NUGENT REPORT

Land Capability Survey of Tasmania

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Department of Primary Industries, Water and Environment
Newtown Offices
2001

Nugent Report
and accompanying 1:100 000 scale map

DEPARTMENT *of* PRIMARY INDUSTRIES, WATER *and* ENVIRONMENT
Tasmania

AUSTRALIA
Natural Heritage Trust
Helping Communities Helping Australia

Published by the Department of Primary Industries, Water and Environment, Tasmania with financial assistance from the Natural Heritage Trust

Printed in house, New Town and by the Printing Authority of Tasmania, Hobart.

ISSN 1036 5249
ISBN 0-7246-69620

Refer to this report as:

DeRose R.C. and Todd D.J. (2001), Land Capability Survey of Tasmania. Nugent Report. Department of Primary Industries, Water and Environment, Tasmania, Australia.

Accompanies 1:100 000 scale map, titled 'Land Capability Survey of Tasmania. Nugent' By R C DeRose and D J Todd, Department of Primary Industries, Water and Environment, Tasmania, 2001.

Contents

Acknowledgements

Many people and organisations have combined to make the production of this report and map possible. The author wishes to thank each of them for their respective contributions.

- The farmers and land managers who allowed us access to their properties during fieldwork, and provided valuable local knowledge. The authors would like to express their sincere thanks to all those individuals for their time and advice.

- The Bureau of Meteorology for providing climate data.

Department of Primary Industries, Water and Environment staff, who contributed to the production of this map and report, include:

- Chris Grose for guidance during mapping, and editing and reviewing of the final report.

- The GIS team of Mark Brown, Simon Lynch and Tony Davidson, for preparation of base maps, climate modelling, and digitising and preparation of the 1:100 000 map.

- The soil survey team of Stacey Spanswick and Darren Kidd for soil investigations within the survey area.

- Various Departmental staff for reviewing and criticising the report prior to publication.

- The staff of Information and Land Services for supplying digital topographic data.

And finally, the Natural Heritage Trust, without whose financial support the project would not have been possible.

SUMMARY

This map describes and classifies the land resources occurring on privately owned and leased Crown land within the area defined by the limits of the Nugent 1:100 000 scale topographic map (Sheet No: 8412). The survey area extends over 170 437ha of land, of which 48 831ha is mapped as exclusion area.

The area lies in south eastern Tasmania and includes the towns of Triabunna and Sorell, together with smaller centres of Orford, Buckland, Midway Point, Dodges Ferry, Dunalley and Murdunna. The survey area extends from Cape Bougainville near Triabunna in the north east to Cape Deslacs on South Arm Peninsula in the south west. It includes the northern half of Forestier Peninsula. A series of high elevation peaks and plateaux in the north west, including Brown Mountain and Mount Hobbs rising to 823m above sea level, and similar landforms in eastern areas centered about Prosser Sugarloaf, form the dominant topographic features in the survey area.

The land is described and assigned land capability classes according to the system defined in the Tasmanian Land Capability Handbook (Noble 1992a, Grose *in press*). The land capability assessment categorises land units according to their ability to produce agricultural goods without impairment to their long term, sustainable, productive potential. Each land unit is assigned one of seven capability classes, from Class 1 to Class 7 with increasing degree of limitation to agricultural production and decreasing range of potential agricultural uses. Classes 1 to 4 land are suitable for cropping activities. Class 3 or better land represents prime agricultural land and is restricted to the better soil types under more favourable site and climatic conditions. Classes 5 and 6 land are suitable for pastoral activities only, while Class 7 land is unsuitable for agricultural use.

In interpreting information contained within this report the reader needs to be aware of the following important points relevant to the land capability classifications system:

- Land capability assessment in Tasmania is based on rainfed agriculture and does **not** consider the potential for irrigated agriculture.
- Climate is an important factor in determining land capability. Thus in areas of low rainfall, the lack of precipitation may limit land capability to Class 4 although, with irrigation, the land may be used at a capability Class 3 level or higher (see comments below).
- Land capability is assessed for broad acre cropping and grazing activities. Horticultural activities, notably orcharding and viticulture are not considered in the evaluation.
- The 1:100 000 scale of survey restricts the minimum area of contiguous land that can be reasonably mapped to about 64ha. Smaller areas of land are occasionally mapped where they are considered significant and easily defined.
- Map units are not pure and may contain up to 40% of another class, although in most cases the area of inclusions will be much smaller than this.

The land capability survey was achieved through a combination of fieldwork, aerial photo interpretation and computer modelling. The major limitations to agriculture were

identified as poor soil properties (poor drainage, high stone content, low natural fertility, shallow rooting depth, and soil salinity), water and wind erosion potential and unsuitable climate.

Table 1 indicates the amount of each land capability class identified. Few areas of prime agricultural land (Class 1, 2 and 3 land) were mapped within the survey area. Small areas of Class 3 land were mapped mainly on basalt soils to the east of Copping where annual rainfall was considered adequate to support a range of cropping activities. Throughout much of the remainder of the survey area low temperatures, coupled with extremely low summer rainfall, produce a short growing season from October to December. This severely restricts the range and types of crops that can be grown. Consequently, most of the land in the vicinity of Sorell and Orielton, for example, is restricted to Class 4 or poorer irrespective of the type of soils present.

The main agricultural activities within the Nugent survey area include dairying, ley farming and the occasional cropping enterprises on the more fertile footslopes and valley flats (Class 4 and 5 land). Here, a wide range of soil types have developed primarily on Tertiary and Quaternary alluvial sediments, but also on steeper basalt terrain and Triassic sandstone. There is a trend towards more non-traditional farming enterprises such as the establishment of viticulture and olive orchards, albeit on a small scale, where suitable soil types and microclimates exist. Elsewhere, gently to moderately sloping land is used primarily for beef and sheep production (Class 5 land). Grazing enterprises also dominate in some coastal areas, such as near Dodges Ferry and Primrose Sands, where extensive Quaternary sand sheets are found (Class 5 and 6 land). The lower slopes and benches of rises and hills provide grazing on productive native and improved pastures (Class 5 and 6 land). Siliceous Triassic and Permian rocks often underlie these areas and produce nutrient poor, erodible soils. Jurassic dolerite is commonly found further upslope, along ridge crests and highland plateaux and, while producing more fertile soils, these are often stony and shallow. Extensive areas of steep hill country support native forest and woodland on steeper slopes (Class 6 land). Rocky mountain lands at higher elevation, together with very steep slopes, coastal cliffs, sand dunes, coastal and inland swamps in high rainfall areas, are unsuitable for any form of agriculture (Class 7).

Within valley systems to the north and west of Sorell more fertile black to brown gradational clay rich soils have developed from underlying basalt, dolerite and recent alluvium and these produce among the best soils for cropping in the region. Historically the area has been used for cereal production, although in recent years cropping of limited acreages of poppies, brassicas, peas and potatoes in addition to cereals has occurred. The agricultural potential for these fertile areas is often limited only by low rainfall (less than 600mm per annum) and can be significantly improved through irrigation, thereby allowing a wider range of crops to be grown with higher crop yields.

While it is recognised that these lands have the potential for improved productivity under irrigation it is acknowledged that there are significant risks associated with intensive irrigation practices. The development of secondary salinity is of particular concern given the variable quality of stream and dam water used for irrigation. Soil salinity is potentially one of the major issues that will determine the long term viability of irrigated agriculture in Tasmania. However, there is presently insufficient information available to evaluate the long term consequences of irrigation in these environments.

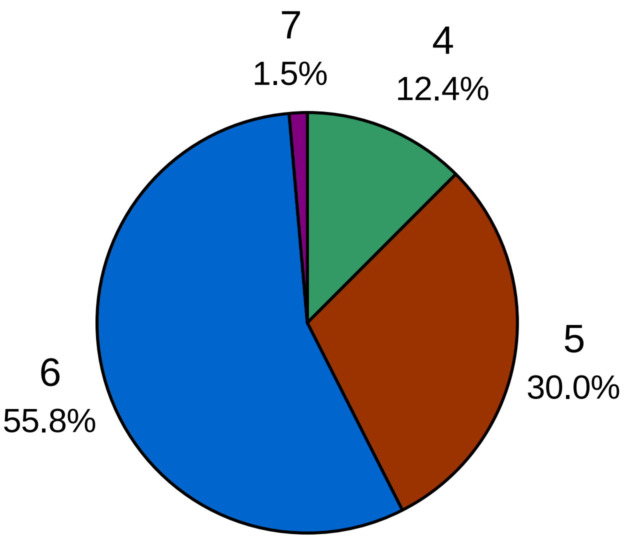


Figure 1. Relative proportion of Land Capability Classes on privately owned and leased Crown land within the Nugent map. Class 3 land only makes up 0.27% of the surveyed area and is too small to be shown relative to other classes.

Figure 1 above indicates the extent of the identified land capability classes within the survey area. These include complex units in which two land classes have been identified but cannot be usefully separated at the scale of mapping. Within each complex the first land class identified is dominant, occupying 50-60% of the unit, while the second class occupies only 40-50%. Complexes occupy only a small percentage of mapped units.

Table 1. Extent of Land Classes and Land Class Complexes on the Nugent map.

Capability Class	Area (ha)	% of map area
3	209	0.1
4	14 000	8.2
4+3	317	0.2
4+5	1 287	0.8
5	34 733	20.4
5+4	127	0.1
5+6	1 827	1.1
6	66 794	39.2
6+5	375	0.22
6+7	162	0.1
7	1 776	1.0
E	48 831	28.6
TOTAL	170 437	100.0

1. INTRODUCTION

This report describes the land capability of the agricultural land within the Nugent topographic map sheet (Sheet numbers 8412). The distribution of the land capability classes identified is depicted in the accompanying map.

This report continues the series published by the Department of Primary Industries, Water and Environment as part of a 1:100 000 scale land capability survey of Tasmanian agricultural land which first started in 1989. This report and map describe and depict the land capability of private freehold and leased or unallocated crown land only. Other areas are considered non-agricultural and are mapped as exclusion areas.

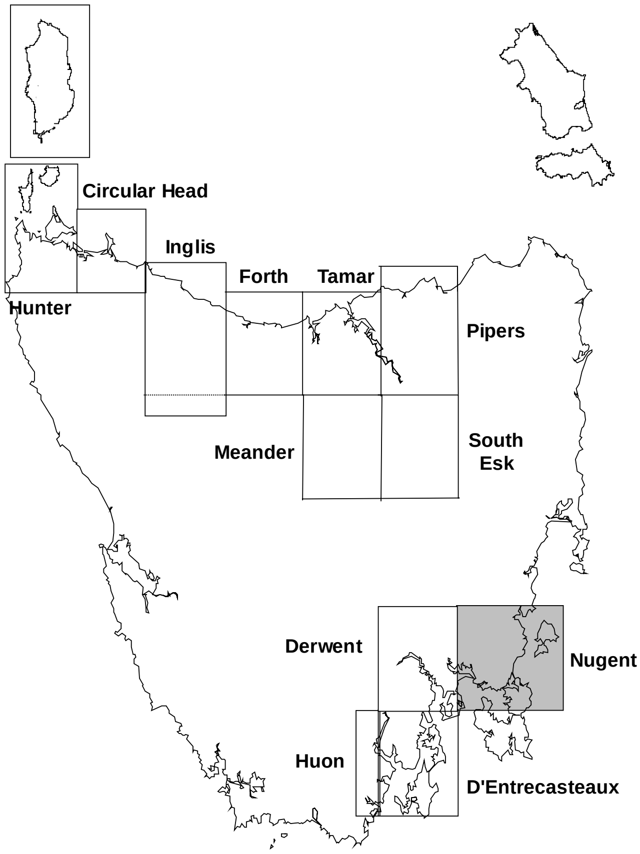


Figure 2. Nugent survey location and previous land capability surveys in Tasmania

The land capability survey aims to: a) identify and map the extent of different classes of agricultural land in order to provide an effective base for land use planning decisions; and b) ensure that the long term productivity of the land is maintained at a sustainable level through the promotion of compatible land uses and management practices. It undertakes to achieve these aims through a program of mapping activities and associated extension and awareness programs such as Farmwi$e and Best Farm Practice.

The land capability classification system for Tasmania comprises a seven class classification which ranks the capability of land to support a range of agricultural uses on a long term sustainable basis (Noble 1992a). The classification system ranks the capability of land to support sustained agricultural production and does not consider suitability for individual crops, silviculture, horticulture, viticulture or other non-agricultural uses. The information printed here and in the accompanying map is intended for use at a regional planning level and is inappropriate for farm scale planning. However, the system and the methodology can be applied at any level.

Ever increasing demands are placed on our agricultural land to produce greater yields with a corresponding greater risk of land degradation. For Tasmania to continue to support a productive agricultural industry into the future, landholders must employ appropriate soil conservation measures. Much of Tasmania's agricultural land has limitations that restrict the variety of crops that can be grown both productively and on a sustainable basis. The land capability classification system provides the framework to determine these limitations, and the classification that results from this process allows land managers to make informed decisions to ensure productive and sustainable use of the land. In other words, the use of land within its' capability.

2. HOW TO USE THIS MAP AND REPORT

This publication comprises a report and map. It is important that the land capability map be used in conjunction with the accompanying report.

Land capability classes are briefly defined in the map legend, and more detailed definitions of land capability classes and subclasses may be found in Chapter 3 of this report. Chapter 4 explains the survey method and the guidelines that were used in assessing land within the survey area. A detailed description of the survey area appears in Chapter 5. A detailed account of land capability classes is presented in Chapter 6, wherein the land capability information is arranged hierarchically, firstly by class and secondly by the geology unit on which the class occurs.

2.1 Limitations of Scale

Special attention must be paid to the limitations of the map imposed by the scale at which it was surveyed.

It is important that the map is used at the scale at which it is published (1:100 000). **The map should not be reproduced at a larger scale (eg. 1:25 000)**. The land capability boundaries found on this map are accurate only at the published scale of 1:100 000. Errors in interpretation will occur if the map is enlarged. If more detail is required, the area of interest should be remapped at a more suitable scale for the end use.

Gunn *et al* (1988) state that, at a scale of 1:100 000, the standard minimum area for a map unit which can be adequately depicted on the map is approximately 64ha. There appears to be little consistency however, as Landon (1991) suggests that a wide range of minimum areas are currently in use. For the purposes of this work, unit areas of less than 64ha have been mapped only where they are identifiable on the basis of clearly visible boundaries (usually topographic), or where they appear at the margins of the map or adjacent to exclusion zones. Impurities in map units will occur where land class changes are a result of less obvious changes in land characteristics.

In any mapping exercise there are always areas which are physically too small to delineate accurately at a given map scale. Surrounding units usually absorbs these areas. The map units shown on this map will therefore often contain more than the one land capability class or sub-class. The map units are assigned the dominant land capability class within them, but it must be recognised that some map units may contain up to 40% of another class.

COMPLEX map units (eg. 4+5) have been mapped in some areas where two land classes are identified that cannot be delineated separately at this scale of mapping. These complex units represent areas where each class occupies between 40% and 60% of the unit area and are shown as striped units on the map. The first digit of the map unit label and the slightly wider of the two coloured stripes represent the dominant land capability class. Further discussion of this issue and the method of labelling units are found in Chapter 3.

The accuracy of the land capability class boundaries depends on a number of factors including the complexity of the terrain, soils and geology. Class boundaries are accurately mapped where topography, or other visible features important in boundary detection, change abruptly. Alternatively, where landscape changes are gradual, such as is often the case with changes in soil depth or slope, the class boundary may be gradual and therefore less accurately mapped.

2.2 Interpretation of the Land Capability Information

The scope and range of applications of land capability information depend upon the scale of the mapping program. This map has been surveyed at a 1:100 000 scale and is targeted for use at the district or regional planning level. Therefore, best use can be made of this map and report by local government, as well as regional and State land use planning authorities.

The information at this scale is **not** suitable for use in planning at the farm level. It does however, provide a general indication of land capability which makes it a useful starting point for more detailed studies. Larger scale maps (1:5 000 or 1:10 000) are suitable for farm planning purposes. For example, they are a useful information source for planning farm layouts, and identifying appropriate soil conservation and land management practices. However, the methodology applies to all scales of mapping and can be utilised equally well by local landowners, and local, regional or State planning authorities. A detailed discussion of the methodology may be found in Chapter 4.

Some examples of suitable uses of land capability information at 1:100 000 scale are:

- **Identifying broad areas of prime agricultural land to be protected for agricultural use**
- **Enabling rational planning of urban and rural subdivisions**
- **Identifying areas for new crops, enterprises or major developments**
- **Identifying areas for expansion of particular land uses**
- **Planning of new routes for highways, railways, transmission lines, etc.**
- **Identifying areas of land degradation, flooding or areas that may require special conservation treatment**
- **Identifying areas of potential erosion hazard**
- **Resolving major land use conflicts**
- **Establishing integrated catchment management (depending on catchment size)**

Describing land capability information through this report and accompanying map is insufficient to ensure the adoption of sustainable land use practices. The move towards more sustainable practices can only occur through increased social awareness and education (a recognition that change is needed) together with the development of an appropriate implementation framework. This includes the legislative and administrative support responsible for putting land use policies into practice.

The land capability maps and reports do not purport to have legal standing as documents in their own right, nor should they attempt to stand alone in planning decisions without being supported by other relevant land resource, economic, social or conservation considerations. Indeed, the interpretation of land capability information can be greatly enhanced when viewed in concert with other resource information. The information is intended as a guide to planning development. More detailed plans, for example route alignments or farm plans, require further fieldwork at a more appropriate scale.

2.3 Copyright

2.4 Availability of Other Reports and Maps in this Series

Land Capability Publications (based on the TASMAP 1:100 000 Series) currently available:

Derwent Report and Accompanying Map
D'Entrecasteaux Report and Accompanying Map
Circular Head Report and Accompanying Map
Hunter Report and Accompanying Map
Inglis Report and Accompanying Map
Forth Report and Accompanying Map
Pipers Report and Accompanying Map
Tamar Report and Accompanying Map
Meander Report and Accompanying Map
South Esk Report and Accompanying Map
Land Capability Handbook (Second Edition)
Land Capability Classification in Tasmania, Information Leaflet

Maps, reports and the handbook are available for purchase by contacting Service Tasmania or direct from:

Senior Land Resource Assessment Officer
Department of Primary Industries, Water and Environment
Resource Management and Protection Division
Land and Water Assessment Branch
GPO Box 46,
KINGS MEADOWS, TAS 7249.

3. LAND CAPABILITY CLASSIFICATION

Land capability classification is an internationally recognised means of land evaluation used to determine the capability of land to support a range of land uses on a long term, sustainable basis.

For the Tasmanian classification system, only agricultural land uses are considered. These are defined as broad scale grazing and cropping uses. Land capability ratings for specific land uses are not evaluated, nor is the capability of land for silvicultural, viticultural, or orchard use incorporated into the classification system.

Land capability may be defined as a rating of the ability of land to sustain a range of land uses without degradation of the land resource. It is an interpretive and somewhat subjective assessment based on the physical limitations and hazards of the land, potential cropping and pastoral productivity, and the versatility of the land in producing a range of agricultural goods.

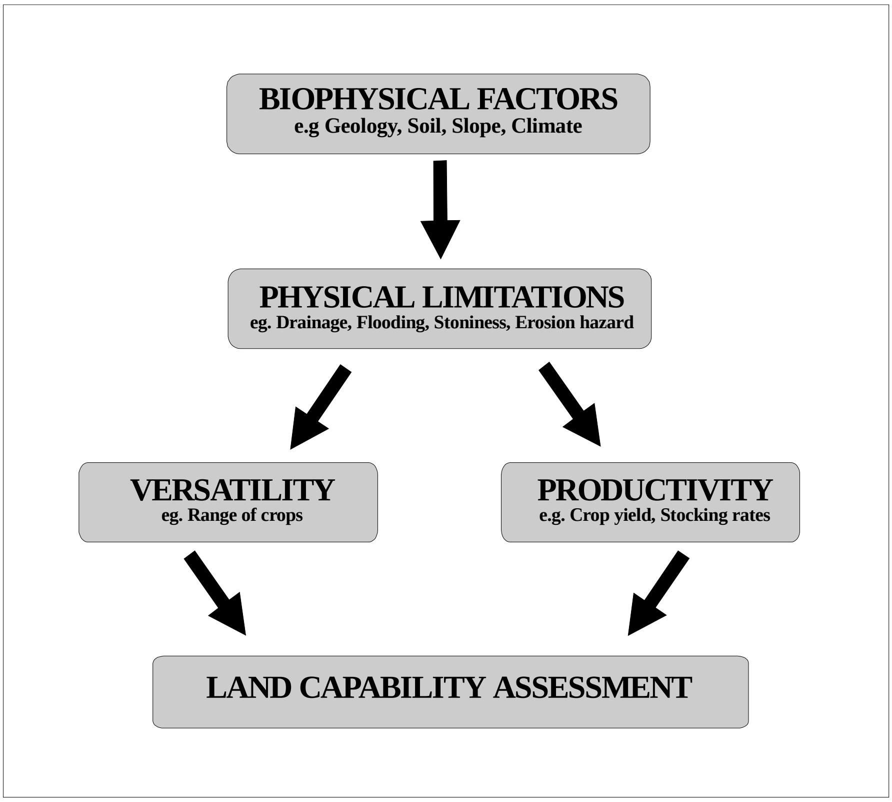


Figure 3. Factors in land capability assessment.

Land capability assessment takes into account the physical nature of the land (eg. geology, soils, slope) plus other factors (eg. climate, erosion hazard, land management practices) which determine how that land can be used without destroying its long term potential for sustainable agricultural production. It also takes into account limitations that might affect agricultural use, such as stoniness, drainage, salinity or flooding. Land capability assessment is therefore based on the permanent biophysical features of the land (including climate), and does not take into account the economics of agricultural production, distance from markets, or sociopolitical factors.

Land capability assessment should not be confused with land suitability assessment which, in addition to the biophysical features, may assess economic, social and/or political factors to determine the best use of a particular type of land. Land capability classification gives a grading of land for broad scale agricultural uses, whereas land suitability classification is applied to more specific, clearly defined land uses, such as classifying land 'suitable' for growing carrots. In addition, land suitability usually defines specific management systems.

3.1 Features of the Tasmanian Land Capability Classification System

The Tasmanian system of land capability classifies land into seven classes according to its' capability to produce agricultural goods. The system is modelled on the United States Department of Agriculture approach to land capability (Klingbiel and Montgomery 1961) and is described in full by Noble (1992a) and Grose (in prep). A summary of the system is presented here to assist in the interpretation of the report and accompanying map. The classification does not attempt to portray specific land uses, nor rank the value of any particular agricultural land use above another. Neither does it attempt to give an indication of land values.

The classification relates primarily to three permanent biophysical features of the landscape - soil, slope and climate - and their interactions, such as soil erodibility, flood risk, soil moisture holding capacity, etc. These three factors have a major influence in determining the capability of the land to produce agricultural goods. Past land use history and present management practices, such as the range of crops grown and soil conservation treatment required, are used as a guide in land capability assessments, but do not necessarily provide an accurate indicator of current land capability.

Three levels are defined within the Tasmanian land capability classification:

- The land capability **Class** - which gives an indication of the general degree of limitation to use
- **Subclass** - which identifies the dominant kind of limitation
- and the **Unit** - which groups land with similar management and conservation requirements, potential productivity, etc.

The land capability system can be used and applied at various scales by mapping to the class, subclass and unit levels. The level at which the mapping is undertaken and presented depends on the purpose and scale of the survey. The levels of the land capability classification system are shown in Figure 4.

The classification system comprises seven classes ranked in order of increasing degree of limitation, and in decreasing order of versatility, for agricultural use. The system is hierarchical. Class 1 land can produce a wider variety of crops and pastures at higher levels of production with lower costs, or with less risk of damage to the land, than any other of the land classes. Class 2 land is more productive than Class 3, and so on.

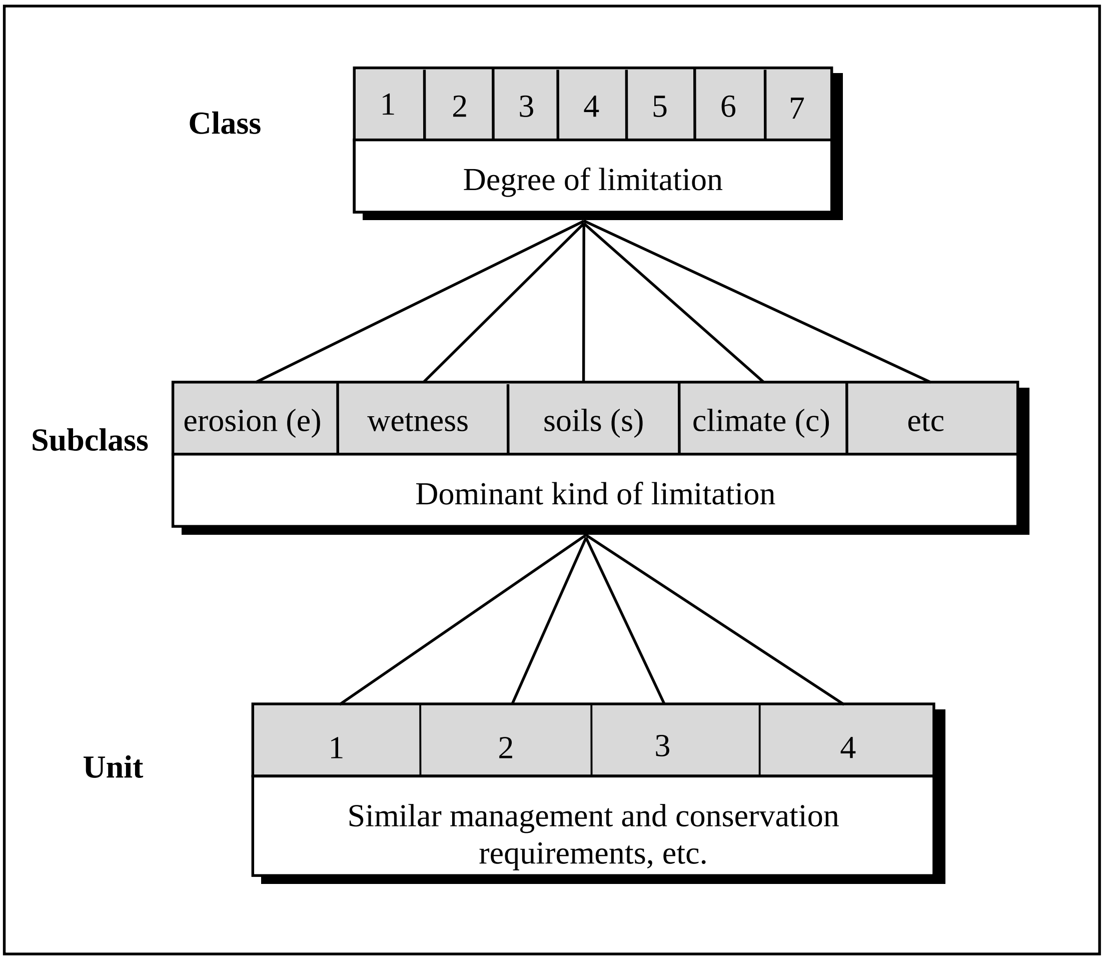


Figure 4. Levels of the land capability classification system. (Adapted from: National Water and Soil Conservation Organisation, 1979, Our Land Resources. NWASCO, Wellington, New Zealand).

Each land class can be subdivided into subclasses depending on the nature of the dominant limitation or hazard to the use of that land. Limitations may be defined as physical factors or constraints, which affect the versatility of the land and determine its capability for long term sustainable agricultural production. Some limitations can be removed or modified through normal management practices or other means. Where such improvements are considered feasible, both physically and economically, land may be classified higher than its' current condition may indicate. Such improvements do not include the use of irrigation water but may include drainage or stone picking.

Each subclass may be further subdivided to unit level. Land capability units are areas of land with similar management and conservation requirements, or differences in productivity, which may not be significant at higher levels within the classification system. Thus an area identified as Class 4h may be further subdivided into 4h1 (Class 4h land subject to gully erosion) and 4h2 (Class 4h land subject to sheet erosion).

The system assesses the versatility of the land to produce a range of agricultural goods that are considered typical for Tasmania, and not just those that are specific or suited to localised areas. For example, small-scale intensive activities like soft fruit orchards and floriculture are not considered when evaluating the versatility of an area. Opportunities for silviculture are another activity that the system does not consider. The main agricultural land uses that are considered when evaluating land include cereals, poppies, broadacre vegetable production, pyrethrum and essential oils, together with pastoral activities such as dairying, and beef, lamb and wool production.

The system considers degradation of the soil resource and does not take into account the possible effects of agricultural land use on landscape values or biodiversity, except where they might impact on the quality of the agricultural resource.

The classification, in particular at the unit level, takes into account the management strategies and soil conservation requirements that the land may need in order to maintain a level of production without long term degradation.

As with most land classification systems certain assumptions are necessary. These include:

a) The land capability classification is an interpretive classification based on the permanent biophysical characteristics of the land.

b) A moderately high level of management being applied to the land.

c) Appropriate soil conservation measures having been applied.

d) Where it is reasonable and feasible for an individual farmer to remove or modify physical limitations (eg. surface and sub-surface drainage, stoniness, low fertility) the land is assessed assuming the improvements have been made.

e) Land capability assessments of an area can be changed by major schemes that permanently change the nature and extent of the limitations (eg. drainage or flood control schemes).

f) The land capability classification is not a productivity rating for specific crops, although the ratio of inputs to outputs may help to determine the land capability class.

g) Land capability does not take into account economic, social or political factors. It is not influenced by such factors as location, distance from markets, land ownership, or skill of individual farmers.

h) Present and past uses of the land (or similar land elsewhere) are guides to potential, in that they can indicate the limits of the capability of the land. Present land use and vegetation cover are not always good indicators of land capability class. The system of land capability is aimed at assessing the potential sustainable productivity of land rather than current productivity.

i) Assessments are based on the capability of the land for sustained agricultural productivity, since use of the land beyond its capability can lead to land degradation and permanent damage.

j) Irrigation, or the potential access to irrigation, is not considered when evaluating land capability.

k) The system is consistent across the State.

It is important to remember that the land capability of an area can change as a result of improved farming practices, such as improvements in crop variety and technical innovations. The information in this report has a limited lifespan and care should be given to its interpretation in future years. Farming practices that today are only available for the advanced or innovative farmer may become common practice in the future.

3.2 Land Capability Class Definitions

The criteria used to define classes are based on observation and experience only, and not on experimental work. Figure 5 outlines the main features of the capability classes. Classes 1-4 only are considered capable of supporting cropping activities on a sustainable basis; Classes 5 and 6 are suitable for grazing activities only, although pasture improvement may be possible on Class 5 land (Class 6 land remaining as native pasture); Class 7 land is unsuitable for any form of sustainable agricultural activity.

Also, there is a range of land that can occur in any one capability class. Thus it is often possible, for example, to identify good and poor quality Class 4 land. While the intensity of mapping required to achieve this is not feasible when mapping land classes at 1:100 000 scale it would be possible to map such differences at the unit level.

The land capability class definitions are as follows:

CLASS 1

Land well suited to a wide range of intensive cropping and grazing activities. It occurs on flat land with deep, well drained soils, and in a climate that favours a wide variety of crops. While there are virtually no limitations to agricultural usage, reasonable management inputs need to be maintained to prevent degradation of the resource. Such inputs might include very minor soil conservation treatments, fertiliser inputs or occasional pasture phases.

Class 1 land is highly productive and capable of being cropped eight to nine years out of ten in a rotation with pasture or equivalent without risk of damage to the soil resource or loss of production, during periods of average climatic conditions.

CLASS 2

Land suitable for a wide range of intensive cropping and grazing activities. Limitations to use are slight, and management and minor conservation practices can readily overcome these. However the level of inputs is greater and the variety and/or number of crops that can be grown is marginally more restricted than for Class 1 land.

This land is highly productive but there is an increased risk of damage to the soil resource or of yield loss. The land can be cropped five to eight years out of ten in a rotation with pasture or equivalent during ‘normal’ years, if reasonable management inputs are maintained.

CLASS		LIMITATIONS	CHOICE OF CROPS	CONSERVATION PRACTICES
1	Under cultivation	very minor	any	very minor
2		slight	slightly reduced	minor
3		moderate	reduced	major
4		severe	restricted	major + careful management
5	Under pastoral use	slight to severe	grazing	
6		severe	grazing	
7		very severe to extreme	No agricultural value	

Figure 5. Features of land capability classes

CLASS 3

Land suitable for cropping and intensive grazing. Moderate levels of limitation restrict the choice of crops or reduce productivity in relation to Class 1 or Class 2 land. Soil conservation practices and sound management are needed to overcome the moderate limitations to cropping use.

Land is moderately productive, requiring a higher level of inputs than Classes 1 and 2. Limitations either restrict the range of crops that can be grown, or the risk of damage to the soil resource is such that cropping should be confined to three to five years out of ten in a rotation with pasture or equivalent during normal years.

CLASS 4

Land primarily suitable for grazing but which may be used for occasional cropping. Severe limitations restrict the length of cropping phase and/or severely restrict the range of crops that could be grown. Major conservation treatments and/or careful management are required to minimize degradation.

Cropping rotations should be restricted to one to two years out of ten in a rotation with pasture or equivalent, during 'normal' years to avoid damage to the soil resource. In some areas longer cropping phases may be possible but the versatility of the land is very limited.

CLASS 5

This land is unsuitable for cropping, although some areas on easier slopes may be cultivated for pasture establishment or renewal and occasional fodder crops may be possible. The land may have slight to moderate limitations for pastoral use. The effects of limitations on the grazing potential may be reduced by applying appropriate soil conservation measures and land management practices.

CLASS 6

Land marginally suitable for grazing because of severe limitations. This land has low productivity, high risk of erosion, low natural fertility or other limitations that severely restrict agricultural use.

CLASS 7

Land with very severe to extreme limitations which make it unsuitable for agricultural use.

E - Exclusion Areas

Land that is not private freehold or leased crown land, is not included for assessment. Other exclusions included urban centres and other obviously non-agricultural areas.

Note on Class Definitions
The length of cropping phase given for Classes 1-4 is intended as a general guide only. Some land will not support production beyond the intensity recommended due to the unacceptable risk of erosion or soil structure decline. Other areas are limited by the risk of loss occasioned by more unpredictable factors such as adverse climatic conditions or flooding. Also, the classification system takes into account the *variety* of crops that can be grown. Thus Class 4 land often incorporates areas where production may be sustainable over a longer period than one or two years out of ten but only a relatively small range of crops can be grown. Whereas in other areas, Class 4 land is such that significant periods of cultivation without a break can lead to severe structure decline, hindering germination, water infiltration, soil aeration and increasing the likelihood of erosion.

It should be noted that capability classes have not been defined on the basis of productivity although a general relationship does exist.

3.3 Land Capability Subclass Definitions

The major subclass limitations together with their respective codes are summarised below. The decision as to whether a subclass should be recorded at the unspecified level (e, w, s, c) or at a more specific level is dependent on the ease with which specific limitations can be identified. For example, the aeolian erosion limitation is recorded only if it is clear that erosion has been caused by wind. If the cause of erosion is uncertain then unspecified erosion is recorded.

- **e** (erosion). Unspecified erosion limitation.
  - **a** (aeolian). Erosion caused by the effects of wind. Usually affects sandy or poorly aggregated soils and can occur on slopes of very low gradient.
  - **h** (water). Erosion resulting from the effects of rainfall, either directly through raindrop impact or through secondary effects of overland flow and surface runoff (including stream bank erosion).
  - **m** (mass movement). Landslip, slumping, soil creep and other forms of mass movement.
- **w** (wetness). Unspecified wetness limitation.
  - **f** (flooding). Limitations created through the surface accumulation of water either from overbank flow from rivers and streams, run-on from upslope areas or because the area lies in a topographic depression.
  - **d** (drainage). Limitations resulting from the occurrence of a ground watertable, or restricted or impeded permeability within the soil profile, leading to the development of anaerobic conditions.
- **s** (soils). Unspecified soil limitation.
  - **g** (coarse fragments). Limitations caused by excess amounts of coarse fragments (particles of rock 2 - 600mm in size), including gravel, pebbles and stones, which impact on machinery, damage crops or limit growth. Coarse fragments may occur on the soil surface or throughout the profile.
  - **r** (rockiness). Limitations caused by boulders or outcrops of bedrock material greater than 600mm in size.
  - **k** (conductivity). Land at risk from salinity (as indicated by high electrical conductivity readings of a 1:5 ratio soil:water paste).
  - **l** (limiting layer). Rooting depth or depth to some limiting layer.
- **c** (climate). Unspecified climatic limitation.
  - **p** (precipitation). Limitations resulting from insufficient, excessive or uneven distribution of rainfall.

  - **t** (temperature). Limitations caused by frost risk or by reduced length of growing season due to low temperatures.

- **x** (complex topography). Limitations caused by irregular, uneven or dissected topography which hinder vehicular access or cultivation.

Use of Information

A valid criticism of the Land Capability methodology is that it is very subjective and dependent on the interpretation of individual surveyors. For this reason, a set of guidelines is being developed (Grose *in prep*) to ensure consistency among surveyors. The guidelines are based on a quantitative assessment of a range of a land attributes critical to the evaluation of land capability. There will, however, always remain some subjectivity in the determination of cut-off points for each land class. This is largely due to the gradational nature of boundary conditions between each class. The guidelines provide as high a level of consistency for land assessment as is possible at the time of writing of this report. Future improvements to the classification may result from increases in knowledge acquired during subsequent mapping programs.

The authors therefore welcome constructive comment and criticism of the report and accompanying map and, in the unlikely event that significant errors in classification are identified at a scale appropriate to the level of mapping, they should be reported to the Senior Land Assessment Officer, Land Assessment Section, Resource Management and Conservation, DPIWE.

4. SURVEY METHOD

Field work for the Nugent Land Capability map was undertaken between October 2000 and January 2001 using information drawn from a wide variety of sources. These included existing soil descriptions and maps held by DPIWE, the advice of farmers, land managers and agricultural advisers within DPIWE, field assessments, aerial photo interpretation and computer assisted modeling techniques. Extensive previous experience gained by land assessment officers in mapping the Derwent and D'Entrcasteaux map sheets (Musk and DeRose 2000, DeRose 2001) was also applied to assist with mapping of the present survey area.

Field assessments involved land capability site descriptions and reconnaissance surveying to extrapolate and map class boundaries. In all, 156 land capability site descriptions were recorded. This information was first recorded on field sheets and later transferred to the DPIWE soils database. The field sheet records the site information required to justify the assessment, together with both the assigned land capability class and subclass. This information included site location, landform description, site aspect and slope. Soils were examined at the majority of sites. This was done using either a push-tube rig, a hand held soil auger, or by examination of existing soil exposures. The information collected included soil horizon depth, pH and EC_e levels, texture, colour, structure and drainage characteristics. An example of a completed land capability description site card appears in Appendix A. Figure 6 presents the distribution of land capability description sites and existing soil description sites across the survey area.

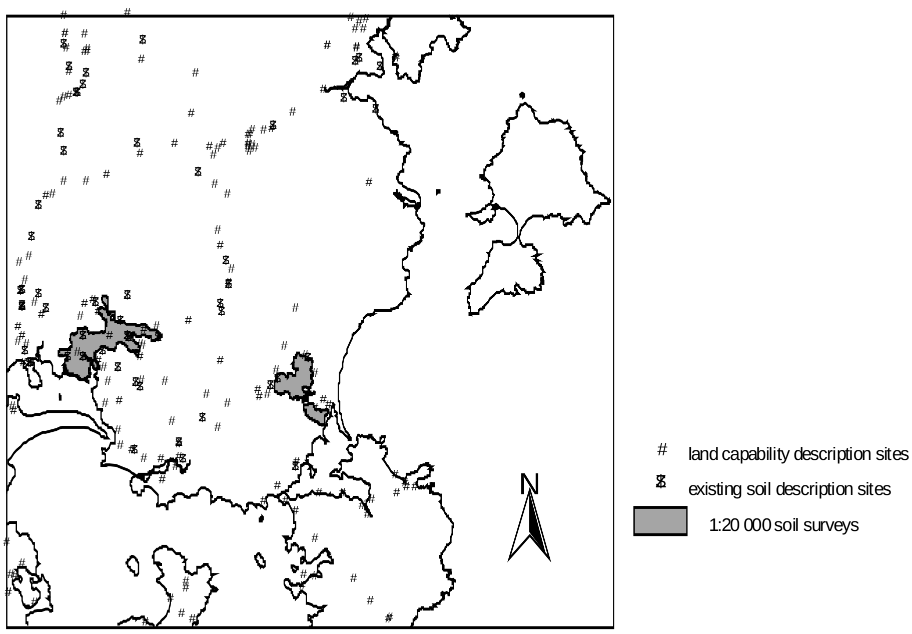


Figure 6. Distribution of land capability description sites and existing soil description sites in the Nugent survey area.

Land capability assessments for the most part follow guidelines outlined in the revised Land Capability Handbook for Tasmania (Grose *in prep*). The guidelines provide criteria for determining the major subclass limitations. These involve assessments of land capability in relation to climate (rainfall, temperature), topographic limitations (slope, wetness, uneven ground, flood risk), soil factors (depth, stoniness, rock outcrops, salinity, drainage), and erosion hazard (wind, water, mass movement). Assessments of soil erosion are based primarily on soil texture, structure and organic matter content in the case of wind erosion and on topographic gradient, soil texture, dispersion (sodicity), and structure in the case of water erosion. In the case of tunnel and mass movement, assessments are based on erosion features evident on hillslopes.

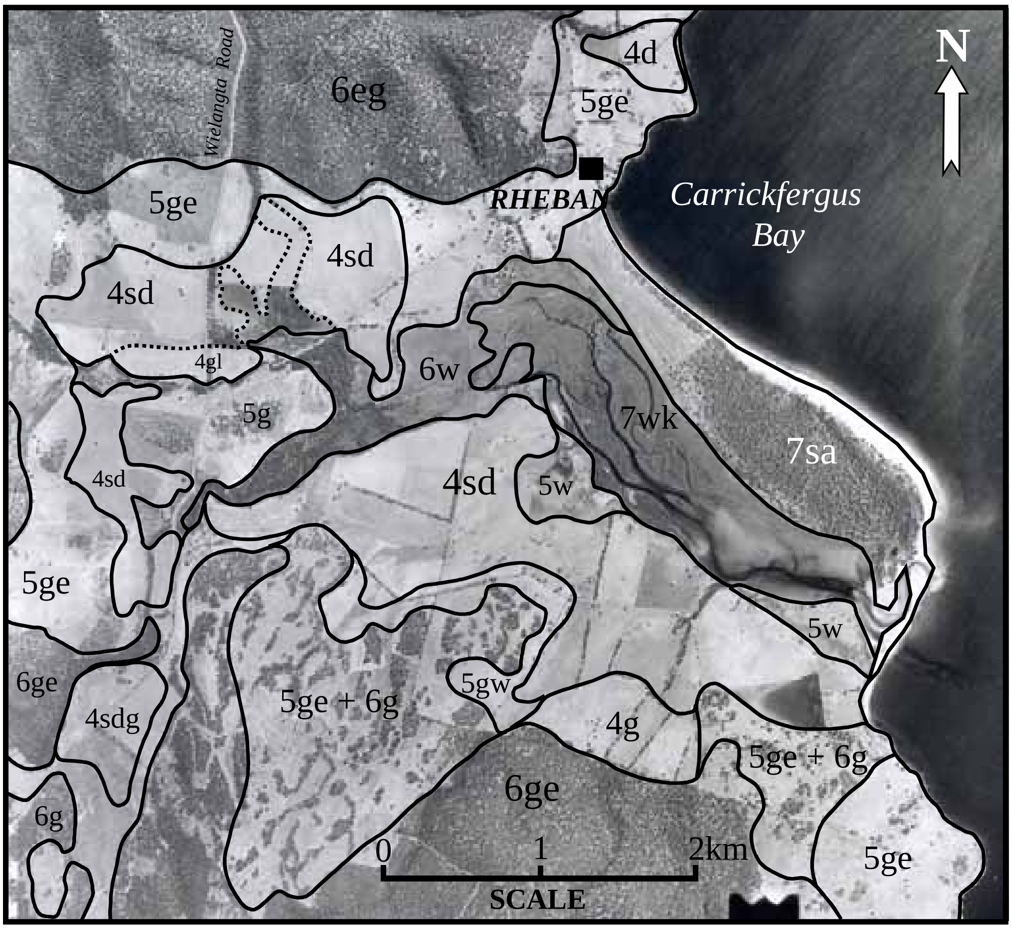


Figure 7. The close association between present vegetation patterns, topography, and land capability can clearly be seen on this aerial photograph, taken in the region of Reban. Soil patterns are also sometimes evident in cultivated fields as shown by the dotted line demarcating class 4sd and 4gl land. **Note:** polygons appear in more detail here than the final 1:100 000 Class map.

Subclass codes appear only on digital versions of the map maintained by DPIWE. These codes are intended to provide further information for potential users as to the nature of limitations that might occur within a particular map polygon. However, as individual subclass boundaries are not identified at this scale of mapping, several subclass codes may appear within a single polygon. The dominant limitation for a polygon is always recorded. In addition, other limitations may be observed. For example, an area of land classified 5g on the basis of significant stone content, may additionally contain small areas with an erosion limitation. Consequently, the land is assigned an additional erosion limitation subclass (hence 5ge), although the actual area limited by erosion potential has not been specifically identified, usually in this case due to the small areal extent of steeper slopes. The first limitation recorded in the polygon is the dominant limitation.

Stereo-pairs of 1:42 000 black and white aerial photographs (Figure 7) and computer generated slope maps and geology overlays were used extensively to extrapolate field assessments and delineate unit boundaries. Slope maps were derived from 1:25 000 contour data with a 10m contour interval. They portray slope information and spatially accurate base information not available with the air photo stereo-pairs. These two information sources were used in concert, whereby map unit boundaries were delineated on the stereo-pairs, then fine tuned according to the additional information provided on the slope map. Once defined accurately, these boundaries were transferred to 1:50 000 base maps from which they were eventually digitised.

Existing maps, reports and site data were drawn upon where available. These included the reconnaissance soils maps of Buckland (Loveday and Dimmock 1958 revised by Spanswick 2000) and Sorell (Loveday 1955 revised by Spanswick 2000), the more detailed 1:20 000 soil maps of the Sorell-Wattle Hill and Bream Creek areas (Loveday 1957), and the 1:50 000 geology maps of Buckland (Blake 1958) and Sorell (Gulline 1982). The 1:200 000 Land Systems of Tasmania (Davies 1988) also proved a valuable resource for providing general information relating soil type, geology, topography, and vegetation to land use.

Wherever possible, attempts were made to establish soil-landscape associations that could be used to provide additional information (eg. Figure 7). In line with accepted land survey method, not all map units have been surveyed. Rather, informed assumptions have been made based on information extrapolated from other similar units. For example, it was generally found that there was a close association between current land use and field land capability assessments. Field mapping indicated that in most places forest margins tended to demarcate the boundary between Class 5 and 6 land, particularly within the large tracts of stony Jurassic dolerite or sandy Triassic sandstone hill country which is characteristic of the eastern portion of the survey area. Consequently vegetation patterns were used alongside photo-interpretation, together with maps of geology and soil, to help delineate the Class 5/6 boundary. This method was applied only in areas where a good understanding existed of the relationships between known information, such as soil type or landform, and land capability class.

The 1:50 000 base maps, with land capability boundaries appended, were digitised and stored using ARC/INFO software. Final publication scale is at 1:100 000. Peers within the DPIWE with experience in agronomy and soil and land evaluation techniques have field checked the land capability map before publication.

5. THE NUGENT SURVEY AREA

5.1 Introduction

The study area lies in the south east of Tasmania (Figure 2) and includes the towns of Triabunna and Sorell, together with smaller centres of Orford, Buckland, Midway Point, Dodges Ferry, Dunalley and Murdunna. It extends over an area of 1704km^2 of which 488km^2 are exclusion areas. Most of these exclusion areas comprise State and National Parks or Forest Reserves.

This section defines the climate, geology, landforms, soils, vegetation and land uses within the study area. An understanding of these parameters is critical to understanding and interpreting the land capability map. The area as a whole covers a diverse range of landforms, soils and climate and encompasses a broad range of land uses. In general there are very few areas of high class agricultural land, although locally extensive areas in valley systems in the west and south west of the survey area are suited to broad scale cropping activities, particularly where irrigation water is available. Towards the west, large tracks of steep and generally stony terrain are suitable only for marginal agricultural use.

5.2 Climate

Climate is an important aspect of land capability evaluation, as it has strong controls over the length of the growing season and the range of crops that can be grown. The major climatic limitations imposed on agricultural practices and potential agricultural land within the survey area are:

- Low and unreliable rainfall in coastal regions and inland valleys
- Sharp drop in moisture availability from winter to summer
- Cold winters and frosts in areas away from coastal maritime influences, and
- Wind hazard in exposed areas.

The Nugent survey area experiences a temperate maritime climate. Seasonal climatic variations become increasingly extreme with distance from the coastline. Altitude is the principal factor dictating local climatic conditions. Consequently, areas inland and at progressively higher elevation become wetter and colder.

There are 23 climate stations currently operating within the survey area, 21 of which collect only rainfall data (Bureau of Meteorology). Three stations record daily temperatures and frosts, and two provide measurement of pan evaporation. The Tunnack station, which lies 5km north of the survey boundary, was used to supplement a lack of climate information in the north western part of the survey area. Rainfall and temperature spatial variations for the study area were modelled by ANUCLIM climatic modelling (Hutchinson *et al*. 1998).

Rainfall

Table 2 shows the mean monthly rainfall, average annual and median rainfalls for selected stations. Of these stations, Hobart Airport receives the lowest rainfall and Nugent the highest. A comparison of average annual rainfall to the average median rainfall indicates that more often than not, the rainfall for any particular year will be below the annual average.

Station Location	J	F	M	A	M	J	J	A	S	O	N	D	Annual Average	Annual median
Bream Creek	56	60	60	69	61	65	70	68	54	67	63	75	761	729
Buckland	50	47	49	54	53	58	56	53	43	59	55	71	648	612
Triabunna	48	51	52	56	53	58	51	46	43	60	55	67	640	606
Nugent	79	50	59	74	49	52	85	78	73	66	71	84	815	786
Sorell	47	40	44	50	44	48	45	41	41	54	46	58	549	535
Levendale	62	51	56	63	55	69	63	67	57	75	69	83	774	748
Dunalley	59	40	51	59	45	55	69	72	60	56	57	65	699	695
Clifton	53	47	42	50	36	36	49	48	49	44	45	71	601	635
Saltwater	59	72	45	72	28	42	48	62	54	45	62	52	631	601
Hobart Airport	41	38	37	45	36	29	46	47	40	48	45	57	509	484
Orford	50	47	48	60	62	52	61	60	50	60	66	68	682	659
Tunnack	46	79	49	39	32	42	52	41	36	51	55	52	572	570

Table 2. Average monthly rainfall, average annual rainfall and median annual rainfall (mm) for selected stations. Figures have been rounded to the nearest mm.

Figure 8 shows the spatial variability of annual rainfall averages. Average annual rainfall for the survey area ranges between 500 and 1100mm (Table 2). Heavy rainfall events in this region are related to south to south easterly weather systems. This is reflected in a general pattern of high annual rainfall averages in the south east of the study area, becoming less towards the north west. Rainfall averages are highest on the Tasman Peninsula, being generally greater than 800mm yr^{-1}. North or north west trending high country, such as inland of Dunalley north to Orford, or from Nugent towards Tunnack, receives between 700 and 950mm yr^{-1}. Inland basin areas such as around Buckland, generally receive annual rainfall less than 700mm. Low-lying coastal areas in the western part of the survey area from Clifton Beach to Sorell and Orielton receive less than 600mm yr^{-1}. This region falls within the rain shadow of high country further to the west and east.

The seasonal distribution in rainfall (Figure 9) can have an important impact on the length of growing season and variety of crops that can be grown. For example, wet winter months may restrict access to paddocks while dry summer months commonly lead to soil moisture deficits and poor plant growth. Figure 9 shows that rainfall is relatively evenly distributed throughout the year. December is normally the wettest month. Slightly higher monthly rainfall can be also expected during April and early winter months. Conversely, lower monthly rainfall can be expected during late summer and early spring months.

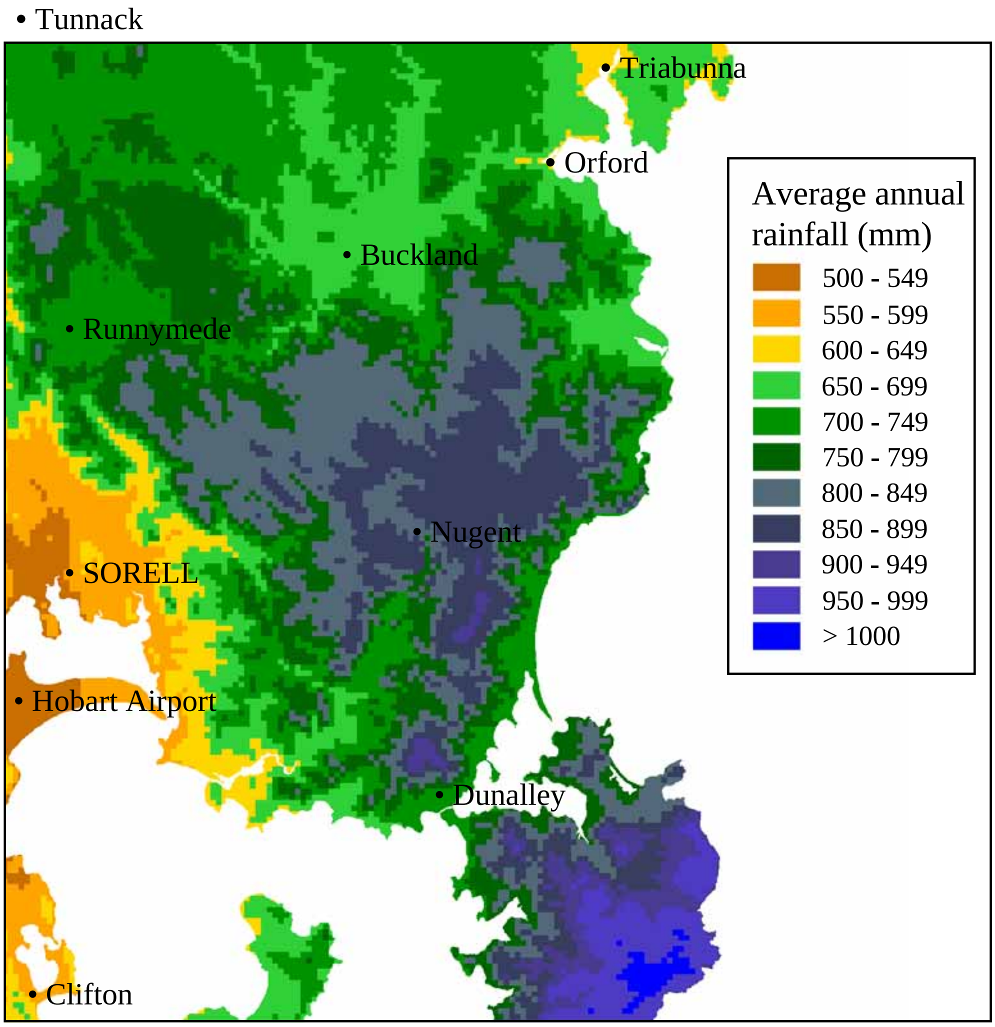


Figure 8. Average annual rainfall (ANUCLIM climate modelling) for the Nugent survey area. Selected climate stations recording rainfall are indicated.

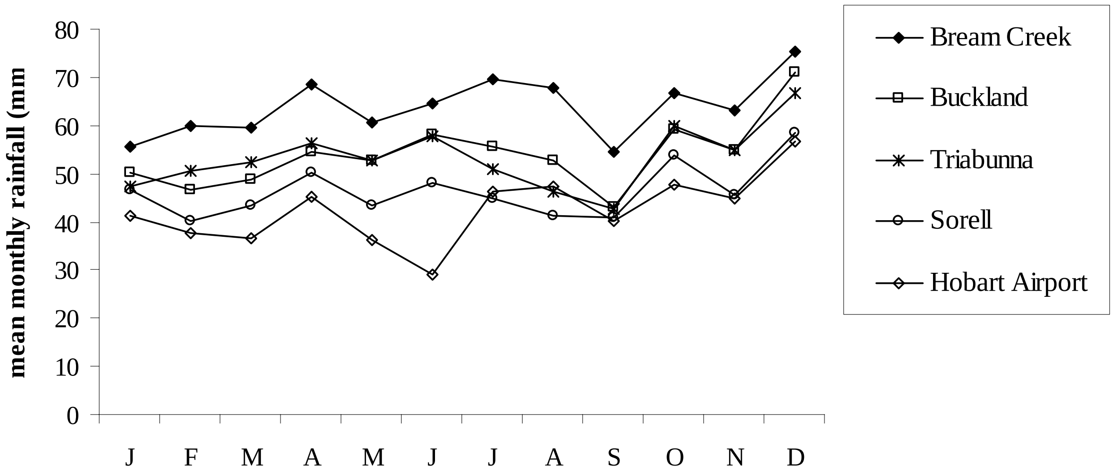


Figure 9. Average monthly rainfall trends for selected stations.

Climatic extremes can have a major impact on agriculture activities. Heavy snow falls and hailstorms are generally restricted to the higher inland areas and droughts are almost non-existent. However, some years may experience lower than average rainfall and this often has a major impact on cropping and grazing activities. Regions with low annual rainfall (eg. Sorell) can experience low (<10mm) monthly rainfalls at any time of the year. Throughout much of the remainder of the survey area, low minimum monthly rainfalls are confined to the period from December to March. Spring rainfall is more reliable with minimum monthly rainfall generally not less than 10mm. In areas with high annual rainfall, monthly minimum rainfall is generally above 10-20mm throughout the year, but with the occasional dry summer month.

Moisture Availability

Moisture availability is important in determining the length of growing season. It is a function of both rainfall and evapotranspiration rates and can be estimated using the index $P/E_w^{0.75}$, where P equals average daily rainfall per month and E_w equals average daily pan evaporation per month (Prestcott and Thomas 1949). Index values above 0.8 indicate available moisture is adequate to sustain growth. Index values between 0.4 and 0.8 may be considered part of the growing season if preceded by substantial periods with values above 0.8.

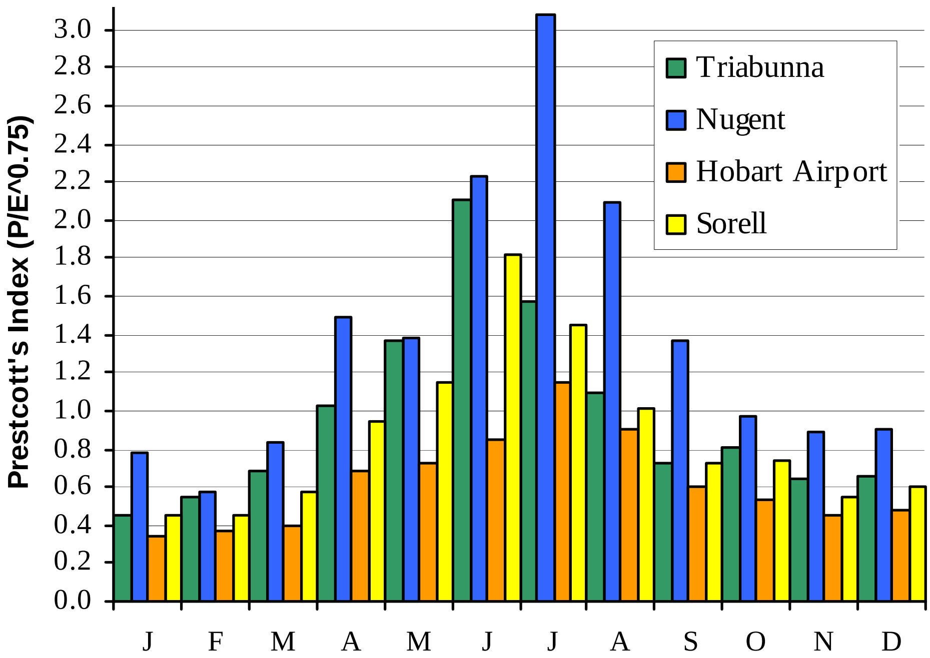


Figure 10. Prestcott's index of moisture availability per month for selected stations.

Moisture availability shows a clear seasonal trend (Figure 10): values are low for all stations during summer months and higher for winter months. This trend is dominated by evaporation. Higher temperatures and longer daylight hours during summer lead to greatly increased rates of evaporation resulting in low moisture availability. Across the survey area, index values are most similar between sites during spring and summer, but show bigger differences during autumn and winter months when areas at higher elevation receive higher rainfall and have fewer sun hours.

Index values indicate that the growing season, as determined by soil moisture is relatively short for drier areas to the south west (eg Hobart Airport, Sorell) and largely confined to winter and early spring months. Soil moisture stress can be expected from October through summer and autumn months. In areas receiving higher rainfall (eg. Nugent), the growing season can be expected to be longer lasting from April to December, with soil moisture deficits occurring predominantly during February and March. Early autumn rainfall in some areas (eg. Nugent, Triabunna) provides higher moisture availability prior to the onset of colder winter months.

Prestcott's index is also useful for indicating periods of wet soil conditions. For example, index values above 1.0 indicate an excess of rainfall over evaporation. While this is generally not a problem for free draining soils, which lose excess soil moisture through subsurface runoff, soils with restricted subsurface drainage conditions will remain relatively wet at these times of the year. Index values indicate that wet soil conditions can be expected during winter months for all but the driest areas (eg. Hobart airport). Wet soil conditions are likely to persist into spring months only at higher altitude and in areas towards the south west, including most of Forestier Peninsula.

Temperature

Seasonal variation in daily temperature can have an important impact of plant growth and the range of crops that can be grown in a locality. For example, an average monthly temperature of 6 °C is commonly accepted as the minimum for crop growth. Above this temperature, crop growth increases and reaches an optimum when daily temperatures are between 20 and 25 °C. Large diurnal variations in temperature, with cold night or very hot day temperatures, can have a deleterious impact on crop growth.

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hobart Airport	17	17	16	13	11	9	8	9	11	12	14	16
Orford	17	17	16	13	11	9	8	9	11	12	14	15
Tunnack	15	16	13	10	9	6	6	6	8	10	11	14

Table 3. Average daily temperature for selected sites.

Distinct seasonal trends are observed at all stations, with maximum temperatures in January and February and minimums in June and July (Table 3, Figure 11). In lowland coastal areas, crop growth can be expected all year as average monthly temperatures (Table 3) remain above 6 °C. Inland localities at higher elevation (eg. Tunnack at 461m) have average temperatures close to 6 °C, indicating little growth for winter months. Furthermore, there is greater diurnal and seasonal temperature variation in inland localities due to greater extremes away from the moderating effect of the coastal oceanic climate.

Average maximum temperatures indicate that optimum growing conditions are only reached in the survey area during summer months. Spring months generally remain below 20 °C with daily temperatures ranging from 6 to 17 °C. This suggests that the area is restricted to cropping varieties that would be suited to cooler climatic zones.

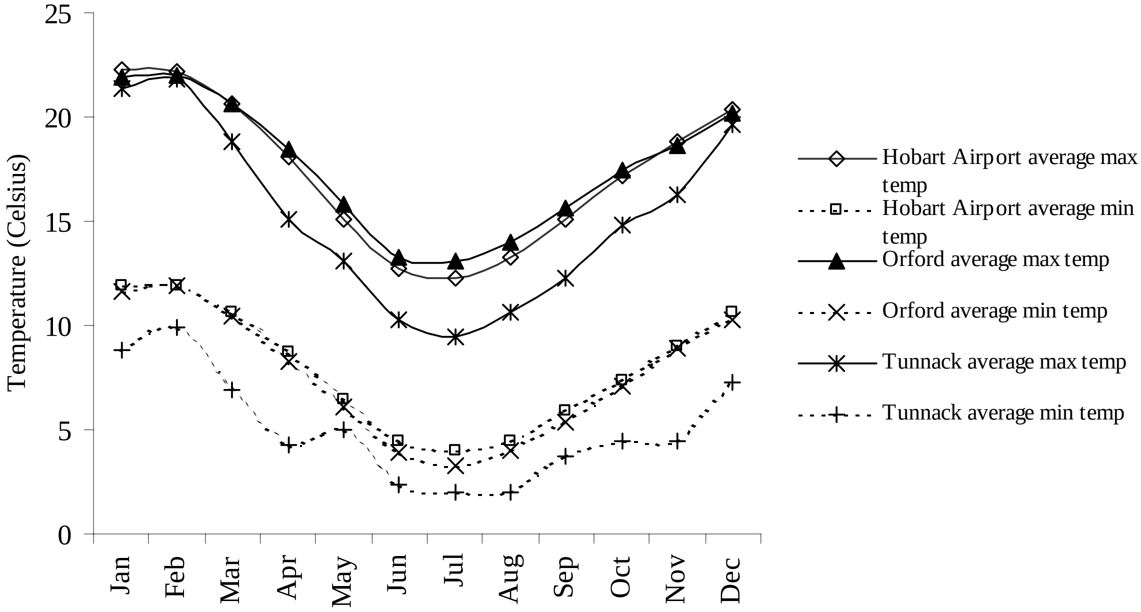


Figure 11. Average monthly minimum and maximum temperatures for selected sites

In regions that have cold winter months the length of the growing season is indicated by the first and last appearance of ground frosts. The average number of frost days per month for selected stations is shown in Figure 12. This is based on the number of days when the minimum temperature falls to 0°C or less. Given Tasmania's unpredictable climate, frosts may occur across most of the survey area at almost anytime of the year. In general however, coastal areas (eg. Hobart Airport, Orford) experience few frosts and these are largely confined to winter months. The occurrence of frosts increases with increasing elevation and distance inland. Tunnack for example, only remains frost-free during late summer months (Figure 12).

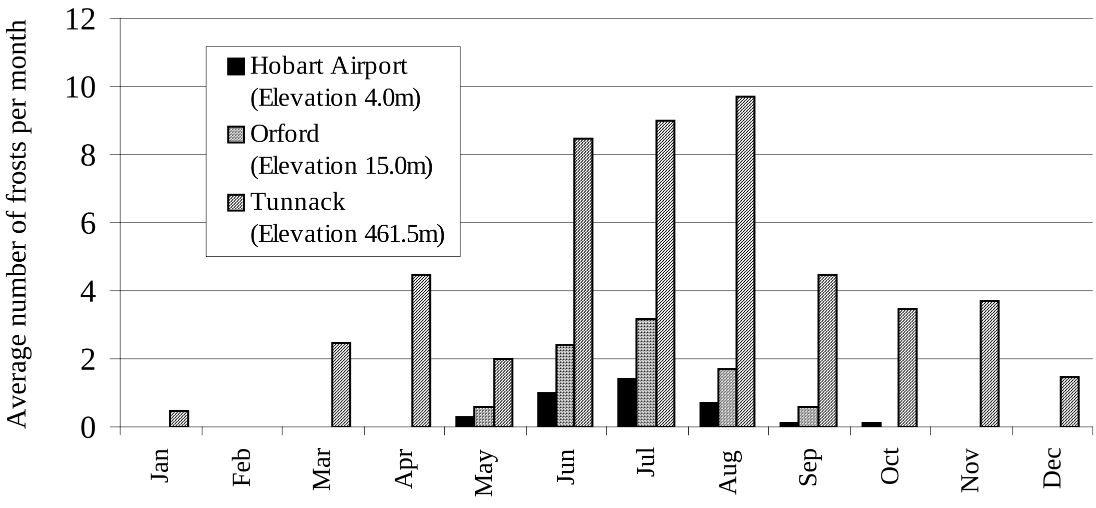


Figure 12. Average number of frost days per month for selected stations (minimum temperatures less than 0°C).

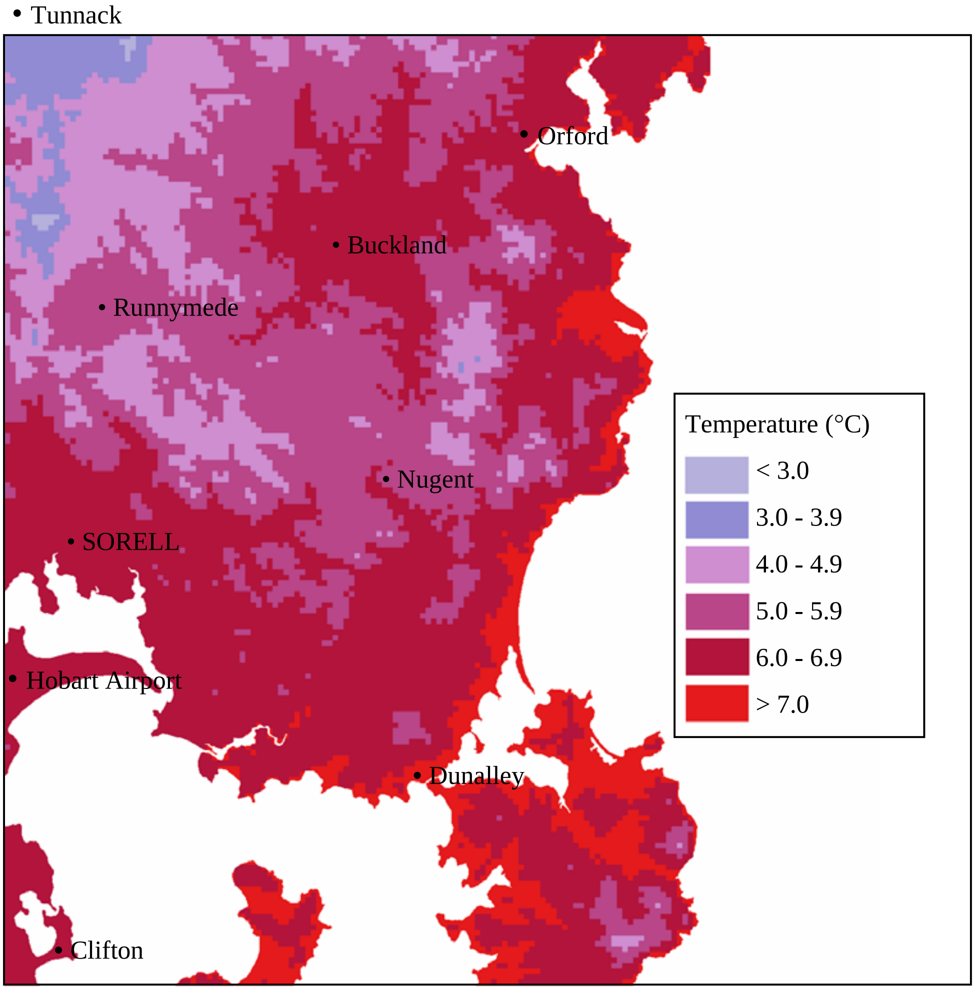


Figure 13. Average daily minimum temperature (from ANUCLIM) for spring months (September, October, and November) in the Nugent survey area. Climate stations are indicated.

Frosts occurring in spring are of most concern to cropping practices, as this is the time when most crops are at a vulnerable growth stage. Figure 13 shows the spatial distribution of average minimum temperatures during spring for the survey area, highlighting areas more prone to frosts during this period. Areas shown to have average minimum temperatures less than 5°C are expected to experience 1-3 days frost a month over this period. Thus in areas from the centre of the survey area towards the north west, spring frosts pose a significant risk to the establishment of frost sensitive crops.

Length of growing season

The combined effects of rainfall, evaporation and temperature determine the length of the growing season. Coastal areas experience favourable growing conditions of mild temperatures and a low chance of frost occurrence, although low rainfall and high evaporation rates are limiting in these areas. Figure 14 shows the rapid decline in soil moisture availability across the survey area over the period from November through to February. Clearly, the length of growing season throughout most of the survey area is limited to spring months when frosts are less common and the soil moisture store has been replenished from winter rains. In warmer and drier coastal areas (eg. Sorell) crop establishment can commence in winter months. Inland towards the north west of the survey area, an increased incidence of frosts coupled with generally wetter soil conditions, restricts the growing season to a short period in late spring. Towards the south west, the number of months when moisture is available for plant growth increases and the growing season may extend into summer months in places with suitable soils and higher summer rainfall (eg. Bream Creek). Further south, on Forestier Peninsula and inland towards Nugent, cultivation is restricted to summer months for soils with slowly permeable subsoils, due to wet soil conditions in spring.

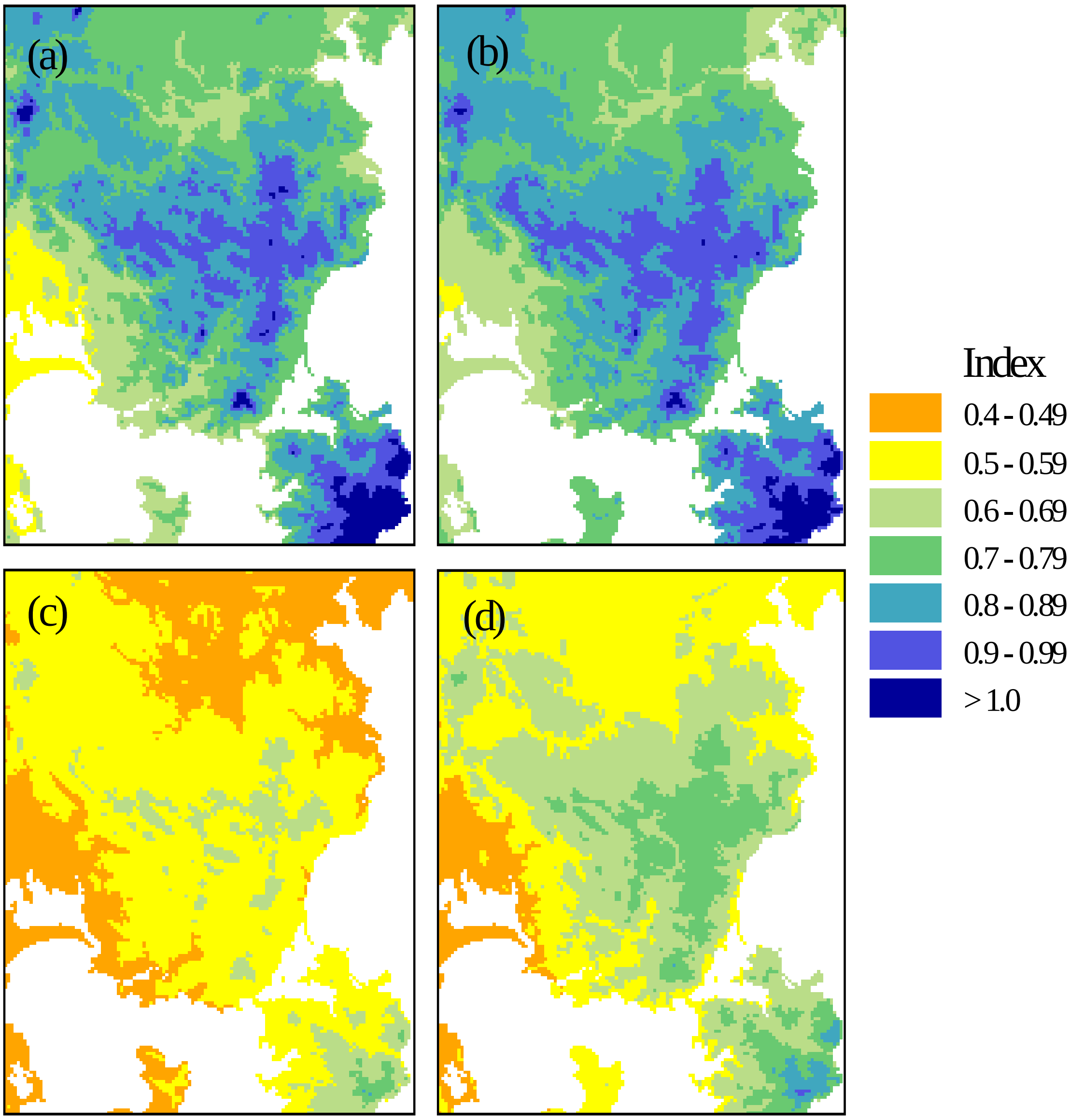


Figure 14. Prestcott's Index for the months of (a) November, (b) December, (c) January, and (d) February. Extreme soil moisture deficits occur over most of the survey area during January.

5.3 Geology and Landforms

The geology of the area is covered by two geological maps: Sorell 1:50 000 (Guilline 1982) and Buckland 1:63 360 (Blake 1958). The sorell map has an accompanying explanatory report with detailed descriptions of all rock types present.

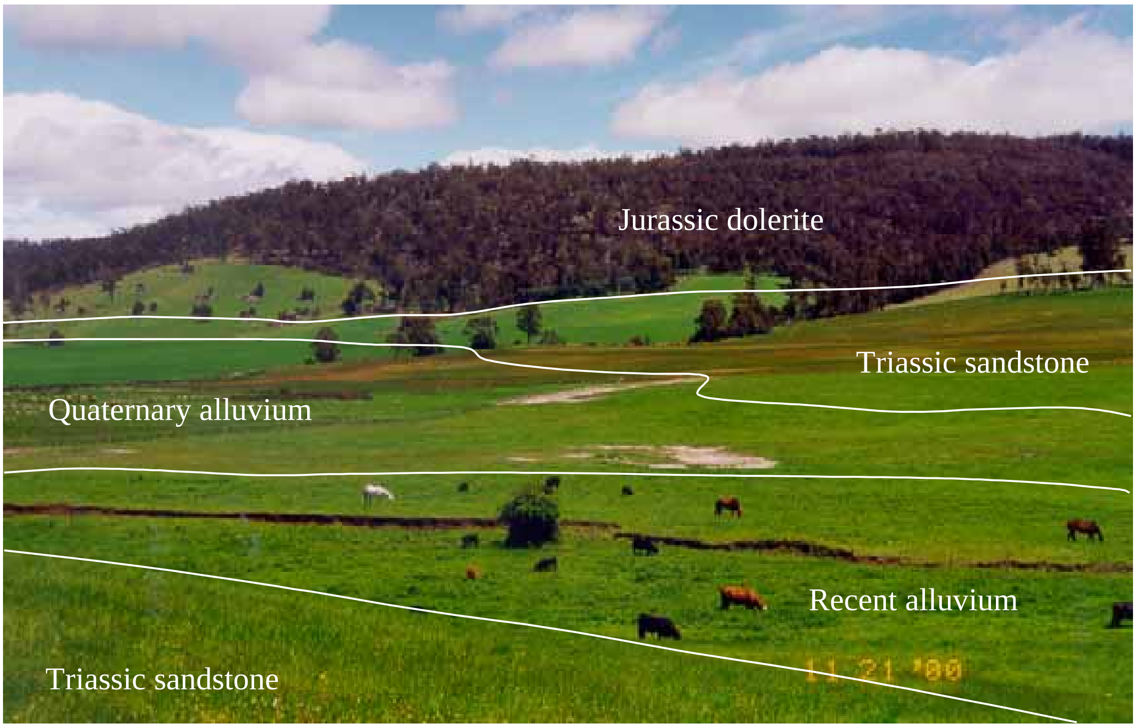


Photo 1. **The typical relationship between geology, landform and land use is illustrated here for valley systems within the Nugent survey area. Jurassic dolerite hills cap Triassic sandstone on lower slopes with Quaternary and recent alluvium filling valley floors (Runnymede GR E545700 N5280600).**

Geology enforces a strong control on the landforms and soil character in the survey area, and shows strong correlation with the distribution of land capability units. The relationship between geology and landforms is illustrated in Figure 15, where the geology of the survey area has been draped over a digital elevation model (DEM). From this image it is apparent that the southern half of the survey area comprises several different rock-types forming low elevation rolling hills. Tertiary and Quaternary sediment deposits are common in the southern part of the survey area. Jurassic dolerite and Triassic sandstone dominate the northern half of the study area, forming moderate to high elevation mountainous terrain. Associations between geology, landforms and soils are further illustrated in three simplified cross-sections (Figure 16, 17 and 18), which provide a clear picture of typical settings for each land capability class.

Permian Mudstone

Permian mudstone is the oldest (250-300 million years BP) rock type in the survey area. Permian rocks cover small (3% of the survey area), but locally extensive areas of land in the vicinity of Forcett and north of Tasman Hill on Forestier Peninsula. Smaller isolated pockets of land occur at Pawleena and south of the Prosser River east of Buckland. Near Forcett, Permian rocks form a series of hills including Mt Elizabeth (235m elevation), Table Hill (200m elevation) and Coopers Hill (160m elevation). Permian terrain commonly forms moderate relief with slopes of 10 to 30% and rounded convex upperslopes. Less commonly they form gentle lowerslopes along valley margins.

Permian rocks usually have a quartz-dominated composition and characteristically massive appearance. Permian rocks are light grey to cream in colour and well bedded.

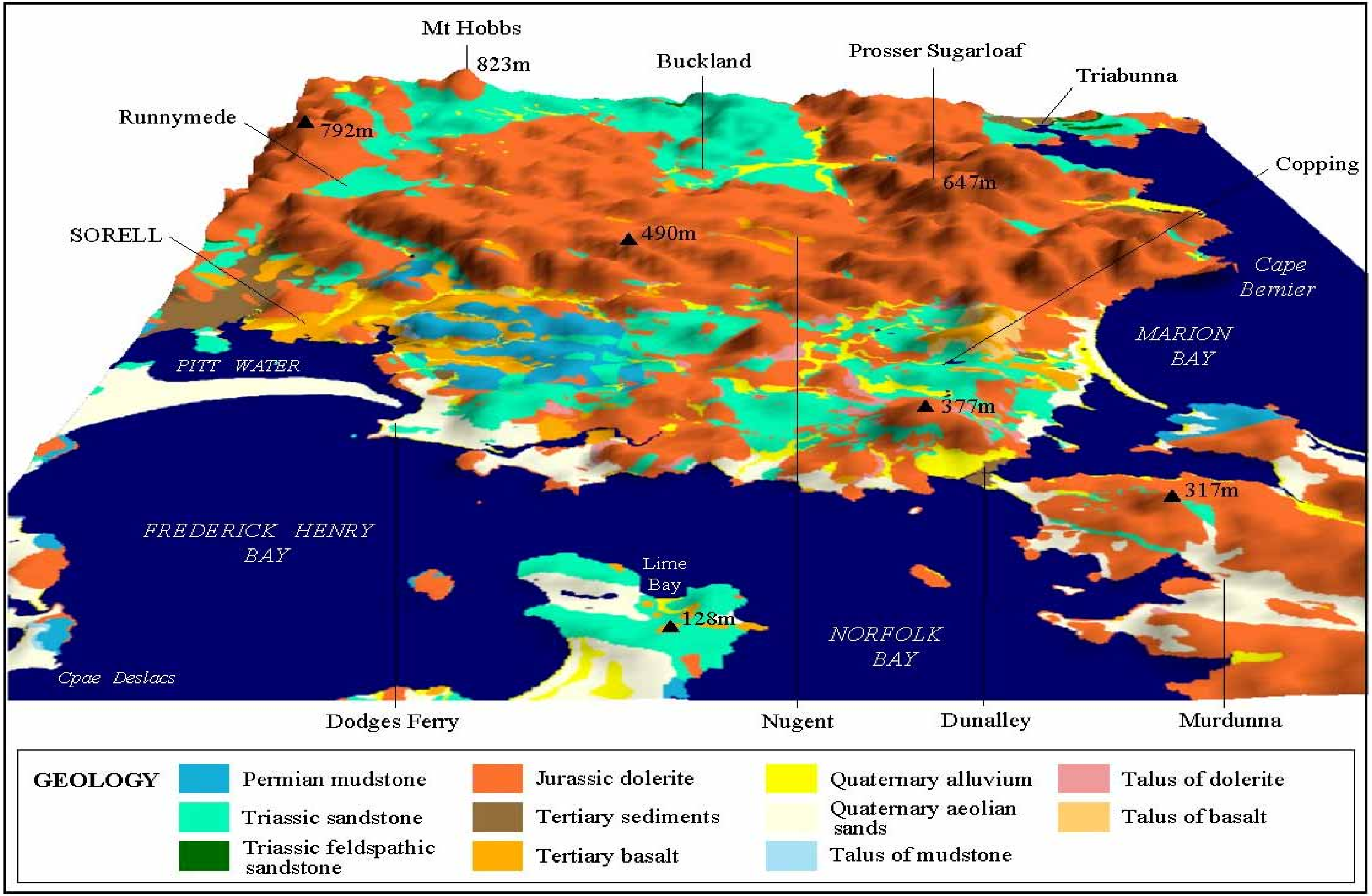
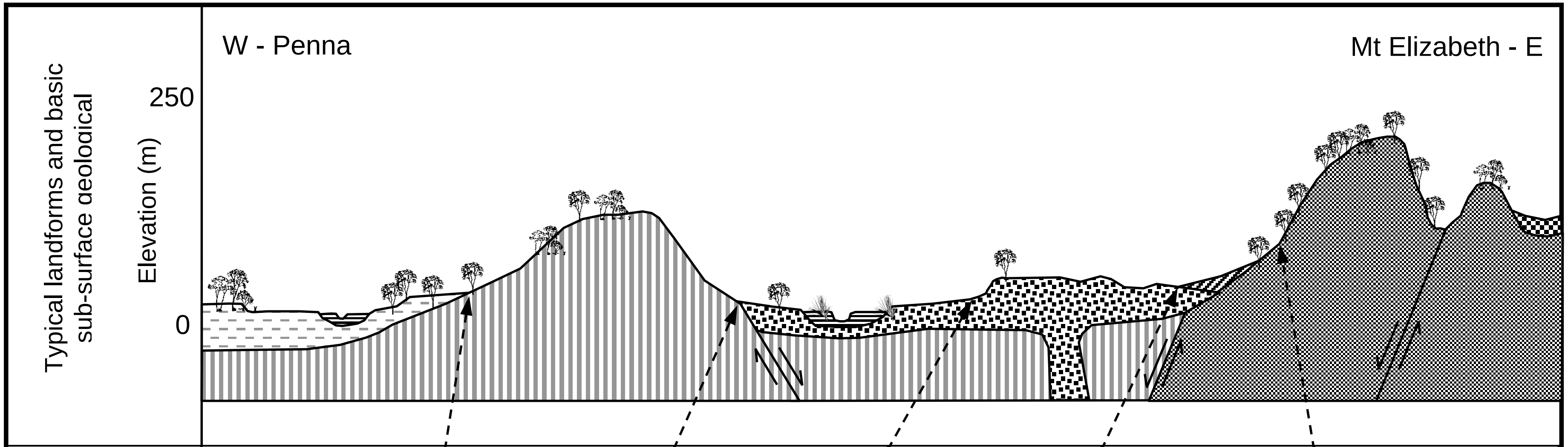


Figure 15. Perspective view looking north showing geology in relation to landforms within the Nugent survey area.



Typical Landform	Broad flats and terraces	Gentle to moderate slopes	Valley flats	Rolling hills	Moderate slopes	Steep dissected hills
Geology	Tertiary sediments and Quaternary alluvium	Jurassic Dolerite and associated slope talus	Tertiary basalt and Quaternary alluvium	Tertiary Basalt	Permian mudstone and Tertiary silcrete	Permian mudstone
Soil Type	Sodosols, Vertosols, Dermosols	Dermosols, Vertosols	Dermosols, Sodosols	Dermosols and Ferrosols	Kurosols, Kandosols	Kurosols, Kandosols
Slope Range	0 – 12 %	5 – 28 %	0 – 5 %	5 – 28 %, >45	5 – 18 %	18 – 56 %
Drainage Status	Poor to imperfect	Moderate	Poor to moderate	Moderate to well	Imperfect	Imperfect
Permeability	Slow to moderate	Moderate	Slow to moderate	Moderate	Slow to moderate	Moderate to slow
Erosion Risk	Low to moderate	Moderate	Low	Low to moderate	Moderate	High
Main Limitations	Drainage, soil structure, salinity, erosion, low rainfall	Stones, erosion, low rainfall	Low rainfall, stones, shallow depth, drainage	Low rainfall, erosion, stones, shallow depth, rockiness	Shallow depth, poor soil fertility and structure, erosion	Erosion, poor soil fertility and structure, shallow depth
Land Capability Classes	4	4, 5, 6	4	4, 5, 6	5, 4	6, 5

Figure 16. Stylised cross-section of typical landforms from Penna through Sorell to Mt Elizabeth. The order of appearance of land capability classes reflects the areal extent within each landform.

Triassic Sandstone

Triassic sandstone (c.240 million years BP) is the second most extensive rock type, covering over 21% of the survey area. A large continuous expanse of Triassic sandstone exists north of Buckland and Runnymede. Smaller blocks of Triassic sandstone commonly occur in the southern part of the study area. These principally occur in the region of Kellevie, Copping, north west of Dunalley, the northern tip of Tasman Peninsula at Lime Bay, and the area to the north east of Dodges Ferry between Dodges Hill and White Hill.

Triassic rocks usually form flat to moderate topographic relief occupying lower slopes and valley floors such as at Runnymede (Photo 1) and Buckland. In the south of the survey area, Triassic sandstone also occurs predominantly in topographic lows with less than 5% slope such as at Copping and Kellevie. Several small hills in the southern part of the survey area, including Dodgers Hill and Black Rock Hill, also occur on Triassic sandstone. North of Buckland Triassic rocks are strongly dissected by river systems forming even steeper more variable terrain.

Triassic sandstones have quartz dominated composition and are characteristically massive, coarse-grained, yellow-brown coloured rocks, often displaying cross-bedding. Feldspathic members containing coal (Kaoota Coal Measures) occur at one location east of Triabunna.

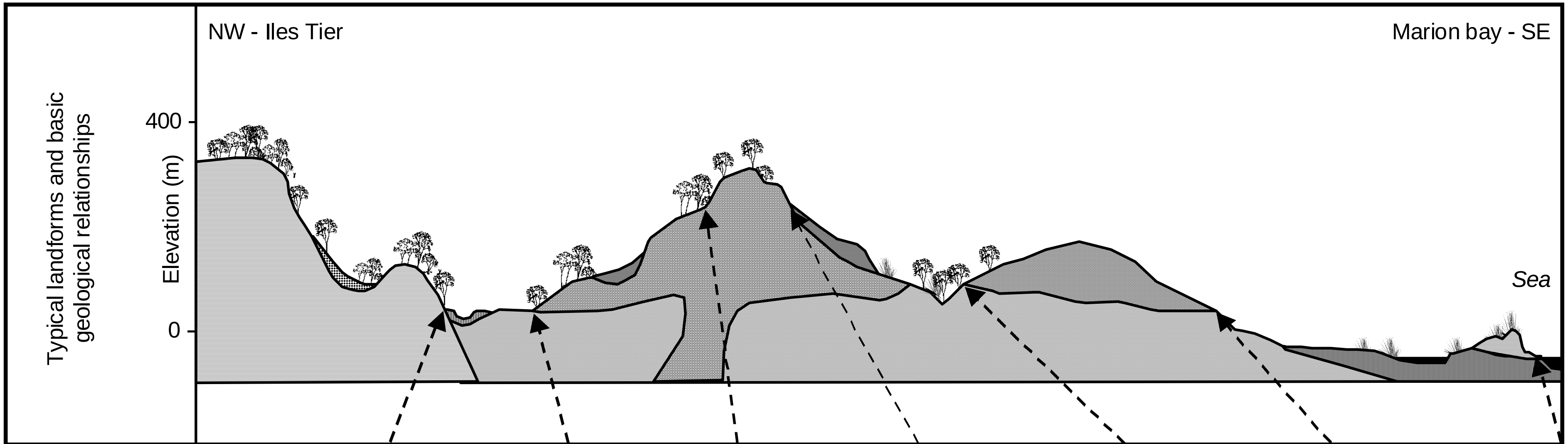
Jurassic Dolerite

Jurassic dolerite (160-200 million years BP) is the most extensively occurring rock type, comprising 62% of the survey area. Large tracts of dolerite hill country occur between Wattle Hill (West of Sorell) and Orford, and on the Forestier Peninsula. Dolerite is also extensive over much of the high country in the north west of the study area. Dolerite is more erosion resistant than other rock types in the study area and consequently tends to form mountainous or hilly terrain. Dolerite commonly caps the summit of hills and mountains, such as Mount Hobbs (823m elevation) which is the highest peak in the survey area. Dolerite rocks typically comprise rounded landforms with convex or plateau-like ridges and steeper valley side-slopes. Along major drainage systems in the north of the survey area valley side-slopes are very steep and rocky and form distinct gorges. Examples include Paradise Gorge west of Orford and along Sandspit River.

Dolerite is an igneous rock composed of several mafic and felsic minerals, typically displaying 'rust-stained' weathering rinds relating to their high iron content. Fresh samples of dolerite are typically dark blue in colour.

Tertiary Basalt

Tertiary basalt covers 4% of the survey area, and is widely distributed as flows or as small dykes and plugs. Basalt in the study area relates to volcanic events occurring during the mid to late-Tertiary (22 million years BP). The largest accumulations of basalt occur around Sorell and Bream Creek. Basalt flows in the Sorell area commonly relatively thin. Localised areas of basalt occur at several locations, including Nugent, Runnymede, Wattle Hill, and around the head of the Carlton River.



Typical Landform	Moderate to steep hills & broad crests	Inland valley basin	Moderate to steep rolling hills	Steep hill tops	Moderate hills, slumps and incised channels	Moderate to gentle slopes and broad crests	Alluvial flats and dunes systems
Geology	Dolerite and Quaternary dolerite talus	Quaternary alluvium, Triassic sandstone	Tertiary basalt and Quaternary basalt talus	Tertiary basalt	Tertiary basalt, talus deposits and Triassic sandstone	Tertiary basalt	Triassic sandstone, Quaternary alluvium and recent aeolian sands
Soil Type	Chromosols, Dermosols	Sodosols, Dermosols, Kurosols	Dermosols, Ferrosols	Ferrosols	Dermosols, Kandosols Kurosols	Dermosols, Ferrosols	Sodosols, Kandosols, Rudosols
Slope Range	5 - >56 %	0 – 12 %	5 – 28 %	0– 56 %	5-45%	5 – 18 %	0 – 12 %
Drainage Status	Moderate to Imperfect	Poor to imperfect	Imperfect to well	Well	Imperfect to poor	Moderate to well	Very poor to very well
Permeability	Moderate to slow	Moderate to slow	Moderate	High	Moderate to slow	Moderate	Slow to rapid
Erosion Risk	Moderate to high	Low to moderate	Moderate	Moderate to high	Low to high	Moderate to low	Low to extreme
Main Limitations	Erosion, stones, rock outcrop, wetness	Poor drainage, poor soil structure and fertility, erosion	Soil slumping, stones	Stones, soil depth	Wetness, slumping, stones, erosion	Shallow depth, erosion, stones, heavy texture	Poor drainage, salinity, erosion
Land Capability Classes	6, 5, 7	5, 4	5, 4	5, 6	5,4,6	4,3,5	5, 7, 6

Figure 17. Stylised cross-section of typical landforms in the Bream Creek area. The order of appearance of land capability classes reflects the areal extent within each landform.

Tertiary basalt forms two different topographic regimes. Basaltic flows form flat to gentle slopes (0-10% slope angles) in areas of low relief (eg. about Sorell), while basaltic dykes and plugs form steeper cone-shaped hills. Basalts in the Bream Creek area relate to a combination of basalt flows and plugs in which varied terrain with slopes up to 30% or more have developed. Recent surface slumping and mass movement erosion is evident on steeper slopes in this area. Basaltic hilltops have a rounded morphology.

Basalt is an igneous rock of similar composition to dolerite, but in comparison is of a browner hue and is often vesicular in appearance.

Tertiary Sediments

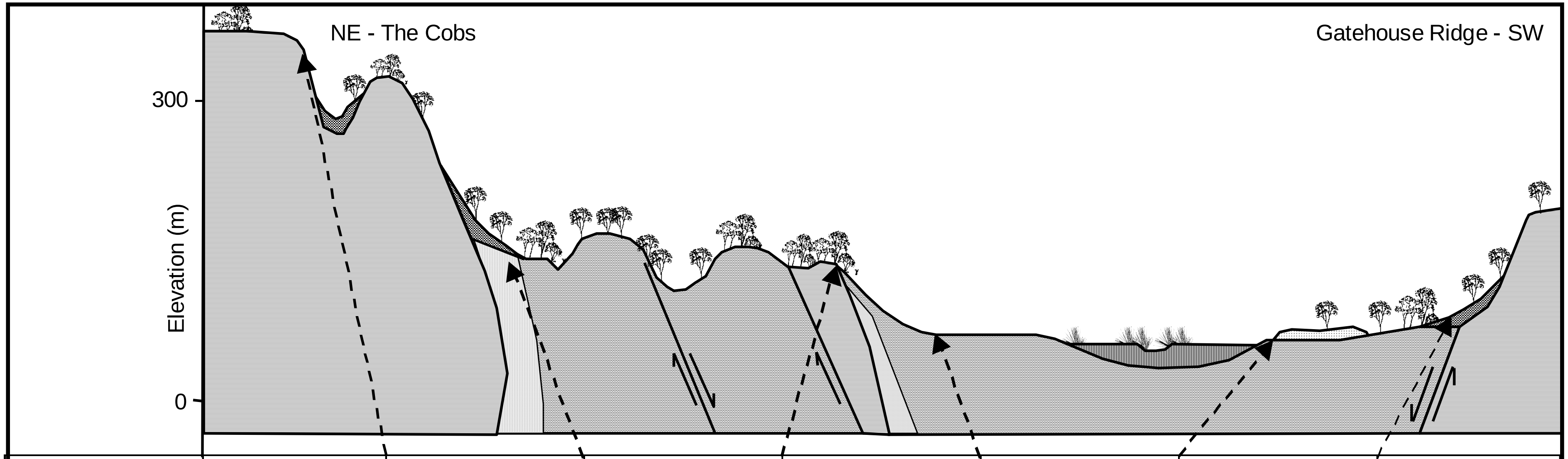
Tertiary sediments (3-55 million years BP) are valley fill deposits covering roughly 2% of the survey area. The single most continuous area of Tertiary deposits extends north of Penna, along valley flats following Frogmore Creek and Orielton Rivulet. Tertiary deposits are also locally extensive as gently sloping fans and valley flats near Triabunna (Salmon Flats) and south of Rheban. Tertiary sediments comprise predominantly thick grey clays, with varied occurrences of sands and gravel lenses. These are frequently overlain by gravelly alluvial fans of indeterminate age adjacent to steeper hills, or by Quaternary alluvium along valley flats and river terraces. Tertiary sediments often include near-surface horizons of cemented secondary weathering products, such as ferricrete, silcrete and calcrete. Ferricrete is extensive in Tertiary sediments north of Mid-way Point. Silcrete deposits commonly occur at the break of slope with Permian hills. An example of this terrain is the south west facing slopes of Corn Hill just south of Pawleena.

Quaternary Sediments

Quaternary deposits (<1.8 million years BP) are confined to the base of valley systems and coastal areas, and extend over 9% of the survey area. Quaternary deposits in the study area encompass a range of sedimentary processes, including fluvial, aeolian, and slope deposits.

Alluvial deposits of sand, clay and gravel commonly occur at the base of valley systems and are generally associated with present drainage systems. Alluvial deposits are normally composed of rounded gravels that form flat terrace landforms. Significant areas of alluvial deposits occur along Sorrel Rivulet and contiguously with major rivers east of Buckland. Most valley systems in southern areas contain alluvium of variable origin. Drainage is highly variable, relating to the heterogeneous nature of these deposits.

Windblown sand deposits are widespread in coastal areas and these are often greater than 6m thick (Gulline 1984). Accretion of Quaternary sand has formed isthmus landforms between headlands at Boomer Island, Green Point, and Carlton Bluff. Sand spits are well developed at Seven Mile Beach, Marion Bay, Cremorne Beach, Carlton Beach and Sandspit.



Typical Landform	Broad crests and plateaux	Steep hills and escarpments	Steep highly dissected hills	Valley side-slopes and footslopes	Valley flats and terraces	Raised valley plateau and footslopes	Moderate to steep slopes
Geology	Jurassic dolerite	Jurassic dolerite and talus deposits	Triassic sandstone	Triassic sandstone and Jurassic dolerite	Quaternary alluvium, Triassic sandstone	Tertiary sediments, Triassic sandstone	Jurassic dolerite talus deposits
Soil Type	Chromosols, Ferrosols, Boulder fields	Chromosols, Dermosols	Kurosols, Podosols	Kurosols, Chromosols	Sodosols, Vertosols, Ferrosols	Kurosols	Chromosols, Dermosols
Slope Range	0 - 18 %	18 - >56 %	12 - >56%	5 – 18 %	0 – 5 %	0 – 12 %	12 – 56 %
Drainage Status	Moderate to poor	Moderate to imperfect	Imperfect to very well	Moderate to imperfect	Moderate to poor	Well to poor	Moderate to imperfect
Permeability	Moderate to slow	Moderate	Slow to rapid	Moderate to slow	Slow	Moderate to slow	Moderate
Erosion Risk	Moderate to high	High to extreme	High to extreme	Moderate to very high	Low to moderate	High to very high	Moderate to high
Main Limitations	Cold climate, stony soils, wetness	Stony soils, erosion, rockiness	Erosion, shallow and stony soils, poor fertility and soil structure	Erosion, soil drainage, poor soil structure, stones	Soil drainage, poor soil structure, erosion, salinity, low rainfall	Poor fertility and structure, wind erosion, stones, wetness, low rainfall	Stony soils, erosion
Land Capability Classes	6,5	6,7	6, 5	5,4	4,5	5, 4	5, 6, 4

Figure 18. Stylised cross-section through landforms across the Buckland plains. The order of appearance of land capability classes reflects the areal extent within each landform.

Talus deposits occur at the base of dolerite slopes extending to level ground in some areas. These talus deposits are composed of sub-angular dolerite boulders ranging in size from 10 to 100 cm.

Basalt hills, especially around Copping and Bream Creek, have extensive talus slopes and isolated patches of talus may occur considerable distances from source areas. These talus deposits are subject to slumping and flow erosion, particularly around Bream Creek. Talus deposits are much less extensive on slopes composed of Permian and Triassic rocks.

5.4 Soils

Available soils information for the Nugent survey area includes the broad scale 1:100 000 reconnaissance surveys of Buckland (Loveday and Dimmock 1958 revised by Spanswick 2000) and Sorell (Loverday 1955 revised by Spanswick 2000), together with the more detailed 1:20 000 soil survey of the Wattle Hill and Bream Creek basalt land systems (Loveday 1957). Land Systems information (Davies 1988) also summarises general soil trends across the region.

All previous surveys point to a clear association between soils and underlying geology. Soil parent materials have, for the most part, been derived from weathering of underlying geological formations, although slope processes have clearly caused localized redistribution of soil materials. In places, coverbed sequences overlie basement geology, and soils are formed in colluvial slope deposits or alluvium along river channels.

The key features of soils occurring within the survey area are summarized below. They are arranged by soil parent material and reflect decreasing importance for agricultural use. The Australian Soil Classification (Isbell 1996) has been used when classifying soils and the appropriate terminology appears at the end of each relevant sentence. Other descriptive nomenclature follows the suggested standards, which appear in the Australian Soil and Land Survey Field Handbook (McDonald *et al.* 1990). Soils information pertaining to soil performance and limitations to land use are described in the relevant land capability sections.

Soils derived from Tertiary Basalt and Basalt Talus deposits

Basalt soils encompass a wide range in profile variability and soil type. Five different toposequences are recognised that reflect differences of soil development in relation to climate (principally rainfall) and topographic position (ie. drainage).

The Sorell sequence is characterised by uniform, generally black or very dark brown, clay rich soils that have developed on undulating basalt flows in areas of relatively low rainfall (<600mm yr^{-1}). The Sorell Clay (Eutrophic Black Dermosol) is the dominant soil of this sequence (Photo 2). It is characterised by a fine granular structured, black light clay surface horizon over a coarse blocky or prismatic structured, very dark grey to olive or brownish grey, heavy clay subsoil. This in turn passes to mealy decomposing basalt at depths below 50cm or more. The Kornhill Clay (Epipedal Black Vertosol) is the other dominant soil of this sequence having formed in colluvial slope deposits at the base of slopes or in topographic depressions. It differs from the Sorell Clay in being deeper (>1.0m) and having a yellowish grey, rusty-brown mottled, lower subsoil horizon. The Noble Clay (Eutrophic Black Dermosol) is characteristic of steeper basalt risers. It is more free draining and in contrast to other members of the sequence, has a dark brown sub-angular blocky structured subsoil which passes to decomposing basalt at depths greater than 45cm.

These are all highly fertile soils having high cation exchange capacity, high base saturation and neutral or neutral to alkaline pH trends. Subsoils are occasionally sodic with low salinity levels that increase with increasing depth.

The Wattle Hill and Pawleena sequences occur in areas of slightly higher rainfall (600 – 700mm yr^{-1}) on generally more dissected and steeper terrain. The Stoneleigh Clay Loam and Maywa Clay are the dominant soils of the Wattle Hill sequence. The Stoneleigh Clay Loam (Eutrophic Red Ferrosol) occurs on gently sloping ridge crests and is characterised by a fine structured dark reddish brown clay loam surface horizon over a strong granular structured reddish brown medium clay subsoil. Profiles are generally shallow and stony with depths to bedrock not normally exceeding 50cm. The Maywa Clay occurs on gentle midslope positions and is a fine textured soil, similar morphologically to the Kornhill Clay, but characterised by generally greyer soil colours, weak or massive structured subsoil and a mottled lower subsoil. These features reflect generally poorer internal drainage. As with the Sorell sequence, the Noble Clay, usually in association with much stonier variants, occupies steeper slopes.

The dominant soil in the Pawleena sequence is the Stoneleigh Fine Sandy Clay Loam (Eutrophic Red Ferrosol). This soil occupies gently sloping crests and upperslopes and consists of a uniform structured reddish brown fine sandy clay loam to about 50cm depth, which overlies, brown mottled heavy clay subsoil containing many basalt fragments. Compared with the Stoneleigh Clay Loam, this soil is deeper, but generally less fertile with an acid pH trend and lower cation exchange capacities and percent base saturation. Delmore Clay Loam (Eutrophic Brown Dermosol) is the other common soil in the Pawleena sequence and occurs on moderate to steeper mid or lower slope positions. It is somewhat similar to the Noble Clay except for the clay loam surface texture, greyish-brown soil colours, and weak to massively structured subsoil.

The Bream Creek and Allenby sequences occur in areas of generally higher rainfall (ie. > 700mm yr^{-1}). The Bream Creek sequence occurs on steep basalt hills where there is a clear association between soil type and topography. The dominant soil is the imperfect to poorly drained Kellevie Clay Loam (Grey Kandosol). This is considered a hydromorphic soil (Loveday 1957) and occurs on moderate sloping mid to lower slope positions. It is characterised by a moderate granular structured dark greyish brown clay loam surface horizon overlying a weakly structured brownish grey mottled, sticky clay. Basalt gravel and stones are present throughout profiles, which are usually > 1m in depth. The Kellevie Clay Loam grades to a more poorly drained variant (Redoxic Hydrosol) on flat benches and along depressions. This soil differs in having a greyish brown subsurface horizon containing concretionary gravel between 30 and 60cm depth, and having a strongly mottled yellowish grey or brown clay subsoil.

The Copping and Bender Clay Loam soils occupy free draining upper slopes and ridge tops of the Bream Creek sequence. The Copping Clay Loam (Mesotrophic Red Ferrosol) is a deep soil occupying crests. It is characterised by a deep (30cm) strong granular structured dark reddish brown clay loam surface horizon over a similarly structured red heavy clay subsoil, that becomes more weakly structured and light reddish brown in colour, before passing to basalt rock at depths exceeding 1.5m. Profiles are normally stony throughout and have strongly acid pH trends with increasing depth. The bender Clay Loam (Eutrophic Red Ferrosol) is a shallower soil of steeper upperslopes. It contrasts in being darker brown coloured, shallower (>75cm), and stonier with horizons containing 20-50% basalt coarse fragments. The pH is also higher, as are cation exchange capacities and percent base saturation.

The Allenby sequence occurs on gentler terrain to the south east of Bream Creek. The dominant soil is the Allenby Clay (Eutrophic Brown Dermosol), which occupies crests and moderate upperslopes. It is similar to the Noble Clay and Delmore Clay Loam and consists of a strong polyhedral structured dark greyish brown clay over a firm dark greyish brown clay subsoil, that contains varying amounts of stone and gravel. The Sorell Clay is the dominant soil of gently sloping lower ridges while the Kornhill Clay occurs along drainage lines and concave footslopes.

Soils derived from Jurassic dolerite

The principal soils developed from dolerite within the survey include black and brown uniform to gradational soils (Self mulching Black Vertosols, Eutrophic Brown Dermosols), greyish brown texture contrast soils (Brown Chromosols, Kurosols, or Sodosols), and reddish brown soils often formed in solifluction deposits (variously Red or Brown Ferrosols and Chromosols).

Black soils on dolerite are uniformly textured, moderately to strongly structured, alkaline, black, cracking clay soils. They occur mainly on gentle to moderately sloping land in areas of low rainfall (eg. Penna and Sorell). The soils are similar in appearance to black soils on basalt, except that they overlie decomposing dolerite, or dolerite colluvium. Soils may have clay loam surface textures and those on sloping terrain tend to have better topographic drainage. Lime is commonly found in lower subsoil horizons.

Brown soils on dolerite are neutral, moderately to strongly structured, gradational soils. They also predominate in areas of lower rainfall, but on generally steeper slopes and along ridge crests. They may also be found on northerly aspect slopes where rainfall is higher. The typical profile has a brown to dark brown, loam or clay loam surface horizon, overlying a brown or reddish brown, medium to heavy clay subsoil. This in turn rests on weathered rock or regolith at about 45cm depth or more. Dolerite fragments usually occur throughout the soil profile in varying amounts, while transitional horizons that contain abundant rounded (exfoliating) stones, may be present to depths of about 70cm.

Grey-brown texture contrast soils cover extensive areas of dolerite terrain throughout the Nugent region generally in areas where annual rainfall exceeds about 640mm. These soils have variable pH trends and are characterized by a weakly structured greyish brown loam or sandy loam surface horizon, over a massive light grey, fine sandy loam or loamy sand subsurface A2 horizon, often containing ferruginous concretions. Surface horizons overlie a light olive brown to brown, weak prismatic or sub-angular blocky structured, medium to heavy clay subsoil, which gradually passes to decomposing dolerite at depths as little as 30cm. These soils are often stony throughout and, for the most part, retain their natural native forest cover. Soil materials are generally dispersive and these soils may be prone to surface erosion where vegetation disturbance occurs. The subsoil and occasionally the A2 horizon are mottled, indicating impeded profile drainage. In low-lying areas, and on very broad gently sloping crests, the soils become poorly drained, and consequently, more intensely mottled.

Reddish brown soils are relatively uncommon and largely confined to areas of high rainfall (>900mm) either in at higher elevations in the north west of the survey area (eg. west of Mt Hobbs) or towards the south east of Forestier Peninsula. These soils are moderately well drained and characterised by neutral to acid pH trends and a bright reddish brown coloured subsoil that extends to depths greater than 1m. They are invariably deeply weathered stony soils, having developed largely in solifluction or talus deposits and contain frequent stones and boulders, particularly in surface horizons. Gradational profiles consist of a 20cm dark brown clay loam to light clay surface horizon over a moderate to strongly structured, light to medium clay, subsoil horizon.

Soils derived from Tertiary sediments and Quaternary alluvial sediments.

The majority of valley systems contain Quaternary alluvial coverbeds on which a broad range of soil types has developed. These include uniform black cracking clays (Black Vertosols), grey clays (Grey Kandosols, Redoxic Hydrosols), dark brown to reddish brown gradational soils (Brown or Black Dermosols, Red Ferrosols, Clastic Rudosols), and a range of texture contrast soils (Grey, Black, or Brown Sodosols). Tertiary clays where exposed carry reddish brown lateritic soils (Brown Kurosols).

Relatively small extents of moderate to strongly structured dark brown or reddish brown soils occur immediately adjacent to rivers and streams across the survey area. These soils are derived from recent alluvium and are typically uniformly textured throughout. Soils derived from dolerite alluvium in areas of higher rainfall are typically well drained dark reddish brown sandy loams. These are nearly always stony and shallow. In areas of low rainfall, particularly where there has been an influence from basalt materials, soils are moderately well drained black to dark brown clay loams. These are also stony in places and typically shallow with soil depths ranging from 40-70cm before passing to alluvial gravels. In areas where flooding is more frequent, the soils are well drained, dark brown, loose, sandy loam to loamy sands. However, these soils are often shallow (30cm) and contain many stones and boulders.

Black and grey cracking clay soils have formed predominantly on flats adjacent to the modern floodplain of rivers, especially in areas of low rainfall (eg. north of Penna). They are imperfectly to poorly drained soils which have uniform, light to medium or heavy clay profiles, with black or very dark grey surface horizons and upper subsoil horizons. Subsoil horizons become dark grey, brown or yellowish brown with depth, and are characterised by lenticular structures and prominent slickensides. These are variably saline soils with vegetation associations characterised by salt tolerant species.

Texture contrast soils are the dominant soil type of higher terraces within most valley systems and these can cover extensive areas of valley flats from Runnymede to Buckland and in coastal areas from Triabunna to Reban, where they often overlie Tertiary gravel deposits. In southern areas, wind blown sand deposits commonly overlie alluvium. These soils are all imperfectly to poorly drained and characterised by a dark grey to grey, strongly mottled clay subsoil, that is usually weakly structured, alkaline and sodic. The subsoil is normally encountered at depths ranging from 30 to 50cm. Surface horizons are highly variable and can range from loose grey sands, to weakly structured dark greyish brown fine sandy loams, or black moderately structured sandy clay loams. A thin, sporadically bleached subsurface A2 horizon is normally present in the coarser textured soils. The soils with darker coloured and finer textured topsoils are associated with colluvial deposits derived from terrain mantled by either black soils from basalt or dolerite. Most soils are relatively stone free, except where they overlie Tertiary gravel deposits and stones may be common in surface horizons.

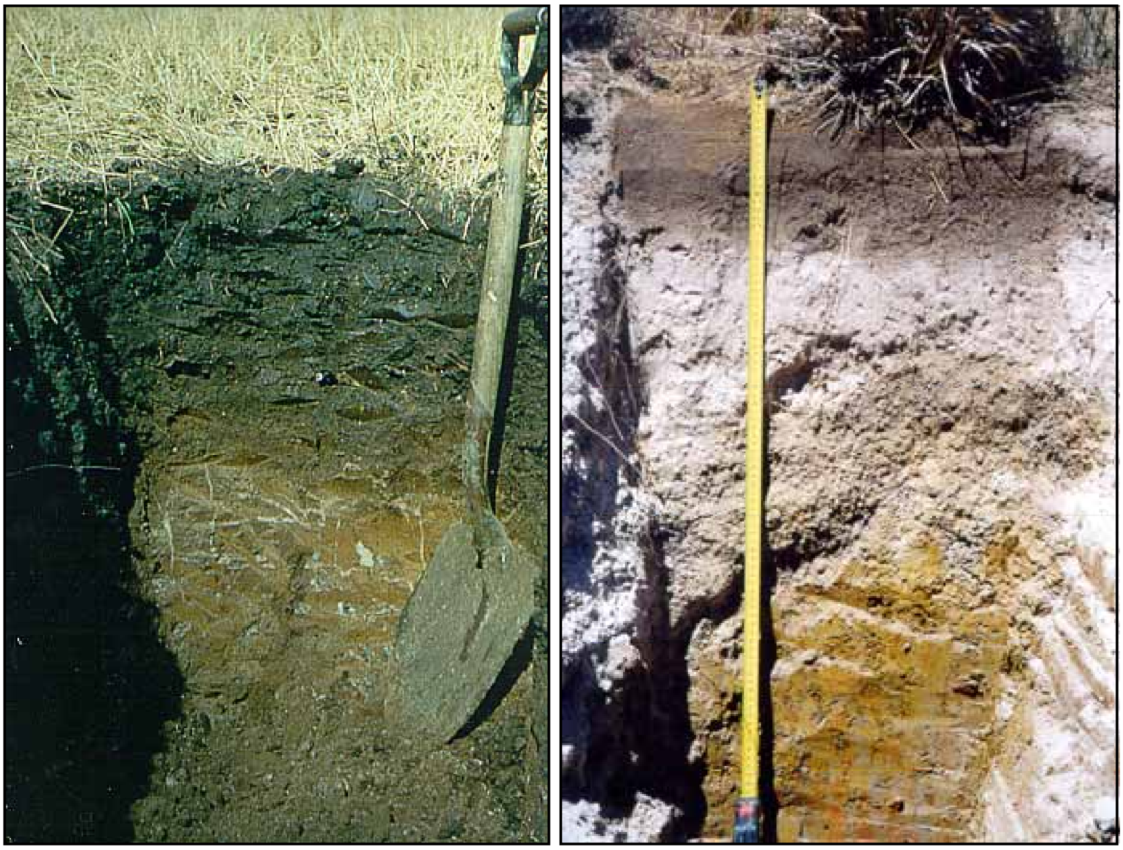


Photo 2. **An understanding of soil variability is important for land capability assessments. Here, the Sorell Clay, a black gradational clay soil (Black Dermosol) from basalt (left), contrasts with a greyish brown texture contrast soil (Brown Kurosol) from Tertiary clays (right). The former soil relates to Class 4p land while the latter relates to Class 5sa land.**

In a number of localities, usually drained swamps, uniformly textured black to dark greyish clay soils were encountered. These were invariably poorly drained to very poorly drained and had strongly mottled plastic subsoils and root staining extending along root channels to the soil surface.

At a number of localities lateritic soils have developed on the dissected pediments of Tertiary clay deposits (Photo 2). These soils are differentiated by coarse textured surface horizons, a zone of abundant ironstone concretions, and haematitic mottling patterns at depth. Surface horizons range from being brown sandy loams to deeper greyish brown loamy sands and most profiles have strongly acid pH trends. Subangular ferricrete nodules commonly litter the ground surface.

Soils derived from Triassic sediments

The principal soils developed on Triassic sandstone include brown to yellowish brown sandy loams (Brown Sodosols), greyish brown loamy sands (Brown Kurosols), deep grey sands (Aeric and Semiaquic Podosols), and brown gradational soils from feldspathic sandstone (Brown Dermosols).

Gradational brown soils were recognised at one locality on gentle ridge crests east of Triabunna. These consist of a well structured dark brown fine sandy clay loam topsoil, over a moderate angular blocky structured, yellowish brown, light clay subsoil.

Brown texture contrast soils are also relatively uncommon in the survey area and confined to areas of lower rainfall. These generally have a weakly structured, brown, fine sandy loam surface horizon over a weak blocky or prismatic structured yellowish brown or greyish brown, faintly mottled, light to medium clay subsoil. A sporadically bleached subsurface A2 horizon may be present in places. These are neutral to alkaline soils with sodic subsoils.

Greyish brown soils with deeper and generally sandier upper horizons are the most common soil type on sandstone and these can cover extensive areas of land within the Nugent survey area. The typical profile consists of a dark grey loamy sand surface horizon over grey to light brownish grey bleached subsurface sand, which inturn overlies a greyish brown, strongly mottled, sandy light to medium clay at variable depths. These are invariably strongly acid and nutrient poor soils. Soil depths can be extremely variable. In places, the brown subsoil was absent and bleached sand passed directly to mealy coarse clayey sand, or occasionally directly to bedrock. Soil depths as little as 30cm are common in ridge crest locations and these can also be extremely stony with angular stones littering the ground surface.

In deeper accumulations of sand, Podzols and ground water podzols (Podosols) have generally developed. These can also cover extensive areas of land in places. Apart from the thick light grey sand, which can extend to depths of 1m or more, the main characteristic of these soils is the presence of a black or reddish brown organic hardpan at depth (Bh, Bhs horizon). The surface horizon is generally an organic enriched fibric sand. These soils contain little clay in surface horizons and are consequently very nutrient poor and have very low soil moisture holding characteristics and are particularly drought prone.

Soils derived from Quaternary aeolian sand deposits

Soils developed in aeolian sand deposits fall into two categories: uniform light brown sands (Arenic Rudosols) from recent calcareous sands, and texture contrast grey sands (Aeric or Semiaquic Podosols) from siliceous sands of older dune phases. Red sandy clay soils (Red Ferrosols) of older dunes were also encountered at one locality (Lagoon Bay).

Locally extensive areas of sandy soils with minimal profile development occur in coastal regions and along sandspits (eg. Seven Mile Beach). These soils consist of uniform sands with the only distinguishing feature being a slightly darker coloured light brownish grey topsoil. This overlies fine to coarse sands, which extend to depths beyond 1m.

Deep Podosols, similar in profile characteristics to those formed on Triassic sandstones, have also formed in aeolian sand deposits. These are commonly associated with locally extensive sand sheets, such as in the region of Dodges Ferry and Primrose Sands. These soils are characterised by thick, loose, single grain, light grey to white, coarse sandy subsurface A2 horizons, which overlie irregular reddish black and yellow sandy subsoils (Bh, Bhs horizons). As with other podosols, these are strongly acid nutrient poor soils.

Reddish brown soils from older sand deposits are relatively uncommon in the Nugent survey area. Where they occur, they are generally formed in intensely weathered sands of older dunes phases where sands have been derived from more iron rich parent materials (eg. dolerite). These are well drained gradational soils that consist of a dark brown sandy loam surface horizon over yellowish red sandy clay loam or sandy clay subsoil horizons.

Soils derived from Permian Sediments

Grey brown soils, which may or may not show strong textural contrast, are the main soil developed on Permian mudstones (Dystrophic Brown or Grey Kurosols, Grey Kandosols).

The typical profile on hillslopes and crests consists of a very shallow greyish brown or dark grey surface horizon over a massive bleached grey subsurface horizon, which passes to a greyish brown or yellowish brown, heavier textured, mottled subsoil. This often abruptly overlies unweathered rock at shallow depths (40-50cm). Deeper soils occur on gentle crests or colluvial lowerslopes. Surface horizons vary in texture from fine sandy loams to silty clay loams, while subsoils are commonly silty clay loams or light clays. Surface horizons are also commonly hardsetting and in places can form a barrier to root development in the case of duripans (silcrete). Under cultivation topsoils, when in a dry state, can turn to a fine powder and are easily eroded.

These soils are generally imperfectly to poorly drained, strongly acid and nutrient poor. In areas adjacent to basalt flows, slightly better soils were encountered that had deeper, darker, and more strongly structured topsoils.

5.5 Vegetation

The vegetation of the study area has been described by Davies (1987), Kirkpatrik and Dickenson (1984) and in the Vegetation of Tasmania (University of Tasmania). Hence, a broad overview of only the principal vegetation associations is presented here.

The dominant vegetation communities identified by Kirkpatrik and Dickenson are:

- dry sclerophyll forest throughout much of the survey area,
- wet eucalypt forest towards the south east on Forestier Peninsula,
- dry coastal vegetation associated with sand dunes,
- tidal marshland and
- cleared land consisting of introduced or native grasses

The distribution of native vegetation is broadly correlated with geology, altitude and climate. Fire and grazing history have also played an important role in the development of the native vegetation types that we see today. Remnant vegetation is mostly confined to upland areas where a combination of soil and/or climatic conditions severely limits agriculture. Lowland and coastal areas have largely been cleared of the original forest cover and replaced by introduced grasslands. Some small areas of forest occur on private land in low lying areas where either slopes are steep or soils are excessively stony, wet, or acid and nutrient poor.

Within agricultural areas, improved pastures consist of perennial ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*). Other grass species may be common in improved pastures such as Phalaris (*Phalaris* spp.) and Cocksfoot (*Dactylis glomerata*). In wet or poorly drained sites rushes become common (eg. *Juncus spp*), while along saline valley flats, Buck's Horn Plantain (*Plantago coronopus)* is often the dominant plant. On sandier soils, poor pastures are often characterised by hardier plants such as bracken fern *(Pteridium esculentum*) or saggs (*Lomandra longifolia*). Unimproved pastures also commonly consist of a range of native grasses, which may include such species as Wallaby grass (*Danthonia spp*), Weeping grass (*Ehrharta stipoides*) and Tussock grass (*Poa spp*), together with a large number of volunteer weed species.

Dry coastal vegetation generally consists of a closed heath comprising a variety of species including Tea Tree (*Leptospernum spp*), Paperbark (*Malaleuca spp*), Banksia (*Banksia marginata*) and Sheoak (*Casuarina spp*). Drooping Sheoak (*C. stricta*) is common on very steep, stony dolerite hillslopes. Coastal dune systems typically support a grassland dominated by Marram grass (*Ammophila arenaria*) or shrubland dominated by Coastal Wattle (*Acacia sophorae*).

Dry sclerophyll forests consist of a wide variety of species that are usually characterised by floristic structure. Permo-triassic landforms are characterised by Black Peppermint Gum (*E. amygdalina*), Silver Peppermint Gum *(E. tenuiramis*), or Blue Gum (*E. globulus*) with a heathy understorey. Dolerite landforms generally carry grassy woodland dominated by Blue Gum, White Gum (*E. viminalis*) or White Peppermint Gum (*E. pulchella*). Poorly drained sites carry open stands of Black Gum (*E. ovata*) or Stringybark (*E. obliqua*) with a shrubby or sedgy understorey. Conversely, particularly dry sites on the sandier soil types have a dense ground cover of Bracken Fern (*Pteridium esculentum*).

Wet sclerophyll forests occur in areas of higher moisture availability and are characterised by a taller understorey of *Acacia* species and green leafy (mesophyll) shrubs. Typical forests consist of open stands of White Topped Stringybark *(E. delegatensis*) or Stringybark, with Swamp Gum *(E. regnans*) becoming increasingly common in gullies and on protected slopes.

Tidal marshlands occur in a number of coastal localities (eg. Bream Creek). This consists predominantly of a heath or sedgeland dominated by rushes (*Juncus kraussii),* Saltmarsh Grass (*Puccinellia stricta*), *Salicornia quinqueflora*, and *Arthrocnemum arbuscula.*

5.6 Land Use

The majority of lowland and coastal areas have been cleared of the native vegetation for agriculture. In general, valley flats, rises and footslopes throughout the survey area are used extensively for agriculture. In contrast, steeper and stonier hillslopes and ridge crests, which can cover very extensive areas at higher elevation in inland localities, retain their original native forest cover. Similarly, forests may remain in areas where particularly poor soil types occur, although these have been disturbed through periodic clearance and regeneration. The greater proportion of agricultural land within the survey area is given over to grazing or grazing and cropping enterprises that produce fine wool, beef cattle, and fat lambs. In the drier areas, pastures are grazed in rotation with dryland crops of wheat, barley, oats, triticale, and poppies. Grazing areas that are unsuited to cash cropping are occasionally rotated with fodder crops such as oats or turnips, during pasture renewal.

Within the drier climate experienced throughout much of the survey area irrigation has the potential to allow a wider range of crops to be grown with less risk of crop failure. However there is presently no major irrigation scheme, such as occurs within the Coal River valley to the west of Sorell. It is proposed to supply treated water to farms in the region of Penna, from the Midway Point Effluent Disposal Scheme. This scheme will need to carefully consider the risks associated with soil salinisation given the predominant soil types (Sodosols and Vertosols) that occur within this area.

Present irrigation is localized and restricted to on-farm dam storage supply. Irrigated cropping options include peas, potatoes, brassicas, and poppies. Horticultural enterprises such as viticulture, olives and stone fruits are also becoming established within the region, but these will also rely on a good supply of irrigation water, particularly in drier areas to the south west. Some small areas of land are being used intensively for market gardening, principally on alluvial and basalt soils near to town centres and local markets, such as near Sorell.

Some areas of land within the survey area are gazetted for recreation and conservation. These include Seven Mile Beach Protected Area, Lime Bay Nature Reserve, Cape Bernier State Reserve, Clifton Beech Coastal Reserve, Sandspit River Wildlife Sanctuary, as well as the much larger Maria Island National Park to the east. Buckland Military Training Area overlaps the northern boundary of the survey area.

Much larger areas of land are gazetted as State Forest. Timber is extracted from these areas for sawlogs or for wood chipping. Most timber is presently extracted from wet sclerophyll forests to the east of Murdunna. The main wood chipping plant and sea-port for export of timber raw materials is located at Freestone Point, to the east of Triabunna. Locally, timber has also been supplied from private forests. Plantation forests are being established in areas previously milled for timber or in some pastureland peripheral to forests.

There is little mining within the survey area, except for stone quarrying of sandstone blocks for the building industry and dolerite and basalt materials for roading.

Photo 3. **Typical pattern of land use within the south western portion of the survey area. Grazing and cropping activities are focussed on valley flats or lowerslopes, while mid and upperslopes are used for occasional grazing or more often retain their native forest cover (Watts Sugarloaf, GR E541500 N5271400).**

Photo 4. Subdivision for housing and small lifestyle blocks is potentially one of the biggest threats to the viability of some of the best agricultural land in south east Tasmania (Sorell, GR E547100 N5263400).

6. LAND CAPABILITY CLASSES ON THE NUGENT MAP

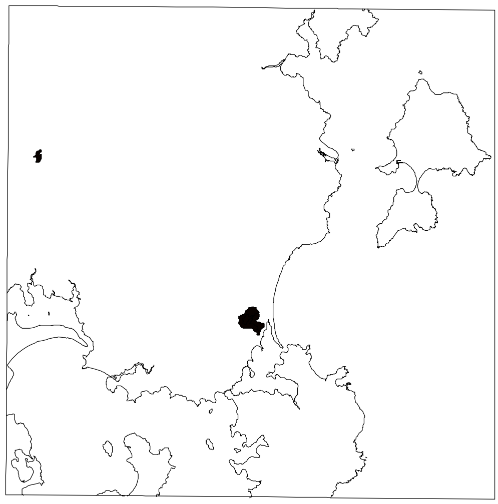
This chapter describes the different classes of land that have been identified during the course of the survey. General information on the nature of the land, climate, soil type and geology are given together with an indication of the major limiting factors to agricultural production. Throughout the text references are made to subclass codes and these are shown in parenthesis. A figure is presented for each class indicating its' distribution across the map. The area of each map unit is also shown in hectares.

6.1 CLASS 1 AND 2 LAND

No Class 1 or 2 land is found in the survey area. Generally poor soil conditions (s) and low fertility coupled with an unsuitable climate of low annual rainfall in coastal localities (p), together with cold winter and spring months (t), limits land capability to Class 3 or poorer.

6.2 CLASS 3 LAND

Class 3	209ha
Class 4 + 3	317ha



Small areas of Class 3 land occur on Tertiary basalt where average annual rainfall exceeds 700mm. These are relatively small areas where the dominant limitations restricting agricultural versatility are climate, stoniness, shallow soil depth and erodibility. They are often mapped in association with Class 4 land due to constraints imposed by map scale. Present land use is predominantly grazing with occasional cropping and horticultural enterprises in places.

Class 3 Land on Tertiary Basalt

Small areas of Class 3 land occur where Red Ferrosols and Brown and Black Dermosols have developed on the crests and slopes of dissected basalt flows east of Copping. These are all relatively fertile soils, which have the capacity to support a broader range of crops than elsewhere in the survey area owing to the higher and more reliable late summer and autumn rainfall. Excellent pasture growth can be expected in most years.

On gentle lower slopes and broad crests facing east towards Marion Bay, the dominant limitations which restrict the agricultural use of this land relates primarily to heavy textures and the moderate to slow permeability of subsoils. Although well structured in upper soil horizons, these Black Dermosols require careful management in order to avoid soil degradation (s). This will be particularly prevalent during the wetter winter and spring months when soils are in a plastic state and may be difficult to cultivate so as to avoid compaction.

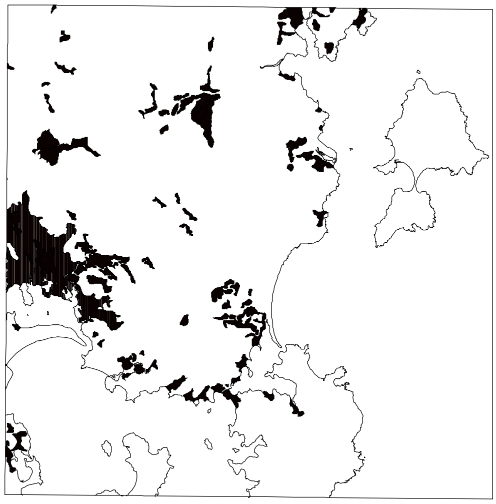
Crests and steeper upper slopes (Photo 5) although generally better drained, are limited in their productive capability by shallow soil depth (l) and in places, stoniness (g). Furthermore, many slopes are in excess of 12% and there are significant risks associated with soil erosion (e) if excessive soil cultivation is undertaken. The small size of these areas, together with the intricate nature of their distribution, has meant that these areas can only be identified at the 1:100 000 scale as complex Class 4+3 map units. Current land use is primarily grazing while a few fields are occasionally cultivated for fodder or cash crops.

A small area of Class 3 land was mapped on gentle lower slopes carrying colluvial basalt soils to the west of Runnymede. Here, the mottled clay subsoil below 50cm depth indicated impeded soil drainage (d) at wetter times of the year. As with other black clay soils from basalt, care needs to be taken to avoid problems associated with soil compaction.

Photo 5. Class 3el land on dissected basalt crests just south of Bream Creek. This land is associated with the Allenby soil sequence. Steeper Class 5mgw land and related slump complexes (reforested Class 6m land) is associated with the Bream Creek soil sequence (Bream Creek, GR E567400 N5258800).

6.3 CLASS 4 LAND

Class 4	14 000ha
Class 4+3	317ha
Class 4+5	1 287ha
Class 5+4	127ha



Class 4 land occupies locally extensive areas along most valley flats together with the footslopes and lower slopes of most major landforms, especially where the better soil types are found. It ranges across most geological types and has a correspondingly wide range of limitations to agricultural use. Approximately 15% of the area mapped as Class 4 has low rainfall (p) as the sole limitation. A further 20% of Class 4 land contains areas where the dominant limitation is low rainfall in conjunction with other limitations. Dominant limitations include drainage (d), poor soil structure (s), erosion (e), shallow soil depth (l), high stone content (g), frost risk (t) and localized salinity (k). Present land use is dominated by grazing together with the occasional fodder and cash crops. Some horticultural activities are also undertaken.

Class 4 Land on Tertiary Basalt

The majority of this land may be found on rolling hills, crests and risers in the vicinity of Sorell and Orielton. Class 4 land on basalt also occurs along valley systems to the west of Sorell at Wattle Hill and Forcett, and on steeper hillslopes to the east of Copping from Bream Creek south to Allanbys Hill. Smaller areas can be found at Nugent and either side of the Carlton River Estuary.

While these areas generally carry highly fertile clay soils their productive capability is severely restricted by the low annual rainfall (p) characteristic of much of the Nugent survey area. Crops that can be grown are largely restricted to dryland varieties, which are normally planted and harvested between late winter and early summer months. The low rainfall limitation is often exacerbated by the high clay content of soils, which retain soil moisture at a tension beyond that available to plants. Dryland cropping activities can become restricted in years with below average spring rainfalls. Many of these areas have the potential for improved capability under irrigation where good quality water is available. Care would need to be taken to ensure that there were no additional risks arising from secondary salinity if poorer quality water was used.

The physical properties of soils indicate that careful management may be required for cropping. In wetter sites, such as along drainage depressions and in areas of higher rainfall, a narrow window of opportunity may exist for cultivation and machinery operations. These need to be carefully timed to avoid soil compaction. Soils often remain in a plastic state due to high soil moisture content that tends to occur during winter and early spring months. Soils in this state are more prone to structural damage when cultivated than soils cultivated in drier climates. This results from either slow permeability in subsoil horizons (d) or significant runon from further upslope (w).

Gentle to moderate benches and lower slopes to the west and north of Bream Creek, where the Kellevie Clay Loam is the dominant soil type, is a prime example of this class of land.

As most soil types have moderate to strong structured topsoils and light clay to clay loam textures, soil erosion is generally not considered to be a problem except where slopes locally exceed about 18%. These areas generally occur along the periphery of gently sloping crests and side slopes, representing the dissected margins of basalt flows. Additionally these sites can become stony (g) and this may prove a problem for cultivation.

There is however, a higher risk of soil erosion (e) on slopes and ridge crests to the east of Sorell where the lighter textured Stoneleigh Fine Sandy Clay Loam is the dominant soil. Here, careful management, including minimum tillage, should be employed on slopes of between 12% and 18% to minimize any impacts from erosion. Avoiding soil erosion is especially important on some of the shallower (l) and stony soils (g) present on steeper upper slopes and ridge crests. These soils often only average 45cm in depth and any loss of soil through erosion is generally unacceptable, as it will result in a major loss in the soil moisture holding capacity, rooting depth, and soil fertility. In general these areas of Class 4 land are only suited to infrequent cultivation for shallow rooting crops.

On gently sloping basalt terrain near Nugent, soils are particularly stony and often contain many basalt cobbles, stones and boulders within soil profiles and littering the ground surface. Here Class 4 land is restricted to small areas which are relatively stone free or where stone picking has been undertaken in the past. Inclusions of Class 5 and occasionally Class 6 land may be found along steep risers where land is often stony and rocky.

Class 4 Land on Jurassic Dolerite

Despite there being extensive tracts of dolerite landforms throughout the survey area, Class 4 land is extremely limited in extent on this rock type. Areas of Class 4 land that do occur are largely confined to gentle lower slopes and footslopes in areas of generally low rainfall. These include valleys to the east of Triabunna, valley margins north and north west of Sorell, footslopes west of Sorell towards Forcett and south towards Lewisham, and gentle slopes in the region of Cremorne.

Most Class 4 land on dolerite is associated with the better soil types (eg. Black or Brown Dermosols, Black Vertosols). As with similar soils on Basalt, the main limiting factor restricting the agriculture potential of these areas is low rainfall (p). Similarly, these areas have the potential for improved capability under irrigation if care is taken to avoid secondary salinitization, especially when waters of less than high quality are used. Other limiting factors that restrict the cropping potential of these areas of land include soil erosion on steeper slopes (e) and excessive stoniness (g). While these soils are generally not prone to severe erosion processes, loss of topsoil can result on the steeper slopes through excessive cultivation. In general Class 4 land is restricted to slopes less than 18%. Steeper slopes are either too stony or carry soils that are more prone to erosion (eg. Brown Dermosols) to warrant cultivation for cash crops.

Photo 6. Class 4p land on basalt and alluvium. Low annual rainfall (p) is the main factor limiting the agricultural potential of these areas. Shallow (l) and stony areas (g) may occur along crests and adjacent to streams. Class 5ge land occupies the steeper, partly forested slopes in the background (Sorell, GR E546600 N5265300).

Photo 7. Class 4g land on recent alluvium from dolerite. These Red Ferrosols have among the best potential for agriculture, but are restricted in their versatility by either high stone content (g) or shallow soil depth to gravels (l). They are also of limited areal extent, being confined to narrow strips of flood prone land adjacent to streams (Triabunna, E573900 N5294100).

Throughout the remainder of the survey area, Class 4 land on dolerite is confined to narrow strips of land around the periphery of valley systems, such as in the region of Buckland and Runnymede. These areas are invariably stony (g) and carry Brown Chromosols and Kurosols that have special management issues related to the relatively coarse texture and poor structure of topsoils. In general these soils are considered to be highly erodible and cultivation should only be undertaken on slopes of less than 12% gradient. Sheetwash and rill erosion will occur if soils are left exposed for any length of time. Furthermore, wind erosion can also result if soil is left exposed for long periods during the drier summer months. While soil drainage is generally not a major problem in these soils, wet soil conditions can occur during winter and spring months due to a combination of slow subsoil permeability and low topographic gradient. This tends to produce a relatively narrow window of opportunity for tillage and machinery operations if soil degradation (soil compaction etc) is to be avoided.

Class 4 land on solifluction deposits from dolerite was identified at one locality north of Levendale. Here well drained and strongly structured Red Ferrosols provide good soil physical properties for tillage. However, cultivation is generally restricted by high stone content (g). Previous stone picking has produced relatively stone free areas in places. Cropping is also restricted by the relatively high elevation (500m) at this locality, which results in cold winter and spring temperatures and frosts (t). Suitable crops are therefore restricted to frost resistant varieties or those which can be grown and harvested over a short period between late spring and early summer months.

Class 4 Land on Quaternary Alluvium and Tertiary Deposits

Class 4 is the dominant capability class on Quaternary and Tertiary alluvial deposits. It includes most areas of the modern flood plain of the rivers, streams and rivulets within the survey area. It also includes higher surfaces, which are locally extensive in inland basins (eg. Buckland, Runnymede). Class 4 land encompasses a wide range of soil types with an equally wide range in limitations to agricultural use. The principal limitations relate to soils and climate.

Land where the range and productivity of crops is constrained by low rainfall (p) is limited in extent, but common along floodplains in the south west of the survey area. These areas contain Black and Brown Dermosols which drain freely, are well aerated and friable. They are well suited to intensive grazing and regular broadacre cropping. However, care should be taken to avoid structural decline and subsoil compaction at wetter times of the year. These areas have the potential for improved capability under irrigation.

Elsewhere on recent flood plain alluvium stone content (g) and shallow soil depth to the underlying gravels (l) are the main limitations restricting versatility of this land. For example, Red Ferrosols, which occur adjacent to small creeks draining dolerite hills in the eastern portion of the survey area, are nearly always stony. Cobble to boulder sized dolerite rocks are common in surface horizons. These are often a major hindrance to cultivation (Photo 7) restricting these areas to shallow root or fodder crops. There is also a significant flood risk for plains draining relatively large catchment areas.

Broader floodplains and drainage depressions in areas of low rainfall (eg. north of Penna) commonly carry black or grey cracking clay soils (Vertosols). These have clay textures throughout and can be distinguished by characteristic large cracks, which appear during dry summer months. Although drainage is rapid upon initial wetting, as water is absorbed into the soil, clays swell and the cracks begin to close up. This leads to reduced infiltration and permeability (d). Consequently these soils can remain in a plastic state for long periods after rainfall, and this can pose a major problem to machinery access for cultivation and harvesting. Operations need to be carefully timed to avoid smearing of topsoil and compaction of subsoil. Cracking and internal shearing of soils (s) can also be a problem for irrigation and plant establishment. Large cracks can stop lateral movement of water and shearing can cause tearing and breaking of plant roots.

Many of these Vertosols are also highly saline at depth (k). Rising groundwater as the result of inappropriate irrigation practices could lead to increases in surface salinity and subsequent reductions in plant growth, particularly for salt sensitive crops.

Throughout the remainder of the survey area Class 4 land on Quaternary alluvium is dominated by texture contrast soils (Grey, Brown, or Black Sodosols). These invariably have brown to grey mottled subsoils that remain in a relatively plastic state for most of the year. The major limitation to the use of these soils thus relates to the poor physical properties (s) and low permeability of subsoil horizons (d). As with other texture contrast soils, wet soil conditions reduce the growing season by restricting vehicle access for cultivation. Careful tillage management is usually required to avoid risks of soil degradation through compaction and loss of soil porosity. These areas of land are also prone to soil erosion due to the poor structure and light surface textures. While slopes are relatively gentle, overland flow could easily result in high intensity rainstorms. Furthermore, the light fine sandy loam surface textures makes the soils prone to wind erosion (a) during dry periods.

Texture contrast soils are also characteristic of gently sloping Tertiary fan deposits in some coastal localities (eg. south west of Triabunna and south west of Reban). These have similar drainage (d) and soil physical (s) limitations to use as other similar soil types. In addition, these areas of land are often very stony, with cobbles and stones being common in upper soil horizons. Stones are not always obvious but are usually brought to the ground surface during cultivation. In general, only fodder or shallow rooting crops are suited to these areas of land.

Class 4 land limited primarily by wind erosion risk (a) is associated with deeply weathered lateritic soils (Brown Kurosols) on broad, gently sloping crests. The most extensive areas occur south of the Prosser River along the Buckland Plains. Surface horizons have a coarse sandy loam texture, which makes them particularly prone to wind erosion unless careful management practices are observed. The use of shelter belts, limited crop rotations, and maintaining soil organic matter levels are essential to minimizing risk from wind erosion. These are also relatively infertile, strongly acid soils that require a high level of fertilizer input to help maintain pasture or crop productivity.

Inclusions of Class 5 land within Class 4 land are common in places where flats become poorly drained or where soils have particularly sandy surface textures. Where these areas are more common, this has occasionally led to a complex of Class 4 + 5 land being identified at the 1:100 000 scale of mapping.

Class 4 Land on Triassic Sandstone

Class 4 land on Triassic sandstones is relatively uncommon as only small outcrops of sandstone occur. However, small areas of Class 4 land on sandstone occur at a number of localities, mostly within areas of lower rainfall. Most soils are coarse textured and erosion prone. Scattered pockets of Class 4 land on sandstone can be found following Orielton Rivulet south to Sorell and south east to around Forcett. Class 4 land also occurs on drainage flats to the south of Kellevie where finer textured soils have developed as a result of colluvial additions of basalt materials supplied by streams draining hills to the east (eg. Ragged Tier).

Risk of wind erosion (a) is the dominant limitation on areas of Class 4 land on sandstone. This is due to light sandy loam surface textures. As with other similarly light textured soils, care needs to be taken to minimize the risk of soil exposure, particularly during drier periods of the year. Cropping rotations should be kept to a minimum to help maintain levels of organic matter and soil cohesion. In general, Class 4 land is limited to slopes of less than 12% due to additional risks from sheetwash and rill erosion in these poorly structured soils.

Class 4 land is also associated with Brown Dermosols developed on feldspathic sandstones to the east of Triabunna. This land occupies ridge crests and upper slopes, and extends onto steeper slopes than elsewhere due to the lower erodibility associated with the much better structure and finer texture of surface horizons. The main limitations include low rainfall (p) restricting the range of crops that can be grown and moderate risk of erosion on steeper slopes (e) restricting areas to occasional cropping.

Imperfect drainage (d) caused by low subsoil permeability is the dominant limitation along drainage flats. Wet soil conditions can restrict access to land and the ability to cultivate soils without causing degradation. In general, Class 4 land on sandstone is confined to slopes between about 3 and 12% where drainage is better. Gentler slopes are often poorly drained while steeper slopes have too high an erosion risk for cultivation. Most areas of Class 4 land remain under pasture or are occasionally cropped for potatoes or brassicas.

Class 4 Land on Permian Mudstone

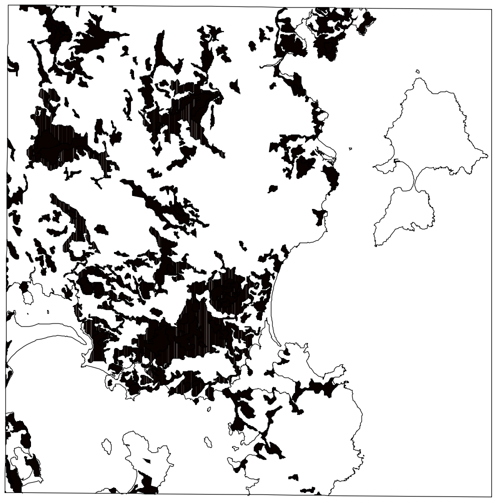
There are very few areas of Class 4 land on Permian mudstone within the survey area. Where mudstones occur, the soils are often either too shallow (l), poorly drained (d) or coarse textured (s) to provide suitable land for broadacre cropping.

Small areas of Class 4 land on mudstone are, however, found peripheral to basalt terrain in the region of Forcett. Here, the influence of residual basalt materials has produced topsoils that are generally, darker, deeper and better structured than elsewhere. As these areas occupy lower slope positions in the landscape, they receive significant runoff from hillslopes. This, together with the slow permeability of subsoils, results in imperfectly drained soils (d) that can remain wet for considerable periods. This can limit access to areas of land for cropping activities. The soils also tend to be nutrient poor and strongly acid and require significant inputs of fertilizer to help maintain productivity.

Class 4 land on mudstone was also identified on lower slope crests south of the Prosser River towards the eastern end of the Buckland plains. This small area of land is elevated above surrounding drainage lines and consequently drainage is generally better than elsewhere. The main limitation here is wind erosion risk (a) and soil degradation (s) related to the poor structure and light, fine sandy loam surface texture.

6.4 CLASS 5 LAND

Class 5	34 733ha
Class 4+5	1 287ha
Class 5+4	127ha
Class 5+6	1 827ha
Class 6+5	375ha



Class 5 land is generally found where soil erodibility (e), stoniness (g), slope steepness, shallow soil depth (l), or generally poor soil conditions (s) preclude cultivation except for pasture improvement. It often occurs at the break of slope between Class 4 land on valley flats and generally stonier Class 6 land on steeper slopes. Class 5 land also includes areas restricted by cold temperatures at elevation above about 500m.

Class 5 Land on Tertiary Basalt and Talus Deposits

Class 5 land of Tertiary basalt is generally found where slopes are either too steep and erodible (e) or soils are too stony (g), shallow (l) or poorly drained (w) to be suitable for broadacre cropping. Examples of this class of land include steeply sloping risers to the east of Sorell at Wattle Hill and much of the dissected basalt terrain lying between Kellevie and Bream Creek.

Crests and risers in the region of Wattle Hill are characterised by relatively free draining, but stony and shallow Brown Dermosols or Red Ferrosols. In most places, Class 5 land generally occupies the narrow strips of steeply sloping land along the dissected margins of basalt flows. Here, slopes commonly exceed 18%. This, combined with the shallow nature of soils (l), which usually average only around 45-50cm in depth, makes these areas unsuitable for cropping as any loss of soil through erosion (e) would result in significant losses in productivity. High stone content (g) in places further increases erosion potential and decreases ground cover. These are however fertile soils, providing good grazing, except during drier months of the year.

Much of the Class 5 land in the region of Bream Creek, about Turnbridge Hill and Benders Hill (eg. Ragged Tier, see Photo 5), occurs on moderately to steeply sloping land, usually above 18% and occasionally above 28% slope. The main limitations, which restrict this area to grazing activities, include a high mass movement erosion risk (m), poor soil drainage (w), and high stone contents (g). Much of this terrain has been moulded in the past by slump and flow erosion processes. Slump complexes are common above about 24% slope and these have produced a series of benches and steeper risers. The higher rainfall in this area (800-1000 mm yr^{-1}) combined with lateral seepage over clay subsoils and ponding of water on benches, depressions and backslopes, has produced hydromorphic soil conditions, resulting in poorly drained soils (eg. Kellevie Clay Loam) that are unsuitable for cropping. In contrast, on higher ground and particularly along ridge crests and steep slopes, free draining Red Ferrosols have developed. Although soils are deep and friable, they are generally unsuited to cropping because of high stone contents or the steep (>28%) erosion prone slopes on which they occur. Despite obvious limitations to broadacre cropping, this area provides some of the most productive grazing land within the entire survey area.

Inclusions of Class 4 land that occur within Class 5 are found in areas where drainage is improved (eg. broad lower slope crests) or where slopes are relatively gentle and stone free (broad upper slopes). Inclusions of Class 6 land may also occur alongside entrenched channels where slopes are very steep (>56%), where mass movement is currently active (Photo 5), or where ridge crests are particularly stony and shallow.

Class 5 Land on Quaternary Alluvium

Class 5 land on alluvium is relatively uncommon, but occurs as narrow strips of land following rivers and smaller streams wherever soils are poorly drained due to periodic waterlogging (w). Many of the narrow valleys are characterised by poorly drained soils that result from runon from surrounding hills or where there is little topographic expression for drainage to occur (eg. alluvial plains) and water ponds during wetter months of the year. Class 5 land on alluvium is also generally more common in higher rainfall regions of the survey area.

Where little land improvement has been implemented, poorly drained flats (w) are characterised by relatively poor pastures with scattered rushes. It is usually difficult to gain access with vehicles to these areas due to the plastic nature of the Black Vertosols, and subsoils of Grey Kandosols, or Grey Sodosols, which are common soil types in these areas. Severe pugging by stock can result during wetter months, and it is generally better to graze these areas during summer and autumn months. In general it is difficult to adequately drain these areas due to the slow permeability of subsoils and lack of topographic gradient.

Improved pastures on Class 5 land are often characterised by a dull sheen and lack of growth during winter and early spring months. In contrast, they take on a lush green look during summer months, at a time when surrounding hillslopes are beginning to dry off.

Areas affected by saline ground water tables (k) do not follow the same trend and instead pastures lack response and take on a reddish hue during summer months. These areas usually occur in the north of the survey area and occupy valley flats in the vicinity of Triassic sandstone hill country.

In a few places adjacent to streams draining the more mountainous areas, land use is restricted to grazing due to physical limitations of shallow soil depth (l) and the stony nature of subsoils (g).

Many areas of Class 5 land are difficult to map owing to their small areal extent and intricate nature of their distribution. Consequently, these areas have been complexed with Class 4 land along the more extensive alluvial flats at Runnymede and Buckland.

Photo 8. Class 5mg land on dissected basalt terrain. These areas provide good grazing owing to the fertile nature of soils and higher rainfall. Localized slumping is a common feature of these hills. Class 4w land occurs on mown areas in the foreground (Ragged Tier, GR E568500

N5262800).

Photo 9. Class 5saw land on Triassic sandstone. Risks associated with wind erosion (a) make these areas unsuitable for cultivation. Poor drainage (w) is also typical of depressions and flats. The coarse sandy soils characteristic of these areas are also nutrient poor and strongly acid making pasture establishment difficult (Salmon Flats, GR E572800 N5290650).

Class 5 Land on Jurassic Dolerite

Class 5 land on Jurassic dolerite is found scattered throughout the survey area to elevations of about 600m above sea level. Most Class 5 land occurs as pockets along gently sloping ridge crests or in mid to lower slope positions in areas underlain by dolerite or dolerite talus deposits.

The majority of Class 5 land on dolerite occurs in regions of lower rainfall, such as towards the south west or in eastern coastal areas (eg. east of Triabunna). A high level of surface stones (floaters) gives a good indication of this land type, which tends to occur on moderate to steep slopes and along ridge crests. The dominant soil type in these areas is generally a Brown Dermosol. High stone content (g) makes Class 5 land unsuitable for cropping in most places. Slopes are generally in excess of 18% and consequently the risk associated with soil erosion (e) is also considered to be a limiting factor that restricts these areas to grazing. Class 5 land on dolerite commonly forms a narrow band less than 300m wide between Class 4 valley floors and Class 6 hillslopes. These areas have generally been merged with adjacent Class 4 land at the 1:100 000 scale of mapping.

Elsewhere in the survey area Class 5 land is restricted to small pockets of land along ridge crests and in lower slope positions (Photo 9). Much of this land is very stony or rocky (g) in character, and the areas of Class 5 land that do occur, are located in colluvial sites where soils are deeper and few surface stones are apparent. In places, stones have been removed through stone picking or windrowing. The dominant soil type in these areas is commonly a Brown or Grey Chromosol. These soils are particularly erosion prone due to the poor structure and light texture of surface horizons. On moderately steep slopes (usually > 12%), the risk of soil erosion (e) becomes the main factor limiting agricultural versatility of this land. A reasonable level of management is generally required to maintain a good pasture cover and avoid sheetwash and generation of overland flow, which can lead to tunnel and gully erosion. In general Class 5 land carrying texture contrast soils has an upper slope limit of 18%. Some north facing slopes carry finer textured soils, and Class 5 land in this instance can extend onto slopes of 28%, although such areas are relatively uncommon. The dominant soil types have slowly permeable subsoils and poorly drained sites (w) have developed in areas of higher rainfall. These areas typically occur along drainage depressions or at higher elevation where there is little topographic runoff.

In the north west of the survey area to the west of Mount Hobbs, Class 5 land occurs at elevations between 500 and 600m and the principal limitation here is the cold climate and high frost risk (t).

Photo 10. Class 5gt land on Jurassic dolerite. In some locations at higher elevation, stony ground and a cold climate restrict land use to grazing (Levendale, GR E544500 N5294200).

Photo 11. Class 5se land on Permian mudstone. Generally poor soil conditions with hardsetting and shallow surface soil horizons makes these areas unsuitable for cropping. Class 6el land occurs on steeper slopes under forest (Pawleena, GR E549500 N5267800).

Class 5 Land on Triassic Sandstone

Class 5 land is the predominant capability class on Triassic sandstone and occurs wherever soil properties (s) or the potential for soil erosion (e) forms the major limitations excluding land use from cropping. Extensive areas of Class 5 land occur in most valley systems and on gentler lower slopes underlain by Triassic sandstone.

The main soil types in areas of Class 5 land include Brown Kurosols and Aeric Podosols. Both are characterised by coarse sandy textured and structureless surface horizons that are particularly prone to wind erosion (a), especially if the cover vegetation is disturbed in any way (Photo 8). Furthermore, soils may become rocky (g) and shallow (l) towards the top of gentle crests. In general the roots of grasses, ferns and shrubs provide the main source of soil cohesion. These soils are also relatively infertile and drought prone during summer months. However, with careful management and a high level of fertilizer inputs these sites can yield reasonable quality pastures. Pastoral grazing is the dominant land use in most places, although there are some quite extensive areas now reverting to bracken fern and native species because of lack of pasture maintenance.

Class 5 land is generally restricted to slopes of less than 18% due to a severe risk of erosion on steeper slopes (e). However, where some of the finer textured and better structured soils are encountered such are Brown Dermosols from feldspathic sandstone, then good grazing land can extend onto steeper slopes of up to 28%.

On relatively flat land or along drainage depressions, poor soil drainage makes areas unsuitable for cropping because of problems associated with wet soil conditions. Poor drainage is due to a combination of low subsoil permeability (d) and considerable runon (w) from surrounding slopes. Wet soil conditions become increasingly common in areas of higher rainfall as occurs towards the south east of the survey area.

High soil salinity levels (k) also restrict land use to grazing in a number of localities. These typically form low angle drainage depressions, such as to the east of Buckland where they drain areas dominated by Tertiary clays and lateritic soil types. These areas represent seepage zones of groundwater and should be planted with salt tolerant species.

In places, such as on slopes near Levendale, the complexity of terrain has led to a complex of Class 5 + 6 land.

Class 5 Land on Permian Mudstone

As with Class 4 land, Class 5 land on Permian mudstones in relatively uncommon due to the lack of this rock type cropping out in favourable localities. Small areas of Class 5 land do however occur on moderate to gentle lower slope positions and along gentle ridge crests at a number of localities. These include hillslopes about Pawleena, Forcett and west of Clifton (Photo 11).

Areas of Class 5 land are often unsuitable for broad-scale cropping owing to the poor physical and chemical properties (s) characteristic of most soils developed in Permian mudstone. On slopes, soils are often shallow (l) and have hardsetting, poorly structured, surface horizons. Shallow soils depths may also relate to the presence of cemented subsoil horizons, which are usually found in gentle lower slope positions.

The soils are often highly erodible and subject to sheetwash, tunnel and gully erosion. Soil erosion is consequently the dominant limitation on terrain with slopes ranging from 12 to 18% making cultivating impractical. In places however, fodder crops are occasionally planted, although with generally poor results.

Class 5 land on Permian mudstone also includes some small areas restricted by poor drainage. These areas generally occur on flats or drainage depressions in lower slope positions and consequently receive significant runon from surrounding slopes which makes them wet for much of the year (eg. Thumbs Marsh to the east of Buckland).

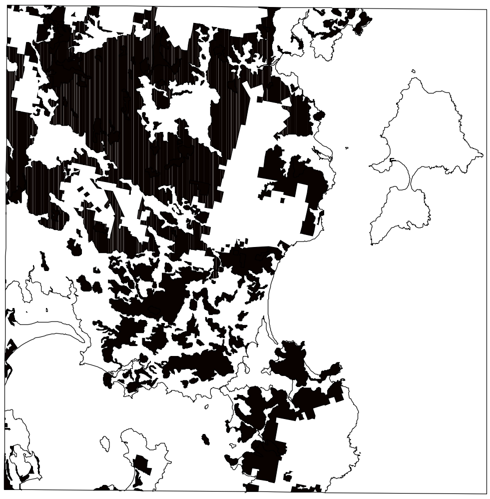
Class 5 Land on Aeolian Sands

Class 5 land occurs on gentle areas of less that 12% slope wherever wind blown sand deposits overlie basement lithologies, such as Triassic sandstone or Tertiary sediments. These areas are most extensive in coastal regions from Dodges Ferry to Primrose Sands. Smaller areas can be found inland of coastal dunes systems such as east of Sloping Main and north west of Cremorne.

The dominant soil types in most places are Aeric or Semi-Aquic Podosols. These are deep coarse textured soils, which are nutrient poor and drought prone in summer months. The main capability limitation is related to the poor physical and chemical soil properties (s). Most areas support relatively poor pastures. In addition there is a high risk from wind erosion (a) as there is little or no soil structure or clay content to help maintain soil structure and cohesion. Most cohesion is provided by plant roots, or occasionally high organic matter contents. Pasture renewal should be restricted to aerial seeding or direct drilling techniques.

6.5 CLASS 6 LAND

Class 6	66 794ha
Class 5+6	1 827ha
Class 6+5	375ha
Class 6+7	162ha



Class 6 land is the most extensive capability class across the Nugent survey area. It can cover considerable areas of land where either excessive stoniness (g) or a very high erosion risk (e) are the dominant physical limitations. It identifies all marginal agricultural land. Other physical limitations, which can severely restrict agricultural activities, include soil wetness (w), extremely poor soil conditions (s) and soil salinity (k). Most areas of Class 6 land remain under native vegetation although some areas support relatively poor improved pastures.

Class 6 Land on Tertiary Basalt and Basalt Talus Deposits

Class 6 land on Tertiary basalt is comparatively uncommon and occurs principally as inclusions within Class 5 or 4 land. It includes the steep and rocky summits of some hills (eg. Benders Hill) as well as the steep side slopes of incised channels and steep risers of some basalt flows. High stone contents (g), frequent rock exposures (r) and generally steep and erosion prone nature (e) of sites, makes these areas unsuitable for most agricultural activities.

Class 6 Land on Jurassic Dolerite

Class 6 land is extensive across the survey area in regions underlain by Jurassic dolerite rocks. It is largely confined to the steeper slopes and inland plateaus where a combination of high stone content (g) and erosion risk (e) are the main limitations severely restricting use of this land. Class 6 land can extend onto gentle slopes if stone contents remain high. Most areas presently remain under native forest cover.

High stone content (g) is a characteristic feature of much of the dolerite terrain in inland areas. Most stones are between 200-600mm in diameter and well rounded through weathering processes (exfoliation). In general, profile stone contents were in the region of 50-70%, with increasing levels present along ridgelines and on steep slopes. Any attempts at cultivation generally bring these stones to the surface and this can result in reduced net pasture cover. Attempts have been made to develop some of the better areas of this type of land by windrowing stones into piles. This has led to a complex of Class 5 + 6 land in places.

Elsewhere, inclusions of Class 7 land are common where stone cover locally exceeds 90%. These areas are invariably forested with sparse understorey vegetation. Similarly inclusions of Class 5 land, of generally not more than a few hectares, may occur within Class 6 land as patches where stone contents are low and soils are deeper. These are most prevalent along the broader ridge crests in areas with a net concave surface expression.

A high risk of soil erosion (e) is the main limitation restricting land use on the steeper areas of Class 6 land. Brown Chromosols are the dominant soil type and these are particularly prone to sheetwash, rill and gully erosion processes, given the relatively poorly developed structure and coarse texture of surface horizons. This tends also to be exacerbated by the high stone content of soils. Consequently, Class 6 land limited by soil erosion was recognised wherever slopes exceeded 18% or more on this soil type.

Removal of forest from these slopes will lead to increased overland flow and could result in the development of rill and gully erosion. Areas of Class 6 land require a high level of conservation management and are only marginally suited to grazing activities. They should retain their forest cover to help protect soils and are therefore more suited to well managed forestry. As most areas are currently protected by forest, active erosion processes are rarely seen.

Photo 12. Class 5w land (foreground) on alluvium and Class 6ge land on dolerite. Sharp land capability boundaries are common within the survey area and more often than not, coincide with distinct soils/geology/vegetation boundaries (Blackmans Plains, GR E576200 N5250300).

Photo 13. Class 6eg land on dolerite occupies large tracts of land in inland localities. Grazing land associated with the more fertile basalt terrain stands out in the foreground and in the middle distance near Nugent (Carlton River Valley, GR E564000 N5266000).

In areas of lower rainfall Brown Dermosols are the dominant soil type. These are generally less erodible than texture contrast soils, and consequently Class 6 land limited by soil erosion is restricted to steeper hillslopes of 28% or more. However, in areas that have been developed, overgrazing can be a problem on these slopes in drier summer months. This commonly results in increases in the area of bare ground and associated erosion processes of sheetwash and soil creep.

Class 6 Land on Quaternary Alluvium

Class 6 land is rarely associated with alluvial deposits. Small extents of Class 6 land on alluvium follow many of the smaller creeks, stream and rivulets in mountainous areas. Very high stone contents (g) are the main limitation, which restrict use of these areas to marginal grazing activities.

Class 6 land was also recognised on extra-tidal valley flats in some coastal locations (eg. Burdens Marshes, Sandspit River flats, and flats near Primrose Sands). These areas carry very poor pastures and lie wet for most of the year. Thus, prolonged periods of soil saturation (w) due to high but fluctuating water tables is the main limitation restricting agricultural use of these areas. Most of these areas are also characterised by serious salt scalds or salt tolerant plants due to the very low elevation of these sites and associated saline groundwaters.

Class 6 Land on Triassic Sandstone

Class 6 land on Triassic sandstone is largely confined to the steeper hillslopes where erosion risk (e) is the major limitation affecting agricultural versatility. Extensive areas of Class 6 land are located in the north of the survey area where landforms are more rugged and of higher relief. Elsewhere, Class 6 land on sandstone is commonly associated with steeper slopes about the dissected margins of valley systems. Most areas of Class 6 land retain their original native forest cover.

The dominant soil types on Triassic sandstone are characterised by poorly structured and sandy textured surface horizons, which are highly erodible and particularly prone to wind erosion. In general, Class 6 land occurs on slopes above 18% where the risks of erosion are such that a high level of conservation management is required. Because soils are also strongly acid, nutrient poor and drought prone, it is often difficult to maintain a good pasture cover on these slopes. In fact, the few areas where attempts have been made to convert forest to grassland land are now abandoned and have particularly poor pastures with a dense cover of bracken fern.

Some areas of Class 6 land in coastal areas were characterised by particularly coarse textured sandy soils overlying either coarse mealy sandstone (eg. Cardwell Ridge on Tasman Peninsula) or organic hardpans in the case of Podosols. In these cases, Class 6 land occurs on slopes of 12% or more and is limited primarily by the very high erosion risk (e) and very poor soil condition (s). Class 6 land is occasionally associated with very shallow depths of soil (l) overlying sandstone. These areas are usually, but not always, confined to the steep slopes and ridge crests. In these areas, as little as 30cm of sandy soil may directly overlie comparatively unweathered sandstone. These shallow soils have very low soil moisture holding capacities and are particularly drought prone. They usually support scrubland or poor pastures dominated by bracken fern.

Class 6 Land on Permian Mudstone

Class 6 land is the dominant capability class on Permian mudstone. It can cover locally extensive areas of steep dissected terrain in the region of Forcett and Pawleena. Class 6 land generally occupies the steeper mid and upper slope positions where a combination of high erosion risk, shallow soil depth, and generally poor soil conditions, make these areas only marginally suited to grazing activities.

The dominant soils on Permian mudstone are typically shallow and have hardsetting and poorly structured surface horizons. This makes them particularly prone to sheetwash, tunnel and gully erosion processes. Consequently erosion risk (e) is the dominant limitation for slopes above about 18%.

Class 6 land can extend onto gentler slopes in places where particularly poor soil conditions occur. Shallow depths (1) are a common feature of narrow ridgelines and spurs and this severely limits soil moisture availability in these localities. Some areas of Class 6 land also carry a very poor pasture cover due to poor topsoil development, low organic matter levels, and poor natural fertility of soils. In places, bleached subsurface A2 horizons can set into an impenetrable concrete-like mass during dry periods. Most root development for smaller plants is confined to the shallow topsoil and consequently a depth limitation (l) is recognised in these soils. Heavy fertiliser applications can help to alleviate the poor nutrient status and acidity in these soils, but is unlikely to be economic in most situations. Most areas of this class of land remain forested.

Class 6 Land on Aeolian Sands

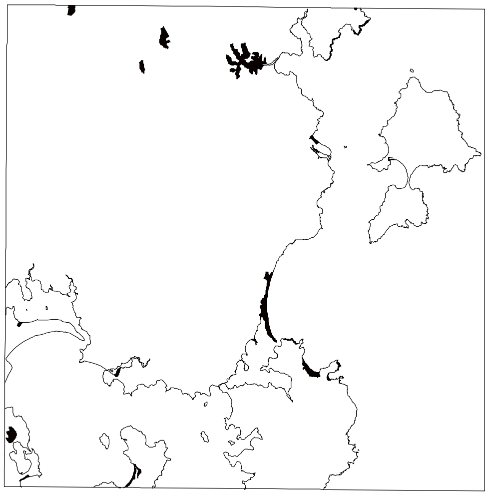
Class 6 land on aeolian sands is largely confined to coastal areas where past dune activity has produced a low elevation undulating terrain dominated by soils with generally little profile development. Most extensive areas occur immediately to the north east and south of Hobart Airport. Elsewhere, narrow strips of Class 6 land lie immediately behind frontal dune systems along the major beaches in the region.

Within areas of Class 6 land the dominant soil types (Rudosols) are characterized by poorly developed topsoils overlying loose calcareous sands. The general lack of cohesion in surface horizons, which are composed mainly of sand grains, makes these soils particularly prone to wind erosion (a) if disturbed in any way. Since there is a very high risk from erosion, any agricultural use should ensure minimal impact on topsoils. Pasture renewal and fertilising should be restricted to aerial application only. As this Class of land occurs in areas of relatively low rainfall, it is also particularly drought prone. This can further exacerbate the potential for erosion unless stocking rates are kept to an absolute minimum during summer months.

Class 6 land also occupies small areas where sand has been deflated from coastal sites or from ancient riverbeds and blown onto surrounding hills underlain by Jurassic dolerite or Triassic sandstone. Most extensive areas of this land occur between Dodges Ferry and Primrose Sands, together with coastal areas on Tasman and Forestier Peninsulas. The main soil types in this instance are Aeric Podosols. These largely comprise thick bleached subsurfaces horizons consisting of almost pure quartz sand grains. In contrast to recent aeolian sand deposits, surface horizons can contain significant organic matter contents, and this can improve moisture retention and impart somewhat less of an erosion risk. Consequently Class 6 land is restricted to moderate slopes with gradients from 12 to 28%. On these slopes, overgrazing and stock "bathing" can cause sand blowouts. Class 7 inclusions are infrequent, but occur where slope gradients locally exceed 28%.

6.6 CLASS 7 LAND

Class 7	1 776ha
Class 6+7	162ha



Class 7 land represents areas unable to support agricultural activities on a sustainable basis. These are usually either very steep areas with extremely erodible soils (e), areas with excessive stone content (g), or very wet swamps with high ground water tables (w). Most Class 7 land occurs in coastal areas, although some is related to steep gorges and mountainous terrain.

Class 7 Land on Quaternary Alluvium

Small areas of Class 7 land can be found on alluvial sediments in coastal bays and on low lying tidal flats behind frontal dune systems. Examples include lower reaches of Bream Creek (Photo 14), Burdens Marshes, Swan Lagoon, and Rushy Lagoon to the northwest of Cremorne. These are essentially wetlands supporting dense swamp vegetation dominated by various salt tolerant plants and rushes. Water is at or near the ground surface for most of the year and consequently the main limitation is one of wetness (w), although high salinity (k) also severely restricts the type of plants that will grow in these areas.

Class 7 Land on Jurassic Dolerite

Class 7 land on dolerite is generally found on very steep slopes in excess of 56%. These areas commonly occupy either steep gorge side slopes or coastal cliffs at low elevations (Photo 16), together with the steep upper slopes and summits of some mountains at much higher elevation (eg. Mount Hobbs). In most cases the physical limitations prohibiting agricultural activities are either an excessive ground cover (visually > 70-90%) of stones and small boulders (g) or large areas of bare rock (r) associated with cliffs. Inclusions of Class 7 land are also common within the large tracts of stony dolerite terrain in hilly areas. These tend to form large piles of stones and boulders on forested hillslopes with very little or no ground cover.

Photo 14. Class 6e (background) and Class 5sa land on Triassic sandstone. The light surface texture of soils makes land on steeper slopes particularly prone to soil erosion (Buckland, GR E559800 N5280100).

Photo 15. Class 7wk land on tidal flats. High water tables and salinity levels make these areas unsuitable for grazing (lower Bream Creek, GR E570500 N5258800).

Class 7 Land on Triassic Sandstone

Class 7 land has not been separately mapped on Triassic sandstone. However, small areas of Class 7 land may occur where cliffs have formed on the very steep dissected margins of inland plateaux. Where these areas are sufficiently extensive (eg. Stonehurst Sugarloaf), this has led to the occasional complex of Class 7 + 6 land. Bare rock (r) and an extreme erosion risk on slopes above 56% are the main limitations prohibiting agricultural activities in these areas.

Class 7 Land on Aeolian Sands

Class 7 land on aeolian sand is associated with coastal dune systems where very fragile loose sandy soils are susceptible to degradation by wind erosion (a) if vegetation disturbance occurs. Dunes are stabilised predominantly by perennial vegetation. The most extensive dune systems occur at Marion Bay and Seven Mile Beach. Smaller dune systems occur at Clifton Beach, Two Mile Beach (Photo 16), Lagoon Bay, Rheban Beach, and Sloping Main on the Tasman Peninsula. These areas are unsuited to agricultural activities due to the extreme risk associated with sand blowouts occurring in the absence of a high level of conservation management.

6.7 EXCLUSION AREAS

Exclusion areas 48 831ha

The Nugent survey area contains areas of State Forest, National Parks and other reserves, which are not included in the land capability classification survey. Many of these areas represent steep land or rugged hills and include Maria Island, the majority of the Forestier Peninsula, and a large tract of land south from Orford to Kellevie. They also include coastal areas such as the Seven Mile Beach Protected Area, Lime Bay Nature Reserve, and Sandspit Wildlife Sanctuary. The Buckland Military Training Area in the north of the survey area is also excluded from this survey.

These areas, together with major urban areas, Conservation Areas, State Recreation and Protected Areas, Hydro Electric Commission areas and Commonwealth administered areas are collectively termed Exclusion areas and do not form part of the area surveyed. These areas appear as white with the letter E on the accompanying land capability map.

The boundaries for most of these areas have been supplied by Forestry Tasmania and some discrepancies have been identified in comparison to the published 1:100 000 scale Land Tenure maps. In addition, arbitrary boundaries have been defined by the survey team and represent areas excluded from agricultural activity on the basis of current land

Photo 16. Class 7gr land associated with gorges east of Orford. An almost complete stone cover and frequent rock outcrops make these areas unproductive for agriculture (Paradise Gorge, GR E570000 N5287400).

Photo 17. Class 7sa land. Coastal dune systems require extensive conservation management and are unsuited to grazing (Two Mile Beach, GR E576500 N5252100).

use (usually urban). These boundaries are not intended to represent the boundaries of individual land titles or local council planning schemes and do not purport to identify exact cadastral locations.

6.8 SUMMARY TABLES

Table 4 summarises the major land capability map units and their characteristics. It does not represent an exhaustive list of all possible units, but instead identifies the most common groupings present within each land capability class. The table attempts to draw upon links between land capability, landforms and geology identified during mapping, and is therefore useful as a guide to the nature of map units identified within the survey area. It also provides an indication of agricultural versatility for each unit in relation to broadacre cropping and stock grazing. A general indication is given of the main land management practices required to sustain this versatility.

Land Capability Class	Land Characteristics						Land Management Issues		
	Geology	Slope range	Topography and elevation	Erosion type and potential severity	Climatic limitation	Principal soil	Main limitations to agricultural use	Main land management requirements (under cultivation)	Agricultural versatility
3	Tertiary basalt	0-18%	crests of low hills and footslopes <150m	Minor sheet and creep	Low rainfall <850mm	Red Ferrosol Brown Dermosol	Soil depth (l), stoniness (g), erosion (e), low rainfall (p)	Moderate soil conservation	Restricted range of crops, very good grazing
4	Recent alluvium	0-5%	narrow flood plains <250m	very minor sheet and minor wind	Low rainfall, minor frost, minor flood risk	Brown Dermosol Red Ferrosol Brown Kandosol	Low rainfall (p), stoniness (g), shallow depth, wetness (w)	Minor soil conservation, drainage, stone picking	Severely restricted range of crops, good grazing
4	Quaternary alluvium	0-12%	dissected terrace remnants <250m	Moderate sheet and wind	Minor frost	Grey, Brown, and Black Sodosols or Kandosols	Soil structure (s), erosion (e), wetness (w)	Moderate soil conservation, erosion control, drainage	Severely restricted range of crops, good grazing, horticulture
4	Tertiary basalt	0-28% (>18%)* 0-18%	Crests and hillslopes <350m	Moderate sheet and creep	Low rainfall, moderate frost	Black and Brown Dermosols, Red Ferrosol	Low rainfall (p) erosion (e), stoniness (g), wetness (w), shallow depth (l)	Minor soil conservation, erosion control, stone picking	Severely restricted range of crops, very good grazing, horticulture
4	Tertiary sediments	0-12%	Valley flats and alluvial fans <80m	Moderate sheet and wind	Low rainfall, minor frost	Grey and Brown Sodosols, Black Vertosol	Soil structure (s), permeability (d), stoniness (g), salinity (k)	Moderate soil conservation, stone picking	Severely restricted range of crops, good grazing, horticulture
4	Tertiary laterite	0-12%	Gentle crests <80m	Moderate wind	Low rainfall, minor frost	Brown Kurosol	Wind erosion (a), fertility and structure (s)	Erosion control	Severely restricted range of crops, grazing
4	Jurassic dolerite	0-28% 0-18%	Mid to lowerslopes of hills in areas of low rainfall <200m	Moderate creep	Low rainfall, minor frosts	Black Vertosol, Brown Dermosol	Low rainfall (p), stoniness (g), erosion (e)	Minor soil conservation, erosion control	Severely restricted range of crops, good grazing, horticulture
4	Jurassic dolerite	0-12%	Colluvial footslopes and valley floors <250m	Moderate sheet, rill and wind	Low rainfall, minor frost	Brown and Grey Sodosol, Brown Kurosol	Erosion (e), stoniness (g), permeability (d), soil structure (s)	Erosion control, moderate soil conservation, stone picking	Severely restricted range of crops, good grazing
4	Jurassic dolerite	0-18%	Gentle crests and upperslopes <500m	Very minor sheet	Moderate frost, wind exposure	Red Ferrosol	Climate (c), Stoniness (g)	stone picking, erosion control, moderate soil conservation	Severely restricted range of crops, good grazing
4	Triassic sandstone	3-12%	Mid to lowerslopes and gentle crests <200m	Moderate wind, sheet and rill	Low rainfall, minor frost	Brown Sodosol Brown Kurosol	Erosion (e), soil structure (s), permeability (d)	Erosion control, moderate soil conservation	Severely restricted range of crops, good grazing
4	Triassic feldspathic sandstone	0-18%	mid-upper slopes and crests of low hills <150m	Minor sheet and creep	Low rainfall, minor frost	Brown Dermosol	Low rainfall, erosion (e)	Erosion control, minor soil conservation	Severely restricted range of crops, good grazing
4	Permian mudstone	0-12%	gentle footslopes and crests <100m	Moderate sheet, rill and gully	Low rainfall, minor frost	Brown and Grey Kurosols	Fertility and structure (s), erosion (e), permeability (d)	Moderate soil conservation, erosion control	Severely restricted range of crops, good grazing, horticulture

Table 4: Characteristics of Class 3 and 4 Land identified in the Nugent survey area.

Land Capability Class	Land Characteristics						Land Management Issues		
	Geology	Slope range	Topography and elevation	Erosion type and potential severity	Climatic limitation	Principal soil	Main limitations to agricultural use	Main land management requirements (under cultivation)	Agricultural versatility
5	Tertiary basalt	18-56% >28%	Steep risers and crests <400mm	Moderate sheet and creep	Low rainfall, moderate frost, wind exposure	Brown and Black Dermosols, Red Ferrosol	Erosion (e), stoniness (g) shallow depth (l)	Erosion control, moderate soil conservation	Grazing, fodder crops
5	Tertiary basalt	5-56%	Midslopes and benches <400m	Minor to moderate slump	Moderate frost, wind exposure.	Brown and Black Dermosols.	Wetness (w), stoniness (g), mass movement (m)	Erosion control, moderate soil conservation	Good grazing
5	Jurassic dolerite	12-28% (>18%)*	Lower to midslopes of hills <200m	Minor to moderate sheet and creep	Low rainfall	Brown Dermosol	Stoniness (g), erosion (e), soil depth (l)	Erosion control, moderate soil conservation	Grazing, fodder crops, horticulture
5	Jurassic dolerite	0-18% (>12%)*	Lowerslopes and broad crests of hills <600m	Moderate sheet gully and wind	Moderate frost	Brown Chromosol, Brown Kurosol, Red Ferrosol	Stoniness (g),erosion (e), wetness (w), climate (t)	Erosion control, major soil conservation	Grazing, fodder crops
5	Recent alluvium	0-5%	Terrace flats <300m	minor wind	Low rainfall, moderate frost	Red Ferrosol Stratic Rudosol	Stoniness (g), rooting depth (l), flood risk (f)	Moderate soil conservation	Grazing, fodder crops, horticulture
5	Quaternary alluvium	0-5%	Flats, low lying areas and depressions <250m	Minor sheet and wind	Low rainfall, minor frost	Grey and Brown Sodosols, Black Vertosol	Wetness (w), salinity (k)	Salt tolerant pasture species, surface drains	Grazing, pasture improvement
5	Tertiary laterite	0-12%	Rises along valley flats <80m	Major wind	Low rainfall	Brown Kurosol	Wind erosion (a), gravels (g)	Major erosion control, moderate soil conservation	Grazing, pasture improvement
5	Triassic sandstone	0-18% (>12%)* 0-12%	lower to mid slopes and benches of hills <550m	Major wind, sheet and tunnel	Low rainfall, moderate frost	Brown Kurosol, Aeric and Semiaquic Podosols	Wind erosion (a), wetness (w), salinity (k), coarse texture (s), stoniness (g)	Major erosion control, major soil conservation	Grazing, pasture improvement
5	Triassic feldspathic sandstone	18-28%	Mid to upper slopes and crests of hills <180m	Moderate sheet	Low rainfall, wind exposure	Brown Dermosol	Erosion (e)	Moderate erosion control	Grazing, pasture improvement, horticulture
5	Permian mudstone	0-18% (>12%)*	lower - mid slopes and broad crests of hills <300m	Major sheet, wind and tunnel	Low rainfall, moderate frost	Grey and Brown Kurosols	Erosion (e), wetness (w), shallow depth (l)	Major soil conservation and erosion control	Grazing, pasture improvement, horticulture
5	Aeolian sand	0-12%	Coastal valleys and footslopes <100m	Major wind	Low rainfall	Aeric Podosol, Semi-Aquic Podosol	Fertility and structure (s), wind erosion (a), wetness (w)	Major soil conservation and erosion control	Grazing, pasture improvement

* For erosion limitation only

Table 4: Characteristics of Class 5 Land identified in the Nugent survey area.

Land Capability Class	Land Characteristics						Land Management Issues		
	Geology	**Slope range**	**Topography and elevation**	**Erosion type and potential severity**	**Climatic limitation**	**Principal soil**	**Main limitations to agricultural use**	**Main land management requirements (under cultivation)**	**Agricultural versatility**
6	Tertiary basalt	>45%	Ridge tops and steep risers	Major creep	Minor frost, wind exposure	Brown Dermosol Red Ferrosol	Rockiness (r), stoniness (g), erosion (e)	No cultivation, erosion control	Limited grazing, silviculture
6	Jurassic dolerite	>28%	Rolling to steep hills <200m	Major creep and sheet	Minor frost, wind exposure	Brown Dermosol	Stoniness (g), erosion (e)	No cultivation, erosion control	Limited grazing, silviculture
6	Jurassic dolerite	All (>18%)*	Rolling to steep hills <650m	Severe sheet, rill and gully	Moderate frost wind exposure	Brown Chromosol, Brown Kurosol	Erosion (e), stoniness (g)	No cultivation, erosion control	Limited grazing, silviculture
6	Recent alluvium	0-5%	Narrow flats alongside creeks and streams	Moderate sheet	Minor frost	Stratic Rudosol	Stoniness (g), flood risk (f)	No cultivation, erosion control	Limited grazing, silviculture
6	Quaternary alluvium	level	coastal flats	-	minor frost major flood	Redoxic Hydrosol	wetness (w), salinity (k)	No cultivation	Limited grazing
6	Triassic sandstone	>18% >12%	slopes and crests of hills <500m	major wind, severe sheet and tunnel	wind exposure moderate frost low rainfall	Brown Kurosol Aeric Podosol	erosion (e), rooting depth (l), rock outcrop (r)	No cultivation Erosion control	Limited grazing, silviculture
6	Permian mudstone	18-56%	mid to upper slopes and ridge crests of hills <300m	severe sheet, rill and tunnel	moderate wind moderate frost wet spring	Grey Kurosol	erosion (e), rooting depth (l), soil (s)	No cultivation, Erosion control	Limited grazing, silviculture
6	Recent aeolian sands	0-12%	footslopes and rounded dunes. <50m	severe wind	wind low rainfall	Arenic Rudosol	wind erosion (a)	No cultivation, Erosion control	Limited grazing
6	Quaternary aeolian sands	12-28%	lower-mid slopes of low hills <100m	major wind	wind low rainfall	Aeric Podosol	wind erosion (a), soil (s)	No cultivation, Erosion control	Limited grazing
7	Recent sand dunes	variable	coastal dunes <20m	severe wind	wind low rainfall	Arenic Rudosol	wind erosion (a), soil texture (s)	protection	Unsuitable for agriculture
7	Recent sediments	level	river and tidal flats <1m	very minor sheet	none	Extratidal Hydrosol	high water table (w), salinity (k)	protection	unsuitable for agriculture
7	Jurassic dolerite	variable	mountain tops and slopes. >500 m, gorges and steep coastal cliffs	minor rock fall on slopes, severe sheet	severe frost, strong winds	Brown Kurosol Red Ferrosol Clastic Rudosol	boulder fields (g) stoniness (g) rock outcrops (r) erosion (e)	protection	unsuitable for agriculture
7	Triassic sandstone	>56%	very steep slopes and cliffs	moderate rock fall, severe sheet	sever frost at high elevations	Brown Kurosol	rock outcrop (r) erosion (e)	protection	unsuitable for agriculture

*For erosion limitation only

Table 4: Characteristics of Class 6 and 7 Land identified in the Nugent survey area. Note: most Class 7 land occurs as inclusions within, or is complexed with Class 6 Land at the 1:100 000 scale of mapping.

GLOSSARY

Aggradation: The sequential accumulation of sediment in fluvial environments.

Alluvial deposits: Sediment transported by rivers and deposited on flood plains.

Basalt: Rock rich in base cations formed from the cooling and solidification of volcanic lava.

Clay: Soil particles of diameter less than 0.002mm.

Coarse fragments: Particles of diameter greater than 2mm which have not formed in soil profile.

Colluvial deposits: Weathered rocks and soil transported and redeposited by gravity, generally at the base of slopes or in hollows.

Complex: A map unit where two land classes are identified but cannot be separated at the scale of mapping. In a complex unit the proportion of the two land classes is between 50/50 and 60/40.

Chromosols: A soil order defined in the *Australian Soil Classification* (Isbell 1996) as having strong texture contrast, is not sodic in the upper B horizon and a pH in the upper B horizon greater than or equal to 5.5.

Degradation: Deterioration of a resource through inappropriate or uncontrolled management or use.

Dermosols: A soil order defined in the *Australian Soil Classification* (Isbell 1996) as having structured B horizons and no strong texture contrast.

Dispersive Soils: Soils composed of aggregates which break down to primary particles as they absorb water. Dispersive soils are inherently unstable and easily eroded. In most cases, dispersive soils are sodic.

Dolerite: A medium grained, basic rock formed from the cooling and crystallisation of magma near the surface of the earths crust.

Drainage: A description of local soil wetness conditions as defined in the *Australian Soil and Land Survey Field Handbook* (McDonald, et al. 1998). Drainage is controlled by landscape position, soil permeability, and the extent of impediments to water movement within the soil profile.

EC_e : Electrical conductivity of the saturation extract of soil. This is usually derived by multiplying the 1:5 soil:water mixture electrical conductivity by a constant that is a function of soil texture.

Ferrosols: A soil order defined in the *Australian Soil Classification* (Isbell 1996) as having a free iron content in the greater part of the B2 horizon greater than 5%.

Ferruginous gravel: Gravel which is composed dominantly of iron-rich materials; also known as ironstone or laterite gravel. It often forms within the soil profile.

Fine sand: Particles of diameters from 0.06 to 0.1mm. They are just visible with the naked eye and feel similar to coarse flour or table salt.

Clacio-marine: Refers to sediments that accumulated in marine environments offshore from glaciated land masses

Graben: Down faulted area of land generally forming a valley.

Horizons: Layers within a soil profile, which have morphological properties different from those above and below.

Horst: Elevated areas of land between grabens.

Hydrosols: A soil order defined in the *Australian Soil Classification* (Isbell 1996) other than Organosols, Podosols and Vertosols which is saturated for at least 2 to 3 months in most years.

Kandosols: A soil order defined in the *Australian Soil Classification* (Isbell 1996) as having no strong texture contrast and a weakly structured B horizon which is not calcareous.

Kurosols: A soil order defined in the *Australian Soil Classification* (Isbell 1996) other than Hydrosols, as having strong texture contrast and a pH in the upper B horizon less than 5.5.

Land Capability: The potential of the land to support a range of practices or uses without degradation. In this report only agricultural uses are considered. Land Capability considers only the physical attributes of the land.

Land Suitability: The potential of the land to support a defined land use. Land suitability usually considers the economic and cultural suitability of a land use in addition to the physical attributes of the land. A comparison of land suitability evaluations for a range of different uses can identify the most suitable use for a particular area.

Limitation: The physical factors or constraints, which affect the versatility of uses of a land unit. Dominant limitations determine land capability for long term agricultural use.

Moisture availability: A measure of the amount of moisture held in the soil which is available for plant uptake. It is defined as the difference between the field capacity and the wilting point of the soil.

Natural fertility: Nutrient status of the soil as determined by organic matter content, cation exchange capacity and the degree of base saturation.

Nutrient availability: The ability of a soil to retain and supply nutrients for plant growth. It is principally governed by the CEC, the organic matter content and the pH of the soil.

Organosols: A soil order defined in the *Australian Soil Classification* (Isbell 1996) as having profiles dominated by organic materials which is not inundated by tides.

Permeability: A description of the potential of a soil to transport water internally as defined in the *Australian Soil and Land Survey Field Handbook* (McDonald, et al. 1998).

Podosols: A soil order defined in the *Australian Soil Classification* (Isbell 1996) as having B horizons dominated by the accumulation of compounds of organic matter and aluminium, with or without iron.

Profile: A vertical cross section of a soil extending from the surface down to the lower limit of soil development.

Rudosols: A soil order defined in the *Australian Soil Classification* (Isbell 1996) as having negligible pedological development.

Saline soil: Where the electrical conductivity of the saturation extract (Ec_e) of soil material indicates the presence of salts. The following approximate categories were used to indicate relative salinity levels in this report:

Low:	<2ds m^{-1}
Moderate:	2 - 8ds m^{-1}
High:	>8 ds m^{-1}

Sedimentary rock: Rock formed from particles which have been transported, deposited and fused through cementing and/or compaction.

Siliceous: Pertaining to rocks or soils, which contain a high proportion of silicon rich minerals such as quartz.

Sodic soils: Soils with a proportion of the cation exchange capacity occupied by sodium ions of greater than 6%. With respect to land use, a soil is considered sodic when the sodium concentration reaches a level that affects soil structure.

Soil pH: A measure of the acidity or alkalinity in a soil. A pH of 7 denotes a neutral soil with a log scale of increasing alkalinity of pH 7 to 14, and a log scale of increasing acidity of pH 7 to 1.

Soil structure decline: The degradation of soil structure. Soil aggregates may be destroyed by excessive cultivation/harvesting or trampling by stock, leaving a compacted, massive or cloddy soil. Soils are particularly susceptible to structural decline when wet.

Sodosols: A soil order defined in the *Australian Soil Classification* (Isbell 1996) as having strong texture contrast, a sodic upper B horizon and a pH in the upper B horizon greater than or equal to 5.5.

Subsoil compaction: Potential for development of traffic compaction pan below the surface, usually 10 to 30cm deep. Pans restrict root growth into the subsoil. Yield response can be obtained on some soils by deep ripping to break the traffic pan.

Sustainable agriculture: The use of farming practices and systems which maintain or enhance economic viability of agricultural production; the natural resource base; and other ecosystems which are influenced by agricultural activities. There are five principles of sustainable agriculture.

1. Farm productivity is sustained or enhanced over the long term.

2. Adverse impacts on the natural resource base of agriculture and associated ecosystems are ameliorated, minimised or avoided.

3. Residues resulting from the use of chemicals in agriculture are minimised.

4. The net social benefit derived from agriculture is maximised.

5. Farm systems are sufficiently flexible to manage risks associated with the vagaries of climate and markets.

Talus: Accumulation of clastic sediments at the foot of a cliff or steep slope.

Tenosols: A soil order defined in the *Australian Soil Classification* (Isbell 1996) as having only weak pedological development.

Texture contrast soils: Soils in which the boundary between two horizons (usually the A and B horizons) is smaller than 50mm (clear, abrupt or sharp), **and**
the clay content in the upper horizon is less than 20% and the clay content in the lower horizon double that of the upper horizon (In this case the clay content must be greater than 20% in the upper B horizon), **or**
the clay content in the lower horizon is 20% higher than the upper horizon where the upper horizon is between 20 and 35% clay.

Vertosols: A soil order defined in the *Australian Soil Classification* (Isbell 1996) as having shrink swell properties with strong cracking when dry, slickensides and/or lenticular structure, and a clay field texture of more than 35% throughout.

Water erosion hazard: The potential for sheet, rill, tunnel or gully erosion to occur on a land surface. The land surface is most prone to water erosion when cultivated and/or when little or no vegetative cover is present. Land management to suit site conditions can minimise the severity, and often prevent most occurrences of water erosion. The degree of hazard depends on soil erodibility, amount of ground cover, slope gradient and length, and rainfall (intensity and amount).

Wind erosion hazard: The potential for a land surface to erode by the action of wind. The land surface is most prone to wind erosion when cultivated and/or when little or no vegetative cover is present. Appropriate land management including maintaining good ground cover will protect the soil surface from wind erosion. The degree of hazard depends on soil erodibility (especially particle size and soil structure), amount of ground cover, the timing and degree of exposure to the wind and wind speed. Loose, structureless soils are most at risk.

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APPENDICES

APPENDIX A Example of a completed Land Capability site description.

LAND CAPABILITY DESCRIPTION CARD

Project code	Site No.	Map Name	Sheet No.	Easting	Northing	Describer	Date
NUGE	53	TRIABUNNA	5629	573450	5293700	RDR	7/11/00

Rainfall	TS	TP	SP	Permeability	Drainage	Elevation	Australian Soil Class	LCC	Geology	Geology map
650mm		AUGER	✓	1 (2) 3 4	1 2 (3) 4 5	20m	4 SoAB FNYY	4sd	Ts	BUCKLAND

Element slope class(p.12)		
LE	Level	(<1%)
(VG)	Very Gentle	(1-3%)
GE	Gentle	(3-10%)
MO	Moderate	(10-32%)
ST	Steep	(32-56%)
VS	Very steep	(56-100%)
PR	Precipitous	(100-300%)
CL	Cliffed	(>300%)

Element Morphological Type	
(C)	Crest
H	Hillock
R	Ridge
S	Simple slope
U	Upper slope
M	Mid slope
L	Lower slope
F	Flat
V	Open depression
D	Closed depression

Mode of Geomorphic activity	
ER	Eroded
EA	Eroded or aggraded
(AG)	Aggraded

Element Type	
BKP	Backplain
BAR	Bar
BRI	Beach ridge
BEN	Bench
BOU	Blow-out
DDE	Drainage depression
DUN	Dune
EST	Estuary
(FAN)	Fan
FOO	Footslope
FOR	Foredune
GUL	Gully
HCR	Hillcrest
HSL	Hillslope
LAG	Lagoon
LDS	Landslide
LEV	Levee
LUN	Lunette
MOU	Mound
PLA	Plain
SCA	Scarp
STC	Stream channel
SWP	Swamp
TEP	Terrace plain
TEF	Terrace flat
TDF	Tidal flat
VLF	Valley flat
	Or code (page 24)

Pattern Type	
(ALF)	Alluvial fan
ALP	Alluvial plain
BEA	Beach ridge plain
COL	Covered plain
DEL	Delta
DUN	Dunefield
FLO	Flood plain
HIL	Hills
LAC	Lacustrine plain
LOW	Low hills
MEA	Meander plain
PNP	Peneplain
PLT	Plateau
PLA	Plain
SAN	Sand Plain
TEL	Terraced land
	Or code (page 48)

2%	Slope angle (eg 10%)
45	Aspect (eg 010)

Surface Condition When Dry	
G	Cracking
M	Self-mulching
L	Loose
S	Soft
(F)	Firm
H	Hard setting
C	surface crust
X	Surface flake

Degree Of Erosion		
X	(X)	Not apparent
0	0	None
1	1	Minor
2	2	Moderate
3	3	Severe
4	4	Very severe

State of Erosion		
A	A	Active
S	S	Stabilized
P	P	Partly stabilized

Type of Erosion		
W	W	Wind
S	S	Sheet
R	R	Rill
G	G	Gully
C	C	Scald
T	T	Tunnel
B	B	Streambank
V	V	Wave
M	M	Mass movement

Inundation Frequency (p. 96)	
(0)	No Inundation
1	< once per 100 years
2	Once in 50-100 years
3	Once in 10-50 years
4	Once in 1-10 years
5	> once per year

Duration of Inundation	
1	< 1 day
2	1-20 days
3	20-120 days
4	>120 days

Coarse Fragments		
Abundance of Coarse Frag.		
(0)	None	0%
1	Very few	(<2%)
2	Few	(2-10%)
3	Common	(10-20%)
4	Many	(20-50%)
5	Abundant	(50-90%)
6	Very abundant	(>90%)

Size of Coarse Fragments		
1	Fine gravel	(2-6mm)
2	Med. gravel	(6-20mm)
3	Cos. gravel	(20-60mm)
4	Cobbles	(60-200mm)
5	Stoned	(200-600mm)
6	Boulders	(600mm-2m)
7	Large boulders	(>2m)

Rock Outcrops		
0	No rock outcrop	
1	V slightly rocky	(<2%)
2	Slightly rockey	(2-10%)
3	Rocky	(10-20%)
4	V rockey	(20-50%)
5	Rockland	(>50%)
	Lithology code (p 160)	

Notes

Substrate: Alluvium over Tertiary clay and gravels

Profile: Duplex profile form.

Location: Salmon Flats, 1km west of Triabunna

General: Present land use grazing with occasional fodder crops.

		Moist colour			Primary mottles			Field Texture		Primary structure			Plus/Parting to 2ND struc			Coarse fragments		Field tests	
Horizon	Lower depth	Hue	V	C	Abundance	Size	Contrast	Qualifier	Code	Grade	Size	Type	Grade	Size	Type	Abundance	Size	pH	EC
A1	9cm	10YR	4	2	(0) 1 2 3 4	1 2 3 4	-	F	SL	V G (W) M S	(1) 2 3 4 5 6 7	PL PR CO AB SB PO LE (GR) CA			/	1	1	6.0	0
					0 1 2 3 4	1 2 3 4				V G W M S	1 2 3 4 5 6 7	PL PR CO AB SB PO LE GR CA							
A2	22	10YR	5	1	0 (1) 2 3 4	(1) 2 3 4	F		SL	V G (W) M S	(1) 2 3 4 5 6 7	PL PR CO AB SB PO LE (GR) CA				1	1	6.4	0
					0 1 2 3 4	1 2 3 4				V G W M S	1 2 3 4 5 6 7	PL PR CO AB SB PO LE GR CA							
B2	50+	10YR	4	3	0 1 2 3 (4)	1 2 (3) 4	P		mc	V G (W) M S	1 2 3 (4) 5 6 7	PL PR CO AB (SB) PO LE GR CA	/					6.4	0
					0 1 2 3 4	1 2 3 4				V G W M S	1 2 3 4 5 6 7	PL PR CO AB SB PO LE GR CA							

APPENDIX A. Example of a completed Land Capability site description.