e9	
3	G	Punakaiki		47fH	6e+bedrock	
3	H	Punakaiki Steepland		47f	8e11	
2	H	Puponga Rolling		62aH		Severe Erosion
2	H	Puponga Steep		62a		Severe Erosion
2	A	Puramahoi		43b	4c3,3s10,3c2,4s5	
2	B	Rameka		80b		Depth limiting in some cases.Some A, steep = C
2&Waimea	A	Ranzau	Rz/Rzg	27d	3s1	
2&Waimea	B	Ranzau	Rz/Rzg	27d		Wet phase
2&Waimea	C	Ranzau	Rz/Rzg	27d		Wetter phase
2&Waimea	B	Richmond Clay	Rm/Rmp	89c		Wetter than silt
2&Waimea	E	Richmond Clay	Rm/Rmp	89c	2w1	Wetter and low lying
2&Waimea	A	Richmond Silt	Rms	89c	3w1	
2&Waimea	A	Riwaka	R & Rw	98a	1s2+2s2	
2&Waimea	C	Ronga	Ro	98b		
2&Waimea	F	Ronga	Ro	98b	4s2	
2&Waimea	E	Rosedale Hill	RdH	37H	6e16,4s4,4e5	
2&Waimea	F	Rosedale Hill	RdH	37H	4s3	
2&Waimea	A	Rosedale Silt	Rd	37	4e5	

B2: Sort by Soil Type Name

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
2&Waimea	E	Rosedale Silt	Rd	37	6e16	
2&Waimea	A	Sherry	Sy	98c	3s2,2s2,3e2	Riwaka Plain only
2&Waimea	B	Sherry Sand	Sy	98c		East/West orientation
2&Waimea	C	Sherry Sand	Sy	98c	3s2	Valley - often sloping
2&Waimea	D	Sherry Sand	Sy	98c	4s3	Climate
2&Waimea	E	Sherry Sand	Sy	98c	3s2,4s12	Altitude. Valley width
2&Waimea	G	Sherry Sand	Sy	98c		Very narrow valley
2&Waimea	H	Spencer Mountain	SnS	58	8e8,8e9	
2&Waimea	E	Spooner Hill	SoH	37aH	4e5	
2&Waimea	F	Spooner Hill	SoH	37aH	7e11,6e16	
2&Waimea	E	Stanley Hill	StH	35cH	6e16	
2&Waimea	F	Stanley Hill	StH	35cH	7e11,7e9	
2&Waimea	E	Stanley Silt	St	35c(?)		
2&Waimea	D	Sunnybank	SH	n/a		
2&Waimea	E	Sunnybank Hill	SyH	n/a		
2&Waimea	E	Tadmor	T/TsH	44cH	4e6,4s7	
2&Waimea	F	Tadmor	T/TsH	44cH	4e1,6e18,3e3,7e11,7	E or F depending on slope
2&Waimea	G	Tadmor	T/TsH	44cH	6e18	
2&Waimea	B	Tahanunui Sand	Tu	68c	6s10,6e24,4s11	Stable. High Organic matter
2	E	Tahanunui Sand	Tu	68c		Climate, especially wind
2&Waimea	G	Tahanunui Sand	Tu	68c	6s10	Raw Sand. Low Organic matter
2&Waimea	B	Tahanunui Sandy Grave	TuG	68c	4e11,7e9	
2&Waimea	A	Takaka Silt		n/a		
2&Waimea	B	Tapawera Sandy Loam	Tw	n/a	4s3+6s4	
2&Waimea	C	Tapawera Sandy Loam	Tw	n/a	4s3+5s4	
2	E	Tarakohe Hill		73bH	6e3	
2	F	Tarakohe Hill		73bH	6e3,6e5,5s2	
2	F	Tarakohe Rolling		73bH + 44H		B if little slope
2	A	Tarakohe Silt		73b		
3	D	Tasman		99	4c1	

B2: Sort by Soil Type Name

Soil Map TDC Soil type Legend Number LUC class Comments

B2: Sort by Soil Type Name

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
3	F	Tasman		99	6e3,4s12	Flooding
2&Waimea	F	Tophouse Hill	TpH	52aH		
2&Waimea	D	Tophouse Stony Silt	Tp	52a		Provided adequate depth
3	F	Tutaki Rolling		42cH	6e18	Check for existing S&B
3	G	Tutaki Rolling		42cH	7e4	
3	G	Tutaki Steep		42c	7e4	
3	H	Tutaki Steep		42c	8e3,7e4	
2&Waimea	A	Waimea	Y/Ym/Yg	98	1s2,2s2,2w1	
2&Waimea	C	Waimea	Y/Ym/Yg	98		Cold, narrow valleys
2&Waimea	H	Waimea	Y/Ym/Yg	98	4s1	Low lying, high water table
3	H	Waiuta		62	7s7	
2	F	Wakamarama		65d	7e25	
2	H	Wakamarama		65d	8e5,8e3	
2&Waimea	B	Wakatu Silt	Wa	30a	3e6	
2&Waimea	D	Wangapeka	Wp	n/a		
2&Waimea	E	Wangapeka	Wp	n/a	4s3	Too bouldery for Cropping + climate
2&Waimea	D	Wantwood Hill	WdH	71e	4e1	
2&Waimea	E	Wantwood Hill	WdH	71e	7e8,4s1+6e5	Mixed with Hs
2&Waimea	B	Wantwood Silt	Wd	71e	2s2,4e1	
2&Waimea	F	Whangamoa Steepland	WgS	42b	7e3	
2	H	Whitcombe		67	8e7	

B2: Sort by Soil Type Name

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments

B3: Sort by Soil Type Number

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
2&Waimea	A	Hau	Hu	27c		
2&Waimea	A	Ranzau	Rz/Rzg	27d	3s1	
2&Waimea	B	Ranzau	Rz/Rzg	27d		Wet phase
2&Waimea	C	Ranzau	Rz/Rzg	27d		Wetter phase
2&Waimea	B	Wakatu Silt	Wa	30a	3e6	
2&Waimea	E	Mapua Hill	MpH	32	6e16	B if slope not too steep
2&Waimea	B	Mapua Sandy	Mp	32	3e6,4e5,4e5+6e16	
2&Waimea	C	Mapua Sandy	Mp	32		Inland north facing slopes
2&Waimea	B	Dovedale gravels	D	33g	3s3	Pans
2&Waimea	C	Dovedale gravels	D	33g		Colder
2&Waimea	D	Dovedale gravels	D	33g		Colder and shallow soils
2&Waimea	A	Motupiko	Mo	33g	3w1,3s3	Brightwater to Wakefield
2&Waimea	B	Motupiko	Mo	33g	3s3+4s4,4s3,3s3	Wakefield to Spooners & Inland - climate
2&Waimea	C	Motupiko	Mo	33g	4s3	High Inland Valleys - cold plus thin soils
2&Waimea	D	Motupiko	Mo	33g	3s3,4s3	Head of Inland Valleys - colder and thinner soils
2&Waimea	E	Motupiko	Mo	33g		High plateaus
2&Waimea	E	Kikiwa rolling	Kar	34b	4e6,3e6,3s3,3e3,4e5	Gentle slopes
2&Waimea	F	Kikiwa rolling	Kar	34b	6e16	Steeper slopes
2&Waimea	C	Kikiwa Silt	Ka	34b	3s3,3s16	
2&Waimea	E	Stanley Hill	StH	35cH	6e16	
2&Waimea	F	Stanley Hill	StH	35cH	7e11,7e9	
2&Waimea	E	Stanley Silt	St	35c		
2&Waimea	A	Rosedale Silt	Rd	37	4e5	
2&Waimea	E	Rosedale Silt	Rd	37	6e16	
2&Waimea	E	Spooner Hill	SoH	37aH	4e5	
2&Waimea	F	Spooner Hill	SoH	37aH	7e11,6e16	
2&Waimea	D	Orinoco	O	37b	3e6	
2&Waimea	E	Orinoco Hill	OH	37bH	4e5,6e11	
2&Waimea	D	Kaiteriteri Sandy Loam	K	37c	4s1	
2&Waimea	F	Kaiteriteri Sandy Loam	K	37c	4s13	

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
2&Waimea	H	Kaiteriteri Hill	KH	37cH	7e9	Production forestry with conditions
2&Waimea	G	Kaiteriteri Hill/Sandy L	KH+K	37cH+37c	7e9	
2&Waimea	E	Rosedale Hill	RdH	37H	6e16,4s4,4e5	
2&Waimea	F	Rosedale Hill	RdH	37H	4s3	
2	F	Patarua		38bH	6e3,7e8	
2&Waimea	G	Pokororo Steepland	PoS	41e	7e9,6e21	Watch Slope
2&Waimea	H	Pokororo Steepland	PoS	41e	7e9	
2&Waimea	F	Ketu Steepland	KuS	42		
2&Waimea	F	Whangamoa Steepland	WgS	42b	7e3	
3	G	Tutaki Steep		42c	7e4	
3	H	Tutaki Steep		42c	8e3,7e4	
3	F	Tutaki Rolling		42cH	6e18	Check for existing S&B
3	G	Tutaki Rolling		42cH	7e4	
3	D	Ahaura		43	4c3,3s10	
3	E	Ahaura		43	3s10,4s5	
2	A	Hamama		43a	4e5,4s5,4c3,3s10	High rainfall
2	E	Hamama		43a		
2	A	Puramahoi		43b	4c3,3s10,3c2,4s5	
2	B	Ikamatua		43c	3s10	Rooting Depth Limitation - D,E,F
2	D	Ikamatua		43c	4s5,3s10	) Short growing season as a result of
2	E	Ikamatua		43c	3s10,3c2	) altitude, valley aspect and valley width
2	F	Ikamatua		43c	4s5,4c3,3s10	)
2	E	Otere		44	6e3,3e9,3c2	
2&Waimea	E	Tadmor	T/TsH	44cH	4e6,4s7	
2&Waimea	F	Tadmor	T/TsH	44cH	4e1,6e18,3e3,7e11,7	E or F depending on slope
2&Waimea	G	Tadmor	T/TsH	44cH	6e18	
2&Waimea	F	Kairuru Complex	Kx/KxH	44d	5s2,6e4	
2	F	Otere Hill		44H	6e3	
3	D	Howard		45a	4c1	)
3	E	Howard		45a	4c1	) Grading difference due to increaseing slope
3	F	Howard		45a	4c1,7c6	)
3	F	Howard Hill		45aH	7e13,6e25,7e11	
3	H	Howard Hill		45aH	7e13	Over 700 m

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
2&Waimea	F	Hope Hill	HeH	45bH	7e11,6e16	Provided not too steep
2&Waimea	G	Hope Hill	HeH	45bH	7e11	
2&Waimea	E	Korere Hill	KeH	45H	6e16	
2&Waimea	F	Korere Hill	KeH	45H	7e11,6e16	
3	F	Blackball		46aH	6e25	
3	G	Blackball		46aH	7e13	
3	H	Blackball		46aH	7s7	
3	F	Arahura		46H	6e25,7e13+6e25	
	H	Kenepuru Steepland		47a	7c6	above 800m
2	F	Onekaka Hill		47d	4e10+7e9,7e25	)
2	G	Onekaka Hill		47d	8e3,7e9,7e25	) Grading difference due to increaseing slope
2	H	Onekaka Hill		47d	8e3	)
2	F	Onekaka Rolling		47dH	6e21,7e25,7e9	
2&Waimea	G	Kawatiri Steepland	KwS	47e	8e3	
2&Waimea	H	Kawatiri Steepland	KwS	47e	7e25,8e3,8e5	
3	G	Kawateri Hill		47eH	6e21	Reversion due to fertility
3	H	Kawateri Hill		47eH	7e25,8e3,8e5	
3	H	Punakaiki Steepland		47f	8e11	
3	G	Punakaiki		47fH	6e+bedrock	
3	D	Craigeburn		52	4c1	
2&Waimea	D	Tophouse Stony Silt	Tp	52a		Provided adequate depth
2&Waimea	F	Tophouse Hill	TpH	52aH		
2&Waimea	H	Katrine	KnH	53b	4s14+6w2	
2&Waimea	F	Katrine Hill	KnH	53bH	4e16,6s12	
2&Waimea	H	Patriarch Steepland	PcS	57g		
2&Waimea	H	Spencer Mountain	SnS	58	8e8,8e9	
2	F	Onahau		59	4s10,6s6	E if sloping or humping/hollowing
2	E	Kotinga		59a	4s10,6s6	
2	F	Kotinga		59a	7s7	
3	H	Okarito		60	7s7	
3	H	Waiuta		62	7s7	
2	H	Puponga Steep		62a		Severe Erosion
2	H	Puponga Rolling		62aH		Severe Erosion

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
2	F	Pakawau		62bH	7e8,7e22	
2	G	Pakawau		62bH	6e21,7e22	Also F or H depending on slope and aspect
2	H	Pakawau		62bH	7e22,8e3	
2	F	Denniston Tableland		64f	7s7+7e25,7c6	
2	H	Denniston Tableland		64f	7c6	
2	H	Denniston Rolling		64fH	7s7	
2&Waimea	H	Lewis Steepland	LS	65	8e5	
2&Waimea	H	Haupiri Steepland	HrS	65b	7e25,7e9,8e5	
2&Waimea	G	Pelorus Steepland	PS	65c	6e21	
2&Waimea	H	Pelorus Steepland	PS	65c	8e5	
2&Waimea	H	Pelorus Hill	PH	65cH	8e5	
2	F	Wakamarama		65d	7e25	
2	H	Wakamarama		65d	8e5,8e3	
3	H	Haast+Lewis		65e+65	8e5	
2&Waimea	F	Matiri Steepland	MtS	65f	8e3,7e22,8e5,6e25	Maybe H, depending on slope
2&Waimea	G	Matiri Steepland	MtS	65f	7e22	
2&Waimea	H	Matiri Steepland	MtS	65f	8e5,8e3,7e22	
2	F	Matiri Hill		65fH	7e22	
2	H	Matiri Hill		65fH		
2	H	Kanieri		66	8e5,8e3	Shallow
2&Waimea	H	Glenhope Steepland	GpS	66a	8e5,6e21,7e25	
2	G	Kanieri Hill		66H	7e9,7e25	
2	H	Kanieri Hill		66H	7e25	
2	H	Whitcombe		67	8e7	
3	H	McKerrow		67a	8e5,8e7	
2	H	Hohounu	HoS	67b	8e7	
2	H	Hohounu	HoS	67bH(?)	8c1	
2&Waimea	B	Tahanunui Sand	Tu	68c	6s10,6e24,4s11	Stable. High Organic matter
2	E	Tahanunui Sand	Tu	68c		Climate, especially wind
2&Waimea	G	Tahanunui Sand	Tu	68c	6s10	Raw Sand. Low Organic matter
2&Waimea	B	Tahanunui Sandy Grave	TuG	68c	4e11,7e9	
2	A	Okari		70b	4sh	Same as Tu but higher rainfall
2	E	Mahinapua		70c		Same as Tu but wind blow

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
2&Waimea	D	Wantwood Hill	WdH	71e	4e1	
2&Waimea	E	Wantwood Hill	WdH	71e	7e8,4s1+6e5	Mixed with Hs
2&Waimea	B	Wantwood Silt	Wd	71e	2s2,4e1	
2	A	Tarakohe Silt		73b		
2	E	Tarakohe Hill		73bH	6e3	
2	F	Tarakohe Hill		73bH	6e3,6e5,5s2	
2	F	Tarakohe Rolling		73bH + 44H		B if little slope
2&Waimea	F	Heslington Steepland	Hs	74b	4s1+6e5,6e5	
2	F	Pikikiruna Steep	PkS	74c	6e3,6e4,7e8	Steep but fertile
2	G	Pikikiruna Steep	PkS	74c	8e1,7e8	Steeper slopes
2	H	Pikikiruna Steep	PkS	74c	8e1,7e8	Longer, steeper slopes
2	E	Pikikiruna Hill		74cH	6e4	
2	F	Pikikiruna Hill		74cH	6e4,5s2,5e2	
2&Waimea	F	Atawhai Steepland	AxS/As	77c	8e1	
2&Waimea	G	Brooklyn Steepland	BrS	77d	6e5,7e1	Majority
2&Waimea	H	Brooklyn Steepland	BrS	77d	7e1	Higher altitude
2&Waimea	E	Brooklyn Hill	BrH/BrS	77dH	6e5	
2&Waimea	F	Brooklyn Hill	BrH/BrS	77dH	6e18,7e1	Slope
2&Waimea	G	Brooklyn Hill	BrH/BrS	77dH	7e1	
2&Waimea	H	Dun Steepland	DuS	79	8e5	
2	B	Rameka		80b		Depth limiting in some cases.Some A, steep = C
2	F	Ligar		81eH	4e2	H on steep slopes
2	H	Ligar		81eH	7e9	
2	H	Bryneira		83a		
2	H	Kini		87a	6w2,7w2,8w1	C if drained
2&Waimea	B	Richmond Clay	Rm/Rmp	89c		Wetter than silt
2&Waimea	E	Richmond Clay	Rm/Rmp	89c	2w1	Wetter and low lying
2&Waimea	A	Richmond Silt	Rms	89c	3w1	
2&Waimea	B	Braeburn	B/Bn	89d	2w1,3w1	
2&Waimea	D	Braeburn	B/Bn	89d	3w1	Climate
2	E	Karangarua		91a	7w2+6e3,6s5,4s11	
3	H	Motukarara		92	7w3,6s10	
2&Waimea	A	Waimea	Y/Ym/Yg	98	1s2,2s2,2w1	

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
2&Waimea	C	Waimea	Y/Ym/Yg	98		Cold, narrow valleys
2&Waimea	H	Waimea	Y/Ym/Yg	98	4s1	Low lying, high water table
2&Waimea	A	Riwaka	R & Rw	98a	1s2+2s2	
2&Waimea	C	Ronga	Ro	98b		
2&Waimea	F	Ronga	Ro	98b	4s2	
2&Waimea	A	Sherry	Sy	98c	3s2,2s2,3e2	Riwaka Plain only
2&Waimea	B	Sherry Sand	Sy	98c		East/West orientation
2&Waimea	C	Sherry Sand	Sy	98c	3s2	Valley - often sloping
2&Waimea	D	Sherry Sand	Sy	98c	4s3	Climate
2&Waimea	E	Sherry Sand	Sy	98c	3s2,4s12	Altitude. Valley width
2&Waimea	G	Sherry Sand	Sy	98c		Very narrow valley
3	D	Tasman		99	4c1	
3	F	Tasman		99	6e3,4s12	Flooding
2	B	Hokitika		99b	4s2	
3	E	Hokitika		99b	4s2,6s12	
3	F	Hokitika		99b	4s2	Flooding
2	A	Karamea Silt		99c	3w3,4s10,3s8,4c3,4s2,3s2	
3	H	Alpine		100		
2&Waimea	D	Atapo Stony	Ap	n/a	3s3	Drainage
2&Waimea	B	Bishopdale clay	B	n/a		
2&Waimea	A	Clifton		n/a		
2&Waimea	A	Graham Silt Loam	G	n/a	3s2	
2&Waimea	B	Graham Silt Loam	G	n/a	3e6	Colder up narrow valleys
2&Waimea	F	Lee Steepland	Les	n/a	7e3	
2&Waimea	A	Maori Gravel	M	n/a		
2&Waimea	D	Matariki	Mar	n/a	4s3	
2&Waimea	E	Matariki	Mar	n/a	3w3,3e6	
2&Waimea	F	Ngamoti Steepland	NS	n/a	7e9,6e11	
2&Waimea	F	Otu Steepland	OtS	n/a		
2&Waimea	D	Sunnybank	SH	n/a		
2&Waimea	E	Sunnybank Hill	SyH	n/a		
2&Waimea	A	Takaka Silt		n/a		
2&Waimea	B	Tapawera Sandy Loam	Tw	n/a	4s3+6s4	

Soil Map	TDC	Soil type	Legend	Number	LUC class	Comments
2&Waimea	C	Tapawera Sandy Loam	Tw	n/a	4s3+5s4	
2&Waimea	D	Wangapeka	Wp	n/a		
2&Waimea	E	Wangapeka	Wp	n/a	4s3	Too bouldery for Cropping + climate

SOIL TEMPERATURE ZONES

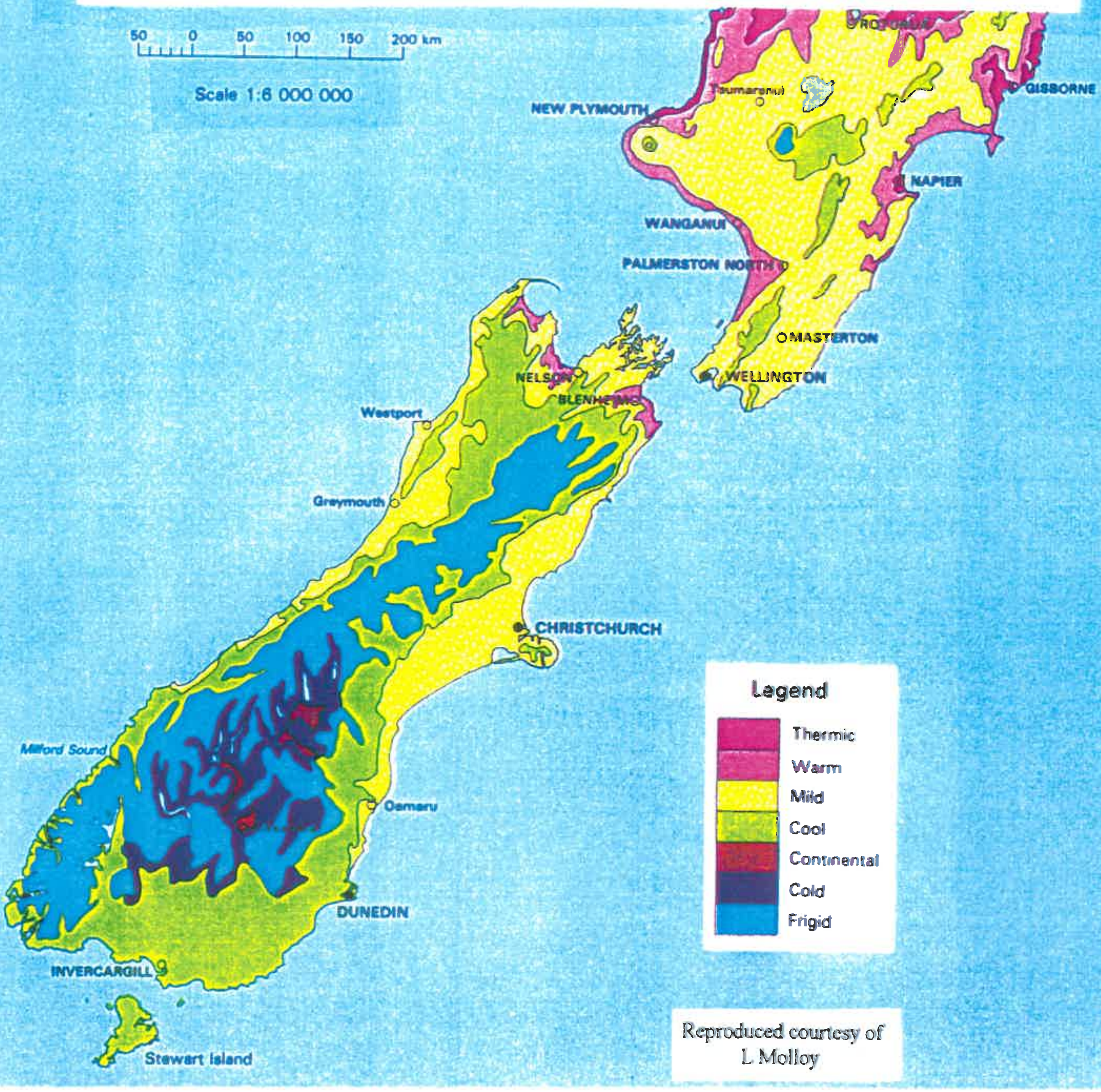
TABLE 14.1
Characteristics of soil temperature zones of Fig. 14.3

Soil temperature zone	Mean soil temperature* (°C) Summer	Winter	Growing season (number of days above a base soil temperature) ≥ 5°C	≥ 15°C	≥ 20°C	Dates in spring when soil temperature expected to reach 10°C†
Thermic	≥ 20	≥ 10	whole year	> 180	> 60	in north all year; in south 4th wk July to 3rd wk August
Warm	≥ 19	≥ 7	whole year	> 150	brief period	4th wk August to 1st wk September
Mild	< 19	≥ 5	300-365	> 100	none	4th wk August to 1st wk October
Cool	< 17	≥ 4	300-365	50-100	none	1st wk October to 2nd wk October
Continental	≥ 17	< 4	< 300	100-150	occasionally	1st wk October to 2nd wk October
Cold	< 17	< 4	< 300	50-100	none	3rd wk October to 2nd wk November
Frigid	< 15	< 2	< 250	< 80	none	mid-summer only or not at all

* All data for 30-cm soil depth
< less than; > greater than; ≥ greater than or equal to
† Note that the surface temperatures of soil beds for seed germination will not be the same as these temperatures at 30 cm depth; consequently, the dates must only be treated as approximate for seed germination.
Zones based on data of R. Aldridge.

Fig. 14.3

Soil temperature zones of New Zealand. The temperature characteristics of the zones are given in Table 14.1.



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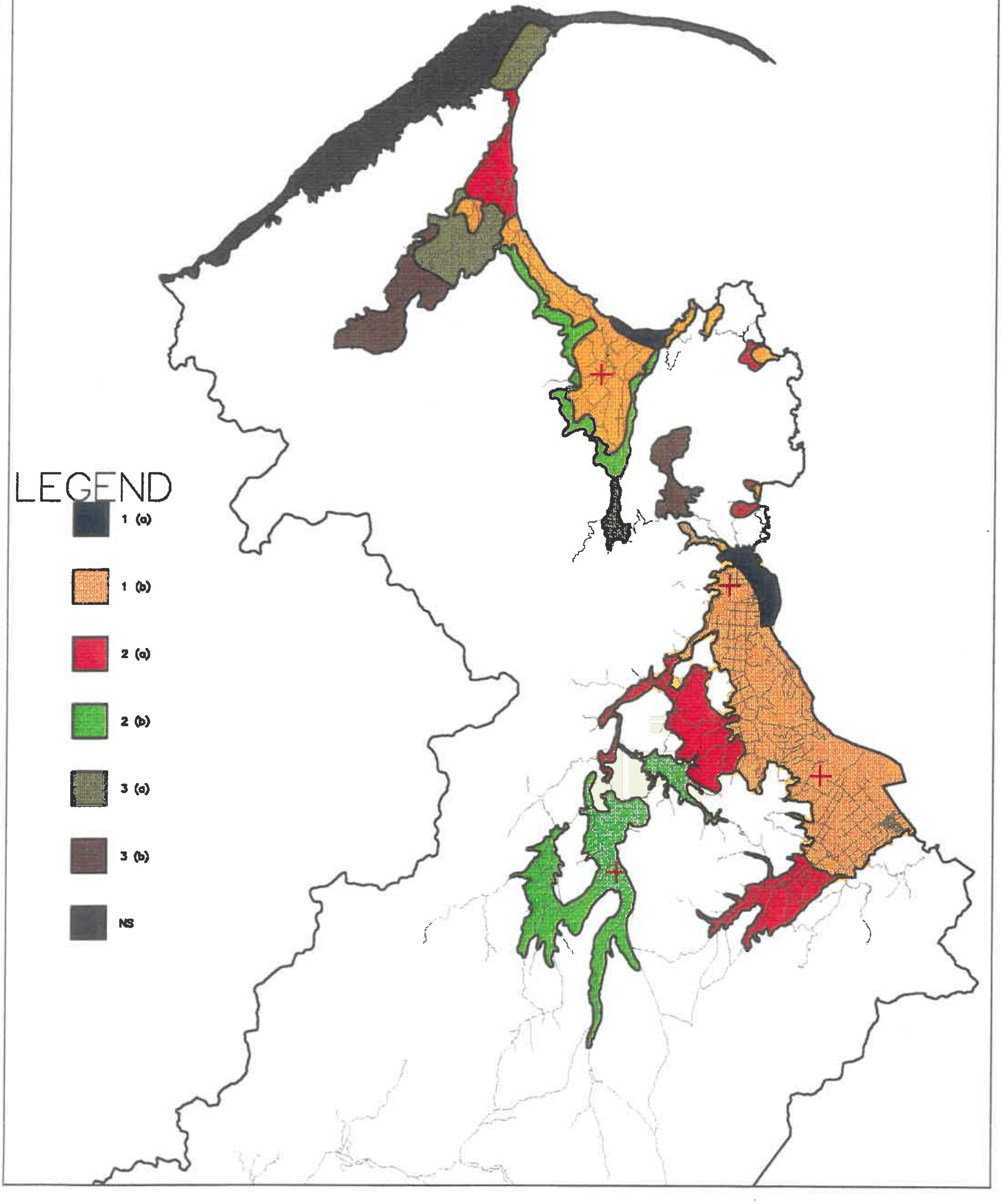
Tasman District Council

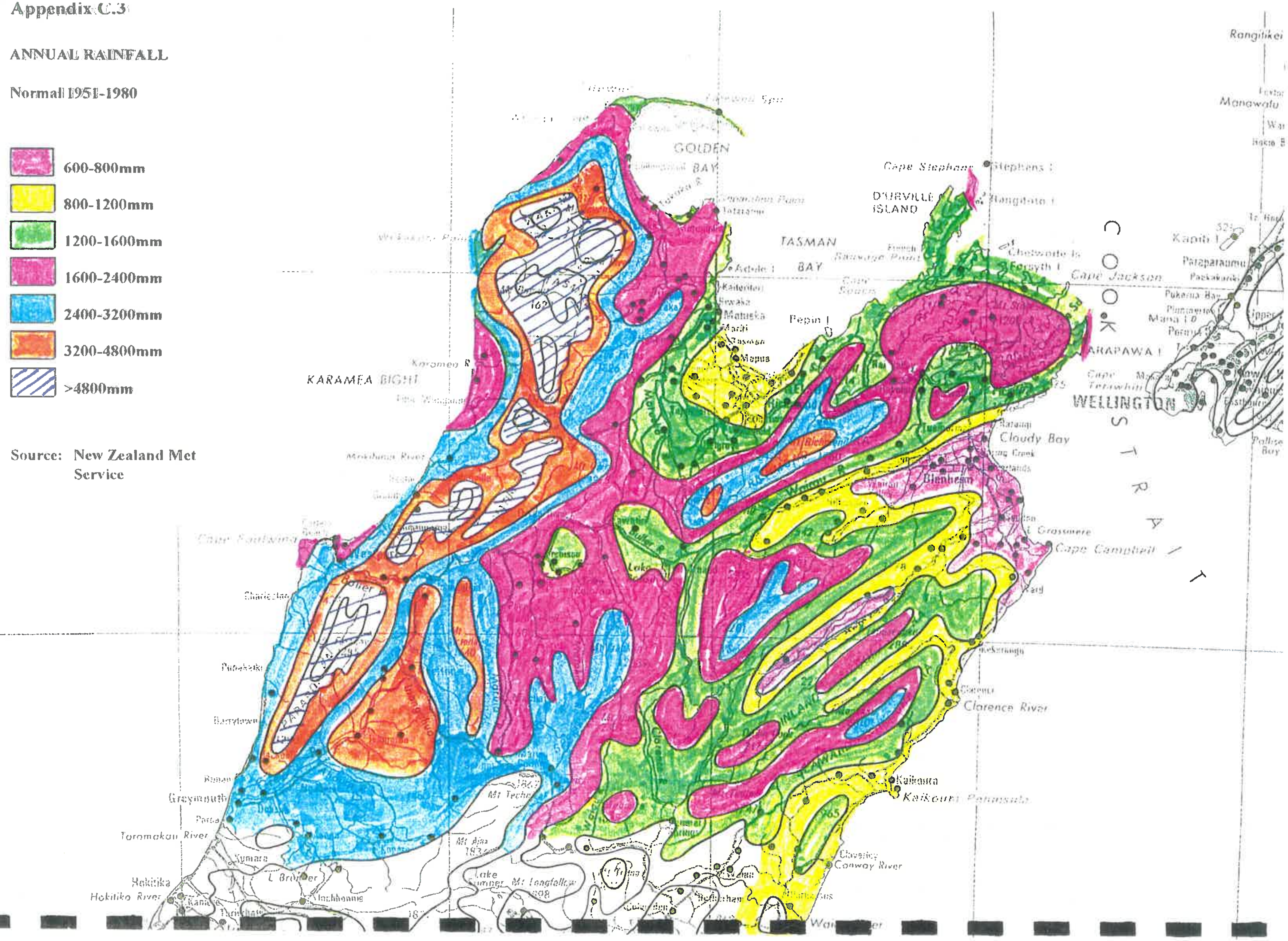
Appendix C.2: SUITABILITY OF CLIMATE FOR HORTICULTURAL CROPS



Appendix C.3

ANNUAL RAINFALL

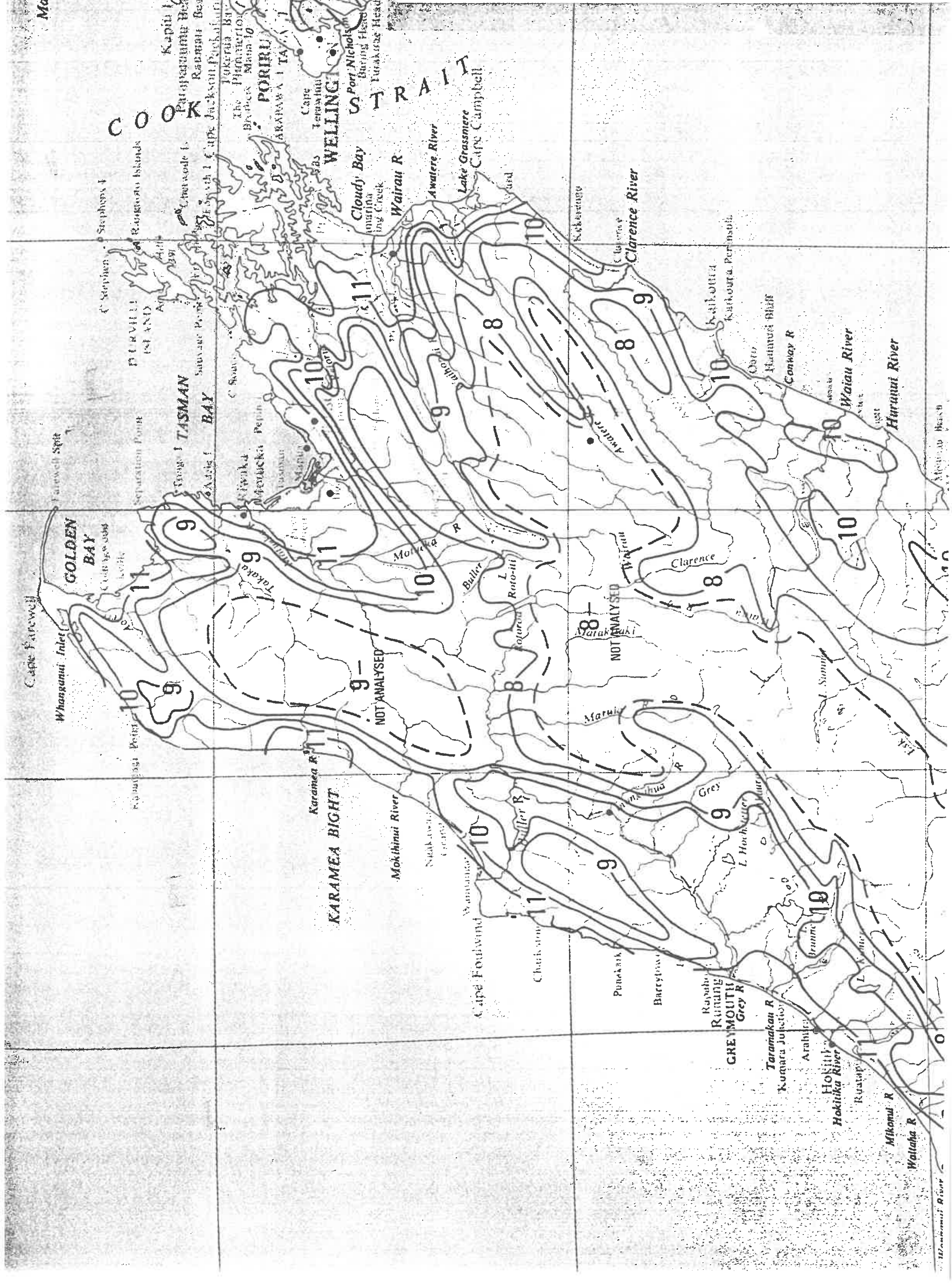
Normal 1951-1980

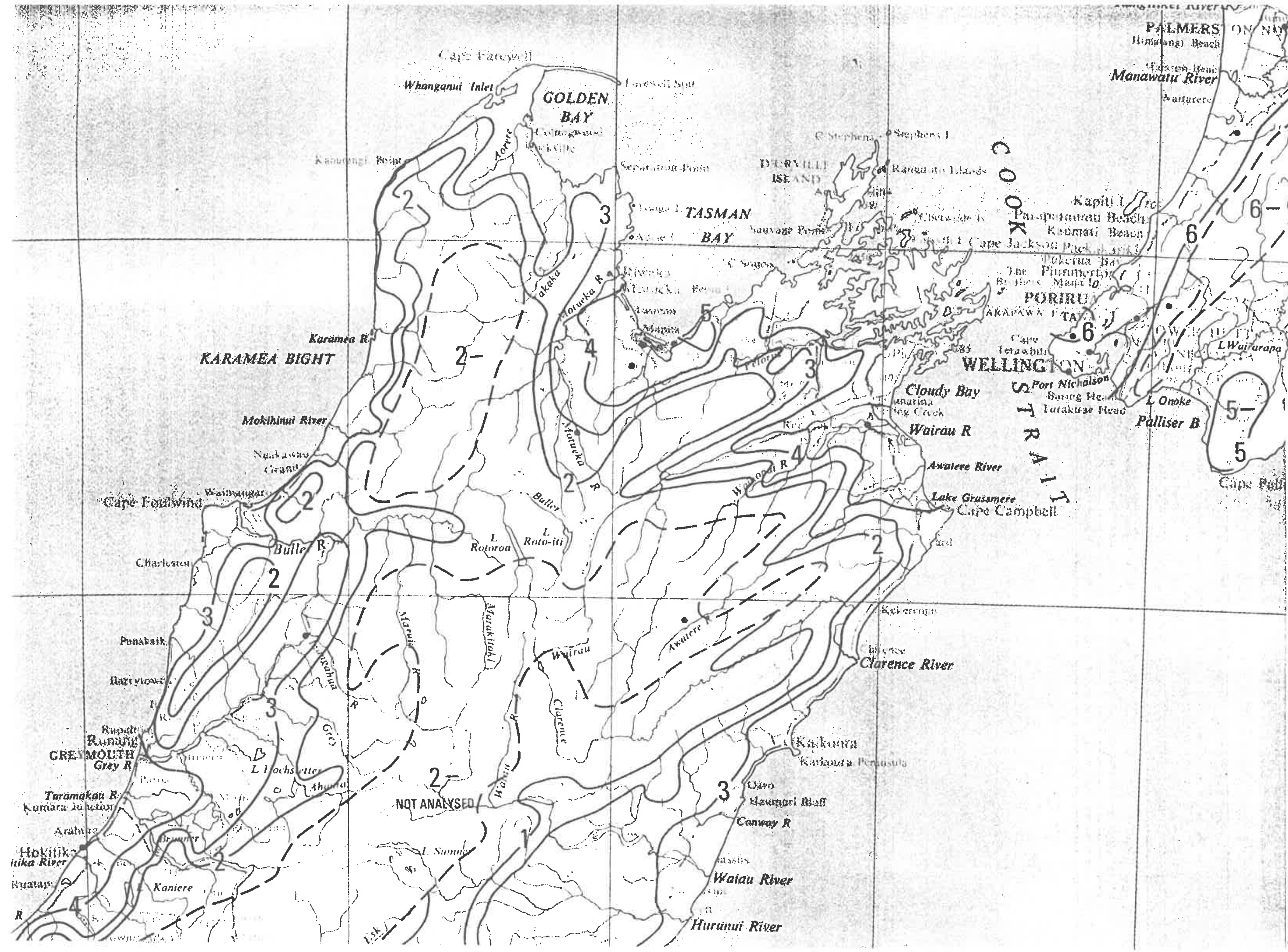


Source: New Zealand Met Service

Appendix C.4 — Mean Annual Air Temperature

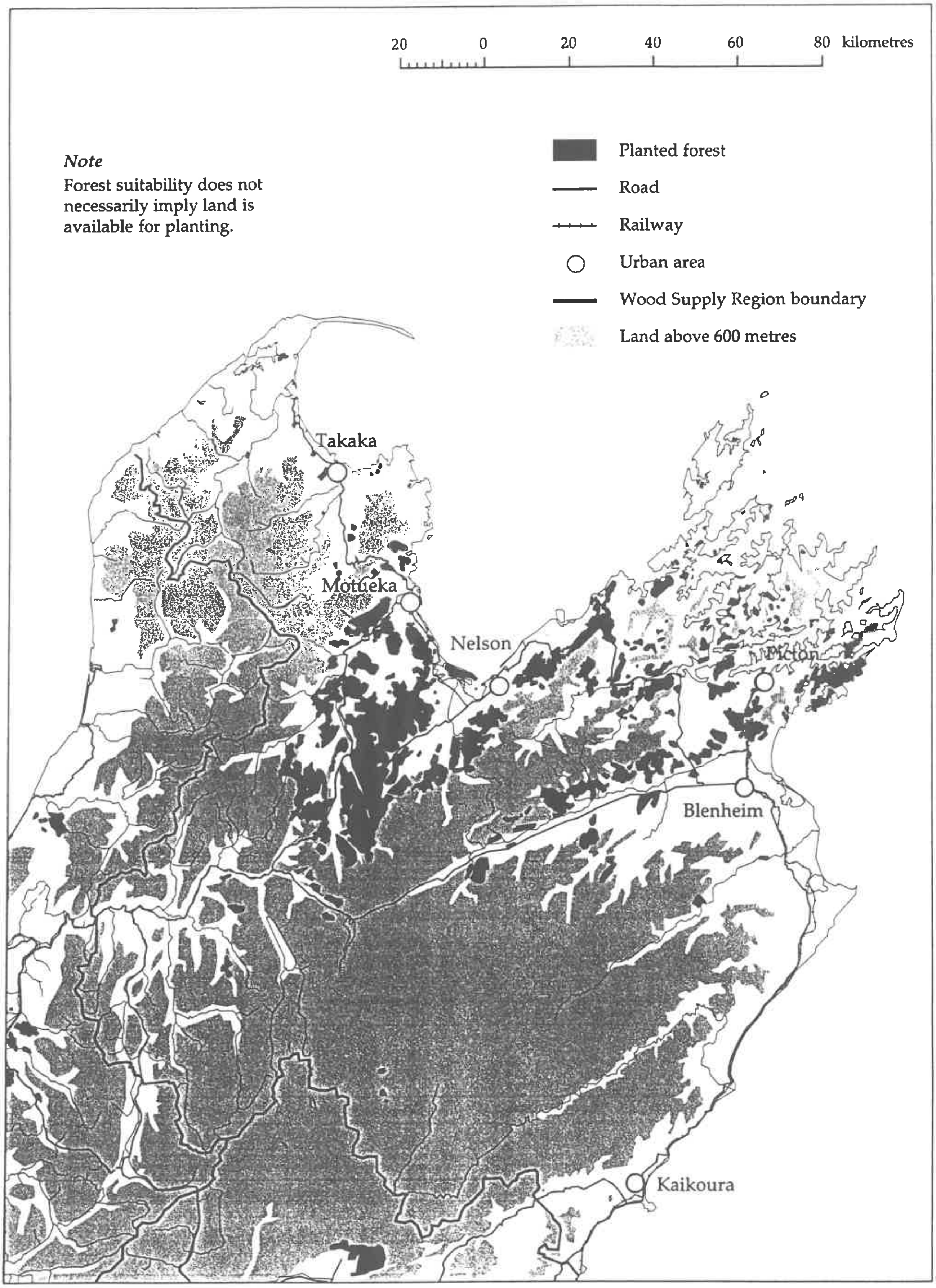
Appendix C.5 — Annual Soil Temperature -10cm Annual Average





Appendix C.6 — Annual Soil Temperature -10cm Average for July

23 *Planted Forest Suitability*



where only 8% of the land area has a site index greater than 25m. These areas are restricted to higher rainfall, lowland districts. The 1.6% of South Island land area with the highest ranking (>29) is restricted to the West Coast and Nelson, and the land area with next highest rankings to the West Coast and Marlborough (and small areas of the North Canterbury sand country).

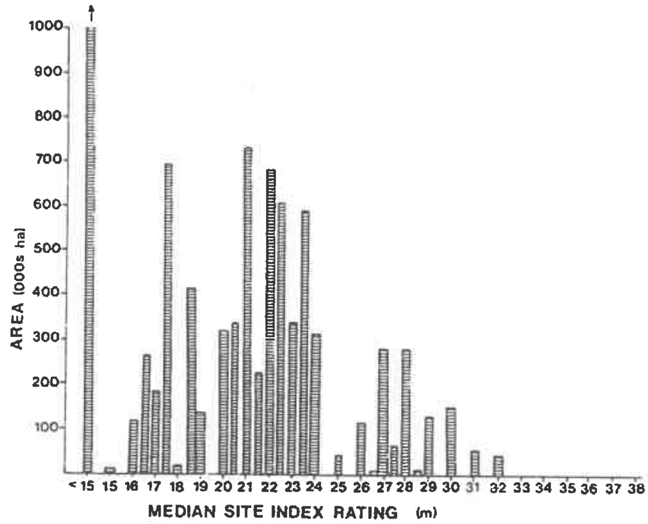


Fig 2A. North Island areas of each site index grouping.

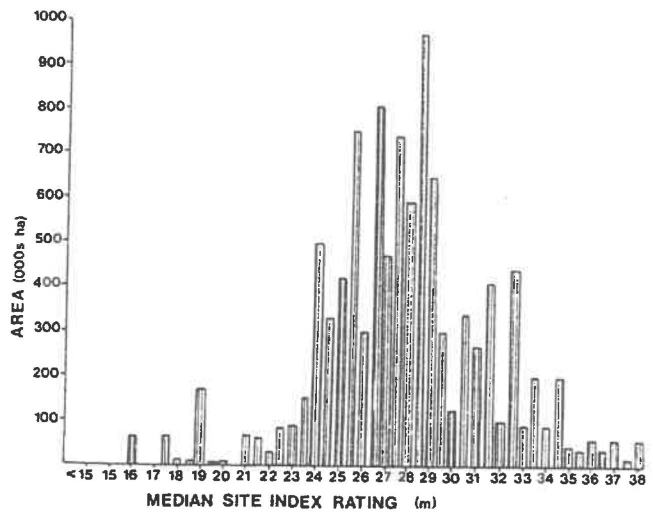


Fig 2B. South Island areas of each site index grouping.

In the extended legends for all regional LUC classifications (e.g., Fletcher 1981), forest suitability was subdivided into three groupings: production, erosion control and protection. Of these, only erosion control forestry is further discussed in this paper. In the NZLRI, erosion control forestry was taken to be exotic forestry that had erosion control as its principal function. In this case specific management procedures are required to minimize erosion (and water management) during establishment and harvesting. In the North Island 26% of land suitable for *Pinus radiata* was assessed as requiring erosion control forestry but only 11% of land in the South Island was similary assessed (Table 3). These differences reflect the greater extent of land in the North Island which is susceptible to mass movement erosion and the consequent need for forestry as an erosion control measure.

This paper has provided a broad analysis of the distribution of site index of *Pinus radiata* in New Zealand. A more

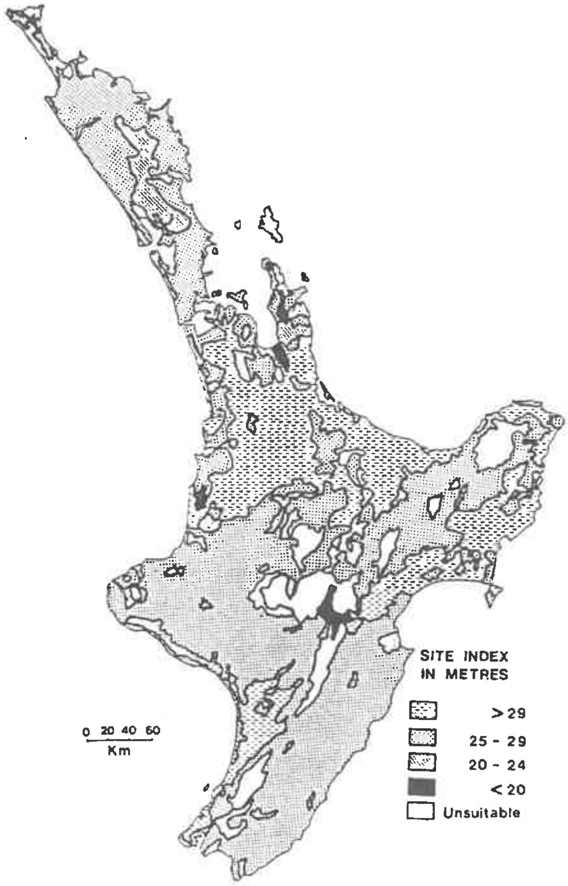


FIGURE 3: Site index rankings for the North Island.

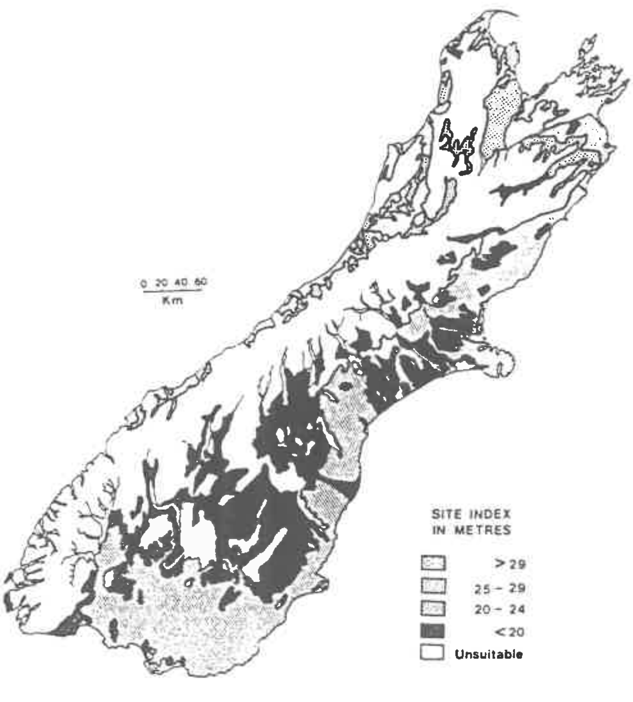


FIGURE 4: Site index rankings for the South Island.

Appendix E: Audit Trail — Comments For Each Map

Notes are made for each map where there has been a change to either the base data or interpretation of the data. Base data may have been changed due to additional information available about soil types, topography etc.

Where there has been a variation from standard interpretation, the reasons are noted.

M25

Some discussion on whether the Tahunanui sandy soils labelled B in the classification system could have in fact been labelled E. Those on the west coast have a higher rain fall, which is beneficial for their flexibility of use, but are also more prone to wind blow. We classified them in the end E. Those sandy soils on the eastern (Golden Bay) side can be very raw, with very little organic matter. Where they are in very small areas, we have labelled all these B, but some of them, (if they are very raw) will be less flexible than those more mature sandy soils. An B classification in this case may be too high.

LUC 7E 22. This classification in the area near Westhaven Inlet was given three separate classifications under our system. That is Class F for those more gently sloping areas lying to the north west. Class G for those more broken areas with generally steeper slopes but at lower altitudes. Class H for those areas that had very steep and deep gorges, generally at slightly higher altitudes and closer to the National Park.

There appears to be a mistake on the LUC on the eastern coast just south of the Collingwood estuary known as Parapara Inlet where the areas marked A are in fact part of the estuary. The soils classified A are in fact much smaller than those shown on the LUC and tend to be around the periphery of the estuary. In a few small areas, specially in the north and west labelled on the LUC as 87A Kini organic soils, if well drained could be classified C. However given the locality and their wetlands status, then we have classed them as H.

M27

The Wangapeka soils in the higher valley's are classified E, but as the valley's broaden out they are classified D. Some areas have a large content and size of stone which could place those parts into Class E.

Tadmor (44cH). Some of this soil is found in a steepland situation. In this case either a G or H classification depending on degree of slope.

M28

Soil type Motupiko (33g). This soil type in the valley floors of streams running into the Buller is in fact a very poor soil type. Therefore we have given it a classification of E. However in the stream valley's running towards the Motueka the soil type is deeper and more flexible and therefore been given classification of either B-D.

Sherry soils at this altitude are classified as E. At lower altitudes they have been classified as A.

Where the Sherry soil exists in very narrow valleys, cropping is probably not a practical situation and we have classified it as E.

An area north of Rockville has been upgraded to an A. Although it is wet, it is sheltered from the north west, so it is a warmer area than other parts of the Aorere Valley.

M29

Kawateri steepland and Kawateri hill soils classified H where very steep otherwise Class G.

Motupiko soil in the narrow valley floors and at higher altitude classified E. They also have high rainfall.

Howard soil type, when found flat and at reasonable altitudes is classified D, where rolling or at higher altitudes possibly E or F.

Howard (45a) on the flatter valley floors Class D, on the rolling hills Class E.

Howard (45a). Once we move into higher altitudes this has been shifted from Class E to Class F. i.e above 600 metres (2000ft).

Howard (45aH). When this land goes above approximately 700 metres then Class G.

Howard (45a) Classed as H above 7-800 metres.

Howard (45aH) on steeper slopes and higher altitudes classified as H.

Hokitika (99b) these soils exist in the valley floors and in places are susceptible to flooding. In these cases they are classed E.

Ikamatua (43c). On the river terraces this soil is classed at these higher altitudes as D, in the valley floors adjacent to the rivers where the soils tend to be thinner and bonier, then classed as F.

Ikamatua (43c) classified F where flood prone.

N25C

COMMENTS

Tarakohoe (73b) together with Otere (44). Where these two soils are found in conjunction with each other they have been classified as Class F, but the flatter pieces could be either Class E or where the Tarakohoe appears as (73b) alone, then could it be classed A.

The Tahunanui Sands (68c) have been classified Class B or C where they exist in reasonably large areas and have a significant amount of organic matter. However they have been classified G where they exist in small areas and are still very much in raw state with little organic matter. e.g. adjacent to the Pohara Motor Camp.

N26A

Coastal sands generally classed B unless considered to be raw with minimal organic matter where they are classed G. The outlet of the Motueka River at Motukarara has been classified as H in light of the flood probabilities together with the estuarine nature of the river meeting the sea.

Dry River Gully (east of Glenview Road - near Substation) was downgraded due to extensive shading as a result of steep high sides to gully.

Plateau at end of Rocklands Road has been upgraded to C. Although it has shallow soil, climate is warm and dry (1 a.)

N26C

We have distinguished here between the Brookland steepland soils as classification G, and the Brooklyn hill soils as classification F, signifying a difference in slope.

Riwaka soils up the Riwaka Valley have been downgraded to Class B because of shading and temperature effects.

Wakamarama steeplands soils (65d). These have been classified H but in areas where slopes are more gentle. Then classification G would be possible.

Pikikiruna (74c,74ch). This soil type has been given Class F where the slope is more gentle and H where steep.

Areas around Little Sydney Valley have been upgraded. The LUC had treated Kaiteriteri Sandy Loam (K) as a hill soil. Orchards are grown in this area presently.

N27 (Western Half of Map Only)

COMMENTS:

Mapua Soils (32). A mixture of LUC classification 4 e5 plus 6 e16 exist together in portions of this map. Where the predominant LUC is 4 e5, it has been given the higher classification of B if 6 e16 is dominant then given classification E. This means that parts of these areas should be classified as the higher class and others within that area would not in fact be up to the standard of that classification.

Kaiteriteri hills soils 37 cH 7 e9. Where these soils have unweathered rock reasonably near to the surface then these soils could be classified G. However where the underlying rock is deeply weathered then we would give it the classification of H. At this stage, neither the soil maps nor our own information is sufficiently detailed to distinguish between the two.

These soils are particularly prone to erosion — especially as the result of cutting roads and tracks. Areas that are already adequately tracked for timer felling operations could remain in that crop, however areas still untracked should probably remain so.

Pokororo Steepland (41e). Where the slopes were steep and long these were classified H. Otherwise generally classified G.

Brooklyn Steepland (77d). Generally classified as G. At higher altitudes classified H.

N27B

The major point in contention on this map is the boundary between Class B and Class E within the Mapua series (32). Class B is currently mostly in orchard and Class E in plantation forestry. Many of the north facing slopes lie adjacent to all the small ephemeral streams, that run from Old Coach Road to the coastline. If we were to mark these in as separate areas, then the map would be very difficult to read. The boundary therefore in this situation to some extent reflects existing land use. In the area just west of the Inland Moutere Highway, generally south facing slopes have been taken out and classed as E with the flatter northerly facing slopes as B. Topography was often a determining factor. Steep faces were graded E, gentle slopes to B.

The LUC area surrounding Pinehill Road has been altered slightly in view of the aspect and existing orchards.

Low areas just to the north west of Mapua have been classified A. These however would be very vulnerable to Global Warming and tidal rises. The very low lying areas within this lowland are thought to be possibly of the soil type Motukarara. If this is the case then they would be classified as a wetland with an H classification.

An area on the north side of Pomoana Road near Ruby Bay was downgraded from B to C due to steepness of ridges.

N27D

WAIMEA PLAINS

The Tahunanui Sands have generally been classed B rather than G because of their higher organic matter.

Some of the lower reaches of the Waimea River and around the estuary have been classified H because of their very low lying nature and susceptibility to Global Warming.

In the Moutere Hills the south facing generally steeper slopes end up as Class E where as the more gently northerly facing slopes appear as Class B.

Where the Waimea Plains meet the estuary then the very low lying areas adjacent to the estuary have been graded either E, where they are very susceptible to tidal influences, or B where they are slightly higher but still very wet. Further up the Waimea Valley the Motupiko soils have been classed A between Brightwater and Wakefield but the adjoining Dovedale soils have been classified B. This is because either they are on the lower slopes and tend to be thinner heavier soils or in some cases they may be more southerly facing.

End of Cotterell Road — downgrade Waimea Silt Loam from A as it is very wet.

Hills to south of Redwood Valley section of inland Motueka Highway (ex TNL block). Downgraded to E as ridges are too steep for horticultural crops.

Aniseed Valley floor — good soils (Waimea Silts) but cold, therefore downgraded.

Ranzau Road east — areas where very wet, impossible to drain for horticulture.

North side Bateup Road — soil map wrong. Soil type heavier than Ranzau Stony Clay Loam. Downgrade from A to B.

N28

Dovedale soils on some maps are classified together with the Motupiko soils (33g). In the narrow valleys toward the top section of the valleys these soils have been down graded to a Class C. This decision was influenced by the width of the valley compared to the height of the hills on either side. To some extent the workability of the area by the meandering or otherwise of streams etc which is usually a sign that the area floods from time to time.

Braeburn (89d) where above Wakefield and on the cooler side of the valley classed D.

At map reference 250760 there is on the LUC indicated Dun Steepland soil (79) which is currently planted in forestry. We have a feeling that this soil type should be a Pelorus steepland soil. We have therefore indicated it as Class G where as normally under a Dun soil it would be Class H.

Dovedale soils in 88 Valley have been upgraded to a C. The Dovedale soils in 88 Valley are better soils than in vallleys on the other side of the Wai-iti Plain. Also the 88 Valley lies well to the sun.

N29

Kikiwa silt and Kikiwa rolling (34b). On the terraces and flats these have been given a class C, in the rolling phase a class E.

Pelorus steepland (65c). In areas where the slope is more gentle, Class F is used. On the steeper slopes Class G, and on the very steep slopes Class H.