OATLANDS
SOIL REPORT

Reconnaissance Soil Map Series of Tasmania

A Revised Edition
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Department of Primary Industries, Water and Environment
Tasmania
2001

of Divisional Report 4/59 Oatlands
By J.D. Cowie
C.S.I.R.O Division of Soils, Adelaide, 1959

Oatlands Report
and accompanying 1:100 000 Oatlands
Soil Reconnaissance Map

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

Natural Heritage Trust
Helping Communities Helping Australia

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This report and accompanying map are revised versions of original work by CSIRO (Cowie, 1959). Mr Cowie was a pedologist with the New Zealand DSIR Soils Bureau. The survey for this report was carried out while he was on exchange duty with CSIRO in 1958. We gratefully acknowledge the original work of Mr Cowie and the CSIRO Division of Soils, Adelaide for supporting this project.

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PREFACE

The Reconnaissance Series

Over a 27 year period (1940 - 1967), the CSIRO Division of Soils, Adelaide undertook a series of reconnaissance (small scale) soil surveys and some more detailed (large scale) soil surveys of the agricultural land in Tasmania. However, most of these reports are out of print and of limited availability, the terminology is dated and inconsistencies in map units exist across map sheets. In 1997, the Department of Primary Industries, Water and Environment (DPIWE) and the Natural Heritage Trust, put together a project to correlate and reprint the maps and reports and to extend this information and its value as a tool for sustainable land management, to a variety of potential users.

This report is part of the "Reconnaissance Soil Map of Tasmania" series which were published at a scale of 1 inch to 1 mile (1:63 360). The reconnaissance series has been expanded to include the soil maps that were not part of the original "Reconnaissance Soil Map of Tasmania" series but mapped at scales of 1 inch to 1 mile and 1 inch to 2 mile (1:126 000). These maps have been reformatted and reprinted by the DPIWE at a scale of 1:100 000 to be consistent with more recent soil mapping scales (eg South Esk 1:100 000 soil map (southern half), Doyle, 1993), the 1:100 000 Tasmanian land capability mapping series and the current Tasmanian Land Tenure map series.

It is not the aim of this project to remap the areas covered by the Reconnaissance series or to change the intensity of mapping, but to correlate, standardise and enhance existing information and provide the public and DPIWE staff with more consistent, reliable and accessible soil resource information.

Correlation of the Oatlands Reconnaissance Soil Map

Defining Map units

In attempting to correlate soils across the Reconnaissance Soil Maps around the State differences in the nature of the map units have caused some problems. Map units on the initial maps investigated (Longford, Quamby and South Esk), essentially depicted broad scale "soil associations". These associations identified and described a dominant soil and a range of minor soils, which were generally associated with recognisable landscape features. For example the Eastfield Association, dominated by the Eastfield Soil Profile Class (SPC), has a range of minor soils such as the Panshanger SPC and the Bloomfield SPC which are found on rolling to steep dolerite hills.

In other parts of the State, including the Oatlands sheet, the map units of the Reconnaissance Soil Maps have been generally defined on the basis of Great Soil Groups (Stace *et al.*, 1968) and parent material, eg Podzolic Soils on Dolerite. In many instances a dominant or representative soil has been identified and where adequate existing data is available it has been possible to define an SPC for that soil. In such cases it is sometimes possible to correlate with SPCs defined elsewhere. However because of insufficient data for the minor soils it is not possible to define and correlate the minor soils around the state. Therefore there is a unit "Podzolics on

Dolerite" and another "Eastfield Association" both of which are dominated by the Eastfield SPC but which may have different minor soils. To correlate these two units based on the dominant soil only, would be incorrect and misleading. Instead the original map unit name has been retained. Where a dominant soil has been identified, the map unit has been assigned a number eg Podzolics on Dolerite 1 (Pd1), with the identified dominant soil outlined in the report and on the legend of the map.

In some instances sufficient data exists to determine that a particular polygon or group of polygons have a different dominant soil to others of a similar map unit name. However the data is insufficient to allow the precise definition of that soil. These map units have been assigned a numerical value. (eg Pm1 & Pm2). The distinction between these polygons and polygons where a dominant soil has been defined (eg Pd1), is apparent by the absence of a defined dominant soil in the report and on the legend of the map.

Due to resource constraints only a limited amount of time could be spent investigating these less well defined soils and map units. Hence the term "insufficient data" occurs widely throughout the legend. The correlation of the Reconnaissance Soil Maps has highlighted how little information is available for some of Tasmania's major soils.

The Oatlands Map

The Oatlands Reconnaissance Soil Map adjoins the Brighton map (Spanswick *et al.*, 2000c) on its southern boundary, the Interlaken (Leamy, 1961), on it's northern boundary the Buckland map (Spanswick *et al.*, 2000d) on its south eastern corner. For an index map of the 1:100 000 Reconnaissance Soil Surveys of Tasmania, see Appendix 7.

Soil Taxonomic Units
A soil taxonomic unit is a general term for a grouping of soils based on similarities of the soils within the group, and differences compared with other groups. Map units consist of defined areas of contiguous soil taxonomic units. As outlined previously the soil taxonomic units used by Cowie in this survey are Great Soil Groups (Stace *et al.*, 1968). These have been replaced where possible by Soil Profile Class (SPC) as this will standardise taxonomic units across the Oatlands map and be consistent with taxonomic units used within the more recent South Esk soil map and by other States. A SPC is a group or class of soil profiles within a map unit which have similar morphological characteristics and may have similar chemical properties (Gunn *et al.*, 1988). The SPCs were constructed through the use of existing reports, historical soil data in the DPIWE soil database and additional fieldwork. A key to soil horizon designations used within the SPCs is provided in Appendix 1. The lines separating horizons within the SPC diagrams are shown by broken and solid lines. The broken lines show a diffuse or gradual change to the next horizon whereas the solid lines show a clear or abrupt transition. If the horizon transition is unknown a larger broken line is used. Where a lack of profile information has meant that SPCs cannot be developed, then specific type profiles of the soil, as identified by Cowie in the original survey, have been used.

Map Edits
Cowie mapped some of the polygons on the Oatlands map as more than one type of map unit. For example a single map unit may be labelled both “Pss” and “Pss with Bms”. This is really a complex unit. However because the occurrence of Pss with Bms is in only a part of the polygon, it is not possible without significant additional fieldwork and aerial photograph interpretation, to split this unit and other units like it. Therefore, we have left these units as is. They are identified on the paper maps and in a notes column attached to the polygon attribute table of the digital maps. This information has also been stored as a separate point coverage, however the coordinates used for the label points are only estimations taken from a visual interpretation of their location on the original published map.

The map units in this survey also include soil complexes. A soil complex consists of two or more dominant soils that occur in an intricate pattern that can't be separated at this scale of mapping without unwarranted effort.

There are two maps for this report in circulation. The map that accompanies this report has polygons coloured according to the different map units identified. The second map, which is intended solely for DPIWE in-house circulation, has map units coloured according to the Australian Soil Classification for the dominant SPC within each unit, no colour is assigned to a map unit if a SPC has not been identified.

Legend
Where possible the dominant soil of each map unit has been classified to soil order using the Australian Soil Classification (Isbell, 1996). Soils have also been classified according to Great Soil Group (Stace *et al.*, 1968).

Edits to the Oatlands Report

The Oatlands report has been reformatted to provide a more consistent structure with other similar reports. The soil terminology used within the Oatlands report has been updated to be consistent with the Australian Soil and Land Survey Field Handbook (McDonald *et al.*, 1990), old imperial measurements have been converted to the metric system and sentence structure has been changed where it did not read with clarity. Edits and additional information about the soils within map units have been recorded within the main body of this report. All the changes made to the report are shown in italics.

No changes have been made to comments referring to Land Use within this report. This information is out of date and is an area that has been identified as requiring further work.

SPC definitions in some map units have been tightened as data available on this map sheet has increased our understanding of some soils. Where these changes have been made to an SPC it has been outlined in the body of the report.

Laboratory Analysed Data

CSIRO laboratory data is available for some of the dominant soils identified on this map. All CSIRO sites have the character "H" at the beginning of the profile number eg H68. An outline of the different methods used is located in Appendix 2.

Future Work

Correlation of the soils identified on this map with others in Tasmania has been extremely difficult due to the lack of existing soil profile data, the complexity of geology and local climate and topography variations. Consequently a number of areas exist where additional work would be valuable.

Podzolics on Mudstone

The soils of the Permian mudstone, sandstone, shale and siltstone are variable. This variation is a reflection of the complex bedding of the Permian lithologies and variations in topography and climate. In many areas on this map sheet the Permian soils have been mapped as a complex with Alluvial soils. In most areas this alluvium is derived from Permian sediments however in some areas Triassic and Jurassic sediments washed from the surrounding hills have been deposited and reworked within this unit. We have been unable to identify the dominant soil or associated soils within this unit.

Soil on Triassic and Permian Sandstones

Cowie (1956) has divided the soils on sandstone into four groups. Podzolic soils and Podzols on Siliceous Sandstone (Pss), Brown soils on Siliceous Sandstone (Bss), Brown soils on Micaeous Sandstone (Bms) and Brown Soils on Feldspathic Sandstone (Bfs). The distinction between the four groups is described in more detail within the body of the report. We were able to broadly define the dominant soil within the Micaeous and Feldspathic sandstone units. However the two groups on siliceous sandstone, Pss and Bss, proved much more difficult. Due to variation within both units over very small distances we were unable to define the dominant soil. However, soils similar to the defined soils on other map sheets such as the Dunrobin SPC and the Ellendale SPC were observed within the Oatlands sheet but their extent on the Oatlands map sheet is unknown.

Many of the soils formed on the Permian and Triassic sediments, including mudstone, siltstone and shale, are sodic to varying degrees, making them prone to dispersion and, on steeper slopes, erosion. These soils are currently used for grazing, forestry and urban development. More work is required on these soils as their erosion risk has important land use implications.

Alluvial Soils

The alluvial soils are important agriculturally, however very little is known about their properties or appropriate management. The soils within this unit vary considerably from recent alluvium of the modern floodplain to older more leached soils of the terraces and alluvial fans. These soils are used intensively for agriculture. Further work is needed to differentiate the soils of this unit and provide land users and planners with more detailed information about their properties and behaviour under different land uses.

Comments referring to Land Use

As mentioned previously no edits have been made to the land use section of this report. This is an area where future work would be extremely beneficial.

Accuracy of Maps

Cadaster data on the original Oatlands Reconnaissance Soil Map was supplied by the Division of National Mapping, Department of National Development Canberra, ACT. No relief data was available when the original map was surveyed. The original map used the Transverse Mercator Projection with Co-ordinates displayed in yards. Soil boundaries were delineated by stereoscopic interpretation of aerial photographs. The old paper soil maps were transferred to electronic form in the early 1990s with the Co-ordinate system converted to the Australian Map Grid, however no projection was recorded. Accuracy checks of the Oatlands digital map have revealed a range of spatial errors. Rivers have changed position over time. However the major source of spatial error on all the Reconnaissance Soil Maps has been caused by the absence of rectification of the aerial photographs during delineation of line work. Hence, Ground Control Points (GCP) in some areas on the map sheet, eg hilltops, do not match current true ground positions.

We have not had the resources or time to address all the inaccuracies within this map. Users of this data need to be aware that in some areas the boundaries of map units may be out by considerable distances.

Edge Matching Errors

There are a couple of areas on this map sheet where the Oatlands Reconnaissance soil map does not edge match with the Brighton Reconnaissance soil map.

In most cases this error is only minor as the geological boundaries, which the Reconnaissance series has basically been mapped on, occur very close to the map sheet boundary. This is particularly evident in the Podzolic Soils on Mudstone (Pm) unit in the south east of the Oatlands Reconnaissance soil map. The underlying geology is a Permian unit of upper Glacio-marine sequence of pebbly mudstone and pebbly sandstone and limestone. A fault exists between this geology unit and the fluvio-lacustrine sequences of sandstone, siltstone and mudstone (Gulline, 1976), which form the Pss unit on the adjoining Brighton Reconnaissance Soil Map. This fault line runs very close to the boundary between the Oatlands and Brighton Reconnaissance Soil Maps. Consequently the Pm unit does not appear on the Brighton map sheet as the southern boundary for this polygon is also the southern boundary of the Oatlands sheet.

An inconsistency exists on the southern boundary between two dolerite units. On the Oatlands sheet the unit is mapped as a Brown Soil on Dolerite 1 (Bd1); on the Brighton sheet the unit is mapped as a Podzolic on Dolerite 1 (Pd1). A transition between the two units exists around the map unit boundary; however, due to a lack of high resolution data and the relative inaccessibility of the area, we were unable to determine exactly where this boundary lies. For the moment the boundary between the two soil map sheets acts as an arbitrary boundary between the two map units.

Appendices

A series of appendices have been attached providing additional information relevant to this report and the accompanying soil map. Much of this information was either unavailable or not recorded with the original report.

TABLE OF CONTENTS

List of Figures

List of Tables

1 INTRODUCTION

This report is the ninth of a series under the general title “Reconnaissance Soil Map of Tasmania”. The original soil map which is the main feature of this report is at a scale of 1:63 360. The revised version of the map accompanying this report is at a scale of 1:100 000. This report incorporates information from a subsequent publication, "The Soils of the Oatlands Rectangle, Tasmania" (Cowie, 1961) which was an expansion by Cowie of his original survey in 1959. A list of soil maps available in this series appears at the back of this report. The area of the Oatlands map is *1145 square kilometres*.

2 PHYSICAL ENVIRONMENT

2.1 Geology & Geomorphology

The Oatlands sheet includes a typical area of what is known as the Southern Midlands of Tasmania. Much of the land is hilly but flats, terraces and basins bordering the rivers and streams are important features of the landscape. The main rivers draining the area are the Clyde, Jordan and Coal which flow south-west and south, and York Rivulet which flows north to join the Macquarie River. Two small and shallow lakes, Lakes Dulverton and Tiberias, occur on the upper reaches of tributaries of the Jordan River. Elevation of the country ranges from approximately *200m* near Melton Mowbray in the south to *923m* near Woods Quoin in the north-west, but most of the country is between *500 and 600m*. Alluvial basins and terraces at between *400m* and *450m* are common.

Sedimentary rocks of Triassic and Permian age, together with Jurassic dolerites which have been intruded into them, are the most extensive rocks in this sheet. Of the sedimentary rocks, siliceous sandstones of Triassic age are the most widespread. Associated with these are micaceous sandstones, mudstones, shales and siltstones which occur only in significant areas bordering the Midland Highway between Melton Mowbray and Spring Hill. Feldspathic sandstones of upper Triassic age occur throughout the sheet but only make up a significant part of the landscape in the York Plains-Nala district. Siliceous mudstones and associated grits of Permian age occur principally in the Tunnack area although there are isolated occurrences in the western part of the sheet. Small areas of basalt, usually as flat-topped cappings on hills occur throughout the district; the largest single area of basalt occurs just north of Spring Hill on the Midland Highway. Alluvial materials border most of the rivers and streams, the most extensive deposits being at York Plains, Bothwell, Oatlands, Jericho and Melton Mowbray.

Associated with these alluvial deposits are wind-blown materials which have accumulated on the eastern sides of the main rivers either as east-west trending dunes or as sand sheets. Wind-blown material also occurs bordering the eastern shores of Lakes Dulverton and Tiberias. Solifluction deposits of Pleistocene age, consisting of dolerite debris with a high proportion of boulders and stones are present in the higher country north of and around Woods Quoin, around Black Tier and Mt. Seymour.

2.2 Climate

Average annual rainfalls for a standard thirty-year period (1911-1940) for recording stations in the district are given in Table 1. These give a fairly broad picture of the overall range in rainfall and show the rain shadow which exists in the Midlands district extending north-east from Melton Mowbray, through Jericho and Oatlands to York Plains. Highest rainfalls occur in the more elevated country around Woods Quoin and around the settlement of Mt Seymour. There is quite a good correlation between rainfall and elevation (rainfall increasing with increasing elevation) and the pattern of rainfall is most likely a great deal more complicated than is suggested above.

Rainfall tends to be fairly evenly distributed, with February the driest month and June the wettest. Nicolls (1947), from calculations of monthly rainfall and temperature records from Oatlands, found that a "dry" period (monthly rainfall: evaporation ratios <0.3) of 2.3. or occasionally 4 months occurred during late spring and summer on an average of once in two to three years.

The average annual temperature for the town of Oatlands (*430m asl*) is *10°C.* Winter temperatures are low and intense radiation frosts are experienced during winter. The yearly average number of frosts (screen temperatures *0° C*) is 45 for Oatlands and average temperatures fall below *7.5°C* for the three months June, July and August, while for two additional months it barely exceeds this.

These low winter temperatures, coupled with frequent dry conditions in summer, mean there is often a fairly short growing season. Snow falls occasionally but, except on the higher parts, seldom lies for any length of time.

2.3 Vegetation

Two main types of vegetational communities were originally present in the area; savannah woodland and sclerophyll forest. The savannah woodland, which tended to be confined to areas of lower rainfall and the shallower soils (dolerite and basalt), consisted chiefly of *Eucalyptus pauciflora, E. ovata,* and other eucalypts, with a ground cover of native grasses such as *Poa caespitosa*, *Themeda australis* and *Danthonia spp.* The sclerophyll forest consisted chiefly of various species of eucalypts, with *Acacia dealbata,* bracken fern, *Leptospermum spp*., Epacrids, broadleaf saggs *(Lomandra spp.),* heaths and mosses. Many areas have been cleared and sown to pasture although large remnants of the original cover still remain, though modified by fire and grazing.

2.4 Land Use

Approximately half the area is farmed while the remainder is still in bush. Farming is mainly concerned with sheep and wool, utilising both improved and unimproved pastures. The fattening of lambs and beef cattle, mainly on improved pastures is concentrated in the Bothwell and York Plains districts. Dairying for town milk supply and the growing of seed potatoes are carried out in the Tunnack district. In the higher country around Woods Quoin and north of Black Tier some timber milling is done, while the cutting of firewood is carried out throughout the undeveloped parts.

Station	***Height (metres)***	***Jan.***	***Feb***	***Mar.***	***Apr.***	May	***June***	***July***	***Aug.***	***Sept.***	***Oct.***	***Nov.***	***Dec.***	***Year***	***No. of Raindays***
Andover	430	38	43	46	53	40	56	46	43	43	63.5	51	63.5	586	
Bothwell		38	38	43	51	38	46	46	41	46	58.5	51	56	552.5	
"Lovely Banks"	370	36	33	38	48	36	48	38	36	38	53	46	58.5	508.5	108
Mt. Seymour	573	43	43	51	58	48	61	51	46	43	63.5	53	66	626.5	142
Oatlands	432	36	43	46	53	46	53	48	48	43	58.5	51	61	586.5	186
"Bow Hill"														627.5	
Apsley														536	
Jericho ("Bowsden")														538	
Jericho ("Northumbria")														518	
Melton Mowbray ("Tranquility")														533	
Melton Mowbray ("Mt Vernon")														475	
Mt. Seymour ("Overton")														685	
Tunnack														640	
Woods Quoin														755	

Table 1 Rainfall data (in mm) for the Oatlands area (1911-1940)

3 SOIL MAP UNITS AND SPC'S

3.1 Soils on Sandstone

3.1.1 Podzolic Soils and Podzols on Siliceous Sandstone (Pss)

Podzolic soils from siliceous sandstone are the most extensive soils from sedimentary rocks on this sheet. Slopes range from undulating to steep with rolling slopes being the most common. Steeper slopes generally occur on the sides of dissecting rivers and streams or where the sandstone is overlain by dolerite or basalt and is protected to a certain extent form erosion. Rock outcrops are common and generally the surface of the soils is stony.

Podzolic soils are the most widespread in this group. The topsoil consists of a dark grey or greyish brown loamy sand and this is underlain by a light grey or brownish grey bleached horizon. The subsoil consists of a yellowish brown sand which in many places passes down to a mottled grey and yellowish brown sandy clay loam or clay at a depth ranging form *30-90cm* from the surface. In some profiles this clay subsoil has a columnar structure with light grey cappings on the columns and a darker grey coating along aggregate faces. The upper sandy horizons are usually stony.

Associated with podzolic soils are brown soils on siliceous sandstone (Bss). They occupy a fairly large part of what has been included in the podzolic group on the soil map but rarely could they be mapped separately.

Podzols on sandstone are found on the more siliceous sandstones under fairly high rainfalls. They occur mainly in the Mount Seymour district, north of Woods Quoin and between Lake Tiberias and Rhyndaston. The topsoil consists of a very dark grey sand and this passes down to a bleached pale brownish grey or grey loose sand sub-surface horizon. At approximately *35cm* from the surface a thin horizon of a coffee coloured, slightly cemented sand occurs. This passes down through a brownish yellow sand with some brownish mottles to a grey sandy clay with prominent brownish yellow mottles. Sandstone occurs at approximately *90cm* while occasional pieces of sandstone may be present through the soil. In some profiles the clay horizon is absent and the sandy horizons may continue to a depth of *90cm* or more. *A similar soil called the Dunrobin SPC was observed on the Ellendale Reconnaissance Soil Map near Hamilton.*

Also included with this group are small areas of brown soils on micaceous sandstones. Their general location is indicated on the soil map.

The native vegetation on these soils was a sclerophyll forest consisting chiefly of *Eucalyptus obliqua, E. viminalis, E. amygdalina* and *E. linearis* with an understorey of *Acacia dealbata*, bracken fern, *Leptospermum spp*., and various heaths.

Land Use

The soils of this group are naturally infertile. This factor, together with their cover of trees with the consequent difficulty of clearing the land, their stoniness, and often difficult access, has hindered their development and large areas still remain in bush. However, in places which are not too steep or too stony some clearing has been done and quite good pastures have been established with heavy dressings of phosphate. Areas of ploughable land are limited but with oversowing and aerial topdressing a large part of the area of these soils could be farmed if warranted.

Correlation

This unit is a complex of deep sandy profiles, with shallower sands over a yellowish brown medium clay. They are generally classified as Chromosols where a clay subsoil is encountered, or Tenosols for deep brown sands, (which may or may not overly the clay subsoils). Some sandy profiles have formed a brown, firm massive horizon, or Bh. These soils are classified as Podosols, indicating an intense leaching process.

Field work verified a wide range of morphologies encountered over relatively short distances. No SPCs were generated due to this complexity and the scale of mapping used.

3.1.2 Brown Soils on Siliceous Sandstone (Bss)

Brown soils on sandstone are widespread throughout the district. However, as they occur in close association with the podzolic soils (Pss), they could rarely be separated from them at the intensity of mapping used. The one area in which they have been separated is the undulating to strongly rolling country of the Oatlands basin.

The surface soil consists of a dark brown sandy loam or loamy sand. This overlies a yellowish or reddish brown loamy sand which grades down through a brownish yellow loamy sand to a greyish yellow sandy clay loam with reddish brown and grey mottles. Occasional fragments of sandstone occur through the profile while rock outcrops are common. The soil rests on sandstone at approximately *90cm.*

Associated with these soils, more especially in the Oatlands basin, are deep accumulations of bright yellowish brown sands with thin dark brown topsoils *(Tenosols).* These are of fairly recent age and most likely owe their origin to wind erosion following cultivation in the early days of settlement. Buried topsoils have been noted while accumulation of sand along fences is very marked.

From their profile morphology it appears that the three groups of soils found on the siliceous sandstone lithology, ie Yellow Podzlics, Podzols and Brown Podzolics, could be arranged in a leaching or podzolization sequence, the least leached being the brown soils, the most leached, the podzols. The factors which determine the degree of podzolization are most likely parent material, topographic position, and rainfall.

Podzols tend to occur in the higher rainfall areas (greater than *580-600mm*) on flattish tops and on the most siliceous rocks. All these conditions need not be fulfilled, however; podzols may develop under lower rainfalls on extremely siliceous rocks in favourable topographic positions. Topographic position is considered important as on a flattish top run-off would be at a minimum and most of the rainfall would be available for leaching. In addition there would not be much erosion. Resistant material would remain in place and there would not be the replacement with fresh material from below.

Not enough is known about the differences in the Triassic sandstones to correlate differences in mineralogical status (eg percentage feldspars) with morphological differences in the soils although it would be expected that podzols will form on the highly siliceous rocks and the brown soils on the less siliceous ones.

The reason for the differences between the brown and podzolic soils is more difficult to explain as they occur in such close association - they have been noted within *45m* of each other. They both occur under a wide range of rainfall (brown soils have been noted near Mt. Seymour settlement under a rainfall of *630mm*). As with the podzols, differences in the mineralogical content of the parent rock may be partly responsible for differences in the soils but this would require a fuller study than has been possible in this survey. However, it was noted that in the Oatlands basin where the brown soils are best developed, the parent rock appears more feldspathic than normal. Another possible factor is their topographic position with the podzolic soils occurring on the lower slopes and the brown soils on the upper slopes. The lower slopes would tend to be accumulating leached material from up-slope which could be readily podzolized.

On upper slopes leached material is being continually removed and replaced by fresh material from below. This relationship does seem to exist but it is not universal and further detailed work would be needed to confirm or deny it.

In many of the profiles of this group the underlying clay horizons appear to be foreign to the rest of the profile. Angular, hard pieces of sandstone are present in the upper sandy horizons but are absent in the lower clay horizons, suggesting a wash of material over the clay subsoil. In places the clay subsoil has a weakly developed columnar structure suggesting solonetzic morphology. It may be that such a horizon has developed in a previous drier climate, then was partly eroded and then had a wash of sandy material on top of it. This would tie in with the work of van Dijk (1959) in Canberra (ie K2 over K3). However, although there does seem to be some correlation between slope and depth of sandy horizons (with deeper sandy horizons found towards bottoms of slopes); deep sandy horizons are also present on flattish tops where no down-slope accumulation of material is possible. It is usually explained that the clay has come from the weathering of the small amounts of feldspathic and micaceous minerals in the sandstone and has been segregated in the lower horizons by downward leaching. However, the down-slope accumulation of a certain amount of sandy material in some situations should not be precluded.

The podzolic soils would be included mainly with Stephens' Yellow Podzolics, with perhaps some of the more sandy ones having accumulation of iron in the subsoil as Podzols. The brown soils would be included in his Brown Podzolic group.

Land Use

The native vegetation on these soils was sclerophyll forest but around Oatlands most of the land has been cleared and sown to pastures.

Correlation

The Brown Soils on Siliceous Sandstone exist in complex with other sandstone soils, and have only been separated into small units. Due to this, and the complexity of the soils on siliceous, micaceous and feldspathic sandstone and the scale of mapping used, no SPC could be generated.

3.1.3 Brown Soils on Micaceous Sandstones 1 (Bms1)

Soils developed on micaceous sandy mudstones, shales, siltstones and sandstones of Triassic Age are grouped as brown soils on micaceous sandstones. In most areas they cannot be shown separately from the Podzolic soils on sandstone and are mapped as a complex with them (see Pss above). The largest area of these soils occurs bordering the Midland Highway between Melton Mowbray and Spring Hill.

In the dominant profiles, the topsoil consists of a dark brown loam or sandy loam which grades down to a dark yellowish brown loamy sand. At approximately *30cm* this passes abruptly to an olive clay with thick dark grey coatings on aggregate faces. In some profiles the dark grey colour is the dominant colour of the horizon and the olive part is present only as small mottles in the interior of the aggregates. With depth the grey coatings become less marked until at approximately *56cm* from the surface this horizon passes to olive clay with faint yellowish brown mottles. The upper sandy horizons are weakly structured while the subsoil has a strongly developed blocky structure. The parent rock, which is present approximately *60 to 90cm* from the surface, occasionally has coatings of lime along cracks.

The morphological features such as the usual lack of a bleached A2, and the presence of lime in the parent material suggest only weak leaching. This is understandable considering the low rainfall and the nature of the parent rock which has enough micaceous and feldspathic minerals to weather and release bases which to a certain extent balance those lost by leaching. However, the sharp texture break, indicating strong downward movement of clay is hard to reconcile with the apparent weak leaching. This could be a normal feature of soils developed under low rainfalls but it is tempting to explain it as due to dispersion and movement of the clay by sodium ions. Under low rainfalls accessions of cyclic salt would be important. Sodium and magnesium ions would also be produced by the weathering of the parent rock. Chemical data support the view that these soils are solonetzic as sodium and magnesium make up 70% of the exchangeable cations while sodium makes up 26%.

Included in this group are soils which show a slightly bleached sub-surface horizon and also soils with browner and more friable subsoils in which the dark grey coatings are not present in aggregate faces. These latter soils usually occur on the finer textured rocks such as shale.

Land Use

In contrast to the soils from siliceous sandstone, these soils carry a less dense vegetative cover although this may be the result of clearing. There is usually a good ground cover of native grasses, which provide rough grazing for sheep and cattle. Rock outcrops are rare so that where slopes are not too steep some improved pastures have been established. The area of these improved pastures could be considerably increased especially with over-sowing and aerial topdressing on the steeper country.

Correlation

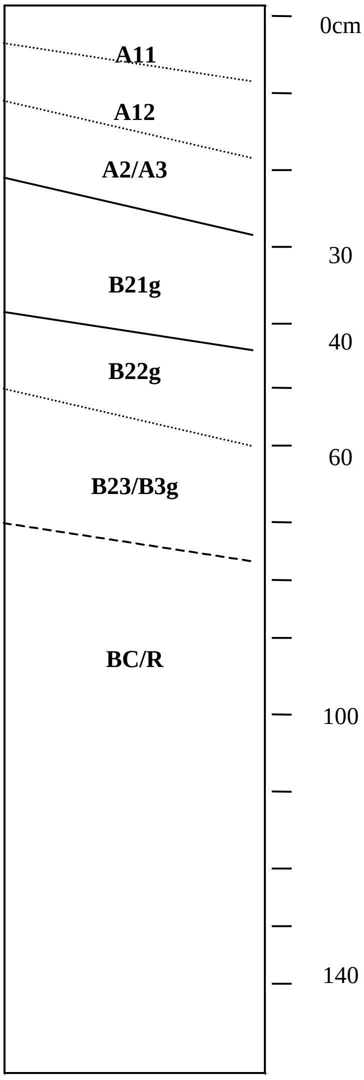
Little work was undertaken in this unit due to its complexity and limited time. Using the available CSIRO site in this unit, and a similar Brown Soils on Micaceous Sandstone type profile from the Ellendale Reconnaissance Soil Map, a broad SPC called the Lovely Banks SPC has been generated. This SPC will be tightened with future work on these soils as more descriptions are obtained.

Lovely Banks Soil Profile Class

Concept **Brown texture contrast soils on micaceous sandstone.**

Aust. Soil Classification Brown or grey Chromosols and Sododols
Great Soil Group Solodic, Solodized Solonetz
Principal Profile Form Dy3
Mapping Units Bms
Parent Material Micaceous Sandstone
Landform Undulating to rolling hills

Vegetation Extensively cleared, with native grasses
Surface Conditions
Permeability Slow
Drainage Imperfectly drained



A11: Brown to dark brown (7.5YR 4/2, 10YR 3/3); loam to sandy loam; weak <2-5mm granular structure; very weak (moist) to weak (dry) consistence; pH 6.2 – 6.3; gradual to diffuse change to

A12: Brown to dark brown (7.5YR 4/2, 10YR 3/3) light loam to sandy loam; weak <2mm granular structure; very weak (moist) to weak (dry) consistence; 0-10% coarse gravels; pH 6.8 – 7.0; diffuse change to

A2/A3: Brown to yellowish brown (7.5YR 5/2, 10YR 5/4); light loam to sandy loam; massive structure; very weak to weak (moist) consistence;
2-10% coarse gravels (sandstone); pH 7.3 – 7.6; abrupt change to

B21g: Mottled; dark grey to dark yellowish brown (10YR 4/1, 4/4) with prominent olive to greyish brown mottles; heavy clay; moderate to strong 20-50mm angular blocky or prismatic structure, parting to strong 10-20mm angular blocky structure; strong to very strong (moist) consistence; 0-2% coarse gravels (sandstone); pH 7.5 – 7.8; clear change to

B22g: Mottled; dark greyish brown to greyish brown (2.5Y 4/2, 5/3) with yellowish brown or greyish brown mottles; heavy clay; weak to moderate 20-50mm angular blocky or prismatic structure, parting to 10-20mm angular blocky structure; strong (moist) consistence; 0-10% angular coarse fragments (sandstone); pH 8.4 – 8.6; gradual change to

B23/B3g: Mottled; olive to yellowish brown (5Y 4/3, 10YR 5/4) with greyish or yellowish brown mottles; sandy medium to heavy clay; massive or moderate 10-20mm angular blocky structure; very strong (moist) consistence; 2-20% angular medium gravels;
pH 8.5 – 9.2;

BC/R: Sandy medium clay

Morphological Sites: CSIRO H191, H227
Analysed Sites: CSIRO H191, H227
Related soil names:
Previously described by:

Soil Profile Class Grid Reference	**Profile Number**	**Horizon**	**Sample Depth (cm)**	**pH water (1:5)**	**EC (d/sm)**	**Total P (mg/kg)**	**Avail K (mg/kg)**	**Org. Carb. (%)**	**Total N (%)**	**C/N Ratio**	**Ca meq**	**Mg meq**	**Na meq**	**K meq**
Lovely Banks	H191	A11	0-8	6.2	0.071	0.034		2.80	0.216	13	7.8	1.8	0.36	0.75
518000E	H191	A12	8-18	6.8	0.051	0.036		1.40	0.117	12				
5300495N	H191	A3	18-28	7.1	0.060	0.020		0.76	0.073	10	4.5	1.4	0.48	0.38
	H191	B21g	30-46	7.8	0.429	0.020		1.20	0.122	10	4.6	5.2	2.80	1.00
	H191	B22g	46-56	8.4	0.568									
	H191	B3	56-74	8.5	0.705						3.4	6.5	3.90	6.50

Soil Profile Class Grid Reference	**Profile Number**	**Horizon**	**Sample Depth (cm)**	**Total Bases**	**ECEC meq**	**BASE SAT (%)**	**ESP (%)**	**Ca/Mg Ratio**	**Gravel (of total) >2000 (um) (%)**	**Sand Coarse >200 (um) (%)**	**Sand Fine <200 (um) (%)**	**Silt (%)**	**Clay (%)**
Lovely Banks	H191	A11	0-8		18.61	58	1.9	4.33	0	5	62	11	16
518000E	H191	A12	8-18										
5300495N	H191	A3	18-28										
	H191	B21g	30-46		9.56	70	5.0	3.21	2	7	65	13	15
	H191	B22g	46-56		16.90	80	16.6	0.88	0	2	36	6	54
	H191	B3	56-74										
							19.2	0.52	2	2	30	6	63

Table 2 Analytical data for the Lovely Banks SPC

3.1.4 Brown Soils on Feldspathic Sandstone 2 (Bfs2)

Brown soils from feldspathic sandstone occur principally in the north-eastern part of the sheet around the York Plains-Nala district. Elsewhere they occur in areas too small to be mapped separately; their general location, however, is indicated on the soils map. Characteristic features of the landscape on which these soils occur are symmetrical conical hills, locally referred to as sugarloaves. These sugarloaves are capped by basalt, which has protected the underlying sandstone from erosion.

Most of these soils are fairly shallow and consist of a brown sandy loam overlying a light brown to yellowish brown sandy loam or loamy sand with many pieces of weathering sandstone. Light yellowish brown feldspathic sandstone occurs *at 30-35c*m from the surface. On lower slopes, where there has been an accumulation of sandy material, the soils are deeper and free of stones. Where the sandstone is overlain by dolerite or basalt, as is quite common, and the soil on the lower slopes is formed from a mixture of the two materials, profiles are varied. Most are heavy textured.

Land Use

The native vegetation on these soils was most probably a savanna woodland with a ground cover of native grasses such as *Danthonia* and *Poa caespitosa*. Natural fertility is higher than on the soils from siliceous sandstone and most of the original trees have now been removed and sheep and cattle are grazed on unimproved pastures. On some farms improved pastures have been established although large areas still remain which could be ploughed and sown to pasture. On land too steep or too stony to plough a marked improvement in pastures could be achieved by over-sowing and aerial topdressing.

Correlation

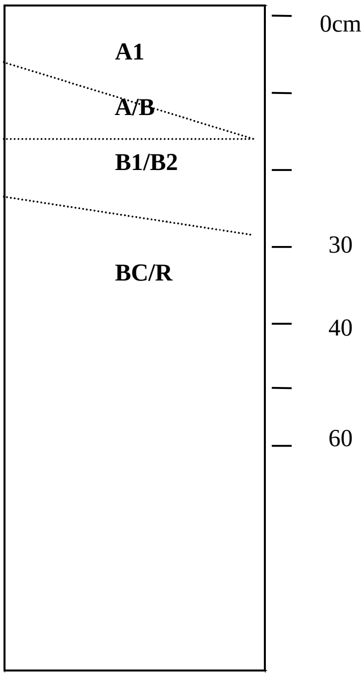
The Brown Soils on Feldspathic Sandstone unit exists mainly as a complex with brown dolerite soils, or soils formed on siliceous sandstone. Pure Bfs units are relatively small, which made identification of this soil type difficult at the scale of mapping used. This unit has been renamed Brown soils on feldspathic sandstone 2 (Bfs2).

A dominant soil, the York Plains SPC, has been defined based on Cowie's description, historical site data, fieldwork and Nicolls' (1947) detailed survey of the York Plains area. The York Plains SPC correlates with the Skeletal Type 2 soils described in Nicolls (1947). The SPC has only been loosely defined with sites concentrated in the north-east of the map sheet. It is expected that this SPC will be improved as more work is done in the area.

Nicolls (1947) identified a second soil type (Type 5) on the lower slopes of the feldspathic sandstone. This soil type is very similar to the Langloh SPC described on the Ellendale Reconnaissance Soil Map. Unfortunately we could not substantiate this due to a lack of data and time. More work is required within the Brown soils on feldspathic sandstone 2 (Bfs2) unit to determine whether the deeper soils on the lower slopes identified by Cowie (1961) and Nicolls (1947) correlate with the Langloh SPC and if the York Plains SPC occurs on the Ellendale sheet.

York Plains Soil Profile Class

Concept	**Sandy brown shallow soils formed on feldspathic sandstone**
Aust. Soil Classification	Brown Kandosols or Tenosols
Great Soil Group	Lithosol
Principal Profile Form	Uc
Mapping Units	Bfs2
Parent Material	Feldspathic Sandstone
Landform	Upper slopes and crests of low hills
Vegetation	Eucalypt savannah woodland and native grasses
Surface Conditions	Firm
Permeability	Moderately to highly permeable
Drainage	Well drained



A1: Dark brown to brown (7.5YR 3/2, 4/3); sandy loam; weak <2-5mm granular structure; very weak to weak (moist) consistence; pH 5.8 – 6.1; sharp to abrupt change to

A/B: Brown to yellowish brown (7.5YR 2/2, 10YR 5/4, 5/8); sandy loam to sandy clay loam; weak 2-10mm subangular or angular blocky, parting to <2mm granular structure; very weak to weak (moist consistence); 0-20% angular sandstone medium gravels; pH 6.1 – 6.4; clear to gradual change to

B1/B2: Brown to yellowish brown (7.5YR 4/4, 10YR 5/8); loamy sand to sandy clay loam; weak 5-10mm subangular or angular blocky; weak (moist) to firm (dry) consistence; 0-10% angular sandstone coarse fragments; pH 6.7 – 7.4; clear change to

BC/R: Sand; massive

Morphological Sites: CSIRO H187, SOILCO 113, OBCSIR OA34
Analysed Sites: CSIRO H187
Related soil names: Brown Soils on Feldspathic Sandstone
Previously described by:

Soil Profile Class Grid Reference	**Profile Number**	**Horizon**	**Sample Depth (cm)**	**pH water (1:5)**	**EC (d/sm)**	**Total P (mg/kg)**	**Avail P (mg/kg)**	**Avail K (mg/kg)**	**Org. Carb. (%)**	**Total N (%)**	**C/N Ratio**	**Ca meq**	**Mg meq**	**Na meq**	**K meq**
York Plains	H187	A1	0-8	5.8	0.054	0.070			4.90	0.284	17	12.7	0.62	0.17	0.44
541106E	H187	AB	8-14	6.1	0.030	0.060			1.85	0.148	13				
5318386N	H187	B1w	14-23	6.4	0.021	0.048			0.72	0.069	10	9.1	0.80	0.19	0.15
	H187	Bc	23-30	6.7	0.027										

Soil Profile Class Grid Reference	**Profile Number**	**Horizon**	**Sample Depth (cm)**	**Total Bases**	**ECEC meq**	**BASE SAT (%)**	**ESP (%)**	**Ca/Mg Ratio**	**Gravel (of total) >2000 (um) (%)**	**Sand Coarse >200 (um) (%)**	**Sand Fine <200 (um) (%)**	**Silt (%)**	**Clay (%)**
York Plains	H187	A1	0-8		28.03	50	0.6	20.48	0	39	19	14	17
541106E	H187	AB	8-14										
5318386N	H187	B1w	14-23										
	H187	Bc	23-30		14.54	71	1.3	11.38	3	47	23	19	8

Table 3 Analytical data for the York Plains SPC

3.2 Soils on Mudstone

3.2.1 Podzolic Soils on Mudstone (Pm)

Soils developed on Permian siliceous mudstones occur chiefly in the Tunnack district but they also occur in scattered localities west and north-west of Bothwell. Slopes range from rolling to steep.

The soils are stony and fairly shallow. The topsoil consists of a shallow light brownish grey sand or loamy sand and this overlies a brown or yellowish grey stony clay loam. This generally passes down to pale greyish yellow clay with yellowish brown mottles. A hard, jointed light grey mudstone is present at *23-60cm* from the surface.

Associated with the soils from mudstone are soils formed from a siliceous grit, which usually occurs on higher flats and ridges above the loam. This is underlain by a brown gritty silty loam which grades through a yellow brown clay to a yellowish grey clay at approximately *90cm*. Some profiles showing a bleached, light grey sub-surface horizon and darker-coloured subsoil have been noted.

Land Use

The mudstone soils are very infertile and little attempt has been made to clear the native sclerophyll forest and establish pastures. Where pastures have been established they are very poor and dry off badly in summer. The associated gritty soils are also rather infertile but some small areas have been cleared and sown to pasture.

Correlation

Not enough information was available to generate an SPC for this unit. The general description given by Cowie (1961) for the dominant soil is very similar to the Forcett SPC identified within this unit on the southern Reconnaissance soil maps. Unfortunately no data was available for this unit. This unit is often mapped on this map sheet as a complex of Podzolics and alluvium; the origin of the alluvium appears to be a mixture of Permian, Triassic and Jurassic sediments washed from the surrounding hills.

3.3 Soils on Dolerite

3.3.1. Podzolic Soils on Dolerite 1 (Pd1)

Podzolic soils from dolerite occur in the higher rainfall areas of the district. In general these areas correspond to the more elevated country between approximately *460-760m* above sea level. Slopes range from undulating to steep and the surface of the ground is usually stony.

Typical profiles show a topsoil of a greyish brown stony silty loam which overlies a bleached light grey to brownish grey sandy loam with rounded iron concretions and some stones. This rests on an olive brown or olive grey clay, plastic and sticky when moist, with some iron concretions and few dolerite stones. Weathered dolerite is present from below approximately *90cm*.

Areas shown as this group on the soil map show all gradations between the profile described above and that described for Brown Soils on Dolerite 1 (Bd1). In some areas the soils consist of a complex with Podzolic soils on the shady south-eastern faces and the brown soils on the ridges and sunny north-western faces. East of Rhyndaston the bleached sub-surface horizon is only weakly developed and subsoils are redder and more friable.

Land Use

Because of the relatively dense cover of bush on these soils together with their steepness and stoniness of the surface, little attempt has been made to farm them except in areas transitional to the brown soils on dolerite where the bush cover is less dense. In most places, however, only rough grazing of sheep on unimproved pastures is carried out. On areas which are not too steep improved pastures could be maintained with adequate topdressing of phosphate.

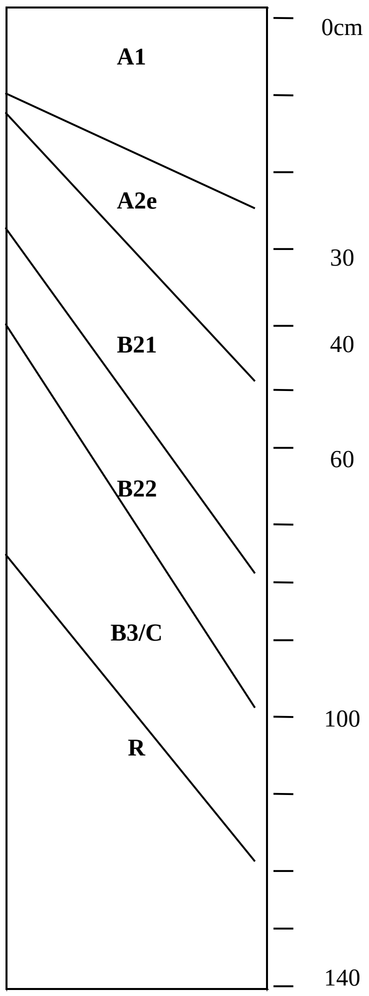
Correlation

The dominant soil of this unit is the Eastfield SPC and correlates with the Type 4 soil identified on the detailed York House Estate soil map (Nicolls, 1947).

The original surveyors of the Buckland and Oatlands sheet have identified a grey mottled poorly drained phase of the Eastfield SPC. This phase is very similar morphologically to the Eastfield Soil Profile Class, but is classed as poorly drained, as opposed to imperfectly drained. The matrix is generally grey to greyish brown, with a shallower A2, and mottles closer to the surface than the Eastfield, indicating poorer drainage. No landform data was available for these sites, but this poorer drainage could be due to landscape position, for example, hillslope depressions that impede through-flow water movement, or lower slope elements receiving increased water volume with respect to mid-slope profiles.

Eastfield Soil Profile Class

Concept	**Brown, mottled, texture contrast soils with dolerite fragments throughout, loamy topsoils, sandy sub-surface, with ironstone, and clayey subsoils developed on dolerite hills.**
Aust. Soil Classification	Eutrophic Brown or Grey Chromosols and Sodosols
Great Soil Group	Grey-Brown Podzolics & Soloths
Principal Profile Form	Db, Dd
Mapping Units	Ea, Ea-Bo, Ea-Bm, Pd1
Parent material	Jurassic Dolerite
Landform	Moderately to steeply undulating hills
Permeability	Slowly permeable
Drainage	Imperfectly drained



A1: Grey to black (19YR 2/1, 3/1, 3/2, 4/1, 4/2, 5/2): sandy loam to loam: massive or weak structure, 2-10mm, subangular blocky structure, very weak to weak (moist) consistence, very few, 2-6mm, ferruginous concretions, variable amounts of dolerite stones and boulders; pH 5.5- 7.0; clear to gradual change to

A2e: Conspicuously bleached (10YR 4/2, 5/1, 5/2, 6/2): fine loamy sand to fine sandy loam; single grain or massive structure; very weak to weak (moist) consistence; common to abundant, <2-6mm, ferruginous concretions, variable amounts of dolerite gravels, stones or boulders; pH 5.5-7.0; sharp to abrupt change to

B21: Mottled: brown (10YR ¾, 4/3, 4/4, 4/6, 5/4): medium to heavy clay; massive to weak or moderate, 50-200mm angular blocky, firm to very firm (moist) consistence, few slickensides; clay skins common; cracks present; very few to few 2-6mm, ferruginous nodules; variable amounts of dolerite fragments, stones or boulders; pH 6.5 – 7.0; abrupt to clear change to

B22: Mottled: brown (2.5Y 4/4, 4/6, 10YR ¾, 4/3, 4/4, 4/6, 5/4, 7.5YR 4/4, 5/6, 4/6, 5YR 3/3); medium to heavy clay; massive to weak or moderate 50-100mm, angular blocky structure; firm to strong (moist) consistence; very few to few 2-6mm, ferruginous nodules; variable amounts of dolerite stones and boulders; slickensides and clay skins common; pH 6.5 – 7.5; sharp to clear change to

B3/C Occasionally mottled; brown (2.5Y 5/4, 5/3, 4/3, 4/4); light to medium clay; strong (moist) consistence; occasionally calcareous soft segregations present; variable amounts of dolerite stones or boulders; slickensides common; pH 7.0-7.5

R: Jurassic dolerite

Morphological sites: CSIRO H86, H78, H24, H163, H125, H237, H128, H250; LRRBD L6, 34, 93, 126; SOILCO 70, 72, 73
Analysed sites: CSIRO H86, H78, H24, H163, H125, H237, H128; LRRBD L12, 43
Related soil names: Eastfield Series, Eastfield Sand, Type 1, Eastfield SPC, Podzolic on dolerite, Shawfield Series, Type 4
Correlation references: Grant (1995b), Stephens et al (1942), Loveday (1957), Doyle (1993), Nicolls (1947), Spanswick & Zund (1999a), Spanswick & Zund (1999b), Spanswick (2000), Spanswick & Kidd (2000a, 2000b, 2000c, 2000d, 2000e)

3.3.2 Brown Soils on Dolerite 1 (Bd1)

Shallow brown soils on dolerite occur throughout the district generally at lower elevations and under a lower rainfall than the Podzolic soils on dolerite. Topography ranges from rolling to steep and rock outcrops are common in some areas.

A typical profile has a dark reddish brown loam topsoil *10–12cm* deep overlying a reddish brown clay which rests on dolerite at *30-60cm* from the surface. Stones may occur on the surface and through the soil. Coatings of lime are occasionally observed down cracks in the dolerite.

Land Use

The native vegetation on these soils was originally a savanna woodland consisting chiefly of scattered eucalypts with a ground cover of native grasses such as *Themeda australis, Poa caespitosa* and *Danthonia spp*. On most farms little attempt has been made to improve the native pastures and they are used for the extensive grazing of sheep. In some areas where slopes are not too steep some pasture improvement has been carried out. Further pasture improvement on these soils is possible. However, lack of soil moisture in summer is a limiting factor in the maintenance of good pastures on these soils, and in their utilisation.

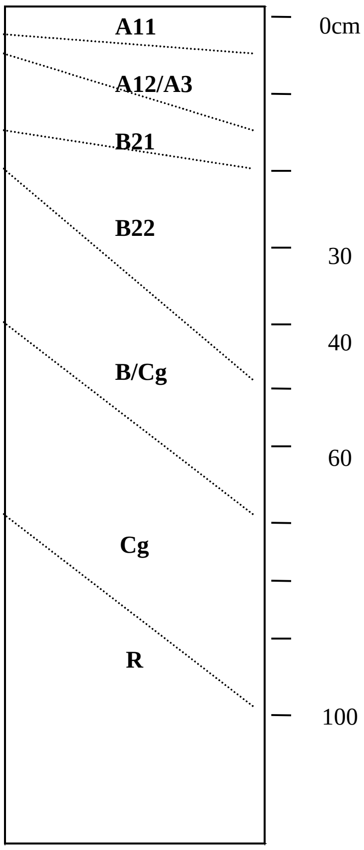
Correlation

The dominant soil of this unit is the Tea Tree SPC. It defines a shallow, stony red-brown gradational to weakly duplex soil which is commonly found on dolerite below 520m and between a rainfall range of 480mm to 635mm. Strong texture contrast soils with clear to abrupt textural boundaries are also found within this unit but more commonly the soils of this unit lack a clear to abrupt boundary. Windblown sand was also observed in the surface of some profiles.

One of the reference sites used to construct the Tea Tree SPC on this map sheet, SOILCO 111, occurs within a Bms1 unit. A small dolerite knoll outcrops within this sandstone unit, too small to map separately at this survey scale, and it is here that the reference site is found.

Tea Tree Soil Profile Class

Concept	**Shallow moderately structured gradational to weakly duplex red brown soils formed on dolerite.**
Aust. Soil Classification	Eutrophic red or brown Dermosols or Ferrosols
Great Soil Group	Non calcic Brown soils
Principal Profile Form	G or D
Mapping Units	Bd1,
Geology	Jurassic Dolerite
Landform	Moderate to steep slopes
Surface Conditions	Many coarse fragments
Permeability	Moderate permeability
Drainage	Moderately well drained



A11: Black to red (7.5YR 3/2, 5YR 2/3, 2/2, 2/1); loam to clay loam; weak-moderate granular structure; weak (moist) consistence; 2-10% dolerite stones; pH 6.0 - 6.5;

A12/A3: Brown to red (7.5YR 3/2, 5YR 2/2, 3/3); clay loam; weak to moderate granular structure; weak (moist) consistence; 10-20% dolerite stones; pH 6.0 - 7.0; gradual boundary change to

B21: Red (5YR 3/3, 4/5, ¾, 2.5YR 2/3); medium to heavy clay; weak to moderate fine to medium (10-50mm) angular blocky, sometimes moderate granular structure; moderate (moist) consistence; 2-20% dolerite gravels; pH 6.5 - 7.5; diffuse boundary to;

B22: Sometimes mottled: red (5YR 3/3, 2.5YR 2/4, 2/3); heavy clay; moderate to strong (20-50mm) angular blocky structure, moderate to strong (moist) consistence; 10-20% dolerite gravels; clay skins often present, pH 7.0 - 8.0; diffuse boundary to

B/Cg: Mottled: red (5YR 3/3, 4/2, 5/8, 4/6; 2.5YR 3/6, 10YR 5/6, 7.5 YR 5/8); heavy clay; massive to weak (20-50mm) angular blocky; moderate (moist) consistence; 10-50% dolerite gravels; calcareous segregations are sometimes present; pH 7.5 - 8.0; diffuse boundary to

Cg: Mottled: red to brown (5YR 3/3, 10YR 5/6, 10YR 5/8, 10YR 8/1); massive structure; pH 8.0

R: Jurassic dolerite

Morphological sites: CSIRO H245, H114, H167, H160; PINK 12022; CARDS C0251, C0252, C0253; SOILCO 41, 111, LCDERW 183
Analysed sites: CSIRO H245, H114, H167, H160; PINK 12022
Related soil names: Brown Soils on Dolerite, Kimbolton Series
Correlation references: Spanswick & Kidd (2000b, 2000c & 2000d)

3.3.3 Miscellaneous Soils on Dolerite 1 (M1)

These soils occur on the higher parts of the district generally above *600-760m*, around the north of Woods Quoin, north of Black Tier and around Mt Seymour. Slopes range from undulating to steep Rock outcrops are common while the surface of the soil is generally stony.

The topsoil, which is approximately *15cm* deep, consists of a dark brown silty loam with few to many stones. This grades down into a reddish or bright yellowish brown clay with few pieces of dolerite. At depth the material becomes very stony and poorly sorted with finer material in the interstices of the boulders and stones. The boulders and stones are mainly dolerite although occasional pieces of sandstone do occur.

Included with this group are soils from solifluction deposits which have profiles similar to those of the Podzolic Soils on Dolerite 1 (Pd1).

Land Use

The native vegetation on these soils consisted of a wet sclerophyll forest and no clearing has been attempted. Clearing and development would be difficult and it is doubtful if these soils have any agricultural potential. Some timber milling is carried out.

Correlation

No work was undertaken in this unit due to its limited extent and poor accessibility. Three SPC's described by Grant et al have been correlated with the Yellow Brown Soil on Solifluction Deposits SPC. These SPC's are the:

***Holloway Soil Profile Class** - red clayey soils under dry forest, annual rainfall 900-1000mm, elevation range 100-600m, (Hill et al,1995);*

***Excalibur Soil Profile Class** - red to brown clayey soils under wet forest, annual rainfall 1000-1400mm, elevation range 300-700mm, (Hill et al ,1995);*

***Interlaken Soil Profile Class** - red to brown clayey soils under mid to high altitude dry forest, which also supports wet forest, annual rainfall 1300mm, elevation range 700-1100m.*

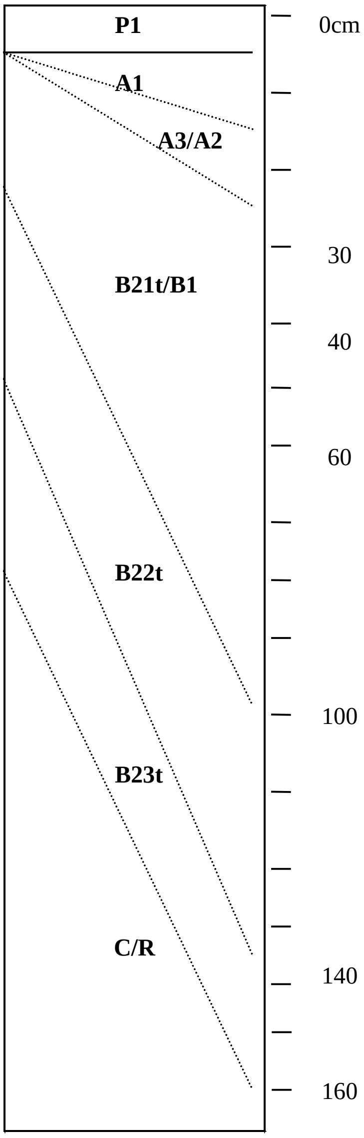
Original CSIRO mapping included stony dolerite soils at elevations ranging from 460-1380m, and with rainfall between 890 – 1650mm/year. The three soil profile classes above all fit within the broad morphological, climatic and topographic parameters used for the YBs units mapped, so have therefore been included in the more general Yellow Brown Soils on Solifluction Deposits SPC. It was not possible to separate these soils at the scale of mapping used. Original CSIRO mapping would not have separated these units, as they would have been considered marginal agricultural land due to stoniness and slope limitations. Many of these soils are now under State Forest, and have therefore had more detailed work undertaken by Forestry Tasmania.

The YBs SPC includes a shallow surface layer of fibric or sapric peat. Though the original surveyor has made no mention of this layer in the text, the M1 unit occurs at a similar elevation and rainfall range as similar units in other parts of the state where a shallow peat layer was observed. The M1 unit on the Oatlands sheet has been predominantly mapped using aerial photographs and, as access into these areas is limited, we suspect that very little field verification occurred in the M1 unit.

Yellow Brown Soils on Solifluction Deposits Soil Profile Class

Concept	**Stony/bouldery soils with gritty sandy loam surface soils and brown, clayey, structured subsoil developed on dolerite solifluction deposits.**

Aust. Soil Classification Eutrophic Red Ferrosols & Brown Dermosols
Great Soil Group Red - Yellow Podzolic, Krasnozem soil
Principal Profile Form Gn
Mapping Units M1, Lw, M1-Lf, M1-Qu, Ybs1
Geology Jurassic or Quaternary dolerite solifluction deposits
Landform Upper slopes, crests and simple slopes of moderate to very steep hillslopes on the Western Tiers and Plateau.
Vegetation Wet sclerophyll forest - *Eucalyptus delegatensis*
Permeability Moderate to highly permeable
Drainage Well drained



P1: Fibric peat or sapric loam

A1: Black (5YR 2/1; 7.5YR 2/1, 4/4, 5/6); sandy loam - heavy loam; moderate <2-5mm granular structure; very weak (moist) consistence, 20-50% dolerite gravels and cobbles; pH 5.0-6.0; clear smooth change to

A3/A2: Black or red (5YR 3/2, 3/3); heavy loam, loamy sand or clay loam; weak to moderate, 2-5mm, granular parting to <2mm granular structure; very weak (moist); consistence; 20-90% dolerite gravels; pH 5.0-6.0; clear wavy change to

B21t/B1: Brown or red (7.5YR 4/4,4/6, 5/6, 5YR 4/6, 2.5YR 4/6,3/6) clay loam to fine sandy clay; moderate 2-5mm granular or subangular blocky structure; weak (moist) consistence; 50-90% dolerite gravels and cobbles; clay skins common; pH 6.0-6.5; gradual smooth change to

B22t: Red or brown (5YR 4/4, 4/6, 7.5YR 4/4, 4/6, 5/6); sandy clay loam - heavy clay loam; massive to moderate 5-20mm angular blocky structure; weak (moist) consistence; 2-20% maganiferous soft segregations; 50-90% dolerite gravel on cobbles; common to many clay skins; pH 5.5 - 6.0; gradual smooth change to

B23t: Red to brown (5YR 4/6, 4/4, 7.5YR 4/4, 4/6, 5/6, 5/8); light clay to heavy clay loam, often with coarse sand; massive to moderate 10-20mm angular blocky parting to 2-10mm angular blocky structure; weak (moist) consistency; <2-50% dolerite gravels and cobbles; clay skins common to many; pH 5.5 - 6.0; diffuse change to

C/R: Light clay; 50-90% dolerite gravels on bedrock or boulders

Morphological sites: LRRBD L155, L153, L154, H182, H240
Analysed sites: LRRBD L153, L154, H182, H240
Related soil names: Holloway (Ho), Excalibur (Ex), Interlaken, Yellow Brown Soils on Solifluction deposits
Correlation references: Grant (1995a), Leamy (1961), Doyle (1993), Spanswick & Zund (1999b), Spanswick & Kidd (2000b & 2000c)

3.4 Soils on Basalt

3.4.1 Brown Soils on Basalt (Bb)

The total area of brown soils on basalt is quite small although they are scattered throughout the district. The basalt occurs as hill-cappings and slopes are mainly flattish with smaller areas of steeper slopes on the margins of the basalt sheets.

Profiles show a topsoil of a dark brown or reddish brown stony loam which rests on a yellowish brown very stony clay. Basalt is present at shallow depths. The surface of the soil is stony. At one locality near Jericho, black soils occur on the lower slopes surrounding a basalt capping. These soils consist of approximately *35cm* of very dark grey to black clay loam with a granular structure which grades down to a dull yellowing brown clay with few iron concretions. The surface of the soil is generally free of stones but occasional pieces of basalt occur through the profile. Such soils are more common south of the Oatlands sheet.

Land Use

The native vegetation consisted of a savanna woodland with a ground cover of native grasses. Some clearing of trees has been done and the native pastures are used for extensive grazing of sheep. An attempt has been made to establish improved pastures on the brown soils on a few farms but their stoniness and draughtiness in summer are limiting factors. On the black soils, very good pastures can be maintained.

Correlation

No SPC has been defined for this unit

3.5 Soils formed on Alluvium

3.5.1 Soils of Alluvial Deposits (A)

Soils formed from alluvial deposits are widespread throughout the Oatlands district. The group includes a variety of soils formed on present day floodplains, old alluvial terraces, basins and fans as well as some developed on wind-blown sands.

The more common soils are:

(I) Black soils of the present floodplains. The black soils occur on low-lying parts of river flats which are occasionally flooded. They are poorly drained and water lies on the surface in hollows during winter and spring. They consist of a deep black granular clay overlying a mottled yellowish brown and very dark grey clay containing some grounded gravels. *This soil is morphologically similar to the Canola SPC, however more work is required to determine if in-fact they do correlate.*

(II) Soils developed on older alluvium on terraces and basins at altitudes between *380 – 440m*. The most common of these soils has a greyish brown sandy loam topsoil overlying a bleached light grey fine sandy loam or loamy sand sub-surface horizon which usually contains small rounded iron concretions. This passes abruptly to a mottled yellowish brown and reddish brown heavy clay with dark grey coatings on aggregates and in the sides of vertical cracks. With depth the subsoil grades into an olive clay and the dark grey coatings disappear. The upper, sandy horizons are weakly structured while the subsoil has a strongly developed columnar structure, which persists to a depth of approximately *75cm*. Rounded gravels of sandstone, dolerite and quartzite occur at depth. In some profiles the bleached sub-surface layer is thin or absent. In summer the upper part of the subsoil cracks vertically. In addition a marked horizontal cracking occurs at the junction of the clay subsoil and the bleached subsurface horizon. Drainage is poor and in winter water lies in pools on the surface. Some saline patches were noted.

These soils are Solodized Solonetzic soils (Sodosols) and are morphologically similar to the Brumby SPC, however more work is required to determine if in-fact they do correlate.
The columnar structure is formed by the swelling and contracting of the sodium/magnesium clays in the subsoil; the washing of the dispersive clays down the cracks forms the distinctive domed structure on the tops of the columns. With increasing age these effects become more marked which is illustrated by the fact that the Solodized Solonetzic soils with thick bleached subsurface horizons and strong columnar structure are best developed on the older surfaces such as those at the 440m level.

CSIRO Soil Surveys (1949-70)

SITE DESCRIPTION

Site Number:	H189	Property Name:		Runoff:	Moderately rapid
Project Code:	CSIRO	Property Owner:		Permeability:	Very slowly permeable
Map Scale:		Nearest Town:	OATLANDS	Drainage:	Poorly drained
Sheet No:		Describer:	Ken D. Nicolls	Elevation:	442 m
Map Name:		Date Cored:	11 May 1959		
AMG Easting:	508043 E	Rainfall:	530 mm	Soil Class:	UN-NAMED
AMG Northing:	5307844 N	Air Temp (3pm):		Northcote PPF:	Dy3.41
Film No:	12990	Type of Site:		Great Soil Group:	Soloth
Run No:	6	Type of Desc:	Soil pit	Soil Taxonomy:	
Frame No:		Soil Samples:	Yes	Land Capability:	
State:	Tasmania	Soil Photos:		Geological Map:	

Location: 7.3KM E of Bochwell, basin north of Melton Mowlroy/Bothwell Rd, pit in track between Rd and Dennistoun Road.
Aust Classn: Eutrophic, Mesonatric, Brown, Sodosol; (Confidence level 4)

Landform: Element drainage depression; Pattern alluvial fan;
Land Surface: Complete clearing - pasture but cultivation at some stage; Microrelief swamp hummock;
Vegetation:
Substrate: unconsolidated material (unidentified);

HORIZON DESCRIPTIONS

A1	0	5	cm	Dry; brown (7.5YR 4/2 moist); brown (7.5YR 5/2 dry); loamy sand; weak very fine (2-5mm) granular structure; very weak (dry); 5.7 field pH; .077 dSm-1; diffuse (>100mm) boundary;
A21	5	15	cm	Dry; light brownish grey (10YR 6/2 moist); white (10YR 8/2 dry); heavy sand; massive structure; very weak (dry); 6.2 field pH; .054 dSm-1; diffuse (>100mm) boundary;
A22	15	23	cm	Dry; light brownish grey (10YR 6/2 moist); white (10YR 8/2 dry); heavy sand; massive structure; very weak (dry); 6.3 field pH; .095 dSm-1; diffuse (>100mm) boundary;
A23	23	25	cm	Light brownish grey (10YR 6/2 moist); white (10YR 8/2 dry); sand; massive structure; very weak (moist); common (1-5 per 100mm2) fine (1-2mm) macropores; few (2-10%) <2mm manganiferous concretions; v few (<2%) gravel coarse fragments; 6.3 field pH; .086 dSm-1; sharp (<5mm) boundary;
B21	28	41	cm	Strong brown (7.5YR 5/8 moist); dark grey (10YR 4/1) primary mottles; heavy clay; strong medium (20-50mm) columnar structure; very firm (moist); fine (<5mm) cracks; few (2-10%) gravel coarse fragments; 5.8 field pH; .42 dSm-1; diffuse (>100mm) boundary;
B22	41	56	cm	Strong brown (7.5YR 5/8 moist); dark grey (10YR 4/1) primary mottles; heavy clay; strong medium (20-50mm) columnar structure; very firm (moist); medium (5-10mm) cracks; few (2-10%) angular grit (2-6mm) gravel; 5.6 field pH; .435 dSm-1; diffuse (>100mm) boundary;
B23	56	69	cm	Strong brown (7.5YR 5/8 moist); grey (10YR 5/1) primary mottles; sandy medium clay; weak medium (20-50mm) columnar structure; very firm (moist); fine (<5mm) cracks; few (2-10%) angular grit (2-6mm) gravel; 5.5 field pH; .369 dSm-1; diffuse (>100mm) boundary;
BC	69	91	cm	Strong brown (7.5YR 5/8 moist); coarse (15-30mm) grey (10YR 5/1) primary mottles; sandy medium clay; weak medium (20-50mm) columnar structure; very firm (moist); few (2-10%) gravel coarse fragments; 5.4 field pH; .327 dSm-1;
C1	117	124	cm	Moist; yellowish brown (10YR 5/6 moist); loamy sand; massive structure; very weak (moist); many (20-50%) angular gravels (20-60mm) sandstone; 5.2 field pH; .408 dSm-1;
C2	190	198+	cm	Moist; dark grey (10YR 4/1 moist); strong brown (7.5YR 5/6) primary mottles; sandy medium clay; massive structure; very weak (moist); few (2-10%) gravel coarse fragments; 5 field pH; .554 dSm-1;

Profile Note: Un-named alluvial soils ; 28-56cm 10y41 coatings on aggregates and root channels; 28-41cm a2 material down cracks; bleached g sand on tops of col. Field pH and EC have been copied from Lab data.

General Note: Isbell classification added by R.Tegg.

Figure 1 Type profile for alluvial soil type (II).

UN-NAMED Soloth Dy3.41 unconsolidated material (unidentified) H189/CSIRO/389 508043E 5307844N OATLANDS

Sample Layer	Depths Upr cm	Lwr cm	pH 1:5 H2O	PH 1:5 CaCl	EC 1:5 dS/m	Soluble Chloride mg/kg	Exchangeable Cations Ca meq	Mg meq	K meq	Na meq	Exch H meq	Exch Al meq	ECEC Sum meq	CEC Meas meq	TEB Sum meq	Base Sat %	ESP %	Ca/Mg Ratio
A1	0	5	5.7		.077 B	80 A	1.9	1	.36	.48 A	7.9 B		11.64		3.74	32	4.1 B	1.90
A1	0	5									4.9 C							
A21	5	15	6.2		.054 B	70 A												
A22	15	23	6.3		.095 B	100 A	.43	.68	.09	.53 A	1.7 B		3.43		1.73	51	15.6 B	.63
A22	15	23									.9 C							
A23	23	25	6.3		.086 B	210 A												
B21	28	41	5.8		.42 B	670 A	.72	6	.5	3.1 A	9.8 B		20.12		10.32	51	15.4 B	.12
B21	28	41									4.3 C							
B22	41	56	5.6		.435 B	750 A	.52	5.4	.46	2.9 A	8.8 B		18.08		9.28	51	16.0 B	.10
B22	41	56									3.9 C							
B23	56	69	5.5		.369 B	680 A	.51	3.7	.27	2.2 A	5.6 B		12.28		6.68	54	17.9 B	.14
B23	56	69									3 C							
BC	69	91	5.4		.327 B	700 A												
C1	117	124	5.2		.408 B	670 A	.82	3	.15	2 A	2.6 B		8.57		5.97	69	23.3 B	.27
C1	117	124									1.4 C							
C2	190	198	5.0		.554 B	810 A	1.4	4.3	.31	3.3 A	5.7 B		15.01		9.31	62	22.0 B	.33
C2	190	198									4.1 C							

Sample Layer	Depths Upr cm	Lwr cm	Loss Ign %	Organic Carbon %	Total N %	C/N Ratio	Avail N mg/kg	Air Dry Moi%	Grav Moi%	Total P %	Avail P mg/kg	Extract P mg/kg	Total K %	Avail K mg/kg	Extract K meq
A1	0	5	6.7	3.3 C	.193 A	17		1.5		.012 A					
A1	0	5													
A21	5	15	2.3	.89 C	.064 A	14		1		.006 A					
A22	15	23	2.3	.39 C	.035 A	11		.6		.004 A					
A22	15	23													
A23	23	25	1.6	.37 C				.7							
B21	28	41	6.2	.74 C	.073 A	10		3.8		.006 A					
B21	28	41													
B22	41	56	5.2					3.6							
B22	41	56													
B23	56	69	3.5					2.7							
B23	56	69													
BC	69	91													
C1	117	124	1.9					1.6							
C1	117	124													
C2	190	198	3.9					3.5							
C2	190	198													

Sample Layer	Depths Upr cm	Lwr cm	Extractable Cu mg/kg	Mn mg/kg	Zn mg/kg	Fe mg/kg	B mg/kg	Free Fe %	Extractable Al %	Si %	Total Fe %	Total S %	Avail SO4-S mg/kg	CaCO3 %	Dispersion	Particle Size GV %	CS %	FS %	S %	C %
A1	0	5														0	24	46	15	8 C
A1	0	5																		
A21	5	15																		
A22	15	23														0	26	49	19	6 B
A22	15	23																		
A23	23	25																		
B21	28	41														7	15	26	7	54 B
B21	28	41																		
B22	41	56														2	15	27	11	49 B
B22	41	56																		
B23	56	69														8	22	37	7	35 B
B23	56	69																		
BC	69	91																		
C1	117	124														42	33	44	5	16 B
C1	117	124																		
C2	190	198														18	17	38	5	36 B
C2	190	198																		

Figure 1 **Cont**

The chemical analysis of this soil supports its classification as a Solodized-solonetz *(Sodosols)* (well towards the solodic end). pH and base saturation are fairly low in the upper horizons but rise with depth. Exchangeable sodium makes up a fair percentage of the exchangeable cations at depth. The origin of the high exchangeable sodium could be from (1) weathering of primary minerals in the soils more or less *in situ*, (2) accessions of cyclic salts, and (3) accumulation of sodium (and magnesium) ions in ground-waters draining into the lower-lying areas. In this latter case sodium would be derived from (1) and (2). Of the three possibilities mentioned it is thought that (2) and (3) are the most important.

In the Tunnack district, soils on old alluvium do not have the columnar structure of the Solodized Solonetz soils in the subsoil. In addition subsoils are more of a yellowish grey colour, no dark grey coatings occurring on aggregate faces or cracks, and the clay is not so sticky or plastic. These soils are generally shallow and overlie mudstone. Drainage is poor and water lies in hollows on the surface of the ground during winter. This soil shows the greyish A2 horizon of the Podzolic soils as well as the grey colours and yellowish-brown mottles of poorly draining soils and is accordingly classified as a Meadow Podzolic soil. No chemical data is available for this soil but from the profile morphology there is little or no evidence suggesting that sodium has played any part in the formation of these soils. They occur under a higher rainfall than the rest of the basin areas and it is possible that cyclic salt is removed readily from the soil under these conditions. In addition the parent material of these soils is largely derived from a very siliceous mudstone and leaching would be carried out under more acid conditions.

(III) Brown sandy soils formed on washed material from sandstone. Many profiles on this material show evidence of poor drainage and have grey subsoil colours with yellowish brown mottles.

(IV) Brown soils from wind-blown material. These soils show a dark brown to brown surface horizon *10 to 17cm* deep. The upper part of the subsoil is a yellowish brown or greyish brown sand and this passes down to a mottled yellowish brown and olive sandy clay at *25 to 60cm*. This horizon usually has a columnar structure with grey bleached sand coating the domed tops of the columns and dark grey coatings down the sides of cracks. Also included in this group are soils in which the sandy horizons are very deep and the sandy clay horizon is absent. These soils show definite solonetzic features and would be classed as Solonetzes *(Sodosols)* or Solodized-Solonetzes *(Sodosols).* However they occur in better drained positions and it is unlikely that accessions of the salt from drainage waters has contributed significantly to the levels of soluble salts within these soils. It is more likely that sodium and magnesium have come from cyclic salt, which could be important in a region of lowish rainfall.

Land Use

The soils of alluvial deposits are among the most productive of the district. Most areas have been cleared and sown to improve pastures, which are utilised for fattening lambs and cattle. Dairying and cropping are carried on to a limited extent. More intensive development of the terrace soils described in (II) may raise problems associated with perched water tables in winter and possibly with nutrient imbalance and localised salinity. Drainage of Lake Tiberias and development of its deep peaty soils is a possibility, though involving severe practical difficulties.

Correlation

No work was undertaken within this unit. More information about the alluvial soils in the north-east of the sheet is available in Nicolls (1947).

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APPENDICES

Appendix 1

List of Key Soil Horizon Designations Used in SPCs

Horizons (some of which may be subdivided eg, A11 and A12)

A1 Topsoil, zone of maximum biological activity, usually dark in colour.

A2 Grey, generally sandy, sometimes bleached, eluvial horizon (less clay, organic matter and sesquioxides than horizons above and below).

A3 Transitional horizon between A and B horizon and more similar to A than B horizon.

B1 Transitional horizon between A and B horizon and more similar to B than A horizon.

B2 Main subsoil horizon, either:

1) illuvial clay, humus or sesquioxide accumulations or

2) maximum pedological development such as structure or colour.

B3 Transitional horizon between B2 and C horizon and having significant amount of clay to still be classed as part of the solum.

BC As above.

C Weathered parent material and partially weathered rock from which the soil has formed.

D Buried horizon which is unlike the pedological organisation of the overlying horizons.

R Bedrock.

P1 Primarily undecomposed organic matter (peat).

P2 Primarily decomposed organic matter (peat).

Horizon Suffixes Used

e conspicuously bleached horizon, for example A2e.

g gleyed horizon caused by very poor drainage.

h accumulation of humified, well decomposed organic matter.

j sporadically bleached horizon, for example, A2j.

k accumulation of carbonate.

m strongly cemented horizon.

t accumulation of silicate clay (illuviation).

w weakly developed B horizon, ie, colour or structured B horizon, little or no illuviation.

For full horizon definitions refer to MacDonald *et al*. (1990). This figure has been modified from Doyle (1993), p 118.

Appendix 2

Analytical Methods for CSIRO sites

The following analytical methodology, taken from Graley (1961), is assumed to be similar for the sites analysed by CSIRO Division of Soils on this map.

The methods of analyses used were essentially those of Piper (1947) but with the following modifications:

pH was determined using a glass electrode and the system described by Raupach (1956).

Phosphorus is reported as “total” P dissolved by four hours boiling with concentrated hydrochloric acid. It was determined by a colorimetric method using butanol to extract the ammonium phosphomolybdate prior to its reduction with stannous chloride to the blue complex.

“Free” ferric oxide was determined using a modification by Haldane (1956) of Jeffries’ method.

Particle size distribution was determined on a number of samples by the International pipette method and on others by the rapid plummet balance method (Marshall, 1956) after dispersion of the soil using “calgon” (Hutton, 1955). Use of the pipette method is indicated in the tabulated data by quoting the results of the silt and clay fractions to one decimal place and of the plummet method to the nearest whole number. Coarse and fine sands are quoted to the nearest whole number for both methods.

Exchangeable metal cations were extracted by leaching with normal ammonium chloride and the leachate examined by titration with E.D.T.A for calcium and magnesium (Bond and Tucker, 1954 and Hutton, 1954) and by the “Eel” flame photometer for potassium and sodium (Stace and Hutton, 1958).

Exchangeable hydrogen has been determined by both the paranitro phenol (to pH 7.0) and meta-nitrophenol (to pH 8.4) methods of Piper (1942) but the total exchangeable cations recorded are the sum of the metal ions and exchangeable hydrogen to pH 8.4.

Values are reported for fractionation of the coarse and fine sands from certain samples. These were determined by sieving through *12.5cm* sieves with hand shaking for twenty minutes.

Appendix 3

Rating table for analytical properties

General analytical properties

	Very low	Low	Medium	High	Very High
Organic Carbon (%)	<1	1-2	2-4	4-8	>8
Total Nitrogen (%)	<0.1	0.1-0.2	0.2-0.4	>0.4	
Total Phosphorus (mg/kg)	<100	100-200	200-500	500-1000	>1000
CEC (meq/100g soil)	<6	6-12	12-25	25-50	>50
Base Saturation (%)	<20	20-40	40-60	>60	

Note: Organic matter content can be estimated by multiplying organic carbon contents by 1.724.

Colwell Extractable Phosphorus and Potassium

Light soils (sandy loams)	Low	Medium	High
P (mg/kg)	<10	10-35	>35
K (mg/kg)	<100	100-200	>200
Heavy soils (clays)	Low	Medium	High
P (mg/kg)	<30	30-80	>80
K(mg/kg)	<150	150-300	>300

Salinity

	None	Slight	Moderate	High	Very High
(dSm-1)	<0.2	0.2-0.7	0.7-1.2	1.2-3.0	>3.0

Soil Acidity

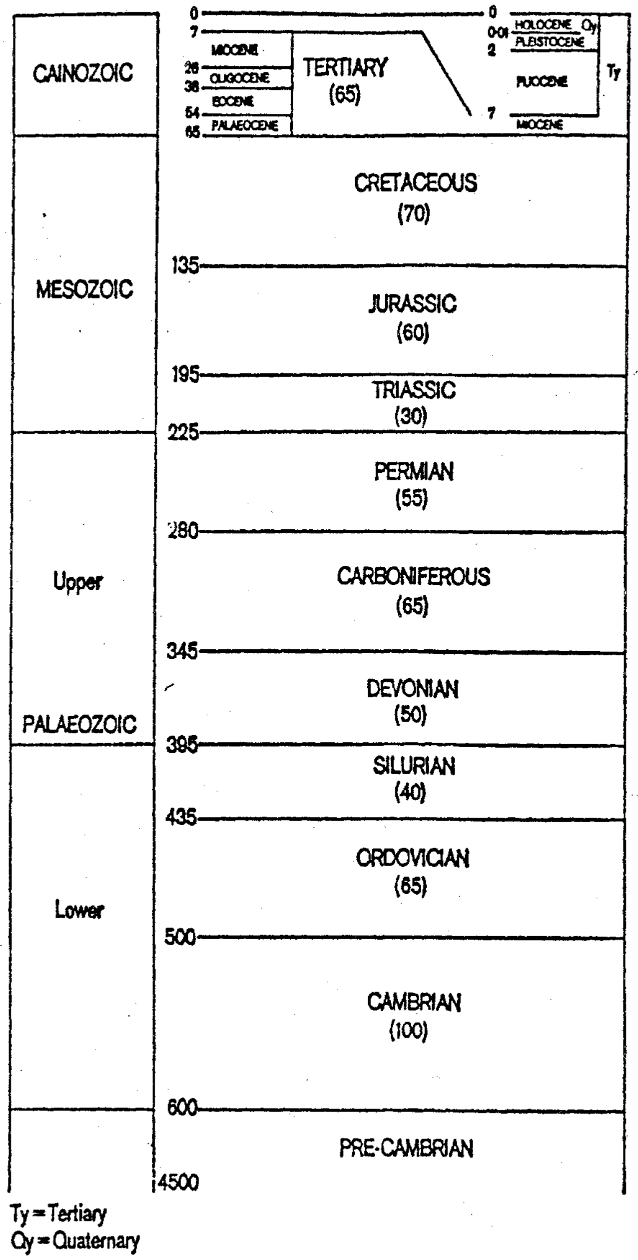
	Slightly	Moderately	Strongly	Extremely
pH range	6.5-6.0	5.9-5.3	5.2-4.5	<4.5

This table has been taken from Doyle (1993) p115

Appendix 4

Geological Timeline

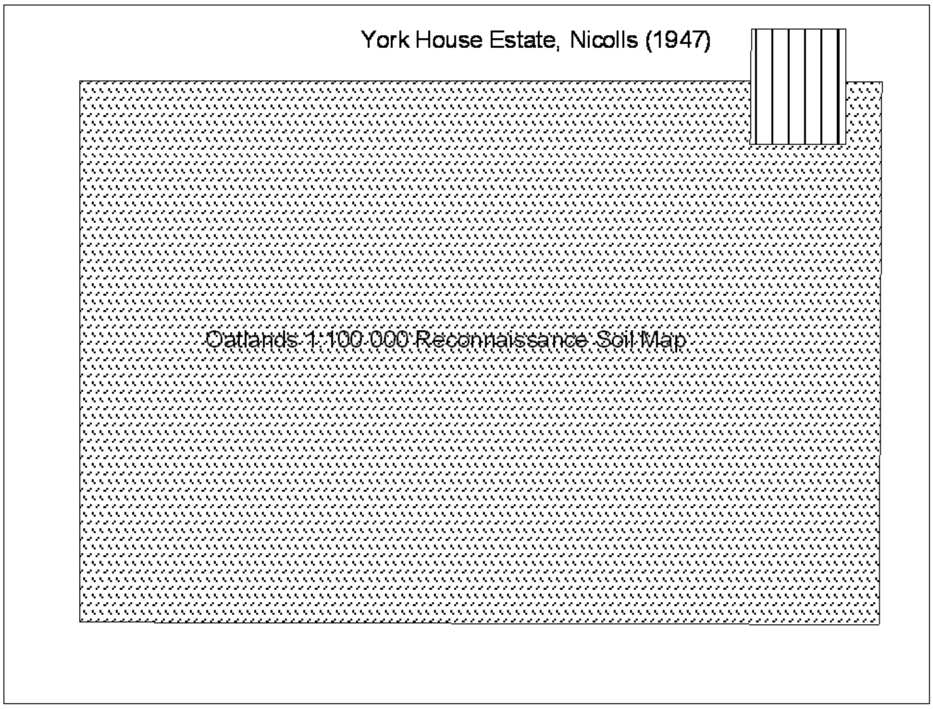
The Geological Timeline is in million of years.



Taken from Brooks J.R.V., and Whitten D.G.A., (1972) Dictionary of Geology. Published by Penguin, England.

Appendix 5

Index Map to Detailed Surveys within the Oatlands 1:100 000 Reconnaissance Soil Map



Appendix 6

List of Reconnaissance Soil Reports

Doyle, R.B. (1993), Soils of the **South Esk** Sheet Tasmania (southern half) Reconnaissance Soil Map. DPIF Soil Survey Series of Tasmania No 1. Scale 1:100 000

Dimmock, G.M. (1956), Reconnaissance Soil Map of Tasmania **Flinders Island**. Div. Rep. Div. Soils CSIRO Aust. 8/56**;** Scale 1: 63 360

Dimmock, G.M. (1960), Soil reconnaissance of the area between the **Tomahawk and Ringarooma Rivers**, N.E Tasmania. Tech memo. Div. Soils CSIRO Aust. 7/60**;** Scale 1:63 360

Dimmock G.M., Spanswick S.B. and Kidd D.B. (2001), Revised **Beaconsfield-George Town** Reconnaissance Soil Map of Tasmania, Department of Primary Industries, Water and Environment, Tasmania. In press. Scale 1:100 000

Hubble, G.D. (1951), Reconnaissance survey of the **Coastal Heath Country, N.W** Tasmania. Div. Rep. Div. Soils CSIRO Aust. 10/51**;** Scale 1:126 720

Kidd D.B. and Spanswick S.B. (2000e), Revised **Burnie Table-Cape** Reconnaissance Soil Map of Tasmania. Department of Primary Industries, Water and Environment, Tasmania. Scale 1:100 000.

Leamy, M.L. (1961), Reconnaissance soil map of Tasmania, Sheet 61. **Interlaken**. Div. Rep. Div. Soils CSIRO Aust. 6/61**;** Scale 1:63 360

Nicolls, K.D. (1955), Soils, geomorphology and climate of an area between the **Lagoon and Arthur Rivers**, West Coast of Tasmania Div. Rep. Div. Soils CSIRO Aust. 7/55**;** Scale 1:126 720

Spanswick S.B. and Zund P. (1999), Revised **Longford** Reconnaissance Soil Map of Tasmania. Department of Primary Industries, Water and Environment, Tasmania. Scale 1:100 000.

Spanswick S.B. and Zund P. (1999), Revised **Quamby** Reconnaissance Soil Map of Tasmania. Department of Primary Industries, Water and Environment, Tasmania. Scale 1:100 000.

Spanswick S.B. (2000), Revised **Sorell** Reconnaissance Soil Map of Tasmania. Department of Primary Industries, Water and Environment, Tasmania. Scale 1:100 000.

Spanswick S.B. and Kidd D.B. (2000), Revised **Buckland** Reconnaissance Soil Map of Tasmania. Department of Primary Industries, Water and Environment, Tasmania. Scale 1:100 000.

Spanswick S.B. and Kidd D.B. (2000), Revised **Brighton** Reconnaissance Soil Map of Tasmania. Department of Primary Industries, Water and Environment, Tasmania. In press. Scale 1:100 000.

Spanswick S.B. and Kidd D.B. (2000), Revised **Hobart** Reconnaissance Soil Map of Tasmania. Department of Primary Industries, Water and Environment, Tasmania. Scale 1:100 000.

Spanswick S.B. and Kidd D.B. (2000), Revised **Ellendale** Reconnaissance Soil Map of Tasmania, Department of Primary Industries, Water and Environment, Tasmania. In press. Scale 1:100 000

Spanswick S.B. and Kidd D.B (2001), Revised **Oatlands** Reconnaissance Soil Map of Tasmania. Department of Primary Industries, Water and Environment, Tasmania. Scale 1:100 000.

Stephens, C.G. and Hosking, J.S. (1932), A soil survey of **King Island**. Bull. No 70 CSIRO Aust**;** Scale 1:126 720.

Appendix 7

An Index Map to the Reconnaissance Soil Maps of Tasmania