TAMAR
REPORT

Land Capability Survey
of Tasmania

K E NOBLE
1992

Tamar Report
and accompanying 1:100 000 scale map

DEPARTMENT OF PRIMARY INDUSTRY TASMANIA

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Authors Note: The Department of Primary Industries, Water and Environment referred to in this document is now titled the Department of Primary Industries and Fisheries.

CONTENTS

1. Introduction

The Department of Primary Industry in 1989 commenced a Land Capability Survey of Tasmania at a scale of 1:100 000. The primary aim of the survey is to identify and map the location and extent of different classes of agricultural land, in order to provide an effective base for land use planning decisions. In addition, the aim is to ensure that the long-term productivity of the land is maintained, through the promotion of compatible land uses and management practices. A land capability classification system has been developed specifically for Tasmania comprising seven classes, and is based on the capability of the land to support a range of agricultural uses on a long-term sustainable basis.

The basis of soil conservation is the proper use and management of the land - that is, using and managing land within its capability. The conservation and correct management of Tasmania's most important agricultural asset, the soil, is vital for sustained productivity. However, much of the land in Tasmania has limitations that restrict the land for agricultural use. The system of land capability recognises these limitations, and classifies the land accordingly.

This report and associated map describes and depicts the land capability of the Tamar map (1:100 000 scale Tasmap Series). It is one in a series of land capability maps and reports for Tasmania. All 1:100 000 maps of the Tasmap Series that contain privately owned land will be mapped. Only Private Freehold and Leased Crown Land will be mapped at 1:100 000 scale, with some selected high priority areas remapped at larger scales.

2. Summary

This map and report describes and classifies the land capability of all privately owned land and leased Crown land on the Tamar map. The map covers the area between Point Sorell and Beechford in the north, to Elizabeth Town and Westwood in the south. Major towns in the area include George Town, Port Sorell, Beaconsfield and Exeter.

The land capability system is based on the capability of the land to produce agricultural goods without impairing the long-term, sustainable productive potential of the land. A land capability classification system has been developed specifically for Tasmania, and categorises the land into seven land capability classes.

The land capability data and boundaries have been determined by a combination of field work and aerial photo-interpretation.

The major constraints which have determined the land capability classes are: slope, erosion hazard, inferior soils (poor soil structure, low fertility soils), and rockiness.

A summary of the areas of the land capability classes mapped on the Tamar map is shown in Table 1.

Class	Area (ha)	% of land area on Tamar map
1	42	0.02
2	604	0.33
3	10 061	5.52
4	56 953	31.26
5	36 773	20.18
6	26 038	14.3
7	874	0.48
Exclusion areas	50 804	27.9
TOTAL	182 149	100

Table 1: Summary of areas on Tamar map.

3. Acknowledgements

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Mr Derek O'Toole for drafting the map and diagrams, and for assistance in the field.

This project has been funded by the National Soil Conservation Program through the Department of Primary Industry, Tasmania.

4. How to use this Map and Report

It is important that the land capability maps be used in conjunction with the accompanying report. Special attention needs to be given to reading and understanding the principles of the land capability classification system, outlined in Sections 6 and 7 of this report. By referring to the map, and locating the area of interest, the land capability class assigned to that area can be determined. This is given by a number (1 to 7) which corresponds to the land capability class. Descriptions of the land capability classes are given on the side legend of the map, and detailed in Section 8. Further detail about each of the land capability classes occurring on the Tamar map is given in Sections 9 and 10, including explanatory diagrams showing the sequence of land capability classes on different rock types.

4.1 Limitations of Scale

Special attention needs to be given to the limitations imposed by the scale of mapping.

It is important that the map be used at the scale at which it is published. DO NOT ENLARGE THE MAP.

Errors in interpretation will occur if the map is enlarged and there will be a reduction in credibility of the information, as small areas would be delineated separately at a larger mapping scale. If more detail is required, the area of interest should be mapped at a larger scale rather than enlarge the smaller scale map.

Regardless of the mapping scale used, there are always some areas which are too small to delineate accurately.

At the map scale used in this survey, 1:100 000, the minimum area which can be adequately depicted on the map represents approximately 64 ha on the ground. Minimum widths of map units are approximately 300 m at this scale of mapping. However in some instances where it was felt important to highlight areas of higher land capability classes, or in areas where the lack of existing detail allowed separating out smaller areas, map units much smaller in size than 64 ha have been delineated.

The areas of land capability classes shown on the maps are rarely made up entirely of the land capability class indicated. They almost invariably contain areas of other land capability classes, too small to depict at the scale of the map. In complex areas, it is not possible to delineate these smaller areas of other land capability classes. In such circumstances the land is assigned to the dominant class, but up to 30% of land of other classes may be included. In the majority of cases, the land capability classes are estimated to be at least 80% pure, with more uniform areas having inclusions of other classes limited to about 10%.

In some areas, two land capability classes may be mapped as a complex, where it has been impossible at the scale of mapping to separate them, and they both occupy between 40 and 60% of the area. In this case both land capability class numbers are included on the map (e.g. 4 + 5).

The accuracy of the land capability boundaries depends on a number of factors including the complexity of the terrain and geology. In some cases the class boundaries may be well defined, such as with abrupt changes in geology or topography. Alternatively, changes may be gradual and more difficult to assess such as with a change in soil depth, soil type, slope, or extent of rockiness. In these cases the boundary is transitional and therefore is less precisely plotted.

4.2 Interpretation of the Land Capability Information

The scope and range of applications of the land capability information depends on the scale at which the surveys are carried out. A scale of 1:5 000 or 1:10 000 is suitable for whole farm planning purposes, to plan farm layouts and to identify appropriate land uses, soil conservation and land management practices. A scale of 1:25 000 is suitable for catchment planning, and 1:50 000 or 1:100 000 scales for district and regional planning.

One of the major uses of this map series at 1:100 000 scale will be for local government, regional and State land use planning decisions. The information at this scale is not intended to be used to make planning decisions at catchment or farm levels, although the information collected will form a useful base for more detailed studies.

Examples of other potential uses of land capability information are:

- Rational planning of urban and rural subdivisions
- Identifying areas for new crops, enterprises or major developments
- Identifying areas for expansion of particular land uses
- Identifying areas of prime agricultural land (Classes 1 to 3) for retention for agricultural use
- Planning for 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

Land capability information combined with other resource data, will be analysed, stored and disseminated with the aid of a GIS (Geographic Information System). This will greatly enhance the accessibility, interpretation and use of this information.

The applications of the land capability information do not depend solely on the maps themselves, but also on the implementation framework - legislation and administration, which are 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.

4.3 Copyright

Both the maps and reports in this series are copyright, and the data is solely owned by the Department of Primary Industry, Tasmania.

Anyone wishing to use any of the information contained in this report or accompanying map should seek permission from the Secretary, Department of Primary Industry, Hobart.

5. Methodology

5.1 Mapping Technique

The land capability maps are produced from a combination of both field work and aerial photo-interpretation. Extensive field work along major roads has been carried out over the survey area to check soil types, soil depths, geological boundaries etc, and to assess the land capability classes. Slopes were measured in the field with an inclinometer to determine critical slopes for different soil types. Soil profiles were examined by augering or by examination of exposures along road cuttings and banks to determine depth of soil horizons and their properties. Exposures were also used to examine the underlying geology. Local agricultural advisory officers were taken in the field to assist with cropping and agricultural information. Land capability class boundaries were transferred onto aerial photographs where possible in the field, using the technique of stereoscopic interpretation (see Photo 1). In areas where access was not possible land capability boundaries were drawn after interpretation of aerial photos and other relevant available information (e.g. geology, soils and land systems maps). The land capability boundaries were then transferred onto the relevant topographic base map. Extensive field checking of the area has been carried out to check the accuracy of boundaries and the land capability assessment assigned to each area.

5.2 Aerial Photography

Aerial photos used for this map have been 1982 Tamar and 1988 Central North surveys, at 1:42 000 scale.

5.3 Exclusion Areas

Only Private Freehold and Leased Crown Land has been mapped (as shown on the Tasmap 1:100 000 Series). All other areas such as State Forests, State Reserves, Conservation Areas, Crown Land, and urban areas, etc., have been excluded from the mapping program.

These excluded areas are indicated on the map by the letter E.

Photo 1. Checking land class boundaries in the field.

6. Land Capability Classification

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

For the Tasmanian classification, agricultural land uses only are covered, and are defined as broadscale grazing and cropping uses. Land capability ratings for specific land uses are not evaluated, nor is the capability of land for forestry 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 to produce a range of agricultural goods (refer to Figure 1).

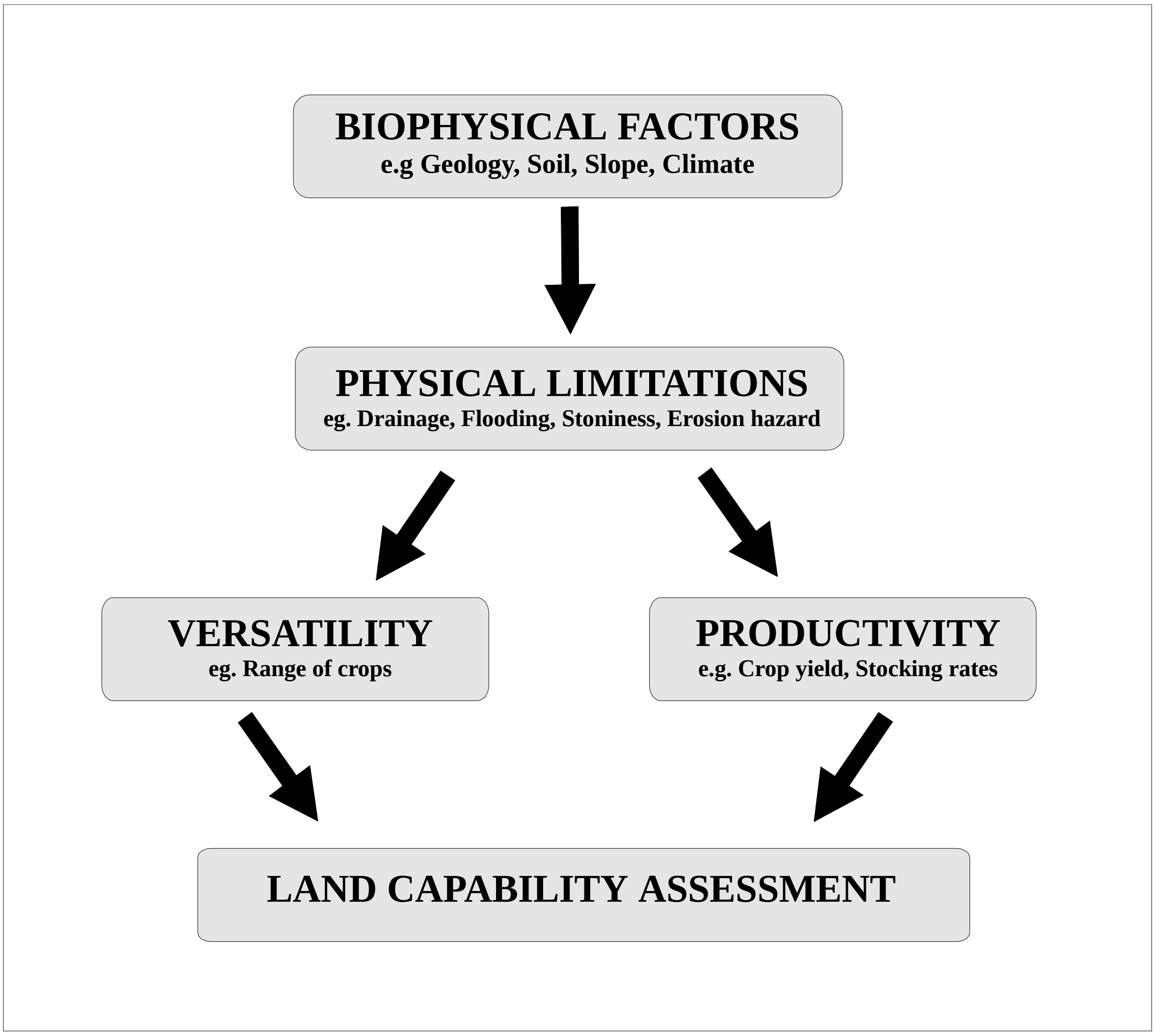

Figure 1. Factors in land capability assessment

Land capability assessment takes into account the physical nature of the land (e.g. geology, soils, slope) plus other factors (e.g. 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, e.g. 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 social or political factors.

Land capability assessment should not be confused with land suitability assessment which, in addition to the biophysical features, may take into account economic, social and/or political factors in evaluating the `best' use of a particular type of land. Land capability classification gives a grading of land for broadscale agricultural uses, whereas land suitability is applied to more specific, clearly defined land uses, such as land `suitable' for carrots.

The land capability classification system for Tasmania gives an indication of the inherent capability of the land for general agricultural production and does not attempt to portray specific land uses, or rank the value of any particular agricultural land use above another. Neither does it attempt to give an indication of land values.

The system of land capability classifies land into a number of classes according to the land's capability to produce agricultural goods (based on broadscale grazing and cropping uses). The system for Tasmania is based on the USDA (United States Department of Agriculture) approach to land capability.

There are generally three levels to the land capability classification:

- The land capability <u>class</u> - which gives an indication of the general degree of limitation to use
- <u>subclass</u> - which identifies the dominant kind of limitation
- and the <u>unit</u> - 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 2

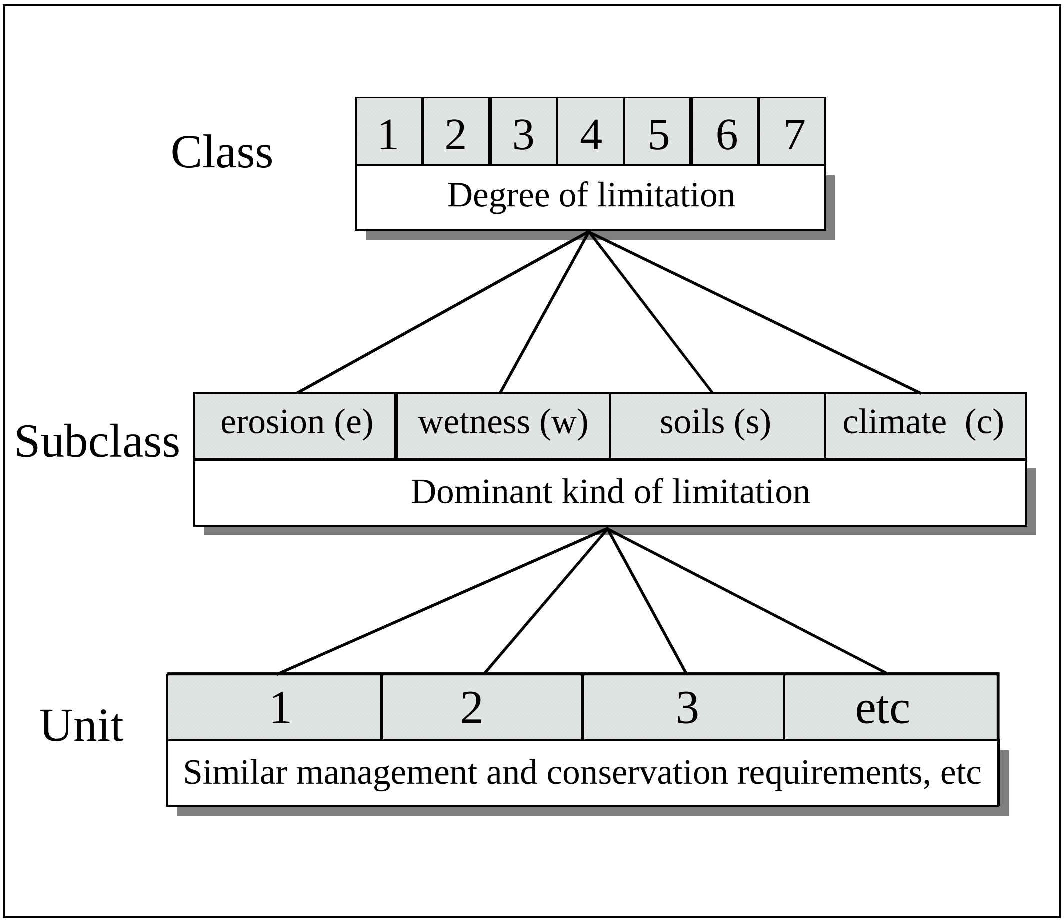

Figure 2: Levels of the land capability classification system.
(Adapted from: National Water and Soil Conservation Organisation, 1979, Our Land Resources. (NWASCO), Wellington, New Zealand.)

References for Further Reading:

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Klingebiel, A.A. & Montgomery, P.H., 1961, Land Capability Classification. Agriculture Handbook No. 210. United States Department of Agriculture, Soil Conservation Service.

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7. Features of the Tasmanian Land Capability Classification System

7.1 The classification is based primarily upon three permanent biophysical features of the landscape - soil, slope and climate, and their interactions. These three factors have a major influence in determining the capability of the land to produce agricultural goods. Other factors which must be taken into account are rock type, erosion hazard, range of crops that can be grown, management practices, soil conservation treatment, risk of flooding and past land use history.

7.2 The classification comprises seven classes ranked in order of increasing degree of limitations to use, and in decreasing order of versatility of use.

7.3 This survey only subdivides land to the class level. Further subdivision of land below the class level would be possible at more detailed scales of mapping, and would group together similar types of land requiring the same kind of management, the same kind and intensity of conservation treatments, and which occur on soils which are adapted to the same kinds of crops, with similar potential yields.

7.4 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 of the other classes of land. Class 2 land is similarly superior to classes 3 to 7, and so on.

7.5 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, the range of crops that can be grown on classes 1 and 2 land would be wider than the range of crops grown on classes 3 and 4 land; and would include vegetable and allied crops, orchards as well as cereals, essential oils and forage crops.

7.6 The classification takes into account physical limitations the land may have. 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. The capability class takes into account the kind and degree of limitations present.

Examples of different kinds of limitations are: erosion hazard, slope, climate, flooding, stoniness, rock outcrops, salinity, poor soil structure, poor internal drainage, low fertility and low soil moisture holding capacity. There may be one or a number of limitations present at any one site, but it is the overall degree of limitation present that determines the capability class.

Physical limitations can be classified as either permanent, or able to be removed or modified. Permanent limitations include slope and most climatic influences. Removable or modifiable limitations include flooding, poor drainage, and the presence of stones. In addition, some climatic effects such as wind and low rainfall can be modified by the installation of shelterbelts and irrigation. The feasibility of the removal of a limitation depends largely on the severity of the limitation, and also on economics. Guidelines are therefore necessary to differentiate between limitations that can be reasonably removed and those that cannot.

Although economics do not feature in land capability assessments, they are a significant consideration when the removal of limitations is contemplated. The following key words: reasonable, feasible, and economic, are considered when deciding if limitations could be modified or removed. Limitations that are assumed to be removable using existing technology on an individual farm basis include poor drainage, stoniness, and low fertility. Where the necessary technology is not a practical proposition, or beyond the capabilities of an individual farmer and requires a catchment or community scheme, the land is classified according to the nature of its present limitations. If in time such schemes become operative, the land can be reclassified (if appropriate) into a higher land capability class.

Many areas have the potential to attain an improved land capability ranking through the application of irrigation. The extent of the beneficial effects of irrigation on land capability will vary considerably, depending upon such factors as available water and economics, which require individual assessment on a property basis. However it is not possible to provide a uniform system of classification of land capability based on irrigation potential on an on-farm basis, so this has not been included in the assessment of capability. In addition, areas within regional irrigation schemes (such as Cressy/Longford, Winnaleah and Coal River) may have a higher land capability ranking than that shown on the map. However because the effect of an irrigation scheme on land capability depends on a number of factors including economics, availability of water and type of irrigation used, the fact that an area falls within the boundary of a designated irrigation scheme has not influenced its capability in this study. Therefore land capability has been assessed assuming no irrigation potential.

With drainage, the land capability is considered assuming that drainage techniques that are currently available within the scope of an `average' farmer to install, have been installed. These would include maintenance of existing drainage lines on individual properties, and installation of basic drainage measures to remove excess surface water. The installation of a large scale drainage scheme or extensive underground drainage, is not considered to be within the scope of individual farmers.

The land capability of areas that fall within Drainage Trust Schemes (e.g. Dairy Plains, King Island, Flinders Island, Mowbray Swamp and Circular Head) has been assessed according to the present condition of the land. In other words, the fact that an area of land falls within the boundary of a Drainage Trust Scheme has not influenced the land capability ranking. This is mainly because not all areas of land within Drainage Trusts are capable of the same increased land capability ranking, and not all areas within the Trust boundaries have been effectively drained to date.

Maps of both Irrigation Scheme areas and Drainage Trust areas will be incorporated into the relevant reports.

Climate is one of the major permanent limitations that restrict the versatility of the land (particularly for cropping), and together with soil and slope, has a major influence in determining the land capability class.

For a land capability survey at this scale (1:100 000) only generalised statements and boundaries relating to climate can be made. At more detailed scales of mapping, climatic boundaries (as they affect land capability) can be more clearly defined. These would be based on more localised effects of topography (including aspect), reliability of rainfall, availability of irrigation water, and more detailed records of rainfall, frosts, wind, etc.

Some of the major climatic constraints to agricultural use in Tasmania are:

- Uneven rainfall distribution (associated with topography, altitude and time of year)
- Unreliable rainfall in certain areas
- Increasing frost hazard, lower mean temperatures and shorter growing seasons in areas away from the coastal maritime influence
- Occurrence of out of season frosts
- Effect of wind in exposed areas
- Extremes of both summer and winter temperatures affecting evaporation and length of growing season.

Section 9 deals more fully with the available relevant climatic information pertinent to each map sheet.

7.7 The system is based on agricultural production (cropping and pastoral productivity) and does not take into account forestry productivity. It is based on cultivation of the land for cropping purposes and not other land use systems which can sustain `crops' on steeper land with longer rotations, and less risk of erosion (e.g. perennial horticulture, tree crops, minimum tillage crops). Indicators of stocking rates are incorporated where possible to support the grazing potential of the land.

7.8 The system considers degradation of the soil resource and does not take into account the possible effects of agricultural land use on water quality, aesthetics, wildlife, etc.

7.9 The basic principle of land capability brings together both facets of conservation - protection of the land, and its potential production. In other words, the balance between use of the land and the risk of degradation.

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

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

(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 is being applied to the land.

(c) Appropriate soil conservation measures have been applied.

(d) Where it is reasonable and feasible for an individual farmer to remove or modify physical limitations (e.g. high water tables, 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 (e.g. 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 and 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.

7.12 The system is consistent across the State.

8. The Land Capability Classes

The land capability class is the broadest grouping of the land capability classification and gives an indication of the general degree of limitation to use.

There are seven classes, arranged from Class 1 to Class 7 in order of increasing degree of limitations or hazards to use, and decreasing degree of versatility (refer to Tables 2 and 3).

Increasing Limitations to Use

Decreasing Versatility

<table>
<tr><th>CLASS</th><th>CROPPING SUITABILITY</th><th>PASTORAL SUITABILITY</th></tr>
<tr><td>1</td><td rowspan="2">High</td><td rowspan="4">High</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td><td>Medium</td></tr>
<tr><td>4</td><td>Low</td></tr>
<tr><td>5</td><td rowspan="3">Unsuitable</td><td>Medium</td></tr>
<tr><td>6</td><td>Low</td></tr>
<tr><td>7</td><td>Unsuitable</td></tr>
</table>

Table 2: Suitability of different land uses for land capability classes.
Adapted from: National Water and Soil Conservation Organisation, 1979, Our Land Resources. (NWASCO), Wellington, New Zealand.)

CLASS		LIMITATIONS	CHOICE OF CROPS	CONSERVATION PRACTICES
1	Under cultivation	Very minor	any	Very minor
2		Slight	Slightly reduced	Minor
3		Medium	Reduced	Major
4		Severe	Restricted	Major + careful management
5	Under pastoral use	Slight to moderate	Grazing	
6		Severe	Grazing	
7		Very severe to extreme	No, or very minor agricultural value	

Table 3: Features of land capability classes.

The criteria used to define the classes are based on observation and experience only, and not on experimental work. Where necessary, soil physical and chemical criteria have been tested in a laboratory situation.

In time, it may be necessary to refine or modify the criteria for the different classes to incorporate changes in technology and increased understanding about the interactions between soils, farming practices and the natural environment. It is anticipated that the guidelines to the classes will be revised, where relevant, to incorporate this new information.

8.1 Class Definitions

CLASS 1

Multiple use land with virtually no limitations to intensive cropping and grazing. It occurs on flat land with deep, well drained soils, and in a climate that favours a wide variety of crops. It is capable of being cropped eight to nine years out of ten in a rotation with pasture or equivalent.

CLASS 2

Land suitable for intensive cropping and grazing. Limitations to use are slight, and these can be readily overcome by management and minor conservation practices. Limitations reduce the length of the cropping phase to five to eight years out of ten in a rotation with pasture or equivalent.

CLASS 3

Land suitable for cropping and intensive grazing. Cultivation for cropping should be limited to two to five successive crops in a rotation with pasture or equivalent. Soil conservation practices and sound management are needed to overcome the moderate limitations to cropping use. The range of crops able to be grown is generally more restricted than on Class 1 or 2 land.

CLASS 4

Land marginally suitable for cropping because of limitations which restrict the range of crops that can be grown, and/or make major conservation treatment and careful management necessary. Cropping rotations should be restricted to one to two years out of ten in a rotation with pasture or equivalent. This land is well suited to intensive grazing.

CLASS 5

Land with slight to moderate limitations to pastoral use. This land is unsuitable for cropping, although some areas on easier slopes may be cultivated for pasture establishment or renewal. 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 levels of production, 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.

8.2 Guides for Identifying the Land Capability Classes

Class 1 land has most or all of the following features :

- land is level or very gently sloping with slopes less than 5%,
- soils are deep, freely drained and have high water holding capacity,
- surface drainage is adequate,
- productivity is high for a wide range of crops,
- erosion hazard is nil to slight,
- soils have a high capacity to withstand frequent cultivation and irrigation without serious damage under sound, average management,
- soil physical and chemical deficiencies can be readily corrected,
- climate does not seriously affect productivity,
- soils do not have excessively high sand or clay contents.

Class 2 land has most or all of the following features:

- slopes may range up to 12%,
- soils are deep and freely drained, and have moderate to high water holding capacities,
- soils have a moderate to high capacity to withstand frequent cultivation and irrigation without serious damage under sound, average management,
- minor conservation measures may be required,
- productivity is high to moderately high for a range of crops,
- adverse soil characteristics can be easily improved,
- the risk of flooding is low.

Class 3 land has most or all of the following features:

- slopes may range up to 18%,
- high to moderately high levels of productivity under improved pasture species and crops,
- the range of crops is generally more restricted than on Class 1 or 2 land,
- soil depth and drainage can be variable,
- conservation measures are necessary under cropping,
- soil physical features and/or slope restrict the amount of cultivation the land will tolerate between pasture phases.

In addition they may have a range of limitations from among the following:

- slope,
- erosion hazard,
- adverse soil characteristics (e.g. stoniness, internal drainage, soil structure, nutrient deficiencies),
- salinity hazard,
- periodic flooding,
- climate.

Class 4 land has a similar set of limitations to those described above for Class 3 but the limitations are more severe so that only occasional cropping is possible, and/or the range of crops able to be grown is severely restricted. Slopes may range up to 30%. Major soil conservation practices may be necessary under cropping.

Class 5 land has many of the following features:

- slopes can range up to around 40%,
- land may be broken by gullies and surface irregularities,
- the degree of stoniness, wetness or other physical limitations prevents the cultivation of the soil for cropping,
- erosion hazard may be moderate to severe,
- nutrient deficiency, acidity or salinity may depress but not prevent plant growth.

Class 6 land is often very steep, rocky or wetlands.

The land may have either a single very severe limitation or a combination of several severe limitations from among the following:

- slope,
- stoniness or rockiness,
- erosion hazard,
- soil physical limitations,
- salinity,
- surface water, flooding,
- nutrient deficiency,
- climate, altitude.

These limitations make this class of land unsuitable to be cleared for grazing and steeper areas should be left under a vegetative cover, because of the potential erosion hazard and low productivity. Conservation measures including revegetation or retention of existing vegetation cover should be adopted.

Class 7 land has a similar set of limitations to those described for Class 6 but the limitations are very severe to extreme, making this land unsuitable for agricultural use.

Note:

1. Slope ranges given are the maximum slopes for the most stable soils in Tasmania (i.e. soils on basalt). Other less stable soils will have slope ranges lower than these for each capability class (see Section 10).

2. The frequency of crop rotations will vary according to the soil type and slope of the land. The cropping rotations indicated are a guide to ensure that soil structure is maintained or improved, thereby preventing degradation of the soil resource under cropping regimes. This applies particularly to sloping land that has the potential to be cultivated for cropping.

3. Slope conversions.

Slope in percentage (%)	Slope in degrees (°)
5	3
12	7
18	10
30	17
40	22

9. Description of Area Mapped

9.1 Topography

The topography of the area covered by the Tamar map varies according to the underlying geological formations which influence and control the landscape and landform features, and determine their resistance to erosion.

Subdued landscapes include alluvial flood plains, flat terraces and low rolling and dissected country, and are formed on;

a) recent alluvial sediments e.g. Meander River, Supply River;

b) windblown sands e.g. Beechford - George Town, Port Sorell;

c) terraces and infill sedimentary basins of Tertiary age clays, sands and gravels e.g. Tamar River terraces, Exeter basin, Parkham area, Birralee - Selbourne - Rosevale - Westwood area, and Port Sorell - East Sassafras area. Some of these areas have undergone subsequent erosion and dissection, while areas capped by basalt have remained relatively preserved;

d) basalt at Thirlstane - East Sassafras, Moltema - Dunorlan; and

e) mudstones and sandstones at Beaconsfield and Parkham.

Steeper hill country occurs on dolerite at Rubicon Hills, Wurra Wurra Hills, Black Sugarloaf Ridge and Tippogoree Hills; and on Permian age mudstones, siltstones and sandstones in the Frankford, Holwell and Glengarry areas.

The highest points on the map are comprised of rocks that are highly resistant to erosion, typically dolerite and quartzite.

The majority of the steepest areas and areas of higher elevation on the map occur in unmapped areas of Forestry Commission land and National Parks such as: Peaked Hill - 340 m; Tippogoree Hills - 350 m; Asbestos Range National Park - Point Vision 350 m; The Tump - 450 m; Mt Careless - 460 m; The Dazzler Range - 520 m; Christmas Hills - 530 m; and Stephens Hill - 540 m.

Some of the steepest areas mapped occur around Mt George - 250 m; Tippogoree Hills - 300 m; Brushy Rivulet - 300 m; Drys Sugarloaf - 320 m; Rubicon Hills, Notley Hills - 350 m; Black Sugarloaf Ridge - 380 m; Stewarts Hill - 420 m; Black Sugarloaf - 500 m; and Kellys Lookout - 550 m. Apart from the higher peaks mentioned, the overall altitude of the undulating low land increases from sea level at the coast to 200 m along the southern boundary of the map around Elizabeth Town and Westwood.

The map area is dissected by the river estuaries of Port Sorell, Port Dalrymple and the Tamar River, and by the north westerly trending Dazzler and Asbestos Ranges, Tippogoree Hills, Rubicon Hills and Black Sugarloaf Ridge.

9.2 Climate

The area experiences a mild to cool maritime climate which is favourable for agricultural production. This maritime influence decreases with distance inland from the coast, and with increasing altitude. Average monthly maximum and minimum temperatures for selected stations in the region are shown in Table 4.

Seasonal variation in temperatures is greater in inland areas. Summers are generally mild to warm, and winters cool to cold. Frosts can be a limiting factor for cropping in some areas, especially inland, and at higher altitudes. Frost information for selected stations is shown in Table 5.

A less favourable climate for cropping occurs in the southern half of the map. In particular, areas with better soils that are used for cropping around Moltema, Dunorlan and Weetah, are affected by frosts. The area around Selbourne and Westwood also experiences a cooler climate than areas further north, and is similarly affected by frosts. Figure 3 shows the average dates of first and last occurrences of air frosts in Tasmania. On average Deloraine experiences more than 100 frosts per year, whereas High Plains experiences around 60 frosts per year. In contrast, Low Head experiences around 10 frosts per year.

Average annual rainfall increases from 700 mm at the coast to 1 000 mm in the central and south western areas of the map (Holwell, Elizabeth Town) and decreases towards the south eastern corner of the map to approximately 700 mm (at Westwood).

Because of the prevailing westerly weather flows, rainfall increases on the western side of the Dazzler Range and the Great Western Tiers and decreases in associated rain shadow areas on the eastern side. Refer to Figure 4 and Table 6 for rainfall information.

Winter predominant rainfall tends to be more reliable than in other seasons. Localised flooding occurs during winter and spring, in particular along the Meander River. Most of the mapped area experiences a summer dry period, and irrigation is a common practice, particularly in cropping and dairying areas. Summer droughts can occur in some years.

Prevailing winds are generally from the west and north west sectors, although variations do occur depending on the time of year, and localised orographic features. Figure 5 shows wind rose information for Low Head and Launceston. During the summer months, afternoon sea breezes are common in coastal areas.

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Station	Altitude (m)	Distance from coast (km)	Temp	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Deloraine	250		Max	21.3	22.5	19.6	16.5	13.2	10.9	10.4	11.4	13.3	15.5	17.7	20.1	16.0
			Min	7.7	8.7	6.3	4.5	2.7	1.0	0.9	1.2	3.1	4.4	5.4	7.2	4.4
George Town	20		Max	22.0	22.8	21.1	18.2	15.3	12.9	12.6	13.2	14.3	16.2	18.3	19.8	17.2
			Min	12.1	12.7	11.1	8.8	6.6	4.5	4.2	4.6	5.6	7.1	9.2	10.5	8.1
Low Head	15		Max	20.2	20.8	19.5	17.1	14.5	12.4	11.8	12.3	13.4	14.9	16.8	18.7	16.0 9.4
			Min	12.8	13.2	12.1	10.3	8.3	6.5	5.9	6.3	7.4	8.6	10.0	11.6	

Table 4: Average maximum and minimum temperatures for selected stations (^{o}C)
(Source: Australia, Bureau of Meteorology, 1990, Average and Extreme Maximum and Minimum Temperatures, Selected Tasmanian Stations. Commonwealth Bureau of Meteorology, Hobart, (unpublished)).

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Deloraine	(a)	11	11	11	11	11	11	11	11	11	11	11	11	
1962-72	(b)	1.5	1.5	3.5	7.5	14.9	17.2	19.3	16.5	12.1	9.6	4.4	1.8	110.1
	(c)	0.2	0.6	1.2	3.9	8.9	12.2	12.8	10.0	6.3	3.9	1.0	0.2	60.9
Low Head	(a)	33	33	33	33	33	33	33	33	33	33	33	33	
1939-72	(b)	-	-	-	-	0.8	2.2	4.0	2.8	0.8	0.1	-	-	10.7
	(c)	-	-	-	-	0.2	0.2	0.5	0.2	0.1	-	-	-	1.2

(a) Number of months of records
(b) Air temperature equal to or less than 2^oC (light frost)
(c) Air temperature equal to or less than 0^oC (heavy frost)

Table 5: Average frequency of frost (days per month)

(Source: Australia, Bureau of Meteorology, 1980, Climatic Survey, Tasmania, Region 3, Northern. Australian Government Publishing Service, Canberra).

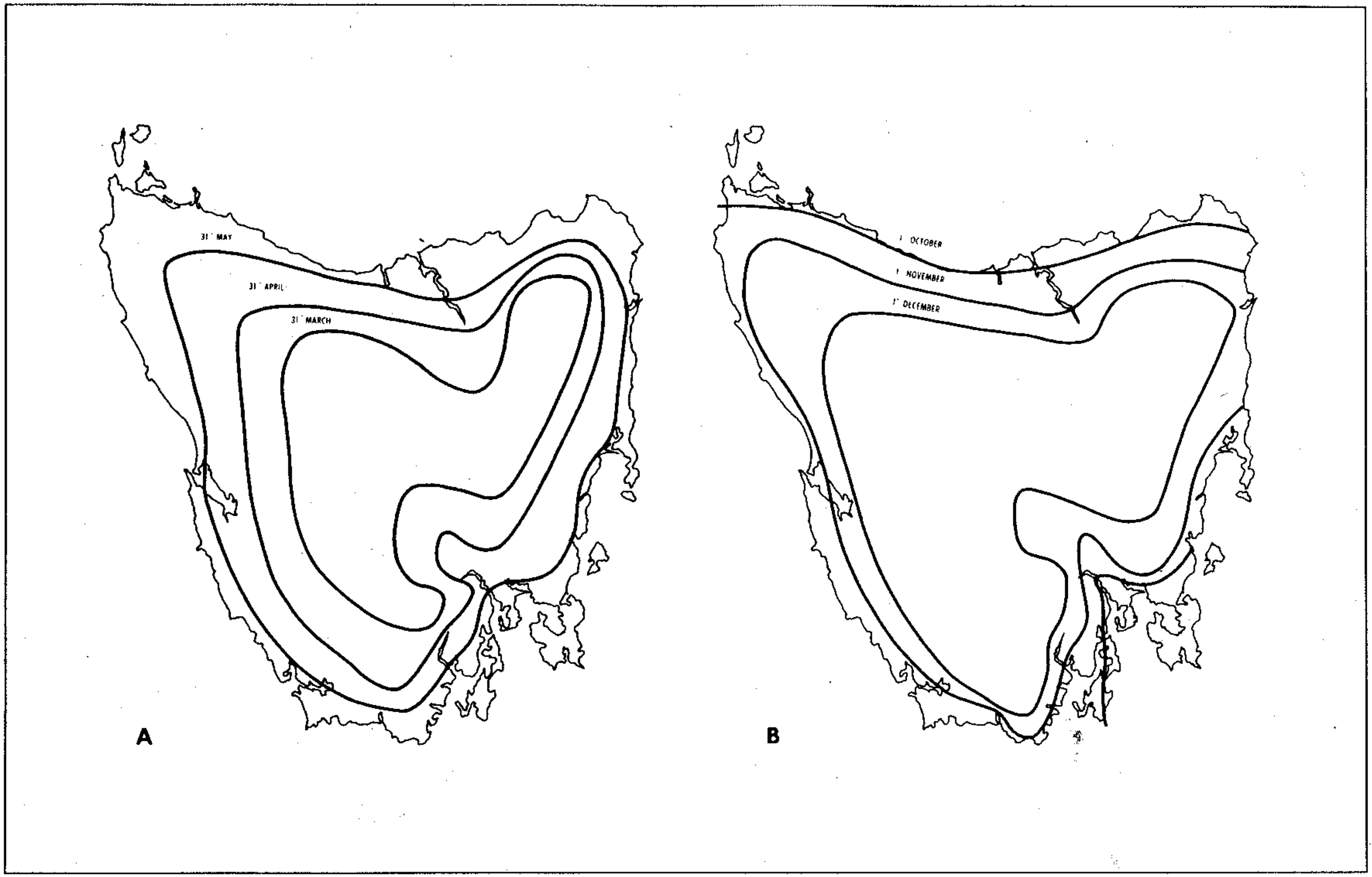


Figure 3: Average dates (A) first occurrences and (B) last occurrences of air frosts in Tasmania.

(Source: Langford, J., 1965, Weather and Climate, in Atlas of Tasmania. Land and Surveys Department, Hobart)

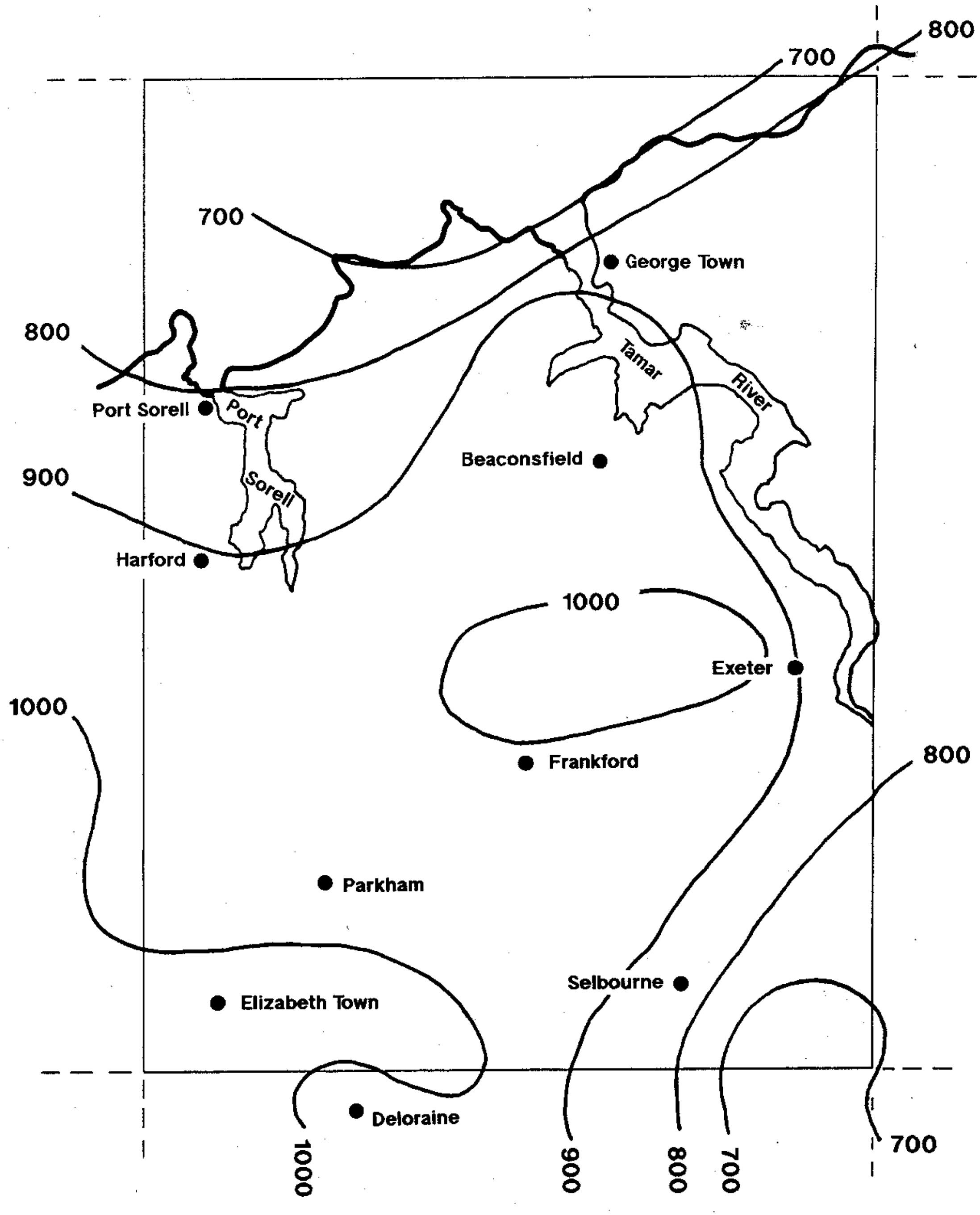
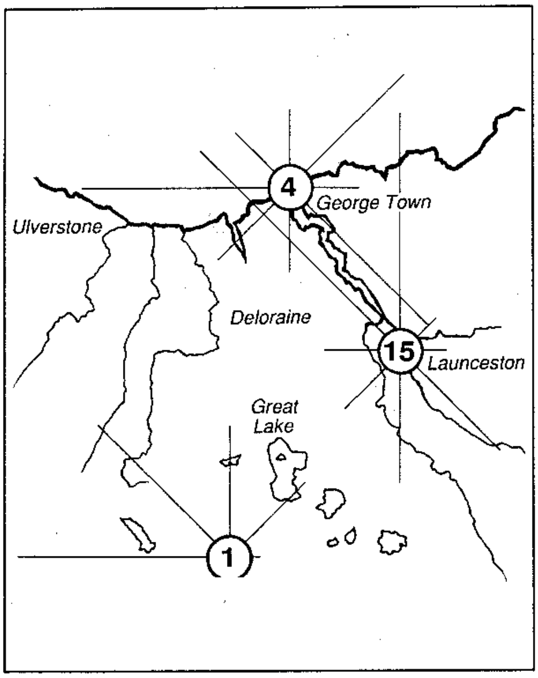


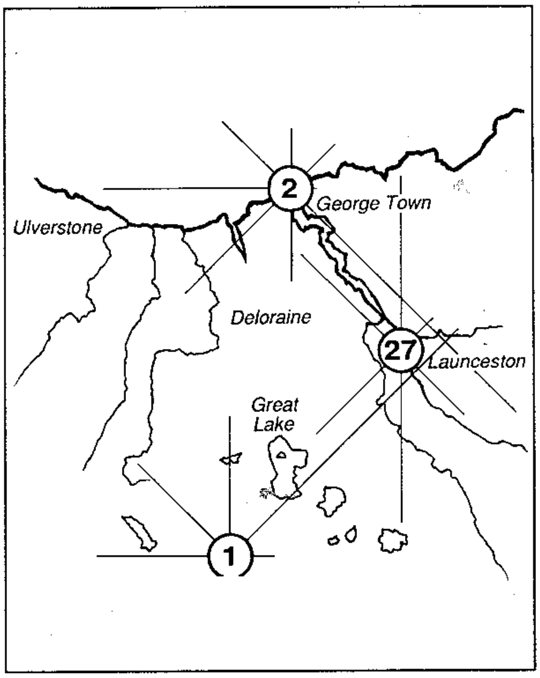
Figure 4: Average annual rainfall (in millimetres) of Tamar map.
(Source: Hydro Electric Commission, 1986, Average Annual Rainfall Map of Tasmania (1:500 000 scale map, unpublished) Hobart, Tasmania.)

Station	Period of Record	No. of full years of records	Average Annual Rainfall	
			(in)	(mm)
Beaconsfield[2]	1908-1927	20	34.4	874
Beaconsfield[2]	1928-1956	29	39.3	998
Beaconsfield[3]	1908-1973	66	37.5	954
Blackwall[2]	1929-1930	2	41.0	1041
Clarence Point[2]	1915-1932	18	33.9	861
Clarence Point[2]	1933-1939	7	29.0	737
Dunorlan[2]	1941-1945	3	35.6	904
Frankford West[2]	1893-1958	65	41.9	1064
Frankford West[3]	1893-1973	79	42.3	1075
George Town[1]	1968-1978	11	34.5	876
Glengarry[2]	1899-1955	56	40.0	1016
Glengarry[3]	1950-1973	24	37.7	959
Glengarry Exp Farm[2]	1931-1956	21	37.1	942
Gravelly Beach[2]	1909-1935	25	33.5	851
Hillwood[2]	1931-1956	26	33.2	843
Kelso[2]	1930-1956	26	30.9	785
Kelso West[2]	1930-1973	42	30.4	773
Kimberley[2]	1917-1924	8	37.3	947
Lefroy[2]	1913-1945	29	32.8	833
Lefroy[3]	1913-1973	47	34.3	872
Low Head[2]	1883-1958	76	27.2	691
Low Head[3]	1882-1973	91	26.8	683
Low Head Lighthouse[1]	1877-1982	105	27.8	706
Moltema[2]	1915-1937	23	39.8	1011
Parkham[2]	1917-1945	29	38.4	975
Selbourne[2]	1919-1945	25	34.3	871
'Riverdale', Selbourne[2]	1954-1957	4	39.1	993

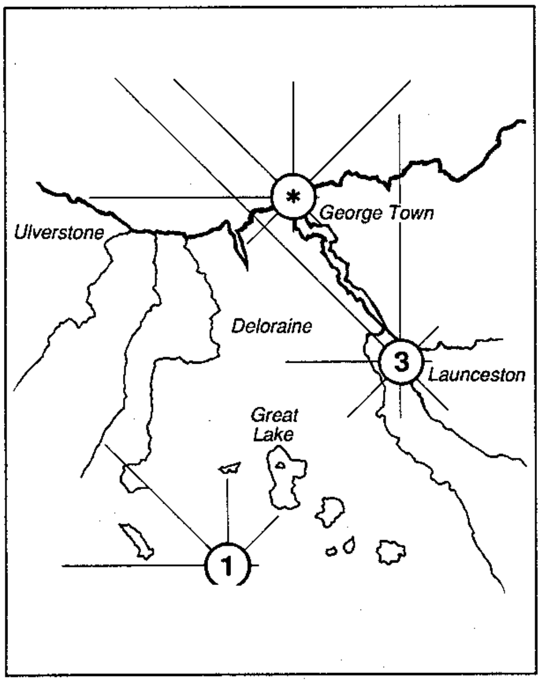
Table 6: Average yearly rainfall for selected stations.
(Source: 1. Australia, Bureau of Meteorology, 1988, Climatic Averages Australia. Australian Government Publishing Service, Canberra.
2. Nicolls, K.D. & Aves, S.M., 1961, Average Yearly Rainfall in Tasmania. Commonwealth Bureau of Meteorology, Melbourne.
3. Australia, Bureau of Meteorology, 1980, Climatic Survey, Tasmania. Region 3, Northern. Australian Government Publishing Service, Canberra.)



Direction of recorded winds for January - 9 am.

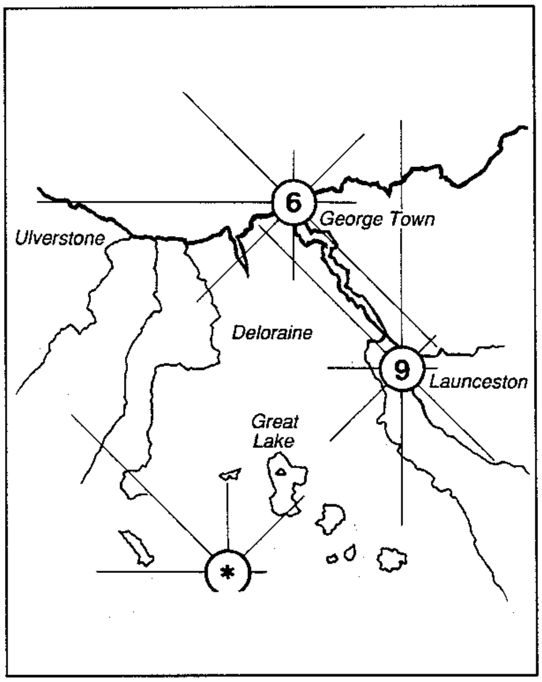


Direction of recorded winds for July - 9 am.



Direction of recorded winds for January - 3 pm.

(9) *Number of recorded calms.*
(*) *No observations available.*



Direction of recorded winds for July - 3 pm.

(9) *Number of recorded calms.*
(*) *No observations available.*

Figure 5: Wind rose information for Low Head and Launceston.
(Source: Langford, J., 1965, Weather and Climate, in Atlas of Tasmania. Lands and Surveys Department, Hobart.)

9.3 Land Use

The major land uses within the Tamar map area are grazing, dairying, cropping and forestry. Sheep grazing predominates over beef cattle, with grazing occurring on improved pastures, native pastures, partially cleared areas, steeper country and stony land.

Dairying is concentrated in the higher rainfall areas in the south west corner of the map, around Parkham, Moltema and Dunorlan. Other areas of dairying occur in the West Tamar area around Frankford, Glengarry, Winkleigh and Flowery Gully. Supplementary irrigation is used during summer months to boost pasture production for dairying.

Three major areas of intensive cropping occur on the map: Thirlstane - East Sassafras area, Moltema - High Plains area, and Selbourne - Westwood area. These areas are generally confined to the red basaltic soils (krasnozems), although because of the complex soil pattern, other areas of poorer grey sandy soils are often utilised. The risk of out of season frosts and shorter growing seasons in the southern areas of the map, reduce the range and yields of crops compared with the northern area around Thirlstane.

The major crops grown are peas, potatoes, onions, beans, poppies and cereals, in particular barley. Forage and green fodder crops are also grown for stock feed (oats, turnips, etc).

Vineyards are situated along the Tamar Valley at Rowella, Kayena, Sidmouth, Deviot and at Glengarry. Apple orchards and berry fruit farms are situated at Hillwood, Sidmouth, Glengarry and Elizabeth Town.

Floriculture is a developing industry in the Elizabeth Town, Port Sorell and Glengarry areas.

In recent years there has been a proposal for an irrigation scheme which would include the south west and south east areas of the Tamar map. The availability of irrigation water would boost the production of crops in the area, although care would have to be taken on the more fragile soils to ensure that soil structural decline, salinity and drainage problems were not exacerbated. This would apply particularly to the Parkham and Selbourne - Quamby Bend areas.

Forestry is also a major land use, with private and commercial forests providing wood for both pulp and sawlogs. Forestry occurs mainly on the dolerite, sandstones, slate and quartzite country, with the majority occurring in unmapped exclusion areas of State Forests.

For further information on land use statistics in Tasmania, refer to `Australian Bureau of Statistics, 1992. Agricultural Statistics Tasmania, 1990-91. Catalogue No. 7114.6.'

9.4 Geology

A wide range of rock types and soil parent materials occur across the Tamar map area. They include Quaternary age alluvium and windblown sand; Tertiary age sand, clay, gravel and basalt; Jurassic age dolerite; Triassic and Permian age sandstone, siltstone and mudstone; Lower Palaeozoic and Ordovician age sandstone, limestone and quartzite; and Cambrian and Precambrian slate, sandstone, siltstone and quartzite.

The geology and geological history of the area has a major influence on the present day topography and landforms. For example, dolerite generally forms rugged, steep and stony landforms because it is highly resistant to erosion, whereas mudstones and sandstones are less resistant, forming lower subdued landforms. Rock type strongly influences the erosion types, drainage characteristics and soil types, and is a major factor influencing land capability.

The Tamar map covers part of two physiographic regions of Tasmania: the Tamar Graben and the North East Coastal Platforms (refer to Figure 6).

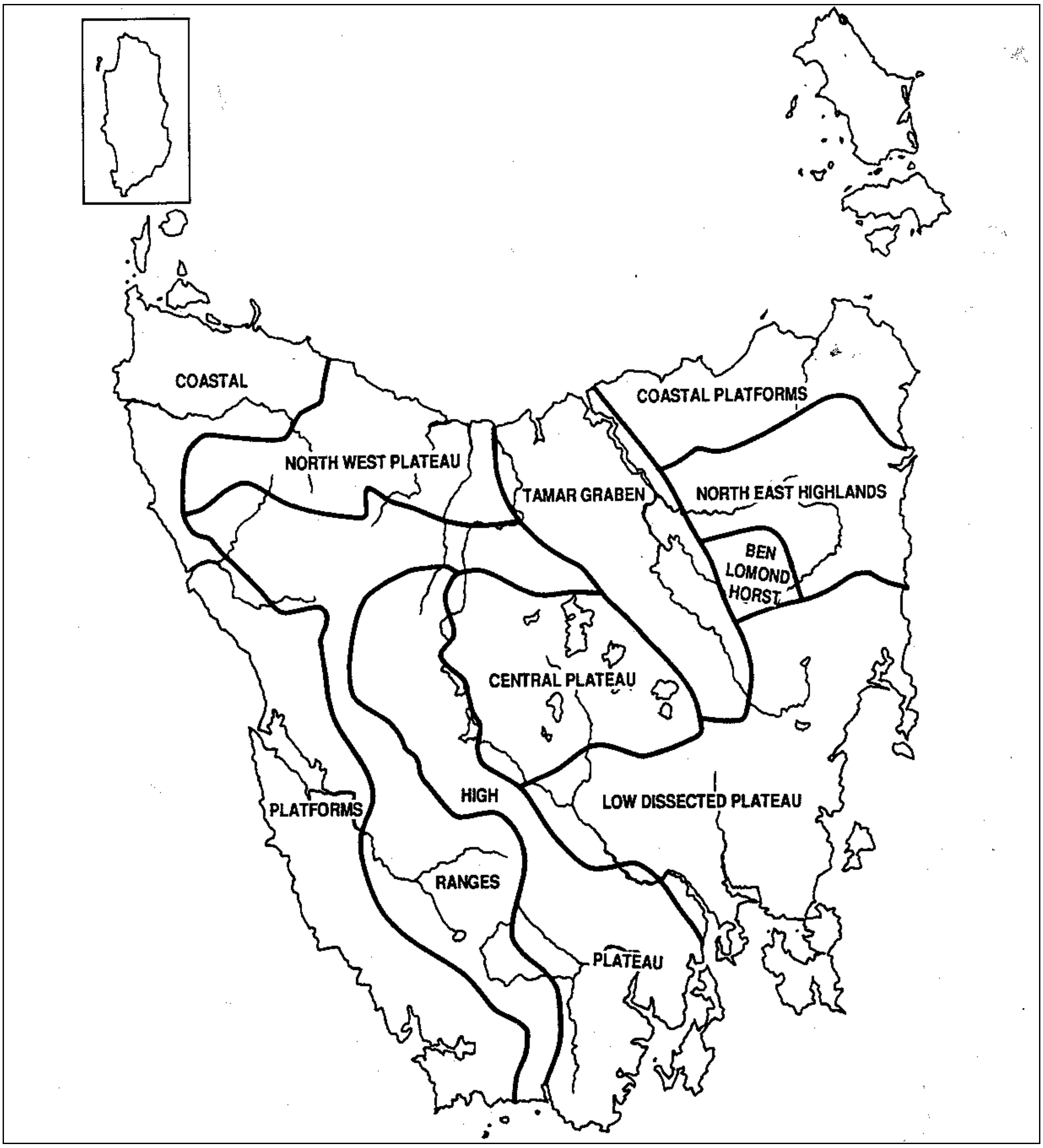


Figure 6: Physiographic regions of Tasmania.
(Source: Australian Bureau of Statistics, 1988, Tasmanian Year Book. Page 32.)

The Tamar Graben was formed by major faulting with a north westerly trend. The north eastern side of the Graben has been dissected by the present Tamar River which drains into the Tamar Estuary. This estuary, and Port Sorell in the north west, are former river valleys drowned by post glacial sea level rise. Many of the fault depressions which occur in the Graben, have been infilled by Tertiary deposits of clays, sands and gravels.

The southern half of the Graben (which is to the south east of the Tamar map) incorporates the Launceston Tertiary Basin. The terrace country around Selbourne and Rosevale is the north western most expression of the Launceston Tertiary Basin.

The Tamar Graben is further dissected by the Asbestos and Dazzler Ranges (quartzite and slate), and large areas of dolerite intrusion which form high points in the landscape.

Where resistant rocks such as dolerite and quartzite outcrop along the coastline, they form steep prominent headlands, often with vertical cliffs (e.g. Point Sorell, Badger Head, West Head).

Along the northern coastline, extensive areas of sand plains and windblown sand dunes occur. These areas are part of the North East Coastal Platforms, which consist mainly of undulating low sand plains, with parallel dune ridges and blow-out dunes. These coastal platforms have been formed by seaward extensions of emerged platforms, by processes of coastal accretion and have subsequently been covered by windblown sands. Coastal sand plains occur east of George Town, with smaller areas around Greens Beach, Badger Beach, Bakers Beach and Port Sorell.

The oldest rocks on the Tamar map are the quartzites, slates and greywackes of Precambrian and Cambrian age. The major occurrence of these rocks is in the exclusion areas of the Dazzler Range and Mt Careless. Other localities where these rock types have been mapped are Franklin Rivulet, Cabbage Tree Hill, Salisbury Hill and Peaked Hill.

Associated with these older rocks, and formed by tectonic activity and igneous intrusion is an area of serpentinite, pyroxenite and gabbro, known as the Andersons Creek Ultramafic Complex. These rocks occur in a small area around Andersons Creek, west of Beaconsfield.

The Mathinna Beds, of Lower Palaeozoic age, are a sequence of sandstones and siltstones which have undergone severe deformation such as folding, induration and metamorphism. These occur in the Lefroy area, with smaller outcrops north towards Beechford and George Town, which have been subsequently covered in part, by younger sediments such as windblown sands.

Limestone of Ordovician age occurs in the Flowery Gully area, and this is presently being mined for commercial fertilisers and industrial use.

Sandstone of Triassic age occurs in the Notley Hills - Bridgenorth area, on the eastern side of Tippogoree Hills, around Exeter, and east of Parkham. The sandstone, together with other sediments principally of Permian age, have been intruded by dolerite which now forms a protective cap. Where these sediments have been protected from erosion by the dolerite, they form steep slopes. However where there is no protective capping, landscapes are more subdued and have lower relief (Refer to Photo 2).

Permian age mudstones, sandstones and siltstones occur around the northern and eastern slopes of Mt George and Tippogoree Hills, in the Beaconsfield area, and in the West Frankford - Birralee, Holwell - Glengarry - Bridgenorth, and Paramatta Creek - Parkham localities.

Extensive areas of dolerite occur throughout the map area, mostly in forested exclusion areas. The dolerite is Jurassic in age, and has intruded into the older basement rocks (Permian and Triassic). It occurs as very thick sheets with feeder dykes, and is highly resistant to erosion. It has been uplifted by faulting and many of the higher points in the landscape are capped by dolerite, with the exception of Asbestos Range, Dazzler Range and Mt Careless (e.g. Stephens Hill, Christmas Hill, Black Sugarloaf, Tippogoree Hills).

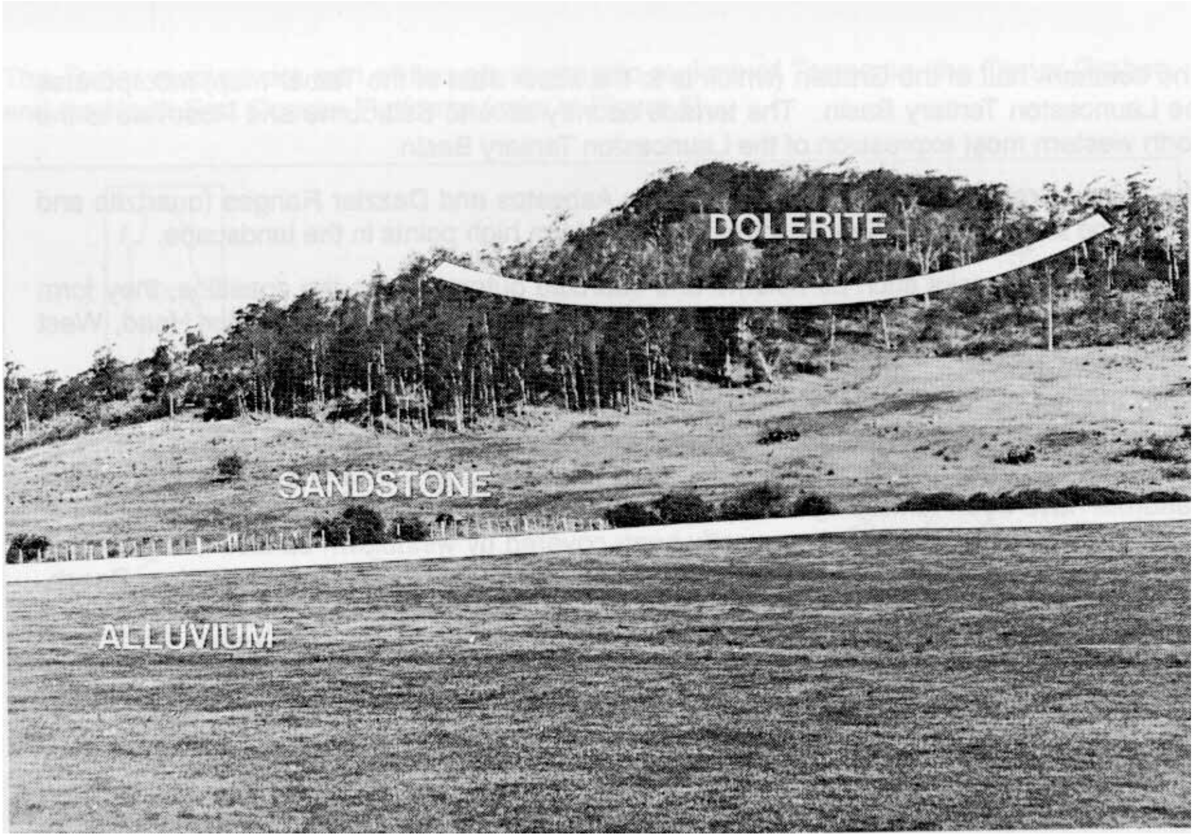


Photo 2: Landscape showing alluvial basin (foreground), with Triassic sandstone (lower slopes), capped with dolerite above. Tamar map 952175*. Bridgenorth Road.

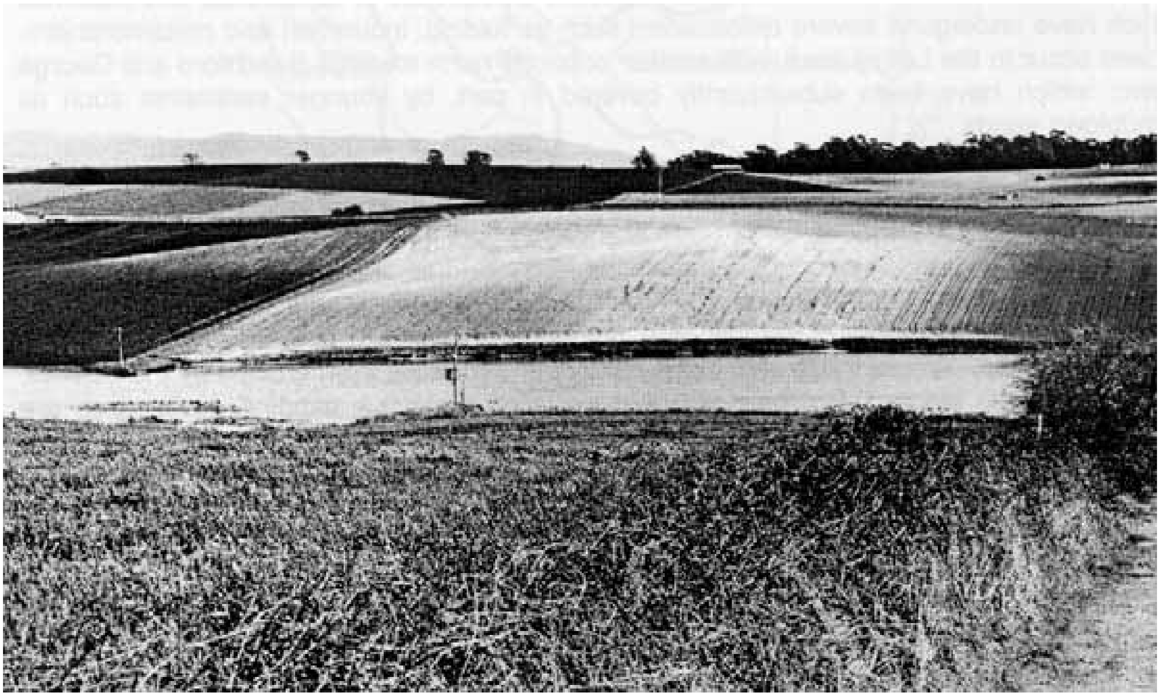


Photo 3: Landscape showing mosaic of soils formed from basalt (dark colours) and Tertiary sediments (light colours). Tamar map 586325. Valleyfield Road.

* Grid references based on the 1:100 000 Tasmap Series

Areas of dolerite talus occur around the margins of these dolerite bodies, and often overlie the older basement rocks through which the dolerite has intruded (e.g. slopes of Christmas Hill, Stephens Hill, Black Sugarloaf, Notley Hills). The orientation of the dolerite ridges follow a north west - south east trend, which has been determined by the faulting pattern within the Graben. Other areas of dolerite occur at: Rubicon Hills, Wurra Wurra Hills, Brushy Rivulet, Dalgarth Hill, Drys Sugarloaf, The Tump, Grassy Hut Tier, The Long Hill, West Head, Sidmouth, Blackwall, Point Sorell and east of George Town.

Tertiary age deposits of sands, clays and gravels are also extensive throughout the mapped area. Localities are along the Tamar River, Selbourne - Westwood area, around Parkham and West Frankford, and in the East Sassafras - Port Sorell area. These deposits are the result of Tertiary sedimentation into the Tamar and Port Sorell troughs, and associated depressions.

There are also areas of basalt occurring throughout the map which have been extruded as volcanic eruptions in Tertiary times. In some areas (e.g. Moltema and Dunorlan), the basalt flows completely overlie and protect the associated underlying Tertiary sediments as plateau cappings, while in other areas (e.g. East Sassafras), the situation is more complex with at least two basalt flows interlayered between the Tertiary sediments (refer to Figure 7 and Photo 3.) In some areas these sediments were partly eroded before further eruptions took place. The landscape, soil and land capability patterns form a dissected mosaic, complicated by the sporadicity of basalt outcrops and subsequent erosion.

It is probable that the basalt flows in the East Sassafras area are a continuation of the Thirlstane and Moriarty Basalts, as identified further west in the Devonport area, and the Tertiary sediments between them correlate to the Wesley Vale Sand (refer to Figure 7). The Thirlstane Basalt overlies the Harford Beds. These basalt flows are mainly valley fills from a number of small eruptive centres along the floors of Pre-Tertiary river systems.

Other areas of basalt occur in the Selbourne - Westwood area, and either side of the Tamar River near George Town. Basanitic dolerite (a coarse grained basalt) occurs in the Rowella - Hillwood - Windermere areas.

Some of the basalt flows have influenced or changed the direction of flow of some rivers, in particular the Tamar River.

The youngest deposits consist of Quaternary age alluvium, swamp deposits, and windblown sands. The alluvial deposits occur along river flats and terraces, and range from confined river valleys to broad depositional infill basins. The major areas of alluvium are found in the Exeter Basin, Meander River flats, Reedy Marsh, around Elizabeth Town and The Avenue Plains.

Windblown sands occur predominantly along the coastal areas. Quaternary talus deposits occur around the margins of some of the basalt and dolerite bodies.

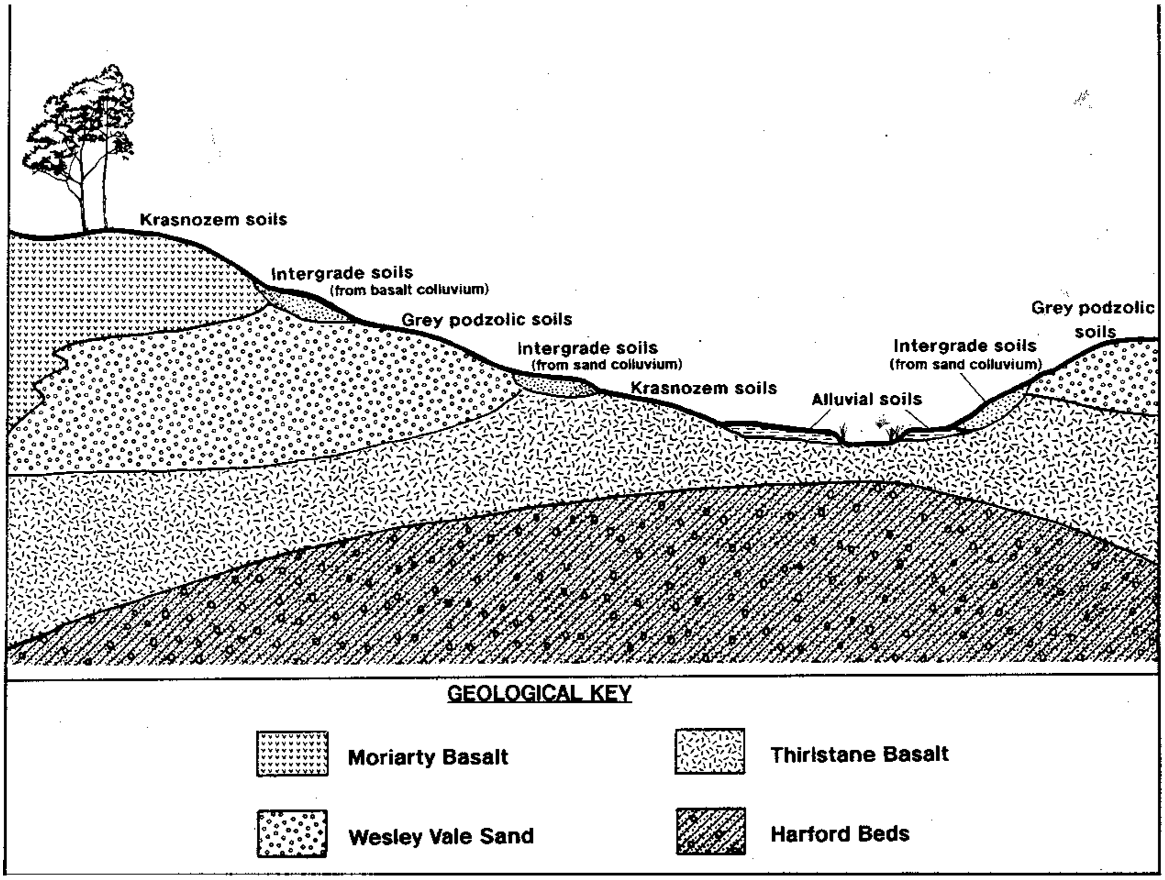


Figure 7: Cross section showing the complex landscape, geological and associated soil patterns in Tertiary sediments and interbedded basalt flows.

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9.5 Soils

The soils of the area are very diverse, resulting from the highly variable geology. They have a complex distribution pattern and have variable profile types which range in colour, depth, structure and texture.

Soil information is available in a number of maps and reports. The published George Town area soil map covers the area between Low Head, Bell Bay, Lefroy and Beechford (Nicolls, 1957). The unpublished Beaconsfield Soil Survey covers the Beaconsfield Municipality, which includes approximately one third of the map area (Dimmock, unpublsihed). A reconnaissance extension of this survey has been mapped covering the Tamar and part of Pipers 1:100 000 map sheets, however this information is also unpublished as work on this map was never completed (Kershaw, unpublished). The unpublished soil survey of part of the Parish of Lewis covers the north eastern corner of the map, east of Beechford (Stephens, unpublished).

Generally speaking, the majority of soils on the Tamar map are poor for cropping use because of poor structure, low fertility or stoniness. However the areas on red basalt soils around Thirlstane - Sassafras, Moltema - High Plains and Selbourne - Westwood have good structure which can withstand regular cropping, although they have low to moderate chemical fertility. (See Section 10.1 for further description of krasnozem soils.)

In the Thirlstane - Sassafras area where the basalt is interlayered between the Tertiary clays, sands and gravels, a very complex soil pattern occurs (refer to Figure 7). Below the basalt outcrops, areas of basalt colluvium are mixed with grey podzolic soils, resulting in a mosaic of kraznozem soils, intergrade or transitional soils which are not true krasnozems, and grey podzolic soils. This soil pattern is visually very evident when these areas are cultivated. An example is shown in Photo 3.

Podzolic soils are fairly extensive throughout the Tamar map area. Podzolic soils are characterised by a sandy, leached A_2 horizon, with clay accumulation in the B horizon, and are also referred to as duplex soils (soils with clayey subsoils). They occur on a wide range of parent materials including sandstones, siltstones, quartzites, slates and sand, gravel and clay deposits. These duplex soils are relatively infertile and are low in nitrogen, phosphorus, potassium and molybdenum. Some areas also have copper and selenium deficiencies which can affect animal production. They are generally very acid with topsoil pH less than 5.0, and require liming and relatively high fertiliser inputs to be farmed successfully. They also have poor soil structure and low organic matter levels, which render them prone to wind and water erosion and unsuitable for general cropping use.

Soils on mudstones have high clay contents in subsoils with poor structure which tend to make them prone to waterlogging. In addition topsoils can also be highly erodible and B horizons are often dispersive.

Soils on dolerite are variable in terms of soil depth and the amount of stones and boulders present throughout the profile. Topsoils are generally grey or grey-brown sandy or silt loams, over heavier clay subsoils. Most of the dolerite soils are imperfectly drained with slow permeability. The major limitation to cropping of the soils on dolerite is the amount of rock outcrops, the presence of surface and subsurface stones and shallow soil depths. The dolerite soils are moderately acid with topsoil pH generally between 5.0 and 6.0. The majority of soils on dolerite are grey-brown podzolic soils. Small areas of lateritic podzolic soils also occur, which have an accumulation of ironstone gravel in the A_2 and upper B horizons. Some areas of krasnozem soils occur under higher rainfall, and these soils have strong red colours, deep profiles, and are friable and well drained.

Podzols occur on the windblown sand deposits near the coast. These soils usually have a dark peaty topsoil overlying a strongly leached light grey sand (A_2 horizon), and a brownish black organic-iron layer which may form a cemented pan. Iron and organic matter has been leached from the A_2 horizon and deposited in the B horizon. The sand may continue for many metres in depth below this pan. These soils are highly susceptible to wind erosion and are unsuitable for cropping because of poor soil structure, low moisture holding capacity and low fertility. Many of these soils, especially those in interdune depressions or drainage lines, are also waterlogged during winter.

Podzol soils may also occur on Tertiary sands and sandy gravel deposits, Triassic sandstones, and Ordivician and Cambrian quartz sandstones and quartzites.

Recent alluvial soils which occur along the major river and stream valleys, are generally deep and have a range of textures from sandy loams to heavy clays. Some of these alluvial soils would be well suited to cropping in areas not subject to regular flooding or frosts, and many areas would benefit from the installation of drainage. The alluvial soils are usually moderately acid, with pH around 5.5 - 6.0.

Some of the soils in the Selbourne - Rosevale - Westwood area, and on a remnant terrace near George Town, are similar to the Woodstock, Brickendon, Cressy and Brumby Soil Associations which are found more extensively further south in the Launceston Tertiary Basin (refer to Quamby Soil Map, Nicolls, 1959).

Some of the soil associations referred to in the text relate to soils from the Quamby Soil Map. Table 7 summarises the major characteristics of the Soil Associations mapped within the Beaconsfield Municipality. The unpublished report which accompanies the Beaconsfield Soil Survey gives further information on the Soil Associations, including profile descriptions and laboratory data.

A copy of the draft Soil Association map of the Beaconsfield Municipality is included in the rear of this report. Special attention should be given to the fact that this soil map was prepared and printed as a draft, and was never published.

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Association	Dominant Soils	Soil Profile	Landscape Features	Parent Materials
ASBESTOS (A)	Lithosols and yellow podzolic soils with some red podzolic soils.	Shallow dark grey sandy loam; over mottled brownish grey and light brownish grey silt loam; over mottled sandy clay loam or clay	Rugged, steep and rocky slopes	Precambrian and lower Palaeozoic sediments (quartzites, phyllites, conglomerates)
BEACONSFIELD (B)	Podzols	Dark grey loamy sand; over light grey or white loose sandy gravel; over white gravelly sand	Undulating surface ranging in elevation from 450' in SW to 100' in NE. Much white angular quartz gravel on surface	Late - Tertiary (marine?) quartz - gravels and sand
CRAYTHORNE (C)	Krasnozems	Dark reddish brown clay loam; over dark red clay' over red to mottled red, yellowish red, yellowish brown and white friable clay	Rolling plateau top	Tertiary basalt
DALRYMPLE (D)	Podzols and Groundwater podzols	Dark grey sand; over greyish brown to light brownish grey sand; over mottled dark grey to yellowish brown and light grey loose to strongly cemented sand	Gently undulating coastal sand plain, ranging in elevation from 30' to 100' or more	Pleistocene littoral sands
EASTFIELD (E)	Grey-brown podzoloc soils	Grey fine sandy loam or silt loam; over light grey fine sandy loam; over dark to very dark yellowish brown clay	Rugged hilly with frequent rock outcrops	Jurassic dolerite
(E-k)	As above with small areas of krasnozems		Rugged hilly with frequent rock outcrops	Jurassic dolerite
ECCLESTONE (Ec)	Lateritic krasnozems, lateritic podzolic soils, grey-brown podzolic soils	Dark brown clay loam; over reddish brown light clay; over red to mottled red, yellowish brown and white clay	Rolling to hilly, with some rock outcrops	Laterized Jurassic dolerite, Tertiary ferruginous sediments, Jurassic dolerite
FLOWERY GULLY (FG)	Terra rossas and other soils	Dark brown silty clay loam to light clay; over dark brown to reddish brown silty clay; over yellowish red clay	Steep slopes with subdued rock outcrops; some sinkholes	Ordovician limestone

Table 7: Soil; Associations, Beaconsfield Municipality.

(Source: Dimmock, G. M., 1964, Report to accompany Beaconsfield Soil Survey, Unpublished Private Communication.)

Association	Dominant Soils	Soil Profile	Landscape Features	Parent Materials
HOLWELL (H)	Podzolic and yellow podzolic soils	Dark greyish brown loam or fine sandy loam; over dark greyish brown light clay; over dark brown blocky clay	Steep slopes; elevation between about 500' and 1400'	Permian mudstones and siltstones
KELSO (K)	Calcareous coastal sands	Dark greyish brown sand; over dark greyish brown to yellowish brown sand; over brown to yellowish brown calcareous sand	Stabilised dunes and beach ridges	Recent calcareous sands
LEGANA (L)	Yellow podzolic soils, lateritic podzolic soils, podzols	Dark grey to dark greyish brown fine sandy loam or sandy loam; over fine sandy loam to sand; over yellowish brown clay	Easy rolling to rolling. Some dissected terraces	Tertiary sands, clays and gravels
NORTON (N)	Yellow podzolic soils	Dark grey silt loam; over mottled light brownish grey and light yellowish brown silty clay loams; over light yellowish brown silty clay loam	Easy rolling to rolling	Cambrian and Ordovician sediments (slates, sandstones and siltstones)
ROBIGANA (Rb)	Podzols, black clays, saline soils, shallow, brown soils	Sand, over thin sandy organic; over mottled sandy clay to sandy clay loam	Marine benches at 10-15', 30' and 40-50' above present SL; some superimposed low sand dunes in places	Pleistocene and ? Recent marine sediments - sand and gravelly clays
ROSEVEARS (Rv)	Mixed yellow podzolic soils, krasnozems and shallow brown soils	Brownish yellow sandy loam; over bleached sandy clay; over brown or dark reddish brown stiff clay	Rolling to hilly; frequent slump benches; some steep rocky scarps	Mixed Tertiary clays and basalt
ROWELLA (R)	Shallow brown soils with small areas of podzols and yellow podzolic soils	Dark brown fine sandy loam; over dark brown to yellowish red clay loam; over dark yellowish red clay	Easy rolling to rolling low plateaux; steep slopes near plateaux edges	Tertiary basalt with some overlying Tertiary sandy and clayey sediments

Key to soil associations (cont)

Association	Dominant Soils	Soil Profile	Landscape Features	Parent Materials
STOCKPORT (Sp)	Generally fine textured hydromorphic soils, sometimes saline; small areas of groundwater podzols	Dark crumbly silty clay loam or clay loam; over dark grey blocky clay; over mottled dark grey and olive brown plastic clay	Lagoon floors with small areas of super-imposed sand dunes	? Pleistocene or Recent swamp deposits - clays and some gravels
SUPPLY (S)	Fine textured hydromorphic soils	Dark grey silt loam, silty clay loam or fine sandy clay loam; over mottled dark grey or yellowish brown clay, silty clay or fine sandy clay over grey clay	Mainly present day floodplains but includes some older terrace remnants	Recent alluvium - fine sandy clay and silty clays
TAMAR (Tm)	Saline grey soils usually fine texture	Dark organic clay or sandy loam; over light sand and sandy clay to grey sticky clay; over dark grey sticky clay	Low-lying waterlogged flats less than 5' above H.W.M.	Recent estuarine deposits - clays and some sands
TATANA (T)	Podzols	Dark grey to light brownish grey sand with organic matter; over light brownish grey sand; over mottled yellowish brown, olive brown, dark brown loose sand	Very gently undulating to easy rolling. General absence of rock outcrops	Permian and Triassic siliceous sandstones
VULCAN (V)	Lateritic krasnozems and other soils	Reddish brown fine sandy loam; over reddish brown fine sandy clay loam; over dark red and weakly mottled red clay	Easy rolling to rolling. Much ironstone gravel on surface; a few strong outcrops of "iron ore" capping low hills	Cambrian ultrabasic rocks
WARRINA (W)	Yellow podzolic soils	Fine sandy loams, sandy loams or silt loams; over mottled light yellowish brown, brown and grey fine sandy clay loam; over bright grey with strong brown and red mottling, sandy clay	Very gently undulating to rolling or hilly, up to about 500' elevation	Permian mudstones and siltstones
YORK TOWN (YT)	Podzols and yellow podzolic soils	Black to very dark grey loamy sand; over grey to light grey to greyish brown sand; over mottled yellowish brown clay	Gently undulating to easy rolling marine (?) plain, sloping from about 180' to 80' or 90'	Tertiary clayey and gravelly sediments

Key to soil associations (cont)

10. Description of Land Capability Classes on Tamar Map

The following sections describe the different types of land which have been mapped in the seven land capability classes found on the Tamar map. The complexity of the pattern of land capability mapped is a reflection of the complex geology, soil types and topography found on this map. A stylised cross section of the West Tamar area showing landform, geology, soil and land capability relationships is shown in Figure 11, at the end of this section.

The majority of land mapped on the Tamar map is Class 4 land, followed by Class 5 and Class 6. The area and percentages of land on the Tamar map is shown in Tables 1 and 9.

10.1 Class 1 (42 ha, 0.02% of Tamar map land area)

Class 1 land on basalt

One area of Class 1 land has been mapped on soils from basalt (krasnozems) at Brierley Grove, west of East Sassafras. Another area east of Thirlstane has been mapped as a complex of Class 2 and Class 1 land. An example of Class 1 land on basalt is shown in Photo 4.

The krasnozem soils have been formed on basalt flows which were extruded in Tertiary times as a result of volcanic eruptions. They are deep, well structured and free draining soils, suitable for intensive cropping use.

Typical krasnozem soil profiles have a strong granular structured, dark red or reddish brown, friable, clay loam A horizon; over a well structured, dark red brown to red brown, friable, clay B horizon; grading to reddish, friable clay with increasing amounts of weathered basalt.

Soil depths are commonly greater than one metre. Topsoil pH levels are moderately acid, ranging between 5.0 and 6.5, and stay more or less constant with depth. Because the soils are free draining and have a strongly developed granular structure, they are easy to work over a wide range of moisture conditions. Organic matter content is high in the surface horizons, and needs to be maintained by the use of green manure crops. This would help maintain the excellent soil structure and retain minerals essential to plant growth.

Topsoil erosion and leaching, particularly in deeply weathered basalt profiles, can result in a loss of nutrients such as calcium, potassium, sulphur, magnesium and nitrogen. These losses can be combatted by the accumulation of nutrients in organic matter in the surface horizons. Phosphorous and molybdenum retention are also common problems on krasnozem soils, and can be combatted by the application of lime and mineral fertilisers (superphosphate and molybdenum super).

Because most of the available nutrients are held in the topsoil, it is extremely important that this topsoil layer be preserved. If lost through erosion, an important part of the nutrient supply is lost. The subsoil horizons lack a high level of available nutrients and higher levels of fertiliser application are required to maintain production.

Class 1 land on basalt can range up to 5% slope. This may include areas of flat land or areas which receive runoff from surrounding slopes, which may require minimal drainage to prevent waterlogging or the accumulation of surface water. Where this is not possible, these areas may be downgraded to Class 2 land.

Class 1 land occurs in areas of favourable climate in the northern half of the map. These areas have a mild maritime climate with less seasonal variation in temperatures compared to areas inland, and a low incidence of frost. Frosts do occur in some areas during winter, however they are generally not a significant hazard to cropping use. Although rainfall is around 800 - 900 mm per annum, any moisture deficits during the growing season can be boosted by on-farm water supplies for irrigation.

The range of crops that can be grown on Class 1 land is the most extensive for any area in Tasmania. Crops include berry fruits, pyrethrum, essential oils, all vegetable and allied crops, cereals, fruit, flower crops and forage and green fodder crops. Yields are consistently high for all crops, and can be boosted further by fertiliser and irrigation inputs.

Class 1 land on basalt is the most versatile land in Tasmania. Because of the excellent soil structural properties, these areas can be cropped intensively. However they still require periods out of cultivation (pasture phases) to maintain soil structure. Compaction by cropping machinery and soil structural decline are potential forms of land degradation on this type of land, and should be monitored closely.

Table 8 summarises the major features of the land capability classes on basalt, according to slope, stoniness and climatic limitations.

Photo 4: Class 1 land on basalt (foreground). Class 2 land on basalt in background. Tamar map 589295. Brierley Grove Road.

CLASS	SLOPE	CROPING VERSATILITY	CLIMATIC LIMITATION	STONINESS LIMITATION	EROSION TYPES (under cultivation)	SOIL MANAGEMENT MEASURES REQUIRED (under cultivation)	LENGTH OF CROPPING PHASE (years out of 10)	LIMITATIONS TO AGRICUALTURAL USE
1	0-5%	All annual crops	Nil	Nil	Nil to slight sheet and rill	No special management practices	8-9 years	None
2	5-12%	All annual crops	Nil	Nil	Slight to moderate sheet and rill	Minor conservation works	5-8 years	None
2	0-5%	All crops except frost tender	Slight	Nil	Nil to slight sheet and rill	No special management practices	8-9 years	Climate
2	5-12%	All crops except frost tender	Slight	Nil	Slight to moderate sheet and rill	Minor conservation works	5-8 years	Climate
3	12-18%	All annual crops	Nil	Nil	Moderate sheet and rill, slight gully	Major conservation works	2-5 years	Slope
3	5-12%	Slightly restricted range of crops	Nil	Moderate	Nil to moderate sheet and rill	None to minor conservation works	2-8 years	Stoniness
3	12-18%	Restricted range of crops	Slight to moderate	Nil	Moderate sheet and rill, slight gully	Major conservation works	2-5 years	Climate, slope
3	0-12%	Restricted range of crops	Slight to moderate	Moderate	Nil to moderate sheet and rill	None to minor conservation works	2-8 years	Stoniness, climate
4	18-30%	Restricted range of crops	Nil	Nil	Severe sheet, rill and gully	Major conservation works	1-2 years	Slope
4	0-18%	Restricted range of crops	Nil	Moderate to severe	Nil to moderate sheet and rill, slight gully	None to major conservation works	2-5 years	Stoniness
4	18-30%	Restricted range of crops	Slight to moderate	Nil	Severe sheet, rill and gully	Major conservation works	1-2 years	Climate, slope
4	0-18%	Severely restricted range of crops	Slight to moderate	Moderate to severe	Nil to moderate sheet and rill, slight gully	None to major conservation works	2-5 years	Stoniness, climate

Table 8: Features of land capability classes on basalt according to slope, stoniness and climatic limitations.

10.2 Class 2 (604 ha; 0.33%)

Class 2 land on basalt

Class 2 land on basalt has been mapped in the Thirlstane and East Sassafras areas, and at High Plains (south of Weetah).

The basalt soils (krasnozems) are similar to those described in Section 10.1. However slopes on Class 2 land are steeper than on Class 1, and can range up to 12%.

To preserve the excellent soil structure and the long-term potential of this land for cropping, Class 2 land should not be cropped in rotation for more than five to eight years, in a ten year cycle. Soils are generally stable, particularly under pasture. When under crop, minor soil conservation works such as graded drains may be necessary to limit sheet and rill erosion. Compaction by cropping machinery also needs to be limited in order to prevent compaction of topsoils which may result in decreased infiltration rates.

At present the areas of Class 2 land on basalt are used for intensive cropping, in particular vegetable crops. The range of crops able to be grown are the same as those mentioned for Class 1 land, excluding however the area at High Plains, which experiences a much higher incidence of frost. The risk of out of season frosts and shorter growing seasons in comparison to the Thirlstane and East Sassafras areas, slightly reduce the range and yields of crops that can be grown here. For this reason i.e. climatic limitation, this area of land has been classified as Class 2.

Average annual rainfalls are between 800 and 900 mm for the Thirlstane-East Sassafras area, and around 1 000 mm at High Plains.

Refer to Photo 5 which shows a typical example of Class 2 land on basalt, and Table 8 which summarises the major features of the land capability classes on basalt, according to slope, stoniness and climatic limitations.

Photo 5: Class 2 land on basalt. Tamar map 584288. Bass Highway.

10.3 Class 3 (10 061ha; 5.52%)

Class 3 land on basalt

Areas of Class 3 land on basalt occur in the following localities: Thirlstane-Harford-East Sassafras, Moltema-Dunorlan-High Plains, and in the Selbourne-Westwood area. Refer to Photo 6 and Table 8.

As with Class 2 land on basalt, the areas in the north western corner of the map have a more favourable climate for crop growing than areas in the south.

The areas mapped as Class 3 land on basalt in the Thirlstane-Harford-East Sassafras area are part of the Tertiary basalt flows, and soils are similar to those on Classes 1 and 2 on basalt.

The soils on basalt in these areas are deep krasnozems with well drained profiles and good soil structure. Refer to Section 10.1 for a description of krasnozem soils. They are suitable for cash cropping but because of the higher slope angles, cultivation and crop rotations should be limited in order to maintain soil structure, prevent loss of top soil by erosion, and to preserve the long term sustainability of this land for cropping.

Slopes are steeper than those on Class 2 land, ranging between 12 and 18%, with the result that the land is more susceptible to water erosion under an intensive cropping regime. Therefore more intensive soil conservation works are required than that on Class 2 land, and careful soil management practices are necessary when cropping is carried out. These measures would include grassed waterways and cut off drains at frequent intervals to intercept surface water flow, and the use of cover and green manure crops to maintain organic matter content and to protect soils from sheet, rill and gully erosion.

At present most of the areas in the Thirlstane-Harford-East Sassafras area on krasnozem soils are being used intensively for cropping purposes. Rainfalls in this area are between 800 and 900 mm.

The areas of Class 3 land on basalt in the southern half of the map are also part of the Tertiary basalt flows, but are a little more variable in terms of the range of slope angles, stone content, soil depth and soil type, than those nearer the coast. These differences may be a reflection of different mineralogical composition, rates of weathering, climate or drainage properties. Stony krasnozems tend to be more common in areas inland from the coast, and some are relatively shallow. In some areas the amount and size of stone is a limitation to cultivation.

Soils are variable with areas of typical krasnozem soils as well as brown and black soils on basalt. These brown and black soils reflect poorer site drainage due to run-on and ground water seepages.

The effects of climate in this area (frosts and shorter growing seasons), reduce the range and yields of crops in comparison to the areas in the north. Rainfall ranges between 700 and 800 m in the Selbourne-Westwood area, and around 1 000 mm in the Moltema-Dunorlan area.

Slopes can range up to 18%. Because of the additional limitation of stoniness and climate, some slopes less than 12% are mapped as Class 3 land.

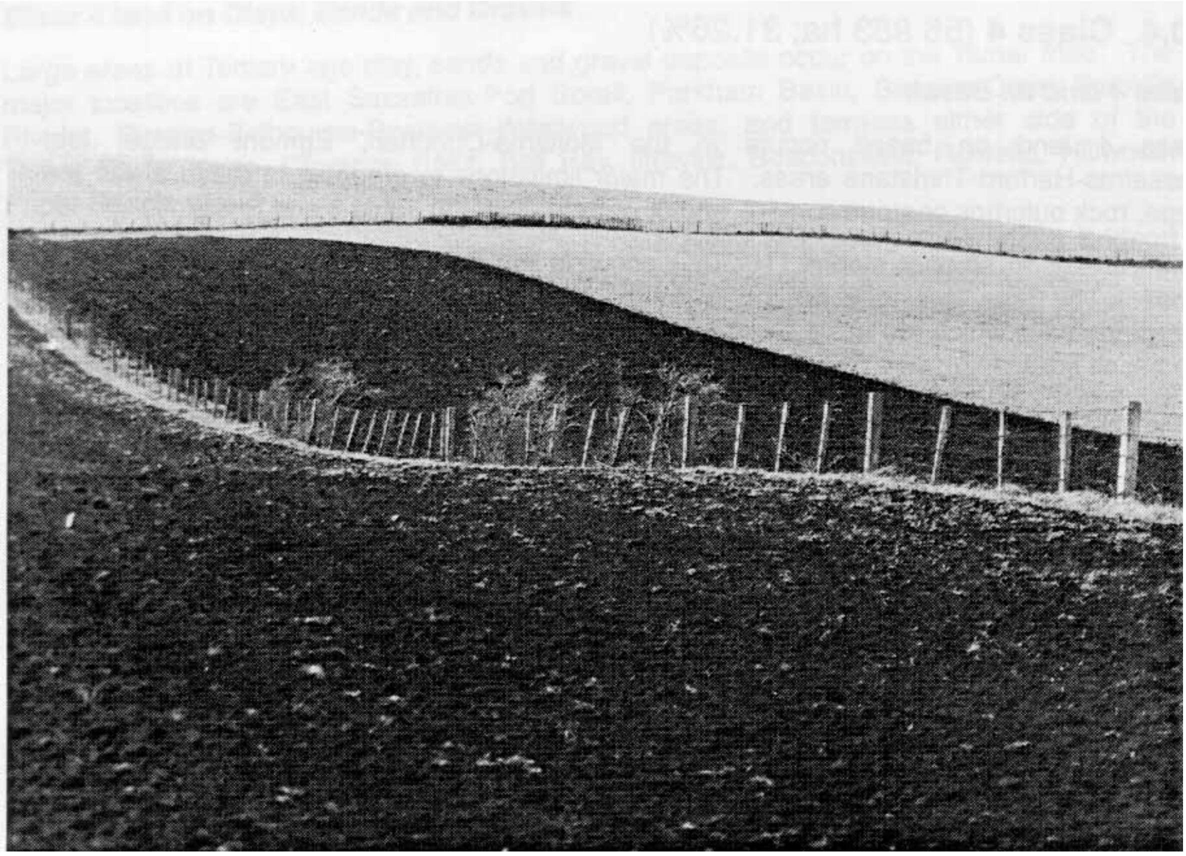


Photo 6: Class 3 land on basalt. Tamar map 593329. Chapel Road.

Other Class 3 land

Around the margins of the basalt flows and outcrops in the Thirlstane-Harford-East Sassafras area, and in small areas at Selbourne and Westwood, are areas of shallow krasnozems, and basalt colluvium admixed with other soils, which form a complex mosaic (Refer to Figure 8). The soils in this area are not true krasnozems, and although they can be used for cropping, they cannot withstand the same intensity of cropping as the krasnozem soils because of their inferior soil structure. Soil profiles are variable in depth and texture. They are not as free draining as krasnozems and often have impeded subsurface drainage, particularly on flatter areas. Slopes can range up to 18%, with some areas on the lower basalt outcrops occurring as flat or undulating terraces.

Other areas of Class 3 land occur around the Quamby Bend-Westwood area on terraces with lateritic podzolic soils of the Cressy Association (Refer to Quamby Soil Map, Nicolls, 1959). The Cressy soils have a loam to clay loam surface texture, overlying friable clay. Ironstone gravel can occur throughout the profile. The Cressy soils in this area often merge with the basalt soils, and may be difficult to differentiate across the boundaries. The Cressy soils have the potential to be used for cropping, and in the past some areas have suffered from over cultivation. Therefore care needs to be taken in the management of these soils, particularly in the area of improving soil structure. Rainfall in this area is around 700 mm and climate (low rainfall and winter frosts) is an additional factor in the capability assessment of this land.

10.4 Class 4 (56 953 ha; 31.26%)

Class 4 land on Basalt

Class 4 land on basalt occurs in the Moltema-Dunorlan, Egmont Bridge, and Sassafras-Harford-Thirlstane areas. The major limitations to cropping in these areas are slope, rock outcrops or stone content, and/or climate (Refer to Table 8 and Photo 7).

Small areas on steeper slopes (18-30%) occur in the East Sassafras-Harford-Thirlstane areas. The area that they occupy is limited and they often occur alongside areas of intergrade soils which are more erosion prone and require more careful management, than the basalt soils.

If cultivation is carried out on these steeper slopes, major soil conservation works and careful soil management practices are necessary. This type of land is only suitable for occasional cropping (one to two years in ten). Although the basalt soils have excellent structure, frequent cropping on these steeper slopes may result in a deterioration of soil structure and induce high levels of soil erosion (sheet, rill and gully). Annual rainfalls in this area are between 800 and 900 mm.

The areas of this type of land that occur in the Moltema-Dunorlan area (e.g. Blackamoor Head, Brumbys Folly, Brooklyn Road) have a combination of slope, stoniness and climate limitations. Slopes can vary up to 30%. The stone content of the soil is also variable and limits cultivation in some areas. The cropping versatility of land in this area is more restricted than areas nearer the coast, because of frost hazard and shorter growing seasons. Rainfalls are around 1 000 mm per annum.

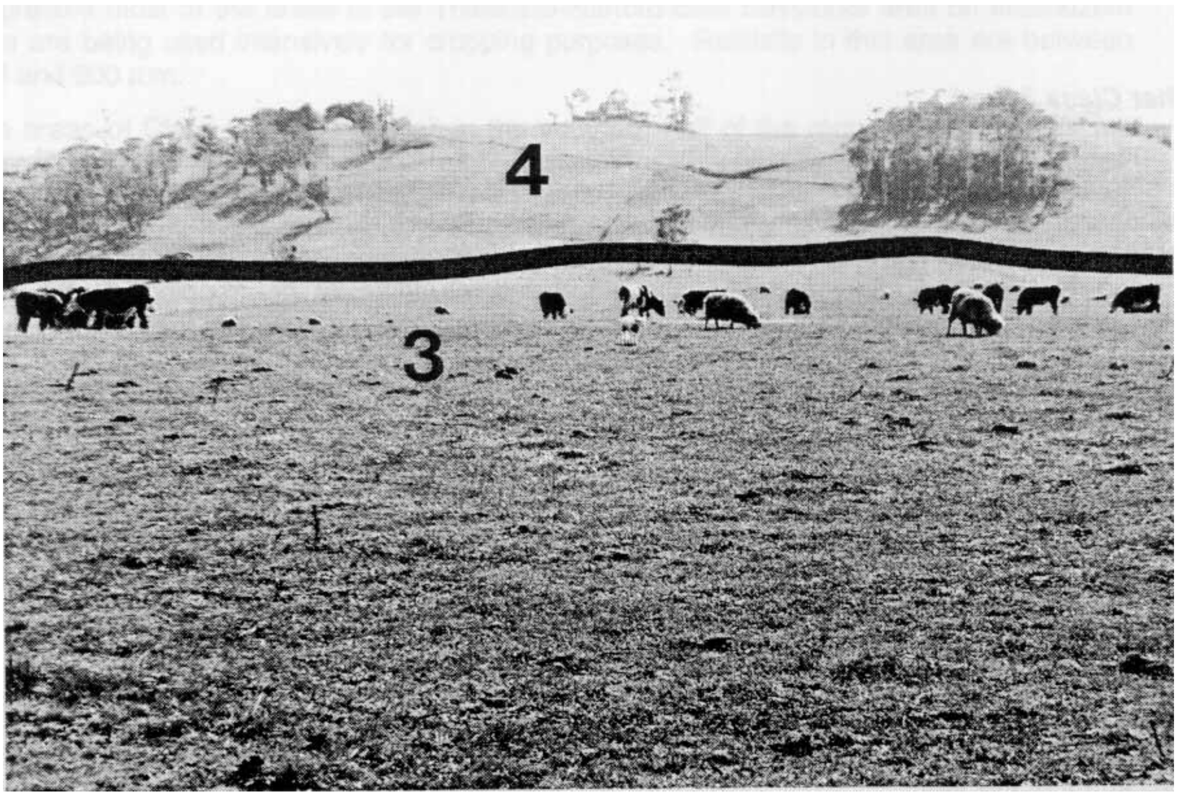


Photo 7: Class 4 land on basalt (background). Class 3 land on basalt in foreground. Tamar map 595103. Brooklyn Road.

Class 4 land on Clays, Sands and Gravels

Large areas of Tertiary age clay, sands and gravel deposits occur on the Tamar map. The major localities are East Sassafras-Port Sorell, Parkham Basin, Saxons Creek-Franklin Rivulet, Birralee-Selbourne-Rosevale-Westwood areas, and terraces either side of the Tamar River (Kelso, Clarence Point, Bell Bay, Ilfraville, Beaconsfield, Rowella, Hillwood, Paper Beach, etc).

Younger deposits mapped as Quaternary age also occur at Doctors Flats, along Bridport Road east of George Town, and include windblown coastal sands at Northdown Beach and on the Cimitiere Plain, and windblown alluvial sands which occur in pockets along the Meander River around Selbourne.

Soils are variable depending on the parent material on which they are formed. The major soil associations mapped in the Beaconsfield Soil Survey (Dimmock, unpublished), are the Legana, York Town and Robigana Associations.

The majority of soils mapped in the Legana Association are duplex yellow podzolic soils which have a strong lateritic influence. Typical profiles may have a dark grey sandy loam surface; overlying a pale compact sandy loam or sand A_2 horizon containing ironstone gravel; over a yellowish brown mottled clay.

The York Town soils are also yellow podzolics but have many quartz gravels associated with them. Typical profiles may have a dark grey loamy sand A_1 horizon; over a light grey sand A_2; and a mottled yellowish brown clay B with organic staining and coatings in the upper part. Quartz gravels occur throughout the profile, concentrated in the A_2 horizon.

The Robigana Association incorporates a wide range of soils including yellow podzolics, podzols and black cracking clays. In some areas basalt has contributed to, or underlies the sandy parent material. Laterite and siliceous gravels are also associated with many of these soils.

Soils on windblown alluvial sands are similar to the Panshanger soils, and there are small areas usually on terrace remnants that have soils which resemble the Brickendon, Woodstock and Cressy soils which occur in greater extent south of the Tamar map in the Launceston Tertiary Basin (refer to Quamby Soil Map, Nicolls, 1959).

In the East Sassafras-Port Sorell area typical soil profiles have a dark grey fine sandy loam A_1 horizon; over a bleached fine sand A_2; over sandy clay. These areas are often used for cropping in conjunction with adjacent areas on basalt; however these soils are less versatile, require higher fertiliser inputs and are more prone to erosion than the krasnozem soils.

Topography is generally flat and easy rolling terrace country, although some slopes up to around 15% do occur. Annual rainfalls range between 700 and 1 000 mm. Soil structural decline on the sandy soils, low fertility, the potential for sheet and rill erosion, and the shallow and gravelly nature of some of the soils, limit the cropping potential of this land. Photos 8 and 9 show examples of this type of Class 4 land.

Photo 8: Class 4 land on Tertiary clay, sand and gravel (foreground). Classes 3 and 4 on basalt in background. Tamar map 603328. Chapel Road.

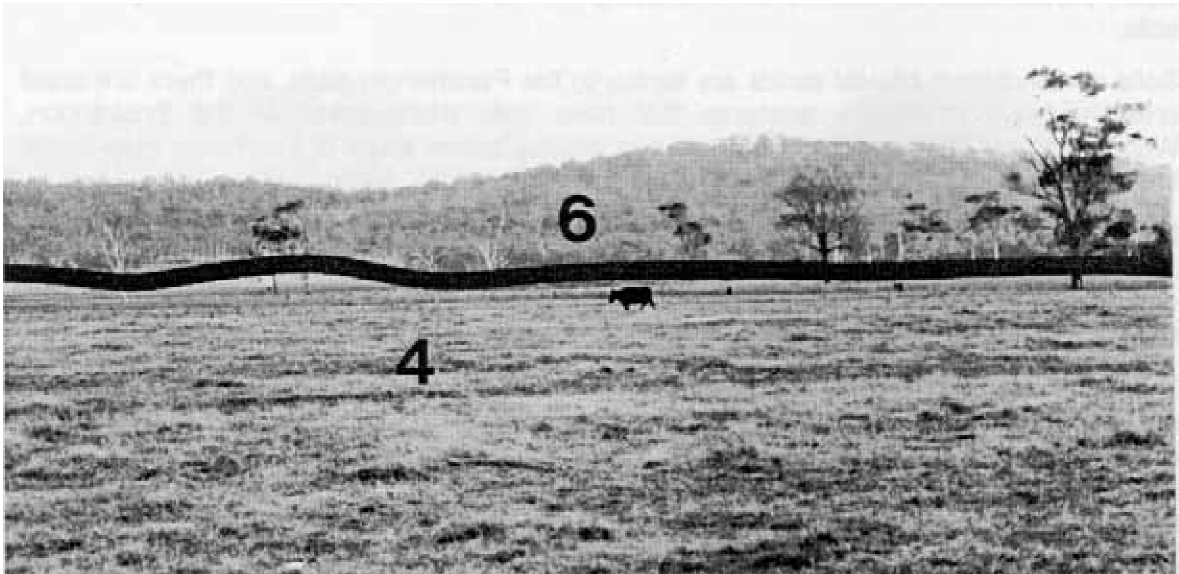


Photo 9: Class 4 land on terraces of Tertiary clay, sand and gravel. Class 6 land on dolerite in background. Tamar map 900425. North west of Rowella.

Class 4 land on sandstones, mudstones and siltstones

Class 4 land has been mapped on Permian age sandstones, mudstones and siltstones, and Triassic age sandstones. Slopes are variable, but can range up to 18%. They occur on the footslopes of steeper hill country, or as undulating slopes within larger valleys or basins where erosion has resulted in low relief landforms. Average annual rainfall ranges between 900 and 1 000 mm.

Localities where this type of Class 4 land occurs are: Winkleigh, Glengarry, Holwell, Frankford, West Frankford, Wings Flats, Franklin Rivulet, Parramatta Creek, Parkham Basin, Beaconsfield, and low rises within the Exeter Basin.

Soil associations mapped on the Beaconsfield Soil Survey (Dimmock, unpublished), are the Warrina and Tatana Associations. Soils can vary depending on which parent material they have developed from, but are predominantly yellow podzolic soils. Sandy podzols have also been mapped within the Tatana Association. The difference between the podzols and podzolics depends on the degree of development of the organic B horizon - where it is well developed, soils are classified as podzols; and where it is not strongly developed, but organic coatings do occur, the soil is classified as a yellow podzolic. Podzols are more commonly developed on sandy or siliceous parent materials, where clay, iron and organic matter are more easily transported and redeposited down the profile.

The Warrina Association soils are yellow podzolics with either duplex or gradational profiles. Duplex profiles are more common and tend to be shallower than gradational profiles. Siliceous gravels and stones can be common throughout and are often found scattered over the soil surface.

A typical soil profile of the Warrina Association may have a dark grey friable fine sandy loam A_1 horizon; over a grey massive fine sandy loam A_2; over a yellowish brown massive fine sandy clay loam A_3; and a yellowish brown mottled clay B horizon. Quartz gravels and waterworn siliceous pebbles are common in the surface horizons.

The Tatana Soil Association occurs on sandstones of both Triassic and Permian age. Typical profiles have a dark grey loose sand A_1 horizon; over a light brownish grey loose sand A_2; over dark brown cemented sand (organic B horizon); over a brown massive sandy clay loam B horizon.

In poorly drained areas soils may be gradational with sandy loam topsoils, or humus podzols (with well developed humus and iron B_2 horizons).

Boundaries between the Tatana and Warrina Soil Associations are ill defined and complex in areas of low relief. The Tatana, Warrina and Supply Association soils form a complex pattern within the Exeter Basin.

Because this type of land occurs on low angled slopes, the majority of it has been developed for agricultural use. However its potential for frequent cropping is limited because of low fertility, poor soil structure particularly on the sandier soils, and the potential for sheet, gully and rill erosion under cultivation. Intensive cultivation on these soils breaks down the structure of the A horizons, making them more vulnerable to erosion.

Photo 10 shows an example of this type of Class 4 land and Figure 8 illustrates the sequence of land capability classes on these deposits.

Photo 10: Class 4 land on Permian sandstones, mudstones and siltstones. Class 5 land on sandstones in background. Tamar map 828212. Frankford Road.

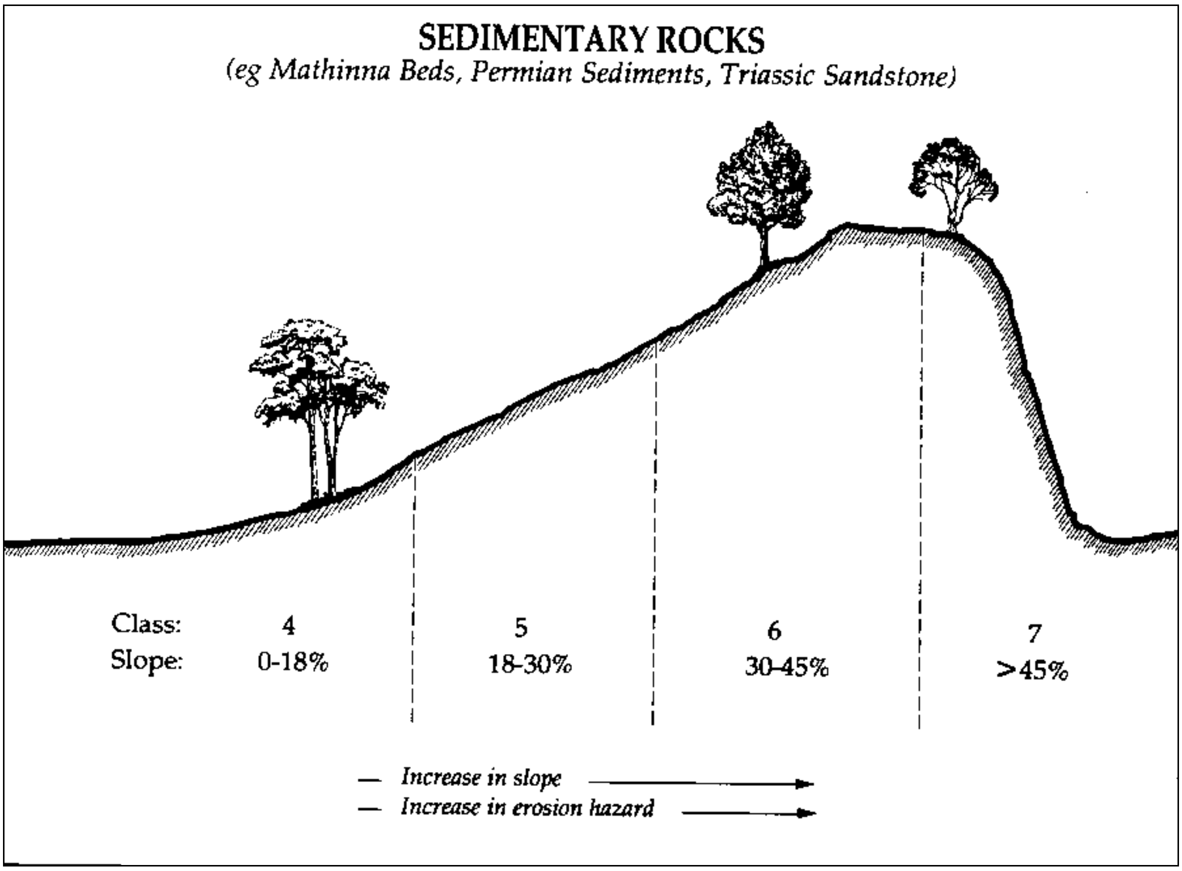


Figure 8: Relationship between land capability classes on sedimentary rock types.

Class 4 land on Alluvium

Alluvial flats adjacent to streams and rivers which are subject to occasional flooding or have poor internal drainage, have been mapped as Class 4. The frequency of flooding can vary, but is usually around two to three times per year. The time of year when flooding occurs is critical, as is the length of time the water stays on the land surface. The risk of flooding in these locations combined with either high water tables or slow internal soil drainage, limit the cropping potential of this land. Refer to Photo 11 for an example of Class 4 land on alluvium.

Localities where this type of Class 4 land occur are: river flats of the Rubicon River and its tributaries at Dunorlan, the Avenue Plains and Parkham Basin; Meander River flats and tributaries at Weetah, Reedy Marsh, Shoulder of Mutton Plain, Egmont, Selbourne, Pipers Lagoon and Pipers Lagoon Creek; Supply River flats and tributaries draining into the Exeter Basin; Middle Arm Creek south west of Beaconsfield, Saxons Creek (West Frankford), Westford and Eastford Creeks at Thirlstane, Johnston Creek (Flowery Gully) and at Holwell.

Class 4 land on alluvium occurs on a wide range of soils depending on the nature of the alluvial deposits. On higher terraces soils can be deep with brown silty to sandy loam textures. Areas with very sandy textures are freely drained and can dry out rapidly during dry periods. In more poorly drained lower areas soils can be grey clay soils with mottled and gleyed subsoils, or dark soils with heavy clay textures. These soils are more prone to surface ponding of water because of slow internal drainage.

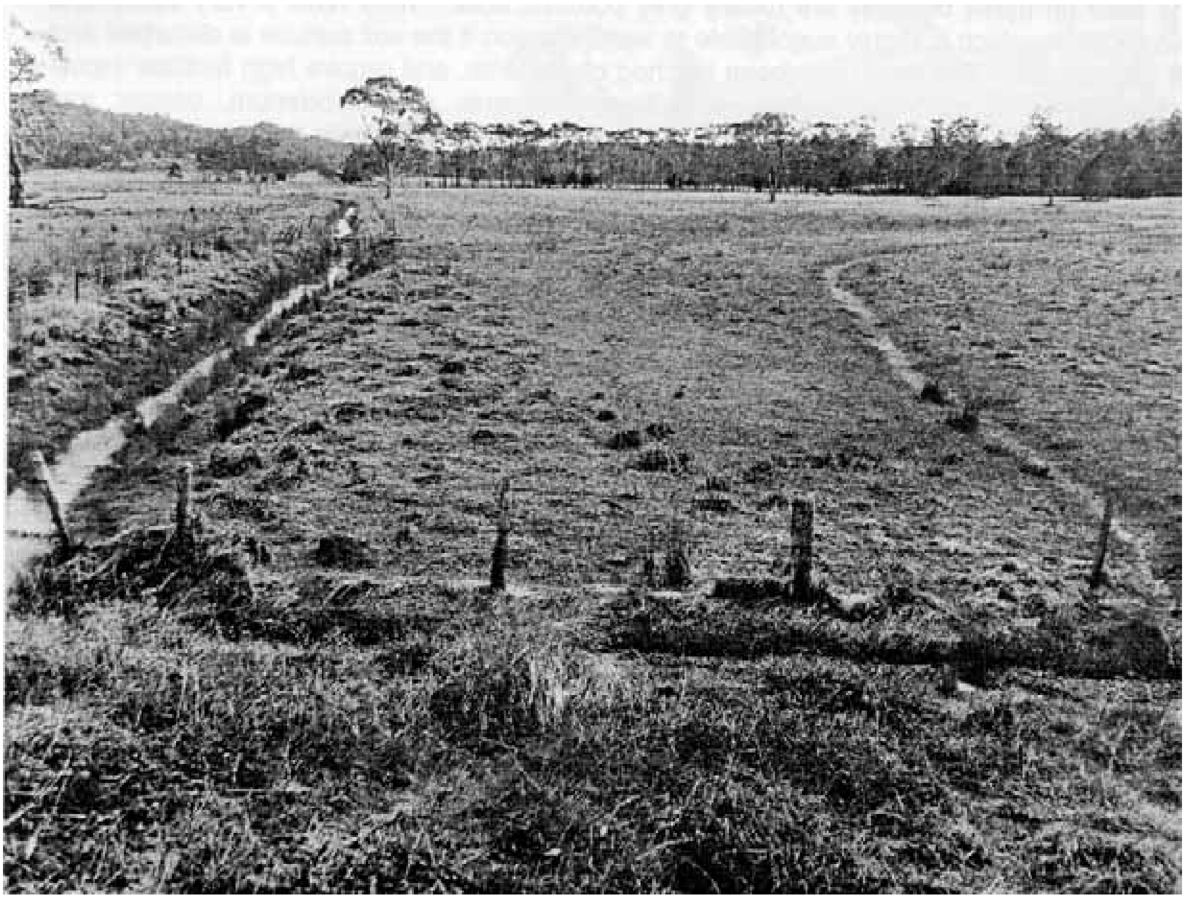


Photo 11: Class 4 land on alluvium. Tamar map 787065. Shoulder of Mutton Plain.

The Supply Association is the major soil type mapped on this type of land in the Beaconsfield Soil Survey (Dimmock, unpublished). These soils generally have gradational profiles with a dark grey, well developed granular silt loam, silty clay loam or fine sandy clay loam surface; over mottled dark grey, massive silty clay or fine sandy clay.

Cropping is limited to occasional crops such as cereals and forage crops because of the soil drainage characteristics. Drainage (where economically feasible) would substantially improve the present condition of some of the heavier clay soils, and would result in more rapid removal of surface water and more intensive use of these areas. Annual rainfall ranges between 800 and 1 000 mm.

Other Class 4 land

Other areas of Class 4 land occur on dolerite, and sedimentary sandstones and siltstones of the Mathinna Bed sequences.

Between Elizabeth Town and Christmas Hill an area of Class 4 land on dolerite has been mapped. Slopes are variable in this area, however the major limitation to agricultural use is the amount of dolerite stones and rocks which can severely hinder cultivation. The soils are red krasnozems which are freely drained and friable.

Outcrops of Mathinna Beds occur in the north eastern corner of the map, around Lefroy and Beechford. Areas of this type of land are more extensive on the adjacent Pipers map.

The soils on these deposits are mostly grey podzolic soils. They have a very sandy and loose topsoil, which is highly susceptible to water erosion if the soil surface is disturbed and left unprotected. The soils have been leached of nutrients, and require high fertiliser inputs including phosphorus and potassium. Trace elements of molybdenum, copper and selenium are also required. These soils are generally very acid, with topsoil pH less than 5.0. Areas around Lefroy have large amounts of quartz gravels present in the soils. Nearer the coast some lower areas have been covered by a veneer of windblown sand.

Slopes can range up to 18%. Above this slope, the potential erosion hazard is considered too severe for this type of land to be safely cultivated for cropping purposes, and has been mapped as Class 5 land. On the steeper slopes, intensive soil conservation measures such as major earthworks would be needed, if cropping was undertaken.

This land is used mainly for grazing, with occasional crops such as root and green fodder crops grown (turnips, chou moellier, etc). The poor soil structure, low fertility and high erosion hazard severely limit the cropping potential of this type of land.

10.5 Class 5 (36 773 ha; 20.18%)

Class 5 land on Basalt

Steeper slopes on basalt (generally 30%) have been mapped as Class 5 land in the Dunorlan-Gannons Hill, and Rosevale-Selbourne areas. Photo 12 shows an example of this type of Class 5 land.

These areas are usually steeper scarp edges around the more subdued and elevated topography of the basalt flows. In some areas the basalt colluvium, erosion debris and associated soils form a veneer over underlying older rocks such as Permian mudstones and sandstones or Tertiary clays and gravels. Although the slopes are steep (in excess of 30%), the soils are generally more stable than those on other rock types, and can be used for grazing. These slopes can be subject to sheet and mass movement erosion, but this does not pose a major limitation to grazing use, as the fertile basalt soils tend to regrass rapidly.

Some areas also are prone to seepage which can increase the potential for landslide events, particularly on cleared, steeper slopes, in areas recently cleared from forest, or undercut by access tracks.

As well as the limitation of slope and erosion hazard, some areas also have significant amounts of rock outcrops. Average annual rainfall is around 800 - 900 mm at Rosevale, and 1 000 mm at Dunorlan.

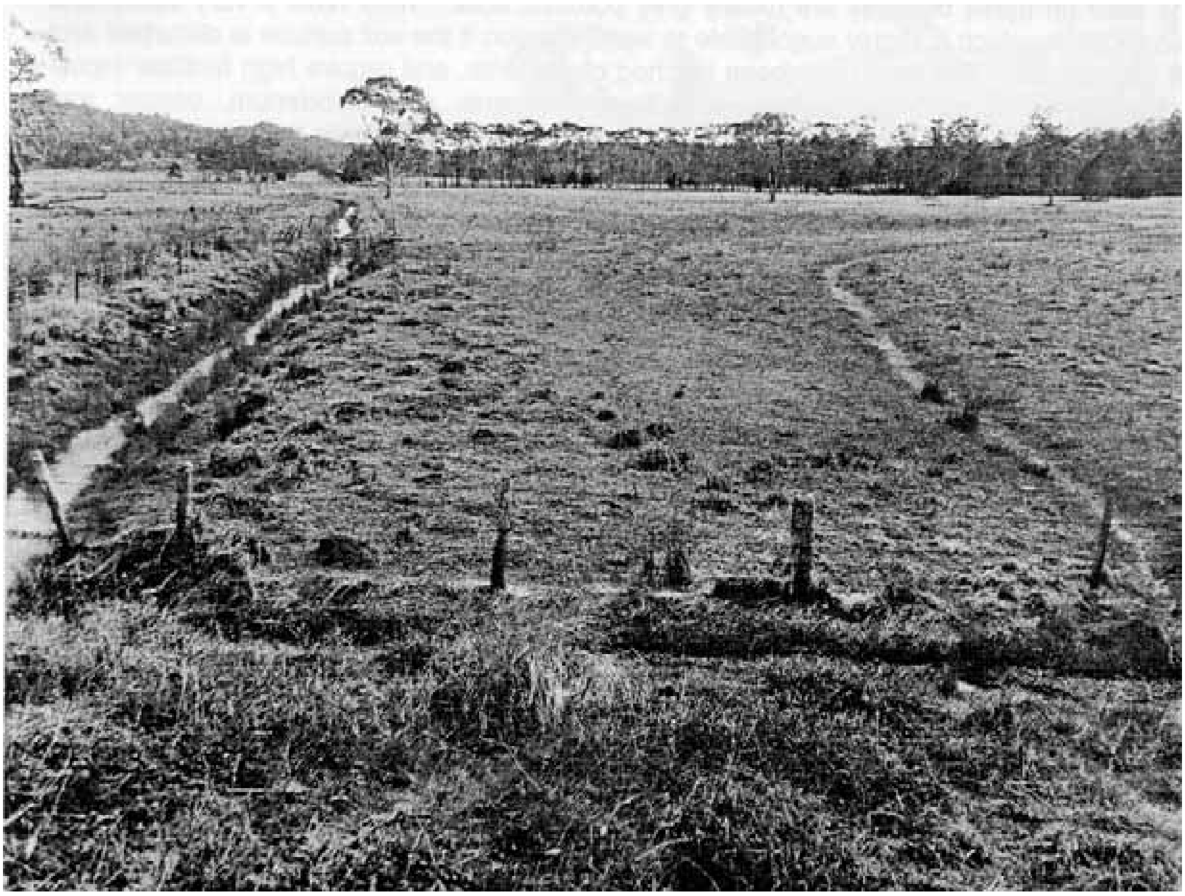


Photo 12: Classs 5 land on basalt. Tamar map 605133. Railton Road.

Class 5 land on sands and gravels

Class 5 land on sands and gravels occur in the north of the map principally in the West Tamar area, north of Beaconsfield. Another area occurs as a complex with Class 4 land at Doctors Flats (south of Lefroy). Slopes are variable and can range up to 30% on steeper areas. Annual rainfalls are around 800 - 900 mm.

The sands and gravels have come from the older rocks of the Asbestos Range and Cabbage Tree and Salisbury Hills. They were deposited as terraces but have subsequently been reworked and redeposited. A large proportion of the gravel is quartz and quartzite. In areas nearer the coast these Tertiary deposits have been partially covered by a veneer of windblown sand.

The quartz gravels and sand are a major source for construction and road material. Where areas have been significantly disturbed by mining, they have been classified as Class 6.

Soil associations mapped in the Beaconsfield Soil Survey (Dimmock, unpublished), are the York Town, Beaconsfield and Dalrymple Associations, which are typically podzolic or podzol soils.

A typical profile of the York Town Association may have a black loamy sand over grey sand; overlying a thin layer of cemented sand followed by a thin layer of dark brown organic coatings; on mottled yellow brown clays. Occasional pieces of quartz gravel occur throughout the profile.

The Beaconsfield Association is generally more gravelly than the York Town Association, and a typical profile may have a black loamy sand overlying grey sandy gravel; over dark brown sandy gravel; over white gravelly sand. The Dalrymple Association occurs on areas where windblown sand has been blown over the gravel terraces nearer the coast. Where the sand is deep enough, these areas have been classified as Class 5 on windblown sand.

Varying amounts of quartz gravels can occur both throughout the soil profile, and scattered over the soil surface. The amount of gravel present severely restricts agricultural use of the land, and this together with poor soil structure, low natural fertility and leaching of nutrients throughout the profile, make this type of land Class 5. Photo 13 shows an example of this type of land.

Photo 13: Class 5 land on quartz gravels. Tamar map 818459. Clarence Point Road.

Photo 14: Class 5 land on basanitic dolerite. Tamar map 957400.

Class 5 land on Dolerite

Class 5 land has also been mapped on dolerite. Slopes can range up to 40%. Although some slopes may be relatively gentle, the amount of dolerite boulders and presence of rock outcrops restrict cultivation and make this land suitable for grazing purposes only.

Localities where this type of land occur are at Low Head, Clarence Point, Point Sorell, East Arm Road, Rubicon Hills, Birralee, Four Springs, north east of Parkham, Sidmouth-Exeter, Rosevale area, Weetah, Ecclestone Road and Rosevale. Some of these areas also comprise talus or boulder slopes below the dolerite bodies which mantle underlying sedimentary strata (e.g. at Holwell, Weetah and Reedy Marsh).

Areas mapped as basanitic dolerite have also been included with this type of land because of the amount of rock outcrops. The composition of this basanitic dolerite has been described as a coarse grained basalt. It is also Tertiary in age, whereas the dolerite is older, Jurassic in age. These areas are around the Rowella, Batman Bridge and Murphys Hill localities.

These areas may be sown to improved pasture species by surface cultivation on the deeper soils around the boulder outcrops. Where the land has so many boulders that surface cultivation is not possible, it has been classified as Class 6 land.

The major soil association mapped in the Beaconsfield Soil Survey (Dimmock, unpublished), is the Eastfield Association. The soil profile depths and degree of profile development can vary depending on the steepness of slope, and depth to bedrock. A typical profile may have a grey or grey-brown fine sandy loam or silt loam A_1 horizon; overlying a pale A_2 horizon often containing fine rounded ironstone gravel; over a dense, impervious, mottled yellow-brown, grey-brown or yellow-grey clay B horizon. Dolerite boulders and stones are common throughout the profile. Depth to bedrock is commonly around 1 metre.

Drainage of these soils is variable, and in winter the dense clay B horizons can restrict water movement, resulting in perched water tables. Average annual rainfalls on this type of land range between 700 and 1 000 mm.

Photo 14 shows an example of Class 5 land on dolerite, and Figure 9 demonstrates the relationship between land capability classes on dolerite.

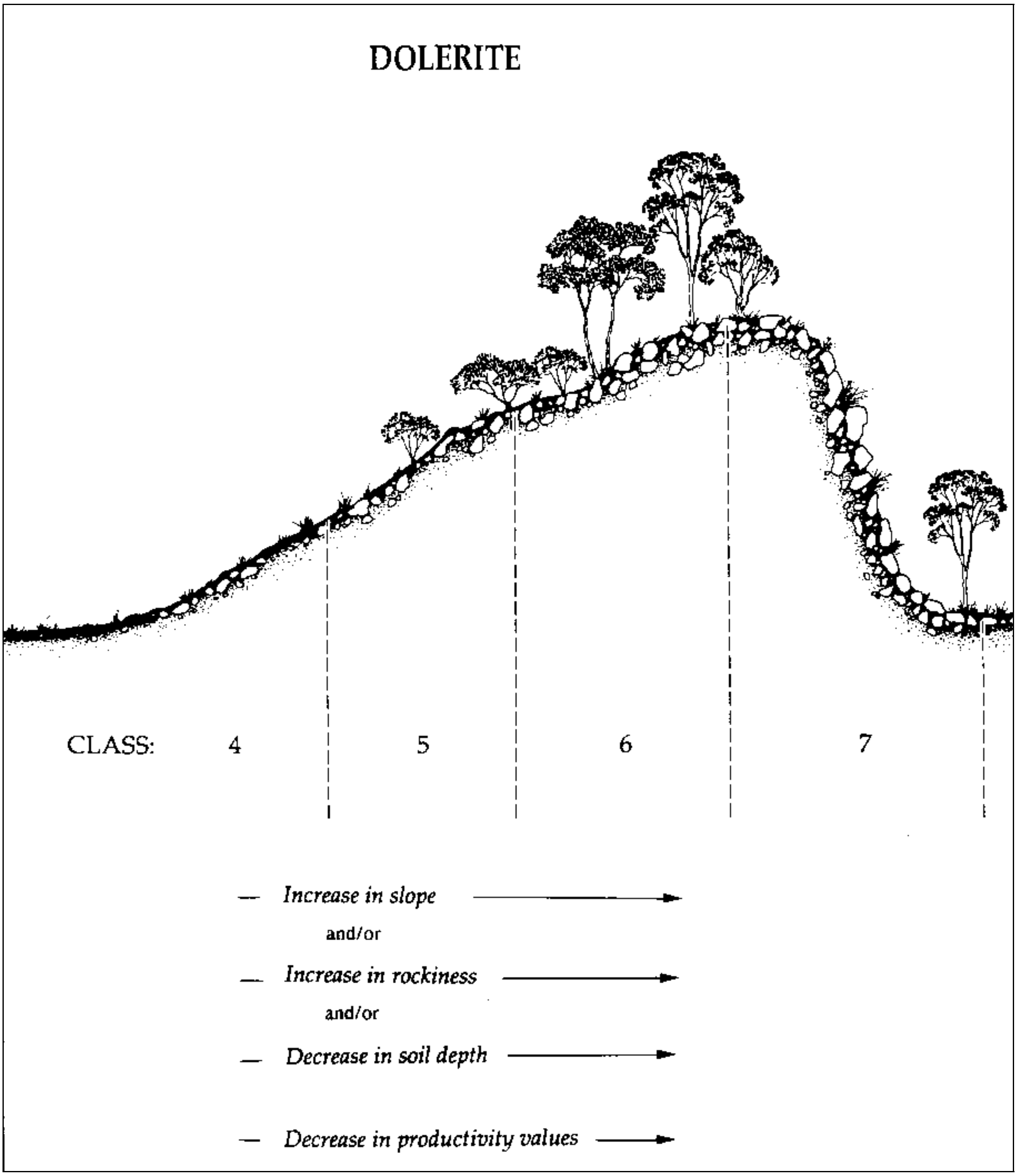


Figure 9: Diagrammatic representation of land capability classes mapped on dolerite.

Class 5 land on Windblown Sand

Class 5 land on semi-consolidated windblown sand deposits occurs in the north of the map sheet along the coastal platforms. This coastal sandplain is gently undulating, consisting of low sand dunes interspersed with wetter depressions and drainage lines. It varies in width, ranging up to 6 kilometres inland from the coast.

Locations where this type of land occur are at Port Sorell (both sides of the estuary), Greens Beach, and between George Town and Beechford. Rainfall ranges between 700 and 900 mm.

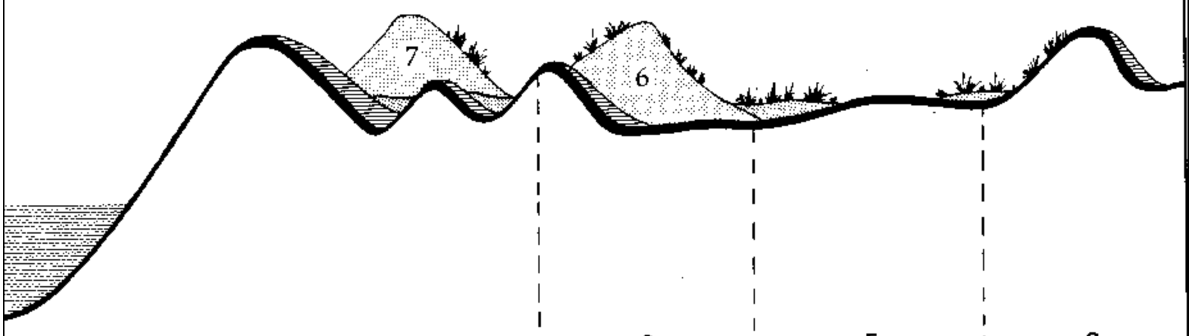
The sand deposits are variable in depth, and in some places outcrops of the underlying older formations such as Mathinna Beds and dolerite, are evident. The sand has been blown inland from the coastal zone but is now stabilised and most has been developed for grazing purposes. The sandy soils have low natural fertility, are low in organic matter, and have a low water holding capacity. Nutrients are easily leached from the plant root zone, and high fertiliser inputs are required to maintain acceptable levels in the soil. Soils are generally well developed with typical podzol features such as a bleached and structureless A_2 horizon and an iron-organic B horizon. Soils depths can be up to one metre to the organic B horizon. The wetter swampy areas have dark organic sandy clay soils. Soil Associations mapped in the Beaconsfield Soil Survey (Dimmock, unpublished), are Stockport, Dalrymple and Kelso.

Although of gentle relief (up to 10% slopes) these areas are not suitable for cultivation for cropping because of poor soil structure, although cultivation may be carried out during the pasture establishment phase. The soils are prone to wind erosion and therefore maintenance of a complete pasture cover and prevention of surface disturbance is necessary. The higher sand dune areas are subject to summer droughts which severely reduce pasture growth, while in some low lying areas the wetter drainage lines and depressions may benefit from drainage to maintain high producing pasture. A further problem is the occurrence of salting in some of the lower lying areas.

The relationship between land capability classes on windblown sand deposits is illustrated in Figure 10. An example of this type of Class 5 land is shown in Photos 15 and 19.

Photo 15: Class 5 land on windblown sand. Tamar map 624405. Milldam Road.

COASTAL WINDBLOWN SANDS



CLASS	7	6	5	6
LANDFORM	Eroding and migrating dunes	Unstable semi-vegetated dune areas	Stabilised sand plains and swamps	Unstable semi-vegetated dune areas
SOILS	Calcareous and siliceous sands	Weakly podzolised sands and sand podzols. Kelso Soil Association*	Humus and sand podzols. Weakly podzolised siliceous sands. Sandy peats. Dalrymple Soil Association*	Weakly podzolised siliceous sands and podzols. Kelso Soil Association*
SOIL PROFILE	Thin sandy topsoil overlying raw sand	Thin humic sandy topsoil on bleached sands, over yellowish brown or grey sandy subsoils. Some profiles have thin humus and iron pans at depth	Profiles highly variable. Includes peaty and humic sands overlying grey mottled sands with iron and humus pans at depth,and profiles similar to Class 6	See Class 6
DRAINAGE	Rapidly drained	Well drained	Well drained on sandier ridges and very poorly drained in depressions	Well drained
LIMITATIONS TO AGRICULTURAL USE	Highly prone to wind erosion. Low fertility, structureless soils. Very low water holding capacity	Prone to wind erosion. Low fertility. Very low water holding capacity	Minor wind erosion. Waterlogging and salting in drainage lines. Low fertility. Very low to very high water holding capacity	Prone to wind erosion. Low fertility. Very low water holding capacity

*Soil Association names from Beaconsfield Soil Survey (Dimmock, unpublished)

Figure 10: Relationship between land capability classes mapped on coastal windblown sands.

Class 5 land on sandstones, slates and quartzites

This type of Class 5 land occurs on older, indurated rock types, including Ordovician, Cambrian and Precambrian sandstones, slates, greywackes, siltstones, conglomerates and quartzites.

Localities where this type of land have been mapped are around Beaconsfield, Punchs Terror, and on lower slopes of the Asbestos and Dazzler Ranges, and Mt Careless. Annual rainfalls range between 700 and 1 000 mm.

Soil associations which occur on these rock types are the Asbestos and Norton Associations from the Beaconsfield Soil Survey (Dimmock, unpublished). These soils are stony gradational soils which have sandy surface horizons overlying yellow-brown clay. Rock fragments of quartz or quartzite are often scattered over the soil surface.

Slopes are generally between 18 and 30%. The sandy and stony nature of the soils combined with low natural fertility and erosion hazard limit this type of land to grazing purposes. Photo 16 shows an example of this type of Class 5 land.

Photo 16: Class 5 land on Ordovician siltstone and conglomerate. Tamar map 804237. Frankford Road.

Class 5 land on sandstones, siltstones and mudstones

Class 5 land has also been mapped on sandstones, siltstones and mudstones of Triassic, Permian and lower Palaeozoic ages, including Mathinna Beds. The majority of slopes range between 18 and 30%, which are steeper than on similar deposits mapped as Class 4 (refer to Figure 8). Some areas on gentler slopes may be cultivated for pasture establishment or renewal, but are not suitable for cropping because of the high erosion risk. The steeper slopes often occur around the edges of dolerite bodies, which has protected them from extensive erosion. Average annual rainfalls range between 800 and 1 000 mm.

Localities where this type of land occur are at Lefroy (Mathinna Beds); Notley Hills and north and east of Parkham (Triassic sandstone), and at Winkleigh, Glengarry, Holwell, Stewarts Hill, Frankford, West Frankford, Notley Hills and Thompsons Hill (Permian sandstones, siltstones and mudstones).

This type of land has a range of soils associated with it because of the complexity of the alternating bands of sandstone, siltstone and mudstone which influence the soil type.

Soil associations which occur on this type of land are the Holwell Association and the steeper slopes of the Warrina and Tatana Associations (from the Beaconsfield Soil Survey; Dimmock, unpublished).

The Tatana Association occurs on the Permian and Triassic sandstones. These soils are predominantly sandy podzols. A typical profile may have a dark grey loose sandy A_1 horizon; over a brownish grey loose sandy A_2 horizon; over a dark brown organic cemented sand (organic B horizon); over mottled brown clayey sand or sandy clay loam.

The soils of the Holwell Association are the most extensive and occur on the Permian mudstones and siltstones. They occur on the steeper slopes and overlap with the Warrina soils on lower slopes. Soil profiles are generally gradational on the Holwell Association and duplex on the Warrina Association. The Warrina soils are similar to those described in Class 4 (Refer to Page 53.) In comparison, the Holwell soils are darker and generally have not developed an A_2 horizon. A typical profile on the Holwell Association may have a dark grey-brown loam or fine sandy loam A horizon, over a dark grey-brown clay B horizon.

The soils formed on Mathinna Bed sandstones and siltstones generally have shallow surface horizons, with a sandy and loose subsurface over clay. In some areas (e.g. around Lefroy), abundant quartz gravels are present.

The soils formed on sandstones are infertile, strongly leached and require high fertiliser inputs to maintain good pastures for grazing. The soils formed on mudstones have better structure but still require supplementary fertiliser inputs.

Soil slip, sheet and gully erosion are the dominant erosion forms. There are also several historic slump (mass movement features) associated with the Permian sediments (e.g. Stewarts Hill area).

Slope, erosion hazard and low fertility combine to make these areas Class 5 land. Photo 17 shows an example of this type of land.

Photo 17: Class 5 land on Permian sandstones, siltstones and mudstones. Class 4 land in foreground. Tamar map 804237. Frankford Road.

Other Class 5 land

Other areas of Class 5 land have been mapped on limestone and ultrabasic rocks.

Class 5 land on limestone has been mapped in the Flowery Gully locality on slopes between 20 and 35%. Soils are red and well structured, typical of Terra Rossa soils which form from weathering Karst limestones. Soil depths can vary in relation to the underlying rock, from a few centimetres to over one metre. The Soil Association mapped is the Flowery Gully Association from the Beaconsfield Soil Survey (Dimmock, unpublished). Sink holes and caves are common features formed by the dissolution of the limestone which contains very high amounts of calcium carbonate. A combination of steep slopes, broken terrain, sink holes and shallow soil depths in places, make this type of land Class 5.

A small area of Class 5 land has also been mapped on igneous and metamorphic rocks of the Andersons Creek Ultramafic Complex. This type of land has been mapped at Barnes Hill and Simmonds Hill, south west of Beaconsfield. Slopes are generally greater than 20%. Soils are variable because of the range of parent materials on which they are formed, but have been mapped as the Vulcan Association (Beaconsfield Soil Survey; Dimmock, unpublished). Large amounts of ironstone gravel, cemented laterite and rock outcrops are common.

10.6 Class 6 (26 038 ha: 14.30%)

Class 6 land has been mapped on a range of parent materials including windblown sands, dolerite, mudstones, sandstones, quartzites, slates, conglomerate and quartz gravels.

Class 6 land on Dolerite

Class 6 land on dolerite is common in all the dolerite areas on the map sheet. The major localities are Mt George, Tippogoree Hills, Stockyard Hills, Sidmouth to Bradys Lookout, Rubicon Hills, Wurra Wurra Hills, Drys Sugarloaf, Christmas Hill, Stephens Hill, Black Sugarloaf, Black Sugarloaf Ridge, Brushy Rivulet, The Tump, The Stony Rises and Grassy Hut Tier.

Class 6 on dolerite generally occurs on steeper slopes (35%), and the amount of dolerite boulders present is significantly more than on similar land mapped as Class 5 (refer to Figure 9 and Photo 18). Annual rainfalls range between 700 and 1 000 mm.

The major soil type mapped in the Beaconsfield Soil Survey (Dimmock, unpublished), is the Eastfield Soil Association as described for Class 5 land on dolerite (Page 60). However profile depths are generally shallower with a significant increase in the amount of dolerite boulders throughout the profile and over the surface of the land.

This type of land is marginal for grazing purposes, because of the amount of rock outcrops present. It is used extensively as run country for sheep. Because of the amount of boulders present, improvement of native pastures is not possible by surface cultivation methods.

Photo 18: Class 6 land on dolerite. Tamar map 801060. North of Exton.

Class 6 land on Windblown Sand

Class 6 land on windblown sand deposits has been mapped on the higher dune ridges of the coastal plain, between George Town and Beechford, and at Greens Beach and Port Sorell. Annual rainfalls in these areas range between 700 and 800 mm.

Refer to Photo 19 for an example of this type of land, and to Figure 10 for a diagrammatic representation of the relationship between land capability classes mapped on windblown sands.

Soil associations mapped in the Beaconsfield Soil Survey (Dimmock, unpublished), which relate to this class of land are the Dalrymple and Kelso Associations (sand podzols and weakly podzolised calcareous sands). The weakly structured and very poorly developed soils are free draining with low moisture holding capacities, low organic matter content, and are subject to severe summer drought. Soils also have low pH and require high fertiliser inputs for grazing purposes.

These areas are highly susceptible to wind erosion if the vegetation cover is disturbed or broken. Most areas are presently stabilised with vegetation, but further development into pasture should be restricted because of the severe erosion hazard. This erosion hazard can be mainly attributed to the following conditions, all of which discourage plant growth: exposure to strong salt-laden winds, the unstable nature of the sand dunes, severe soil moisture deficiencies, very weak soil development and nitrogen deficiency. Eroded areas require stabilisation with suitable vegetation (e.g. marram grass), and prevention of stock trampling, grazing and vehicle access in these areas is critical for protection against wind erosion.

In some areas (e.g. Cimitiere Plain and Beechford area) it was difficult to separate the higher, recent dune areas with little soil development, from more stabilised areas, because of the intricate mosaic of dunes and swales.

The severe wind erosion potential of these areas combined with poor soil development and infertile soils, combine to make this type of land marginally suitable for grazing purposes.

Photo 19: Class 6 land on windblown sand. Class 5 land in foreground. Tamar map 932563. Settlement Road.

Class 6 land on sandstones, slates and quartzites

This type of Class 6 land has been mapped on the flanks of the Asbestos Range, south of Badger Head and west of York Town, Cabbage Tree Hill (Beaconsfield), slopes between the Dazzler Range and Mt Careless, and at Punchs Terror (south of Dunorlan).

Geology and soil types are the same as those mapped on Class 5 land on sandstones, slates and quartzites (Page 64). However slopes are steeper than those mapped on Class 5, and can range between 30 and 45%. Soils are generally shallower and stonier, with some profiles consisting predominantly of rock fragments. Average annual rainfalls range between 700 and 1 000 mm.

The steep slopes and shallow, stony soils make this type of land marginally suitable for grazing purposes.

Other Class 6 land

Class 6 land on rounded quartz and quartz conglomerate occurs around the Beaconsfield Reservoir, and along Kelso Road, and Badger Head Road. These areas have obvious signs of disturbance and have been mined for the quartz gravels for road building. Because of this disturbance there are very few areas with typical soil profiles of the Beaconsfield Association (Beaconsfield Soil Survey; Dimmock, unpublished). Although slopes are not steep (usually less than 30%), the amount of interference with these soils have rendered them suitable only for rehabilitation for marginal grazing purposes.

Class 6 land has also been mapped on steep gorges or scarp edges in mudstone, sandstone or siltstone hill country around Stewarts Hill, and West Frankford localities. Soils are the Holwell Association, similar to those on Class 5 land on the same parent material - however they are generally shallower because of the steeper slopes and removal of soil material by erosion. Some of these areas are mapped along the cliff or scarp edges of historic slump features.

10.7 Class 7 (874 ha; 0.48%)

Class 7 land has been mapped on windblown sands along the coast, and on very steep slopes on quartzites, greywackes and slates. All Class 7 land is unsuitable for agricultural use.

Class 7 land on Windblown Sands

The unstable belt of recent windblown sands along the coast has been mapped as Class 7 land because of the extreme erosion hazard (both present and potential). These areas comprise the foredune and adjacent unstable sand dunes and sand plains (refer to Figure 10). These dunes are the most exposed and have very little or no soil development. This together with the rolling nature of the dunes gives them the potential for extreme wind erosion. Where exposed, the sand is easily transported by wind, with extensive areas of blow out dunes and wind eroded areas present. Revegetation is crucial in order to stabilise the dunes and prevent migration of sand onto productive farmland.

The areas of Class 7 land on coastal windblown sand generally occur as a narrow strip up to approximately 0.25 km wide, along the coastline. At Five Mile Bluff the area is more extensive, extending up to 1.5 km inland.

Class 7 land on coastal sand dunes has been mapped at Northdown Beach, and from Low Head to east of Beechford.

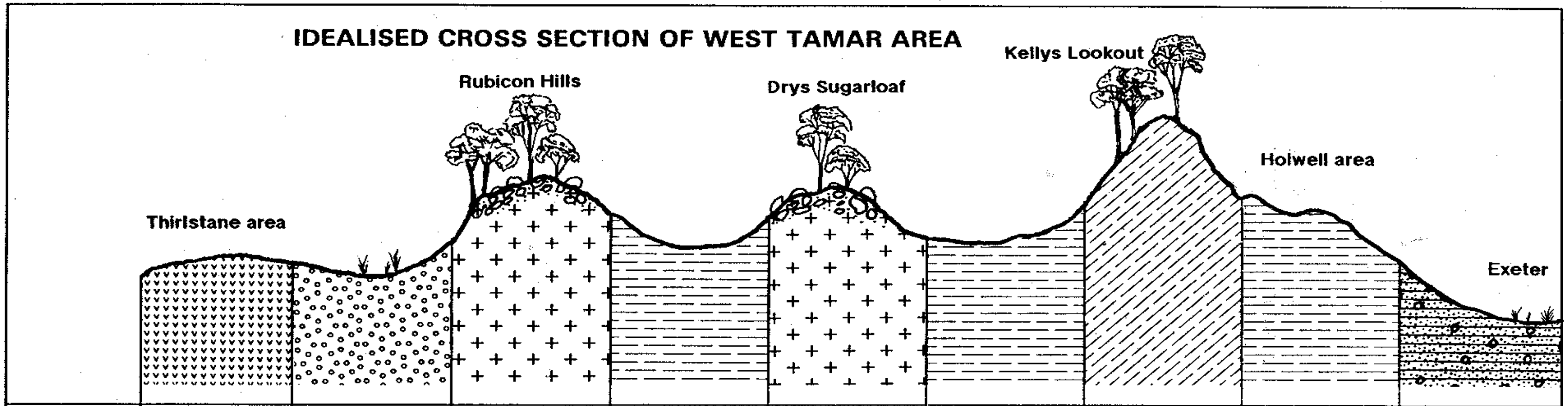
Soils mapped are the Kelso Association (Beaconsfield Soil Survey; Dimmock, unpublished), which is a weakly podzolised calcareous sand, with very weak soil profile development.

Class 7 land on sandstones, slates and quartzites

This type of Class 7 land occurs on extremely steep slopes on Precambrian age sediments. These rocks are very hard and highly siliceous, and form the backbone of the Asbestos and Dazzler Ranges. The areas of Class 7 mapped on this type of land occur south of Badger Head, and at Flowers Hill (west of York Town).

Slopes are generally very long and steep (over 45%). Soils can be quite stony with angular fragments of quartzite throughout the profile and over the soil surface. The Asbestos Soil Association has been mapped on this type of land in the Beaconsfield Soil Survey (Dimmock, unpublished).

The extremely steep slopes and potential erosion hazard make this land unsuitable for agricultural use.



Geology	Tertiary Basalt	Tertiary clays, gravel and sand	Jurassic dolerite	Permian mudstone. Cambrian siltstone and quartzite	Jurassic dolerite	Permian mudstone, sandstone and siltstone	Precambrian and Ordovician sandstone, slate and quartzite	Permian mudstone, siltstone, and sandstone	Quaternary alluvial clays and sands. Permian sandstone and mudstone. Triassic sandstone
Soils	Krasnozem soils. Deep free draining gradational soils with clay loam topsoils.	Variable and complex soil pattern. Gradational and duplex soils with sandy loam and clay loam topsoils.	Duplex or gradational soils with boulders and rock outcrops.	Duplex and gradational soils with sandy loam and sandy clay loam topsoils.	Duplex and gradational soils with clay loam and gravelly clay loam topsoils. Boulders and rock outcrops.	Duplex and gradational soils with sandy loam and clay loam topsoils.	Asbestos and Norton Soil Associations.* Stony and shallow duplex soils with gravelly, sandy loam topsoils.	Holwell, Warrina and Tatana Soil Associations.* Duplex and gradational soils with sandy loam and clay loam topsoils.	Tatana, Warinna and Supply Soil Associations.* Duplex and gradational soils with sandy loam topsoils. Uniform clay soils.
Slope	0-30%	0-18%	>20%	>18%	>20%	0-30%	18-45%	0-30%	0-10%
Limitations	Slope, sheet and rill erosion.	Sheet and rill erosion, poor drainage.	Slope, rockiness.	Slope, sheet and gully erosion. Mass movement.	Slope, rockiness.	Sheet, rill and gully erosion. Mass movement.	Shallow, stony, low fertility soils. Sheet and gully erosion. Mass movement.	Sheet, rill and gully erosion. Mass movement.	Sheet, rill and streambank erosion. Waterlogging and flooding.
Land capability classes	1, 2, 3, 4	4	5, 6, 7	5, 6	5, 6, 7	4, 5	5, 6	4, 5	4

*Soil Association names from Beaconsfield Soil Survey (Dimmock, unpublished)

Figure 11: Cross section of West Tamar area showing landform, geology, soil and land capability relationships

10.8 Summary of Land Capability Classes on Tamar Map

Class	Area (ha)	% of land area on Tamar map
1	42	0.02
2	604	0.33
3	10 061	5052
4	56 953	31.26
5	36 773	20.18
6	26 038	14.3
7	874	0.48
Exclusion	50 084	27.9
TOTAL	182149	100

Table 9: Summary of areas on Tamar map.

11. Map Availability

An index of the land capability maps (based on the Tasmap 1:100 000 Series) is shown on the rear cover of this report.

Publications currently available in the series are:-

PIPERS REPORT AND ACCOMPANYING MAP

TAMAR REPORT AND ACCOMPANYING MAP

LAND CAPABILITY HANDBOOK

Flat Maps are also available for purchase.

Maps and reports are available for purchase from your nearest Department of Primary Industry and Fisheries Office, or can be ordered direct from:

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