SOIL CONSERVATION AUTHORITY

A STUDY OF LAND CAPABILITY IN THE SHIRE OF BANNOCKBURN

Prepared by

P.J. Jeffery - Land Studies Section
R.T. Costello - Land Capability Section

February 1981

SOIL CONSERVATION AUTHORITY
378 Cotham Road, Kew Victoria 3101

Land capability information for use in broad-scale planning is usually provided at scales of 1:50 000 or smaller. The presentation of map units on 1:25 000 aerial photo mosaics in the report has been adopted to facilitate use in the field of information readily observable on aerial photos, and to evaluate the feasibility of this method of presenting information. It does not imply that detailed field traverses have been made to locate variability not seen on the photos, e.g. some soil changes. It is therefore essential that before any detailed application of the maps, the map units must be field checked.

TABLE OF CONTENTS

List of Land Systems

List of Appendices

FOREWORD

The study is intended as an aid to planning. Its purpose is to advise planners of the physical characteristics of the land, and the likely effects of any changes of land use.

The study is intended to provide information for broad-scale planning. The maps should not be expanded for any purpose without re-interpretation by staff experienced in land mapping. Areas of different types of land that were too small to separate out at the scale of the present study, would need to be mapped separately in larger-scale mapping for more detailed planning.

A low management requirement does not mean that the land should be set aside for that use, because there may be several other, possibly more important uses that also have a similar rating.

ACKNOWLEDGEMENTS

We express our thanks to the many people involved in preparing the report. In particular Lyn Matthews in preparing the block diagrams, Greg Dunnett and Phil Timney for the aerial photo mosaics and drafting, and Bryan Young and Rosemary Hook of the Land Studies Section.

1. SUMMARY

The report describes a study of the environment of the Shire of Bannockburn and the capability of the different types of land to support various land uses - particularly subdivision.

There are forty-two map units described in the study. Many of these units are complex land systems containing up to three or four different but related types of land (i.e. land components). In some cases, individual land components have been mapped as units. The land capability mapping is at a fairly broad scale (1:63 360 - photo mosaics at 1:25 000) suitable as input for broad-scale planning but not adequate for individual site decisions.

The capability of the land to support three main activities has been examined.

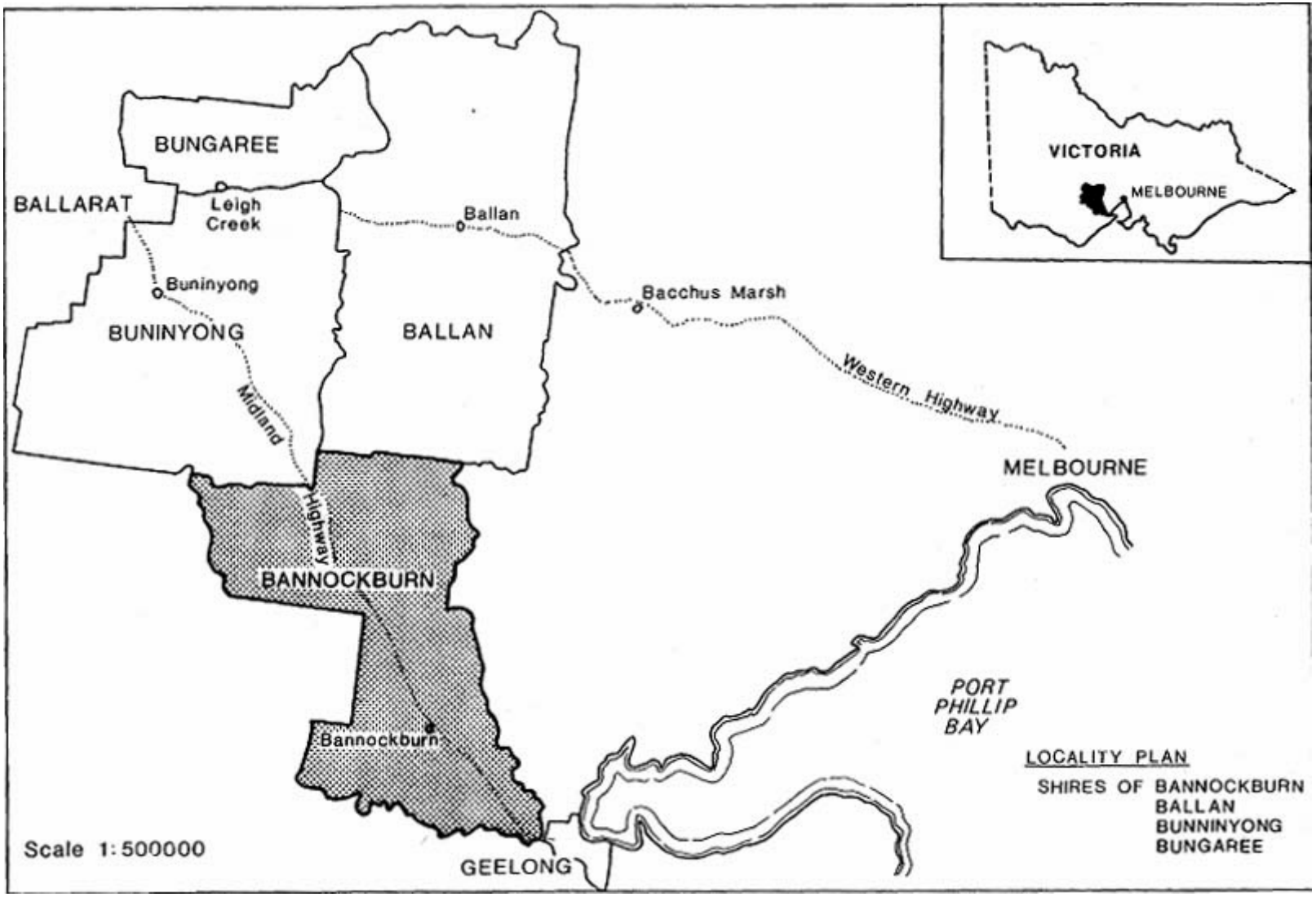
1. Erosion risk associated with soil disturbance.
2. Constraints on construction (small buildings, secondary roads, etc.).
3. Effluent disposal by soil absorption - risk of failure and difficulties of installation.

The rating value is interpreted in terms of the level of special management required to overcome the limitations imposed by the land features, e.g. slopes, stoniness, etc.

The ratings for specific activities or aspects of land performance are combined to give an overall rating for rural subdivision - farmlets with houses, low-cost access, effluent disposal by soil absorption.

The rating again is interpreted as the levels of special management required to minimise hazard to the land, the water supply and the user.

The map units which are most capable of supporting small lot rural subdivision are Tgn, Tgnd, Tgs, Qao, Org, Orgd, Tgc and Qau.


BUNGAREE
BALLARAT
Leigh Creek
Ballan
Buninyong
BUNINYONG
BALLAN
Bacchus Marsh
Western Highway
Midland
Highway
MELBOURNE
BANNOCKBURN
Bannockburn
PORT PHILLIP BAY
GEELONG
Scale 1:500000
VICTORIA
MELBOURNE
LOCALITY PLAN
SHIRES OF BANNOCKBURN
BALLAN
BUNNINYONG
BUNGAREE

2. INTRODUCTION

2.1 Location of the Study Area

The Bannockburn Shire lies to the north-west of Geelong, and comprises about 700 square kilometres. The study forms part of a land capability appraisal of four adjacent shires, Bungaree, Ballan, Buninyong and Bannockburn.

2.2 Purposes of the Study

The purpose of the study is to provide assessments of land capability which could be used by planners. Several town water supply catchments have been proclaimed in the Ballarat region, the largest being the Lal Lal catchment and the East Moorabool (SheOaks) catchment. These catchments extend into the four shires referred to above. As these shires are developing planning schemes, the mapping has been extended beyond the catchment boundaries to encompass the land in all four shires. In this way, the study may be useful to the shires in promoting sound land use throughout the study area as well as within the catchments.

2.3 Land Capability

Sound land use planning should consider two aspects related to the natural features.

(a) Whether the natural land features will adversely affect or limit the proposed land use.
(b) Whether the land use will damage the land or environment, perhaps even to the point where the use can no longer be continued.

Where there are limitations caused by the land features, we need to know if they can be practically overcome by special structural design or land management techniques.

Land capability assessment provides a means of obtaining this information.

The Soil Conservation Authority has developed land capability rating systems for a wide range of land uses, which will enable land to be rated on a five-class scale. Cn this scale, land is rated from *Class 1,* with a very high capability for a specified use, through to *Class* 5, which has a very low capability for the same use.

Land capability assessments may be made to meet the requirements of different levels of planning. At the most detailed level, ratings are applied to areas of land which are uniform with respect to the relevant land features. These areas are referred to as land components and are mappable on large-scale maps. Broader-scale mapping units, known as land systems, which contain consistent combinations of land components, may be used for broader-scale planning.

Before a land capability study is made, the planning objective must be known. The level of detail required for broad-strategy planning for example, differs markedly from that required for detailed urban or farm project planning.

In all assessments of land capability, even those which involve the most detailed mapping and data collection, conclusions are based on averages and other generalisations from a limited number of sites. The resulting ratings provide a sound guide for a choice of land or for a particular land use within the area assessed. They should not be used, however, as a substitute for site surveys when specific on-site information is needed.

These assessments are concerned only with the physical features of the land, taking no account of the several other factors, such as social and economic considerations, which are necessarily involved in the ultimate decisions.

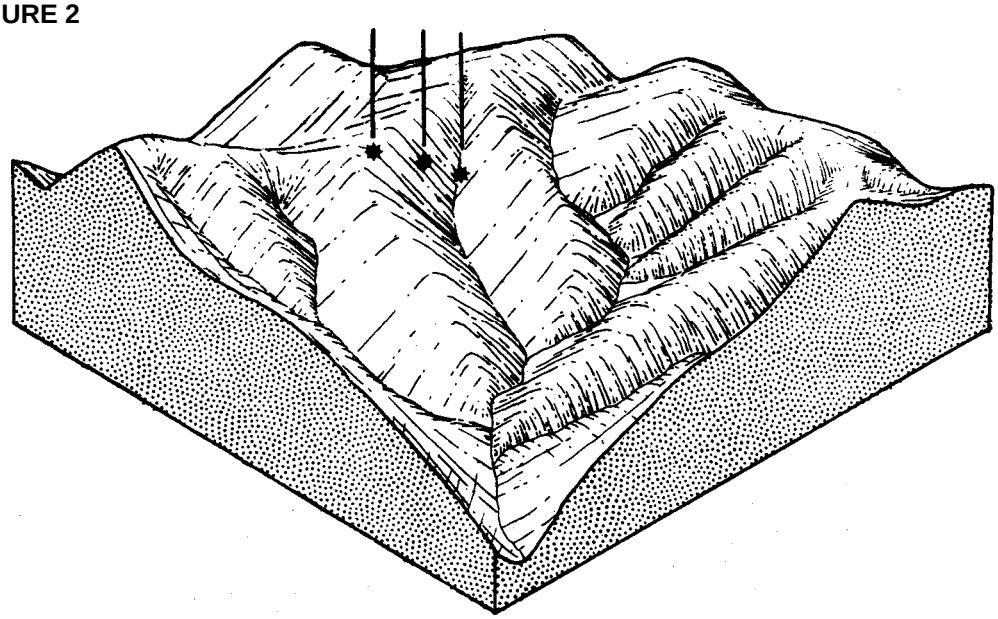
3. LAND SYSTEMS AND COMPONENTS

3.1 Definitions of Land Systems and Components

Land System: *A* land system is an area of land, distinct from surrounding terrain, within which there is **a** recurring pattern of particular land components. The land components generally occur in similar proportions, and have similar interrelationships in each occurrence of a particular land system.

Land Component: *A* land component is an area of land, distinct from the surrounding terrain, having a particular combination of geological material, landform, soil and native vegetation.

FIGURE 2



SCHEMATIC BLOCK DIAGRAM showing parts of a land system representing steep hills. The pattern of the three components - the crests(l), the steep slopes(2) and the drainage lines(3) - are shown for only one section of the land system. However, this pattern can be seen in many other places in the block diagram. Thus the land within the boundaries of a land system is not homogeneous, and the land capability assessments within this report refer to the major components of the land system. In this case, it would refer to (2) the slopes.

3.2 Summary of Land Systems & Components.

Map symbol	Area		Dominant Land Features					
	km ^{2}	%	Average annual rainfall	Geology	Landscape	Native Vegetation	Soils	Forms of soil deterioration
Qbg	48.0	6.8	610-660	Pleistocene basalt	Slightly dissected plains	Woodland(?): *E. ovata, E. viminalis, E. rubida, E. obliqua*	Mottled, dark grey sodic duplex soils, coarse structure	Surface compaction, minor sheet erosion
Qbgd	29.0	4.1	530-610	Pleistocene basalt	Slightly dissected plains	Woodland ? : *B. camaldulensis, E. leucoxylon, B. melliodora*	Mottled, dark ***grey*** sodic duplex soils, coarse structure	Surface compaction, minor sheet erosion
Qbgw	27.0	3.9	500-580	Pleistocene basalt	Slightly dissected plains	Woodland(?): *E. leucoxylon*	Mottled, dark grey sodic duplex soils, coarse structure	Surface compaction, minor sheet erosion
Qbf	46.0	6.6	510-630	Pleistocene basalt	Plains	Woodland(?): *E. camaldulensis, B. leucoxylon, E. melliodora*	Mottled, dark sodic duplex soils, coarse structure	Minor sheet erosion
Qbgs	62.0	8.9	500-7O	Pleistocene basalt	Stony plains in south	Woodland(?): *E. camaldulensis*	Stony, mottled dark grey sodic duplex soils, coarse structure	Minor sheet erosion, surface compaction
Qbs	0.3	0.04	610-660	Pleistocene basalt	Stony rises	Woodland(?): *E. viminalis*	Red shallow stony gradational soils	Minor sheet erosion, nutrient decline
Qbsd	7.3	1.0	500-600	Pleistocene basalt	Stony rises	Woodland(?): *E. camaldulensis*	Stony black clay soils, uniform texture, coarse structure	Minor sheet erosion, nutrient decline
Qah	9.9	1.4	510-570	Quaternary alluvium	Broad alluvial flats	Open forest: *E. leucoxylon, E. camaldulensis*	Red duplex soils	Minor sheet erosion on exposed soil
Qya	4.4	0.6	600-680	Quaternary alluvium	Alluvium in the north	Woodland: *B. viminalis, E. radiata, E. camaldulensis*	Dark uniform soils (variable texture - mainly clay loams)	siltation
Qyad	6.7	0.9	500-600	Quaternary alluvium	Scattered occurrences of alluvium	Woodland(?): *E. camaldulensis*	Dark uniform soils (variable)	siltation
Qab	9.0	1.3	500-610	Holocene river alluvium	Terraces and flood plains	Open woodland: *E. camaldulensis*	Dark uniform soils of medium or heavy texture	siltation
Qau	1.0	0.1	580-600	Quaternary alluvium on Ordovician sediments	Cut and fill terraces	Woodland(?): *E. camaldulensis*	Red mottled yellow duplex Boils	Minor sheet erosion
Qaf	4.2	0.6	500-560	Quaternary fault apron	Gently sloping plains	Open forest: *E. microcarpa, E. leucoxylon, E. polyanthemos, E. goniocalyx*	Dark brown shallow uniform soils, weak structure	Moderate sheet, rill, gully and tunnel erosion
Qam	8.8	1.2	560-580	Mixed geology Holocene sand	Wide creek valley with a broad and generally level but hummocky floor	Woodland: *B. viminalis, E. camaldulensis*	Brown sand soils, uniform texture	Nutrient decline
Qbc	0.3	0.04	650-685	Pleistocene basalt	Slightly dissected plain		Black clay soils, uniform texture, coarse structure	Minor sheet erosion
Aped	1.1	0.1	610-630	Pleistocene basalt	Slightly dissected plains		Black clay soils, uniform texture, coarse structure	Minor sheet erosion
Qde	1.0	0.1	585-635	Recent sands, silts and clays	Swamps and depressions	Woodland: *E. ovata*	Mottled grey duplex soils	Surface compaction
Qded	2.7	0.4	500-600	Recent sands, silts and clays	Swamps and depressions	Tussock and sedge land	Variable but mainly clay soils, e.g. black uniform clay soils, coarse structure	Surface compaction
Qbb	7.7	1.1	610-660	Pleistocene basalt	Scarp beside creek including river channel in places	Open forest: *E. viminalis, B. ovata*	Shallow brown duplex or gradational soils	Minor sheet and rill erosion, low landslip hazard
Qbbd	8.2	1.2	510-580	Pleistocene basalt	Scarp beside creek including river channel in places	Woodland(?): *E. camaldulensis*	Shallow brown duplex or gradational soils	Minor sheet and rill erosion, low landslip hazard
Qlu	0.3	0.04	600-630	Recent sands	Lakeside sand ridges	Open forest: *E. viminalis, Pteridium esculentum*	Yellow Band soils, uniform texture	Fertility decline
Qao	9.0	1.3	510-570	Older alluvium (Quaternary, Tertiary?)	Undulating plains	Open forest: *E. leucoxylon*	Mottled yellow duplex soil. Red duplex soil, medium to coarse structure	Minor sheet erosion on exposed soil

Map symbol	Area		Dominant Land Features					
	km ^{2}	%	Average annual rainfall	Geology	Landscape	Native Vegetation	Soils	Forms of soil deterioration
Tgn	85.0	12.1	585-685	Tertiary gravels, sands and clays	Undulating plains and broad crests	Low open forest - Woodland: *E. viminalis, E. obliqua, E. radiata, E. rubida, (E. pauciflora - Durdidwarrah area) Callistris columellaris*	Mottled yellow duplex soils, fine structure	Minor sheet erosion
Tgnd	24.5	3.5	550-630	Tertiary: gravels, sands and clays	Undulating plains and broad crests	Low open forest: *E. macrorhyncha, E. polyanthemos*	Mottled yellow duplex soils, fine structure	Minor sheet erosion
Tgs	95.4	13.92	500-585	Tertiary unconsolidated sediments	Undulating plains	Woodland to open forest: *E. viminalis, Acacia spp., Casuarina spp.*	Mottled, yellow and red duplex soils, both fine structure	Minor sheet erosion
Tgc	1.5	0.2	540-570	Tertiary calcareous clay	Undulating plain	Open forest: *E. leucoxylon, Casuarina app., Acacia pycnantha*	Mottled yellow sodic duplex soils - coarse structure	Minor sheet and rill erosion
Tbd	1.3	0.2	560-600	Tertiary basalt	Gentle to moderate slopes	Woodland: *E. leucoxylon*	Dark uniform clays and chocolate gradational soils	Moderate sheet erosion when fallowed
Tgm	1.0	0.1	510-570	Tertiary limestone or basalt	Gentle slopes	Open forest: *E. leucoxylon, E. camaldulensis*	Black or chocolate self- mulching clay soils or red duplex soils	Moderate sheet and rill erosion
Tam	25.0	3.6	500-610	Various Tertiary strata	Steep valley sides	Open forest: *E. leucoxylon, E. camaldulensis, E, viminalis*	Black clays with some red gradational or duplex soils	Moderate landslide hazard, rilling on exposed soil
Tog	3.6	0.5	500-530	Tertiary sediments	Steep valley sides	Open forest: *E. leucoxylon, E. viminalis, E. camaldulensis*	Red duplex soils, uniform clayey soils	Minor sheet and rill erosion
Tsc	0.3	0.04	610-635	Tertiary sediments	Scarps	Open forest: *E. obliqua, E. viminalis*	Mottled yellow duplex soils	High sheet and rill erosion
Tad	1.9	0.3	500-550	Tertiary sediments	Scarps	Low open forest	Mottled yellow or brown duplex soils	Moderate rill and gully erosion
Dgg	3.3	0.5	510-560	Devonian granite	Undulating terrain	Woodland: Woodland: *E. leucoxylon*	Mottled brown duplex soils	Minor sheet erosion
Dgh	0.1	0.02	510-560	Devonian granite	Gentle scarps	Woodland: Woodland: *E. leucoxylon*	Mottled brown duplex soils, coarse structure	Moderate gully and sheet erosion
Org	47.0	6.7	585-685	Ordovician sediments	Slightly dissected plains	Open forest: *E. viminalis, E. obliqua*	Mottled yellow duplex soils	Minor sheet, rill and gully erosion, surface compaction
Orgd	j.2	0.4	550-590	Ordovician sediments	Slightly dissected plains	Open forest: *E. polyanthemos, Casuarina spp.*	Mottled yellow duplex soils	Minor sheet, rill and gully erosion, surface compaction
Ores	3.5	0.5	600-WO	Ordovician sediments	Broad ridge tops	Low open forest to open forest: *E. macrorhyncha, E. polyanthemos, E. goniocalyx*	Mottled yellow duplex soils	Minor sheet erosion
Orm	6.7	1.0	630-685	Ordovician sediments	Slightly dissected plains	Open forest: *E. viminalis, E. obliqua*	Mottled yellow duplex soils	Moderate sheet, rill and gully erosion
Orh	8.1	1.1	660-710	Ordovician sediments	Hilly	Open forest: *E. dives, E. viminalis, E. obliqua, E. radiata*	Mottled yellow gradational or duplex soils, fine structure	Severe sheet and rill erosion, surface compaction
Orhd	4.2	0.6	580-600	Ordovician sediments	Hilly	Low open forest: *E. polyanthemos, E. leucoxylon*	Mottled yellow duplex or gradational soils, fine structure	Moderate sheet and rill erosion, surface compaction
Ore	37.6	5.4	700-610	Ordovician sediments	Closely dissected steep hills	Open forest: *E. dives, E. viminalis, E. obliqua, E, radiata*	Mottled yellow gradational or duplex soils, fine structure	Severe sheet and rill erosion
Orsd	46.0	6.6	560-600	Ordovician sediments	Closely dissected steep hills	Low open forest: *E. polyanthemos, E. leucoxylon, E. viminalis, E. macrorhyncha, E. sideroxylon, E. melliodora*	Mottled yellow gradational or duplex soils, fine structure	Severe sheet and rill erosion
Quarries Reserv-oirs (Res)	4.4 2.5	0.6 0.4						

4. METHOD OF LAND CAPABILITY ASSESSMENT

4.1 Assessing the Land

The dominant type of land within each land system was evaluated. The capability ratings, therefore, are quite generalised and often do not apply to the smaller components within the land system such as drainage lines, stony rises, etc. If required, they may be assessed in more intensive studies with larger scale base maps.

Initially, the units were evaluated for three aspects of capability for rural subdivision.

1. Erosion Risk Associated with Soil Disturbance

This rating is intended to present the relative dangers of erosion on the different types of land as a result of land uses which tend to leave the soil unprotected for significant periods of time. Examples would be clearing, preparation for urban development or other extensive construction works, road building, overgrazing and cultivation (see Map 2).

2. Constraints on Construction

The ratings identify land characteristics which will pose problems for construction activities such as housing and secondary road construction. The factors considered include slope, depth and type of rock, the quality of the soil for foundations, soil drainage, flood risk and site stability (see Map 3).

3. Disposal of Effluent in the Soil

The ratings refer to the risk of failure of soil absorption trenches, the ease of installation and the relative risk of pollution of watercourses from failing systems (see Map 4).

4.2 Subdivision

(i) Rural Subdivision

From an analysis of the ratings of these three aspects of capability an overall rating has been given for rural subdivision (see Map 5). Rural subdivision is described as: Farmlets requiring a house site, a dam site, effluent disposal on-site and low-cost access - i.e. gravel roads and access tracks**.**

(ii) Urban Sub Division

The management required for urban development can be obtained by using the ratings for:

1. Erosion hazard associated with soil disturbance) No special map.
2. Constraints on construction) See Maps 2 & 3.

Urban subdivision is described as: Intensive housing developments on small blocks with sealed roads, curbed and channelled, and fully serviced, including sewerage and town water supply.

The "Erosion Rating" will give some indication of soil loss during the development and construction stage, while the "Construction Rating" will indicate problems.

The assessment systems are based on the performance of the land under the usual or average management inputs. In this study, the rating is expressed in terms of the level of special or additional management required to overcome the limitations imposed by the land features. There are five classes of special management:

1 None
2 Low
3 Moderate
4 High
5 Extremely high

4.3 Land Capability Rating Classes

The land has been rated into five capability classes with special management requirements ranging from none to extremely high management.

Land Capability Class	Level of Special Management Required	Degree of Limitation	General Description
1	None	None to Very Slight	Areas with high capability for subdivision. The limitations of long term instability, engineering difficulties or erosion hazards do not occur or they are very slight. Standard designs and installation techniques with normal site preparation and management, should be satisfactory to minimise the impact on the environment.
2	Low	Slight	Areas capable of being subdivided. Slight limitations are present in the form of engineering difficulties and/or erosion hazard. Careful planning and the use of standard specifications for site preparation, construction and follow up management should minimize developmental impact on the land.
3	Moderate	Moderate	Areas with fair capability under normal management for subdivision. Moderate engineering difficulties and/or erosion hazard. Careful planning and the use of standard specifications for site preparation, construction and follow up management should minimise developmental impact on the land.
4	High	High	Areas with poor capability under normal management for subdivision. There are considerable engineering difficulties during development and/or a high erosion hazard exist during and after construction. Extensively modified design and installation techniques, exceptionally careful site preparation and management are necessary to minimise the impact on the environment.
5	Extremely High	Severe	Areas with very poor capability under normal management for subdivision. Limitations to development, either long term instability hazards, erosion or engineering difficulties cannot be practically overcome with current technology. Severe deterioration of the environment will probably occur if development is attempted in these areas.

5. LAND CAPABILITY ASSESSMENT

The following tables summarise the land capability ratings for the various uses.

MAP UNIT:
The first column contains the Map Symbol which can be used to identify the unit on the map.

LAND FEATURES THAT AFFECT THE PARTICULAR ASPECT OF CAPABILITY:
The second column contains portions of the general description of the unit that are particularly related to the aspect of capability being considered, e.g. slope and soil characteristics for predicting erosion risk associated with soil disturbance.

LAND CAPABILITY CLASS AND LEVELS OF SPECIAL MANAGEMENT REQUIRED:
The third column shows the capability class of the land and the associated level of special management required to overcome or minimise the problem. There are five land capability classes and associated levels of special management ranging from very low (i.e. normal management) to extremely high (techniques either beyond present technology or not normally economically feasible).

COMMENTS:
The fourth column contains comments and refers to specific problems or management considerations.

5.1 Erosion Risk associated with Land Disturbance

MAP SYMBOL	LAND FEATURES THAT AFFECT EROSION HAZARD	LAND CAPABILITY CLASS AND LEVEL OF SPECIAL MANAGEMENT REQUIRED	COMMENTS
Qbg Qbgd Qbgw Qbf	Gentle to flat topography with moderately stable clayey soils. coarse structure. The subsoil clay of the duplex soils is highly sodic and the topsoil is hardsetting.	1-2 Nil to low	There is no visible erosion on grazing land. Bare soil will sheet erode. Any sediment from disturbed areas mainly consists of fine aggregates and easily settled particles with lesser quantities of dispersible clay. Poor drainage may hinder revegetation in some areas, especially if topsoil is not respread.
Qbgs Qbs Qbsd	Gently sloping stony areas with finely pedal clay soils - no dispersible clay.	1-2 Nil to low	The stoniness is commonly a deterrent to soil disturbance. Any wash from exposed sites will consist of fine easily settled aggregates – no dispersible clay. Soils are fertile and revegetate readily - stones will hinder resowing.
Qah	Flat to gently sloping land with alkaline duplex soils on the higher terrace and variable uniform loams on the river flats.	1 River flats - Nil 2 Higher terrace - Low	The loams of the river flats have almost negligible erosion hazard under cropping and grazing. There may be areas of stream-bank erosion in the channel and perhaps gully erosion in the path of storm-water discharge. The duplex soils of the higher terrace will sheet erode if exposed - revegetation of construction sites as soon as possible is recommended.
Qya Qyad	Alluvium associated with major water-courses consisting of generally flat land close to the stream and including the stream channel. Lower terraces often flood and have variable soils. Some areas to the north are salt affected.	4 Watercourses - High 1-2 Terrace - Low	The gentle to flat gradients reduce the risk of erosion except in the channel where gully erosion and stream-bank erosion may occur. Vegetated filter zones on either side of the watercourse are advisable. Soils generally are moderately easy to revegetate, except in gully eroded, seasonally wet or salty areas.
Qab	Wide alluvial flats associated with the lower Moorabool River (including the river channel). Soils are uniform loams and clays but there are some higher gently sloping terraces with red duplex soils.	1 River flats - Nil 2 Higher terraces and channel - Low	The uniform soils of the river flats have almost negligible erosion hazard under cropping and grazing. There may be areas of river-bank erosion in the channel. The red duplex soils of the higher terraces will sheet erode if exposed to storm rainfall - particularly if they are fine / cultivated - rapid revegetation of construction sites is recommended.
Qau	Higher terraces associated with the Moorabool with yellow duplex soils on gently sloping land. The topsoil is deep and quite permeable while the yellow clay is only slowly permeable.	2 Low	There is no erosion obvious in grazing land. Sheet and rill erosion will occur on disturbed soil if exposed to storm rainfall - rapid revegetation of construction sites is recommended.
Qaf	Gentle to moderate sloping land below the Rowsley scarp. Soils are variable but in general, slake rapidly.	2-3 Low to moderate	This soil is subjected to high velocity flows from the escarpment of the Rowsley Fault. Drainage lines must be protected to avoid severe gully erosion - several deep gullies occur at the northern end of the unit.
Qsm	Wide valley floor and moderate to steep valley sides, with deep sand deposits scattered randomly over the landscape. The unit includes the stream channel and flats.	2-3 Low to moderate	When the vegetation is disturbed, especially during sand extraction, wind erosion can occur on the sandy areas. Advice on restoration should be sought. The steep sides of the valley can be sheet and rill eroded unless protected by vegetation.
Qbc Qbcd	Gentle short slopes with self-mulching chocolate clayey soils with fine structure and little or no dispersibility. These soils are fertile and are often used for specialised crops.	1-2 Low	Disturbed soil washes readily if exposed to storm runoff. Any wash from cultivation or construction sites will be in the form of fine aggregates that are easily settled. Soils are fertile and are easily revegetated.
Qde Qded	Flat depression with heavy dark clays that do not disperse. Seasonal ponding of water occurs.	1 Nil	Water flows have low velocities as there is little or no gradient. Little or no erosion occurs - sediment deposition may occur.
Qbb Qbbd	Moderate to steep slopes usually forming the sides of stream valleys or gorges with shallow finely-pedal, stony soils that have no dispersible clay.	3-4 Moderate to high	Soils will sheet and rill erode if exposed for any distance down the slope. Sediment will be fine aggregates easily settled. Soils are fertile and will revegetate quickly but sowing may be a problem due to slope and stones.
Qlu	Gentry sloping sandy rises close to reservoirs and boggy depressions. As the sands are fairly deep and very permeable, there is usually little runoff even in heavy rain storms. The sands are low in nutrient status and moisture holding capacity.	2-3 Low to moderate	Wind erosion can occur on any bare exposed areas of sand. Wind breaks should be maintained around disturbed areas. Erosion by water is not usually a problem because the sands are so permeable.
Qao Tgn Tgnd _Tgs Tgc	Gently sloping to flat land. Soils generally have a sandy loam topsoil over a moderately stable mottled yellow or red clay that is finely structured and of low dispersibility. There are some areas of deep sand and some rises have ironstone deposits (except in Tgc).	2-3 Low to moderate	In general, there is little evidence of erosion on the gentle slopes. However, there may be gullies or salting in the drainage lines - especially where drainage lines occur near a unit boundary (i.e. Ors, etc.). Sheet erosion occurs on cultivated paddocks and construction sites. Runoff would contain sand, silt and clay (some dispersible).
Tbd	Gentle to moderately sloping land with moderately stable	2-3 Low to moderate	There is no visible erosion from grazing land. Moderate sheet and

MAP SYMBOL	LAND FEATURES THAT AFFECT EROSION HAZARD	LAND CAPABILITY CLASS AND LEVEL OF SPECIAL MANAGEMENT REQUIRED	COMMENTS
Tgm	chocolate or red clayey soil containing insignificant quantities of dispersible clay.	(depend on slope)	rill erosion can occur on cultivated areas and construction sites. Runoff from disturbed land will contain easily settled, fine clay aggregates. Revegetation is relatively easy even if topsoil is lost.
Tsm Tcg	Very steep to moderate valley sides cut into various unconsolidated sediments and rock types. The main soils are fertile black clays (no dispersion) and red duplex soils (low to moderate dispersion) - both soils slake rapidly. The average slopes are around 20-25%, but the range is much wider- some more than 50%.	3-4 Moderate to high	The erosion hazard increases with steepening slopes. There is little evidence of erosion under sensibly managed grazing land because the fertile soils grow good protective vegetation. Sediment build-up occurs at fences below old cultivation paddocks. Sediment is mainly fine clay aggregates. Landslips occasionally occur in wet times, particularly on the black soils.
Tsc Tsd	Moderate to steep slopes usually leading down to watercourses; soils are of variable stability and overlay deep unconsolidated sediments.	3-4 Moderate to high	Sheet and rill erosion from construction sites may contain silt and dispersible clay. Revegetation may be moderately difficult because of low fertility subsoil. Further clearing is not recommended on slopes 20+%.
Dgg	Gentle to moderate slopes with sandy loam topsoil over coarsely-structured clay of low dispersibility, crests may have granite outcrops.	2 Low	The gentle slopes and protective pasture, result in little or no erosion when sensibly grazed. However, the topsoil washes readily and the clay will gully if exposed to storm runoff. Revegetation may be difficult unless topsoil is respread.
Dgh	Moderate to steep slopes with shallow rocky soils. The slopes are usually fairly short.	4 High	With a vegetative cover, these slopes are fairly stable, but if the soils are disturbed and exposed to surface runoff, very fast rill and gully erosion can occur. Sediment consists of sand and clay - some dispersible clay. Revegetation may be difficult as soils are often shallow with infertile subsoil.
Org Orgd	Long gentle slopes with duplex soils consisting of a loamy topsoil over yellow red mottled clay of moderate dispersibility. Some lower slopes are sodic and salting may occur in drainage lines - especially near Tgn.	2 Gentle slopes - Low 3 Depressions - Moderate	There is usually little erosion on the long gentle slopes. The depressions are sodic and the subsoil clay will gully readily if the soil is exposed to runoff water. Runoff would contain fine sediment and dispersed clay. Dams sometimes fail by tunnelling. Revegetation of construction sites is difficult unless topsoil is respread.
Orc	Broad crests associated with the steep Ordovician country. The soils are generally shallow with limited fertility and moisture holding capacity.	2-3 Low to moderate	There is little erosion on grazing land and none in the undisturbed forested areas. Sheet and rill erosion can occur in disturbed areas (roadsides, etc.) unless quickly revegetated – topsoil must be respread to achieve revegetation. Sediment would be mainly clay (some dispersible), silt and fine sand.
Orm	Moderate to gentle slopes mottled yellow duplex soils with a moderately dispersible clayey subsoil. Some lower slopes and depressions are sodic, salting may occur in the drainage lines.	3 Moderate	Drainage lines must be protected. Sensible management of the slopes (maintenance of vegetative protection) will minimise erosion hazard. There is often active gully erosion within the drainage lines. The runoff would contain fine sediments and dispersible clay. Topsoil must be respread on disturbed areas to achieve regeneration.
Orh Orhd	Moderately steep slopes with poor yellow duplex or gradational soils over slates and sandstone. The soils are often shallow - particularly. on upper slopes - and are relatively poor in nutrient status; the clay is moderately dispersible.	4 High	Drainage lines must be protected. The slopes must be carefully managed, avoiding over-grazing and limiting activities that will damage the protective vegetation. Pasture improvement will help to reduce gully and tunnel erosion. The runoff from eroding areas would contain fine sediment and dispersible clay.
Ors Orsd	Steep slopes that are often very long with poor yellow gradational and duplex soils over slates and sandstone. The soils in most areas are shallow, stony and relatively low in nutrients - especially the subsoil clay which is generally dispersible. The shallow depth to rock, particularly on crests and steep upper slopes, limit moisture availability (hence plant growth) in summer.	4 High - slope 10-25% 5 Extremely high - slope 25+%	Drainage lines must be protected. Gully and tunnel erosion often occur on cleared land; the runoff would be high in fine sediment and dispersed clay. Incorrectly managed earthworks contribute significantly to runoff pollution. Revegetation can be very difficult due to lack of topsoil, infertile shallow subsoil and steep slopes. Further clearing is not recommended.

5.2 Constraints on Construction

MAP SYMBOL	LAND FEATURES THAT AFFECT EROSION HAZARD	LAND CAPABILITY CLASS AND LEVEL OF SPECIAL MANAGEMENT REQUIRED	COMMENTS
Qbg Qbgd Qbgw Qbf	Highly expansive subsoil (CH clay of shrink-swell around 20%); very slow profile percolation and gentle slopes and most of the unit is poorly drained, low areas pond water; the depth to hard basalt rock varies from surface outcrop (stony rises) to more than 3 m.	3-4 Moderate to high	Special foundations resistant to soil movement are required - also thicker subgrade for roads. Where rock is near or on the surface, heavy machinery or blasting may be necessary. Special drainage may be needed - avoid drainage lines or provide appropriate drainage.
Qbgs Qbs Qbsd	Stony plains and gentle rises with hard basalt bedrock at or very close to the surface, over 50-90% of the landscape. Soils are very clayey and have a high shrink-swell potential.	4 High	Blasting or heavy machinery is needed for any excavations. Soils are expansive - high shrink-swell. Extensive flat areas are poorly drained.
Qah	Flat to gently undulating alluvial terraces associated with the Leigil and Bandon Rivers. The lower flats are flood prone while most of the higher terrace is above flood levels and the soils there have moderate shrink-swell potential. Soils are deep and alkaline - sometimes with lime.	2 Higher terrace - Low 3 Lower terraces - Extremely high	Note, the lower terraces of this unit are valuable cropping land - they may also be flood prone. Delineate flood zones and define setbacks from watercourses.
Qya Qyad	Alluvial flats; the lower terraces are subject to high velocity flooding. Soils are variable, but the lower terrace have seasonally poor drainage and are often boggy.	2 Higher terraces - Low 5 Lower terraces - Extremely high	Delineate flood zones and define set backs from watercourses (see - Erosion Hazard associated with Disturbed Soil).
Qab	Alluvial flats with dark uniform loams and clays. Much of the land is subject to flooding (various return periods). The clayey soils are seasonally poorly drained and have a high shrink-swell potential. There are some higher terraces with duplex soils that are well drained.	2 Lower terraces - Low 5 Lower terraces - Extremely *high*	Note: This is prime agricultural land (vegetables and other crops) - it may also occasionally flood. Delineate flood zones and define setbacks from watercourses.
Qau	Rolling land on deep alluvial deposits. Gentle slopes 1-5%; subsoil has moderate shrink-swell potential.	1-2 Nil to low	Avoid depression lines or provide appropriate special management.
Qaf	Gentle slopes with brown duplex soils with a moderate to highly expansive clay. Soils are moderately well drained.	2-3 Low to moderate	Avoid drainage lines or provide special management including stabilization where necessary. There are deep gullies at the northern end of this unit.
- Qsm	Wide stream valley with variable topography on the valley floor, the valley sides are steep. There are extensive sand deposits throughout the unit and some areas of basalt rock. Low flats near the stream are flood prone.	2 Undulating areas - Low 5 Stream flats - Extremely high	Delineate flood zones and define set-backs from watercourses.
Qbc Qbcd	Gentle slopes; black cracking, plastic clay soils; CH clay with high shrink-swell potential and slow percolation rates; moderate site drainage.	3 Moderate	Note: This land is prime agricultural land (onions, etc.). Special building foundations resistant to soils movement. Thicker subgrade for roads. Gentle sloping batters to avoid slumping.
Qde Qded	Flat depressions with dark highly expansive clays of very poor drainage and percolation rates - seasonal flooding occurs.	5 Extremely *high*	Unless extensive drainage and fill works are contemplated, these localised areas can be avoided.
Qbb Qbbd	Steep to moderate slopes with hard basalt very close to the surface - often out-cropping; the valley floor is poorly drained and may be flood prone,	4-5 High to extremely high	Heavy machinery or blasting is required for excavation. Where there is unconsolidated material below the basalt, land slips or slumps may occur. Avoid drainage lines (component 2).
Qlu	Gentle rises and hummocks with deep sands associated with boggy depressions (Qde) and reservoirs. Interdune	1-2 Nil to low	The sand makes firm foundation material although batters and the sides of excavations may tend to slump when the sand is dry and

MAP SYMBOL	LAND FEATURES THAT AFFECT EROSION HAZARD	LAND CAPABILITY CLASS AND LEVEL OF SPECIAL MANAGEMENT REQUIRED	COMMENTS
	low-lying areas may be boggy. The sandy soil of the rises have no shrink-swell potential (unified group - generally SP.).		loose.
QaO Tgn Tgnd -Tgs Tgc	Long gentle slopes, generally with moderately deep soils over deep, unconsolidated clays, sands and gravels. The subsoil clay of the duplex soils generally have a moderate shrink-swell (i.e. CL to CL-CH clays). There are some areas of red ironstone capping on higher land (except in Tgc) and some areas of sand (parts of Tgn, Tgnd, Tgs) with mainly SP soils.	2 Low	Avoid drainage lines or design appropriate drainage. Shrink-swell may cause some damage to structures, i.e. brick dwellings on normal strip foundations. Special soil foundations resistant to soil movements should be used.
Tbd Tgm	Gentle sloping land with moderate to highly expansive clayey soils (i.e. high shrink-swell potential). Hard basalt rock may be close to the surface on some crests and rises, although generally, the basalt is well weathered and crumbly.	3 Moderate	Special soil foundations resistant to soil movements should be used.
Tsm Tcg	Very steep to moderately sloping valley sides associated with major watercourses (including the Moorabool). The slopes are extremely variable. The common black clayey (CH) soils have a high shrink-swell potential and are well known for landslips and slumping batters. The red duplex soils have moderate to high shrink-swell.	3-5 Moderate to extremely high	Individual site inspections and geomechanical investigations are essential as this unit is extremely variable. Avoid landslip areas and where possible avoid cut and fill operations on steep slopes. Note: Any extensive gently sloping areas are usually valuable cropping land.
Tsc Tsd	Moderate to steep slopes on unconsolidated sediments. Some steep slopes below basalt cappings can be landslip prone. In some places, outcrops of very hard rock (quartzite and/or ironstone) occur.	3-4 Moderate to high	Where possible avoid cut and fill operations on steeper slopes, especially if there is evidence of slumping.
Ogg	Lower slopes – gentle gradients with deep sandy loam topsoil and deep medium clay subsoil of low to moderate shrink-swell. Upper slopes - gentle to moderate gradients often with high proportions of granite outcrops: depth to *very* hard rock is commonly 30-200 cm.	2 Low 3 Moderate	Some drainage problems may be encountered in lower lying areas. Construction on many hill tops will have to be planned to allow for the presence of granite outcrops; blasting may be necessary.
Dgh	Moderate to steep rocky slopes with shallow soils over very hard rock; the slopes are generally fairly short.	4 High	Construction normally requires considerable cut and fill, may involve blasting. (See "Erosion Risk Associated With Land Disturbance".)
Org Orgd	Gentle slopes with moderately deep soils (generally around 100 cm). The subsoil clay has a low to moderate shrink-swell (CL-CH). There may be some seasonal drainage problems near the drainage lines.	2 Low	Avoid drainage lines or design appropriate drainage. Erosion from construction sites could be a problem. (See "Erosion Hazard Associated With Land Disturbance".)
Orc	Gentle sloping broad crests with shallow to moderately deep soils over moderately hard rock (slates, etc.).	2 Low	Erosion from construction sites could be a problem.
Orm	Moderate slopes with mottled yellow duplex soils - the subsoil clay has a low to moderate shrink-swell. Depth to rock (generally rippable) is 50-100 cm.	2 Low	Careful layout with respect to the contours of the land will minimise problems of access as well as minimising erosion. Erosion from construction sites will be a problem. (See "Erosion Hazard Associated With Land Disturbance".)
Orh Orhd	Moderately steep slopes with shallow soils over moderately hard rock (slates, etc.). Some rock outcrop may occur on upper slopes and crests.	4 High	It is essential to plan construction works in accordance with the contours of the land. As far as practical, use ridges for access and construction - avoid drainage lines. Erosion from construction sites will be a major problem. (See "Erosion Hazard Associated With Land Disturbance".)
Ors Orsd	Steep to very steep slopes (commonly 15-50%). Shallow gradational soils are most common especially on steep slopes. The. sedimentary rock varies in hardness - it is usually rippable (slates, etc.). On some crests and upper slopes, particularly in the east, rock outcrops occurs, often in ridges.	4-5 High to extremely high	Some areas are just too steep and the rock to close to the surface to be used for normal construction purposes. On less steep areas, the comments applying to Orh and Orhd also apply. Erosion from construction sites will be a major problem.

5.3 Effluent Disposal by Soil Absorption

MAP SYMBOL	LAND FEATURES THAT AFFECT EROSION HAZARD	LAND CAPABILITY CLASS AND LEVEL OF SPECIAL MANAGEMENT REQUIRED	COMMENTS
Qbg Qbgd Qbgw Qbf	Flat to gently sloping land with seasonally poorly drained soils, especially on extensive areas of less than 2% slope – low areas pond water. Percolation rates are usually extremely slow due to the heavy poorly structured subsoil clay.	4 High	Choose higher or sloping land well away from depressions or drainage lines. Maximise trench length; low density development; consider separate sullage and sewage absorption fields or alternative systems if town water is to be supplied. Rock may hinder installation in some areas.
Qbgs Qbs Qbsd	Gently sloping to flat land with very stony soils; some of the smaller, higher areas have moderately permeable soils but the large flatter areas are usually clayey and are seasonally poorly drained.	4 High	Rock will cause problems for installation. The extensive flatter, clayey areas will require similar management to Qbg.
Qah	Alluvium associated with watercourses. Flat or gently sloping land. Lower terraces are flood prone and are often seasonally poorly drained. Percolation rates are variable. Higher terraces are moderately well drained.	2-3 Higher terraces - Low to moderate 5 Lower terraces - Extremely high	The higher terraces are class 2 when the top sandy topsoil is deeper than 50 cm. Avoid flood prone land and lower terraces. There is often a high risk of polluting the ground-water associated with the creek and effluent from any failures will have little chance of purification before reaching the watercourses.
Qya- --Wad	Alluvium associated with watercourses. Flat or gently sloping land. Lower terraces are flood prone and are often seasonally poorly drained; percolation rates are variable.	5 Lower terraces - Extremely high 3 Higher terraces - Moderate	Avoid flood prone land and lower terraces. There is often a high risk of polluting the ground-water associated with the creek and effluent from any failures will have little chance of purification before reaching the watercourses.
Qab	Alluvium associated with watercourses. Flat or gently sloping land. Lower terraces are flood prone and are often seasonally poorly drained; percolation rates are variable.	5 Lower terraces - Extremely high 3 Higher terraces - Moderate	Avoid flood prone land and lower terraces. There is often a high risk of polluting the ground-water associated with the creek and effluent from any failures will have little chance of purification before reaching the watercourses.
Qau	Gently sloping land with mottled yellow duplex soils. The fine sandy loam topsoil sometimes exceeds 50 cm in depth but the land is fairly close to the Moorabool River.	3 Moderate	While some of the area has deep topsoil (and slowly permeable subsoil clay), the proximity to the river increases the risk of pollution if a failure occurs. Delineate set-backs from the lower alluvium (Qyad).
Qaf	Gentle slopes with deep clayey soils; imperfect soil drainage. Note: the clayey black soils below areas of Qbbd have slow percolation rates.	3 Moderate	Avoid depressions and lower slopes where poor drainage and surface flows will cause problems.
¯Qsm	Broad river valley with sandy areas scattered throughout. While the sand is highly permeable, the permeability of the soils on the other materials (basalt, Tertiary sediments and alluvium) are variable. Much of the alluvial land is flood prone or poorly drained.	4 High 2 Sandy areas - Low	Delineate flood prone and poorly drained areas - and define set-backs from watercourse. As far as practical, keep development on sandy or Tertiary areas. Further detailed mapping is required.
Qbc Qbcd	Gentle slopes with heavy black clayey soils of low permeability when wet. Soils are generally moderately well drained because of the sloping topography.	3 Moderate	Avoid low-lying areas. Low density development is preferable. Note: This unit is prime cropping land.
Qde Qded	Flat depressions with very heavy impermeable soils. Seasonal ponding of water occurs.	5 Extremely high	Avoid these localised areas.
Qbb	Shallow stony soils on steep slopes, usually leading to a	4-5 High to extremely high	Rock, stone and slope will hinder installation. Failures are likely to

MAP SYMBOL	LAND FEATURES THAT AFFECT EROSION HAZARD	LAND CAPABILITY CLASS AND LEVEL OF SPECIAL MANAGEMENT REQUIRED	COMMENTS
Qbbd	watercourse. Percolation rates are usually slow to moderate where there is sufficient soil to test.		drain freely into major watercourses. Class 5 occurs on the rocky scarps where soils are *very* shallow or absent.
Qlu	Deep well-drained sandy soils adjacent to reservoirs and depressions (Qde); percolation rates are extremely rapid. There is an impermeable clay 70 to 150 cm from the surface.	2 Low	The excessively rapid percolation rates may allow effluent to reach the watertable without sufficient treatment - design adequate set-backs from water bodies and depressions.
Qao Tgn Tgnd . Tgs Tgc	Gently sloping land with deep sandy loam topsoils over finely structured clays which are moderately permeable. There are some poorly drained areas – depressions and any extensive areas of less than 2% slope - where seasonal watertables will be a problem.	2 Sandy topsoil > 50 cm - Low 3 Topsoil < 50 cm - Moderate	Avoid depression lines and delineate set-backs from areas. Extensive areas of slope less than 2% may require management similar to Qbg. Shrubs and trees on the absorption fields will help absorption from the trenches.
Tbd Tgm	Gentle slopes with heavy clay soils that are moderately well drained; slow to moderate percolation rates.	3 Moderate	Select well drained areas; avoid lower slopes as poor soil drainage is likely to cause problems.
Tsm Tcg	Moderate to very steep river valley sides with various soils and geologies; the dominant soils (black clay and red duplex), while well drained by lateral movement; a rocky scarp may occur at the top of the slope where the unit adjoins a basalt plain.	3-4 Moderate to high	The gentler slopes are moderate. The proximity of a major watercourse will increase the risk of pollution. Any failing systems on the steeper slopes may drain freely to the river. More detailed mapping is required. Note: Excess soil moisture triggers slips or batter slumping in landslip prone areas.
Tsc Tsd	Moderate to steep slopes often leading down to major watercourses. Soils have variable percolation rates but have free surface drainage; some places outcrops of very hard rock (quartzite or ironstone) occur.	3-4 Moderate to high	Any failures are likely to drain freely into major watercourses. Layout and installation may be a problem on the steeper slopes.
Ogg	Gentle to moderate slopes with deep sandy loam topsoils. The very gently sloping lower slopes are often seasonally poorly drained with a fairly impermeable heavy clay subsoil. Mid-slopes are moderately well drained. Upper slopes and crests may be rocky.	2 Upper slopes - Low 3 Lower slopes - Moderate	Avoid depression lines and seasonally wet areas. There may be some problems with installation on the upper slopes because of hard rock outcrop and shallow soils.
Dgh	Moderate to steep short stony slopes leading down to creek flats. The soil varies in depth between the granite outcrops. The topsoil is permeable but is of variable depth over clay.	4 High	Any failures are likely to drain freely into a major watercourse. Rock and variable soil depth will hinder and, in some areas, prevent satisfactory installation.
Org Orgd	Gentle slopes with imperfectly drained soils with clay loam to loamy topsoils 10-30 cm over a slowly permeable medium clay. Cleared lower slopes of less than 3% are often poorly drained – seasonal watertables and sometimes salting occur.	3 Moderate	Avoid depression lines and where possible avoid the long gentle lower slopes. If the latter is not possible, lower density subdivision and specialised disposal systems will be required. Perennial vegetation with high transpiration rates growing on the absorption fields will help absorption from the trenches.
Orcd	Broad crests with moderately well drained to imperfectly drained duplex soils. The subsoil clay is slowly permeable.	3 Moderate	There are two relevant points - the soils are of limited depth and permeability, but the crest position means that any failures occur a considerable distance from the drainage line. Avoid clearing.
Orm	Moderately sloping land with imperfectly drained yellow mottled duplex soils; lower slopes are less well drained.	3 Moderate	Avoid and define set-backs from depression lines. Areas under trees are better drained.
Orh Orhd	Moderately steep slopes with moderate to shallow yellow gradational or duplex soils; overall percolation rates are moderate to slow - percolation rates through the subsoil clay are very slow; soils are moderate to imperfectly drained.	3-4 Moderate to high	Avoid depression lines and delineate set-backs. Some steep upper slopes have outcropping rock (slates) or very shallow soils and there will be some danger of effluent coming to the surface. Avoid clearing in the absorption field area.
Ors Orsd	Steep slopes with moderately well drained red mottled yellow gradational soils; most of this land is uncleared; soils become shallower as slopes steepen; on some crests or slopes of more than 20-30%.	4-5 High to extremely High	Where this unit is closely associated with major watercourses, the risk of effluent reaching the creek from failing systems is high. Special precautions would be required. The steep slopes may cause problems with installation and layout. Avoid drainage lines. Uncleared areas are usually better drained than equivalent cleared areas - less prone to failure. On many crests and very steep areas, there may be too little soil for adequate treatment of the effluent.

5.4 Rural Subdivision

MAP SYMBOL	LAND FEATURES THAT AFFECT EROSION HAZARD	LAND CAPABILITY CLASS AND LEVEL OF SPECIAL MANAGEMENT REQUIRED	COMMENTS
Qbg Qbgd Qbgw Qbf	Gently sloping plain with expansive soils that are poorly drained; The subsoil heavy clay has a shrink-swell of about 20% (CH) and is impermeable - low areas pond water. Basalt rock varies in depth from surface outcrop to deeper than 3 m.	3 Moderate	Safe effluent disposal and providing suitable foundations for roads and buildings will be the main problems. Excavations (including dams) may strike very hard basalt rock. Flatter areas are often treeless and wind swept.
Qbgs Qbs Qbsd	Gentle slopes and rises with very stony shallow soils. The stoniness is particularly severe on rises and convex surfaces. Extensive areas usually have dark expansive clayey soils but some small patches (particularly Qbgs) may have a sandy wash. Less stony areas are generally seasonally poorly drained with high shrink-swell heavy clays.	4 High	Rock will be the main obstacle for access, construction and water supply (dams). Blasting or heavy equipment is generally required. Areas that are less stony may have effluent disposal problems - slow percolation rates and seasonally poor drainage.
Qah	Flat to gently sloping land associated with major streams. The lower terraces with uniform loams, etc., are generally flood prone. The upper terraces with red or dark duplex alkaline duplex soils have only minor erosion problems and moderate shrink-swell potential.	1-2 Higher terraces - Low 5 Lower terraces - Extremely high	Delineate flood zones; keep development on the higher terraces.
Qya Qyad	Alluvial flats with variable soils. The lower terraces are usually flood prone and have high seasonal watertables.	5 Lower terraces - Extremely high 2 Higher terraces - Low	Flood risk, the risk of pollution from effluent disposal systems and the proximity of development to watercourses are major problems. Development on higher non-flood-prone terraces with adequate set-back distances from the watercourses may be possible.
Qab	Flat to gently sloping land associated with the lower Moorabool River. The lower, flood prone or seasonally-wet terraces are by far the most common type of land - they have dark uniform soils. There are some areas where higher terraces with red duplex soils occur.	5 Lower terraces - Extremely high	Flood risk, the risk of pollution from effluent disposal systems and the proximity to the Moorabool River are the main problems. There may be some areas where development is possible on the higher terraces.
Qau	Flat to gently sloping land forming higher terraces to the Moorabool River. Soils are yellow duplex with fine sandy loam topsoil up to 50-60 cm deep.	2 Low	Define set-back distances from the Moorabool River for effluent disposal and construction sites.
Qaf	Gentle fault wash slopes; soils are deep - over 3 m, moderately expansive and prone to gully erosion because of rapid runoff from the Rowsley scarp.	3 Moderate	Drainage lines which carry rapid flows from the Rowsley Fault should be protected - maintain a good vegetative cover. Effluent disposal fields will need to be moderately large in clayey areas.
Qsm	Extremely variable unit - broad river valley with moderate to steep sides and sand deposits scattered across the surface; lower areas near the creek are flood prone; other areas are either basalt, alluvial terraces or Tertiary sediments.	3-4 Moderate to high	Further more detailed mapping is required. Also, delineate flood zones, restore old sand mining areas, delineate steep or rocky areas. Note: Sandy areas are too permeable for farmlet dams.
Qbc Qbcd	Gentle slopes on basalt; dark coloured self-mulching clayey soils that are highly expansive non-dispersible, slowly permeable and moderately well drained.	3 Moderate	Note: These soils are valuable for onion growing, etc. Suitable foundations for an expansive soils should be provided.
Qde	Flat depressions; seasonally flooded; heavy dark	5 Extremely high	These localised areas can be avoided. Aside from the flood risk,

MAP SYMBOL	LAND FEATURES THAT AFFECT EROSION HAZARD	LAND CAPABILITY CLASS AND LEVEL OF SPECIAL MANAGEMENT REQUIRED	COMMENTS
Qded	expansive clays, high in organic matter.		poor drainage and poor engineering qualities of the soil, effluent disposal fields will not function.
Qbb Qbbd	Moderate to preciptious slopes; shallow clayey soils on basalt; rock outcrop increases with slope; landslips occur on steep slopes where there is unconsolidated material under the basalt.	4 High	Aside from the problems of rock outcrop, slope and landslip risk, these slopes usually lead down to major watercourses. Erosion from development sites or failing effluent disposal systems will be a serious pollution risk. Also there are few if any suitable dam sites.
Qlu	Low sandy rises associated with swamps and reservoirs to the north of the Shire. The loose sands are highly permeable and non-expansive. Exposed soil is easily wind blown.	2 Low	Small farmlet dams will not hold water unless sufficient clayey material is located to line them. Much of this unit is close to the Durdidwarrah Reservoir.
Qao Tgn Tgnd Tgs Tgc	Gently sloping land with moderate to imperfectly drained yellow or red duplex soils on unconsolidated sediments. The sub-soil clays have low dispersibility and low to moderate shrink-swell. Only extensively flat areas and any depressions are poorly drained. Some other areas contain deposits of gravel or sand.	2-3 Low to moderate	Effluent disposal may be moderately difficult on flat land - (slopes less than 2%), because of poor soil drainage. Avoid drainage lines. Sandy areas are generally unsuited for farmlet dams (soil too permeable), as are some of the crest areas (no catchment) and shallow iron- stone soils.
Tbd Tgm	Gentle slopes with heavy clay soils that are moderately well drained, slow to moderately permeable and moderate to highly expansive. The soils are quite fertile.	2 Low	This is good cropping and grazing land. Some problems may be encountered due to the expansive clay and in any poorly drained low areas.
Tsm Tcg	Very steep to moderately sloping valley sides associated with major watercourses that have cut through various sediments and rock types. The main soils are black uniform clays (often landslip prone), and red duplex soils (less unstable but more erodible). The most common slopes are around 20-25% but they can be much steeper and in some areas, gentler. Soils are slow to moderately permeable.	3-5 Moderate to extremely high	Careful planning is essential. More detailed mapping is required - slope map, etc. Some areas are landslip prone; (see "Construction"). This unit is close to major watercourses such as the Moorabool - pollution (from erosion or effluent) may have little chance of surface treatment before reaching the stream. The aesthetics of the valley systems are likely to be of concern. There are very few areas suitable for dams due to the slope, also dams may trigger soil slumps.
Tsc Tsd	Moderate to steep slopes on unconsolidated material. A basalt capping is often found at the top of Tsc; there is a moderate to high erosion risk depending on slope.	3-4 Moderate to high	Subdivision is generally not recommended when this unit forms steep sides of a gorge. The steep slopes and proximity to the watercourse gives rise to a severe pollution risk. There are few if any suitable sites for farmlet dams.
Ogg	Gentle to moderate slopes on granite. Crests and upper slopes often have granite outcrops. Soils of the upper slopes erode rapidly if not protected while the gentle lower slopes tend to be poorly drained - often with seasonal watertables.	3 Moderate	On the upper slopes any rock outcrops will have to be considered during subdivision planning. Erosion control measures will be necessary during development. Advice from the SCA is available for the subdivider. Some seasonal drainage problems may occur on the lower slopes.
Dgh	Moderate to steep rocky slopes with moderate to shallow soils between outcrops. The short slope leads down to creek alluvium.	4 High	Rock, slope and proximity to the creek (pollution) are the main problems. The soils are easily eroded and there is unlikely to be suitable dam sites for farmlets.
Org Orgd	Gentle slopes on sedimentary rock with imperfectly drained mottled yellow duplex soils. The subsoil clay is moderately dispersible and may be sodic – salting may occur on some lower slopes and drainage lines.	2-3 Low to moderate	Although the soils are easily eroded, the slopes are gentle. As long as construction and access tracks are kept out of depression lines and all works and batters are quickly revegetated, problems will be minimised. Running water should not be allowed to flow on bare soil surfaces Some dams fail by tunnelling.
Orcd	Broad crests in the steep Ordovician country. The soils are generally shallow with limited moisture holding capacity and fertility. Although slowly to moderately permeable, the soils are well drained (shedding excess).	3 Moderate	The crest position will create difficulties for dam siting. The soils are shallow and stony and there are problems in finding sufficient catchments. The surrounding units are generally steep (Orsd).
Orm	Moderate slopes on sedimentary rock; moderate to imperfectly drained, mottled yellow duplex soils. The subsoil clay is dispersible and some areas are tunnel prone. Lower slopes in particular may be highly sodic.	3 Moderate	Erosion of disturbed soil surfaces will be a problem. The presence of dispersible clay in the soil is an important factor in gullying and in the failure of farm dams by tunnelling. All earthworks must be stabilized. Advice from the SCA is available for the subdivider.
Orh Orhd	Moderately steep slopes on sedimentary rock with moderate to shallow soils with mottled yellow subsoil clay. On some steeper upper slopes, shallow stony soils may barely - cover the slates. The soils are low in fertility and contain dispersible clay - tunnelling occurs in some areas.	4 High	It is essential that all earthworks be stabilized. Access should be along crests. If subdivision is allowed, the developer should ensure that each block has a good house site with safe access and a satisfactory dam site. The SCA would be interested in commenting on proposals within this unit.
Ors Orsd	Steep to very steep slopes on sedimentary rock with shallow stony gradational soils of low to very low fertility. Most of the unit remains uncleared. There may be areas of gentler slopes too small to be mapped at this scale.	Slopes of: 15-25% - High 25+% - Extremely High	In general, subdivision is not recommended for this unit because of the steep slopes and shallow erodible soils. Any access should be located on the ridges or gentler slopes. Further clearing is generally not recommended. Suitable dam sites are not common - especially in steeper areas. The SCA would be very interested in commenting ovally proposals within this unit.

6. HOW THE RATINGS CAN BE USED

6.1 Erosion Risk associated with Land Disturbance

The ratings can be used as an input to planning. A method of using this kind of information, which has been successfully used by the Town and Country Planning Board, is as follows:

Nil to low erosion risk (Classes 1 & 2). The Authority will generally have no objections to the land use on the basis of erosion risk. However, other planning considerations may be of concern, such as proximity to water courses or water storages.

Moderate erosion risk (Class 3). This land requires careful management and control, and some generalised guidelines for this are contained in the report. Applications for development of land of moderate erosion risk can also be referred to the SCA for advice particularly where more intensive developments are planned, e.g. small-lot subdivisions, etc.

High erosion risk (Class 4). Land with a high erosion risk requires significant levels of special management. The Authority should be involved at the earliest possible time, so that advice can be given in the initial planning stage.

Severe erosion risk (Class 5). Land with severe erosion risk has limitations imposed by the land features that are so severe that the special management required to overcome the limitations has either not been developed or is not economically feasible for most projects. Because of the erosion hazard the Authority would object to development of the land unless the limitations were overcome to its satisfaction.

It is recommended that, as far as possible, the various forms of development be directed into appropriate areas which have no greater than moderate erosion risk.

6.2 Constraints on Construction

The ratings which indicate the degree of limitation imposed by key land characteristics, give an indication of the relative difficulty and thus of relative costs of construction activities normally associated with subdivision.

Nil to very low level of limitation (Class 1 & 2). Where lower-cost development is required, land in class 1 and 2 should be considered.

Moderate level of limitation (Class 3). Class 3 usually indicates one or more of such limiting factors as:

- moderate slopes - causing an increased requirement for excavation and some problems for access and operation, but the land is often more aesthetically pleasant
- high shrink-swell soils - causing foundations to move with changes in soil moisture unless suitable designs are used, e.g. concrete slabs for houses, extra sub-grade for roads
- occasional rock outcrops or moderately shallow soils - possibly causing the need for heavy earth moving equipment or blasting
- seasonally poor drainage - linking access and earthworks to drier periods or necessitating drainage schemes, etc.

The moderate level of limitations, although fairly easy to cope with, add extra cost to the price of development.

High level of limitation (Class 4). Class 4 indicates limitations caused by either steep slopes or very shallow soils and surface rock, or combination of many moderate limitations. The land is very expensive by comparison to develop satisfactorily.

Severe level of limitation (Class 5). Class 5 represents land with limitations, such as flooding, very steep rocky slopes or unstable land-slip prone slopes. The cost of satisfactorily overcoming these limitations for subdivision is normally unacceptable.

6.3 Effluent Disposal by Soil Absorption

The ratings refer to the ease of installation and the risk of failure of the soil absorption trenches associated with septic effluent disposal systems. It is assumed town water is or eventually will be supplied and that all-waste systems are to be installed.

The following gives a brief outline of the criteria that were used to put the various types of land into the five classes and the kind of special management that may be necessary.

Nil to very low level of limitation (Class 1). Land with good percolation rates (not excessive or too slow) with no drainage problems or difficulties for construction.

Low levels of limitation (Class 2). Land with only minor problems such as slightly-limiting percolation rates or moderate drainage. Few problems are envisaged as long as systems are well sited, well constructed and well maintained. In the urban situation, some blocks may not have sufficiently large areas suitable for the absorption field by the time buildings and hard surface areas are planned.

Moderate levels of limitation (Class 3). This land has moderately serious limitations for absorption fields in either or both of the following aspects:

(a) Installation - Moderate slopes or stones and boulders in the soil will add to installation costs.

(b) Function of the trenches is limited by:

- *percolation* rates being moderately slow because of heavy sub-soil textures. Trench lengths of 50-120 m are required (site test dependant).
- *site drainage.* Imperfect site drainage will slow percolation rates during wet, cold months. Intercept drains up slope will reduce the effects of run-on.

Deep rooted, rapidly transpiring perennial plants on the absorption field will also improve drainage and percolation rates. Normal size urban blocks are unlikely to have sufficient area for the absorption field in most cases. Blocks in flatter areas with low-permeability and with clayey sub-soils should have an area of 500-2000 m^2 set aside for the absorption field. This allows for winter storage in the soil. Very poorly drained areas should be avoided.

High levels of limitation (Class 4). This land has serious limitations in either or both of the following aspects:

(a) Access and Installation problems such as steep slopes, surface stones or boulders, or shallow soil over hard rock.

(b) Function of the trenches is limited by one or more of the following:

- *slow percolation rates* caused by heavy soils with low permeability. Trench lengths of 120-250 m are required depending on site tests.
- *poor site drainage* will practically stop percolation during the colder, wetter months. Allowance for adequate storage in the topsoil should be made during this period. For this purpose, an envelop of 2000-3000 m^2 should be reserved exclusively for the absorption field. This can easily be fitted on most 2 ha blocks leaving room for other activities. The absorption field should be free from buildings, hard paving and trafficking and it should not receive run-on water from other sources. Perennial plants that have high transpiration rates will improve the water disposing capability of the field.

Severe levels of limitation (Class 5). This land has severe limitations to the extent that the systems will not work or that other methods of disposal are cheaper. The problems may be in:

- *Installation* - rock surfaces or extremely shallow soil, slopes in excess of 30%.
- *Pollution risk* - flood prone land, drainage lines, landslip areas.
- *Very poor drainage* - waterlogged areas.
- *Impermeable soil* - percolation rates less than 0.05 m/day that require more than 250 m of trenches.

7. CONCLUSION RURAL SUBDIVISION

Of the units assessed as having low special management requirement, the units Tgn, Tgnd, Tgs, Org, Orgd, Tgc and Qao have the most potential for rural subdivision. However, Tgs in the south and some of the Tgn plains to the north, comprise the lighter-textured cereal-cropping land of the shire. The remainder has variable agricultural value. Where sand sheets occur on any of the units (as shown on the photo mosaics), special consideration should be given to farmlet water-supply as it is impractical to store water in farm dams on deep sands. This also applies to Qlu.

The gentle to moderately sloping units of Orm and Dgg are also capable of supporting satisfactory rural subdivisions as long as sufficient attention is given to layout and erosion control. Orc has similar potential but because it occurs on crests there may be difficulties for filling farmlet dams from natural drainage.

Qau and some of the other higher, non-flood-prone terraces associated with the alluvial units Qab, Qah, Qya and Qyad, may have potential for rural subdivision, but their close proximity to the rivers and streams increases the risk of pollution and damage to the environment of the watercourse. The flood prone areas of these units have been assessed as Class 5, as have the depressions (Qde & Qded) that are seasonally inundated.

The remaining gentle to moderately sloping land has moderate to high limitations for rural subdivision for various reasons. Also, much of the extensive, nearly flat basalt plains (Qbg, Qbgd, Qbf and Qbsd) are not as aesthetically attractive as some of the more undulating country. On the other hand, many of the units are valuable for cropping, particularly Qbc, Qbcd, Qbf, Tbd, Qaf and Tgm, and slightly less so Qbg, Qbgd and Qbgw. The stoniness of Qbs, Qbsd and Qbgs, severely limits their usefulness for most activities aside from grazing.

Any subdivision proposals in the steep erodible or unstable units such as Ors, Orsd, Orh, Orhd, Dgh, Tsm, Tcg, Tsd or Tsc, should be referred to the Soil Conservation Authority at the earliest possible time so that the feasibility or management techniques required can be determined.

BIBLIOGRAPHY

Balger, P. (1980) Meridith 1:50 000 Geological Map. Department of Minerals and Energy.

Central Planning Authority (1971) Resources Survey. Barwan Region. Government Printer, Melbourne.

Color Company INC (1971) Munsell Soil Color Charts (U.S.A.)

Garvin, R.J., Knight, M.R., and Richmond, T.J. (1979) Guidelines for Minimising Soil Erosion and Sedimentation from Construction Sites in Victoria. Soil Conservation Authority, Melbourne.

Jeffery, P.J., Costello, R.T., and King, P. (1979) A Study of Land Capability in the Shire of Bungaree.

Jeffery, P.J., and Costello, R.T. (1979) A Study of Land Capability in the Shire of Ballan. Soil Conservation Authority, Melbourne.

Neil, R.C., and Scales, P.I. (1976) Terrain evaluation, Soil Assessment and Infra-Structure Costing in the Strategic Planning of New Cities. Proc. Annual Eng. Conf., Townsville 1976.

Northcote, K.H. (1979) A Factual Key for the Recognition of Australian Soils. Rellim Technical Publication, Adelaide.

Rowe, K., Howe, D.F., and Alley, N.F. (1980) Guidelines for Land Capability Assessment. Soil Conservation Authority, Melbourne.

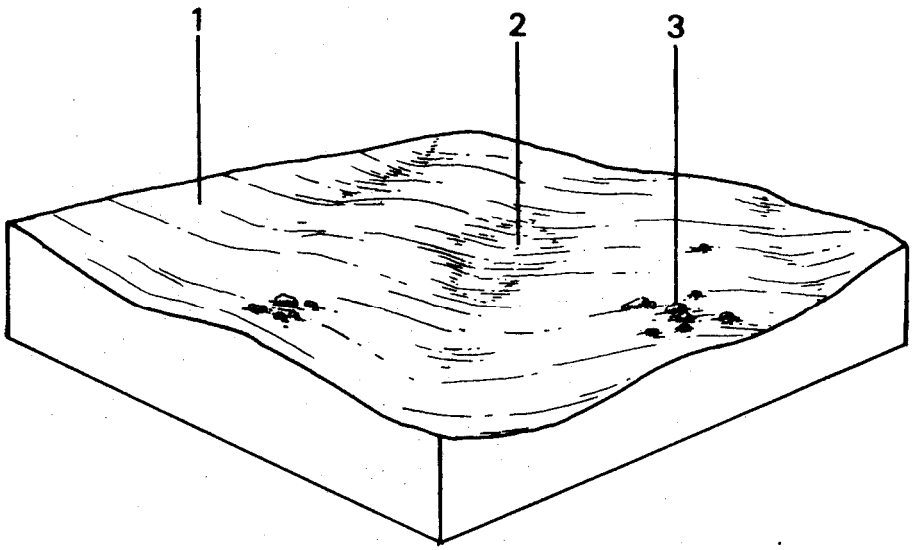
8. APPENDICES

APPENDIX 1 - MAP UNIT DESCRIPTIONS

As well as the component descriptions, each map unit has a block diagram and general description of the type of land normally found in the map unit. Included with this general description is *a Soil Profile Description.*

The soil descriptions represent the most common soil types likely to be found in the dominant component of the map units. There may be variations in such things as the thickness of the horizons (layers) and there. may even be areas of soil which do not conform at all. However, the soils described will be the ones most commonly encountered. The profile description describes a vertical cross-section of the soil. The A horizons (particularly the Al horizons) refer to the topsoil layers. The B horizon represents the sub-soil and is often clayey.

Qbg
Plains with Duplex Soils on Quaternary Basalt



SCHEMATIC BLOCK DIAGRAM

Qbg Flat to gently undulating basaltic plains with poorly drained sodic duplex soils predominating. This extensive plain occurs in the north around Meredith and with a total area of 48 km^2, represents 6.8% of the Shire.

Qbg is similar to Qbgd but the climate is wetter. (The land is used mainly for grazing, with some cropping). Extensive flat or low lying areas are particularly poorly drained and are subject to seasonally high watertables and some surface ponding.

SOILS

The most common soil occurs in Component 1. The heavy clay subsoil is slowly permeable, highly expansive and may be 1 to 4 m thick. While the Factual Key classifies the soil on the relatively thin B1 horizon which is dark, the overall impression from a deep excavation is of a yellowish *grey* duplex soil.

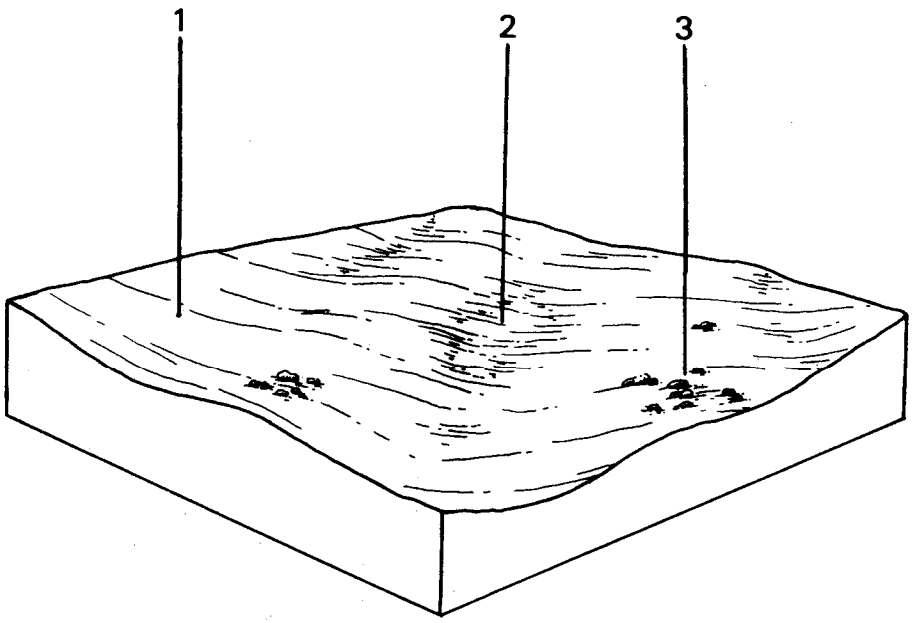
Mottled, Dark Grey Sodic Duplex Soils - Coarse Structure

Factual Key: Dd 2.43/CL, 10-60 cm/basalt, 30-400 cm

Horizon	Depth (cm)	Description
Al	0-20	Brownish black (10YR 3/2) when moist; clay loam; weak subangular blocky 7 mm; consistence when slightly moist is firm; pH 5.4; sharp boundary.
A2	20-50	Greyish yellow brown (10YR 5/2) when moist; clay loam; apedal and massive; consistence when slightly moist is firm; some buckshot gravel increasing to 60-80% at the A2/B21 interface - average size 4 mm; pH 6.0; sharp boundary.
B21	50-100	Brownish black (10YR 3/3) when moist; heavy clay with yellow mottling with a moderate sub-angular blocky 50 mm breaking down to a strong angular blocky 2 mm; consistence when slightly moist is extremely firm; pH 7.5; diffuse boundary.
B22	100-200+	Greyish yellow brown (10YR 4/2) when moist; heavy clay; strong subangular blocky 80 mm breaking down to a strong angular blocky 2 mm; consistence when slightly moist is extremely firm; may contain basalt floaters; pH 8.0.

COMPONENT	1	2	3
Proportion %	95	3	2
CLIMATE			
Rainfall (av.) mm	Annual 610 - 660		
Temperature (av) ^{0}C	Annual 12		
GEOLOGY			
Age, rock	Pleistocene, basalt		
TOPOGRAPHY			
Landscape	Extensive, slightly dissected plains in the north of the Shire		
Elevation (range) m	240 - 365		
Local relief (av.) m	2		
Drainage pattern	Dendritic		
Drainage density km/km^2	0.5		
Land form	Plain		
Position on land form	Long gentle upper slopes	Depression	Stony rise
Slope (range) %, slope shape	1-3 ; Straight	1-2 ; Straight	2-5 ; Convex
NATIVE VEGETATION	Woodland (?)		
Structure	*E. ovata, E. viminalis,*		*E. viminalis, E. rubida,*
Dominant species	*E, rubida, E. obliqua*		*E. obliqua, E. ovata*
SOIL			
Parent material	In-situ weathered rock	Alluvium	In-situ weathered rock
Description	Mottled dark-grey sodic duplex soils coarse structure	Black clay soils, uniform texture, coarse structure	Red shallow stony gradational soils
Factual key	Dd 2.43	Ug 5.1	Gn 3.11
Surface texture	Clay loam	Clay	Clay loam
Permeability	Low	Low	High
Depth (range) m	1.0 -	4.0	0.2 - 0.5
LAND USE	Grazing, occasional cropping (cereal)		Grazing
SOIL DETERIORATION			
Critical land features	Hard setting surfaces, slowly permeable subsoils	Clay soils in drainage lines Seasonal high watertables	Overland flow, leaching
Processes	Overland flow, periodic waterlogging	Overland flow, periodic waterlogging	Slopes
Forms	Surface compaction, minor sheet erosion	Surface compaction, minor rill erosion	Sheet erosion, nutrient decline

Qbgd
Plains with Duplex Soils on Quaternary Basalt. drier than Qbg



SCHEMATIC BLOCK DIAGRAM

Qbgd Flat to gently undulating basalt plains scattered throughout the southern two-thirds of the Shire. Total area is 29 km2, representing 4.1% of the Shire.

Qbgd is similar to Qbg except that the climate is drier and River red gum (*E. camaldulensis*) is more common.

The land is particularly poorly drained in the flatter areas, having seasonally high watertables and areas of surface ponding. It is used for grazing and cereal cropping.

SOILS

The major soil is that of Component 1. The heavy clay of the subsoil is impermeable, highly expansive and may be 0.5 to 3 m thick. While the Factual Key classifies the soil on the relatively thin B1 horizon which is dark, the overall impression from observation of a deep excavation is of the yellowish-grey clay of the duplex soil.

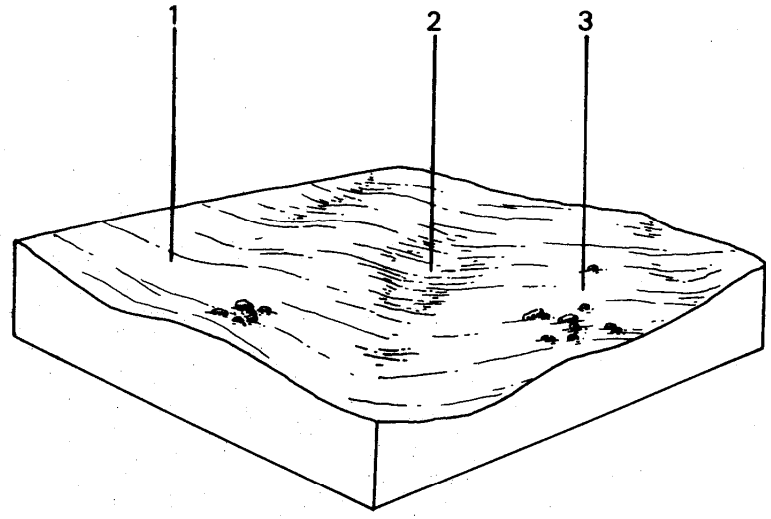
Mottled Dark Grey Sodic Duplex Soils - Coarse Structure

Factual Key: Dd 2.43/CL, 10-60 cm/basalt, 30-400 cm

Horizon	Depth (cm)	Description
Al	0-20	Brownish black (10YR 3/2) when moist; clay loam; weak sub-angular blocky 7 mm; consistence when slightly moist is firm; pH 5.4; sharp boundary.
A2	20-50	Greyish yellow brown (10YR 4/2) when moist; clay loam; apedal and massive; consistence when slightly moist is firm; some buckshot gravel throughout the A2 increasing to 50-70% buckshot average size 4 mm at the A2/B1 interface; pH 6.0; sharp boundary.
B21	50-80	Brownish black (10YR 3/1) when moist; heavy clay with yellow mottling with a moderate sub-angular blocky 50 mm breaking to a strong blocky 2 mm; consistence when slightly moist is extremely firm; pH 7.5; diffuse boundary.
B22	80-150+	Greyish yellow brown (10YR 4/2) when moist; heavy clay; strong sub-angular blocky 80 mm breaking down to a strong angular blocky 2 mm; consistence when slightly moist is' extremely firm; may contain basalt floaters; pH 8.0.

COMPONENT Proportion %	1 95	2 3	3 2
CLIMATE Rainfall (av.) mm Temperature (av.) °C	Annual 530 - 610 Annual 12 - 13		
GEOLOGY Age, rock	Pleistocene, basalt		
TOPOGRAPHY Landscape Elevation (range) in Local relief (av.) m Drainage pattern Drainage density km/km^2 Land form Position on land form Slope (range) %, slope shape	Extensive, slightly dissected plains 61 - 265 8 Dendritic 0.7 - Long gentle upper slopes 1-3 ; Straight	Depression 1-2 ; Straight	Stony rise 2-5 ; Convex
NATIVE VEGETATION **Structure** Dominant species	Woodland ? *E. camaldulensis, E. leucoxylon, E. melliodora*	*E. camaldulensis*	
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	In-situ weathered rock Mottled dark grey sodic duplex soils coarse structure Bd 2.43 Clay loam Low 1.0 - 3.0	Alluvium Black clay soils, uniform texture coarse structure Ug 5.1 Clay Low	In-situ weathered rock Red shallow stony gradational soils Gn 3 Clay loam High 0.2 - 0.5
LAND USE	Grazing, cropping (cereal)		Grazing
SOIL DETERIORATION Critical land features Processes Forms	Hard setting surfaces, slowly permeable subsoils Overland flow, periodic waterlogging Minor sheet erosion, surface compaction	Seasonal high watertables Low lying areas Overland flow, periodic waterlogging Billing, minor gully erosion in disturbed soil. Salting	Gradient Overland flow Minor sheet erosion

Qbgw
Plains with Duplex Soils with a Sandy A Horizon on Quaternary Basalt



SCHEMATIC BLOCK DIAGRAM

Qbgw Flat to gently undulating basalt plains similar to Qbgd but with sandy topsoils. Several large areas occur in the southern half of the Shire. The total area is 27.0 km^2, representing 3.9% of the study area.

The sand in the topsoil does not originate from the basalt parent material, but is a wash and, in some cases a wind-blown addition. The subsoil is a heavy, sodic clay of low permeability and high shrink-swell potential (cracks on drying), often containing basalt floaters. It can be a problem for building foundations. The land has seasonally poor drainage - especially on the flatter areas. The main land use is grazing, with some cereal cropping.

SOILS

The most common soil type occurs on Component 1. The amount of sand in the Al and A2 horizons vary.

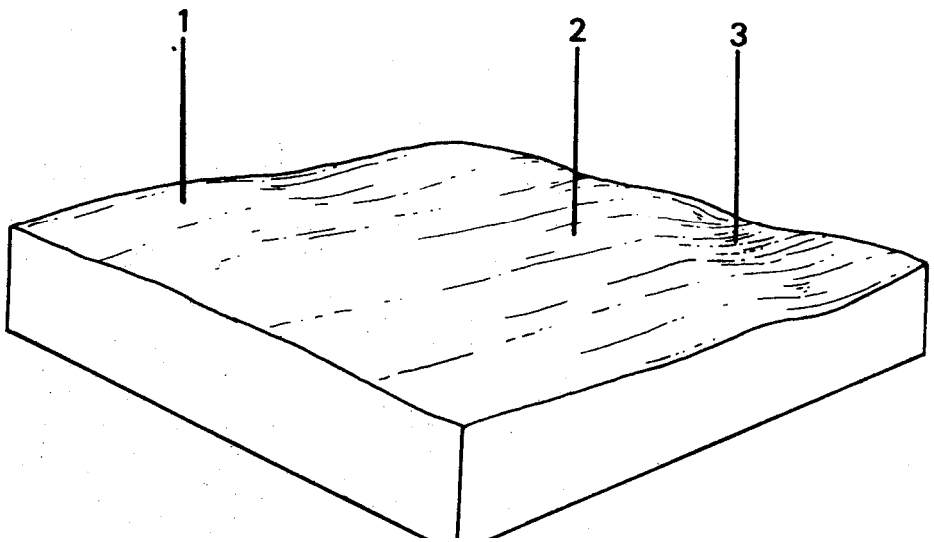
Mottled Dark-grey Sodic Duplex Soils - Coarse Structure

Factual Key: Db 2.43 (Some Dd 2.43)/LS-SCL, 20-50 cm/basalt 100-200 cm

Horizon	Depth (cm)	Description
Al	0-15	Greyish brown (7.5YR 4/2) when moist, loamy sand; apedal and massive; consistence when moist is friable; pH 4.5; clear boundary.
A2	15-40	Greyish yellow brown (101R 5/2) when moist, with brown rootline mottles; loamy sand; apedal single-grained; consistence when moist is loose; pH 4.0; abrupt boundary.
B1	40-60	Dark brown (10YR 3/3) when moist, with orange mottles; medium clay; moderate sub-angular blocky 30 mm; consistence when wet is plastic; pH (.0; gradual boundary.
B2	40-100+	Dark brown (10YR 3/3) when moist; with yellow mottles; heavy clay; moderate angular blocky 80 mm; consistence when moist - very plastic; when dry - very hard; may contain basalt floaters; pH 9.0.

COMPONENT Proportion %	1 95	2 3	3 2
CLIMATE Rainfall (av.) mm Temperature (av.) ^{o}C	Annual 500 - 580 Annual 13		
GEOLOGY Age, rock	Pleistocene, basalt		
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2 Land form Position on land form Slope (range) %, slope shape	Slightly dissected plains throughout the southern part of the Shire 61 - 249 14 Dendritic 0.6 Long gentle slopes Slopes 1-3 ; Straight	Drainage line Depression 1-2 ; Straight	Stony rise - 2-5 ; Convex
NATIVE VEGETATION Structure Dominant species	Woodland (?) *E. leucoxylon*		
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	In-situ weathered rock Mottled dark grey sodic duplex soils, coarse structure Db 2.33 and Db 2.43 Sandy loam Moderate-low 1.0 - 3.0	Alluvium Black clay soils, uniform texture, coarse structure U^{g} 5.1 Clay Low	In-situ weathered rock Red shallow stony gradational soils Gn 3 Clay loam High 0.2 - 0.5
LAND USE	Grazing, occasional cropping (cereal)		Grazing
SOIL DETERIOATION Critical land features Processes Forms	Hard setting surfaces, slowly permeable subsoils Overland flow, periodic waterlogging Surface compaction, sheet erosion	Clay soils in drainage line Overland flow, periodic waterlogging Surface compaction, minor rill erosion	Slopes Overland flow, leaching Sheet erosion, nutrient decline

Qbf
Plain with Clay Soils and Duplex Soils and Quaternary Basalt



Qbf Extensive flat to gently undulating plains located in the centre of the Shire, along the Midland Highway. Having a total area of 46 km^2, it occupies 6.6% of the Shire.

Black cracking clays, although sporadic in occurrence, are more common than in Qbgd. Their occurrence may be related to the depth of bedrock.

Cropping and grazing are the main uses, with the black cracking clays favoured for cropping.

SOILS

The soil description for Component 2 (the black uniform clay) is the same as for Map Unit Qbcd. The soil description below refers to Component 1.

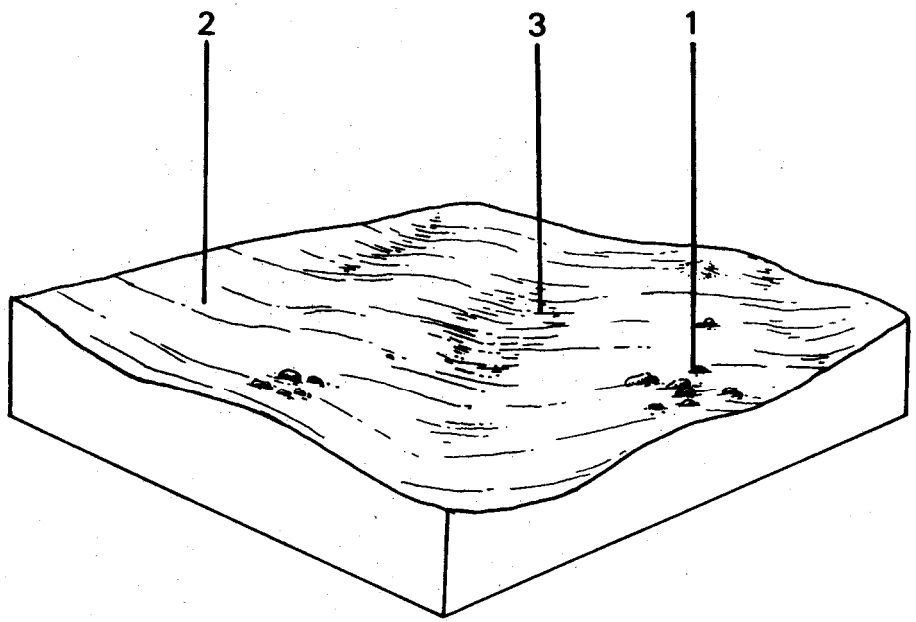
Mottled, Dark Sodic Duplex Soils - Coarse Structure

Factual Key: Dd 2.43/CL, 10-60 cm/basalt, 30-400 cm

Horizon	Depth (cm)	Description
A1	0-20	Brownish black (10YR 3/2) when moist; clay loam; weak subangular blocky 7 mm; consistence when slightly moist is firm; pH 6.0; sharp boundary.
A2	20-50	Greyish yellow brown (10YR 5/2) when moist; clay loam; apedal and massive; consistence when slightly moist is firm; buckshot gravel increases to 40-70% at the A2/B21 interface; pH 6.0; sharp boundary.
B21	50-110	Brownish black (10YR 3/1) when moist; heavy clay with yellow mottling with a moderate subangular blocky 50 mm breaking down to a strong angular blocky 2 mm; consistence when slightly moist is extremely firm; pH *7.5;* diffuse boundary.
B22	110+	Greyish yellow brown (10YR 4/2) when moist; heavy clay; strong subangular blocky 80 mm breaking down to a strong angular blocky 2 mm; consistence when slightly moist is extremely firm; pH 8.0.

COMPONENT Proportion %	1 50	2 40	3 10
CLIMATE Rainfall (av.) mm Temperature (av.) ^{o}C	Annual 510 - 630 Annual 13		
GEOLOGY Age, rock	Pleistocene, basalt		
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density kmvkm^2 Land form Position on land form Slope (range) %, slope shape	Plain in the centre of Survey Area along the Midland Highway 60 - 260 2 Dendritic 0.4 Plain Plain 1-3 ; Straight		Depression lines 1-2 ; Concave
NATIVE VEGETATION Structure Dominant species	Woodland (?) *E. camaldulensis, E. leucoxylon, E. melliodora*		
SOIL Parent material Description Factual key Surface texture permeability Depth (range} m	In-situ weathered rock Mottled dark sodic duplex soils, coarse structure Dd 2.43 Clay loam Very low 1.0 - 2.0	 Black clay soils, uniform texture, coarse structure Ug 5.1 Light to medium clay Very low 0.5 - 1.0	Alluvium mainly from basalt Black cracking clays, coarse structure Ug 5.1 Medium clay Very low 1.5 - 2.5
LAND USE	Cropping and grazing		Grazing
SOIL DETERIORATION Critical land features Processes Forms	Hard setting surfaces Overland flow Minor sheet erosion		

Qbgs
Stony Plains with Duplex Soils on Quaternary Basalt



SCHEMATIC BLOCK DIAGRAM

Qbgs Flat to gently undulating, stony, basalt plains, mainly in the south-east corner. The 62 km^2 total area represents 8.9% of the Shire; the third-largest unit.

The most striking feature is the quantity of surface stones. In less extreme cases, these have often been picked up to allow for agriculture and grazing and put in piles or used for stone fences. Apart from the black clayey soils which may occur where the surface is particularly rocky, the soil is similar to, but stonier than in Qbgd. In both cases, however, the clay has low permeability, high plasticity and high shrink-swell potential. The most common land use is grazing.

SOILS

The most common soil occurs on Component 1.

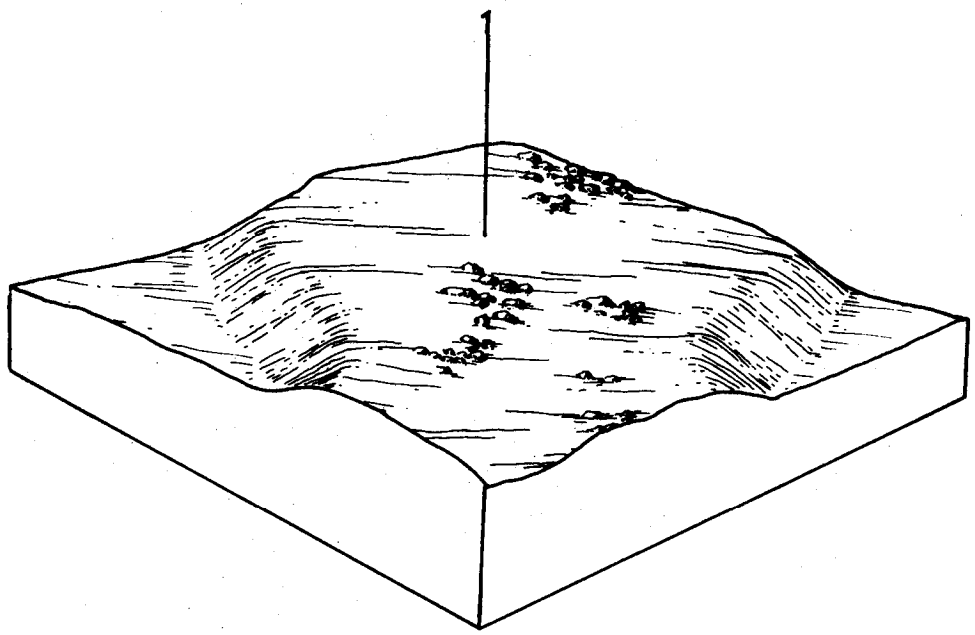
Stony Mottled Dark Grey Duplex Soils - Coarse Structure

Factual Key: Dd 2.43/CL-LC, 10-30 cm/basalt, 50-100 cm

Horizon	Depth (cm)	Description
A1	0-10	Brownish black (10YR 3/2) when moist; clay loam; weak subangular blocky 5 mm; consistence when dry is hard; surface stones 1 to 30%; pH 6.0; abrupt boundary.
A2	10-15	Greyish yellow brown (10YR 5/3) when moist; clay loam; apedal and massive; consistence when dry is hard; 1-25% basalt stones; pH 6.0; abrupt boundary.
B21	15-35	Brownish black (10YR 3/1) when moist; heavy clay; moderate subangular blocky 40 mm; consistence when slightly moist is very firm; 1-25% basalt stones; pH 7.5; diffuse boundary.
B22	35-60+	Greyish yellow-brown (10YR 4/2) when moist; heavy clay; moderate subangular blocky 60 mm; consistence when slightly moist is very firm; 1-60% basalt atones; pH 8.5.

COMPONENT Proportion %	1 75	2 20	3 5
CLIMATE Rainfall (av.) mm Temperature (av.) ^{o}C	Annual 500 - 560 Annual 13		
GEOLOGY Age, rock	Pleistocene basalt		
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2	Stony plains south of Shire 30 - 85 7 Dendritic 0.4		
Land form Position on land form Slope (range) %, slope shape	Stony plain Upper slope (?) 1-4 ; Convex	Plain Lower slope (?) 1-3 ; Straight	Drainage line Depression 1-2 ; Straight
NATIVE VEGETATION Structure Dominant species	Woodland ? *E. camaldulensis*		
SOIL			
Parent material Description Factual key Surface texture Permeability Depth (range) m	In-situ weathered rock Stony, mottled dark grey sodic duplex soils, coarse structure Dd 2.43 Clay loam Low 0.5-1.0	In-situ weathered rook Mottled dark grey sodic duplex soils, coarse structure Dd 2.43 Clay loam Low 1.0-2.0	Alluvium Black clay soil; uniform textures coarse structure Ug 5.1 Clay Low 1.5
LAND USE	Grazing		
SOIL DETERIORATION Critical land features Processes Forms	Hard Betting surfaces, slowly permeable subsoils Overland flow Minor sheet erosion, surface compaction	Hard setting surfaces, slowly permeable subsoils Overland flow, periodic waterlogging Minor sheet erosion, surface compaction	Clay soils in drainage lines Overland flow Minor sheet erosion, surface compaction

Qbs
Stony Rises with Gradational Soils on Quaternary Basalt



SCHEMATIC BLOCK DIAGRAM

Qbs Stony rises on the basalt plains in the north of the Shire. There are only a few localities large enough to be mapped separately at this scale; smaller stony areas elsewhere have been identified by using the symbol “st”.

The total area of 0.3 km^2 represents only 0.04% of the total study area. The soil is relatively fertile but the surface basalt stones and boulders generally limit its use to grazing.

SOILS

The soils of this unit are generally very shallow (Um). When soil fills deep crevices in the rock, a Gn (as described) or a Db soil may develop. In extreme cases, a grey heavy clay (in the B22 horizon) may be found.

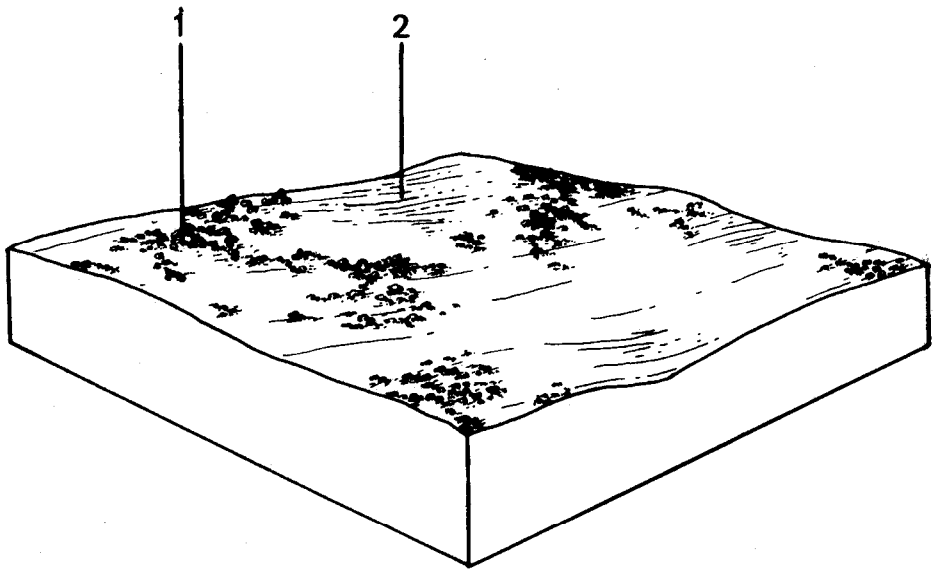
Red Shallow Stony Gradational Soils

Factual Key: Gn 3.11/L-LC, 5-40 cm/basalt, 5-70 cm.

Horizon	Depth (cm)	Description
A	0-15	Brownish black (5YR 3/2); when moist; gravelly loam; weak subangular blocky 5 mm; consistence when moist is friable; 5% small stones (basalt); pH 5.5; diffuse boundary.
B	15+	Dark reddish brown (5YR 3/4) when moist; clay loam to light clay; strong angular blocky 1 mm; consistence when moist is friable; 40-60% stones (basalt); pH 6.0. In many instances the B horizon is only present where the soil is deep in crevices in the basalt.

COMPONENT Proportion %	1 100
CLIMATE Rainfall (av.) mm Temperature (av.) °C	 Annual 610 - 660 Annual 12
GEOLOGY Age, rock	 Pleistocene basalt
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km2 Land form Position on land form Slope (range) %, slope shape	 Scattered stony areas in the north of the Shire 270 - 340 1 - - Stony areas - 1-4 ; concave scarps, straight tops
NATIVE VEGETATION Structure Dominant Species	 Woodland ? *E. viminalis*
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	 In-situ weathered rock Red shallow stony gradational soils Gn 3.12 Clay loam High 0.1 - 1
LAND USE	Grazing
SOIL DETERIORATION Critical land features Processes Forms	 Slope, shallow permeable soil Overland flow; leaching Low sheet erosion, nutrient decline

Qbsd
Stony Rises with Gradational Soils on Quaternary Basalt Drier than Qbs



SCHEMATIC BLOCK DIAGRAM

Qbsd Low stony rises on basalt. There are several small patches in the south of the Shire but only one extensive area, which is to the west of Lethbridge. The total area of 7.3 km^2 represents 1.0% of the Shire.

The small areas of Qbsd occur as stony rises on the basalt plains or as isolated remnants of basalt in other units. The large area west of Lethbridge has a slightly higher elevation than the surrounding basalt and Tga units. The degree of surface stoniness varies considerably and many areas have been cleared to allow for grazing and some cropping. Rock piles and stone fences are common around these areas.

Irrespective of surface stoniness, all areas have shallow black uniform soils, usually with large quantities of rock, overlying hard bedrock. The soils are not very permeable but drainage is better than in other gently sloping basalt units because there is surface runoff to surrounding lower land.

SOILS

The most common soil is found on both Components 1 and 2, and is usually a Ug 5.12, although others occasionally do occur.

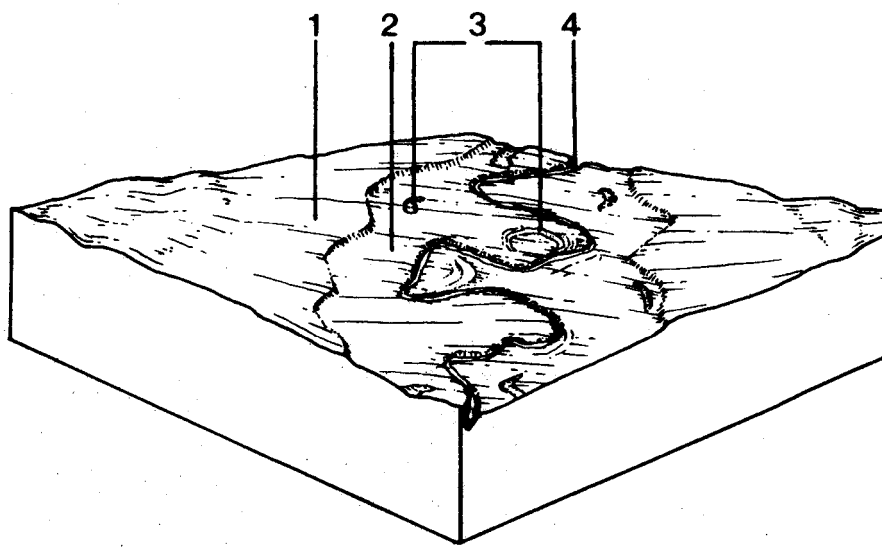
Stony Black, Clay Soils, Uniform Texture, Coarse Structure

Factual Key: Ug 5.12/LC-MC; 10-20 cm/basalt, 50-100 cm

Horizon	Depth (cm)	Description
Al	0-10	Black (10YR 2/1) when moist; light medium clay; strong angular blocky 10 mm; consistence when moist is firm; 5-70% surface stones; pH 7.0; clear boundary.
B	10-60	Brown black (10YR 3/1) when moist; heavy clay; strong angular blocky 3 mm: consistence when wet, very plastic; 10-50% basalt stones and boulders; pH 8.5.
R	60+	Basalt rock.

COMPONENT Proportion %	1 90	2 10
CLIMATE Rainfall (av.) mm Temperature (av.) ^{o}C	Annual 500 - 600 Annual 12	
GEOLOGY Age, rock	Pleistocene basalt	
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2 Land form Position on land form Slope (range) %, slope shape	Stony rise area west of Lethbridge 110 - 235 10 Dendritic 0.2 Stony rise Slopes 1-5 ; Convex	Drainage line Depression 1-2 ; Straight
NATIVE VEGETATION Structure Dominant species	Woodland ? *E. camaldulensis*	
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	In-situ weathered rock Stony black clay soil, uniform texture, coarse structure Ug 5.12 or Ug 5.14 Clay Low 0.5 -.1.0	In-situ weathered rock with some alluvium Black clay soil, uniform texture, coarse structure Ug 5.1 Clay Low 1.0 - 2.0
LAND USE	Grazing	
SOIL DETERIORATION Critical land features Processes Forms	Slope gradient Overland flow Minor sheet erosion, nutrient decline	Slope gradient Overland flow Minor rill erosion

Qah
Terraces with Duplex and Variable Uniform Texture Soils on Quaternary Alluvium



SCHEMATIC BLOCK DIAGRAM

Qah Fairly level terraces on older alluvium associated with the Leigh and Barwon Rivers in the south of the Shire. There are a total of 9.9 km^2 and this represents 1.4% of the Shire.

The higher terraces, that represent Component 1, are the only ones which seem unlikely to flood. Most of Inverleigh is built on these terraces; the lower terraces are used for sports grounds, grazing, cropping and other activities tolerant of seasonal waterlogging and occasional floods.

SOILS

The soils of the lower terraces are fairly undifferentiated, mainly consisting of blackish brown loams to clayey soils with isolated sand areas. The main soil of Component 1, the higher terraces is described below.

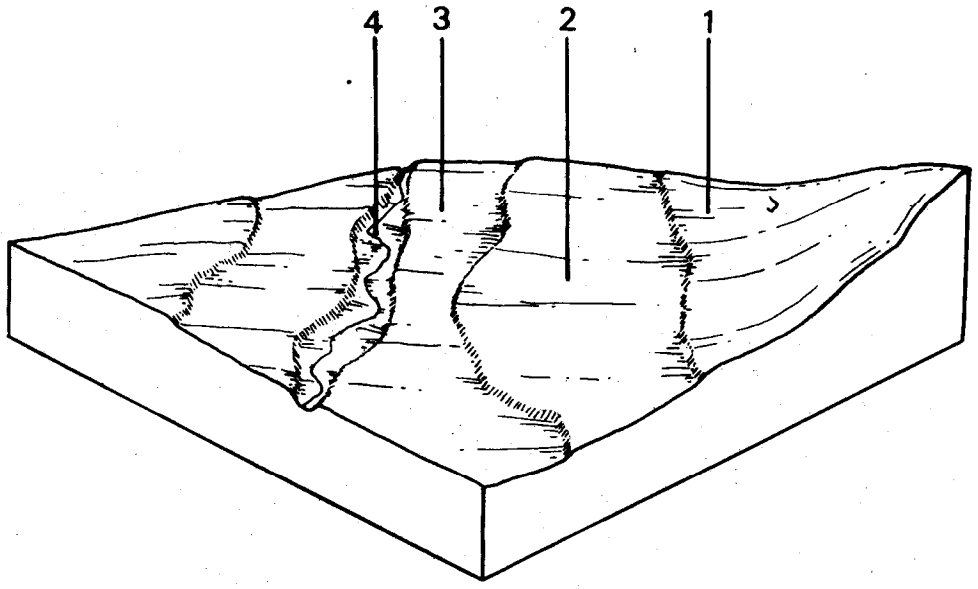
Red Duplex Soils

Factual Key: Dr 2.23/SL-L, 30-45 cm/alluvial sands and clays. 60-100 cm.

Horizon	Depth (cm)	Description
Al	0-5	Dark brown (7.5YR 3/3) when moist; loamy sand to sandy loam; apedal single-grained; consistence when dry is loose; pH 6.0; abrupt boundary.
A2	5-45	Brown (7.5YR 4/4) when moist; loamy sand to sandy loam; apedal single-grained; consistence when dry is slightly hard; pH 6.5; abrupt boundary.
B2	45-60	Dark reddish-brown (5YR 2/2) when moist; with brownish black (when moist) cutans (clay skins) on the outside of peds; medium clay; medium to strong blocky structure 50 mm; consistence when moist is very firm; pH 8.0; abrupt boundary.
BC	60-75	Bright brown (7.5YR 5/8) when moist; with common distinct red and grey mottles; light medium clay; moderate blocky structure 20 mm; consistence when moist is firm; often with hard accumulations of lime up to 50%, 20 mm; pH 9.0.
C	75+	Alluvium - brown clay with some lime and ironstone pebbles at depth.

COMPONENT Proportion %	1 45	2 35	3 5	4 15
CLIMATE Rainfall (av.) mm Temperature (av.) °C	Annual 510-570 Annual 13			
GEOLOGY Age, rock	Quaternary alluvium			
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2	Broad alluvial flats in the south of the Shire 30 - 80 5 - -			
Land form Position on land form Slope (range) %, slope shape	Terrace 2 Higher terraces 0-3 ; Straight	Terrace 1 Lower terraces. 0-2 : Straight	Depressions and billabongs in Terrace-1 Low lying wet areas 0-2 ; Concave	River channel bed, banks and levees - 0-2 ; Concave
NATIVE VEGETATION Structure Dominant species	 *E. leucoxylon* *E. camaldulensis*	Open forest *E. camaldulensis*		
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	Unconsolidated gravel, sand, silt and clay Red duplex soils - some dark duplex soils Dr 2.23 and Dd 2.13 Loamy sand and sandy loam Moderate 0.5 - 1.0	Dark uniform loams Um 1.2 Loam - clay loam High 0.2 - 0.8	Dark clay soils Dd 2.43. Ug. Um Clay loam to clay Low 0.8 - 1.5	Channel - variable; levee - uniform fine sands Variable Uc 1.23 (levee) - - -
LAND USE	Residential, grazing, some cropping	Cropping, grazing, sporting facilities (flood hazard)	Grazing	Recreation
SOIL DETERIORATION Critical land features Processes Forms	Limited permeability Overland flow Minor sheet erosion on exposed soil	Low situation affected by flooding from river Overland flow, periodic waterlogging Siltation		Overland flow, periodic waterlogging Streambank erosion

Qya
Terraces with Variable Soils on Quaternary Sediments



SCHEMATIC BLOCK DIAGRAM

Qya River deposits of gravels, sands, silts, and clays along the main streams in the north of the Shire. The unit occupies 0.6% of the Shire and covers 4.4 km^2. The unit is variable. Three different terraces are recognized though these do not occur in a repeated pattern and one or more may be absent at any given site. The oldest terrace has the greatest soil profile differentiation, the youngest the least.

Salting may occur in some areas, the salt having been transported by ground-water from the surrounding Tertiary and Ordovician sediments.

The unit is mainly used for grazing, with occasional fodder crops. Waterlogging and flooding hazard limit other uses.

SOILS

The soils of Component 2 (the most common component) are extremely variable, ranging from sands to clays. They are usually dark Um soils (clay loams and loams). As no meaningful soil description can be given at this scale, the description that follows is for duplex soils of a higher terrace.

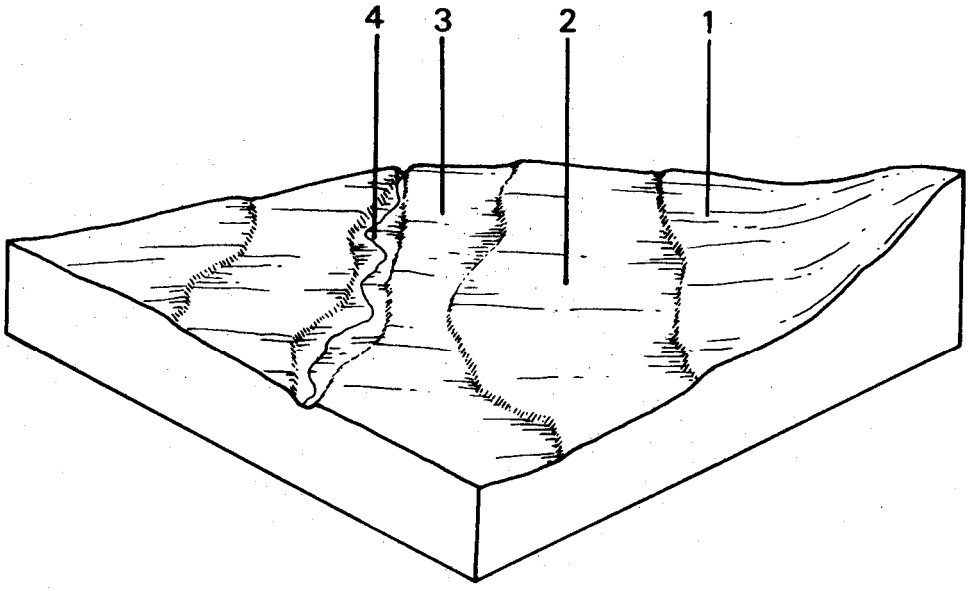
Mottled Yellow Duplex Soils

Factual Key: Dy 3.42/CL, 15-40 am/recent alluvium, 70-150 cm

Horizon	Depth (cm)	Description
Al	0-10	Dark brown (10YR 3/4) when moist; clay loam; apedal and massive; consistence when slightly moist is friable; pH 6.8; clear boundary.
A21	10-20	Dull yellowish brown (10YR 5/3) when moist; sandy clay loam; apedal and massive; consistence when slightly moist is friable; pH 6.3; diffuse boundary.
A22	20-25	Gravelly layer.
B	25-100	Bright yellowish brown (10YR 6/8) when moist; with abundant distinct red mottles; medium clay; strong angular blocky 40 mm breaking down to =angular blocky 2 mm; consistence when slightly moist is firm; pH *5.3.*
C	100+	Alluvial deposits - stratified clays, sands and gravels.

COMPONENT Proportion %	1 30	2 50	3 5	4 15
CLIMATE Rainfall(av.) mm Temperature(av.) °C	Annua1600 - 680 Annual 12			
GEOLOGY Age, rock	Quaternary alluvium			
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2	Alluvium of the northern creeks in the Shire 240 - 360 5 - 5.7			
Land form	Terraces			Stream channel
Position on land form	Higher terraces	Middle terrace	Lowest terrace	Stream bed and banks
Slope (range) %, slope shape	1-5 ; Straight	0-2 ; Straight	0-2 ; Straight	-
NATIVE VEGETATION Structure Dominant species	Woodland (?) *E. viminalis, E. radiata, some E. camaldulensis*			
SOIL Parent material	Unconsolidated river deposits			
Description	Mottled yellow duplex soils	Dark uniform soils (variable texture-mainly clay loams)	Uniform (variable) sands through to clay	Variable-from clayey to stony material
Factual key	Dy 3.42	Um 5.52 and others		
Surface texture	Clay loam	Clay loam	Variable	-
Permeability	Moderate - low	Moderate - low	Variable	-
Depth (range) m	1.2 - 2.0	1.2 - 2.0	0.5 - 1.0	-
LAND USE	Grazing	Grazing, some market gardens on larger areas	Grazing, recreation	
SOIL DETERIORATION Critical land features	Hard setting surfaces	Low lying areas prone to flooding		Exposed surfaces
Processes	Overland flow	Overland flow, periodic waterlogging	Some accumulation of salts. Undercutting by stream, periodic waterlogging, overland flow	
Forms	Minor sheet erosion	Siltation	Streambank erosion, salting, flooding	

Qyad
Terraces with Variable Soils on Quaternary Sediments. Drier than Qya



SCHEMATIC BLOCK DIAGRAM

Qyad River and stream deposits of clay, silt, sand and gravel in the southern half of the Shire. The 6.7 km^2 total area of the unit represents 0.9% of the Shire.

River channel, banks and terraces are the landforms comprising this unit. The spacial arrangement of these and the number of terraces present at any locality is very variable within the unit. The soil profile shows greatest differentiation on the higher, older terraces and least on the lower, younger ones.

The higher terraces are mainly used for grazing, with some fodder crops and market gardening where the terraces are wider. Waterlogging and flooding on the lower terraces limit their usefulness for purposes other than passive recreation.

SOILS

The soils of Component-2 (the most common component) are variable ranging from loams to clays. As no meaningful soil description can be given at this scale, the description that follows is for duplex soils of a higher terrace.

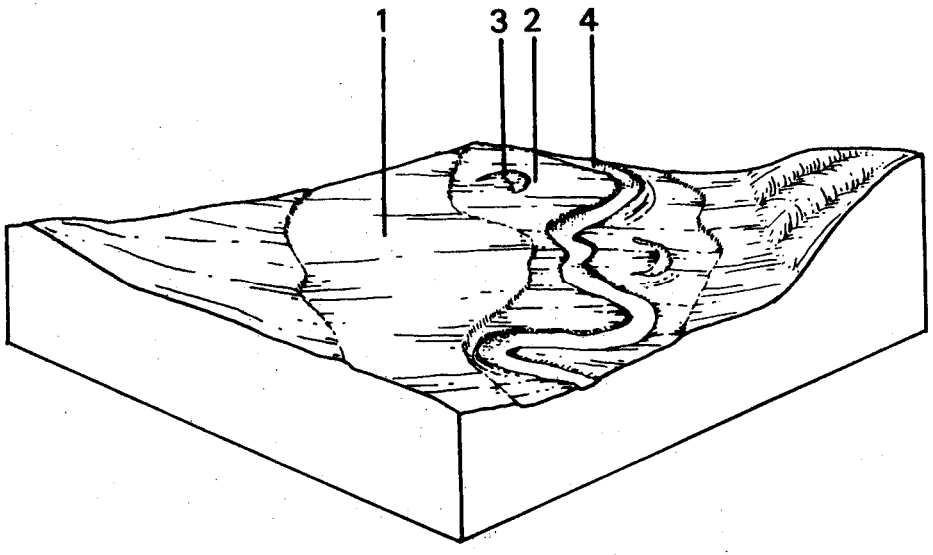
Mottled Yellow Duplex Soils

Factual Key: Dy 3.41/CL, 15-40 cm/alluvium, 70-150 cm

Horizon	Depth (cm)	Description
Al	0-10	Dark brown (10YR 3/4) when moist; clay loam; apedal and massive; consistence when slightly moist is friable; pH ^{4}.8; clear boundary.
A2	10-20	Dull yellowish brown (10YR 5/3) when moist; sandy clay loam; apedal and massive; consistence when slightly moist is friable; pH 4.3; diffuse boundary.
B	20-100	Bright yellowish brown (10YR 4/8) when moist; with abundant distinct red or yellow brown mottles: medium clay; strong angular blocky 40 mm breaking down to an angular blocky 2 mm; consistence when slightly moist is firm; pH 5.3.
C	100+	Alluvial deposits - stratified clays, sands and gravel.

COMPONENT	1	2	3	4
Proportion %	30	50	5	15
CLIMATE				
Rainfall (av.) mm	Annual 500 - 600			
Temperature (av.)°C	Annual 13			
GEOLOGY				
Age, rock	Quaternary alluvium			
TOPOGRAPHY				
Landscape	Scattered occurrences of alluvium in centre and south of Shire			
Elevation (range) m	30- 260			
Local relief (av.) m	10			
Drainage pattern	1			
Drainage density km/km^2	5.2			
Land form	Terraces		Terrace	Stream channel
Position land form	Higher terraces	Middle terrace	Low	Lowest
Slope (range) %, slope shape	1-5; straight	2-3 ; straight	1-2 ; straight	- ; variable
NATIVE VEGETATION				
Structure	Woodland (?)			
Dominant species	*E. camaldulensis*			
SOIL				
Parent material	Unconsolidated alluvial Sediments			
Description	Mottled yellow duplex soils	Dark uniform soils (variable)	Uniform - variable sands through to clays	Variable - from clayey to stony materials
Factual key	Dy 3.42	Um 5.52 and others	Uc - Ug	-
Surface texture	Clay, loam	Clay loam	Variable	-
Permeability	Moderate - low	Moderate - low	Variable	-
Depth (range) m	1 - 2	1 - 2	1	-
LAND USE	Grazing	Grazing with some market gardens	Recreation	
SOIL DETERIORATION				
Critical land features	Hard setting surfaces	Low situation affected by flooding from river		Exposed soil surfaces
Processes	Overland flow	Overland flow, periodic waterlogging	Undercutting by stream, periodic waterlogging	
Forms	Minor sheet erosion	Siltation	Stream-bank erosion	

Qab
Terraces with Uniform Texture Soils on Holocene Sediments



SCHEMATIC BLOCK DIAGRAM

Qab Alluvial flats and terraces associated with the Moorabool River, south of Maude. They have an area of 9 km^2 or 1.3% of the Shire.

The most common soil is the dark, uniform, heavy textured soil which is found on the middle terrace. In some areas there are higher, sloping terraces which have red duplex soils, The middle terrace contains billabongs which are old river channels that were cut off when the river changed its course in the past. Components 3 & 4 and much of Component 2 are subject to flooding, but the frequency and intensity of flooding is variable. The middle and higher terraces are used for market gardening.

SOILS

The main soil type is found on Component 2.

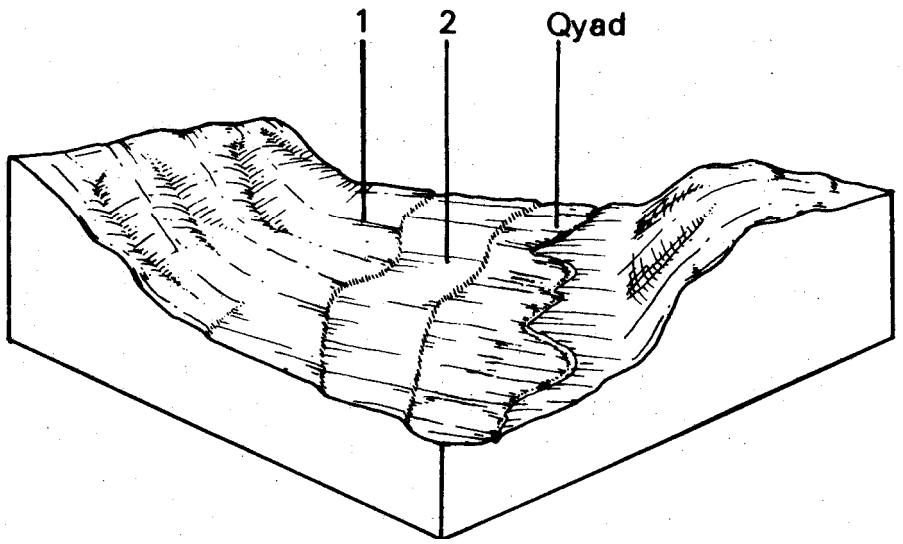
Dark Uniform Soils of Medium or Heavy Texture

Factual Key: Ug 5.1/CL-MC, 5-20 cm/alluvium, 100-200 cm

Horizon	Depth (cm)	Description
A	0-60	Brownish black (10YR 3/1) when moist, with grey mottles; medium clay; moderate subangular blocky 5 mm; consistence when moist is firm; pH 6.5; clear boundary.
B	60-80+	Black (10YR 2/1) when moist with yellow mottles; medium clay; strong angular blocky 4mm: consistence when moist is firm; pH 8.0.

COMPONENT	1	2	3	4
Proportion %	6	80	4	10
CLIMATE				
Rainfall (av.) mm	Annual 500 - 610			
Temperature (av.) °C	Annual 13			
GEOLOGY				
Age, rock	Holocene river alluvium	Miocene sediments ?		
TOPOGRAPHY				
Landscape	Terraces and flood plains along the Moorabool hills			
Elevation (range) m	30 - 122			
Local relief (av.) m	14			
Drainage pattern	Dendritic			
Drainage densitykm/lan^2	4.3			
Land form	Higher terrace	Middle terrace and billabongs		River channel and terrace
Position on land form	Gentle upper slopes	Terrace	Billabong	Bottom
Slope (av.) %, slope shape	1-6 ; Convex	1-2 ; Straight	1-2 ; Concave	1-2 ; Straight
NATIVE VEGETATION				
Structure	Open woodland			
Dominant species	*E. camaldulensis*			
SOIL				
Parent Material	Unconsolidated materials			
Description	Red duplex soils	Dark uniform soils of medium or heavy texture	Dark gradational soils	Uniform soils (variable)
Factual key	Dr 2.1	Um / Uf	Gn 3.51	Uc
Surface texture	Fine sandy loam	Clay loam	Clay loam	Silty clay loam (variable)
Permeability	Moderate	Moderate-high	Low	-
Depth (range) m	1.0 - 2.0	1.0 - 2.0	0.8 - 1.2	-
LAND USE	Some farm houses	Cultivation (Market garden)		Water supply, wild life conservation, recreation
SOIL DETERIORATION				
Critical land features	Hard setting surfaces	Low situation affected by flooding from river		
Processes	Overland flow	Overland flow, periodic waterlogging	Sub-surface flow, overland flow, periodic waterlogging	Overland flow
Forms	Very minor sheet erosion	Siltation	Siltation	Stream-bank erosion

Qau
Higher Terraces with Duplex Soils on Quaternary and Ordovician Sediments



Qau Higher terraces adjacent to the lower alluvial terraces of Qyad, occurring east of Maude, on the Moorabool River. The 1.0 km^2 total area represents only 0.1% of the Shire.

1.5 to 2.5 metres of soil and unconsolidated material overlies sedimentary rock and appears to be alluvium deposited on terraces cut into the Ordovician sediments. It is the presence of sedimentary rock close to the surface which separates the terraces of this unit from those of Qyad.

The gentle slopes, of 1-3%, are used for cropping and grazing. The unit is not flood prone.

SOILS

Neither of the components show any signs of erosion except for minor sheet erosion during fallow periods. The soils are moderately sodic - especially the lower component.

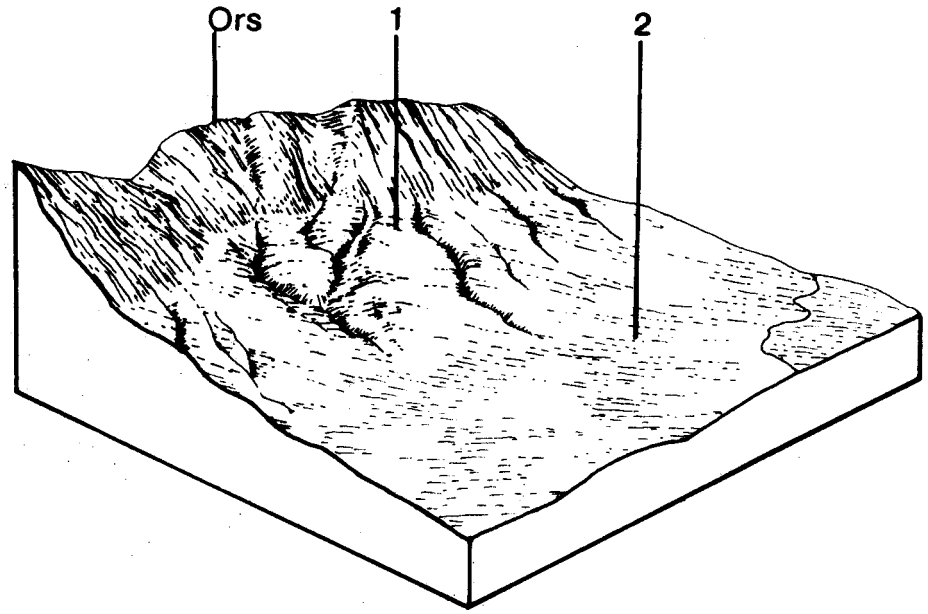
Red Mottled Yellow Duplex Soils

Factual Key: Dy 3.42/FSL, 40-70 cm/alluvium, 100-150 cm

Horizon	Depth (cm)	Description
Al	0-50	Dark brown (10YR 3/3) when moist; hydrophobic fine sandy loam; apedal and massive; consistence when dry is soft; pH 5.5; clear boundary.
A2	50-60	Yellowish brown (10YR 3/3) when moist; fine sandy loam; apedal and massive; consistence when dry is soft; pH 6.0; abrupt boundary.
B	60-100+	Yellowish brown (10YR 5/4) when moist; with red mottles; heavy clay; strong subangular blocky 20 mm; consistence when slightly moist is extremely firm; contains some rounded pebbles; pH 8.0.

COMPONENT	1	2
Temperature °C	60	40
CLIMATE		
Rainfall (av.) mm	Annual 580 - 600.	
Temperature (av.) °C	Annual 12	
GEOLOGY		
Age, rock	Quaternary alluvium on Ordovician sediments	
TOPOGRAPHY		
Landscape	Cut and fill terraces east of Maude adjacent to the Moorabool River	
Elevation (range)	65-90	
Local relief (av.) m	15	
Drainage pattern	Dendritic	
Drainage density km/km^2	3.0	
Land form	Terraces	
Position on land form	Upper	Lower
Slope (range) %, slope shape	1-4 ; Straight	1-2 ; Straight
NATIVE VEGETATION		
Structure	Woodland ?	
Dominant species	*E. camaldulensis*	
SOIL		
Parent material	Unconsolidated river deposits	
Description	Red mottled yellow duplex soils	Yellow mottled yellow duplex soils
Factual key	Dy 3.42	Dy 3.43
Surface texture	Fine sandy loam	Sandy loam
Permeability	Moderate	Moderate
Depth (range) m	1.0 - 2.0	0.8 - 1.5
LAND USE	Cropping and grazing	
SOIL DETERIORATION		
Critical land features	Hard setting surfaces	
Processes	Overland flow	
Forms	Minor sheet erosion	

Qaf
Fan-Plain with mixed Uniform and Duplex Soils on Quaternary Sediments



Qaf Colluvial and alluvial outwash from the scarp of the Rowsley Fault along the eastern boundary at the northern end of the Shire. The total area of the unit is 4.2 km^2, which represents 0.6% of the Shire.

The soils of the upper steeper, slope strongly reflect the geology of the Rowsley Scarp. In most cases this is mainly basalt and the soils are dark brown uniform or dark duplex soils. Further south, where limestone forms the scarp, alkaline red mottled yellow duplex soils occur. The lower, gentler, slopes being formed on a mix of colluvium and alluvium do not reflect the geology of the scarp as strongly and generally have red duplex and occasionally red mottled yellow, duplex soils.

The main land use is cropping and grazing. Gully erosion can be very severe in these soils, because the deep sodic deposits are subject to high-velocity flowing water from the escarpment.

SOILS

The soils on this unit are quite variable. The following description represents one of the more common soils of Component 1.

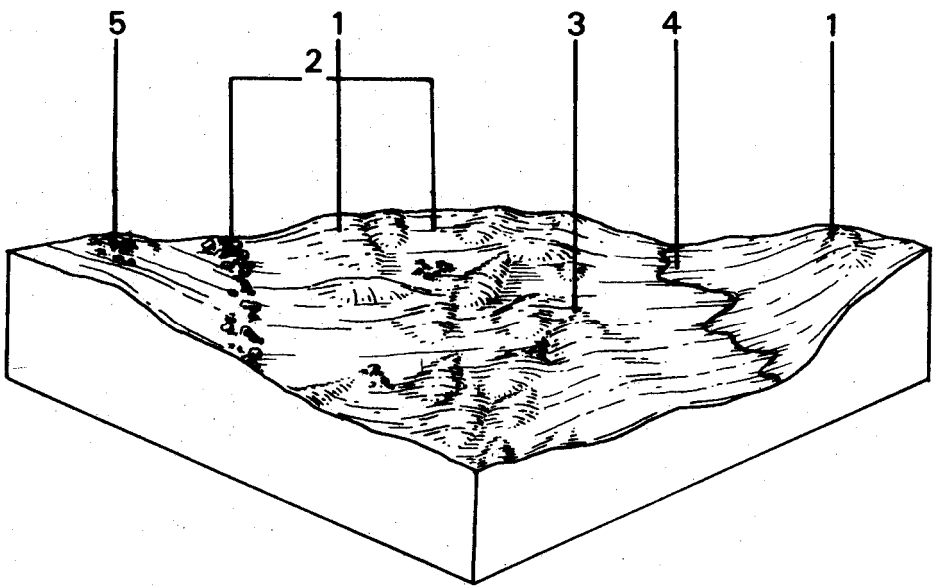
Dark Brown Shallow Uniform Clayey Soils - Weak Structure

Factual Key: Ug 5.3/CL -LMC, 10-20 cm/colluvium of basalt origin, 40-100 cm

Horizon	Depth (cm)	Description
A	0-15	Dark brown (10YR 3/3) when moist; self-mulching medium clay; moderate angular blocky 5 mm; consistence when moist is firm and very plastic when wet; pH 6.5; clear boundary.
B	15-50	Brown (7.5YR 4/4) when moist; clay; weak subangular blocky 5 mm; consistence when moist is hard; 20% lime as soft accumulations; pH 8.5.

COMPONENT Proportion %	1 60	2 40
CLIMATE Rainfall (av.) mm Temperature (av.) °C	Annual 500 - 560 Annual 12	
GEOLOGY Age, rock	Quaternary fault aprons, gravel, sand and clay	
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/^{2} Land form Position on land form Slope (range) %, slope shape	Gently sloping plain below the Rowsley Fault scarp 240 7 Parallel 1.2 Plain Upper slope 2 – 6	Lower slope I-3
NATIVE VEGETATION Structure Dominant species	Open forest *E. microcarpa, E. leucoxylon E. polyanthemos, E. goniocalyx*	*E, microcarpa, E. leucoxylon E. polyanthemos, E. goniocalyx E. ovata*
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	Unconsolidated sediments Dark brown shallow uniform soils, weak structure Ug 5.31 Light clay to clay loam Low 0.4 - 1.0	Red duplex soils, coarse structure, sodic Dr 3.23- Clay loam Low 1.5 - 2.5
LAND USE	Grazing, some cereal cropping	
SOIL DETERIORATION Critical land features Processes Forms	Poor soil structure, sodic soils - dispersibility, low permeability, long elopes Overland flow, sub-surface flow, movement of salts Moderate sheet, rill, gully and tunnel erosion	

Qsm
Valley Floor with Uniform and Duplex Soils on Mixed Parent Materials



SCHEMATIC BLOCK DIAGRAM

Qsm A wide valley floor containing large sand deposits with scattered occurrences of basalt (Qbgd) and Tertiary sediments (Tgs) and with alluvium in the depressions (Qyad). All these components are too small to be mapped separately at this scale. There are three occurrences of the unit - two in the south-west and one in the south-east corner of the Shire. The total area of 8.8 km^2, represents 1.2% of the study area.

Although the macro-relief of the valley floor is fairly level, on a micro-scale, it has many short, sharp slopes and rises. The sandy ridges and hummocks occur randomly across this landscape. Extractive industries are slowly removing many of the larger sand deposits. Unless quickly revegetated, the loose sands are easily washed or blown away.

SOILS

Soil descriptions for the basalt, Tertiary and alluvial soils can be found in units Qbgd, Tgs and Qyad respectively. The soil described below occurs on the sandy ridges and hummocks (Component 1).

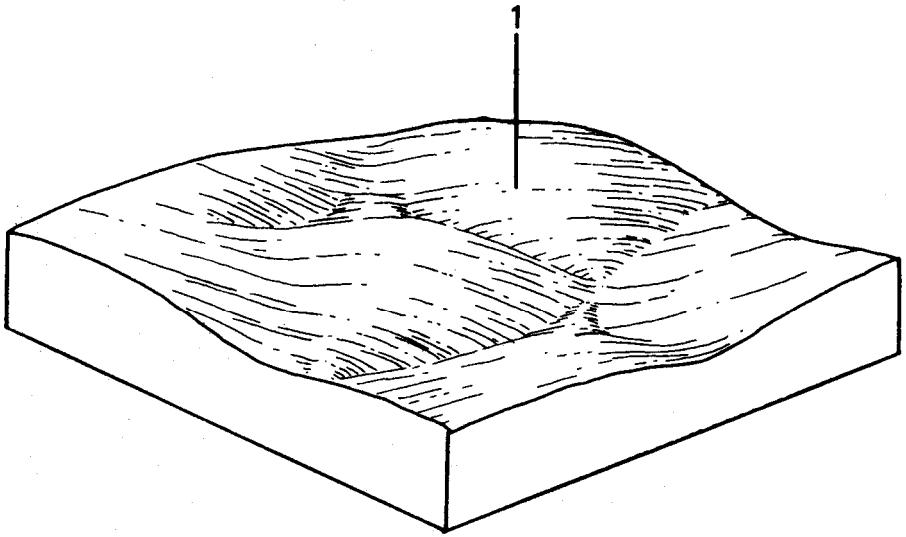
Brown Sand Soils - Uniform Texture

Factual Key: Uc 1.21/LS-S, 10-25 cm/unconsolidated sand, 50-80 cm

Horizon	Depth (cm)	Description
A	0-20	Dark greyish brown (10YR 4/2) when moist; loamy sand; apedal and single-grained; consistence when slightly moist is loose; pH 6.0; diffuse boundary.
B	20-60	Brown (7.5YR 5/4) when moist; sand; apedal and single-grained; consistence when moist is loose; pH 6.0; diffuse boundary.
C	60-100+	Light brown (7.5YR 6/4) when moist sand; apedal and single-grained; consistence when moist is loose; pH 6.5.

COMPONENT Proportion %	1 60	2 15	3 10	4 10	5 5
CLIMATE Rainfall(av.) mm: Temperature (av.) °C	Annual 560 - 580 Annual 13				
GEOLOGY Age, rock	Holocene sand	Pleistocene basalt	Tertiary unconsolidated sediments	Holocene alluvium	Tertiary ? ferrocrite
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2	Wide creek valley with a broad and generally level but hummocky floor; south of survey area 30 - 107 7 Dendritic 2.8				
Land form	Sandy ridges, scarps and hummocks	Level areas and rock outcrops	Lower lying areas between hummocks	Drainage line	Outcrop
Position on land form	Upper slope	Mid slope		Lower slope	Mid slope
Slope (range) %, slope shape	2-15 ; Convex	1-2 ; Convex	1-3 ; Straight	1-2 ; Straight	3-8 ; Convex
NATIVE VEGETATION Structure Dominant species	Woodland ? *E. viminalis*	*E. camaldulensis*			
SOIL Parent material	Unconsolidated sands	In-situ weathered rock	Unconsolidated sediments	Unconsolidated sediments	Unconsolidated sediments
Description	Brown sand soils, uniform texture	Mottled yellow duplex soils, coarse structure	Mottled red duplex soils	Uniform soils (variable)	Mottled brown duplex soils
Factual key	Uc 1.21	Dd 2.43	Dr 3.22	Uc - Urn	Db 2.22
Surface texture	Loamy sand	Clay loam	Fine sandy loam	Silty clay loam (variable)	Fine sandy loam
Permeability	High	Moderate-low	High-moderate	High	Moderate
Depth (av.) m	0.7 - 1.5	0.5 - 1.0	0.5 - 1.5	1.0 - 2.0	0.3 - 0.80
LAND USE	Sand extraction	Grazing			
SOIL DETERIORATION Critical land features	Nutrient holding capacity	Hard setting surface, slowly permeable sub-soils	Slope gradient	Slope position, flooding	Slope gradient
Processes	Leaching	Overland flow, periodic waterlogging	Overland flow	Waterlogging, stream-bank undercutting	Overland flow
Forms	Nutrient decline	Compaction of surfaces, low sheet erosion	Low sheet erosion	Stream-bank erosion	Moderate sheet erosion

Qbc
Plains with Clay Soils on Quaternary Basalt



SCHEMATIC BLOCK DIAGRAM

Qbc Small areas of black, cracking, clay soils on gently undulating basalt plains in the northern section of the Shire. The unit covers only 0.3 km2 or 0.04% of the survey area - one of the smallest units.

It is similar to Qbcd, but the climate is wetter. The land-use is mainly cereal cropping and grazing. The heavy clay soil retains moisture well but is difficult to work into a fine seedbed except at optimum moisture content. The unit generally has a low erosion hazard, and could be used more intensively. The clay, however, is highly expansive and has a high plasticity index - special foundations for constructions are required.

SOILS

The soil is fairly homogeneous throughout this unit.

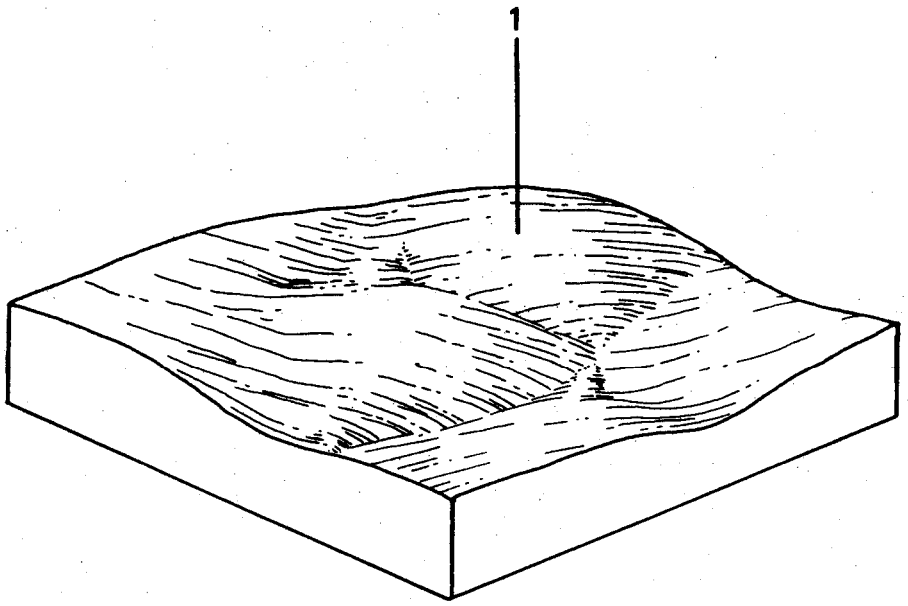
Black Clay Soils, Uniform Texture - Self Mulching

Factual Key: Ug 5.14/LC-MC, 10-30 cm/basalt, 80-160 cm

Horizon	Depth (cm)	Description
A	0-20	Black (10YR 2/1) when moist; medium clay; strong angular blocky 15 mm; consistence when moist is very firm; pH 7.0; clear boundary.
B	20-80	Brownish black (10YR 3/1) when moist; heavy clay; strong angular blocky 2 mm; consistence when wet, very plastic; occasional basalt stones and boulders; pH 8.5; diffuse boundary.
C	80-120	Grey (2.5YR 4/0) when moist; heavy clay; strong angular blocky 1 mm; consistence when wet is very plastic; occasional basalt stones and boulders; pH 8.0.
R	120+	Basalt rock at variable depth.

COMPONENT Proportion %	1 100
CLIMATE Rainfall (av.) mm Temperature (av.) °C	 Annual 650 - 685 Annual 12
GEOLOGY Age, rock	 Pleistocene, basalt
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/h Land form. Position on land form Slope (range) %, slope shape	 Slightly dissected plains in the north of the Shire 228 - 267 5 Dendritic 1.7 Plain - 2-10 ; Convex
NATIVE VEGETATION Structure Dominant species	 (?)
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	 In-situ weathered rock Black clay soils. uniform texture, coarse structure - self mulching Ug 5.14 Heavy clay Moderate 0.8 - 1.6
LAND USE	Cropping (cereal), occasional grazing
SOIL DETERIORATION Critical land features Processes Forms	 Slope Overland flow Minor sheet erosion

Qbcd
Plains with Clay Soils on Quaternary Basalt. Drier than Qbc



SCHEMATIC BLOCK DIAGRAM

Qbcd Gently sloping areas of black uniform, self-mulching clays on basalt. There are four areas (near She Oaks) totalling 1.1 km^2 and comprising 0.1% of the Shire.

This unit supports similar land uses to Qbc; however, the climate here is drier. The black soils are quite fertile and are often used for onion growing and other cropping. Sheet erosion of fallow land can occur. During the summer, deep cracks appear as the clay dries out and shrinks; the magnitude of this shrink-swell property can be a problem for foundation construction.

SOILS

As there is only one component, the soil description below represents the whole unit.

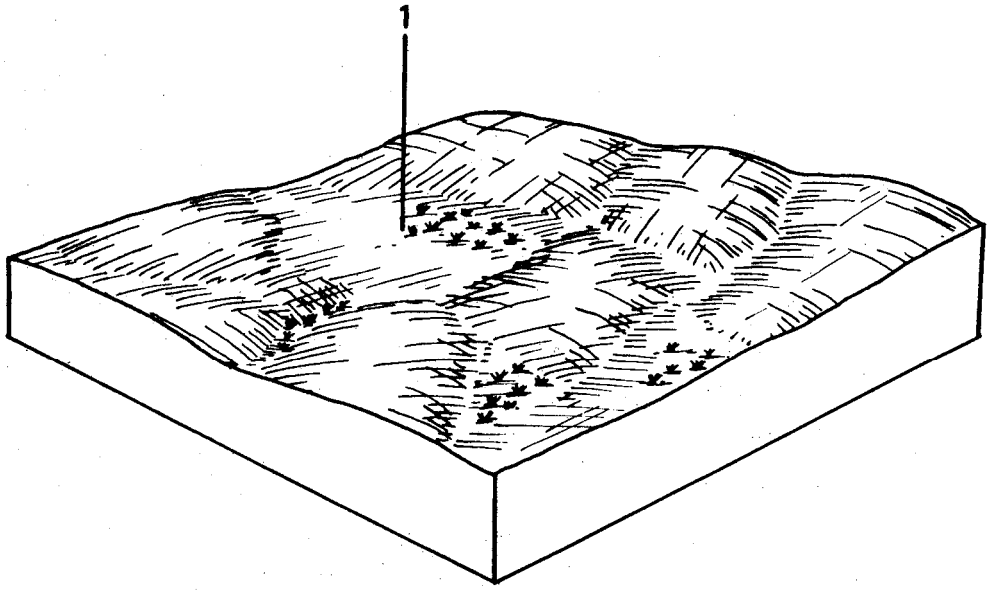
Black Clay Soils, Uniform Texture - Self-Mulching

Factual Key: Ug 5.14/LC-MC, 10-30 cm/basalt, 80-160 cm

Horizon	Depth (cm)	Description
A	0-20	Black (10YR 2/1) when moist; medium clay; strong angular blocky 15 mm; consistence when moist is firm; pH 7.0; clear boundary.
B	20-80	Brownish black (10YR 3/1) when moist; heavy clay; strong angular blocky 2 mm; consistence when wet, very plastic; occasional basalt stones and boulders; pH 8.5; diffuse boundary.
C	80-120	Grey (2.5YR 4/0) when moist; heavy clay; strong angular blocky 1 mm; consistence when wet is very plastic; occasional basalt stones and boulders; pH 8.0.
R	120+	Basalt rock.

COMPONENT Proportion %	1 100
CLIMATE Rainfall (av.) mm Temperature (av.) ^{o}C	 Annual 610 - 630 Annual 2
GEOLOGY Age, rock	 Pleistocene, basalt
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2 Land form Position on land form Slope (range) %, slope shape	 Slightly dissected plains 185 - 251 3 Dendritic 1.7 Plain - 1-4 s Convex
NATIVE VEGETATION Structure Dominant species	 (?)
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	 In-situ weathered rook Black clay soils, uniform texture, coarse structure - self mulching Ug 5.14 Heavy clay Moderate 0.8 - 1.5
LAND USE	Market garden (onions), cropping (cereal), 000asional grazing
SOIL DETERIORATION Critical land features Processes Forms	 Slope Overland flow Minor sheet erosion

Qde
Depressions with Heavy Clay Soils on Recent Sediments



SCHEMATIC BLOCK DIAGRAM

Qde Swamps and depressions mainly in the northern part of the Shire. The total of only 1.0 km^2, represents 0.1% of the Shire. The tendency of the land to be waterlogged or flooded, particularly in winter, limits its usefulness for anything more intensive than grazing.

SOILS

The soils are usually dark, with a high content of organic matter at the surface. Almost all of these depressions occur with the Tgn and the soils have a higher sand content in the topsoil than the Qde depressions in the basalt to the south. The following is a common soil.

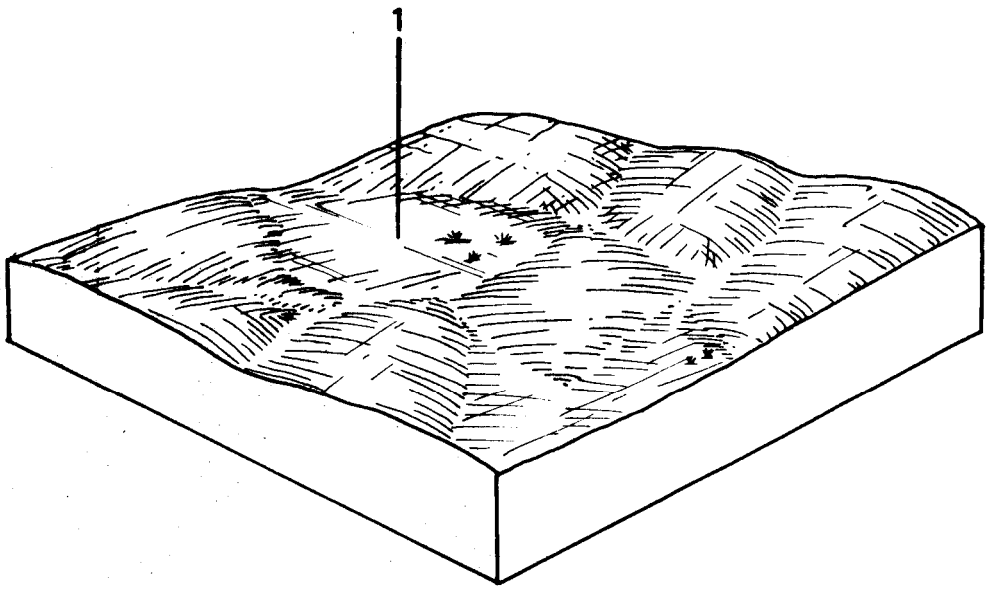
Mottled Grey Duplex Soils

Factual Key: Dg 2.41/organic loam, 25 cm/unconsolidated sediments 100+ cm. 01 N

Horizon	Depth (cm)	Description
0	0-10	Brownish black (10YR 2/2) when moist; organic loam; moderate subangular blocky 3 mm; consistence when wet is "spongy" non plastic; pH 5.5; clear boundary.
Al	10-25	Brownish black (2.5YR 3/1) when moist; loam; weak subangular blocky 3 mm; consistence when wet is slightly plastic; pH 6.5; clear boundary.
A2	25-45	Dark greyish yellow (2.5YR 4/2) when moist with coarse yellow mottles; fine sandy loam; apedal and massive; consistence when wet is slightly plastic and "spewy"; pH 7.0; clear boundary.
B	45-100+	Dark greyish yellow (2.5YR 4/2) when moist with yellow mottles; medium clay; moderate angular blocky 3 mm (possibly a coarse primary structure exists also); consistence when wet is plastic; pH 6.5.

COMPONENT Proportion %	1 100
CLIMATE Rainfall (av.) mm Temperature (av.) ^{o}C	 Annual 585 - 635 Annual 12
GEOLOGY Age, rock	 Recent sands, silts and clays
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2 Land form Position on land form Slope (range) %, slope shape	 Swamps and depressions in northern, wetter parts of the area 240 - 565 1 - - Swamps and depressions - 0-2 ; Flat
NATIVE VEGETATION Structure Dominant species	 Sedgeland *Lepidosperma longitudinale*
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	 Unconsolidated sands, silts and clays Mottled grey duplex soils Gn or Ug Light clay/clay Low 1.0 - 2.5
PRESENT LAND USE	Grazing, occasional cropping (cereal)
SOIL DETERIORATION Critical land features Processes Forms	 Slowly permeable soils, seasonal high watertables Periodic waterlogging Surface compaction

Qded
Depressions with Heavy Clay Soils on recent sediments drier than Qde



SCHEMATIC BLOCK DIAGRAM

Qbed Swamps and depressions in the southern part of the Shire. There are only a few small areas, totalling 2.7 km^2 or 04%0 of the Shire.

The tendency to waterlogging and seasonal ponding of water, limits any intensive use of these areas. They are generally used for light grazing.

SOILS

The soils are usually dark near the surface but may be lighter or gleyed at depth. The following describes the most common soil type.

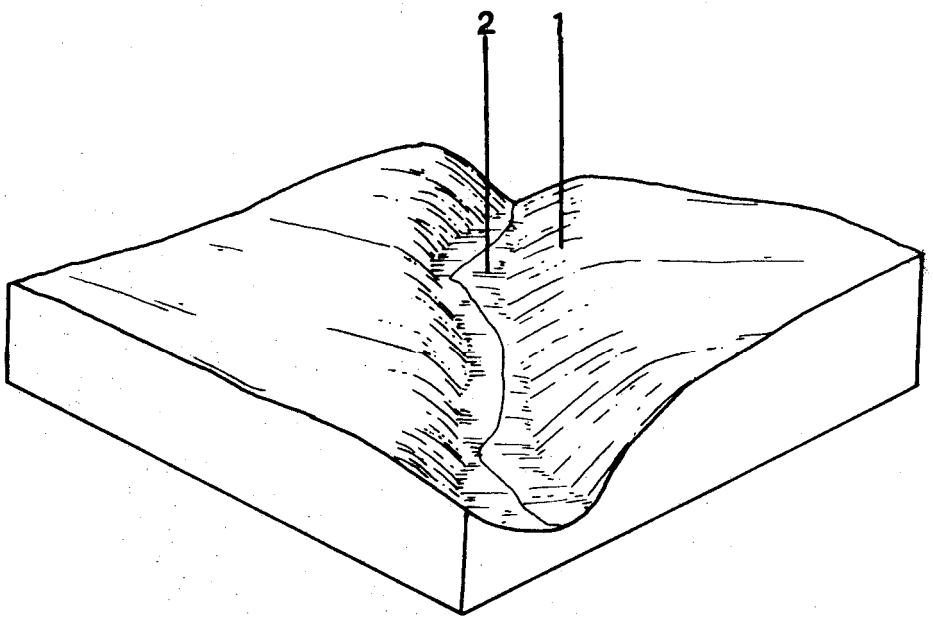
Black Uniform Clay Soils - Coarse Structure

Factual Key: Ug 5.1/C, 20 cm/variable (generally basalt), 100+ cm

Horizon	Depth (cm)	Description
A	0-20	Brownish black (7.5YR 2/2) when moist with bright brown rootline oxidation; light medium clay; strong angular blocky 3 mm; pH 6.0; diffuse boundary.
B	20-100+	Brownish black (10YR 2/2) when moist; medium clay; strong angular blocky 10 mm; consistence when wet is very plastic; pH 6.0.

COMPONENT Proportion %	1 100
CLIMATE Rainfall (av.) mm Temperature (av.) ^{o}C	 Annual 500 - 600 Annual 13
GEOLOGY Age, rock	 Recent clays, silts and sands
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2 land form Position on land form Slope (range) %, slope shape	 Swamps and depressions in the centre and south of the Shire 80 - 230 1 - - Swamps and depressions 1-2 ; Straight
NATIVE VEGETATION Structure Dominant species	 Tussock and sedgeland
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	 Unconsolidated clays, silts and *sands* Variable, but mainly clayey soils, e.g. dark uniform clay soils, coarse structure Ug 5.15 Clay Low 2
LAND USE	Grazing, occasional cropping (cereal)
SOIL DETERIORATION Critical land features Processes Forms	 Slowly permeable toils, seasonal high watertables Periodic waterlogging ' Surface compaction

Qbb
Steep-sided Valleys with Duplex Soils on Quaternary Basalt



Qbb Scarps and alluvial flats in the north of the Shire associated with creeks that have out into the basalt plain. The unit totals 7.7 km^2, representing 1.1% of the Shire.

The size of the alluvial flats is variable throughout the unit; where they are large enough, they have been mapped as a separate unit, Qya.

The slopes of the scarps vary in steepness, but are generally rocky and have shallow stony soils: There may be some risk of landslips when unconsolidated sediments below the basalt are exposed by the scarp. Also, where the dark clayey soils are deep, slumping may occur particularly in batters. The main land use is grazing.

This unit is similar to Qbbd but the climate here is wetter.

SOILS

The most common soil, an example. of which is described below, occurs on the slopes (Component 1). It is usually a brown duplex but there may be areas of a red gradational soils or black clays where the soil is deeper.

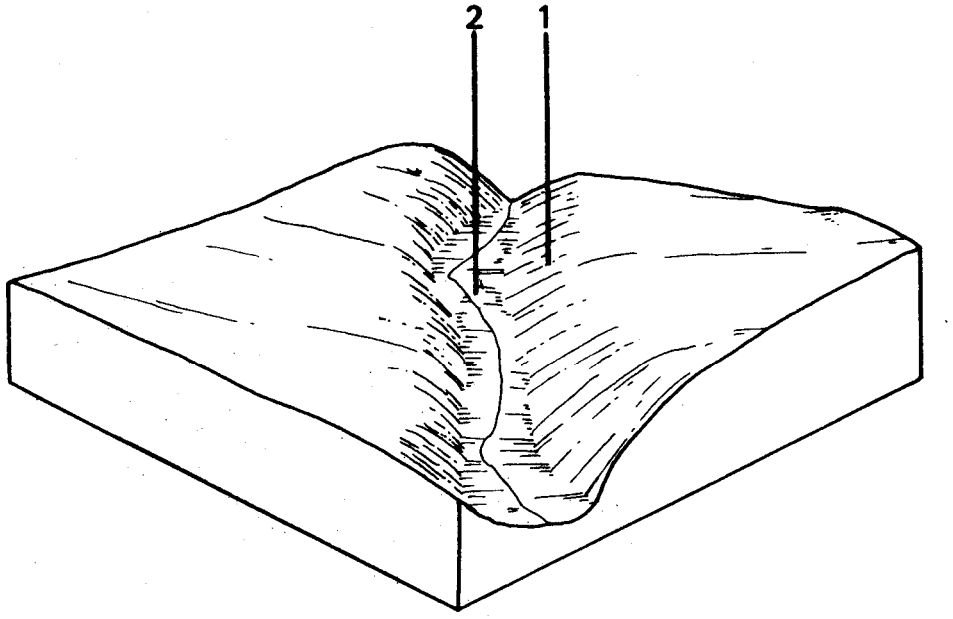
Shallow Brown Duplex Soils

Factual Key: Db 1.11/CL, 20-40 cm/basalt, 10-45 cm

Horizon	Depth (cm)	Description
A	0-20	Brownish black (7.5YR 3/2) when moist; clay loam; weak subangular blocky 5 mm; consistence when dry is slightly hard; 20% stones of parent material (4-30 cm average diameter); pH 6.0; abrupt boundary.
B	20-30	Dark brown (10YR 3/3) when moist; medium clay; moderate to strong angular blocky 4 mm; consistence when dry is hard; 00% stones of parent material (10-50 cm average diameter) and 5% of buckshot; pH 6.0; abrupt boundary.
R	30+	Weathering basalt.

COMPONENT	1	2
Proportion %	60	40
CLIMATE		
Rainfall (av.) mm	Annual 610 - 660	
Temperature (av.) °C	Annual 12	
GEOLOGY		
Age, rock	Pleistocene, basalt	
TOPOGRAPHY		
Landscape	Scarps beside main creeks in the north of the Shire usually including the creek alluvium	
Elevation (range) m	200 - 350	
Local relief (av.) m	15	
Drainage pattern	-	-
Drainage density km,/km^2	-	-
Land form	Steep valley side with local rock outcrop	Creek bed and flood plain
Position on land form	-	
Slope (range) %, slope shape	10-35 ; Convex	1-5 ; Straight
NATIVE VEGETATION		
Structure	Open forest	
Dominant species	*E. viminalis, E. ovata*	
SOIL		
Parent material	In-situ weathered rock	Unconsolidated sedimentary and in-situ weathered rock
Description	Shallow brown duplex or gradational soils	Black clay soils, uniform texture, coarse structure
Factual key	Db 1.11	Ug 5.1
Surface texture	Clay loam	Clay
Permeability	Moderate	Low
Depth (range) m	0.3 - 1.2	1.0 - 2.0
LAND USE	Grazing	
SOIL DETERIORATION		
Critical land features	Slope, hard setting surfaces	Seasonal high watertables Poorly drained site, low permeability
Processes	Overland flow	Overland flow, periodic waterlogging
Forms	Minor sheet and rill erosion, low landslip hazard	Streambank erosion, surface compaction

Qbbd
Steep-sided Valley with Duplex Soils on Quaternary Basalt drier than Qbb



SCHEMATIC BLOCK DIAGRAM

Qbbd Moderate to very steep scarps caused by creeks cutting into the basalt plain. Includes the alluvium of the creek unless these areas are sufficiently large to be mapped as a separate unit. There are about a dozen occurrences of the unit throughout the southern half of the Shire, including some sections along the stony lip of the Moorabool River near She Oaks. The total of 8.2 km^2, represents 1.2% of the Shire. It is similar to Qbb in the north but the climate of Qbbd is drier.

The slopes are usually stony. There is generally not much erosion evident despite the steep slopes because a protective grassland cover develops readily on the fertile, moderately permeable soils. Gullying will occur rapidly if the soil is exposed to concentrated runoff. Where the soils are deeper or the basalt overlies unconsolidated material, landslips may occur. Grazing and recreation are the main land uses.

SOILS

The soil description below is representative of Component 1.

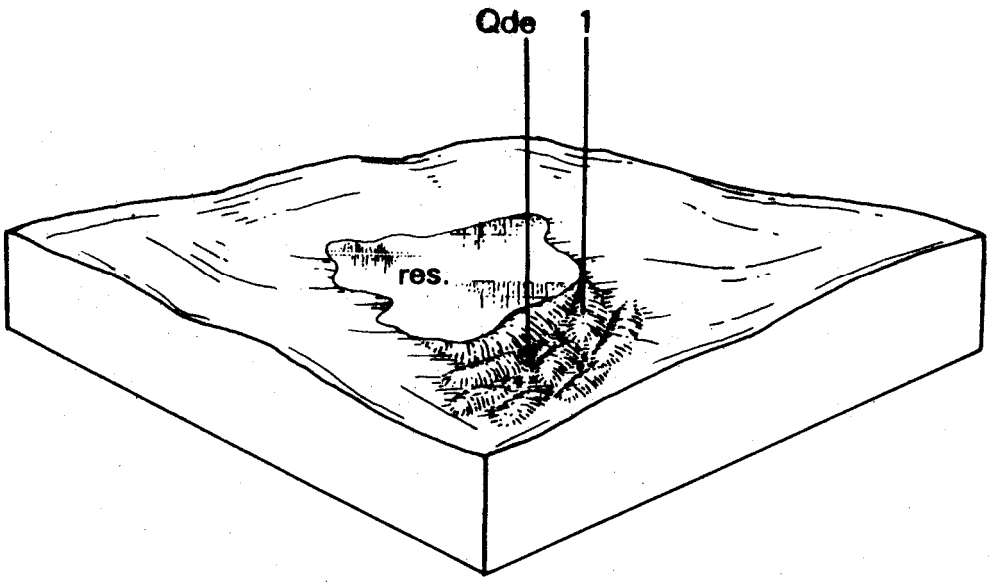
Shallow Brown Duplex Soils

Factual Key: Db 1.11/CL, 20-40 cm/basalt, 10-45 cm

Horizon	Depth (cm)	Description
A	0-20	Brownish black (7.5YR 3/2) when moist; clay loam; weak subangular blocky 5 mm; consistence when dry is slightly hard; 20% stones of parent material (8 cm average size); pH 6.0; abrupt boundary.
B	20-30	Dark brown (10YR 3/3) when moist; medium clay; moderate to strong angular blocky 4 mm; consistence when dry is hard; 80% stones of parent material (30 cm average size) and 5% of buckshot; pH 6.0; abrupt boundary.
R	30+	Weathering basalt.

COMPONENT Proportion %	1 70	2 30
CLIMATE Rainfall (av.) mm Temperature (av.) ^{o}C	Annual 510 - 580 Annual 13	
GEOLOGY Age, rock	Pleistocene, basalt	
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2 Land form Position on land form Slope (range)'J6, slope shape	Scarp beside main creek including the river channel in places 30 - 198 38 Dendritic 1.2 Scarp with local rock outcrop Slope 10-30 ; Convex	Creek bed Flood plain 1-3 ; Straight
NATIVE VEGETATION Structure Dominant species	Woodland (?) *E. camaldulensis*	
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	In-situ weathered rock Shallow brown duplex or gradational soils Lb 1.11 Clay loam $Hi^{9}h$ 0.5 - 1.5	Unconsolidated sedimentary and in-situ weathered rock Black clay soils, uniform texture, coarse structure UR 5.1 Clay Low 1.0 - 2.5
LAND USE	Grazing	
SOIL DETERIORATION Critical Processes Forms	Steep slope, hard setting surfaces Overland flow, sub surface flow Minor sheet and rill erosion, low landslip hazard	Poorly drained site, low permeability Overland flow, periodic waterlogging Streambank erosion, surface compaction

Qu
Lakeside Sandridge with Uniform Sand Soils on recent Wind Blown Deposits



Qu Lakeside sandridges associated with Qde and Res, in the north of the Shire (Durdidwarrah Area). This unit covers 0.312 km^2, representing 0.04% of the survey area.

The Reservoirs (Res) are considered to have been larger areas of Qde which were converted to water storage. The areas of Qde, including those now Res, are presumably the source of sand for these sandridges which have built up on their south-eastern side. Where areas of Qde are surrounded by sand, the depressions are regarded as secondary, having formed subsequent to the deposition of the sand from a larger associated depression. These secondary depressions probably indicate further wind movement of the sand after initial deposition.

SOILS

The soil parent material is sand, producing a deep uniform profile. These soils are free drained and their fertility is low. If exposed they can be wind eroded. The colour of the deep sands may be reddish or yellowish.

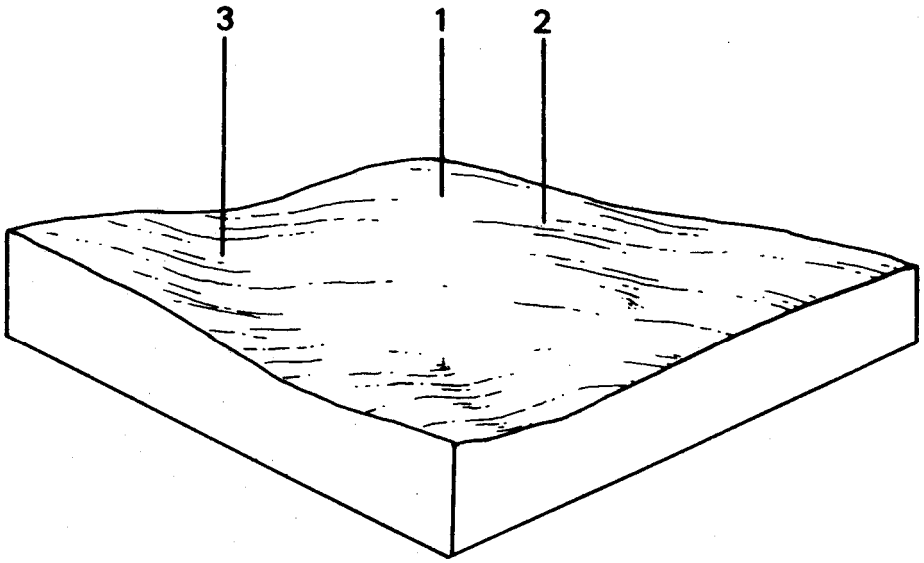
Yellow Sand Soils - Uniform Texture

Factual Key: Uc 2.21/sand; 10-25 cm/loose sand; 70 cm

Horizon	Depth (cm)	Description
Al	0-7	Brownish grey (101R 4/1) when moist; sand; apedal single-grained; consistence when dry is soft; pH 6.0; clear boundary.
A2	7-25	Greyish yellow brown (10YR 5/2) when moist (10YR 7/1) when dry); sand; apedal single-grained;' consistence when dry is soft; pH 5.5; diffuse boundary.
B1	25.-45	Dull orange (7.5YR 6/4) when moist; sand; apedal single-grained; consistence when dry is soft; pH 6.0; diffuse boundary.
B2	45-70	Dull reddish brown (5YR 5/4) when moist; sand; apedal single-grained; consistence when dry is slightly hard; pH 5.5; diffuse boundary.
C	70-170	Bright brown (7.5YR 5/6) when moist; sand; apedal single-grained; consistence when dry is soft; pH 6.0; abrupt boundary.
D	170-200+	Buried clay similar to Tgn.

COMPONENT Proportion %	1 100
CLIMATE Rainfall (av.) mm Temperature (av.) °C	 Annual 600 - 630 Annual 12
GEOLOGY Age, rock	 Recent, sands
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density k.A.^{2} Land form Position on land form Slope (range) %, elope shape	 'Lakeside sandridges' to the north of the Shire (Durdidwarrah Area) 350 - 365 1 - 2 - Lakeside sandridges - 1 - 3 Convex
NATIVE VEGETATION Structure Dominant species	 Open Forest *E. viminalis, A. melonoxylon, A. mearnsii, Banksia marginata, Pteridium esculentum*
SOIL Parent Material Description Factual Key Surface texture Permeability Depth (range) m	 Unconsolidated sand Yellow sand soils, uniform texture Uc2 Sand High 1 - 2
LAND USE	Grazing, Forestry, Water Supply
SOIL DETERIORATION Critical land features Processes Forms	 Low water holding capacity Low nutrient holding capacity Leaching Fertility Decline

Qao
Plains with Duplex Soils on Quaternary, or Older, Sediments



SCHEMATIC BLOCK DIAGRAM

Qao undulating to gently sloping plains on older alluvium in the southern part of the Shire, particularly near Inverleigh. The total area of 9.0 km^2, represents 1.3% of the study area.

There are some similarities between Qao and the Tertiary plains of Tgs. Both are on fairly old deposits of unconsolidated material, although the Tgs deposits are older, and both have ironstone on higher areas.

The main land use is grazing, with cereal cropping in some areas. The higher parts of the town of Inverleigh are located on the unit.

SOILS

There are two common soil types - the mottled yellow duplex soils of the higher land (Components 1 & 2) and the red duplex soils of the lower or flatter land (Component 3) - the latter often have dark clay skins around the peds of the subsoil clay. The soils of Component 2 are described below, while those for Component 3 are similar to those described for unit Qah.

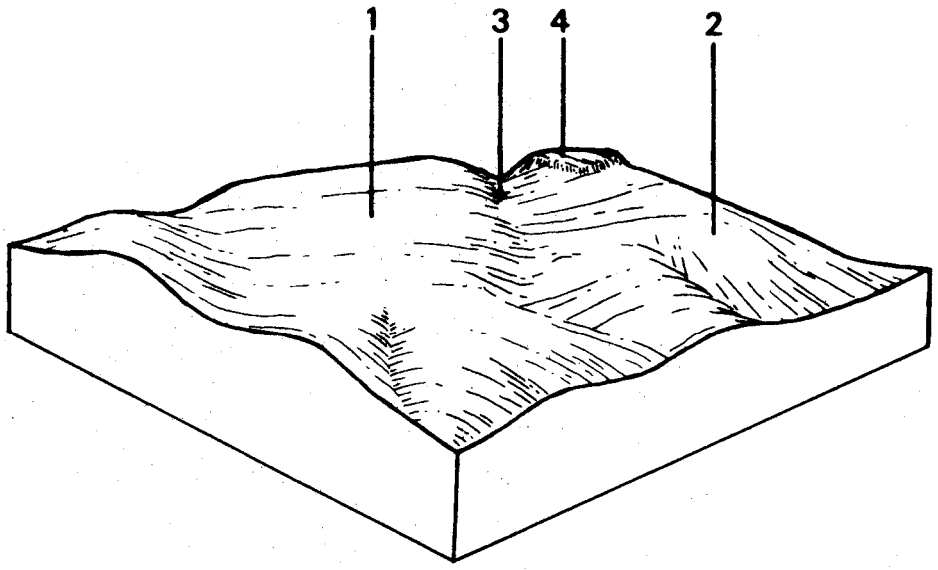
Red Mottled Yellow Duplex Soils

Factual Key: Dy 3.42-43/SL-LFS, 30-40 cm/alluvial clay, sand and gravel, 75-150 cm

Horizon	Depth (cm)	Description
Al	0-10	Dark brown (10YR 3/3) when moist; hydrophobic, sandy loam; apedal and massive; consistence when dry is hard; pH 6.0; abrupt boundary.
A2	10-30	Dull yellowish brown (10YR 5/3) when moist; sandy loam; apedal and massive; consistence when dry is very hard; pH 6.5; abrupt boundary.
B	30-100+	Bright yellowish brown (10YR 6/6) when moist with many red or yellow mottles; medium clay; strong angular blocky 2 mm; consistence when moist is firm; pH 7.5

COMPONENT	1	2	3
Proportion %	10	45	45
CLIMATE			
Rainfall (av.) mm	Annual 510 - 570		
Temperature (av.) °C	Annual 13		
GEOLOGY			
Age, rock	Older alluvium (Quaternary - Tertiary?)		
TOPOGRAPHY			
Landscape	Undulating plains in the south of the Shire		
Elevation (range) m	55 - 85		
Local relief (av.) m	15		
Drainage pattern	Dendritic		
Drainage density km/km^2	0.7		
Land form	Undulating plain		
Position on land form	Crest	Mid-slope	Lower elope
Slope (range) %, slope shape	0.3 ; Convex	2-5 ; Straight	1-2 ; Straight
NATIVE VEGETATION			
Structure	Open forest		
Dominant species	*E. leucoxylon*		
SOIL			
Parent material	Ferricrete and ferruginous sandy gravels	Unconsolidated older alluvium - clay, sand and gravel	
Description	Gravelly red mottled yellow duplex soils fine structure	Mottled yellow duplex soils	Red duplex soils, medium to coarse structure
Factual key	Dy 3.42 or Dy 3.43	Dy 3.43	Dr 2.25
Surface texture	Fine sandy loam	Fine sandy loam	Fine sandy loam
Permeability	Moderate	Moderate	Moderate to low
Depth (range) m	0.3 - 0.9	0.8 - 1.5	0.5 - 1.0
LAND USE	Grazing, gravel extraction	Grazing, residential, cereal cropping	
SOIL DETERIORATION			
Critical land features	Limited permeability		
Processes	Overland flow		
Forms	Minor sheet erosion on exposed soil		

Tgn
Plains with Duplex Soils on Tertiary Sediments



SCHEMATIC BLOCK DIAGRAM

Tgn Predominantly fairly deep soils (gently undulating plains) of unconsolidated Tertiary clays, sands, silts and gravels which are scattered throughout the north-central and north-western parts of the Shire. There are also some broad crests in the Ors unit with Tertiary remnants; and these have been mapped as Tgn where they are large enough. On some of the higher crests there are areas of ferricrete (ironstone layers) with shallow red duplex soils. Patches of deep sand occur randomly in the landscape, particularly in the north-west of the Shire. The unit occupies 85.0 km^2 or 12.1% of the Shire - the second largest unit.

The main use of this land is grazing, with some sand and gravel extraction. Some of the poorer areas have been left forested with a low-quality timber.

SOILS

Although there may be differences in soil depth and the structure and mottling of the clay, the major soil of Tgn is fairly consistent. The description below refers to Component 1 and, in particular, describes the most common soil of the extensive undulating plains.

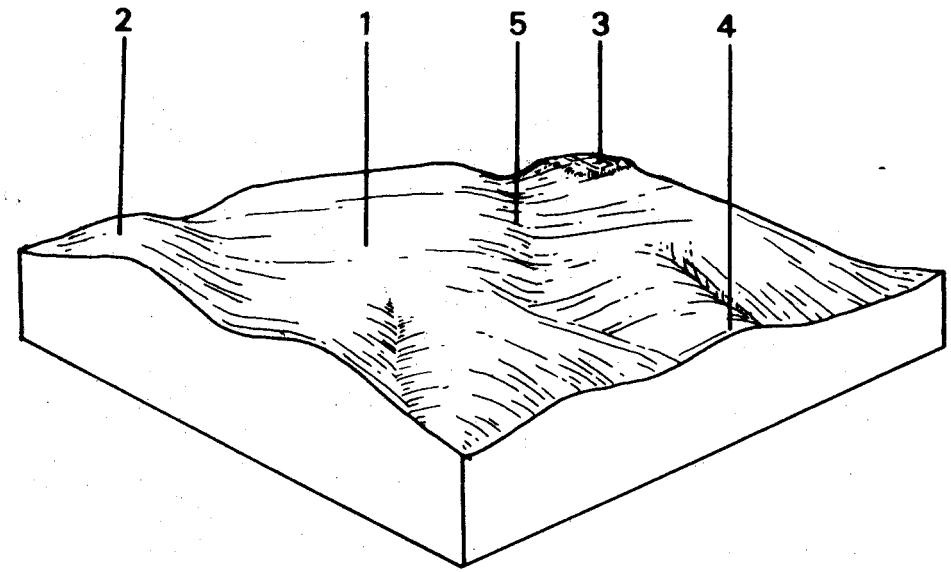
Mottled Yellow Duplex Soils, Fine Structure

Factual Key: Dy 3.41/SL-FSL, 10-40 cm/tertiary sediments, 100-200 cm.

Horizon	Depth (cm)	Description
Al	0-10	Dark brown (7.5YR 3/4) when moist; sandy loam; weak subangular blocky 10 mm; consistence when slightly moist is firm; pH 5.0; abrupt boundary.
A2	10-20	Dull yellowish brown (10YR 5/4) when moist; sandy loam; apedal and massive; consistence when slightly moist is firm; 50% buckshot concentrated at A/B boundary; pH 6.0; abrupt boundary.
B1	20-35	Yellowish brown (10YR 5/6) when moist; few distinct red mottles; medium clay; strong angular blocky 2 mm; consistence when slightly moist is film; 4% buckshot; pH 5.5; diffuse boundary.
B2	35-150	Yellowish brown (10YR 5/6) when moist; with abundant distinct red mottles; medium clay; strong angular blocky 2 mm; consistence when slightly moist is firm; 4% buckshot; pH 5.5; diffuse boundary.
C	150+	Weathering Tertiary sediments.

COMPONENT Proportion %	1 70	2 15	3 13	4 2
CLIMATE Rainfall (av.) mm Temperature (av.) ^{o}C	Annual 585 - 685 Annual 12			
GEOLOGY Age, rock	Tertiary; gravels, sands and clays			
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2	Undulating plains and broad crest in the north of the Shire 220 - 370 3 Dendritic 1.6			
Land form Position on land form Slope (range) 96, slope shape	Undulating plain Well-drained non-sandy areas 1-3 ; Convex and Straight	Undulating plain Patches of deep sandy soil 1-3 ; Convex	Drainage lines Low lying areas 1-3 ; Concave	Remnant ca^{pp}in^{g}- ironstone Some crests - especially near Ore 2-4 ; Straight
NATIVE VEGETATION Structure Dominant species	Low open forest - woodland *E. viminalis, E. obliqua, B. radiata, E. rubida,* (*E. pauciflora* - Durdidwarrah area) *Callitris columellaris* in lower stratum	*E. viminalis Pteridium esculentum*	*E. ovata*	*E. obliqua* *B. radiata* *Xanthorrhoea australis*
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	Unconsolidated gravel, sand and clay Mottled, yellow duplex soils, fine structure Dy 3.41 Sandy clay loam to loamy sand Moderate 1.0 - 2.0	Unconsolidated sand Yellow sand soils, uniform texture Uc 2.33 Sand High 0.8 - 3.0	Unconsolidated gravel, sand and clay Mottled yellow duplex soils Dy 3.42 Clay loam, sandy clay loam Moderate 1.5 - 2.5	Ironstone (ferricrete) and sandy clays Red duplex soils over ironstone Dr 2.21 Sandy loam, loamy sand Moderate 0.2 - 0.8
LAND USE	Grazing, gravel extraction, mining			
SOIL DETERIORATION Critical land features Processes Forms	Hard setting surfaces, dispersibility, permeability Leaching of salts, overland flow Minor sheet erosion	Low water holding capacity, low nutrient holding capacity Leaching Fertility decline Minor wind erosion	Seasonal high watertables Hard setting surfaces, permeability Some accumulation of salts, overland flow, periodic waterlogging Sheet and rill erosion, minor gully erosion. Some salting, especially *when* adjacent to Ordovician sediments	Hard setting surfaces Overland flow Minor sheet and rill erosion

Tgnd
Plains with Duplex Soils on Tertiary Sediments Drier than Tgn



Tgnd Gently undulating terrain on Tertiary clay, sand and gravel deposits in the north of the Shire. The 24.5 km^2 represents 3.5% of the study area. Tgnd is very similar to Tgn but the climate is drier and, in the north east, it is mainly associated with remnant Tertiary cappings on the broad crests of the steep Ordovician land (Orsd). The areas of ironstone and quartz gravels are more common, although in many cases, these deposits may not be deep or extensive enough to be of great commercial value.

The soils are mostly moderate to well structured but are often poor in nutrient status. Also, the freely draining sandy soils, together with the high position in the landscape, can lead to low water retention for plant growth during dry periods. As a result, the land is used for grazing or is left as low, open, natural forest.

SOILS

The most common soil type is red mottled yellow duplex soil with a texture of sandy loam to loamy sand at the surface. This occurs mainly on Component 1, although the soils of Component 5 are similar but greyer and those of Component 4 have a high gravel content.

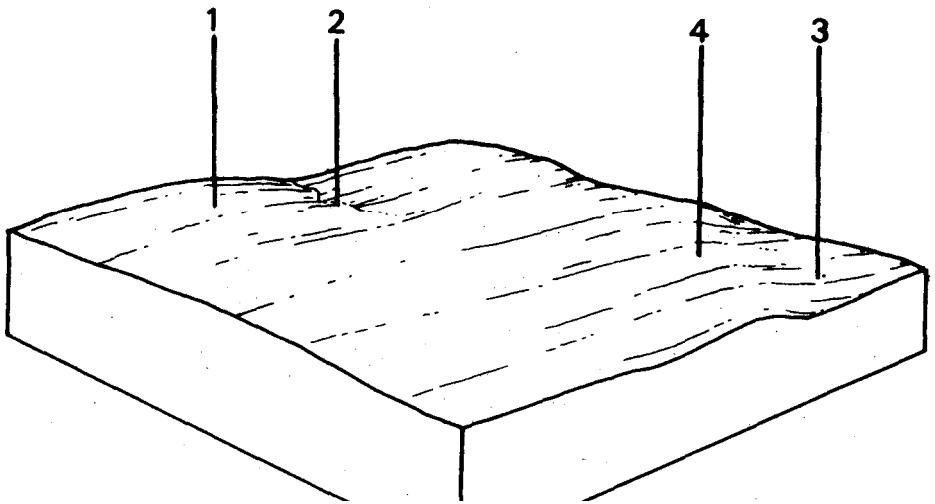
Mottled Yellow Duplex Soils

Factual Key: Dy 3.41/SL-LS, 5-25 cm/unconsolidated clay, sand or gravel, 30-200 cm.

Horizon	Depth (cm)	Description
Al	0-10	Brownish black (10YR 3/1) when moist; loamy sand; apedal and massive; consistence when moist is friable; sometimes with quartz gravels 15 mm; pH 5.0; abrupt boundary.
A2	10-20	Greyish brown (10YR 5/2) when moist; loamy sand; apedal and massive; consistence when moist is friable; sometimes with quartz gravel 0-60%, 20 mm; pH 5.5; abrupt boundary.
B	20-100	Yellowish brown (10YR 5/6) when moist with many fine red-brown mottles; medium cloy moderate subangular blocky structure 5 mm; consistence when moist is firm sometimes with quartz gravel 0-40%, 20 mm;
C	100+	Gravelly or sandy clay, etc.

COMPONENT Proportion %	1 40	2 20	3 15	4 15	5 10
CLIMATE Rainfall (av.) mm Temperature (av.) ^{o}C	Annual 550 - 630 Annual 12				
GEOLOGY Age, rock	Tertiary; gravels, sands and clays				
TOPOGRAPHY Landscape Elevation (range) m Local. relief (av.) m Drainage pattern Drainage density km/km^2	Undulating plains and broad crests of Tertiary capping in the north of the Shire 170 - 365 30 Dendritic 0.7				
Land form	Lower crests and slopes	Sandy areas	Higher crests with ferricrete (ironstone)	Lower crests with quartz gravel	Drainage lines
Position on land form	-	-	-	-	-
Slope (range) %, slope shape	1-5 ; Convex	1-5 ; Convex	1-5, Convex	2-10 ; Convex	1-5 ; Concave
NATIVE VEGETATION Structure Dominant species	*E. macrorhyncha* *E. polyanthemos* (*E. obliqua*) (*E. camaldulensis* near 'Bamganie')	*E. viminalis* *E. leucoxylon* *Acacia mearnsii* bracken (*Casuarina* and *Callitris* in some areas	Low open forest *E. pacrorhyncha* *E. polyanthemos* *E. leucoxylon* *E. goniocalyx* *E. obliqua* *Xanthorrhoea australis* *Hakea* spp.	*E. macrorhyncha* *E. obliqua* *E. polyanthemos* *E. leucoxylon* *E. sideroxylon* *Xanthorrhoea australis*	*E. macrorhyncha* *E. leucoxylon* *Leptospermum* spp. *Banksia marginate*
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	Unconsolidated sandy clays Mottled yellow duplex soils, fine structure Dy 3.41 Sandy loam - loamy sand Moderate 0.3 - 2.0	Unconsolidated sands Uniform sandy soils Uc 2.21 or 2.33 Sand High 0.7 - 2.0	Ferricrete (ironstone) Red duplex soils Dr 2.31 Loamy sand High 0.1 - 0.6	Gravels and gravelly clay and sands Gravelly mottled yellow duplex soils Dy 3.41 Loamy sand - sandy loam Moderate 0.3 - 1.0	Unconsolidated gravels, sand and clay Mottled yellow duplex soils Dy 3.41 Sandy loam Moderate to low 1.0 - 2.0
LAND USE	Grazing, natural forest, recreation, sub-division				
		Sand extraction	Ironstone gravel extraction	Quartz-gravel extraction	
SOIL DETERIORATION Critical land features Processes Forms	Limited permeability Surface runoff Minor shoat erosion	Highly permeable sand Leaching Nutrient decline	Limited permeability Surface runoff Minor sheet erosion		Seasonal high watertable Periodic waterlogging Surface compaction

Tgs
Plains with Duplex Soils on Tertiary Sediments - South of Maude



Tgs Gently undulating to flat plains throughout the southern half of the Shire. Having a total area of $_{95.4}$ i.e. i.e. 13.92% of the Shire, this is the largest unit mapped.

The soils usually have a sandy loam surface layer and the yellow or red subsoil clay overlies unconsolidated clay, sand and gravel of marine Tertiary origin or occasionally isolated ironstone deposits.

The main land use is grazing and cereal cropping, areas remain timbered and are used for recreation, sand and gravel extraction and low-quality forestry.

SOILS

Generally, the most common soil is that of Component 1. There are a few areas *where* the more sodic, poorer more erodible soil of Component 2 is more common (i.e. around Lethbridge township). The soil described below is representative of Component 1.

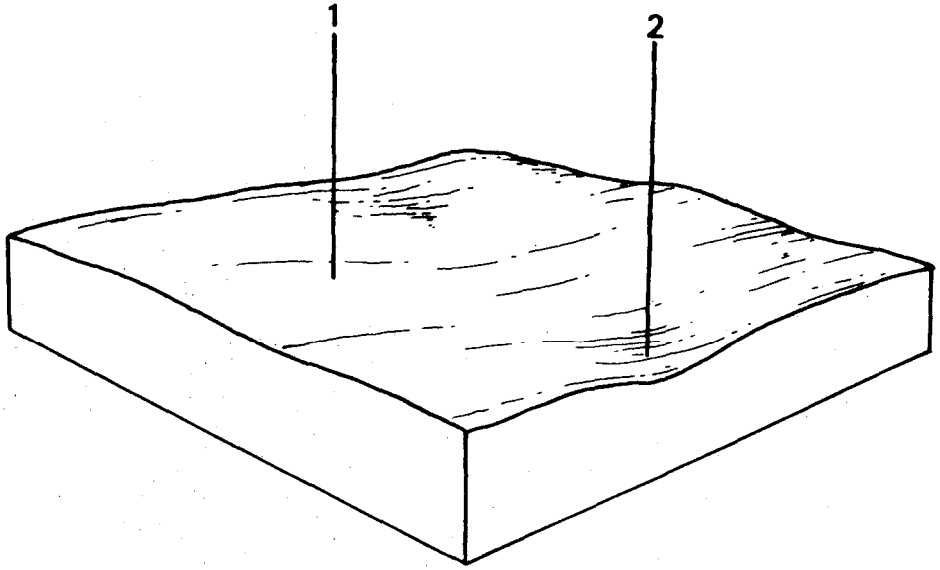
Mottled Yellow Sodic Duplex Soils

Factual Key: Dy 3.43/FSL-FSCL, 15-50 cm/tertiary sediments, 80-180 cm.

Horizon	Depth (cm)	Description
Al	0-20	Dark brown (7.5YR 3/3.) when moist; loam fine sandy; hydrophobic; apedal and massive; consistence when dry is slightly hard; pH 7.0; clear boundary.
A2	20-40	Brown (7.5YR 4/3) when moist; sandy loam; hydrophobic; apedal and massive; consistence when dry is slightly hard; pH 7.0; abrupt boundary.
B21	40-60	Bright yellowish brown (10YR 6/6) when moist; with brown and red mottles; medium clay; strong subangular blocky 15 mm; consistence when moist is firm; 1% buckshot 5 mm; pH 6.0; clear boundary.
B22	60-150	Brown (10YR 4/6) when moist with red mottles; clay; strong angular blocky 2 mm; consistence when moist is firm; pH 9.0; clear boundary.
C	150-200+	Bright yellowish brown (10YR 6/8) when moist; with large white mottles; clay; consistence when moist is friable; pH 9.0.

COMPONENT Proportion %	1 80	2 10	3 9	4 1
CLIMATE Rainfall (av.) mm Temperature (av.) ^{o}C	Annual 500 - 585 Annual 15			
GEOLOGY Age, rock	Tertiary unconsolidated sediments			
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2 Land form Position on land form Slope (range) %, slope shape	Undulating plains throughout the southern half of the Shire 27 - 206 12 Dendritic 0.7 Undulating plains Upper plain 2-5 ; Straight	Drainage line 1-2 ; Concave	Lower plain 1-5 ; Straight	Sand ridge with ferricrete 3-5 ; Convex
NATIVE VEGETATION Structure Dominant species	Woodland to open forest *E. leucoxylon, Acacia pycnantha E. melliodora, Casuarina stricta, Dwarf E. viminalis dominates, some areas south)*	*E. camaldulensis*	*E. leucoxylon Acacia spp*	*E. viminalis, Acacia pycnantha.*
SOIL Parent material Description Factual key Surface texture Permeability Depth (av.) m	Unconsolidated clay, silt. sand and gravel Mottled yellow duplex and red duplex exile, both fine structured Dy3.43 – Dr3.43 Fine sandy loam Moderate 1.0 - 2.0	Unconsolidated sediments and recent alluvial deposits Mottled yellow duplex. soils, fine structure Dy 3.43 Sandy loam Moderate to low 1-5 - 2.5	Unconsolidated clay, silt, sand and gravel Mottled yellow sodic duplex soils, coarse structure Dy3.43 Sandy loam Low 2.0	Unconsolidated sediments and ferricrete Mottled red duplex soils, acidic Dr 3.21 Fine sandy loam High 0.7 - 1.8
LAND USE	Cropping, grazing, low quality forestry, ironstone gravel extraction, town sites		Grazing, some cropping, town site	Grazing
SOIL DETERIORATION Critical land features Processes Forma	Hard setting surfaces Overland flow Minor sheet erosion	Seasonal high watertables Slope position Overland flow Periodic waterlogging Minor gully erosion	Dispersibility Overland flow, sub-surface flow Moderate gully erosion	Hard setting surfaces Overland flow Minor sheet erosion

Tgc
Plains with Duplex Soils on Tertiary Calcareous Clay



SCHEMATIC BLOCK DIAGRAM

Tgc Undulating plains of calcareous clays; the only mapped area is near Maude. The total area of 1.5 km^2 represents, 0.2% of the Shire.

The topography is almost indistinguishable from the Tgs land further south, but the soils are generally heavier, particularly in the subsoil. The main land use is grazing and cereal cropping.

SOILS

The main soil type is an alkaline yellow duplex soil with a coarse structured grey mottled yellow clay that is about 12.5% dispersive (plummet balance method). The clay is fairly impermeable and flat or low areas tend to be seasonally poorly drained.

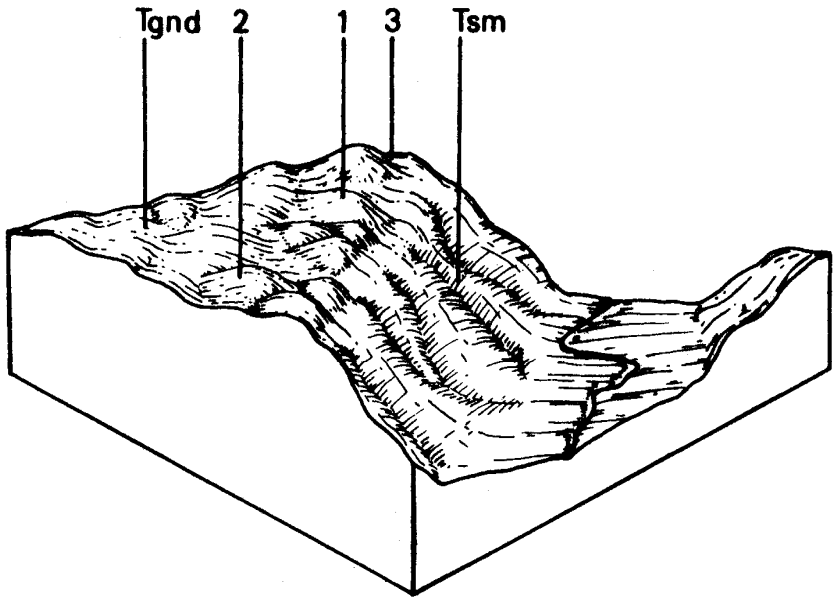
Mottled Yellow Sodic Duplex Soils - Coarse Structure

Factual Key: Dy 3.23/FSL-FSCL, 10-30 cm/clay with limestone, 100-150 cm.

Horizon	Depth (cm)	Description
Al	0-10	Dark brown (10YR 3/3) when moist; fine sandy loam; weak subangular blocky 3 mm; consistence when moist is friable; pH 6.0; clear boundary.
A2	10-15	Greyish yellow brown (10YR 4/3) when moist; fine sandy loam with buckshot gravel 5%, 10 mm; apedal and massive; consistence when moist is firm, when wet - "spewy". pH 7.0; abrupt boundary.
B21	15-30	Greyish yellow-brown (10YR 4/3) when moist; with distinct yellow mottles; heavy clay with soft accumulations of lime 5%, moderate blocky structure 50 mm breaking down to strong angular blocky 10 mm; consistence when moist is very firm; pH 7.5;clear boundary.
B22	30-85	Dull yellowish brown (10YR 5/3) when moist, with faint fine yellow mottles; heavy clay with lime 5%; moderate angular blocky 2-20 mm; consistence when moist is very firm; pH 8.0; gradual boundary.
BC	85-100	Orange (7.5YR 7/6) when moist; heavy clay (no lime accumulations; weak angular blocky 3 mm; consistence when moist is very hard; pH 8.5
C	100+	Clay with limestone.

COMPONENT Proportion %	1 80	2 20
CLIMATE Rainfall (av.) mm Temperature (av.) °C	Annual 540 - 570 Annual12	
GEOLOGY Age, rock	Tertiary calcareous clays	
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density lm/km^2 Land form Position on land form Slope (range) 96, slope	Undulating plain near Maude 150 - 165 8 Dendritic 0.7 Undulating plain Flats and slopes 1-5; Convex or Straight	Depression lines 0-2. ; Concave
NATIVE VEGETATION Structure Dominant species	Open forest *E. leucoxylon,* *Casuarina* spp. *Acacia pycnantha*	*E. leucoxylon* *E. camaldulensis?*
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	Calcareous clays, etc Mottled yellow sodic duplex soils. coarse structure Dy 3.23 Loam - fine sandy loam Low 100 - 150	Calcareous clays and alluvium Mottled yellow sodic duplex soils Dy 3.23 Fine sandy clay loam Low 100 - 150
LAND USE	Grazing- some cereal cropping	
SOIL DETERIORATION Critical land features Processes Forms	Limited soil permeability, dispersible clays Overland flow Minor sheet and rill erosion	Seasonal high watertable Overland flow. periodic waterlogging Surface compaction

Tbd
Slopes with Clay Soils on Tertiary Basalt



SCHEMATIC BLOCK DIAGRAM

Tbd Isolated crests and slopes near Maude, with moderate to gentle gradients, on Tertiary basalt (older, well weathered basalt). The total area of 1.3 km^2, amounts to (only) 0.2% of the Shire.

The black clayey soils, being fertile and having good water holding capacity, are suited to the common uses of cropping and market gardening. However, they do require optimum moisture for seedbed preparation and, once cultivated, deep rilling can occur very rapidly. Under grazing, those soils grow good pasture and, being well protected, are quite stable.

SOILS

The most common soil type (described below) is a uniform, black, cracking clay. There are, however, odd areas of chocolate or red-brown gradational soils.

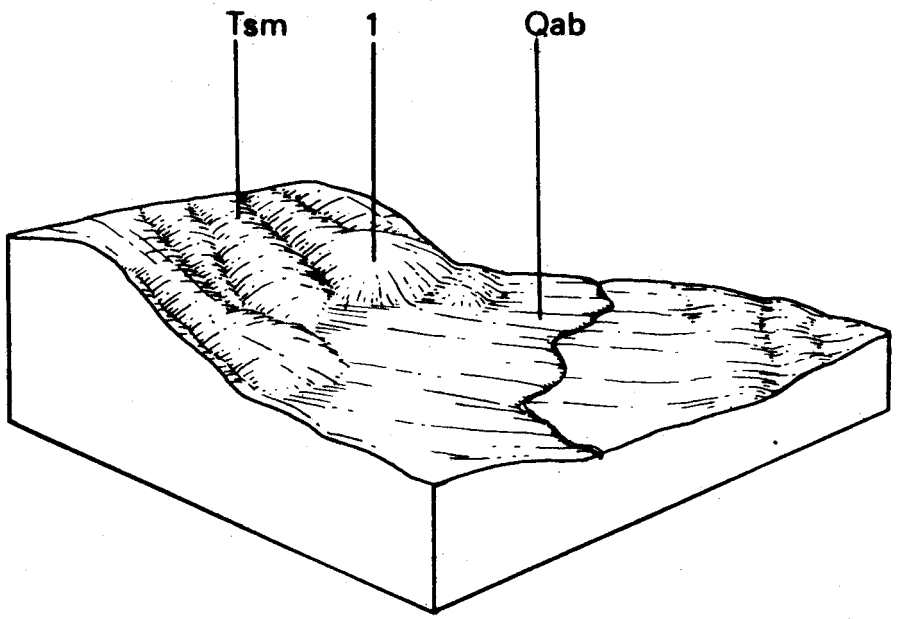
Dark Uniform Clay Soils

Factual Key: Ug 5.1 / LC-MC, 10-70 cm/older basalt, 10-80 cm.

Horizon	Depth (cm)	Description
All	0-20	Brownish black (7.5YR 3/2) when moist; light medium clay; moderate subangular blocky, 5mm; consistence when moist is friable; pH 8.0.
Al2	20-50	Brownish black (7.5YR 3/2) when moist; light medium clay; strong subangular blocky; consistence when moist is friable1 pH 8.5.
C	50+	Rotting basalt (greenish grey) with lime.

COMPONENT Proportion %	1 50	2 45	3 5
CLIMATE Rainfall (av.) mm Temperature (av.) °C	Annual 560 - 600 Annual 12		
GEOLCGY Age, rock	Tertiary basalt		
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2 Land form Position on land form Slope (range) %, slope shape	Isolated occurrences of gentle to moderate slopes near Maude 170 - 190 15 Dendritic 1 Crest Highest 1-5 ; Convex	Slopes Medium 5-15 ; Convex-Straight	Drainage line Lowest 1-3 ; Concave
NATIVE VEGETATION Structure Dominant species	Woodland ? *E. leucoxylon*		
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	In-situ weathered rock Dark uniform clays and sodic chocolate gradational soils Ug 5.1 - Gn 3.12 Clay - clay loam Moderate 0.5 - 1.0	Dark uniform clays and sodic chocolate gradational soils Ug 5.1 - Gn 3.12 Clay - clay loam Moderate 0.3 - 0.8	Yellow mottled dark sodic duplex soils, coarse structure Dd 2.43 Clay loam Low 1 - 1.5
LAND USE	Cropping - grazing		Grazing
SOIL DETERIORATION Critical land features Processes Forms	Slope gradient, soil permeability Overland flow Moderate sheet erosion when fallowed	Slope gradient, soil permeability Overland flow Moderate sheet erosion	Seasonal high watertable Soil permeability, sodic soil, position on landscape Overland flow, period waterlogging Surface compaction

Tgm
Slopes with Variable Clayey Soils on Mixed Tertiary Limestone and Basalt



SCHEMATIC BLOCK DIAGRAM

Tgm Gentle to moderate slopes on variety of Tertiary materials in the Moorabool valley. There are only three areas, totalling 1.0 km^2, or o.1% of the Shire. The main land use is cropping and, particularly on the black and chocolate clays, market gardens. There are probably many other small areas of Tgm scattered throughout the Tsm unit that were unmappable at the scale of this report.

SOILS.

The deep subsoils and soil parent material usually has a considerable lime content. The dominant soils are either self-mulching, dark clays, similar to those of Ten, or sandy red duplex soils with clay subsoils like those described below. The latter are usually formed when the soil parent material has a higher sand content.

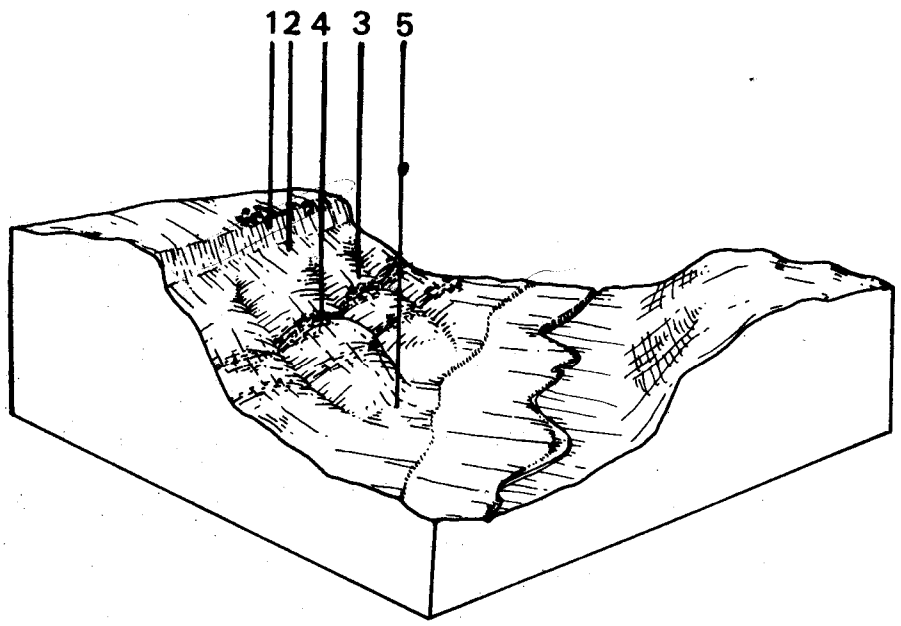
Red Duplex Soils

Factual Key: Dr 8.33/SL-FSL, 10-30 cm/unconsolidated sandy material and limestone, 60-150 cm

Horizon	Depth (cm)	Description
Al	0-10	Dark reddish-brown (5YR 3/3) when moist; fine sandy loam; apedal and massive; consistence when dry is slightly hard; pH 6.0; abrupt boundary.
A2	10-15	Dull reddish-brown (5YR 4/4) when moist; fine sandy loam; apedal and massive; consistence when dry is hard; pH 7.0; abrupt boundary.
B	15-150	Dull reddish brown (5YR 4/3) when moist; heavy clay; strong angular blocky 50 mm breaking to 10 mm; consistence when dry is very hard; pH 8.5; abrupt boundary.
C	150+	Limestone layers with sandy clay.

COMPONENT Proportion %	1 100		
CLIMATE Rainfall (av.) mm Temperature (av.) °C	 Annual 510 - 570 Annual 12		
GEOLOGY Age, rock	 Tertiary limestone or basalt		
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2 Land form Position on land form Slope (range) %, slope shape	 Gentler slopes in the Moorabool Valley 60 - 170 30 Dendritic 1.6 Slopes - 3-12% ; Straight		
NATIVE VEGETATION Structure Dominant species	 Open forest *E. leucoxylon, E. camaldulensis*		
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	 Limestone, unconsolidated materials with lime, older basalt Black or chocolate, self-mulching clays on clayey parent material Ug 5.1 Light to medium clay Low to moderate 1.0 - 2.0	or	Red duplex soils on sandier parent material Dr 2.43 Sandy loam Moderate 1.0 - 2.0
LAND USE	Cropping - some market gardening, grazing		
SOIL DETERIORATION Critical land features Processes Forms	 Limited soil permeability, slope gradients Overland flow, cultivation Moderate sheet and rill erosion		

Tsm
Steep Valley Sides with Clay Soils on Variable Parent Materials



SCHEMATIC BLOCK DIAGRAM

Tsm Moderately to very steeply sloping sides of river gorges, e.g. along the southern stretches of the Moorabool River, mostly cut through Tertiary deposits. The total area of 25 km^2 comprises *5.6%* of the Shire.

Because the gorge cuts through many geological strata, the nature of the surface material on the sides of the gorge can be extremely variable. At the top of the slope, there may be younger basalt capping (Quaternary).

Below the younger basalt, there are Tertiary sediments, older basalt (Tertiary), more unconsolidated (Tertiary) sediments including limestone and some quartzite strata and, near the stream, there may be Ordovician slates and sandstones. The meandering of the river affects the steepness of the sides of the gorge and the topography is further complicated by the entrenching of subsidiary streams.

The main land use depends on slope and soil, which change very rapidly along the sides of the gorge. A more detailed study at a larger scale would be essential to plan specific land uses for individual allotments, paying particular attention to the high landslip risk associated with the black clays.

SOILS

Throughout the unit, the most commonly encountered soil types are uniform black or chocolate, self-mulching clays (especially along the Moorabool) or sandy red duplex soils (similar to Tog). Where the soils become very shallow on steeper slopes, (especially over limestone) a grey-brown clay loam with white lime patches may occur.

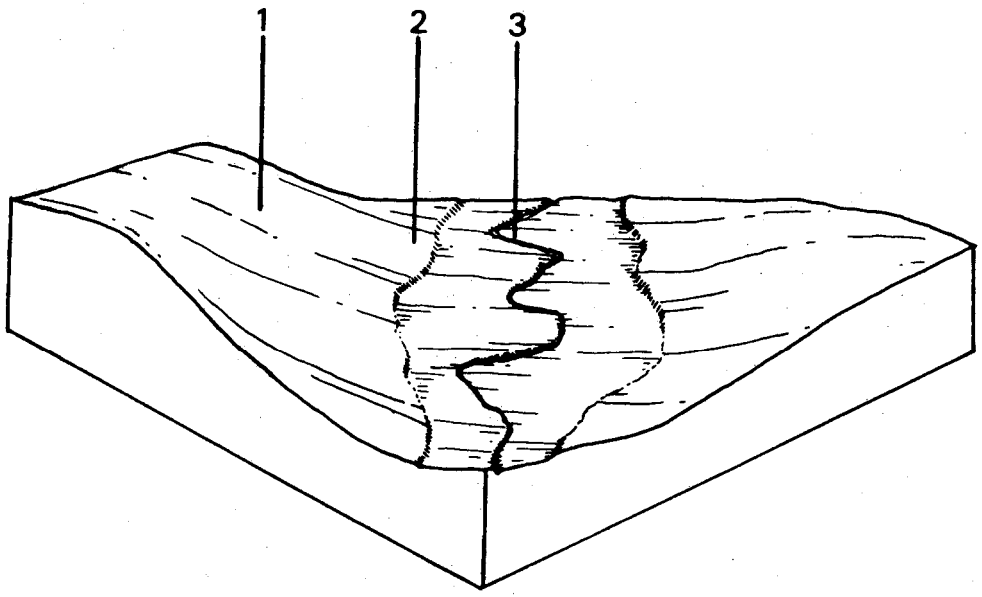
Black Clay Soils

Factual Key: Ug 5.1/LC-MC, 30-100 cm/lime, clay and sand, 30-100 cm.

Horizon	Depth (cm)	Description
All	0-5	Brownish black (10YR 3/1) when moist; medium clay; strong angular blocky structure 2 mm; consistence when moist is plastic; pH 6.5; abrupt boundary.
Al2	5-50	Black (10YR 2/2) when moist with few large brown mottles; heavy clay; strong angular blocky structure 5 mm with large vertical cracks; consistence when dry, very hard and wet, very plastic; pH 8.5; abrupt boundary.
C	50-200+	Dark brown (10YR 3/4) when moist, with many faint brown mottles; medium clay, moderate sub-angular blocky structure, consistence when moist is plastic; containing 20A lime deposits 8 mm; pH 9.0.

COMPONENT Proportion %	1 15	2 20	3 5	4 50	5 10
CLIMATE Rainfall (av.) mm Temperature (av.) °C	Annual 500 - 610 Annual 12				
GEOLOGY Age, rock	Quaternary basalt	Tertiary unconsolidated sediments-gravel, sand and clay - some lime	Tertiary (older) basalt	Various Tertiary strata, unconsolidated sediments, limestone etc.	Ordovician slates and sandstones interbedded
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/ km^2 Land form Position on land form Slope (range) 96, slope shape	Steep river valley aides south of Maude 30 - 183 45 Dendritic Scarp Stony upper elope or crest 20-60; Convex/straight	Upper slope or crest 10-50 ; Convex	Sides of the Mid-slope 10-50 ; straight	river valley Mid-slope 10-50 ; Straight/concave	Lower slope 10-50 ; Straight/Concave
NATIVE VEGETATION Structure Dominant species	Open forest *E. leucoxylon,* *E. camaldulensis*			(*E. viminalis* and *Acacia mearnsii* on sandy areas)	*E. leucoxylon*, some *E. melliodora,* *E. viminalis*
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	In-situ weathered basalt Stony, shallow brown clay soils Db 1.11 or Ug 5.1 Clay loam Moderate 0.1- 0.5	In-situ unconsolidated sediments with some areas of colluvial basalt Black clays or yellow duplex soils Ug 5.1 or Dy 3.43 Clay to clay loam Moderate to low 0.5 - 1.2	In-situ older basalt with colluvium from higher land Black clays or red-brown gradational or duplex, soils Ug 5.1. Gn 3.11 Clay to clay loam Moderate 0.3 - 1.0	In-situ unconsolidated sediments and limestone, with colluvium from higher land. Some quartzite outcrops Black clays with some are gradational or duplex soils and some sandy areas (Quartzite) Ug 5.1, Dr 2.13, Dr 2.43, Uc Mostly clay - some sandy areas Moderate 0.3 - 2.0	In-situ slates and sandstone with colluvium Mottled yellow gradational or duplex soils Gn 3.72 or Dy 3.42 Fine sandy clay loam Moderate to low 0.3 - 1.0
LAND USE	Grazing	Grazing, some cropping on gentler slopes			Grazing
SOIL DETERIORATION Critical land features Processes Forms	Steep slopes Undercutting, Slumping, rock falls	Moderate to steep slopes, deep black clayey soils Overland flows Moderate landslip hazard, rilling on exposed soil			Moderate to very steep slopes, dispersible clay Overland flow Moderate sheet and rill erosion

Tcg
Steep Valley Sides with Duplex Soils - on Variable Tertiary Sediments



SCHEMATIC BLOCK DIAGRAM

Tcg Moderately to steeply eloping sides of the gorge associated with Bruce's Creek near Bannockburn. The total area of 3.6 km represents 0.596 of the Shire.

The height and slope of the sides vary along the gorge; generally the height and elope decreases toward the north (Component 2 becomes more common) and the slopes are greater on the outside bends than on the inner. The inner bends, in fact, often have small flat terraces.

The main land use is grazing, with some creels associated recreation.

SOILS

The soils vary with slope and position in the landscape but red duplex soils (described below) are common, especially on the upper slopes of Component 1. On the lower slopes, there is a dark, uniform, clay, similar to that described for Tem. On gentler slopes of Component 2, a yellow duplex soil similar to Tgs may occur and the alluvium of Component 3 has similar soils to Qyad.

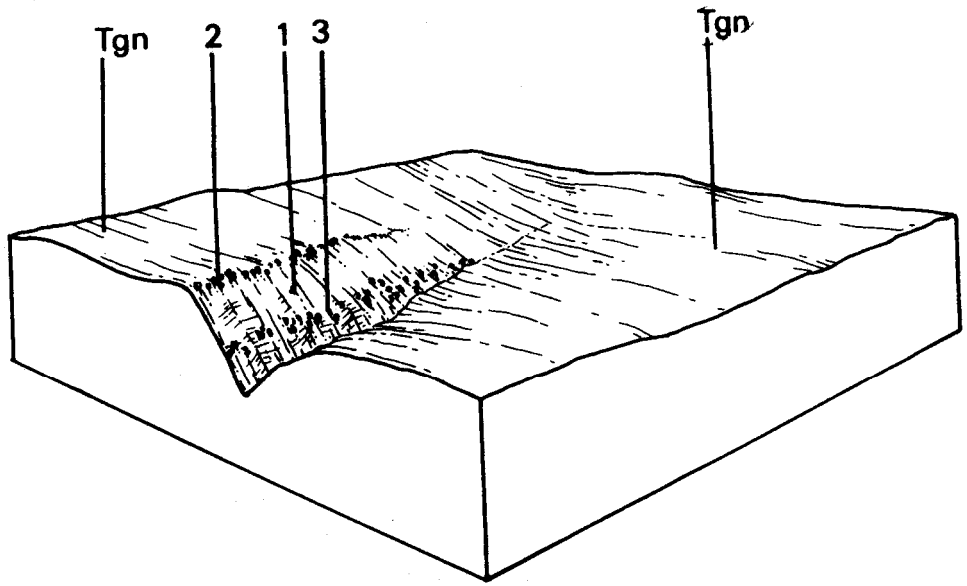
Red Duplex Soils

Factual Keys Dr 2.13/FSL-SL, 10-40 cm/unconsolidated sediments, 40-100 cm.

Horizon	Depth (cm)	Description
Al	0-20	Dark reddish-brown (5YR 3/3) when moist; sandy loam; apedal and massive; consistence when moist is friable; pH 6.0; abrupt boundary.
B21	20-50	Reddish brown (5YR 4/6) when moist; medium clay; moderate to strong angular blocky 5mm; consistence when moist is firm; pH 7.0; diffuse boundary.
B22	50-60	Reddish brown (5YR 4/6) when moist with fine yellow mottles; medium clay; moderate prismatic; structure 30 mm; consistence when dry is hard; soft accumulations of lime 2096; pH 8.0.
C	60+	Sandy clay with lime (some areas - gravels or quartzite.)

COMPONENT Proportion %	1 50	2 30	3 20
CLIMATE Rainfall (av.) mm Temperature (av.) ^{o}C	Annual 500 – 530 Annual 13		
GEOLOGY Age, rock	Tertiary unconsolidated sediments with some limestone		
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km,/km^2 Land form Position on land form Slope (range) %, slope shape	Gorge associated with Bruce's Creek near Bannockburn 46 - 125 15 Dendritic 4.6 Scarps and steeper slopes Valley sides - mainly south of Bannockburn 15-30 ; Straight	Moderate to gentle slopes Valley aides - mainly north of Bannockburn 5-20 ; Straight	Creek alluvium and channel Valley floor 0-3 ; Concave
'NATIVE VEGETATION Structure Dominant species	Open forest *E. leucoxylon, E. viminalis, E. camaldulensis* (lower slopes)		*E. camaldulensis* (some *E. viminalis*)
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	Unconsolidated sediments including lime Red duplex soils and dark clayey uniform soils Dr 2.13, Ug 5.1 Sandy loam-clay Moderate 10 - 50	Yellow and some red duplex soils my 3.43 Fine sandy loam Moderate to low 30 - 80	Alluvium Uniform soils (variable) Mainly Um and Ug Variable Variable 50 - 150
LAND USE	Grazing, natural forest		Recreation, some grazing
SOIL DETERIORATION Critical land features Processes Forms	Steep slopes Overland flow Minor sheet and rill erosion	Moderate slopes Overland flow Minor sheet and rill erosion	Low situation affected by flooding from stream Overland flow Streambank erosion, siltation

Tsc
Irregular Surfaces with Shallow Uniform Texture Soils on Tertiary Sedimentary Rock



SCHEMATIC BLOCK DIAGRAM

Tsc Moderate to steep elopes and gorges associated with streams that have cut down through the Tertiary sediments. There are only three small areas in the north-west of the Shire, and the total of 0.3 km^2 represents only 0.04% of the study area.

In some places the stream has first cut through the basalt plain, and basalt may be found at the top of the scarp as a capping to the Tertiary sediments. Ironstone (ferricrete) outcrops occasionally occur at the top of the Tertiary sediments, while further down the slope there may be quartzite outcrops. The unit is mainly used for grazing and has a fairly high erosion hazard if the soil is exposed**.**

SOILS

The soils are shallow over the Tertiary clays, sands and gravels. Where there is basalt at the top of the scarp, colluvium from this source often makes the soils darker with well structured clays. A common soil on moderate slopes where basalt is not present is described below.

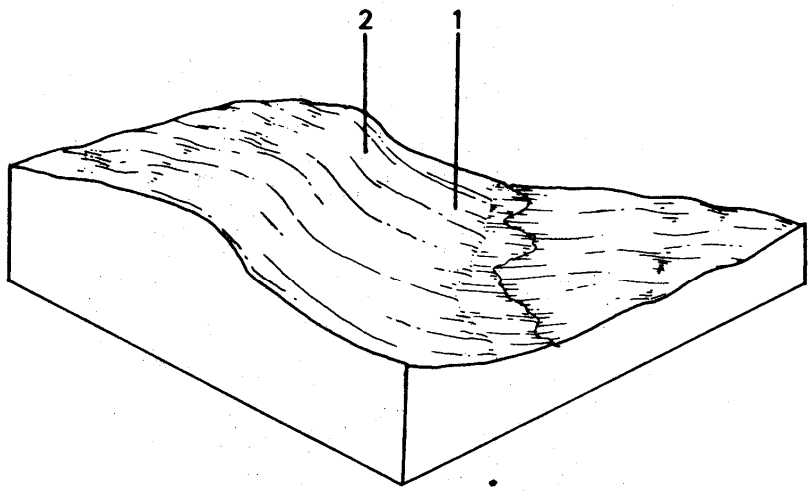
Mottled Yellow Duplex Soils

Factual Key: Dy 3.41/SL-SCL, 10-20 cm/tertiary clay, sand and gravel, 30-120 cm.

Horizon	Depth (cm)	Description
Al	0-10	Brownish black (10YR 3/2) when moist; sandy loam; apedal and massive; consistence when slightly moist is firm; pH 6.0; clear boundary.
A2	10-15	Greyish yellow brown (10YR 5/2) when moist; sandy loam; apedal and massive; consistence when slightly moist is firm; pH 6.0; abrupt boundary**.**
B	[1]5-45	Dull yellow orange (10YR 6/5) when moist; light clay; moderate sub-angular blocky 3 mm; consistence when slightly moist is firm; pH 6.5; clear boundary.
C	45+	Tertiary clay with gravel or sand.

COMPONENT Proportion %	1 90	2 5	3
CLIMATE Rainfall (av.) mm Temperature (av.) ^{o}C	Annual 610 – 635 Annual 12		
GEOLOGY Age, rock	Tertiary gravel, sands and clays and sometimes colluvium from basalt	Tertiary ironstone	Tertiary, quartzite
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2	Gentle valley 320 - 350 10 - -		
Land form Position on land form Slope (range) %, slope range	Scarp - 10-30 ; straight - concave	Rise - 2 ; straight	Outcrop - 2-10 ; straight
NATIVE VEGETATION Structure Dominant species	Open forest (?) *E. obliqua, E. viminalis*		
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	Unconsolidated gravels, sands and clays Mottled yellow duplex soils Dy 3.41 Sandy loam to sandy clay loam Moderate 0.3 - 1.2	Ironstone Reddish shallow uniform soils Um 1 Loam High 0.1 - 0.3	Quartzite Brown shallow uniform soils Um 1 Loam - sandy loam High 0.1 - 0.3
LAND USE	Grazing		
SOIL DETERIORATION Critical land features Processes Forms	 Overland flow High sheet and rill erosion	Exposure, routing depth Overland flow High sheet, rill and wind erosion	

Tsd
Valley Sides with Duplex Soils on Tertiary Sediments



SCHEMATIC BLOCK DIAGRAM

Tsd - Gentle to moderate slopes produced by shallow downcutting of streams mostly in the Tgs unit south-west of Bannockburn. There are only a few occurrences within the Shire and the 1.9 km^2 represents only 0.3% of the study area.

At the top of the slope there may be a layer of cemented sand and ferricrete just below the soil. Some of the streams have an associated elope on one side only; the land through which the stream cute having been eroded away on the other side.

The main land use is native forest production and ironstone gravel extraction, with some areas of grazing on the lower slopes. The municipal tip is also located on one of the lower slopes.

SOILS

The soils at the top of the scarp are much redder and have much more ironstone gravel than those of the lower slopes, which progressively become browner, then yellow, down the slope. The latter soils (Component 1) slake readily and are also somewhat dispersible.

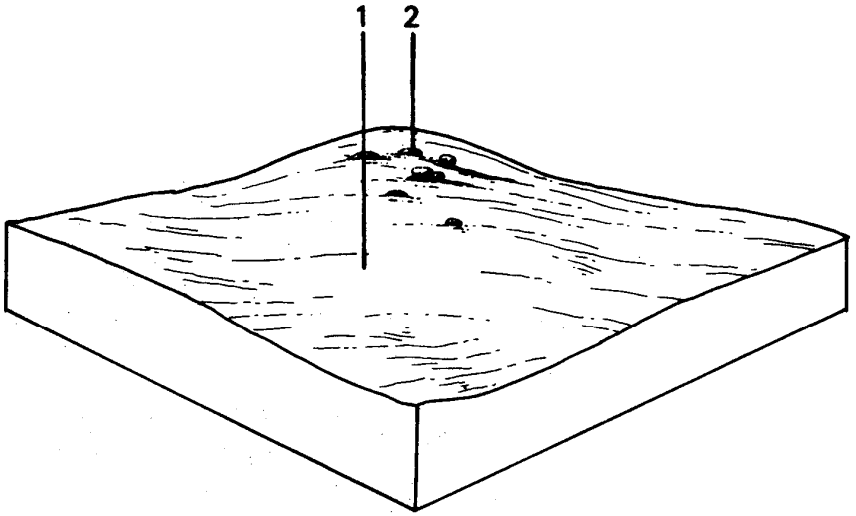
Mottled Brown Duplex Soils

Factual Key: Db 2.43/FSL, 15-40 cm unconsolidated clay sand and gravel, 40-100 cm.

Horizon	Depth (cm)	Description
A1	0-5	Dark brown (7.5YR 3/3) when moist; hydrophobic, fine sandy loam; apedal and massive; consistence when dry is soft; pH 5.5; abrupt boundary.
A2	5-25	Dull brown (7.5YR 5/4) when moist; fine sandy loam; apedal and massive; consistence when dry is slightly hard; pH 6.0.
B21	25-40	Dark brown (7.5YR 3/4) when moist; with common distinct brown mottles; light medium clay; weak angular-blocky 5 mm; consistence when dry is slightly hard; pH 8.0.

COMPONENT Proportion %	1 75	2 25
CLIMATE Rainfall(av.) mm Temperature(av.) °C	Annual 500 – 550 Annual 15	
GEOLOGY A^{g}e. rock	Tertiary unconsolidated sediments (gravel, sand and clay) with a ferruginous stratum at the top of the scarp	
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2 Land form Position on land form Slope (range) %, elope shape	Scarp of sandy creek 60 - 100 14 Dendritic 1.3, Lower colluvial elope - 3-15 ; Concave/straight	Upper slope - 10-30 ; Convex
NATIVE VEGETATION Structure Dominant species	Low open forest *E. viminalis, E. leucoxylon* *Acacia pycnantha, Acacia mearnsii*	*E. viminalis, Casuarina* spp. *Acacia pycnantha*
SOIL Parent material Description Factual key Surface. texture Permeability Depth (range) m	Colluvium Mottled yellow or brown duplex soils Dy 3.43 Db 2.43 Fine sandy loam Moderate 0.4 - 1.0	Ferricrete and ferruginous sands Gravelly red duplex soils Dr 2.21 Fine sandy loam Moderate 0.3 - 0.8
LAND USE	Gravel stripping (ironstone), natural forest - some grazing	
SOIL DETERIORATION Critical land features Processes Forms	Steep slopes Overland flow Moderate rill and gully erosion	Moderate to gentle slopes Overland flow Moderate sheet and rill erosion

Dgg
Plains and Rises with Duplex Soils on Devonian Granite



SCHEMATIC BLOCK DIAGRAM

Dgg - Plains and rises on granite located at and to the north of Lilydale House, Dog Rocks. These are three areas, totalling 3.3 km^2, or 0.5% of the Shire**.**

The rises usually have granite outcrops and tore on the upper slopes and crest. The lower slopes are much gentler. The wash from this land system, being sandy, may influence the topsoil texture of surrounding land systems.

The main land use is grazing but there is a flora and fauna reserve at Lilydale House, Dog Rocks. This Boil has a particular susceptibility to Boneseed (*Chrysanthemoides monilifera*) infestations.

SOILS

The most common soil type is that of Component 1.

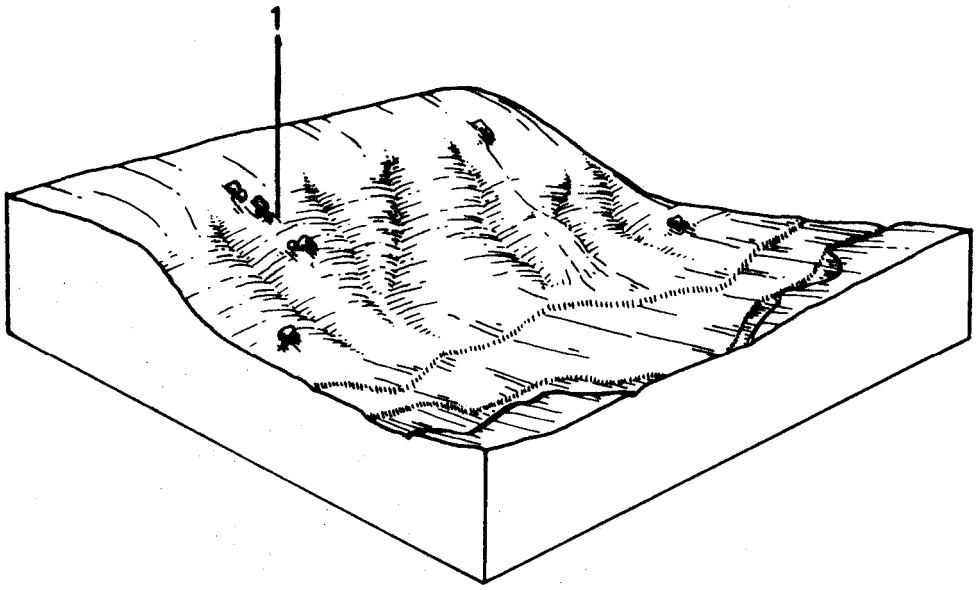
Mottled Brown Duplex Soils

Factual Key: Dy 3.42/sandy loam, 25-50 cm/granite 100-200 cm

Horizon	Depth (cm)	Description
Al	0-25	Dark brown (10YR 3/3) when moist; sandy loam; apedal and massive; consistence when slightly moist is firm; pH 5.5; clear boundary.
A2	25-35	Dull yellow orange (10YR 6/3) when moist; clayey coarse sand; apedal and massive; consistence when slightly moist is loose; pH 7.0; abrupt boundary.
	35-50+	Bright brown (7.5YR 5/8) when moist; with red mottles; medium clay; strong angular blocky 2 mm; consistence when moist is firm; moderate dispersibility and slaking; pH 7.5.

COMPONENT Proportion %	1 60	2 40
CLIMATE Rainfall (av.) mm Temperature (av.) °C	Annual 510 – 560 Annual 13	
GECLOGY, Age, rock	Devonian granite	
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km^2 Land form Position on land form Slope (av.) %, slope shape	Three isolated occurrences of undulating terrain on the south-eastern border 30-99 35 Dendritic 1.3 Plain Lower dope 1-; Straight	Rise with tore on crest Upper slope 3-10 ; Convex
NATIVE VEGETATION Structure Dominant species	Woodland ? *E. leucoxylon*	
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	In-situ weathered rock Mottled brown duplex soils Db 2.22 Sandy loam Moderate 1.0 - 2.0	Shallow mottled brown duplex soils Db 2.22 Sandy loam Moderate 0.3 - 1.0
LAND USE	Grazing	
SOIL DETERIORATION Critical land features Processes Forms	Slope position Surface runoff Minor sheet erosion	Slope gradient, hard setting surfaces Surface flow Moderate sheet and rill erosion

Dgh
Slopes with Duplex Roils on Devonian Granite



SCHEMATIC BLOCK DIAGRAM

Dgh Moderate slopes cut in the granite plains by Sutherland Creek and Moorabool River at "Darriwill", Hope's Bridge. There are only three small areas, comprising 0.1 km^2 in total, or 0.0296 of the Shire.

The slopes often have huge granitic outcrops and the depth of soil varies from a few centimetres to over a metre in some places. The mottled brown, duplex soils will rill and gully readily if the vegetative cover is damaged, particularly in areas which receive surface runoff from the granite plains.

SOILS

The soil occurs in patches between the rock. Where the soils are very shallow, only the A horizons may be present. The description refers to deeper profiles.

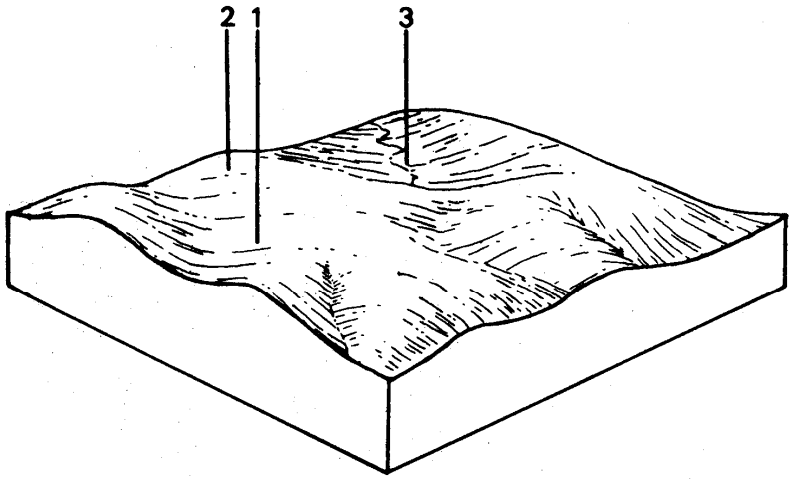
Mottled Brown Duplex Soils - Coarse Structure

Factual Keys Db 2.22/SCL, 5-20 cm/granite

Horizon	Depth (cm)	Description
Al	0-15	Dark brown (10YR 3/3) when moist, Bandy clay loam; hydrophobic; apedal and massive; consistence when dry is hard; pH 6.0; abrupt boundary.
A2	15-35	Dull yellowish brown (10YR 4/3) when moist; sandy clay loam; apedal and massive; consistence when dry is hard; pH 6.0; abrupt boundary.
B	35-60+	Brown (10YR 4/6) with red mottles, clay; coarse primary structure breaking down to a find angular blocky structure 2 mm; consistence when moist is firm; clay slakes rapidly when wetted; pH 7.0.

COMPONENT Proportion %	1 100
CLIMATE Rainfall (av.) mm Temperature (av.) ^{0}C	 Annual 510 – 560 Annual 13
GEOLOGY Age, rock	 Devonian granite
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2 Land form Position on land form Slope (range) %, elope shape	 Gentle scarps at Darriwill area 46 - 61 15 Dendritic 1.4 Scarps with tore - 10-20 ; Straight
NATIVE VEGETATION Structure Dominant species	 Woodland ? *E. leucoxylon*
SOIL Parent material Description Factual key Surface texture Permeability Depth (av.) m	 In-situ weathered rock Mottled brown duplex soils, coarse structure Db 2.22 Sandy loam Moderate 0.5 - 1.2
LAND USE	Grazing
SOIL DETERIORATION Critical land features Processes Forms	 Slope gradient, dispersibility Sub-surface and overland flow Moderate gully and sheet erosion

Org
Plains with Duplex Soils on Ordovician Sedimentary Rock



SCHEMATIC BLOCK DIAGRAM

Org - Gentler Ordovician land which has been separated from the Ors unit on the basis of slope, vegetation and soils. The unit is scattered across the northern part of the Shire and occupies 6.7% of the survey area, 47 km^2.

There are some areas of salting on the lower slopes and drainage lines, particularly where this unit is close to Tgn. The salting appears to be associated with clearing; the increased water infiltrating through the soil and picking up soluble salts within the Tertiary and Ordovician sediments. These salts are then deposited where, the water comes to the surface. It is mainly used for grazing and cereal cropping but some parts are still forested.

SOILS

The soils do not vary much except in the drainage lines, although they do get shallow towards the crests. The description below is fairly typical of soil profiles found in Component 1.

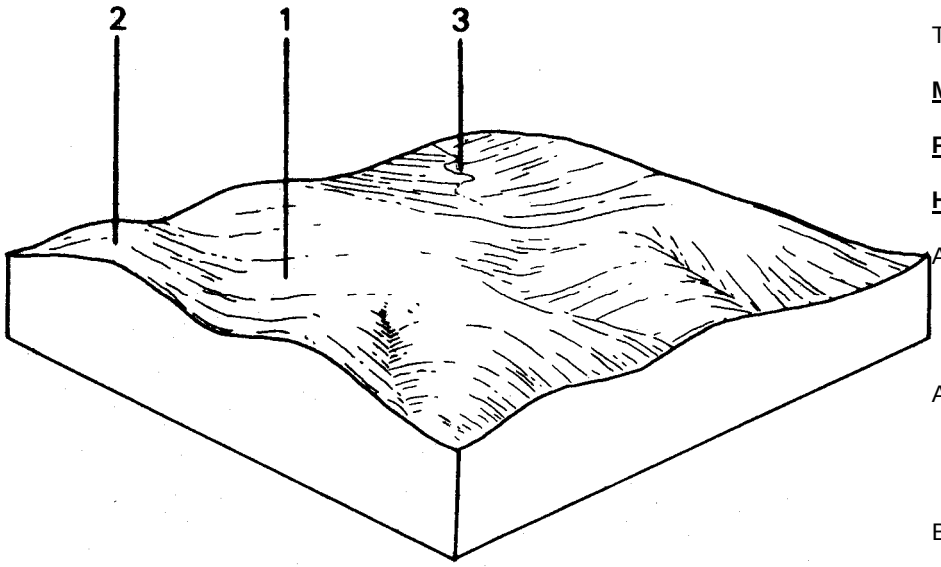
Mottled Yellow Duplex Soils

Factual Keys: Dy 3.41/CL-L, 10-40 cm/slate and sandstone, 80-180 cm

Horizon	Depth (cm)	Description
Al	0-10	Brownish black (10YR 3/2) when moist, clay loams, apedal and massive; consistence when dry is hard; pH 5.8; sharp boundary.
A2	10-30	Greyish yellow brown (10YR 4/2) when moist; clay loam; apedal, hydrophobic and massive; consistence when dry is very hard; pH 5.8; sharp boundary.
B	30-150	Yellowish brown (10YR 5/6) when moist; red mottling; medium clay; strong angular blocky 2 mm; consistence when dry is very hard, pH 5.5; with 4% gravel.
C	150	Slates and sandstone interbedded.

COMPONENT Proportion %	1 80	2 15	5 5
CLIMATE			
Rainfall(av.) mm Temperature(av.) °C	Annual 585 – 685 Annual 12		
GEOLOGY Age, rock	Ordovician, slate and sandstone		
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km Land form Position on land form Slope (range) %, slope shape	Long gentle slope 3-6 ; Straight	Slightly dissected plains 210 - 350 8 Dendritic 1.8 Undulating plain Crest 1-3 ; Convex	Drainage line 1-3 ; Concave
NATIVE VEGETATION			
Structure Dominant species	Open forest *E. viminalis, E. obliqua*	*E. obliqua, E. radiata*	*E. ovata, E. obliqua*
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) in	In-situ weathered rock Mottled yellow duplex soils Dy 3.41 Clay loam Moderate-low 0.8 - 1.8	In-situ weathered rock Mottled yellow duplex soils Dy 3.41 Loam - clay loam High 0.5 - 1.0	Alluvium-clay. silt, sand and gravel Mottled yellow and red gradational soils Gn 3 Clay loam Low-moderate 1.5 - 2.5
LAND USE	Grazing with some forestry and cropping (cereal)		
SOIL DETERIORATION Critical land features Processes Forms	Hard setting surfaces Overland flow, leaching of salts Minor sheet, rill and gully erosion, surface compaction	Hard setting surfaces, dispersibility Overland flow, leaching of salts Minor sheet and rill erosion, surface compaction	Moderate dispersibility, poorly drained site, hard setting surfaces, seasonal high watertable Overland flow, accumulation of salts, periodic waterlogging Salting, minor gully erosion

Orgd
Plains with Duplex Soils on Ordovician Sedimentary Rock Drier than Org



Orgd - Gently undulating plain on Ordovician sediments in the Bamganie area, near the Leigh River and in some isolated patches east of She Oaks. (it is similar to Org but has a drier climate.) The total area of the unit is 3.2 km^2 which represents 0.4% of the Shire.

The main soil is a mottled yellow, duplex soil formed on slates and sandstone; however, there are occasional sandy ridges. (Salting may occur on lower slopes and in the drainage lines, especially where the unit is close to Tgn or Tgnd. Gully erosion may occur in salt-affected areas.

The main land use is grazing with some cereal cropping.

SOILS

The most common soil is that of Component 1.

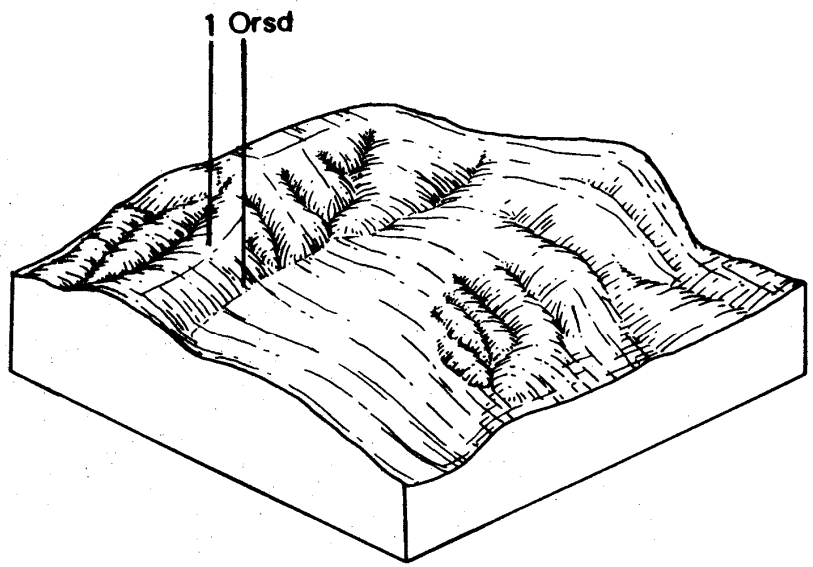
Mottled Yellow Duplex Soils

Factual Keys: Dy 3.41/FSL-LS, 10-40 cm/Ordovician sediments, 100-200 cm.

Horizon	Depth (cm)	Description
Al	0-10	Brownish black (10YR 3/2) when moist; fine sandy loam; apedal and massive; consistence when dry is hard; pH 5.8; sharp boundary.
A2	10-30	Greyish yellow brown (10YR 4/2) when moist; fine sandy loam; apedal and massive; consistence when dry is hard; pH 5.8; sharp boundary.
B	30-150	Yellowish brown (10YR 5/6) when moist; red mottling; medium clay; strong angular blocky 2 mm; consistence when dry is very hard; pH 5.5; with 4% gravel.

COMPONENT Proportion %	1 80	2 15	3 5
CLIMATE Rainfall (av.) mm Temperature (av.) ^{o}C	Annual 585-685 Annual 12		
GEOLOGY Age, rock	Ordovician slate and sandstone	Remnants of Tertiary sandy capping over Ordovician sediments	Ordovician; slate and sandstone
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km2 Land form Position on land form Slope (range) %, slope shape	Slightly dissected rolling plains in the "Sammie" area near the Leigh River 200 - 255 10 Dendritic 1.3 Rolling plain Long gentle slope 2-5 ; Straight	Sandy ridges 1-3 ; Convex	Depression line 1-3 ; Concave
NATIVE VEGETATION Structure Dominant species	Open forest ? *E. Polyanthemos, Casuarina* Spp. and others ?	*E. Viminalis* ?, *Casuarina* Spp.	*E. Camaldulensis*
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	In-site weathered rook Mottled yellow duplex soils Dy 3.41 Fine sandy loam Moderate-low 1.0 - 2.0	Unconsolidated sands over in-situ weathered rock Pale uniform sands over mottled yellow duplex soils Uc 1/Dy 3.41 Sand - Loamy sand High 1.0 - 2.0	Alluvium Mottled yellow duplex soils Dy 3.21 Clay loam Low-moderate 1.5 - ^{2}.5
LAND USE	Grazing with some cropping (cereal)	Grazing	Grazing with some cropping (cereal)
SOIL DETERIORATION Critical land features Processes Forms	Hard setting surfaces Overland flow, leaching of salts Minor sheet, rill and gully erosion, surface compaction	Permeability, nutrient-holding capacity Leaching Nutrient decline	Moderate dispersibility, poorly rained site, hard setting surfaces, seasonal high watertable Overland flow, accumulation of salts, periodic waterlogging Some salting, gully erosion

Orcd
Broad Ridge Tops with Duplex Soils on Ordovician Sedimentary Rock



SCHEMATIC BLOCK DIAGRAM

Orcd Broad crests associated with the Orad land system to the north-east of the Shire. It represents the intermediate stage in natural erosion of the landscape that occurs between the broad crests capped with Tertiary sediments (Tgn and Tgnd) and the narrow crests of steep Ordovician country (Orsd). Although the Tertiary material has largely been removed by natural erosion, it still has some influence on the soil, e.g. the topsoil is sandier than usual. There is a group of about ten small areas of this unit east of Meredith, totalling 3.5 km^2, or 0.5% of the Shire.

The land is generally cleared and grazing is the main land use.

SOILS

The soils vary from red mottled yellow duplex soils through to red duplex soils where the influence of the Tertiary is stronger. The former are more common and an example is described below.

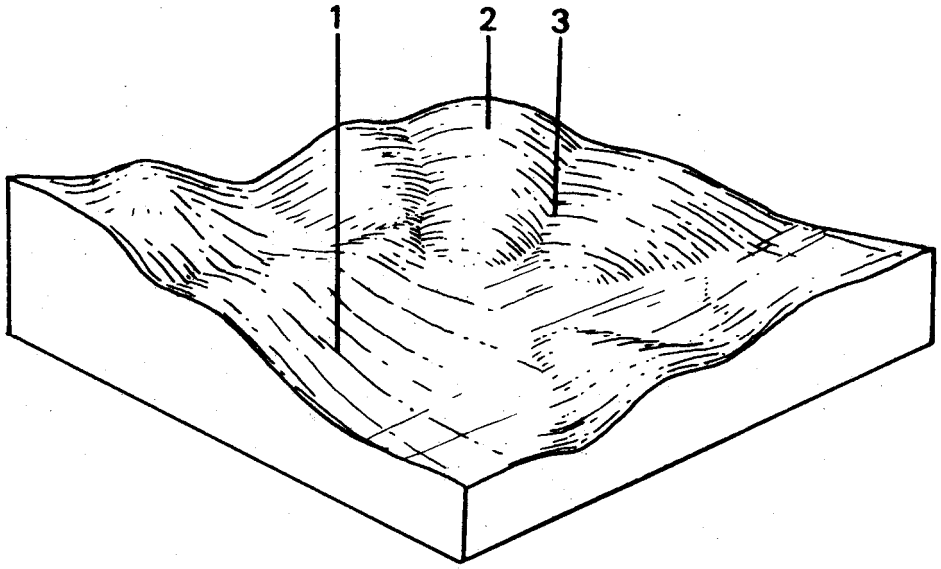
Mottled Yellow Duplex Soils

Factual Key: Hy 3.41/FSL-LS, 10-40 cm/Ordovician sediments, 50-150 cm

Horizon	Depth (cm)	Description
Al	0-10	Brownish black (10YR 3/2) when moist; fine sandy loam; apedal and massive; consistence when dry is hard; pH 5.8; sharp boundary.
A2	10-30	Greyish yellow brown (10YR 4/2) when moist; fine sandy loam; apedal and massive; consistence when dry is very hard; pH 5.8; sharp boundary.
B	30-80	Yellowish brown (10YR 5/6) when moist; with red mottling; medium clay; strong angular blocky 2 mm; consistence when dry is very hard; pH 5.5; with 4% gravel.
C	80+	Weathering Ordovician sediments.

COMPONENT Proportion %	1 100
CLIMATE Rainfall (av.) mm Temperature (av.) ^{0}C	 Annual 600 - 630 Annual 12
GEOLOGY Age, rock	 Ordovician slates and sandstones
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2 Land form Position on land form Slope (range), slope shape	 Some broader ridge tops west of Steiglitz 16e8- 335 50 Dendritic 1.1 Broad ridge tops Crest 1-5 ; Convex
NATIVE VEGEPATION Structure Dominant species	 Low open forest to open forest *E. macrorhyncha, E. polyanthemos, E. goniocalyx*
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	 In-situ weathered rock Mottled yellow acid duplex soils- Dy 3.41 and Dr 3.41 Fine sandy clay loam Moderate 0.3 - 1.2
LAND USE **SOIL DEPERIORATION** Critical land features Processes Forms	 Low quality forestry Hard setting surface Overland flow Minor sheet erosion

Orm
Moderate Slopes with Duplex Soils on Ordovician Sedimentary Rock



SCHEMATIC BLOCK DIAGRAM

Orm Rolling terrain on Ordovician slates and sandstones to the north of the Shire. The total area of 6.7 km^2 represents 1.0% of the Shire.

The land has been separated from Org on the basis of slope and local relief. The steeper slopes of Orm increase the hazard of erosion on disturbed soil surfaces. Most of the land is cleared and it is generally used for grazing.

SOILS

The soils do not vary much except in the drainage lines and on some of the narrower create. The main variation is in depth to the sedimentary rock. The example below represents a fairly common profile.

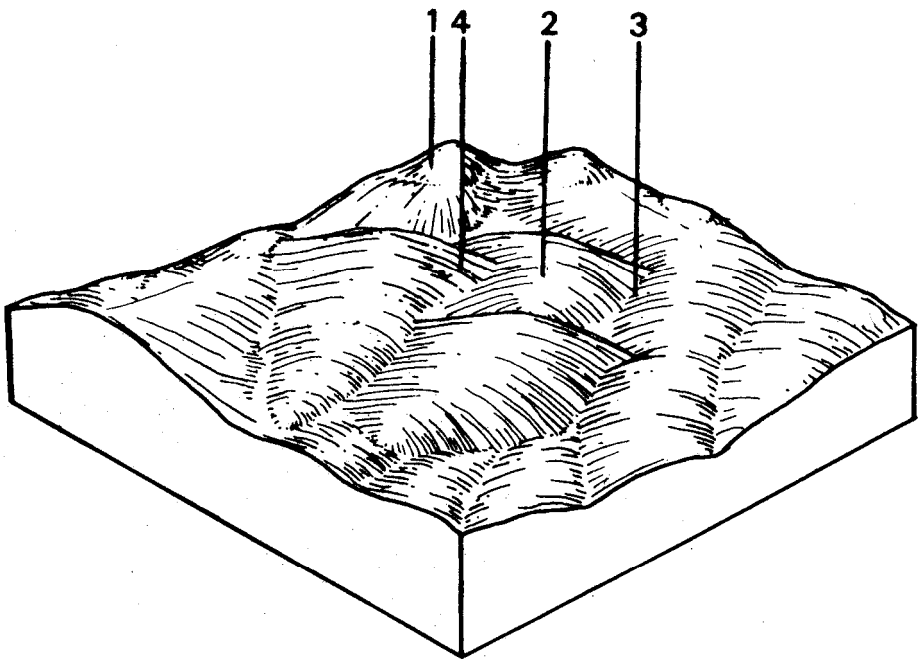
Mottled Yellow Duplex Soils

Factual Key: DY 3.41/CL-L, 10-40 cm/slates and sandstone, 60-120 cm

Horizon	Depth (cm)	Description.
Al	0-10	Brownish black (10YR 3/2) when moist; clay loams; apedal and massive; consistence when dry is hard; pH 5.8; sharp boundary.
A2	10-25	Greyish yellow brown (10YR 4/2) when moist; clay loam; apedal, hydrophobic and massive; consistence when dry is very hard; pH 5.8; sharp boundary.
B	25-120	Yellowish brown (10YR 5/6) when moist; red mottling; medium clay; strong angular blocky 2 mm; consistence when dry is very hard; pH 5.5; with 4% gravel.

COMPONENT Proportion %	1 85	2 10	3 5
CLIMATE Rainfall (av.) mm Temperature (av.) ^{0}C	Annual 630 - 685 Annual 12		
GEOLOGY Age, rock	Ordovician; slate and sandstone		
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km^2 Land form Position on land form Slope (range) %, slope shape	Slightly dissected plains 310 - 350 13 Dendritic 1.8 Rolling plain Long gentle slope 3-10 ; Straight	Crest 1-3 ; Convex	Drainage line 1-3 ; Concave
NATIVE VEGETATION Structure Dominant species	Open forest *E. viminalis, E. obliqua*	Open forest Woodland *E. obliqua, E. radiata*	Open forest *E. ovata, E. obliqua*
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	In-situ weathered rock Mottled yellow duplex soils Dy3.41 Clay loam Moderate-low 0.6 - 1.2	In-situ weathered rock Shallow stony red gradational soils Gn 3.71 Gravelly loam High 0.4 - 0.7	Alluvium-clay, silt, sand and gravel Mottled yellow and red gradational soils Gn .3 Clay loam Low-moderate 1.5 - 2.5
LAND USE	Grazing with some forestry		
SOIL DETERIORATION Critical land features Processes Forms	Hard setting surfaces Overland flow, leaching of salts Moderate sheet, rill and gully erosion	Hard setting surfaces, dispersibility Overland flow, leaching of salts Minor sheet and rill erosion, surface compaction	Moderate dispersibility, poorly drained site, hard setting surfaces, seasonal high watertable Overland flow, accumulation of salts, periodic waterlogging Moderate salting, gully erosion

Orh
Hills with Gradational Soils on Ordovician Sedimentary Rock



SCHEMATIC BLOCK DIAGRAM

Orh Hilly terrain on Ordovician elates and sandstone located in the north-central and north-western parts of the Shire. There are only a few areas of mappable dimensions and the total of 8.1 km^2 represents 1.1% of the Shire.

The slopes are not as steep as for Ore though the soils are fairly shallow and just as erodible. The sedimentary rock is often exposed or is just below the surface on the upper slopes and crests.

Most of the land is cleared but is only capable of supporting grazing at a fairly low carrying capacity. The drainage lines often contain gullies, some of which are still actively eroding. It is similar to Orhd but the climate here is wetter.

SOILS

The most common soils are either mottled yellow gradational or duplex soils, often depending on the steepness of the slope. The soil described is common on Component 1.

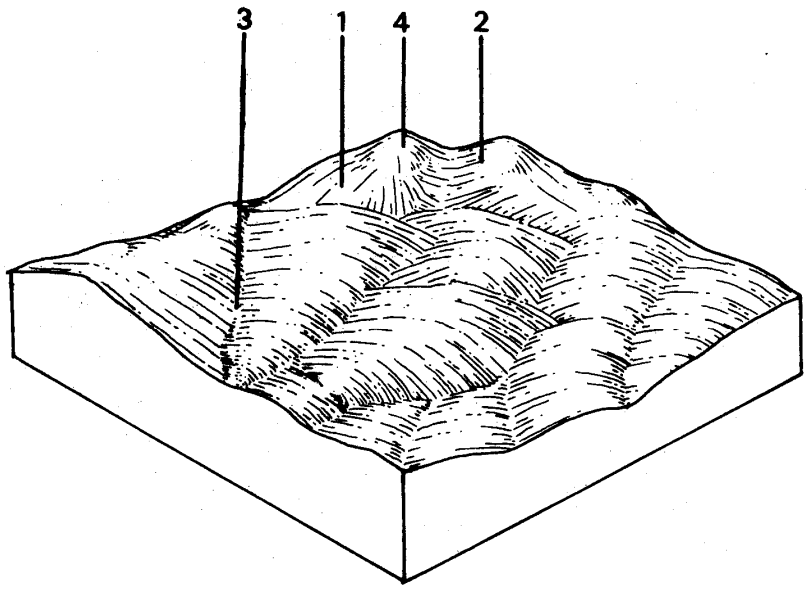
Red Mottled. Yellow Gradational Soils - Fine Structure

Factual Key: Gn 3.71/CL, 5-15 cm/slates and sandstone, 50-120 cm

Horizon	Depth (cm)	Description
A	0-8	Brown (7.5YR 4/3) when moist; gravelly clay loam; apedal, massive and hydro-phobic; consistence when dry is hard; pH 5.5; diffuse boundary.
B1	8-30	Bright reddish brown (5YR 5/6) when moist with abundant red brown mottles; light medium clay; moderate angular blocky 3 mm; consistence when moist is firm; pH 5.8; diffuse boundary with colluvial stones.
B2	30-70	Reddish brown (5YR 4/6) when moist with abundant red mottles; medium clay; strong angular blocky 3 mm; consistence when moist is firm; pH 6.0; diffuse boundary.
B/C	70-80	As B2 with 60-8096 weathering. Ordovician sedimentary rock.
R	80+	Ordovician rock.

COMPONENT Proportion %	1 48	2 45	3 5	4 2
CLIMATE Rainfall (av.) mm Temperature (av.) ^{0}C	Annual 660 - 710 Annual 12			
GEOLOGY Age, rock	Ordovician; elates and sandstones			
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km/km Land form Position on land form Slope (range) 16, elope shape	Hilly areas in the north of the Shire 213 - 350 45 Dendritic 3.4 Hills Dry exposed slopes 10-25 ; Straight	Crest 0-10 ; Convex	Drainage line 1-10 ; Concave	Moist protected elopes 8-20 ; Straight
NATIVE VEGETATION Structure Dominant species	Open forest *E. dives, E. obliqua E. viminalis, E. radiata*	*E. obliqua, E. dives, E. viminalis, H. radiata*	*E. radiata, E. viminalis, E. obliqua*	Tall open forest *E.obliqua, E. ovata, E. radiata, E. viminalis,*
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	In-situ weathered rock Mottled yellow gradational or duplex soils, fine structure Gn 3.71 or Dy 3.41 Fine sandy loam High 0.5 - 1.2	In-situ weathered rock Shallow stony red and yellow gradational soils Gn 3.71 Gravelly loam High 0.3 - 0.8	Alluvium, clay, silt, sand, gravel Black rational soil, (variable) Gn 3 Clay loam Moderate-low 7 1	In-situ weathered rock Mottled yellow gradational or duplex soils, fine structure Gn 3.71 or Dy 3.41 Fine sandy loam High 0.8 - 1.8
LAND USE	Mainly forestry, grazing			
SOIL DETERIORATION Critical land features Processes Forms	Steep slopes, hard setting surfaces Overland flow Moderate sheet and rill erosion, surface compaction	Moderate slopes, hard setting surfaces Overland flow Moderate sheet and rill erosion, surface compaction	Moderate permeability, hard setting surfaces, dispersibility, seasonal high watertable hard setting surfaces Overland flow, subsurface flow, waterlogging Moderate ' gully. erosion, surface compaction	 Overland flow Minor sheet and rill erosion

Orhd
Hills with Gradational Soils on Ordovician Sedimentary Rock Drier than Orh



SCHEMATIC BLOCK DIAGRAM

Orhd Hilly terrain on Ordovician sediments located within the generally steeper Ordovician country between Maude and the Durdidwarrah Reservoirs. There are only a few areas of mappable dimensions and the total of 4.2 km^2 represents 0.6% of the Shire. It is similar to Qrh, but the climate is drier.

The slopes are not as steep as for Orsd, but the soils are fairly shallow and are just as erodible. The sedimentary rock is often exposed or is just below the surface on the upper elopes and crests. The drainage lines often contain gullies, some of which are still actively eroding. Most of the land is cleared but is only capable of supporting grazing at a fairly low carrying capacity.

SOILS

The soils are fairly consistent within the land system. Where slopes are gentler and therefore the soils are deeper, duplex soils are more common than gradational soils. The soil described below represents an example of a gradational soil found on steeper slopes.

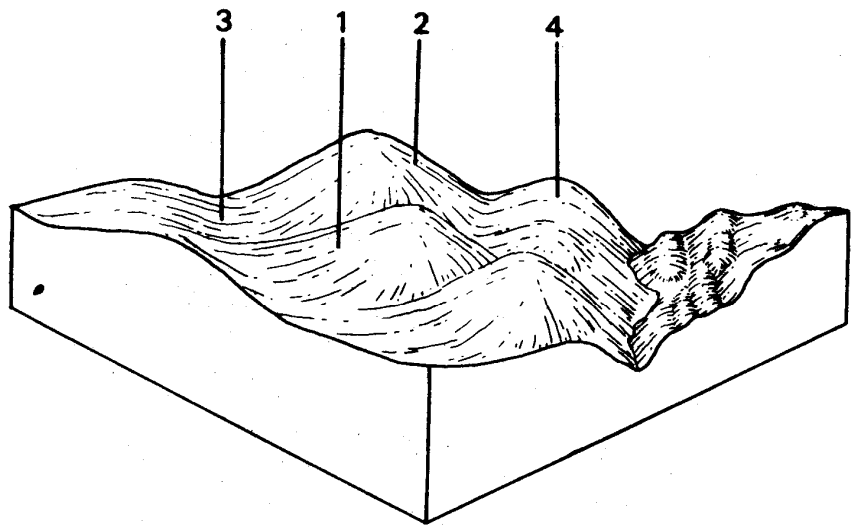
Mottled, Yellow Gradational Soils - Fine Structure

Factual Key: Gn 3.71/CL, 5-15 cm/weathered Ordovician sediments, 30-100 cm

Horizon	Depth (cm)	Description
A	0-8	Brown (7.5YR 4/3) when moist; gravelly clay loam; apedal, massive and hydrophobic; consistence when dry is hard; pH 5.5; diffuse boundary.
B1	8-30	Bright reddish brown (5YR 5/6) when moist with abundant red brown mottles; light medium clay; moderate angular blocky 3 mm; consistence when moist is firm; pH 5.8; diffuse boundary with colluvial stones.
B2	30-50	Reddish brown (5YR 4/6) when moist with abundant red mottles; medium clay; strong angular blocky 3 mm; consistence when moist is firm; pH 6.0; diffuse boundary.
B/C	50-60	As B2 with 60-80% weathering. Ordovician sedimentary rock.
R	60+	Ordovician rock.

COMPONENT Proportion %	1 49	2 44	3 5	4 2
CLIMATE Rainfall (av.) mm Temperature (av.) °C	Annual 580 - 600 Annual 12			
GEOLOGY Age, rock	Ordovician elates and sandstones			
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km^2 Land form	Hilly areas mainly in north-east of the Shire 137 - 335 30 Dendritic 1.3 Hill			
Position on land form Slope (range) 96, slope shape	Dry exposed slopes 10-20 ; Straight	Crests 2-10 ; Convex	Drainage lines 2-6 ; Concave	Moist protected slopes 5-15 ;.Straight
NATIVE VEGETATION Structure Dominant species	Low open forest *E. polyanthemos, E. leucoxylon*	*E. melliodora, E. sideroxylon*	Open forest *E. polyanthemos, E. ovata*	*E. viminalis, E. leucoxylon*
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	In-situ weathered rock Yellow mottled duplex or gradational soils, fine structure Dy 3.41 Fine sandy loam High 0.5 - 1.0	In-situ weathered rock Shallow stony gradational soils *Gn* 3.71 Gravelly loam High 0.2 - 0.5	Alluvium; clay, silt, sand and gravel Black gradational soils (variable) *Gn* 3.4 Clay loam Moderately low >1.0	In-situ weathered rock Yellow mottled duplex or gradational soils, fine structure Dy 3.41 Fine sandy loam High 0.8 - 1.5
LAND USE	Grazing, low production forestry, recreation			
SOIL DETERIORATION Critical land features Processes Forms	Moderate slopes, hard setting surfaces, low fertility soils Overland flow Moderate sheet and rill erosion, surface compaction	Moderate slopes, hard setting surfaces; low fertility shallow soils Overland flow Moderate sheet and rill erosion, surface compaction	Moderate permeability, hard setting surfaces, dispersibility. Seasonal high watertable Overland flow, subsurface flow, periodic waterlogging Moderate gully erosion, salting, surface compaction	Steep slopes, hard setting surfaces, low fertility soils Overland flow Minor sheet and rill erosion, surface compaction

Ors
Steep Hills with Gradational Soils on Ordovician Sedimentary Rock



SCHEMATIC BLOCK DIAGRAM

Ore Steep hills and gorges on Ordovician elates and sandstones to the north of the Shire. Ore covers 37.6 km^2 or 5.4% of the survey area.

The combination of steep slopes, shallow erodible Boils and low fertility, limits the usefulness of this land for agronomic purposes. This low capacity for production has been recognised by past landowners and much of the land is uncleared. Those areas that are cleared are only capable of supporting grazing at a relatively low carrying capacity. There are often gullies in the drainage lines of grazing land.

Recreation and low-quality forestry are other land uses that occur and, more recently, there has been some rural subdivision and bush-block development. The access tracks and clearings in some of these developed areas are often badly eroded, contributing sediments and dispersible clay to the Moorabool System.

SOILS

The soils of this unit are fairly consistent. They are shallow, stony, gradational soils except on small gently sloping areas where deeper duplex soils may occur.

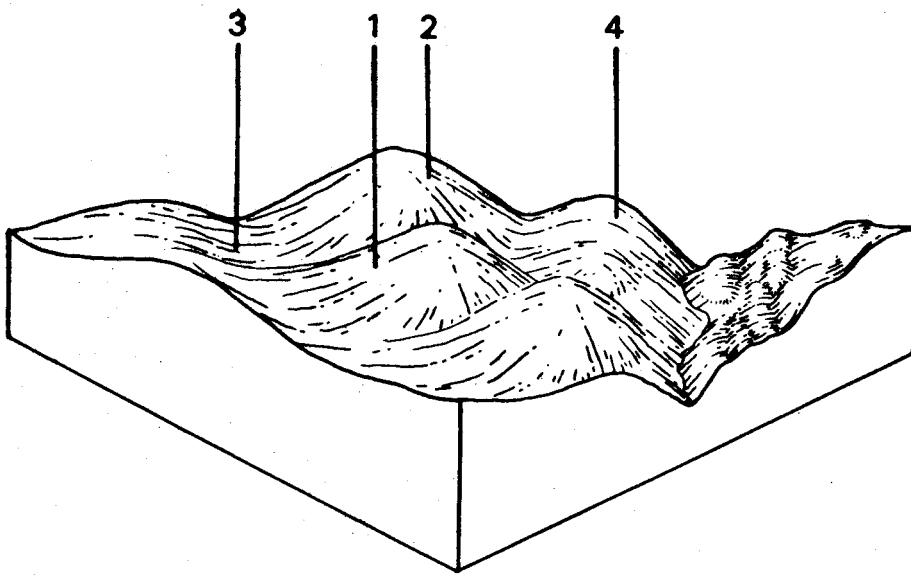
Mottled Yellow Gradational Soils- Fine Structure

Factual Key: Gn 3.71/CL, 5-15 cm/weathered Ordovician sediments, 30-100 cm

Horizon	Depth (cm)	Description
A	0-8	Brown (7.5YR 4/3) when moist; fine sandy clay loam, sometimes with gravel; apedal, massive and hydrophobic; consistence when dry is hard; pH 5.5; diffuse boundary.
B1	8-30	Bright reddish brown (5YR 5/6) when moist with abundant red brown mottles; light medium clay; moderate angular blocky 3 mm; consistence when moist is firm; pH 5.8; diffuse boundary with colluvial stones.
B2	30-50	Reddish brown (5YR 4/6) when moist with abundant red mottles; medium clay; strong angular blocky 3 mm; consistence when moist is firm; pH 6.0; diffuse boundary.
B/C	50-60	As B2 with 60-80% weathering. Ordovician sedimentary rock.
R	60+	Ordovician rock.

COMPONENT Proportion %	1 48	2 45	3 5	4 2
CLIMATE Rainfall (av.) mm Temperature (av.)mm	Annual 610 - 700 Annual 12			
GEOLOGY Age, rock	Ordovician; slates and sandstones			
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km^2 Land form Position on land form Slope (range) 16, slope shape	Closely dissected steep hilly areas to the north of the Shire 210 - 365 80 Dendritic 6.5 Hills and ridges Dry exposed slopes 15-35 ; Straight	Crest 0-15, Convex	Drainage line 2-10, Concave	Moist protected slopes 10-25 ; Straight
NATIVE VEGETATION Structure Dominant species	*E. dives, E. obliqua,* *E. viminalis, E. radiata*	Open forest *E. obliqua, E. dives,* *E. viminalis, E. radiata*	*E. radiata, E. viminalis* *E. obliqua*	Tall open forest *E. obliqua, E. ovata* *E. radiata, E. viminalis*
SOIL Parent material Description Factual key Surface Texture Permeability Depth (range) m	In-situ weathered rock Mottled yellow gradational or duplex soils fine structure Gn 3.71/Dy 3.41 Fine sandy loam Moderate 0.4 - 1.2	In-situ weathered rock Shallow stony red and yellow gradational soils Gn 3.71 Gravelly loam High 0.2 - 0.7	Alluvium, clay, silt, sand, gravel Dark gradational soils (variable) Gn 4 Clay loam Low 1	In-situ weathered rock Mottled yellow gradational or duplex soils fine structure Gn 3.71/Dy 3.41 Fine sandy loam Moderate 0.8 - 1.8
LAND USE	The land is generally uncleared, some forestry, grazing areas that have been cleared			
SOIL DETERIORATION Critical land features Processes Forms 	Steep slopes, hard setting surfaces Overland flow Severe sheet and rill erosion	Moderate slopes, hard setting surfaces Overland flow Severe sheet and rill erosion	Moderate permeability, hard setting surfaces, dispersibility, seasonal high watertable Overland flow, subsurface flow, periodic waterlogging Severe gully erosion	Steep slopes, hard setting surfaces Overland flow Severe sheet and rill erosion

Orsd
Steep Hills with Gradational Soils on Ordovician Sedimentary Rock Drier than Ors



Orsd Closely dissected terrain with steep rugged slopes and poor shallow soils in the north-east of the Shire. Having a total area of 46 km^2, it comprises 6.6% of the total study area.

The combination of steep elopes, shallow erodible soils and low fertility, limits the usefulness of this land for agronomic purposes. This low capacity for production has been recognised by past landowners and much of the land is uncleared. Those areas that are cleared are only capable of supporting grazing at a relatively low carrying capacity. There are often gullies in the drainage lines of grazing land.

Recreation and low-quality forestry are other land uses that occur and, more recently, there has been some rural subdivision and bush-block development. The access tracks and clearings in some of these developed areas are often badly eroded, contributing sediments and dispersible clay to the Moorabool System.

Mottled, Yellow Gradational Soils - Fine Structure

Factual Key: Gn 3.71/CL, 5-15 cm/weathered Ordovician sediments, 30-100 cm.

Horizon	Depth (cm)	Description
A	0-8	Brown (7.5YR 4/3) when moist; fine sandy clay loam, sometimes with gravel; apedal, massive and hydrophobic; consistence when dry is hard; pH 5.5; diffuse boundary.
B1	8-30	Bright reddish brown (5YR 5/6) when moist with abundant red brown mottles; light medium clay; moderate angular blocky 3 mm; consistence when moist is firm; pH 5.8; diffuse boundary with colluvial stones.
B2	30-50	Reddish brown (5YR 4/6) when moist with abundant red mottles; medium clay; strong angular blocky 3 mm; consistence when moist is firm; pH 6.0; diffuse boundary.
B/C	50-60	As B2 with 60-80% weathering. Ordovician sedimentary rock.
R	60+	Ordovician rock.

COMPONENT Proportion %	1 50	2 45	3 3	4 2
CLIMATE Rainfall(av.) mm Temperature(av.) ^{0}C	Annual 560 - 600 Annual 12			
GEOLOGY Age, rook	Ordovician; slates and sandstones			
TOPOGRAPHY Landscape Elevation (range) m Local relief (av.) m Drainage pattern Drainage density km,/^{y}rm^{2} Land form	Closely dissected steep hilly areas mainly in the north-east of the Shire 91 - 350 52 Dendritic 5.4 Hills			
Position on land form	Dry exposed slopes	Crest	Drainage lines	Moist protected slopes
Slope (range)%, slope shape	14-40 ; Straight	2-10 ; Convex	2-6 ; Concave	10-30 ; Straight
NATIVE VEGETATION Structure	Low open forest		Open	forest
Dominant species	*E. polyanthemos, E. macrorhyncha* *E. leucoxylon, E. sideroxylon* *E. viminalis, E. melliodora*		*E. polyanthemos, E. ovata,* *E. leucoxylon, E. melliodora*	*E. viminalis* *E. leucoxylon*
SOIL Parent material Description Factual key Surface texture Permeability Depth (range) m	In-situ weathered rock Mottled yellow gradational or duplex soils, fine structure Gn 3.71 Fine sandy loam High 0.5 - 1.0	In-situ weathered rock Shallow stony gradational soils Gn 3.71 Gravelly loam High 0.1 - 0.4	Alluvium, clay, silt, sand, gravel Black gradational soils (variable) Gn 3.4 Clay loam Moderately low 1.0	In-situ weathered rock Mottled yel1ow gradational or duplex soils, fine stricture Gn 3.71 Fine sandy loam High 0.5 - 1.2
LAND USE	Low quality forestry; recreation, some grazing. Much of this land is Crown land.			
SOIL DETERIORATION Critical land features Processes Forms	Steep slopes, hard setting surfaces, low fertility, shallow soils Overland flow Severe sheet and rill erosion	Moderate slopes, hard setting surfaces, low fertility shallow soils Overland flow Severe sheet and rill erosion	Moderate permeability, hard setting surfaces, dispersibility, seasonal high watertable Overland flow, subsurface flow, periodic waterlogging Severe gully erosion, Occasional salting	Steep slopes, hard setting surfaces, low fertility soils Overland flow Severe sheet and rill erosion

APPENDIX 2 - LAND FEATURES WHICH DETERMINE LAND CAPABILITY

The land features used in capability rating Systems can impose limitations to the use of land through effects on the production, the management or the hazards. This section explains why these land features are important in determining capability.

1. Slope

As slope increases, erosion hazard increases because the erosivity of the runoff water increases. Lack of adequate ground cover, such as occurs during construction activities, on tracks and intensive use areas, under cropping uses where cultivation is required, or as a result of overgrazing, accentuates the erosion hazard.

A main influence of slope on rating for capability for urban and similar uses is related to the increasing cost of providing engineering services as slope increases. The slope categories used in urban ratings have been chosen on the basis of per block costs of building and providing services, as described by Neil, R.C. and Scales, P.J. (1976).

For agricultural activities, steeper slopes are more difficult and costly to work and may impose limitations on the type of machinery which can be used.

Seepage problems increase with slope on certain soil types, and may increase the risk of mass movement such as slumping of the batters of excavations and road cuts. Problems with the absorption and retention of septic effluent below the soil surface increase as the slopes become steeper.

In general, the cost of developing and managing land increases as slope increases.

2. Landslip Hazard

Landslips are an important factor to consider with respect to human safety, damage to property and access. High landslip hazard can be a permanent limitation to some land uses because even where it may be technically possible to prevent landslips, the coat would be generally prohibitive.

3. Percentage of Outcropping Boulders

Boulders are a physical barrier to excavation, cultivation and plant growth, and so inhibit land uses involving these activities. These limitations may be overcome to a certain extent by blasting which involves additional costs. For extensive uses, such as grazing, boulders can be regarded as a permanent limitation, as it is not economical to remove them and there may be additional costs involved in the increased management required as compared with boulder free land.

4. Availability of Dam Sites

For agricultural uses dams may be required for irrigation or for stock water. In areas where reticulated water is not available, dams may also be needed for domestic uses.

Factors which affect the location and construction of farm dame are:-

(a) slope (between 2 - 10% at the site).
(b) availability of natural depressions or drainage lines.
(c) adequate catchment for the required size of dam.
(d) sufficient clay material of a suitable type for the embankment.
(e) depth to bed-rock.
(f) soil percolation rate (also gravel and sand seams).

5. Site Drainage

Site drainage is influenced by rainfall, soil permeability, the steepness of slope, slope shape and the position on the slope. It is important for most land uses that water flows freely from the site. Poor site drainage may result in that the land may become waterlogged and boggy, plant growth may be inhibited, roads and buildings maybe damaged through subsidence and efficient effluent disposal will not be possible.

Special practices or management to overcome poor site drainage will add to the cost of development and management.

6. Soil Profile Permeability

Soils of low permeability do not readily drain vertically through the profile, although when on sloping land lateral flow above a horizon of low permeability may occur. Areas with such soils may become waterlogged and plant growth could be inhibited. Soils with poor permeability may become too boggy for the use of agricultural machinery at certain times of the year.

Poor soil permeability may result in loss of production (reduced plant growth) and increased management restrictions, and increased costs in overcoming the problems of effluent disposal. Conversely, an extremely permeable soil may suffer from excessive leaching of plant nutrients or an inability to retain moisture for plant growth. Such a soil may also drain too rapidly to perform the purification function required for septic effluent disposal.

7. Infiltration

The ability of soil to absorb applied water (rain or irrigation water) has an important effect on the production of surface runoff and may also affect the ability of soil to provide moisture for plant growth because of limitations to the amount of water entering the soil.

Raindrop splash and, in some instances, wash of surface soil may cause "surface sealing" which results in the blocking of surface pores and a reduction in the amount of water penetrating the soil. Soils differ in their resistance to surface sealing. Maintenance of an effective ground cover which prevents raindrop splash or surface wash is the best way to retain soil infiltration capacity.

8. Gravel and Stones

Excavation of soils with large amounts of stones and gravel require special machinery. The sides of construction trenches and holes in these soils are less stable.

Because stones occupy soil volume and do not contribute to the availability of plant nutrients or moisture they reduce the productive potential of soils. Soils with stones and gravel are difficult to cultivate and they are far less suited to intensive cropping and gardens than are stone-free soils. Stones cause problems with mechanical harvesting of root crops (notably potatoes).

Soil micro-organisms are essential to the purification of Septic effluent, but stony or gravelly soils provide a less suitable environment for these organisms than stone -and gravel-free soils. Thus populations of micro-organisms in very stony soils are small. Furthermore, effluent flows quickly through stony soils which reduces the time available for purifying processes which take place in the soil. For some land use activities, limitations imposed by stones and gravel can be overcome by special management or technology, (e.g. engineering problems of excavating in stony soils). These usually increase the costs of the operation.

The limitations to plant growth can be overcome by importing topsoil which in effect is changing the nature of the land. Stones and gravel soils intended for intensive cropping can be regarded as a permanent limitation, causing lower plant yields and increased management problems unless the importation of topsoil can be justified. The problems of septic effluent disposal by absorption in these soils are difficult to overcome and may be regarded as a permanent limitation to the commonly used tile drain disposal systems.

9. Depth to Rock

If bedrock is close to the surface, excavation will be costly and cultivation may be difficult or impossible. Plant growth and water penetration are adversely affected by shallow soils.

These limitations to engineering activities may be overcome by blasting. In low intensity uses bedrock at shallow depth is regarded as a permanent limitation and will result in increased costs of agricultural production through the difficulty of constructing farm dams and reduced plant yield.

10. Depth to Winter Water Table

This factor is dependent on the soil profile permeability and site drainage. If the water table is too close to the surface the topsoil will become boggy and problems similar to those of described for site drainage and profile permeability may arise. Special management requirements, such as drainage, may be required to enable efficient effluent disposal and to prevent damage to roads and buildings, both during and after construction.

11. Depth of Cultivable Soil

For intensive cropping it is necessary to cultivate soils deep enough to provide a good soil structure for root and water penetration. Plant growth will be limited if this depth is less than 0.5 metres.

12. Limiting Soil Depth for Pasture Roots

The depth of rooting of pasture plants may be restricted by such soil features as a heavy clay subsoil or a gravel bed. If this feature is close to the surface, root development, and therefore plant growth, will be restricted. Reduction in pasture production results in reduced economic returns and increased costs would be incurred in overcoming the problem by methods such as deep ripping the clayey subsoil.

13. Moist Consistence and Dry Consistence

Consistence determination provides an indication of the coherence of soil. If soil becomes boggy when moist or hard and powdery when dry, then fine cultivation, and thus management for intensive cropping, will be restricted.

14. A Horizon pH

The pH of the soil is a measure of the acidity or alkalinity. Most plants have a limited pH range for optimum growth. A pH differing from the optimum for high plant yield will result in reduced crop production or may require costly treatment to bring the pH closer to the optimum.

15. A Horizon Soil Texture

The A horizon or topsoil texture provides an indication of the likely physical performance of the soil or whether the topsoil will become sticky when wet (clay) or unstable when dry (sand) which are important considerations for some recreation pursuits.

The texture of the A horizon is one of the soil features which influences whether water can easily penetrate the topsoil. It also affects the ability of the soil to retain moisture available for plant use and the nutrient supplying ability of the soil. This factor may limit the growth of lawns and gardens in urban use and plant yield in agricultural uses.

Some of the limitations imposed by soil texture can be reduced or overcome by special treatments such as addition of stabilising chemicals or organic matter or simply by importing better quality topsoil.

16. A Horizon % Organic Matter

Generally the higher the level of organic matter in the topsoil, or A horizon, the better the structure and chemical fertility of the soil. Such soils are good usually for intensive cropping.

Low organic matter content may be overcome by management techniques such as the growing of *green* manure crops or the addition of fertilizers.

APPENDIX 3 - CONSERVATION MANAGEMENT PRACTICES

General recommendations for engineering activities

Engineering activities will be cheaper, more efficient and less harmful to the environment if attention is given to erosion and sediment control in the planning and design phases of a project rather than only during construction. Basic considerations in erosion and sediment control are:-

i) Bare soils will erode more rapidly than vegetated, mulched or paved areas.

ii) Erosion rates are significantly influenced by the amount of overland flow which in turn is effected by surface infiltration rates.

iii) Sand and silt sized material is removed easily from drainage waters, however it is usually impractical to remove the finer particles that contribute to turbidity of drainage waters.

An erosion and sediment control programme is based on the following principles:-

i) Keep the area of soil exposed to a minimum.

ii) Minimise the time the soil is exposed and as far as possible avoid having the soil exposed during periods when high intensity or prolonged rain is prevalent.

iii) Carry out earthworks in a manner that allows for the different erodibility and fertility of topsoils and subsoils.

iv) Control surface drainage.

v) Trap eroded soil before it damages downslope land, structures or waterways.

The most suitable programme for a specific development depends on local circumstances and will usually involve a combination of the practices outlined below. More detailed information about conservation practices applicable to construction sites are given in the "Guidelines for Minimising Soil Erosion and Sedimentation from Construction Sites in Victoria", (obtainable from the Soil Conservation Authority). Further advice can be provided by the SCA.

Some general conservation management objectives are listed below.

i) Development should be programmed to minimise the area disturbed at any one time and to allow rapid protection (by vegetation, mulching or paving) of bared areas. This is particularly important on steep slopes, in areas where highly erodible soil horizons will be exposed, and if the area will be bare during high intensity rains. It may be necessary to establish temporary vegetative or other protection on areas that would otherwise be bare but remain unworked for long periods during construction.

ii) When planning roads and general levelling operations for building sites etc., steep slopes should be avoided as much as possible to reduce the amount of cut and fill needed. Aligning roads just off the contour in steep areas assists with surface drainage of the roads.

iii) Topsoil and subsoil should be handled separately and placed in separate stockpiles (if stockpiling is necessary). Stockpiles should not be established within flood zones or in drainage lines, and if they are to remain unworked for long periods they should be protected by establishing a vegetative or other cover.

iv) Adequate compaction of soil used for backfilling trenches, for fill batters and for general fill operations is necessary for short and long term stability. Allowance should be made for settlement of fill material where settlement could damage structures or interfere with surface drainage.

17. B Horizon Emerson Dispersion and Slaking Class

Dispersion and slaking are important for their influence on the erodibility of a soil. This is particularly important in construction activities where the B horizon, or sub-soil, is exposed in cut batters or where the material is used in earth embankments. It can also be important in other uses, such as "paths and tracks', where the area has been denuded of vegetation and possibly some topsoil. A high degree of slaking or dispersibility of soils will lead to soil erosion in these land uses.

In a highly dispersible soil, soil pores may become blocked thus reducing water infiltration and adversely affecting land uses' requiring good drain-age such as effluent disposal.

The problem of a dispersible B horizon may be overcome by careful management such as ensuring batters are well. vegetated.

18. B Horizon Unified Soil Group

The Unified Soil Classification is used by engineers to group soils with similar engineering properties. Such properties include, bearing capacity, drainage characteristics and the amount of shrinking and swelling a soil undergoes as the moisture content changes.

The soils of the area have been grouped according to these engineering properties. Soils having inherent engineering problems increase construct-ion costs.

19. B Horizon Shrink-Swell

Shrink-swell is a percentage measurement of how much a soil increases and decreases in volume when wet and dry respectively. These measurements were made on soil from the B Horizon.

Shrink-swell influences the capability for land uses which require a table foundation such as roads or buildings. Buildings and roads may shift or crack if constructed on soil, which undergo large changes in volume when wetting or drying.

A high shrink-swell value requires special construction techniques such as laying a deeper than usual road paving or using a concrete slab rather than strip footings for dwelling construction.

20. Slumping of Batters

Batters are man made earthern slopes. A knowledge of the stable angle (angle of repose) for the material involved is necessary for good management.

Slumping problems will increase in some areas because of low soil strength when wet and/or greater seepage. The increased mass of saturated soil increases the risk of slumping.

As with erosion hazard these problems can be overcome with careful management.

21. Erosion Hazard

Erosion can cause serious damage during building construction and on areas denuded of vegetation, such as picnic grounds unsealed roads, cropland and overgrazed areas. Sedimentation of water courses and pollution of the water are also undesirable consequences of erosion. Most erosion can be prevented by correct management. However, the greater the potential erosion hazard, the greater will be the level of management required.

22. Flood Hazard

Flood hazard is an important factor in terms of human safety, damage to property and general inconvenience. Thus flood prone land should not be used for capital intensive uses, but may be capable of supporting extensive land uses such as grazing.

In some areas the problem may be overcome by building levee banks or retarding basins. Some change in flooding characteristics may be possible by special management aimed-at delaying surface runoff. However, when dealing with large catchments, the problem can be regarded as a long term hazard and a permanent limitation.

v) Where revegetation of bared areas is to be undertaken, the following measures should be followed, as appropriate:-

(a) The surface of the subsoil should be loosened and/or roughened (e.g. by scarifying on broad areas, or by saw-tooth finish of cut batters) prior to topsoil spreading.

(b) Topsoil should be moist when spread, (i.e. neither too pet nor dry), and depths of about 5 to 10 cm are probably sufficient in most cases; deeper layers of topsoil may slump on steep slopes.

(c) The area should be sown with grasses & legumes. Specific recommendations for seed and fertiliser mixtures can be provided by SCA district offices. Autumn sowings are generally most successful for establishing vegetation with minimum management inputs such as follow-up watering or re-seeding.

(d) In critical areas (e.g. batters, steep areas, drainage lines) early stability can be assisted by chemical and/or organic mulches.

(e) Follow-up waterings, fertilizing and mowing may be necessary to establish and maintain a persistent and dense vegetative cover.

vi) Construction traffic should be confined where possible, to existing or proposed road alignments. Drainage line crossings which are to remain when construction activities have concluded should be established as early as possible. If it is necessary to cross, drainage lines at other than sites where permanent crossings are to be established, temporary culverts or causeways should be established.

vii) Measures should be undertaken to prevent construction traffic depositing soil onto roads outside the construction site.

viii) Roads, parking areas, footpaths and driveways should be paved as early as practical.

ix) Control of drainage by either temporary, or preferably permanent works is necessary from the start of construction. Interception banks and/or channels should be used to divert upslope drainage away from bared areas. This is particularly important for cut or fill batters. Cut-off drains to intercept ground-water flow maybe required above cut batters. Berm drains should be installed on high batters. Cross drains and/or channels and/or pipes should be established as necessary within the construction area to prevent the uncontrolled concentration of surface drainage.

x) Drains should be designed and should discharge in a manner that will not cause scouring and erosion. Pipes or. paved or grassed channels may be needed to convey water down steep slopes and batters. Prevention of erosion from drain outlets may require level-spreaders, and concrete or rip rap aprons.

xi) The increased flows that usually accompany development of an area and the possible need to stabilise natural waterways should be allowed for in planning and construction. The increased flows maybe modified by using

grassed waterways, sediment/retardation basins and overland flow rather than concrete pipes and channels.

xii) The settleable fraction of eroded material in water draining bared areas should be removed by passing the water through sediment basins or, over grass filter-strips, or by other means before it enters natural waterways or underground drains, or damages down-elope land or structures. Sediment removal is generally easier if only small volumes of water are involved. Reducing the time between installing pipes and completing drainage pits and inlets, and providing temporary inlet protection during construction will significantly reduce the sediment load leaving a construction site.

xiii) Construction tracks, borrow pits and other temporary works that involve land disturbance should have similar drainage control, surface stabilization and sediment control measures to those used for permanent structures and works. Once they are no longer required for construction, the areas should be re-instated and stabilized. Careful planning and design may enable temporary works to become a permanent feature - for example a sediment basin could become a water trap in a golf course or a lake in an urban park.

B. General recommendations for agricultural activities

i) As far as practicable areas of different capability should be treated as separate management units. This may involve fencing to facilitate control of grazing.

ii) Natural waterways should be carefully managed. In grazing areas, waterways which receive substantial flows should be excluded from grazing; in cropping areas such waterways should not be cultivated.

APPENDIX 4 – GLOSSARY

AERIAL PHOTO INTERPREPATION: The science of identifying and describing land images on aerial photograph.

ALLUVIUM: Material such as sand, silt or clay deposited on land by streams.

AVAILABLE WATER: The portion of water in a soil that can be readily absorbed by plant roots.

BATTERS: Sloping earthen surfaces produced when excavations or embankments are made, for example: when a road is cut into a slope or where it is built up to cross a depression.

BEDROCK: he solid rook that underlies the soil and other unconsolidated material or that which is exposed at the surface.

BOULDERS: Rock fragments larger than 60 cm in diameter.

CALCAREOUS SOIL: A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce visibly when treated with cold, diluted hydrochloric acid.

CLAY: As a soil separate the mineral soil particles less than 0.002 millimeter in diameter. As a soil texture class, soil material that is 40% or more clay, less than *45%* sand, and lees than 40% silt.

DISPERSIBLE CLAY: Clay particles which can move out of soil aggregates into colloidal suspension.

GRAVEL: Rounded or angular fragments of rock ranging from 2 mm to 75 mm in diameter.

GRAVELLY SOIL: Material from 15 to 50% by volume as rounded or angular rock fragments.

GULLY EROSION: Erosion of soil or soft rock material by running water that forms distinct channels that are larger and deeper than rills and that usually carry water only during and immediately after heavy rain.

HARDSETTING: A soil layer that becomes very hard on drying - particularly applying to topsoil.

HORIZON (SOIL): A soil horizon is a layer of soil approximately parallel to the surface having distinct characteristics produced by soil forming processes. It is one of the layers of soil that make up the soil profile.

INFILTRATION: The downward entry of water into the soil.

LAND COMPONENT: A land component is an area of land, distinct from surrounding terrain, having an integrated assemblage of particular classes of geological material, landform, soil and native vegetation.

LAND SYSTEM: A land system is an area of land, distinct from . surrounding terrain, within which there are particular - classes of land characteristics and maximal covariance between them, expressed as a recurring sequence of particular land components. The land components generally occur in similar proportions, and have similar interrelationships in each occurrence of a particular land system.

LIGHT TEXTURE SOIL: Sand and loamy sand.

LIQUID LIMIT: The minimum percentage (by weight) of moisture at which a small sample of soil will barely flow under a standard treatment. Synonymous with "upper plastic limit". See plastic limit and plasticity index.

LOAM: Soil material that is 7 to *27%* clay particles, 28 to 50% silt particles and lees than 52% sand particles.

MOTTLING, SOIL: Irregular patches of different colours that vary in number and size. Mottling generally indicates poor aeration and impeded drainage.

ORDOVICIAN: Geological age - 500 to 435 million years ago.

PARENT MATERIAL OR PARENT ROCK: The unconsolidated and more or less chemically weathered mineral or organic matter from which the solum of soils is developed by pedogenic processes.

PARTICLE SIZE ANALYSIS: Determination of the various amounts of different size separates in a soil sample, usually by sedimentation and/or sieving.

PEDS: An individual natural soil aggregate.

PERCENT SLOPE: The vertical distance over the horizontal distance multiplied by 100. 20% slope is the equivalent of 1 vertical unit to 5 horizontal units.

PERMEABILITY SOIL: The ease with which gases, liquids, or plant roots penetrate or pass through a bulk mass of soil or a layer of soil.

pH: A numerical designation of acidity and alkalinity in a soil.

PLAIN: Any flat area, large or small, having few if any prominent surface irregularities.

PLAIN, SLIGHTLY DISSECTED: Any flat area intersected by shallow widely spaced valleys.

PLAIN, CLOSELY DISSECTED: Any land surface having a gradual succession of rounded hills or undulations, i.e. intersected by deep, closely spaced valleys.

PLASTIC LIMIT: The minimum moisture percentage by weight at which a small sample of soil material can be deformed without rupture. Synonymous with "lower plastic limit". See liquid limit and plasticity index.

PLASTICITY INDEX: The numerical difference between the liquid and the plastic limit or, synonymously, between the lower plastic limit and the upper plastic limit.

PLATEAU: An elevated plain, limited on at least one side by an abrupt descent (more than 150 metres in height).

PROFILE, SOIL: A vertical section of the soil extending through all its horizons and into the parent material.

ROCK SIZE: Record of average size of largest dimension.

SALTING: Harmful accumulation of salts in the soil.

SELF-MULCHING SOIL*:* A soil in which the surface layer becomes so well aggregated that it does not cruet and seal under the impact of rain but instead serves as a surface mulch upon drying. Such soils often occur on expansive clays.

SLOPE: The inclination of the land surface from the horizon.

SLAKING: Breakup of soil aggregates into micro-aggregates when wetted.

SODIC SOIL*:* a) A soil containing sufficient exchangeable sodium (salt) to interfere with the growth of most crop plants.

b) when sodium comprises more than *5.5%* of exchangeable cations within the bottom of the solum.

SOIL: The unconsolidated mineral material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

SOIL STRUCTURE: The combination or arrangement of primary soil particles into secondary aggregates, or peds.

SOIL TEXTURE: The relative proportion of sand, silt and clay particles in a mass of soil.

SOLUM: The upper and most weathered part of the soil profile; the A and B horizons.

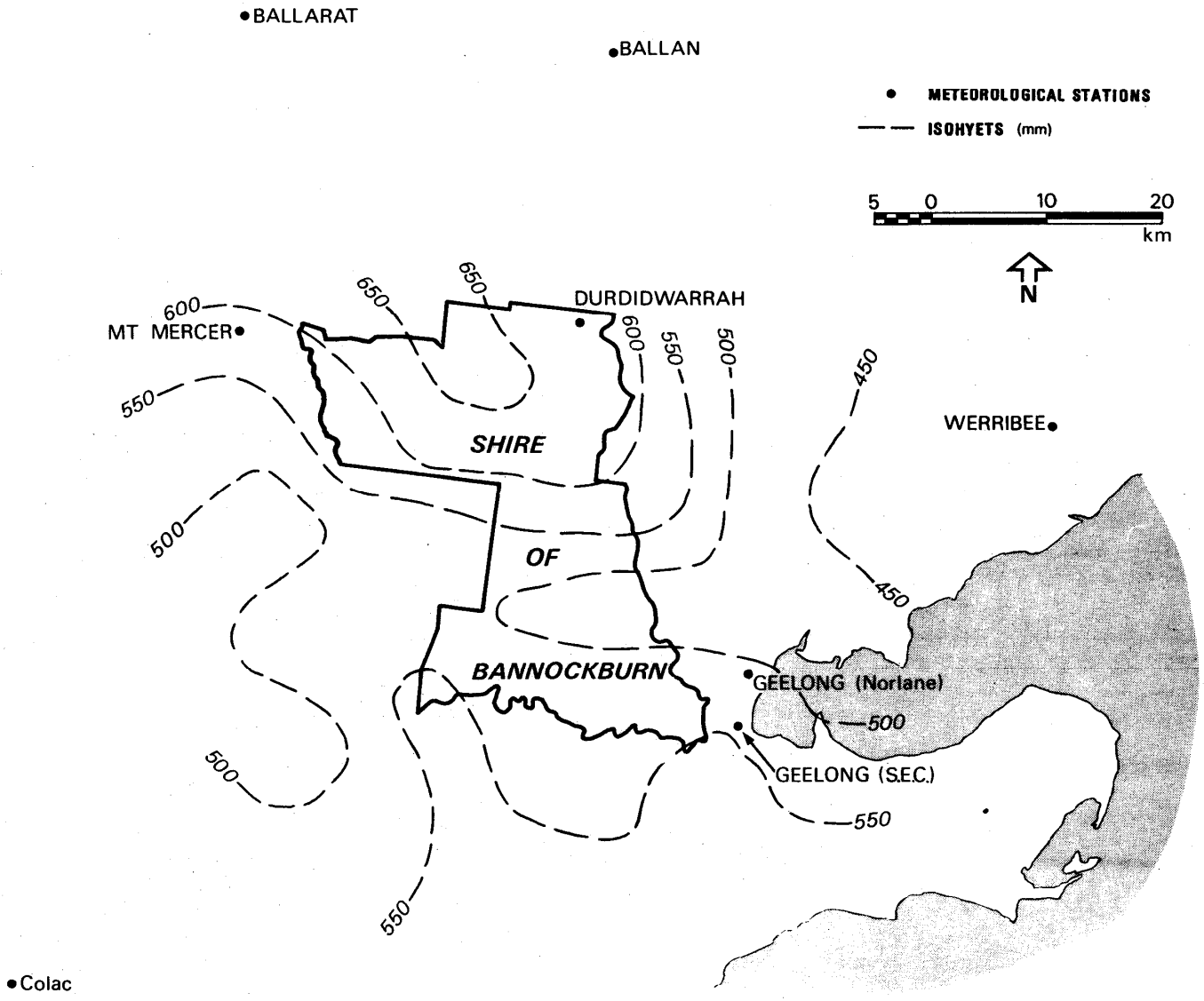
STONY RISE: Steep-sided, meandering, lava flows with rough, blocky surfaces.

STONY SOIL: A soil containing more than 15% by volume of solid fragments more than *75* mm in diameter.

WATER TABLE: The upper surface of ground water or that level below which the soil is saturated with water; locus of points in soil water at which the hydraulic pressure is equal to atmospheric pressure.

WATER TABLE PERCHED: The water table of a saturated layer of soil which is separated from an underlying saturated layer by an impermeable unsaturated layer.

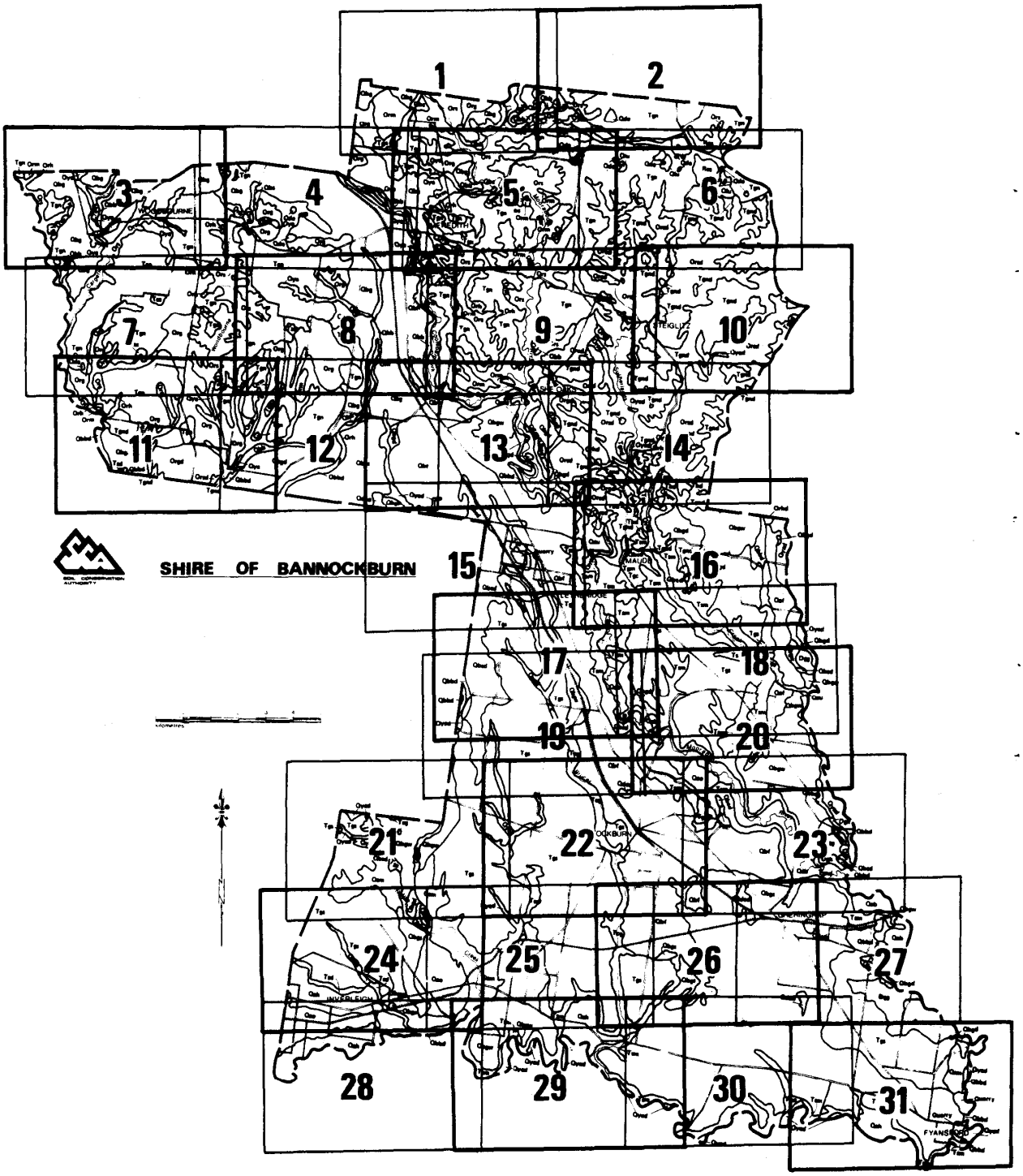
APPENDIX 5 – RAINFALL & METEOROLOGICAL STATIONS



LAND SYSTEM & COMPONENT NAMES

SYMBOL	NAME
Qbg	PLAINS WITH DUPLEX SOLIS ON QUATERNARY BASALT.
Qbgd	PLAINS WITH DUPLEX SOILS ON QUATERNARY BASALT. DRIER THAN Qbg.
Qbgw	PLAINS WITH DUPLEX SOILS WITH A SANDY A HORIZON ON QUATERNARY BASALT.
Qbf	PLAIN WITH CLAY SOILS AND DUPLEX SOILS ON QUATERNARY BASALT.
Qbgs	STONY PLAINS WITH DUPLEX SOILS ON QUATERNARY BASALT.
Qbs	STONY RISES WITH GRADATIONAL SOILS ON QUATERNARY BASALT.
Qbsd	STONY RISES WITH GRADATIONAL SOILS ON QUATERNARY BASALT. DRIER THAN Qbs.
Qah	TERRACES WITH DUPLEX AND VARIABLE UNIFORM TEXTURED SOILS ON QUATERNARY ALLUVIUM.
Qya	TERRACES WITH VARIABLE SOILS ON QUATERNARY SEDIMENTS.
Qyad	TERRACES WITH VARIABLE SOILS ON QUATERNARY SEDIMENTS. DRIER THAN Qya.
Qau	HIGHER TERRACES WITH DUPLEX SOILS ON QUATERNARY AND ORDOVICIAN SEDIMENTS.
Qab	TERRACES WITH UNIFORM TEXTURED SOILS ON HOLOCENE SEDIMENTS.
Qaf	FAN-PLAIN WITH MIXED UNIFORM AND DUPLEX SOILS ON QUATERNARY SEDIMENTS.
Qsm	VALLEY FLOOR WITH UNIFORM AND DUPLEX SOILS ON MIXED PARENT MATERIALS.
Qbc	PLAINS WITH CLAY SOILS ON QUATERNARY BASALT.
Qbcd	PLAINS WITH CLAY SOILS ON QUATERNARY BASALT. DRIER THAN Qbc.
Qde	DEPRESSIONS WITH HEAVY CLAY SOILS ON RECENT SEDIMENTS.
Qded	DEPRESSIONS WITH HEAVY CLAY SOILS ON RECENT SEDIMENTS. DRIER THAN Qde.
Qbb	STEEP-SIDED VALLEYS WITH DUPLEX SOILS ON QUATERNARY BASALT.
Qbbd	STEEP-SIDED VALLEYS WITH DUPLEX SOILS ON QUATERNARY BASALT. DRIER THAN Qbb.
Qlu	LAKESIDE SANDRIDGE WITH UNIFORM SAND SOILS ON RECENT WIND BLOWN DEPOSITS.
Qao	PLAINS WITH DUPLEX SOILS ON QUATERNARY, OR OLDER, SEDIMENTS.
Tgn	PLAINS WITH DUPLEX SOILS ON TERTIARY SEDIMENTS.
Tgnd	PLAINS WITH DUPLEX SOILS ON TERTIARY SEDIMENTS. DRIER THAN Tgn.
Tgs	PLAINS WITH DUPLEX SOILS ON TERTIARY SEDIMENTS - SOUTH OF MAUDE.
Tgc	PLAINS WITH DUPLEX SOILS ON TERTIARY CALCAREOUS CLAY.
Tbd	SLOPES WITH CLAY SOILS ON TERTIARY BASALT.
Tgm	SLOPES WITH VARIABLE CLAYEY SOILS ON MIXED TERTIARY LIMESTONE AND BASALT.
Tsm	STEEP VALLEY SIDES WITH CLAY SOILS ON VARIABLE PARENT MATERIAL.
Tcg	STEEP VALLEY SIDES WITH DUPLEX SOILS ON VARIABLE TERTIARY SEDIMENTS.
Tsc	IRREGULAR SURFACES WITH SHALLOW UNIFORM TEXTURE SOILS ON TERTIARY SEDIMENTARY ROCK.
Tsd	VALLEY SIDE WITH DUPLEX SOILS ON TERTIARY SEDIMENTS.
Dgg	PLAINS AND RISES WITH DUPLEX SOILS ON DEVONIAN GRANITE.
Dgh	SLOPES WITH DUPLEX SOILS ON DEVONIAN GRANITE.
Org	PLAINS WITH DUPLEX SOILS ON ORDOVICIAN SEDIMENTARY ROCK.
Orgd	PLAINS WITH DUPLEX SOILS ON ORDOVICIAN SEDIMENTARY ROCK. DRIER THAN Org.
Orcd	BROAD RIDGE TOPS WITH DUPLEX SOILS ON ORDOVICIAN SEDIMENTARY ROCK.

SYMBOL	NAME
Orm	MODERATE SLOPES WITH DUPLEX SOILS ON ORDOVICIAN SEDIMENTARY ROCK.
Orh	HILLS WITH GRADATIONAL SOILS ON ORDOVICIAN SEDIMENTARY ROCK.
Orhd	HILLS WITH GRADATIONAL SOILS ON ORDOVICIAN SEDIMENTARY ROCK. DRIER THAN Orh.
Ors	STEEP HILLS WITH GRADATIONAL SOILS ON ORDOVICIAN SEDIMENTARY ROCK.
Orsd	STEEP HILLS WITH GRADATIONAL SOILS ON ORDOVICIAN SEDIMENTARY ROCK. DRIER THAN Ors.



INDEX MAP TO PHOTO MOSAICS

ADDITIONAL MAP SYMBOLS

sa	Sand sheets or dunes
st	Surface stones
i	Ironstone gravels
g	Other gravels
salt	Salt affected areas

Not all areas of the above have been marked on the map. The areas that are marked represent the beginning of an inventory - particularly with respect to salting.