QUEENSLAND
DEPARTMENT
OF PRIMARY
INDUSTRIES
QV88003

LAND RESOURCES BULLETIN

PLANE CREEK SUGAR CANE LAND SUITABILITY STUDY

A. K. Wills
Land Resources Branch
and D. E. Baker
Agricultural Chemistry Branch

Department of Primary Industries
Queensland Government

Queensland Government Technical Report

For information about this report contact soils@qld.gov.au

Queensland Department of Primary Industries
Land Resource Bulletin QV88003

PLANE CREEK SUGAR CANE
LAND SUITABILITY STUDY

A. K. Wills
Land Resources Branch

and

D. E. Baker
Agricultural Chemistry Branch

Department of Primary Industries, Queensland Government
Brisbane 1988

ISSN 0811-9007

AGDEX 524

This publication was prepared for Queensland Department of Primary Industries officers. The contribution of operating funds from the Bureau of Sugar Experiment Stations for the conduct of this study is gratefully acknowledged.

Queensland Government

Queensland Department of Primary Industries
GPO Box 46
Brisbane 4001.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

MAPS

Summary

- Suitable existing or potential canelands should be retained as far as possible for cane growing, or other agriculture if applicable. Non-agricultural land uses should be located in areas already zoned non-rural or in areas classed as unsuitable for sugar cane.

- Further agricultural development on to coastal plains should be preceded by a comprehensive drainage scheme.

- More research into salinity/sodicity is needed.

- Soil erosion on sloping canelands is manageable and can be treated by using soil conservation measures. Erosion from non-agricultural sources is serious and should be treated progressively as an inherent part of the main activity.

- Decisions to diversify out of cane should be cognisant of land resource characteristics and limitations as they affect the crop concerned.

- The higher risk of land degradation from subdivision into hobby farms should be recognised, and land users should be made aware of official concern and the fact that advice and assistance are available to minimise off-site impacts.

- The Plane Creek Land Use Action Committee should continue to meet regularly after the release of this report, and should refer to it on any issue affecting agricultural land use.

Glossary and Abbreviations

ATM	Australian Transverse Mercator - an Australian standard geographic grid reference system.
BSES	Bureau of Sugar Experiment Stations (with stations at Sarina and Te Kowai, Mackay).
debil-debil	Recurring patterns of relatively steep-sided, flat-topped hummocks, rising above a planar surface.
dunder	Effluent from ethanol production.
PCLUAC	Plane Creek Land Use Action Committee (see Section 6.3.5).
UMA	Unique map area, an area identified by a number and individually described on a computer file in terms of soils, topography, geology and land use factors.

1. INTRODUCTION

The Plane Creek Sugar Cane Land Suitability Study (hereinafter referred to as the Plane Creek Study) is one of a series of Land Resources Branch studies being carried out on behalf of the Queensland sugar industry. It follows the Mackay Sugar Cane Land Suitability Study (hereinafter referred to as the Mackay Study) and has closely similar aims. A related study was also completed for the Proserpine lowland area in 1981 (Thompson, Baker and Cannon).

These studies were instigated in the late 1970s as a result of the demand for land for cane expansion, and the concurrent loss of cane land to urban expansion. The need for an objective land inventory, showing areas of importance to the sugar industry, was evident; so that the cumulative impact of the steady loss of agricultural land would be more apparent to local authorities.

The Mackay Study was started in 1979 and the report published six years later (Holz and Shields 1985). The Plane Creek Study was started in 1981. Prior to publication, much of the preliminary data from both studies has been used for Shire Plans, environmental impact studies, and in decisions made by the Central Sugar Cane Prices Board.

Although sugar industry fortunes have changed since the start of the studies, the survey data now available are still of value in determining the best areas for land use change and for alternative land uses. Land use issues have been regularly discussed at meetings of the Mackay Land Use Committee and the Plane Creek Land Use Action Committee over the duration of the surveys.

The Plane Creek Study is designed to be as compatible as possible with the Mackay Study, but the report is intended to be an independent document providing all that is required for land use planning purposes in the study area. While addressing the same topics as the Mackay Study, it does so in a concise format to avoid unnecessary duplication. Readers interested in detailed explanation and discussion are directed to the Mackay Study report, and references to it are given in this report.

1.1 Aims of the study

The main aim of the Plane Creek Study is to carry out a cane land suitability survey of the Plane Creek Mill Area and adjacent lands. The findings of the survey are then to be assessed in relation to existing land use, and are to provide the basis for land use recommendations. Maximum compatibility with the Mackay Study is a further aim.

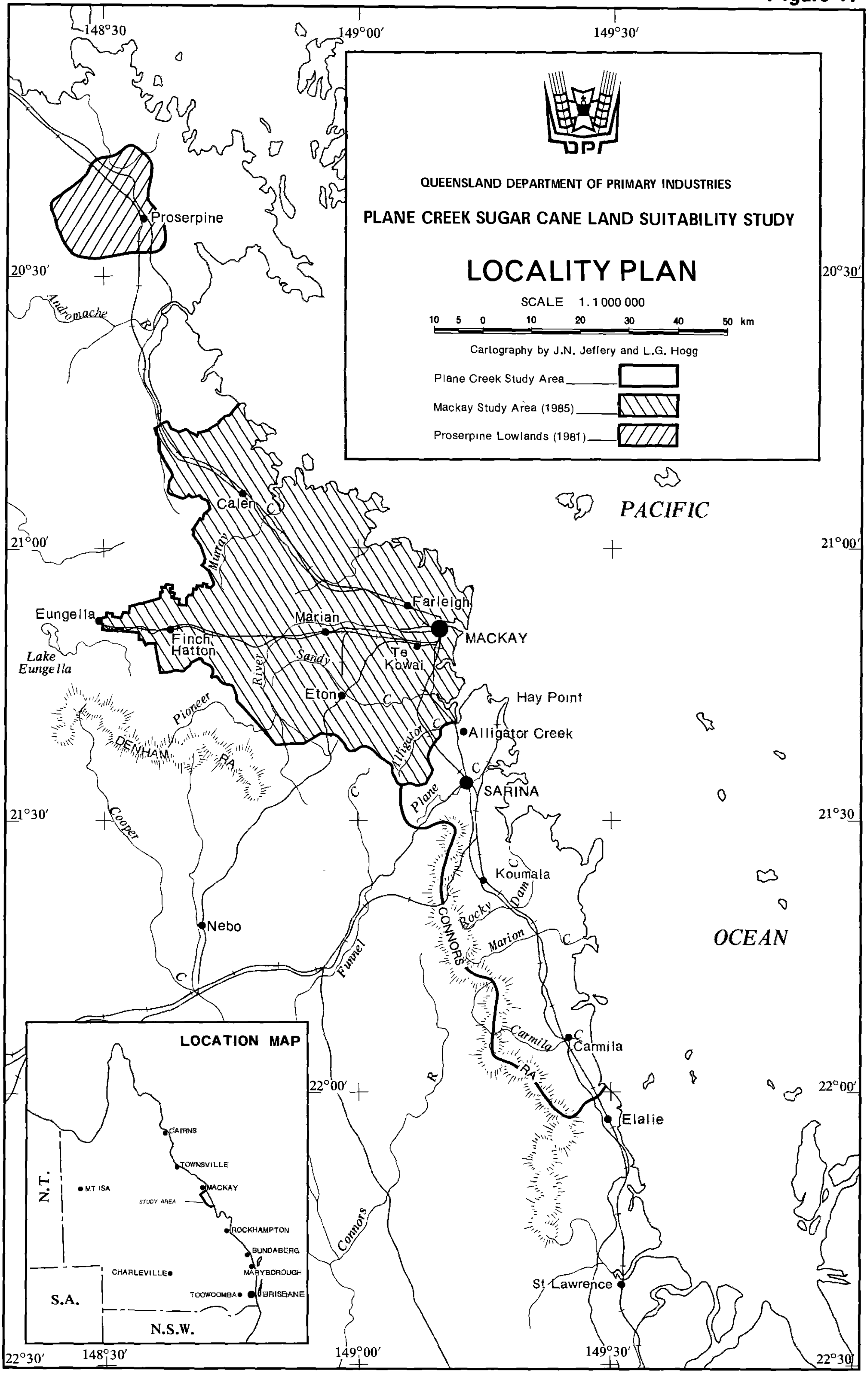
1.2 The study area

The study area adjoins the Mackay Study area at Alligator Creek north of Sarina, and extends southwards to Bluewater Creek between Flaggy Rock and Clairview. The eastern limit is the coastline and the western limit the Connors Range watershed.

The total area is 161 650 ha. When the mountain ranges, coastal salt flats, and urban/industrial land are deducted, the area with agricultural or pastoral potential totals 63 000 ha.

Figure 1 shows the location of the study area and its relationship to the Mackay Study. Significant centres are Sarina where the Plane Creek Mill is located, at the northern extremity of its supply area; and Hay Point, an expanding port complex with other industrial projects planned for its vicinity.

Figure 1.



D.P.I. Ref. No. 85-87-P2571

2. PHYSICAL RESOURCES

This section covers climate, geology, landforms, hydrology and vegetation. Soils are excluded as they form Chapter 4 on their own.

The study area's climate is seasonal with mild, dry winters and hot, wet summers. A wide range of tropical and sub-tropical crops could be grown in the area, but soils and drainage reduce the agricultural possibilities severely.

There are four main lithological units in the area, from volcanics of the Upper Devonian - Lower Carboniferous, through sediments and conglomerates, to intrusives of the Carboniferous-Mesozoic eras. These have eroded to produce a variety of depositional land types. The main landform subdivisions are the sub-coastal mountains and the coastal plains, broken up by discontinuous coastal ranges and enclosed alluvial plains. Hydrologically, the area is a series of short coastal streams.

Vegetation in the study area is generally disturbed except in inaccessible country. However there are enough relict trees and regrowth to enable a reconstruction of the common species making up major communities, although many smaller and more fragile species from the undisturbed areas would now be lost.

2.1 Climate

The climate of the study area features a strong seasonal contrast between a hot, rainy summer half-year and a relatively dry cooler season. The climate is classified as Cwa according to the Koppen system (Koppen and Geiger 1936) modified by James (1966) and applied to Australia by Dick (1975), that is, rainy climates with mild, dry winters and a hot summer. On this basis it compares with southern China, southern Florida, Uruguay and the southern extremity of Brazil, and the southern parts of Mozambique (Trewartha, Robinson and Hammond 1967). Other classifications using pattern analysis techniques indicate that similar climate is experienced on the Mozambique coast between Vilanculos (22°S) and Mossuril (15°S) (Russell and Moore 1976).

2.1.1 Rainfall, evaporation and relative humidity

The median annual rainfall for Sarina is 1596 mm (Bureau of Meteorology, data print-out, Brisbane 1980) and for Koumala 1383 mm (Bureau of Meteorology and Australian Water Research Council 1968). A 15-year unofficial record from Carmila West has been standardised to correspond with the two official records and indicates median annual rainfall of 1590 mm. The distribution of rainfall is strongly seasonal with over 70% received from December to March inclusive (see Figure 2.1). The spatial distribution of rainfall is variable, depending on distance from the sea and elevation (Wills and Young 1982). Centres close to the sea have higher rainfall but lower intensity due to more rain days. Rainfall declines inland except where hills cause uplift and induce orographic rainfall. Because of topographic factors around Carmila West, which may affect rainfall, the Koumala rainfall distribution is considered more typical of what can be expected on the coastal plains south from Sarina.

Official Class A Pan evaporation data are available only for Te Kowai (BSES, Mackay). These are superimposed on the Koumala diagram in Figure 2.1 to allow comparison of rainfall against evaporation. A simple water budget shows periods of water deficiency (see Table 2.1). It indicates that October is normally the month of highest water deficit and March the month of highest water surplus.

The mean relative humidity at Te Kowai varies from a maximum in February, of 77% at 9 a.m. and 70% at 3 p.m., to a minimum in September, of 60% at 9 a.m. and 52% at 3 p.m. (Bureau of Meteorology 1975a).

Table 2.1. Annual water budget - Koumala (mm)

	J	F	M	A	M	J	J	A	S	O	N	D
Median rainfall[1]	178	239	188	44	40	41	15	10	14	45	67	124
Median evaporation[2]	195	158	163	145	119	104	114	142	185	226	215	233
Water deficit	17	0	0	12	79	63	99	132	171	181	148	109
Change	0	+64	+25	-89	0	0	0	0	0	0	0	0
Storage	0	64	89	0	0	0	0	0	0	0	0	0

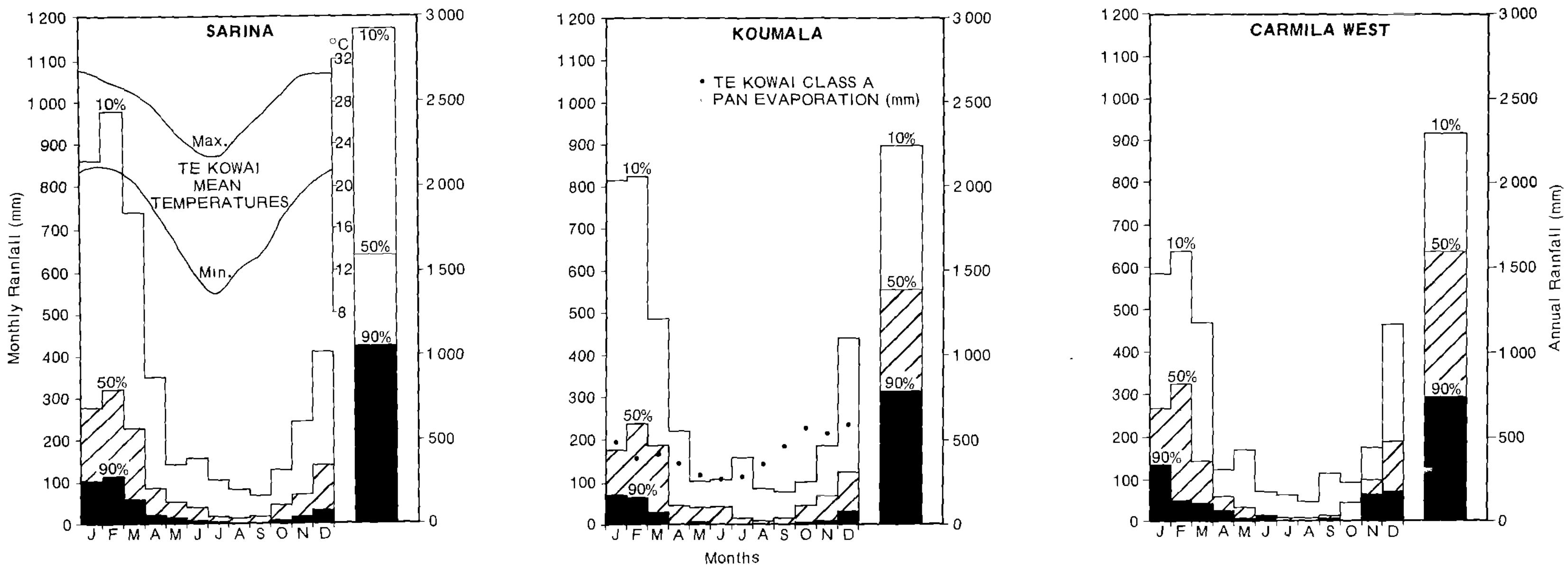
Source: 1. Review of Australia's Water Resources, Bureau of Meteorology and Australian Water Resources Council (Melbourne 1968).

2. Bureau of Meteorology, data print-out, 26/10/82.

2.1.2 Temperature, radiation and cloud

The nearest temperature data available are for Te Kowai. These data are superimposed on the Sarina diagram in Figure 2.1 and show a normal annual cycle from a maximum in December/January to a minimum in July.

Average daily radiation is affected by the angle of the sun and cloud cover. The following figures are interpolated from small scale maps (Bureau of Meteorology 1975b).



(Percentage figures indicate probability of exceeding the monthly and annual rainfall values shown)

Figure 2.1 CLIMATIC DIAGRAMS

Table 2.2. Average global radiation (mWh cm-2)

Jan	Apr	Jul	Oct
625	525	415	670

Cloud cover is also interpolated from small scale maps (Bureau of Meteorology 1979a).

Table 2.3. Median cloud cover in oktas (eighths of sky covered)

	Jan	Apr	Jul	Oct
9 a.m.	6<	3<	1	3<
3 p.m.	5-6	4<	<2	2-3

2.1.3 Wind

The nearest wind recording centre is at Mackay where winds are predominantly south-easterly. The following table is derived from published wind roses for Mackay (Bureau of Meteorology 1979b). Figures in brackets are the percentage of calms observed.

Table 2.4. Prevailing winds - Mackay

	Jan	Apr	Jul	Oct
9 a.m.	SE (8)	S-SE (4)	S (6)	SE-NE (2)
3 p.m.	SE-NE (1)	SE (0)	SE (0)	ENE (0)

2.1.4 Agroclimatology

The traditional agricultural pursuits of the district have been selected to suit the local climate as well as soils, landform, drainage and other factors. Where weather factors diverge from the optimal regime, a crop becomes vulnerable. A major part of agricultural research is aimed at evolving characteristics which will counter these vulnerabilities, or at developing management practices which lessen the risks from abnormal weather patterns. The main agricultural activities of the district are discussed below in this context.

Sugar-cane. Sugar-cane is a tropical plant which grows best under abundant rainfall and sunlight, and in high temperatures. Cane may be grown outside the tropics by extending the growth and maturation phase beyond the annual cycle and by selecting tolerant cane varieties which extend its range.

The Central District which includes the Plane Creek Mill Area lies sufficiently within the tropics for an annual cycle of production to be the norm. Rainfall is the main limiting factor and this has resulted in the Eton Irrigation Scheme which is now nearing completion, its southern extremity extending into the Plane Creek Mill Area.

Other parts of the Plane Creek Mill Area have sufficiently variable rainfall to warrant supplementary irrigation. These areas are detailed in Table 6.1. A study of irrigation responses was carried out for a number of mill areas including Plane Creek. Results for Plane Creek suggested that there was a response of 0.415 tonnes sugar per 100 mm (0.107 tons of sugar per inch) of irrigation applied in the February/March period. No significant response was noted for other times (White 1970). For the Mackay district generally, water applied prior to October has little effect on yields once the plant or ratoon crop has been satisfactorily established (Leverington 1971).

The only other factor which occasionally limits cane growth is frost, and this is very infrequent. The areas which are prone to frost are well known (McAleese 1964) and they are generally inland, alluvial flats where cold air collects on still, clear nights in midwinter. Cane quarantine plots west of the Connors Range are prone to more frequent frost damage.

Overcast weather may occasionally restrict cane growth by reducing sunlight.

Excessive rainfall and flooding seldom affect cane growth, although prolonged waterlogging can be harmful (Ridge 1972), but they can have a serious effect on harvesting and accessibility. If cane lodges (falls over) due to excessive wetness, some crop is lost and quality is affected. Unseasonal rains can restrict access at critical times for fertilising, cultivation or herbicide spraying. Lodging-resistant varieties of cane are available for planting in areas which are prone to wetness, and the problem of accessibility in wet conditions is best overcome by draining and landforming.

Grazing. The main concern of beef producers in the study area is the winter feed gap. This is being tackled by the introduction of practices such as ponding of low-lying coastal areas which support Para grass (*Brachiaria mutica*) through the dry season. Perennial legumes have had limited success and newer introductions of *Aeschynomene spp.*, for example Glenn jointvetch (*Aeschynomene americana* cv. Glenn), are expected to be more persistent through the wet season. The increasing adoption of the fodder shrub *Leucaena leucocephala* is another factor which will reduce the impact of the winter dry period and future droughts.

Weather factors, other than drought, have little effect on livestock industries in the area.

Other crops. Of the crops being considered as alternative sources of income by canegrowers, soybeans and maize are the most favoured.

Soybeans have generally grown well in the Mackay district but harvesting could be difficult in wetter than average years if soil conditions are still saturated in the April-May period. Soybeans need irrigation to ensure growth at critical times.

Maize also needs irrigation if planted in the July/August period. Summer plantings are risky as the crop cannot stand waterlogging.

Tomatoes and cucurbits grow well in the district. Pineapples, papaws and bananas also grow well if well drained. Mangos, lychees and custard apples prefer drier areas with supplementary irrigation.

For speculative crops such as jojoba and aloe vera, the climatic suitability is still unknown. The last five years of weather have been dry generally and extremely dry at times. Such crops have to experience a full range of seasonal variation over a prolonged period before their suitability to the district can be confidently stated.

2.1.5 Weather hazards

Although frost and hail are occasional problems, the main hazard is the tropical cyclone. High winds and heavy rain can cause lodging of sugar cane over large areas, and disrupt harvesting. Cyclones have crossed the coastline of the region six times between 1909 and 1980, compared to four times for the Mackay area. This does not include cyclones which have come close to but have not crossed the coastline.

Although the short term effects of cyclones are adverse, there is a strong argument that their net effect is beneficial due to the major input they make to surface and groundwater reserves.

2.2 Geology

The only published geological map of the area is the Mackay 1:250 000 sheet SF/55-8 of the Bureau of Mineral Resources geological series (Jensen, Gregory and Forbes 1966). This shows broadly the distribution of each rock unit. More recent mapping of the Mackay 1:100 000 sheet has provided more detail and some reclassification. This sheet extends into the study area as far as 21°30'S ;or eight kilometres south of Sarina (Martin, Willmott and O'Flynn, in preparation).

2.2.1 Geological formations

The formations found in the study area are discussed below in order of geological age. In brackets beside each name are given its map symbol and computer code.

Upper Devonian - Lower Carboniferous

. Connors Volcanics (D/Co, DCO)

This formation is described as intermediate flows and pyroclastics, and is lithologically similar to the Campwyn Beds, but without interbedded sedimentary rocks. The major unit of Connors Volcanics is located in the south around Carmila West, and minor intrusions of Urannah Complex are also found there in areas too small to be mapped.

. Campwyn Beds (D-Cc, DCC)

These beds are a thick heterogenous rock unit comprising intermediate, basic and acid volcanic rocks, interbedded with marine sediments, sandstone, siltstone, conglomerate and limestone. The main unit lies between Sarina and Hay Point, with secondary occurrences south of Koumala and in minor coastal outcrops extending almost to Carmila. The western beds of the main unit appear to be modified by the Mount Chelona intrusion.

Lower Permian

. Carmila Beds (Pla, PLA)

The Carmila Beds are the dominant lithic formation in the study area and comprise conglomerate, greywacke, tuff, acid volcanics and shale. Conglomerates are the most characteristic aspect of the formation observable in exposures and the coarse conglomerates noted in the Mackay Study (p 17) are even more prevalent as quarry material throughout the Plane Creek area.

Carboniferous - Mesozoic

. Urannah Complex (C-Mr, CMR)

The intrusive rocks of the Urannah Complex are dominantly granitic. However diorite, grandiorite and acid, intermediate or basic dykes also make up the complex. Significant blocks of this unit occur throughout.

Mesozoic

. Un-named (Mi, MI)

A minor intrusion at Mount Chelona is described as granite, granophyre or dolerite and grouped with larger intrusive outcrops outside the study area at Mount Jukes, Mount Blackwood and Mount Vince. The Mount Chelona outcrop has been more recently described as granodiorite by Martin, Willmott and O'Flynn (in preparation).

Tertiary

- Tertiary sedimentary rocks overlain by Quaternary soil and minor alluvium (Qs/Ta, QSTA)

Tertiary mudstone, siltstone, shale, sandstone and conglomerate are found in consolidated layers and pans below more recent deposition in the lower Rocky Dam Creek area and Devils Flat Creek east of Ilbilbie. Patches of conglomerate and gravels also underlie the Quaternary deposits north and east of Koumala.

- Tertiary volcanics (Tv, TV)

This geological unit is associated mainly with the small islands lying up to 60 km off the mainland. The only mainland occurrence is a small outcrop near Glendower Point.

Quaternary

- Quaternary soil and minor alluvium (Qs, QS)

This unit is concentrated along the coastal plain from Notch Point to the southern limit of the study area.

- Quaternary sand, silt, mud, clay and gravel (Qa, QA)

The major expression of this unit occurs in the flat plains around Alligator Creek which is the southern extremity of the Pioneer valley coastal plain. This unit also includes the coastal salt flats and the river alluvia of upper Rocky Dam Creek and upper Carmila Creek.

- Quaternary dune deposits (Qd, QD)

Sand dunes occur in characteristic locations adjacent to beaches. They are all in the active stage and there are no relict dunefields as found in the Mackay Study area (p 20).

2.3 Landforms

Jensen, Gregory and Forbes (1972) recognised only two physiographic units within the study area, i.e., the coastal lowlands, and the mountainous areas including the Connors Range. At the scale of the Plane Creek study, it is appropriate to subdivide the area further and four major landform units are described. These are:

a. the sub-coastal mountains,
b. discontinuous coastal ranges,
c. coastal plains, and
d. enclosed alluvial plains.

These are illustrated in Figure 2.2.

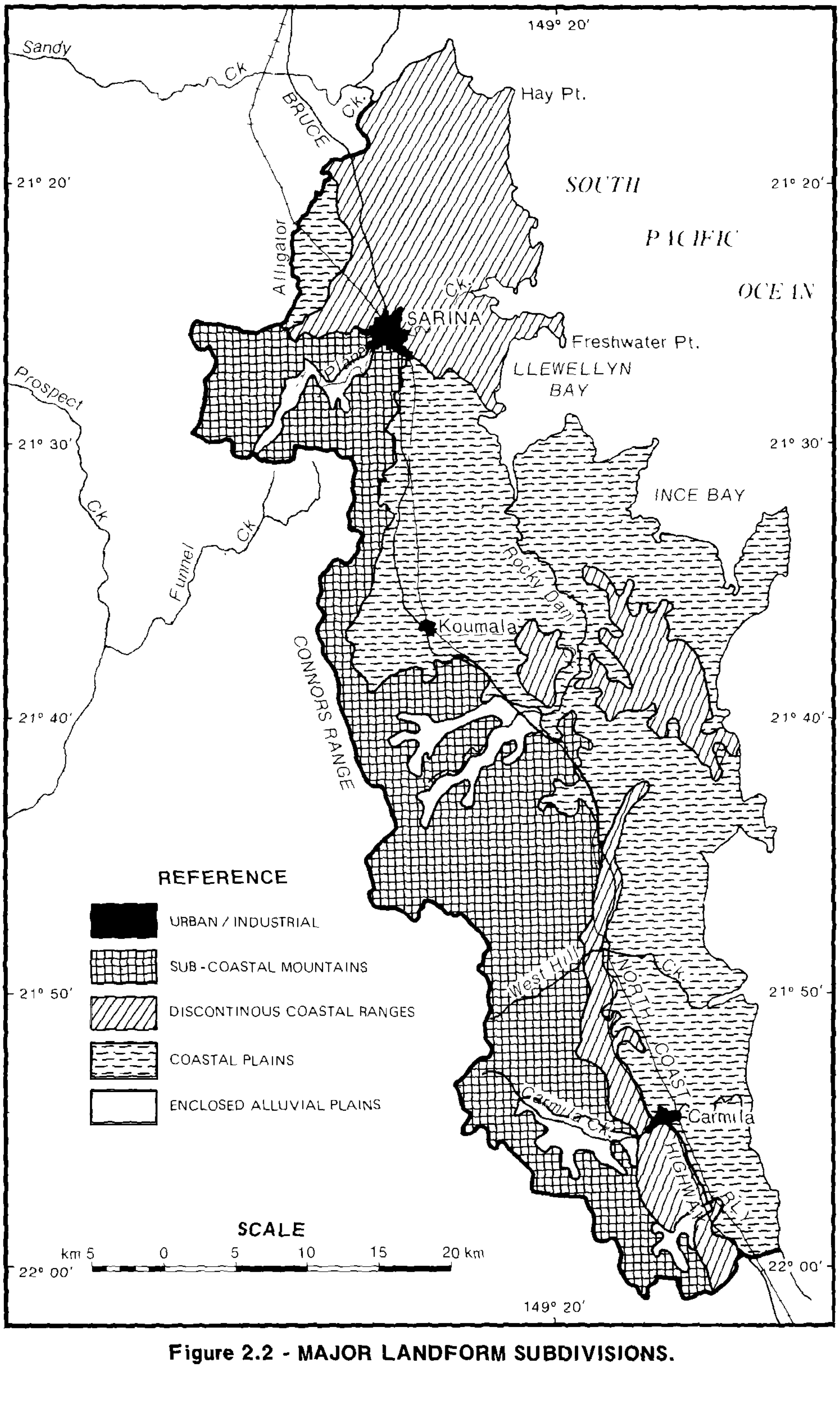


Figure 2.2 - MAJOR LANDFORM SUBDIVISIONS.

2.3.1 The sub-coastal mountains

This landform subdivision comprises the main watershed of the Connors Range and its outlying ridges. Its highest point is Black Mountain (685 m) west of Koumala. Most of the watershed lies between 300 and 500 m elevation. The major outlying ridges extend towards the discontinuous coastal ranges subdividing the Plane Creek catchment from the coastal plains and separating the plains around Koumala from those south of Ilbilbie.

In the north, the geology of the Connors Range is mainly Carmila Beds with Urannah Complex inliers, giving way to Connors Volcanics in the south.

2.3.2 Discontinuous coastal ranges

The main units of this landform subdivision are the Campwyn Beds block and the eastern segment of the Mount Funnel Range. These ranges trend north-west to south-east and their highest elements lie against the geological fault line between Campwyn Beds and Carmila Beds.

The northern block between Sarina and Hay Point is centred on Mount Samourgassi (144 m) although the highest ridge is at the south-western limit with Mount Chelona (204 m) at its centre.

Mount Funnel (344 m) is a very distinctive landform feature at the centre of the Mount Funnel Range.

A low range of hills on Carmila Beds south of Ilbilbie lies against the main watershed and eventually merges with it at Bulls Head Bluff (446 m). The western limit of this block is demarcated by a line of bluffs and scarps from Bulls Head Bluff through De Costa Bluff (454 m) to a line of unnamed west-facing scarps, west of Carmila and Flaggy Rock.

2.3.3 Coastal plains

This landform subdivision comprises three separate areas -

- the plains between Alligator Creek and Splitters Creek at Dawlish,
- the plains around Koumala between Yukan and Karremal, and
- the plains from Mosquito Creek to the southern limit of the area.

These coastal plains are separated from the enclosed alluvial plains on the basis of indicators which suggest that marine rather than fluvial processes have influenced their development. The planar nature of the land surface shows little evidence of slopes formed by existing streams. Even major streams such as Rocky Dam Creek have cut down steeply through the plain, suggesting a eustatic change. Fragments of coral and abundant calcareous nodules at one or two metres depth in coastal plains at Splitters Creek and Bell Creek also suggest recent marine influence.

Studies of sea level change for north-eastern Queensland over the period up to 250 000 years BP have shown a drop in sea level of one to two metres, but nothing of the order necessary to explain the present elevation of coastal lands in the study area (Cook and Mayo 1977, Chappell 1983).

Nevertheless, the existing plains, especially in the south, could be a relict of the higher sea level of an earlier inter-glacial phase.

2.3.4 Enclosed alluvial plains

In contrast to the coastal plains, these alluvial plains are the product of deposition by fluvial process from valley sideslopes. They are typically enclosed valleys and there are four major examples:

- Plane Creek, west of Sarina;
- upper Rocky Dam Creek, west of Mount Christian;
- Carmila Creek, west of Carmila; and
- Flaggy Rock Creek, west of Flaggy Rock.

All these streams flow through constrictions in the discontinuous coastal ranges before flowing out on to the coastal plains.

2.4 Hydrology

Compared to the Pioneer Basin, the catchments of the study area are all relatively small. Even Plane Creek, the largest stream, is only comparable in size to Cattle Creek above Pinnacle, a minor part of the Pioneer catchment. The area is in effect a series of short coastal streams cutting back against the Connors Range, diminishing in size as the range and the coastline converge southwards.

2.4.1 Catchment statistics

For planning purposes, the area has been divided into sub-catchments. The sub-catchment number constitutes the prefix to each UMA number, so that land resource data can be extracted by sub-catchment.

Sub-catchments have been delineated by marking the line of the watershed on airphotos, with the exception of boundaries on coastal plains where no clear watershed is evident. In those cases, lines were drawn equidistant between visible channels draining towards different major watercourses flowing out of the hills.

The sub-catchments are identified in Table 2.5 and their locations are shown in Figure 2.3.

Table 2.5. Sub-catchments of the Plane Creek Mill Area

Catchment No. (UMA prefix)	Description	Area (ha)
1	Alligator Creek, right bank	5 130
2	Bells Creek	4 410
3	Louisa Creek, minor north-flowing creeks	5 890
4	Cabbage Tree Creek to Hay Point	7 570
5	West Plane Creek	5 680
6	Ching Creek, mid Plane Creek	3 170
7	Minor streams, Sarina to Inneston	12 660
8	Tedlands Creek, lower Rocky Dam Creek	6 130
9	Cherry Tree Creek	10 100
10	Three Sisters, northern slopes	2 900
11	Sandy Creek	5 040
12	Upper Rocky Dam Creek	4 040
13	Mid Rocky Dam Creek	10 920
14	Mount Funnel, eastern slopes	17 250
15	Upper Marion Creek	5 610
16	Lower Marion Creek	4 960
17	Coastal plains traversed by Basin Creek, West Hill Creek and Spider Creek	13 500
18	Mountain streams, Koota to Tinerta	13 920
19	Upper Carmila Creek	8 050
20	Lower Carmila Creek	9 270
21	Upper Flaggy Rock Creek	2 870
22	Lower Flaggy Rock Creek to Bluewater Creek	2 580

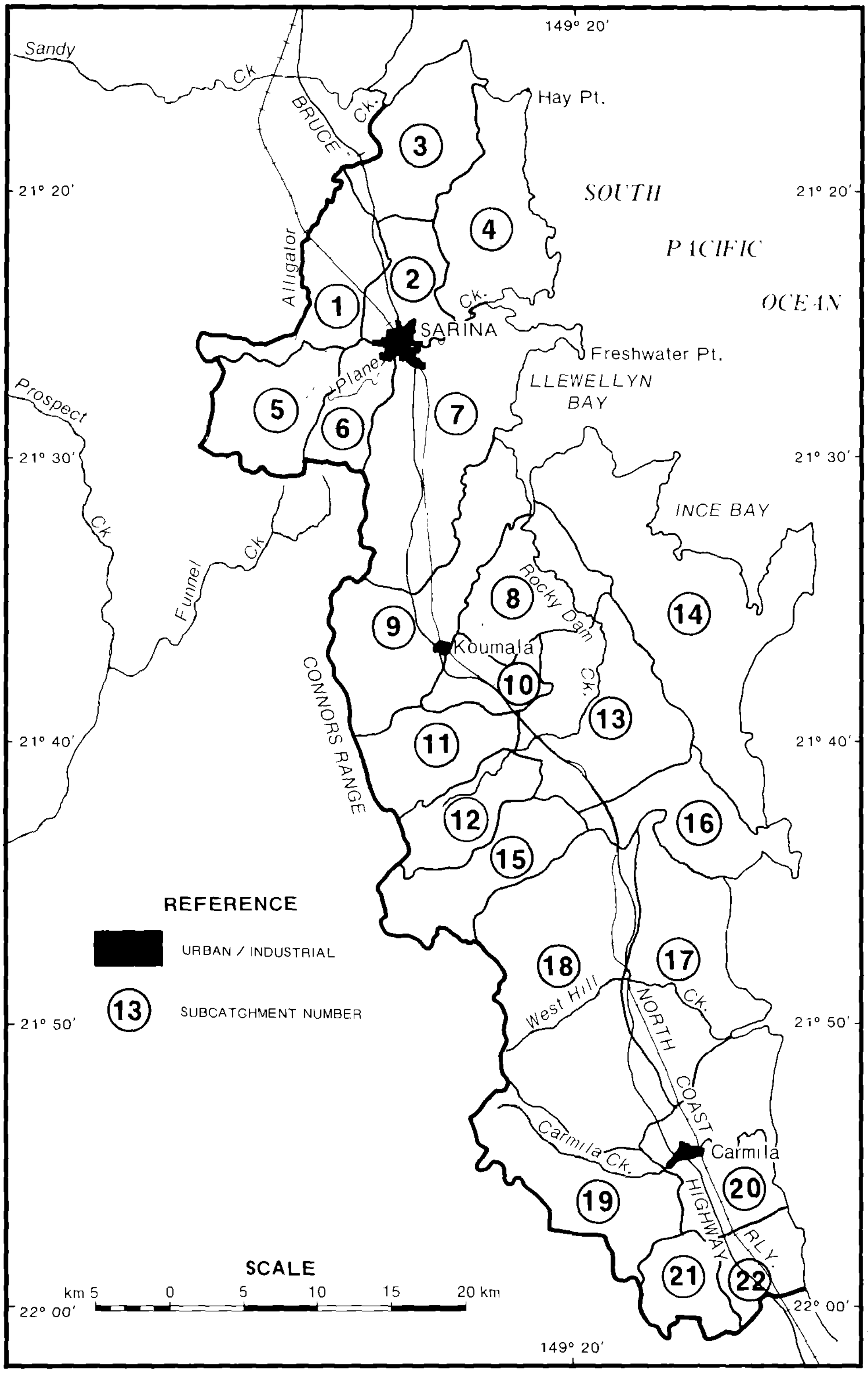


Figure 2.3 - SUB-CATCHMENTS OF THE PLANE CREEK MILL AREA.

associated with heavy fracturing of the rock and are probably located in fault zones. This applies to the area around Koumala in particular where bores are used for the town water supply and some irrigation. The yield from bores located off these fractured zones is usually less than 2 l/s. This unit is not considered to be a major supplier of water, although useful supplies can be located.

The Carmila Beds occupy the area south from Koumala to Carmila. These rocks have not yielded any significant supplies and, even in fractured rock areas, supplies are no greater than 5 l/s. There are no irrigation bores in the area south of Koumala to Carmila. There is, however, a small area of higher yielding bores near Sarina. These are located in a much higher rainfall area and are associated with a large fault through Sarina, and may in fact be tapping the volcanics of the Campwyn Beds in this area.

The superficial alluvial deposits, although quite extensive in the south have not yielded any significant supplies. The general yield is less than 1 l/s and suitable for stock-watering only.

Water quality. Water quality in the area varies greatly. The alluvial deposits associated with Carmila Creek yield good quality water on the upper reaches but are affected by salt water near the coast. The Alligator Creek alluvium produces poor quality water and is affected by sea water in Alligator Creek itself.

The quality in the Campwyn Beds is more variable. As a rule, water encountered in the fractured zones is of good to fair quality, and it can often be excellent after recent recharge. In the sedimentary rocks of the unit the quality is generally fair to poor and suitable for stock only.

The Carmila Beds generally produce fair to poor quality water suitable for stock-watering. However, as in the Campwyn Beds, supplies located in fractured volcanics can be of good quality and similarly the sedimentary rocks often produce poor quality water.

The superficial alluvial deposits generally produce fair to good quality water from shallow wells or bores.

2.5 Vegetation

Very little of the native vegetation in the study area is in an undisturbed state. Much of the agricultural land has been completely cleared of natural vegetation and grazing land is all disturbed to some degree. Some areas of grazing land have been cleared and have regrown to something approaching the original biomass level.

Because of the extent of disturbance, no detailed botanical description is attempted here; but some analysis of relationships between major soils groups and common tree species was undertaken.

The site description sheet described in Section 3.1 has provision for recording the following vegetation parameters;

- structure code (after Specht 1970),
- estimated cover and height of the tree layer,
- species and representation of three major tree species,
- species and representation of three major understorey species,
- estimated cover and height of the understorey,
- species of the three major ground layer species, and
- percentage bare ground.

2.5.1 Representation of main species

During the field survey, wherever the tree layer dominated other vegetation, whether disturbed or not, the species and numbers of the three major tree species and three major understorey species, within a 20 m radius of the site, were recorded.

Of the 876 sites described, 118 had significant vegetation recordings. From these data, it was determined that sixteen tree species were represented in eighty percent of the record and that other species were represented too rarely for statistical analysis. The sixteen most common tree species are listed in Table 2.6, in order of frequency.

Table 2.6. Relative frequency of most common tree species

Botanical name	Frequency	Common name
Eucalyptus intermedia	100	Pink bloodwood
E. alba	79	Poplar gum
Melaleuca viridifola	68	Broadleaf tea-tree
Tristania suaveolens	52	Swamp mahogany
Eucalyptus drepanophylla	45	Queensland grey ironbark
E. tereticornis	41	Queensland blue gum
E. tesselaris	32	Moreton Bay ash
Planchonia careya	32	Cocky apple
Melaleuca spp. (excl. viridiflora)	27	Paperbark tea-tree
Acacia leptocarpa	26	
Eucalyptus papuana	25	Ghost gum
Pandanus spp	12	Pandanus, screw pine
Albizia lebbeck	8	
Macaranga tanarius	7	
Lantana camara	6	Lantana
Casuarina littoralis	6	She oak

A detailed study of vegetation species as environmental indicators (Young, unpublished) revealed, in addition to the most common tree species listed in Table 2.6, the following species mainly from the ground and shrub layers.

Table 2.7. Relative frequency of shrubs, ground layer species and less common trees

Botanical name	Frequency	Common name
Themeda australis	100	Kangaroo grass
Imperata cylindrica	80	Blady grass
Fimbristylis dichotoma	55	
Flemingia lineata	55	
Eustrephus latifolius	50	Wombat berry
Glochidion lobocarpum	50	
Uraria lagopodioides	50	
Heteropogon contortus	40	Black spear grass
Phyllanthus virgatus	40	
Timonius timon	40	Swizzle tree
Chrysopogon fallax	35	Golden beard grass
Ficus opposita	35	Sandpaper fig
Glochidion perakense	35	
Murdannia graminea	35	
Vigna vexillata	35	Wild cowpea
Xanthorrhoea media	35	Blackboy, grass tree
Axonopus compressum	30	Broadleaf carpet grass
Coelospermum reticulatum	30	
Cyperus cyperoides	30	
Emilia sonchifolia	30	Emilia, Red Tassel flower
Eragrostis brownii	30	Brown's lovegrass
Glycine tabacina	30	Glycine pea
Mimosa pudica	30	Sensitive weed
Albizia toona	25	Mackay cedar
Breynia oblongifolia	25	Coffee bush
Desmodium triflorum	25	
Justicia procumbens	25	
Acacia bidwillii	20	Corkwood wattle
Centella asiatica	20	
Cycas media	20	Zamia palm
Desmodium gangeticum	20	
Eucalyptus exserta	20	Bendo, Queensland peppermint
Hypoxis hygrometrica	20	
Livistona decipiens	20	
Passiflora spp.	20	
Ruellia australis	20	
Tricoryne elatior	20	

2.5.2 Native vegetation related to soil groups

Open forest as defined by Specht (1970) is the most common structural form in relatively undisturbed or substantially regrown parts of the study area. Pink bloodwood, poplar gum and Queensland blue gum are ubiquitous species in the tree layer (14-22 m), the latter present generally in low numbers. Broadleaf tea-tree and swamp mahogany are also ubiquitous in the tall shrub to lower tree layer (6-14 m), but tend to be mutually exclusive. Where they occur together at a site, they are usually in separate clumps. *Acacia leptocarpa* and cocky apple are also ubiquitous but are generally present in low numbers.

The discussions which follow are based on numbers of each tree and shrub species recorded within the standard area at each site. It does not take into account the size of each tree or shrub. Thus for example, one large Queensland blue gum could represent a greater biomass than a large number of small specimens of broadleaf tea-tree.

Against the first mention of each soil type discussed below, is a percentage figure in brackets which indicates the percentage of all sites described for that soil which were in, or on the edge of, land growing sugar-cane. This may be taken as an indicator of the degree of disturbance which might have affected the reliability of the vegetation description. The following soils are not included because sufficient vegetation data for a modal description were not available at the sites described: Borstal, Cabbage Tree, Chelona, Moffat, Prendergast, Shinfield, Spider, Swayneville.

Pink bloodwood - poplar gum open forest. Pink bloodwood and poplar gum generally dominate these associations which usually occur on hill soils.

The exception is the Samourgassi lithosol (33%) which is found mainly in the area north-east of Sarina and supports one of the richest vegetation communities of the area. Moreton Bay ash is the main tree species followed by pink bloodwood, with the shrub layer dominated by cocky apple and broadleaf tea-tree. Important minor species are *Albizia lebbeck* and *Livistona decipiens*. In the ground layer, black spear grass, blady grass and grass-trees are common.

In the same geographic area, the Louisa yellow podzolic soil (34%) also supports a wide range of species. Pink bloodwood is dominant followed by Queensland grey ironbark and then poplar gum. In the shrub layer small-leaved *Melaleuca* species are dominant although some broadleaf tea-tree is also present, along with cocky apple. The ground layer contains kangaroo grass, blady grass and grass-tree.

Also in the same geographic area as the Samourgassi and Louisa soils, the Hector prairie soil (90%) supports a varied tree layer dominated by poplar gum with cabbage gum, pink bloodwood and Moreton Bay ash co-subdominant, followed by Queensland grey ironbark. The shrub layer is equally varied, being dominated by swamp mahogany, followed by *Acacia leptocarpa*, *Macaranga tanarius*, swizzle tree, cocky apple and lantana. Due to dense tree and shrub cover, the ground layer is sparse.

The Malin gleyed podzolic soil (100%) is a granodiorite-derived soil surrounded by areas of Hector, Cliftonville and Samourgassi soils. It carries a similar mix of vegetation, dominated by poplar gum with Moreton Bay ash subdominant, and pink bloodwood and Queensland blue gum also present. Cocky apple, broadleaf tea-tree, swamp mahogany and *Acacia leptocarpa* are co-dominant in the shrub layer.

A more widespread granitic soil is the Urannah lithosol (28%) which occurs on blocks of the Urannah intrusive complex along the Connors Range. Pink bloodwood and Queensland grey ironbark are co-dominant in the tree layer, with poplar gum, cabbage gum and Queensland blue gum also present. There is a varied shrub layer which includes broadleaf tea-tree, swamp mahogany, cocky apple, swizzle tree, Zamia palm and *Glochidion perakense*.

The Koumala yellow podzolic soil (53%) is part of the same geological complex as the Urannah soil, but occupies a lower position in the landscape. Pink bloodwood and Queensland blue gum are co-dominant with poplar gum subdominant. Some unusually tall clumps of *Acacia leptocarpa* occur on this soil, but normally cocky apple, Pandanus, swamp mahogany and broadleaf tea-tree comprise the shrub layer.

The major soil of the Connors Range and its outliers is the Breen lithosol (33%). It supports pink bloodwood dominant over poplar gum and Queensland grey ironbark. Broadleaf tea-tree is dominant in the shrub layer with swamp mahogany and cocky apple also present.

The last soil in this vegetation association is not a hill soil but presents many of the environmental characteristics of one. The Leichhardt cobbly, alluvial soil (68%) is well-drained and in a generally humid environment. Pink bloodwood is clearly dominant with poplar box subdominant, and Queensland blue gum and *Albizia lebbeck* also present. The shrub layer comprises mainly swamp mahogany, *Acacia leptocarpa*, *Livistona decipiens* and cocky apple.

Queensland grey ironbark - Queensland blue gum woodland. These communities are unusual because of the low frequency of occurrence of the ubiquitous pink bloodwood, poplar gum and broadleaf tea-tree.

The Saddle grey-brown podzolic soil (69%) has Queensland grey ironbark dominant in the tree layer, with Queensland blue gum subdominant and pink bloodwood also present. Cocky apple is clearly dominant in the shrub layer but *Macaranga tanarius* and lantana are also significant.

The Cliftonville duplex soil (86%) is similar to the Saddle soil but located among the Hector and Samourgassi soils previously mentioned. Its vegetation is a blend of the characteristics of all three. The tree layer comprises equal representation of Queensland grey ironbark, Queensland blue gum and Moreton Bay ash, and the shrub layer is dominantly swamp mahogany.

Pink bloodwood - poplar gum woodland with abundant *Melaleuca* - swamp mahogany understorey. The characteristic feature of these communities is the understorey which is dominated by swamp mahogany and species of *Melaleuca* other than the broadleaf tea-tree.

The Turnor solodic soil (78%) has a woodland canopy of pink bloodwood dominant over poplar gum, with an abundant understorey of swamp mahogany. The sites described are low in species diversity and this structure may be the effects of past clearing.

The Hannan alluvial soil (87%) supports a scattered tree layer of pink bloodwood, Queensland blue gum and poplar gum over an abundant understorey of *Melaleuca leucodendron*, with swamp mahogany, Pandanus, she oak, cocky apple and lantana also present.

The Turpad siliceous sand (61%) supports a woodland of poplar gum, pink bloodwood and Queensland blue gum, with cocky apple, broadleaf tea-tree, other *Melaleuca* species, swamp mahogany and Pandanus in the shrub layer.

The Freddy soloth to yellow podzolic soil (58%) has almost an open forest canopy of pink bloodwood and poplar gum co-dominant, with an abundant understorey of *Melaleuca leucodendron*, other *Melaleuca* species, broadleaf tea-tree and swamp mahogany.

The Tedlands soloth to solodic soil (51%) merges with the next group, in having an open forest to woodland canopy of pink bloodwood dominant and poplar box co-subdominant with Queensland blue gum. The understorey is a mixture of broadleaf tea-tree, swamp mahogany and other *Melaleuca* species.

Pink bloodwood - broadleaf tea-tree, low open forest to woodland. These communities are characterised by an abundant broadleaf tea-tree shrub layer and low frequency of poplar gum and swamp mahogany.

The Marwood podzol (83%) has an open forest tree layer of pink bloodwood, and an abundance of broadleaf tea-tree in the shrub layer with *Acacia leptocarpa* subdominant and Pandanus also present.

The Ilbilbie soloth (30%) has a woodland to low open forest layer of pink bloodwood over an abundant broadleaf tea-tree shrub layer. There is a greater variety of minor species such as poplar gum, Queensland grey ironbark, Moreton Bay ash and cabbage gum in the tree layer; and swamp mahogany, *Acacia leptocarpa* and Pandanus in the shrub layer.

The Gillinbin soloth (87%) has a woodland to open forest layer of pink bloodwood over an abundant shrub layer of broadleaf tea-tree. Poplar gum, Queensland blue gum and Moreton Bay ash are also present.

Poplar gum - broadleaf tea-tree (or other *Melaleuca*) woodland. These communities are recognised by a woodland tree layer dominated by poplar gum, over a shrub layer predominantly broadleaf tea-tree or other *Melaleuca* species.

The Sunnyside (86%) and Sarina (90%) solodic soils have a poplar gum dominant tree layer with pink bloodwood subdominant. Broadleaf tea-tree is dominant in the shrub layer, with swamp mahogany and *Acacia leptocarpa* also present.

The Cherry Tree gravelly solodic soil (83%) has a tree layer dominated by poplar gum with pink bloodwood and Queensland blue gum also present, and a shrub layer of small leaf *Melaleuca* species and swamp mahogany.

The Alligator solodic soil (78%) is transitional to the next group and has an abundant mix of broadleaf tea-tree and swamp mahogany in the shrub layer, its poplar gum dominant tree layer having pink bloodwood, Queensland blue gum and Moreton Bay ash present.

Broadleaf tea-tree low open forest to woodland, with emergents. These communities are poorly drained and are characterised by an abundant shrub layer of broadleaf tea-tree.

The Bell black earth (90%) has a scattered tree layer of Queensland blue gum emergents with poplar gum sub-dominant, and Moreton Bay ash, pink bloodwood, *Nauclia orientalis* (Leichhardt tree) and *Macaranga tanarius* also present. The shrub layer is dominated by broadleaf tea-tree with swamp mahogany, other *Melaleuca* species, Pandanus and swizzle tree also present.

The Karloo solodic soil (72%) has a scattered tree layer of Moreton Bay ash, poplar gum and pink bloodwood emergents, over a shrub layer dominated by a mixture of broadleaf tea-tree and other *Melaleuca* species.

The Splitter solodic soil (67%) has an abundance of broadleaf tea-tree and swamp mahogany in the shrub layer, with only scattered poplar gum emergents in the tree layer.

Table 2.8 summarises the soils : vegetation relationships.

Table 2.8. Native vegetation related to soil groups

SOIL TYPE	TREES: Pink bloodwood	Poplar gum	Queensland blue gum	Moreton Bay ash	Queensland grey iron–bark	Cabbage gum	*Albizia lebbeck*	*Macaranga tanarius*	Leichhardt tree	Broadleaf tea–tree	Swamp mahogany	*Acacia leptocarpa*	Cocky apple	*Melaleuca spp.*	SHRUBS	Lantana	Pandanus	Grasstree	Swizzle tree	*Glochidion perakense*	*Livistona decipiens*	Zamia palm	She oak
Samourgassi	■			●			▲			■			■					▲			▲		
Louisa	●	▲			■					▲			▲	■									
Hector	■	●		■	▲	■	▲				■	■	▲			▲			▲				
Malin	▲	●	▲	■						■	■	▲	■										
Urannah	●	▲	▲		●	▲				▲	▲		▲						▲	▲		▲	
Koumala	●	■	●							▲	▲	▲	▲				▲						
Breen	●	■			■					●	▲		▲										
Leichhardt	●	■	▲				▲				▲	▲	▲								▲		
Saddle	▲		■		●			▲					●			▲							
Cliftonville			■	■	■						●												
Turnor	■	▲									●												
Hannan	■	▲	▲								▲		▲	●		▲	▲						▲
Turpad	▲	■	▲								■		■	■			■						
Freddy	■	■								■	■			●									
Tedlands	●	■	■							●	■			▲									
Marwood	■									●		■					▲						
Ilbilbie	■	▲		▲	▲	▲				●	▲	▲					▲						
Gillinbin	●	▲	▲	▲						●													
Sunnyside	▲	■								●	▲	▲											
Sarina	▲	■								●	▲	▲											
Cherry Tree	▲	●	▲							■	■				■								
Alligator	▲	●	▲	▲							■												
Bell	▲	■	■	▲				▲	▲	●	▲				▲		▲		▲				
Karloo	▲	▲		■						●					■								
Splitter		▲								●	●												

Key ● dominant ■ subdominant ▲ commonly present

3. LAND RESOURCES SURVEY METHOD

The Plane Creek Study initially involved a reconnaissance phase to determine the main soil types and air photo interpretation to place them in a landscape context. Field data from 420 sites were used in legend making (preliminary soils reference) and to highlight the main soil types and areas requiring further data and analysis. Preliminary comparison with soils of the Mackay Study also took place at this stage.

The final soils descriptions and mapping were based on field data from 876 field descriptions, and laboratory data from 33 representative soil profiles.

3.1 Soils

The free survey method of selecting soil description sites was used. This is subjective and is based on the surveyor's assessment of land units as seen on the ground and in stereoscopic views of air photos. The exact locations of sites are a compromise between centrality within the UMA and ease of access.

An additional bias is introduced because of the nature of the project aims, in that data were more intensively collected in existing canelands and potential cane areas, than in remote and inaccessible areas which obviously lacked agricultural potential.

Soils data were recorded in the field on computer forms. They are similar to the 'FILL-IN SITE DESCRIPTION SHEET' given as an example in the Australian Soil and Land Survey Field Handbook (McDonald *et al.*, 1984). The type of data recorded include:

General	**Soils (for each horizon)**
map location	horizon depths
airphoto location	colours, moist and dry
slope	mottling
elevation	texture
rainfall	structure
microrelief	pans
geology	inclusions
vegetation species	field pH
vegetation structure	
caneland suitability assessment	

Soil types were mainly determined according to observable soil profile criteria although landscape factors also exerted influence, and chemical data were considered before the final decision. Each soil type was compared with the Mackay Study soil profile classes, and a decision had to be made on whether it was closely similar enough to be given the same name, similar enough to mention as a related soil, or dissimilar and therefore a new soil type. The perceived relationships between Mackay, Proserpine and Plane Creek soils are given in Section 4, Table 4.1.

3.2 Caneland suitability

The suitability of land for growing sugar-cane is based on assessments, made in the field, of a number of limitations. This is later supported by chemical and physical data.

The suitability classification has five classes which represent increasing limitations to long term sugar-cane production:

Class 1 - Land suitable with no limitations,
Class 2 - Land suitable with slight limitations,
Class 3 - Land suitable with moderate limitations,
Class 4 - Land marginally suitable with severe limitations,
Class 5 - Unsuitable land.

Land considered marginally suitable is particularly sensitive to the economics of the industry when compared with suitable land. It requires high capital inputs to become suitable for growing sugar-cane in the long term and is often the first to be taken out of production in depressed economic periods.

Land is placed into one of the five classes after considering relevant limitations to production. In the Plane Creek Study, the limitations assessed were:

erosion (e) - an assessment of erosion potential based on land slope, surface soil texture, assessed dispersibility of subsoil, and observed erosion.

flooding (f) - an assessment based on observed evidence of flooding and the knowledge of local residents, not an important factor for sugar-cane but relevant to alternative crops.

salinity (s) - this limitation covers footslope salinity, sodicity in the soil profile and saltwater intrusion. The assessment is based on observed features and chemical data.

water holding capacity (m) - an assessment based on soil texture and depth of coarse textured surface soil, local comment and observed moisture stress in crops relative to cane on other soils, supported by physical analysis in the laboratory.

nutrient status (n)	-	an assessment based on chemical analysis.
soil workability (k)	-	a relative assessment of time available for satisfactory cultivation between excessive wetness and excessive dryness, based on observations of soil texture and consistence, land surface characteristics and local comment.
stone (r)	-	an assessment of existing amounts of stone in or on the surface soil of a size which could affect cultivation or harvesting operations.
topography (t)	-	a combined assessment of land surface features which could make the operation of large machinery difficult or dangerous, or prevent the design of a satisfactory contour plan for soil conservation.
wetness (w)	-	an assessment based on observed seepages, indicators of wetness in the soil profile, vegetation species and local comment.
soil depth (d*)	-	an assessment combining aspects of water-holding capacity, nutrient status and erosion risk, more significant for alternative crops than for sugar cane.

The maximum limitation normally determined the overall suitability for canegrowing, but combinations of a number of limitations could result in a less suitable overall assessment. For each site, the observable part of its UMA was assessed. The assessments for each site record provided the raw data in determining modal suitability limitations for soil type descriptions and UMA records.

3.3 Planning base

Map 3, Land Use and Land Suitability, constitutes the planning base. This draws together the major criteria relevant to broad scale land use planning. These main features shown on Map 3 are:

- Agricultural Land - land suitable for growing sugar-cane, suitability classes 1, 2 and 3.
- Lands marginal and unsuitable for agriculture, divided into uplands and lowlands, suitability classes 4 and 5.
- Sugar mill location and tramways.

---

* to conform with the Mackay study, this assessment is not included in the UMA datafile, but can be extracted from the site datafile.

- Land unavailable for agriculture, i.e. urban/industrial, National Park and State Forest or Timber Reserves.

- Shire boundaries.

Map 3 is fundamental to land use planning and its interpretation and application are discussed in Section 6.

3.4 Data storage and retrieval

Survey data are stored in two forms:

a. the site datafile of field site description data as described in Section 3.1, and

b. the UMA datafile, which records the following items of information for each UMA:

   - eastings, northings and ATM zone for the 'central' labelling point in each UMA;
   - the UMA identifying number (prefix indicates sub-catchment);
   - the main soil type;
   - the geological code;
   - associated soil types;
   - landform class as per Speight (1984);
   - minimum, modal and maximum slopes;
   - erosion assessment;
   - salinity - presence or absence;
   - limitations - as per Section 3.2;
   - cane suitability class;
   - areas - total
     - assigned
     - available
     - non agricultural;
   - distance to Sarina;
   - distance to cane collection point; and
   - shire code letter.

All of the foregoing data are coded, and the codes are explained in Appendix A. The datafile is reproduced on microfiche enclosed with this report and uncoloured maps of numbered UMAs may be obtained from Land Resources Branch**. Alternatively, processed data and thematic maps may be provided by Land Resources Branch for land use planning purposes.

** Land Resources Branch, Queensland Department of Primary Industries, Meiers Road, Indooroopilly, Q. 4068.

4. SOILS

4.1 Introduction

Soils of the study area have been previously mapped by Isbell and Murtha (1970) as part of broadscale 1:1 000 000 mapping. In this study, 33 soil profile classes and four miscellaneous mapping units were identified. The soil profile classes are grouped into landscape units which have similar topography and geological formation or parent material.

Details of each soil profile are given in Appendix B, while Section 4.2 highlights distinctive aspects of each soil type which may not be immediately obvious in the standardised descriptions. It also discusses spatial distribution of the soils, their situation in the landscape, and relationship to each other and to soils described in the Mackay and Proserpine Lowlands Studies.

Standard descriptions are those employed in the Mackay Study, as detailed in the introductory paragraphs of Section 9.2 in that report, with the following exceptions:

a. the 'upper B2' and 'lower B2' phraseology is not used, and

b. soil colour names are those used by Thompson, Baker and Cannon (1981) in the Proserpine Lowlands study, although the hue, value/chroma ratings are from Oyama and Takehara (1967).

4.2 Morphology and distribution

The Plane Creek soils are grouped according to parent material/landform combinations, in conformity with the Mackay Study.

The main difference with the Mackay Study is the division of the steep uplands, Mackay's 'Mountains and Hills' (MT), according to observed differences between steepland soils of the main geological groups. Although these steep units have been sampled at less intensity, there are sufficient data to demonstrate differences.

A characteristic of the soils of the fluvial and coastal plains is the wide range of solodic-solodized solonetz soils described. This is partly because of the broad range covered by those Great Soil Groups, and also the relationship between the soils and specific parent material/landform situations. The area comprises several discrete small catchment areas and the soils of each area reflect the unique combination of parent material, hydrological and sedimentation conditions. A precise relationship is impossible to define without further study, but there are sufficient local differences to warrant a fine separation of the soil types.

4.2.1 Soils of the steep uplands on exposed intrusive outcrops

The Mt Chelona outcrop was originally described as being 'composed of tor-forming homogenous medium-grained pink granite' (Jensen, Gregory and Forbes 1966). More recent survey (Martin, Wilmott and O'Flynn, in preparation) has determined that the outcrop is granodiorite (PKgc).

One soil type is defined in the area of the outcrop. The Chelona lithosol covers minor areas of soil with negligible profile development in steeplands of granitic boulders. Regolith from this outcrop forms the raw material for the surrounding Malin and Marwood soils.

4.2.2 Soils of uplands derived from granodiorite

The main characteristic of soils surrounding Mt Chelona is the abundant quantities of medium to coarse gritty sand found throughout the soil profiles. The Malin soil lies above the Marwood in the landscape, on gently undulating to undulating slopes. It is similar to the Gargett soils' deep A horizon variant of the Mackay Study. The Marwood soils occupy the lower slopes and drainage lines and are generally much deeper than described in Appendix B. They abut alluvial soils from surrounding geologies, and the division usually coincides with a main drainage line. The Malin and Marwood soils are closely associated and may intergrade.

4.2.3 Soils of uplands derived from acid to intermediate intrusives and dykes

These soils are formed on elements of the Urannah Complex (C-Mr) or on colluvial/alluvial material derived therefrom.

Sedentary soils. The Urannah and Koumala soils occur mainly in the areas south and west of Koumala. The Urannah soil as described is that found in the lower slope ranges, and may be compared with the Septimus soil of the Mackay Study. Much of the area mapped as Urannah is very steep land with negligible profile development and closely resembles the Chelona description. Conversely, small unmappable areas of deeply weathered soils occur which resemble the Finch Hatton soil of the Mackay Study, which occurs on similar geology.

The Koumala soil generally occurs on undulating low hills below the steepest outcrops of the Urannah Complex. Although the two soils occur together they may be formed on different elements of the Urannah complex as their development is quite different. The Koumala soil most closely resembles the Dunwold soil of the Mackay Study.

The Swayneville soil is a prairie soil found mainly on undulating low hills in the western part of the Plane Creek catchment. It is quite different from the Urannah and Koumala soils and again may reflect a different element of the Urannah Complex. Recent geological mapping (Martin, Willmott and O'Flynn, in preparation) outlines a separate geologic unit of Early Permian or Early Cretaceous leucocratic intrusive rocks (PKg1), which coincides approximately with the distribution of the Swayneville soil. The Swayneville soil is similar to the Uruba soil of the Mackay Study.

Colluvial and alluvial soils. The Turpad soil is a siliceous sand found on gently undulating to undulating colluvial slopes around the Three Sisters outcrop south of Koumala and in the Turner's Paddock area. It is a coarse, gritty, light grey sand which is deeper than described and could be part of the A horizon of a giant podzol.

The Borstal soil is the only black earth mapped in the Urannah Complex, located at about 100 m elevation near the geological boundary with Carmila Beds. It may well be formed on a basic dyke associated with the discontinuity. The black earth tends towards wiesenboden in drainage lines, and the Borstal soil is distinctive in having a significant medium to coarse sand fraction in the gleyed B22 horizon. It is similar to the Spider soil gound in Connors Volcanics west of Carmila and to the Silent Grove soil of the Mackay Study.

The Shinfield soil is the alluvial soil associated with the Swayneville soil at West Plane Creek. It is a solodic-solodized solonetz on level to gently undulating alluvial plains. Its B horizon retains the dark colours and bright mottling of the soils upslope and this distinguishes it from other solodic soils in the area.

4.2.4 Soils of uplands derived from basic to intermediate volcanics

These soils are formed on elements of the Campwyn Beds (D-Cc). Areas of the Campwyn Beds in proximity to Mount Chelona and other intrusive blocks have developed on them a distinct suite of soils not found extensively elsewhere. These are the Hector and Cliftonville associated soils which have distinctive colour and structure. Away from the intrusive contact, the soils are more leached as typified by the Louisa yellow podzolic soil. A common characteristic of all Campwyn Beds soils and their associated alluvials, is an abundance of ironstone nodules in some part of the soil profile.

Sedentary soils of uplands. The Samourgassi soil is a lithosol occurring on the steep hills of the Campwyn Beds. The described soil is that found in the lower slope range only. Although the median solum depth is only 0.4 m, appreciable root-accessible usable soil in a weathered and unweathered rock matrix, has been observed in cuttings to depths over 2.0 m.

The Hector prairie soil occurs on the undulating low hills west of Mount Samourgassi. Well structured with good internal drainage, this soil has a neutral or sometimes acid soil reaction trend although it may be developed on basic parent material. The Hector soil is usually located below the Samourgassi soil and above the Cliftonville soil. It is similar to the basic parent material variant of the Wagoora soil in the Mackay Study.

Colluvial soils. The Cliftonville soil is similar to the Hector soil in its A horizon, but is deeper and the B horizon is grey with increasing mottling or gleying with depth. The soil reaction trend is alkaline. The differential development of the Cliftonville and Hector soils is considered to be a function of lateral drainage, the drainage away from the shallower Hector profiles resulting in wetter conditions and movement of salts towards the Cliftonville profiles. Although Cliftonville soils are often located below areas of Hector soils, they may be formed higher in the landscape as a result of local drainage impedence.

The Louisa soils occur in similar landscape situations to those of the Cliftonville soils, i.e. on lower slopes of undulating low hills, but Hector soils are less common in association, and areas of Louisa tend to merge upslope directly with the Samourgassi soil. In contrast to Cliftonville soil, the Louisa soil is a yellow podzolic soil with an acid to strongly acid soil reaction trend. It occurs on the Campwyn Beds and variation increases with distance towards minor areas around coastal promentaries.

4.2.5 Soils of uplands derived from acid volcanics

These soils are developed on the Carmila Beds (Pla) which extend from north to south of the area. The Breen lithosols and the Freddy duplex soils do not relate strictly to landscape. Breen soils predominantly occur in the steep uplands but may also occur on low rises at lower elevations. The Freddy soil, although predominantly colluvial, sometimes occurs on low rises which appear to be sedentary.

The Breen soil is a typical lithosol. Where there is any soil development, it usually displays a conspicuous bleach overlying rock. The steep upland block typically merges abruptly with a colluvial strip of Freddy soils, which in turn merges with the alluvial plains.

The Freddy soil is usually a shallow, gravelly soloth or yellow podzolic soil. In addition to its conspicuously bleached A2 horizon, the entire profile is typically light grey in colour, with abundant colluvial gravel, sometimes forming a conglomerate pan, especially near watercourses.

4.2.6 Soils of uplands derived from intermediate flows and pyroclastics

These are sedentary soils developed on Connors Volcanics (D/Co) which occur only in the far south and enclose the catchments of Carmila Creek and Flaggy Rock Creek.

The Moffat soil is classed as a grey-brown podzolic soil. Its parent rock weathers readily and the BC horizon often extends beyond the normal sampling depth of 1.2 m. In steeper areas it is shallower and stonier and tends to be a lithosol.

The Saddle soil is also classed as a grey-brown podzolic soil. It is usually located in low, sedentary to colluvial positions in the landscape.

4.2.7 Soils derived from Quaternary alluvium

These soils cover a wide range of alluvial situations. They are broadly divided between soils on alluvium which can be related to specific watercourses, and soils of the extensive coastal plains which, over much of the area, resemble raised beaches.

Uniform soils of floodplains, levees and terraces. These soils usually occur in the narrower upper tracts of creeks. The Leichhardt soil in particular is an undeveloped alluvial soil not related to any specific parent rock, and commonly occurs on the initial plain formation at the highest point of a valley floor. Without its river rock, it would probably be similar to the Hannan soil.

The Hannan alluvial soil usually occurs on levees or recent terraces associated with narrow floodplains. It is a deep, dark, unbleached, sandy loam to sandy clay loam with a tendency to heavier texture at depth. It is often associated with the Gillinbin soloth on adjacent higher terraces.

Uniform clay soils in areas of restricted drainage. The major soil in this group is the Bell black earth. Its most extensive occurrence is around Bells Creek north of Sarina and it coincides with the outwash areas from surrounding intrusive and older volcanic rocks. This pattern is repeated in smaller areas south of Sarina, where tracts of black earths on watercourses coincide with geological discontinuities. Black earths often border on areas of solodic-solodized solonetz, with intergrade soils commonly found. These are usually dark solodic soils with shallow A horizons which may be the result of deposition from nearby cultivation.

The Spider soil is associated with a similar intrusive/old volcanic situation. It coincides with the upper tract of Spider Creek which flows around an intrusive plug in the Connors Volcanics. The result is a very poorly drained situation producing a wiesenboden soil.

Duplex soils of alluvial plains. Apart from the Gillinbin soloth, this group consists of solodic-solodized solonetz distinguished mainly by colour and bleach.

The Gillinbin soloth occurs on older river terraces south of Koumala and predominantly along Marion Creek and Gillinbin Creek. It is characterised by a deep A horizon with a sporadic bleach, over a B horizon which is often reddish-brown or with red mottling. It is often located above the Hannan soil found on lower terraces.

The Cabbage Tree soil is a dark, solodic-solodized solonetz usually found in alluvial floodplains adjacent to Campwyn Beds formations. Its profile of a shallow A horizon and a dark B horizon resembles a black earth, and sporadic occurrences of such soils may be found on the fringes of Bell soils. In the cultivated state, the shallow, lighter textured A1 is sometimes undetectable, hence the occasional uniform profile description.

The Sarina solodic-solodized solonetz occurs mainly in the upper Plane Creek valley adjacent to the Shinfield soil, but is quite different because of different parent material - the Carmila Beds. The sporadic bleach is faint and discontinuous, and difficult to detect, especially in cultivation. Although the texture of the B horizon can be heavy, its structure is better than most solodic soils.

The Turnor soil commonly occurs along watercourses in the Turner's Paddock area south of Koumala. Its material is mixed Urannah Intrusive Complex and Campwyn Beds. Its A horizon is typically shallow with a thin, conspicuously bleached A2 horizon.

The Prendergast solodic-solodized solonetz is usually located on alluvial plains below the Moffat and Saddle grey-brown podzolic soils on adjacent hillslopes.

The Cherry Tree soil is a gravelly, solodic-solodized solonetz which has abundant large manganiferous nodules and ferruginized gravel in most profiles. From the configuration of its major unit, it appears to be an old outwash area of coarse, colluvial material which coincides with the courses of Cherry Tree and Duff Creeks, and terminates in a littoral bar east of Yukan at the estuary of Rocky Dam Creek. Its parent material is mixed, as the three major geological units are in its proximity and upper catchment.

Duplex soils of coastal plains. The Tedlands soil is an acid to neutral duplex soil which straddles the division between soloth and solodic-solodized solonetz soils. It is characterised by a bright yellow mottle or matrix colour in the B horizon and an absence of coarse gravel, in contrast to the adjacent Cherry Tree soil which is grey and gravelly. The main area of Tedlands soil lies east of Koumala, but minor units occur to the north and south.

The Sunnyside soil occupies the coastal floodplains on the right bank of Alligator Creek, and is an extension of a much larger area of closely similar soils on the left bank, in the Mackay Study Area. Its distinguishing characteristic is the silty texture of its shallow, sporadically bleached A horizon and the pure grey matrix colour of the B horizon.

The Alligator soil has been described separately but may simply be a three-way intergrade of adjacent Sunnyside and Cliftonville soils and the Dundula soil of the Mackay study located across the Alligator Creek estuary. Its distinguishing characteristic is the presence of layers of ironstone nodules, sometimes abundant, which are not so common in other coastal plain soils.

The Splitter solodic-solodized solonetz main unit is located between the main Sunnyside unit and the Marwood podzol below Mount Chelona. It combines the sandy characteristics of the granite-derived soil with the strong, alkaline trend of the solodic soil, to produce a very hardsetting, naturally compacted, bleached solodic-solodized solonetz.

The Karloo solodic-solodized solonetz is the major soil of the coastal plains south of Marian Creek. It occurs downslope of Freddy soil on the foothills of the Carmila Beds, and may be associated with isolated areas of Ilbilbie soils.

Duplex soils of relict plains. The main occurrence of the Ilbilbie soloth is north-east of Ilbilbie in an area which has been deep-ripped in places and where broken fragments of a cemented hardpan have been exposed. Other areas have hardpans of varying composition and depth. The soils are broadly similar to the Kinchant and Allandale soils of the Mackay study.

4.2.8 Miscellaneous units

Frontal Dunes (Fr), Gullied Lands (GU), Mangroves and Saltmarsh (MG) and Urban and Industrial (UI) classifications are equivalent to those in the Mackay Study.

4.2.9 Mapping units and soil variability

The soils are mapped as compound mapping units, as described in the Mackay Study report, Part 1, p. 38. Many intergrades and anomalies occur in the soils of the Plane Creek area. Variability within UMAs is indicated by the number of associated soils listed - the more soils recorded the greater the variation to be expected. On the site datafile, code 227 indicates soil type. This is the same two letter abbreviation which is used on the soils map. A number of suffixes may be added or a second soil type may be mentioned. The meanings of those are listed below using the Freddy soil as an example:

FD+ — A good example of a Freddy soil, used in synthesizing the modal description.

FD — An average example of a Freddy soil, falling within a reasonable range of morphological attributes.

FD- — A soil which comes closer to the Freddy description than to that of another soil, but with one significant departure from the modal description, e.g. -

- opposite soil reaction trend due to local drainage factors
- shallow profile due to stone in profile, which may be assumed to be a Freddy soil.

FD-IB — An intergrade between the Freddy and Ilbilbie soils.

NP — No provision - a soil which does not approach any of the descriptions in the report.

Table 4.1. Correlation of Plane Creek soils with soils of the Mackay and Proserpine lowland studies

Plane Creek soils	Mackay and Proserpine soils	
	Close similarity	Moderate similarity
Malin	Gargett, deep A horizon variant	
Marwood	Marwood	
Urannah		Septimus
Koumala		Dunwold
Swayneville	Uruba	
Turpad		Gargett, deep A horizon variant
Borstal	Silent Grove	
Hector	Wagoora, basic parent material variant	
Louisa	Mentmore	Campwyn, Belmunda
Breen		Dittmer
Freddy		Ossa; Balberra; Prospect
Bell	Victoria Plains	Myrtle
Leichhardt		Kelsey
Hannan		Pioneer, Lethe
Gillinbin		Marian
Cabbage Tree		Seaforth, dark B horizon variant; Eton; Gregory
Sarina		Etowrie
Cherry Tree		Calen; Bubialo
Tedlands	Brook	Seaforth, yellow B horizon variant
Sunnyside	Sunnyside	
Alligator		Sunnyside, Dundula
Karloo		Narpi
Ilbilbie		Kinchant; Slater

4.3 Chemical and physical attributes

A total of thirty-four representative soil profiles were sampled for laboratory analysis. Morphological and analytical data for these profiles are listed in Appendix C. Methods of analysis used and general interpretations of the soil test values are as outlined in Bruce and Rayment (1982) except that chloride determined by both methods 2.2 and 2.11 is via an automated colorimetric procedure.

All profiles were sampled with a Jarret auger in 0.1 m increments to 1.2 m or shallower if parent rock was encountered. When an horizon boundary occurred, the 0.1 m sample was divided accordingly.

Soil profile classes were arranged into eight broad groups as shown in Table 4.2. Analytical soil properties as determined in the laboratory are discussed in terms of these groupings.

Table 4.2. Groupings of soils from Plane Creek

Group	Description	Soil profile class name	Sites
A	Solodic soils - extreme properties	Alligator, Cherry Tree, Sunnyside, Karloo, Turnor	B28, G13, 727, 724, 725, G26, I56, F20.
B	Solodic soils - moderate properties	Sarina, Shinfield, Cliftonville, Cabbage Tree, Prendergast	G73, C27, C63, C10, A33, I52.
C	Soloths - hillslopes, intergrading with podzolics	Louisa, Freddy	G09, I54, G44.
D	Soloths - on plains	Tedlands, Ilbilbie, Gillinbin	D48, I05, C54, F96.
E	Prairie soils	Hector, Swaynesville, Saddle	C15, H01, I53.
F	Granite derived soils	Urannah, Malin, Koumala, Turpad	C95, I70, I72, E30.
G	Black earths	Bell, Borstall, Spider	G11, H16, H32, I59, I74.
H	Alluvial soils	Hannah	D46.

pH, salinity, sodicity. The pH of surface soil to 0.1 m ranges from 5.1 to 7.1 with a mean of 5.7 ± 0.4. Soil groupings A, B and G exhibited an alkaline pH trend with increasing depth, with group A the most alkaline. Group A solodics have a mean pH of 9.9 at 0.6 m while groups B and G reach alkaline pHs of 8.1 and 7.9 respectively, at 1.2 m. Soils with neutral to acid profile reaction trends are groups C, D, E, F and H. Figure 4.1 shows pH trends for some of the groups.

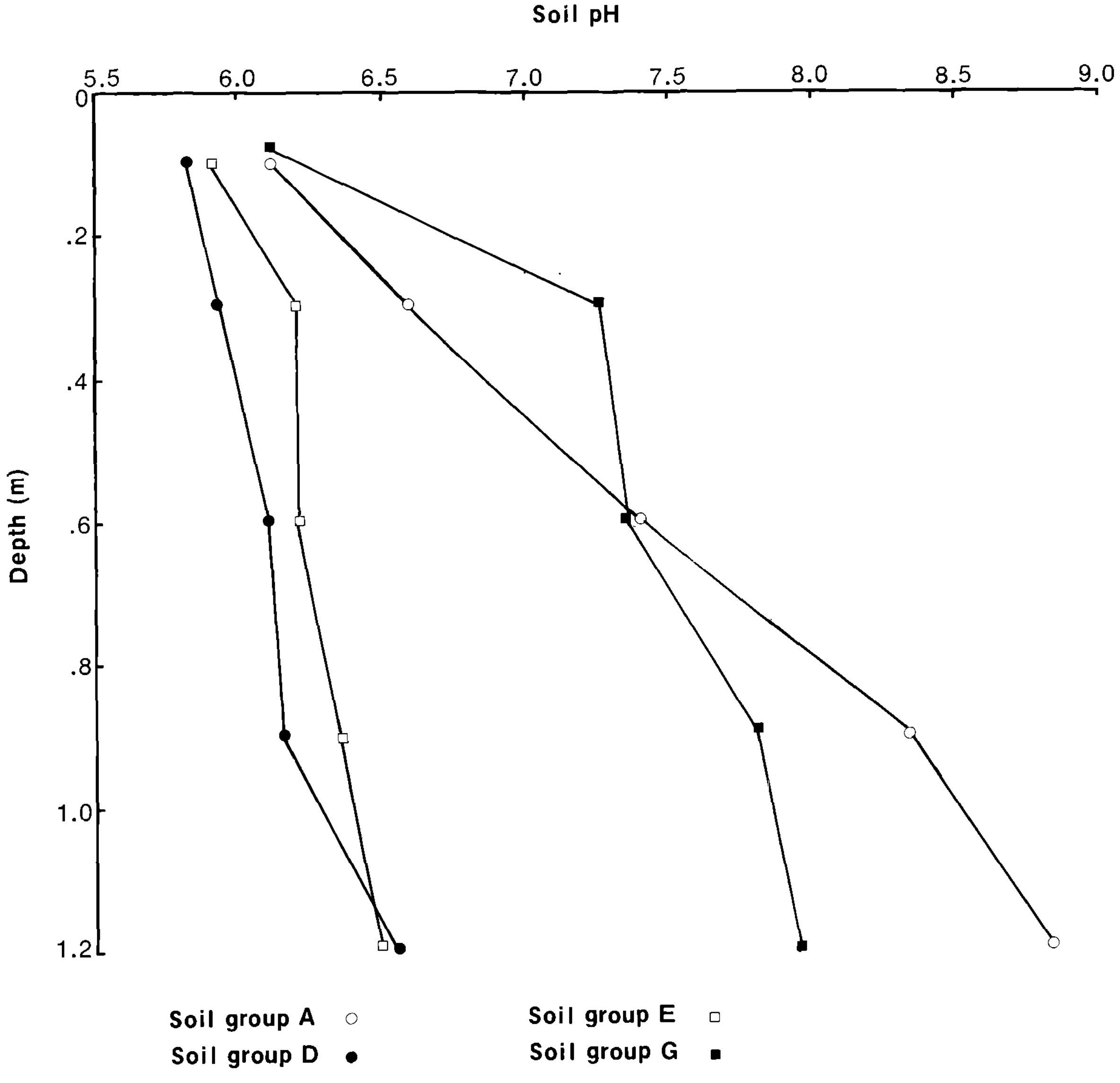


Figure 4.1 pH profiles for selected soil groups.

All soil groupings are rated as non-saline (Northcote and Skene 1972). Highest levels of chloride (0.057%) at 1.2 m were recorded in group A. These low chloride levels indicate the strongly leaching environment in the survey area. With respect to soil sodicity (Northcote and Skene 1972) soil groups A and D were rated as strongly sodic (ESP >15) at 0.3 and 0.9 m, respectively. The highest mean ESP of 39 occurred in the group A solodic soils at 1.2 m. All other groups are non-sodic (ESP <5) in the surface 0.1 m, but the B group solodic soils, and group C soloths are sodic (ESP 6 to 14) at approximately 0.6 m. Figure 4.2 illustrates ESP profile trends for some of the groups.

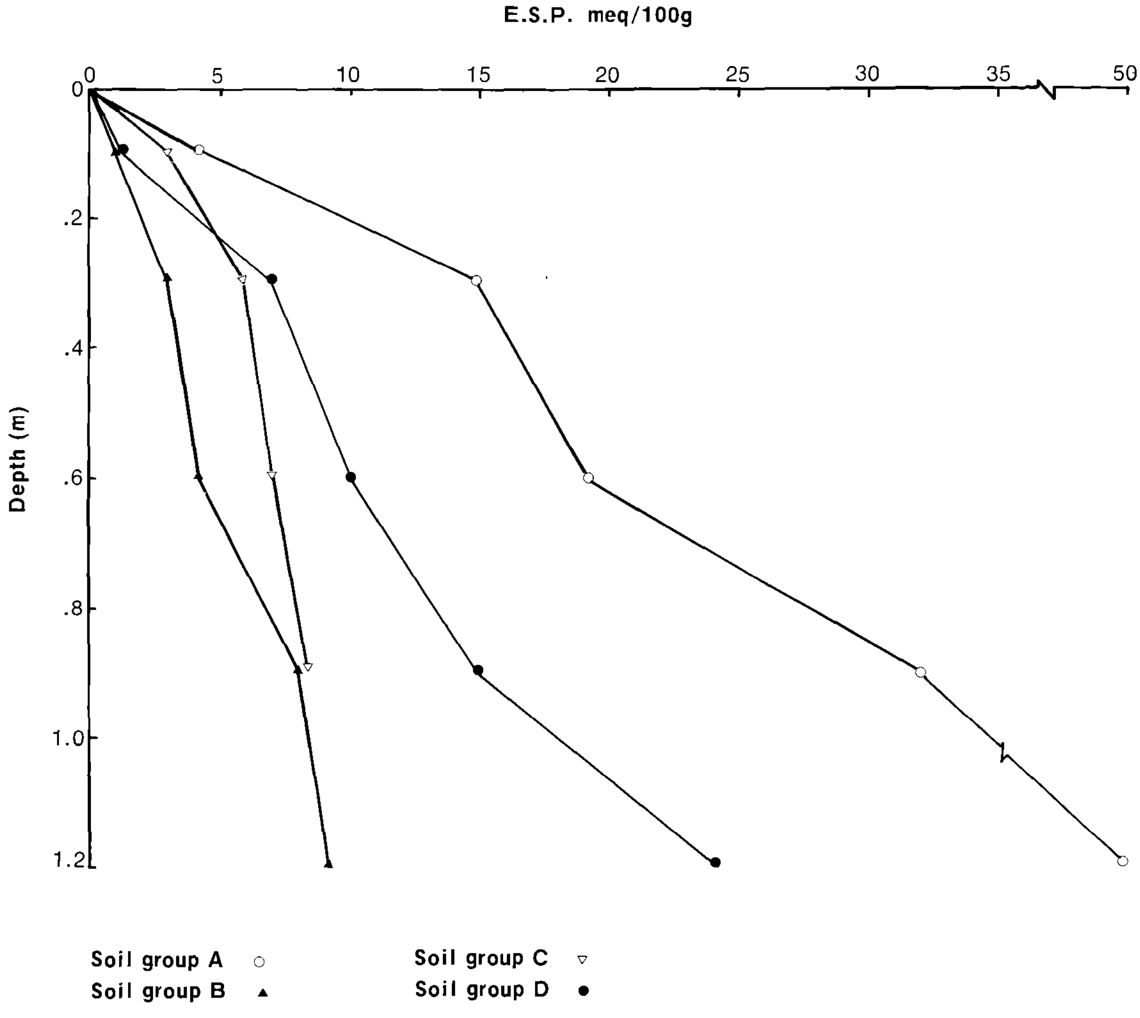


Figure 4.2 Exchangeable sodium percentage profiles for selected soil groups.
*All other profiles < 5 E.S.P. to 1.2m.

Exchangeable Calcium (Ca), Magnesium (mg), Mg/Ca ratio. Calcium is the dominant exchangeable cation in the profile in Groups B, E, G and H and in the surface 0.3 m of Groups A, C, D and F. Sodium is dominant at 1.2 m in Group A soils. Magnesium is dominant in the B horizon of the Group C soloths and in the subsoils of the granite derived soils of Group F (see Table 4.3).

Thompson *et al.* (1981) described their Slater soil as a low sodium soloth with magnesium as the dominant cation. The subsoils of the soloths in Groups C and D are similar, but magnesium accounts for only around 50% of the basic exchangeable cations at depth. Teakle (1950) and Stace *et al.* (1968) also described soloths with a similar proportion of magnesium.

Magnesium to calcium ratios were calculated for the groups and are listed in Table 4.3 Bruce and Crack (1978) found Mg:Ca ratios of 5:1 common for duplex soils in Queensland. In the Plane Creek district, a range of 0.6 to 1.3 was recorded for the solodic soils of Group A while a mean ratio of 5:1 was recorded for the subsoils of Group C soloths. For other soils in this survey, the ratio never exceeded 1.4. In the Proserpine district, Thompson *et al.* (1981) recorded ratios of 1.0 to 1.5 for solodic soils and 1.4 to 5.0 for soloths.

Table 4.3 Mean exchangeable Ca, Mg, Mg/Ca ratio for the groups

Soil groups and depths** (m)	Ca^{++}	(±SD^{+})	100 Ca / CEC*	Ca^{++}	(±SD^{+})	100 Mg / CEC	Mg
A - Solodic soils (extreme)							
0-0.1	1.92	0.33	27	1.54	0.25	22	0.8
0.2-0.3	2.26	1.38	28	1.91	1.32	24	0.8
0.5-0.6	4.32	1.86	27	4.99	2.77	32	1.2
0.8-0.9	6.28	3.59	33	6.60	2.46	35	1.1
1.1-1.2	5.58	3.55	28	7.06	2.52	35	1.3
B - Solodic soils (moderate)							
0-0.1	4.54	2.46	34	2.49	1.19	9	0.5
0.2-0.3	8.28	4.99	30	4.58	2.8	17	0.6
0.5-0.6	8.22	1.72	49	5.38	0.97	32	0.7
0.8-0.9	11.86	4.63	55	7.88	2.32	37	0.7
1.1-1.2	11.68	6.96	49	9.32	2.06	39	0.8
C - Soloths (hillslopes)							
0-0.1	2.63	1.00	35	1.11	-	15	0.4
0.2-0.3	1.16	0.53	31	0.67	0.07	18	6.0
0.5-0.6	0.70	0.38	9	3.06	1.6	39	5.0
0.8-0.9	1.41	-	28	2.42	-	48	1.7

Table 4.3 Mean exchangeable Ca, Mg, Mg/Ca ratio for the groups (cont.)

Soil groups and depths** (m)	Ca++	(±SD+)	100 Ca / CEC*	Ca++	(±SD+)	100 Mg / CEC	Mg
D - Soloths (plains)							
0-0.1	1.84	0.89	33	0.88	0.31	16	0.5
0.2-0.3	0.96	0.82	25	0.78	0.29	21	0.8
0.5-0.6	1.94	2.08	22	2.94	1.29	34	1.5
0.8-0.9	2.27	2.19	23	3.86	1.72	39	1.7
1.1-1.2	3.17	2.24	23	6.56	1.81	47	2.1
E - Prairie soils							
0-0.1	7.47	1.11	43	3.95	0.25	23	0.5
0.2-0.3	7.09	1.45	44	3.28	1.16	21	0.5
0.5-0.6	7.24	0.51	43	6.74	4.78	40	0.9
0.8-0.9	10.55	1.49	52	10.39	7.43	51	1.0
1.1-1.2	13.86	0.90	63	11.32	6.86	52	0.8
F - Granite derived soils							
0-0.1	3.45	1.24	41	1.53	0.54	18	0.4
0.2-0.3	2.28	2.08	39	0.98	0.63	17	0.4
0.5-0.6	2.62	1.97	39	2.34	2.57	35	0.9
0.8-0.9	3.23	2.45	38	4.31	3.69	51	1.4
1.1-1.2	4.61	4.14	47	6.09	5.41	62	1.3
G - Black earths							
0-0.1	17.2	7.6	48	8.01	4.0	22	0.5
0.2-0.3	18.0	5.0	59	8.79	3.7	29	0.5
0.5-0.6	12.9	2.8	59	7.62	2.4	35	0.6
0.8-0.9	15.2	4.5	61	9.59	3.5	39	0.6
1.1-1.2	12.9	4.2	61	8.66	3.2	41	0.7
H - Alluvial soils							
0-0.1	5.9	-	42	2.13	-	14	0.4
0.2-0.3	8.3	-	58	2.55	-	18	0.3
0.5-0.6	10.0	-	54	3.07	-	17	0.3
0.8-0.9	8.7	-	57	2.55	-	17	0.3
1.1-1.2	9.5	-	62	2.76	-	18	0.3

* CEC = cation exchange capacity
** units are meq/100 g
\+ SD = standard deviation of x

Magnesium to calcium ratios greater than one, in association with relatively low ESP (<6) can cause clay dispersion in the subsoils of illitic clays (Emerson and Bakker 1973). These chemical properties occur in the subsoils of the soloths in Groups C and D and could pose potential problems such as impeded infiltration.

Surface 0.1 m exchangeable calcium range from 1.9 meq/100 g in the solodic soils to 17.2 meq/100 g in the black earths and levels are generally regarded as adequate. Yield responses by sugar cane to calcium fertiliser have been reported on coarse textured soils in the Mackay district with exchangeable calcium levels below 1.5 meq/100 g, Baker *et al.* (1985).

Magnesium levels range from 0.88 meq/100 g in the soloths to 8.0 meq/100 g in black earths.

Ratios of calcium and magnesium have been used by Coughlan (1969) and Shaw *et al.* (1986) to indicate clay mineralogy. Ca to Mg ratios range from 1.5 to 2.76 in the surface 0.1 m, while those in the subsoils range from 0.24 in the soloths to 3.3 in the alluvial soils at 0.6 m. This large range of ratios indicates a diversity of clay types are present.

Particle size, available water, CEC. Figure 4.3 shows the profile trends of mean clay percentage for selected soil groups. The highest clay contents occur in soil groups A, B and G. Highest surface 0.1 m clay contents being in the black earths (Group G) and the highest subsoil clay content occurring in the prairie soils (Group E). The prairie soils (Group E) have the highest proportion of silt in the profile with levels exceeding 30% for the surface 0.3 m.

Cation exchange capacity (CEC) follows a similar pattern to the clay percentage profiles. The black earths (Group G) recorded the highest values of 35 meq/100 g, while the lowest average values of 6 meq/100 g were recorded for the granite-derived soils in Group F. Figure 4.4 illustrates the trends with depth for the various soil groups. CEC levels in the surface 0.1 m range from 5 to 35 meq/100 g over the survey area and are regarded as being in the low to medium range.

Plant available water capacity (PAWC) was calculated using the method of Shaw and Yule (1978) and are listed in Table 4.3. The equations for calculating PAWC were developed for cracking clays and some duplex soils at Emerald and may not be totally suited to these soils, especially the solodic and soloths in soil groups A, B, C and D.

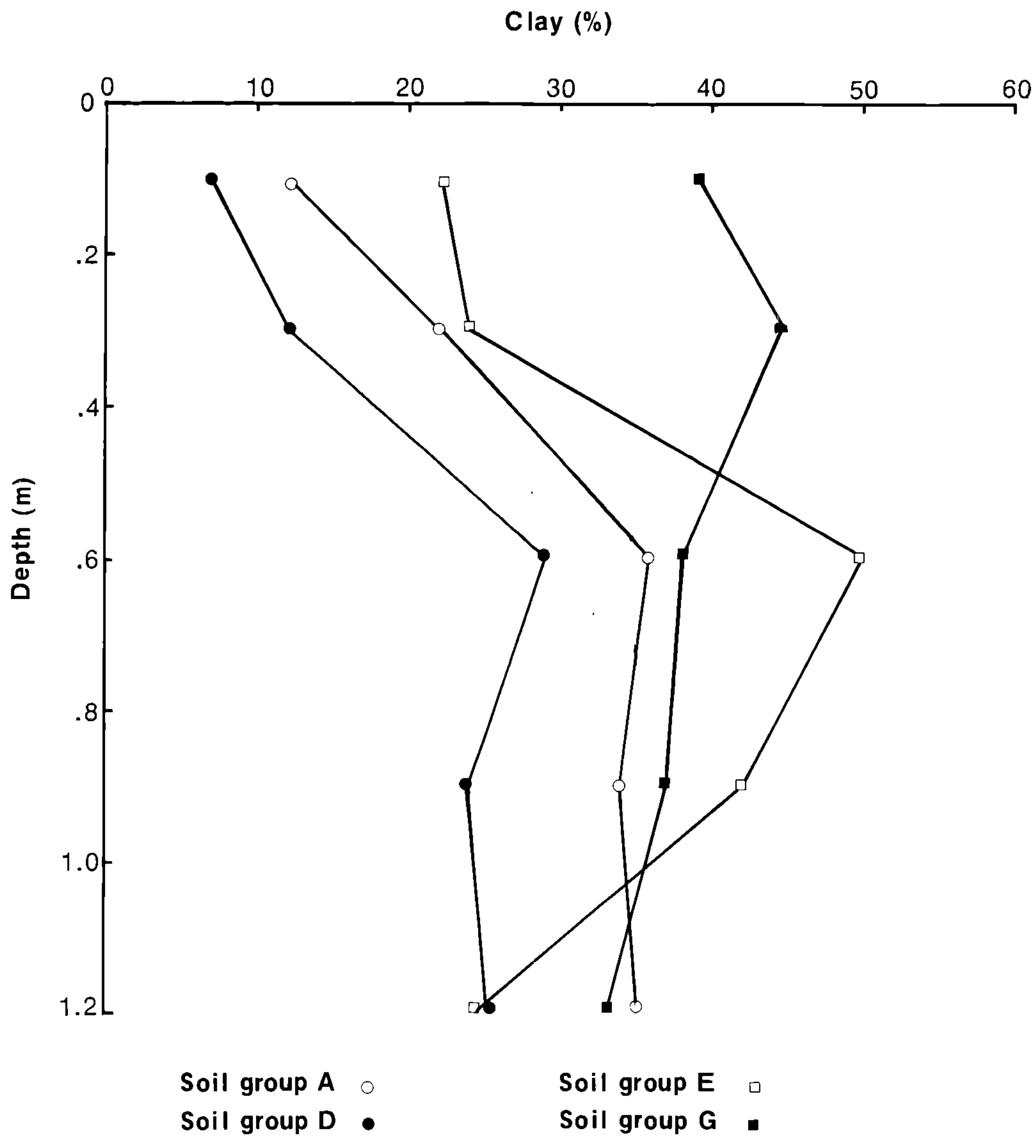


Figure 4.3 Clay percentage profiles for selected soil groups.

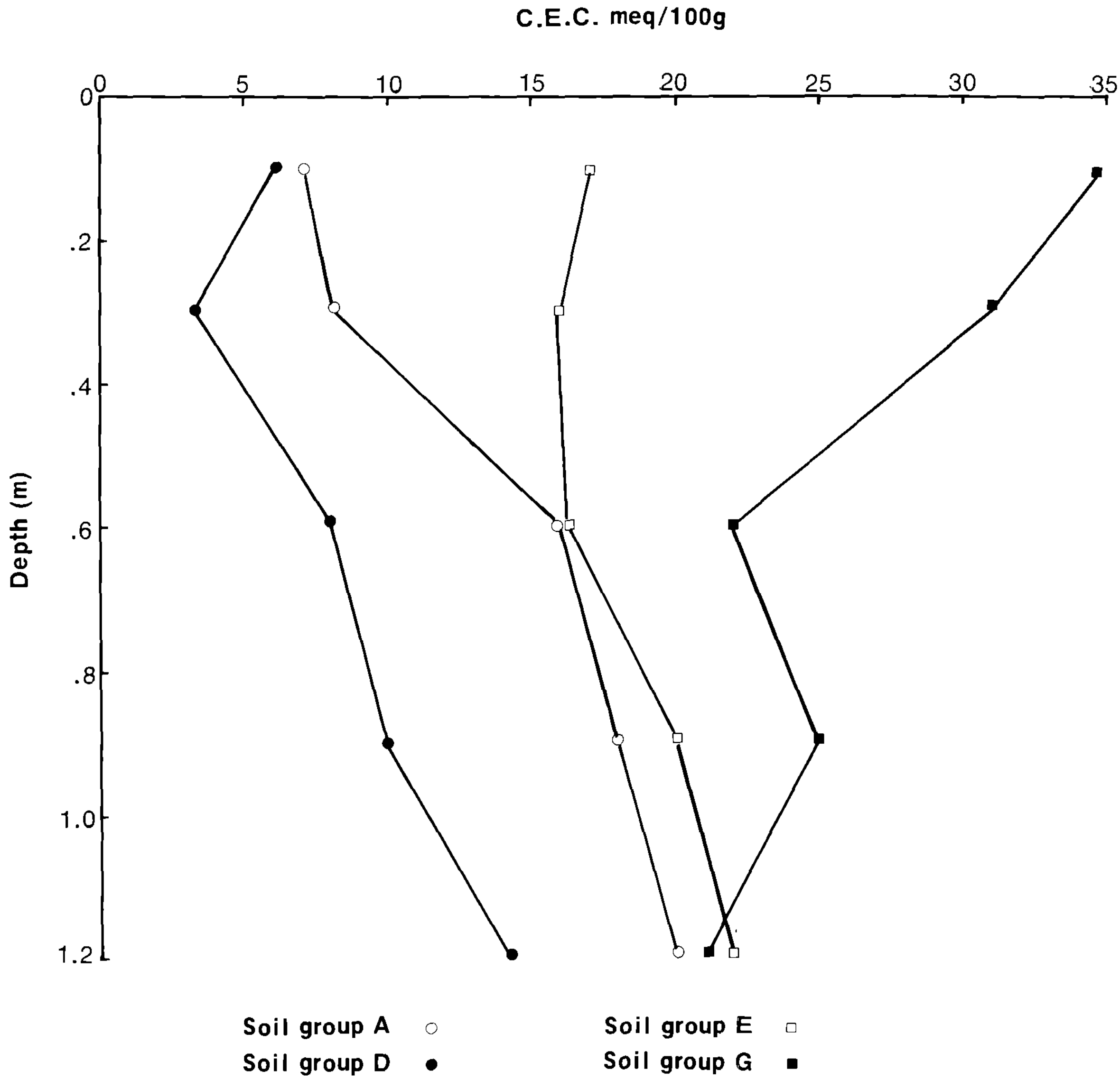


Figure 4.4 **Cation exchange capacity profiles for selected soil groups.**

Table 4.4. Calculated PAWC for the soil groups

Soil group	Assumed rooting depth (m)	Average predicted PAWC (mm)
A	0.9	136
B	0.9	138
C	0.9	128
D	0.9	131
E	0.9	141
F	0.9	126
G	0.9	136
H	0.9	133

The table shows that all rooting depths were estimated as 0.9 m with the prairie soils in Group E containing the highest PAWC of 141 mm.

4.5 Fertility

Table 4.5 lists fertility levels for the soil groups.

Table 4.5 Fertility levels* for the soil groups

Soil group	Acid P ppm	Bicarb P ppm	Organic Carbon %	Total Nitrogen %	Extr. K meq %	Exch. Cation Ca meq %	Exch. Cation Mg meq %	DTPA Trace Elements Fe (ppm)	Mn (ppm)	Cu (ppm)	Zn (ppm)
A Solodic soils	very low	low	low	low	medium	low	low	adequate	high	medium	medium
B Solodic soils	medium	medium	medium	low	high	adequate	adequate	adequate	high	medium	medium
C Soloths	low	low	low	low	medium	adequate	adequate	adequate	medium	medium	medium
D Soloths	very low	low	low	low	medium	low	low	adequate	medium	medium	medium
E Prairie soils	low	very low	medium	low	medium	adequate	adequate	adequate	high	medium	medium
F Granite derived	low	low	medium	low	high	adequate	low	adequate	medium	medium	medium
G Black earths	low	low	high	high	medium	adequate	adequate	adequate	high	medium	medium
H Alluvial soils	high	high	low	low	high	adequate	adequate	adequate	high	medium	medium

* Based on levels from Bruce and Rayment (1982).

Organic carbon, nitrogen and sulphur. The black earths (Group G) have the highest mean organic carbon (uncorrected Walkley and Black) and total nitrogen values (4.1% C and 0.32% N respectively). The mean organic carbon level for all soils is 1.8%. Carbon:nitrogen (C:N) ratios range from 11 to 18 for the soil groups with Groups C, D, and E having ratios of 16 or higher. Probert (1977) recorded a ratio of around 14 for similar soils in north Queensland. Baker *et al.* (1985) recorded a ratio of 14 for Mackay soils and Thompson *et al.* (1984) recorded 16 for Proserpine soils. C:N ratios around 15 have been suggested by Blakemore and Muller (1968), Iritani and Arnold (1960) and Spain *et al.* (1983) as associated with less fertile soils. However some exceptions to this generalisation were found in the Mackay area by Baker *et al.* (1985) where fertile soils had ratios up to 20.

The C:N:S ratios for soil groups in this study, together with ratios recorded for other soils from north Queensland, are summarised in Table 4.6. Somewhat similar findings are apparent.

Table 4.6. C:N:S ratios for north Queensland soils

Reference	C:N:S ratios
Probert (1977)	135:10:1.14
Crack and Isbell (1970)	133:10:1.33
Baker *et al.* (1985)	165:10:2.15
This study	148:10:1.89

Phosphorus. Table 4.7 lists the soil phosphorus status of the soil groups as assessed by the acid and bicarbonate extraction methods. Apart from the alluvial soils, phosphorus fertilisation would be necessary for the bulk of the soils used for cropping which are rated as low to very low in phosphorus. Pastures at or below (5-10 pm) bicarb P may be P deficient requiring supplements for grazing animals. Thompson *et al.* (1981) found that most soils in the Proserpine area had bicarbonate extractable phosphorus values less than 15 ppm, while Crack and Isbell (1970) found most solodic soils averaged 6.5 ppm bicarbonate phosphorus.

Table 4.7. Phosphorus status for the soil groups

Soil groups	(ppm) Acid P *x	+SD	(ppm) Bicarbonate P x	SD
(A) Solodic soils	9	6	12	11
(B) Solodic soils	24	22	39	28
(C) Soloths	13	10	15	9
(D) Soloths	6	2	6	2
(E) Prairie soils	15	2	4	3
(F) Granite-derived soils	17	7	12	11
(G) Black earths	10	5	13	8
(H) Alluvial soils	70	-	69	-

* x = mean value; + SD = Standard Deviation

For the Mackay soils, Baker *et al.* (1985) found bicarbonate P levels ranged from 5 to 20 ppm, and classified them as very low to medium. By that assessment, only Group H alluvial soils and Group B solodic soils would have adequate phosphorus status. All other groups would require phosphorus fertilisation for most crops.

Figure 4.5 shows profile trends for total P. The prairie soils have the highest levels of total P, while the soloths (group D) have the lowest content of any group.

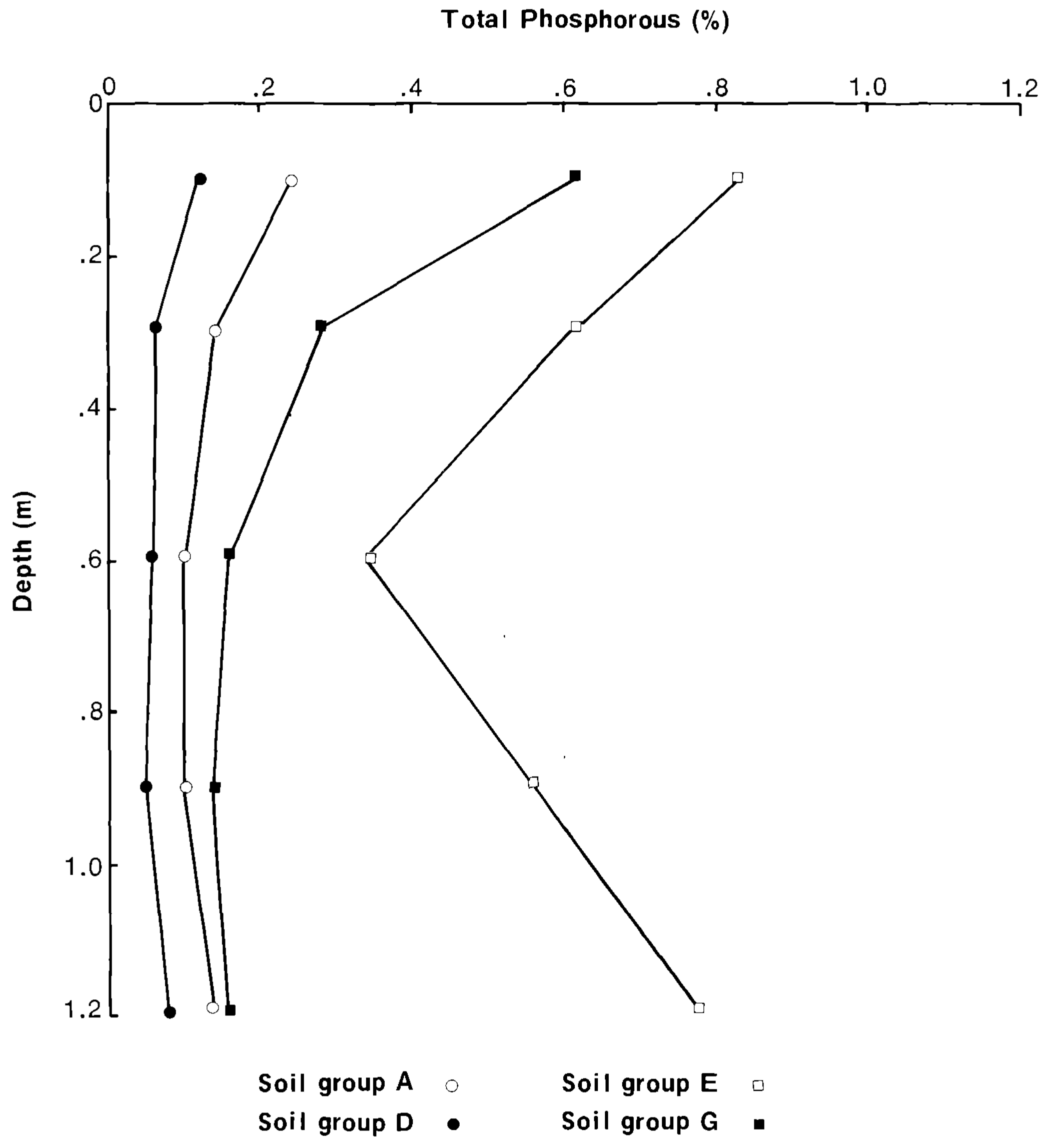


Figure 4.5 Total phosphorous profiles for selected soil groups.

Crack and Isbell (1970) and Thompson (1981), reported total phosphorus levels for north Queensland solodic soils of 0.015% and 0.1% respectively. Values for total P are higher for Plane Creek soils, possibly reflecting different parent materials.

Potassium. No soil group has extractable potassium below 0.2 meq/100 g. The highest value of 0.81 meq/100 g was found for the alluvial soil (H) while the lowest was found in the group D soloths. For all soils the mean was 0.45 meq/100 g. Figure 4.6 shows profile trends for Total K for some groups.

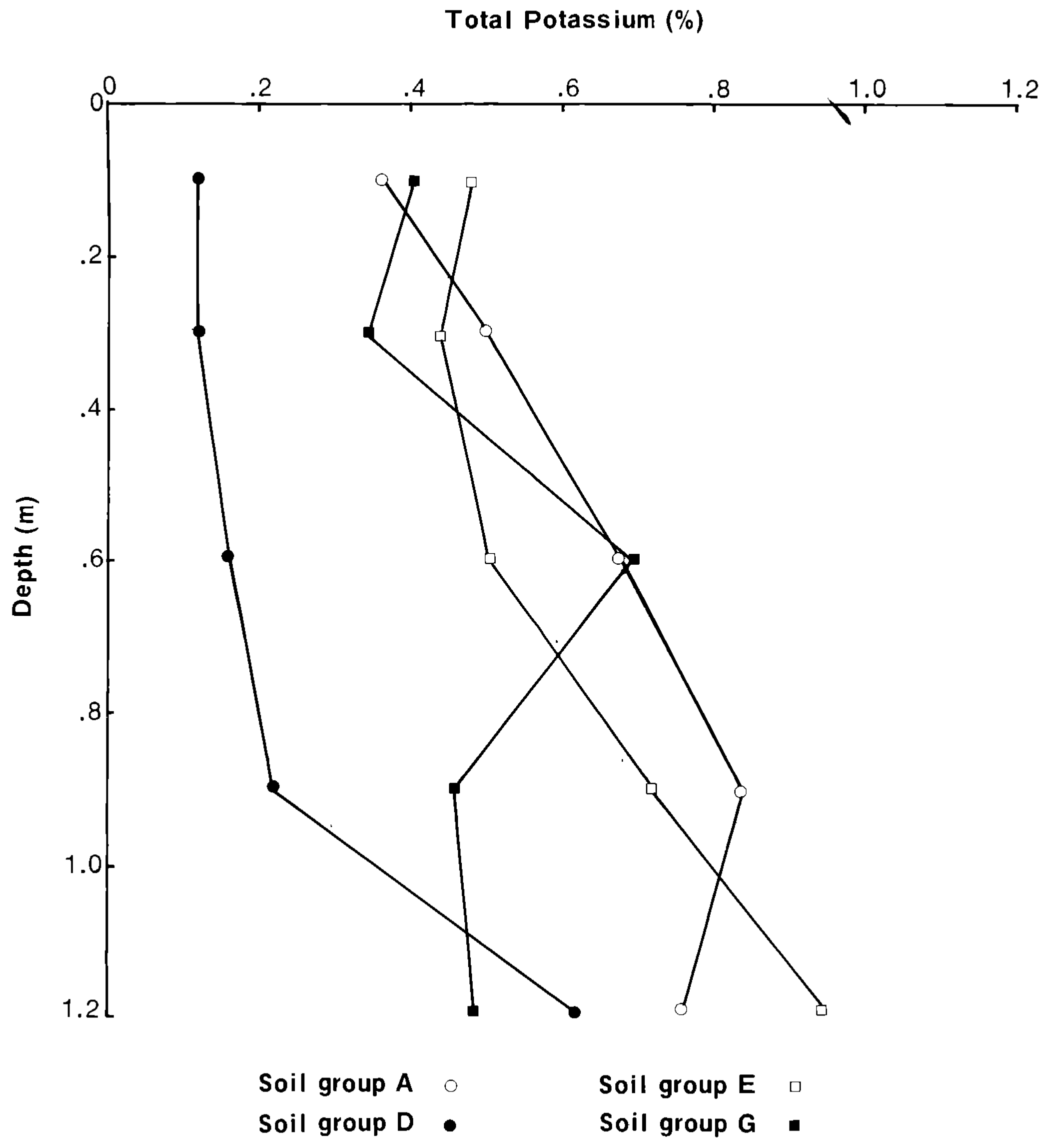


Figure 4.6 Total potassium profiles for selected soil groups.

Total K values are related to the extractable trend with the highest profile level around 1% in group H and the lowest (0.1%) in group D.

Extractable copper (Cu), zinc (Zn), manganese (Mn), iron (Fe). All soil groups appear to have adequate levels of extractable copper and zinc. The black earths (soil Group G) have the highest mean levels of Cu and Zn of 5.6 ppm and 2.1 ppm respectively. No yield responses to Cu and Zn would be expected on these soils.

The black earths (soil Group G) have the highest mean DTPA iron level of 240 ppm, while the soloths have the lowest mean level of 79 ppm. Manganese levels range from 23 ppm for the soloths to 68 ppm for the prairie soils. Manganese toxicity could emerge when soils are waterlogged, especially if soil pH declines as a consequence of poor fertiliser practice.

5. LAND SUITABILITY FOR SUGAR CANE

The method of assessing caneland suitability is outlined in Section 3.2. For detailed discussion of limitations to cane production, refer to the Mackay Report, Part 2, pp 18-29. Soil nutrient levels and limitations are discussed in Section 4.3 of this report.

5.1 Cane suitability related to soils

Table 5.1 summarises the degree of each limitation assessed for each soil described in Section 4.2.

Class 1 (50 ha)

Only minor areas of Class 1 (no limitations to canegrowing) land are found in the Plane Creek study area. Only one UMA of 53 hectares has been so classified, an area of predominantly Gillinbin soil. Most Gillinbin soils are only slightly limited by wetness (W1-2).

Another favourable soil is Hannan which may be located in areas of slight flood risk and because of light texture can be moisture-limited (m2 f1-2). Some of the minor areas of Hannan soils are Class 1, but at UMA scale there is usually some slight limitation.

Class 2 (14 800 ha)

The Class 2 land is usually found on colluvium or alluvial plains. Marwood is a coarse sandy soil, surrounding Mount Chelona. It is slightly susceptible to erosion and has a low waterholding capacity (e2 m2).

Wetness is a problem on the heavier textured soils and can occur in colluvial/alluvial situations where erosion is also a risk, for example Prendergast (e1-2 w2) and Cliftonville (e2 w1-2 s2) or Sarina (e1-2 w1-2 s1-2 k1-2) where sodicity and soil workability are additional limitations.

Soil workability and wetness are a common combination of limitations to canegrowing. Despite being on colluvial slopes, the heavy texture of the Borstal soil combined with its drainage situation make it workability and wetness-limited (k2 w2). The Turnor solodic soil on alluvial plains (k1-2 w2) is in a similar situation. Sodic influences often show up in poorly drained areas of heavy soils and this is represented by Cabbage Tree (k2 w2 s1-2 f1-2) which, in its narrow valley situations, may also be affected by flooding. Shinfield (s2 k2 w2) and Cherry Tree (s2-3 k2 w2) soils show sodicity increasing in importance.

Class 3 (34 970 ha)

A Class 3 soil is one which has significant limitations to canegrowing. However most of the soils in this class have few individual limitations at the Class 3 level. It is commonly a number of factors which combine to put the soil into Class 3.

Granitic soils on lower hill slopes are typically erosion-limited, for example Koumala (e2-3); and they may also have moisture limitations, for example Malin (m2-3 e2). Other better-structured and heavier-textured hill soils are also erosion prone, for example Hector (e2-3); they may be restricted by topographic irregularities, for example Saddle (e2-3 t1-2); and they may also contain stone which makes cultivation difficult, for example Swayneville (e3 t2 r1-2).

Duplex soils on the lowest hills and colluvial slopes, experience a range of limitations because of seasonal variation, for example Louisa (e2-3 m2 k1-2 w1-2) and Freddy (e2 m2 k1-2 w1-2). Moisture availability is a problem in the dry season, while low slopes and seepage situations make soil workability and wetness common restrictions in the wet season.

The paradox of being moisture-limited as well as wetness/workability-limited is more prevalent on the coastal plains, where compact B horizons underlie shallow-coarse-textured A horizons. These B horizons, when saturated, will become boggy and retain large amounts of soil water in the wet season; but will become rock-hard and impermeable in the dry season. Plants tend to remain shallow-rooted, and therefore sensitive to variations in moisture levels outside their normal water-use requirement.

The best example of this seasonal contrast is the Ilbilbie soil (k2 w2 m2) which often has a hardpan in the profile which can further affect soil moisture fluctuations. The Tedlands soil has similar limitations (k2-3 w2-3 m1-2), as has the Karloo soil but with the significant addition of a sodicity limitation (s2 k2 w2 m2). Other sodic soils are Sunnyside (s2 k2 w2 f2 m1-2) and Alligator (s2 k2 w2 f2) which also have a flooding limitation. While flooding is not a major drawback to canegrowing it can affect accessibility at critical times, to the extent that investigations have been requested on the flooding in the Dawlish area for instance (Palmer 1979). Another soil type which can, at times, be severely affected by wetness, flooding and sodicity is Bell (w2-3 k2 s2 f2).

The remaining Class 3 soil is Leichhardt, a coarse-textured, cobbly, alluvial soil, which is erosion-prone and has a low water-holding capacity (e2 r2 m1-2).

Class 4 (13 270 ha)

Soils which are marginal for canegrowing would not normally be developed, unless market conditions were attractive enough to warrant expenditure on the major limitations to canegrowing found in those soils.

The Turpad soil is a coarse sand, limited by erosion and moisture availability (e3-4 m3), while the Spider and Splitter soils have an opposite set of problems (s3 k3 w3 f2).

Class 5 (94 680 ha)

Some 69 400 hectares of land in the study area are mountainous and are unsuitable for sugar-cane or other forms of cultivation. Forestry is a possible land use for some parts, and the area as a whole is important as a water supply protection area. The fragility of the area and its potential to affect sedimentation and water quality on the plains, is seen in the streams below the Goonyella railway cuttings. These streams are choked with rock and gravel.

Soils described in this Class 5 mountainous country are Chelona (m5 t5 r5 e5), Urannah (m4 t4 r2 e5), Samourgassi (m3-4 t4 r4 e3-4), Breen (m4-5 t4 r4 e4) and Moffat (m2 t4 r4 e3).

The remaining Class 5 area is the mangroves, salt flats and frontal dunes covering some 25 280 hectares. Because of its obvious unsuitability for agriculture, this land was not included in the soil survey. This is not to say that canegrowing has not been attempted on this type of country; but the rationality of such development is questionable.

Table 5.1. Soil types in landform groups, showing caneland suitability limitations and areas

Landform/ soil	Caneland suitability limitations	Class	Total area
Soils derived from Mt Chelona granodiorite			
Chelona	m5 n5 t5 r5 e5	5	90
Malin	m2-3 n3 e2	3	410
Marwood	m2 n2-3 e2	2	310
Soils derived from acid to intermediate intrusives and dykes of the Urannah Complex			
Urannah	m4 n2 t3 r2 e5	5	12 300
Turpad	m3 n3 e3-4	4	340
Koumala	n2-3 e2-3	3	1 320
Swayneville	n2 t2 r1-2 e3	3	370
Shinfield	n2-3 s2 k2 w2	2	250
Borstal	w2	2	60
Soils derived from basic to intermediate volcanics of the Campwyn Beds			
Samourgassi	m3-4 n3 t4 r4 e3-4	5	11 190
Louisa	m2 n2-3 k1-2 w1-2 e2-3	3	6 590
Hector	n2 e-3	3	2 970
Cliftonville	n2 s2 w1-2 e2	2	1 120

Table 5.1. Soil types in landform groups, showing caneland suitability limitations and areas (cont.)

Landform/ soil	Caneland suitability limitations	Class	Total area
Soils derived from acid volcanics of the Carmila Beds			
Breen	m4-5 n4 t4 r4 e4	5	39 730
Freddy	m2 n2-3 k1-2 w1-2 e2	3	4 940
Soils derived from intermediate flow and pyroclastics of the Connors Volcanics			
Moffat	m2 n3-4 t4 r4 e3	5	7 960
Saddle	n1-2 t1-2 e2-3	3	620
Uniform soils of floodplains, levees and terraces			
Leichhardt	m1-2 n2 r2 e2	3	910
Hannan	m2 n2 f1-2	2	2 170
Uniform clay soils in areas of restricted drainage			
Spider	s3 k3 w3 f2	4	80
Bell	s2 k2 w2-3 f2	3	2 270
Duplex soils of alluvial plains			
Gillinbin	n2 w1-2	2	2 080
Cabbage Tree	n2 s1-2 k2 w2 f1-2	2	250
Turnor	k1-2 w2	2	1 970
Prendergast	n2-3 w2 e1-2	2	290
Sarina	n2 s1-2 k1-2 w1-2 e1-2	2	1 090
Cherry Tree	n2-3 s2-3 k2 w2	2	2 350
Duplex soils of coastal plains			
Splitter	n3 s3 k3 w3 f2	4	420
Karloo	n3 m2 s2 k2 w2	3	11 760
Alligator	n2-3 s2 k2 w2 f2	3	1 210
Sunnyside	m1-2 n2-3 s2 k2 w2 f2	3	2 500
Tedlands	m1-2 n2-3 k2-3 w2-3	3	5 350
Duplex soils of the relict plains			
Ilbilbie	n3-4 m2 k2 w2	3	7 200
Frontal Dunes		5	2 090
Gullied Lands		5	150
Mangroves and Saltmarsh		5	23 070
Urban and Industrial		-	3 880

5.2 Cane suitability mapping

Map 1 'Land Suitability for Sugar-Cane' is derived from the UMA datafile. Thus the suitability class for a particular UMA, based where possible on specific data, may not correspond with the soil type suitability class, based on modal values, as described in the previous section.

The Plane Creek study area does not contain significant areas of Class 1 land although there are large areas of Class 2 land which have only very slight limitations. Class 3 is the major class of suitable land. Class 4 land is less common and is often land which has been degraded from Class 3 or even 2 by poor land use practices. Class 5 land covers the largest area in the survey and is divided between steeplands and coastal saltflats, mangroves and frontal dunes.

Known areas of salinity or sodicity are also indicated on the Land Use and Land Suitability map. Soda patches are generally very small but are indicators of a possibly larger problem in the future. Figure 5.1 shows the general distribution of areas considered to be susceptible to salting in the study area. These areas are mainly heavy solodic soils on flat coastal plains, away from main drainage lines.

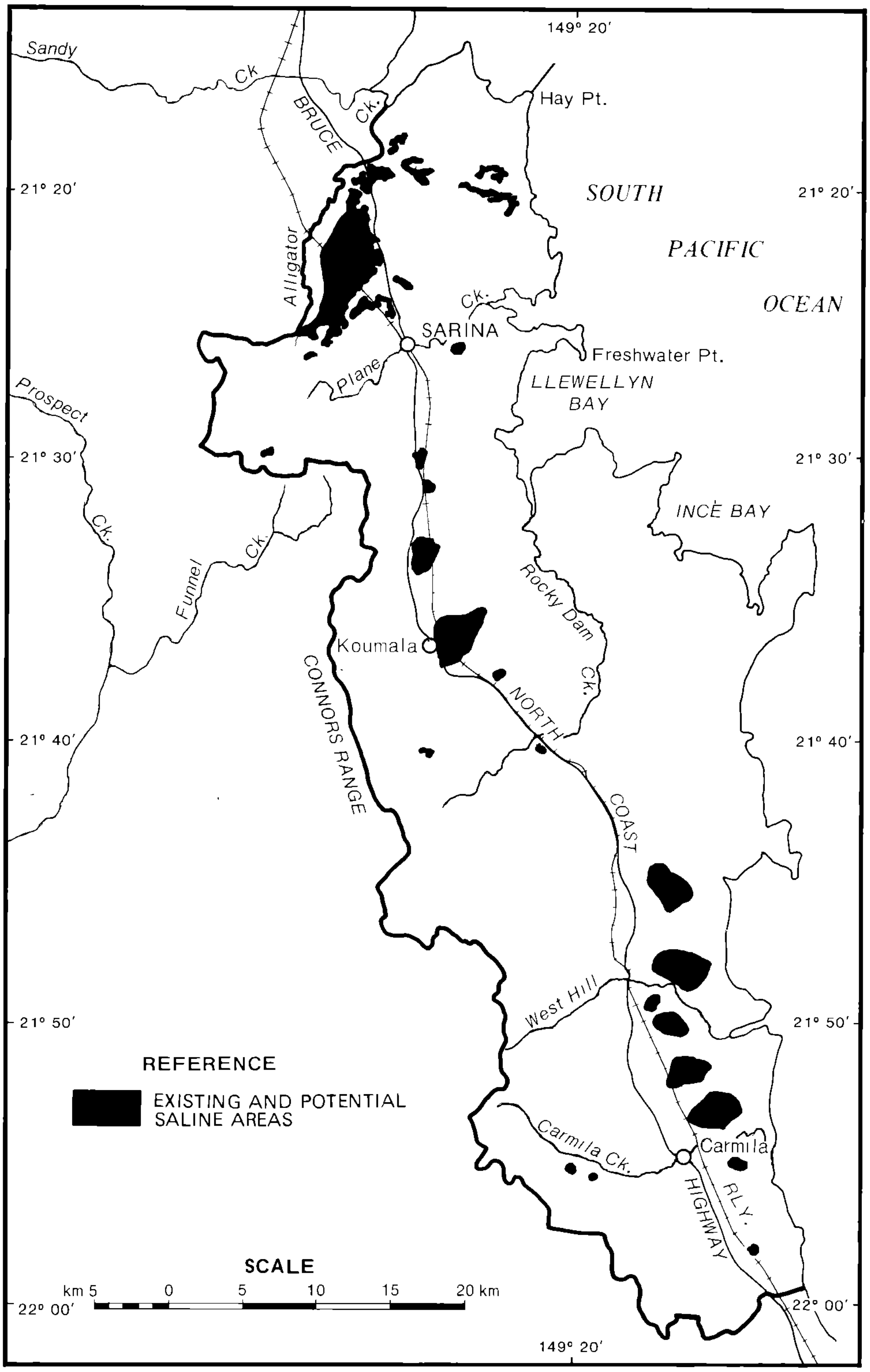


Figure 5.1 – AREAS SUSCEPTIBLE TO SALTING

5.3 Cane suitability areas related to Plane Creek Mill

The overall distribution of areas of the different cane suitability classes is shown in Table 5.2, which shows distribution related to distance from the mill. Table 5.3 presents the same data related to local authority areas.

Table 5.2. Areas of land grouped by cane suitability class and distance from Sarina

Distance from Sarina (km)	Class (ha) Suitable 1		2		3		Marginal 4		Unsuitable 5		Urban/ Industrial	
	A*	U*	A	U	A	U	A	U	A	U	A	U
0 - 9	0	0	1100	670	1990	2020	530	1260	490	6640	30	1450
10 - 19	0	0	1240	1260	3280	3630	100	700	530	12560	110	1180
20 - 29	0	0	1700	2910	960	1860	200	390	120	7850	10	970
30 - 39	0	0	790	2390	560	1530	140	4850	80	11510	0	0
40 - 49	0	0	440	530	160	2170	40	1850	10	14600	0	0
50 - 59	40	10	270	130	540	9400	20	980	30	16240	0	80
60 - 69	0	0	390	270	550	4290	40	800	70	11550	0	60
70 - 79	0	0	280	150	250	510	10	290	190	8310	0	0
80 <	0	0	170	130	170	1090	20	1070	30	3890	0	0
	40	10	6380	8440	8460	26500	1100	12190	1550	93150	150	3740

* A = assigned, U = unassigned

Table 5.3. Areas of land grouped by cane suitability class and local authority area

Cane suitability class*	Local authority Sarina (ha)	Broadsound (ha)	Total area by class (ha)
1	-	50	50
2	12180	2810	14990
3	21630	14380	36010
4	9320	5330	14650
5	51410	44540	95950

* Includes urban and industrial areas

From Table 5.2, it is relevant to note that less than 1% of assigned caneland occurs on Class 1 land, 36% on Class 2 land and 48% on Class 3 land. Approximately 2650 ha or 15% of currently assigned land are considered marginal or unsuitable for long term cane production. Theoretically, this area could be fully reassigned to suitable land within 20 kilometres of Sarina. There is an overlap of 1% of the assigned land into the Urban/Industrial classification. This arises from the time differential between cane assignment mapping and recent land subdivision. By the time of report publication, this land is likely to be out of cane production. The data clearly indicate there is no shortage of suitable unassigned land for sugar-cane production in the Plane Creek mill area.

The main conclusions to be drawn from Table 5.3 are that, within the study area, Broadsound Shire is less well endowed with suitable caneland than Sarina Shire. Some 33 800 ha or 36% of Sarina Shire are considered suitable for sugar-cane production compared to 17 200 ha or 26% in Broadsound Shire.

6. LAND UTILISATION

The study area comprises land for agriculture, towns and industry, grazing, forestry and minor recreational uses. Although the study deals predominantly with the needs of the local sugar industry, it recognises the other land uses in the area and the complementary aspects of competition for land as the markets for products fluctuate.

This section examines the land uses, recent changes which have taken place and recommendations for a stable land use policy in the area.

6.1 Current land uses

Sugar-cane is the major land use of the area, with beef cattle grazing the only other significant industry. There are extensive areas of largely virgin forests in the steeplands to the west. Some minor agricultural and horticultural crops may become more important as cane growers diversify. Around Sarina, there are increasingly significant areas of residential, recreational and industrial areas, but such uses are less important further south.

6.1.1 Sugar-cane

Sugar-cane has been the major economic base of the district for many years, and the area has expanded from around the mill in Sarina to Koumala and thence to the Carmila district. In the past, cane was grown in the Kalarka district, 35 kilometres south of Carmila, and there were proposals to establish a mill there to process the southern cane.

The main concentrations of sugar-cane are around Sarina and Koumala, with minor pockets concentrated along the main creeks from Ilbilbie to Flaggy Creek (see Map 3, Land Use/Land Suitability). The total gross assigned area of cane is 15 320 hectares (1984).

Transport of cane from the more distant southern farms is implemented by contract trucking and Queensland Railways. This is both expensive and difficult to organise. Under depressed market conditions, the economics of this part of the mill's operation is questionable. At the northern end of the mill area, caneland is being lost to urban development, making the mill's tramline network gradually less economic. While the mill's transport problems are perceived quite clearly, the diverse problems of growers are no less important. Growers in low return areas need to assess their individual situations and determine, with each other and the mill, a co-ordinated strategy aimed at more cost-efficient production. This may eventually involve land use change. Some of the soils of the southern parts of the Plane Creek Mill Area would be suitable for crops other than sugar-cane, provided markets are available.

6.1.2 Grazing

Grazing of beef cattle is a major but less intensive land use. There are few specialist beef producers, and many of the smaller producers are also canegrowers. Clearing of land and establishment of pastures have often been an interim phase towards assignment of the land for sugar-cane production.

Undeveloped country has a low carrying capacity and native pastures produce poor liveweight gains. About 60 000 ha of land have been developed since the late 1960s, using mainly Kazungula setaria (*Setaria sphacelata* cv. Kazungula), Rodd's Bay plicatulum (*Paspalum plicatulum* cv. Rodd's Bay), pangola grass (*Digitaria decumbens*), siratro (*Macroptilium atropurpureum* cv. Siratro) and Schofield stylo (*Stylosanthes guianensis* cv. Schofield).

The humid coastal conditions result in poor legume persistence, despite pasture renovation strategies and introduction of other stylos. Glenn jointvetch (*Aeschynomene americana* cv. Glenn) is a recently introduced legume which seems to be more adaptable to the heavy grazing and periodic waterlogging experienced on the Mackay wet coast.

Grazing of dairy cattle is carried out in the Sarina Shire, but west of the Connors Range and outside the Plane Creek study area.

6.1.3 Other agriculture

Apart from sugar-cane and grazing, there are no significant areas of other commercial agriculture in the study area. Minor areas of other crops include:

- Pineapples - at Alligator Creek and Koumala, for local markets.
- Jojoba and aloe vera - small plots of these crops have been planted, but their long term future is uncertain.
- Maize and soybeans - these have been suggested as cash crops to supplement canegrowers' current incomes.

6.1.4 Forestry

Forestry is not a major industry in the Plane Creek area, being mainly confined to the following sections of the Connors Range:

Timber Reserve	179	Kelvin and Sarina	4060 ha
State Forest	129	Long Hill	2750 ha
State Forest	125	Porphyry Hill	470 ha.

The majority of the area under the control of the Forestry Department is steep and rugged and has been primarily reserved for watershed protection purposes with incidental timber production. Within each of these areas the flatter, open, hardwood forest types are grazed under Special Lease. Some recreational use is made of Long Hill State Forest by a Mackay-based bushwalking club.

The Department offers advice on planting trees for windbreak, forest plot and rehabilitation purposes. Landholders whose proposals are approved may then purchase the trees at concessional rates. Few landholders have taken advantage of this scheme in the study area to date.

A proposal to establish agroforestry on assigned land identified as unsuitable for growing cane in the long term is being considered with cane grower representatives.

6.1.5 Secondary industry

The only major secondary industry in the study area is the alcohol plant in Sarina, which uses molasses from the sugar mill to produce ethanol. The company uses 590 ha of the coastal plain at Oonooie to spread its waste product, called dunder.

Although not strictly a secondary industry, the coal loading terminals at Hay Point play an early part in the secondary industry process by facilitating the movement of coal to manufacturing centres overseas. The terminals and associated residential areas occupy a total of 1400 ha.

6.1.6 Residential

The major residential centre is Sarina town with a population of 7200 and a built-up area of 600 ha. Although the town has slowly expanded, most new development has taken place in separate subdivision areas on or near the main highways, and on roads radiating from Hay Point. The urban and industrial areas shown on all the maps accompanying this report indicate the main development centres, but there are many smaller groups of houses and hobby-farms too small to map.

Centres south of Sarina have shown little growth, with the exception of a Lands Department development at Green Hill, east of Ilbilbie.

6.1.7 Recreational

Parts of the coast between Hay Point and Carmila have always been popular as camping and fishing areas. These areas are slowly developing to fulfil the demand for beach-houses from canegrowers and miners from the hinterland. At this stage of its development, the Green Hill project, mentioned in the previous section, falls into this category.

6.1.8 National Parks

The major National Park in the study area is at Cape Palmerston (NP801). Other parks are at West Hill Island (NP94) and a nearby area of sand dunes on the mainland (NP114). These areas are inaccessible except by all-terrain vehicle, boat or helicopter.

6.1.9 Irrigation

Of the eight sugar mill districts in the Mackay cane growing region, irrigation is least practised by farmers in the Plane Creek Mill area. Lack of natural water resources, a direct result of the topography, is the major reason for this. With the proximity of the coastal ranges to the ocean, watersheds are relatively small in area, providing seasonal runoff patterns of short duration. Consequently watercourses generally provide inadequate and unreliable irrigation supplies. The absence of significant ground water aquifers is a consequence of the same phenomenon.

Carmila Creek is the most extensively utilised irrigation supply with other streams including Flaggy Rock, West Hill, Marian, Rocky Dam, Cherry Tree and Alligator Creeks providing a limited source. The Plane Creek catchment is fully committed to the water requirements of Sarina township, Plane Creek sugar mill and the power alcohol plant in Sarina. In general, property owners appear less irrigation-conscious than farmers in other districts and this explains the small number of on-farm storages. However the area is not as prone to drought conditions as other cane-growing districts, such as the Septimus-Mia Mia and Brightley areas of the Pioneer Valley and the Kelsey Creek and Up River areas west of Proserpine. Spray irrigation is the main form employed, with travelling irrigator layouts replacing the traditional spraylines.

There are presently three irrigators on the right bank of Alligator Creek, although there are 25 canegrowers who will be able to take advantage of water supplied from the Mount Alice main channel of the Eton Irrigation scheme.

Other significant areas of irrigation are at Cherry Tree Creek, Rocky Dam Creek, West Hill Creek, Gillinbin Creek, Carmila Creek and Flaggy Rock Creek. The irrigation situation is summarised in Table 6.1.

Table 6.1. Irrigation in the Plane Creek Mill area

Catchment (see Fig 2.3)	Stream (1)	Number of irrigators	Significant farm dams	Sugar-cane	Hectares pastures	Small crops
1	Alligator	3	1	32	4	
3			3			
4			3			
6	Plane Creek	1		42		
7			1			
9	Cameron, Cherry Creek	4	4	123		
11	Arrowroot	1		15		
12	Rocky Dam	4	1	26	49	5
13	Rocky Dam	5		40	114	8
15	Marion	1			20	10
16	Marion	1			24	
17	West Hill, Spider	2		29		
18	Gillinbin	2			58	10
19	Carmila	12		183		11
20	Carmila	3		72		
22	Flaggy Creek	5		36		9

6.2 Land use changes

Since the 1960s, advances in machinery technology have enabled canegrowers to operate on wet, flat lands more easily than in the past. As a result, there has been a gradual transfer of assignments from steeplands, which are well-drained but difficult to cultivate and harvest, to the heavier soils of the coastal plains. At the same time, new assignments have been predominantly on to the coastal plains.

Other land use changes affecting the study area are the development of the Hay Point area and the demand for residential land nearby. This has resulted in the relinquishment or transfer of assignments away from the area. Further land subdivision has been stimulated by the decline in the sugar market and this has started to intrude into the better caneland.

6.2.1 Land degradation

Two main forms of land degradation occur in the study area, soil erosion and salting/sodicity.

The erosion problem in the area is moderate to serious. The most widespread form of soil erosion is sheet erosion which is often masked by routine cultivations. Where it is worst, it results in minor gullies at the lower corners of cane paddocks. Active, deep gullying occurs in Bell soils in upper Bells Creek, where landform and geology combine to create an erosion-prone situation, which is aggravated by grazing in the vicinity of the gully heads and increased clearing in the catchment area. A similar, smaller scale situation occurs south of Dents Mountain at Koumala South. Minimum till cultivation and crop residue retention would do much to reduce sheet erosion. The gullying problems will continue unless runoff is controlled by soil conservation structures, and the gully heads fenced off and stabilised.

In terms of area affected, the problem of salinity does not appear particularly serious; but visible soda patches seldom decrease, and there is every likelihood of an increase in salinity or soda-affected areas in years to come. Some of the larger areas of new cane on flatlands have experienced drainage difficulties and soda occurrences have been noticed. There is no causal link established as yet, but inefficient drainage is considered to be a major contributor to the concentration of mobile salts. Although existing soda patches are costly to rehabilitate, the future of areas with potential for salting can be improved by implementation of co-ordinated drainage schemes. This will require mutual cooperation among landowners, and some council direction may be needed to stimulate this.

Considerable land degradation has been initiated by the upgrading of transport arteries through the study area. Quarries and road or rail cuttings have exposed large areas of soil to the elements. These are bound to result in off-site erosion and gullying. Rehabilitation of disturbed areas associated with major road-works should be undertaken.

The dunder disposal area at Oonooie is another area of degradation. The land is open to erosion and heavy rainfall can quickly move heavy concentrations of toxic waste into the mangroves and estuaries.

6.2.2 Land use competition

Land use competition in the study area became apparent during the latest period of sugar industry expansion, which roughly coincided with expansion of the coal export infrastructure in the area. Demand for real estate in the Hay Point area impinged on areas of caneland between Sarina and Hay Point. Initially, much of the subdivided land was on steep country unsuitable for canegrowing. At the same time, the duplication of the Hay Point railway excised a small area of land from each farm it passed through.

With the depression in sugar prices, some canegrowers were keen to alleviate their financial difficulties by subdividing their land and transferring or giving up their assignments. This has accelerated the already established steady trend towards reduction of the mill's oldest supply areas, making the established tram network less efficient in terms of area serviced.

6.3 Land use recommendations

Recommendations for future land use in the study area are discussed below in approximately descending order. Each subject area is concluded by a single statement covering the recommendation and these statements are repeated in the summary of recommendations at the beginning of the report.

6.3.1 Preservation of valuable agricultural land

The trend to non-agricultural land uses in the Sarina-Hay Point area should be contained, so that major areas of sugar-cane and potential caneland remain intact. Subdivision in this district should be restricted until existing subdivisions are substantially settled. Any future subdivision approvals in the district should be aimed at consolidating existing land use types to diminish potential conflicts between land owners involved in different activities.

If, due to industry restructure, major areas of suitable caneland eventually go out of cane production, the area should initially be assessed for other agriculture and, if found suitable, retain its rural zoning.

This survey and associated reports (Wills 1985) are recommended for determining the suitability of areas of land for canegrowing and other activities.

Recommendation. Suitable existing or potential canelands should be retained as far as possible for canegrowing, or other agriculture if applicable. Non-agricultural land uses should be located in areas already zoned non-rural or in areas classed as unsuitable for sugar-cane.

6.3.2 Drainage and salting

Expansion of cane on to the coastal plains has caused problems of unco-ordinated drainage between farms, leading to erosion, ponding and salinisation. There are considerable areas of coastal plains which may eventually be planted to sugar-cane. In their natural state these are poorly drained and have soda patches. A coordinated drainage scheme should be planned and incorporated into farm design, prior to any further major development.

The study area suffers from minor outcrops of what are locally known as 'soda patches'. Their inter-relationships with geology, and surface and subsurface drainage, are not well understood, and more research is needed into this topic.

Recommendation. Further agricultural development on to coastal plains should be preceded by a comprehensive drainage scheme. More research into salinity/sodicity is needed.

6.3.3 Soil erosion

Sugar-cane should eventually be reassigned from the erosion-prone Class 4 or 5 lands. On other areas, erosion can be minimised effectively by soil conservation measures and conservation management practices.

In the study area, erosion from non-agricultural activities is as serious as that from agriculture. Off-site effects of highway and rail improvements should be given higher priority by the authorities involved. Liquid waste disposal at Oonooie warrants investigation to minimise the potential erosion and pollution hazards.

Recommendation. Soil erosion on sloping canelands is manageable and can be treated by using soil conservation measures. Erosion from non-agricultural sources is serious and should be treated progressively as an inherent part of the main activity.

6.3.4 Diversification and hobby farms

Grazing has been the main basis for diversification among canegrowers and is expected to continue. This will depend to some extent on technology development within the industry and markets.

Many canefarmers are looking to alternative crops for extra income while the sugar market is depressed. Crops such as aloe vera and jojoba do not require large areas of land; nor are their requirements well known. For field crops such as maize or soybean, the land resource database can be assessed to indicate areas suitable for those crops. Most conventional crops have higher requirements than sugar-cane and would therefore require the better classes of caneland for their production.

Some of the de-assigned steeplands on canefarms may be suited to tree crops, but the units are so small that many of the areas were not mapped in this study. Nevertheless, such areas could generate income and have a beneficial influence on erosion, sedimentation and footslope salinity.

Recommendation. Decisions to diversify out of cane should be cognisant of land resource characteristics and limitations as they affect the crop concerned.

6.3.5 The Plane Creek Land Use Action Committee

The Plane Creek Land Use Action Committee was formed on 10 September 1981 to plan and promote efficient land use in the Plane Creek Mill area. Its membership comprises:

- Chairman and Secretary, who are also Chairman and Secretary of the Plane Creek Mill Suppliers' Committee.
- 1 ordinary member from the Plane Creek Mill Suppliers' Committee.
- 2 canegrower members of the Sarina Shire Council.
- 2 canegrower members of the Broadsound Shire Council.
- 2 management representatives from Plane Creek Mill.
- 1 BSES (Sarina) representative.
- 1 Land Resources Branch (QDPI) representative.

The Committee provides a forum for discussion of land use issues. It does not have authority to determine land use but the members have access to other bodies which do. They may therefore provide better-informed inputs to land use decisions made elsewhere.

Preliminary maps and survey data were used to provide a map of land suitability for the Sarina Shire Development Control Plan, and also to assist State Government bodies in preparing environmental impact statements. This report will be distributed to all bodies concerned with land use, including members of the Committee.

Recommendation. The Plane Creek Land Use Action Committee should continue to meet regularly after the release of this report, and should refer to it on any issues affecting agricultural land use.

ACKNOWLEDGEMENTS

My thanks to -

- the canegrowers of the Plane Creek Mill area for allowing access to their land to collect the information needed for this study.
- the members of the Plane Creek Land Use Action Committee, particularly the Chairman, Mr Jim Pedersen, and the Secretary, Mr Peter Sheedy, for their support and assistance during the course of the survey.
- Mr Bill Webb, BSES extension officer at Sarina, for his advice and assistance; and Mr Mike Haysom at BSES, Te Kowai for use of his soil drying and crushing equipment.
- Dr Bill McWhinney and computing staff at SRI for use of the computer terminal.
- Mr Ross Manderson of Queensland Department of Forestry, Mr Max Brown and Mr Bill Legg of Queensland Water Resources Commission for their contributions to Sections 6.1.4, 6.1.9 and 2.4.2 respectively.
- Mr Peter Young formerly of Queensland Department of Primary Industries' Botany Branch for early assistance with vegetation.
- Mr Greg Holz and Mr Peter Shields for advice and assistance; and Mr Ron Ebersohn for field assistance.
- Mr Kerry Rosenthal, Mr Col Ahern and Mr Graham Tuck for computing assistance and Ms Monica Bentley for laser printing preparation.
- Mr Charles Ellis, Mr John Myers and Ms Lynda Belsham for drafting support.
- Mr Ed Turner and Mr Bob Reid for general editing and technical advice on soils.
- Ms Lyn Landers and Ms Pat Adair for typing the report.

REFERENCES

Baker, D.E., Holz, G.K. and Shields, P.G. (1985), Chemical and physical characteristics, in G.K.Holz and P.G.Shields, *Mackay Sugar Cane Land Suitability Study - Part 1, Land Resource Inventory,* Queensland Department of Primary Industries, Land Resources Bulletin QV85001.

Blakemore, L.C. and Miller, R.B. (1968), Organic matter, in *Soils of New Zealand*, Soil Bureau Bulletin No 26, 55-67.

Bruce, R.C. and Rayment, G.E. (1982), *Analytical methods and interpretations used by the Agricultural Chemistry Branch for soil and land use surveys,* Queensland Department of Primary Industries Bulletin QB 82004.

Bruce, R.C. and Crack, B.J. (1978), Chemical attributes of some Australian acid tropical and sub-tropical soils, in C.S. Andrew and E.J. Kamprath (eds.) *Mineral Nutrition of Legumes in Tropical and Sub-Tropical Soils*, CSIRO, Melbourne.

Bureau of Meteorology and Australian Water Resources Council (1968), *Review of Australia's Water Resources. Monthly Rainfall and Evaporation. Drainage Divisions I to XII. Part 1 - Data Tabulations,* Melbourne.

Bureau of Meteorology (1975a), *Climatic averages. Queensland,* Canberra.

Bureau of Meteorology (1975b), Global radiation, Map Set 2, in *Climatic Atlas of Australia*, Canberra.

Bureau of Meteorology (1979a), Cloud, Map Set 7 in *Climatic Atlas of Australia,* Canberra.

Bureau of Meteorology (1979b), Wind roses, Map Set 2, in *Climatic Atlas of Australia*, Canberra.

Chappell, J. (1983), Evidence for smoothly falling sea level relative to north Queensland, Australia, during the past 6000 yr. *Nature*, **302**, 406-08.

Cook, P.J. and Mayo, W. (1977), *Sedimentology and Holocene history of a tropical estuary (Broadsound, Queensland)*, Bureau of Mineral Resources, Geology and Geophysics, Canberra, Bulletin 170.

Coughlan, K.J. (1969), Prediction of the moisture holding characteristics of Queensland soils - a preliminary study, *Queensland Journal of Agricultural and Animal Sciences* **26**, 465-73.

Crack, B.J. and Isbell, R.F. (1970), Studies on some solodic soils in north-eastern Queensland, I. Morphological and chemical characteristics, *Australian Journal of Experimental Agriculture and Animal Husbandry* **10**, 334-41.

Dick, R.S. (1975), A map of the climates of Australia : according to Koppen's principles of definition, *Queensland Geographical Journal* **3**, 33-69.

Emerson, W.W. and Bakker, A.C. (1973), The comparative effects of exchangeable calcium, magnesium and sodium on some physical properties of red-brown earth subsoils, *Australian Journal of Soil Research* **11**, 151-57.

Holz, G.K. and Shields, P.G. (1985a), *Mackay sugar cane land suitability study. Part 1 Land Resource Inventory.* Queensland Department of Primary Industries, Land Resources Bulletin QV85001.

Holz, G.K. and Shields, P.G. (1985b), *Mackay sugar cane land suitability study. Part 2 Land Suitability.* Queensland Department of Primary Industries, Land Resources Bulletin QV85002.

Iritani, W.M. and Arnold, C.Y. (1960), Nitrogen release of vegetable crop residues during incubation as related to their chemical composition, *Soil Science* **89**, 74-82.

Isbell, R.F. and Murtha, G.G. (1970), Soils, in *Burdekin-Townsville Region, Queensland, Resource Series*, Department of National Development, Canberra.

James, P.E. (1966), *A geography of man*, 3rd edition, Waltham, Mass., Blaisdell, 480-1.

Jensen, A.R., Gregory, C.M. and Forbes, V.R. (1966), *Geology of the Mackay 1:250 000 sheet area Queensland*, Bureau of Mineral Resources, Geology and Geophysics, Canberra, Report 104.

Koppen, W. and Geiger, R. (eds.) (1936), *Handbuch der Klimatologie*, Borntraeger, Berlin, 41-3.

Leverington, K.C. (1971), Irrigation practices in the Queensland sugar industry, *Proceedings International Society Sugar Cane Technologists* 899-905.

Martin, J.E., Willmot, W.F. and O'Flynn, M.L. (in prep.), *Geological map commentary, Mackay 1:100 000 sheet area Queensland.* Geological Survey of Queensland, Brisbane.

McAleese, C.M. (1964), Some frost observations in the Carmila West area, 1963, *Proceedings Queensland Society Sugar Cane Technologists* 97-103.

McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J. and Hopkins, M.S. (1984), *Australian Soil and Land Survey Field Handbook*, Inkata Press, Melbourne.

Northcote, K.H. and Skene, J.K.M. (1972), *Australian soils with saline and sodic properties*, CSIRO, Australia, Division of Soils, Soil Publication No. 27.

Oyama, M. and Takehara, H. (1967), *Revised Standard Soil Colour Charts*, Fujihara Industry Co. Ltd., Tokyo.

Palmer, E.C. (1979), *A preliminary assessment of the feasibility of an agricultural drainage scheme for the Dawlish area*, Department of Local Government, Brisbane.

Probert, M.E. (1977), *The distribution of sulphur and carbon-nitrogen-sulphur. Relationships in some north Queensland soils.* CSIRO Australia, Division of Soils, Technical Paper No. 31.

Ridge, D.R. (1972), Waterlogging effects on cane growth. *Canegrowers Quarterly Bulletin* **35**(4), 119-20.

Russell, J.S. and Moore, A.W. (1976), Classification of climate by pattern analysis with Australasian and southern African data as an example, *Agricultural Meteorology* **16**, 45-70.

Shaw, R.J. (1986), *Towards a quantitative irrigation water quality assessment model for Australia. A report of studies during a 1984 Churchill Fellowship in Israel and U.S.A.* Queensland Department of Primary Industries Study Tour Report, (in press).

Shaw, R.J. and Yule, D.J. (1978), *The assessment of soils for irrigation, Emerald, Queensland,* Queensland Department of Primary Industries, Agricultural Chemistry Branch Technical Report No. 13.

Spain, A.V., Isbell, R.F. and Probert, M.E. (1983), Soil organic matter, in, *Soils: an Australian Viewpoint,* Division of Soils, CSIRO, Melbourne/Academic Press, London, 551-64.

Specht, R.L. (1970), Vegetation, in G.W. Leeper (ed.) *The Australian Environment*, 44-67. CSIRO/Melbourne University Press, Melbourne.

Speight, J.G. (1984), Landform, in *Australian Soil and Land Survey Field Handbook*, R.C. McDonald, R.F. Isbell, J.G. Speight, J. Walker and M.S. Hopkins, Inkata Press, Melbourne, 8-43.

Stace, H.C.T., Hubble, G.D., Brewer, R., Northcote, K.H., Sleeman, J.R., Mulcahy, M.J. and Hallsworth, E.G. (1968), *A Handbook of Australian Soils*, Rellim Technical Publications, Glenside, South Australia.

Teakle, L.J.H. (1950), *Notes on the soils of coastal Queensland and portions of the hinterlands with special reference to the tropical latitudes.* University of Queensland Papers, Faculty of Agriculture, No. 1 : 1-40.a

Thompson, W.P., Baker, D.E. and Cannon, M.G. (1981), *Soils of the Proserpine Lowland, North Queensland*, Queensland Department of Primary Industries, Agricultural Chemistry Branch, Technical Report No. 18.

Trewartha, G.T., Robinson, A.H. and Hammond, E.H. (1967), *Physical Elements of Geography*, McGraw-Hill, New York.

Viets, F.G. Jr. and Lindsay, W.L. (1973), Testing soils for zinc, copper, manganese and iron, Chapter II, rev. ed. in L.M. Walsh and J.D. Beaton (eds.) *Soil testing and plant analysis*. Soil Science Society of America Incorporated, Madison, Wisconsin.

White, B.J. (1970), Climate, sugar yields and irrigation response in Queensland, *Proceedings Queensland Society Sugar Cane Technologists Conference* Mackay, 57-64.

Wills, A.K. (1985), A planning index for canelands, *Proceedings Australian Society Sugar Cane Technologists Conference* Bundaberg, 73-8.

Wills, A.K. and Young, P. (1982), An agroclimatic examination of the southern limit to cane growing in the Central District, *Proceedings Australian Society Sugar Cane Technologists Conference* Townsville, 161-9.

APPENDIX A. UMA Datafile Codes and Explanation

Each UMA data listing is designed to fit an 80 character line of print-out, although this number of characters is not limiting if subsequent users wish to add to the datafile.

Characters

Labelling point location

1- 6	Eastings co-ordinates	) corresponds to
7-13	Northings co-ordinates	) Australian 1:100 000
14-15	ATM Zone	) series maps.

16-19 UMA number

20-21 Two letter abbreviation for dominant soil type (corresponds to soil map reference abbreviation).

22-24 Geological mapping code (modified), (see section 2.2.1).

25-26 Two letter abbreviations for associated soil types.

27-28 (Note: abbreviations from the Mackay Study may be included here).

29-30 Two letter code for landform pattern (see Annexe A, Table 4 of Speight 1984).

Slopes

31-32	minimum)	percentage slopes up to a
33-34	modal)	maximum value of 99.
35-36	maximum)	

37 Erosion assessment (under cultivation) code:

0 No water erosion
1 Sheet erosion only
2 Slight sheet and rill erosion
3 Moderate sheet and rill erosion
4 Severe sheet and rill erosion
5 Slight sheet, rill and gully erosion
6 Moderate sheet, rill and gully erosion
7 Severe sheet, rill and gully erosion

38 Salt-affected soils:

F saline/sodic patches associated with uplands; that is, usually footslopes and nearby alluvium
P saline/sodic patches on alluvial plain
I saline patches due to sea water intrusion
A absent

Limitations to cane production (1-5)

39 m - moisture availability
40 n - soil nutrient
41 s - salinity/sodicity
42 t - topography
43 k - soil workability
44 r - stoniness
45 w - wetness
46 e - erosion
47 f - flooding
48 blank

Suitability for long term sugar-cane production

49 1 Suitable with no limitations
2 Suitable with slight limitations
3 Suitable with moderate limitations
4 Marginally suitable with severe limitations
5 Unsuitable

Areas (hectares)

50-53 Total area

54-57 Area assigned to sugar-cane

58-61 Potential area for assignment

62-65 Alienated land, not available for agriculture (Note: All areas are measured at scale 1:50 000 by digitizer/planimeter, and require adjustment to match gazetted areas of assignment).

66-67 blank

Distances (kilometres)

68-70 Estimated road distance from labelling point to Sarina (Plane Creek Mill).

71-72 Estimated road distance from labelling point to nearest tram or rail pick-up point.

73 Shire code:

- B Broadsound
- S Sarina

74 blank

75-78 PCLS Plane Creek Sugar Cane Land Suitability Study

79-80 Record type number : 23.

Table 4
Simple types of erosional landform pattern characterised by relief and modal slope

Relief	*Modal terrain slope*						
	LE *Level* *<1%* *(About 1:300)*	**VG** *Very gently inclined* *1%–3%* *(About 2%)*	**GE** *Gently inclined* *3%–10%* *(About 6%)*	**MO** *Moderately inclined* *10%–32%* *(About 20%)*	**ST** *Steep* *32%–56%* *(About 40%)*	**VS** *Very steep* *56%–100%* *(About 70%)*	**PR** *Precipitous* *>100%* *(About 150%)*
Very high >300 m (About 500 m)	—	—	—	**RM** Rolling mountains	**SM** Steep mountains	**VM** Very steep mountains	**PM** Precipitous mountains
High 90–300 m (About 150 m)	—	—	**UH** Undulating hills	**RH** Rolling hills	**SH** Steep hills	**VH** Very steep hills	**PH** Precipitous hills
Low 30–90 m (About 50 m)	—	—	**UL** Undulating low hills	**RL** Rolling low hills	**SL** Steep low hills	**VL** Very steep low hills	**B** Badlands
Very low 9–30 m (About 15 m)	—	**GR** Gently undulating rises	**UR** Undulating rises	**RR** Rolling rises	**SR** Steep rises	**B** Badlands	**B** Badlands
Extremely low <9 m (About 5 m)	**LP** Level plain	**GP** Gently undulating plain	**UP** Undulating plain	**RP** Rolling plain	**B** Badlands	**B** Badlands	**B** Badlands

APPENDIX B. Soils Descriptions

Notes

1. Solum Depth: Unless otherwise stated, solum depth is 1.2 m or more.

2. Mottles: Many of the mottled duplex soils display up to 50% mottling, frequently a grey matrix with a yellow mottle and less frequently a yellow matrix with a grey mottle. There is no apparent significant difference between the two cases. For purpose of constructing a modal description, the dominant matrix colour is taken as the determinant of PPFs and hue-value/chroma ratings. However, a major subdominant colour in the mottle, which may occasionally be present as a matrix colour, would be included in general colour descriptions.

ILBILBIE (Ib)

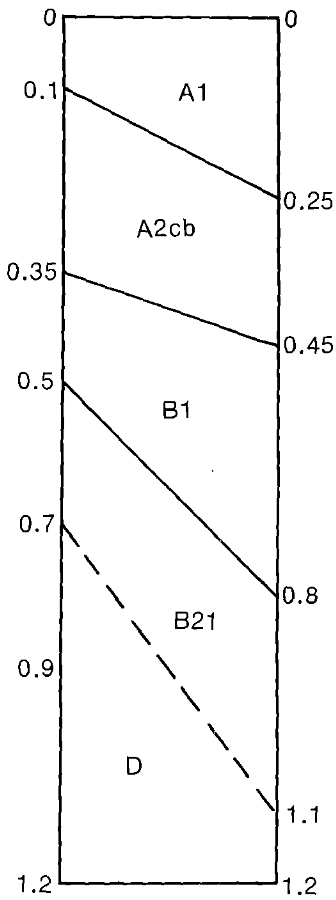
Concept: Acid, bleached, mottled, light grey, duplex soil, with discontinuous hardpan of Tertiary sediments.

Principal Profile Form: Dy 3.41, Dg 2.41, Dg 2.81, Dy 3.31

Great Soil Group: Soloth

Parent Material: Alluvium, possibly Tertiary

Landform: Coastal alluvium, 0.1% slopes.



A1: Dark to brown (10YR 3/3, 4/2, 4/3, 7.5YR 4/2, 5/3), light grey (10YR 7/2) dry; fine sandy clay loam to sandy clay loam; hardsetting; massive; pH 5.5-6.0. Clear to -

A2cb: Grey brown to brown (7.5YR 6/2, 6/3, 5/3, 10YR 5/3, 6/3), light grey (10YR 8/2) dry, conspicuous bleach; fine sandy clay loam to sandy clay loam; massive; pH 5.0-6.0. Clear to -

B1: Grey-brown to brown (7.5YR 6/2, 6/3, 10YR 5/3), 10-30% distinct yellow mottles; light clay (sandy); may have fragments of ironstone pan; weak granular structure; few iron-manganese concretions or nodules; pH 4.5-5.8. Clear to -

B21: Grey to brown or light grey (10YR 6/1, 6/2, 6/4, 7/2, 7.5YR 6/3, 7/2, 5YR 6/3, 7/2), 5-25% distinct or prominent yellow mottles; light clay to medium-heavy clay (may be sandy); moderate angular blocky structure; pH 4.5-5.8.

may have D: Light grey to yellow-brown (10YR 7/1, 6/2, 6/3, 7/2, 7.5YR 6/2), 5-20% distinct or prominent yellow or red mottles; light clay to medium clay (sandy to coarse sandy); moderate blocky angular structure; pH 4.8-6.2.

Comments: Median solum depth to hardpan 1 m. Debil-debil common in undisturbed areas.

KARLOO (Kl)

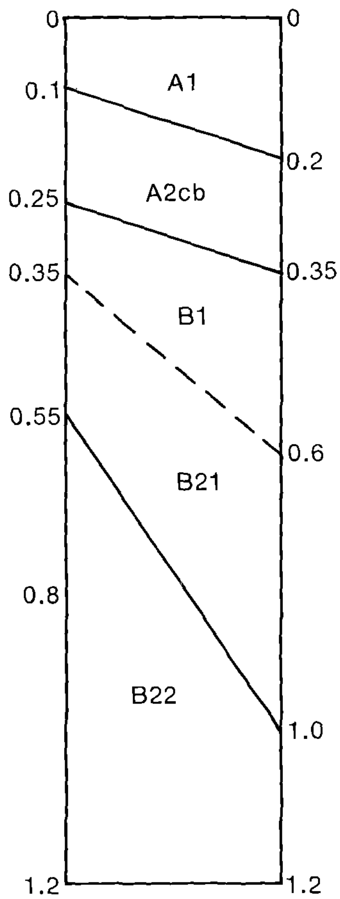
Concept: Alkaline, bleached, mottled, grey-brown duplex soil.

Principal Profile Form: Dy 3.43

Great Soil Group: Solodic - solodized solonetz

Parent Material: Quaternary alluvium

Landform: Coastal alluvial plains, 0-1% slopes.



A1: Grey to grey-brown (10YR 4.2, 7.5YR 4/2, 5./2), light grey (10YR 7/2) dry; fine sandy clay loam to silty clay loam; hardsetting; massive; pH 5.8-6.2. Clear to -

A2cb: Brown to yellow-brown (7.5YR 4.3, 10YR 4/3, 5/2, 5/3, 6/3), light grey (10YR 8/2) dry; may have 2-10% distinct yellow mottles; conspicuous bleach; fine sandy clay loam to silty clay loam; massive; pH 5.5-6.2. Abrupt to -

may have B1: Grey to yellow-brown (10YR 6/2, 6/3, 6/4), 5-20% yellow mottles; silty clay to heavy clay; moderate angular blocky structure; few iron-manganese nodules or concretions; pH 5.5-7.8. Clear to -

B21: Grey to yellow-brown (10YR 5/2, 5/3, 5/4, 6/2, 6/3); 5-30% distinct yellow mottles; medium-heavy to heavy clay; moderate angular blocky structure; few iron-manganese nodules or concretions; pH 6.8-9.2. Clear to -

B22: Grey to brown (10YR 5/1, 5/3, 5/4, 6/3, 7.5YR 4/6), 0-25% distinct yellow mottles; medium clay to heavy clay; weak to moderate polyhedral structure; iron-manganese concretions common, may have carbonate nodules or soft segregations; pH 8.5-9.2.

Comments: Debil-debil common in undisturbed areas.

SPLITTER (S1)

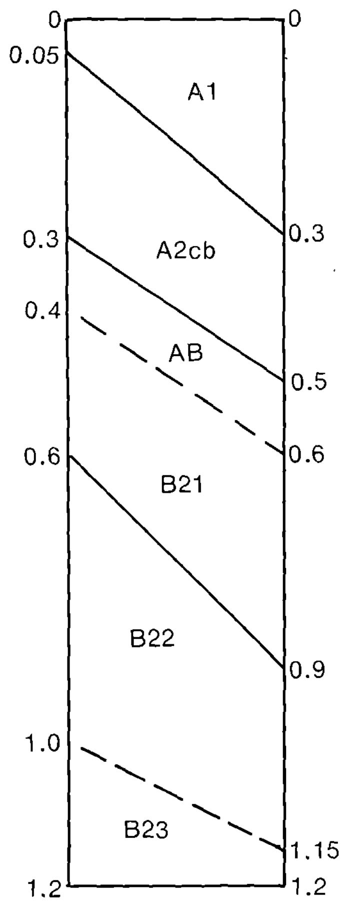
Concept: Sandy, strongly alkaline, bleached, mottled, grey duplex soil.

Principal Profile Form: Dy 3.43, Dg 2.43

Great Soil Group: Solodic - solodized solonetz

Parent Material: Quaternary alluvium

Landform: Coastal alluvial plains, 0-1% slopes.



A1: Dark to grey-brown (10YR 2/1, 2/2, 3/2, 7.5YR 4/2), grey (10YR 6/2) dry; sandy loam to fine sandy clay loam; hardsetting; massive; pH 4.8-9.0. Clear to -

A2cb: Dark to yellow-brown (10YR 3/2, 4/2, 4/3, 5/3), yellow-brown (10YR 6/3) dry, conspicuous bleach; loamy sand to fine sandy clay loam; massive; pH 5.5-9.2. Clear to -

may have AB: Grey (10YR 6/1, 6/2), 10-15% faint to distinct yellow mottles; light clay to medium clay (sandy); weak granular structure; pH 5.5-9.2. Gradual to -

B21: Grey (10YR 4/1, 5/1, 5/2, 6/1), 0-40% yellow mottles; medium clay to heavy clay (sandy); moderate angular blocky structure; few soft segregations of iron-manganese; pH 9.0-9.5. Clear to -

B22: Grey (10YR 5/1, 6/1), 5-40% yellow or white mottles; light-medium clay to heavy clay (sandy); weak, angular blocky structure; carbonate nodules or segregations common; pH 9.2-9.5. Clear to -

may have B23: Grey to light grey (5Y 6/2, 7/2, 10YR 6/2), 0-30% yellow or red mottles; heavy clay (sandy); massive; carbonate nodules common; pH <9.5.

ALLIGATOR (Ag)

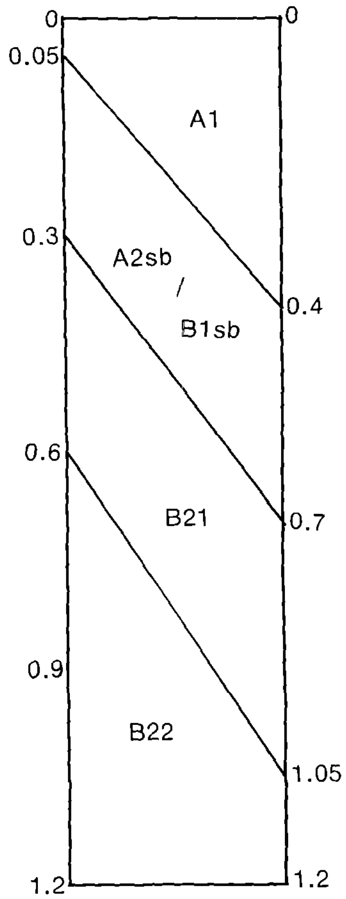
Concept: Silty, alkaline, bleached, mottled, grey-yellow duplex soil with discontinuous layers of ironstone nodules.

Principal Profile Form: Dy 3.33, Gn 3.23, Uf 6.41

Great Soil Group: Solodic - solodized solonetz to grey clay

Parent Material: Quaternary alluvium

Landform: Coastal alluvial plains, 0-2% slopes



A1: Dark to grey (10YR 2/2, 2/3, 3/2, 3/3, 4/2, 4/3, 5/2), grey (10YR 5/2) dry; fine sandy clay loam to light clay; hardsetting; weak to moderate granular structure; pH 5.5-8.8. Clear to -

A2sb/B1sb: Dark to grey or brown (10YR 3/2, 3/3, 4/2, 4/3, 5/1, 5/2, 5/3, 5/4), light grey (10YR 7/2) dry, 0-10% distinct yellow mottle, sporadic bleach; silty clay loam to light-medium clay; weak granular structure; few to many iron-manganese or ironstone nodules; pH 5.5-9.5. Clear to -

B21: Grey to yellow-brown (10YR 4/1, 5/1, 5/2, 5/3, 6/2, 7/4), 5-40% distinct yellow mottles; light-medium clay to heavy clay; weak to moderate angular blocky structure; may have few to many iron-manganese nodules; pH 6.5-9.5. Clear to -

B22: Grey to yellow-brown (10YR 4/1, 5/1, 5/3, 6/3, 2.5Y 4/1, 6/3, 7.5Y 6/3), 2-30% distinct yellow mottles; medium-heavy to heavy clay; weak to moderate blocky structure; few iron-manganese nodules; pH 8.0-9.5.

Comments: Gn 3.23 and Uf 6.41 apparently result from disturbance of the A horizon.

SUNNYSIDE (Su)

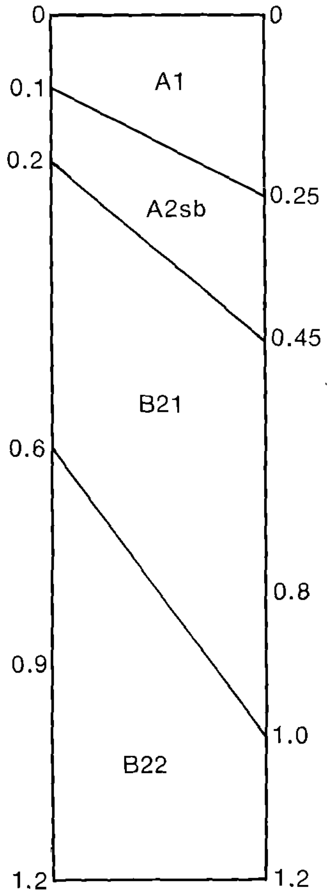
Concept: Silty, alkaline, bleached, mottled, grey duplex soil.

Principal Profile Form: Dy 3.33, Dy 3.43, Dg 2.33

Great Soil Group: Solodic-solodized solonetz

Parent Material: Quaternary alluvium

Landform: Coastal alluvial plains, slopes 0-1%



A1: Dark to brown (10YR 3/3, 4/2, 4/3), light grey (10YR 7/2) dry; fine sandy clay loam to silty clay; hardsetting; weak granular structure; pH 5.5-6.2. Clear to -

A2sb: Grey to yellow-brown (10YR 5/1, 5/2, 5/3, 4/2, 4/3, 6/3), light grey (10YR 7/2) dry; 0-25% distinct yellow mottles; sporadic bleach; fine sandy clay loam to silty clay; weak granular structure; may have few iron-manganese nodules; pH 5.5-5.8. Clear to -

B21: Grey to light grey (10YR 5/1, 6/1, 6/2, 7/1), 5-40% distinct or prominent yellow mottles; heavy clay; moderate to strong angular blocky structure; few iron-manganese nodules; pH 6.0-9.2. Gradual to -

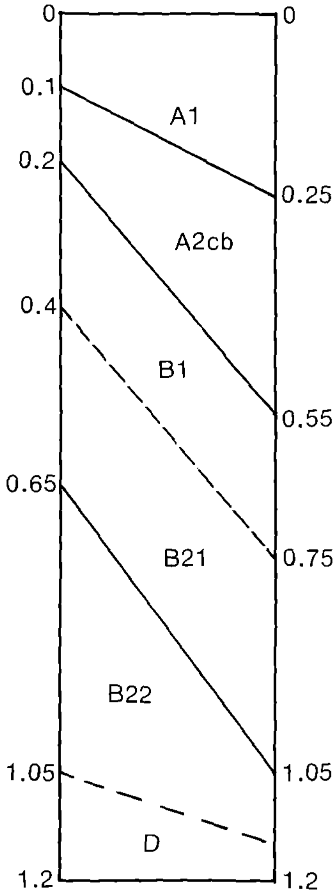
B22: Grey (10YR 4/1, 5/1, 5/2, 6/1, 6/2), 2-10% faint yellow mottles; heavy clay; weak to moderate angular blocky structure; carbonate nodules common; pH 8.2-9.2.

Comments: Slight debil-debil occurs in undisturbed areas.

TEDLANDS (T1)

Concept: Acid to neutral, bleached, mottled, grey-yellow duplex soils.

Principal Profile Form: Dy 3.41, Dy 3.42, Dy 3.32, Dy 3.31
Great Soil Group: Soloth to solodic-solodized solonetz
Parent Material: Quaternary alluvium
Landform: Coastal alluvial plains, slopes 0-1%.



A1: Dark to brown (10YR 3/2, 3/3, 4/3, 3/4, 7.5YR 4/2, 4/3), light grey (10YR 7/3) dry; fine sandy clay loam to silty clay loam; hardsetting; massive; pH 5.5-6.5. Clear to -

A2cb: Brown to yellow-brown (10YR 5/3, 5/3, 5/4, 6/4, 7.5YR 4/3, 5/3, 6/3, 6/2), light grey (10YR 8/2) dry, 0-15% distinct yellow mottle; sporadic or conspicuous bleach; fine sandy clay loam to silty clay; massive; pH 5.5-6.2. Clear to -

may have B1: Brown to yellow-brown or light grey (10YR 4/3, 5/4, 6/3, 6/2, 7/2, 7.5YR 5/3, 6/3), 5-35% distinct yellow mottles; silty clay to medium clay; massive to weak granular structure; may have minor concentrations or iron-manganese nodules or concretions; pH 5.3-6.3. Clear to -

B21: Grey to yellow-brown (7.5YR 5/2, 5/3, 6/2, 6/3, 7/3, 10YR 5/2, 6/2, 6/3, 5/4, 6/4), 5-40% distinct yellow mottles; light-medium to heavy clay; moderate angular blocky structure; few iron-manganese nodules or concretions; pH 5.0-7.5. Clear or gradual to -

B22: Grey to light grey or yellow brown (10YR 5/1, 5/3, 6/2, 7.5YR 5/2, 6/2, 6/3, 7/3, 4/6), 2-50% distinct yellow mottles; light clay to heavy clay; moderate angular blocky structure; pH 5.5-7.5.

may have D: Grey to brown (10YR 5/2, 5/3, 6/2, 6/3, 6/4, 7.5YR 5/4), 0-15% distinct yellow mottles; sandy or fine gravelly light clay to heavy clay; weakly structured to massive to weak granular structure; pH 5.2-7.5.

Comments: Mottling in B21 and B22 horizons is bright yellow with a tendency for yellow to become the dominant colour. Debil-debil common in undisturbed areas.

CHERRY TREE (Ch)

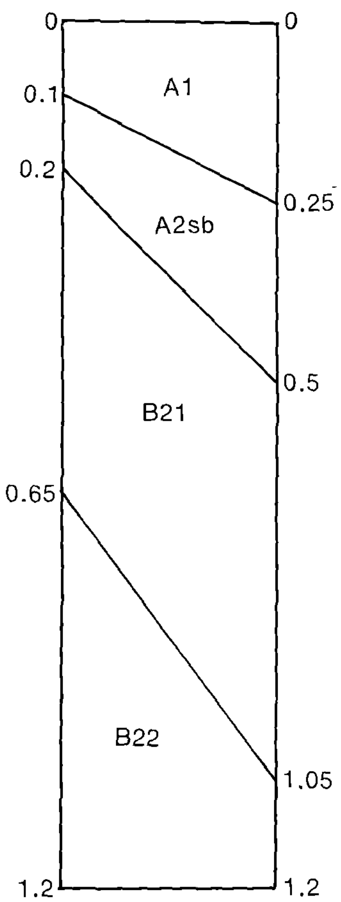
Concept: Gravelly, alkaline, bleached, mottled, grey-brown duplex soil.

Principal Profile Form: Dy 3.33, Dy 3.43

Great Soil Group: Solodic-solodized solonetz

Parent Material: Quaternary alluvium and Tertiary gravels

Landform: Stagnant alluvial plains, slopes 0-1%



A1: Dark to brown or grey (10YR 3/2, 3/3, 4/3, 4/4, 7.5YR 3/2, 4/3, 5/2), light grey (10YR 7/2) dry; clay loam to fine sandy clay loam; hardsetting; massive; pH 5.5-6.5. Clear to -

A2sb: Dark to yellow-brown (10YR 3/2, 4/2, 4/3, 5/3, 5/4, 6/4, 7.5YR 4/2, 4/3, 5/3), light grey dry (10YR 8/2), sporadic bleach, occasionally conspicuous; fine sandy clay loam; massive; few to many iron-manganese nodules; pH 5.2-6.2. Clear to -

B21: Grey to yellow-brown (10YR 4/1, 5/1, 5/2, 5/3, 5/4, 6/3), 10-50% distinct yellow mottles; medium-heavy to heavy clay with very few stone or iron-manganese nodules; strong angular blocky; pH 7.0-9.2. Clear to -

B22: Grey (5Y 5/1, 10YR 4/1, 5/1, 6/1, 5/2, 5/3), 10-35% distinct yellow or brown mottles; medium clay to heavy clay; moderate to strong angular blocky; iron-manganese concretions common; pH 8.5-9.5.

PRENDERGAST (Pg)

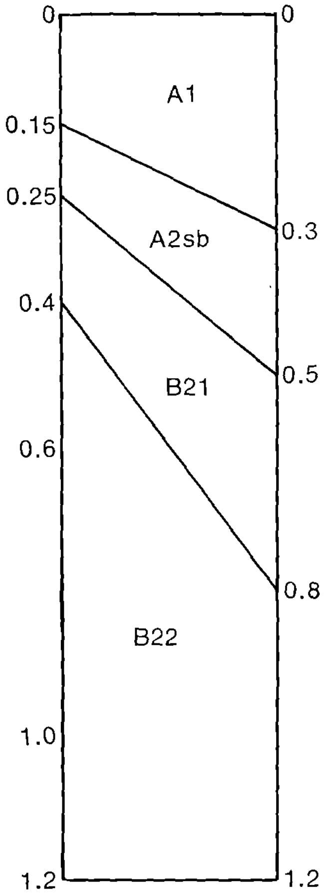
Concept: Neutral to alkaline, mottled brown, duplex soil.

Principal Profile Form: Dy 3.33, Dy 3.42, Db 2.32

Great Soil Group: Solodic-solodized solonetz

Parent Material: Quaternary alluvium

Landform: Alluvial plains, slopes 0-2%



A1: Dark to brown or grey (10YR 2/2, 2/3, 3/2, 3/3, 4/2), grey (10YR 6/2) dry; fine sandy to silty clay loam; hardsetting; weak granular to massive structure; pH 5.5-6.0. Clear to -

A2sb: Dark to yellow-brown (10YR 3/2, 4/2, 4/3, 5/3), light grey (10YR 7/2) dry, sporadic bleach; fine sandy clay loam to silty clay; weak to moderate granular structure; pH 5.8-6.5. Abrupt to -

B21: Brown to grey or yellow-brown (10YR 3/4, 4/3, 5/2, 6/4), 10-40% distinct yellow or brown mottles; heavy clay; strong angular blocky structure; pH 6.0-9.0. Clear to -

B22: Brown to grey or yellow-brown (7.5YR 4/3, 10YR 4/2, 6/2, 6/3), 2-40% distinct yellow mottles; medium clay to heavy clay; moderate to strong structure; iron-manganese or carbonate nodules common; pH 6.8-9.5.

Comments: Occasional bleaching also recorded in A1 horizon or on surface of B21 horizon.

TURNOR (Tn)

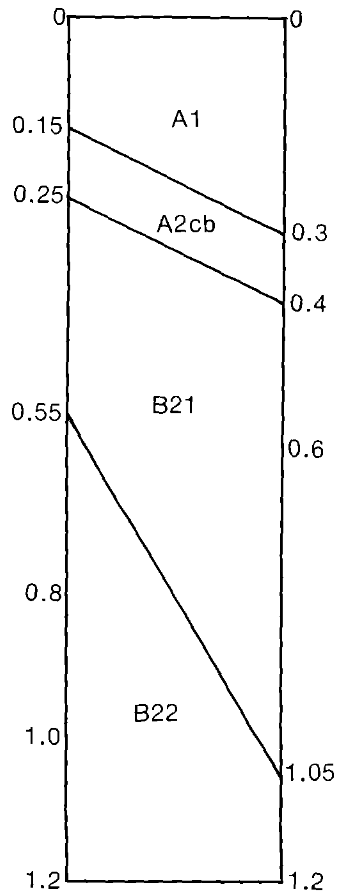
Concept: Alkaline, conspicuously bleached, mottled, grey-brown duplex soil with iron-manganese inclusions.

Principal Profile Form: Dy 3.43, Dy 3.33.

Great Soil Group: Solodic - solodized solonetz

Parent Material: Quaternary alluvium

Landform: Alluvial plains, slopes 0-1%



A1: Dark to brown (10YR 3/2, 3/3, 2/3, 4/3, 4/2), grey (10YR 6/2) dry; sandy clay loam to silty clay; hardsetting; weak granular to massive structure; pH 5.5-6.5. Clear to -

A2cb: Grey to yellow-brown (10YR 4/2, 4/3, 4/4, 5/2, 5/3), light grey (10YR 7/3) dry, may have 2-10% brown or yellow mottles, conspicuous bleach; sandy clay loam to fine sandy clay loam; weak granular to massive structure; pH 5.8-6.8. Abrupt to -

B21: Grey to yellow-brown (10YR 4/2, 5/1, 5/2, 5/3, 5/4, 6/2, 6/3, 6/4), 10-40% distinct yellow mottles; medium clay to heavy clay; strong, blocky structure; few to many iron-manganese nodules; pH 5.8-8.5. Clear to -

B22: Grey to yellow-brown (10YR 4/2, 5/1, 5/2, 5/4, 6/2, 2.5Y 5/3), 0-25% distinct yellow mottles; light-medium clay to heavy clay; moderate to strong, blocky structure; iron-manganese concretions and nodules common to abundant; pH 7.2-9.2.

SARINA (Sn)

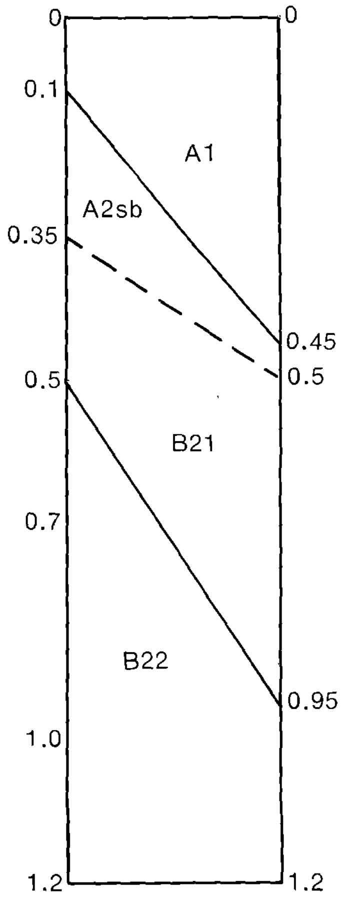
Concept: Alkaline, sporadically bleached, mottled, grey-brown duplex soil.

Principal Profile Form: Dy 3.33

Great Soil Group: Solodic-solodized solonetz

Parent Material: Quaternary alluvium

Landform: Alluvial plains, slopes 0-3%



A1: Dark to yellow (10YR 2/2, 2/3, 3/2, 4/2, 4/3), light grey (10YR 7/2) dry; fine sandy clay loam to silty clay loam; hardsetting; weak fine granular structure; pH 5.5-6.0. Clear or abrupt to -

A2sb: Grey (10YR 4/2, 4/3, 5/2), light grey (10YR 8/2) dry, 0-10% faint yellow mottles, sporadic bleach; fine sandy clay loam; weak fine granular structure; pH 5.5-6.2. Clear to -

B21: Grey to yellow-brown (10YR 4/2, 5/2, 5/3, 6/3, 6/4), 10-25% distinct yellow mottles; medium clay to heavy clay; moderate blocky structure; may have few iron-manganese nodules; pH 6.0-9.0. Gradual to -

B22: Grey to brown (10YR 4/1, 5/1, 4/3, 5/3, 6/2), 5-35% distinct yellow mottles; light-medium to heavy clay; moderate blocky to granular structure; may have few iron-manganese concretions; pH 8.2-9.5.

Comments: Occasional bleaching also recorded in A1 horizon and on surface of B21 horizon.

CABBAGE TREE (Ct)

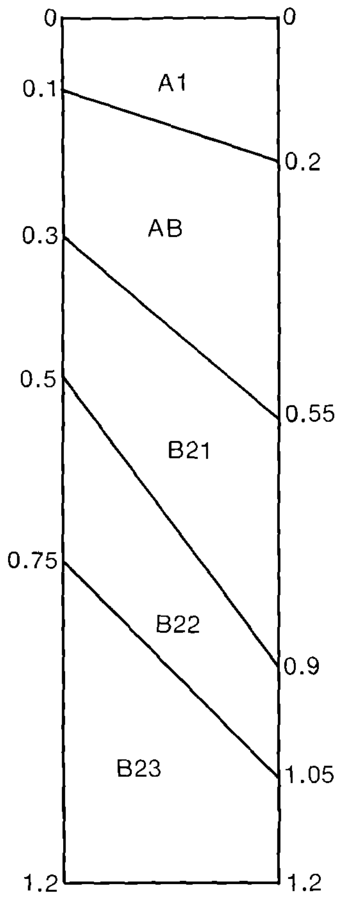
Concept: Neutral to alkaline, mottled, dark duplex soil.

Principal Profile Form: Dd 2.33, Dd 2.32, Uf 6.41

Great Soil Group: Solodic-solodized solonetz

Parent Material: Quaternary alluvium

Landform: Alluvial plains, slopes 0-2%



A1 (+ A2sb): Dark to brown (10YR 2/2, 2/3, 3/1, 3/2, 7.5YR 4/3), grey (10YR 6/1) dry; clay loam to light clay; hardsetting; weak structure; pH 5.5-6.2. Clear or gradual to -

may have AB: Dark (10YR 2/1, 3/2, 3/3), 10% faint or distinct brown mottles; clay loam to light-medium clay; weak granular structure; pH 5.8-7.0. Clear or gradual to -

B21: Dark to yellow brown (10YR 3/1, 3/2, 5/3, 6/4), 5-30% faint or distinct brown or yellow mottles; light-medium to heavy clay; angular blocky structure; pH 6.0-7.8. Clear or gradual to -

B22: Grey (10YR 4/1, 5/1, 5/2, 6/2), 10-40% prominent yellow mottles; medium clay to heavy clay; angular blocky structure; pH 7.0-8.5. Clear to -

B23: Grey (10YR 4/1, 5/1, N 5/0) or yellow (10YR 5/6, 5/8), 20-50% distinct or prominent yellow, grey or dark mottles; light-medium to heavy clay, sometimes gritty; few inclusions of iron-manganese, quartz or carbonates; moderate angular blocky structure; pH 7.2-8.8.

Comments: A1 horizon is frequently AP, thus destroying the A2 horizon. A faint sporadic bleach is likely between 0.1 and 0.3 m.

GILLINBIN (Gb)

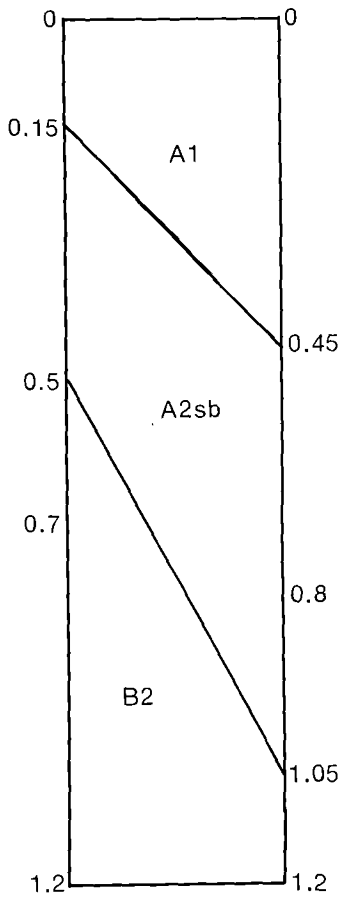
Concept: Acid, bleached, red-brown duplex soil with deep A horizon.

Principal Profile Form: Dy 3.31

Great Soil Group: Soloth

Parent Material: Quaternary alluvium

Landform: Alluvial plains, slopes 0-2%



A1: Dark to grey-brown (7.5YR 2/2, 3/2, 4/2, 4/3, 4/4, 10YR 3/2, 4/2), light grey (7.5YR 7/2) dry; sandy clay loam to silty clay loam; hardsetting; weak granular structure; pH 5.5-6.0. Clear to -

A2sb: Grey-brown to yellow-brown (10YR 5/3, 6/3, 7.5YR ;4/2, 5/4), light grey (10YR 8/2) dry, sporadic bleach, 0-15% faint or distinct yellow mottles; sandy clay loam to silty clay loam; weak granular to massive structure; pH 5.5-6.2. Clear or abrupt to -

B2: Grey to brown (10YR 5/2, 6/2, 6/3, 6/4, 5/3, 7.5YR 4/4), 10-35% distinct or prominent yellow and red or grey mottles; light clay to heavy clay; moderate blocky structure; few iron-manganese concretions; pH 5.5-6.8.

HANNAN (Hn)

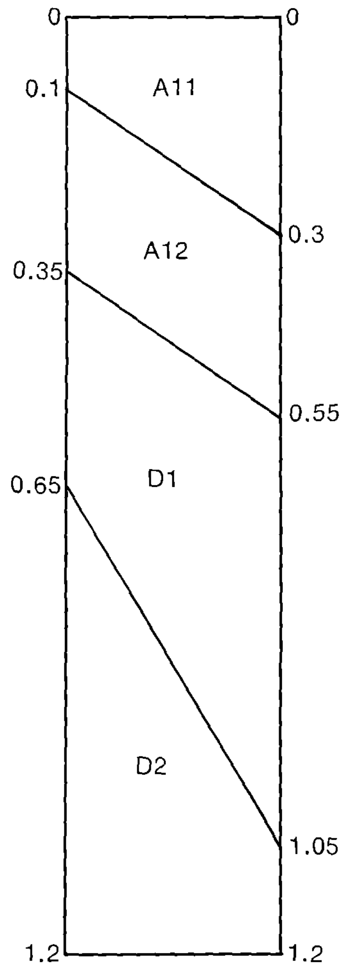
Concept: Acid, brown, uniform (tending gradational), sandy to fine sandy soil.

Principal Profile Form: Um 1.23, Um 1.21

Great Soil Group: Alluvial soil

Parent Material: Quaternary alluvium

Landform: Lower terraces, slopes 0-2%



A11: Dark to grey (10YR 2/2, 2/3, 4/2, 7.5YR 2/2, 2/3, 3/2, 3/3), grey (10YR 5/2) dry; sandy loam to fine sandy clay loam; hardsetting; weak granular structure; pH 5.2-6.2. Gradual to -

A12: Dark to grey (7.5YR 2/2, 3/2, 3/3, 10YR 2/3, 3/1, 4/2); sandy loam to fine sandy clay loam; massive; pH 5.0-6.0. Clear or gradual to -

D1: Dark to red-brown or yellow-brown (10YR 2/2, 3/3, 6/3, 7.5YR 3/3, 4/3, 4/4, 5YR 4/3, 4/4); sandy clay loam to sandy light-medium clay; weak granular structure; pH 5.2-6.2. Gradual or diffuse to -

may have D2: Brown to red-brown or yellow-brown (7.5YR 4/4, 5/4, 5/6, 5YR 5/4); sandy clay loam to sandy light clay; weak granular structure; pH 5.8-6.5.

SPIDER (Sr)

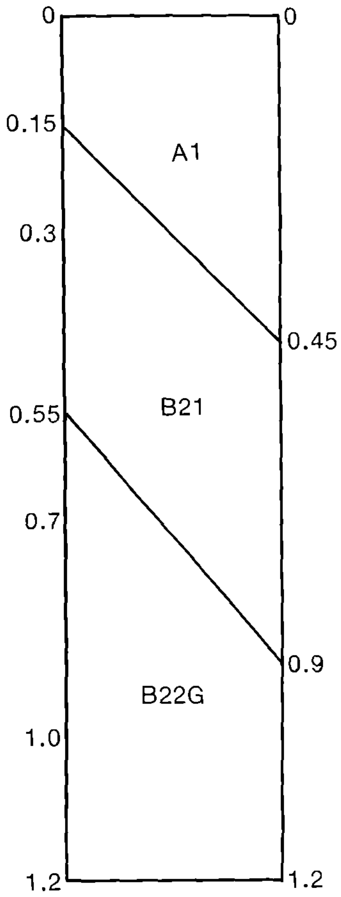
Concept: Alkaline, self-mulching, black, cracking clay, gleyed at depth, in drainage depressions of hills.

Principal Profile Form: Ug 5.16, Ug 5.11

Great Soil Group: Wiesenboden

Parent Material: Quaternary alluvium

Landform: Depressions and drainage lines in alluvial plains, slopes 1-2%



A1: Dark (10YR 2/1, 2/2, 7.5YR 2.2), grey (10YR 4/2) dry; light clay to heavy clay; cracking, self-mulching; granular; pH 5.5-9.5. Clear to -

B21: Dark to grey (10YR 2/1, 2/2, 7.5YR 2/1, 10YR 6/2, 2.5Y 5/4), may have up to 25% yellow or grey mottles; heavy clay; strong angular blocky structure; pH 8.5-9.5. Clear or gradual to -

B22: Dark to yellow (7.5YR 3/1, 10YR 3/1, 6/1, 5/8, 6/8), 10-20% faint or distinct gley mottles; medium to heavy clay; medium to strong blocky; may have few to many carbonate nodules or concretions; pH 9.0-9.5.

BELL (Be)

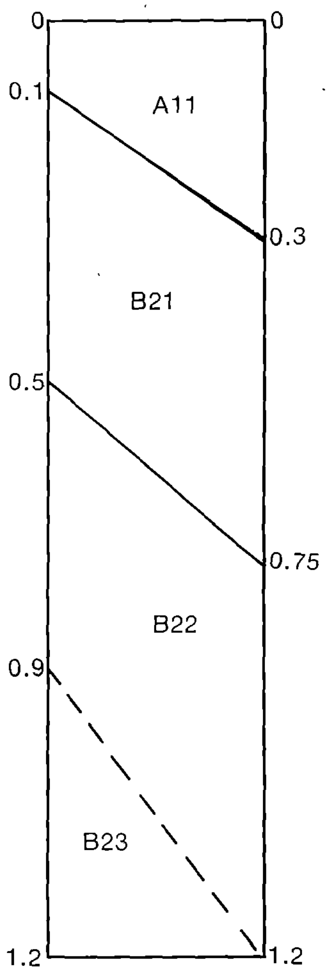
Concept: Alkaline, black, self-mulching, cracking clay developed on Quaternary alluvium.

Principal Profile Form: Ug 5.16, Ug 5.28, Ug 5.15

Great Soil Group: Black earth

Parent Material: Quaternary alluvium

Landform: Depression areas and drainage lines in alluvial plains, slopes 0-1%



A11: Dark (10YR 2/1, 2/2, 3/1, 3/2), grey (10YR 5/1) dry; cracking, self-mulching, medium clay to heavy clay; moderate granular structure; pH 5.6-7.2. Clear to -

B21: Dark to grey (10YR 2/1, 2/2, 5/1); heavy clay; moderate angular blocky structure; pH 7.0-9.2. Gradual to -

B22: Dark to brown or grey (10YR 3/2, 4/3, 4/1, 5/1, 6/1, 5Y 6/1), 0-30% distinct yellow mottles; heavy clay; angular blocky; few iron-manganese nodules; pH 7.5-9.0.

B23: Grey to yellow grey (10YR 4/1, 6/1, 2.5Y 5/3, 5Y 5/1, 2.5GY 5/1), 5-10% faint or distinct yellow mottles; medium-heavy to heavy clay; weakly structured to massive; few to many carbonate concretions; pH 8.2-9.2.

Comments: Debil-debil microrelief in areas of poor external drainage.

LEICHHARDT (Lh)

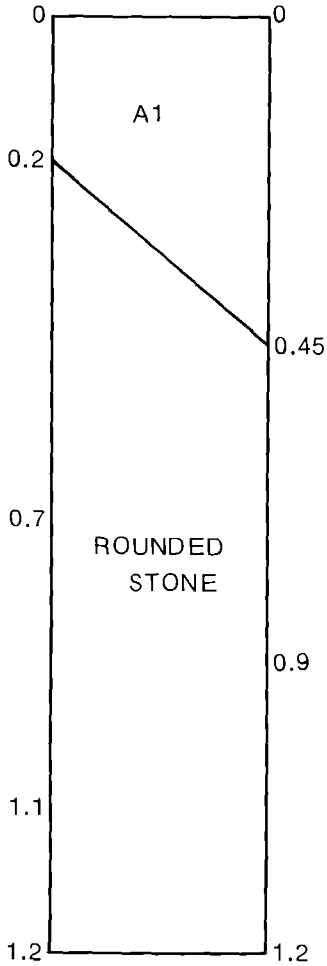
Concept: Cobbly, dark, acid loams in upper reaches of alluvial plains.

Principal Profile Form: Um 1.23, Um 2.21

Great Soil Group: Alluvial soil

Parent Material: Coarse outwash rock and gravel from steep catchments of mixed geology.

Landform: Gently undulating, alluvial plain, slopes 0-5%



A1: Dark to grey or brown (10YR 2/1, 2/2, 3/2, 3/3, 7.5YR 3/2, 2/2), grey (10YR 5/1) dry; sandy clay loam to fine sandy clay loam; medium hardsetting to loose; may have up to 50% subangular or rounded stone; massive; pH 5.2-6.2. Abrupt to rounded stone or gravel.

Comments: Median solum depth to stone or gravel 0.35 m.

SADDLE (Sd)

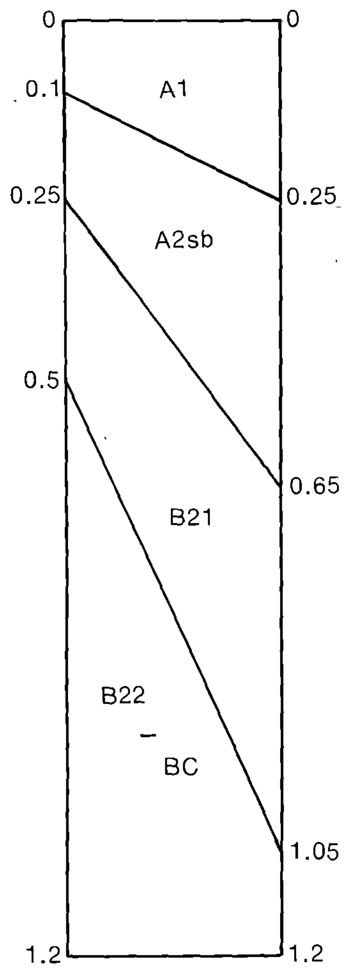
Concept: Neutral to alkaline, bleached, mottled, yellow-brown duplex soil.

Principal Profile Form: Db 2.13, Dy 3.33, Dy 3.32, Db 2.32

Great Soil Group: No suitable group

Parent Material: Intermediate flows and pyroclastics (Connors Volcanics)

Landform: Undulating low hills, mid to lower slopes 2-6%



A1: Dark to brown (10YR 2/2, 7.5YR 2/2, 2/3, 3/2, 3/3, 3/4), brown (7.5YR 4/3) dry; sandy clay loam to silty clay loam; hardsetting; weak granular structure; pH 5.8-6.0. Clear to -

A2sb: Dark to brown (7.5YR 2/2, 2/3, 3/3, 4/6, 10YR 3/3, 4/3, 4/4), brown (7.5YR 5/4) dry; sporadic bleach; silty clay loam to light clay; weak granular structure; may have iron-manganese nodules; pH 5.8-7.5. Clear to -

B21: Brown to yellow (7.5YR 4/6, 5/6, 10YR 5/4, 5/6, 5/8), 10-25% distinct or prominent red mottles; medium clay to heavy clay; moderate angular blocky structure; pH 5.8-9.2. Gradual to -

B22-BC: Brown to yellow (7.5YR 3/4, 4/4, 10YR 4/6, 5/6, 6/6, 6/4), 0-20% grey or red mottles; light clay to heavy clay; may have grit or stone; strong structure reducing to weak in BC; pH 7.0-9.5.

MOFFAT (Mf)

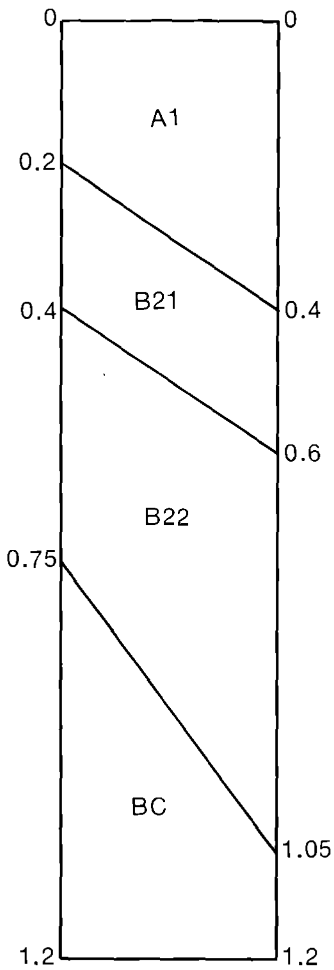
Concept: Shallow, acid to neutral, mottled, brown duplex soil on deeply-weathered rock.

Principal Profile Form: Db 2.12, Dy 3.52, Db 2.11

Great Soil Group: Grey-brown podzolic soil

Parent Material: Intermediate flows and pyroclastics (Connors Volcanics)

Landform: Undulating low hills, mid to upper slopes 4-9% and steeper.



A1: Dark (10YR 2/2, 3/2, 2/3, 7.5YR 2/2, 3/2), grey (10YR 5/2) dry; may have sporadic bleach; sandy clay loam to fine sandy clay loam; hardsetting; weak granular structure; pH 5.5-6.0. Clear to -

B21: Red-brown to yellow-brown (5YR 4/8, 6/8, 7.5YR 4/4, 10YR 4/3, 5/4), 20-30% yellow, brown or red mottles; light-medium clay to heavy clay; moderate angular blocky structure; pH 5.8-7.0. Gradual or clear to -

B22: Yellow to brown (10YR 6/8, 5/6, 7.5YR 4/6), 0-20% brown or red mottles; light clay to heavy clay; moderate structure; few iron-manganese concretions; pH 5.8-7.5. Clear to -

BC: Yellow-brown (10YR 4/3, 5/3, 5/4, 6/4, 6/8, 5/6), 0-20% parent material derived, white and/or red mottles; sandy clay loam to sandy light clay; weakly structured to massive; pH 5.8-8.0.

FREDDY (Fd)

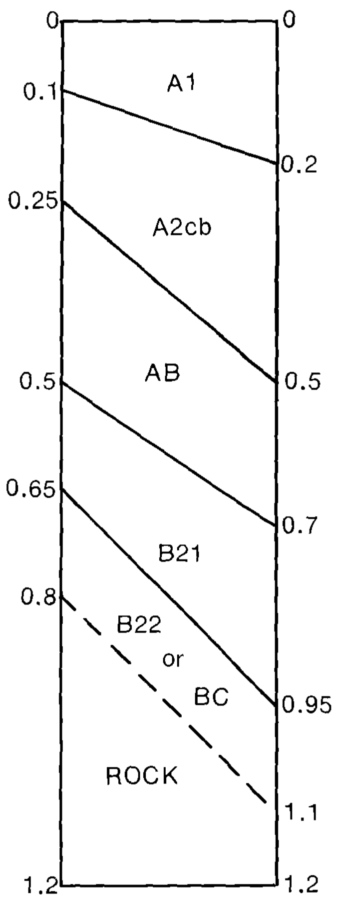
Concept: Gravelly, acid, bleached, mottled, light grey duplex soil.

Principal Profile Form: Dy 3.41, Dg 2.41

Great Soil Group: Soloth to yellow podzolic soil

Parent Material: Acid volcanics

Landform: Colluvial slopes of undulating low hills, 1-6%



A1: Dark to brown (10YR 3/2, 3/3, 4/2, 4/3, 7.5YR 4/1), light grey (10YR 7/2) dry; sandyclay loam to fine sandy clay loam; hardsetting; weakly structured to massive; pH 5.8-6.3. Clear to -

A2cb: Brown to grey (10YR 4/3, 5/3, 5/4, 5/1, 6/1), light grey (10YR 8/2) dry, conspicuous bleach; sandy clay loam to fine sandy clay loam; massive; pH 5.8-6.3. Clear to -

may have AB: Grey to yellow-brown (10YR 6/1, 6/3, 6/4); sandy clay loam to sandy light clay; 10% subangular gravel; massive; pH 5.5-6.3. Clear to -

B21: Grey to yellow-brown or light grey (10YR 5/2, 6/2, 6/3, 6/4, 7/1, 7/3, 7/4), 10-25% distinct to prominent yellow mottles; sandy clay to heavy clay; weak to moderate structure; may have up to 50% rounded gravel; pH 5.2-6.3. Clear to -

may have B22 or BC: Grey to yellow brown (10YR 5/2, 6/2, 6/3, 6/4), 0-50% yellow mottles; gritty or gravelly light clay to heavy clay; 30% rounded gravel; massive; few iron-manganese nodules; pH 5.6-6.2.

Comments: Median solum depth 0.85 m
Slight debil-debil occurs in flatter, undisturbed areas.

BREEN (By)

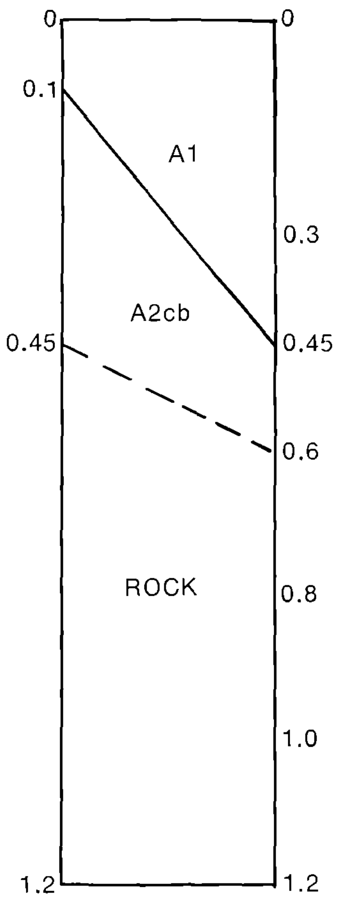
Concept: Shallow, stony, acid, light brown, sandy clay loams on low to steep slopes.

Principal Profile Form: Um 1.21, Um 1.23, Um 2.12

Great Soil Group: Lithosol, no suitable group

Parent Material: Acid volcanics

Landform: Gently undulating rises to rolling hills, slopes 2-20% and steeper.



A1: Dark to grey or yellow-brown (10YR 2/2, 3/2, 3/3, 4/3, 4/1, 5/3, 6/3), light grey (10YR 7/2) dry; sandy clay loam to fine sandy clay loam; 10% angular to rounded volcanic cobble and stone; hardsetting; massive; pH 5.2-6.5. Clear to -

may have A2cb: Yellow brown to light grey (10YR 6/3, 7/2), light grey (10YR 8/1) dry, conspicuous bleach; sandy clay loam; 50% angular volcanic stone; massive; pH 4.8-5.0.

Comments: Median solum depth 0.45 m within slope range sampled.

LOUISA (Ls)

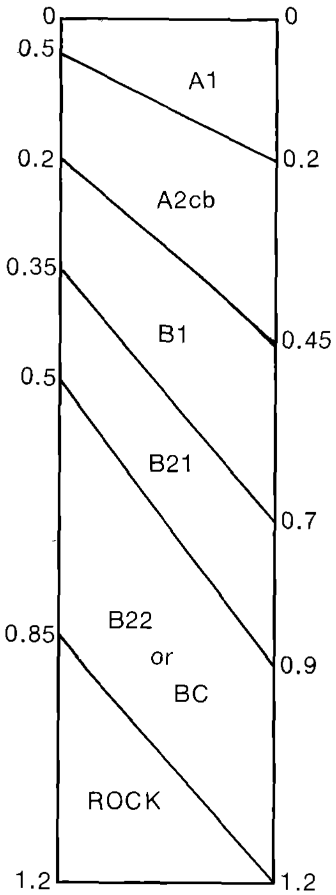
Concept: Gravelly, acid, bleached, mottled, yellow duplex soil.

Principal Profile Form: Dy 3.41, Dy 3.31, Gn 2.81

Great Soil Group: Yellow podzolic soil

Parent Material: Basic to intermediate volcanics

Landform: Lower slopes of undulating low hills, 2-8%



A1: Dark to brown (7.5YR 3/2, 4/2, 4/3, 10YR 3/2, 3/3, 4/2), grey (10YR 6/2) dry; sandy loam to fine sandy clay loam; hardsetting; weak to massive; pH 5.8-6.0. Clear to -

A2cb: Brown to light grey (10YR 4/3, 5/3, 5/4, 6/3, 8/2), light grey (10YR 7/2) dry, conspicuous bleach; gravelly loamy sand to gritty light clay; 10% rounded ironstone; massive; pH 4.8-6.0. Clear to -

B1: Brown to yellow-brown or light grey (7.5YR 4/4, 5/6, 10YR 5/4, 6/4, 7/4, 6/6); gritty or gravelly, light to light-medium clay; 30% rounded ironstone; massive; few iron-manganese nodules; pH 4.8-6.0. Gradual to -

B21: Yellow-grey to yellow (2.5Y 6/4, 10YR 6/4, 6/6), 10-40% distinct to prominent red mottles; light-medium to medium-heavy clay, may have up to 30% stone; weak to moderate polyhedral structure; pH 4.8-6.0. Clear to -

B22 or BC: Yellow-brown to yellow or red-brown (10YR 5/4, 6/4, 6/6, 6/8, 7.5YR 5/6, 5YR 5/6, 6/6), 10-35% prominent red and grey mottles; light to medium-heavy clay, 15% stone; weak structure; pH 4.8-6.0.

Comments: Median solum depth 1.1 m.
Slight debil-debil occurs in flatter, undisturbed areas.

CLIFTONVILLE (Cv)

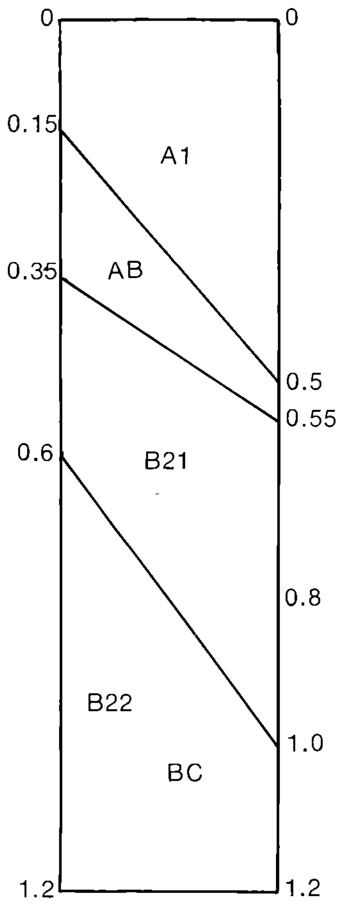
Concept: Gravelly, alkaline, mottled, yellow-brown duplex soil with abundant iron-manganese nodules.

Principal Profile Form: Dy 3.13

Great Soil Group: No suitable group

Parent Material: Basic to intermediate volcanics

Landform: Colluvial slopes of undulating low hills, 2-4%



A1: Dark to grey (10YR 3/2, 2/1, 2/2, 2/3, 4/2, 7.5YR 3/3), grey (10YR 5/2) dry; sandy clay loam to light clay; hardsetting; weak granular structure; pH 5.5-7.0. Clear to -

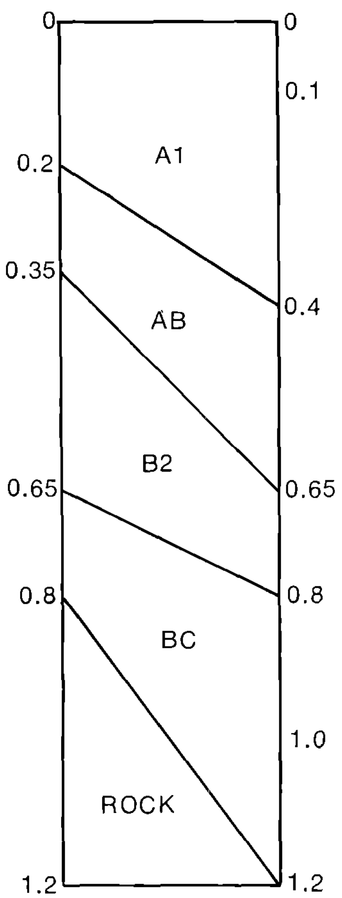
may have AB: Dark to yellow-brown (10YR 3/2, 4/2, 5/2, 5/4); clay loam to light-medium clay; 70% rounded ironstone; weakly structured to massive; pH 6.0-7.5. Clear to -

B21: Grey to yellow-brown (10YR 4/2, 4/3, 5/3, 5/4, 6/3), 5-25% distinct yellow mottles; light-medium to medium-heavy clay, sometimes gritty or gravelly; moderate blocky structure; few iron-manganese nodules; pH 6.8-9.5. Clear to -

B22 - BC: Grey to yellow-brown (10YR 5/1, 5/2, 6/3, -BC; 6/4, 4/2), 10-30% distinct yellow mottles; gritty or gravelly light clay to heavy clay; 15% rounded or angular volcanic stone; moderate structure; few to many iron-manganese nodules; pH 8.5-9.5.

HECTOR (Ht)

Concept:	Gravelly, neutral, mottled, brown duplex to gradational soil.
Principal Profile Form:	Db 1.52, Dy 3.52, Gn2.81, Uf 6.61
Great Soil Group:	Prairie soil
Parent Material:	Basic to intermediate volcanics
Landform:	Undulating low hills, slopes 3-12%



A1: Dark to brown (10YR 2/1, 2/2, 2/3), grey (10YR 4/2) dry; clay loam to light clay; hardsetting; weak granular structure; pH 5.5-6.0. Clear to -

AB: Dark to brown(10YR 2/2, 3/2, 3/3); stony light clay; 70% angular volcanic ironstone; weak granular structure; pH 5.8-6.0. Clear to -

B2: Brown to yellow-brown (10YR 4/4, 3/3, 4/3, 5/3), 5-20% distinct red or yellow mottles; light-medium to heavy clay, sometimes gravelly; moderate angular blocky structure; pH 5.8-6.5. Clear or gradual to -

BC: Grey to yellow-brown (10YR 5/2, 5/3, 5/4, 6/3); light to medium clay, sometimes gravelly, weak granular structure; pH 5.8-7.8.

Comments: Median solum depth 1.05 m.

SAMOURGASSI (Si)

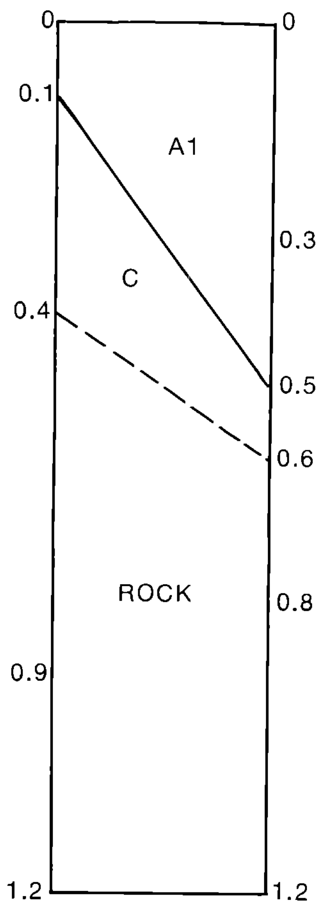
Concept: Shallow, stony, acid, brown, lithosol to gradational soil on moderate to steep slopes.

Principal Profile Form: Um 1.23, Um 1.21, Uf 1.23

Great Soil Group: Lithosol

Parent Material: Basic to intermediate volcanics

Landform: Undulating to rolling hills, slopes 6-20% and steeper



A1: Dark (10YR 3/1, 2/2, 2/3, 3/3, 7.5YR 3/3), grey (10YR 5/2) dry; sandy clay loam to light clay; 30% angular volcanic stone; loose to hardsetting; weak granular structure; pH 5.5-6.0. Clear to -

may have C: Brown to yellow-brown (10YR 4/3, 5/4, 7.5YR 4/4); sandy clay loam to light-medium clay; 70% angular ferruginous or volcanic stone; weak granular structure; pH 5.8-6.2.

Comments: Median solum depth 0.4 m within slope range sampled.

SHINFIELD (Sf)

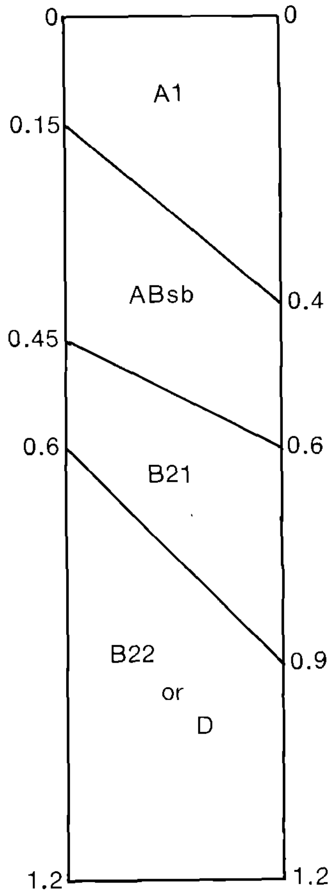
Concept: Alkaline, sporadically bleached, mottled, grey-yellow duplex soil on alluvial plains.

Principal Profile Form: Dy 3.33, Db 2.13, Dd 2.13, Dy 3.13

Great Soil Group: Solodic-solodized solonetz

Parent Material: Quaternary alluvium

Landform: Level to gently undulating alluvial plains, slopes 0-3%.



A1: Dark to grey-brown (10YR 2/2, 3/3, 4/2, 7.5YR 4/2) grey (10YR 6/2) dry, fine sandy clay loam; hardsetting; weak granular structure; pH 5.5-7.0. Clear to -

ABsb: Yellow to yellow-brown (10YR 4/3, 5/3, 5/4), yellow-brown to light grey (10YR 6/3, 7/3) dry, 15-25% distinct red or yellow mottles; sporadic bleach; light to medium-heavy clay; weak granular structure; pH 5.8-7.2. Clear to -

B21: Dark to grey (10YR 3/1, 5/2, 6/2), 10-50% distinct yellow or red mottles; medium to heavy clay; moderate angular blocky structure; pH 6.8-8.8. Clear to -

B22 or D: Grey to yellow-brown (10YR 4/1, 4/2, 6/2, ;6/3, 10-35% distinct yellow or red mottles; light-medium to heavy clay, sometimes gritty or gravelly; weak to moderate angular blocky structure; few to many iron-manganese concretions or nodules; pH 7.5-9.2.

BORSTAL (Bs)

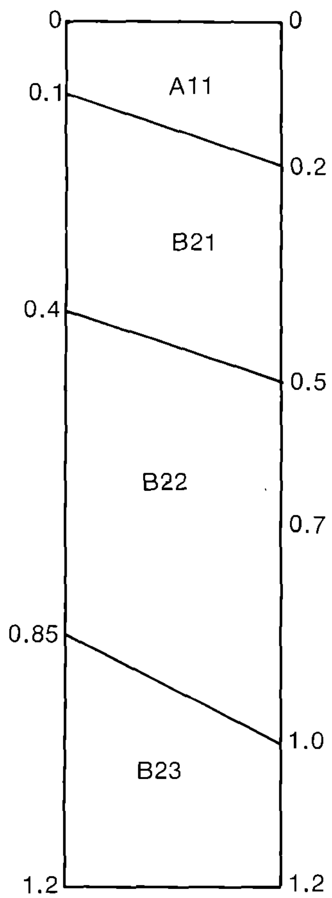
Concept: Black, self-mulching, cracking clay, gleyed and sandy at depth.

Principal Profile Form: Ug 5.16

Great Soil Group: Black earth to wiesenboden

Parent Material: Acid to intermediate intrusives and dykes

Landform: Gently undulating plain, slopes 1-4%



A11: Dark (10YR 2/1, 2/2, 3/2) dry; 0-2% faint brown rootline mottles; medium-heavy to heavy clay; cracking, self-mulching; pH 5.5-6.0. Clear or gradual to -

B21: Dark (10YR 2/1, 2/2), 2-5% faint brown rootline mottles; heavy clay; strong structure, angular blocky; pH 7.5-8.0. Clear to -

B22: Dark to grey (10YR 2/1, 3/2, 4/2), 10-20% distinct brown mottles; light-medium to heavy clay; moderate structure; pH 7.5-8.2. Clear to -

B23: Grey (10YR 4/1, 4/2, 5/2), 10-40% distinct yellow and gleyed mottles; medium to medium-heavy clay with medium to coarse sand; moderate structure; few to many iron-manganese and carbonate concretions; pH 7.5-8.5.

TURPAD (Tp)

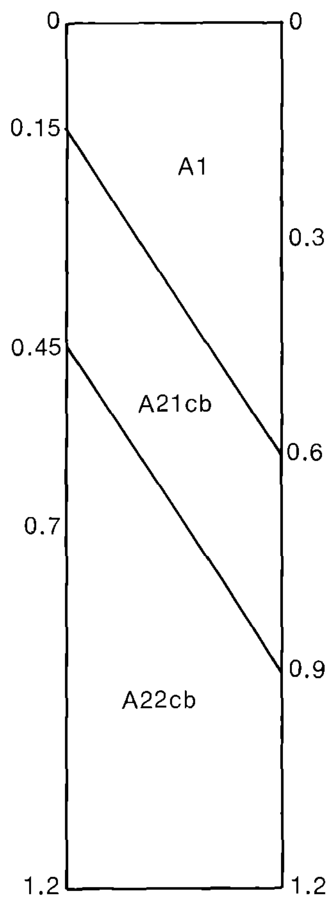
Concept: Acid, grey loamy sands to sandy clay loams in footslopes of granitic hills.

Principal Profile Form: Uc 1.21, Uc 2.22, Um 1.21

Great Soil Group: Siliceous sand. (Possible A horizon of a giant podzol)

Parent Material: Acid to intermediate intrusives

Landform: Gently undulating to undulating rises, slopes 1-7%



A1: Grey to dark (10YR 4/2, 3/2, 3/1, 7.5YR 4/2), light grey (10YR 7/1) dry; loamy sand to sandy clay loam; loose to weakly hardsetting; massive; pH 5.8-6.3. Gradual to -

A21cb: Yellow-brown to grey (10YR 6/2, 6/1, 5/3, 7.5YR 4/3, 5/3), light grey (10YR 8/2) dry, conspicuous bleach; loamy coarse sand to sandy clay loam; massive; pH 5.5-6.0. Gradual to -

A22cb: Yellow-brown to light grey (10YR 5/3, 6/3, 6/4, 7/3, 8/3, 7.5YR 5/4), light grey (10YR 8/3) dry, may have 15-25% prominent yellow mottles, conspicuous bleach; coarse sand to sandy clay loam; heavy quartz or fine gravel; massive; pH 5.5-6.0.

SWAYNEVILLE (Sv)

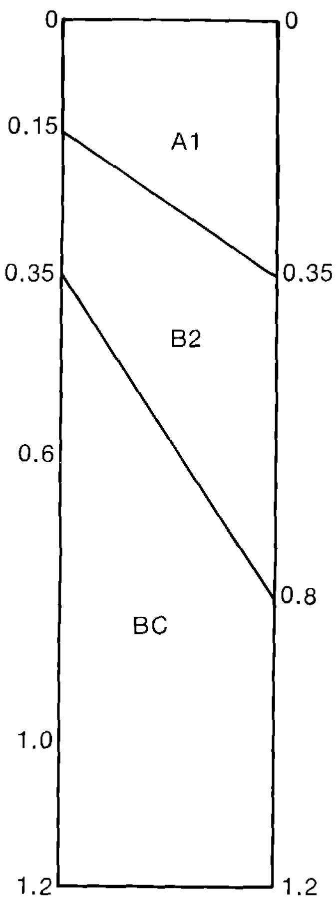
Concept: An acid to neutral, mottled, brown duplex soil on lower slopes of granitic hills

Principal Profile Form: Db 2.11, Db 2.12, Dy 3.12

Great Soil Group: Prairie soil, no suitable group

Parent Material: Acid to intermediate intrusives and dykes (leucocratic)

Landform: Undulating low hills, slopes 3-12%



A1: Dark to brown or grey (10YR 3/2, 2/2, 3/3, 2/5Y 3/1, 4/1), grey (10YR 5/2, 6/2) dry; sandy clay loam to fine sandy clay loam; weak to moderate crumb structure; pH 5.7-6.0. Clear to -

B2: Brown to yellow (7.5YR 4/3, 4/4, 5/4, 10YR 4/3, 4/4, 6/6), 10-20% distinct red or dark mottles; medium clay to heavy clay; moderate angular blocky structure; pH 5.7-7.0. Clear or gradual to -

BC: Brown to red-brown, yellow or light grey (10YR 4/3, 5/4, 6/4, 6/5, 5/6, 5YR 4/6, 2.5Y 7/2), 0-25% red, dark or yellow mottles; sandy clay to medium clay; weak structure; pH 6.0-7.0.

KOUMALA (Km)

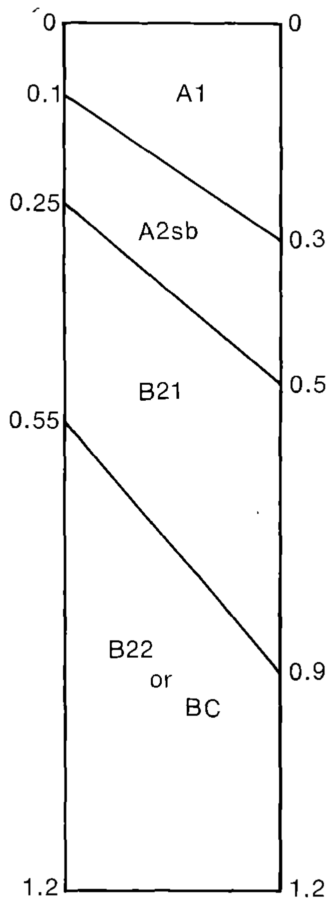
Concept: An acid, bleached, mottled, yellow duplex soil on the lower slopes of granitic hills.

Principal Profile Form: Dy 3.31, Db 2.32

Great Soil Group: Yellow podzolic soil

Parent Material: Acid to intermediate intrusives

Landform: Undulating low hills, slopes 3-12%



A1: Dark to brown (10YR 2/2, 2/3, 7.5YR 3/2, 2/3) grey (10YR 5/2) dry; sandy clay loam to fine sandy clay loam; hardsetting; weak structure; pH 5.5-6.0. Clear to -

A2sb: Dark to brown (10YR 3/2, 3/3, 4/2, 4/3, 7.5YR 3/2, 4/3) grey (10YR 5/1) dry; sporadic bleach; sandy clay loam to fine sandy clay loam; massive; pH 5.8-6.0. Abrupt to -

B21: Brown to yellow (10YR 4/4, 5/4, 5/6, 5/8, 6/6), 5-30% distinct red or grey mottles; gritty light-medium clay to heavy clay; moderate to strong structure; pH 5.8-6.5. Clear to -

B22 or BC: Grey to yellow (10YR 4/2, 5/4, 6/3, 5/8, 6/6, 6/8), 10-40% red, yellow or grey distinct mottles; light clay to heavy clay; moderate to weak structure; inclusions of fine felspathic gravel; pH 6.0-7.0.

URANNAH (Un)

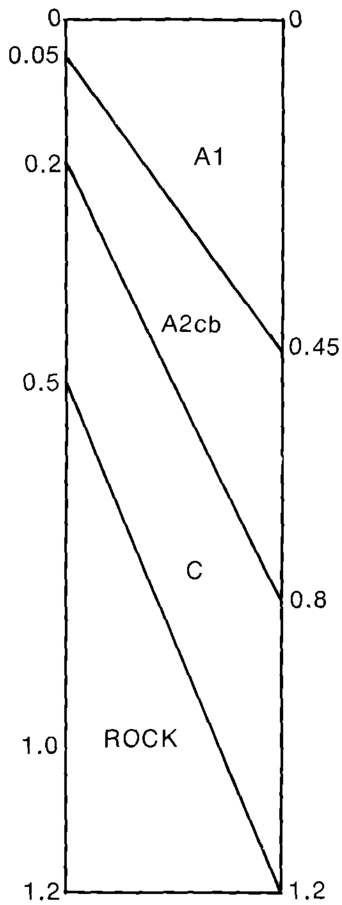
Concept: Shallow, acid sandy clay loams in sedentary situations on granitic hills

Principal Profile Form: Um 1.21, Um 2.21, Uc 2.12

Great Soil Group: Lithosol, no suitable group

Parent Material: Acid to intermediate intrusives

Landform: Undulating to rolling hills, slopes 4-17% and steeper



A1: Dark to grey (10YR 2/2, 2/3, 3/2, 4/2), grey (10YR 5/2) dry; sandy loam to sandy clay loam; loose to weakly hardsetting; massive; pH 5.5-6.3. Clear to -

may have A2cb: Brown to yellow-brown (7.5YR 3/3, 6/4, 10YR 5/3), light grey (10YR 7/4) dry, conspicuous bleach; sandy clay loam; massive; pH 5.8-6.5. Gradual or clear to -

(B): (Rudimentary B horizons in the form of occasional pockets of medium to heavy clay; may be encountered in some profiles.)

C: Yellow-brown to brown (10YR 6/3, 6/4, 7/6, 7.5YR 5/4, 6/6); gritty loamy sand to gritty sandy clay; massive; pH 5.8-7.0.

Comments: Depth of soil profile depends on depth of weathering. Median solum depth is 0.7 m within the slope range sampled.

MARWOOD (Mw)

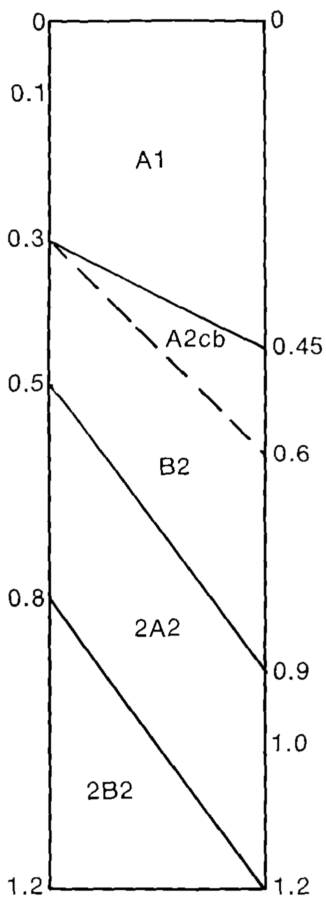
Concept: An acid, bleached sand with iron-organic B horizon in deep A horizon of an acid, gleyed duplex soil, developed on coalescing alluvial fans.

Principal Profile Form: Uc 1.21, Uc 2.21, Uc 2.23, Um 2.23

Great Soil Group: Podzol in deep A horizon of gleyed podzolic soil

Parent Material: Colluvium and alluvium from coarse-grained granodiorite

Landform: Gently undulating to level plains, slopes 2-3%



A1: Dark to grey or brown (10YR 2/2, 3/2, 3/3, 4/1, 5/2, 7.5YR 3/2, 3/4), grey (10YR 5/2) dry; loamy sand to clay loam sandy; weakly hardsetting; massive; pH 5.0-6.3. Clear to -

may have A2cb: Grey to brown or yellow-brown (7.5YR 4.2, 5/4, 10YR 6/2, 6/4), yellow-brown (10YR 6/3) dry, conspicuous bleach; sand to coarse sandy loam; massive; pH 5.0-6.0. Clear to -

B2: Grey-brown to yellow or light grey (2.5Y 6/2, 10YR 5/6, 7/3, 7.5YR 5/6, 6/2), 0-10% faint yellow mottling; coarse sandy loam to clay loam sandy; massive; pH 5.5-6.5. Clear or gradual to -

2A2: Yellow-brown to light grey (10YR 5/3, 6/4, 7/3), 0-20% distinct yellow mottles; coarse sand to clay loam coarse sandy; massive; pH 5.3-6.3. Clear or gradual to -

2B2: Light grey to yellow-grey (10YR 7/2, 7.5YR 7/4, 2.5Y 6/3), 0-30% distinct yellow and/or red mottles; gritty sandy clay loam to coarse sandy clay; massive; pH 5.5-7.0.

Comments: Intergrades with Malin soil; compares closely with Marwood soil of Mackay study.

MALIN (Mx)

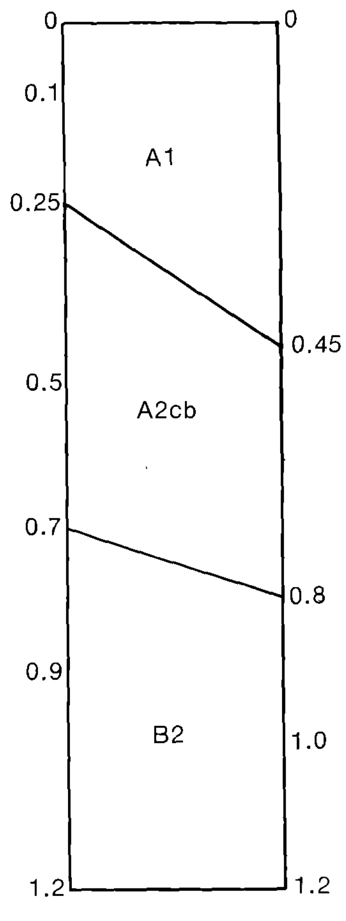
Concept: An acid, bleached, mottled, grey, coarse sandy, duplex soil

Principal Profile Form: Dg 2.41, Dy 3.41, Dy 3.81

Great Soil Group: Gleyed podzolic soil

Parent Material: Coarse grained granodiorite

Landform: Pediment slopes around granitic outcrop, 2-6%



A1: Dark to grey or brown (10YR 2/2, 3/2, 3/3, 7.5YR 4/2), grey (10YR 6/2) dry; sandy loam to clay loam sandy; weakly hardsetting; massive; pH 5.5-6.0. Clear to -

A2cb: Grey to yellow-brown (10YR 4/2, 5/4, 6/3), light grey (10YR 8/3) dry; loamy sand to sandy clay loam; conspicuous bleach; massive; pH 5.5-6.0. Gradual or clear to -

B2: Yellow-brown to light grey (10YR 5/4, 6/2, 7/1); 25-40% medium, distinct to prominent yellow, red or grey mottles; light clay to medium clay with coarse sand or quartz grit; moderate coarse angular blocky; pH 5.5-6.0.

Comments: Intergrades with Marwood soil

CHELONA (Cn)

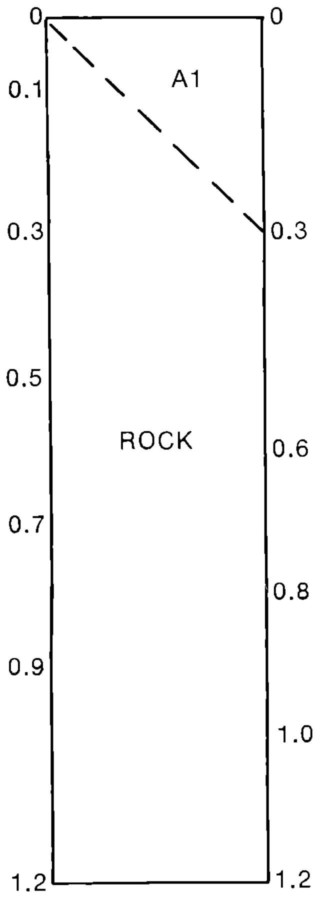
Concept: Shallow, acid, coarse sands in depressions of steep outcrop

Principal Profile Form: Uc 1.21

Great Soil Group: Lithosol

Parent Material: Coarse grained granodiorite

Landform: Steep rocky outcrops, 6-15% and steeper



A1: Dark to grey or brown (10YR 3/2, 3/3, 7.5YR 4/2); loamy coarse sand to clay loam coarse sandy; loose surface grading to massive; pH 5.5-6.0.

Comments: A typical solum depth is estimated to be less than 0.2 m where soil material accumulates.

Appendix C

MORPHOLOGICAL AND ANALYTICAL DATA FOR REPRESENTATIVE SOIL PROFILES

SOIL TYPE MALIN
SITE NO. C95
A.M.G. REFERENCE: 729 300 mE 7 635 720 mN ZONE 55

GREAT SOIL GROUP: Gleyed podzolic soil
PRINCIPAL PROFILE FORM: Dg2.81
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Weathered granodiorite
CONFIDENCE SUBSTRATE IS PARENT MATERIAL.

SLOPE: 2 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane

ANNUAL RAINFALL: 1650 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A11	0 to .25 m	Brownish black (10YR3/2) moist, greyish yellow-brown (10YR5/2) dry; sandy clay loam; dry very weak. Clear to-
A12sb	.25 to .45 m	Greyish yellow-brown (10YR5/2) moist, dry sporadically bleached; sandy clay loam; moderately moist very weak. Diffuse to-
A2cb	.45 to .60 m	Dull yellowish orange (10YR6/4) moist, dry conspicuously bleached; sandy loam; abundant fine gravel; moderately moist loose. Clear to-
B21	.60 to .90 m	Dull yellowish orange (10YR7/3) moist; many medium prominent yellow mottles; light clay; moderately moist very weak. Gradual to-
BC	.90 to 1.10 m	Dull yellowish orange (10YR7/3) moist; many medium prominent yellow mottles, few fine prominent red mottles; light clay; abundant fine gravel; moderately moist loose.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	6.2	.03	.002																	
.10	6.0	.10	.013	54	26	10	6	6	3.2	1.4	.14	.26	.034	0.84	.024	1.0		05	.81	
.30	5.4	.02	.002	49	31	12	7	2	.43	.54	.10	.05	.014	1.21	.007	0.6		04	.95	
.60	5.4	.02	.002	56	24	7	10	4	1.1	1.1	.10	.07	.013	1.44	.005	0.8		05	.99	
.90	5.9	.02	.002	56	20	6	13	10	1.7	5.4	.33	.15	.010	2.34	.006	1.6		07	.99	
1.10	6.2	.01	.001	48	29	10	10	9	2.0	5.5	.38	.12	.013	2.71	.003	1.6				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	0.8	.11	23	28	.40	97	13	0.5	0.6

SOIL TYPE. SHINFIELD
SITE NO: C63
A.M.G. REFERENCE: 721 800 mE 7 623 910 mN ZONE 55
GREAT SOIL GROUP: Solodic-solodized solonetz
PRINCIPAL PROFILE FORM: Dy3.13
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Very few

SUBSTRATE MATERIAL. Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 0%
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane

ANNUAL RAINFALL: 1600 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY:

HORIZON	DEPTH	DESCRIPTION
APsb	0 to .25 m	Dark brown (10YR3/3) moist, dry sporadically bleached; sandy clay loam; few angular few rounded; dr moderately weak. Abrupt to-
B21	.25 to .50 m	Greyish yellow-brown (10YR5/2) moist; many fine distinct yellow mottles; medium clay; dry moderately firm; very few manganiferous nodules. Clear to-
BC	.50 to .75 m	Dull yellowish brown (10YR5/3) moist; common fine distinct yellow mottles, common fine distinct grey mottles; light medium clay; many subangular; dry moderately weak; few manganiferous nodules. Abrupt to-
D	.75 to 1.20 m	Brownish grey (10YR4/1) moist; medium clay; moderately moist moderately firm; very few manganiferous nodules.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.5	.04	.003																	
.10	5.4	.06	.002	21	36	22	21	11	3.6	2.1	.32	.26	.046	0.70	.012	1.8		10	.79	
.30	6.2	.03	.003	17	30	18	38	15	7.2	4.7	.90	.19	.021	0.64	.006	2.9		17	.87	
.60	7.5	.04	.003	25	29	16	31	15	7.4	5.6	1.3	.17	.020	0.84	.003	2.8		14	.98	
.90	8.5	.06	.004	14	28	23	35	25	13	11	3.4	.30	.027	0.76	.002	4.0		18	.99	
1.20	8.8	.07	.005	6	35	27	34	28	15	12	4.3	.22	.034	0.74		4.6				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.0	.06	23	48	.20	102	50	1.0	0.5

SOIL TYPE: ILBILBIE
SITE NO: C54
A.M.G. REFERENCE: 743 330 mE 7 597 830 mN ZONE 55

GREAT SOIL GROUP: Soloth
PRINCIPAL PROFILE FORM: Dy3.41
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL. Tertiary sediments
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 1 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Coastal plain

VEGETATION
STRUCTURAL FORM: Woodland
DOMINANT SPECIES: Eucalyptus intermedia, Melaleuca viridiflora, Eucalyptus alba, Acacia leptophloia, Xanthorheia sp., Pandanus sp.

ANNUAL RAINFALL: 1600 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .15 m	Greyish brown (7.5YR4/2) moist, brownish grey (7.5YR6/1) dry; sandy clay loam; dry very weak. Gradual to-
A2cb	.15 to .40 m	Dull brown (7.5YR6/3) moist, light brownish grey (7.5YR7/2) dry, conspicuously bleached; sandy clay loam; moderately moist very weak. Clear to-
B1	.40 to .80 m	Dull brown (7.5YR6/3) moist; many medium distinct yellow mottles; light clay; moderately moist moderately weak. Clear to-
B21	.80 to 1.10 m	Dull orange (5YR6/3) moist; few fine prominent yellow mottles; light medium clay; moderately moist moderately weak.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.6	.02	.002																	
.10	5.7	.01	.002	56	36	5	1	2	.56	.47	.19	.05	.009	0.08	.012	0.4		02	0	
.30	5.6	.01	.002	47	40	9	4	2	.38	.41	.14	.05	.007	0.08	.004	0.3		02	.99	
.60	5.7	.01	.002	44	38	6	10	2	.19	.78	.25	.05	.007	0.10	.005	0.6		04	.99	
.90	6.1	.01	.002	47	30	8	14	4	.20	1.1	.51	.05	.006	0.15	.003	0.8		06	.99	
1.10	6.1	.01	.002	47	26	6	17	10	.10	3.4	1.4	.10				1.7				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	0.9	.06	4	6	.09	77	13	0.2	0.3

SOIL TYPE. SARINA
SITE NO: C27
A.M.G. REFERENCE: 727 400 mE 7 626 800 mN ZONE 55

GREAT SOIL GROUP: Solodized solonetz/solodic soil
PRINCIPAL PROFILE FORM: Dy2.33
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 0 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane

ANNUAL RAINFALL: 1700 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1sb	0 to .10 m	Greyish yellow-brown (10YR4/2) moist, dry sporadically bleached; very few fine distinct dark mottles; clay loam, fine sandy; moderately moist moderately weak. Clear to-
B1cb	.10 to .15 m	Dull yellowish brown (10YR5/3) moist, dry conspicuously bleached; few fine distinct yellow mottles; heavy clay; moist very firm. Clear to-
B21	.15 to .50 m	Dull yellowish orange (10YR6/3) moist; very few fine faint yellow mottles; heavy clay; moist moderately strong. Gradual to-
B22	.50 to 1.00 m	Greyish yellow-brown (10YR6/2) moist; very few fine faint yellow mottles; heavy clay; moist moderately strong; very few manganiferous nodules. Clear to-
B23	1.00 to 1.20 m	Greyish yellow-brown (10YR5/2) moist; very few fine faint dark mottles; heavy clay; moist very firm.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.7	.28	.015																	
.10	6.3	.10	.005	19	27	26	28									2.4		12	.72	
.30	5.8	.13	.009	3	22	18	56	25	15	8.6	1.3	.33	.020	0.57	.025	6.2		22	.61	
.90	7.8	.19	.015	6	25	27	45	32	20	9.9	2.0	.66	.024	0.79	.010	6.1		19	.84	
1.20	8.2	.13	.015	1	35	29	40	32	22	9.9	2.4	.91	.029	0.87	.003	5.9		19		

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.3	.11	65	87	1.7	110	62	1.9	1.6

SOIL TYPE: HECTOR
SITE NO: C15
A.M.G. REFERENCE: 727 870 mE 7 638 390 mN ZONE 55

GREAT SOIL GROUP: Prairie soil
PRINCIPAL PROFILE FORM: Dy3.52
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Very few

SUBSTRATE MATERIAL. Basic to intermediate volcanics
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 7 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating low hills

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane

ANNUAL RAINFALL: 1650 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .40 m	Black (10YR2/1) moist, greyish yellow-brown (10YR4/2) dry; clay loam; weak subangular blocky; moderately moist moderately weak. Clear to-
AB	.40 to .55 m	Brownish black (10YR3/2) moist; light clay; subangular gravel; weak granular; moderately moist moderately firm; few manganiferous nodules. Clear to-
B2	.55 to .80 m	Dull yellowish brown (10YR5/4) moist; common fine distinct red mottles; medium clay; weak granular; moderately moist moderately firm. Clear to-
BC	.80 to 1.20 m	Bright yellowish brown (10YR6/6) moist; very few fine distinct grey mottles; medium clay; weak granular; moderately moist moderately weak.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.9	.04	.002																	
.10	6.2	.06	.002	16	27	35	22	25	7.5	3.6	.14	.53	.080	.50	.036	2.2		13	.68	
.30	6.5	.03	.002	20	25	40	22	18	8.6	2.4	.10	.14	.052	.50	.019	1.9		12	.62	
.60	6.2	.03	.003	12	14	17	56	18	7.0	3.2	.10	.16	.026	.29	.014	3.2		22	.29	
.90	6.9	.03	.002	19	13	27	39	21	12	5.2	.19	.13	.049	.61	.009	3.4		19	.68	
1.20	6.8	.03	.002	25	20	37	19	15	14	5.9	.52	.12	.016	.44	.004	2.6				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	2.6	.15	18	30	.35	115	40	1.3	3.3

SOIL TYPE CLIFTONVILLE
SITE NO C10
A.M.G. REFERENCE: 727 820 mE 7 639 300 mN ZONE 55

GREAT SOIL GROUP: No suitable group
PRINCIPAL PROFILE FORM: Dy3.13
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Colluvium from basic to intermediate volcanics
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 3 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane

ANNUAL RAINFALL: 1600 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .25 m	Brownish black (10YR3/2) moist, greyish yellow-brown (10YR6/2) dry; silty clay loam; dry moderately weak. Abrupt to-
AB	.25 to .35 m	Dull yellowish brown (10YR5/4) moist; light medium clay; many subangular; dry moderately firm. Clear to-
B21	.35 to .65 m	Greyish yellow-brown (10YR4/2) moist; many fine distinct yellow mottles; medium clay; dry moderately firm. Clear to-
B22	.65 to 1.05 m	Brownish grey (10YR5/1) moist; few fine prominent yellow mottles; medium clay; dry moderately firm; few. Clear to-
BC	1.05 to 1.20 m	Brownish grey (10YR5/1) moist; few fine prominent yellow mottles; light clay; many angular; dry moderately weak; many many manganiferous nodules.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.8	.03	.003																	
.10	5.7	.04	.005	9	37	40	17	12	4.7	2.5	.14	.11	.036	0.36	.020	1.8		09	.69	
.30	6.5	.02	.002	17	22	20	40	15	7.2	4.2	.41	.09	.018	0.46	.010	3.3		17	.66	
.60	6.9	.02	.003	5	33	26	38	16	8.1	5.0	.73	.10	.014	0.39	.006	3.1		16	.67	
.90	7.5	.04	.004	11	33	22	30	13	7.5	5.0	1.0	.10	.011	0.48	.003	2.7		14	.90	
1.20	8.1	.06	.006	15	24	17	38	16	9.3	6.3	1.5	.11	.011	0.48	.002	3.3				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.5	.15	7	12	.40	110	62	1.0	0.8

SOIL TYPE ALLIGATOR
SITE NO. B28
A.M.G. REFERENCE: 728 420 mE 7 640 160 mN ZONE 55

GREAT SOIL GROUP: Grey clay
PRINCIPAL PROFILE FORM: Uf6.41
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 1 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Coastal plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane

ANNUAL RAINFALL: 1600 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
AP	0 to .10 m	Greyish yellow-brown (10YR4/2) moist; light clay; wet very weak. Clear to-
A12	.10 to .40 m	Greyish yellow-brown (10YR5/2) moist; few fine distinct orange mottles; light clay; weak granular; moderately moist very weak; few manganiferous nodules, few manganiferous concretions. Clear to-
B21	.40 to .80 m	Dull yellowish orange (10YR7/4) moist; many medium prominent orange mottles, common medium prominent grey mottles; medium heavy clay; weak granular; moderately moist moderately firm; very few manganiferous nodules. Clear to-
B22g	.80 to .95 m	Dull yellowish orange (10YR6/3) moist; many coarse prominent gley mottles, common medium distinct orange mottles; heavy clay; moderate subangular blocky; moderately moist moderately firm; few manganiferous nodules. Gradual to-
B23	.95 to 1.20 m	Bright yellowish brown (10YR6/6) moist; few fine distinct gley mottles, few fine prominent red mottels; medium clay; weak granular; moderately moist very weak; few ferruginous nodules, few carbonate nodules, very highly calcareous, few manganiferous nodules.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.8	.03	.003																	
.10	5.8	.04	.004	11	21	48	20	13	1.1	1.6	.15	.21	.043	.08	.017	1.4		08	.82	
.30	5.9	.07	.013	10	20	41	28	11	1.9	1.8	.47	.08	.023	1.04	.015	1.7		11	.71	
.60	6.0	.13	.025	8	11	27	52	21	4.6	6.1	.19	.08	.014	1.67	.006	2.9		19	.67	
.90	7.5	.21	.035	12	22	27	35	17	4.9	7.6	2.9	.06	.011	1.62	.004	2.5		15	.99	
1.20	9.1	.34	.042	19	25	24	31	14	4.1	7.1	2.9	.06	.012	1.77	.002	2.1				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.3	.20	20	34	.50	183	69	1.5	1.3

SOIL TYPE CABBAGE TREE
SITE NO: A33
A.M.G. REFERENCE: 733 050 mE 7 636 040 mN ZONE 55

GREAT SOIL GROUP: Solodized solonetz/solodic soil
PRINCIPAL PROFILE FORM: Dd2.13
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 2 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane

ANNUAL RAINFALL: 1600 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .25 m	Brownish black (10YR2/2) moist; silty clay; moderately weak.
B1	.25 to .40 m	Brownish black (10YR3/2) moist; common fine distinct brown mottles; medium clay; moderately firm.
B21	.40 to .55 m	Brownish black (10YR3/2) moist; few fine distinct brown mottles; heavy clay; very firm.
B22a	.55 to .70 m	Greyish yellow-brown (10YR5/2) moist; many fine prominent yellow mottles; medium heavy clay; very firm.
B22b	.70 to .90 m	Brownish grey (10YR5/1) moist; many fine prominent yellow mottles; medium clay; moderately firm.
B23	.90 to 1.20 m	Gleyed grey (N 5/0) moist; many fine distinct yellow mottles; medium heavy clay; very firm; few manganiferous soft segregations.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	6.2	.02	.002																	
.10	5.9	.02	.001	13	29	26	34	20	8.9	4.6	.27	.13	.046	0.35	.031	3.0		15	.38	
.30	6.5	.02	.002	6	19	22	51	22	13	6.4	.56	.09	.021	0.25	.015	3.7		18	.55	
.60	7.0	.03	.003	17	27	17	38	18	11	6.8	.58	.08	.016	0.40	.006	3.4		16	.69	
.90	7.8	.04	.004	19	33	16	34	19	11	7.5	.57	.08	.012	0.39	.002	3.3		15	.81	
1.20	7.7	.03	.003	20	32	16	31	19	11	7.8	.45	.09	.014	0.40	.002	3.4				

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus		Rep. K	DTPA-extr.			
			Acid	Bicarb.		Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	2.3	.09	7	10	.29	168	29	3.9	1.5

SOIL TYPE CHERRYTREE
SITE NO 727
A.M.G. REFERENCE. 734 820 mE 7 611 650 mN ZONE 55

GREAT SOIL GROUP: Solodized solonetz/solodic soil
PRINCIPAL PROFILE FORM: Dy3.43
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 0 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Eucalyptus tereticornis, Sugar cane

ANNUAL RAINFALL: 1200 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
APsb	0 to .10 m	Dull yellowish brown (10YR4/3) moist, dry sporadically bleached; clay loam, fine sandy; dry moderately weak. Clear to-
A2cb	.10 to .20 m	Dull yellowish brown (10YR4/3) moist, dry conspicuously bleached; few fine distinct yellow mottles; clay loam, fine sandy; dry moderately weak. Abrupt to-
B21	.20 to .80 m	Greyish yellow-brown (10YR5/2) moist; common fine distinct yellow mottles; heavy clay; dry very firm; few manganiferous nodules. Gradual to-
B22	.80 to 1.20 m	Brown (10YR4/6) moist; few fine distinct grey mottles; heavy clay; moderately moist very firm; many manganiferous concretions.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.1	.33	.031																	
.10	5.6	.05	.004	14	34	34	19	6	2.1	1.2	.55	.11	.017	0.19	.012	1.2		07	.86	
.30	5.9	.05	.009	12	21	21	46	13	3.8	4.2	1.5	.08	.009	0.25	.007	2.9		15	.83	
.60	6.6	.11	.019	9	16	22	53	21	6.6	8.8	3.6	.15	.010	0.42	.005	4.1		20	.99	
.90	8.2	.19	.032	2	31	26	40	24	7.5	9.1	5.9	.73	.011	0.73	.006	3.8		18	.99	
1.20	8.8	.23	.041					17	5.3	6.6	5.0	.07	.013	0.50	.001	2.5				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	.80	.07	3	3	.38	65	90	0.8	1.0

SOIL TYPE CHERRYTREE
SITE NO 725
A.M.G. REFERENCE: 733 250 mE 7 609 920 mN ZONE 55

GREAT SOIL GROUP: Solodized solonetz/solodic soil
PRINCIPAL PROFILE FORM: Dy3.43
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 1 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane, Improved pastures

ANNUAL RAINFALL: 1300 mm

REMARKS: Soda patch

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1p	0 to .15 m	Greyish brown (7.5YR5/2) moist; sandy clay loam; dry very weak. Clear to-
A2cb	.15 to .35 m	Dull brown (7.5YR5/3) moist, dry conspicuously bleached; sandy clay loam; dry very weak; few manganiferous concretions. Gradual to-
B2	.35 to .65 m	Dull yellowish orange (10YR6/3) moist; few fine distinct yellow mottles, very few medium distinct grey mottles; medium clay; moderately moist moderately firm; few. Abrupt to-
BD	.65 to .70 m	Dull yellowish orange (10YR7/2) moist; common medium prominent yellow mottles; medium clay; moderately moist moderately firm; many carbonate nodules, very highly calcareous. Abrupt to-
D	.70 to 1.20 m	Pale yellow (2.5Y8/4) moist; light clay; moderately moist very weak. Abrupt to-

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
.10	7.7	.07	.003	54	31	11	4	3	1.8	.74	.33	.10	.017	0.14	.002	0.4		02	.99	
.30	9.3	.15	.013	33	31	16	17	8	.61	.82	5.3	.14	.009	0.09	.004	1.0		07	.99	
.60	9.9	.26	.015	34	28	13	24	15	.57	1.3	12	.15	.003	0.19	.001	1.8		13	.99	
.90	9.9	.31	.015	39	16	17	27	23	.53	1.5	22	.16	.003	0.89	.009	3.1		18	.90	
1.20	9.9	.33	.019	26	16	16	40	30	.40	1.8	29	.22	.004	0.38	.010	4.0				

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
			Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
.10	.66	.03	43	18	.16	40	4	0.1	0.8

SOIL TYPE CHERRYTREE
SITE NO 724
A.M.G. REFERENCE: 734 440 mE 7 610 200 mN ZONE 55

GREAT SOIL GROUP: Solodized solonetz/solodic soil
PRINCIPAL PROFILE FORM: Dy3.43
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 1 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane, Improved pastures

ANNUAL RAINFALL: 1250 mm

REMARKS: Soda patch

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1p	0 to .15 m	Greyish brown (7.5YR5/2) moist; clay loam, fine sandy; dry very weak. Clear to-
A2cb	.15 to .40 m	Dull brown (7.5YR5/3) moist, dry conspicuously bleached; light sandy clay loam; dry very weak; few manganiferous concretions, few manganiferous nodules. Abrupt to-
B1	.40 to .80 m	Dull yellowish brown (10YR5/3) moist; few fine faint yellow mottles; medium clay; moderately moist moderately weak; few carbonate nodules, very highly calcareous. Clear to-
B2	.80 to 1.20 m	Dull yellowish orange (10YR6/3) moist; many fine distinct yellow mottles; medium heavy clay; moderately moist moderately firm; few manganiferous nodules, very highly calcareous, few carbonate nodules, very highly calcareous.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	5.9	.05	.003																	
.10	5.8	.03	.002	30	33	26	11	5	2.1	.95	.43	.08	.023	0.08	.016	0.9		04	.91	
.30	6.5	.03	.004	30	32	25	13	4	1.6	.58	.74	.02	.008	0.07	.007	1.0		05	.99	
.60	9.8	.30	.015	26	24	24	25	11	4.1	3.7	3.8	.06	.007	0.08	.004	1.9		12	.99	
.90	9.9	.42	.032	12	28	30	31	17	2.0	5.2	8.5	.12	.003	0.09	.001	2.4		15	.99	
1.20	9.8	.25	.022	16	20	29	35	19	1.4	5.4	11	.12	.004	0.10	.001	2.8				

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus		Rep. K	DTPA-extr.			
			Acid	Bicarb.		Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	.80	.07	5	8	.21	73	25	0.5	0.9

SOIL TYPE SPIDER
SITE NO I74
A.M.C. REFERENCE. 742 480 mE 7 575 580 mN ZONE 55

GREAT SOIL GROUP: Black earth
PRINCIPAL PROFILE FORM: Ug5.16
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 1 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Tristani siaveolens, Eucalyptus tereticornis, Improved and native pastures

ANNUAL RAINFALL: 1500 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Cracking

HORIZON	DEPTH	DESCRIPTION
A1	0 to .45 m	Black (10YR1.1/1) moist, brownish black (10YR3/2) dry; heavy clay; dry moderately strong. Gradual to-
AB	.45 to .65 m	Brownish black (10YR3/1) moist; few fine faint yellow mottles; medium heavy clay; moderately moist very firm. Abrupt to-
B21	.65 to 1.20 m	Greyish yellow-brown (10YR6/2) moist; many medium prominent yellow mottles; heavy clay; moderately moist very firm; many manganiferous nodules.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS % @ 105C	FS	S	C	Exch. Cations CEC m.eq/100g	Ca	Mg	Na	K	Total Elements P %	K	S	Moistures ADM % @ 105C	1/3b	15b	Disp.Ratio R1	R2
Bulk .10	5.9	.08	.004																	
.10	6.1	.08	.002	23	21	18	36	31	10	6.4	.91	.37				6.3	35	20	.82	
.30	8.3	.06	.002	12	36	15	35	22	13	7.0	1.2	.13				5.4	27	15	.69	
.60	8.6	.12	.011	14	38	14	31	19	9.5	6.4	1.8	.05				5.1	26	14	.92	
.90	8.4	.19	.022	21	32	13	31	20	9.7	8.5	1.3	.02				5.7	27	14	.93	
1.20	8.4	.13	.011	17	37	15	27	18	9.0	8.6	.68	.04				4.2				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Phosphorus Acid ppm	Bicarb.	Rep. K m.eq%	DTPA-extr. Fe ppm	Mn	Cu	Zn
Bulk .10	4.3	.32	8	3	.31	275	53	4.4	0.8

SOIL TYPE URANNAH
SITE NO I70
A.M.G. REFERENCE: 733 440 mE 7 594 250 mN ZONE 55

GREAT SOIL GROUP: Lithosol
PRINCIPAL PROFILE FORM: Um2.21
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Few gravel

SUBSTRATE MATERIAL Acid to intermediate intrusives
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 16 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Rolling low hills

VEGETATION
STRUCTURAL FORM: Woodland
DOMINANT SPECIES: Eucalyptus intermedia, Eucalyptus tereticornis, Eucalyptus drepanophylla, Clochidion perakense, Planchonia careya,

ANNUAL RAINFALL: 1550 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .15 m	Brownish black (7.5YR2/2) moist, greyish brown (7.5YR5/2) dry; light sandy clay loam; few subangular; dry very weak. Gradual to-
A2cb	.15 to .40 m	Dark brown (7.5YR3/3) moist, dull brown (7.5YR5/3) dry, conspicuous bleach; sandy clay loam; dry very weak; many. Gradual to-
BC	.40 to .75 m	Dull brown (7.5YR5/4) moist; light sandy clay loam, fine gravelly; dry very weak. Gradual to-
C	.75 to .90 m	Dull brown (7.5YR5/4) moist; light sandy clay loam, fine gravelly; dry loose.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size % @ 105C CS	FS	S	C	Exch. Cations m.eq/100g CEC	Ca	Mg	Na	K	Total Elements % P	K	S	Moistures % @ 105C ADM	1/3b	15b	Disp.Ratio R1	R2
Bulk .10	6.1	.05	.001																	
.10	6.0	.03	.001	58	24	10	7	12	4.5	1.5	.14	.35				1.6	16	06	.13	
.30	6.3	.02	.001	51	27	14	10	12	5.5	1.1	.18	.22				1.5	16	07	.74	
.60	6.4	.02	.001	55	24	10	10	7	4.0	1.1	.15	.16				1.3	13	05	.78	
.90	6.4	.02	.001	67	16	7	6	5	3.8	1.4	.13	.09				1.4	12	05	.87	

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Phosphorus ppm Acid	Bicarb.	Rep. K m.eq%	DTPA-extr. ppm Fe	Mn	Cu	Zn
Bulk .10	2.8	.20	21	6	.68	67	104	0.8	5.6

SOIL TYPE KOUMALA
SITE NO I72
A.M.G. REFERENCE. 732 100 mE 7 598 850 mN ZONE 55

GREAT SOIL GROUP: Soloth
PRINCIPAL PROFILE FORM: Dy3.31
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Acid to intermediate intrusives
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 6 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating low hills

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Eucalyptus tereticornis, Improved pastures

ANNUAL RAINFALL: 1600 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .25 m	Brownish black (10YR2/3) moist, greyish yellow-brown (10YR5/2) dry; clay loam, fine sandy; dry very weak. Clear to-
A2sb	.25 to .40 m	Dull yellowish brown (10YR4/3) moist, greyish yellow-brown (10YR6/2) dry, dry sporadically bleached; clay loam, fine sandy; moderately moist very weak. Abrupt to-
B21	.40 to .60 m	Yellowish brown (10YR5/6) moist; few fine distinct red mottles; medium heavy clay; moist very firm. Gradual to-
BC	.60 to 1.00 m	Yellowish brown (10YR5/8) moist; many fine distinct grey mottles; medium clay; moderately moist moderately firm. Gradual to-
C	1.00 to 1.20 m	Dull yellowish orange (10YR6/4) moist; light clay, fine gravelly; moderately moist moderately weak.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.9	.03	.001																	
.10	5.6	.07	.006	31	41	13	14	10	4.4	2.3	.21	.25				1.9	17	08	.45	
.30	5.8	.03	.002	28	44	14	14	8	2.5	1.9	.12	.06				1.7	15	08	.68	
.60	6.2	.02	.001	17	23	10	46	14	4.8	6.5	.45	.08				4.3	31	19	.39	
.90	6.5	.01	.001	12	34	14	38	16	6.6	9.4	.73	.10				4.5	31	18	.56	
1.20	6.9	.01	.001	36	34	13	14	17	8.4	11	.89	.05				4.2				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.8	.12	5	3	.50	92	41	1.0	1.3

SOIL TYPE BORSTAL
SITE NO I59
A.M.G. REFERENCE: 736 280 mE 7 596 840 mN ZONE 55

GREAT SOIL GROUP: Black earth
PRINCIPAL PROFILE FORM: Ug5.16
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated basic to intermediate colluvium
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 3 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Lantana camara, Improved pastures, Imperata cylindrica

ANNUAL RAINFALL: 1500 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Cracking

HORIZON	DEPTH	DESCRIPTION
A11	0 to .15 m	Black (10YR1.1/1) moist, brownish black (10YR2/2) dry; medium heavy clay; dry moderately firm. Clear to-
A12	.15 to .50 m	Black (10YR2/1) moist; few fine faint brown mottles; heavy clay; moderately moist very firm. Clear to-
B21	.50 to .85 m	Greyish yellow-brown (10YR4/2) moist; common fine distinct brown mottles; light medium clay, sandy; moderately moist moderately weak. Gradual to-
B22	.85 to 1.05 m	Greyish yellow-brown (10YR4/2) moist; many fine prominent yellow mottles, few fine distinct dark mottles; medium clay, sandy; moderately moist moderately firm. Clear to-
CD	1.05 to 1.20 m	Greyish yellow-brown (10YR4/2) moist; common fine distinct yellow mottles, common fine distinct dark mottles; light clay, sandy; dry moderately weak.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.6	.09	.006																	
.10	5.9	.04	.003	18	24	17	37	37	17	5.5	.31	.15	.046	0.59	.053	4.5		21	.48	
.30	7.2	.04	.002	11	22	14	51	30	19	7.1	.54	.06	.012	0.46	.017	5.0		23	.68	
.60	7.4	.03	.002	27	37	12	23	13	8.9	4.0	.37	.02	.004	0.91	.004	2.6		11	.92	
.90	7.5	.03	.002	29	32	12	27	16	11	5.2	.43	.07	.005	0.81	.003	3.4		13	.88	
1.20	7.5	.02	.002	33	31	11	22	11	7.9	3.7	.35	.07	.008	0.80	.002	2.5				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	5.1	.43	3	10	.38	439	22	7.1	2.4

SOIL TYPE KARLOO
SITE NO I56
A.M.G. REFERENCE. 749 880 mE 7 575 840 mN ZONE 55

GREAT SOIL GROUP: Solodized solonetz/solodic soil
PRINCIPAL PROFILE FORM: Dy3.43
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 1 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Coastal plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane

ANNUAL RAINFALL: 1250 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1sb	0 to .15 m	Greyish brown (7.5YR4/2) moist, greyish yellow-brown (10YR6/2) dry, dry sporadically bleached; silty clay loam; dry very weak. Clear to-
A2cb	.15 to .25 m	Brown (7.5YR4/3) moist, dull yellowish orange (10YR7/2), dry conspicuously bleached; few fine prominent yellow mottles; silty clay loam; dry very weak; few manganiferous nodules, concretions. Abrupt to-
B21	.25 to .75 m	Dull yellowish brown (10YR5/3) moist; common fine distinct yellow mottles; heavy clay; dry moderately strong; many manganiferous concretions, and soft segregations. Gradual to-
B22	.75 to 1.20 m	Brown (7.5YR4/6) moist; medium heavy clay; dry very firm; few manganiferous concretions, few carbonate soft segregations, very highly calcareous.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.4	.16	.019																	
.10	5.7	.04	.004	9	32	39	18	7	2.2	1.3	.39	.42	.038	1.28	.015	1.2		08	.84	
.30	6.6	.03	.004	12	25	29	32	8	4.9	3.6	.91	.12	.022	1.11	.007	2.3		13	.89	
.60	7.5	.04	.006	6	21	25	44	19	6.3	6.2	1.2	.20	.017	1.09	.006	3.3		17	.97	
.90	8.4	.08	.011	6	28	25	39	16	6.0	6.7	1.9	.12	.027	1.32	.006	2.8		16	.99	
1.20	9.2	.28	.019	6	28	20	46	19	6.9	8.4	3.4	.20	.047	1.30	.005	3.3				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10			18	11	1.2	151	56	2.3	2.5

SOIL TYPE FREDDY
SITE NO I54
A.M.G. REFERENCE: 729 550 mE 7 622 510 mN ZONE 55

GREAT SOIL GROUP: Yellow podzolic soil
PRINCIPAL PROFILE FORM: Dg2.81
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated gravel
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 3 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane

ANNUAL RAINFALL: 1600 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .25 m	Greyish yellow-brown (10YR4/2) moist, dull yellowish orange (10YR7/2) dry; sandy clay loam; dry very weak. Abrupt to-
A2cb	.25 to .45 m	Dull yellowish orange (10YR7/3) moist, light yellowish orange (10YR8/3) dry, conspicuous bleach; few fine faint yellow mottles; sandy clay loam; dry loose. Clear to-
B1	.45 to .75 m	Dull yellowish orange (10YR7/2) moist; light clay; many rounded ferruginous fine gravels; moderately moist loose; many manganiferous nodules. Clear to-
B21	.75 to 1.00 m	Light grey (10YR8/2) moist; common fine prominent yellow mottles; light medium clay; moderately moist very weak. Abrupt to dense gravel layer.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.2	.14	.013																	
.10	5.8	.10	.013	23	37	29	13	7	2.4	1.1	.42	.55	.021	0.86	.021	0.9		06	.86	
.30	5.9	.02	.004	19	37	30	14	2	1.3	.76	.38	.05	.005	0.87	.007	0.7		06	.99	
.60	6.1	.02	.003	26	26	28	18	4	1.2	1.1	.39	.05	.005	0.98	.006	0.8		07	.93	
.90	6.0	.01	.003	36	20	17	24	5	1.4	2.4	.41	.09	.005	1.34	.006	1.0		08	.99	

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus		Rep. K	DTPA-extr.			
			Acid	Bicarb.		Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10			11	24	.47	93	44	0.4	0.8

SOIL TYPE SADDLE
SITE NO· I53
A.M.G. REFERENCE. 743 450 mE 7 575 250 mN ZONE 55

GREAT SOIL GROUP: Grey-brown podzolic soil
PRINCIPAL PROFILE FORM: Db2.32
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 7 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating low hills

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane

ANNUAL RAINFALL: 1500 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .25 m	Brownish black (7.5YR2/2) moist; silty clay loam; dry moderately weak. Clear to-
A2sb	.25 to .40 m	Very dark brown (7.5YR2/3) moist, dry sporadically bleached; silty clay loam; dry moderately weak; few manganiferous nodules. Abrupt to-
B21	.40 to .75 m	Brown (7.5YR4/6) moist; common fine distinct red mottles; medium clay; dry moderately firm. Gradual to-
B22	.75 to 1.00 m	Brown (7.5YR4/4) moist; common fine distinct red mottles, few fine distinct dark mottles; heavy clay; dry very firm; few. Abrupt to-
B23	1.00 to 1.20 m	Yellowish brown (10YR5/6) moist; common fine prominent pale mottles; light medium clay; few angular volcanic stones; dry moderately firm.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	5.7	.06	.008																	
.10	5.9	.04	.004	18	16	38	26	10	8.5	3.8	.57	.19	.097	0.17	.029	2.7		14	.72	
.30	6.2	.01	.002	16	15	38	28	13	7.1	2.4	.19	.04	.072	0.16	.016	2.5		14	.73	
.60	6.3	.01	.002	7	11	27	56	8	6.4	3.3	.25	.07	.043	0.15	.017	3.5		22	.53	
.90	6.1	.01	.002	5	10	27	56	8	8.4	4.7	.35	.10	.029	0.15	.006	4.2		22	.59	
1.20	6.7	.01	.002	20	12	32	35	18	14	6.6	.57	.12	.043	0.91	.003	4.5				

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
			Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10			12	23	.24	91	94	1.3	1.7

SOIL TYPE PREDNERGAST
SITE NO I52
A M G REFERENCE 742 200 mE 7 573 830 mN ZONE

GREAT SOIL GROUP: Solodized solonetz/solodic soil
PRINCIPAL PROFILE FORM: Db2.33
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 1 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane
ANNUAL RAINFALL: 1400 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .25 m	Brownish black (10YR2/2) moist; clay loam,fine sandy; dry very weak. Clear to-
A25b	.25 to .40 m	Brownish black (10YR3/2) moist; silty clay loam; dry very weak; few manganiferous nodules. Abrupt to-
B21	.40 to .65 m	Dull yellowish brown (10YR4/3) moist; common fine faint brown mottles; heavy clay; dry moderately firm; few manganiferous nodules. Clear to-
B22	.65 to .95 m	Brown (7.5YR4/3) moist; common fine distinct yellow mottles, common fine distinct dark mottles; heavy clay; dry very firm; many felspathie grit. Abrupt to-
B23	.95 to 1.20 m	Greyish yellow-brown (10YR4/2) moist; few fine faint yellow mottles; heavy clay; moderately moist very firm; few.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size CS % @ 105C	FS	S	C	Exch. Cations CEC m.eq/100g	Ca	Mg	Na	K	Total Elements P %	K	S	Moistures ADM % @ 105C	1/3b	15b	Disp.Ratio R1	R2
.10	6.3	.02	.002	33	32	22	12	12	2.3	1.3	.12	.78	.065	1.86	.018	1.4		08	.91	
.30	6.2	.01	.002	26	31	26	15	11	2.4	1.0	.12	.50	.041	1.75	.022	1.6		08	.94	
.60	6.5	.02	.002	18	21	18	42	19	7.1	4.0	.45	.28	.027	1.35	.010	3.9		17	.80	
.90	7.4	.02	.003	23	23	17	35	19	9.1	5.6	.74	.14	.024	1.39	.007	3.7		15	.94	
1.20	8.1	.04	.003	9	20	28	43	27	.17	10	1.4	.12	.026	1.09	.005	5.3				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Phosphorus Acid ppm	Bicarb.	Rep. K m.eq%	DTPA-extr. Fe ppm	Mn	Cu	Zn
.10	1.1	.07	30	44	1.0	89	52	1.5	1.7

SOIL TYPE TEDLANDS
SITE NO I05
A.M.G. REFERENCE: 741 200 mE 7 609 920 mN ZONE 55

GREAT SOIL GROUP: Soloth
PRINCIPAL PROFILE FORM: Dy3.41
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 1 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Coastal plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Improved pastures

ANNUAL RAINFALL: 1300 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1sb	0 to .10 m	Greyish brown (7.5YR5/2) moist, light brownish grey (7.5YR7/2) dry, dry sporadically bleached; silty clay loam; dry very weak. Clear to-
A2cb	.10 to .25 m	Greyish brown (7.5YR6/2) moist, light grey (7.5YR8/1) dry, conspicuously bleached; silty clay loam; dry very weak. Clear to-
AB	.25 to .45 m	Dull brown (7.5YR6/3) moist; few fine faint yellow mottles; silty clay loam; moderately moist very weak; many manganiferous soft segregations. Clear to-
B21	.45 to .95 m	Greyish brown (7.5YR6/2) moist; few fine prominent yellow mottles; medium heavy clay; moderately moist moderately firm. Abrupt to-
D	.95 to 1.20 m	Dull yellowish orange (10YR6/4) moist; medium clay; moderately moist moderately firm.

Depth (metres)	1:5 Soil/Water pH	EC (mS/cm)	Cl (%)	Particle Size CS (% @ 105C)	FS	S	C	Exch. Cations CEC (m.eq/100g)	Ca	Mg	Na	K	Total Elements P (%)	K	S	Moistures ADM (% @ 105C)	1/3b	15b	Disp.Ratio R1	R2
Bulk .10	5.3	.16	.014																	
.10	5.5	.10	.011	12	39	39	9	6	1.5	.76	.64	.09	.018	0.15	.027	1.0		04	.81	
.30	5.6	.04	.003	9	36	39	15	5	.31	1.1	.45	.02	.005	0.16	.009	1.1		05	.87	
.60	5.8	.04	.004	6	22	37	32	10	.36	3.1	1.3	.09	.004	0.25	.007	2.0		12	.80	
.90	5.7	.05	.008	8	33	34	22	11	.25	4.4	2.2	.07	.004	0.22	.005	1.9		11	.99	
1.20	5.7	.09	.015	11	42	19	26	17	.28	8.5	4.7	.13				2.8				

Depth (metres)	Org.C (W&B) (%)	Tot.N (%)	Extr. Phosphorus Acid (ppm)	Bicarb.	Rep. K (m.eq%)	DTPA-extr. Fe (ppm)	Mn	Cu	Zn
Bulk .10	1.6	.10	7	3	.36	139	15	0.3	0.6

SOIL TYPE BELL
SITE NO H32
A.M.G. REFERENCE 729 870 mE 7 602 950 mN ZONE 55

GREAT SOIL GROUP: Black earth
PRINCIPAL PROFILE FORM: Ug5.16
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Few gravel

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 2 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Melaleuca viridiflora, Pandanus sp., Sugar cane

ANNUAL RAINFALL: 1250 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Cracking

HORIZON	DEPTH	DESCRIPTION
A1	0 to .50 m	Brownish black (10YR2/2) moist, brownish grey (10YR4/1) dry; few fine faint brown mottles; heavy clay; dry moderately strong. Clear to-
B21	.50 to .75 m	Yellowish grey (2.5Y6/1) moist; common fine distinct yellow mottles; medium clay; moderately moist moderately firm. Gradual to-
D	.75 to .95 m	Greyish yellow (2.5Y6/2) moist; few fine faint yellow mottles; light clay; many subangular fine gravels and stone; moderately moist very weak.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.6	.12	.004																	
.10	5.9	.10	.003	7	17	32	41	34	19	6.4	.54	.18				4.6	32	19	.58	
.30	6.9	.10	.005	3	13	32	51	29	19	7.5	.78	.10				4.8	38	21	.61	
.60	7.0	.03	.002	8	29	29	33	21	14	6.6	.51	.11				3.9	29	15	.86	
.90	7.2	.03	.001	20	29	25	26	18	13	6.2	.47	.11				3.7	27	13	.89	

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus		Rep. K	DTPA-extr.			
			Acid	Bicarb.		Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	2.9	.12	15	11	.34	172	109	4.4	2.5

SOIL TYPE BELL
SITE NO H16
A.M.G. REFERENCE: 730 900 mE 7 634 000 mN ZONE 55

GREAT SOIL GROUP: Black earth
PRINCIPAL PROFILE FORM: Ug5.16
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 1 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Native and improved pastures

ANNUAL RAINFALL: 1650 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Cracking

HORIZON	DEPTH	DESCRIPTION
A11	0 to .12 m	Black (10YR2/1) moist; medium heavy clay; moderately moist very firm. Clear to-
A12	.12 to .65 m	Black (10YR2/1) moist; medium heavy clay; moist very firm. Diffuse to-
B21	.65 to 1.00 m	Grey (5Y6/1) moist; few fine distinct yellow mottles; medium heavy clay; moist very firm; many manganiferous nodules. Gradual to-
B22	1.00 to 1.20 m	Grey (5Y5/1) moist; few fine distinct yellow mottles; medium heavy clay; moist very firm.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size % @ 105C CS	FS	S	C	Exch. Cations m.eq/100g CEC	Ca	Mg	Na	K	Total Elements % P	K	S	Moistures % @ 105C ADM	1/3b	15b	Disp.Ratio R1	R2
Bulk .10	7.1	.13	.012																	
.10	7.1	.14	.014	11	7	30	47	42	28	15	1.1	.22	.054	0.14	.003	6.2			.46	
.30	7.9	.04	.003	4	17	21	52	39	24	15	.55	.12	.013	0.08	.090	5.9		23	.73	
.60	6.8	.06	.009	3	22	20	51	24	15	8.6	1.4	.27	.016	0.63	.012	4.7		20	.66	
.90	8.0	.03	.003	6	19	24	49	35	21	14	.51	.16	.012	0.11	.005	5.6		22	.80	
1.20	8.0	.04	.003	6	23	24	45	30	17	12	.46	.16	.017	0.16	.001	4.9				

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Phosphorus ppm Acid	Bicarb.	Rep. K m.eq%	DTPA-extr. ppm Fe	Mn	Cu	Zn
Bulk .10	5.6	.53	5	13	.32	185	48	8.3	2.4

SOIL TYPE SWAYNEVILLE
SITE NO H01
A.M.C. REFERENCE. 719 650 mE 7 622 280 mN ZONE 55

GREAT SOIL GROUP: Prairie soil
PRINCIPAL PROFILE FORM: Db2.32
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Few cobbles

SUBSTRATE MATERIAL Acid to intermdeiate intrusives and dykes
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 7 %
LANDFORM ELEMENT TYPE: Undulating low hills
LANDFORM PATTERN TYPE:

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Tristania suaveolens, Sugar cane

ANNUAL RAINFALL: 1600 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .20 m	Brownish black (10YR2/2) moist, greyish yellow-brown (10YR5/2) dry; sandy clay loam; dry moderately weak. Clear to-
A2sb	.20 to .30 m	Brownish black (10YR3/2) moist, dry sporadically bleached; sandy clay loam; moderately moist moderately weak. Gradual to-
B21	.30 to .65 m	Dull yellowish brown (10YR4/3) moist; few fine distinct red mottles; medium heavy clay; moderately moist moderately firm. Clear to-
C1	.65 to 1.05 m	Yellowish brown (10YR5/6) moist; light medium clay; moderately moist moderately firm. Gradual to-
C2	1.05 to 1.20 m	Dull yellowish brown (10YR5/4) moist; clay loam; moderately moist moderately weak.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g					%			% @ 105C				
Bulk .10	5.6	.06	.004																	
.10	5.7	.16	.019	36	30	18	18	16	5.9	4.2	.29	.97	.065	0.77	.026	2.2		12	.70	
.30	6.0	.02	.002	29	31	18	21	16	5.1	4.8	.27	.16	.054	0.68	.018	2.4		13	.68	
.60	6.2	.05	.003	14	25	21	39	23	7.6	13	.59	.21	.033	1.05	.012	3.7		20	.62	
.90	6.1	.03	.002	14	35	22	32	30	10	20	.80	.17	.087	1.32	.006	4.5		19	.57	
1.20	6.0	.02	.002	15	42	25	19	30	12	20	.87	.11	.166	1.43	.004	4.9				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.7	.10	15	25	.45	82	69	1.3	1.2

SOIL TYPE SARINA
SITE NO. G73
A.M.G. REFERENCE: 722 600 mE 7 625 500 mN ZONE 55

GREAT SOIL GROUP: Solodic-solodized solonetz
PRINCIPAL PROFILE FORM: Dy3.33
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 0 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane

ANNUAL RAINFALL: 1650 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1sb	0 to .30 m	Dark brown (10YR3/3) moist, dull yellowish brown (10YR5/3) dry, dry sporadically bleached; silty clay loam; dry very weak. Abrupt to-
B1	.30 to .50 m	Dull yellowish brown (10YR5/3) moist; few fine distinct yellow mottles; light medium clay; moderately moist moderately firm; few manganiferous concretions, few manganiferous nodules. Clear to-
B21	.50 to 1.05 m	Greyish yellow-brown (10YR6/2) moist; many fine prominent yellow mottles, few fine prominent dark mottles; medium heavy clay; moderately moist moderately firm. Clear to-
B22	1.05 to 1.20 m	Greyish yellow-brown (10YR5/2) moist; many fine distinct brown mottles; light medium clay; moderately moist moderately firm; few manganiferous concretions, few manganiferous soft segregations.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.4	.10	.004																	
.10	5.2	.08	.002	9	47	27	20	11	2.7	1.7	.17	.45	.062	0.96	.016	1.8		11	.76	
.30	5.3	.03	.002	8	46	27	20	10	2.9	1.5	.31	.11	.050	0.93	.012	2.1		12	.77	
.60	6.6	.02	.002	6	39	20	37	13	6.2	4.7	.57	.21	.044	0.92	.005	2.4		16	.70	
.90	7.5	.02	.003	5	35	21	38	16	7.7	6.5	.96	.26	.012	0.61	.006	2.8		18	.80	
1.20	8.0	.03	.002	8	43	17	33	16	9.6	7.5	1.2	.23	.016	0.61	.007	3.0				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.5	.10	17	30	.53	84	97	1.3	1.4

SOIL TYPE SUNNYSIDE
SITE NO G26
A.M.G. REFERENCE: 726 720 mE 7 635 360 mN ZONE 55

GREAT SOIL GROUP: Solodized solonetz/solodic soil
PRINCIPAL PROFILE FORM: Dy3.33
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 1 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Plain

VEGETATION
STRUCTURAL FORM: Woodland
DOMINANT SPECIES: Eucalyptus alba, Tristani suaveolens, Melaleuca viridiflora, Acacia leptophloia, Imperata cylindrica

ANNUAL RAINFALL: 1600 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .15 m	Dark brown (10YR3/3) moist, greyish yellow-brown (10YR6/2) dry; silty clay loam; dry very weak. Clear to-
A2sb	.15 to .35 m	Dull yellowish brown (10YR5/3) moist, greyish yellow-brown (10YR6/2) dry, sporadically bleached; many fine prominent yellow mottles; silty clay loam; dry very weak; few manganiferous nodules. Clear to-
B21	.35 to .65 m	Brownish grey (10YR6/1) moist; common fine prominent yellow mottles; heavy clay; moderately moist moderately firm; few manganiferous nodules. Clear to-
B22	.65 to 1.20 m	Brownish grey (10YR6/1) moist; very few fine faint yellow mottles; heavy clay; moderately moist very firm; few carbonate soft segregations, few carbonate nodules.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	6.1	.04	.004																	
.10	6.0	.03	.002	11	57	24	10	7	1.9	1.2	.29	.08	.014	0.10	.014	0.8		04	.80	
.30	6.1	.02	.004	14	46	24	18	7	1.5	2.2	.50	.06	.008	0.12	.006	1.3		07	.84	
.60	6.3	.05	.007	7	32	21	42	19	4.7	8.1	1.9	.14	.007	0.17	.004	2.9		15	.90	
.90	9.3	.24	.017	13	37	24	32	17	12	9.5	3.3	.12	.006	0.15	.006	2.8		13	.99	
1.20	9.0	.36	.055	13	36	21	35	20	5.2	11	4.8	.13	.006	0.18	.003	3.1				

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus		Rep. K	DTPA-extr.			
			Acid	Bicarb.		Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.4	.07	5	7	.12	44	97	0.5	0.6

SOIL TYPE FREDDY
SITE NO: G44
A.M.G. REFERENCE: 730 460 mE 7 621 460 mN ZONE 55

GREAT SOIL GROUP: Soloth
PRINCIPAL PROFILE FORM: Dg2.41
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Very few

SUBSTRATE MATERIAL Unconsolidated colluvium
CONFIDENCE SUBSTRATE IS PARENT MATERIAL.

SLOPE: 2 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Eucalyptus alba, Tristani suaveolens

ANNUAL RAINFALL: 1500 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Loose

HORIZON	DEPTH	DESCRIPTION
A1	0 to .15 m	Dark brown (10YR3/3) moist, greyish yellow-brown (10YR6/2) dry; clay loam, fine sandy; many subangular gravels; dry very weak. Clear to-
A2cb1	.15 to .40 m	Brownish grey (10YR5/1) moist, light grey (10YR7/1) dry, conspicuous bleach; clay loam, fine sandy; few subangular ferruginous gravels; dry loose. Clear to-
A2cb2	.40 to .50 m	Brownish grey (10YR6/1) moist, light grey (10YR8/1) dry, conspicuous bleach; sandy clay loam; many subangular ferruginous gravels; dry very weak. Clear to-
AB	.50 to .70 m	Brownish grey (10YR6/1) moist; few fine faint yellow mottles; light clay; abundant subangular ferruginous stone; dry moderately weak. Clear to-
B21	.70 to .80 m	Dull yellowish orange (10YR7/3) moist; common fine prominent yellow mottles, few fine prominent pale mottles; medium clay; moderately moist moderately firm.

Depth metres	1:5 Soil/Water pH	EC mS/cm	Cl %	Particle Size % @ 105C CS	FS	S	C	Exch. Cations m.eq/100g CEC	Ca	Mg	Na	K	Total Elements % P	K	S	Moistures % @ 105C ADM	1/3b	15b	Disp.Ratio R1	R2
Bulk .10	5.4	.03	.001																	
.10	5.6	.03	.001	38	33	19	10	6	1.5	1.1	.11	.29				1.1	18	06	.87	
.30	5.3	.02	.001	30	32	20	13	3	.44	.59	.15	.05				0.8	15	05	.99	
.60	5.8	.04	.003	28	29	17	23	6	.29	3.0	.78	.09				1.6	18	09	.99	
.80	6.1	.06	.008	26	21	20	30	10	.52	6.3	1.7	.12				2.4	24	13	.99	

Depth metres	Org.C (W&B) %	Tot.N %	Extr. Phosphorus ppm Acid	Bicarb.	Rep. K m.eq%	DTPA-extr. ppm Fe	Mn	Cu	Zn
Bulk .10	1.0	.06	26	15	.50	82	18	0.3	0.8

SOIL TYPE CHERRYTREE
SITE NO: G13
A.M.G. REFERENCE: 731 200 mE 7 609 820 mN ZONE 55

GREAT SOIL GROUP: Solodized solonetz/solodic soil
PRINCIPAL PROFILE FORM: Dy3.13
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 1 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane

ANNUAL RAINFALL: 1400 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .30 m	Dark brown (10YR3/3) moist, greyish yellow-brown (10YR6/2) dry; clay loam,fine sandy; weak granular; moderately moist very weak. Clear to-
ABSB	.30 to .45 m	Greyish yellow-brown (10YR4/2) moist, sporadic bleach; dry sporadically bleached; light clay; abundant subangular gravel; moderately moist very weak; many manganiferous nodules. Clear to-
B1	.45 to .70 m	Dull yellowish brown (10YR5/3) moist; many fine prominent yellow mottles; medium clay; many subangular gravels; weak; moderately moist moderately weak; few manganiferous nodules. Clear to-
B21	.70 to .90 m	Dull yellowish brown (10YR5/4) moist; many fine prominent yellow mottles; heavy clay; fine gravel; weak; moderately moist very firm. Clear to-
B22	.90 to 1.20 m	Brownish grey (10YR4/1) moist; many fine distinct brown and orange mottles; heavy clay; fine gravel; weak; very firm; few manganiferous concretions, non-calcareous, few manganiferous nodules, non-calcareous.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.9	.03	.003																	
.10	6.2	.02	.001	30	32	26	15	8	1.9	1.2	.18	.38	.024	.71	.015	1.0		06	.78	
.30	6.3	.01	.001	35	26	23	18	7	1.9	.72	.10	.17	.016	.75	.007	0.9		06	.88	
.60	7.1	.02	.002	40	20	13	24	9	3.6	2.0	.50	.11	.017	1.01	.003	1.4		11	.95	
.90	7.5	.05	.006	11	23	23	46	19	9.6	6.5	1.6	.09	.010	.81	.003	2.3		18	.99	
1.20	8.1	.08	.009	10	28	25	37	21	12	7.8	2.3	.09	.010	.88		2.4				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	0.8	.06	6	10	.20	73	19	0.4	0.7

SOIL TYPE BELL
SITE NO: G11
A.M.G. REFERENCE: 729 700 mE 7 607 360 mN ZONE A5

GREAT SOIL GROUP: Black earths
PRINCIPAL PROFILE FORM: Ug5.16
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 1 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane

ANNUAL RAINFALL: 1600 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Cracking, hard setting

HORIZON	DEPTH	DESCRIPTION
A1p	0 to .30 m	Brownish black (10YR2/2) moist, greyish yellow-brown (10YR4/2) dry; silty clay; moderate granular; moderately moist moderately weak. Clear to-
B21	.30 to .90 m	Brownish black (10YR3/2) moist; very few fine faint red mottles; heavy clay; moderate granular; moderately moist very firm. Clear to-
B22	.90 to 1.20 m	Brownish grey (10YR4/1) moist; few fine distinct orange mottles; heavy clay; few rounded; moderate granular; moderately moist moderately firm; non-calcareous.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.7	.03	.001																	
.10	5.6	.07	.007	17	28	28	28	26	7.8	4.8	.20	.32	.079	.42	.034	2.6		16	.61	
.30	5.9	.02	.001	11	31	24	35	26	11	5.2	.23	.22	.054	.40	.018	2.8		17	.69	
.60	6.9	.02	.002	7	25	21	49	28	15	11	.37	.11	.024	.43	.012	3.5		21	.79	
.90	7.8	.04	.004	10	18	23	49	30	18	12	.59	.09	.021	.43	.006	3.5		21	.84	
1.20	7.9	.11	.013	24	19	17	38	22	16	9.1	.68	.09	.021	.45	.005	2.7				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.8	.12	15	26	.46	130	45	3.6	2.4

SOIL TYPE LOUISA
SITE NO: G09
A.M.G. REFERENCE: 732 050 mE 7 644 400 mN ZONE 55

GREAT SOIL GROUP: Yellow podzolic soil
PRINCIPAL PROFILE FORM: Dy3.41
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 4 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Undulating rises

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Eucalyptus drepanophylla, Eucalyptus intermedia, Eucalyptus alba, Planchonia careya, Heteropogon contortus, Imperata cylindrica

ANNUAL RAINFALL: 1500 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1sb	0 to .20 m	Dark brown (10YR3/3) moist, greyish yellow-brown (10YR6/2) dry, dry sporadically bleached; clay loam,fine sandy; weak; moderately moist very weak. Clear to-
A2cb	.20 to .35 m	Dull yellowish orange (10YR6/3) moist, light grey (10YR8/2) moist, dry conspicuously bleached; very abundant rounded few angular; moderately moist. Clear to-
B1fm	.35 to .50 m	Dull yellowish orange (10YR7/4) and bright yellowish brown (10YR6/6) moist; mottled; light medium clay; abundant rounded; weak moderately moist moderately weak; many ferruginous nodules, many manganiferous nodules. Clear to-
B21	.50 to .65 m	Bright yellowish brown (10YR6/6) moist; many medium prominent red mottles, few fine distinct pale mottles; medium clay; many rounded ironstones and angular stones; weak; moderately moist moderately firm; few ferruginous nodules, few manganiferous nodules. Clear to-
C	.65 to .80 m	Orange (5YR6/6) moist; few fine distinct pale mottles; medium clay; many angular stones.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	6.1	.03	.002																	
.10	6.1	.02	.002	39	35	21	8	9	3.9	1.1	.11	.25	.028	.24	.014	1.2		06	.40	
.30	6.4	.01	.001	47	29	20	10	6	1.7	.65	.12	.23	.034	.39	.009	1.1		06	.87	
.60	5.4	.05	.007	16	13	20	51	13	.59	4.9	.46	.11	.011	.48	.019	2.2		19	.38	

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.8	.10	2	6	.17	61	18	0.7	0.7

SOIL TYPE GILLINBIN
SITE NO: F96
A.M.G. REFERENCE: 748 350 mE 7 596 520 mN ZONE 55

GREAT SOIL GROUP: Soloth
PRINCIPAL PROFILE FORM: Dy3.41
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Small pebbles

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 1 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane

ANNUAL RAINFALL: 1350 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .25 m	Greyish yellow-brown (10YR4/2) moist, dull yellowish orange (10YR7/2) dry; silty clay loam; dry very weak. Clear to-
A2cb	.25 to .50 m	Dull yellowish brown (10YR5/3) moist, light grey (10YR8/2) dry, conspicuously bleached; common fine distinct yellow mottels; clay loam, fine sandy; dry very weak. Clear to-
AB	.50 to .70 m	Greyish yellow-brown (10YR5/2) moist; few fine faint yellow mottles; light medium clay fine sandy; dry moderately weak; many manganiferous nodules. Clear to-
B21	.70 to 1.00 m	Greyish yellow-brown (10YR6/2) moist; common fine distinct red mottles, few fine distinct yellow mottles; medium heavy clay sandy; moderately moist moderately firm; few ferruginous-organic nodules. Gradual to-
B22	1.00 to 1.20 m	Reddish brown (5YR4/8) moist; few fine distinct grey mottles; medium clay fine sandy; dry moderately firm; few ferruginous-organic nodules, many manganiferous soft segregations.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.3	.07	.002																	
.10	5.8	.04	.001	16	45	26	13	9	2.9	1.3	.28	.34				1.3	22	07	.69	
.30	6.1	.03	.001	21	43	18	16	5	2.3	1.0	.36	.05				1.4	18	07	.97	
.60	6.3	.03	.002	16	34	17	31	8	5.2	3.5	.73	.13				3.1	25	14	.76	
.90	6.4	.03	.002	14	34	15	35	11	5.3	3.9	.88	.14				3.1	28	15	.70	
1.20	6.8	.03	.002	16	37	17	27	11	5.6	4.2	1.0	.13				2.8				

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus		Rep. K	DTPA-extr.			
			Acid	Bicarb.		Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	0.9	.06	10	7	.38	81	50	1.3	1.0

SOIL TYPE TURNOR
SITE NO. F20
A.M.G. REFERENCE: 735 070 mE 7 598 640 mN ZONE 55

GREAT SOIL GROUP: Solodized solonetz/solodic soil
PRINCIPAL PROFILE FORM: Dy3.43
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL.

SLOPE: 1 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Alluvial plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Tristania suaviolens, Eucalyptus alba, Sugar cane

ANNUAL RAINFALL: 1500 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .15 m	Brownish black (10YR3/2) moist, brownish grey (10YR6/1) dry; sandy clay loam; dry very weak. Clear to-
A2cb	.15 to .35 m	Greyish yellow-brown (10YR4/2) moist, light grey (10YR7/1) dry, conspicuously bleached; sandy clay loam; dry very weak. Clear to-
B1	.35 to .55 m	Dull yellowish brown (10YR5/3) moist, greyish yellow-brown (10YR6/2) moist; few fine distinct yellow mottles; light clay; few subangular; dry moderately weak; few manganiferous nodules, many. Gradual to-
B21	.55 to .70 m	Dull yellowish orange (10YR6/4) moist; few fine distinct yellow mottles; medium clay; moderately moist moderately firm; few manganiferous concretions, few. Gradual to-
B22	.70 to 1.20 m	Greyish yellow-brown (10YR5/2) moist; common fine prominent yellow mottles; light medium clay; moderately moist moderately weak; many.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.9	.04	.001																	
.10	5.8	.03	.002	47	31	16	7	7	2.1	.95	.20	.12				1.1	15	05	.76	
.30	6.0	.02	.001	44	34	16	11	5	1.5	1.1	.19	.03				1.2	14	05	.83	
.60	6.1	.03	.003	41	26	10	24	8	3.1	2.6	.49	.05				2.5	19	09	.99	
.90	6.1	.07	.010	32	28	13	24	14	6.3	5.2	1.2	.07				3.9	25	12	.69	
1.20	7.0	.20	.030	34	30	11	26	16	8.0	6.8	2.3	.06				4.2				

Depth	Org.C (W&B)	Tot.N	Extr. Phosphorus		Rep. K	DTPA-extr.			
			Acid	Bicarb.		Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.2	.09	10	3	.34	55	56	0.6	1.7

SOIL TYPE TEDLANDS
SITE NO: D48
A.M.G. REFERENCE: 731 680 mE 7 614 620 mN ZONE 55

GREAT SOIL GROUP: Solodized solonetz/solodic soil
PRINCIPAL PROFILE FORM: Dy3.42
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL:

SLOPE: 1 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Coastal plain

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Eucalyptus alba, Tristania suaviolens, Eucalyptus intermedia, Melaleuca viridiflora, Acacia leptophloia, Sugar cane

ANNUAL RAINFALL: 1350 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .15 m	Dark brown (10YR3/3) moist, greyish yellow-brown (10YR5/2) dry; clay loam,fine sandy; moderately moist very weak. Clear to-
A2cb	.15 to .50 m	Dull yellowish brown (10YR5/4) moist, dull yellowish orange (10YR7/2) dry, conspicuously bleached; few fine prominent yellow mottles; clay loam, fine sandy; moderately moist very weak. Clear to-
B21	.50 to .90 m	Dull brown (7.5YR6/3) moist; many medium distinct yellow mottles; medium heavy clay; moderate; moderately moist moderately weak; few manganiferous concretions. Gradual to-
B22	.90 to 1.20 m	Dull brown (7.5YR6/3) moist, brown (10YR4/6) moist; many medium prominent brown mottles, many medium prominent grey mottles; medium clay; weak; moderately moist very weak.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.9	.04	.004																	
.10	6.1	.02	.002	28	41	23	8	5	2.3	.94	.25	.31	.010	.11	.011	0.7		04	.77	
.30	6.3	.01	.001	39	33	23	8	3	.79	.58	.10	.05	.005	.10	.004	0.5		03	.99	
.60	6.5	.02	.003	22	27	14	38	14	1.8	4.1	1.2	.14	.006	.19	.005	2.1		15	.86	
.90	6.4	.06	.010	21	33	17	28	13	3.1	5.7	2.3	.17	.005	.28	.002	2.2		14	.99	
1.20	7.1	.22	.040	29	32	15	22	13	3.4	6.5	4.3	.12	.007	.61	.002	2.0				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.7	.10	4	9	.23	95	13	0.2	1.5

SOIL TYPE TURPAD
SITE NO. E30
A.M.G. REFERENCE: 732 340 mE 7 606 570 mN ZONE 55

GREAT SOIL GROUP: Siliceous sand
PRINCIPAL PROFILE FORM: Uc2.22
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Acid intrusives
CONFIDENCE SUBSTRATE IS PARENT MATERIAL.

SLOPE: 2 %
LANDFORM ELEMENT TYPE:
LANDFORM PATTERN TYPE: Gently undulating plains

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane

ANNUAL RAINFALL: 1600 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A1	0 to .15 m	Brownish black (10YR2/3) moist, greyish yellow-brown (10YR5/2) dry; light sandy clay loam; dry very weak. Gradual to-
A2cb1	.15 to .50 m	Brownish grey (10YR6/1) moist, light grey (10YR7/1) dry, conspicuously bleached; sandy loam; dry loose. Clear to-
A2cb2	.50 to .95 m	Dull yellowish brown (10YR5/3) moist, dry conspicuously bleached; clay loam,sandy; moderately moist loose. Clear to-
AB	.95 to 1.20 m	Dull yellowish brown (10YR5/3) moist; few fine distinct yellow mottles; light sandy clay loam; moderately moist very weak; many manganiferous concretions, many manganiferous nodules.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.7	.05	.003																	
.10	5.8	.06	.001	63	23	8	7	5	1.5	.83	.09	.32				0.8	10	04	.45	
.30	5.7	.01	.001	54	32	9	4	1	.56	.31	.10	.04				0.4	08	03	.99	
.60	6.0	.01	.001	61	26	8	4	1	.29	.34	.09	.03				0.4	08	02	.99	
.90	5.8	.01	.001	68	19	3	7	2	.42	.50	.12	.06				0.7	09	03	.99	
1.20	5.7	.01	.001	60	22	6	7	2	.47	.68	.06	.07				0.9				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.0	.06	20	9	.54	44	27	0.3	0.6

SOIL TYPE HANNAN
SITE NO D46
A.M.G. REFERENCE: 725 940 mE 7 625 450 mN ZONE 55

GREAT SOIL GROUP: Alluvial soil
PRINCIPAL PROFILE FORM: Um6.41
SOIL TAXONOMY UNIT:
FAO UNESCO UNIT:

SURFACE COARSE FRAGMENTS: Nil

SUBSTRATE MATERIAL Unconsolidated substrate materials
CONFIDENCE SUBSTRATE IS PARENT MATERIAL

SLOPE: 0 %
LANDFORM ELEMENT TYPE: Valley flat
LANDFORM PATTERN TYPE: Gently undulating plains

VEGETATION
STRUCTURAL FORM:
DOMINANT SPECIES: Sugar cane

ANNUAL RAINFALL: 1650 mm

PROFILE MORPHOLOGY:

CONDITION OF SURFACE SOIL WHEN DRY: Hard setting

HORIZON	DEPTH	DESCRIPTION
A11	0 to .25 m	Brownish black (10YR2/2) moist, greyish yellow-brown (10YR5/2) dry; clay loam, fine sandy; moderately moist moderately weak. Diffuse to-
A12	.25 to .50 m	Brownish black (10YR3/1) moist; clay loam, fine sandy; moderately moist moderately weak. Diffuse to-
D1	.50 to .90 m	Brownish black (10YR2/2) moist; clay loam, fine sandy; moderately moist moderately weak. Gradual to-
D2	.90 to 1.20 m	Brownish black (10YR2/3) moist; sandy light clay; moderately moist moderately weak.

Depth	1:5 Soil/Water			Particle Size				Exch. Cations					Total Elements			Moistures			Disp.Ratio	
	pH	EC	Cl	CS	FS	S	C	CEC	Ca	Mg	Na	K	P	K	S	ADM	1/3b	15b	R1	R2
metres		mS/cm	%	% @ 105C				m.eq/100g						%		% @ 105C				
Bulk .10	5.6	.22	.028																	
.10	5.4	.05	.003	26	47	14	14	14	5.8	2.1	.26	.28	.094	0.97	.019	1.6		09	.94	
.30	5.9	.02	.002	21	48	14	18	14	8.1	2.5	.25	.12	.089	0.92	.016	1.9		10	.77	
.60	6.1	.01	.001	22	42	15	21	18	9.8	3.0	.25	.13	.068	0.90	.020	2.4		12	.36	
.90	6.3	.01	.002	33	34	14	18	15	8.6	2.5	.27	.09	.041	0.93	.015	2.0		10	.58	
1.20	6.3	.01	.001	30	37	13	20	15	9.3	2.7	.32	.12	.048	0.91	.014	2.2				

Depth	Org.C	Tot.N	Extr. Phosphorus		Rep.	DTPA-extr.			
	(W&B)		Acid	Bicarb.	K	Fe	Mn	Cu	Zn
metres	%	%	ppm		m.eq%	ppm			
Bulk .10	1.4	.09	69	60	.80	115	63	1.4	1.5