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LAND RESOURCES BULLETIN

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Soils of Cape York Peninsula

A. J. W. Biggs and S. R. Philip
Resource Management
Mareeba

DPI DEPARTMENT OF PRIMARY INDUSTRIES
QUEENSLAND

Queensland Government Technical Report

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This publication was initially prepared for the CAPE YORK PENINSULA LAND USE STRATEGY and has now been organised for officers of the Department of Primary Industries. It may be distributed to other interested individuals and organisations.

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Summary

The Queensland and Commonwealth Governments established the Cape York Peninsula Land Use Strategy (CYPLUS) when it became apparent that the governments were required to make land use and planning decisions concerning the Peninsula with very little supporting information. Current land uses on the Peninsula include grazing, mining, conservation, tourism and traditional uses by aboriginal people. Land use conflict is a major concern.

Operating under the Natural Resources Analysis Program within CYPLUS, this project (NR02) described the soils of approximately 132 500 km^2 of mainland, from 16° S to Cape York. Nearly all islands other than the Prince of Wales Group were excluded. Aspects of climate, geology, physiography and vegetation on the Peninsula are also reported.

A total of 113 soil types were described and grouped according to their associated geologies. Prior surveys and advanced remote sensing were used as an aid to mapping in certain areas. Kandosols are the most common soil on the Peninsula, followed by Dermosols, Hydrosols and Tenosols. Many soils display indications of laterisation, and most are hardsetting. The majority of soils are acidic, have a low base status, and are infertile, with extremely low phosphorus levels.

The soils were also considered in respect of their position in the landscape. Seven natural landscapes have been defined, based on distinctions in physiology, geology, vegetation and landuse.

Each of the 6074 UMA's were individually assessed for their suitability for the following land uses: peanuts, sorghum/maize, high input pastures, medium input pastures, low input pastures. Land not suitable for these uses was divided into two categories: land suitable for low intensity grazing, and land not suitable for any of the designated uses. As the level of inputs required increases, the amount of suitable land decreases. Approximately 4 448 400 ha is suitable for low/medium input pasture development, but only 243 300 ha is suitable for peanut cropping.

The issues of salinity and erosion on the Peninsula have been discussed in separate reports, but the base data, like other data sets such as vegetation (CYPLUS project NROI) present opportunities for integration. This facility is of significant value to those involved in Property Management Planning on the Peninsula.

The information generated in the course of NR02 is stored in the CYPLUS GIS and that of this Department and is currently being used by local and regional groups actively involved in land use issues on the Peninsula.

1. Introduction

1.1 Background to study

The Queensland and Commonwealth Governments established the Cape York Peninsula Land Use Strategy (CYPLUS) when it became apparent that the governments were required to make land use and planning decisions with very little supporting information. Base information on the natural resources of the region was scarce and dispersed. There was little knowledge of current activities. Processes for involving the diverse population and interest groups in decision making were absent.

The Natural Resources Analysis Program (NRAP) was developed and implemented as one of the initial government actions under CYPLUS to collect or collate data that would overcome some of the most severe information deficiencies. The initial emphasis was on the collection of inventory data that would be available for ongoing interpretation. Emphasis was placed on collecting data to support planning at the regional level. However, this has value for resource management at local levels because of the extensive nature of the principal land uses. Geographic Information System (GIS) technology was seen to provide the means for data storage, updating, analysis and interpretation and information output.

This report details the findings of NRAP Project NR02 - Soil Survey and Agricultural Land Suitability Assessment for users outside CYPLUS.

1.2 Study area

The study area (Figures 1, 2) is defined as all lands north of the southern boundary of Cook Shire (16° S approximately), including the portion of Carpentaria Shire which is north of the Nassau River. All islands within the three mile limit, and the Prince of Wales Group are also included (approximately 10° 30' S). Due to the limited time for the study, and for ease of map production, the bottom of the survey area was regarded as 16° S. The mainland area within the bounds of this study is approximately 132 500 km^2.

1.3 Aim

The original aim of NR02 was to enhance the Atlas of Australian Soils (Isbell, Webb and Murtha, 1968) mapping for selected parts of Cape York Peninsula (CYP) to provide a sound basis for future planning. However, it was recognised early in the project that the scale and resultant level of detail of this valuable mapping work could be improved upon. The aim of the project then became the production of a soil map cover of Cape York Peninsula suitable for use at 1:250 000 scale. This was to be based on the maximum practical amount of field work, of necessity less than that recommended for 1:250 000 mapping. All available existing soil description data was used directly and available mapping was used as background information.

Although not specified in the original project proposal, the need for a broad-scale agricultural suitability assessment was recognised during the project and this was incorporated.

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FIGURE 1

LOCALITY MAP

Cyplus Study Area

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SCALE 1:3 000 000

kilometres 60 0 60 kilometres

Geographic units of Decimal Degrees

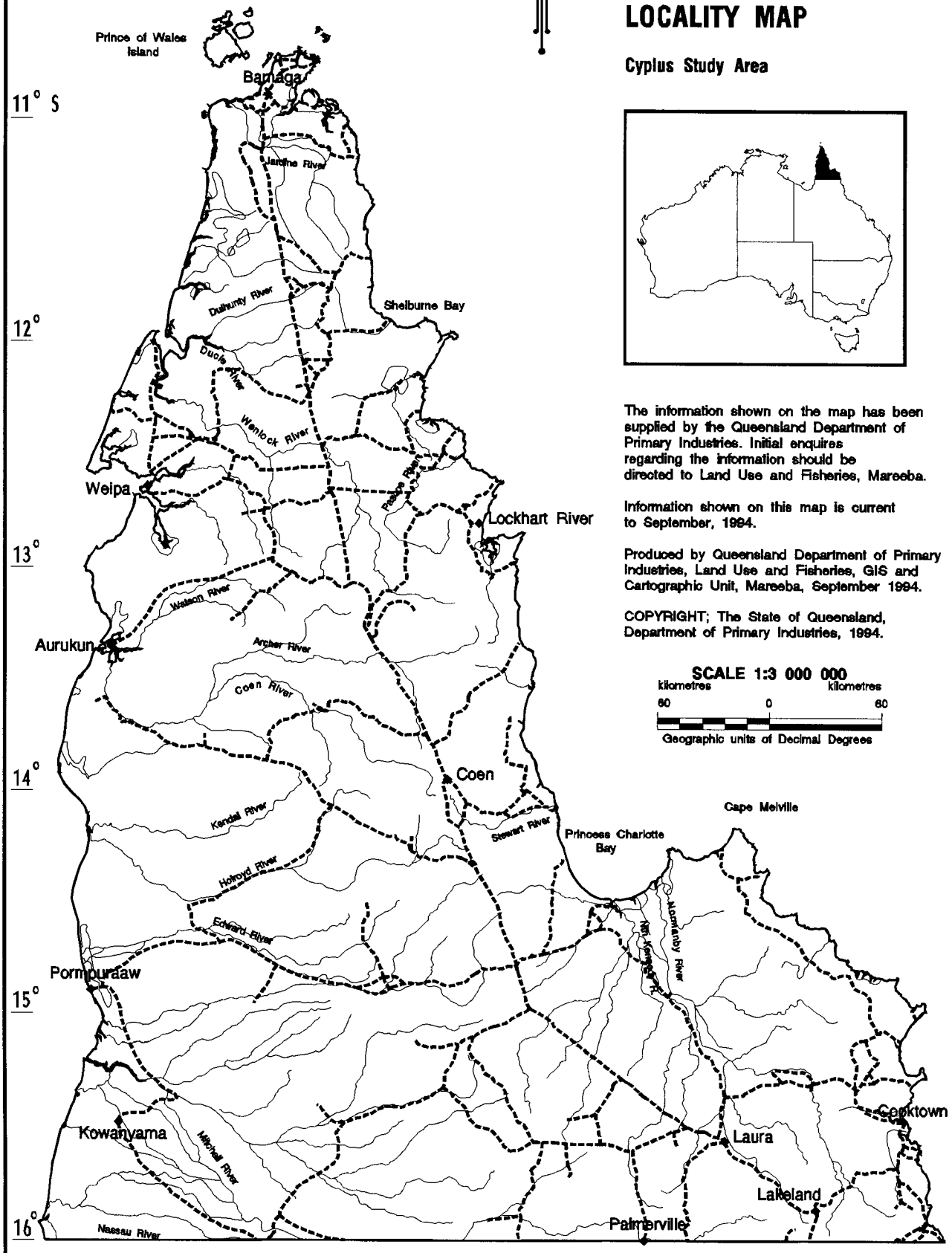

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FIGURE 2

MAP SHEET REFERENCE

1:250 000 Map sheet Key

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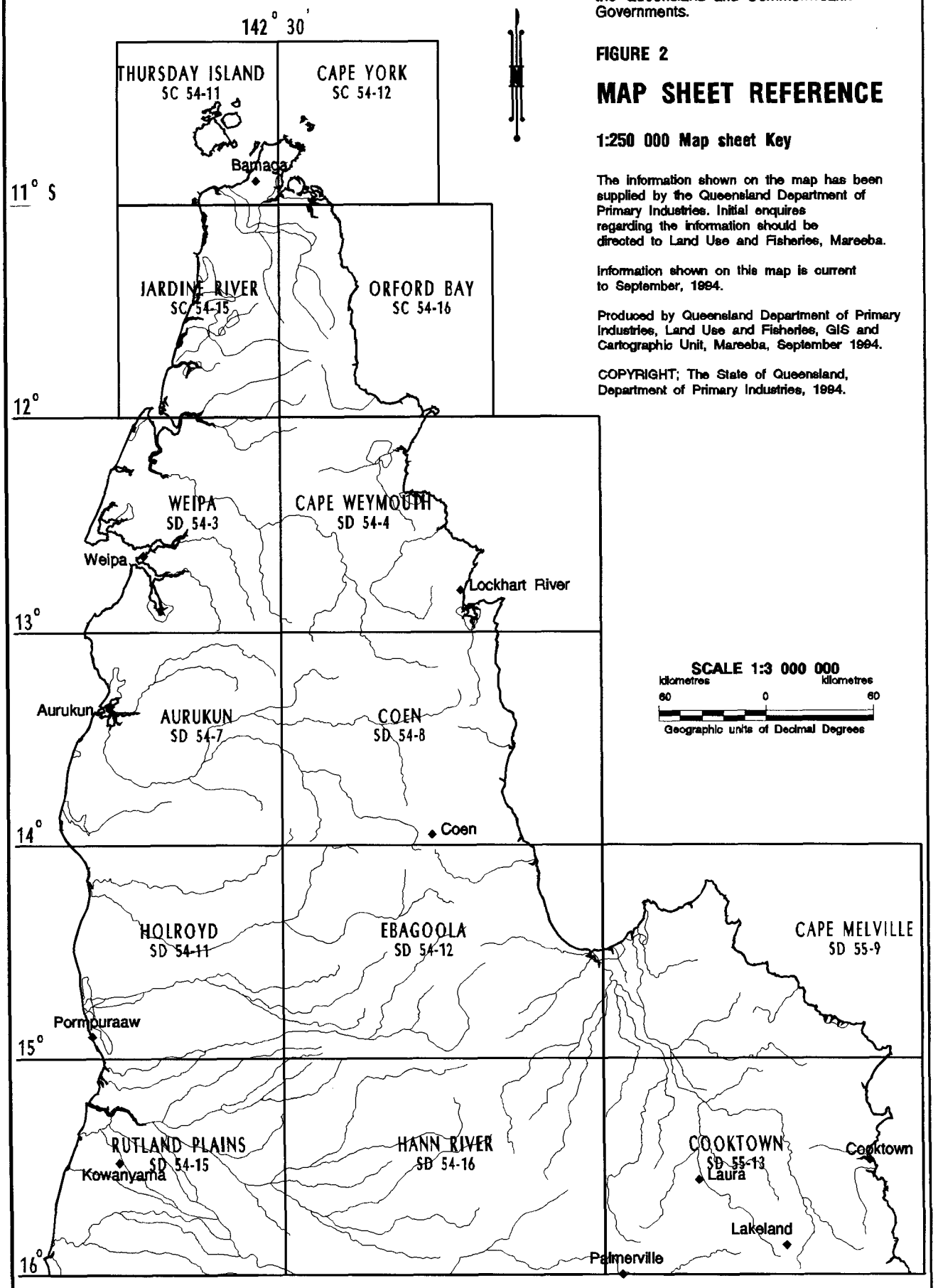

1.4 Previous studies

Soil survey work has historically been limited on CYP. One of the earliest mentions of the nature of the soils on the Peninsula was by the Jardine brothers, who commented on the gilgaied country north of the Archer River (Norton, 1909). However, it was not until the late 1960's that a serious attempt at mapping was made as part of the afore-mentioned Atlas of Australian Soils, Sheet 7 (Isbell, Webb and Murtha, 1968). This work was published at a scale of 1:1 000 000, with the mapping units based on Principal Profile Form (Northcote, 1979) and landform. Approximately 500 sites were described within the CYPLUS study area. Site descriptions from the Atlas work were combined with additional sites to create the report *The Lands of the Mitchell-Normanby Area* (Galloway *et al.*, 1970). This exercise produced a Land Systems map at 1:1 000 000 scale, and vegetation, soils, pastures and generalised geology maps at 1:2 000 000. Isbell, Gillman, Jones and others (1973, 1976, 1979) published a series of papers on the morphology and fertility of the sandy earths and earthy sands of the northern and central Peninsula. This was based on information gathered during the Atlas work, and subsequent pasture trials.

Godwin (1985), from Queensland Department of Environment and Heritage (QDEH), produced a report concerning the land units of the Weipa region. It provides detailed descriptions of the soils and vegetation of the area, based on a number of transects. The soils of the Weipa area have also been studied through postgraduate research from the University of Queensland. Most authors (Grundy, 1979; Fulton, 1983) however, have tended to look at the fertility and rehabilitation of these soils rather than their spatial distribution.

Bleeker and Laut (1987) led an investigation into the suitability of part of the Lockhart River Valley for oil palm and cashews. This report did not produce a soil map of the valley, rather a 1:50 000 map of vegetation structure boundaries. It did however give an indication of the soil complexity within the valley, *via* tables relating soil and vegetation occurrence.

The soil associations of "Batavia Downs" (then a QDPI research station) were mapped at 1:250 000 scale in 1991 by Grundy and Heiner. These authors have also produced a report of the agricultural soils of the Lakelands area (Grundy and Heiner, 1994).

1.5 Methodology

Limitations to ground truthing as a result of the short project length, remoteness of the survey area and weather-restricted field seasons were the main considerations in the methodology of this project. Consequently, a free survey method as described by Reid (1988) was adopted. Site description methodology conforms to the Australian Soil and Land Survey Field Handbook (McDonald *et al.*, 1990).

Aerial photograph coverage of CYP is limited. The primary mapping tool was high altitude (approx. 1:84 000 scale) panchromatic photographs of 1960's and 1970's vintage. Landsat TM scenes were utilised as an aid for developing overviews of large landscape features. Gamma ray spectrometric imagery was an important aid for the Ebagoola and Hann River sheets. The aim of the exercise was 1:250 000 scale mapping, but the final scale was approximately 1:900 000

based on the criteria of one site/cm^2 of map area. Access limitations required extrapolation of interpretations over large areas, particularly in the central west.

The 19 weeks of field work in which 905 sites were described was predominantly vehicle-based and during the dry season. Consequently, the hardsetting nature of some soils restricted the depth to which they were augered. Helicopter work during the late wet season provided access to some remote areas. Sites were dug principally with a 3" hand auger, but road cuttings and other exposures were taken advantage of. Full chemical analyses was obtained for 31 sample profiles.

Site and chemical analysis data from previous surveys was obtained, and where necessary databased in current QDPI format. Approximately 500 field sites from Isbell, Webb and Murtha (1968) were databased, including 40 sites with detailed chemical analyses. Descriptions of 57 sites from Bleeker and Laut (1987) were accessed by NR02. The 76 sites described by Grundy and Heiner in the course of the "Batavia Downs" work, and 74 sites from the Lakelands study were also incorporated in NR02 work.

Field work was often conducted with CYPLUS team NR01 (Vegetation survey), with whom 300 sites were described conjointly.

Landscape salinity potential for selected areas of the Peninsula was investigated using Electro-magnetic Induction (EM) techniques. The results and implications are discussed in Biggs (1995b) and illustrated on a map associated with that report.

GIS methodology is described in Section 5 and Appendix 6.

2. Factors related to soil distribution

2.1 Climate

2.1.1 Rainfall

The climate of Cape York Peninsula is typically monsoonal with an average annual rainfall ranging from approximately 900 to over 2000 mm. Isohyet trends are illustrated in Figure 3. The high rainfall zones are restricted to the south-eastern Wet Tropics Zone, Iron Range, and to a lesser extent Bamaga. The majority of the Peninsula only receives between 900 and 1500 mm with the amount increasing to the north and the south-east. In nearly all areas, greater than 90% of the annual total falls in the six months from November to April, and between 70 and 90% falls in the four months from December to March. The seasonality of rainfall at selected locations on the Peninsula is displayed in Figure 4.

Although the climate is monsoonal, the duration and intensity of any wet season varies considerably.

2.1.2 Temperature

Available data is limited but indicates a general trend of increase in mean maximum from the north and east to the west and south-west (Figure 5). For nearly all centres, maximums exceeding 40°C and minimums lower than 10°C can occur. Data from selected stations is presented in Figure 6. Temperatures below 5°C and frosts are rare, with most occurrences in the Palmerville area.

Orographic influences and distance from the sea appear to be significant determinants of the weather any locality receives.

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FIGURE 3

RAINFALL

Mean Annual Rainfall

200mm Intervals

Source: Rainfall information supplied by the Queensland Department of Primary Industries, Water Resources.
The data is based on information prepared by the Commonwealth Bureau of Meterology combined with records obtained by the Department of Primary Industries for the period 1920-1969.

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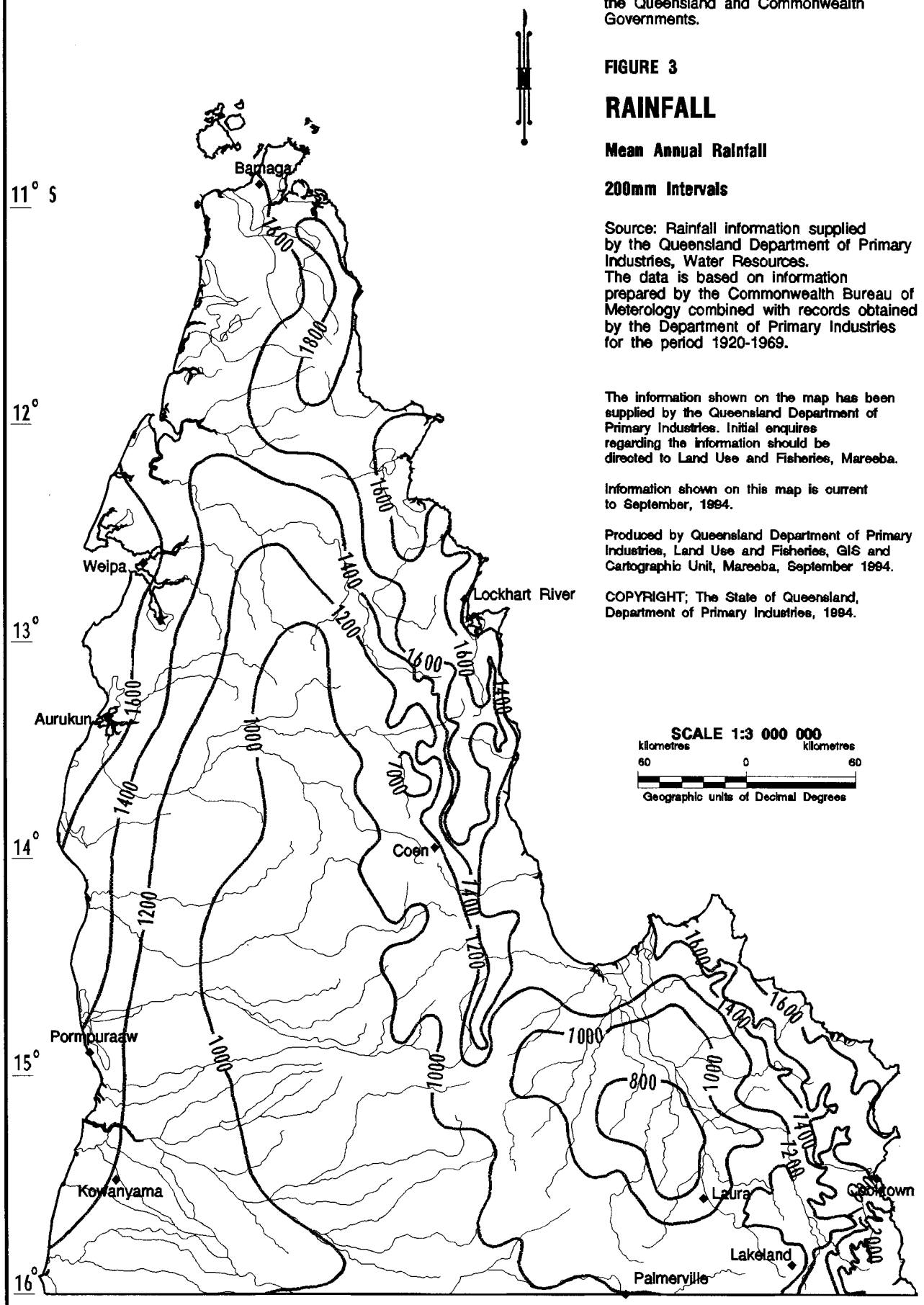

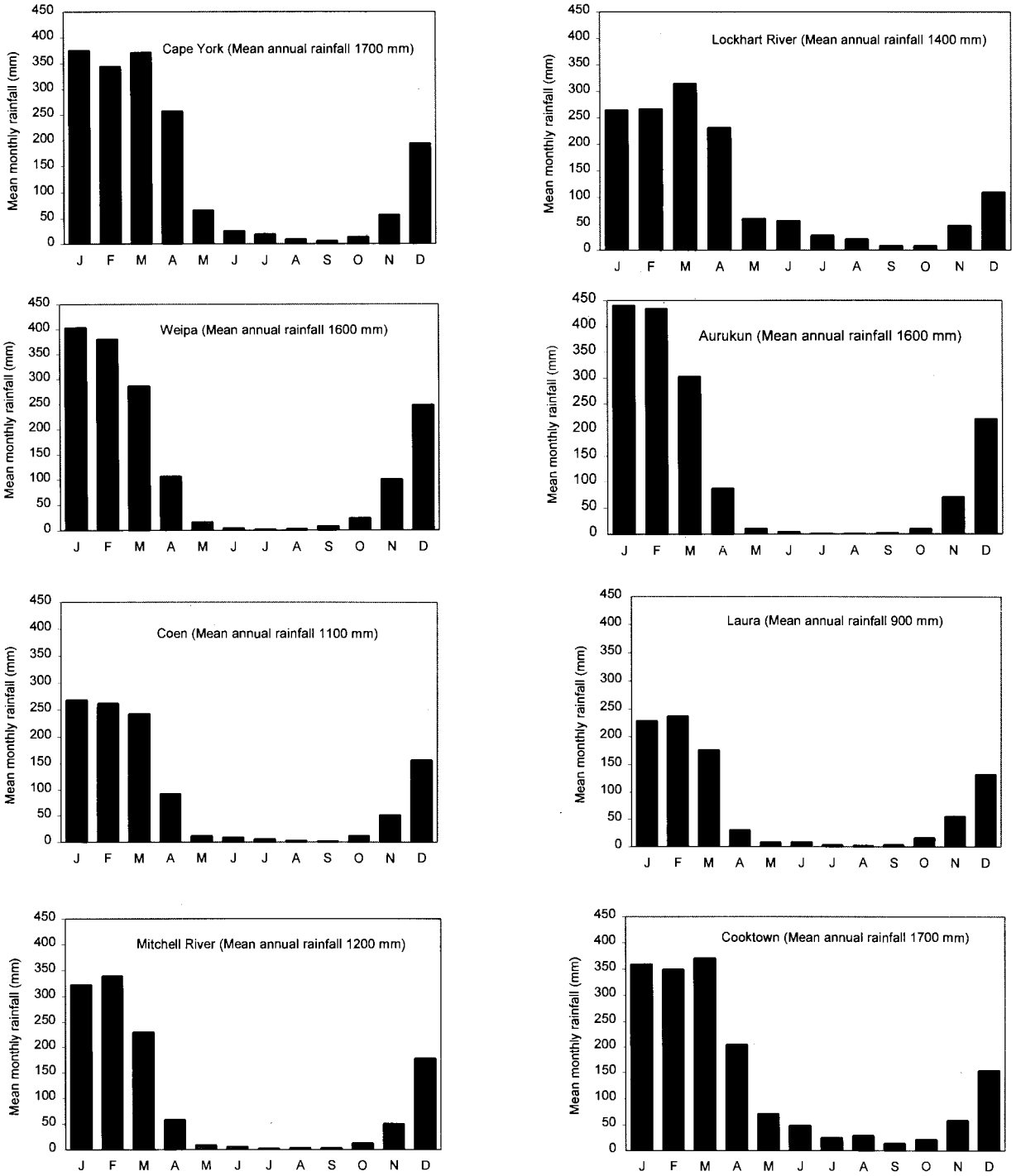

Figure 4 Seasonality of rainfall at selected stations, CYP
Source: Bureau of Meteorology (1971)

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FIGURE 5

ISOTHERMS

Mean Maximum Summer Temperature

1 Degree Celcius Intervals

Source: Hutchinson (1989)

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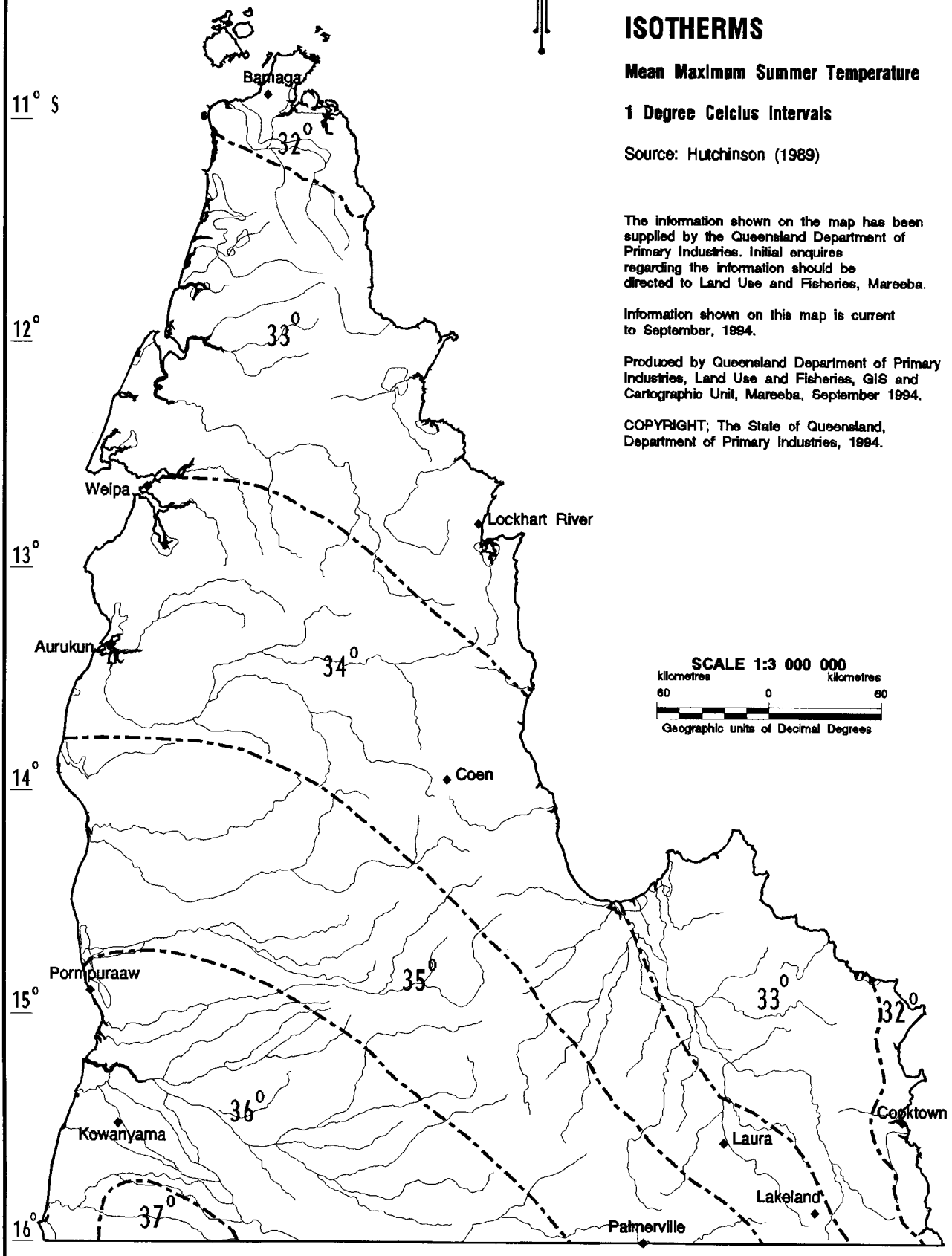

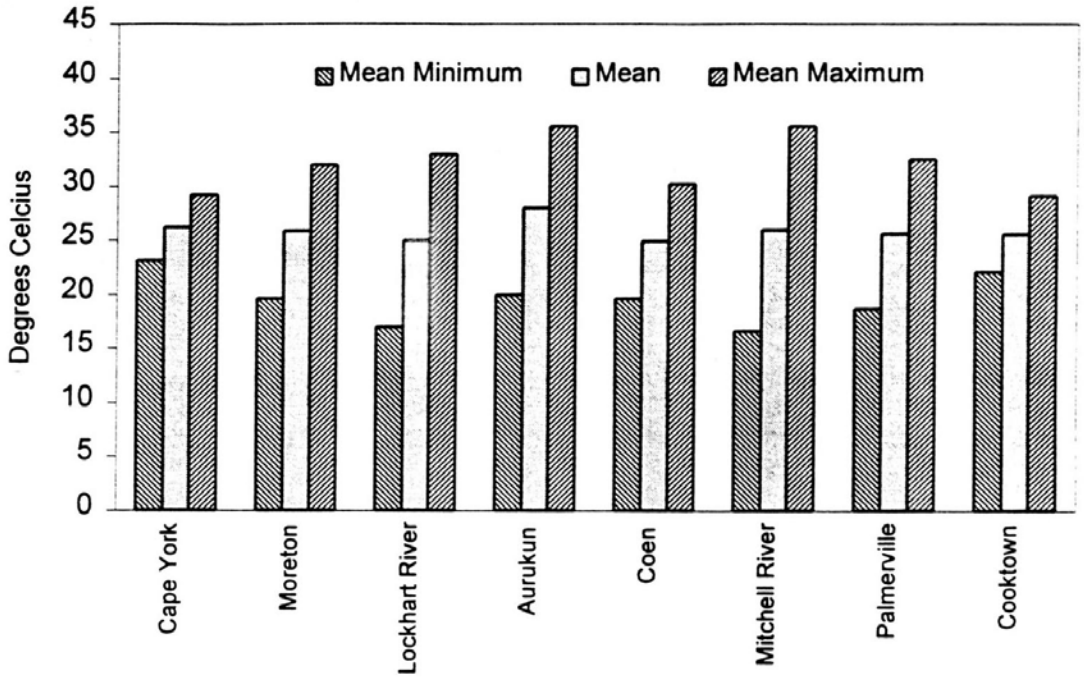

Figure 6 **Mean minimum and maximum for selected locations, CYP**
(Source: Bureau of Meteorology, 1971)

2.2 Geology

Cape York Peninsula has a diverse range of geological units, many of which have been studied in detail. The occurrence of a large number of economically important minerals eg. gold, tin, bauxite, kaolin (Denaro and Ewers, 1995) has no doubt stimulated much of this interest. In the 1960's and 1970's, geological maps (1:250 000 scale), and associated texts were produced for the Peninsula by a number of authors (summarised in Table 1). There are some inconsistencies in this map series, notably on the edges surrounding the Cape Melville and Cooktown sheets. CYPLUS project NR05 (Bain, 1995) has corrected these edge-matching problems.

Table 1 **1:250 000 Geology, Explanatory Notes Series**

1:250 000 Map Sheet Name	Authors of Explanatory Notes
Torres Strait	Willmott & Powell (1977b)
Jardine River	Powell & Smart (1977)
Orford Bay	Powell & Smart (1977)
Weipa	Smart (1977b)
Cape Weymouth	Willmott & Powell (1977a)
Aurukun	Smart (1977a)
Coen	Whitaker & Gibson (1977a)
Holroyd	Grimes (1977)
Ebagoola	Whitaker & Gibson (1977b)
Cape Melville	Lucas & de Keyser (1965a)
Rutland Plains	Needham & Doutch (1973)
Hann River	Whitaker & Grimes (1977)
Cooktown	Lucas & de Keyser (1965b)

The CYPLUS study area encompasses seven distinct geological entities (Figure 7). All bar two (the Coen Inlier and the Laura Basin), are parts of larger units which extend either further south, or in the case of the Cape York-Oriomo Inlier, further north. A summary of the units is provided in Table 2.

2.2.1 Yambo Inlier

The Yambo Inlier consists of Proterozoic rocks that formed about 1500 m.y.a (Denaro and Ewers, 1995). It is separated from the Coen Inlier and the Laura Basin by the Kimba Arch, and from the Hodgkinson Formation to the east by the Palmerville Fault. The steep sided hillslopes of the Dargalong Metamorphics are dominated by gneiss, schist, quartzite and amphibolite (Whitaker and Grimes, 1977). In areas it is intruded by dolerite and members of the Kintore Supersuite. The latter results in an undulating landscape of less relief than the Dargalong Metamorphics.

2.2.2 Coen Inlier

Of a similar age to the Yambo Inlier are the metamorphosed sediments of the Coen Inlier, which exist as a north-trending ridge from approximately 15° 30' S to the coastline at Temple Bay. Subdivided into the Sefton, Holroyd and Coen Metamorphics, they are mostly schists, gneiss, amphibolite and greenstone (Whitaker and Grimes, 1977; Wilmott and Powell, 1977a). Minor dolerite intrusions are present at its northern and southern extremities. Steep sided hills are the norm, with generally narrow valley floors. Ewers and Bain (1992) have recently revised the Coen and Holroyd Metamorphics within the Ebagoola sheet area.

The Coen Metamorphics are primarily restricted to an area surrounding the township of Coen (Whitaker and Gibson, 1977a), while the Holroyd Metamorphics dominate the southern end of the Inlier, although scattered outcrops also occur in the Coen area. Within the southern extent of the Holroyd Metamorphics, are alternating outcrops of quartzite and greenstone. The Sefton Metamorphics outcrop in the northern-most section of the Inlier, particularly around Lockhart River.

Cape York Batholith. Members of the Cape York Batholith outcrop in both the Coen and Yambo Inliers. They dominate the eastern edge of the central portion of the Coen Inlier, resulting in the actively eroding Great Escarpment. Relief elsewhere on this unit varies from subdued dissected undulating plains to rises, to steep sided outcrops such as Mt Buthen Buthen and the McIlwraith ranges. Of Silurian to late Devonian age, the dominant lithology is adamellite, although granodiorite, granite and aplite are also present. The Batholith was divided into six components by the authors of the Explanatory Notes Series, but this subdivision has since been revised by a number of authors. Denaro and Ewers (1995) present a good discussion of the current knowledge of the Batholith.

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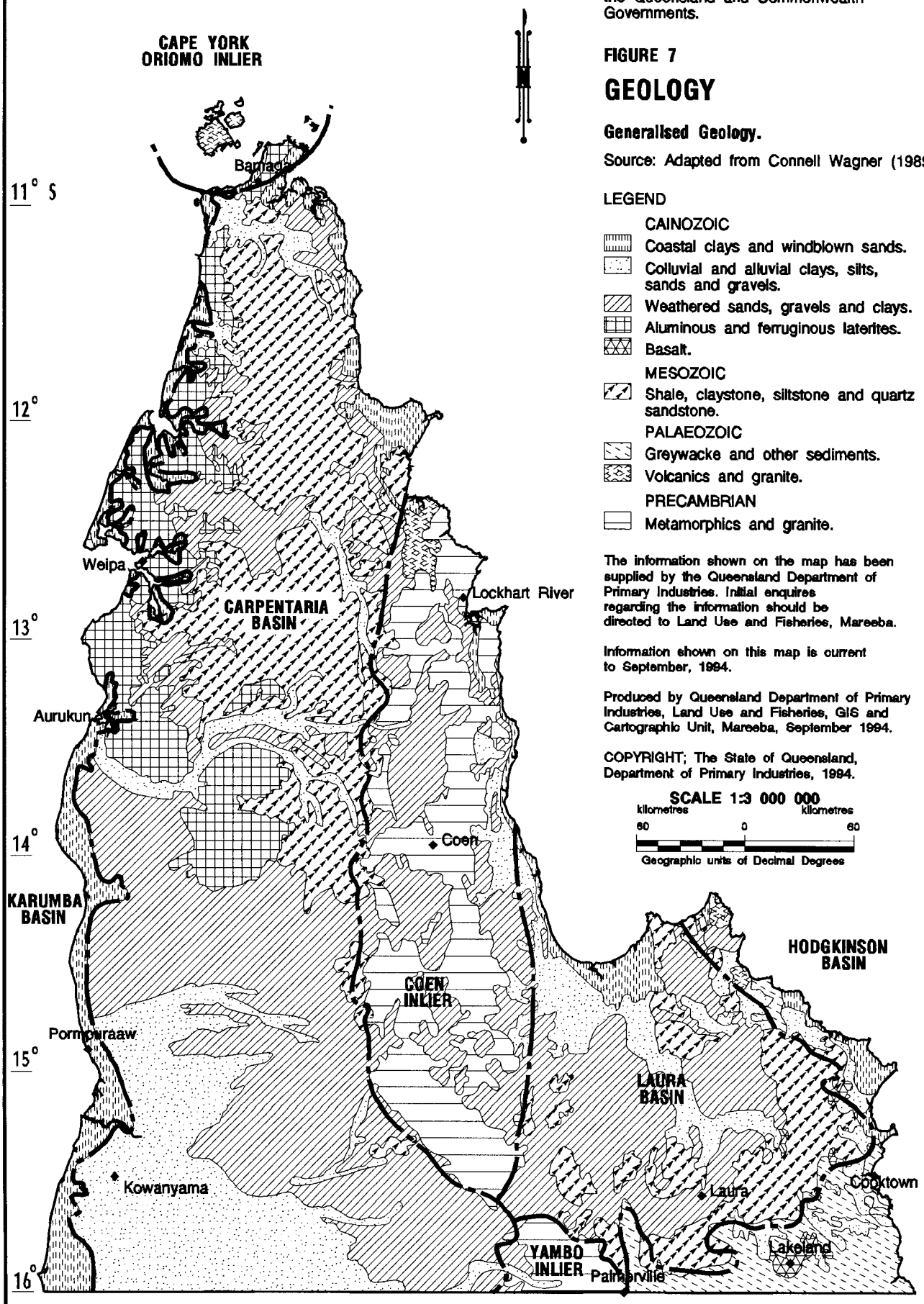
FIGURE 7

GEOLOGY

Generalised Geology.

Source: Adapted from Connell Wagner (1989)



LEGEND

CAINOZOIC
- Coastal clays and windblown sands.
- Colluvial and alluvial clays, silts, sands and gravels.
- Weathered sands, gravels and clays.
- Aluminous and ferruginous laterites.
- Basalt.

MESOZOIC
- Shale, claystone, siltstone and quartz sandstone.

PALAEOZOIC
- Greywacke and other sediments.
- Volcanics and granite.

PRECAMBRIAN
- Metamorphics and granite.

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SCALE 1:3 000 000
kilometres 60 0 60 kilometres
Geographic units of Decimal Degrees

Extensive units of Permian acid intrusives also outcrop in the northern portion of the Coen Inlier. They are dominated by granites, granodiorite, and adamellite (Whitaker and Gibson, 1977a, Knutson *et al.*, 1994). Landform in the lower areas is generally undulating rises but the major features are steep mountains or hills.

Volcanic outcrops. Outcrops of acid volcanics occur in the Iron Range area. Three units — the Janet Ranges Volcanics, Kangaroo Volcanics and Cape Grenville Volcanics — are recognised and probably appeared during the same igneous cycle in the Carboniferous to Early Permian (Wilmott and Powell, 1977b, Denaro and Ewers, 1995). The steep hills to mountains are dominated by rhyolitic welded tuff, with associated rhyolite, breccia, agglomerate, rhyodacitic and dacitic welded tuff, andesite and metabasalt.

2.2.3 Hodgkinson Province

To the east of the Yambo Inlier are components of the Hodgkinson Province. This extensive unit of steep, actively deflating hillslopes with an intense dendritic drainage pattern extends from isolated outcrops at Cape Melville in the north, to the bottom of the survey area.

The dominant component is the Devonian to Carboniferous age Hodgkinson Formation. It was described by Amos and de Keyser (1964) as "a very thick accumulation of micaceous greywacke, siltstone and slate with intercalations of chert, basic volcanics, conglomerate and rare lenses of limestone". It is extensively folded and faulted. It has been sub-divided into four members as described by Bultitude *et al.* (1993). Significant colluvial fans are associated with many areas of the Formation.

Adjacent to, and to the west of the Hodgkinson formation is a narrow band of Chillagoe Formation. Within the study area, the north-south trending ridge of steep hills with undulating valley floors is comprised of fine, even-grained green sandstone in the west of the unit, with basic volcanics, chert, green gritty sandstone and unfossiliferous limestone elsewhere (Lucas and de Keyser, 1965b; Bultitude *et al.*, 1993).

Between the Chillagoe Formation and the Palmerville Fault lie the Little River Coal Measures. Formed in the Late Permian, this unit consists of both thick and thin bedded sandstones, shale, impure limestone and impure coal (Lucas and de Keyser, 1965b; Wells, 1989).

The Hodgkinson Formation has been intruded in a number of places eg. Cape Melville, Black Mountain, Mt Finnegan and Mt Amy, by acid igneous material of Permian age which belongs to a variety of Suites and Supersuites (Bultitude and Champion, 1992). Typically these formations are present as steep hills or mountains, often with boulder formations. Also outcropping within the Hodgkinson formation are the small faulted ridges of the Normanby Formation. These are north-north-east trending bands of sandstone, shale, conglomerate, impure limestone beds, rhyolite and impure coal. (Lucas and de Keyser, 1965b; Wells, 1989).

Three Cainozoic basalt units have erupted within the Hodgkinson Province in the CYPLUS study area, the northern-most of which is the McIvor River Basalt Province as defined by Bultitude *et al.* (1993). Varying from gentle plains to undulating rises, it is essentially a valley-fill flow derived from two small shield volcanoes (Denaro and Ewers, 1995). This unit

was originally grouped by Lucas and de Keyser (1965b) with the Piebald Basalt Province to the south.

The Piebald flow was derived from a number of vents and appears to have flowed down the Endeavour River valley, with undulating rises to rolling low hills as the dominant landforms. Evidence suggests that the flows appeared in the late Pliocene to Pleistocene (Denaro and Ewers, 1995).

The largest basalt unit within the Hodgkinson is the relatively flat series of flows at Lakeland Downs. These were derived from a number of vents, one of the largest of which has given the unit its name — McLean Basalt. Two periods of eruption are suggested, the first in the late Miocene, and the second in the early Pliocene (Denaro and Ewers, 1995).

2.2.4 Laura Basin

Located between the Coen Inlier to the west, and the Hodgkinson Formation to the east and south, the Laura Basin is a significant feature in the hydrology of the Peninsula. It extends offshore into Princess Charlotte Bay, to the edge of the Continental Shelf (Smart and Rasidi, 1979). The uplands of the Basin consist of dissected sandstone hillslopes. Uppermost is the Battle Camp Formation, consisting of conglomerate, glauconitic sandstone, shaly sandstone and leached shale of Lower Cretaceous age (Lucas and de Keyser, 1965b). In the north-east and south-west of the Cooktown sheet, the outcrops are more contiguous than in the area between these two zones. This central zone is more dissected, revealing the underlying Jurassic Dalrymple Sandstone. This latter unit consists of conglomerate, grit, sandstone and minor shale (Lucas and de Keyser, 1965b). Intrusions of Permian granite are also present.

The lowlands of the basin contain extensive areas of residual sands derived from the sandstones. Further downslope are large alluvial plains.

Outcropping west of Laura is an area of Wolena Claystone - an olive grey silty and sandy claystone with calcareous concretions. It is slightly younger than the Battle Camp Formation, but still placed in the Lower Cretaceous (Lucas and de Keyser, 1965b). It appears to be similar in nature to the Rolling Downs Group. It is uncomformably overlain by the Fairview Gravel which also outcrops in a restricted area west of Laura.

2.2.5 Carpentaria Basin

The largest geological component of the study area is the Carpentaria Basin, consisting of sediments of both marine and fluvial origin ranging from quartzose conglomerate to claystone.
The dominant units outcropping in the north of the study area are the sandstones of the Helby Beds which grade laterally into the Gilbert River Formation to the south-east. In the Temple Bay area, the underlying Garraway sandstones are exposed.

Dominating the centre of the Basin, from north of Weipa to west of Musgrave are the fine grained sediments of the Rolling Downs Group. These have been exposed as the overlying Bulimba Formation has been eroded. Heavily laterised remnants of the Bulimba sandstones are represented as the Aurukun Surface, which parallels the exposure of the Rolling Downs Group.

In the southern half of the survey area, the Basin is represented by large areas of residual sands; weathering products from the overlying sandstones. In the south-west (and extending below the survey area) are large depositional clay plains, associated with major rivers such as the Alice, Mitchell and Nassau.

2.2.6 Karumba Basin

The complex coastal deposits of the Karumba Basin extend in a band along the west coast of the Peninsula, although north of Weipa it narrows significantly. It is dominated by beach ridges and marine clay plains deposited at various periods within the Quaternary.

Although not part of this basin, the east coast exhibits extensive dunefields at Cape Flattery, Temple Bay and Shelburne Bay. Significant marine plains similar to those of the Karumba Basin exist at the southern and eastern sides of Princess Charlotte Bay. These east coast deposits are mostly of ages contemporary with the deposits on the west coast.

2.2.7 Cape York-Oriomo Inlier

The Cape York-Oriomo Inlier trends north and north-east from the tip of CYP to Papua New Guinea (Wilmott and Powell, 1977b). The two main features within the survey area are the Torres Strait Volcanics and the subsequent intrusions of acid igneous material in the form of a porphyritic microgranite. All are aged in the Carboniferous. The volcanics, which are sub-divided into five units, are comprised of sheets of welded tuffs with minor agglomerate, rhyolite, andesite and interbedded sediments (Wilmott and Powell, 1977b). One of the larger intrusions of the porphyritic microgranite encompasses nearly half of Horn Island. Both the volcanics and granites are characterised by heavily dissected, steep sided hills and low hills.

2.3 Physiography

The physiography of CYP has been discussed by a range of authors, in particular, those referred to in Table 1. Those authors applied local names to landforms eg. Glennie Tablelands. As mentioned, there are some inconsistencies between map sheets. Horn *et al.* (1995) present a more regionalised view. Pain *et al.*, (1995) have compiled a Regolith-landform map for the Peninsula at 1:1 000 000 scale.

Table 2 Geological units of CYP (from 1:250 000 Geological Series)

Geological Unit[1]	Map Units[2]	Lithology[3]	Typical landform[4]	Soil Types[5]	Map Ref.[6]	Comments
Quaternary coastal deposits Recent sand deposits Older sand deposits Marine sediments	 Qhm, Qd Qpm, Czd Qac, Qhp, Qm	 Shelly quartzose sand Quartzose sand Silt, clay, minor sand	 Foredunes, beach ridges Dunes, beach ridges Tidal flats, playas, plains	 Vy, Db, Cv, Ss Dn, Cv, Sd, Mn, Go, Ns	10	Dunes are restricted to east coast, beach ridges on extensive chenier plains, esp. in south west Marine clays deposits vary in age
Quaternary swamp deposits	Ql	Silt, clay, sand	Lakes and swamps	Mp	9	Minor occurences associated with variety of surfaces, esp. alluvia and sandstone derived surfaces
Quaternary alluvium Younger alluvia Older alluvia	 Qa, Qha Qpa, Qas	 Silt, clay, sand Sand, silt, clay	 Alluvial plains, levees and terraces Alluvial plains, prior streams, terraces	 Kd, Bn, Gv, Wk, Ga, Vc, Mc, Mh	8	Different age alluvia often intermingled. Source type influences nature of alluvia. Wk, Ga, Vc from D-Ch derived alluvia
Yam Creek Beds	Czk	Clayey quartzose sandstone, granule and pebble conglomerate	Colluvial/alluvial plains, pediments	Wm, Ym	1b	Extensive deposits associated with Pascoe River valley, between CPj to east, and JKg to west
Un-named	Czx	Mottled clayey sand, gritty and pebbly	Footslopes, colluvia, pediments	Kj, Gs	4b	Derived from D-Ch. Often mixed with associated alluvia
Un-named	Czt	Piedmont fans, earthy fossil breccia, slightly ferruginous	Hillslopes, footslopes	Ar	6a	Derived from Jl and Klc. Often mixed with Czx
Un-named	Czc	Leached clay, silt	Gently undulating plains to undulating rises	Ld, LdRp	5b	Minor occurences associated with KTi on the Hann River Sheet
Piebald Basalt McLean Basalt	Czp Cze	Olivine basalt Olivine basalt, pyroclasts	Gently undulating plains, undulating rises	Ed, Bh Br, Bh, Nm	3	Combination of shield volcanoes and vents. Valley-fill flows
Tertiary Nephelinite	Czn	Olivine nephelinite	Undulating rise?	Ed	3	Isolated vent? in the east of Ebagoola sheet area
Tertiary/Quaternary sands	TQs	Quartzose sand, silt	Gently undulating plains to undulating rises	Km, Cr, Em, Bm, Gg, Hn, Ct, Bb	7	Often difficult to distinguish from sands derived more recently from sandstone in south-east
Fairlight gravels	Tf	Rounded quartzose pebble gravel, sandstone, billy	Gently undulating plains to undulating rises	Em, Tr, Gg	6	Isolated outcrops unconformably overlying Wolena claystone west of Laura
Tertiary Ferricrete	Tpf	Ferricrete, laterite	Undulating rises to low hills	Bt, Sp	5a	Isolated units
Lilyvale Beds	Tmpv	Clayey quartzose sand, sandy clay, granule gravel, pebbly in places	Colluvial and Alluvial fans and plains	Sv, Lv, Qt	1, 8b	Extensive unit derived from, and to the east of the Great Escarpment. Intermingled with Qa
Falloch Beds	Tmph	Clayey quartzose sand, sandy clay, granule gravel, pebbly in places	Alluvial fans	Sv, At, Gk, Wm, Ym	1b	West of McIlwraith Ranges
Wyaaba Beds	Tmpy	Clayey quartzose sand, interbedded sandy clay, granule gravel, pebbly in places	Alluvial plains, plains	Ab	8a	Underlies TQs in area between Aurukun Surface and coastal deposits on Aurukun Sheet. Extends south (under TQs) to below 16° S. Outcrops near 16° S
Tertiary and Quaternary Ferricrete	T&Qf	Ferricrete, minor bauxite	Gently undulating plains to undulating rises on plateaux	Wu, Km, Em, Cr, Bt, Sp	5a	Western to central peninsula. Remnants of Aurukun Surface. Less laterisation
Tertiary and Quaternary Bauxite	T&Qa	Bauxite, minor ferricrete	Gently undulating plains to undulating rises on plateaux	Wp, Ad, Mp	5a	Extensive Aurukun Surface - derived from laterised KTi. Vrilya Pt to Holroyd River

Table 2 (cont'd)

Bulimba Formation	KTi	Clayey quartzose sandstone, granule conglomerate, sandy claystone, local granule gravel and pebble beds	Undulating rises	Bt, Sp, Ld, Bv, Hk	5	Extensive exposures between Aurukun Surface and underlying Klr. Often poorly laterised
Wolena Claystone	Klo	Olive grey silty and sandy claystone with calcareous concretions	Gently undulating plains to undulating rises	Pn, Ml, Bv	5	Isolated outcrops west of Laura
Battle Camp Formation	Klc	Conglomerate, glauconitic sandstone, shaly sandstone, leached shale	Steep hills, occasionally undulating rises	Cm, Em, Dt, Tr	6	Rugged terrain, heavily dissected in areas. Overlies Dalrymple Sandstone
Rolling Downs Group	Klr	Silty mudstone, siltstone, calcareous nodules, some glauconitic and labile sandstone	Gently undulating plains to undulating rises	Bv, Ml, Pn, Ld, Hk, Rb	5	Major erosional landscape in northern Carpentaria Basin. Underlies Aurukun Surface and KTi.
Albany Pass beds	JKa	Clayey quartzose sandstone and pebble conglomerate	Undulating rises to rolling low hills	Kl, Wu	6	Extensive area overlain by T&Qf in the Bamaga-Lockerbie area
Helby Beds	JKb	Clayey quartzose sandstone and pebble conglomerate, minor mudstone, highly bioturbated	Gently undulating plains to undulating rises	Hm, Jd, Gv, Em	6	Very extensive area from Jardine River to Bertie Ck. Southern boundary merges with Klr. Approaches east coast, where overlain by Qd in areas
Gilbert River Formation	Jkg	Clayey quartzose sandstone and siltstone, granule conglomerate, minor pebble conglomerate; glauconitic in upper part	Undulating rises to steep hills. Often mesa type capping on hills	Cm, Tr, Dt	6	Extensive outcrops in north-south trend from east of the Olive River to north-west of Coen. Overlies Klr to west and SDm, SDk, SDf and Pw to east (in southern half only)
Garraway Beds	Jw	Clayey micaceous quartzose sandstone, granule and pebble conglomerate, carbonaceous in parts	Gently undulating plains to undulating rises	Em, Hm	6	Extensive outcrop in north-south trend from south eastern margin of Temple Bay to north of Pascoe River
Dalrymple Sandstone	Jl	Quartz sandstone, conglomerate, grit, shale	Steep hills, mesa type cappings	Cm, Dt, Ar	6	Often revealed where Klc has been eroded
Normanby Formation	Pn	Impure sandstone, siltstone, coal conglomerate, limestone, rhyolite	Rolling rises to steep low hills	Pl	4	Northerly trending folded and faulted ridge outcropping in D-Ch
Little River Coal Measures	Pur	Sandstone, shale, impure coal, limestone	Undulating rises to steep low hills	Fl, Cm, Hg	4	Narrow unit sandwiched between Palmerville Fault to west and S-Dh to east
Wolverton Adamellite	Pw	Leucocratic biotite adamellite or granite	Undulating rises to steep low hills	Dr, Se, Dx, Am	1	Valley floors and lower slopes exposed from erosion of overlying sandstone
Twin Humps Adamellite	Put	Hornblende-biotite adamellite, leucocratic biotite adamellite or granite	Steep hills to mountains	Dr, Dx, Am	1	Major outcrops just north of Coen
Altanmoui Granite	Pgi	Medium grained porphyritic biotite adamellite with marginal variations	Steep hills to mountains	Am	1	Restricted to boulder formations of Cape Melville and the Altanmoui Ranges
Puckley Granite	Pgk	Coarse porphyritic adamellite, aplite dykes	Steep hills	Am, Dx	1	Outcropping in margins of Laura Basin
Trevethan Granite	Pgv	Medium-grained porphyritic hornblende-biotite granodiotite	Steep hills	Hs, Am	1	Black Mountain boulder formation
Finlayson Granite	Pgf	Medium grained porphyritic adamellite	Steep low hills to mountains	Hs, Dr	1	Extensive outcrops in D-Ch in south-east
Mareeba Granite	Pgm	Coarse, porphyritic granodiorite and adamellite	Steep hills	Am, Dr	1	Minor outcrops on south-eastern margin of survey area

Table 2 (cont'd)

Weymouth Granite	Plw	Porphyritic biotite granite, some microgranite	Steep hills to mountains	Dr, Am, Dx	1	Major outcrops both north and south of Iron Range. Intruded on CPj, CPh and Ps
Unspecified acid pluton	Cup	Porphyritic microgranite		Dx, Dr, Am	1	
Muralug Ignimbrite	Cm	Brownish grey rhyolite welded tuff, some rhyolite volcanic breccia and dacite? welded tuff	Rolling low hills to steep hills, occasionally undulating rises	Er, Gw, Dl	2a	Largest outcrop of the volcanics in the Torres Straits. Prince of Wales and Entrance Islands
Goods Island Ignimbrite	Cg	Dark grey dellenite to dacite welded tuff, some interbedded siltstone and sandstone	Rolling low hills to steep hills, occasionally undulating rises	Er, Gw, Dl	2a	Significant outcrops on Hammond, Thursday, Friday and Goode Islands
Endeavour Strait Ignimbrite	Cn	Greenish grey rhyolite welded tuff, some rhyolite, andesite, agglomerate and hornfels	Rolling low hills to steep hills, occasionally undulating rises	Er, Gw, Dl	2a	Significant outcrop on Horn Island. Intruded by Cup. Minor outcrops on Prince of Wales and Wednesday Islands, and between Punsand and Simpson Bays
Eborac Ignimbrite	Ce	Light grey rhyolite welded tuff, some rhyolite and agglomerate	Rolling low hills to steep hills, occasionally undulating rises	Er, Gw, Dl	2a	Significant outcrop on Mt Adolphus Island. minor outcrops at Cape York and Mt Roma.
Unspecified acid intrusions	CPh	Hybrid and granophyric hornblende - biotite microadamellite and granodiorite	Rolling to steep low hills to hills	Am, Dx, Dr	2a	Minor band faulted against CPj and western edge of Plw
Dolerite intrusions	CPo	Dolerite	Undulating rises to steep low hills	Rm	2	Scattered minor intrusions between the Pascoe and Kangaroo Rivers
Kangaroo River Volcanics	CPk	Rhyolite welded tuff and breccia, andesite, dacite? and rhyodacite welded tuff, minor rhyolite	Steep hills	Er, Tz, Dl	3	Major outcrop between Temple Bay and Pascoe River mouth. Abuts CPh
Janet Ranges Volcanics	CPj	Recrystallized acid welded tuff flows, agglomerate	Rolling to steep hills	Er, Tz, Dl	2	Extensive outcrop north-west of Iron Range. Narrow outcrop faulted against Plw south-west of Iron Range
Pascoe River Beds	DCp	Sandstone, siltstone, shale, arkose, greywacke, minor chert, tuff, coal, conglomerate	Dissected plains	-	2	Minor exposures associated principally with erosion of overlying Czk by the Pascoe River
Hodgkinson Formation	D-Ch	Greywacke, slate, minor volcanics and limestone	Heavily dissected rolling to steep hills, occasionally undulating rises	Jn, Ek, Hg	4	Extensively folded and faulted. Intruded by granites. Associated colluvia and alluvia
Chillagoe Formation	S-Dh	Volcanics, chert, sandstone, minor limestone	Rolling low hills to undulating rises	Fl, Hg, Cm	4	Narrow band faulted between Pur and western margin of D-Ch
Wigan Adamellite	SDw	Leucocratic biotite adamellite or granite, in part porphyritic	Undulating rises to steep hills	Dr, Se, Dx	1	Minor outcrops around the upper reaches of the Wenlock River
Blue Mountains Adamellite	SDb	Biotite adamellite, hornblende	Steep hills	Dr, Am, Dx	1	Minor outcrops to the west of and within the McIlwraith block
Flyspeck Granodiorite	SDf	Biotite granodiorite, hornblende	Steep low hills to hills	Dr, Oc, Dx	1	Minor outcrops along the western margin of the McIlwraith block, and north-west of Coen. Significant outcrops to east of SDk, on the Ebagoola Sheet
Kintore Adamellite	SDk	Muscovite-biotite adamellite, muscovite granite, pegmatite, aplite	Undulating rises to steep hills	Dr, Dx, Qt, Se	1	Extensive outcrops, comprising the Great Escarpment for much of the Coen Inlier, esp. on the Ebagoola Sheet. Intrudes on Ph, Pc, Ps
Morris Adamellite	SDm	Porphyritic biotite adamellite	Undulating rises to steep low hills	Dr, Dx	1	Outcrops north and south of the Archer Shear Zone. Overlain by JKg in areas
Lankelly Adamellite	SDl	Porphyritic biotite adamellite - some muscovite granite and pegmatite	Steep low hills to mountains	Dr, Qt, Dx	1	Extensive block east of Coen. Bounded by Coen Shear Zone in south-west of unit

Table 2 (cont'd)

Dolerite intrusions	Po	Dolerite	Gently undulating plains to undulating rises	Rm	3	Minor narrow intrusions in Ph in south of Coen Inlier. More significant intrusions in Pd within the Yambo Inlier
Sefton Metamorphics	Ps, Psg	Muscovite-quartz schist and phyllite, quartzite, muscovite-biotite-quartz-feldspar schist and gneiss, amphibolite. Some greenstone	Rolling to steep hills or mountains, but also undulating rises	Gl, Pc, Lm	4	Extensive outcrops north and south of Iron Range. Intruded by SDk, SDw and more recently Plw and CP? Psg outcrops to the north and south of the W. Claudie River
Holroyd Metamorphics	Ph, Phg, Phq	Muscovite-quartz schist and phyllite, quartzite, biotite-muscovite-quartz-schist, biotite-quartz-feldspar gneiss, feldspathic schist. Greenstone	Rolling to steep hills or mountains, but also undulating rises	Gl, Pc, Pl, Ps, Cl, Hv, Cb	4	Cb restricted to bands of Phg, which alternate with ridges of quartzite (Phq)
Coen Metamorphics	Pc, Pcn	(Sillimanite)-biotite-muscovite-quartz schist, quartzite, biotite-quartz-feldspar gneiss, amphibolite, garnet-amphibole-quartz-feldspar gneiss, calc-silicate rocks	Rolling to steep hills or mountains, but also undulating rises	Gl, Pc, Pl, Ps, Cl	4	Minor outcrops with generally north-south trend east and north of Coen. Major outcrop at Coen
Dargalong Metamorphics	Pd	Biotite-plagioclase-quartz gneiss, leucocratic gneiss, amphibolite, plagioclase-muscovite-biotite-quartz schist, migmatite	Undulating rises to steep low hills	Hv, Pl, Gl	4	Outcrops in Yambo Inlier, to the west of the Palmerville Fault. Extends south out of the CYPLUS area

1 Geological Unit derived from 1:250 000 Geological Series.
2 Map Units derived from 1:250 000 Geological Series. Only the most common codes are listed.
3 Lithology descriptions derived from 1:250 000 Geological Series map references. Only the most common lithologies are listed.
4 Landform terms are as described by McDonald *et al.* (1990). Only dominant landforms are listed.
5 Soil Type codes as per the *Soils of Cape York Peninsula* map reference. Only dominant map units are listed. Soil names are given in sections 3.2.1 to 3.2.7 and detailed descriptions of the soils are outlined in Appendix 1.
6 Map Reference unit as per the *Soils of Cape York Peninsula* map reference

Isbell (1980) provides a good discussion of the soil landscapes - essentially physiographic regions, which Connell Wagner (1989) further refined (Figure 8).

Broadly speaking, the study area can be divided into three groups of units:

- the depositional surfaces (including coastal deposits),
- the dissected Cainozoic surfaces (including the Rolling Downs Group, Helby Beds and Aurukun surface) and,
- the hilly to mountainous areas (the Hodgkinson Province, Coen and Yambo Inliers).

For detailed discussion of the physiography of CYP, reference should be made to any of the above authors.

2.4 Water resources

The water resources of CYP have been discussed comprehensively by CYPLUS project NR16 (Horn *et al.,* 1995) and reference should be made to that report for more detail.

In brief, the Peninsula consists of five major hydro-geological provinces:

- the Carpentaria Basin
- the Laura Basin
- the Karumba Basin
- the Coen Inlier
- the Hodgkinson Basin

Groundwater reserves are considered as large, although seasonality is a common factor. Recharge is often rapid and this has been isolated as an issue of concern with regard to potential pollution.

Water quality is variable but generally adequate for agricultural and mining use.

2.5 Vegetation

The nature and distribution of the vegetation of CYP has been studied by a number of authors, and is currently under investigation by Neldner and Clarkson (1995) of the Queensland Herbarium.

Pedley and Isbell (1971) published a report on the vegetation of the Peninsula, with an accompanying map, which detailed 10 broad categories of vegetation, including a number of sub-units. The vegetation of the Mitchell-Normanby area was described by Story in Galloway *et al.*, (1970). Tracey and Webb (1975) commented on the vegetation of the closed-forests in the south-east of the Peninsula, while Lavarack and Stanton (1977) discuss the vegetation of the Jardine River area. Bleeker and Laut (1987) reported on the vegetation of the Lockhart River valley in the course of a suitability assessment.

Neldner and Clarkson (1995) have sub-divided the Peninsula into thirty broad vegetation groups (Table 3). The most prevalent units are woodlands and tall woodlands dominated

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LAND USE STRATEGY

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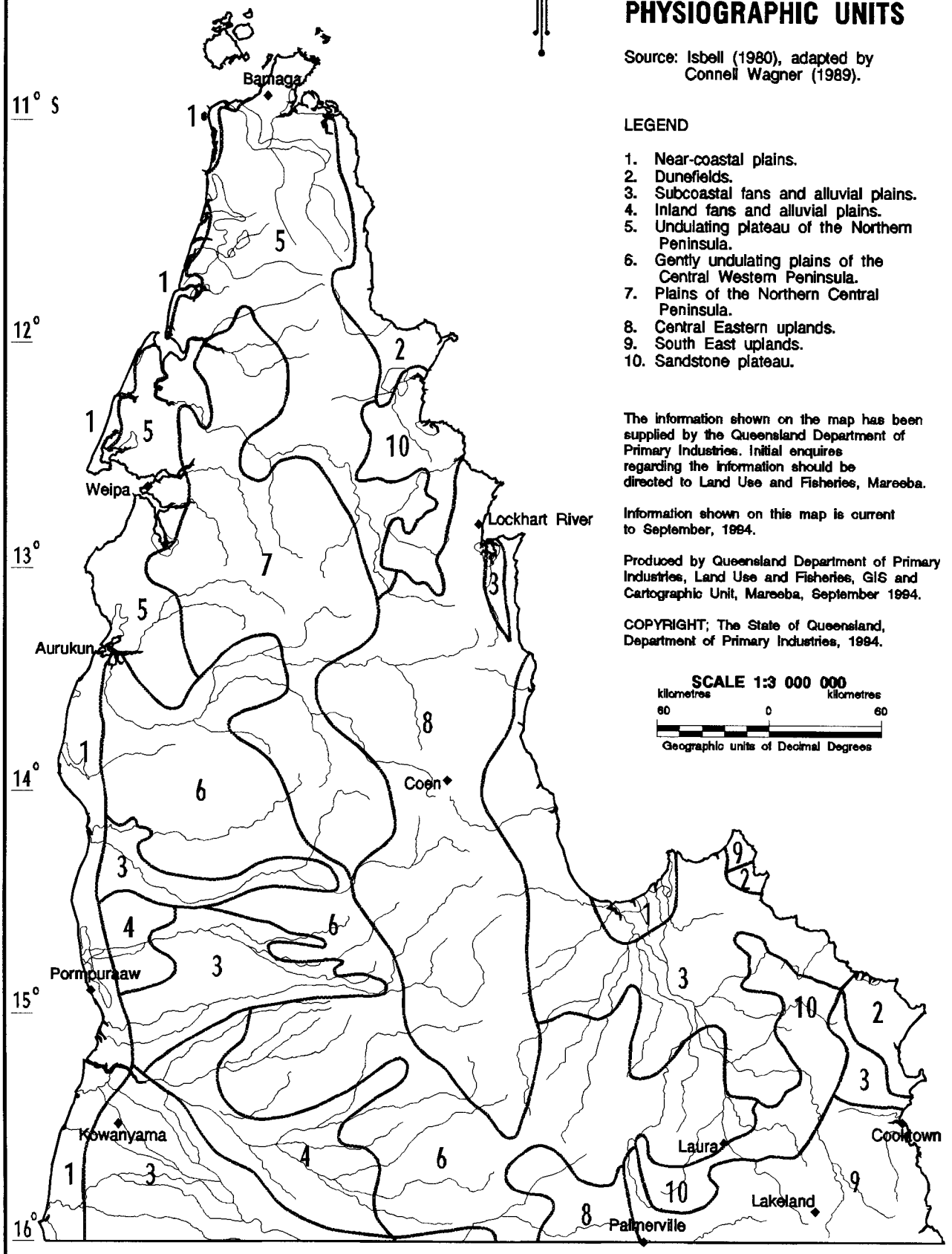
FIGURE 8

PHYSIOGRAPHIC UNITS

Source: Isbell (1980), adapted by Connell Wagner (1989).

LEGEND

1. Near-coastal plains.
2. Dunefields.
3. Subcoastal fans and alluvial plains.
4. Inland fans and alluvial plains.
5. Undulating plateau of the Northern Peninsula.
6. Gently undulating plains of the Central Western Peninsula.
7. Plains of the Northern Central Peninsula.
8. Central Eastern uplands.
9. South East uplands.
10. Sandstone plateau.



The information shown on the map has been supplied by the Queensland Department of Primary Industries. Initial enquires regarding the information should be directed to Land Use and Fisheries, Mareeba.

Information shown on this map is current to September, 1994.

Produced by Queensland Department of Primary Industries, Land Use and Fisheries, GIS and Cartographic Unit, Mareeba, September 1994.

SCALE 1:3 000 000
kilometres 60 0 60 kilometres
Geographic units of Decimal Degrees

Table 3 Broad vegetation groups, Cape York Peninsula

Broad vegetation group	% of CYP area	Dominant soils
1. Closed-forests of the Wet Tropics Region	0.39	Rl, Jn
2. Closed-forests of the McIlwraith-Iron Range region	1.35	Dr, Hs
3. Closed-forests of northern CYP and the Torres Strait Islands	0.56	Hm, Kl, Em
4. Closed-forests of coastal dunes, dune-fields and the Jardine River frontage	0.32	Dn, Db, Cv
5. Deciduous low closed-forests on slopes and alluvia	0.46	Am, Bv, Dr, Pn
6. Gallery closed-forests and *Melaleuca* spp. dominated open forests on alluvia	2.51	Mh, Ae, Ln, Lv
7. Woodlands and open-woodlands dominated by *Eucalyptus chlorophylla, E. microtheca* or *E. acroleuca*	5.01	Kd, Ab, Bv, Ml
8. Woodlands and open-woodlands dominated by *Eucalyptus clarksoniana, E. novoguinensis* or *E. polycarpa*	5.63	Bv, Ab, Mc, Bn, Kd, Cr
9. Woodlands and open-woodlands dominated by *Eucalyptus cullenii, E. crebra,* or *E. persistens* subsp. *tardicidens*	3.97	Jn, Dr, Ek, Hg, Pl
10. Woodlands dominated by *Eucalyptus hylandii* or *E. tetrodonta* on sandstone, metamorphic and ironstone ranges	7.26	Cm, Bv, Dx, Hv, Cr
11. Open-woodlands and woodlands dominated by *Eucalyptus leptophleba* on river frontages and northern undulating plains	3.05	Bv, Ml, Dr
12. Woodlands dominated by *Eucalyptus leptophleba, E. platypyhlla* or *E. erythrophloia* on undulating hills and plains in the south-east	0.89	Jn, Br, Kj, Gs, Ga
13. Open-forests and woodlands dominated by *Eucalyptus nesophila* or *E. hylandii*	0.93	Jn. Gw, Rl
14. *Eucalyptus* spp. open-forests of the Wet Tropics Region	0.08	Rl, Jn
15. Open-forests and woodlands dominated by *Eucalyptus tessellaris, E. clarksoniana* or *E. brassiana* on coastal plains and ranges	0.87	Dr, Qt, Gl, Kd
16. Woodlands and tall woodlands dominated by *Eucalyptus tetrodonta* on deeply weathered plateaus and remnants	19.40	Wp, Kb, Hm, Cr, Em, Kl, Ad
17. Woodlands dominated by *Eucalyptus tetrodonta* on erosional surfaces and residual sands	16.87	Cr, Bv, Dx, Hm
18. Low open-woodlands and low woodlands dominated by *Melaleuca viridiflora* on depositional plains	10.41	Ab, Sv, Cr, Hn
19. Open-forests and low open-forests dominated by *Melaleuca* spp. in seasonally inundated swamps	1.37	Mp, Hn
20. Low open-woodlands and tall shrublands dominated by *Melaleuca stenostachya, M. citrolens* or other *Melaleuca* spp.	2.46	Ab, Hn, Cr, Cm, Ek
21. Tussock grasslands on marine plains and alluvial plains	4.04	Mn, Kd, Hn, Ab
22. Closed-tussock grasslands and open-woodlands on undulating clay plains	0.75	Ml, Pn, Bv, Wk, Ga
23. Tussock grasslands on longitudinal drainage depressions, headlands and continental islands	1.28	Hn, Cr, Ab, Kb, Ct
24. Open-heaths and dwarf open-heaths on dune-fields, sandplains and headlands	3.34	Hm, Dn, Gv
25. Woodlands and herblands on beach ridges and the littoral margin	0.73	Cv
26 . Closed-forests and low closed-forests dominated by mangroves	1.19	Sd, Go
27. Sedgelands, lakes and lagoons	1.02	Gv, Dn
28. Vegetation of the coral atolls, shingle cays and sand cays	0.02	Not surveyed
29. Rocky and bare sandy areas including saltpans, sand blows and rock pavements	1.17	Go, Sd, Mn
30. Miscellaneous vegetation group dominated by *Acacia* spp. or members of the Myrtaceae family occurring on a variety of landforms	2.64	Hm, Em, Dx, Cr, Gv, Wu

Source: Neldner and Clarkson (1995)

by *Eucalyptus tetrodonta*, followed by low open-woodlands and woodlands dominated by *Melaleuca viridiflora*. Both units are found throughout the Peninsula. Woodlands and open-woodlands dominated by other *Eucalyptus* spp. are also significant. Extensive areas of open-heath and dwarf-open heath are found in the north and on coastal dunefields. Open grasslands are prevalent on marine clay plains and the clay plains of the interior. Closed forests exist in the high rainfall zones of the south-east, Iron Range and Bamaga.

3. Soils

3.1 Introduction

One hundred and thirteen individual soil types have been mapped and described in this survey. Detailed descriptions of these are supplied in Appendix 1. Table 4 provides an alphabetic list of the soils, and brief details, including a concept and the percent of the Peninsula that they occupy.

Within this report, the soils have been considered from three perspectives.

a) In terms of the geological/geomorphological unit(s) from which they are derived - see Section 3.2.
b) In terms of (a), but also taking into consideration their geographical location in respect to seven *Soil Landscapes* on the Peninsula - see Section 3.3.
c) In terms of the Australian Soil Classification (Isbell, 1993) - see Section 3.4.

The soil type (or soil profile class) names have been derived from a number of sources. In some instances, where there is a good level of agreement between the soil as described by NR02, and as described by a previous survey, the name attributed to the soil by the previous survey has been maintained eg. *Kimba* and *Clark*, from Galloway *et al.* (1970). In other cases, where a lesser degree of correlation with a previous survey exists, a shortened or modified version of the previous name has been used, eg. *Bullhead* from Grundy and Heiner (1994) is known as *Bull* in NR02.

In situations where a name cannot be obtained from a previous survey, an attempt has been made to choose a name that indicates a known area in which the soil exists, eg. *Jardine, Cox, Picanninny.*

Section 3.6 provides further discussion on the relationship between NR02 and previous surveys.

3.2 Perspective 1 - geological and geomorphological

The regional scale (1:500 000) map produced as a result of this survey (available separate to this report) includes a Reference based primarily on geological divisions (Appendix 2). Secondary divisions based primarily on landform are also present.

The following section discusses the soils of the Peninsula in the order in which they occur on the Map Reference.

Table 4 Alphabetical list of soils, concept, associated Landscapes and % of CYP

Soil code	Soil name	Concept	Landscape[1]	Area %[3] of CYP
Ab	Antbed	Very deep Gradational or occasionally Duplex sodic mottled grey soils formed on alluvial plains	M, ER	4.37
AbAv	Antbed Acid Variant	As for Ab, field pH 5.5 in A1, grading to 3.5 in B23	ER	0.03
Ad	Andoom	Very deep Uniform or Gradational yellow massive soils with aluminous concretions	B, ER, H	2.29
Am	Altanmoui	Moderately deep Uniform brown coarse sands formed on hillslopes of granite boulder formations	E, LR	0.66
Ar	Audaer	Moderately deep Uniform mottled yellow massive soils formed on footslopes of sandstone hills	HF[2]	0.29
At	Attack	Deep Gradational mottled yellow massive soils formed on colluvia from acid plutonic hillslopes	LR[2]	0.10
Bb	Bimbus	Deep bleached Uniform sands over coffee rock, formed on residual sands	ER	0.45
Bl	Bull	Deep Uniform or occasionally Gradational non-cracking brown clays formed on basalt	HF	0.03
Bm	Brom	Deep Gradational or Uniform mottled grey massive soils formed on residual sands	ER	0.96
BmCp	Brom Coarse Phase	As for Bm, but coarse sandy throughout	ER[2]	0.08
Bn	Bend	Deep Gradational or Uniform grey or yellow-brown soils formed on alluvial plains	ER, M	0.48
Br	Burn	Deep Uniform red structured clay soils with nodules, formed on basalt	HF	0.13
Bt	Bertie	Deep Gradational or Uniform red massive soil with ferruginous nodules, formed on remnant surfaces	B	1.27
Bv	Batavia	Deep Gradational mottled yellow soil formed on silstone, mudstone or claystone	B	4.94
BvRp	Batavia Rocky Phase	Similar to Batavia, few, increasing to many 6-60 mm angular platy siltstone throughout	B	0.02
Cb	Crosbie	Moderately deep Uniform red structured clays formed on greenstone	E[2]	0.05
Ck	Cook	Moderately deep Duplex non-sodic red soils formed on greywacke and slate	HF	0.08
Cl	Chlory	Moderately deep Duplex sodic brown soils formed on schist, phyllite, quartzite and gneiss	E[2]	0.44
Cm	Camp	Very shallow, bleached rocky Uniform sandy soils formed on sandstone hillslopes	H, LR, HF	3.52
CmEv	Camp Red Variant	As for Cm, but red-brown and no A2 horizon	HF[2]	0.16
Cr	Clark	Deep bleached Gradational yellow massive soils formed on residual sands	E, ER	9.86
CrCp	Clark Coarse Phase	As for Cr, but coarse sandy throughout	E	0.01
Ct	Citri	Deep bleached Duplex sodic soils formed in drainage depressions on residual sands	ER, E	1.89
CtCp	Citri Coarse Phase	As for Ct, but coarse sandy throughout	E[2], ER[2]	0.02
Cv	Caravan	Deep to very deep coloured Uniform sands formed in beach ridges on chenier and beach ridge plains	ER, M, H	0.82
CvCp	Caravan Coarse Phase	As for Cv, but coarse sandy throughout	E[2]	0.04
CvDp	Caravan Deep Phase	As for Cv, but moderately deep A1 horizon	M, ER[2]	0.03
Cx	Cox	Deep Uniform or Gradational red massive soils on alluvial plains within the Rolling Downs Group	B	0.32
Db	Doughboy	Very deep bleached Uniform sands on coffee rock and occasionally orstein, formed in beach ridges	E, LR[2], H[2]	0.37
Dl	Del	Moderately deep Duplex sodic mottled grey soils formed on footslopes of acid volcanic hills	H[2]	0.11
Dn	Daunt	Giant Uniform bleached sand over orstein pan, in coastal sand dunes	H	0.71
Dr	Drop	Moderately deep Gradational yellow soils formed on hillslopes of adamellite or granite	E, LR	2.83
Dt	Deighton	Deep Uniform yellow massive sands formed on residual sands or sandstone	ER[2], E[2]	2.61
DtCp	Deighton Coarse Phase	As for Dt, but coarse sandy throughout	E[2]	0.02
DtRp	Deighton Rocky Phase	As for Dt, few grading to common 2-20 mm angular to rounded quartz throughout	E[2]	0.96
Dx	Dixie	Deep bleached Uniform, grey and yellow coarse sands derived from adamellite and granite	E, LR	2.22
Ed	Endeavour	Deep Gradational or occasionally Uniform red structured soil formed on basalt	HF[2]	0.14
Ek	Eykin	Moderately deep Duplex sodic grey soils formed on greywacke and slate	HF	0.50
Em	Emma	Deep Gradational massive red soils formed on sandstone	LR, H[2]	2.66
Er	Eborac	Very shallow bleached Uniform brown soils on acid volcanic hillslopes	H[2]	0.30
Fd	Ford	Moderately deep bleached Gradational grey massive soils formed on footslopes of silicified sandstone	HF[2], H	0.61
Fl	Fairlight	Moderately deep Gradational red structured soils formed on limestone hillslopes	HF	0.13
Ga	Greenant	Deep Duplex sodic acid to alkaline yellow soils formed on alluvial plains	HF	0.49

Table 4 (cont'd)

Gg	Ginger	Deep bleached Uniform sands on lower slopes and drainage depressions on residual sands	E	0.35
GgRp	Ginger Rocky Phase	As for Gg, common 2-60 mm sub-angular or angular quartz throughout	E^2	0.07
Gk	Geike	Deep Gradational mottled grey massive soils formed on colluvia from acid plutonic hillslopes	LR^2	0.10
Gl	Gail	Shallow Gradational yellow massive soils formed on schist, phyllite, quartzite and gneiss	E, LR	0.60
Go	George	Moderately deep Uniform saline mottled clays formed in recent estuarine deposits	ER, M	1.07
Gp	Gap	Deep Gradational yellow soils fomred on colluvia from acid volcanic hillslopes	LR^2	0.05
Gs	Gibson	Deep Duplex sodic yellow or grey soils on colluvia and pediments from greywacke and slate	HF	0.66
Gv	Grevil	Deep Uniform bleached sand over coffee rock formed in drainage depressions and footslopes on sandstones in the north of the Peninsula	H, LR	1.89
GvCp	Grevil Coarse Phase	As for Gv, but coarse sandy throughout	H	0.04
Gw	Galloway	Moderately deep Gradational or Uniform red massive soils formed on acid volcanic hillslopes	H^2	0.15
Hg	Hodge	Very shallow to shallow bleached Uniform or Gradational brown soils formed on greywacke and slate	HF	0.74
Hk	Hesket	Deep bleached Gradational mottled grey soils occurring in drainage depressions and swamps	B	0.44
Hm	Harmer	Deep Gradational bleached yellow massive soils formed on sandstones	H	2.61
Hn	Hann	Deep bleached Duplex soils on footslopes and drainage depressions in residual sands	E, ER	5.11
Hs	Henderson	Moderately deep Duplex non-sodic red soils formed on adamellite and granite	LR, E	0.86
Hv	Haven	Moderately deep Gradational yellow or brown massive soils with ferruginous nodules, formed on schist, phyllite, quarztite and gneiss	E^2	0.87
Ib	Isabella	Deep Gradational red massive soils derived from sandstone, and a basaltic influence	HF^2	0.03
Jd	Jardine	Deep bleached Unifrom yellow massive sands formed on sandstone	H	1.32
Jn	Jeannie	Moderately deep Gradational or Uniform yellow soils formed on greywacke and slate	HF	1.71
Kb	Kimba	Very deep Gradational red massive soils formed on residual sands	ER, E	4.30
KbRp	Kimba Rocky Phase	As for Kb, with few to many sub-rounded quartz throughout	M^2	0.01
Kd	Kennedy	Very deep Uniform or occasionally Gradational massive surfaced or cracking grey clays formed on alluvial plains	E, ER, M	3.19
Kj	Kingjack	Moderately deep Gradational non-sodic yellow soils on colluvia and pediments from greywacke and slate	HF	0.56
Kl	Kool	Deep Uniform red massive soils formed on residual sands	E, H^2	0.92
Ld	Lydia	Deep bleached Gradational or Duplex mottled grey soils overlying siltstone or mudstone	B	0.87
LdRp	Lydia Rocky Phase	As for Ld, with many 6-20mm sub-rounded platy ferruginized siltstone throughout	B	0.05
Lk	Lukin	Deep Duplex non-sodic red soils formed on schist, phyllite, quartzite and gneiss	E	0.15
Lm	Lamond	Deep Gradational brown structured soils derived from schist, phyllite, quartzite and gneiss	LR	0.11
Ln	Lions	Deep Gradational grey massive or structured soils on terraces under rainforest	LR, HF^2	0.01
LRC	Lockhart River Complex	Complex unit of Kd, Ln, Mh, Lv	LR	0.32
Lv	Livis	Deep Uniform coarse sands in prior streams on fans derived from acid plutonic rocks	LR, E	0.22
Mc	Mitchell	Deep Uniform or Gradational yellow, brown or red massive soils on terraces of major streams and rivers	E, ER, M HF	0.99
Mg	Moonlight	Deep bleached Gradational yellow massive soil formed on alluvia within the Rolling Downs Group	B	0.14
Mh	Morehead	Deep brown recent alluvia derived from major streams and rivers	E, ER, M, HF	0.27
Mk	Merkunga	Deep bleached Gradational or occasionally Duplex mottled grey soil formed on alluvia within the Rolling Downs Group	B	0.26
Ml	Myall	Deep Uniform or Gradational mottled yellow structured clay soils formed on siltstone, mudstone or claystone	B	2.00
Mn	Marina	Very deep Uniform frequently cracking saline grey clays formed on marine plains	M, ER, E, H	1.90
Mp	Mapoon	Deep Duplex or Gradational soils with a dark loamy surface over a mottled grey clay formed in swamps	B, ER^2	1.48
Nm	Norman	Moderately deep Uniform cracking dark clays formed on footslopes of basalt flows	HF	0.03
NmSp	Norman Shallow Phase	As for Nm, but shallow	HF^2	0.01
Ns	Nassau	Moderately deep saline Duplex grey soils associated with saltpans on marine plains	M, ER, E, H	0.32
Oc	Orchid	Deep Gradational red structured soils formed on granodiorite hillslopes	LR^2	0.18
Ol	Olive	Deep bleached Gradational mottled grey soils with nodules, formed on alluvial plains	HF^2	0.63
Pa	Pinnacle	Deep bleached Gradational grey massive soils derived from adamellites	E^2	0.02

Table 4 (cont'd)

Pc	Pack	Shallow Gradational or Uniform red massive soils on schist, phyllite, quartzite and gneiss	E	0.75
Pl	Poll	Very shallow Uniform brown soils formed on schist, pyhllite, quartzite, gneiss and greenstone	E, LR	0.68
Pn	Picanninny	Deep Uniform cracking brown or grey structured clay, formed on recent exposures of siltstones, claystones or mudstones	B	0.56
Ps	Packsaddle	Shallow Gradational brown structured soils formed on lowers slopes on schist, phyllite, quartzite, gneiss and greenstone	E[2]	0.11
Qt	Quarantine	Moderately deep Duplex sodic neutral to alkaline soils on lower slopes and fans derived from acid plutonic rocks	E, LR	1.08
Rb	Rokeby	Moderately deep Gradational red or yellow massive soil with feruginized sedimentary fragments	B[2]	0.06
Rl	Rule	Deep Gradational or Uniform structured red clays derived from greywacke and slate	HF	0.23
Rm	Raymond	Moderately deep Gradational red clay soils formed on dolerite intrusions	E[2]	0.07
Sd	Skardon	Recent estuarine deposites under mangroves	H, M[2], ER[2], E[2], LR[2]	0.91
Se	Shea	Moderately deep Gradational red massive soils formed on adamellite	E[2]	0.20
Sp	Scorpion	Deep Gradational or Uniform yellow massive soil with ferruginous or manganiferous nodules formed on laterised remnants of Bulimba Formation	H, M[2], LR[2]	1.73
Ss	Somerset	Very deep Uniform coastal sands deposited on laterite and other surfaces	H	0.26
SsFp	Somerset Ferric Phase	As for Ss, with abundant ferric nodules	H[2]	0.01
St	Strath	Deep Unifrom red massive sands formed on residual sands	ER[2]	0.48
Sv	Silver	Deep Duplex sodic soils formed on colluvial plains derived from acid plutonic hillslopes	E, LR	1.52
Tr	Therese	Deep Uniform red massive sands formed on sandstone	H[2], LR[2]	0.81
Tz	Tozer	Deep Duplex non-sodic brown soils formed on acid volcanic hillslopes	LR[2]	0.02
Vc	Victor	Very deep Duplex non-sodic red soils over saline horizons, formed on terraces of major streams and rivers associated with Hodgkinson Formation	HF	0.27
Vy	Vrilya	Very deep Uniform sands with minimal profile development, formed in foredunes	E, ER, H, M	0.10
Wk	Wakooka	Deep bleached Gradational non-sodic yellow soils formed on alluvial plains derived from greywacke and slate	HF[2]	0.33
Wl	Wheeler	Deep bleached Gradational mottled grey massive soils formed on alluvia within the Rolling Downs Group	B	0.08
Wm	Weymouth	Deep Gradational mottled yellow massive soils on colluvial fans from acid plutonic hillslopes	LR[2]	0.04
Wp	Weipa	Deep Gradational or Uniform red massive soil with aluminous concretions	ER, H, B	3.01
Wu	Witchura	Moderately deep Gradational or Uniform red massive soils with ferruginous nodules	ER	0.46
WuYv	Witchura Yellow Variant	As for Wu, but yellow	ER[2]	0.11
Ym	Yam	Deep Gradational yellow massive soils on colluvial fans developed from acid plutonic hillslopes	LR[2]	0.03
Misc.	Miscellaneous land	Urban, river channels		0.37

1 See Section 3.3

2 Indicates soils that are not directly portrayed in a Landscape but are associated with it.

3 1% = approx. 132 500 ha
5% = approx. 662 500 ha

3.2.1 Soils on acid igneous rocks (adamellites and granites)

These soils are often coarse textured in nature, and vary according to landscape position. The hillslope soils are generally shallower and reflect better drainage than those found on the extensive plains and pediments associated with the igneous hills.

(a) Sedentary soils on plains and hillslopes

Altanmoui is a Uniform brown coarse sand restricted to boulder formations such as Cape Melville and the Altanmoui Ranges. Classified as a Paralithic Orthic Tenosol, it has large quantities of coarse fragments throughout the profile. It consists of an extensive A1 overlying B1 and B2 horizons. Although parent rock was not reached in the only site described, it is expected to be at < 1.0 m depth.

Drop is extensively distributed along the Great Escarpment and other hillslopes of adamellite. Its texture can vary considerably and its *in situ* nature is reflected by an often indistinguishable boundary between the B3 horizon and weathered parent material. *Drop* is either a Yellow Dermosol or Yellow or Brown Kandosol, with texture in the B2 ranging from coarse sandy clay loam to medium clay. The A1 and bleached A2 horizons are light to medium textured. Coarse fragments are present throughout the profile.

Dixie also has an extensive distribution within the acid igneous country. However, where *Drop* is generally confined to the steeper hillslopes, the Bleached-Orthic Tenosol *Dixie,* is more prevalent on undulating rises and plains and dissected country to the west of the Great Escarpment. Its Uniform coarse sandy profile is heavily bleached and often reflects evidence of localised transportation. In some areas, a gravel layer over rock may be encountered at < 1.0 m depth.

Henderson is a Red Chromosol principally restricted to adamellites in the Lockhart River area. The profile consists of light textured A1 and A2 horizons over a variable A3/B1, below which is a clay B2. The B3 that grades to rock has a texture range of clay loam to light medium clay. *Henderson* is usually found under closed forest.

Orchid is very restricted in occurrence. The deep well structured soil has only been described on hillslopes in the "Wolverton area". It is suggested this Red Dermosol is derived from localised occurrences of a more basic igneous rock. The profile is generally high in clay throughout, and lacks A2 or A3 horizons. A B3 is found at close to 1.0 m, and parent material is probably encountered by 1.5-2.0 m.

Pinnacle occurs in similar areas to *Dixie* but is not very widespread. The pale bleached profile of this Grey Kandosol suggests it is well leached, however it has retained a certain amount of clay. The B2 possess a coarse sandy clay loam texture. It may be that *Pinnacle* is a leached version of *Drop.* The soil is vegetated by *Eucalyptus tetrodonta* woodlands.

Quarantine is a Grey Sodosol commonly found in footslope or poorly drained areas. In most cases it appears to have developed *in situ*, no doubt with some colluvial influence, but in a few areas it appears that it has been derived from dominantly colluvial material. The vegetation reflects the poor drainage associated with this soil

and *Melaleuca foliolosa* is a common indicator species. Erosion can be a hazard. The salinity risk associated with this soil is unclear. *Drop* is commonly found upslope of *Quarantine*, while *Dixie* and *Silver* are often associated on adjacent plains.

Shea is a moderately deep Red Kandosol located in certain areas at the foot of the Great Escarpment. A bleached A2 horizon indicates a certain amount of leaching. The hard rock found at 1.0 m probably prevents deep drainage during the wet season, allowing fluctuating water tables to influence the profile morphology. As with nearly all other Red Kandosols on the Peninsula, *E. tetrodonta* woodland are the dominant vegetation.

(b) Associated colluvial plains and pediments

Attack, ***Geike, Weymouth*** and ***Yam*** are all Yellow or Grey Kandosols formed on colluvia/alluvia derived from large acid igneous masses. Slopes are generally low and drainage poor. The profiles vary from yellow (*Attack, Weymouth, Yam*) to pale (*Geike)* and are typically mottled. Bleached horizons are present in *Yam, Weymouth, Attack* and occasionally *Geike*. Surface textures are light, grading to clay loam/light clay B horizons except for *Weymouth.* Both *Attack* and *Weymouth* are coarse sandy. Vegetation on these soils ranges from heaths to *Eucalyptus tetrodonta* woodlands. *Weymouth* and *Yam* are restricted to an area west of Iron Range while *Attack* and *Geike* are found between Iron Range and Coen.

Silver occurs extensively on the colluvial plains between the Great Escarpment and the east coast of the Peninsula, from Lockhart River to Musgrave. The profile of this Redoxic Hydrosol shows evidence of a long history of leaching, with clay content in the bleached coarse sand A horizons very low. The B horizon is not encountered until at least 0.55 m and is usually preceded by an A3/B1 horizon that contains lenses of clay. The apparent variation of texture in the sodic clay B2 in the description in Appendix 1 may merely reflect variation in depth to the B2 proper. Upon exposure, the B2 horizon hardens to a very strong consistency. Although the poor drainage is reflected in the *Melaleuca* spp. dominant vegetation, it is suspected lateral movement of water through the soil could be significant. *Quarantine* and *Livis* are commonly associated with *Silver*. In certain areas, the colluvial/alluvial fans on which *Silver* exists have overlain coastal deposits, eg. *Marina.*

3.2.2 Soils on acid volcanic rocks (rhyolite)

Occurrences of these soils are limited to two geological provinces within the Peninsula: the Cape York-Oriomo Inlier at the tip, and the northern section of the Coen Inlier. The soils are typically shallow and rocky.

(a) Sedentary soils on hillslopes

Del is located principally in the area to the north west of Lockhart River but is also suspected to exist on the islands in the Prince of Wales Group. It is a mottled Grey Sodosol located in poorly drained footslopes and is usually subdominant to other soils within UMA's. Vegetation is dominated by *Melaleuca viridiflora* woodlands.

Eborac is a Bleached-Leptic Tenosol found on rocky hillslopes. It is more extensive than most of the soils within this group, as the rolling to steep hillslopes on which it

occurs is one of the most common landforms of the volcanics. The soil displays evidence of profile development, including a bleached A2 horizon.

Galloway, a moderately deep Red Kandosol of a variable nature, is found on the Torres Straits volcanics. Given the small number of sites for this soil (and the other soils within this group) it is difficult to speculate whether variation of the upper horizons is a common or restricted feature. Vegetation on this soil is usually open forests or woodlands, in comparison to the sparse shrubby vegetation found on *Del* and *Eborac*.

Tozer is a non-sodic Red or Brown Chromosol associated with closed forests on the volcanics in the high rainfall Iron Range area. Slopes are steep and as with *Galloway,* the significant variation apparent in the upper soil may merely be a function of the small number of sites.

(b) Associated colluvial/alluvial fans

Gap is a Dermosolic Oxyaquic Hydrosol found on colluvia/alluvia associated with acid volcanics in the northern Coen Inlier. It grades from grey A1, A2 horizons to a yellow-grey A3 and then multiple yellow B1 and B2 horizons. The soil is vegetated by heaths, and despite the high rainfall environment and relatively flat landscape, it is not mottled.

3.2.3 Soils on intermediate and basic volcanic rocks (dolerite and basalt)

The soils derived from basalt are essentially restricted to the south-east of the Peninsula in the Lakelands-Mt Webb-Shiptons Flat area. They are used for intensive agriculture and cropping.

Bull is a Brown Dermosol (Xanthozem) associated with imperfectly drained areas of basalt. It is mottled and contains manganiferous or ferro-manganiferous nodules throughout the profile. Colour in the B2 varies considerably from red-brown to brown or yellow. The soil is cropped in the Lakeland Downs area.

Burn is a Red Ferrosol extensively cropped on the flatter lava flows at Lakeland Downs. Ferro-manganiferous or manganiferous nodules are present throughout the red profile. The soil is well structured and has a high clay content, although field textures only range from light clay to light medium clay. In upper slope areas, particularly around vents, considerable quantities of coarse fragments are visible and the depth of the profile decreases.

Endeavour is another Red Ferrosol very similar to *Burn*, the main difference being a lack of segregations. Endeavour is located in the Mt Webb-Shiptons flat area on Piebald Basalt, and is usually vegetated by closed forest.

Norman and ***Norman Shallow Phase*** are Black or Brown Vertosols found in drainage depressions on the McLean Basalt. The formation of Vertosols in poorly drained areas on basalt is well documented (Beckman *et al.,* 1974). Textures are medium-heavy clay to heavy clay and lenticular structure is prevalent. Rock is usually encountered by 1.20 m and carbonate is often found in the B3/BC horizon. Field pH

increases with depth, verging on alkaline in the lowest horizons. Gilgai are prevalent on the self mulching surface. *Norman Shallow Phase* is only 0.4 m deep and has a large number of basaltic coarse fragments throughout the profile. Neither of these soils are cultivated due to the small size of their occurrences and the unfavourable landform in which they develop. Natural vegetation on this soil and also *Bull* and *Burn,* is *Eucalyptus leptophleba, E. platyphylla or E. erythrophloia* woodlands.

Raymond is the only soil described on intermediate volcanic rocks on the Peninsula. Occurrences of this Red Dermosol are small and scattered, mostly in the southern Coen Inlier, and Northern Yambo Inlier, but also in the Northern Coen Inlier. Landform varies from plains to rolling low hills. The soil grades from a dark sandy clay loam A1 to a red A2 of similar texture. Below this lies red, structured light clay to light medium clay B horizons. Rock is encountered at 1.00 m in the only site describing this soil. There is no evidence of a B3 horizon. Vegetation is usually woodlands dominated by *Eucalyptus hylandii* and *E. tetrodonta.*

3.2.4 Soils on metamorphic rocks

This group of soils has a primary division based on gemorphology, and a second division according to type of metamorphic rock. The soils of the Coen Inlier and Yambo Inlier are formed on medium grade metamorphics such as schist, gneiss, greenstone or quartzite, while those of the Hodgkinson and Chillagoe Formations are formed on lower grade metamorphics such as greywacke and slate. Nearly all soils are characterised by a depth of <1.5 m and the presence of coarse fragments within the profile.

(a) Sedentary soils on plains and hillslopes

Coen and Yambo Inliers

Crosbie is a Red Dermosol formed on patches of greenstone within the Coen Inlier. Its distribution is scattered and units are often (although not always) small. Except for the difference in texture profile, it is similar to *Raymond.* The shallow depth (0.8 m) of the profile and the soils patchy occurrence are limitations to its use.

Chlory is a common soil in the southern section of the Coen Inlier, often associated with *Poll* and *Gail.* The profile of this Brown Sodosol is typically only 0.6 m deep and coarse fragments are a feature throughout. It is usually formed on undulating rises or low hills of schists. The apparent sodicity of the B2 horizon varies.

Gail is frequently found on the steeper slopes of the Coen Inlier. It is shallow (0.2 m) and light textured, although heavy enough in the B horizon for it to be classified as a Kandosol. The dark surface overlies a sporadically bleached mottled A2 which in turn overlies a yellow-brown B2/B3 on rock. Coarse fragments are present in low percentages.

Haven is a moderately deep Yellow or Brown Kandosol with ferruginous nodules throughout the profile. In nature it has many similarities with *Scorpion.* Difficulty in digging the soil prevented the authors from reaching the C horizon but it is suspected to be at <1.5 m. *Haven* is found adjacent to outcrops of *Raymond* in the Yambo Inlier. It is also widespread in the southern and south-western sections of the Coen Inlier.

Petalostigma banksii is a feature of the shrub layer in the *Eucalyptus tetrodonta* or *E. hylandii* woodlands.

Lukin is a Red Chromosol found under *Eucalyptus tetrodonta* woodlands and is associated with soils such as *Gail* and *Pack*. *Lukin* only occurs in narrow bands, usually <20 m width that are of variable length. It is apparently associated with minor exposure of a more basic? lithology perhaps greenstone, within the Coen Metamorphics. The profile exhibits a distinct texture contrast, the A horizons with textures of loamy sand to sandy loam, over B horizons of light clay to medium heavy clay.

Lamond is found on hillslopes within the Sefton Metamorphics. The soil is a Brown Dermosol with a deep structured A horizon, overlying yellow-brown structured light clay to light medium clay B horizons. Both coarse fragments and ferro-manganiferous nodules may be present in the B horizon. The distribution of the soil is limited to hillslopes under closed forest in the Iron Range area.

Pack is similar to *Gail* and the two soils are often concurrent throughout the Coen and Yambo Inliers. The dark A horizon of this Red or Brown Kandosol overlies B horizons of variable colour. Coarse fragments are present in the B2/B3 and occasionally present in the A and B1 horizons. Parent rock is encountered by 0.3 m. Vegetation is similar to most soils on the Coen and Yambo Inliers, ie. *Eucalyptus hylandii* or *E. tetrodonta* woodlands.

Poll is essentially a Lithic Orthic Tenosol, frequently found in areas of contacts between acid igneous and metamorphics rocks. The very shallow profile is dominated by quartz coarse fragments. Vegetation is often sparser than on other soils of the Inliers.

Packsaddle is found in drainage depressions within the Holroyd Metamorphics. It is only a shallow (0.4 m) Brown Dermosol and occurrences are small in size, frequently associated with *Crosbie*, *Lukin, Chlory* and *Pack*. The dark surface is well structured, despite only having a loam texture. Clay content increases with depth to a maximum in the medium clay B3 horizon. Although not described, heavier textured variants of this soil were noted in the field.

Hodgkinson and Chillagoe Formations

The Hodgkinson Formation dominates the south-east of the Peninsula and is represented by a heavily dissected landscape of low hills and hills based on greywacke and slate. Extensive colluvial plains and pediments are often associated. The Chillagoe Formation exists as a narrow band of rocks between the Yambo Inlier and the western margin of the Hodgkinson Formation.

Cook is a moderately deep Red Chromosol found in scattered small occurrences throughout the Hodgkinson Formation. Coarse fragments are present throughout the profile and the medium clay B2 overlies rock at between 0.75 and 1.0 m. It is generally associated with *Jeannie* but may also be associated with *Rule*. Two of the larger occurrences of *Cook* are found on areas of a very hard, dark meta-siltstone, that apparently has a higher iron content than the surrounding greywackes and slates.

Eykin is a Grey Sodosol found on landforms ranging from dissected undulating rises to rolling hills. It is most common under *Eucalyptus persistens* communities in the hills south of Lakeland Downs. A light textured A1 and bleached A2 overly sodic structured clay B horizons that grade into weathered rock before 1.0 m. Fragments of slate are common throughout the profile. *Jeannie* and *Hodge* are the most commonly associated soils.

Fairlight is a moderately deep Red Dermosol restricted to the limestone and associated rocks of the Chillagoe Formation. The Gradational profile has strong fine structure throughout and reaches a maximum of a medium clay in the B2. A yellow-brown B3 clearly overlies rock at between 0.55 and 0.90 m. Vegetation on the undulating rises to rolling hills is commonly *Eucalyptus cullenii* or *E. crebra* woodlands or open woodlands. *Fairlight* appears to be consistent with the soil described in Land Unit 7B of Godwin (1991).

Hodge is a very shallow to shallow soil in character with *Poll, Eborac* and *Camp*. It is commonly associated with *Jeannie* and less commonly with *Eykin* and *Fairlight.* The texture of the profile varies considerably, hence its classification as either a Tenosol or Kandosol. The dark or grey A1 overlies a bleached A2 that either directly overlies rock or frequently grades to a brown B3 horizon which then overlies rock. Coarse fragments are a feature of the profile. Vegetation is similar to that found on *Eykin.*

Jeannie is the most widespread soil on the Hodgkinson Formation. Its morphology varies and it may be classified as a Brown Kandosol or a Yellow Dermosol. The texture of the A1 ranges from a sandy loam to a light clay. The similarly textured A2 is occasionally bleached. Red mottles are a feature of the B2 but not the B3 which grades into weathered parent material. In many instances the lower boundary of the B3 is very unclear. Coarse fragments are found throughout the profile. Vegetation varies, but is invariably a mixture of *Eucalyptus* species in woodlands or open woodlands.

Rule is found in the high rainfall closed forest areas of the south-east, from Cooktown to south of 16°S . A Red Dermosol, it has a Gradational or Uniform texture trend and is well structured throughout. Parent material was never reached when describing this soil, although on a number of occasions, what was apparently a B3 was described. The landform is typically undulating to steep. This soil is apparently similar to the *Galmara* soil described by Murtha (1986) for the Wet Tropical Coast.

(b) Associated colluvial plains and pediments

Two soils, both derived from Hodgkinson Formation, comprise this subgroup. Both are typically found in footslopes and associated downslope colluvia.

Gibson is a texture contrast soil with sodic mottled grey or yellow B2 horizons. The surface horizons, including the bleached A2 are massive and no heavier in texture than sandy loam. A massive or structured sandy clay loam to light clay A3/B1 is present between the A2 and B2. Soil reaction trend varies from acid to alkaline. In some areas, drainage maybe poor enough for the soil to be classified as a Hydrosol rather than a Sodosol. Vegetation on this soil reflects the poor drainage. Although,

Eucalyptus chlorophylla E. microtheca or *E. acroleuca* dominate the upper strata, *Melaleuca viridiflora* is common in the lower strata. *Melaleuca foliolosa* is a good indicator species.

Kingjack shows similar morphological characteristics to *Gibson* in terms of colour and structure, but classifies as a Yellow Dermosol. It is non-sodic and more commonly Gradational than Duplex. It surface field textures are siltier than *Gibson.* The bleached A2 horizon overlies a yellow or yellow-grey B2 that may occasionally contain ferruginous nodules. Vegetation understorey is often similar to *Gibson,* but *Eucalyptus platyphylla* and *E. leptophleba* are the most common upper strata. *Melaleuca foliolosa* is generally absent. *Kingjack* and *Gibson* are commonly concurrent and appear to integrade. It is often difficult to delineate boundaries between the two soils.

3.2.5 Soils of the Rolling Downs Group and lateritised Bulimba Formation

The soils of this group are divided into two distinct sub-groups, the first of which consists of highly weathered soils found on an older (and higher) surface while the second consists of younger less weathered soils found on the underlying sediments. There is a continuum between many of the soils, particularly those in subgroup (b). The nature of all soils reflect both the nature of their parent material and the climatic conditions under which they were formed. Segregations of pedogenic origin are a key feature, with iron and aluminium compounds more prevalent in the better drained more weathered soils (subgroup a) and manganese dominant segregations more prevalent in the less weathered, less permeable or less well-drained soils (subgroup b).

(a) Sedentary soils on deeply weathered plateaus and remnants
These soils are located in the uppermost part of the Rolling Downs Landscape (Figure 10) on highly weathered sandstone surfaces such as the Aurukun surface. The soils are all deep or very deep Kandosols with high concentrations of segregations in the subsoil and often the surface horizons.

Andoom is a very deep Bauxitic Yellow Kandosol prevalent under *Eucalyptus tetrodonta* woodlands and tall woodlands on the Weipa Plateau. It invariably occurs in conjunction with *Weipa* and *Mapoon*, but is usually sub-dominant to *Weipa.* It occurs in the slightly less well-drained areas, eg. margins of drainage lines. The concentration of aluminous concretions is variable and lower in the surface than the yellow subsoil.

Bertie is a Red Kandosol common to remnants of the weathered surfaces rather than the plateaus. These remnants are lower in the landscape than the plateaus and are usually present as ridges, vegetated by *Eucalyptus tetrodonta* woodlands and tall woodlands with *E. cullenni* common. The segregations prevalent throughout this soil are ferruginous in nature but closer to the Aurukun surface there may be bauxitic concretions also present. Surface colour and texture vary, but with depth the range of characteristics tends to decrease.

Rokeby is restricted to ferruginised remnant surfaces west of Coen. Only 2 sites characterise the soil and they differ greatly in A3/B1 colour. The soil is a Red or

Yellow Kandosol that contains a high percentage of coarse fragments. These coarse fragments are a heavily ferruginised fine grained sediment such as siltstone. The nature of the soil makes description of the profile difficult, as disturbance of the coarse fragments can influence the apparent colour of the soil. Vegetation is *Eucalyptus hylandii* or *E. tetrodonta* woodlands.

Scorpion is a Yellow Kandosol and is essentially the less well-drained counterpart of *Bertie*. It occurs in the same areas and is usually found on the edges of ridges. *Scorpion* is usually sub-dominant to *Bertie*. The A1 and paler A2 vary in texture from loamy fine sand to fine sandy clay loam. Texture in the A3/B1 increases slightly and the colour trends more towards yellow-brown. The B2 horizon is typically yellow-brown or yellow with a texture between fine sandy clay loam and clay loam heavy. As with *Bertie*, ferruginous nodules are a feature of the profile, but *Scorpion* may also contain ferro-mangniferous or manganiferous nodules. Soil reaction is acid.

Weipa is the dominant bauxitic soil of the Aurukun Surface. A Red Kandosol, it contains aluminous concretions throughout, but may also contain some ferruginous concretions. As indicated, it exists in conjunction with *Andoom*. Surface colour varies, probably reflecting differing levels of organic matter influence. With depth, colour grades towards red or red-brown. Textures vary little throughout the profile, and Uniform medium texture profiles are not uncommon.

(b) Sedentary soils on level plains to undulating rises on weathered rock

The soils of this sub-group exist in an erosional landscape, in comparison to the relict landscape of the previous subgroup. Figure 10 illustrates the relationship between the two surfaces and their respective lithologies. The fine grained and argillaceous sediment of the Rolling Downs Group give rise to high clay content soils that exist in an apparent weathering sequence from *Picanninny* to *Lydia*.

Batavia is a Yellow or Brown Dermosol that is commonly Bleached-Ferric, Ferric or Mottled. A hardsetting, medium textured, and commonly mottled dark or grey A1 overlies an occasionally conspicuously bleached A2 with similar textures. The A3 horizon tends towards yellow-brown or yellow with an increase in texture. The B1 horizon displays similar characteristics to the A3, but sub-angular blocky or polyhedral structure becomes evident. The B2 horizons extend to an average of 0.95 m and are yellow-brown or yellow, with clay content increasing with depth. A maximum of medium heavy clay is reached in the B22. Below the B2 lies a red mottled grey or pale medium heavy to heavy clay B3 that frequently possesses lenticular structure. The contrast between the B2 and B3 horizons is quite obvious in the field. Field pH decreases in the B3. It is suggested that the B3 represents a pallid zone in what is essentially a lateritic profile. Ferruginous to manganiferous nodules are present throughout the soil in percentages ranging from <2 to >50. Vegetation on this soil can vary but is usually a form of *Eucalyptus tetrodonta* or *E. leptophleba* woodland. The presence of species such as *Melaleuca viridiflora* and *Petalostigma banksii* in the understorey appears to be a function of drainage and content of segregations. *Batavia* is one of the most common soils on the Peninsula and is extensively distributed wherever Rolling Down Group sediments are exposed. The two most commonly associated soils are *Myall* and *Lydia*, although it frequently adjoins ridges of *Bertie* and *Scorpion*.

Batavia Rocky Phase is a Uniform fine textured rocky soil restricted to ridges in the "Wolverton" area, just north of the Archer River. Few, increasing to many angular platy siltstone fragments are present throughout the profile. It is suggested that these fine grained ridges are not as heavily lateritised as the arkose sediments of the Aurukun Surface. The ridges west of Coen on which the soil *Rokeby* is found could be regarded as comtemporaneous with *Batavia Rocky Phase*.

Lydia is a Grey Dermosol or Redoxic Hydrosol that can, in concept, be considered as a less well-drained leached version of *Batavia*. The two soils are often found in conjunction, but with *Lydia* always showing evidence of less drainage. In some cases, the land surface does not indicate any drainage variation. Differences in deep drainage, perhaps related to the underlying parent material may be the cause. The soil is generally grey throughout, although a yellow-brown colour is not uncommon in the bleached A2, the B1 and B21 horizons. Texture trends are similar to those of *Batavia* although the A1 and A2 may be silty. Segregations are less common in *Lydia*, occasionally present in the A2, B1 and B21 horizons. The content of segregations in the B22 varies, and they tend to be more manganiferous than ferruginous. Vegetation reflects the differing drainage conditions. *Eucalyptus clarksoniana, E. novoguinensis* or *E. polycarpa* woodlands or open woodlands are the norm. *Melaleuca viridiflora* is a common understorey species.

Lydia Rocky Phase contains many ferruginised siltstone fragments throughout the profile. It is found in poorly drained areas of leached Rolling Downs Group sediments in the south of the Peninsula.

Myall lies between *Picanninny* and *Batavia* in the suggested weathering sequence. It is commonly found with both soils and in some areas the intermingling of either *Myall* and *Batavia* or *Myall* and *Picanninny* is such that they cannot be mapped separately. In these cases they often appear to grade into each other eg. a *Myall* with an A2 horizon will be found. *Myall* is a Yellow or Brown Dermosol as is *Batavia*, but whereas the former is a Xanthozem according to Stace *et al.* (1968) the latter is a Yellow Podzolic. *Myall* is characterised by a hardsetting surface with normal gilgai and a Uniform fine or Gradational texture profile dominated by yellow or brown colours. The profile is structured and mottled throughout. The surface of the soil may be dark or grey and quite often has faint orange mottles. The A3 and B1 differ mostly in texture, the latter ranging from light clay to medium clay. The B2 horizons increase in texture and are yellow or yellow-brown with red a common mottle colour. The range of quantity of ferruginous or manganiferous nodules increases in the B2 horizons in comparison to the upper horizons. The B23 horizon is variable, but many show similar properties to the B3 horizon of *Batavia*. When associated with *Picanninny*, *Myall* is usually vegetated by *Eucalyptus chlorophylla* or *E. leptophleba* woodlands. On occassion though, particularly when heavily gilgaied and *Batavia* is concurrent, *Myall* may be vegetated by *Melaleuca viridiflora* woodlands.

Picanninny is a Brown or Grey Vertosol that is suspected to be the youngest of the soils on the Rolling Downs Group. It is often found in areas of apparently recent exposure, eg. footslopes of the Embley Range, or parallel to creeks. Vegetation on this soil is predominantly grasslands with scattered *Eucalyptus leptophleba, E. chlorophylla* or *E. papuana.* Slopes are typically <3% but on occasions may be 3-

10%. Normal gilgai are common on the cracking hardsetting surface. The A1 horizon is dark or grey and heavy textured. The B1 tends to be grey or brown in colour. Mottles and manganiferous nodules are a feature of both these and subsequent horizons. The B2 horizons are medium to heavy clays with lenticular structure and are grey or yellow-grey in colour. Field pH increases with depth.

3.2.6 Soils on sandstone

These soils are derived from a range of arkose sediments such as Helby Beds, Gilbert River Formation, Bulimba Formation and Dalrymple Sandstone. They are all sandy soils and range in depth and rock content. Shallow rocky soils are a feature of dissected sandstone hills and plateaus while deep rock free soils are most common on undulating landscapes of low relief. A catena involving *Harmer, Jardine* and *Grevil* is a feature of the northern sandstones in the Heathlands area (Figure 9).

(a) Sedentary soils on plains and hillslopes

Audaer is a moderately deep Mottled Yellow Kandosol found on hillslopes in the south-east of the Peninsula. Of Uniform medium texture, it clearly overlies rock. The surface is dark or brown while the A2 is grey or brown. Both have a texture range of fine sandy clay loam to clay loam. The clay loam B1 varies in colour and has a small percentage of ferro-manganiferous nodules. The red mottled yellow clay loam B2 is massive and also contains a small number of ferro-manganiferous nodules. Hillsides of *Audaer* are typically covered in *Eucalyptus tetrodonta* woodlands.

Camp is a very shallow Bleached-Leptic Tenosol common to dissected sandstone hillcrests, hillslopes and plateaux (caps). The thin grey or brown light textured surface overlies a similarly textured bleached A2 horizon on rock or weathered rock. It is covered in a variety of vegetation, but typically *Eucalyptus hylandii* and *E. tetrodonta* woodlands.

Camp Red Variant is restricted to the sandstone hills of the Bathurst Ranges. It is similar to *Camp* but lacks an A2. The B horizon is red-brown in colour.

Deighton is a widespread soil, particularly in the southern half of the Peninsula. It has the distinction of belonging to both Groups 6 and 7. Given that Group 7 soils are derived from what was once Group 6 material, it is not surprising. However, for other soils, eg. Red Kandosols (*Kimba* and *Emma*) a discernible difference could be found between those derived directly from sandstone, and those derived from remnant sands. In some areas, the boundary between the two groups is unclear. *Deighton* is an Orthic or Bleached Orthic Tenosol with six recognisable horizons in the first 1-2 m. The surface is dark or grey, the colour often being a reflection of recent fire history. The often bleached A2 has a texture of sand to loamy sand. Both the A1 and A2 may contain small quantities of quartz coarse fragments. A3 and B1 horizons are similarly coloured (usually yellow or yellow-brown) and textured sand to sandy loam. The B1 grades into a yellow-brown, yellow or yellow-grey B2 of similar texture, that may contain a small number of ferruginous nodules. Like most of the soils of Groups 6 and 7, *Deighton* is vegetated by *Eucalyptus tetrodonta* woodlands.

Deighton Rocky Phase contains quartz coarse fragments throughout the profile. This soil is found in areas more closely associated with soils of Group 7, in particular the southern edge of the Coen Inlier where there is a variable layer of residual sand overlying a granitic surface.

Deighton Coarse Phase is coarse sandy throughout. Its sole occurrence is in the Running Creek area east of Ebagoola.
Emma is a Red Kandosol found on the sandstone in both the north and south of the Peninsula. A dark or grey-brown sand to fine sandy loam A1 overlies A2 and A3 horizons that progressively get redder. Textures in the A2 are light but the A3 may increase to a sandy clay loam as can the red B1 horizon. The B2 horizons are very red (eg. 10R 3/6) and may occasionally be mottled. Textures range from light sandy clay loam to clay loam. This soil has many favourable characteristics, but it is inherently infertile.

Ford is a Grey Kandosol commonly found on the edges of sandstone scarps, particularly where the sandstone has been silicified, eg. in the Desert area. The soil is characterised by a grey upper profile, and a conspicuously bleached A32 and B1. No A2 horizon is present. Surface textures are loamy sand to sandy loam, grading to clay loam in the B1 and light clay in the B2. The profile is massive and has significant quantities of angular coarse fragments throughout. Vegetation is usually *Eucalyptus hylandii* or *E. tetrodonta* woodlands; *E. cullennii* or *E. crebra* may also be present.

Harmer is a Yellow Kandosol often found in conjunction with *Emma*, but even more commonly found with *Jardine* and *Grevil* on the northern sandstones. Figure 13 indicates that it is usually found on the upper slopes of undulating rises vegetated with heath and *Eucalyptus tetrodonta* woodlands. Texture throughout the profile is similar to that of its red counterpart *Emma*. A dark or grey light textured A1 overlies a bleached A2 which in turn overlies a yellow-brown, yellow or pale A3 with a texture range of loamy sand to sandy loam. The B1 has similar properties to the A3 but may be slightly heavier textured. The B2 horizons are yellow or pale-yellow light sandy clay loams to clay loams. Mottles are present in the lower B2 and are occasionally evident in the B21. The soil is quite infertile.

Isabella is a Red Kandosol differing from *Emma* by the intensity of redness. It is derived from sandstone, but has been influenced by basaltic vents, in the area north-west of Cooktown. Texture trend is similar to that of *Emma*. The light textured surface is dark or red (2.5YR 2/2 or 2/4) while the A2/A3 is red. By 0.3 m hues are 7.5R or 10R with a value of 3 in comparison to *Emma* which is only 2.5YR or 5 YR with a value of 4. The B2 is a red (7.5R 3/6) sandy clay loam grading to clay loam sandy. Vegetation is *Eucalyptus hylandii* or *E. tetrodonta* woodlands or closed forests.

Jardine is a Bleached-Orthic Tenosol usually located downslope of *Harmer* in the Heathlands area (Figure 9). The profile is well leached and drainage is imperfect at best. Texture within the profile is loamy sand throughout. A grey single grain surface overlies a similar A21 which in turn overlies a bleached A22. A yellow-brown, pale yellow or yellow B1 is found between 0.30 and 0.70 m below which exists a pale or yellow mottled B2. The soil is vegetated by open-heaths.

Therese is an Orthic Tenosol and occupies better drained positions in the landscape, often in dissected, low hills and hills of sandstone vegetated with *Eucalyptus tetrodonta*. Surface colour varies from dark to grey while the A2 varies from red-brown to yellow-brown. A transitional horizon (A3/B1) exists between the A2 and the red or red-brown B2. Textures range from sand to loamy sand in the first three horizons, to loamy sand to sandy loam in the B2.

(b) Drainage depressions and associated alluvia

Grevil, as mentioned, exists in the lowest part of the Heathlands Landscape. Poor drainage in footslope or alluvial positions has led to development of this Semiaquic Podosol. A grey sand to loamy sand A1 horizon of up to 0.2 m depth overlies a conspicuously bleached A2 horizon. Below this lies a variable B2, usually a B2hs or B2h. The strength of the B2 varies, from weak to very firm. Vegetation is open heath and waterlogging tolerant species are common. The largest expanse of *Grevil* lies along the Jardine River.

Grevil Coarse Phase is simply a coarse sandy version of *Grevil*, found east of Iron Range.

3.2.7 Soils on deep remnant sands of a former sandstone surface

As indicated, these soils are derived from residual sands that are relicts of previous arkosic surfaces. The soils have many features similar to the soils of Group 6 and in the case of *Deighton*, are indistinguishable. As with Group 6, the soils are divided into two groups based on landform. The soils are all relatively infertile, with low ECEC's and except for *Citri* and *Hann* are Tenosols or Kandosols. A catena involving *Kimba, Clark, Hann* and *Citri* exists in a large area in the Central West of the Peninsula (Figure 13). All soils except *Hann, Citri* and to a lesser extent *Ginger* are vegetated with *Eucalyptus tetrodonta* woodlands or tall woodlands.

(a) Plains and hillslopes

Brom is a Mottled or Bleached-Mottled Grey Kandosol found mostly in areas in the eastern extremities of the Kendall Surface, adjacent to the Coen Inlier. The soil surface is dark or grey, ranging from sandy loam to fine sandy clay loam. It overlies a frequently conspicuously bleached A2 horizon that grades to a mottled pale or yellow-brown A3 with a texture of light sandy clay loam to clay loam. A mottled pale B1 grades to a B2 of similar colour and texture (sandy clay loam to clay loam). The B2 may occasionally contain ferruginous or manganiferous nodules. *Brom* evidently evolves in areas of poorer drainage, but has not been weathered enough to lose its clay content.

Brom Coarse Phase is a feature of residual sands associated with streams on the Normanby Plain in the "Violet Vale"-"Lilyvale area". It is likely that the coarse sandy textures are a function of the influence of the acid igneous block to the west.

Clark occupies the largest area of any soil on CYP. It is a Yellow Kandosol, with a dominantly dark, but possibly grey (depending on fire) light textured and often structureless surface horizon overlyiing a bleached A2. This in turn grades to a

yellow-brown, yellow-grey or yellow occasionally mottled loamy sand to light sandy clay loam A3. A B1 with similar properties is also present. Ferruginous or manganiferous nodules may be present in either horizon. The B2 horizons are yellow or pale-yellow and often mottled. Ferruginous or manganiferous nodules may be present and in greater quantities than in the A3 and B1. The presence of nodules is generally a feature of landscape position and localised drainage, with occurrences of *Clark* in lower slope areas more likely to contain nodules within the top 1.0 m than upper slope occurrences. Quartz coarse fragments of a small size are occasionally present in either part or all of the profile. As indicated in Figure 13, *Clark* frequently occurs downslope of *Kimba*, but upslope of *Hann*.

Clark Coarse Phase is only a minor soil and as with *Brom Coarse Phase*, its coarse sandy nature may be a function of influence by material derived from acid igneous rocks.

Kool is a Red Kandosol with a Uniform medium texture profile. A dark sandy clay loam to clay loam A1 grades to a red-brown, red or dark A3 horizon. Occasionally a grey or yellow-brown A2 horizon is present. A red clay loam B1 grades to similar B2 horizons. Coarse fragments or segregations are absent from the profile. *Kool* is widespread, often sub-dominant to *Kimba*, although a large area of the soil is present east of Cape Keer Weer. This occurrence is located on a plateau contemporary with the Aurukun surface but it has little evidence of segregations except in drainage lines and cuttings. Given that both *Andoom* and *Weipa* possess Uniform medium texture profiles, it is not surprising to find a soil such as *Kool* in this location.

Kimba is another very common Red Kandosol in the southern half of the Peninsula. It is comparable to *Emma* and invariably occurs in association with *Clark* and *Strath*. Its prevalence decreases towards the west, where *Clark* is more dominant. In terms of texture trend, *Kimba* is similar to *Clark*. The A1 varies considerably in colour but generally reflects organic matter accumulation. The loamy sand or sandy loam is usually loose and structureless, as is the A2 horizon. A significant colour and texture change is often observable in the red-brown or red A3 and B1 horizons where texture grades from loamy sand to light sandy clay loam in the A3 to sandy loam to sandy clay loam in the B1. The B2 horizons are red and grade from light sandy clay loam to clay loam sandy. Mottles, segregations and coarse fragments are generally absent from the profile. Landform typically varies from gently undulating plains to undulating rises.

Kimba Rocky Phase is restricted to an area along the Palmer River where alluvial influences have deposited coarse fragments in areas of residual sands. Vegetation on this soil is *Eucalyptus hylandii* woodlands rather than *E. tetrodonta*.

Strath is an Orthic Tenosol commonly associated with *Kimba,* particularly in the area of the Desert. A structureless dark or brown sand A1 overlies a yellow-brown or red-brown A2 which in turn grades to a red or red-brown loamy sand B1 horizon. Below this is an extensive red loamy sand to sandy loam B2. Landform and vegetation are similar to that of *Kimba*. The soil is very infertile.

Witchura is a Ferric Red Kandosol found throughout the Peninsula. It is associated with sandstone that has been laterised but it is more contemporary with the Aurukun surface proper rather than the remnants that give rise to the ferruginous soil *Bertie*. A dark light textured A1 overlies a red-brown or red A3 of slightly heavier texture. An A2 horizon is occasionally present. The B1 has similar characteristics to the A3. The B2 horizons are red, with textures in the sandy clay loam to clay loam range. Ferruginous nodules are a feature of the whole profile, with an abundance of 10-50%.

Witchura Yellow Variant has similar properties to *Witchura* but trends yellow-brown with depth. It is found adjacent to the south-western edge of the Coen Inlier.

(b) Drainage depressions

Bimbus is a variable sandy soil found in poorly drained areas of residual sands, particularly in the south. Its surface horizon is dark or grey, quite acid and may be up to 0.25 m deep. Below this lies an extensive bleached sand A2 horizon which grades to a variable B2 horizon. The B2 may be humic or humo-sesquic, or may be yellow, grey or grey-brown with distinct mottling, hence the classification of the soil as both Podosol and Tenosol. Although the vegetation is usually *Eucalyptus tetrodonta* dominated, it commonly contains species tolerant of poor drainage, eg. *Cyperus, Gahnia.*

Citri is a very distinctive feature of the heavily dissected sands in the Edward River Landscape (Figure 13). It is always associated with *Hann* but the dominance of either in any given drainage line varies, particularly with increasing drainage line width. A Sodosolic Hydrosol, the soil is characterised by a shallow series of A horizons over very hard sodic B horizons displaying prismatic or columnar structure. The A1 is dark or grey loamy sand to fine sandy loam and often very thin and crusty. The conspicuously bleached A2 has similar textures but a slightly higher pH. A sharp or clear boundary is evident to the B1 (occasionally present) or B2 horizon. These are usually grey in colour with varying amounts of mottles. Manganiferous nodules may be present in the B2. The whole profile is invariably dry and the difference in consistency between the A and B horizons is very significant. The strength of the B2 often restricted augering of the soil. Vegetation on this soil is very indicative of the profile characteristics. Stunted *Melaleuca viridiflora* (narrow leaf biotype) give way to stunted *M. citrolens* as the depth of the A horizons decreases. In many cases, the centre of a drainage line may only be vegetated by short-lived grass and sedge species.

Citri Coarse Phase is restricted to an area on the upper Morehead River where nearby acid igneous rock have provided a coarse sandy influence to the profile.

Ginger, a Redoxic Hydrosol, is a Uniform sandy soil that is probably related to *Bimbus*. Extensive leaching of the profile has occurred but podsolisation is not evident within the top 1.30 m. It is possible that it exists at depths greater than this, in which case the soil should perhaps be considered as a deep variant of *Bimbus*. *Ginger* consists of an organic matter influenced A1 over a bleached A2 that may extend as deep as 1.10 m. A mottled grey or pale A3/B1 horizon is evident in some profiles. The B2 horizon is pale, pale-yellow or yellow-brown and mottled. Vegetation is often similar to that found on *Bimbus*.

Ginger Rocky Phase is found in conjunction with soils such as *Deighton Rocky Phase*. It contains quartz coarse fragments throughout the profile.

Hann is a Redoxic Hydrosol that has already been mentioned in association with *Citri*. It occurs at seepage zones and is invariably moist or wet, even well into the dry season. This moisture availability has an influence on the vegetation. The prolonged growing season of both ground and shrub layers has contributed to the build-up of an extensive A1 horizon that may be as deep as 0.25 m. Texture of the A1 varies from sand to loamy sand. Below the A1 horizons lies an extensive bleached sand A2 which grades into a mottled pale, grey or yellow-brown B2. This horizon is a light clay to medium clay with moderate structure. It is commonly sodic. The watertable is often evident at or above the B2. Field pH is acid throughout the profile. Comparisons can certainly be drawn between *Hann* and *Silver* in terms of profile morphology and perhaps genesis. They both appear to have evolved from relatively moderate clay content soils under the continuous or frequent influence of fluctuating water tables.

3.2.8 Soils of the alluvial plains

The soils of the alluvial plains vary considerably depending principally upon the source of the alluvia. Distance from streambeds is a factor but its importance varies. The soils of the plains typically have moderate to high clay contents and are often slowly permeable. The soils of the levees and associated areas are often sandy, permeable and well drained.

(a) Plains

The soils of this subgroup are all located on level or near-level plains that are in many instances poorly drained. Nearly all of the soils are classified as Hydrosols. Slight depressions are not uncommon on the plains and these usually contain a hydromorphic version of the surrounding soil. The depth and speed of floodwaters over the plains may have some effect on the soil surface nature through either erosion, and/or deposition.

Antbed is a very deep Redoxic Hydrosol common to the alluvial plains of the central and south-west of the Peninsula. It appears to be sourced from a mixture of alluvia derived from metamorphic rocks and arkosic sediments. The plains are invariably dotted with magnetic termite mounds. Vegetation varies from grasslands to *Melaleuca viridiflora* low open woodlands and woodlands. The soil is heavily mottled and generally possesses a Gradational texture profile. The A1 is dark or grey and may display considerable organic matter influence. It overlies a mottled grey A2 horizon that is occasionally conspicuously bleached. Colour in the A3 tends towards yellow with yellow or orange mottles evident. These three A horizons and the following B1 can set to a very firm consistency upon drying — something that occurs quite rapidly following the end of the wet season. Excavation of the soil below 0.3 m is difficult during the dry season. The B1 breaks to a series of B2 horizons whose colour may change from grey or pale to yellow with depth. They are typically heavy textured and structured. Field pH becomes alkaline with depth. A continuum from orange mottles in the upper profile, to soft segregations and/or hard manganiferous or ferruginous segregation is commonly observable.

Antbed Acid Variant has profile morphology similar to that of *Antbed* except the pH trends strongly acid with depth, rather than strongly alkaline.

Bend is found in the Mitchell River Landscape (Figure 14) in both the Lakefield area and the south-west of the Peninsula. It is usually found close to rivers and associated with *Kennedy* and *Antbed.* The presence of structure varies in this silty soil, hence its classification as Kandosol or Dermosol. A thin, dark or occasionally grey, clay loam (with variable quantities of silt or fine sand) A1 overlies a mottled grey, brown or yellow clay loam to light clay B1. An A3 is occasionally present. Like *Antbed*, *Bend* also sets very hard upon drying and can be difficult to auger or dig. The B1 grades to B2 horizons that are grey or yellow-brown in colour and well mottled. Textures range from clay loam to medium clay and are often silty. The soil may be massive or moderately structured. Soil reaction trend is slightly acid to neutral throughout. Gilgai may occasionally be found on the surface, particularly in the heavier textured structured version of the soil. Various bloodwoods or *Eucalyptus tessellaris* are the more common species within the woodlands and low open woodlands found on *Bend.*

Greenant is found on alluvia derived from Hodgkinson Formation. It is often closely associated with *Wakooka.* Under Stace *et al.* (1968) this Sodosol or Redoxic Hydrosol would be regarded as a Solodic Soil or Soloth. It possesses a dark or grey massive loamy sand to fine sandy clay loam A1 over an often extensive bleached A2 of similar texture. The colour of the B2 horizon varies greatly and is usually yellow-brown, yellow-grey or yellow, but may also be brown or pale. It is mottled and well structured. Field pH in the B ranges from acid to alkaline. *Greenant* is generally vegetated by *Eucalyptus chlorophylla* woodlands or open woodlands, but *E. microtheca* or *E. acroleuca* may also be present. On occasion, *Greenant* and *Wakooka* may intergrade.

Kennedy is a very deep Vertosol found extensively throughout the Edward River Landscape (Figure 13). In some cases, the soil may be classified as a Hydrosol. Gilgai are occasionally a feature. The hardsetting and frequently cracking surface is grey and occasionally yellow-brown. Mottling is a feature. Textures range from silty clay loam to light medium clay. The A1 overlies an A3/B1 that is usually a mottled grey or brown silty light medium clay to medium clay. It may be massive or structured. The B2 horizons textures are typically silty medium clay to medium heavy clay with angular blocky or lenticular structure. Colour is usually grey but may be olive-brown or brown. Manganiferous nodules become a feature in the B23 and occasionally the B22. Mottles are prevalent in the upper B2 horizons. Field pH increases with depth. The B24 and B25 horizons are lenticular grey medium heavy to heavy alkaline clays. The consistency throughout the profile ranges from firm when moderately moist to very firm when dry.

In the south-west of the Peninsula, the inland occurrences of *Kennedy* are more likely to be non-cracking and lighter textured in the surface than those occurrences closer to the coast. These soils are more prone to sheet and rill erosion and it is suggested they are more sodic. Vegetation on Kennedy is usually a form of open woodland with *Eucalyptus chlorophylla, E. microtheca* or *E. acroleuca* dominant

Lockhart River Complex is a mixture of soils, found as the name suggests, in the Lockhart River Valley. Bleeker and Laut (1987) provide discussion of the soils and vegetation of the area. The soils are closely intermingled and photopattern provides

little clue. It was concluded that at the scale of mapping involved in NR02, it was not easy to delineate individual soils, hence the formation of a complex. The key soils in the complex are *Kennedy*, *Bend, Lions, Morehead* and *Livis.*

Olive is a Redoxic Hydrosol found in the area west of Laura and its surface horizons bear a resemblance to those of *Antbed*, particularly when dry. Deep pits of *Olive* however confirm that the two soils are different. The A1 and bleached A2 horizon of *Olive* are light textured. Neither of the horizons are mottled. The A3 is occasionally bleached, usually mottled and medium textured. Ferro-manganiferous or manganiferous nodules are present in small to moderate quantities. The B1 horizon is similar to the A3 but may be structured. Below the B1 lies a mottled, grey, pale or pale-yellow clay loam sandy to light medium clay B2. Ferro-manganiferous or manganiferous nodules are prevalent. Vegetation on *Olive* usually is *Melaleuca viridiflora* dominated low open woodlands or woodlands.

Wakooka is a Yellow Dermosol found on alluvia that appears to be derived principally from Hodgkinson Formation. As indicated, it is commonly found in conjunction with *Greenant* and may merge in upper plain areas with colluvial soils such as *Kingjack.* In certain areas, the distinction between alluvial and colluvial material is very unclear. The plains on which *Wakooka* is found are generally vegetated with *Eucalyptus clarksoniana, E. novoguinensis* or *E. polycarpa* woodlands or open woodlands. The surface of *Wakooka* is hardsetting dark, grey or brown and medium textured. Below this lies a bleached mottled A2 of similar texture, a grey, yellow-brown or yellow medium textured A3 and slightly heavier textured B1. Structure is evident in the B1. Ferruginous or manganiferous nodules may occur in the A3, B1 and B2 horizons. The depth at which the B21 horizon begins varies considerably. Both it and the B22 are typically yellow, yellow-brown or yellow-grey and heavily mottled. Texture ranges from light clay to medium clay and sub-angular blocky structure is evident.

(b) Levees terraces and prior streams

These soils are predominantly sandy in nature and some show evidence of stratification. Some are restricted to certain rivers or geological areas, while others are widespread.

Cox, along with its companion soils *Wheeler* and *Moonlight*, occupy relatively small areas, confined to within the Rolling Downs Group, particularly the Merluna Plain. The sandy nature of the three soils contrasts with the clayey nature of the surrounding soils and it is likely that the alluvia is derived from Bulimba Formation sandstones. Some creeks within the Rolling Downs Group that do not pass near a source of sand have clayey soils on their levees. *Cox* is a Red Kandosol that contains variable quantities of segregations in the B2. The surface is a dark loamy sand to fine sandy clay loam. Below the A1 is a red-brown A2 of similar texture that grades to a slightly heavier textured red or red-brown A3 and B1. The B2 horizons are red and medium textured with manganiferous nodules in variable quantities. Mottling is evident in the B22, where segregations are more prevalent and may be ferruginous or manganiferous. Vegetation on *Cox* is usually *Eucalyptus tetrodonta* woodlands, but species such as *E. confertiflora* may also be present. If the B2 horizon is exposed, it will form a "creek rock" of a petroferric nature.

Lions is found under closed-forests on creeks and rivers with fine grained/argillaceous alluvia derived from metamorphic rocks either from the Coen Inlier or from the Hodgkinson Formation. This Brown Dermosol or Oxyaquic Hydrosol soil has some similarities to *Bend* in that it is often silty and may be structured or massive. The surface is dark silty loam to clay loam with a relatively high pH (in comparison to most other soils on the Peninsula). The horizon below the A1 is variable and may be classed as an A2 or B3, depending on colour and texture. The B2 horizon may be grey, yellow-brown or brown with a texture of sandy clay loam to silty clay loam.
Livis is found on the eastern side of the Great Escarpment within the Ebagoola Landscape (Figure 12). It can perhaps be regarded as similar to *Bimbus* in terms of profile nature but is however coarse sandy throughout, as it is derived from acid igneous colluvia/alluvia. Vegetation varies considerably from gallery closed forests to *Melaleuca* spp. open forests with a subcanopy of *Livistonia mulleri.* The profile possesses an extensive A horizon up to 0.3 m deep. The A11 is dark and only thin while the A12 is grey. Both typically have a texture of loamy coarse sand. The A2 horizon is also quite extensive and is occasionally bleached. Its colour varies but is usually grey or yellow-grey. It merges with a B2 horizon that may exhibit Podosolic characteristics, hence the classification of the soil as Tenosol or Podosol. Small sub-angular quartz coarse fragments are a feature of the profile. The prior streams on which *Livis* is found are often only discernible by a vegetation change.

Mitchell is a soil common to the terraces of large creeks and rivers in the southern half of the Peninsula. The soil properties vary. It is either a Brown or Red Kandosol, and frequently shows evidence of stratification in the top 0.2 m. It is suggested that *Mitchell* is added to infrequently by flood events. The surface is a dark or grey fine sandy loam to fine sandy clay loam. A2 horizons are frequently present and are typically brown although they may also be grey, red-brown or yellow-brown. The A3 colours are in a similar range to those of the A2 (where present) with brown most common. Following the A3, horizonation varies. In some cases it is best described as a B1 but in others, it is a B21. It is typically yellow, brown or red light fine sandy clay loam to fine sandy clay loam and may show weak structure. The B2 (or B22) is quite similar to the B1/B21.

Moonlight occurs in conjunction with *Cox* and *Wheeler* and can perhaps be considered as existing between the two soils in catenary terms. A Yellow Kandosol, it has a dark or grey fine sandy loam to loam A1 over a bleached A2 of similar texture. The A2 is followed by a yellow or yellow-brown clay loam heavy B21. This horizon has variable quantities of ferruginous or manganiferous nodules present. The B22 is pale and mottled. Texture ranges from clay loam heavy to light clay. Manganiferous or ferruginous nodules are present in high concentrations. Both of the B2 horizons display weak polyhedral structure while the rest of the profile is massive.

Morehead is a soil comprised of recent depositional material associated with the levees of rivers and some creeks. A Stratic Rudosol, its profile morphology varies considerably. It is generally characterised by a very thin dark or brown A1(1) over further A1 material or a paler A2 horizon. Both horizons are usually medium textured, with a fine sandy influence. Granular structure may be evident. Below the surface horizons, stratification is evident in the form of various C and D horizons. Colour typically stays brown or dark while texture may stay constant or drop back to

sand. The nature of these soils is of course dependent on the flooding history of the waterway, the source(s) of alluvia and the vegetation along the banks. Alluvia within stream channels ranges from pale yellow coarse sand to brown or dark fine textured material.

Merkunga is a Redoxic Hydrosol or Mesotrophic Dermosol associated with alluvia along major rivers within the Aurukun surface and underlying Rolling Downs Group. A dark or grey fine sandy clay loam to clay loam overlies a bleached mottled A2 that may contain manganiferous nodules. The extensive A3/B1 is mottled grey, pale or yellow-brown with a texture of fine sandy clay loam to light clay. The B2 horizons are also mottled and typically grey or pale. Textures range from light clay to light medium clay and both horizons are structured. The frequency of manganiferous nodules ranges from 2-50%. Vegetation on this soil is typically *Eucalyptus leptophleba* dominant open woodlands and woodlands.

Victor is a soil of key interest with regards to salinity. It is found on terraces of the Laura, Palmer and Normandy Rivers. All of these rivers are associated with Hodgkinson Formation. The soil is a Red Chromosol of variable depth, below which exists D horizons with very high salinity ratings. The surface of the soil is typically dark and light to medium textured, below which is a red-brown or yellow-brown A2. This overlies a series of variable A3 and B1 horizons that are typically red, red-brown or yellow. Mottles are generally a feature. The series of B2 horizons are red or occasionally red-brown with light clay to medium clay textures that are commonly fine sandy or silty. Angular blocky structure is a feature. Field pH of the B2 is neutral. The D horizon has been described as a yellow-grey clay with silcrete and quartz prevalent. Depth to the D varies from 1.0 m to 2.0 m.

Wheeler, as mentioned, is associated with *Cox* and *Moonlight*. A Grey Kandosol, it is commonly vegetated by *Eucalyptus tetrodonta* woodlands. As for *Moonlight*, the profile has a fine sandy influence. The dark or grey A1 ranges from loamy fine sand to fine sandy clay loam. The bleached A2 is of a similar texture and contains manganiferous or ferruginous nodules. The A3 is usually pale or yellow-brown fine sandy clay loam with manganiferous nodules. B2 horizons are mottled pale and medium textured. Manganiferous or ferruginous nodules are evident in varying amounts.

3.2.9 Soils of the swamps

Two types of swamps have been described on the Peninsula. The origin of both is subject to debate.

Hesket is a Redoxic Hydrosol found in small swamps largely restricted to the Rolling Downs Group, although it is occasionally found on the Aurukun Surface. Diameter of swamps is usually <25 m and they are commonly ringed by ferricrete. *Hesket* is generally a bleached soil with mottles a feature of most horizons. The surface is light to medium textured, as is the bleached A2. The A3 ranges from light fine sandy clay loam to clay loam fine sandy and is usually grey or yellow-brown. The B1 is paler in colour, slightly heavier in texture and structured. It grades to B2 horizons of light clay to light medium clay texture. Ferruginous nodules are often found in the B2,

and occasionally in the A1, A2, A3 and B1. The swamps are usually vegetated by *Melaleuca viridiflora* of <15 m height. It is possible that the formation of may be related to gilgai.

Mapoon is vegetated by various *Melaleuca* spp. including large *M. leucodendron* of up to 25 m in height in the north, and shorter *M. saligna* and *M. clarksonii* in the south-west. The soil is typically found on the Aurukun and Kendall Surfaces, however small swamps with *Mapoon* type soil are found in the alluvial country of the central- and south-west of the Peninsula. *Mapoon* shows more evidence of organic matter accumulation than *Hesket* and may be classified as a Humose or Melanic Orthic Redoxic Hydrosol. The morphology of *Mapoon* varies a great deal more than that of *Hesket*. It typically consists of an organic-influenced medium textured surface overlying an occasionally bleached, grey medium textured horizon. Below this are mottled grey or pale clay B horizons that are usually structured. Horizons of a variable nature are commonly found below the B2g. Field pH of the profile ranges from very strongly acid to slightly acid.

3.2.10 Soils of the coastal margin

The soils of the coastal areas are divided into two categories that are principally related to texture and mode of formation.

(a) Beach ridge and dune deposits
The soils within this category are all dominated by the sand fraction and have been deposited by wind and/or wave action. Windblown dune deposits are essentially a feature of the east coast and are quite extensive in areas, eg. Cape Flattery. Beach ridge deposits of varying ages are found on both coasts but are a major feature of the west coast, particularly the central and south-west. In areas the beach ridges have been reworked by coastal movement and only narrow strips remain. Smart (1976a, 1976b) provides a detailed discussion of the nature of the south-western beach ridges while Pye (1982) discusses the east coast dune deposits.

Caravan is an Orthic Tenosol found extensively along the west coast of the Peninsula. Colour within the profile varies considerably, with yellow-brown or grey common. It consists of an A1 showing some evidence of organic matter accumulation, over a paler A2. Below the A2 are B2 horizons displaying distinct to prominent mottling. Following the B2, two scenarios are possible. Some of the remnant deposits of *Caravan* lie directly on marine clays, and this is evident as a D horizon. Other deeper deposits of *Caravan* frequently have a 2A2e and then mottled pale 2B horizons. It is likely that the B2 and 2B2 horizons reflect wet season and dry season water table fluctuations. Shells may be a feature in any horizon. Vegetation on *Caravan* varies from open woodlands to heath or herblands.

Caravan Coarse Phase is found in the Lilyvale area where Pleistocene? beach ridges are evident in the vicinity of the Palmer Fault. It is likely that the coarse sand derived from the acid igneous pluton to the west has been the source of material for the soil.

Caravan Deep Phase is a version of *Caravan* that has an A1 horizon 0.35 to 0.65 m in depth. It is found in the Frenchs Lagoon area in the south-west of the Peninsula.

Doughboy is largely restricted to beach ridge and dune deposits on the east coast. It is a Podosol with variable properties, depending on landscape position. Some occurrences, particularly in swales are more likely to be Aquic while others are Semiaquic. The surface horizon varies in depth considerably (0.2 - .5 m) and overlies a similarly variable bleached A2. A narrow B1 is occasionally present. The B21 horizon may be humic or humosesquic whereas the B22 is often sesquic in nature. Consistency of the B2 varies from very weak to firm. Below the B2, may lie 2A2e and 2B2 horizons. These are probably formed in a similar manner to the equivalent horizons in *Caravan*. Vegetation on *Doughboy* varies from woodlands to dwarf open heaths.

Daunt is found only in the dunefields of the east coast. A Giant Podosol, its nature probably varies in a similar manner to that of *Doughboy*, ie. as a result of landscape position. Location within the dunefield may also have a significant bearing on despositional or erosional forces acting on the soil. Blowouts are a significant feature of the dunefields. Only one site was described for *Daunt*, due to the inaccessibility of the dunes. It consisted of a thin dark A1 overlying an extensive (15 m) bleached sand A2 below which were sesquic B2 horizons spanning nearly 5 m. Bleached 2A2 horizons and sesquic and humosesquic horizons are found below the B2. Vegetation on the dunefields is predominantly heath, but it may be lacking in active blowouts. Perched lakes are very common.

Somerset is an Orthic Tenosol found on both the east and west coasts. It occurs in areas of sand that has been deposited on, or influenced by another surface (usually lateritic in nature). The profile consists of multiple A2, B1 and B2 horizons below a dark A1. Textures range from sand to loamy fine sand throughout. The profile is red or red-brown throughout except for the A1 and A21 horizons. Vegetation is often *Eucalyptus tetrodonta* woodlands, but in exposed areas it may be heath.

Somerset Ferric Phase is a shallow form of *Somerset* in which the soil sits directly on ferricrete or similar materials. Ferruginous nodules are found within the profile. The soil only occupies small areas, and is vegetated by heath.

Vrilya is a Siliceous Arenic Rudosol found in foredunes along the coastline of the Peninsula. In many instances it is present only as a narrow band <20 m in width, and vegetated by herblands or bare. The soil is characterised by a lack of profile development other than a darker surface (extending to 0.6 m). Below this are extensive yellow-grey bleached A2 horizons. These may perhaps be interpreted as C rather than A2 horizons (Murtha *pers. comm.*). *Vrilya* usually grades into *Doughboy* or *Caravan.*

(b) Estuarine and near coastal plains

Extensive estuarine and near coastal plains are found on the central- and south-western coasts, and also in the vicinity of Princess Charlotte Bay on the east coast. These plains typically consist of large areas of Vertosols and saltpans interspersed by beach ridges. The plains are often incised by rivers and variable amounts of localised alluvial influence exist.

George is a variable Supratidal Hydrosol associated with saltpans. Only one site was described and the soil was observed to vary according to degree of tidal influence. It also exists in some non-tidal areas where it appears to be more consolidated. The only site described was in a bare saltpan with mangroves found on the margins. The surface of the soil consisted of a very thin yellow-brown alkaline light clay below which was a grey light medium clay. The profile trends moderately acid in the brown heavier textured B2 horizons and then mottled yellow in the B3. Presence of a saline water table prevented extensive description of the neutral grey C? horizon. Structure within the profile was difficult to gauge.

Marina is the most extensive soil on the coastal plains. Close to the coast, or low lying areas, it is usually an Aquic Vertosol, but further inland the older deposits are generally Grey Vertosols. The plains are typically flat but in some areas may be gently undulating. Gilgai are commonly (but not always) found. The soil surface is a mottled dark or grey light clay to light medium clay that is usually pedal, but on occasion massive. It is followed by a B1 with a similar range of characteristics. The extensive B2 horizons are mottled grey medium clay to heavy clay although texture may drop back to a light clay below 1.0 m, in which case it is usually interpreted as a B3 horizon. Field pH trend varies but is typically extremely acid to moderately acid in the surface, remaining either very strongly acid to moderately acid throughout, or trending alkaline with depth. Tussock grasslands with occasional halophytes are the dominant vegetation on *Marina*.

Nassau is a Hypersalic Hydrosol found on the margins of some saltpans. Occurrences are generally small and vegetated by species such as *Antidesma parviflora, Melaleuca acaciodes* and *Eucalyptus microtheca* The soil is a mottled grey colour throughout and consists of a medium textured A1 and bleached A2 over a fine sandy clay loam to sandy light clay A3/B1. The B2 is a structured light medium clay to medium heavy clay with a very firm to strong consistency. Salinity is a major feature of this soil. Field pH is moderately acid in the surface, grading to very strongly acid in the A3/B1 and B2 horizons. It is possible that this soil has formed from saline influences on local alluvia rather than consolidation of saltpan material.

Skardon is the Intertidal Hydrosol found in mangroves along the Peninsula coastline. The only site recorded was difficult to dig and describe due to a watertable just below the surface. It was Arenaceous in nature but it is likely that *Skardon* varies considerably. Sites described by Smith and Biggs (unpubl.) in mangroves of the Cairns area were typically argillaceous. *Skardon*, and the associated mangroves are found in narrow strips intermittently along the coast, with major occurrences in the Lockhart River and Escape River areas.

3.3 Perspective 2 - the Soil Landscape

To provide a brief overview of the soils and explain their position in the landscape, it is convenient to segment the Peninsula into large natural divisions (**Landscapes**). These are based on distinctions in physiography and geology, as well as elements of vegetation and current land use. Seven of these natural divisions have been recognised. These include one or more of the

soil landscapes described by Isbell (1980) eg. the Lockhart River Landscape includes portions of the soil landscapes "Sub-coastal fans and alluvial plains" and "Central Eastern Uplands".

Galloway *et al.* (1970) described the combinations of landform, geology, soils and vegetation within the Mitchell-Normanby study as land systems. Portions of these Land Systems are encompassed in the ten soil Landscapes described below eg. Edward River Landscape includes elements of the Balurga, Mottle, Cumbulla, Inkerman and Battersea Land Systems.

Table 4 provides an alphabetic list of all soils described in the study area, together with their Landscape occurrence and the Map Reference unit to which they belong. Within Table 4, the following symbols are used:

- H Heathlands Landscape
- B Batavia Landscape
- LR Lockhart River Landscape
- ER Edward River Landscape
- E Ebagoola Landscape
- M Mitchell Landscape
- HF Hodgkinson Landscape

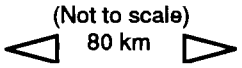
Pages 52-65 provide general locations and idealised diagrams of each Landscape and a brief description of their component soils. Note that the locality diagrams are only indicative of the major occurrences.

Within each diagram, the following symbols are used:

Indicates direction of surface water flow where it is an important factor in soil formation or erosion

Indicates direction of deep drainage where it is an important factor in soil formation or secondary salinisation

100 m Indicates approximate elevation (a.s.l.) of feature



Indicates approximate width of sketched section. The sections are not to scale

3.2.1 *Heathlands Landscape*

The Heathlands landscape dominates the northern quarter of CYP, stretching from coast to coast. It consists principally of soils derived from sandstone that are vegetated with heaths and *E. tetrodonta* woodlands (Figure 9).

Significant accumulations of windblown sand exist on the east coast as dune formations, with Giant Podosols (*Daunt*) the most common soil. Although only one site within the dune systems was described by NR02, it was observed that the depth to the B horizons varies with landscape position. Active blowouts are a feature with perched lakes common at the tail of the blowouts.

Kandosols (*Harmer, Emma*) and Tenosols (*Jardine*) on undulating rises of sandstone comprise the largest unit within the Heathlands Landscape. A recognisable catena exists, with the heavier textured soils towards the upper slopes of the landscape. Both the Kandosols and Tenosols are infertile (Isbell *et al.* 1976).

Podosols (*Grevil*) are associated with both large (Jardine River) and small (Cockatoo Ck) alluvial systems. They generally occur on the lower slopes in the afore-mentioned catena. Poor drainage, flooding and infertility are obvious limitations to the agricultural development of these soils.

Shallow infertile rocky soils (*Camp*, minor *Ford*) prevail on the outcrops of parent material eg. McHenry Uplands.

Intermittent remnants of the Aurukun surface are present on the western side of the Landscape. The degree of laterisation varies, but bauxitic (*Weipa, Andoom*) and ferruginous (*Bertie, Scorpion, Witchura*) soils are dominant. Both groups of soils are infertile, with their moisture supply restricted by the presence of bauxite or ironstone segregations within the profile.

Minor occurrences of marine clays (*Marina*) and beach ridge material (*Vrilya, Caravan*) occur on the western coastline. *Vrilya* is restricted to the fore-dunes and is similar to the *Toolakea* (Murtha, 1986) soil of the Wet Tropical Coast. In some areas, older beach ridge deposits may have developed a red colour - a result of influence by the adjacent and underlying lateritic surface. These soils are known as *Somerset.* A shallower version deposited on ferricrete or ferruginized sandstone is *Somerset Ferric Phase.*

To the north of the Heathlands Landscape are minor areas of ferruginized sandstone. Heavier textured Kandosols (*Kool*) are common.

The outcrops of rhyolite and granite at Cape York and in the Prince of Wales group of islands commonly produce infertile shallow rocky soils (*Eborac* and *Altanmoui* respectively). More fertile, but still rocky, Red Chromosols (*Galloway*) are also derived from the rhyolite hillslopes. Sodosolic Hydrosols (*Del*) are a feature of the footslopes.

HEATHLANDS LANDSCAPE

West East

SOILS

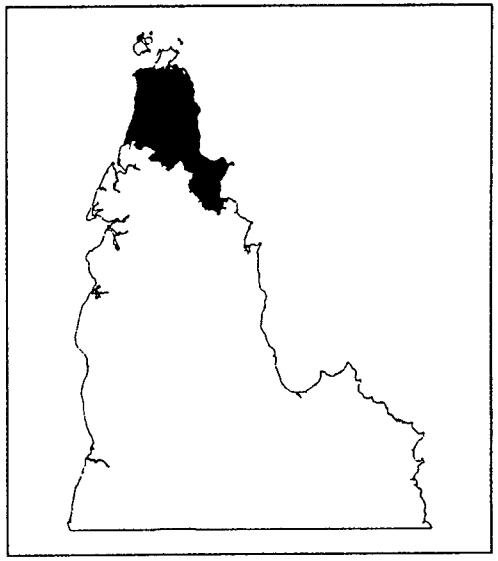
Ad Andoom - Very deep Uniform or Gradational yellow massive soils with aluminous concretions
Cm Camp - Very shallow bleached rocky Uniform sandy soils
Cv Caravan - Very deep coloured Uniform sands
Dn Daunt - Giant deep Uniform bleached sands over orstein
Gv Grevil - Deep bleached Uniform sand over coffee rock
Hm Harmer - Deep bleached Gradational yellow massive soils
Jd Jardine - Deep bleached Uniform yellow earthy sands
Mn Marina - Very deep Uniform, frequently cracking saline grey clays formed on marine plains
Sd Skardon - Recent estuarine deposits under mangroves
Ss Somerset - Very deep Uniform coastal sands deposited on laterite and other surfaces
Vy Vrilya - Very deep Uniform sands with minimal profile development
Wp Weipa - Deep Gradational or Uniform red massive soils with aluminous concretions

VEGETATION

3 Closed-forests
10 Woodlands (*E. hylandii* or *E. tetrodonta*) on hillslopes
16 Woodlands and tall woodlands (*E. tetrodonta*) on deeply weathered plateaus and remnants
17 Woodlands (*E. tetrodonta*) on erosional surfaces and residual sands
21 Tussock grasslands on marine plains
24 Open heaths and dwarf open heaths on dunefields, sandplains and headlands
25 Woodlands and herblands on beach ridges and the littoral margin

(Not to scale)

80 km



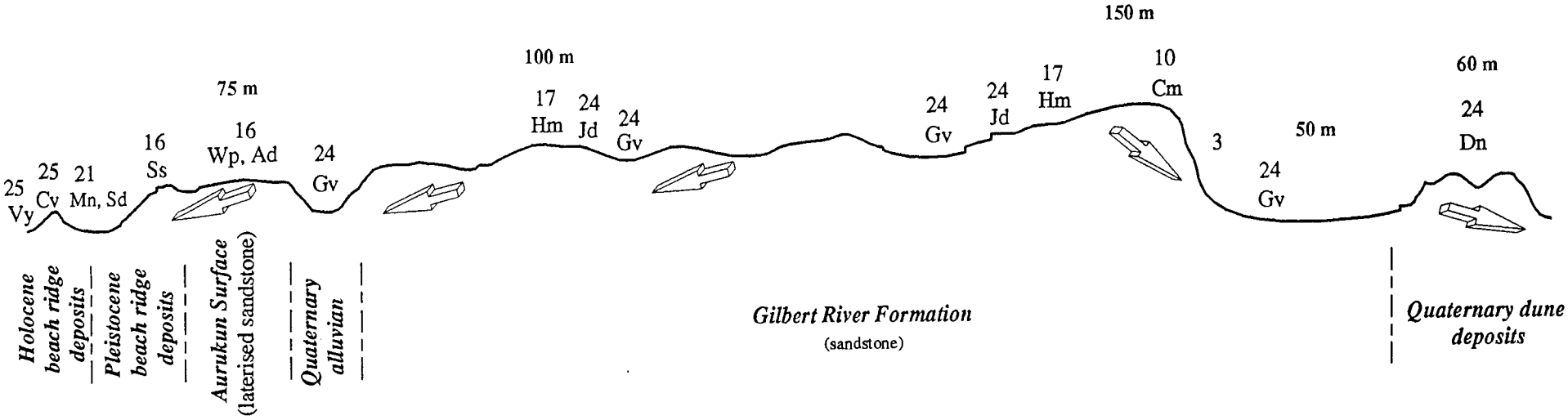


Figure 9 Heathlands Landscape

3.2.2 *Batavia Landscape*

The Batavia Landscape is associated with the Rolling Downs Group (siltstone, labile glauconitic sandstone, mudstone), which extends down the centre of CYP from east of Weipa to scattered elements in the south (Figure 10). The Landscape reflects the exposure of this Group, following the removal of the overlying Aurukun Surface (Bulimba Formation). The soil types appear to be linked to the relative age of exposure of the parent material.

Highest in the Landscape are remnants of the Aurukun surface eg. the Embley Range. These surfaces vary in their degree of laterisation, with some examples in the south showing only minor evidence. On the Weipa plateau, the lateritic horizons are aluminous (bauxitic) in nature. Slightly lower in the landscape are heavily ferruginized Red and Yellow Kandosols (*Bertie, Scorpion*). These are often on the lowest remnants of the Bulimba Formation. As mentioned in 3.3.1, both groups of soils have a number of limitations.

Associated with the footslopes of the lateritic remnants are clay soils derived from recent exposures of the underlying sediments of the Rolling Downs Group. A number of catenas exist, reflecting the erosional and weathering history of the local landscape. On the freshest exposures, often lying parallel to migrating streams, are Vertosols (*Picanninny*) and Dermosols (*Myall*). These soils are often gilgaied, restricting their suitability for cropping. They are however, suitable for pasture development, particularly given that they are often vegetated with grasslands or open woodlands. It is suspected that there may be a salinity risk associated with these soils, but **further investigation of the matter is required**, particularly with reference to local development plans.

It is suggested that these clay soils exist in a weathering sequence, with the next stage being the dominant soil of the Rolling Downs Group, the *Batavia*. It often has significant quantities of ferruginous or manganiferous nodules at depth. Fertility of this soil, and its poorly drained counterpart (*Lydia*) is low.

Minor areas of soils of alluvial origin (*Cox, Moonlight, Wheeler, Merkunga*) are associated with streams and rivers. *Merkunga* appears to be associated with the larger rivers, while the Red, Yellow and Grey Kandosols (*Cox, Moonlight* and *Wheeler*) are generally restricted to the terraces of minor streams. *Cox* in particular has many favourable characteristics for agricultural development but unfortunately is restricted to narrow occurrences either side of creeks.

Redoxic Hydrosols (*Hesket, Mapoon*) occur in the swamps common to this Landscape. *Mapoon* is restricted (within this Landscape) to the Aurukun Surface, particularly north of Andoom. The formation of these swamps is considered by some authors as a laterite-karst feature (Grimes, 1979). *Hesket* is more commonly associated with the Rolling Downs Group, particularly the *Batavia* soil. The swamps are usually shallower and smaller in diameter than the *Mapoon* swamps, and are often ringed by ferricrete. Pain and Ollier (1992) discuss the nature of ferricrete associated with swamps and some other features located in the Batavia Landscape. Flooding, and poor drainage are the over-riding restrictions on the use of these soils for agriculture.

Also associated with the Batavia Landscape, but not depicted in Figure 10 are the soils *Rokeby*, *Batavia Rocky Phase* and *Lydia Rocky Phase*. *Rokeby* exists in the area of Rokeby National Park and is similar in nature to *Bertie*, although it contains ferruginized coarse fragments (siltstone?) rather than ironstone of pedogenic origin. The *Batavia Rocky Phase* is restricted to hillslopes in the "Wolverton" area, and it contains ferruginized coarse fragments in sufficient quantity to preclude its use for agricultural development other than low input grazing.

Lydia Rocky Phase is a feature of outcrops of weathered Cretaceous sediments in the southern half of the Peninsula.

BATAVIA LANDSCAPE

West East

SOILS

Ad Andoom - Very deep Uniform or Gradational yellow massive soils with aluminous concretions
Bt Bertie - Deep Gradational or Uniform red massive soils with ferruginous nodules
Bv Batavia - Deep Gradational mottled yellow soils formed on argillaceous sediments
Cx Cox - Deep Uniform or Gradational red massive soils on alluvial plains
Hk Hesket - Deep bleached Gradational grey soils occuring in drainage depressions and swamps
Ld Lydia - Deep bleached Gradational or Duplex mottled grey soils formed on argillaceous sediments
Mp Mapoon - Deep Duplex or Gradational soils with a dark loamy surface over a mottled grey clay, formed in swamps
Mk Merkunga - Deep bleached Gradational mottled grey soils formed on alluvia
Mg Moonlight - Deep bleached Gradational yellow massive soils developed on alluvia
Ml Myall - Deep Uniform or Gradational yellow structured clay soils formed on argillaceous sediments
Pn Picanninny - Deep Uniform cracking brown or grey structured clays formed on argillaceous sediments
Sp Scorpion - Deep Gradational or Uniform yellow massive soils with ferruginous or manganiferous nodules
Wp Weipa - Deep Gradational or Uniform red massive soils with aluminous concretions
Wl Wheeler - Deep bleached Gradational grey massive soils formed on alluvia

(Not to scale)

60 km

VEGETATION

7 Woodlands and open woodlands (*E. chlorophylla, E. microtheca* or *E. acroleuca*)
8 Woodlands and open woodlands (*E. clarksoniana, E. novoguinensis* or *E. polycarpa*)
11 Open woodlands and woodlands (*E. leptophleba*) on undulating plains and river frontages
16 Woodlands and tall woodlands (*E. tetrodonta*) on deeply weathered plateaus and remnants
17 Woodlands (*E. tetrodonta*) on erosional surfaces and residual sands
18 Low open woodlands and low woodlands (*Melaleuca viridiflora*) on depositional plains
19 Open forests and low open forests dominated by *Melaleuca spp.* in seasonally inundated swamps
22 Closed tussock grasslands and open woodlands on undulating clay plains
24 Open heaths and dwarf open heaths

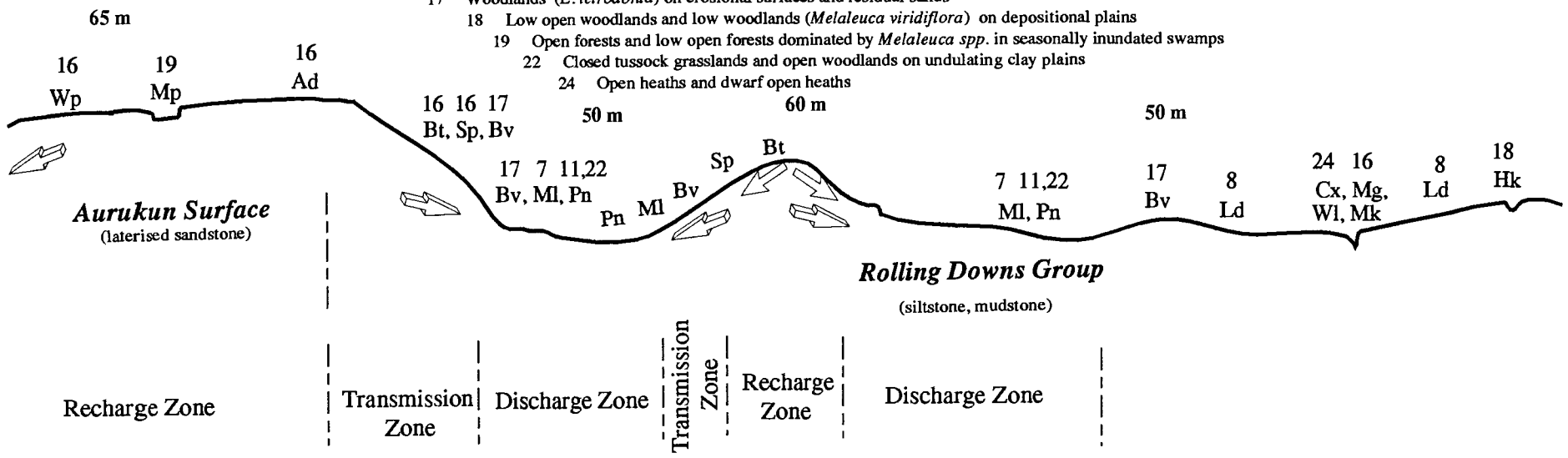


Figure 10 Batavia Landscape

3.2.3 *Lockhart River Landscape*

This Landscape encompasses the high rainfall area in the vicinity of Iron Range. It includes a wide range of lithology's and landforms, and abuts the Batavia Landscape to the west (Figure 11).

Coastal deposits within this landscape are restricted to a very narrow strip (*Skardon, Vrilya, George*) on the eastern edge.

Immediately inland is a narrow band of soils (*Silver, Quarantine*) derived from the High Range, which is comprised of adamellite. The acid plutonic origin of these soils is evident in their morphology and chemistry. *Silver* may have formed as a result of considerable weathering of older fan deposits, as it has a deep bleached A2 horizon. *Quarantine* is probably younger, and is more often associated with the footslopes of the hills, in comparison to *Silver* which exists on plains and fans. Both *Quarantine* and *Silver* are sodic at depth and are invariably vegetated with low open woodlands and low woodlands dominated by *M. viridiflora.* Poor drainage and permeability, occasional flooding and poor fertility restrict agricultural land use options.

A mixture of moderately deep rocky soils (*Drop*) and Red Chromosols (*Henderson*) are present on the hillslopes of the High Range. Drop varies in texture and structure, and tends to occur on relatively active weathering surfaces. Slope and rock content restrict its agricultural use. *Henderson* prevails under closed forest.

The Lockhart River Valley is comprised of a complex of alluvial soils *(Lockhart River Complex*) covered by closed gallery forest and open grasslands (Bleeker and Laut, 1987). Present within the complex are heavy textured soils (*Kennedy*), intermingled with other lighter texture alluvia (*Bend, Lions, Livis*). *Lions* is common on terraces under gallery forest, and bears resemblance to the *Tully* soil described by Murtha (1986) Flooding and uneven topography are limitations. *Kennedy* and *Bend* are discussed under the Mitchell Landscape.

To the west of the valley, Mt Carter is a steep mountain of Sefton metamorphics (schist, phyllite, quartzite, greenstone). The eastern edge of this block is wetter, with clayey structured soils (*Lamond*) present under closed forest. The drier western margin of the block merges with Permian Granites (*Altanmoui, Drop*). A narrow band of volcanics (dominantly rhyolite) forms the western margin of the uplands. Shallow rocky soils (*Eborac*) prevail.

Between the volcanics, and the Batavia Landscape to the west, is an area of dissected sandstone, with Tenosols (*Camp*) and Kandosols (*Emma*) common on the hillslopes and Podosols (*Grevil*) present in the valley floors (Wenlock River valley). *Camp* is shallow, rocky and infertile, whereas the Red Kandosol *Emma*, has characteristics favourable to development for cropping and grazing but slope can be a restriction.

Associated with the Lockhart River Landscape are *Tozer, Gap, Yam* and *Weymouth.* The first of these is a Red Chromosol formed on acid igneous rocks under closed-forest. Slopes are generally moderate to high (10-32%). The latter three are yellow, mottled soils located in the area to the west of Tozers Gap. They are associated with colluvia derived from the surrounding acid igneous rocks. Wetness and vegetation restrictions can be limitations to agricultural development on all three soils.

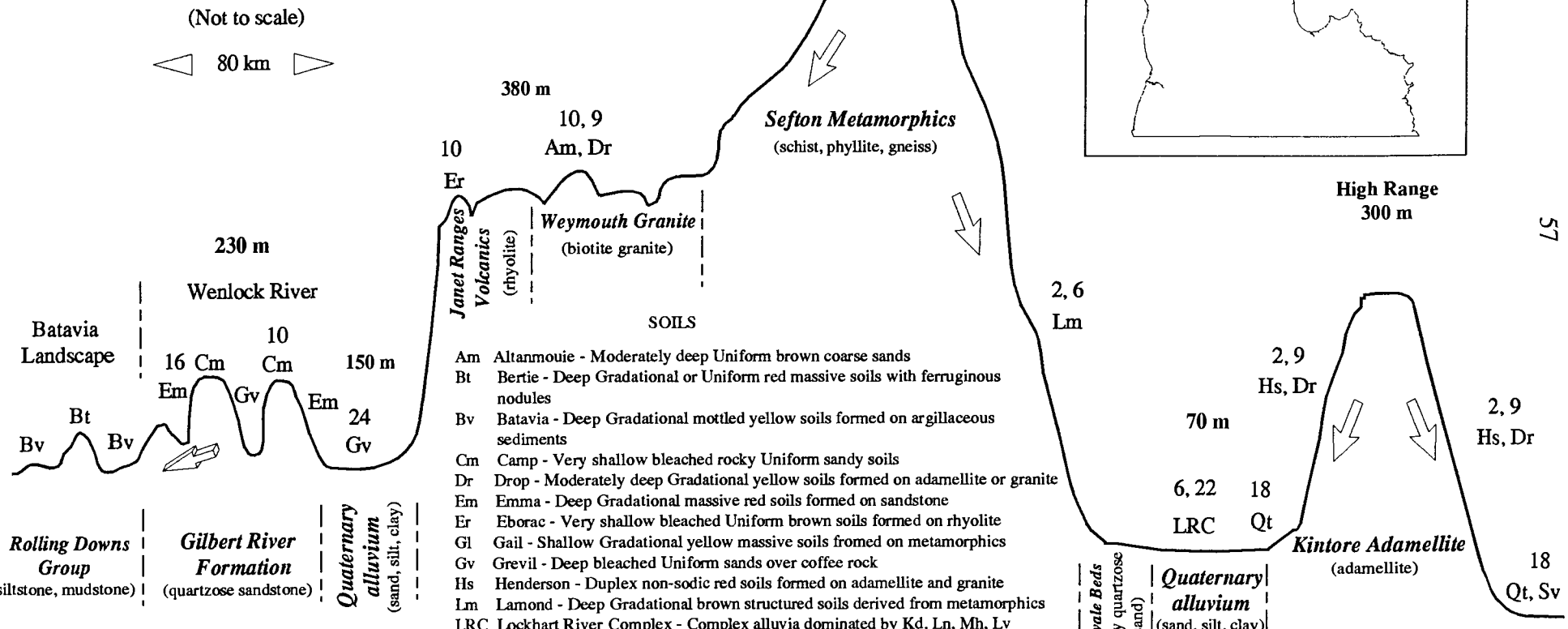
LOCKHART LANDSCAPE

WEST

EAST

VEGETATION

2 Closed forests
6 Gallery closed forests and *Melaleuca spp.* dominated open forests on alluvia
9 Woodlands and open woodlands (*E. cullenii, E.crebra* or *E. persistens*)
10 Woodlands (*E. hylandii* or *E. tetrodonta*) on hillslopes
16 Woodlands and tall woodlands (*E. tetrodonta*) on deeply weathered plateaus and remnants
18 Low open woodlands and low woodlands (*Melaleuca viridiflora*) on depositional plains
22 Closed tussock grasslands and open woodlands on undulating clay plains
24 Open heaths and dwarf open heaths



SOILS

Am Altanmouie - Moderately deep Uniform brown coarse sands
Bt Bertie - Deep Gradational or Uniform red massive soils with ferruginous nodules
Bv Batavia - Deep Gradational mottled yellow soils formed on argillaceous sediments
Cm Camp - Very shallow bleached rocky Uniform sandy soils
Dr Drop - Moderately deep Gradational yellow soils formed on adamellite or granite
Em Emma - Deep Gradational massive red soils formed on sandstone
Er Eborac - Very shallow bleached Uniform brown soils formed on rhyolite
Gl Gail - Shallow Gradational yellow massive soils fromed on metamorphics
Gv Grevil - Deep bleached Uniform sands over coffee rock
Hs Henderson - Duplex non-sodic red soils formed on adamellite and granite
Lm Lamond - Deep Gradational brown structured soils derived from metamorphics
LRC Lockhart River Complex - Complex alluvia dominated by Kd, Ln, Mh, Lv
Pl Poll - Very shallow rocky Uniform brown soils formed on metamorphics
Qt Quarantine - Duplex sodic neutral to alkaline soils on lower slopes and fans derived from acid igneous rocks
Sv Duplex sodic soils with deep coarse sandy surface

Figure 11 Lockhart Landscape

3.2.4 *Ebagoola Landscape*

Located on the east coast, within the Ebagoola and Coen map sheets, the Ebagoola Landscape encompasses a range of geologies and soils associated with the eastern edge of the Coen Inlier (Figure 12).

Western-most are the Proterozoic Coen Metamorphics. These rocks produce a range of soils, with local variation in the lithology having a significant effect on soil type. The hillslopes are dominated by shallow to moderately deep Kandosols (*Gail, Pack*) and Tenosols (*Poll*). The latter occur particularly where the metamorphics abuts the Kintore Adamellite. The agricultural use of these soils is restricted principally by their depth, rockiness and the slopes on which they occur.

Minor bands (often < 30 m wide) of a more basic? material within the Metamorphics produce deep Red Chromosols (*Lukin*). Slope and the small size of the occurrences (landscape complexity) of this soil restrict its agricultural use.

Footslopes and drainage depressions are often dominated by Sodosols (*Chlory*) and Dermosols (*Packsaddle*). The latter appears to be associated with the afore-mentioned more basic? material. A Red Dermosol (*Crosbie*), is associated with bands of greenstone. As with *Lukin*, landscape complexity can be a limitation to agricultural use of both *Packsaddle* and *Crosbie*.

Minor outcrops of dolerite produce a Red Dermosol (*Raymond*), but occurrences are very small.

The Kintore Adamellites are generally much lower in relief than the metamorphics, with undulating to rolling rises or low hills characteristic, except for on the Great Escarpment. *In situ* Yellow Dermosols or Kandosols (*Drop*) are the main weathering product on the slopes of the Great Escarpment which are often steep (32-56%). The footslope area is dominated by Grey Sodosols (*Quarantine*). On occasion, Red Kandosols (*Shea*), apparently derived from the igneous block, may be present. To the west of the Great Escarpment, bleached sandy soils (*Dixie*) are dominant. A number of soils (*Deighton, Deighton Rocky Phase* and *Ginger Rocky Phase*) associated with the previous sandstone surface are present on hillcrests and upper slopes of the undulating rises.

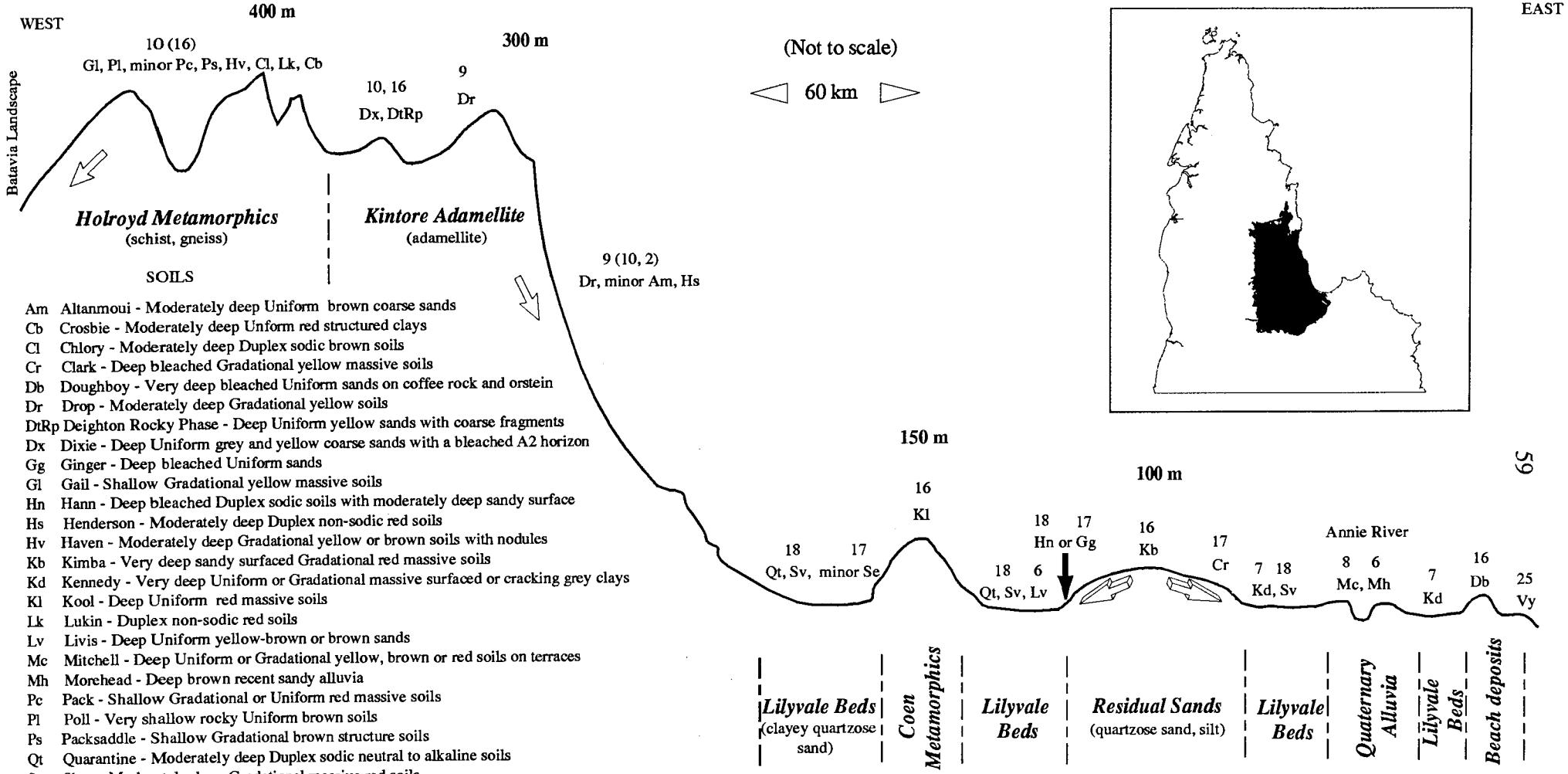
An intermittent narrow band of Coen Metamorphics exists east of the Great Escarpment. Medium textured Red Kandosols (*Kool*) are dominant, and may be remnants of a previous sandstone surface. Elsewhere, this soil is suitable for a range of land uses, but in this particular area, slope is a restriction to land use.

Extensive islands of residual sands dominated by Red and Yellow Kandosols (*Kimba, Clark*) are scattered across the colluvial/alluvial fans which dominate the low country. It is suspected that these sands are remnants of a previous sandstone surface. Both soils have favourable physical characteristics, but their use for pastures is restricted by poor fertility. At the footslopes of these units are bleached soils (*Hann, Ginger*), formed where seepage zones exist. Although they are infertile, and poorly drained, the fact that these soils remain moist nearly all year round can have benefits to grazing management. *Brom Coarse Phase* is probably derived from the previous sandstone surface but has been influenced by coarse material derived from the Kintore Adamellite.

The afore-mentioned fans of Tertiary alluvia and colluvia are comprised mostly of deep surfaced coarse sandy Sodosolic or Redoxic Hydrosols (*Silver*). Areas of alluvial clay (*Kennedy*) are occasionally interspersed. Sandy alluvial soils (*Mitchell, Morehead*) are only minor, commonly associated with the major streams and rivers eg. Stewart River. A coarse sandy alluvial soil (*Livis*) is associated with small prior streams.

Coastal deposits are not significant, mostly in the form of a narrow foredune (*Vrilya*) and intermittent narrow bands of saltpan (*George*) and mangrove (*Skardon*), although in some areas, beach ridges (*Doughboy*) have developed.

EBAGOOLA LANDSCAPE



SOILS

Am Altanmoui - Moderately deep Uniform brown coarse sands
Cb Crosbie - Moderately deep Unform red structured clays
Cl Chlory - Moderately deep Duplex sodic brown soils
Cr Clark - Deep bleached Gradational yellow massive soils
Db Doughboy - Very deep bleached Uniform sands on coffee rock and orstein
Dr Drop - Moderately deep Gradational yellow soils
DtRp Deighton Rocky Phase - Deep Uniform yellow sands with coarse fragments
Dx Dixie - Deep Uniform grey and yellow coarse sands with a bleached A2 horizon
Gg Ginger - Deep bleached Uniform sands
Gl Gail - Shallow Gradational yellow massive soils
Hn Hann - Deep bleached Duplex sodic soils with moderately deep sandy surface
Hs Henderson - Moderately deep Duplex non-sodic red soils
Hv Haven - Moderately deep Gradational yellow or brown soils with nodules
Kb Kimba - Very deep sandy surfaced Gradational red massive soils
Kd Kennedy - Very deep Uniform or Gradational massive surfaced or cracking grey clays
Kl Kool - Deep Uniform red massive soils
Lk Lukin - Duplex non-sodic red soils
Lv Livis - Deep Uniform yellow-brown or brown sands
Mc Mitchell - Deep Uniform or Gradational yellow, brown or red soils on terraces
Mh Morehead - Deep brown recent sandy alluvia
Pc Pack - Shallow Gradational or Uniform red massive soils
Pl Poll - Very shallow rocky Uniform brown soils
Ps Packsaddle - Shallow Gradational brown structure soils
Qt Quarantine - Moderately deep Duplex sodic neutral to alkaline soils
Se Shea - Moderately deep Gradational massive red soils
Sv Silver - Deep bleached Duplex sodic soils with moderately deep coarse sandy surface
Vy Vrilya - Very deep Uniform sands with minimal profile development

VEGETATION

2 Closed forests
6 Gallery closed forests and *Melaleuca spp.* dominated open forests on alluvia
7 Woodlands and open woodlands (*E. chlorophylla, E. microtheca* or *E. acroleuca*)
8 Woodlands and open woodlands (*E. clarksoniana, E. novoguinensis* or *E. polycarpa*)
9 Woodlands and open woodlands (*E. cullenii, E.crebra* or *E. persistens*)
10 Woodlands (*E. hylandii* or *E. tetrodonta*) on hillslopes
16 Woodlands and tall woodlands (*E. tetrodonta*) on deeply weathered plateaus and remnants
17 Woodlands (*E. tetrodonta*) on erosional surfaces and residual sands
18 Low open woodlands and low woodlands (*Melaleuca viridiflora*) on depositional plains
25 Woodlands and herblands on beach ridges and the littoral margin

Figure 12 Ebagoola Landscape

3.2.5 *Edward River Landscape*

Dipping from the centre of mid-CYP to the west coast, the Edward River Landscape is situated between the Aurukun surface to the north and the Mitchell River Landscape to the south (Figure 13).

The highest features in the landscape are outcrops of sandstone (*Camp, Ford*) and lateritic and non-lateritic plateaus (*Weipa, Andoom, Witchura, Kimba, Clark*). These are derived from the Aurukun Surface. *Witchura* is similar in nature to *Bertie*. The western edge of these plateaux is often poorly defined, and grades into undulating rises of Red, Yellow and Grey Kandosols (*Kimba, Clark, Brom*) dissected by drainage features.

This lower surface is referred to as the Kendall Surface, as discussed by Grimes (1979). Relief becomes less prominent towards the west, but the frequency of drainage lines (*Hann, Citri*) becomes greater. The mode of formation of these drainage lines is unclear, but very distinct catenas exist. *Kimba* is usually uppermost in the catena, rapidly grading to *Clark* with progression downslope. The occurrence of ironstone in *Clark* generally increases towards the lower slopes. The footslopes are a zone of poor drainage, as discussed under the Ebagoola Landscape. The depth to a B horizon decreases rapidly towards the centre of the drainage line, where the very shallow surfaced *Citri* is present. A discernible trend in the vegetation structural characteristics follows the changes in soil type (see section 3.7). The intensity of the drainage network varies over the Landscape.

Significant alluvial deposits (*Morehead, Mitchell, Kennedy, Antbed*) are associated with the major rivers and streams. *Morehead* and *Mitchell* are sandy soils found on levees and terraces. The latter exhibits more substantial profile development, but its alluvial origin is still evident. *Mitchell* is generally high enough above the river bed for flooding to be infrequent in comparison to *Morehead*, which is frequently flooded. *Kennedy* and *Antbed* are impermeable soils that are found on the frequently flooded plains. *Kennedy* is heavier in texture, and can be very sodic and alkaline. *Antbed* is lighter textured at the surface, but still sets to a very strong consistency. Magnetic termite mounds are a common feature. Both *Antbed* and *Kennedy* contain salts at depth.

The coastal plains are dominated by cracking saline clays (*Marina*) interspersed with beach ridges (*Caravan, Caravan Deep Phase*) of Holocene and Pleistocene age. Both *Caravan* and *Marina* vary in nature, depending on distance from the tidal zone or relative age.

Marina is less hydromorphic further inland, whereas closer to the tidal zone it cracks less, and shows evidence of greater influence from saline watertables. As expected for a soil of marine origin, it contains high levels of $SO^{=}_4$ S and Cl^-.

Saltpans (*George, Nassau*) and mangroves (*Skardon*) are a feature of the tidal and extra-tidal zones. The saltpans vary in consistency from wet muds to dry surfaced soils with a shallow saline watertable. Their nature probably varies with seasonal influences. The edges of the saltpans often consist of a Hypersalic Hydrosol (*Nassau*) which lies in a zone less affected by tidal influences. Halophytes are common on this soil.

Caravan has similarities with the soil *Hull*, described by Murtha (1986). It often shows evidence of dual B horizons. It is suspected they are related to the wet season and dry season water tables. The nature and origin of the beach ridges of the south-western Peninsula is well described in Smart (1976a, 1976b).

EDWARD RIVER LANDSCAPE

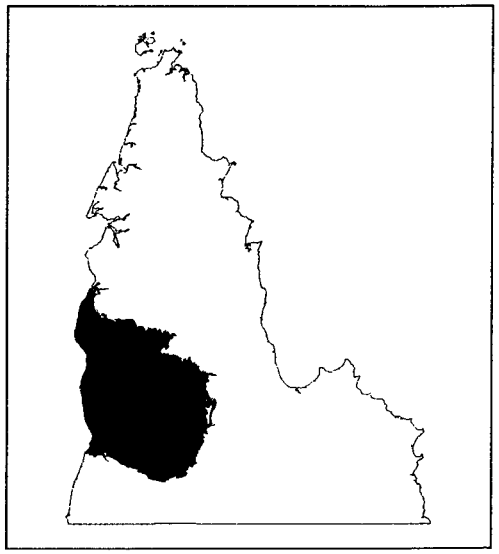
West East

SOILS

Ab Antbed - Deep Gradational sodic mottled grey soils formed on alluvial plains
Ad Andoom - Very deep Uniform or Gradational yellow massive soils with aluminous concretions
Bb Bimbus - Deep bleached Uniform sands over coffee rock
Bm Brom - Deep Gradational or Uniform mottled grey massive soils formed on residual sands
Cr Clark - Deep bleached Gradational yellow massive soils formed on lower slopes of residual sands
Ct Citri - Deep bleached Duplex sodic soils formed in drainage depressions on residual sands
Cv Caravan - Moderately deep coloured Uniform sands formed in beach ridges on chenier plains
CvDp Caravan Deep Phase - As for Caravan, moderately deep A1 horizon
Go George - Moderately deep saline mottled clays formed in recent estuarine deposits (saltpans)
Hn Hann - Deep bleached Duplex sodic soils formed on footslopes and drainage depressions in residual sands
Kb Kimba - Very deep sandy surfaced Gradational red massive soils formed on residual sands
Mn Marina - Very deep Uniform, frequently cracking saline grey clays formed on marine plains
Ns Nassau - Moderately deep saline Duplex mottled grey soils associated with saltpans
Vy Vrilya - Very deep Uniform siliceous sands with minimal profile development, formed on foredunes
Wp Weipa - Deep Gradational or Uniform red massive soils with aluminous concretions
Wu Witchura - Moderately deep Gradational or Uniform red massive soils with ferruginous nodules

VEGETATION

16 Woodlands and tall woodlands (*E. tetrodonta*) on deeply weathered plateaus and remnants
17 Woodlands (*E. tetrodonta*) on erosional surfaces and residual sands
18 Low open woodlands and low woodlands (*Melaleuca viridiflora*) on depositional plains
21 Tussock grasslands on marine plains
23 Tussock grasslands on longitudinal drainage depressions
25 Woodlands and herblands on beach ridges and the littoral margin
29 Bare areas (saltpans)



(Not to scale)

100 km

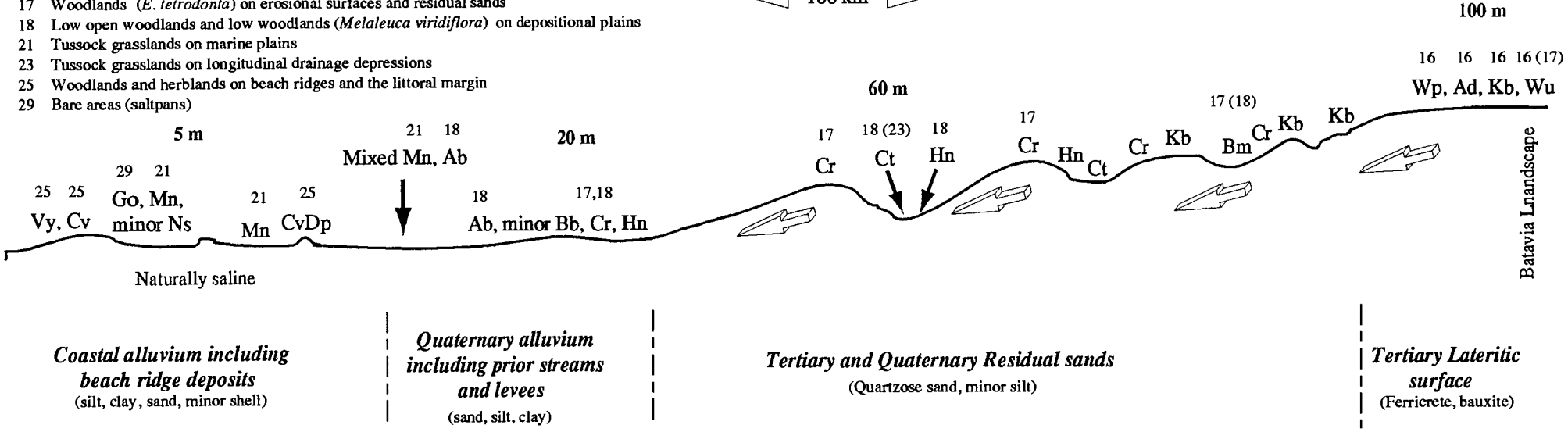


Figure 13 Edward River Landscape

3.2.6 *Mitchell Landscape*

The Mitchell Landscape occurs in the south-western corner of the CYPLUS study area, and a small area in Lakefield National Park (Figure 14).

In the south-west, the heavy textured soils and other alluvia have been deposited by the Mitchell, Alice and Nassau Rivers. Massive surfaced sodic clays (*Kennedy*) dominate the flat landscape, with associated deposits of *Bend, Antbed, Mitchell* and *Morehead*. As discussed earlier, both the *Kennedy* and *Antbed* are impermeable. The occurrences of *Kennedy* closer to the coast crack more frequently, particularly around drainage depressions and swamps, than the occurrences further inland. The inland version is apparently more sodic and alkaline. Erosion along drainage lines is more prominent. The boundary between the *Kennedy* and the cracking clays of marine origin (*Marina*) is very obscure in parts, no doubt as a result of reworking of both by river action. *Bend* is lighter textured than *Kennedy* but displays some similar characteristics. Both *Bend* and *Kennedy* are relatively fertile, however flooding can be a limitation to their agricultural use.

Beach ridges (*Caravan, Caravan Deep Phase*) are interspersed on the marine clay plains, as described in the Edward River Landscape. *Caravan Coarse Phase* appears to be restricted to an occurrence east of the Palmer fault, in Lakefield National Park.

MITCHELL LANDSCAPE

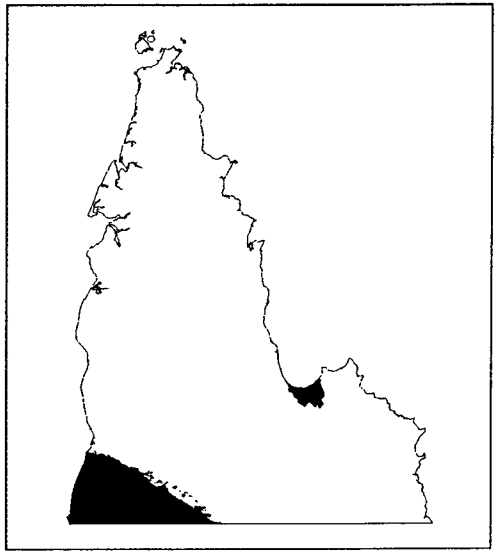
West East

SOILS

Ab Antbed - Sodic Gradational mottled grey soils formed on alluvial plains
Bn Bend - Gradational or Uniform grey or yellow-brown soils formed on alluvial plains
Cv Caravan - Coloured stratified Uniform sands formed in beach ridges on chenier plains
Go George - Saline mottled clays developed in recent estuarine deposits (saltpans)
Kd Kennedy - Uniform to Gradational massive surfaced or cracking grey clays formed on alluvial plains
Mc Mitchell - Deep Uniform or Gradational yellow, brown or red soils on terraces
Mh Morehead - Brown recent sandy alluvia
Mn Marina - Uniform, frequently cracking sodic grey clays formed on marine plains
Ns Nassau - Saline Duplex mottled grey soils associated with playas
Vy Vrilya - Uniform siliceous sands with minimal profile development, formed on foredunes

VEGETATION

6 Gallery closed forests and *Melaleuca spp.* dominated open forests on alluvia
7 Woodlands and open woodlands (*E. chlorophylla, E. microtheca* or *E. acroleuca*)
8 Woodlands and open woodlands (*E. clarksoniana, E. novoguinensis* or *E. polycarpa*)
18 Low open woodlands and low woodlands (*Melaleuca viridiflora*) on depositional plains
21 Tussock grasslands on marine plains
25 Woodlands and herblands on beach ridges and the littoral margin
29 Bare areas (saltpans)



(Not to scale)

◁ 120 km ▷

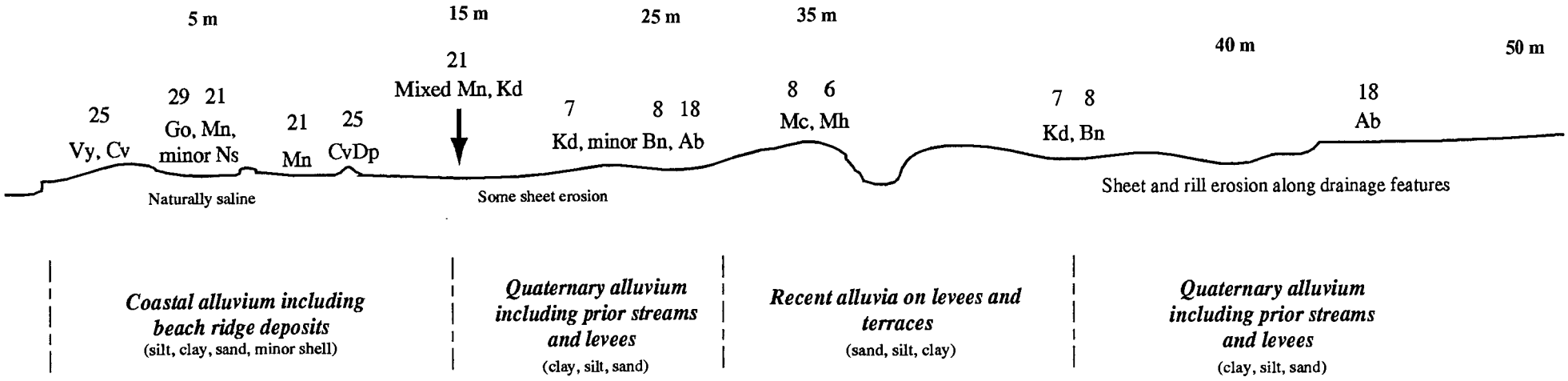


Figure 14 Mitchell Landscape

3.2.7 *Hodgkinson Landscape*

Dominating the south-eastern corner of the study area, the Hodgkinson Landscape is comprised of steep hills of greywacke and slate (Hodgkinson Formation) with associated colluvial and alluvial material (Figure 15).

The uplands are steeply dissected and in many areas capped with sandstone (Battle Camp Formation). Very shallow rocky Tenosols (*Camp*) are the most common soil on the sandstone. A similar, but more loamy soil (*Hodge*) also occurs on the metamorphics, subdominant to Yellow Kandosols/Dermosols (*Jeannie*) and Grey Sodosols (*Eykin*). Where the sandstone cap is significant, a moderately deep Yellow Kandosol (*Audaer*) occurs on the hillslopes. The genesis of this soil appears to be influenced by both sandstone and metamorphic surfaces. All of the soils formed on the hillslopes are primarily limited by slope and rockiness, with respect to pasture production and cropping.

The footslopes of the hills are comprised of a complex of Yellow Dermosols (*Kingjack*) and Yellow Sodosols (*Gibson*). It is often difficult to predict where one of these soils occurs in place of the other. *Gibson* is moderately fertile, but wetness and erodibility can be limitations to agricultural development.

Gibson and *Kingjack* grade into alluvial equivalents (*Wakooka*, *Greenant*). The boundary between the two groups of soils is often indistinct. Flooding and fertility are common limitations to agriculture.

Along the rivers and major streams are occurrences of *Morehead*, *Mitchell* and the Red Chromosol (*Victor*). This last soil warrants special mention, although its distribution appears to be restricted to scattered occurrences on the Palmer, Laura and Normanby Rivers. The surface of the soil is a freely draining, but relatively infertile Red Chromosol. The depth of this soil varies between one and three metres. Below it are D horizons with high salt levels, and significant quantities of silica segregations.

In the high rainfall (1800 mm) Wet Tropics Area on the eastern side of the Landscape, greater leaching conditions exist in comparison to the areas of Hodgkinson Formation to the west. A Red Dermosol (*Rule*) is the most common soil under closed-forests. This soil appears to be similar to the *Galmara* described by Murtha (1986) in the Mossman to Cape Tribulation area.

Natural erosion levels are suspected to be high in this Landscape. Significant accelerated erosion exists, particularly with regards to roads constructed through areas of the *Victor*, *Greenant* and *Gibson* soils. Biggs (1995a) provides further discussion of the nature of erosion in this Landscape.

There is a moderate risk for the development of secondary salinity associated with *Gibson* and *Victor*. Both soils, particularly *Victor* contain appreciable salts at depth, and exist in parts of the landscape that are potentially subject to alteration which may induce hydrological imbalance eg. tree clearing. The matter is discussed in further detail by Biggs (1995b).

HODGKINSON LANDSCAPE

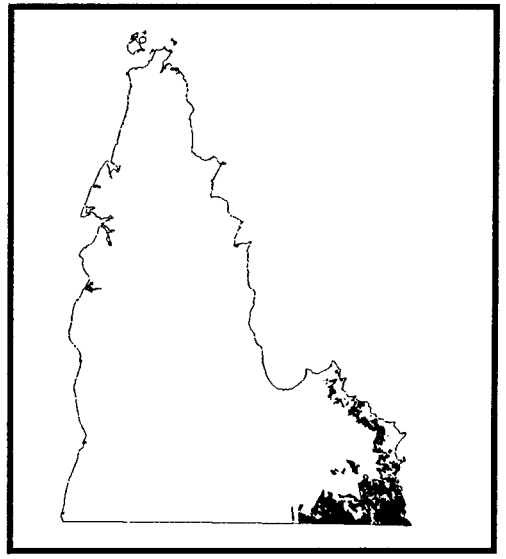
West — East

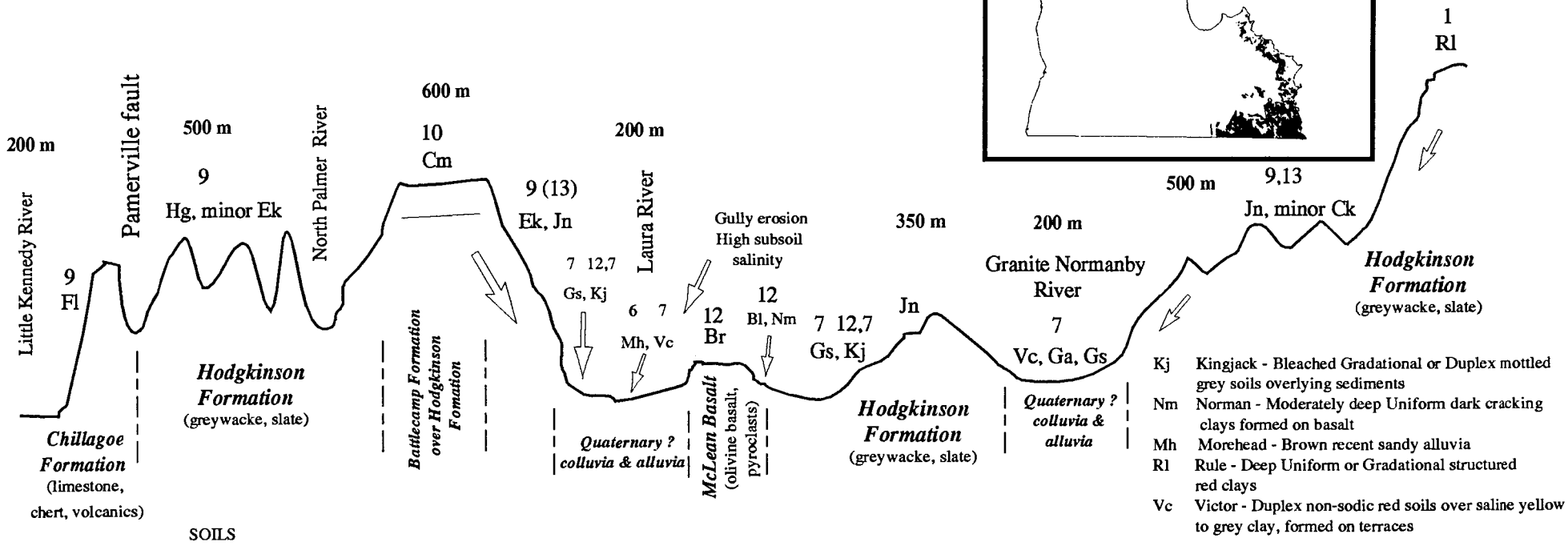
VEGETATION

1 Closed Forests of the Wet Tropics region
6 Gallery closed forests and *Melaleuca spp.* dominated open forests on alluvia
7 Woodlands and open woodlands (*E. chlorophylla, E. microtheca* or *E. acroleuca*)
9 Woodlands and open woodlands (*E. cullenii, E.crebra* or *E. persistens*)
10 Woodlands (*E. hylandii* or *E. tetrodonta*) on hillslopes
12 Woodlands (*E. leptophleba, E. platyphylla* or *E. erythrophloia*)
13 Open forests and woodlands (*E. nesophila* or *E. hylandii*)

(Not to scale)

160 km





Kj Kingjack - Bleached Gradational or Duplex mottled grey soils overlying sediments
Nm Norman - Moderately deep Uniform dark cracking clays formed on basalt
Mh Morehead - Brown recent sandy alluvia
Rl Rule - Deep Uniform or Gradational structured red clays
Vc Victor - Duplex non-sodic red soils over saline yellow to grey clay, formed on terraces

SOILS

Bl Deep Uniform or Gradational non-cracking brown clays formed on basalt
Br Burn - Deep Uniform red strcutured clays with nodules formed on basalt
Ck Cook - Duplex non-sodic red soils formed on greywacke and slate
Cm Camp - Bleached rocky Uniform sandy soils derived from sandstone
Ek Eykin - Shallow Duplex sodic soils developed on greywacke and slate
Fl Fairlight - Moderately deep Gradational red structured soils formed on limestone
Ga Greenant - Duplex sodic acid to alkaline yellow soils formed on alluvial plains
Gs Gibson - Duplex sodic yellow or grey soils on colluvial/alluvial fans derived from greywacke and slate
Hg Hodge - Shallow bleached Uniform or Gradational brown soils formed on greywacke and slate
Jn Jeannie - Gradational yellow soils formed on greywacke and slate

Figure 15 Hodgkinson Formation

3.4 Perspective 3 - Australian Soil Classification

The 113 soil profile classes can be amalgamated into 16 broad categories based on the Australian Soil Classification (Isbell, 1993), using Order and Family (depth) criteria. The categories and their respective percentages of the area of the Peninsula are provided in Appendix 3. A soil map, compiled using these categories, is provided at the rear of this report.

3.5 Soil chemistry

Thirty-one profiles from twenty-four soil types were sampled in the course of NR02. Analytical data stemming from CSIRO work on the Atlas of Australian Soils provided information on fifteen soil types over thirty-nine sites. Full site descriptions and analytical results for the NR02 sites are listed in Appendix 3. Selected analyses were also available from Pastures Branch activities on the Peninsula, and works such as Grundy and Heiner (1991). Analyses were available for a total of thirty-eight soil profile classes.

The NR02 profiles were sampled at standard depths of 0-10 cm bulk, 0-10, 20-30, 50-60, 80-90, 110-120 and 140-150 cm. These depths varied if morphological boundaries existed within sampling horizons, or if physical impedance prevented sampling eg. extreme hardness (*Citri*) or presence of abundant segregations or coarse fragments (*Bertie, Andoom, Witchura*). CSIRO analysis sites were usually sampled at 10 cm intervals, but the depths at which certain analyses were conducted varied. Methods used in the analysis of NR02 samples are described in Baker and Eldershaw (1993).

The data has been considered from the perspective of the Australian Soil Classification (Isbell, 1993). The Orders and soil profile classes under consideration are listed in Table 5.

The ranges and mean values for selected analyses are listed in Table 6.

Table 5 Soil profile classes analysed on CYP

Order	Soil profile classes (No. of sites analysed)	Total number analysed
Rudosol	Mh (1)	1
Tenosol	Jd(3) Gg(2) Dx(3) Dt(1) Tr(1)	10
Podosol	Gv(2)	2
Kandosol	Ad(1) Bm (1) Bt(1) Cr(4) Cx(1) Em(4) Hm(4) Kb(9) Kl(1) Ol(4) Wl(1) Wp(1) Wu(1)	33
Dermosol	Bn(1) Bv(3) Ld(1) Ml(1) Rl(1) Wk(2)	9
Ferrosol	Ed(1)	1
Vertosol	Kd(2) Mn(1) Pn(2)	5
Chromosols	Vc(2)	2
Sodosols	Ek(1) Ga(1) Gs(1)	3
Hydrosols	Ab(1) Ct(1) Hn(1) Sv(1)	4

3.3.1 Soil pH

The soils of the Peninsula are typically moderately acid to slightly acid, with the exception of the Vertosols, Sodosols and Hydrosols. Given the high leaching conditions of the region, the soil reaction trend is not surprising. The generally higher pH values of the younger soils (*Picanninny, Myall*) of the Rolling Downs Group in comparison to the more weathered soils (*Batavia, Lydia*) would appear to support this.

In many cases, higher pH values are linked to soils or horizons that are slowly or very slowly permeable and have moderate to high ESPs either throughout the profile (*Pn No.2*, *Kd No.2*) or in the B horizons (*Sv, Ct, Ab*).

The pH of the Hydrosols varies considerably as a result of the range in profile morphology of the soils within this order, eg. *Silver* is a highly leached soil with a deep, sandy A2 overlying a clay B, whereas *Hesket* is a leached soil with a Gradational texture profile. Differing parent material and mode of formation are also significant factors eg. alluvial soils *vs* colluvial or *in situ* soils.

3.3.2 Electrical conductivity (EC), chloride (Cl) and sodicity

Electricity conductivity and chloride are used to give a measure of soil salinity and the proportion of salinity that is related to chloride ions.

The majority of soils on CYP have a very low soil salinity rating (EC) and correspondingly very low Cl levels. No discernible profile trend is evident.

The Vertosols, Sodosols and Hydrosols recorded higher average subsoil values for EC and the Vertosols and Hydrosols higher average Cl values, than the other Orders. Surface EC values of all of these soils except for *Marina* are very low, but increase with depth. The lower surface values probably reflect the high leaching conditions on the Peninsula. The rate of increase of salinity is quite substantial and usually occurs > 0.5 m. It appears to be related to an increase in clay content associated with the B horizons.

The soil *Victor* has very low EC and Cl ratings throughout the soil profile until a D horizon is reached (at variable depth). This D horizon records extreme salinity and Cl levels.

The sodicity of a soil is generally indicated by the ratio of exchangeable Na to ECEC, expressed as a percentage (ESP). According to the categories of Northcote and Skene (1972), most soils of the Peninsula are non-sodic. This applies particularly to the sandier soils (clay content <35%).

Table 6 Ranges and means for selected chemistry of Peninsula soils

Order	Depth (cm)	pH[1] (1:5)	EC[2] (1:5)	Cl[2] (1:5)	ESP[3,4] (%)	ECEC[4] m.equiv/100g soil	Ca[6]	Mg[6]	K[6]	Ca/Mg[4]	Base status[4] cmol(+)/kg clay	CS[4] (%)	FS[4] (%)	SI[4] (%)	CL[4] (%)
Rudosol	0-10	M.Ac	V.L	V.L	6	4.8[5]	N.S	N.S	N.S	2.1	121	73	20	2	4
	50-60	M.Ac	V.L	V.L	3	1.0[5]	N.S	N.S	N.S	1.0	26	87	8	2	4
	110-120	Sl.Ac	V.L	V.L	2	1.7[5]	N.S	N.S	N.S	0.7	42	72	13	2	4
Tenosol	0-10	M.Ac	V.L	V.L	16-68 (37)	1.0-4.0 (2.4)	N.S	N.S	N.S	0.7-3.5 (2.2)	6-93 (33)	80-90 (85)	8-15 (12)	0-1 (1)	1-8 (4)
	50-60	M.Ac-Sl.Ac	V.L	V.L	22-74 (49)	0.4-1.2 (0.8)	N.S	N.S	N.S	0.3-2.0 (1.2)	2-34 (11)	65-88 (77)	10-23 (17)	2-3 (3)	0-14 (6)
	110-120	M.Ac-Sl.Ac	V.L	V.L	12-82 (40)	0.5-1.7 (0.9)	N.S	N.S	N.S	0.2-1.0 (0.5)	2-10 (6)	63-76 (70)	16-19 (18)	2-4 (3)	1-17 (8)
Podosol	0-10	M.Ac	V.L	V.L	47-55 (51)	1.5-1.9 (1.7)	N.S	N.S	N.S	1.6-2.3 (1.8)	73-96 (85)	25-72 (45)	24-57 (41)	1-12 (4)	2
	50-60	M.Ac-Sl.Ac	V.L	V.L	60-66 (63)	0.6-2.0 (1.3)	N.S	N.S	N.S	0.7-1.0 (0.9)	20-33 (26)	23-60 (41)	24-60 (40)	2-5 (3)	2-3 (3)
	110-120	M.Ac-Sl.Ac	V.L	V.L	88-82 (85)	1.0	N.S	N.S	N.S	0.5	16	21-50 (32)	18-46 (32)	1-5 (3)	6-11 (9)
Kandosol	0-10	St.Ac-M.Ac	V.L	V.L	0.4-6 (2.5)	1.0-6.0 (4.4)	N.S	N.S	N.S	0.6-1.9 (1.2)	4-61 (32)	55-89 (70)	7-39 (24)	1-3 (2)	2-16 (9)
	50-60	M.Ac-Sl.Ac	V.L	V.L	0.6-3 (1.3)	1.0-3.0 (2)	N.S	N.S	N.S	0.3-1.4 (0.7)	2-14 (7)	43-85 (70)	11-45 (23)	0-3 (1)	4-26 (16)
	110-120	M.Ac-Sl.Ac	V.L	V.L	0.6-3 (1.4)	1.0-5.0 (2.6)	N.S	N.S	N.S	0.05-0.5 (0.2)	2-9 (5)	46-81 (65)	12-41 (26)	1-4 (2)	22-45 (33)
Dermosol	0-10	M.Ac-Sl.Ac	V.L	V.L	1-5 (3)	1.0-12 (7)	N.S-S	N.S-S	N.S	0.6-2.0 (1.4)	7-39 (21)	2-43 (12)	23-81 (49)	4-50 (22)	9-57 (19)
	50-60	M.Ac-Sl.Ac	V.L	V.L	1-7 (5)	3.0-12 (7)	N.S-S	N.S-S	N.S	0.1-0.9 (0.4)	7-18 (12)	1-44 (12)	16-57 (35)	5-39 (17)	29-62 (38)
	110-120	St.Ac-Sl.Ac	V.L	V.L	2-18 (9)	3.0-36 (16)	N.S-S	N.S-S	N.S	0.03-0.7 (0.2)	5-21 (12)	1-16 (11)	15-43 (26)	10-30 (15)	31-59 (48)
Ferrosol	0-10	N	L	V.L	1	23.0	S	S	S	3.3	61	15	29	19	38
	50-60	M.Ac	V.L	V.L	0.6	3.0	N.S	N.S	N.S	0.8	6	9	25	12	57
	110-120	M.Ac	V.L	V.L	0.4	3.0	N.S	N.S	N.S	1.3	4	4	17	11	71
Vertosol	0-10	M.Ac-M.Al	V.L - M	V.L - H	0.1-4 (2)	10-60 (24)	S	S	S	0.6-1.3 (0.9)	18-35 (26)	2-10 (4)	7-31 (14)	10-52 (22)	38-77 (60)
	50-60	St.Ac-St.Al	V.L - H	V.L - H	1-31 (13)	18-62 (30)	S	S	S	0.7-1.2 (1.0)	30-51 (40)	1-9 (5)	5-26 (15)	12-35 (17)	38-73 (59)
	110-120	St.Ac-St.Al	V.L-V.H	V.L - H	6-54 (26)	19-63 (30)	S	S	S	0.7-1.2 (0.9)	33-44 (41)	4-12 (6)	5-25 (13)	10-37 (19)	51-75 (60)
Chromosol	0-10	Sl.Ac-N	V.L	V.L	0.1-0.6	7.0	S	N.S-S	N.S	3.3-8.6 (6.0)	45-65 (55)	6-32 (19)	47-59 (53)	11-25 (18)	10-15 (10)
	50-60	Sl.Ac-N	V.L	V.L	(0.3)	2.0-6.0 (4)	N.S-S	N.S-S	N.S	0.8-4.4 (2.6)	12-17 (14)	1-27 (14)	42-49 (46)	10-22 (16)	20-33 (27)
	110-120	M.Ac-Sl.Ac	V.L	V.L	0.9-1.3 (1.1) 1-4.5 (2.8)	3.0-8.0 (6)	N.S-S	S	N.S	0.2-0.8 (0.5)	12-26 (19)	1-25 (13)	33-46 (40)	15-29 (22)	20-29 (25)
Sodosol	0-10	M.Ac-Sl.Ac	V.L	V.L	1-4 (3)	2.0-9.0 (5)	N.S-S	N.S-S	N.S	1.0-1.1 (1.0)	16-26 (22)	7-37 (18)	13-55 (33)	20-42 (30)	14-40 (24)
	50-60	M.Ac-M.Al	V.L - L	V.L	7-15 (10)	6.0-16 (11)	N.S	N.S-S	N.S	0.1-0.3 (0.2)	13-27 (21)	3-26 (11)	12-24 (18)	11-29 (22)	44-57 (50)
	110-120	N-St.Al	V.L - M	V.L	20-25 (23)	6.0-14 (10)	N.S	N.S	N.S	0.2	28-29 (29)	2-11 (7)	14-52 (33)	15-30 (23)	23-49 (36)
Hydrosol	0-10	St.Ac-Sl.Ac	V.L	V.L	2-14 (7)	2.0-4.0 (2)	N.S	N.S	N.S	0.8-1.4 (1.0)	8-130 (65)	12-78 (34)	17-70 (45)	4-18 (9)	1-46 (13)
	50-60	M.Ac-M.Al	V.L - M	V.L	11-44 (22)	1.0-10 (6)	N.S-S	N.S-S	N.S-S	0.5-1.2 (0.9)	16-94 (50)	9-91 (46)	8-30 (20)	1-25 (11)	1-50 (24)
	110-120	M.Ac-St.Al	V.L - H	V.L - H	41-47 (44)	1.0-23 (11)	N.S-S	N.S-S	N.S	0.5-1.2 (0.9)	22-127 (58)	14-79 (47)	17-38 (25)	1-12 (6)	1-39 (22)

1 Levels derived from Baker & Eldershaw (1993)
St. Ac = Strongly acid (5.1-5.5)
M. Ac = Moderately acid (5.6-6.0)
Sl. Ac = Slightly acid (6.1-6.5)
N = Neutral (6.6-7.3)
Sl. Al = Slightly alkaline (7.4-7.8)
M. Al = Moderately alkaline (7.9-8.4)
St. Al = Strongly alkaline (8.5-9.0)

2 Levels derived from Shaw (1988)
V.L = Very low
L = Low
M = Moderate
H = High
V.H = Very high

3 High ESP's are less meaningful in soils with low ECEC's

4 Means given in brackets

5 Sum of cations only

6 Levels derived from Baker & Eldershaw (1993)
N.S = Not sufficient
S = Sufficient

Table 6 (cont'd)

Order	Depth (cm)	Total P[7] (%)	Total K[7] (%)	Total S[7] (%)	Bic. P[4] (mg/kg)	SO_4 S[4] (mg/kg)	C:N[4]	Fe[4] (mg/kg)	Mn[9] (mg/kg)	Cu[9] (mg/kg)	Zn[9] (mg/kg)
Rudosol	0-10	N.S	N.S	N.S	NA[9]	NA	31	NA	NA	NA	NA
	50-60	N.S	N.S	N.S							
	110-120	N.S	S	N.S							
Tenosol	0-10	N.S	N.S	N.S	1-3 (2)	2	13-22	NA	NA	NA	NA
	50-60	N.S	N.S	N.S		1	(17)				
	110-120	N.S	N.S	N.S							
Podosol	0-10	N.S	N.S	N.S	NA	NA	21-26	NA	NA	NA	NA
	50-60	N.S	N.S	N.S			(23.5)				
	110-120	N.S	N.S	N.S							
Kandosol	0-10	N.S	N.S	N.S	1-2 (1.5)	2-4 (3)	10-65	14-32	M - H	V.L -L	V.L
	50-60	N.S	N.S	N.S		1-8 (3)	(25)	(20)			
	110-120	N.S	N.S	N.S							
Dermosol	0-10	N.S - S	N.S	N.S - S	1-15 (6)	6-9 (7)	11-24	22-50	M - H	L - M	V.L - M
	50-60	N.S - S	N.S	S		2-49 (25)	(17)	(34)			
	110-120	N.S - S	N.S	N.S - S							
Ferrosol	0-10	S	N.S	S	3	19	15	15	H	H	M
	50-60	S	N.S	S		275					
	110-120	S	N.S	S							
Vertosol	0-10	S	S - V.S	S	2-125	4-5 (4)	12-20	19-270	M - H	M	M
	50-60	S	S - V.S	S	(41)	1-2 (1)	(17)	(110)			
	110-120	S	S - V.S	S							
Chromosol	0-10	S	S - V.S	S	1	1-2	19-37	8-27	M - H	M	M
	50-60	S	V.S	S		1	(28)	(17)			
	110-120	S	V.S	S							
Sodosol	0-10	N.S - S	S - V.S	S	1-15 (5)	4-7 (5)	15-20	9-190	M - H	L - M	V.L
	50-60	N.S	V.S	S		3-12 (8)	(17)	(79)			
	110-120	N.S	V.S	S							
Hydrosol	0-10	N.S (S)	S - V.S	S	1-2 (1.5)	1-3 (2)	15-70	17-54	V.L -	V.L	V.L
	50-60	N.S	V.S	S		1-8 (3)	(42)	(27)	M		
	110-120	N.S	S - V.S	S							

7 Levels derived from Baker & Eldershaw (1993)
N.S = Not sufficient
S = Sufficient
V.S = Very sufficent

8 NA = Not available

9 Levels derived from Baker & Eldershaw (1993)
V.L = Very low
L = Low
M = Moderate
H = High

High ESP values are found in the Tenosols and Rudosols, but these are not overly significant as these soils have very low clay contents, and ECECs. Some of the Sodosols, Vertosols and Hydrosols record the highest values, particularly in the subsoil. Within the Vertosols, *Kennedy* has consistently higher levels than *Picanninny*, while *Marina* posesses very high levels (it has been excluded from the range in Table 6). The higher subsoil ESPs in the Dermosols are found in *Batavia*, particularly in relation to its B3 horizon.

3.3.3 Exchangeable cations, ECEC and base status

Exchangeable cations in all soils were determined at pH 7.0 as described in Baker and Eldershaw (1993). If soil pH exceeded 8.5, they were also determined using an alcoholic method similar to that of Loveday (1974).

Cape York Peninsula soils, with the exception of the Vertosols, are typically insufficiently supplied with Ca, Mg and K. Some Dermosols (*Myall*), Chromosols (*Victor*), Sodosols (eg. *Eykin*) and Hydrosols (*Silver*) are sufficiently supplied in some or occasionally all horizons. The trends in cation levels with depth vary. Surface accumulation, particularly of Ca and Mg is common. A decrease with depth in the upper horizons is common, particularly in the Tenosols and Kandosols, but an increase at >0.5 m is not uncommon, particularly in the Kandosols and some of the Hydrosols, eg. *Silver*. As with changes in EC, rapid increases in cations, particularly Mg appear to be linked to increases in clay content in the B1 and B2 horizons. *Batavia* also exhibits similar trends with respect to its high clay B3 horizon.

It is apparent that soils of marine origin (*Marina*), or derived from parent material of marine origin (*Picanninny, Myall, Batavia, Eykin*) have higher Ca and Mg levels than soils derived from sandstone.

Ca/Mg ratios typically decline with depth and are usually <1.0 at >1.0 m depth. In *Batavia*, values of <0.1 are found in the B3 horizon. The Vertosols are the only group of soils not displaying a decline in range or mean ratio with depth - values remain approximately stable. Emmerson (1977) comments that Ca/Mg levels of <0.5 commonly cause dispersion in Australian soils.

Low effective cation exchange capacity (ECEC) is frequently a characteristic of tropical soils (Brady, 1984). Given the predominance of kaolin in these soils, low ECEC values are not surprising. Data incorporated in NR02 would on most accounts support this. The majority of soils, particularly those with <35% clay have an ECEC of <10 m.equiv. kg^{-1} soil. Many show a trend of higher values in the surface, than in the remainder of the profile. Isbell and Smith (1976) noted that for Red Earths in North Queensland, there was a link between organic carbon and CEC in the surface.

The Rudosols, Tenosols and Podosols of the Peninsula all posess an ECEC of <5 m.equiv. kg^{-1} soil, largely reflecting the low clay content of these soils. Higher levels in the A1 are a feature, and values continue to decline with depth. The Kandosols display higher values in the upper and lower profile than in the middle. The ECEC of *Kool* was considerably higher in the upper and mid-profile than the other Kandosols, and these values were not included in Table 6. The values at these points were 15 and 6.5 m. equiv. kg^{-1} soil respectively. The alluvial soils *Cox* and *Wheeler*, found together in the northern Peninsula, posess values in the mid- and lower profile that were up to twice those found in the other Kandosols.

The ECEC of the Dermosols varies considerably. *Myall, Batavia* and *Bend* possess the highest levels. Values are stable in at least the upper 60 cm of the former two soils while a distinct jump (32-36 m.equiv. kg^{-1} soil) linked to the B3 horizon is found at 110-120 cm in *Batavia*. *Lydia*, the most leached of the analysed Dermosols, has the lowest ECEC throughout the profile.

The Ferrosol *Endeavour* has a low ECEC other than in the surface, which has a value of 23 m.equiv. kg^{-1} soil. This no doubt reflects the high organic matter influence (4.8% organic carbon), a result of the closed forest found on this soil.

As expected, the mean ECEC of the Vertosols is higher than that of any other Order of soils on the Peninsula. The range of ECEC would be considerably less if the analysis of *Picanninny* No. 2 was excluded. This soil has a very high clay content (73-77%) and correspondingly high ECEC (60-63).

The only Chromosol analysed was *Victor*. It displays a similar trend to, but higher values than the Kandosols. The ECEC of the D horizon is 27. The Sodosols displayed the expected increase in CEC in the B horizons. *Gibson* has the highest values in the range, and *Greenant* the lowest.

The Hydrosols posess a similar trend to that of the clay soils, with ECEC increasing with depth. The sandier Hydrosols eg. *Hann,* had the lowest values. Surprisingly, *Silver* has the highest values at 110-120 cm, a value over twice that found in *Antbed.*

For any given Order, base status varies considerably within the profile. For the Rudosols, Tenosols, Kandosols, Dermosols and Ferrosols, values tend to decrease rapidly below the soil surface. This probably reflects the influence of organic matter accumulation at the surface. The remaining orders exhibit a decrease in base status mid profile but a subsequent increase at greater depths. In some cases this reflects the presence of an A2 or similar leached horizon in the upper- to mid-profile and a clay B horizon in the lower profile. In the case of the Vertosols however, the trend is reversed with the highest values attained mid-profile. The reason for this is unclear.

3.3.4 Particle size distribution

The particle size distribution of the soils varies considerably and reflects such influences as parent material, weathering and alluvial influences. Soils such as Rudosols, Tenosols and Kandosols, that are sourced from quartzose rocks (adamellites and sandstones), are high in coarse sand and/or fine sand and low in silt. Soils derived from fine grained parent materials have higher silt and clay contents, eg. some Dermosols, Vertosols, Sodosols.

The high fine sand and silt proportion in surface horizons of many soils probably contribute to their hardsetting nature, eg. Sodosols, some Dermosols. Interestingly, *Antbed*, which is one of the hardest setting soils on the Peninsula does not have a high silt content (although this is based on only one sample). The same applies to the samples of *Olive*, which also sets very hard.

Within the Kandosols, it is apparent that *Kimba* has slightly higher coarse sand, silt and clay percentages throughout, but a lower fine sand content than *Clark.* The only sample of *Kool*

indicates a very high fine sand component. The analyses of *Weipa, Andoom* and *Bertie* suggest a higher clay content in the bauxitic or ferruginous soils. The Tenosols show variation that is apparently linked to parent material. *Dixie*, which is derived from adamellites, has a higher coarse and fine sand fraction than *Jardine* or *Therese*, which are derived from sandstones.

The Hydrosols show similar variation, eg. *Silver* in comparison to *Antbed.* An interesting trend concerns the soils within the catenary sequence in the Edward River Landscape. From *Kimba* to *Citri*, the coarse sand fraction decreases but the fine sand fraction increases. This perhaps reflects some downslope movement of finer material, and is perhaps partially responsible for the accumulation of clay in the drainage depressions.

3.3.5 Clay mineralogy

The type of clay in a soil can be inferred from CEC/clay ratio (clay activity ratio), CEC and total K levels (Baker and Eldershaw, 1993). Norrish and Pickering (1983) suggest that tropical soils are typically dominated by Kandite class (1:1) clays. Clay activity ratio (CAR) is equal to base status/100. Hence soils with a base status of <40 cmol(+) kg^{-1} clay would be likely to be dominated by kandite class clays. Ignoring surface values due to the influences of organic matter, all soils except for some of the Vertosols and Hydrosols fall into this category.

Isbell and Smith (1976) found that red, yellow and grey massive earths in North Queensland were all dominated by kaolin. CSIRO analyses on the Peninsula indicated soils such as *Olive, Batavia, Kimba, Emma, Clark* and *Harmer* were dominated by kaolin (65-80%) with illite the next most common mineral (5-20%). Haematite increased to 10-20% at depth in *Kimba* while goethite behaved similarily in *Emma*. Analysis of *Weipa* found kaolin was the most common mineral, followed by gibbsite, boehmite and haematite. Gunn (1967) indicated that kaolin was dominant in a Red Earth at the top of a lateritic profile in North Queensland. These results contrast with those of Grundy (1979) who found that *Weipa* was dominated by minerals such as boehmite, haematite and gibbsite with kaolinite only present in small quantities. The difference in location between Grundy's and CSIRO's samples may be responsible for the different mineralogy. The latter sample was from a less weathered part of the Aurukun Surface.

3.3.6 Carbon and nitrogen

C/N ratios for the surface of Peninsula soils should be considered with the nature of the Peninsula vegetation borne in mind. Vegetative growth is prolific during the wet season, but drops off rapidly in the dry season. Fuel loads, particularly of grass can be quite high and both hot and cool fires are frequent events. There are suggestions that the fire regime on the Peninsula has changed in the last 50 years (Stanton, *pers. comm.*). Burnt organic matter is often found in the surface of the sandier soils, and is often hydrophobic.

The potential for variation is highlighted when the Kandosol samples of NR02 and CSIRO are considered separately. NR02 analyses of *Kimba* and *Clark* indicated a C/N range of 60-65 (62), while CSIRO samples had a range of 10-23 (15). The differences in nitrogen were only minor, 0.01-0.04 (0.02) for NR02 and 0.04-0.07 (0.05) for CSIRO. The range in organic carbon was however greater, with the mean value for NR02 twice that of the CSIRO samples.

Bearing this sort of variation in mind, the range and means of C/N ratios are presented in Table 6. All soils have ratios >10, and many are >20. The very high ratios in *Silver* and *Hann* are a reflection of an almost total absence of nitrogen in these sandy soils.

3.3.7 Total P, K and S

The quantity of total P, K and S in a soil can give an indication of the potential supply of each nutrient, in comparison to exchangeable values, which give an indication of available supply.

The soils of CYP vary considerably in their total levels of these three elements. The sandier soils (Rudosols, Tenosols, Podosols and Kandosols) are generally insufficiently supplied ie. <0.02% P, <0.5% K and <0.02% S. P and S levels are often stable throughout the profile, while K levels commonly increase with depth. Trends worth noting include the substantially greater K levels in sandy soils (*Dixie*) derived from acid plutonic rocks, in comparison to those derived from sandstone (*Jardine, Therese, Ginger*). This is supported by radiometric imagery (see section 3.8). Within the Kandosols, the soils *Emma* and *Harmer* show relatively stable levels of P, K and S throughout the profile, whereas *Kimba* and *Clark* often show increasing P and K levels at depth.

Supply of P, K and S in the Dermosols ranges from insufficent to well supplied. Levels of K often increase with depth, while trends in P and S vary. Both *Bend* and *Rule* are sufficient in all three elements throughout the profile. Supplies of K are very high for the two Dermosols associated with the Hodgkinson Formation (*Rule*, *Wakooka*) and similarily for the Sodosols (*Eykin, Gibson, Greenant*) associated with this geology. Warrell *et al.* (1984) comment on the disparity in K levels between basaltic and metamorphic soils on the Atherton Tablelands. This trend appears to be present on the Peninsula also.

Sulfur is sufficiently supplied in the Hydrosols, Sodosols, Vertosols and Ferrosols. As indicated, K is lacking in the Ferrosols, but it is amply supplied in the other four Orders. Potassium levels decrease with depth in the Hydrosols, are stable in the Vertosols and increase in the Chromosols and Sodosols. Phosphorus is not well supplied in the Hydrosols and Sodosols, but is sufficient in the Chromosols, Vertosols and Ferrosols. Both P and S often decrease with depth, but some increases are evident eg. Chromosols.

3.3.8 Available P and S

Within NR02, levels of surface phosphorus and sulfate-sulfur were used as indicators of fertility, as these two nutrients have historically been indicated as limiting to beef production. Figure 16 illustrates the range in phosphorus and sulfur levels for those soils sampled during NR02 and additional profiles sampled during Atlas of Australian Soils work. The majority of samples had very low levels of both nutrients.

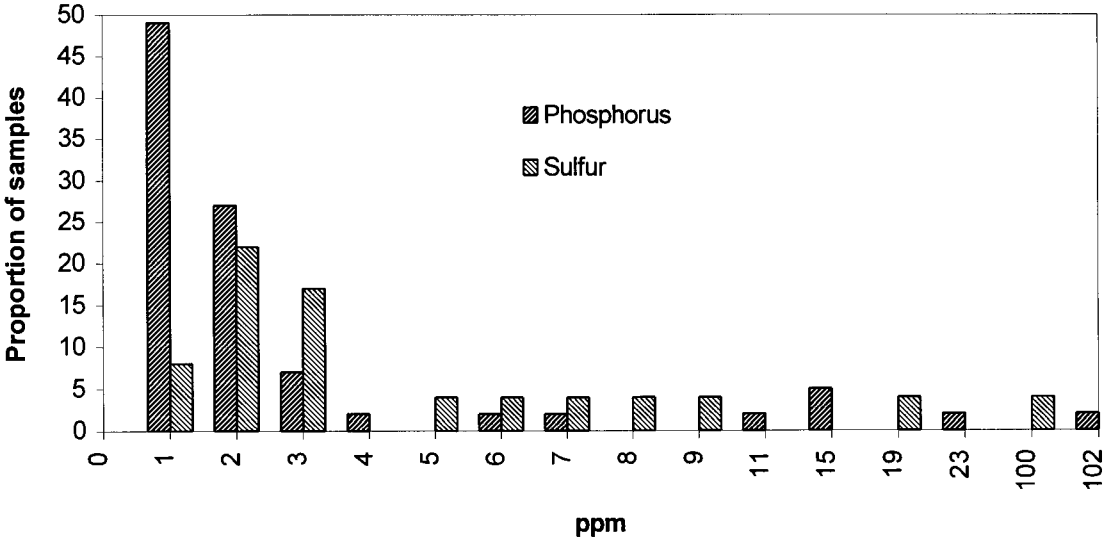


Figure 16 Range of P and S values recorded for selected soils of CYP

Unfortunately, not all profiles were analysed for either bicarbonate P or sulphate S. This applies particularly to the CSIRO samples. Pastures Branch analyses were useful for providing extra information. No analyses were available for the Podosols or Rudosols. Based on figures for the Tenosols, and comments of Isbell and Gillman (1973), it is likely that these soils have very low levels of bicarbonate P. Sulfate-sulfur levels are probably also very low.

The Kandosols are uniformly very low in available P. Cox did posess 33 mg/kg, but this figure is regarded with suspicion. Isbell *et al.* (1976) commented on the low P status of soils mapped as *Emma* and *Harmer* in the Heathlands area. *Kimba* and *Clark* have been given fertility classes of N6 rather than N8 as a result of discussions with Pastures Branch staff, Beef Cattle Husbandry staff and landholders of the Peninsula. S levels are typically <4 mg/kg in both the surface and mid-profile although a sample of *Kimba* from the Desert did record a value of 8 mg/kg at 50-60 cm.

P levels in the Dermosols range from very low (*Rule*, *Wakooka, Myall*) to moderate (*Bend*). S levels however are generally more sufficent. The surface soil is typically >4 mg/kg, as is the mid-profile, except for Bend. The Ferrosols and Chromosols are low to very low in bicarbonate extractable P, a factor perhaps linked to the iron content of the soils. S figures are very low in the Chromosol *Victor*, although the D horizon of this soil has a value of 81 mg/kg. *Endeavour* has high levels in the surface and very high levels at depth, surpassed only by *Marina*.

The quantity of available P in the Vertosols is typically low to moderate, but on occasion can be very high. *Kennedy* records levels from 6 to 102 mg/kg and *Norman* has in excess of 125 mg/kg (based on analyses of *Normanby* and *Bubbler* in Grundy and Heiner, 1994). As indicated, *Marina*, has very high levels (100 at 0-10 cm and 300 mg/kg at 50-60 cm). Excluding this soil though, the Vertosols are typically low in S at the surface, decreasing to very low levels at depth.

Both the Sodosols and Hydrosols are typically very low in available P, except for *Gibson*, which has moderately high amounts. Two of the three analysed Sodosols, display expected evidence of S accumulation at depth. Values in *Gibson* however decline. The Hydrosols, except for *Silver,* are very low in S throughout the profile. The jump in S levels at depth in *Silver* is not surprising as it is a Sodosolic Hydrosol. No S value was available for the B horizon of *Citri*, but it is likely that it is high.

3.3.9 Available micronutrients (Fe, Mn, Cu, Zn)

Micronutrients are present in varying levels in Peninsula soils. Given the frequency of ferric and/or manganiferous segregations in the soils, it would not be surprising for these two elements to be well supplied. Analyses indicate that manganese levels are consistently medium to high except for the Sodosolic Hydrosols. Iron levels vary considerably.

Unfortunately, available micronutrient data is not available for Rudosols, or Podosols and is only available for one Tenosol. However Isbell and Gillman (1973) found that Tenosols in the Coen area were uniformly low in total Cu and Zn, and remarked that the levels of Cu were amongst the lowest in Queensland. The NR02 analysis of a similar soil agreed with these findings, and in fact had the lowest levels of micronutrients of any soil analysed by NR02.

Kandosols sampled by NR02 were very low in Zn and very low to low in Cu. These results agreed with the findings of Isbell *et al.* (1976) who studied the Kandosols *Emma* and *Harmer*.

The availability of Cu and Zn in the Dermosols varies. *Lydia* and *Myall* are very low in Zn. Of all the Dermosols, *Bend* has the most ample supply, followed by *Rule*. Only total levels are available for *Batavia.*

The Ferrosols are well supplied in all micronutrients, as are the Vertosols, although the range of Fe content in the latter is quite considerable. No link could be identified between Fe content and parent material.

The analyses of *Victor* reveal a moderate supply of micronutrients, in comparison to the Sodosols. *Eykin* and *Greenant* are typically very low in Zn and low to medium in Cu. *Gibson* however is moderately supplied in Zn and Cu, with Zn levels up to 15 times those of *Eykin* and *Greenant*. Copper levels are also many times greater.

Levels of Cu and Zn, particularly the latter, in the Hydrosols are generally very low, although *Antbed* has medium Cu levels. All are low in Mn, but surprisingly, *Silver* has the highest levels. *Hann* has the lowest levels of all micronutrients for the Hydrosols.

3.6 Relationship to previous surveys

As indicated in 1.4, a number of previous surveys have been reported on for the CYPLUS study area. The relationships between the units described in those works and this survey are set out below.

3.6.1 Mitchell-Normanby Report

Encompassing nearly half of the CYPLUS study area, the Mitchell-Normanby Report described 8 major groups of soils divided into 36 families (mapping units). It is possible from their maps and soil descriptions to draw up a table relating their soil types to those described by NR02 (Table 8). Generally the correlation between units is good, and where it is exceptionally so, the name from the Mitchell-Normanby report has been retained, eg. *Kimba, Clark.*

Table 7 Relationship between NR02 and Mitchell-Normanby soils

Mitchell-Normanby	NR02
Allluvial Soils	
Morehead	Mh
Helenvale	Mc (Bn?)
Bosworth	Bn
Nassau	Ns, Go
Cracking Clay Soils	
Carpentaria	Included in Mn
Marina	Mn
Koolatah	Kd
Yanko	Kd
Gilbert	Kd
Wrotham	Pn
Texture Contrast Soils	
Gamboola	Gs, (Kj)
Hanna	Ct? Hn?
Alice	Sv
Massive Earths	
Kimba	Km
Coleman	Km, Pc?
Clark	Cr
Kalinga	Mix of Ol, Cr, Km
Welcome	Ab?
Staaten	Ab/Cr mix
Crowbar	?
Lorraine	?
Brooklyn	Jn, Hg
Structured Red and Brown Soils	
Springvale	Br, Ed (Fl)
Wyaaba	Bn?
Waterhole	Kd/Bn intergrade
Uniform Medium to Fine Texture Soils	
Healy	Tr, Dt
Bridge	Gg (including Bb)
Bathurst	Gg
Dinah	Dn, Db
Cardwell	Dx, DtRp, Dt
Shallow Rocky Soils	
Mungana	Am, Cm
Emu	Hg, Pl

3.6.2 Soils of Lakeland Downs

Site information from Grundy and Heiner (1994) was heavily relied upon for the mapping of the MacLean Basalt province. Table 8 demonstrates the relationship between the more detailed study and the soils described in NR02.

Table 8 Relationship between Grundy and Heiner (1994) and NR02 soils

Grundy and Heiner Lakelands Report	NR02 SPC
Blackburn	Burn
Laura	Burn
MacLean	Burn
Bullhead	Bull
Bubbler	Norman, Norman Shallow Phase
Normanby	Norman
Lily	-

3.6.3 Soil Associations of Batavia Downs

Heiner and Grundy (1991) mapped "Batavia Downs" at a 1:250 000 scale, providing a valuable reference area for familiarisation with the soils of the Rolling Downs Group. Their map linework was incorporated within the NR02 mapping, although differences in the classification of some soils exists. Table 9 indicates the soils described by Heiner and Grundy, and the equivalent NR02 soils.

3.7 Soil-vegetation relationships

Galloway *et al.* (1970) and Pedley and Isbell (1971) have both referred to the noticeable trends involving soil and vegetation types on the Peninsula. Both structure and floristics appear to be influenced by soil factors such as wetness, clay content, depth to an impermeable layer and salinity.

In the course of NR01, 300 sites were described in conjunction with NR02 (vegetation mapping). These correlated sites, general field observations and an intersect between soil and vegetation coverages have provided a good basis for identifying some of the relationships between soil and vegetation on the Peninsula.

Table 9 Relationship between Grundy and Heiner (1991) and NR02 soils

"Batavia Downs" soil associations			NR02 Soils
Mapping code	**Major Great Soil Group**	**Associated soils**	
Soils of the undulating to rolling hills (H) on sedimentary rocks (S)			
LHS	Lithosol (L)	Earthy Sand	*Camp*
Soils of the undulating low hills (L) on sedimentary rocks (S)			
RELS	Red Earth (RE)	Yellow Earth, Earthy Sand	*Emma*
YELS	Yellow Earth (YE)	Grey Earth, Red Earth, Earthy Sand	*?*
ESLS	Earthy Sand(ES)	Red Earth, Yellow Earth	*Deighton, Therese*
Soils of the gently undulating rises on sedimentary rocks (S)			
RERS	Red Earth (RE)	Yellow Earth, Earthy Sand	*Emma*
YERS	Yellow Earth (YE)	Red Earth, Earthy Sand	*Harmer, Batavia*
ESRS	Earthy Sand (ES)	Yellow Earth, Red Earth	*Deighton, Therese*
GERS	Grey Earth (GE)	Yellow Earth	*Brom*
Soils on the gently undulating rises on claystone colluvia (C)			
BCRC	Brown clay (BC)	Xanthozem	*Picanninny*
XRC	Xanthozem (X)	Brown clay	*Myall*
Soils of the level to gently undulating plains (P) on sedimentary rocks (S)			
GEPS	Grey Earth (GE)	Yellow Earth, Podsol	*Lydia, Wheeler*
YEPS	Yellow Earth (YE)	Grey Earth, Podsol	*Batavia, Moonlight*
REPS	Red Earth (RE)	Podsol, Yellow Earth	*Emma, Cox?*
ESPS	Earthy Sand (ES)	Podsol	*Grevil*
Soils of the gently undulating plains and rises (P) on tertiary lateritic remnants (R)			
REPR	Red Earth (RE)	Yellow Earth, Earthy Sand	*Bertie*
YEPR	Yellow Earth (YE)	Grey Earth, Red Earth, Earthy Sand	*Scorpion*
Soils of the alluvial plains (AP)			
PAP	Podsol (P)		*Grevil*
Miscellaneous units			
S	Seasonal or permanent swamps		*Mapoon, Hesket*
I	Ironstone ridges		*Bertie, Scorpion*

These relationships appear to concern the morphology of the soil profiles rather than the soil chemistry. Correlations were found between clay content and stem density[1], basal area[2] and number of taxa and; depth to an impermeable layer and stem density, basal area and number of taxa.

Example 1. The Batavia Landscape

The Batavia Landscape of the northern and central Peninsula contains soils with a range of surface and subsoil clay contents. Particle size analyses of correlated sites are available for the majority. Figure 17 illustrates a trend of decreasing basal area and stem density as subsoil clay content increases. This follows a change from tall woodlands and woodlands to low-open woodlands and grasslands. Although *Scorpion* has a greater stem density than *Andoom*, the diameter of trees on the latter is clearly greater. The two Dermosols, *Lydia* and *Batavia*, have relatively similar morphology. *Lydia* is however, more poorly drained. It is suggested that this difference in moisture availability could be the reason for the greater vegetation density on *Lydia*.

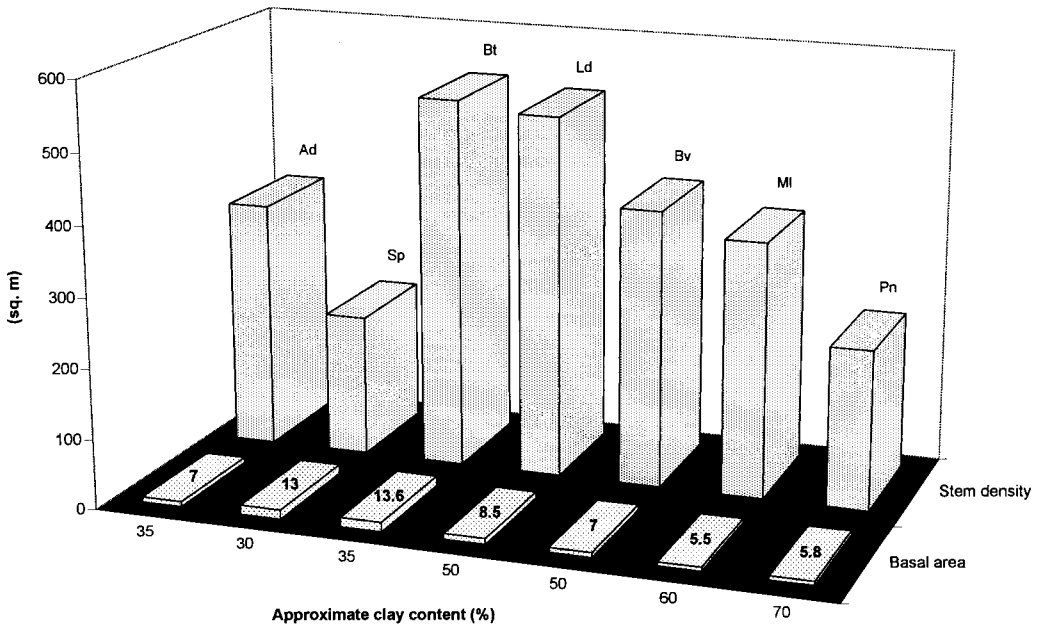


Figure 17 Vegetation structural parameters, Batavia Landscape

Example 2 Edward River Landscape

A second example which illustrates a good relationship between vegetation, soil type and moisture supply are the drainage depressions of the Edward River Landscape. Figure 18 portrays the location of the soils within the local environment of a drainage depression.

[1] Stem density is a measure of the number of stems (in the tree layer) per unit area.

[2] Basal area is a function of both stem density and the diameter of the stems and is measured in m^2 ha^{-1}.

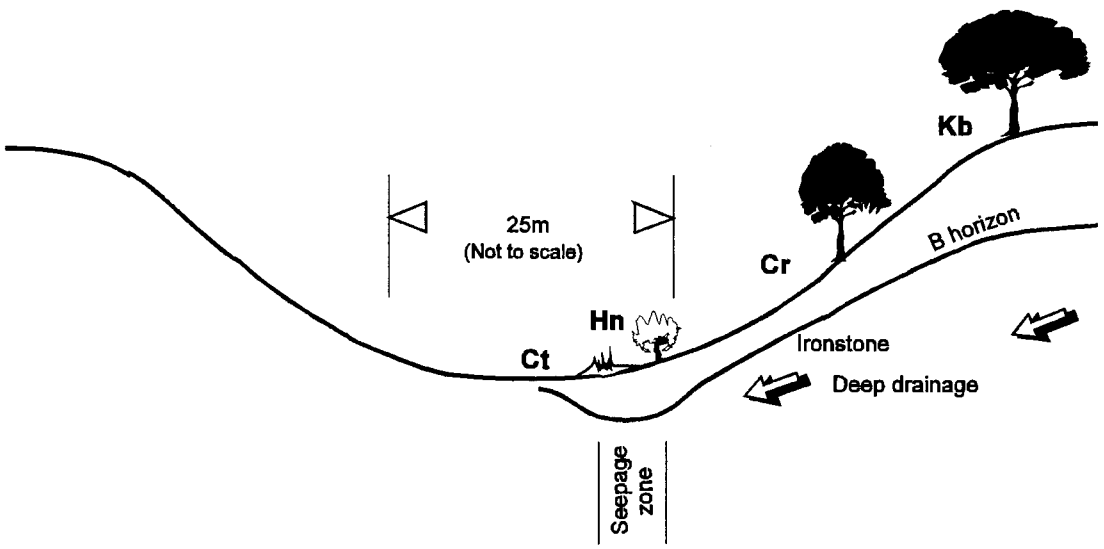


Figure 18 Cross-section of a drainage depression, Edward River Landscape

The depth to the B2 horizon, and in particular an impermeable layer, appears to follow the inverse of the topography. The sandy Red Kandosols (*Kimba*) of the upper slopes do not appear to have an impermeable layer within considerable depth of the surface. The Yellow Kandosol (*Clark*), in the mid-slope position often has a zone of ironstone at 1.0 to 1.5 m. In lower slopes, the ironstone may be as shallow as 0.4 m. Sodosols (*Hann*), with a moderately deep (0.5-1.0 m) bleached A horizon over an acid clayey sand, grading to a sandy clay are the most common soils of the seepage zone found at the footslope of the rises. The depth to the B horizon decreases very rapidly as the centre of the drainage line is approached. The soil found in the centre of the drainage lines (*Citri*), is a very shallow surfaced Hydrosol. These are generally Solodized Solonetz or Solodic Soils according to Stace *et al.* (1968). The height and density of vegetation decreases very rapidly from upslope to downslope. Figure 19 illustrates the relationship between depth to the B horizon, basal area, stem density and number of taxa.

The significant increase in stem density at the seepage zone appears to be directly related to the greater soil water availability for longer periods of the year. Mid-way through the dry season; water was found at 1.0 m. *Citri* in comparison, remains very dry and *South* relatively dry for the majority of the year. The lack of an increase in basal area in conjunction with the stem density increase at the seepage zone indicates that the vast majority of stems are narrow.

Differences in soil chemistry may also influence the composition of the vegetation. The subsoil of *Citri* contains appreciable levels of salts in comparison to the other soils which contain low or very low levels. The high sodium levels in *Citri* also have an interactive effect on moisture supply as sodium decreases the permeability of soils. The zero value for basal area on this soil results from a near total absence of woody species.

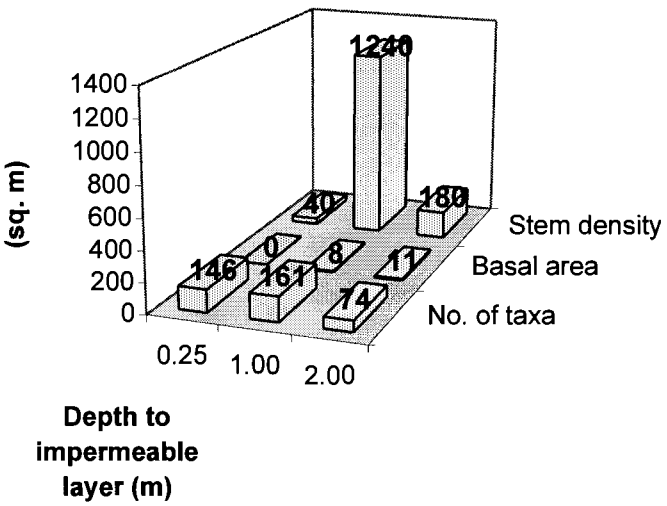


Figure 19 **Vegetation structural parameters, drainage depression, Edward River Landscape**

3.8 The use of gamma-ray spectrometric imagery

The role of gamma-ray spectrometric imagery in regolith[1] mapping on the Peninsula has been well discussed by Wilford (1992). This form of remote sensing gives an indication of Potassium, Uranium and Thorium contents of the soil/rock surface *via* gamma ray counts. Given the often close correlation between regolith and the soil profile, imagery of this sort was considered as a valuable aid to mapping in NR02.

Hardcopy of imagery for the Hann River and Ebagoola Sheets was obtained from Australian Geological Survey Organisation and used as an aid to aerial photograph interpretation. Correlation was generally found to be good, and in certain areas, particularly on the Hann River sheet, the imagery provided a valuable insight into the origin of the soil surface.

An example warranting particular mention exists in the "Dixie"-"Killarney"-"Kimba" area. In this area, nearly all of the overlying sandstone surface has been stripped revealing the underlying igneous and metamorphic rocks, which are covered by a coarse Tenosol (*Dixie*). The crests of some rises in this undulating dissected landscape still retain a veneer of residual sand ie. sand sourced from the original sandstone surface. In the field this was very difficult to pick, and panchromatic aerial photography did not at first indicate all of the occurrences of such residual sand. The difference in gamma-ray signal between the residual sands and the more recently derived coarse granitic sands was clearly evident on imagery and greatly enhanced the accuracy of the NR02 mapping.

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[1] Regolith is the mantle of materials, including weathered rocks and sediments, altered or formed by land surface processes (Speight and Isbell, 1990)

4. Agricultural land suitability assessment

4.1 General

The suitability of the soils of Cape York Peninsula for a number of land uses has been assessed using the methods described by Land Resources Branch Staff (1990). The land uses directly[1] assessed were:

- Low input pastures (sown legume, native grass and possible phosphorus supplementation)
- Medium input pastures (sown legume, native grass, fertiliser application)
- High input pastures (timber clearing, cultivation, fertiliser application, sown pasture)
- Sorghum/maize cropping
- Peanut cropping

These land uses were chosen because they are currently practiced on the Peninsula. The pastures categories were derived after discussion with staff of the QDPI Pastures Management Unit, and Beef Cattle Husbandry Group.

The land suitability assessment for cropping uses has been made on a different basis to that for the improved pasture categories. The latter is based on prevailing economic and marketing conditions in the beef industry on the Peninsula. The suitability assessment for cropping uses assumes that there are no infrastructural restrictions in relation to product handling and marketing.

4.2 Methodology

4.2.1 Soil mapping base

Land suitability assessment is based on NR02 soil mapping at a scale of 1:900 000 and a published map scale of 1:500 000. At this scale, individual map units (or UMA's[2]) usually comprise more than one, and up to four soil types. There is commonly a dominant soil in each UMA, ie. one soil comprising 60% or more of the UMA, but in many cases there are two or more sub-dominant soils.

In all cases, the percentage of each soil is recorded in the UMA DATA FILE - a file of information entered into a database for each UMA mapped in the study. There are over 6000 UMA's in the NR02 UMA data file.

As explained in 4.2.2, the suitability of each of the soils within each UMA is assessed for each land use. However, it is difficult to thematically portray the complex results generated in such a

[1] Two other categories are displayed on the map associated with this section of the report. The generation of these categories is discussed in **4.3.**

[2] A unique map area (UMA) is a mappable area of land with a defined soil and topographic composition.

process. Hence the map associated with this section of the report is compiled using the suitability of the dominant soil only, within each UMA.

4.2.2 Suitability assessment process

Land suitability assessment for selected agricultural uses is based on the evaluation of particular land properties which determine plant growth, machinery usage and the management of land degradation. It follows that these properties are the natural resource factors which determine the profitability of selected land uses in average cost/price structure circumstances.

The NR02 land suitability assessment has evaluated 12 land properties which encompass climatic, soil and topographic attributes. These are referred to as land use limitations, shortened to the term **limitations**. They are:

- Climate (C)
- Moisture Supply (M)
- Fertility (N)
- Wetness (W)
- Flooding (F)
- Rockiness (R)
- Topography (T)
- Physical Condition (P)
- Vegetation (V)
- Water Erosion (E)
- Landscape Complexity (X)
- Salinity (S)

The first step in the process is to determine the limitation levels that apply to each soil/land type in each UMA. Table 10 shows the limitation levels that apply to a *Picanninny* soil in UMA 1683. This information is recorded in the UMA data file so that for <u>each</u> soil in <u>each</u> UMA, a value or code is recorded for <u>each</u> of the above limitations (Figure 20, part 2). This code or value expresses the level of restriction in the UMA. Each code is identified by its prefix eg. N5 indicates 3-8 ppm phosphorus and greater than 4 ppm sulfate- sulfur.

The second stage in the process is to determine the effect of each limitation on each land use. This is the interpretive phase of land suitability assessment. It requires knowledge gained from farming and extension experience, as well as that from agricultural research. In the case of the present study, the suitability criteria have been developed in consultation with DPI staff who have worked on CYP, in the fields of cropping, pasture management and beef cattle husbandry.

The level of expression of each limitation determines how suitable the UMA is for various land uses. However, the effect of the limitation will vary for different land uses. For example, in a rocky soil, the level of rock will have a more adverse effect on cropping uses than it will on improved pasture production. Five classes of suitability have been used to portray the degree of effect of each limitation level on respective land uses: Classes one to five respectively imply a negligible, minor, moderate, severe and extreme effect on the land use.

The implication of the above is that if a UMA is given for example, an Rf4 code for rockiness (ie. 20-50% of 2-6 mm size stone present in the profile), this will translate to class 2 for maize and class 5 for peanuts.

Table 10 Example of the relationship between limitations and suitability classes for a UMA

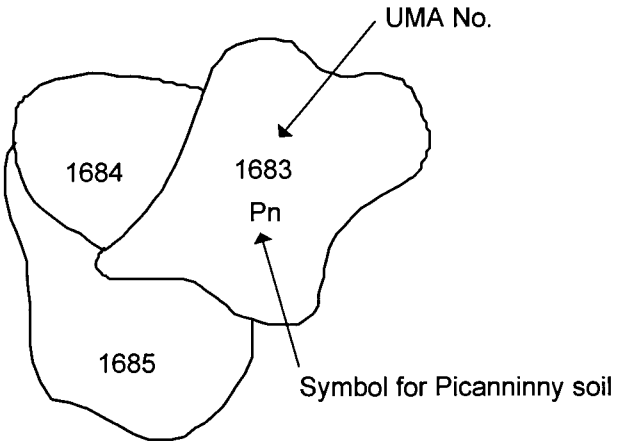
Simplified description of UMA No. 1683	**Limitation levels**[1]	**Limitation classes**[2]				
		Low input pasture	Medium input pasture	High input pasture	Sorghum maize	Peanuts
Picanninny (Pn) Deep cracking grey clay soil on level plains	**N5** (3-8 ppm P, > 4 ppm $S0_4$-S)	0[3]	0	0	2	2
	W4v (Imperfectly drained, very slowly permeable)	1	1	0	4	5
	T2 (Microrelief 0.1- 0.3 m)	1	1	2	2	3
	P7 (Strongly adhesive soils, narrow moisture range, moderately hardsetting)	2	2	2	3	4
	E2u (1-3%, slowly drained clays and unstable soils)	1	1	3	3	4
	So (Discharge zone)	1	1	0	0	0
Land Suitability Class		**2**	**2**	**3**	**4**	**5**

[1] These are inherent properties of the soil/land type
[2] These are interpreted values based on the inherent properties
[3] This value indicates that more investigation is required.

Taking the case of UMA 1683, with *Picanninny* the dominant soil type, Table 10 shows how each limitation level is expressed as a limitation class for each land use. The limitation classes for each land use are also recorded in the UMA data file, as shown in Figure 20, part 2.

The final suitability class of the UMA for a particular land use is determined by the limitation with the greatest expression, that is with the highest suitability class (Table 10). In some cases, when several limitations are present at say a class 2 level, the final suitability class may be set at class 3 if there is a significant interactive effect. The suitability class is recorded in the UMA data file. The final suitability classes given to the land uses are defined as follows:

1. Part of soil map



2. Part of the data file for UMA 1683

Limitation level codes

UMA 1683	Pn	70%	C1	M2l	N5	W4v	F0	R0	T2	P7	Vc1e1	E2u	X1	So

translates to

Limitation classes and final suitability class

for low input pastures — for peanuts

1	1	1	2	1	1	1	2	1	1	1	1	**2**	1	2	2	5	1	1	3	4	1	4	5	0	**5**

Limitation class for respective limitations

Final suitability of the UMA for respective land

Figure 20 Example of soil map and UMA data file

Class 1	suitable land with negligible limitations
Class 2	suitable land with minor limitations
Class 3	suitable land with moderate limitations
Class 4	marginal land which is presently considered unsuitable due to severe limitations
Class 5	unsuitable land with extreme limitations

4.2.3 Explanation of individual limitations

Appendix 5 provides an explanation of each of the limitations used in the study. For each limitation, there is a page of explanation of how it was assessed. This is followed by a table which shows how increasing levels of expression of the limitation affect each land use ie. the relationship between limitation level and limitation class.

4.3 Summary of findings

The results of the suitability assessment process are summarised in Table 11 and displayed on the map associated with this report. The assessment was such that overlap between land uses exists, hence the figures in Table 11 do not sum to the total area of the Peninsula. The overlap between land uses is evident on the maps attached to this report.

Table 11 Summary of agricultural land suitability assessment results

Land use	Area (ha)
Land suitable for peanuts, sorghum and maize	243 300
Land suitable for sorghum and maize	1 812 000
Land suitable for high input pastures	3 445 300
Land suitable for low and medium input pastures	4 448 400
Land suitable for low intensity grazing of native pastures	6 148 100
Land not suitable for nominated land uses	966 120

4.4 Discussion

As indicated in **4.1**, the suitability of each UMA for five land uses was **directly** assessed. Land assessed as unsuitable for any of the five land uses consists of those areas allocated a final suitability class of 4 or 5. Class 5 land includes mangroves, saltpans, urban areas and slopes >32%. It is designated as "**Land not suitable for the nominated land uses**". Class 4 land is mostly country with a very low fertility status and/or land vegetated with heaths. It is native pasture grazing land, which in many cases is associated with areas suitable for one or more pastoral development categories, and hence is a useful component of the total grazing

system. (refer to **4.5** for further explanation). In many cases, it is not geographically or economically practical to exclude the Class 4 land from use. Bearing these factors in mind, land assessed as Class 4 for low input pastures has been labelled as "**Land suitable for low intensity grazing of native pastures**".

Low input pastures
Poor pasture nutrition, related to low soil fertility, in particular low phosphorus levels, is a major restriction to beef cattle production based on the grazing of native pastures, and the establishment of legumes for the grazing of improved pastures (McKeague, 1992). Low input pastures are generally regarded as the minimum form of development for long-term profitable and sustainable beef cattle production. Wet season phosphorus supplementation of cattle is recognised as an important part of increasing weight gain and herd viability (Boorman, 1990).

Medium input pastures
This form of development is the next step in pasture improvement, and may be conducted in areas where soil phosphorus levels are low, but the potential for greater pasture production is high, if soil phosphorus levels are raised. The cost of transport and application of fertiliser will have a significant bearing on the economic viability of this form of development. Fertiliser application may or may not occur in conjunction with phosphorus supplementation.

Land assessed as suitable for low or medium input pasture development **only** is generally restricted from other land uses by slope, rockiness, or moisture supply. Vegetation type may also have an effect, as illustrated in Appendix 5. Closed-forests are generally regarded as unsuitable for land uses that do not involve clearing.

The two land uses are portrayed together on the map because suitable land includes Classes 1-3. The minor differences in limitations between low and medium input pasture development does not result in any land that is assessed as suitable for low input pastures being assessed as unsuitable for medium input pastures.

High input pastures
The requirements for this type of development are closer to those for the cropping land uses than for the other pasture land uses, given that tree clearing is involved. Both existing vegetation and regrowth can cause problems, but landholders on the Peninsula appear to be developing methods to counter these problems. Factors such as rockiness and wetness are not as restricting as for cropping, because cultivation is only required for the establishment of a pasture, and at infrequent intervals.

Sorghum/maize and peanuts
All land assessed as suitable for peanuts is also assessed as suitable for sorghum/maize cropping, but the opposite does not apply due to the greater effects that rockiness and soil physical characteristics can have on peanuts. Land indicated as suitable for cropping of sorghum/maize is dominantly in the north on the Aurukun Surface, where the presence of nodules in the surface horizon is not a major restriction. High temperatures are a restriction to sorghum/maize cropping in the south-west. Areas assessed as suitable for peanuts are located in the Lakelands area in the south, and areas of sandstone derived soils in the north.

It is important to note that not all land suitable for cropping is suitable for pasture development. Fertility and existing vegetation are not major restrictions to cropping, but can restrict pasture development.

4.5 Suitability assessment and Peninsula grazing systems

The nature of the environment on Cape York Peninsula is such that grazing systems often require a range of soil/land types to cater for seasonal variations.

An example is the Batavia Landscape. The clay soils (*Picanninny, Myall and Batavia*), found in the lower parts of the landscape, are indicated as suitable for a number of uses, in particular high input pasture grazing. The ironstone ridge soils (*Bertie*, *Scorpion*) are only assessed as being suitable for low input pasture grazing, due to a number of limitations eg. rockiness, fertility. The clay soils are often poorly drained and during the wet season, cattle move to the drier ironstone ridges. Any property or grazing system design must therefore include these ridge soils, which on a stand-alone basis are considered unsuitable for intensive pasture development, but when considered in the context of the whole system, play a valuable role.

5. GIS information

5.1 Introduction

The purpose of this section is to provide information relating to the creation, interrogation, interpretation and location of digital data associated with NR02. It is aimed at assisting technical and non-technical users of the information. The digital data is contained in a Geographic Information System (GIS) using ARC INFO Ver. 6.1.1 software[1].

A GIS is essentially the computer storage of spatial information. In the case of NR02, a primary dataset, comprising the boundaries of 6074 individual soil mapping units, is stored and attached to data files containing information about the soil, vegetation and landform properties of each of the map units, together with interpreted information on agricultural land suitability.

A secondary dataset exists, consisting of field site information only. It contains a description of soil, landform and vegetation characteristics for an observed point (site). Descriptive terminology within this dataset is per McDonald *et al.* (1990).

5.2 Components of the system

5.2.1 Primary dataset

The NR02 GIS primary dataset has three major components:

1. The Arc (line) coverage - consisting of coded lines which form the soil boundaries. Each mapped area (polygon) is referred to as a UMA (Unique Mapping Area).

2. The Polygon coverage - representing UMA's with polygon specific attribute information (such as shape, climatic zone, and land use) attached to unique identifiers.

3. The Related databases
   (a) Primary databases containing, for each UMA:
   - component soils - represented by a soil name code and its percentage of the UMA
   - landform, vegetation and geological codes
   - codes for the properties (limitations) which determine agricultural suitability

   (b) Secondary databases containing, for each UMA, interpreted suitability information for each of the five land uses.

[1] At the time of publication

5.2.2 Secondary dataset

The secondary dataset has two components

1. A points coverage representing the spatial location of NR02 sites.
2. An associated (but not linked) site database containing a fixed field text file.

5.3 Boundary modification

The NR02 survey area is not completely contiguous with the CYPLUS defined study area boundary. A difference occurs at the southern boundary. Soil mapping is completed to the southern mapsheet boundary of the Rutland Plains, Hann River and Cooktown 1:250 000 mapsheets ie. latitude 16°S.

5.4 Digital data capture

The digital information capture has followed guidelines, standards and procedures stipulated in McColm *et al.* (1992) and Musto (1990).

5.4.1 Line Capture and Verification (Primary dataset only)

The initial transfer of soil mapping boundaries from 1:84 000 panchromatic aerial photographs to base maps was carried out with an artiscope. Line capture followed using two methods:

i) Digitising[1] - performed within the GIS cartography unit of QDPI Mareeba on ten of the fourteen map sheets.

ii) Scanning[2] - conducted by ESRI, Western Australia on the Cooktown, Hann River, Ebagoola and Coen sheets.

The following steps were taken to verify line capture:

i) A series of plotted overlays were produced at 1:100 000 and 1:250 000 scale to confirm arc integrity between air photos and basemaps. The arc code identifier was also confirmed.

ii) A UMA identifier was added as a label point to each polygon. This allowed the creation of a digital dataset that has complete spatial definition, thus achieving topological[3] integrity.

The above process is represented schematically in Figure 21.

---

[1] Digitising - manual line tracing using a computer linked tracing mechanism
[2] Scanning - an automated digital line capturing process
[3] Topology - criteria relating geometrical properties and spatial relations

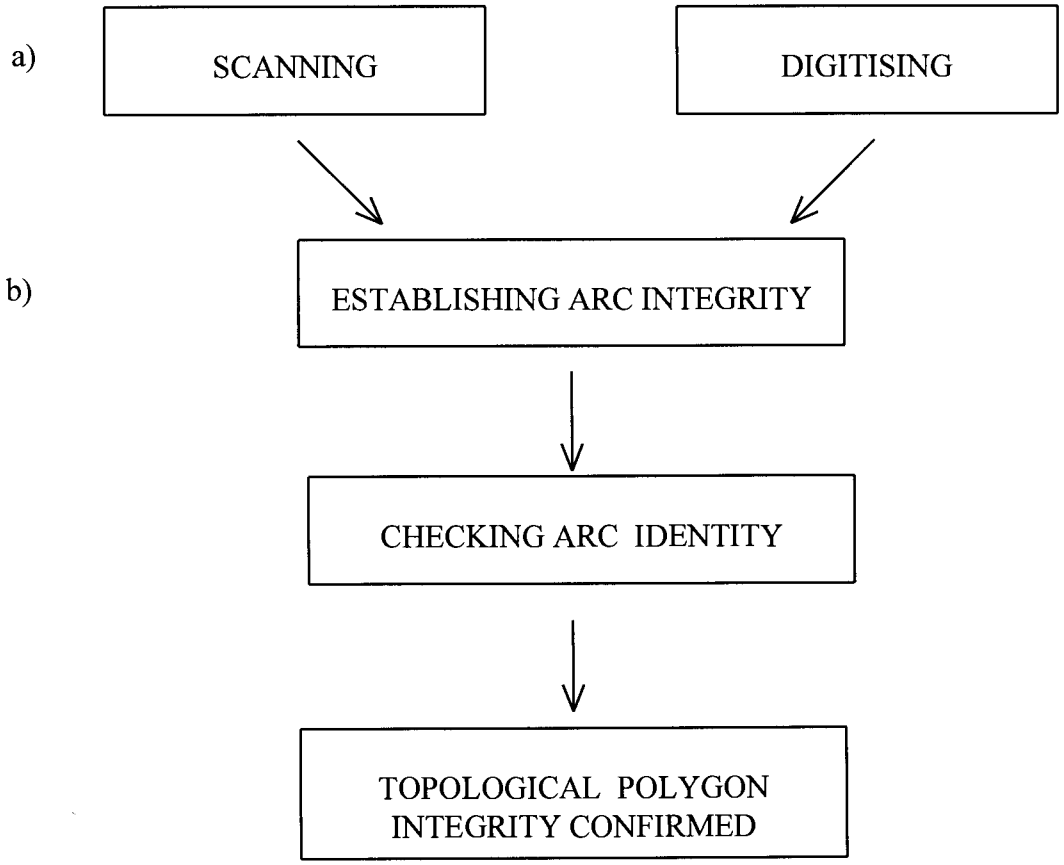


Figure 21 Process to create digital coverage

5.4.2 Creation of the soil and agricultural land suitability databases

The NR02 soil survey information, together with that from previous surveys, resulted in the definition of 113 soil types with associated topographic and vegetation features. This resource data was used in the following process to create various data files within the GIS.

Step 1 A soil type "look-up table" was created which contains a soil name code and codes for typical landform, geological and vegetation characteristics of each soil. Additionally a value for each of the twelve land use limitations associated with each soil is entered. (These limitations are explained in Section 4.)

Step 2 During the soil mapping process, each of the map units (UMA's) delineated contained up to four individual soil types. The respective soil codes and percentage of each was entered into a UMA database file.

Step 3 The soil type "look-up table" was used to create a complete set of limitation level codes for each soil in each UMA.

Step 4 An editing process was then initiated to modify the attribute values for those UMA's where the soil limitation levels were atypical, ie. different from that in the look-up table.

As explained in Section 4, the various limitation levels for each of the twelve limitations are interpreted in terms of their effect on each of the five land uses assessed in the study. Each limitation level is expressed as one of five limitation classes.

Step 5 A suitability "look-up table" was created which relates each limitation level to one of five limitation classes for each of the five land uses.

Step 6 The suitability "look-up table" was then used to create a suitability data base. This comprises, for each soil in the UMA, a set of limitation classes for each of the land uses.

The final suitability class for each land use is allocated according to the dominant limitation.

The process described above is represented schematically in Figure 22.

5.5 Specifications

Appendix 5 provides details of the coverage and database files as well as general specifications of the base mapping and projection type.

5.6 Use of the GIS

5.6.1 Constraints

The format and amount of data stored in the GIS provides a significant potential for interrogation and output of information. However, there are two major constraints:

(i) Scale - The data has been compiled at a survey reliability scale of 1: 800 000 (equivalent to an average ground truth intensity of one site per 64 km^2). While reliability decreases if used at larger scales, NR02 regards use of the data at no greater than 1: 250 000 scale as acceptable.

(ii) Reliability - Where a cumulative amount of error is incurred throughout the creation processes (eg. transfer of line-work from photos to base maps, then digital capture of line-work) the reliability is $\pm$ 350 metres, implying that map boundaries can vary up to 350 metres in any direction on the ground.

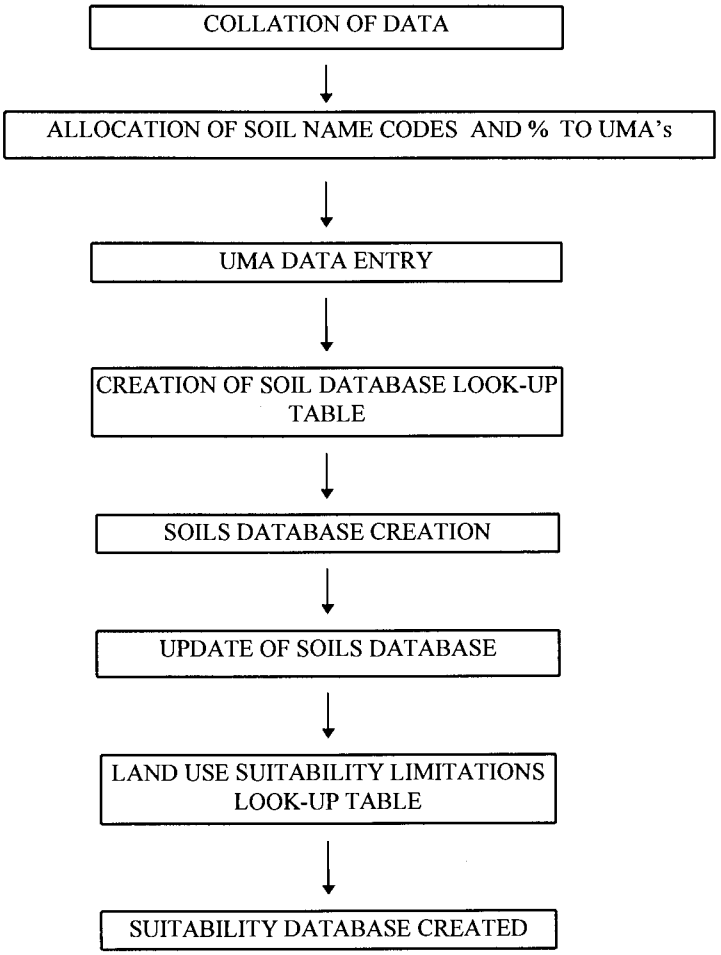


Figure 22 Creation of the soil and agricultural land suitability databases

5.6.2 Interrogation

Interrogation of the data can be carried out on 3 levels:

(i) Simple - a selection of information from one related database eg. isolate *Batavia* soils that are greater than 50 ha, or isolate land that is Class 1 for sorghum/maize.

(ii) Complex - requires the interrogation of more than one related database file to satisfy a range of selection criteria. For example, isolate areas of *Batavia* soil greater than 50 ha that are suitable for growing sorghum.

(iii) Interactive - this requires access to other datasets, eg. geology, vegetation, regolith, ground water resources, the digital cadastral data base (DCDB), etc. For example, isolate areas of *Batavia* soil greater than 50 ha that are suitable for growing sorghum, are vegetated with *Eucalyptus tetradonta* woodlands and a *Melaleuca viridiflora* understory and are 1 km from a permanent water supply.

5.6.3 Output

Information generated from the GIS can be provided in hardcopy map format (including overlays).

Numerical data with statistical criteria can be provided, for example, the total area, number and size distribution of UMA's with *Batavia* soil. Statistical data can be obtained from one, or a combination of the files.

5.7 Access

It is the intention of CYPLUS that information will be accessible at a number of locations in North Queensland, which have yet to be determined. The information will also be held at Department of Lands (Cairns) and National Resource Inventory Commission (Canberra). In the interim, all NR02 information will be available from the Resource Management, GIS and Cartographic Unit, QDPI Mareeba and the equivalent section at Resource Assessment and Planning, QDPI Indooroopilly.

At present, application for the acquisition and use of CYPLUS datasets requires the completion of a Memorandum of Understanding. This document refers to the rights of the custodians of the data, and any special conditions that may apply to the use of the data.

6. Conclusions

NRAP project NR02 has clearly enhanced the current state of knowledge of the soils of Cape York Peninsula. The description of over 900 new sites, combined with those from previous surveys has led to the characterisation of 113 soil types for the Peninsula. The increased detail of mapping has provided an opportunity to generate regional scale assessments of agricultural land suitability for a range of land uses that are currently practised on the Peninsula. A comprehensive GIS contains information relevant to both the component soils of the 6075 UMAs and their assessed suitability for six agricultural uses.

The agricultural land suitability assessment indicated that significant areas of land are suitable for cropping of sorghum/maize (1 812 000 ha) with a component (243 300 ha) of this suitable for cropping of peanuts. Larger portions of the Peninsula have been asssessed as suitable for some form of pasture improvement (3 445 300 ha for high input and 4 448 400 ha for low/medium input pastures respectively). It is important to note that this assessment has been based on physical land properties only, and is not necessarily indicative of profitability in all situations.

The project has incorporated many new approaches to the methodology of regional scale soil survey, including the use of gamma-ray spectrometric imagery, a field which most certainly warrants further investigation in the context of it's value to soil survey. A number of new databasing methods were investigated. Extensive testing of the Australian Classification (Isbell, 1993) was conducted, providing valuable information to its author.

The information generated in NR02 presents many opportunities for integration with other data sets. Preliminary correlations have already been investigated with the vegetation survey (NR01) project. Reports and maps on salinity and erosion hazard have been produced.

Although the agricultural land suitability assessment only looked at six principal land uses, the construction of the GIS provides the option of investigating suitability for other land uses. NR02 information is currently being used as part of Property Management Planning on the Peninsula. It is hoped that it will provide a sound basis for this and regional land use planning purposes, and indicate where further study needs to be concentrated.

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APPENDIX 1

DETAILED DESCRIPTIONS OF SOILS OF CAPE YORK PENINSULA

This Appendix contains detailed descriptions of the soils encountered in NR02. They are listed in alphabetical order according to their full name.

All codes used in the description of these soils are outlined in the Australian Soil and Land Survey Field Handbook (McDonald *et al.*, 1990).

A guide to interpreting the relevant sections of a description is provided below.

Name: Where possible, soil names are taken from the landscape eg. *Picanninny* from Picanninny Plains on "Merluna".

Concept: A very brief description of the characteristics of a soil, including comment on parent material and genesis where necessary.

Classification: Three classification systems are referred to.

Aust: The 3rd Approximation of "A Classification system for Australian Soils" (Isbell, 1993). Descriptions are to the Subgroup level.

GSG: Soils have been allocated to the most appropriate Great Soil Group as described by Stace *et al.* (1968). NSG indicates No Suitable Group.

PPF: Principle Profile Form derived from Northcote (1979). A maximum of 5 PPF's are indicated.

Landform: General range of landforms (Relief/Modal Slope categories) with Element indicated where necessary.

Geology: Geological unit(s) on which the soil type occurs. Not all have been included and complicated units have been summarised. Codes displayed refer to the Map References of the 1:250 000 Geological Series Maps (1963 - 1977).

Vegetation: Structural units as described by Neldner and Clarkson (in prep).

Microrelief: An indication of the range of microrelief types, vertical interval and horizontal interval.

Surface condition: An indication of the condition of the soil surface eg. Hardsetting.

Surface coarse fragments: A description of the frequency of occurrence, size, shape and lithology of surface coarse fragments (including segregations).

Soil description: The description of each horizon within the soil type gives an indication of the range of characteristics recorded in field descriptions of the soil. Colours utilised are from the Revised Standard Soil Colour Charts (Oyama and Takehara, 1992). The interpreted terms utilised to describe these colours

are derived from the QDPI standard (Table 12) based on the Value/Chroma rating system of Northcote (1979).

Value/Chroma 2a = 4/1, 4/2 to 6/1, 6/2
Value/Chroma 2b = 5/3, 5/4 to 6/3, 6/4

The profile diagram to the left of a description provides a visual indication of the variability of the lower depth of each horizon.

Variants: These are profiles deemed to be similar to the soil type save for a particular feature eg. mottling. Where that feature will have an effect on land use, that soil is referred to as a **Phase**.

Number of sites: Number of sites used to compile the description.

Land Use Limitations described are outlined in detail in Appendix 5. Only the most commonly occurring limitations are listed.

Table 12 Colour scheme utilised in Appendix 1

	Value/Chroma Rating					
Hue	**1**	**2a**	**2b**	**3**	**4**	**5**
10R	dark	red-grey	red-brown	pale-red	red	red
2.5YR	dark	grey-brown	red-brown	pale-red	red	red
5YR	dark	grey-brown	brown	pale	red-brown	red-brown
7.5YR	dark	grey-brown	brown	pale	yellow-brown	brown
10YR	dark	grey	yellow-brown	pale	yellow	brown
2.5Y	dark	grey	yellow-grey	pale-yellow	yellow	olive-brown
5Y	dark	grey	yellow-grey	pale-yellow	yellow	olive

Name: Altanmoui (Am)

Concept: Moderately deep Uniform brown coarse sands formed on hillslopes of granite boulder formations

Classification:

Aust: Basic Paralithic Orthic Tenosol

GSG: Earthy Sand

PPF: Uc5.23

Landform: Steep hills

Geology: Altanmoui granite (Pgi)

Vegetation: *E. hylandii* or *E. tetrodonta* woodlands

Microrelief: None

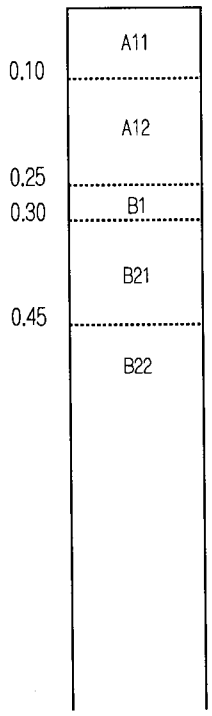
Surface condition: Firm

Surface coarse fragments: Abundant 2-6 mm angular quartz

Soil Description:

Land Use Limitations

Climate:	<35°C, <1500 mm (C2), <35°C, >1500 mm (C1)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, highly permeable (W2h)
Flooding frequency:	No flooding (F0)
Rockiness:	2-6 mm, > 50% (Rf5)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	10-32%, stable (E4s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk inflow zone (Si1)



A11	0 - 0.10	Dark (10YR 3/1); Coarse sandy loam; Abundant 2-20 mm angular adamellite; Moderate 2-5 mm cast; Dry, very weak; Field pH 6.5; Gradual boundary to;
A12	0.10 - 0.25	Dark (10YR 3/2); Coarse sandy loam; Abundant 2-6 mm angular adamellite; Massive; Dry, very weak; Field pH 6.5; Gradual boundary to;
B1	0.25 - 0.30	Grey (10YR 4/2); Coarse sandy loam; Abundant 2-6 mm angular adamellite; Massive; Dry, firm; Field pH 6.5; Gradual boundary to;
B21	0.30 - 0.45	Brown (10YR 4/3); Coarse sandy loam; Abundant 2-6 mm angular adamellite; Massive; Dry, firm; Field pH 6.5; Gradual boundary to;
B22	0.45 - 0.50	Brown (10YR 4/4); Coarse sandy loam; Abundant 2-6 mm angular adamellite; Massive; Dry, firm; Field pH 6.5.

Limit of augering

Number of sites: 1

Name: Andoom (Ad)

Concept: Very deep Uniform or Gradational yellow massive soils with aluminous concretions

Classification:

Aust: Bauxitic Dystrophic Yellow Kandosol

GSG: Yellow Earth

PPF: Um2.27, Um4.23, Gn2.21, Gn2.22, Gn2.25

Landform: Gently undulating plains on plateaux

Geology: Tertiary and Quaternary aluminous laterite (T&Qa)

Vegetation: *E. tetrodonta* woodlands and tall woodlands

Microrelief: None

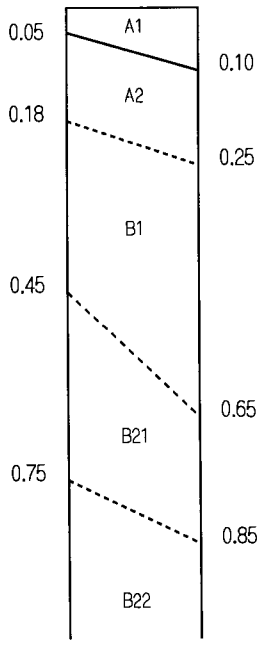
Surface condition: Hardsetting

Surface coarse fragments: Very many 2-6 mm rounded aluminous concretions occasionally present

Land Use Limitations

Climate:	<35° C, >1500 mm (C2)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Rockiness:	2-6 mm, 20-50% (Rf4)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk recharge zone (Si1)

Soil Description:



A1 0 - 0.10 Grey (10YR 4-5/1); Sandy clay loam to clay loam fine sandy; Massive or weak 2-5 mm angular blocky or moderate 2-5 mm cast; Dry, firm to very firm; Few to common 2-6 mm aluminous concretions; Field pH 6.0 to 7.0; Clear boundary to;

A2 0.10 - 0.20 Yellow-brown or brown or yellow-grey (10YR 4-6/3 or 2.5Y 6/3); Sandy clay loam to clay loam; Massive; Dry, weak to firm; Few to common 2-6 mm aluminous concretions; Field pH 6.0 to 6.5; Gradual boundary to;

B1 0.20 - 0.50 Pale-yellow or yellow-brown (10YR 7/4-5 or 7.5YR 5/5); Sandy clay loam to clay loam; Massive; Dry, weak to firm; Few to common 2-6 mm aluminous concretions; Field pH 6.0 to 7.0; Gradual or diffuse boundary to;

B21 0.50 - 0.80 Pale-yellow or yellow or brown or red-brown (10YR 7/6 or 6/6 or 7.5YR 6/4 or 5YR 5/7); Sandy clay loam to clay loam; Massive; Dry, weak to firm; Many to very many 6-20 mm aluminous concretions; Field pH 6.5 to 7.0; Diffuse boundary to;

B22 0.80 - 1.50 Red-brown or yellow-brown or yellow or pale-yellow (5YR or 7.5YR 6/6 or 10YR 6-7/6); Sandy clay loam to light clay; Many fine distinct red mottles occasionally present; Massive; Moderately moist, firm; Very many 2-20 mm aluminous concretions; Field pH 6.5 to 7.0.

Limit of augering

Number of sites: 7

Name: Antbed (Ab)

Concept: Very deep Gradational or occasionally Duplex sodic mottled grey soils formed on alluvial plains

Classification:

Aust: Ferric or Sodic Sodosolic or Dermosolic Redoxic Hydrosol

GSG: Solodic Soil

PPF: Gn3.91, Dy3.43, Gn3.06, Gn3.93, Gn3.96

Landform: Level to gently undulating alluvial plains

Geology: Quaternary alluvium (Qa)

Vegetation: *M. viridiflora* low open woodlands and woodlands

Microrelief: None

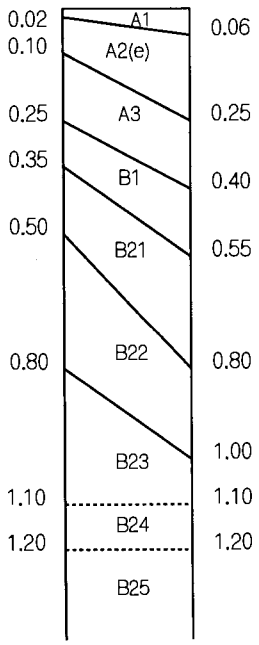
Surface condition: Hardsetting

Surface coarse fragments: None

Soil Description:

Land Use Limitations

Climate:	>35°C, <1500 mm (C3), <35°C, <1500 mm (C1)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Very poorly drained, very slowly permeable (W6v)
Flooding frequency:	Every year (F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, hardsetting (including large aggregates) (P2)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1), Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	0-1%, unstable (E1u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Non-saline (Sn)



A1 0 - 0.05 Dark or grey (10YR 3-6/1-2); Few fine distinct orange mottles occasionally present; Loamy fine sand to silty loam to clay loam; Massive; Dry to moderately moist, weak to firm; Field pH 6.0 to 6.5; Abrupt or clear boundary to;

A2(e) 0.05 - 0.15 Occasionally conspicuously bleached - grey (7.5YR or 10YR or 2.5Y 5/2 or 6/1); Few to common fine distinct orange mottles; Loamy fine sand to fine sandy clay loam; Massive; Dry to moderately moist, weak to firm; Field pH 5.5 to 6.0; Clear boundary to;

A3 0.15 - 0.30 Grey or yellow-brown or yellow (10YR 5/2 or 6/1-5); Common to many fine faint or distinct yellow or orange mottles; Sandy clay loam to silty clay loam; Massive; Dry to moderately moist, weak to firm; Many 2-6 mm ferro-manganiferous nodules occasionally present; Field pH 5.5 to 6.5; Clear boundary to;

B1 0.30 - 0.40 Grey or yellow or occasionally yellow-brown (10YR 5-6/2 or 5/5 or 6/4); Common to many fine faint to distinct or prominent orange or red mottles; Fine sandy clay loam to light clay; Massive to weak < 2 mm sub-angular blocky; Dry to moderately moist, firm to strong; Few to common 2-6 mm ferruginous nodules occasionally present; Field pH 6.0 to 6.5; Clear boundary to;

B21 0.40 - 0.60 Grey or pale or yellow (10YR or 2.5Y 6/1-2 or 10YR 5-6/5); Common to many fine to medium distinct or prominent yellow, orange or red mottles; Light clay fine sandy to medium clay; Massive to strong < 2-10 mm angular or sub-angular blocky; Dry to moderately moist, firm to strong; Common to many 2-6 mm ferruginous nodules occasionally present; Field pH 6.0 to 7.0; Clear or gradual boundary to;

B22 0.60 - 0.90 Grey or pale or occasionally yellow-brown (N 6/0 or 10YR or 2.5Y 7/1 or 10YR 5/4); Common to many medium prominent yellow, orange or red mottles; Medium clay to heavy clay; Massive to strong < 2-10 mm angular or sub-angular blocky; Dry very strong to moderately moist, firm; Very few 2-6 mm manganiferous soft segregations or ferruginous nodules occasionally present; Field pH 6.0 to 8.0; Clear or gradual boundary to;

B23	0.90 - 1.10	Grey or pale (N 5-6/0 or 2.5Y 7/1); Many medium distinct or prominent orange mottles; Sandy medium clay to heavy clay; Strong < 2-10 mm angular blocky or 2-5 mm sub-angular blocky; Moderately moist, firm to very firm; Very few 2-6 mm ferruginous nodules occasionally present; Field pH 8.0 to 10.0; Gradual or diffuse boundary to;
B24	1.10 - 1.20	Grey or yellow (2.5Y 6/1 or 5/2 or 6/5); Many medium distinct or prominent yellow mottles; Coarse sandy light clay to medium heavy clay; Few 2-6 mm sub-angular quartz occasionally present; Massive or strong < 2-5 mm angular blocky; Moderately moist, firm to very firm; Very few 2-6 mm ferruginous nodules or common 2-6 mm soft manganiferous segregations; Field pH 8.5 to 10.0; Diffuse boundary to;
B25	1.20 - 1.50	Yellow (10YR 5/5); Medium clay sandy; Moderate 2-5 mm angular blocky; Moderately moist, firm; Field pH 10.0;

Limit of augering

Variants: Acid variant (AbAv): Field pH 5.5 at A1, grading to 3.5 in B23. **Number of sites:** 1

Number of sites: 43

Name: Attack (At)

Concept: Deep Gradational mottled yellow massive soils formed on colluvia from acid plutonic hillslopes

Classification:

Aust: Bleached Mesotrophic Yellow Kandosol

GSG: Yellow Earth

PPF: Gn2.75

Landform: Gently undulating plains on colluvial fans

Geology: Tertiary and Quaternary colluvial sands (TQs)

Vegetation: *E. tetrodonta* woodlands

Microrelief: None

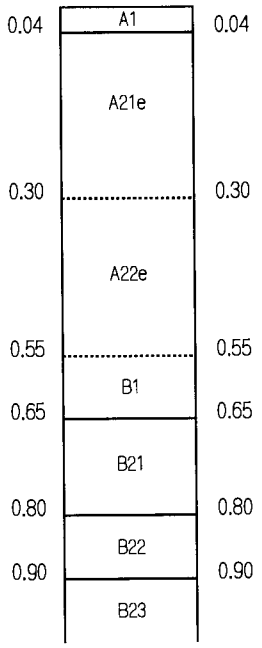
Surface condition: Loose

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, slowly permeable (W4s)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, unstable (E3u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)

Surface coarse fragments: Common 2-6 mm angular quartz

Soil Description:



A1	0 - 0.04	Grey (10YR 5/2); Loamy coarse sand; Few 2-6 mm angular quartz; Massive; Dry, weak; Field pH 4.5; Clear boundary to;
A21e	0.04 - 0.30	Grey (2.5Y 6/2); Coarse sand; Few 2-6 mm angular quartz; Massive; Dry, weak; Field pH 6.5; Gradual boundary to;
A22e	0.30 - 0.55	Pale-yellow (2.5Y 7/4); Coarse sand; Few 2-6 mm angular quartz; Massive; Dry, weak; Field pH 7.0; Gradual boundary to;
B1	0.55 - 0.65	Yellow (2.5Y 7/6); Light coarse sandy clay loam; Very few 2-6 mm angular quartz; Massive; Dry, weak; Field pH 7.0; Gradual boundary to;
B21	0.65 - 0.80	Yellow (10YR 6/6); Few medium prominent red mottles; Coarse sandy light clay; Very few 2-6 mm angular quartz; Massive; Moderately moist, weak; Field pH 7.0; Clear boundary to;
B22	0.80 - 0.90	Yellow (10YR 6/6); Common medium prominent red mottles; Coarse sandy light clay; Very few 2-6 mm angular quartz; Massive?; Moderately moist, weak; Field pH 7.0; Clear boundary to;
B23	0.90 - 1.00	Yellow (10YR 6/6); Few fine prominent red mottles; Light clay coarse sandy; Very few 2-6 mm angular quartz; Massive?; Moderately moist, weak; Common 2-6 mm ferro-manganiferous nodules; Field pH 7.0;

Limit of augering

Number of sites: 1

Name: Audaer (Ar)

Concept: Moderately deep Uniform mottled yellow massive soils formed on footslopes of sandstone hills

Classification:

Aust: Mottled Mesotrophic Yellow Kandosol

GSG: Yellow Earth

PPF: Um4.22, Um4.23

Landform: Hillslopes on gently undulating plains to undulating rises

Geology: Bulimba Formation (KTi), Quaternary colluvia (Czt)

Vegetation: *E. tetrodonta* woodlands and tall woodlands

Microrelief: None

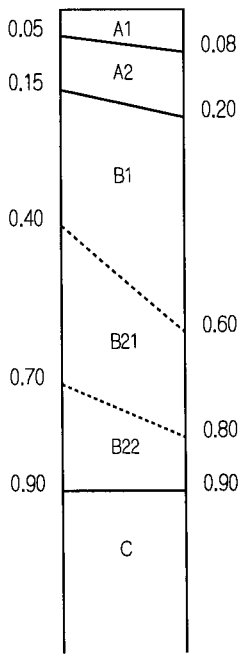
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C2), <35°C, >1500 mm (C1)
Moisture Supply:	80 - 100 mm/m (M3)
Fertility:	<3 ppm P, < 4 ppm SO_4 S (N8)
Wetness:	Poorly to imperfectly drained, moderately permeable (W5m, W4m)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Moderate risk intake zone (Si2), transmission zone (St2)

Soil Description:



A1	0 - 0.06	Dark or brown (7.5YR 3/2 or 10YR 3/3); Fine sandy clay loam to clay loam; Massive; Dry to firm; Field pH 6.5 to 7.0; Abrupt or clear boundary to;
A2	0.06 - 0.17	Grey or brown (10YR 4/2 or 7.5YR 4/3); Fine sandy clay loam to clay loam; Massive; Dry, firm; Field pH 6.0 to 6.5; Clear boundary to;
B1	0.17 - 0.50	Red-brown or yellow-brown (5YR 4/6 or 10YR 5/4); Clay loam; Massive; Dry, firm; Very few 2-6 mm ferro-manganiferous nodules; Field pH 6.0 to 7.0; Diffuse boundary to;
B21	0.50 - 0.75	Yellow (7.5YR or 10YR 6/6); Common fine distinct red mottles; Clay loam; Massive; Dry, firm; Very few 2-6 mm ferro-manganiferous nodules; Field pH 5.5 to 6.0; Diffuse boundary to;
B22	0.75 - 0.90	Yellow (10YR 6/5-6); Common to many fine distinct red mottles; Clay loam to clay loam heavy; Massive; Dry, firm; Few 2-6 mm ferro-manganiferous nodules; Field pH 5.5 to 6.0; Clear boundary to;
C		Rock

Number of sites: 2

Name: Batavia (Bv)

Concept: Deep Gradational mottled yellow soil formed on siltstone, mudstone or claystone

Classification:

Aust: Ferric or Bleached-Ferric or Mottled or Manganic Mesotrophic Yellow Dermosol; Bleached-Ferric or Mottled Mesotrophic Brown Dermosol

GSG: Yellow Podzolic Soil

PPF: Gn3.74, Gn3.84, Gn3.94, Gn3.04

Landform: Gently undulating plains to undulating rises

Geology: Rolling Downs Group (Klr, Klr*), Bulimba Formation (KTi), Wolena Claystone (Klo)

Vegetation: *E. tetrodonta* woodlands, minor *E. leptophleba* open-woodlands

Microrelief: Occasionally normal gilgai; vertical interval 0.1 to 0.3 m; horizontal interval 5 to 10 m

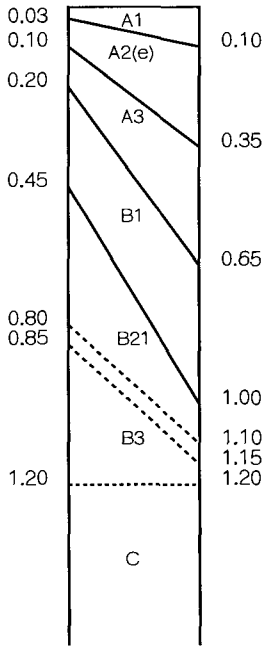
Surface condition: Hardsetting

Surface coarse fragments: Common to abundant 2-6 mm ferruginous nodules occasionally present

Land Use Limitations

Climate:	<35°C, <1500 mm (C1), <35°C, >1500 mm (C2)
Moisture Supply:	80 - 100 mm/m (M3)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, moderately permeable (W4m)
Flooding frequency:	No flooding (F0)
Rockiness:	2-6 mm, 20-50% (Rf4)
Topography:	No microrelief (T0) to microrelief vertical interval 0.1 - 0.3 m (T2)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1), Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	High risk transmission zone (St3), recharge zone (Si3), occasionally outflow zone (So3)

Soil Description:



A1 0 - 0.05 Dark or grey or brown (10YR 3/1-2 or 4/1-3); Very few to common, fine faint yellow or orange mottles; Sandy loam to fine sandy clay loam; Massive to weak 2-5 mm cast; Dry, firm to very firm; Very few to many 2-6 mm ferruginous, ferro-manganiferous or manganiferous nodules; Field pH 6.0 to 6.5; Abrupt or clear boundary to;

A2(e) 0.05 - 0.15 Occasionally conspicuously bleached - grey or yellow-brown or brown (10YR 4-6/2-4); Few to many fine faint to distinct yellow to orange mottles; Fine sandy loam to fine sandy clay loam; Massive; Dry, weak to very firm; Very few to common 2-6 mm ferruginous, ferro-manganiferous or manganiferous nodules; Field pH 5.5 to 6.0; Clear or gradual boundary to;

A3 0.15 - 0.45 Yellow-brown or yellow (10YR 5-6/4-6); Few to common fine faint yellow to red mottles; Fine sandy clay loam to light clay; Massive; Dry, firm to very firm; Very few to abundant 2-6 mm ferruginous, ferro-manganiferous or manganiferous nodules; Field pH 5.5 to 6.0; Clear or diffuse boundary to;

B1 0.45 - 0.55 Yellow-brown or yellow (10YR 5/4-8 or 6/6); Common, fine faint to distinct yellow to red mottles; Fine sandy clay loam heavy to light clay; Massive to moderate 2-5 mm sub-angular blocky or polyhedral; Dry to moderately moist, firm to very firm; Very few to many 2-20 mm ferruginous or ferro-manganiferous nodules; Field pH 5.5 to 6.0; Gradual or diffuse boundary to;

B21 0.60 - 0.70 Yellow-brown or yellow (10YR 5/6-8 or 6/4-8); Common to many, fine distinct red mottles; Light clay to light medium clay; Moderate to strong 2-5 mm polyhedral; Dry to moderately moist, firm to very firm; Few to abundant 2-20 mm ferruginous, ferro-manganiferous or manganiferous nodules; Field pH 5.5 to 6.0; Diffuse boundary to;

B22 0.70 - 0.95 Yellow or yellow-brown (10YR 5-6/4-6); Common to many, fine distinct to prominent red mottles; Light clay to medium heavy clay; Moderate to strong, 2-5 mm polyhedral; Dry to moderately moist, firm; Few to abundant 2-6 mm ferruginous, ferro-manganiferous or manganiferous nodules; Field pH 5.0 to 6.0; Clear or diffuse boundary to;

B3	1.00 - 1.20	Grey or pale or yellow-brown (10YR 6/2-3 or 7/1-2); Many, fine prominent red mottles; Medium heavy clay to heavy clay; Moderate to strong, 2-5 mm lenticular or sub-angular blocky; Moderately moist, firm; Very few to many 2-6 mm ferruginous nodules; Field pH 4.5 to 5.5; Gradual boundary to rock
	Limit of augering	

Phase: Rocky phase (BvRp): Few, increasing to many, 6-60 mm angular platy siltstone throughout. **Number of sites:** 1

Number of sites: 42

Name: Bend (Bn)

Concept: Deep Gradational or Uniform grey or yellow-brown soils formed on alluvial plains

Classification:

Aust: Mottled Eutrophic Brown or Grey Dermosol or Kandosol

GSG: Grey Earth

PPF: Gn3.92, Gn3.91, Um5.52, Gn2.82

Landform: Alluvial plains

Geology: Quaternary alluvia (Qa)

Vegetation: *E. clarksoniana, E. novoguinensis* or *E. polycarpa* woodlands and low open woodlands

Microrelief: Normal gilgai occasionally present; vertical interval 0.30 m; horizontal interval 10 m

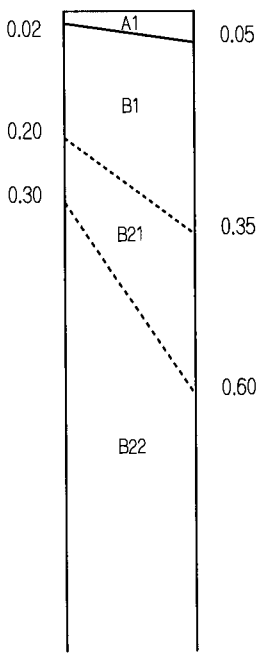
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	>35°C, <1500 mm (C3), <35°C, >1500 mm (C1)
Moisture Supply:	100 - 140 mm/m (M2)
Fertility:	8-20 ppm P, <4 ppm SO_4 S (N4)
Wetness:	Imperfectly drained, slowly permeable (W4s)
Flooding frequency:	Every year (F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0), microrelief vertical interval 0.1 - 0.3 m (T2)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, hardsetting (including large aggregates) (P2)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	0-1%, stable (E1s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Non-saline (Sn)

Soil Description:



A1 0 - 0.02 Dark or grey (10YR 3-4/1); Clay loam fine sandy to clay loam silty to clay loam; Massive to moderate 2-5 mm cast; Dry, firm to very firm; Field pH 6.0 to 6.5; Abrupt or clear boundary to;

A3 0.02 - 0.15 (occasionally present) Dark or grey (10YR 3/2 or 4/1-2); Clay loam fine sandy to light clay; Massive; Dry, very firm to strong; Field pH 6.5 to 7.0; Clear boundary to;

B1 0.02 - 0.25 Grey or brown or yellow (10YR 4/2-3 or 5/5); Few to many fine distinct orange or red mottles; Clay loam silty to light clay; Massive to moderate 2-5 mm sub-angular; Dry, very firm to strong; Field pH 6.5 to 7.0; Gradual boundary to;

B21 0.25 - 0.40 Grey or yellow-brown (10YR 4/2-3 or 5/2-3); Common fine distinct yellow, brown orange or red mottles; Clay loam to light clay silty to light medium clay; Massive to moderate 2-5 mm sub-angular; Moderately moist, very firm; Field pH 6.0 to 7.0; Gradual boundary to;

B22 0.40 - 1.00 Grey or yellow-brown (10YR 5/2-3 or 6/2); Common to many fine distinct yellow, brown, orange or red mottles; Clay loam to light medium clay silty to medium clay; Massive to moderate 2-5 mm sub-angular to angular blocky; Moderately moist, strong; Field pH 6.0 to 6.5;

Limit of augering

Number of sites: 13

Name: Bertie (Bt)

Concept: Deep Gradational or Uniform red massive soil with ferruginous nodules formed on remnant surfaces

Classification:

Aust: Ferric Mesotrophic Red Kandosol

GSG: Red Earth

PPF: Gn2.14, Um4.21, Gn2.75, Um4.23

Landform: Hillslopes on undulating plains to rises

Geology: Rolling Downs Group (Klr*), Bulimba Formation (KTi)

Vegetation: *E. tetrodonta* woodlands and tall woodlands

Microrelief: None

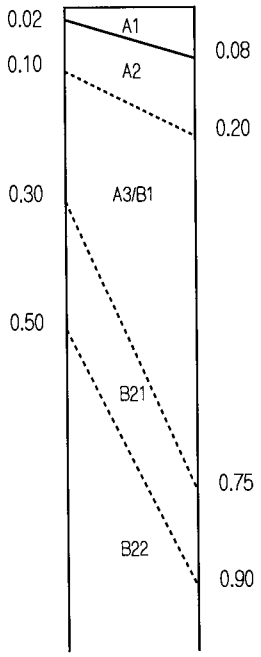
Surface condition: Hardsetting

Surface coarse fragments: Very many 2-20 mm sub-rounded ferruginous nodules occasionally present

Land Use Limitations

Climate:	<35°C, >1500 mm (C2), <35°C, <1500 mm (C1)
Moisture Supply:	40 - 80 mm/m (M3, M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, moderately to highly permeable (W2m, W2h)
Flooding frequency:	No flooding (F0)
Rockiness:	2-6 mm, 20-50% (Rf4)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1), Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	High risk inflow zone (Si3)

Soil Description:



A1 0 - 0.03 Dark or grey-brown or brown (10YR 3/2 or 7.5YR 3-4/2-4 or 5YR 3-4/2); Sandy loam to clay loam; Massive; Dry, weak to firm; Many to very many 2-20 mm ferruginous nodules; Field pH 6.0 to 6.5; Abrupt or clear boundary to;

A2 0.03 - 0.15 Grey or yellow-brown or brown or red-brown or red (10YR 4-5/2-4 or 5YR 3/3-4 or 2.5YR 4/4); Sandy loam to clay loam; Massive; Dry weak to very firm; Many to very many 2-20 mm ferruginous nodules; Field pH 6.0 to 6.5; Gradual boundary to;

A3/B1 0.15 - 0.45 Red or red-brown or yellow-brown or yellow (2.5YR 4/6-8 or 5YR or 10YR 5-6/4-6); Sandy clay loam to clay loam; Massive; Dry, firm to very firm; Few to very many 2-20 mm ferruginous nodules; Field pH 6.0 to 6.5; Diffuse boundary to;

B21 0.45 - 0.65 Red or red-brown (10R 3-4/6-8 or 2.5YR or 5YR 3-4/4-6); Clay loam to sandy light clay; Massive; Dry, firm; Common to very many 2-20 mm ferruginous nodules; Field pH 6.0 to 6.5; Diffuse boundary to;

B22 0.65 - 1.00 Red (10R 4/6 or 2.5YR 3/6); Clay loam to light clay; Massive; Dry to moderately moist, firm; Many to very many 2-20 mm ferruginous nodules; Field pH 6.0.

Limit of augering

Number of sites: 12

Name: Bimbus (Bb)

Concept: Deep bleached Uniform sands over coffee rock, formed on residual sands

Classification:

Aust: Parapanic or Fragic Humic Aeric or Semiaquic Podosol; Basic Regolithic Bleached Tenosol

GSG: Podzol/(Rudimentary) Podzol

PPF: Uc2.33, Uc2.21

Landform: Drainage depressions on gently undulating plains to undulating rises

Geology: Quaternay alluvia (Qa, Qpa, Qas), Tertiary and Quaternary colluvial sands (TQs)

Vegetation: *E. tetrodonta* woodlands

Microrelief: None

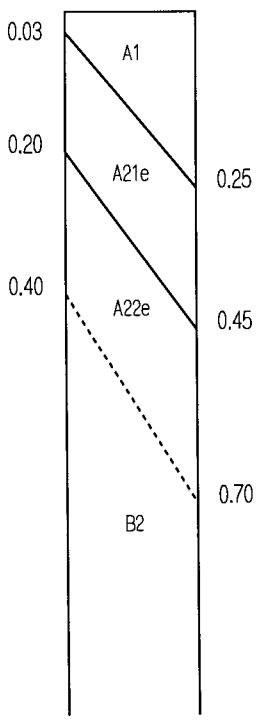
Surface condition: Loose to soft

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1), <35°C, <1500 mm (C2), >35°C, <1500 mm (C3)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Poorly drained, highly permeable (W5h)
Flooding frequency:	No flooding to every year (F0-F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	0-1%, stable (E1u)
Landscape complexity:	Unit size < 20 ha (X1)
Salinity:	Low risk transmission zone (St1)

Soil Description:



A1	0 - 0.15	Dark or grey (7.5YR or 10YR 3-5/1 or N 3/0); Sand to loamy sand; Single grain; Dry to moderately moist, very weak; Field pH 4.0 to 5.5; Abrupt or diffuse boundary to;
A21e	0.15 - 0.30	Grey or grey-brown (10YR or 7.5YR 5-6/1); Sand; Single grain; Dry to moderately moist, very weak; Field pH 4.5 to 6.0; Clear or diffuse boundary to;
A22e	0.30 - 0.50	Grey or grey-brown or pale (10YR 6-7/2 or 7.5YR 6/2-3 or 7-8/1); Sand; Single grain; Dry to moderately moist very weak; Field pH 5.5 to 6.5; Gradual or diffuse boundary to;
B2(h,hs)	0.50 - 1.00	Brown or yellow-brown or yellow or grey or grey-brown (7.5YR 5/2-3 or 6/3 or 4/2-3 or 3/3; or 10YR 6/3-4 or 6/6-8 or 5/4); Few to many fine to medium faint to distinct yellow, orange or brown mottles; Sand; Single grain to massive; Moderately moist, very weak to very firm; Field pH 5.0 to 6.5;

Limit of augering

Number of sites: 11

Name: Brom (Bm)

Concept: Deep Gradational or Uniform mottled grey massive soils formed on residual sands

Classification:

Aust: Mottled or Bleached-Mottled Mesotrophic Grey Kandosol

GSG: Grey Earth

PPF: Gn2.81, Gn2.94, Um4.26

Landform: Lower slopes on gently undulating plains to undulating rises.

Geology: Tertiary and Quaternary colluvial sands (TQs)

Vegetation: *E. tetrodonta* woodlands

Microrelief: None

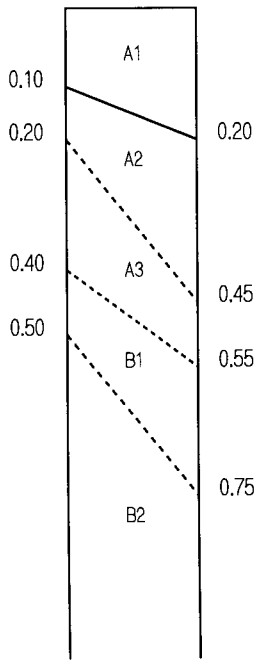
Surface condition: Soft to firm

Land Use Limitations

Climate:	<35°C, >1500 mm (C1), <35°C, <1500 mm (C2)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, moderately permeable (W4m)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)

Surface coarse fragments: None

Soil Description:



A1 0 - 0.16 Dark or grey (10YR 3-4/1); Sandy loam to fine sandy clay loam; Single grain to massive; Dry, firm to moderately moist, weak; Field pH 5.0 to 6.5; Clear or gradual boundary to;

A2(e) 0.16 - 0.35 Frequently conspicuously bleached - grey or yellow-brown (10YR 5/1-2 or 6/3); Sandy loam to fine sandy clay loam; Massive; Dry, firm to moderately moist, weak; Field pH 5.0 to 6.5; Gradual or diffuse boundary to;

A3 0.35 - 0.45 Pale or yellow-brown (10YR 7/2-3 or 6/3-5); Few to common fine faint to distinct yellow mottles; Light sandy clay loam to clay loam; Massive; Dry, firm to moderately moist, weak; Field pH 5.5 to 6.5; Diffuse boundary to;

B1 0.45 - 0.65 Pale (10YR 7/2-3); Common fine distinct orange or prominent yellow mottles; Sandy clay loam to clay loam; Massive; Dry, firm to moist, weak; Field pH 5.5 to 7.0; Diffuse boundary to;

B2 0.65 - 1.10 Pale (10YR 7/2 or 7-8/3); Common to many fine distinct red or prominent yellow mottles; Sandy clay loam to clay loam; Massive; Dry, firm to moist, weak; Many 6-20 mm ferruginous or common 2-6 mm manganiferous nodules occasionally present; Field pH 5.5 to 7.0;

Limit of augering

Phases: Coarse phase (BmCp): Coarse throughout. **Number of sites:** 1

Number of sites: 10

Name: Bull (Bl)

Concept: Deep Uniform or occasionally Gradational non-cracking brown clays formed on basalt

Classification:

Aust: Mottled, Manganic or Haplic Eutrophic Brown Dermosol

GSG: Xanthozem

PPF: Uf6.34, Uf6.31, Gn3.72, Gn3.92

Landform: Level plains to undulating rises on lava plains

Geology: McLean Basalt (Cze), Piebald Basalt (Czp)

Vegetation: Cleared *E. leptophleba, E.platyphylla* or *E. erythrophloia* woodlands

Microrelief: None

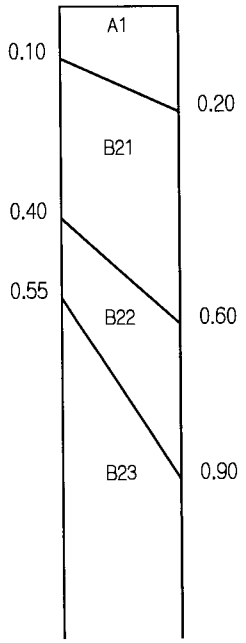
Surface condition: Loose to firm

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	100 - 140 mm/m (M2)
Fertility:	8-20 ppm P, >4 ppm SO_4 S (N3)
Wetness:	Imperfectly drained, slowly permeable (W4s)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1), transmission zone (St1)

Soil Description:



A1 or Ap 0 - 0.15 Dark or brown (5YR 3/2 or 7.5YR 2-3/2-3); Clay loam to light clay; Weak to moderate 2-10 mm angular-blocky or granular; Dry, firm or very firm; Very few to common < 2-6 mm manganiferous or ferro-manganiferous nodules; Field pH 5.5 to 6.0; Clear boundary to;

B1 0.15 - 0.35 (occasionally present) Dark or red-brown or brown (5YR 3/2-3 or 7.5YR 4/4-6); Clay loam to light clay; Massive or strong < 2-5 mm polyhedral; Dry, firm to very firm; Very few < 2-6 mm manganiferous or ferro-manganiferous nodules; Field pH 6.0 to 6.5; Clear or gradual boundary to;

B21 0.15 - 0.45 Brown or yellow-brown or red-brown or red (10YR 4/3 or 4/6 or 7.5YR 4/4 or 5/4-6 or 5YR 4/4 or 2.5YR 3/4-6); Few to many medium faint to distinct yellow or red mottles occasionally present; Light clay to light medium clay; Moderate to strong < 2-5 mm polyhedral; Dry, firm to very firm; Few to common < 2-6 mm manganiferous or ferro-manganiferous nodules; Field pH 6.0 to 7.0; Clear or gradual boundary to;

B22 0.45 - 0.70 Red-brown or yellow or brown or yellow-brown (5YR 4/7-8 or 4/4 or 10YR 4-5/6 or 7.5YR 4/4 or 5/6 or); Few to many medium faint or distinct yellow or red mottles frequently present; Light clay to light medium clay; Weak to strong < 2-5 mm polyhedral; Dry, firm or very firm; Very few to common < 2-6 mm manganiferous or ferro-manganiferous nodules; Field pH 6.0 to 7.0; Clear or gradual boundary to;

B23 0.70 - 1.20 Yellow or yellow-brown or red-brown (10YR 5/4-6 or 5YR 4/8); Common to many medium or coarse faint to distinct red mottles; Light clay; Weak or moderate 2-5 mm polyhedral or weak 10-20 mm lenticular; Dry, firm; Very few to many < 2-6 mm manganiferous or ferro-manganiferous nodules; Field pH 6.5 to 7.0;

Limit of augering

Number of sites: 15

Name: Burn (Br)

Concept: Deep Uniform red structured clay soils with nodules formed on basalt

Classification:

Aust: Manganic or Haplic Eutrophic Red Ferrosol

GSG: Euchrozem/Krasnozem

PPF: Uf6.31

Landform: Level to gently undulating plains

Geology: McLean Basalt (Cze)

Vegetation: Cleared *E. leptophleba, E. platyphylla* or *E. erythrophloia* woodlands

Microrelief: None

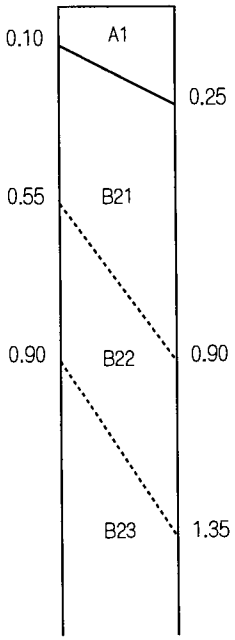
Surface condition: Loose to firm

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	> 140 mm/m (M1)
Fertility:	3-8 ppm P, >4 ppm SO_4 S (N5)
Wetness:	Well drained, highly permeable (W2h)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)

Soil Description:



A1 or **Ap**	0 - 0.15	Dark or red or red-brown (10R or 2.5YR or 5YR 2/2-4 or 2.5YR 2/3-4); Light clay to light medium clay; Weak or moderate 5-20 mm angular blocky or granular; Dry, firm to very firm; Very few to few < 2-6 mm ferro-manganiferous nodules occasionally present; Field pH 6.0; Clear boundary to;
B1	0.15 - 0.35	(occasionally present) Red or red-brown (10R 3/4 or 2.5YR or 5YR 3/3); Light clay to light medium clay; Weak to strong 2-5mm polyhedral or weak 2-5mm angular blocky; Dry, very firm; Very few to few < 2-6 mm ferro-manganiferous nodules; Field pH 6.0 to 6.5; Gradual boundary to;
B21	0.15 - 0.70	Red (10R or 2.5YR 3/4-6); Light clay to light medium clay; Moderate to strong 2-10 mm polyhedral; Dry, firm to very firm; Very few to few < 2-6 mm ferro-manganiferous nodules; Field pH 6.0 to 7.0; Gradual or diffuse boundary to;
B22	0.70 - 1.15	Red (10R 3/4-6 or 2.5YR 3/6); Light clay to light medium clay; Weak to strong 2-10 mm polyhedral; Dry, firm to very firm; Very few to common < 2-6 mm ferro-manganiferous or manganiferous nodules; Field pH 6.5 to 7.0; Gradual or diffuse boundary to;
B23	1.15 - 1.40	Red (10R 3/4-6 or 2.5YR 3/6); Light clay to light medium clay; Weak to strong 2-10 mm polyhedral; Dry, weak to very firm; Few to many < 2-6 mm ferro-manganiferous or manganiferous nodules; Field pH 6.5 to 7.0.

Limit of augering

Number of sites: 39

Name: Camp (Cm)

Concept: Very shallow, bleached rocky Uniform sandy soils formed on sandstone hillslopes

Classification:

Aust: Haplic Lithic or Paralithic Bleached-Leptic Tenosol

GSG: Lithosol

PPF: Uc2.12

Landform: Undulating rises to steep hills

Geology: Gilbert River Formation (Jkg), Battle Camp Formation (Klc)

Vegetation: *E. hylandii, E. tetrodonta* woodlands

Microrelief: None

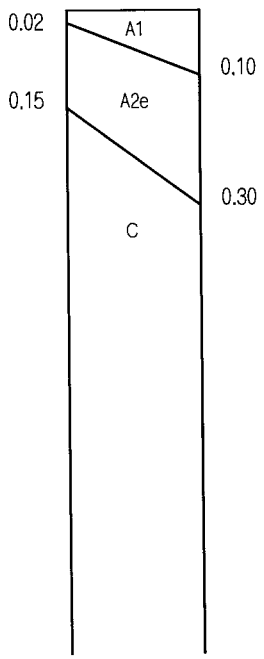
Surface condition: Hardsetting, occasionally soft or loose

Surface coarse fragments: Many to abundant 20-60 mm sub-rounded to sub-angular sandstone

Land Use Limitations

Climate:	<35°C, >1500 mm (C1), <35°C, <1500 mm (C2)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, highly permeable (W2h)
Flooding frequency:	No flooding (F0)
Rockiness:	20-60 mm, >50% (Rg5)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	10-32%, unstable (E4u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)

Soil Description:



A1 0 - 0.03 Grey or brown (7.5YR 4/2-3 or 10YR 4/1); Sand to sandy loam; Many to abundant 20-60 mm sub-rounded to sub-angular sandstone; Single grain to massive; Dry, weak to firm; Field pH 5.0 to 6.5; Clear boundary to;

A2e 0.03 - 0.25 Conspicuously bleached - brown or grey (7.5YR 5/3-4 or 10YR 4/2-3); Sand to loamy sand; Abundant 20-60 mm sub-angular to angular sandstone; Massive; Dry, weak to firm; Field pH 6.0 to 7.0; Abrupt or clear boundary to;

C Rock

Variants: Red Variant (CmEv): As for Cm, but red-brown **Number of sites:** 2

Number of sites: 11

Name: Caravan (Cv)

Concept: Deep to very deep coloured Uniform sands formed in beach ridges on chenier and beach ridge plains

Classification:

Aust: Basic Regolithic Orthic Tenosol

GSG: (Rudimentary) Podzol/Siliceous Sand

PPF: Uc2.23, Uc2.21, Uc2.34, Uc5.11

Landform: Beach ridges

Geology: Quaternary (Holocene) beach ridge deposits (Qhm), Quaternary (Pleistocene) beach ridge deposits (Qpm)

Vegetation: Woodlands and herblands on beach ridges and the littoral margins, minor open heath or dwarf-open heath

Microrelief: None

Surface condition: Loose

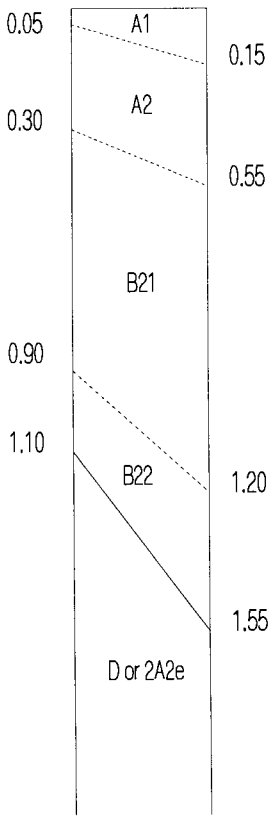
Surface coarse fragments: None

Land Use Limitations

Climate:	>35°C, <1500 mm (C3), <35°C, <1500 mm (C2), <35°C, >1500 mm (C1)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, highly permeable (W4h)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	1-3%, unstable (E2u)
Landscape complexity:	Isolated unit (Xi)
Salinity:	Non-saline (Sn)

Soil Description:

Limit of augering



A1	0 - 0.10	Dark or grey (10YR 2-4/1-2 or 5/1); Sand; Single grain; Dry, very weak; Field pH 5.5 to 7.5; Gradual or diffuse boundary to;
A2	0.10 - 0.45	Pale or grey or yellow-brown (10YR 5-6/1-4); Sand; Single grain; Dry to moderately moist, very weak to weak; Field pH 6.0 to 7.0; Diffuse boundary to;
B21	0.45 - 0.95	Yellow-brown or yellow or pale (10YR 5-6/3 or 6/5-6 or 8/2); Many medium distinct or prominent yellow or orange mottles; Sand; Single grain to massive; Moderately moist, very weak to weak; Field pH 6.0; Gradual boundary to;
B22	0.95 - 1.30	Pale or grey (10YR 8/1 or 2.5Y 6/1); Common to many fine to medium prominent yellow or orange mottles; Sand to light fine sandy loam; Single grain to massive; Moderately moist, very weak; Field pH 5.0 to 7.0; Clear or diffuse boundary to;
Either		
D	1.30 - 1.70	Grey (5Y 6/1); Fine sandy medium clay; Moderate 2-5 mm lenticular; Moderately moist, strong; Field pH 7.0;
or		
2A2e	1.30 - 1.45	Conspicuously bleached - pale or yellow-brown (10YR 8/1-3 or 5/4); Few fine or medium faint to distinct yellow mottles occasionally present; Sand; Few to common 2-20 mm sub-angular platy shells or sub-rounded quartz occasionally present; Single grain; Moderately moist, very weak; Field pH 5.5 to 9.5; Gradual boundary to;
2B21	1.45 - 1.65	Pale (10YR 8/1-2); Many prominent medium yellow mottles; Sand; Single grain; Moderately moist, very weak; Field pH 5.5 to 6.0; Diffuse boundary to;
2B22	1.65 - 1.80	Pale-yellow (10YR 7/8); Few fine prominent pale mottles; Sand; Single grain; Wet, very weak;

Phases: Deep surface phase (CvDp): A1 to 0.35-0.65 m. **Number of sites:** 4
Coarse phase (CvCp): coarse sandy throughout. **Number of sites:** 2

Number of sites: 14

Name: Chlory (Cl)

Concept: Moderately deep Duplex sodic brown soils formed on schist, phyllite, quartzite and gneiss

Classification:

Aust: Eutrophic Mottled-Subnatric Brown Sodosol

GSG: Solodic Soil

PPF: Dy3.22

Landform: Hillslopes on undulating rises to rolling low hills

Geology: Coen Metamorphics (Pc), Holroyd Metamorphics (Ph)

Vegetation: *E. tetrodonta* woodlands

Microrelief: None

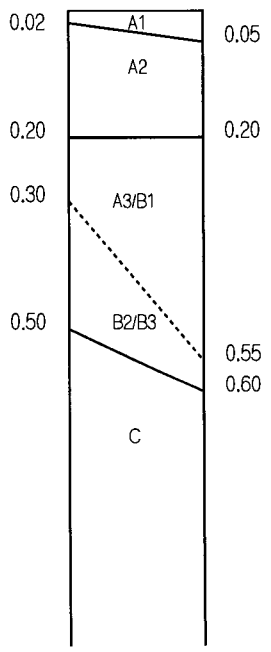
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	40 - 80 mm/m (M5, M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, slowly permeable (W4s)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, unstable (E3u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk outflow zone (So1)

Soil Description:



A1	0 - 0.03	Dark or grey (10YR 3-4/2); Loamy fine sand to sandy loam; Few 2-60 mm angular quartz; Massive; Dry, firm; Field pH 6.0 to 7.5; Abrupt or clear boundary to;
A2	0.02 - 0.20	Grey or yellow-brown (10YR 4/2 or 5/3); Loamy fine sand to sandy loam; Few or common 2-6 mm and few 6-60 mm angular quartz; Massive; Dry, firm; Field pH 6.0 to 7.0; Clear or gradual boundary to;
A3/B1	0.20 - 0.40	Grey or brown or yellow-brown (10YR 4/2-4 or 5/4); Light clay; Few 2-6 mm or abundant 6-20 mm angular quartz; Moderate 2-5 mm angular blocky; Moderately moist, firm; Field pH 7.0; Gradual boundary to;
B2/B3	0.40 - 0.60	Yellow or yellow-brown (10YR 5/5 or 2.5Y 5/3); Common fine prominent red mottles; Sandy medium clay to medium heavy clay; Abundant 20-60 mm angular quartz and schist occasionally present; Moderate 20-60 mm angular blocky; Moderately moist, firm to dry, very strong; Field pH 7.0 to 9.5; Clear boundary to;
C		Rock

Number of sites: 3

Name: Citri (Ct)

Concept: Deep bleached Duplex sodic soils formed in drainage depressions on residual sands

Classification:

Aust: Sodic or Bleached-Manganic Sodosolic Redoxic or Oxyaquic Hydrosol

GSG: Solodic Soil, Solodized Solonetz

PPF: Dy2.42, Dy2.43, Dy3.43, Dy3.42, Dy2.22

Landform: Drainage depressions in gently undulating plains to undulating rises.

Geology: Tertiary and Quaternary colluvial sands (TQs)

Vegetation: *M. viridiflora* low open woodlands and woodlands, tussock grasslands

Microrelief: None

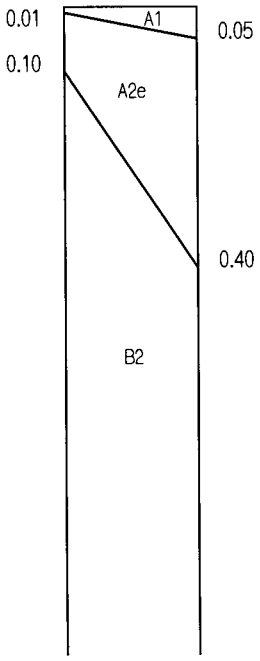
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1), >35°C, <1500 mm (C3)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Poorly drained, very slowly permeable (W5v)
Flooding frequency:	Every year (F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	0-1%, very unstable (E1v)
Landscape complexity:	Unit size < 20 ha (X1)
Salinity:	Low risk outflow zone (So1)

Soil Description:



A1	0 - 0.03	Dark or grey (10YR 2-4/1); Few fine distinct orange mottles occasionally present; Loamy sand to fine sandy loam; Massive; Dry, weak to firm; Field pH 5.0 to 6.0; Sharp or clear boundary to;
A2e	0.03 - 0.25	Conspicuously bleached - grey or brown or red-brown (10YR 5-6/1-2 or 7.5YR 6/3 or 5YR 4-5/4); Few fine distinct orange mottles occassionally present; Sand to fine sandy loam; Massive; Dry, very weak to very firm; Field pH 6.0 to 7.0; Sharp or clear boundary to;
B1	0.25 - 0.55	(occasionally present) Grey or yellow (10YR 4-5/1-2 or 2.5Y 5/5); Few to common fine to medium distinct to prominent yellow to grey mottles; Sandy light clay to light clay sandy; Strong 10-100 mm columnar to prismatic; Dry to moderately moist, very firm to very strong; Field pH 7.0 to 8.5; Abrupt boundary to;
B2	0.25 - 0.90	Grey (10YR 4-6/1-2); Few to many fine to medium distinct yellow to brown mottles; Light clay sandy to medium heavy clay; Strong 5-100 mm angular blocky to prismatic to columnar; Moderately moist, firm to very strong; Few to many 2-20 mm manganiferous nodules occasionally present; Field pH 7.0 to 9.5.
	Limit of augering	

Variants: Coarse phase (CtCp): Coarse sandy throughout. **Number of sites:** 1

Number of sites: 12

Name: Clark (Cr)

Concept: Deep bleached Gradational yellow massive soils formed on residual sands

Classification:

Aust: Bleached or Bleached-Mottled or Bleached-Ferric Mesotrophic Kandosol

GSG: Yellow Earth

PPF: Gn2.74, Gn2.34, Gn2.35, Gn2.64, Gn2.75

Landform: Gently undulating plains to undulating rises

Geology: Tertiary and Quaternary colluvial sands (TQs)

Vegetation: *E. tetrodonta* woodlands

Microrelief: None

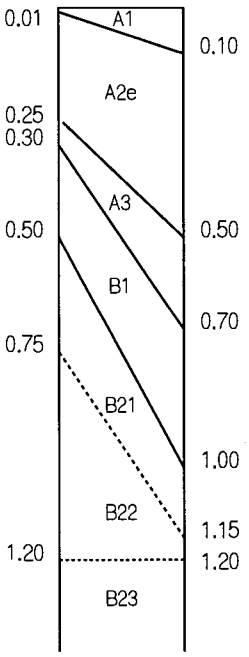
Surface condition: Firm to hardsetting

Surface coarse fragments: None

Soil Description:

Land Use Limitations

Climate:	<35°C, >1500 mm (C1), >35°C, <1500 mm (C3)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	3-8 ppm P, <4 ppm SO_4 S (N6)
Wetness:	Moderately well drained, moderately permeable (W3m)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	1-3%, stable (E2s), 3-10%, stable (E3s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)



A1 0 - 0.05 Dark or grey (10YR 2-4/1-2); Sand to sandy loam; Very few to few 2-6 mm sub-angular to sub-rounded quartz coarse fragments occasionally present; Single grain to massive; Dry, very weak to firm; Field pH 6.0 to 7.0; Abrupt or clear boundary to;

A2e 0.05 - 0.35 Conspicuously bleached - grey or yellow-brown or brown (10YR or 2.5Y 4-6/2-4); Sand to loamy sand; Very few to few 2-6 mm sub-angular to sub-rounded quartz coarse fragments occasionally present; Massive; Dry, weak to firm; Field pH 6.0 to 7.0; Clear or gradual boundary to;

A3 0.35 - 0.45 Yellow-brown or yellow-grey or yellow (10YR 5-6/4-6 or 2.5Y 6/3-6); Few to common fine faint to distinct yellow mottles occasionally present; Loamy sand to light sandy clay loam; Few 2-6 mm sub-angular to sub-rounded quartz coarse fragments occasionally present; Massive; Dry to moderately moist, weak to very firm; Very few to common 2-6 mm ferruginous or ferro-manganiferous or manganiferous nodules occasionally present; Field pH 6.0 to 6.5; Clear or diffuse boundary to;

B1 0.45 - 0.70 Yellow-brown or yellow-grey or yellow (10YR 5-6/5-6 or 2.5Y 6/4-6 or 7.5YR 5/5-6); Few to many fine faint to prominent yellow to red mottles occasionally present; Sandy loam to sandy clay loam; Very few to common 2-6 mm sub-angular to sub-rounded quartz coarse fragments occasionally present; Massive; Dry to moderately moist, weak to very firm; Very few to common 2-6 mm ferruginous or ferro-manganiferous or manganiferous nodules occasionally present; Field pH 5.5 to 6.5; Gradual or diffuse boundary to;

B21 0.70 - 0.90 Yellow or pale-yellow (10YR 6/5-7 or 2.5Y 5-6/5-6 or 10YR or 2.5Y 7/4-6); Few to many fine faint to prominent orange to red mottles; Sandy clay loam to sandy light clay; Very few to common 2-6 mm sub-angular to sub-rounded quartz coarse fragments occasionally present; Massive; Dry to moderately moist, weak to very firm; Very few to abundant 2-20 mm ferruginous or ferro-manganiferous or manganiferous nodules occasionally present; Field pH 6.0 to 7.0; Gradual or diffuse boundary to;

B22 0.90 - 1.20 Yellow or pale-yellow (10YR 5-6/5-6 or 2.5Y 6/4-6 or 2.5Y 7/3-6 or 7.5YR 5/7-8); Few to many fine distinct to prominent yellow to red mottles; Sandy clay loam to sandy light clay; Very few to common 2-20 mm sub-angular to sub-rounded quartz coarse fragments occasionally present; Massive; Moderately moist, weak to very firm; Very few to abundant 2-20 mm ferruginous or ferro-manganiferous or manganiferous nodules occasionally present; Field pH 6.0 to 7.0.

Limit of augering

Phases: Coarse phase (CrCp): Coarse sandy throughout. **Number of sites:** 2

Number of sites: 65

Name: Cook (Ck)

Concept: Moderately deep Duplex non-sodic red soils formed on greywacke and slate

Classification:

Aust: Haplic Mesotrophic Red Chromosol

GSG: Red Podzolic Soil

PPF: Dr2.21

Landform: Undulating rises to steep hills

Geology: Hodgkinson Formation (D-Ch)

Vegetation: *E. nesophila* or *E. hylandii* open forests and woodlands

Microrelief: None

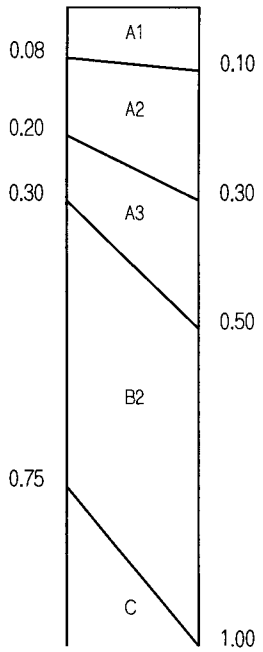
Surface condition: Hardsetting

Surface coarse fragments: Many 20-60 mm angular greywacke and slate

Land Use Limitations

Climate:	<35°C, >1500 mm (C2)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, >4 ppm SO_4 S (N7)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Rockiness:	6-20 mm, > 50% (Rm5)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Isolated unit (Xi)
Salinity:	Moderate risk inflow zone (Si2)

Soil Description:



A1	0 - 0.10	Dark or red-brown (7.5YR 3/2 or 5YR 4/3); Fine sandy loam to clay loam; Common to abundant 6-20 mm angular metamorphic coarse fragments; Weak 2 - 5 mm granular; Dry, weak; Field pH 6.0; Clear boundary
A2	0.10 - 0.20	Red-brown or pale (5YR 4/3 or 7.5YR 7/4); Clay loam; Abundant 6-20 mm angular metamorphic coarse fragments; Massive; Dry, weak; Field pH 6.0; Clear boundary to;
A3	0.20 - 0.30	Red (2.5YR 4/4 or 3/6); Clay loam; Abundant 6-20 mm angular metamorphic coarse fragments; Massive; Weak 2-5 mm sub-angular blocky; Dry, firm; Field pH 5.5; Clear boundary to;
B2	0.30 - 0.75	Red (10R or 2.5YR 3/6); Medium clay; Common 2-6 mm and few 6-20 mm angular metamorphic coarse fragments; Strong 2-5 mm polyhedral; Dry, very firm; Field pH 5.5; Clear boundary to;
C		Rock

Number of sites: 2

Name: Cox (Cx)

Concept: Deep Uniform or Gradational red massive soils on alluvial plains within the Rolling Downs Group

Classification:

Aust: Ferric or Manganic or Haplic Mesotrophic Red Kandosol

GSG: Red Earth

PPF: Gn2.14, Gn2.11, Um4.21

Landform: Level to gently undulating alluvial plains

Geology: Quaternary alluvia on Rolling Downs Group (Klr)

Vegetation: *E. tetrodonta* woodlands

Microrelief: None

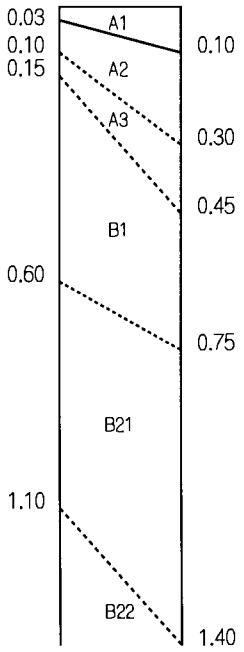
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C1),<35°C, >1500 mm (C2)
Moisture Supply:	80 - 100 mm/m (M3)
Fertility:	3-8 ppm P, <4 ppm SO_4 S (N6)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	Less than 1 in 10 years (F1)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	0-1%, stable (E1s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Non-saline (Sn)

Soil Description:



A1 0 - 0.05 Dark (7.5YR or 5YR 3/2); Loamy sand to fine sandy clay loam; Massive; Dry, firm to very firm; Field pH 6.0 to 6.5; Clear or abrupt boundary to;

A2 0.05 - 0.15 Red-brown (5YR 4/3-4); Loamy sand to fine sandy clay loam; Massive; Dry, firm; Field pH 5.5 to 6.5; Gradual or diffuse boundary to;

A3 0.15 - 0.30 Red or red-brown (2.5YR 3/3 or 5YR 4/3); Sandy loam to clay loam; Massive; Dry, weak to firm; Field pH 6.0 to 6.5; Diffuse boundary to;

B1 0.30 - 0.70 Red or red-brown (10R 3-4/4-6 or 5YR 4/4 or 2.5YR 3/6); Sandy clay loam to clay loam heavy; Massive; Dry, weak to firm; Field pH 6.0 to 7.0; Gradual or diffuse boundary to;

B21 0.70 - 1.10 Red (10R 3-4/3-6); Sandy clay loam to clay loam heavy; Massive; Dry, weak; Few to many < 2-6 mm manganiferous nodules; Field pH 5.0 to 6.0; Diffuse boundary to;

B22 1.10 - 1.20 Red (10R 4/6 or 2.5YR 3/4); Few, to common fine, faint to distinct yellow to red mottles; Sandy clay loam heavy to clay loam; Massive; Dry, weak to firm; Many to very many 2-6 mm ferruginous or ferro-manganiferous or manganiferous nodules; Field pH 5.5;

Limit of augering

Number of sites: 5

Name: Crosbie (Cb)

Concept: Moderately deep Uniform red structured clays formed on greenstone

Classification:

Aust: Haplic Eutrophic Red Dermosol

GSG: No suitable group

PPF: Uf4.41

Landform: Hillslopes on gently undulating plains to undulating rises

Geology: Holroyd Metamorphics (Phg)

Vegetation: *E. tetrodonta* or *E. hylandii* woodlands

Microrelief: None

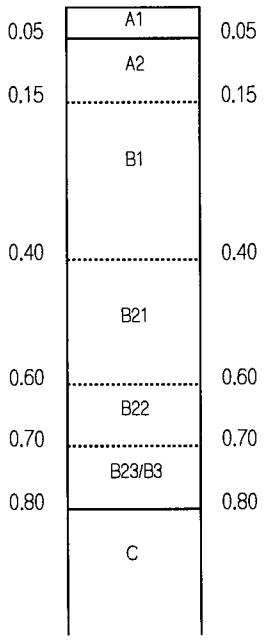
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	80 - 100 mm/m (M3))
Fertility:	3-8 ppm P, >4 ppm SO_4 S (N5)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Isolated unit (Xi)
Salinity:	Low risk inflow zone (Si1)

Soil Description:



A1	0 - 0.05	Dark (5YR 3/2); Light clay; Moderate < 2 mm granular; Dry, weak; Field pH 7.0; Clear boundary to;
A2	0.05 - 0.15	Red (2.5YR 3/3); Light clay; Moderate < 2 mm polyhedral; Dry, firm; Very few 2-6 mm ferro-manganiferous nodules; Field pH 7.5; Gradual boundary to;
B1	0.15 - 0.40	Red (2.5YR 3/6); Light clay; Strong < 2 mm polyhedral; Moderately moist, weak; Few 2-6 mm manganiferous nodules; Field pH 7.5; Gradual boundary to;
B21	0.40 - 0.60	Red (2.5YR 3/6); Light medium clay; Strong < 2 mm polyhedral; Moderately moist, weak; Few 2-6 mm manganiferous nodules; Field pH 7.0; Gradual boundary to;
B22	0.60 - 0.70	Red (2.5YR 3/6); Medium clay; Strong < 2 mm polyhedral; Moderately moist, weak; Common 2-6 mm manganiferous nodules; Field pH 7.5; Gradual boundary to;
B23/B3	0.70 - 0.80	Red (2.5YR 3/6); Light medium clay; Few 6-20 mm sub-angular quartz; Strong < 2 mm polyhedral; Moderately moist, weak; Few 2-6 mm manganiferous nodules; Field pH 7.5; Clear boundary to;
C		Rock

Number of sites: 1

Name: Daunt (Dn)

Concept: Giant Uniform bleached sand over orstein pan, in coastal sand dunes

Classification:

Aust: Fragic Humosesquic Aeric Podosol

GSG: (Giant) Podzol

PPF: Uc2.3

Landform: Dunes

Geology: Quaternary dunes (Qd)

Vegetation: Open-heath and dwarf open-heath

Microrelief: None

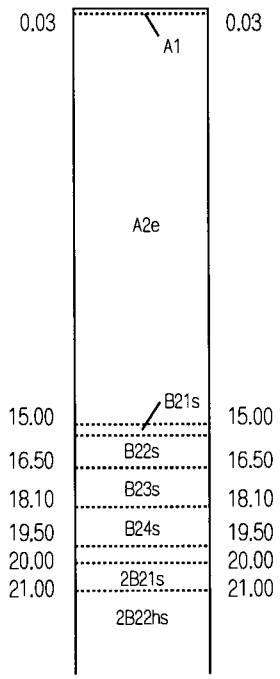
Surface condition: Loose

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C2)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Rapidly drained, highly permeable (W1h)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	3-10%, unstable (E3u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Non-saline (Sn)

Soil Description:



A1	0 - 0.03	Dark (7.5YR 3/1); Sand; Single grain; Dry, very weak; Diffuse boundary to;
A2e	0.03 - 15.00	Conspicuously bleached - grey-brown grading to pale grading to white (7.5YR 6-8/1); Sand; Single grain; Dry, very weak; Diffuse boundary to;
B21s	15.00 - 15.30	Brown (7.5YR 4/4); Sand; Massive; Dry, weakly cemented, continuous, orstein pan; Diffuse boundary to;
B22s	15.30 - 16.50	Yellow-brown (7.5YR 5-6/6); Sand; Massive; Dry, weakly cemented, continuous orstein pan; Diffuse boundary to;
B23s	16.50 - 18.10	Yellow (10YR 6-7/6); Sand; Massive; Dry, weakly cemented, continuous, orstein pan; Diffuse boundary to;
B24s	18.10 - 19.50	Pale-yellow (10YR 7/4); Sand; Massive; Dry, weakly cemented, continuous, orstein pan; Diffuse boundary to;
2A2e	19.50 - 20.00	Conspicuously bleached - white (10YR 8/2); Sand; Single grain; Dry, loose; Diffuse boundary to;
2B21s	20.00 - 21.00	Dark (7.5YR 3/2); Sand; Massive; Dry, weakly cemented, continuous orstein pan; Diffuse boundary to;
2B22hs	21.00 - 21.50	Brown (7.5YR 4/3); Sand; Massive; Dry, weakly cemented, continuous coffee rock pan.

Limit of exposure

Number of sites: 1

Name: Deighton (Dt)

Concept: Deep Uniform yellow massive sands formed on residual sands or sandstone

Classification:

Aust: Basic Regolithic or Lithic Bleached-Orthic Tenosol; Basic Regolithic or Paralithic Orthic Tenosol

GSG: (Yellow) Earthy Sand

PPF: Uc4.21, Uc2.12, Uc2.21, Uc2.23

Landform: Hillslopes on undulating rises; occasionally gently undulating plains

Geology: Helby Beds (JKb), Tertiary and Quaternary colluvial sand (TQs), Gilbert River Formation (JKg), Bulimba Formation (KTi)

Vegetation: *E. tetrodonta* woodlands

Microrelief: None

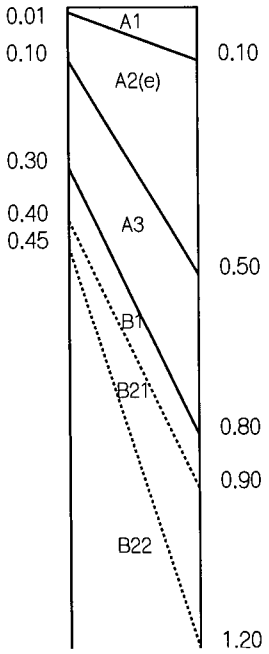
Surface condition: Loose to firm

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Moderately well drained, highly permeable (W3h)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, unstable (E3u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)

Surface coarse fragments: Few to many < 2-6 mm angular quartz, or sandstone, or subrounded ferruginous nodules occasionally present

Soil Description:



A1	0 - 0.05	Dark or grey (N 2/0 or 2.5Y 5/1-2 or 10YR 2-4/1-2); Sand to sandy loam; Very few to few < 2-6 mm angular to sub-angular quartz coarse fragments occasionally present; Dry, very weak to weak; Field pH 6.0 to 7.0; Sharp or clear boundary to;
A2(e)	0.05 - 0.25	Frequently conspicuously bleached - grey or brown or yellow-brown (10YR 4-6/1-4); Sand to loamy sand; Few < 2-6 mm angular to sub-angular quartz coarse fragments occasionally present; Dry, very weak to firm; Field pH 6.0 to 7.0; Clear or gradual boundary to;
A3	0.25 - 0.40	Yellow-brown or yellow (10YR 5-6/3-6); Sand to sandy loam; Massive; Dry to moderately moist, very weak to firm; Field pH 6.0 to 6.5; Clear or diffuse boundary to;
B1	0.40 - 0.55	Yellow-brown or brown or yellow (10YR or 7.5YR 5-6/4-6); Sand to sandy loam; Massive; Dry to moderately moist, very weak to firm; Field pH 6.0 to 6.5; Gradual or diffuse boundary to;
B21	0.55 - 0.80	Yellow or yellow-brown or yellow-grey (10YR or 7.5YR 5/6 or 6/8-8 or 2.5Y 6/4 to 6/8); Sand to sandy loam; Few to many 2-20 mm ferruginous or ferro-manganiferous nodules occasionally present; Field pH 6.0 to 7.0; Gradual or diffuse boundary to;
B22	0.80 - 1.20	Yellow-brown or yellow (7.5YR 5/5-6 or 10YR or 7.5YR 6/6-8); Sand to sandy loam; Massive; Few 2-6 mm ferruginous nodules occasionally present; Field pH 5.5 to 7.0.

Limit of augering

Phases: Rocky phase (DtRp): Few, grading to common 2-20 mm angular to rounded quartz throughout. **Number of sites:** 5
Coarse phase (DtCp): Coarse sandy throughout. **Number of sites:** 1

Number of sites: 40

Name: Del (Dl)

Concept: Moderately deep Duplex sodic mottled grey soils formed on footslopes of acid volcanic hills

Classification:

Aust: Eutrophic Subnatric Grey Sodosol

GSG: Solodic Soil/Soloth

PPF: Dg2.42, Dy2.41

Landform: Footslopes of low hills to hills

Geology: Janet Ranges volcanics (Cpj), Muralug (Cm), Endeavour Strait (Cn), Eborac (Ce) and Goods Island (Cg) Ignimbrite

Vegetation: *M. viridiflora* low open woodlands and woodlands

Microrelief: None

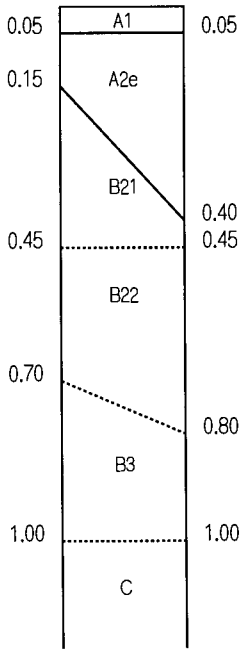
Surface condition: Hardsetting

Surface coarse fragments: Few 60-200 mm angular rhyolite

Land Use Limitations

Climate:	<35°C, <1500 mm (C2)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, >4 ppm SO_4 S (N7)
Wetness:	Poorly drained, slowly permeable (W5s)
Flooding frequency:	Less than 1 in 10 years (F1)
Rockiness:	60-200 mm, 2-10% (Rc2)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	1-3%, unstable (E2u)
Landscape complexity:	Isolated unit (Xi)
Salinity:	Low risk outflow zone (So1)

Soil Description:



A1	0 - 0.05	Grey or pale (10YR 6-7/2); Silty loam to fine sandy clay loam; Massive; Wet, firm; Field pH 5.5; Abrupt boundary to;
A2e	0.05 - 30	Conspicuously bleached - grey or pale (10YR 6-7/2); Fine sandy clay loam to silty clay loam; Massive; Wet, firm; Field pH 5.5; Clear or abrupt boundary to;
B21	0.30 - 0.45	Pale (10YR 7/3); Light medium clay to medium clay; Structure? Wet, firm; Field pH 6.0; Gradual boundary to;
B22	0.45 - 0.75	Grey or pale (10YR 4/1 or 2.5Y 7/1); Common medium distinct yellow mottles; Light medium clay to heavy clay; Structure? Wet, firm; Field pH 4.5 to 7.5; Gradual boundary to;
B3	0.75 - 1.00	Grey or pale (10YR 6/1 or 5Y 8/2); Many medium distinct yellow mottles; Light clay; Field pH 4.5 to 8; Gradual boundary to;
C		Rock

Number of sites: 2

Name: Dixie (Dx)

Concept: Deep bleached Uniform, grey and yellow coarse sands derived from adamellite and granite

Classification:

Aust: Basic Regolithic or Lithic Bleached-Orthic Tenosol

GSG: (Grey) Earthy Sand/(Yellow) Earthy Sand

PPF: Uc2.12, Uc2.23, Uc2.21, Uc2.22

Landform: Gently undulating plains to undulating rises

Geology: Kintore (SDk), Lankelly (SDl) and Aralba (SDa) Adamellite, Flyspeck Granodiorite (SDf)

Vegetation: *E. tetrodonta* or *E. hylandii* woodlands

Land Use Limitations

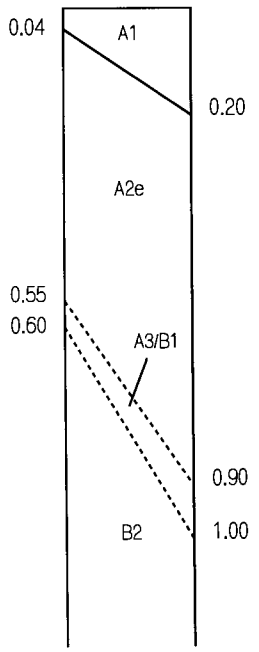
Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	< 40 - 60 mm/m (M6, M5)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, highly permeable (W2h)
Flooding frequency:	No flooding (F0)
Topography:	2-6 mm, 20-50% (Rf4)
Rockiness:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, unstable (E3u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk inflow zone (Si1)

Microrelief: None

Surface condition: Loose to hardsetting

Surface coarse fragments: Common to abundant 2-6 mm sub-angular quartz

Soil Description:



A1 0 - 0.10 Dark or grey or grey-brown (10YR 3-4/1-2 or 7.5YR 4-5/1); Coarse sand to loamy coarse sand; Few to many 2-6 mm sub-angular quartz coarse fragments; Single grain to massive; Dry, very weak to firm; Field pH 6.0 to 7.0; Abrupt or clear boundary to;

A2e 0.10 - 0.75 Conspicuously bleached - grey or yellow-brown or pale or yellow-grey (10YR 5/1-3 or 6/1-2 or 7/1-2 or 2.5Y 5-6/2-3); Coarse sand to loamy coarse sand; Few to many 2-6 mm sub-angular quartz coarse fragments; Massive; Dry, very weak to firm; Field pH 6.0 to 7.0; Gradual or diffuse boundary to;

A3/B1 0.75 - 0.85 Grey or yellow-brown or yellow-grey (10YR 6/2-4 or 5/3-4 or 2.5Y 6/4); Few to many medium prominent yellow or orange mottles occasionally present; Coarse sand to loamy coarse sand; Few to many 2-6 mm sub-angular or angular quartz; Massive; Dry to moderately moist, weak to firm; Field pH 6.0 to 6.5; Gradual or diffuse boundary to;

B2 0.85 - 1.20 Yellow-brown or pale or yellow-grey (10YR 5-6/4 or 7/2 or 2.5Y 6-7/4); Few to common fine to medium distinct yellow mottles; Coarse sand to loamy coarse sand; Few to common 2-6 mm sub-rounded to angular quartz coarse fragments; Massive; Dry to moderately moist, very weak to firm; Field pH 6.0 to 7.0.

Limit of augering

Number of sites: 30

Name: Doughboy (Db)

Concept: Very deep bleached Uniform sands on coffee rock and occasionally orstein, formed in beach ridges

Classification:

Aust: Fragic or Parapanic Humic Semiaquic Podosol; Fragic Sesquic Semiaquic Podosol; Fragic Humic Aquic Podosol;

GSG: Podzol/(Rudimentary) Podzol

PPF: Uc2.33, Uc2.23

Landform: Beach ridges and dunes

Geology: Quaternary younger dune sand (Qd), Quaternary Holocene (Qhm) and Pleistocene (Qpm) beach ridge deposits

Vegetation: Open-heaths and dwarf open-heaths, closed forests, woodlands and open-woodlands dominated by *E. clarksoniana, E. novoguinensis* or *E. polycarpa*

Microrelief: None

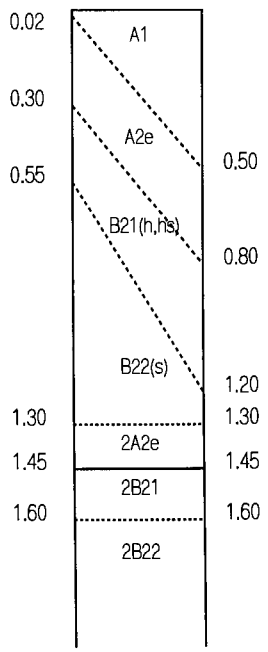
Surface condition: Loose or soft

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C2), <35°C, >1500 mm (C1)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, highly permeable (W4h)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	1-3%, unstable (E2u)
Landscape complexity:	Isolated unit (Xi)
Salinity:	Non-saline (Sn)

Soil Description:



A1	0 - 0.20	Dark or grey-brown or grey (10YR 2-4/1 or 7.5YR 3-4/1); Sand to loamy sand; Single grain; Dry to moderately moist, loose to very weak; Field pH 4.5 to 5.5; Gradual or diffuse boundary to;
A2e	0.20 - 0.50	Conspicuously bleached - grey-brown or grey or pale (7.5YR 4-7/1); Sand; Single grain; Dry to moderately moist, very weak; Field pH 5.0 to 6.0; Diffuse boundary to;
B1	0.50 - 0.60	(occasionally present) Pale or grey-brown (7.5YR 5-7/2); Common medium distinct grey mottles occasionally present; Sand; Single grain; Moderately moist, very weak; Field pH 5.5 to 6.0; Clear or diffuse boundary to;
B21 (h,hs)	0.50 - 1.00	Dark or brown or grey-brown (10YR 2/2 or 7.5YR 4/2-4); Many medium distinct grey mottles occasionally present; Sand; Single grain to massive; Moderately moist, very weak to firm; Field pH 5.0 to 5.5; Gradual or diffuse boundary to;
B22(s)	1.00 - 1.30	Yellow-brown or grey-brown (7.5YR 5/6 or 7.5YR 4/2); Many medium prominent yellow mottles occasionally present; Sand; Single grain to massive; Moderately moist, very weak to firm; Field pH 5.0 to 6.0; Diffuse boundary to;
2A2e	1.30 - 1.45	Conspicuously bleached - pale (10YR 8/1-2); Few medium distinct yellow mottles occasionally present; Sand; Single grain; Moderately moist, very weak; Field pH 5.5; Clear or diffuse boundary to;
2B21	1.45 - 1.60	Pale (10YR 8/1); Many medium prominent yellow mottles; Sand; Single grain; Moderately moist, very weak; Field pH 5.5; Diffuse boundary to;
2B22	1.65 - 1.80	Pale-yellow (10YR 7/8); Few fine prominent pale mottles; Sand; Single grain; Wet, very weak; Field pH 5.0.

Limit of augering

Number of sites: 9

Name: Drop (Dr)

Concept: Moderately deep Gradational yellow soils formed on hillslopes of adamellite or granite

Classification:

Aust: Mottled or Bleached Mesotrophic Yellow Kandosol; Bleached-Mottled or Mottled Mesotrophic Yellow Dermosol; Haplic Mesotrophic Brown Kandosol

GSG: Yellow Earth/Yellow Podzolic Soil

PPF: Gn2.41, Gn3.91, Gn2.74, Gn3.74, Gn3.04

Landform: Hillslopes on undulating rises to steep hills

Geology: Lankelly (SDl), Kintore (SDk) and Wolverton (Pw) Adamellite, Flyspeck Granodiorite (SDf), Finlayson Granite (Pgf)

Vegetation: *E. cullenii, E. crebra* woodlands and open woodlands

Land Use Limitations

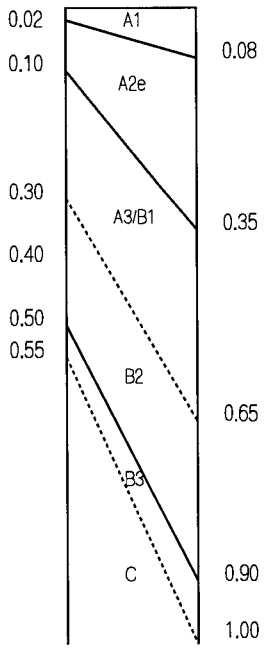
Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, moderately permeable (W4m)
Flooding frequency:	No flooding (F0)
Rockiness:	6-20 mm, 10-20 % (Rm3)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	10-32%, stable (E4s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk inflow zone (Si1)

Microrelief: None

Surface condition: Hardsetting

Surface coarse fragments: Few to many 2-200 mm angular quartz or adamellite or granite

Soil Description:



A1	0 - 0.05	Dark or grey (10YR 2-4/1 or 5/2); Loamy coarse sand to loamy sand to coarse light sandy clay loam; Few to common 2-20 mm sub-angular to angular quartz or granite; Massive; Dry, firm; Field pH 6.0 to 6.5; Abrupt or clear boundary to;
A2e	0.05 - 0.20	Conspicuously bleached - brown or yellow-brown or yellow (10YR 4-6/3 or 6/5); Loamy coarse sand to loamy sand to sandy clay loam; Very few to common 2-20 mm sub-angular quartz or granite; Massive; Dry, firm; Field pH 6.0 to 6.5; Clear or gradual boundary to;
A3/B1	0.20 - 0.45	Grey or yellow-brown or yellow (10YR 4/1-2 or 5/4-6 or 6/6); Coarse sandy loam to coarse sandy clay loam; Very few to many 2-6 mm angular to sub-angular quartz or granite; Massive; Dry to moderately moist, firm; Field pH 5.5 to 6.5; Gradual boundary to;
B2	0.45 - 0.60	Grey or yellow-brown or yellow (10YR 5/2-6 or 6/6); Common to many fine faint to prominent yellow to red mottles; Coarse sandy clay loam to medium clay; Few to many 2-6 mm angular to sub-angular quartz or granite; Massive to moderate 2-5 mm sub-angular blocky; Field pH 6.0; Clear or diffuse boundary to;
B3	0.60 - 0.80	Yellow-brown (10YR 5-6/4); Coarse sandy clay loam to medium clay; Few to many 2-6 mm sub-angular quartz or granite; Massive to moderate < 2 mm sub-angular blocky; Moderately moist, weak to firm; Field pH 6.0; Diffuse boundary to;
C		Rock

Number of sites: 26

Name: Eborac (Er)

Concept: Very shallow bleached Uniform brown soils on acid volcanic hillslopes

Classification:

Aust: Haplic Lithic Bleached-Leptic Tenosol

GSG: NSG, affin. with Lithosol

PPF: Um2.12

Landform: Hillslopes on rolling low hills to hills

Geology: Eborac Ignimbrite (Ce)

Vegetation: Open heaths and dwarf open heaths

Microrelief: None

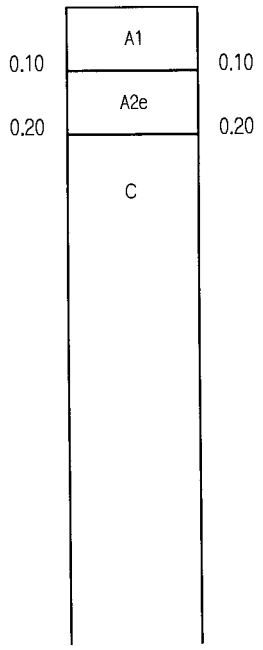
Surface condition: Firm

Surface coarse fragments: Abundant 6-200 mm angular rhyolite

Land Use Limitations

Climate:	<35°C, <1500 mm (C2)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Rockiness:	20-60 mm, 20-50% (Rg4)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	10-32%, stable (E4s)
Landscape complexity:	Isolated unit (Xi)
Salinity:	Low risk intake zone (Si1)

Soil Description:



A1	0 - 0.10	Grey-brown (7.5YR 4/2); Sandy clay loam; Few 20-60 mm angular volcanic coarse fragments; Strong 2-5 mm cast; Dry, firm; Clear boundary to;
A2e	0.10 - 0.20	Conspicuously bleached - yellow-brown (10YR 5/3); Coarse sandy clay loam; Few 6-20 mm angular volcanic coarse fragments; Massive; Dry, firm; Clear boundary to;
C		Rock

Number of sites: 1

Name: Emma (Em)

Concept: Deep Gradational massive red soils formed on sandstone

Classification:

Aust: Haplic Dystrophic Red Kandosol

GSG: Red Earth

PPF: Gn2.14, Gn2.15

Landform: Gently undulating plains to undulating rises

Geology: Helby Beds (Jkb), Gilbert River Formation (Jkg), Tertiary sandstone (Tf)

Vegetation: *E. tetrodonta* woodlands and tall woodlands

Microrelief: None

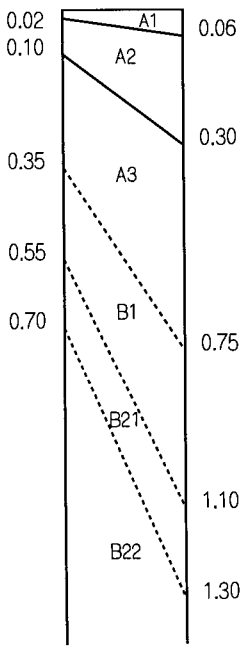
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1), <35°C, <1500 mm (C2)
Moisture Supply:	40 - 80 mm/m (M3, M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, highly permeable (W2h)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)

Soil Description:



A1 0 - 0.04 Dark or grey-brown (5YR 3-4/2 or 7.5YR or 10YR 3/2); Sand to fine sandy loam; Massive; Dry, very weak to firm; Field pH 5.5 to 6.5; Clear or abrupt boundary to;

A2 0.04 - 0.20 Red-brown or brown (5YR or 7.5YR 3-4/3-4); Sand to fine sandy loam; Massive; Dry, very weak to firm; Field pH 6.0 to 6.5; Clear or gradual boundary to;

A3 0.20 - 0.40 Red or red-brown (2.5YR 4/4-6 or 5YR 4/6); Loamy sand to sandy clay loam; Massive; Dry, weak to firm; Field pH 5.5 to 6.5; Diffuse boundary to;

B1 0.40 - 0.75 Red (2.5YR 3-4/6 or 10R 4/6); Loamy sand to sandy clay loam; Massive; Dry to moderately moist, weak to firm; Field pH 6.0 to 7.0; Gradual or diffuse boundary to;

B21 0.85 - 1.00 Red (10R 3-4/6 or 2.5YR 4/6-8) Few to common fine to medium distinct to prominent yellow mottles occasionally present; Light sandy clay loam to clay loam; Massive; Moderately moist, weak to firm; Very few 2-6 mm ferruginous nodules occasionally present; Field pH 5.5 to 7.0. Diffuse boundary to;

B22 1.00 - 1.50 Red (10R or 2.5YR 3/6 or 10R or 2.5YR 4/6-8); Few to common fine to medium distinct yellow mottles occasionally present; Sandy clay loam to clay loam; Massive; Moderately moist, weak to firm; Field pH 6.0.

Limit of augering

Number of sites: 27

Name: Endeavour (Ed)

Concept: Deep Gradational or occasionally Uniform red structured soil formed on basalt

Classification:

Aust: Haplic Mesotrophic Red Ferrosol

GSG: Krasnozem/Euchrozem

PPF: Gn3.11, Gn3.12, Uf6.31

Landform: Level plains to rolling low hills

Geology: Piebald basalt (Czp)

Vegetation: Closed forests or *E. leptophleba, E. platyphylla* or *E. erythrophloia* woodlands

Microrelief: None

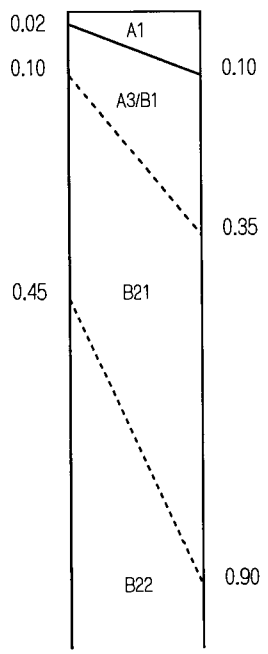
Surface condition: Firm

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C2)
Moisture Supply:	> 140 mm/m (M1)
Fertility:	3-8 ppm P, >4 ppm SO_4 S (N5)
Wetness:	Well drained, highly permeable (W2h)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Strongly adhesive soils, moderate moisture range, moderately hardsetting (P5)
Vegetation factor:	Regrowth control no problem, existing vegetation a problem (Vc1e2)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)

Soil Description:



A1 0 - 0.05 Dark or occasionally red-brown (2.5YR 2-3/2 or 5YR 3/4); Clay loam to light clay; Strong 2-5 mm granular or polyhedral; Dry to moderately moist, weak; Field pH 6.5 to 7.5; Clear or gradual boundary to;

A3/B1 0.05 - 0.20 Red (2.5YR 2-3/3 or 3/4 or 5YR 3/3); Clay loam to light clay; Strong < 2 mm or 2-5 mm polyhedral; Dry to moderately moist, weak; Field pH 6.0 to 7.0; Gradual or diffuse boundary to;

B21 0.20 - 0.50 Red (10R 3/3 or 2.5YR 3/3-6); Light clay to light medium clay; Strong < 2 mm or 2-5 mm polyhedral; Dry to moderately moist, weak; Field pH 6.0; Gradual or diffuse boundary to;

B22 0.50 - 1.20 Red (10R 2-3/3 to 2.5YR 3/4-6); Light clay to light medium clay; Strong < 2 mm polyhedral; Moderately moist weak to firm; Field pH 6.0 to 7.0;

Limit of augering

Number of sites: 7

Name: Eykin (Ek)

Concept: Moderately deep Duplex sodic grey soils formed on greywacke and slate

Classification:

Aust: Eutrophic Mottled-Subnatric Grey Sodosol

GSG: Solodic Soil

PPF: Dy3.43, Dy3.42

Landform: Undulating rises to rolling hills

Geology: Hodgkinson Formation (D-Ch)

Vegetation: *E. cullenii, E.crebra* or *E. persistens* woodlands and open woodlands

Microrelief: None

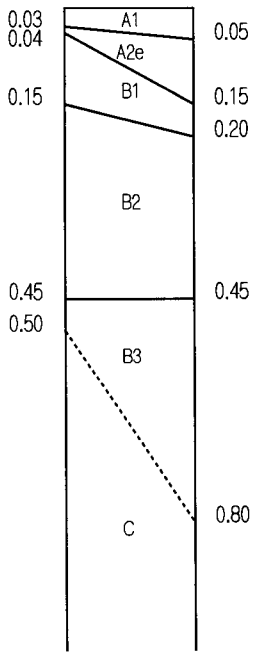
Surface condition: Hardsetting

Surface coarse fragments: Abundant 6-60 mm angular greywacke and slate

Land Use Limitations

Climate:	<35°C, <1500 mm (C1)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	<3 ppm P, >4 ppm SO_4 S (N7)
Wetness:	Imperfectly to poorly drained, slowly permeable (W6s, W5s)
Flooding frequency:	No flooding (F0)
Rockiness:	6-20 mm, 20-50 % (Rm4)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, unstable (E3u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	High risk outflow zone (So3)

Soil Description:



A1	0 - 0.04	Dark or brown (10YR 3/2 or 7.5YR 4/3); Loamy sand to sandy loam; Few to many 2-6 mm angular metamorphic or sub-rounded quartz coarse fragments; Massive; Dry, firm; Field pH 5.5 to 7.0; Abrupt or clear boundary to;
A2e	0.04 - 0.15	Conspicuously bleached - brown or yellow-brown (10YR 4-5/4 or 5/3); Loamy sand to sandy loam; Common to many 6-20 mm angular metamorphic coarse fragments; Massive; Dry, firm; Field pH 5.5 to 6.5; Abrupt boundary to;
B1	0.15 - 0.20	Yellow-brown (10YR 5-6/4 or 7.5YR 5/4); Sandy clay to light medium clay; Common 6-20 mm angular platy metamorphic or sub-rounded quartz coarse fragments; Massive to weak 2-5 mm sub-angular blocky; Dry, very firm; Field pH 6.0; Clear or gradual boundary to;
B2	0.20 - 0.45	Yellow-grey (2.5Y 5-6/3-4); Common to many fine faint red or yellow mottles; Light medium clay to medium heavy clay; Many to very many 2-20 mm angular metamorphic or quartz coarse fragments; Moderate to strong 2-50 mm sub-angular to angular blocky; Dry, very firm to strong; Field pH 6.0 to 9.0; Clear or gradual boundary to;
B3	0.45 - 0.60	Yellow-grey or pale (2.5Y 6-7/3); Few to common fine faint grey to distinct red and yellow mottles; Light clay; Many 2-6 mm angular platy metamorphic coarse fragments; Moderate 2-5 mm sub-angular blocky; Dry, firm to very strong; Field pH 6.5 to 7.5; Diffuse boundary to;
C		Rock

Number of sites: 4

Name: Fairlight (Fl)

Concept: Moderately deep Gradational red structured soils formed on limestone hillslopes

Classification:

Aust: Haplic Eutrophic Red Dermosol

GSG: Terra Rossa

PPF: Gn3.12, Gn3.11

Landform: Undulating rises to rolling hills

Geology: Chillagoe Formation (S-Dh)

Vegetation: *E. cullenii, E.crebra* or *E. persistens* woodlands and open woodlands

Microrelief: None

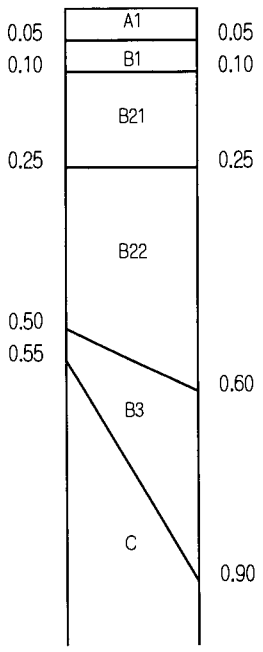
Surface condition: Hardsetting

Surface coarse fragments: Few 60-200 mm angular metamorphic

Land Use Limitations

Climate:	<35°C, <1500 mm (C1)
Moisture Supply:	80 - 100 mm/m (M3)
Fertility:	3-8 ppm P, >4 ppm SO_4 S (N5)
Wetness:	Well drained, highly permeable (W2h)
Flooding frequency:	No flooding (F0)
Rockiness:	2-10%, 60-200 mm (Rc2)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk inflow zone (Si1)

Soil Description:



A1	0 - 0.05	Red-brown (5YR 2/4 or 3/3); Clay loam; Few 60-200 mm angular metamorphic rocks or 6-20 mm angular quartz; Moderate 5-10 mm sub-angular blocky or strong 2-5 mm granular; Dry, firm; Field pH 6.5 to 7.0; Gradual boundary to;
B1	0.05 - 0.10	Red or red-brown (2.5YR 3/4 or 5YR 3/6); Light clay; Moderate 5-10 mm sub-angular blocky or strong 2-5 mm polyhedral; Dry, firm; Field pH 6.5; Gradual boundary to;
B21	0.10 - 0.25	Red (2.5YR 3/4 or 4/6); Light medium clay to medium clay; Strong 2-5 mm polyhedral; Moderately moist, weak; Field pH 6.0 to 6.5; Diffuse boundary to;
B22	0.25 - 0.55	Red (2.5YR 3-4/6 or 10R 3/5); Light medium clay to medium clay; Strong 2-5 mm polyhedral; Moderately moist, weak; Field pH 6.0 to 7.0; Diffuse boundary to;
B3	0.55 - 0.70	Yellow-brown (7.5YR 5/6); Light clay to light medium clay; Massive; Moderately moist, weak; Field pH 6.0 to 7.0; Clear boundary to;
C		Rock

Number of sites: 3

Name: Ford (Fd)

Concept: Moderately deep bleached Gradational grey massive soils formed on footslopes of silicified sandstone hills

Classification:

Aust: Haplic Dystrophic Grey Kandosol

GSG: Grey Earth

PPF: Gn2.81

Landform: Footslopes of gently undulating to rolling rises

Geology: Silicified Bulimba Formation (KTi)

Vegetation: *E. hylandii* or *E. tetrodonta* woodlands

Microrelief: None

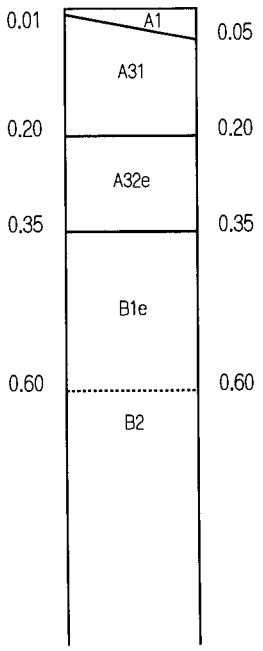
Surface condition: Hardsetting

Surface coarse fragments: Many to very many 6-60 mm sandstone

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, moderately permeable (W4m)
Flooding frequency:	No flooding (F0)
Rockiness:	6-20 mm, 20-50 % (Rm4)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk transmission zone (St1), outflow zone (So1)

Soil Description:



A1	0 - 0.03	Dark or grey (10YR 3/1 or 2.5Y 4/2); Loamy sand to sandy loam; Common to abundant 6-60 mm angular ferruginized or silicified sandstone; Massive? Dry, firm; Field pH 6.0; Clear or abrupt boundary to;
A31	0.05 - 0.20	Grey (10YR 4/1); Light sandy clay loam; Common 6-20 mm angular ferruginized or silicified sandstone; Massive; Field pH 6.3; Clear boundary to;
A32e	0.20 - 0.35	Conspicuously bleached - grey (10YR 5/2); Sandy clay loam; Common 6-20 mm angular ferruginized or silicified sandstone; Massive; Field pH 6.0; Clear boundary to;
B1e	0.35 - 0.60	Conspicuously bleached - yellow-brown (10YR 6/3); Clay loam sandy heavy; Common 6-20 mm angular ferruginized or silicified sandstone; Massive; Field pH 5.8; Gradual boundary to;
B2	0.60 - 0.70	Brown (7.5YR 6/3); Light clay sandy; Common 6-20 mm angular ferruginized or silicified sandstone; Massive; Field pH 5.8.

Limit of augering

Number of sites: 2

Name: Gail (Gl)

Concept: Shallow Gradational yellow massive soils formed on schist, phyllite, quartzite and gneiss

Classification:

Aust: Haplic Mesotrophic Yellow Kandosol

GSG: Yellow Earth

PPF: Gn2.31

Landform: Undulating rises to steep hills

Geology: Coen (Pc) and Sefton (Ps) Metamorphics

Vegetation: *E. hylandii* or *E. tetrodonta* woodlands

Microrelief: None

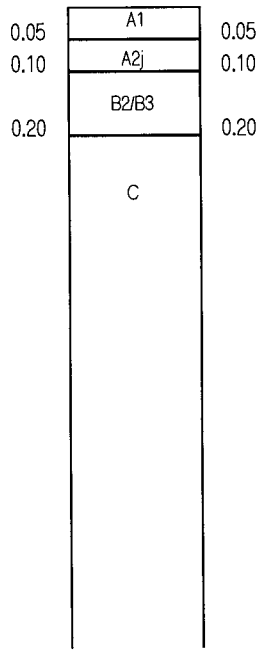
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, moderately permeable (W4m)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	10-32%, stable (E4s)
Landscape complexity:	Isolated unit (Xi)
Salinity:	Low risk inflow zone (Si1)

Soil Description:



A1	0 - 0.05	Dark (10YR 3/1); Sandy loam; Few 2-6 mm angular quartz; Massive; Dry, very firm; Field pH 6.5; Abrupt boundary to;
A2j	0.05 - 0.10	Sporadically bleached - grey (10YR 5/2); Common fine distinct orange mottles; Sandy loam; Few 2-6 mm angular quartz; Massive; Dry, very firm; Field pH 6.5; Clear boundary to;
B2/B3	0.10 - 0.20	Yellow-brown (10YR 6/4); Light sandy clay loam; Few 2-6 mm angular quartz; Massive; Dry, firm; Field pH 6.0; Clear boundary to;
C		Rock

Number of sites: 1

Name: Galloway (Gw)

Concept: Moderately deep Gradational or Uniform red massive soils formed on acid volcanic hillslopes

Classification:

Aust: Bleached Mesotrophic Red Kandosol

GSG: Red Earth

PPF: Gn2.11, Um5.51

Landform: Hillslopes on undulating rises to steep low hills

Geology: Muralug (Cm), Endeavour Strait (Cn), Eborac (Ce) and Goods Island (Cg) Ignimbrite

Vegetation: *E. nesophila* or *E. hylandii* open forests and wooodlands

Microrelief: None

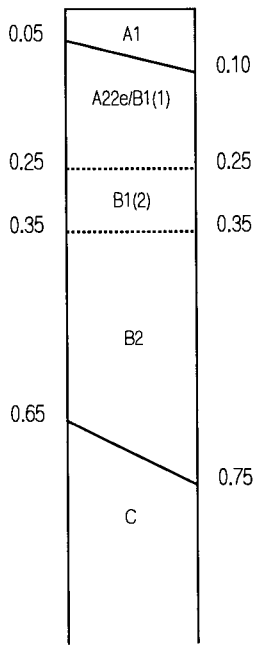
Surface condition: Hardsetting

Surface coarse fragments: Abundant 60-200 mm angular coarse fragments

Land Use Limitations

Climate:	<35°C, <1500 mm (C2)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Rockiness:	60-200 mm, >50% (Rc5)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	10-32%, stable (E4s)
Landscape complexity:	Isolated unit (Xi)
Salinity:	Low risk intake zone (Si1)

Soil Description:



A1	0 - 0.07	Dark or brown (10YR 3/2 or 7.5YR 3/3); Sandy loam to clay loam; Moderate 2-5 mm cast; Common to very many 6-20 mm angular coarse fragments; Dry, weak; Abrupt or gradual boundary to;
A21	0.07 - 0.10	(where present) Grey (10YR 4/2); Sandy loam; Common to very many 6-20 mm angular coarse fragments; Massive; Dry, weak; Abrupt boundary to;
A22e/ B1(1)	0.07 - 0.25	Occasionally conspicuously bleached - yellow-brown or red-brown (7.5YR 6/3 or 5YR 5/3); Sandy loam to clay loam; Common to very many 6-20 mm angular coarse fragments; Massive; Dry, weak to firm; Gradual boundary to;
B1(2)	0.25 - 0.35	Red-brown (5YR 4/4); Sandy loam to clay loam; Common to many 6-20 mm angular coarse fragments; Massive; Dry, weak to firm; Gradual boundary to;
B2	0.35 - 0.70	Red or red-brown (2.5YR 4/8 or 5YR 5/6); Sandy clay loam to light clay; Common to very many 6-20 mm angular coarse fragments; Dry, firm; Clear boundary to;
C		Rock

Number of sites: 2

Name: Gap (Gp)

Concept: Deep Gradational yellow soils formed on colluvia from acid volcanic hills

Classification:

Aust: Mesotrophic Dermosolic Oxyaquic Hydrosol

GSG: Yellow Podzolic Soil

PPF: Gn3.74

Landform: Colluvial fan

Geology: Tertiary and Quaternary colluvial sands (TQs)

Vegetation: Open heaths and dwarf open heaths

Microrelief: None

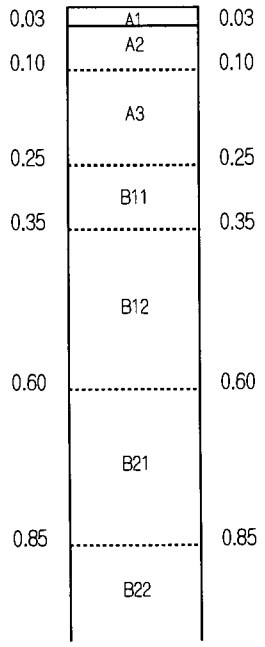
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C2)
Moisture Supply:	80 - 100 mm/m (M3)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, moderately permeable (W4m)
Flooding frequency:	1 in 2-10 years to every year (F2, F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk outflow zone (So1)

Soil Description:



A1 0 - 0.03 Grey (10YR 4/2); Fine sandy loam; Very few 2-6 mm sub-rounded quartz; Massive; Moderately moist, firm; Field pH 6.0; Clear boundary to;

A2 0.03 - 0.10 Grey (10YR 5/2); Fine sandy loam; Very few 2-6 mm sub-rounded quartz; Massive; Moderately moist, firm; Field pH 6.0; Gradual boundary to;

A3 0.10 - 0.25 Yellow-grey (2.5YR 5/3); Light clay loam fine sandy; Few 2-6 mm sub-rounded quartz; Massive; Moderately moist, firm; Field pH 6.5; Gradual boundary to;

B11 0.25 - 0.35 Yellow (2.5Y 6/5); Few fine prominent red mottles; Clay loam; Few 2-6 mm sub-rounded quartz; Massive; Moderately moist, firm; Field pH 6.5; Gradual boundary to;

B12 0.35 - 0.60 Yellow (2.5Y 6/6); Clay loam heavy; Common 2-6 mm sub-rounded quartz; Massive; Moderately moist, firm; Field pH 6.5; Gradual boundary to;

B21 0.60 - 0.85 Yellow (2.5Y 6/6); Light clay; Common 2-6 mm sub-rounded and very few 6-20 mm angular quartz; Moderate 2-5 mm sub-angular blocky; Moderately moist, weak; Field pH 6.5; Gradual boundary to;

B22 0.85 - 1.10 Yellow (2.5Y 6/6); Few fine faint red mottles; Medium clay; Strong 5-10 mm sub-angular blocky; Moderately moist, firm; Field pH 6.0;

Limit of augering

Number of sites: 1

Name: Geike (Gk)

Concept: Deep Gradational mottled grey massive soils formed on colluvia from acid plutonic hillslopes

Classification:

Aust: Mottled Mesotrophic Grey Kandosol

GSG: Grey Earth

PPF: Gn2.84

Landform: Gently undulating plains on colluvial fans

Geology: Tertiary and Quaternary colluvial sands (TQs)

Vegetation: Open heaths and dwarf open heaths

Microrelief: None

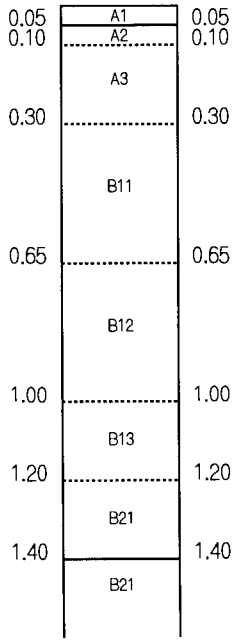
Surface condition: Firm

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, moderately permeable (W4m)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk outflow zone (So1)

Soil Description:



A1	0 - 0.05	Grey (N 3/0 or 10YR 6/1); Sandy loam; Massive; Dry, weak; Field pH 5.0; Clear boundary to;
A2(e)	0.05 - 0.10	Occasionally conspicuously bleached - grey or pale (10YR 5/2 or 7/2); Sandy loam; Massive; Moderately moist, weak; Field pH 6.5; Gradual boundary to;
A3	0.10 - 0.30	Yellow-brown (10YR 6/3); Few fine distinct orange mottles; Light sandy clay loam; Massive; Moderately moist, weak; Field pH 6.5; Gradual boundary to;
B11	0.30 - 0.65	Pale (10YR 7/3); Common fine distinct orange mottles; Light sandy clay loam; Massive; Moderately moist, weak; Field pH 6.0; Diffuse boundary to;
B12	0.65 - 1.00	Pale (10YR 7/3); Many medium distinct orange and common medium prominent pale mottles; Light sandy clay loam; Massive; Moderately moist, weak; Field pH 6.0; Diffuse boundary to;
B13	1.00 - 1.20	Pale (10YR 7/3); Many medium distinct orange and common medium prominent pale mottles; Sandy clay loam; Massive; Moist, firm; Field pH 6.0; Gradual boundary to;
B21	1.20 - 1.40	Pale (10YR 7/2); Common medium prominent orange or brown mottles; Sandy light clay to light clay; Massive; Moist, firm; Field pH 6.0; Clear boundary to;
B22	1.40 - 1.50	Pale (10YR 7/1); Few medium prominent orange and few coarse prominent red mottles; Sandy light clay; Massive; Moist, firm; Field pH 6.0;

Limit of augering

Number of sites: 2

Name: George (Go)

Concept: Moderately deep Uniform saline mottled clays formed in recent estuarine deposits

Classification:

Aust: Haplic Supratidal Hydrosol

GSG: Solonchak

PPF: No provision

Landform: Supra-tidal and inter-tidal flats

Geology: Quaternary coastal alluvium (Qac)

Vegetation: Bare, occasionally mangroves or halophytes

Microrelief: None

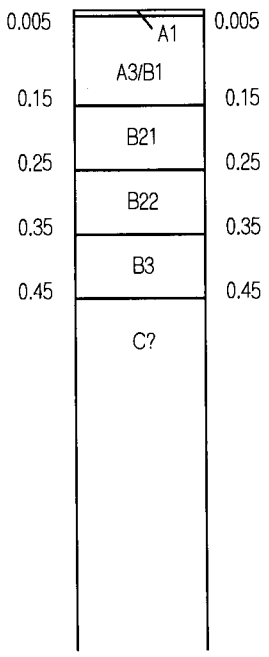
Surface condition: Soft, cracking

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1), <35°C, <1500 mm (C2), >35°C, <1500 mm (C3)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Very poorly drained, very slowly permeable (W6v)
Flooding frequency:	Every year (F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Strongly adhesive soils, narrow moisture range, moderately hardsetting (P7)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	0-1%, very unstable (E1v)
Landscape complexity:	Isolated unit (Xi)
Salinity:	Naturally saline (Ss)

Soil Description:



A1	0 - 0.005	Yellow-brown (10YR 5/4); Light medium clay; Massive? Moist, weak; Field pH 9.0; Sharp boundary to;
A3/B1	0.005 - 0.15	Grey (10YR 4/2); Light medium clay; Strong 2-5 mm polyhedral? Moist, weak; Field pH 8.0; Clear boundary to;
B21	0.15 - 0.25	Brown (10YR 4/4); Medium heavy clay; Strong 2-5 mm polyhedral? Moist, firm; Field pH 6.0; Clear boundary to;
B22	0.25 - 0.35	Brown (7.5YR 4/6); Medium clay; Strong 2-5 mm polyhedral? Moist, firm; Field pH 6.0; Abrupt boundary to;
B3	0.35 - 0.45	Yellow (2.5Y 7/6); Many fine prominent grey mottles; Medium clay; Weak 2-5 mm lenticular; Moist, firm; Field pH 5.0; Abrupt boundary to;
C?	0.45 - 0.60	Grey (10YR 5/1); Clay; Wet; Field pH 7.0.

Limit of augering

Number of sites: 1

Name: Gibson (Gs)

Concept: Deep Duplex sodic yellow or grey soils on colluvia and pediments from greywacke and slate

Classification:

Aust: Eutrophic Mottled-Subnatric Yellow Sodosol; Sodic Sodosolic Redoxic Hydrosol

GSG: Solodic Soil/Soloth

PPF: Dy3.43, Dy3.41, Dy3.42

Landform: Footslopes of rises and and hillslopes

Geology: Pleistocene? and recent colluvia (Czx)

Vegetation: *E. chlorophylla, E. microtheca* or *E. acroleuca* woodlands and open woodlands

Microrelief: None

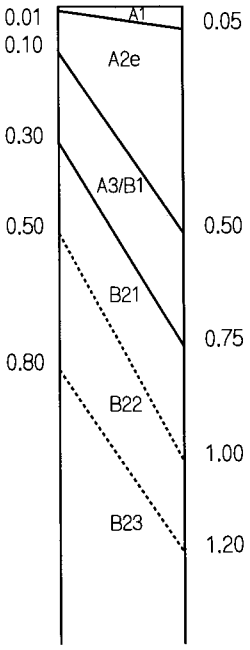
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C1), <35°C, >1500 mm (C2)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	8-20 ppm P, >4 ppm SO_4 S (N3)
Wetness:	Poorly drained, slowly permeable (W5s)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, unstable (E3u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	High risk outflow zone (So3)

Soil Description:



A1 0 - 0.03 Dark, grey or grey-brown (7.5YR 3-4/2 or 10YR 4-5/2 or 2.5Y 4/1-2); Loamy sand to loam; Massive; Dry, weak to firm; Field pH 6.0 to 7.0; Abrupt or clear boundary to;

A2e 0.03 - 0.25 Conspicuously bleached - grey or yellow-brown or yellow-grey (10YR 5/2-4 or 6/3 or 2.5Y 6/2-4); Loamy sand to sandy loam; Few to common 2-20 mm sub-angular quartz; Massive; Dry, weak to very firm; Field pH 5.5 to 6.5; Abrupt or gradual boundary to;

A3/B1 0.25 - 0.50 Grey or yellow-grey or yellow-brown or pale (2.5Y 5/2-3 or 10YR 6-7/4); Few to common fine distinct yellow to orange mottles; Sandy clay loam to sandy light clay; Massive to strong angular blocky; Few to many 2-5mm manganiferous nodules occasionally present; Field pH 6.0; Clear or gradual boundary to;

B21 0.50 - 0.80 Grey or yellow-brown or yellow-grey or yellow (10YR 6/2-5 or 2.5Y 5/1 or 5/4); Few to many fine distinct yellow, orange or red mottles; Sandy light medium clay to medium heavy clay; Strong 2-20 mm sub-angular blocky to prismatic; Moderately moist, firm to very strong; Field pH 5.0 to 8.0; Gradual or diffuse boundary to;

B22 0.80 - 1.00 Yellow-brown or grey (10YR 6/3-5 or 5Y 5/2); Few to many fine distinct yellow, orange or red mottles; Sandy medium clay to medium clay; Strong 2-5 mm angular blocky to 5-10 mm prismatic; Moderately moist, strong; Field pH 8.0 to 10.0; Diffuse boundary to;

B23 1.00 - 1.20 Yellow-grey or pale or grey (2.5Y 6/4 or 7/2 or 5Y 6/1); Few to many fine faint to distinct yellow, orange or red mottles; Light medium clay silty to medium clay; Strong 2-5 mm angular blocky to 10-20 mm prismatic; Moderately moist, strong; Many 2-6 mm calcareous nodules occasionally present; Field pH 9.0 to 10.0

Limit of augering

Number of sites: 10

Name: Ginger (Gg)

Concept: Deep bleached Uniform sands on lower slopes and drainage depressions on residual sands

Classification:

Aust: Dystrophic Orthic Redoxic Hydrosol, Basic Regolithic Bleached-Orthic Tenosol

GSG: Siliceous Sand/(Grey) Earthy sand

PPF: Uc2.23, Uc2.22

Landform: Drainage depressions and footslopes in gently undulating plains to undulating rises

Geology: Quaternary interfluvial sand (Qs), Tertiary and Quaternary colluvial sand (TQs)

Vegetation: *E. tetrodonta* woodlands

Microrelief: None

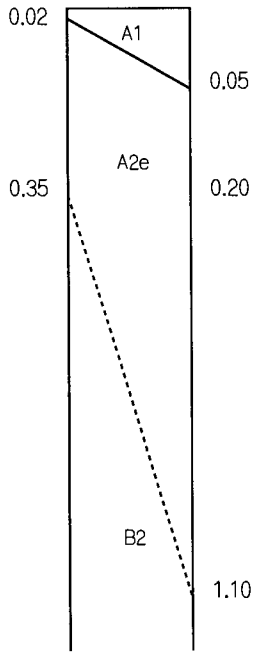
Surface condition: Loose or soft

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Poorly drained, highly permeable (W5h)
Flooding frequency:	Less than 1 in 10 years to every year (F1-F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	0-1%, unstable (E1u)
Landscape complexity:	Unit size < 20 ha (X1)
Salinity:	Low risk outflow zone (So1), inflow zone (Si1)

Soil Description:



A1 0 - 0.05 Dark or grey or grey-brown (10YR 3-5/1 or 7.5YR 4/1-2); Sand to loamy sand; Single grain to massive; Dry, very weak to weak; Field pH 5.0 to 6.5; Abrupt or clear boundary to;

A2e 0.05 - 0.60 Conspicuously bleached - grey or grey-brown or pale (10YR 6/1 or 7/2 or 7.5YR 5-8/2); Sand to loamy sand; Single grain to massive; Dry to moderately moist, very weak to weak; Field pH 5.0 to 6.5; Gradual or diffuse boundary to;

A3/B1 0.60 - 0.80 (occasionally present) Grey or pale (10YR 5/2 or 7/2-3); Common to many distinct yellow to orange mottles; Sand; Single grain to massive; Moderately moist to wet, very weak to weak; Clear or gradual boundary to;

B2 0.60 - 1.30 Pale or pale-yellow or yellow-brown (10YR 7/2-4 or 6/3); Common to many fine medium distinct to prominent yellow mottles; Sand; Single grain to massive; Moderately moist to moist, very weak to weak; Field pH 5.5 to 6.0;

Limit of augering

Phases: Rocky phase (GgRp): Common 2-60 mm sub-angular or angular quartz throughout. **Number of sites:** 2

Number of sites: 21

Name: Greenant (Ga)

Concept: Deep Duplex sodic acid to alkaline yellow soils formed on alluvial plains

Classification:

Aust: Mesotrophic Mottled-Subnatric Yellow, Grey or Brown Sodosol; Bleached-Manganic Sodosolic Redoxic Hydrosol

GSG: Solodic Soil/Soloth

PPF: Dy3.41, Dy3.42, Dy3.43, Dg2.41, Db2.41

Landform: Alluvial plains/fans

Geology: Quaternary alluvia (Qa) and Pleistocene? colluvia (Czx)

Vegetation: *E. chlorophylla, E. microtheca* or *E. acroleuca* woodlands and open woodlands

Microrelief: None

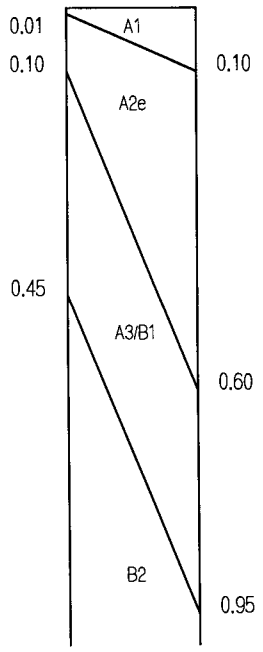
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C1)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	3-8 ppm P, >4 ppm SO_4 S (N5)
Wetness:	Poorly drained, slowly permeable (W5s)
Flooding frequency:	1 in 2-10 years (F2)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	1-3%, very unstable (E2v)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Medium risk outflow zone (So2)

Soil Description:



A1 0 - 0.05 Dark or grey or grey-brown (10YR 3-5/2 or 7.5YR 4/2); Few fine faint brown or orange mottles occasionally present; Loamy sand to fine sandy clay loam; Massive; Dry, firm to strong; Field pH 6.0 to 7.0; Abrupt or gradual boundary to;

A2e 0.05 - 0.40 Conspicuously bleached - grey or yellow-brown or brown or pale (10YR 5-6/2-4 or 7.5YR 5-7/3); Loamy sand to fine sandy clay loam; Massive; Dry, firm to strong; Field pH 5.5 to 6.5; Clear or gradual boundary to;

A3/B1 0.40 - 0.85 Yellow-brown or yellow or pale (10YR 5/3-5 or 6/4-6 or 7/1-3); Few to common fine distinct orange or red mottles; Sandy clay loam to medium clay; Massive to moderate 2-5 mm sub-angular blocky; Dry, firm to strong; Field pH 5.5 to 6.0; Clear or gradual boundary to;

B2 0.85 - 1.20 Brown or yellow-brown or yellow or yellow-grey or pale (10YR 4-6/4 or 10YR 6/5 or 2.5Y 4/2 or 8/1); Few to many fine distinct yellow, orange or red mottles; Light clay to medium heavy clay; Moderate to strong 2-50 mm angular or sub-angular blocky, or prismatic; Dry to moderately moist, very firm to very strong; Field pH 5.5 to 9.0;

Limit of augering

Number of sites: 14

Name: Grevil (Gv)

Concept: Deep Uniform bleached sand over coffee rock formed on drainage depressions and footslopes on northern sandstone

Classification:

Aust: Parapanic or Fragic Humic Aquic or Semiaquic Podosol

GSG: Podzol/(Rudimentary) Podzol

PPF: Uc2.34, Uc2.32, Uc2.33, Uc2.21

Landform: Drainage depressions and footslopes on gently undulating plains to undulating rises

Geology: Tertiary and Quaternary sands (TQs), Quaternary alluvia (Qa), Helby Beds (Jkb)

Vegetation: Open heath and dwarf open heath

Microrelief: None

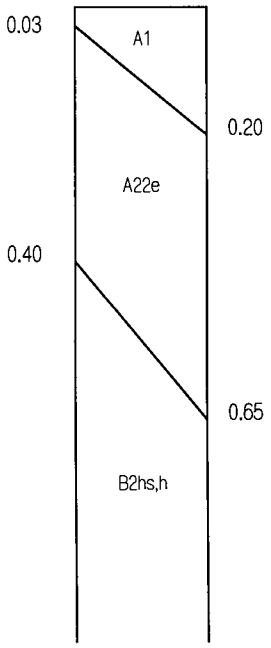
Surface condition: Loose to soft

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C2)
Moisture Supply:	< 40 - 80 mm/m (M4, M5)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly to very poorly drained, highly permeable (W4h, W5h, W6h)
Flooding frequency:	1 in 2-10 years to every year (F2, F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	0-1%, unstable (E1u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Non-saline (Sn)

Soil Description:



A1	0 - 0.08	Grey (7.5YR or 10YR 3-5/1); Sand to loamy sand; Single grain to massive; Dry to moist, loose to weak; Field pH 4.5 to 6.0; Clear or diffuse boundary to;
A2e	0.08 - 0.45	Conspicuously bleached- grey or pale (10YR 5-6/1-2 or 7/2 or 7.5YR 6-8/2); Sand to loamy sand; Single grain to massive; Dry to moderately moist, loose to weak; Field pH 4.5 to 6.0; Clear or diffuse boundary to;
B2hs,h	0.45 - 1.00	Brown or dark or yellow-brown or grey-brown (10YR 3/2-3 or 4/3 or 5/2-4; or 7.5YR 3/2 or 4/2-3 or 5/4); Sand to loamy sand; Single grain to massive; Dry to wet, very weak or dry to moderately moist, very firm; Field pH 5.0 to 6.5.

Limit of augering

Variants: Coarse sandy phase (GvCp): Coarse sandy throughout. **Number of sites:** 3

Number of sites: 24

Name: Hann (Hn)

Concept: Deep bleached Duplex soils on footslopes and drainage depressions in residual sands

Classification:

Aust: Sodic Sodosolic Redoxic Hydrosol; Bleached-Ferric Chromosolic Redoxic Hydrosol

GSG: Soloth/Gleyed Podzolic

PPF: Dg4.41, Dy5.41, Dg3.41

Landform: Footslopes on gently undulating plains or undulating rises

Geology: Tertiary and Quaternary colluvial sands (TQs)

Vegetation: *M. viridiflora* low open woodlands and woodlands

Microrelief: None

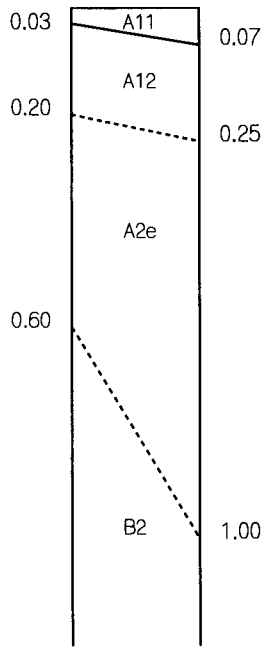
Surface condition: Firm to hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	>35°C, <1500 mm (C3), <35°C, >1500 mm (C1)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Poorly drained, slowly permeable (W5s)
Flooding frequency:	1 in 2-10 years (F2)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	1-3%, unstable (E2u)
Landscape complexity:	Unit size < 20 ha (X1)
Salinity:	Low risk outflow zone (So1)

Soil Description:



A11	0 - 0.04	Dark or grey (7.5YR 3/1 or 10YR 3/1-2 or 4/1); Sand to loamy sand; Single grain to massive; Dry to moderately moist, very weak to weak; Field pH 5.0 to 6.0; Clear boundary to;
A12	0.04 - 0.25	Grey or grey-brown (10YR 4/1 or 7.5YR 4-5/1); Sand to loamy sand; Massive; Dry, very weak to weak; Field pH 6.0; Gradual boundary to;
A2e	0.25 - 0.80	Conspicuously bleached - grey-brown or pale (7.5YR 6/1-2 or 7/3 or 10YR 6-7/1 or 7/2); Sand; Single grain to massive; Moderately moist to moist, very weak to weak; Field pH 6.0; Gradual boundary to;
B2	0.80 - 1.15	Pale or grey or yellow-brown (10YR or 7.5YR 7/1 or 10YR 6/1-3); Common to many fine prominent yellow to red mottles; Light clay to medium clay; Moderate < 2 to 10 mm lenticular or sub-angular; Moist, firm to very firm; Few to common manganiferous or ferruginous 2-6 mm nodules occasionally present; Field pH 5.0 to 6.0.

Limit of augering

Number of sites: 15

Name: Harmer (Hm)

Concept: Deep Gradational bleached yellow massive soils formed on sandstones

Classification:

Aust: Bleached or Bleached-Mottled Dystrophic Yellow Kandosol

GSG: Yellow Earth

PPF: Gn2.74, Gn2.75, Gn2.34, Gn2.35

Landform: Gently undulating plains to undulating rises

Geology: Gilbert River Formation (JKg), Helby Beds (JKb), Bulimba Formation (KTi)

Vegetation: *E. tetrodonta* woodlands, open heaths and dwarf open heaths

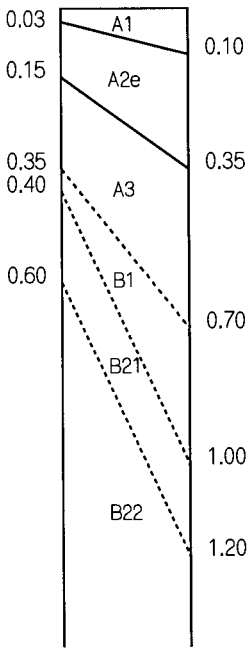
Microrelief: None

Surface condition: Firm

Surface coarse fragments: None

Land Use Limitations	
Climate:	<35°C, <1500 mm (C2), <35°C, >1500 mm (C1)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Moderately well drained, moderately permeable to highly permeable (W3m, W3h)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)

Soil Description:



A1 0 - 0.05 Dark or grey (10YR 3-5/1); Loamy sand to (fine) sandy loam; Single grain or massive; Dry, weak to firm; Field pH 6.0 to 7.0; Abrupt or clear boundary to;

A2e 0.05 - 0.25 Conspicuously bleached - yellow-brown or yellow-grey or pale (10YR 5-6/3-4 or 2.5Y 6-7/4); Loamy sand to sandy loam; Massive; Dry, weak to firm; Field pH 6.0 to 6.5; Clear or gradual boundary to;

A3 0.25 - 0.45 Yellow-brown or yellow or pale (10YR 6/4 or 6/6 or 2.5Y 7/4 or 7.5YR 5/5); Loamy sand to sandy loam; Massive; Dry, weak to firm; Field pH 6.0 to 6.5; Gradual or diffuse boundary to;

B1 0.45 - 0.55 Yellow or pale-yellow (10YR 6-7/5-6 or 2.5Y 6/6); Sandy loam to sandy clay loam; Massive; Dry, weak to firm; Field pH 5.5 to 6.5; Diffuse boundary to;

B21 0.55 - 0.90 Yellow or pale-yellow (10YR 5-7/6-8 or 7.5YR 7/7-8); Few to common fine faint to distinct orange mottles occasionally present; Light sandy clay loam to clay loam; Massive; Dry to moderately moist, weak to firm; Field pH 5.5 to 6.5; Diffuse boundary to;

B22 0.90 - 1.50 Yellow or pale-yellow (10YR 6-7/6-8 or 7.5YR 5-7/8); Few to many fine faint to distinct yellow, orange or red mottles; Light sandy clay loam to clay loam; Massive; Moderately moist, weak to firm; Field pH 6.0 to 6.5;

Limit of augering

Number of sites: 22

Name: Haven (Hv)

Concept: Moderately deep Gradational yellow or brown massive soils with ferruginous nodules, formed on schist, phyllite, quartzite and gneiss

Classification:

Aust: Ferric Mesotrophic Brown or Yellow Kandosol

GSG: Yellow Earth

PPF: Gn2.45, Gn2.74, Gn2.95

Landform: Undulating rises

Geology: Holroyd Metamorphics (Ph, Phq), Dargalong Metamorphics (Pd)

Vegetation: *E.tetrodonta* or *E. hylandii* woodlands

Microrelief: None

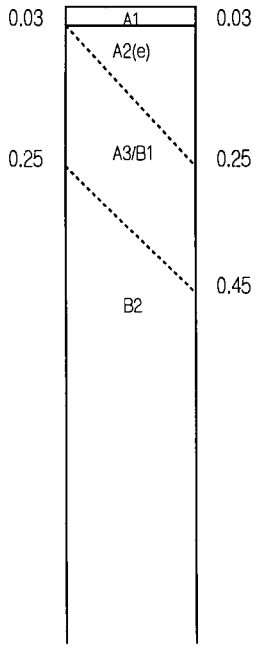
Surface condition: Hardsetting

Surface coarse fragments: Few to common 2-6 mm ferruginous nodules

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, moderately permeable (W4m)
Flooding frequency:	No flooding (F0)
Rockiness:	2-6 mm, 20-50% (Rf4)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk inflow zone (Si1)

Soil Description:



A1 0 - 0.03 Dark or grey (10YR 3-4/2); Sandy loam to fine sandy loam; Massive; Dry, firm; Common to many < 2 -6 mm ferruginous nodules; Field pH 7.0; Clear or abrupt boundary to;

A2(e) 0.03 - 0.20 Occasionally conspicuously bleached - brown or yellow-brown or yellow-grey (10YR 4/3 or 5/4 or 2.5Y 6/3); Loamy sand to fine sandy loam; Massive; Dry, firm; Common to many 2-6 mm ferruginous nodules; Field pH 7.0; Gradual boundary to;

A3/B1 0.20 - 0.35 Yellow-brown or yellow or yellow-grey (7.5YR 5/5 or 10YR 5/5-6 or 2.5Y 6/5); Common fine distinct red mottles occasionally present; Light sandy clay loam to fine sandy clay loam; Massive; Dry, weak; Many to very many 2-6 mm ferruginous nodules; Field pH 7.0; Gradual boundary to;

B2 0.35 - 0.60 Brown or yellow-brown or yellow or yellow-grey (7.5YR 4/5 or 10YR 6/6 or 5/4 or 2.5Y 6/5); Many fine distinct or prominent mottles occasionally present; Sandy clay loam to clay loam sandy; Massive; Moderately moist, weak; Many 2-6 mm ferruginous nodules; Field pH 5.5 to 7.0;

Limit of augering

Number of sites: 6

Name: Henderson (Hs)

Concept: Moderately deep Duplex non-sodic red soils formed on adamellite and granite

Classification:

Aust: Haplic or Bleached-Mottled Mesotrophic Red Chromosol

GSG: Red Podzolic Soil

PPF: Dr2.22, Dr3.41, Dr4.22, Dr2.12, Dr4.11

Landform: Hillslopes on undulating rises

Geology: Kintore (SDk) and Morris (SDm) Adamellite; Trevethan Granite (Pgv)

Vegetation: Closed forest, minor *E. tetrodonta* woodlands

Microrelief: None

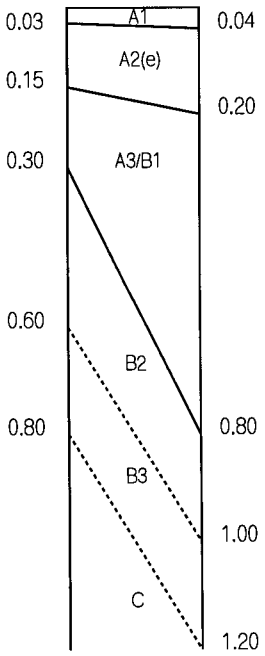
Surface condition: Firm to hardsetting

Surface coarse fragments: Common to many 2-20 mm sub-angular to sub-rounded quartz or granite

Land Use Limitations

Climate:	<35°C, <1500 mm (C2), <35°C, >1500 mm (C1)
Moisture Supply:	80 - 100 mm/m (M3)
Fertility:	3-8 ppm P, <4 ppm SO_4 S (N6)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Rockiness:	6-20 mm, 10-20 % (Rm3)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth no problem, existing vegetation a problem (Vc1e2)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Unit size < 20 ha (X1)
Salinity:	Low risk inflow zone (Si1)

Soil Description:



A1	0 - 0.03	Dark or grey (7.5YR or 10YR 3-4/1-2) Coarse sand to sandy loam; Few to common 2-60 mm angular to sub-angular quartz coarse fragments; Massive; Dry weak to firm; Field pH 6.0 to 7.0; Abrupt boundary to;
A2(e)	0.03 - 0.15	Occasionally conspicuously bleached - brown or yellow-brown or red-brown (10YR 3-6/3 or 5YR 4/4); Coarse sand to sandy loam; Very few to abundant 2-60 mm angular to sub-angular quartz coarse fragments; Massive; Dry, weak to firm; Field pH 6.5 to 7.0; Clear boundary to;
A3/B1	0.15 - 0.50	Red-brown or brown (5YR 3-4/4 or 5YR 4/3-7 or 7.5YR 4/3-4); Coarse sand to coarse sandy light clay; Very few to many 2-20 mm angular to sub-angular quartz coarse fragments; Massive to weak 2-5 mm angular blocky; Moderately moist, weak to firm; Field pH 7.0; Clear or gradual boundary to;
B2	0.50 - 0.80	Red or red-brown (2.5YR 3-4/6 or 5YR 4/4); Light clay sandy to medium clay; Few to many 2-20 mm angular to sub-angular quartz coarse fragments; Moderate < 2-5 mm angular to sub-angular blocky; Moderately moist, firm to very firm; Field pH 6.0 to 7.0; Gradual boundary to;
B3	0.80 - 1.00	Yellow-brown or brown or grey (7.5YR 5/6 or 10YR 4/2-3); Common fine faint red mottles may be present; Clay loam to light medium clay; Many to abundant 2-6 mm angular quartz coarse fragments; Weak to strong 2-5 mm sub-angular to angular blocky; Moderately moist, firm to strong; Field pH 6.0 to 6.5; Diffuse to;
C		Rock

Number of sites: 10

Name: Hesket (Hk)

Concept: Deep bleached Gradational mottled grey soils occurring in drainage depressions and swamps

Classification:

Aust: Bleached-Ferric or Bleached Dermosolic Redoxic Hydrosol

GSG: Gleyed Podzolic

PPF: Gn3.04

Landform: Drainage depressions and swamps on level to gently undulating plains

Geology: Rolling Downs Group (Klr), Bulimba Formation (KTi), Tertiary and Quaternary aluminous laterite (T&Qa)

Vegetation: *M. viridiflora* open forests and low open forests

Microrelief: Debil debil occasionally present

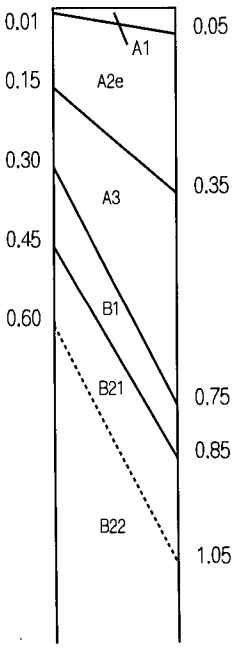
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	>35°C, <1500 mm (C3), <35°C, <1500 mm (C1)
Moisture Supply:	80 - 100 mm/m (M3)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Poorly drained, moderately permeable (W5s)
Flooding frequency:	Every year (F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, hardsetting (including large aggregates) (P2)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	0-1%, unstable (E1u)
Landscape complexity:	Unit size < 20 ha (X1)
Salinity:	Non-saline (Sn)

Soil Description:



A1 0 - 0.03 Dark or grey (10YR 3-5/2); Loamy fine sand to fine sandy clay loam; Massive; Dry, firm to very firm; Common 2-6 mm ferruginous nodules occasionally present; Field pH 6.0; Sharp or abrupt boundary to;

A2e 0.03 - 0.25 Conspicuously bleached - grey or yellow-brown (10YR 6/2-4); Few to common faint yellow mottles occasionally present; Loamy fine sand to fine sandy clay loam; Massive; Dry, firm to very firm; Very many 2-6 mm ferruginous nodules occasionally present; Field pH 5.5 to 6.0; Clear or gradual boundary to;

A3 0.25 - 0.40 Grey or yellow-brown (10YR 6/2-4); Few to common fine faint yellow to orange mottles; Light fine sandy clay loam to clay loam fine sandy; Massive; Dry, firm to very firm; Very many 2-6 mm ferruginous nodules occasionally present; Field pH 6.0; Clear or gradual boundary to;

B1 0.40 - 0.55 Grey or pale (10YR 6/2 or 7/2); Common to many fine faint to distinct yellow to red mottles; Fine sandy light clay to light clay; Weak to moderate 2-5 mm sub-angular to angular blocky; Moderately moist, firm to very firm; Very many 2-6 mm ferruginous nodules occasionally present; Field pH 5.5 to 6.0; Clear or diffuse boundary to;

B21 0.55 - 0.80 Grey or pale or yellow-brown (10YR 6-7/2-3); Many distinct fine to medium yellow to red mottles; Light clay to light medium clay; Moderate 2-5 mm sub-angular blocky to polyhedral; Moderately moist, firm to very firm; Few to very many 2-6 mm ferruginous nodules; Field pH 5.5-6.0; Diffuse boundary to;

B22 0.80 - 1.00 Grey or pale or yellow-brown (10YR 6-7/2-3); Common to many prominent fine red mottles; Light clay to light medium clay; Strong <2-5 mm polyhedral; Moderately moist, weak to firm; Many to very many 2-6 mm ferruginous nodules occasionally present; Field pH 5.0 to 5.5.

Limit of augering

Number of sites: 8

Name: Hodge (Hg)

Concept: Very shallow to shallow bleached Uniform or Gradational brown soils formed on greywacke and slate

Classification:

Aust: Haplic Paralithic Bleached-Leptic Tenosol; Bleached Dystrophic Brown Kandosol

GSG: Lithosol

PPF: Uc2.12, Um2.12, Gn2.81

Landform: Undulating rises to steep hills

Geology: Hodgkinson Formation (D-Ch), Chillagoe Formation (S-Dh), Little River Coal Measures (Pur)

Vegetation: *E. cullenii, E.crebra* or *E. persistens* woodlands and open woodlands

Microrelief: None

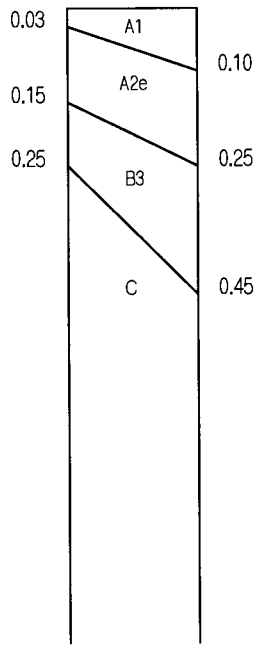
Surface condition: Hardsetting, occasionally soft

Land Use Limitations

Climate:	<35°C, <1500 mm (C1)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, highly permeable (W2h)
Flooding frequency:	No flooding (F0)
Rockiness:	20-60 mm, 20-50% (Rg4)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	10-32%, unstable (E4u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Moderate risk intake zone (Si2)

Surface coarse fragments: Very many 6-200 mm angular greywacke, slate or quartz

Soil Description:



A1	0 - 0.05	Dark or grey (7.5YR 3-4/2); Sand to loam; Many 6-20 mm to very many 20-60 mm angular metamorphic; Massive; Dry, weak to firm; Field pH 5.5 to 6.5; Sharp or clear boundary to;
A2e	0.05 - 0.20	Brown (7.5YR 5/3-4); Sand to sandy clay loam; Many 6-20 mm to very many 20-60 mm angular metamorphic; Massive; Dry, weak to firm; Field pH 5.5 to 6.5; Clear or diffuse boundary to;
B3	0.20 - 0.30	(frequently present) Brown (7.5YR 6/4); Sandy loam to clay loam sandy; Many 6-20 mm to very many 20-60 mm angular metamorphic; Massive; Dry, weak to firm; Field pH 5.5; Clear or gradual boundary to;
C	Rock	

Number of sites: 4

Name: Isabella (Ib)

Concept: Deep Gradational red massive soils derived from sandstone, and a basaltic influence

Classification:

Aust: Haplic Mesotrophic Red Kandosol

GSG: Red Earth

PPF: Gn2.11, Gn2.14

Landform: Gentle rises to rolling low hills

Geology: Quaternary sands on Battlecamp Formation (Klc) and Dalrymple sandstone (Jl)

Vegetation: *E. hylandii* or *E. tetrodonta* woodlands, closed forests

Microrelief: None

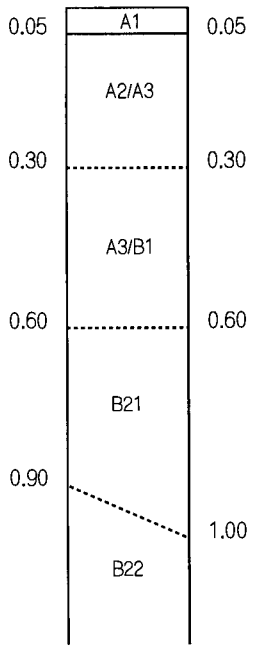
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C2)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	3-8 ppm P, <4 ppm SO_4 S (N6)
Wetness:	Well drained, highly permeable (W2h)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation a problem (Vc1e2)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)

Soil Description:



A1	0 - 0.05	Dark or red (2.5YR 2/2 or 2/4); Loamy sand to sandy loam; Massive; Moderately moist, very weak to weak; Field pH 6.0; Abrupt or clear boundary to;
A2/A3	0.05 - 0.30	Red (2.5YR 2/4 or 3/5); Loamy sand to light sandy clay loam; Massive; Moderately moist, very weak to weak; Field pH 6.0; Gradual or diffuse boundary to;
A3/B1	0.30 - 0.60	Red (7.5R 3/3 or 10R 3/6); Sandy loam to sandy clay loam; Massive; Moderately moist, very weak to weak; Field pH 6.0; Diffuse boundary to;
B21	0.60 - 0.95	Red (7.5R 3/6); Sandy clay loam; Massive; Moderately moist, weak; Field pH 6.0; Diffuse boundary to;
B22	0.95 - 1.20	Red (7.5R 3/6); Clay loam sandy; Massive; Moderately moist, weak to firm; Field pH 6.0

Limit of augering

Number of sites: 2

Name: Jardine (Jd)

Concept: Deep bleached Uniform yellow massive sands formed on sandstone

Classification:

Aust: Basic Regolithic Bleached-Orthic Tenosol

GSG: (Yellow) Earthy Sand

PPF: Uc2.23

Landform: Level plains to undulating rises

Geology: Quaternary alluvia (Qpa)

Vegetation: Open heaths and dwarf open heaths

Microrelief: None

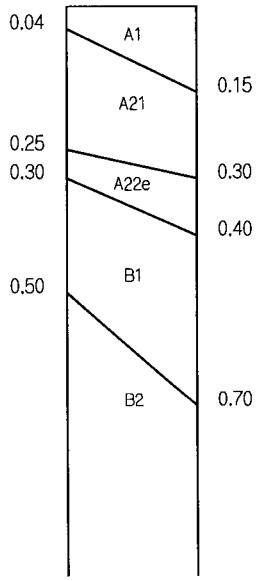
Surface condition: Soft

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C2)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, highly permeable (W4h)
Flooding frequency:	Less than 1 in 10 years (F1)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	3-10%, unstable (E3u)
Landscape complexity:	Unit size > 20 ha (X0), Isolated unit (Xi)
Salinity:	Low risk intake zone (Si1)

Soil Description:



A1 0 - 0.05 Grey (10YR 4/1 or 5/2); Loamy sand; Single grain; Dry, very weak; Field pH 5.5 to 6.5; Abrupt boundary to;

A21 0.05 - 0.25 Grey (10YR 5/1 or 6/2); Loamy sand; Single grain to massive; Moderately moist, very weak; Field pH 5.5 to 6.5; Abrupt or gradual boundary to;

A22e 0.25 - 0.35 Conspicuously bleached - grey or occasionally yellow (10YR 6/1-2 or 6/5); Loamy sand; Massive; Moderately moist, very weak; Field pH 6.0 to 6.5; Clear or diffuse boundary to;

B1 0.35 - 0.70 Yellow-brown or pale-yellow or yellow (10YR 6-7/4 or 5/6 or 2.5Y 7/5); Loamy sand; Massive; Moderately moist, very weak to weak; Field pH 6.0 to 7.0; Abrupt or diffuse boundary to;

B2 0.70 - 1.30 Pale or pale-yellow or yellow (2.5Y 7/4-6 or 10YR 6/5); Few to common fine faint yellow mottles; Loamy sand; Massive; Moderately moist, very weak; Field pH 6.0;

Limit of augering

Number of sites: 10

Name: Jeannie (Jn)

Concept: Moderately deep Gradational or Uniform yellow soils formed on greywacke and slate

Classification:

Aust: Mottled or Bleached-Mottled Mesotrophic Yellow Dermosol Haplic Mesotrophic Brown Kandosol;

GSG: Yellow Earth/Yellow Podzolic Soil

PPF: Gn3.71, Gn3.74, Gn3.84, Um4.23, Uf6.51

Landform: Undulating rises to steep hills

Geology: Hodgkinson Formation (D-Ch)

Vegetation: *E. cullenii, E.crebra, E. persistens*, or *E. hylandii* woodlands and open woodlands

Microrelief: None

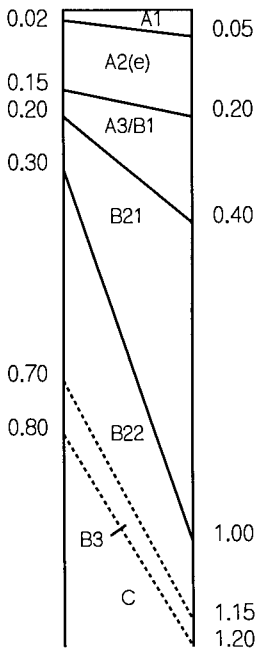
Surface condition: Hardsetting

Surface coarse fragments: Common to many 6-20 mm greywacke, slate or quartz

Land Use Limitations

Climate:	<35°C, >1500 mm (C2), <35°C, <1500 mm (C1)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, moderately permeable (W4m)
Flooding frequency:	No flooding (F0)
Rockiness:	6-20 mm, 20-50 % (Rm4)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	10-32%, stable (E4s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Moderate risk inflow zone (Si2), Transmission zone (St2)

Soil Description:



A1	0 - 0.03	Dark or grey-brown or brown (10YR 3/2 or 7.5YR 3/2 or 4/2-3); Sandy loam to light clay; Few to many 2-20 mm sub-angular to angular platy metamorphic coarse fragments; Massive; Dry, firm to very firm; Field pH 5.5 to 6.5; Clear or abrupt boundary to;
A2(e)	0.03 - 0.15	Occasionally conspicuously bleached - yellow-brown or brown (10YR or 7.5YR 5/3); Sandy loam to light clay; Common to many 2-60 mm sub-angular to angular platy metamorphic coarse fragments; Massive; Dry, firm to very fine; Field pH 5.5 to 6.0; Clear or gradual boundary to;
A3/B1	0.15 - 0.30	Yellow-brown, brown or grey (10YR 4-5/3 or 10YR 5-6/4 or 2.5Y 5/2); Few fine distinct red mottles occasionally present; Sandy loam to light medium clay. Few to many 2-60 mm sub-angular to angular platy metamorphic coarse fragments; Massive to moderate 2-5 mm sub-angular blocky to polyhedral; Dry, firm to very firm; Field pH 5.5 to 6.0; Clear boundary to;
B21	0.30 - 0.50	Yellow-brown or yellow (7.5YR or 10YR 5-6/5-6); Few to common fine distinct red mottles; Clay loam heavy to light medium clay; Massive to strong 2-5 mm angular blocky to polyhedral; Few to many 2-60 mm sub-angular to angular platy metamorphic coarse fragments; Dry, weak to firm; Field pH 5.5 to 6.0; Clear or gradual boundary to;
B22	0.50 - 0.70	Yellow (10YR 5/6 or 6/5); Common fine distinct red mottles; Light medium clay to medium clay; Massive to strong 2-5 mm angular blocky to polyhedral; Many 2-6 mm angular metamorphic coarse fragments; Dry to moderately moist, weak to firm; Field pH 5.0 to 6.0; Diffuse boundary to;
B3	0.70 - 90	Red-brown or yellow (5YR 5-6/6 or 10YR 5/6); Light clay to silty light medium clay; Many 2-6 mm angular platy metamorphic coarse fragments; Massive; Dry, firm; Field pH 6.0; Diffuse boundary to;
C		Rock

Number of sites: 14

Name: Kennedy (Kd)

Concept: Very deep Uniform or occasionally Gradational massive surfaced or cracking grey clays formed on alluvial plains

Classification:

Aust: Sodic or Vertic Dermosolic Oxyaquic Hydrosol; Mottled or Epihypersodic or Endohypersodic or Sodic-Acidic Massive Grey or Aquic Vertosol

GSG: Grey Clay/No suitable group

PPF: Uf6.33, Uf6.51, Ug5.24, Gn3.91, Gn3.92

Landform: Drainage depressions to plains on alluvial plains

Geology: Quaternary alluvia (Qa)

Vegetation: *E. chlorophylla, E. microtheca* or *E. acroleuca* woodlands and open woodlands

Microrelief: Normal gilgai occasionally present; vertical interval 0.30 m; horizontal interval 4-8 m

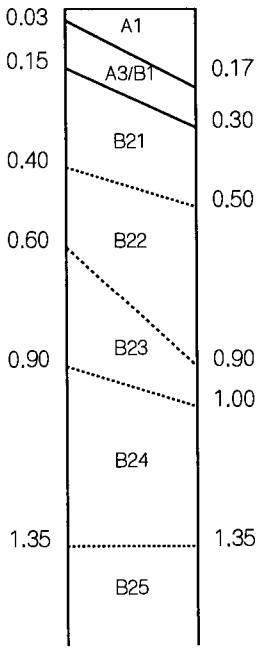
Surface condition: Hardsetting, frequently cracking

Surface coarse fragments: None

Land Use Limitations

Climate:	>35°C, <1500 mm (C3), <35°C, <1500 mm (C1)
Moisture Supply:	80 - 100 mm/m (M3)
Fertility:	3-8 ppm P, <4 ppm SO_4 S (N6)
Wetness:	Poorly drained, very slowly permeable (W5v)
Flooding frequency:	Every year (F3)
Rockiness:	No rock (R0)
Topography:	Microrelief vertical interval 0.1 - 0.3 m (T2)
Soil physical condition:	Strongly adhesive soils, narrow moisture range, hardsetting (including large aggregates) (P8)
Vegetation factor:	Regrowth control no problem, existingvegetation no problem (Vc1e1)
Erodibility:	0-1%, very unstable (E1v)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk outflow zone (So1)

Soil Description:



A1 0 - 0.10 Grey or yellow-brown (10YR 4/1-2 or 5/1-3); Few to many fine distinct orange mottles; Silty clay loam to light medium clay; Massive; Dry, firm to strong; Field pH 6.0 to 6.5; Abrupt or gradual boundary to;

A3/B1 0.10 - 0.20 Grey or brown (10YR 4/1-3 or 5/2); Few to many fine distinct orange to brown mottles; Silty light medium clay to medium clay; Massive to moderate 2-5 mm sub-angular to angular blocky; Dry to moderately moist, firm to very firm; Field pH 6.0 to 6.5; Clear or gradual boundary to;

B21 0.20 - 0.45 Grey or olive-brown or brown or dark (10YR or 2.5Y 4/2-3 or 10YR 3/2-3); Few to common fine distinct orange mottles; Silty medium clay to medium clay; Moderate to strong 2-5 mm angular to sub-angular blocky; Moderately moist, firm to very firm; Field pH 6.0 to 7.0; Gradual boundary to;

B22 0.45 - 0.85 Grey or olive-brown or brown (10YR or 2.5Y 4/2-3); Few to common fine distinct orange mottles; Medium clay silty to medium heavy clay; Strong 2-5 mm angular blocky to lenticular; Moderately moist, firm to very firm; Very few to few 2-6 mm manganiferous nodules occasionally present; Field pH 4.5 to 7.0; Gradual or diffuse boundary to;

B23 0.85 - 1.00 Grey (10YR, 2.5Y or 5Y 4/1); Common fine distinct orange or brown mottles; Medium clay silty to medium heavy clay; Moderate 5-10 mm angular blocky to 2-5 mm lenticular; Moderately moist, very firm; Very few to few 2-6 mm manganiferous nodules; Field pH 7.0 to 10.0; Gradual boundary to;

B24 1.00 - 1.35 Grey (2.5Y 4/2); Heavy clay; Strong 5-10 mm lenticular; Moderately moist, very firm; Few 2-6 mm manganiferous nodules; Field pH 10.0; Gradual boundary to;

B25 1.35 - 1.50 Grey (10YR 4/2); Few fine distinct yellow mottles; Medium heavy clay; Strong 2-5 mm lenticular; Moderately moist, very firm; Field pH 10.0;

Limit of augering

Number of sites: 16

Name: Kimba (Kb)

Concept: Very deep Gradational red massive soils formed on residual sands

Classification:

Aust: Haplic Mesotrophic or Eutrophic Red Kandosol

GSG: Red Earth

PPF: Gn2.14, Gn2.15

Landform: Gently undulating plains to undulating rises

Geology: Tertiary and Quaternary colluvial sands (TQs)

Vegetation: *E. tetrodonta* woodlands and tall woodlands

Microrelief: None

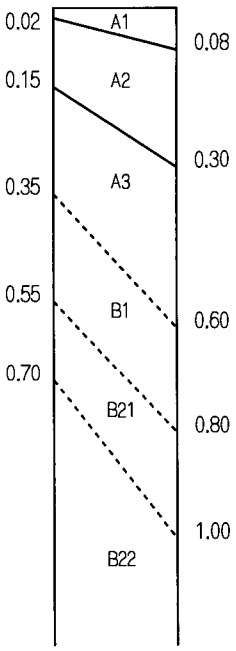
Surface condition: Loose to firm, occasionally hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1), <35°C, <1500 mm (C2), >35°C, <1500 mm (C3)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	3-8 ppm P, <4 ppm SO_4 S (N6)
Wetness:	Well drained, highly permeable (W2h)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)

Soil Description:



A1	0 - 0.05	Dark or grey or grey-brown or brown or red-brown (10YR 3-4/1-2 or 7.5YR or 5YR 3-4/2-4); Loamy sand to sandy loam; Single grain to massive; Dry, very weak to firm; Field pH 5.5 to 7.0; Abrupt or clear boundary to;
A2	0.05 - 0.20	Grey or brown or red-brown (10YR 4-5/2 or 7.5YR or 5YR 4/3-4); Loamy sand to sandy loam; Single grain to massive; Dry, very weak to weak; Field pH 5.5 to 7.0; Clear or gradual boundary to;
A3	0.20 - 0.45	Brown or red-brown or red (7.5YR 3-4/3-4 or 5YR 4/3-6 or 2.5YR 3-4/4-6); Loamy sand to light sandy clay loam; Massive; Dry to moderately moist, weak to firm; Field pH 5.5 to 7.0; Gradual or diffuse boundary to;
B1	0.45 - 0.70	Red-brown or red (5YR 4/4-6 or 2.5YR 3/3-6 or 4/6); Sandy loam to sandy clay loam; Massive; Dry to moderately moist, weak to firm; Field pH 6.0 to 7.0; Gradual or diffuse boundary to;
B21	0.70 - 0.90	Red (2.5YR 3/4-6 or 10R 3/4 or 4/6); Light sandy clay loam to clay loam sandy; Few 2-6 mm angular to sub-angular quartz occasionally present; Massive; Dry to moderately moist, weak to very firm; Field pH 6.0 to 7.0; Diffuse boundary to;
B22	0.70 - 1.50	Red (2.5YR 3/6 or 4/8 or 10R 3-4/6); Sandy clay loam to clay loam sandy; Massive; Moderately moist, weak to very firm; Field pH 6.0 to 7.0.

Limit of augering

Phase: Rocky phase (KbRp): Few to many sub-rounded quartz throughout. **Number of sites:** 1

Number of sites: 41

Name: Kingjack (Kj)

Concept: Moderately deep Gradational non-sodic yellow soils on colluvia and pediments from greywacke and slate

Classification:

Aust: Bleached-Mottled Mesotrophic Brown Dermosol

GSG: Yellow Podzolic Soil

PPF: Gn3.84, Gn3.04, Gn3.05, Dy5.41

Landform: Gently undulating plains, to undulating rises

Geology: Pleistocene? and recent colluvia (Czx)

Vegetation: *E. leptophleba, E. platyphylla* or *E. erythrophloia* woodlands

Microrelief: None

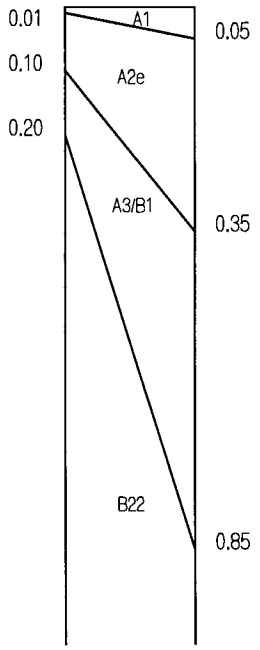
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C2)
Moisture Supply:	80 - 100 mm/m (M3)
Fertility:	8-20 ppm P, >4 ppm SO_4 S (N3)
Wetness:	Imperfectly drained, slowly permeable (W4s)
Flooding frequency:	Less than 1 in 10 years (F1)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	1-3%, unstable (E2u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Moderate risk outflow zone (So2)

Soil Description:



A1 0 - 0.03 Dark or grey (10YR 3-5/1-2); Few fine distinct orange mottles occasionally present; Fine sandy loam to silty clay loam; Massive; Dry, weak to very firm; Field pH 6.0 to 7.0; Abrupt or clear boundary to;

A2e 0.03 - 0.15 Conspicuously bleached - grey or yellow-brown (10YR 4/2 or 5-6/2-3); Few fine faint to distinct orange mottles occasionally present; Fine sandy loam to silty clay loam; Massive; Dry, firm to very firm; Field pH 5.5 to 6.5; Abrupt or clear boundary to;

A3/B1 0.15 - 0.40 Yellow-brown or yellow-grey or yellow (10YR 5/4 or 6/6 or 2.5Y 5/3 or 6/6); Few to common fine faint to distinct yellow to red mottles; Fine sandy clay loam to light clay; Weak to moderate 2-5 mm sub-angular blocky; Dry, firm to very firm; Field pH 5.5 to 6.5; Clear or gradual boundary to;

B2 0.40 - 1.00 Yellow or yellow-grey (10YR 5-6/6-8 or 2.5Y 5-6/4); Few to many fine distinct to prominent brown, yellow, orange, red or grey mottles; Fine sandy light clay to medium clay; Many to abundant angular to sub-rounded quartz to metamorphic coarse fragments occasionally present; Moderate to strong 2-10 mm angular to sub-angular blocky; Dry to moderately moist, firm to strong; Few to many < 2-20 mm ferruginous nodules occasionally present; Field pH 5.5 to 7.0.

Limit of augering

Number of sites: 15

Name: Kool (Kl)

Concept: Deep Uniform red massive soils formed on residual sands

Classification:

Aust: Haplic Eutrophic Red Kandosol

GSG: Red Earth

PPF: Um5.52, Um4.21, Gn2.12, Um4.23

Landform: Gently undulating plains, gently undulating to undulating rises

Geology: Tertiary and Quaternary colluvial sands (TQs), Bulimba Formation (KTi), Gilbert River Formation (JKg), Garraway Beds (Jw)

Vegetation: *E. tetrodonta* woodlands and tall woodlands

Microrelief: None

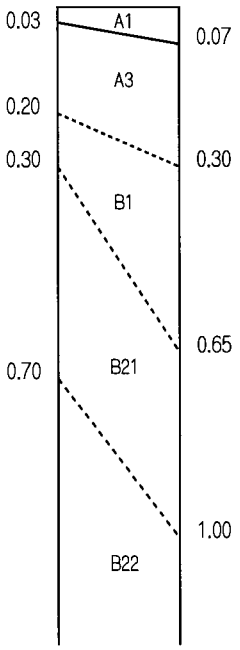
Surface condition: Hardsetting, occasionally soft

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	80 - 100 mm/m (M3)
Fertility:	3-8 ppm P, <4 ppm SO_4 S (N6)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)

Soil Description:



A1 0 - 0.05 Dark (5YR or 7.5YR or 10YR 3/1-2); Sandy clay loam to clay loam; Massive; Dry to moderately moist, weak to firm; Field pH 6.0 to 7.0; Clear or gradual boundary to;

A2 0.05 - 0.20 ; (occasionally present) Grey or yellow-brown (10YR 4/1 or 7.5YR 5/3-4); Light sandy clay loam to clay loam; Massive; Dry, firm; Field pH 6.0 to 6.5; Gradual boundary to;

A3 0.05 - 0.35 Dark or red-brown or red (5YR 3/2-4 or 5/4-5 or 2.5YR 3/5); Sandy clay loam to clay loam; Massive; Dry to moderately moist, weak to firm; Field pH 6.0 to 7.0; Gradual or diffuse boundary to;

B1 0.35 - 0.45 Red (10R or 2.5YR 3/3 or 2.5YR 4/4-6); Clay loam; Massive; Moderately moist, weak to firm; Field pH 6.0 to 7.0; Gradual or diffuse boundary to;

B21 0.45 - 0.75 Red or red-brown (2.5YR 3/4 or 4/6 or 5YR 3/6); Clay loam to light clay; Massive; Moderately moist, weak to firm; Field pH 6.0 to 7.0; Gradual or diffuse boundary to;

B22 0.75 - 1.20 Red (10R or 2.5YR 4/6); Clay loam to light clay; Massive; Moderately moist, weak to firm; Field pH 6.0 to 7.0;

Limit of augering

Number of sites: 12

Name: Lamond (Lm)

Concept: Deep Gradational brown structured soils derived from schist, phyllite, quartzite and gneiss

Classification:

Aust: Mottled or Haplic Mesotrophic Yellow or Brown Dermosol

GSG: Xanthozem

PPF: Gn3.71

Landform: Undulating rises to rolling low hills

Geology: Sefton metamorphics (Ps)

Vegetation: Closed forests

Microrelief: None

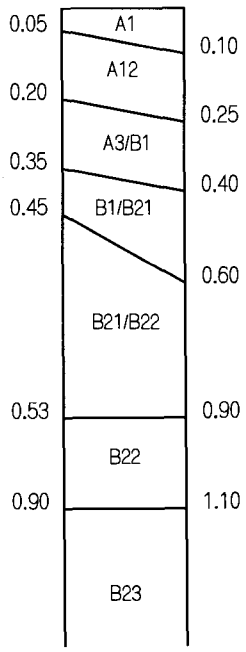
Surface condition: Firm

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C2)
Moisture Supply:	100 - 140 mm/m (M2)
Fertility:	3-8 ppm P, >4 ppm SO_4 S (N5)
Wetness:	Imperfectly drained, moderately permeable (W3m)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation a problem (Vc1e2)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk inflow zone (Si1)

Soil Description:



A11 0 - 0.07 Dark or grey-brown (10YR 3/2 or 7.5YR 4/2); Fine sandy clay loam to clay loam; Strong 2-5 mm cast; Moderately moist, weak; Field pH 5.5 to 6.0; Gradual boundary to;

A12 0.07 - 0.25 Grey or brown (10YR 4/2 or 7.5YR 4/4); Fine sandy clay loam to clay loam; Common 2-6 mm angular quartz occasionally present; Strong < 2 mm polyhedral or moderate 2-5 mm cast; Moderately moist, weak; Field pH 5.5; Gradual or diffuse boundary to;

A3/B1 0.25 - 0.38 Yellow-brown or red-brown (10YR 5/4 or 7.5YR or 5YR 4/6); Few medium distinct red mottles occasionally present; Clay loam fine sandy to clay loam; Few 20-60 mm sub-angular or common 6-20 mm angular quartz; Strong < 2 mm polyhedral; Moderately moist, weak; Field pH 5.5 to 6.0; Gradual or diffuse boundary to;

B1/B21 0.37 - 0.53 Yellow or red-brown (10YR 5/5 or 7.5YR or 5YR 4/6); Common fine faint or few medium distinct red mottles; Light clay; Common 20-60 mm sub-angular quartz occasionally present; Strong 2-5 mm polyhedral; Moderately moist, weak; Field pH 5.5 to 6.0; Diffuse boundary to;

B21/B22 0.53 - 0.90 Yellow or yellow-brown (10YR or 7.5YR 5/6); Common fine faint or prominent red mottles; Light clay to light medium clay; Common 20-60 mm angular quartz occasionally present; Strong 2-5 mm polyhedral; Moderately moist, weak to firm; Few 2-6 mm ferro-manganiferous nodules occasionally present; Field pH 5.5 to 6.0; Diffuse boundary to;

B22/B23 0.90 - 1.10 Yellow-brown (7.5YR 6/6); Common medium faint red mottles; Light medium clay; Strong 2-5 mm polyhedral; Moderately moist, firm; Few 2-6 mm ferro-manganiferous nodules; Field pH 6.0; Diffuse boundary to;

B23/B24 1.10 - 1.50 Yellow-brown (7.5YR 6/6); Few medium faint red mottles; Light clay; Strong 2-5 mm polyhedral; Moderately moist, firm; Few 2-6 mm ferro-manganiferous nodules; Field pH 6.0;

Limit of augering

Number of sites: 3

Name: Lions (Ln)

Concept: Deep Gradational grey massive or structured soils on terraces under rainforest

Classification:

Aust: Haplic Mesotrophic Brown Dermosol; Mesotrophic Kandosolic Oxyaquic Hydrosol

GSG: Yellow Earth/Grey Earth

PPF: Gn2.82, Gn2.84, Um6.32

Landform: Terraces

Geology: Quaternary alluvia (Qa)

Vegetation: Gallery closed forests and *Melaleuca* spp. open forests

Microrelief: None

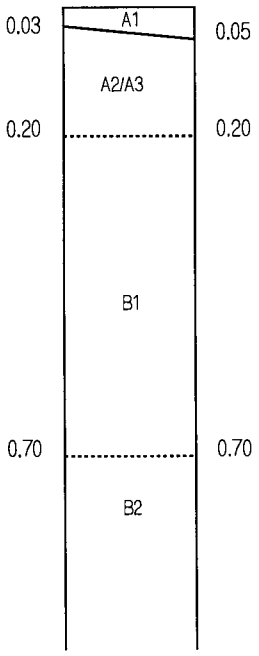
Surface condition: Soft

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1), <35°C, <1500 mm (C2)
Moisture Supply:	80 - 100 mm/m (M3)
Fertility:	3-8 ppm P, <4 ppm SO_4 S (N6)
Wetness:	Moderately well drained, moderately permeable (W3m)
Flooding frequency:	Every year (F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	0-1%, stable (E1s)
Landscape complexity:	Isolated unit (Xi)
Salinity:	Non-saline (Sn)

Soil Description:



A1 0 - 0.04 Dark (7.5YR 3/2 or 10YR 3/1); Silty loam to clay loam; Massive or moderate 2-5 mm cast; Dry, very firm or moderately moist, weak; Field pH 7.0 to 8.0; Clear or gradual boundary to;

A2/A3 0.04 - 0.20 Dark or grey or brown (10YR 3-4/2 or 7.5YR 4/3); Light fine sandy clay loam to silty clay loam; Massive; Dry, very firm or moderately moist, weak; Field pH 6.0 to 7.0; Gradual boundary to;

B1 0.20 - 0.70 Brown or yellow-brown (7.5YR 3/3 or 5/4 or 10YR 5/3); Sandy clay loam or silty clay loam heavy; Massive; Dry, very firm or moderately moist, weak; Field pH 6.0 to 6.5; Gradual boundary to;

B2 0.75 - 1.00 Grey or yellow-brown or brown (10YR 4/2 or 5/3 or 6/4 or 7.5YR 4/6); Sandy clay loam or silty clay loam; Massive or moderate 2-5 mm sub-angular blocky; Dry, firm or moderately moist, weak; Field pH 6.0 to 6.5.

Limit of augering

Number of sites: 4

Name: Livis (Lv)

Concept: Deep Uniform coarse sands in prior streams on fans derived from acid plutonic rocks

Classification:

Aust: Basic Regolithic Orthic or Bleached-Orthic Tenosol; Fragic Humic Semiaquic Podosol

GSG: (Grey) Earthy Sand/Podzol

PPF: Uc2.21, Uc4.21

Landform: Levees and prior streams on alluvial fans or plains

Geology: Quaternary alluvia (Qa), Lilyvale Beds (Tmpv)

Vegetation: *Melaleuca* spp. open forests, gallery closed forests

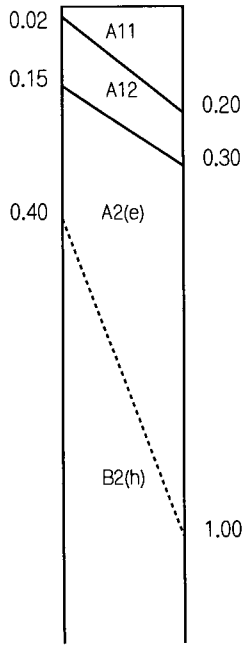
Microrelief: None

Surface condition: Hardsetting or soft

Surface coarse fragments: Common 2-6 mm sub-angular quartz occasionally present

Land Use Limitations	
Climate:	<35°C, >1500 mm (C1), <35°C, <1500 mm (C2)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, highly permeable (W4h)
Flooding frequency:	Every year (F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	0-1%, unstable (E1u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Non-saline (Sn)

Soil Description:



A11 0 - 0.04 Dark (10YR 3/1); Loamy coarse sand to coarse sandy loam; Very few to common 2-6 mm sub-angular quartz; Single grain to massive; Dry, very weak to weak; Field pH 6.0; Abrupt boundary to;

A12 0.04 - 0.25 Grey (10YR 4/1-2); Loamy coarse sand; Few to common 2-6 mm sub-angular quartz occasionally present; Single grain to massive; Moderately moist, weak; Field pH 5.5 to 6.5; Clear boundary to;

A2(e) 0.25 - 0.60 Occasionally conspicuously bleached - yellow-grey or grey or yellow-brown (2.5Y 4-5/1 or 10YR 4-5/2 or 6/3); Coarse sand to loamy coarse sand; Few to many 2-6 mm sub-angular quartz occasionally present; Single grain to massive; Moderately moist, very weak to weak; Field pH 5.5 to 6.0; Gradual or diffuse boundary to;

B2(h) 0.60 - 1.20 Brown or yellow-brown (10YR 4/3 or 5/4 or 7.5YR 6/3); Coarse sand; Few to common 2-6 mm sub-angular quartz; Single grain to massive; Moderately moist, very weak to weak; Field pH 7.0;

Limit of augering

Number of sites: 5

Name: Lukin (Lk)

Concept: Deep Duplex non-sodic red soils formed on schist, phyllite, quartzite and gneiss

Classification:

Aust: Haplic Mesotrophic Red Chromosol

GSG: Red Podzolic Soil

PPF: Dr2.21

Landform: Undulating rises

Geology: Coen metamorphics (Pc)

Vegetation: *E. tetrodonta* woodlands and tall woodlands

Microrelief: None

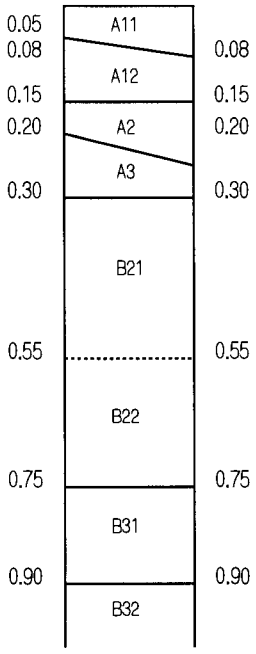
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, >4 ppm SO, S (N7)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Unit size < 20 ha (X1)
Salinity:	Low risk inflow zone (Si1)

Soil Description:



A11	0 - 0.06	Dark or grey (10YR 2/1 or 5/1); Sandy loam; Very few 2-6 mm sub-rounded quartz; Moderate 2-5 mm granular; Dry, firm; Field pH 7.0; Clear boundary to;
A12	0.05 - 0.15	Dark (10YR 3/2); Sandy loam; Few 2-6 mm sub-rounded quartz; Massive; Dry, firm; Field pH 7.0; Clear boundary to;
A2	0.15 - 0.20	Brown (10YR 4/3 or 7.5YR 6/4); Loamy sand; Few 2-6 mm sub-rounded quartz; Massive; Moderately moist, firm; Field pH 7.0; Clear boundary to;
A3	0.20 - 0.27	Brown (7.5YR 4/4); Loamy sand; Common 2-6 mm sub-rounded quartz; Massive; Moderately moist, firm; Field pH 6.0; Clear boundary to;
B21	0.30 - 0.55	Red (2.5YR 4/5-6); Light clay to medium clay; Very few 2-6 mm angular quartz; Moderate < 2 mm polyhedral; Moderately moist, firm; Field pH 6.0; Gradual boundary to;
B22	0.55 - 0.75	Red (2.5YR 4/6); Medium heavy clay; Very few 2-6 mm angular quartz; Moderate < 2 mm polyhedral; Moist, firm; Field pH 6.0; Clear boundary to;
B31	0.75 - 0.90	Brown (7.5YR 5/4); Common fine distinct red mottles; Medium heavy clay; Very few 2-6 mm angular quartz; Moderate 2-5 mm sub-angular; Moist, firm; Field pH 6.0; Clear boundary to;
B32	0.90 - 1.00	Grey (10YR 6/2); Common medium prominent red mottles; Medium heavy clay; Very few 2-6 mm angular quartz; Moderate 2-5 mm angular blocky; Moist, firm; Field pH 6.0;

Limit of augering

Number of sites: 2

Name: Lydia (Ld)

Concept: Deep bleached Gradational or Duplex mottled grey soils overlying siltstone or mudstone

Classification:

Aust: Bleached-Ferric or Bleached-Manganic Dermosolic Redoxic Hydrosol; Bleached-Acidic or Bleached-Mottled Mesotrophic Grey Dermosol

GSG: Gleyed Podzolic

PPF: Gn3.04, Dg2.41

Landform: Level plains to gentle rises

Geology: Rolling Downs (Klr), Leached clay and silt (Czc)

Vegetation: *E. clarksoniana, E. novoguinensis* or *E. polycarpa* woodlands and open woodlands

Microrelief: None

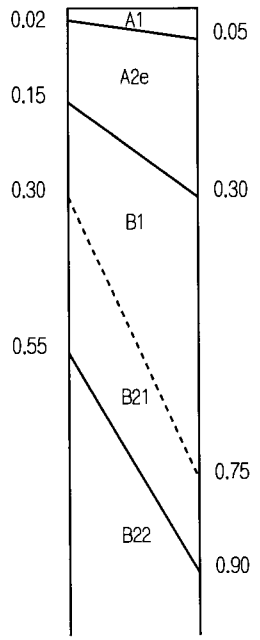
Surface condition: Hardsetting

Surface coarse fragments: Many 2-6 mm sub-rounded ferruginous nodules occasionally present

Soil Description:

Land Use Limitations

Climate:	<35°C, >1500 mm (C2), <35°C, <1500 mm (C1)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Poorly to imperfectly drained, moderately permeable (W5m, W4m)
Flooding frequency:	No flooding (F0), occasionally less than 1 in 10 years (F1)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, hardsetting (including large aggregates) (P2)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0), Unit size < 20 ha (X1)
Salinity:	High risk outflow zone (So3), transmission zone (St3)



A1 0 - 0.03 Dark or grey (10YR 3-5/1-2); Few fine distinct orange mottles occasionally present; Loamy fine sand to silty clay loam; Massive; Dry, firm to very firm; Field pH 5.5 to 6.0; Abrupt boundary to;

A2e 0.04 - 0.20 Conspicuously bleached - grey or yellow-brown (10YR 5-6/2-3); Few fine distinct orange mottles occasionally present; Loamy fine sand to silty clay loam; Massive; Dry, firm to very firm; Few to common 2-6 mm ferruginous or manganiferous nodules occasionally present; Field pH 5.0 to 6.0; Clear or gradual boundary to;

B1 0.20 - 0.50 Grey or yellow-brown (10YR 6/2-4); Common to many fine faint yellow to red mottles; Fine sandy clay loam to fine sandy light clay; Massive to weak 2-5 mm sub-angular blocky; Dry, firm; Field pH 5.5 to 6.0; Diffuse boundary to;

B21 0.50 - 0.75 Grey or pale or yellow-brown (10YR 6-7/2-3); Many distinct fine orange or red mottles; Light clay; Moderate 2-5 mm polyhedral to angular blocky; Common to many 2-6 mm ferruginous nodules occasionally present; Dry, firm; Field pH 5.0 to 5.5; Clear or diffuse boundary to;

B22 0.75 - 1.00 Grey or pale (10YR 5-7/1-2); Few to many distinct fine yellow to red mottles; Light clay to medium clay; Strong 2-5 mm polyhedral; Dry to moderately moist, weak to firm; Very few to common 2-6 mm manganiferous, ferro-manganiferous or ferruginous nodules; Field pH 5.0 to 6.0.

Limit of augering

Phases: Rocky phase (LdRp): Many 6-20 mm sub-rounded platy ferruginized siltstone throughout. **Number of sites:** 1

Number of sites: 19

Name: Mapoon (Mp)

Concept: Deep Duplex or Gradational soils with a dark loamy surface over a mottled grey clay formed in swamps

Classification:

Aust: Humose or Melanic Orthic Redoxic Hydrosol; Sodic Sodosolic Redoxic Hydrosol; Mesotrophic Kandosolic Redoxic Hydrosol; Magnesic Kurosolic Redoxic Hydrosol....

GSG: Humic Gley

PPF: Dg4.11, Dg4.81, Gn3.92, Gn3.04

Landform: Swamps on level plains to undulating rises

Geology: Tertiary and Quaternary aluminous laterite (T&Qa), Bulimba Formation (KTi), Quaternary alluvia (Qa)

Vegetation: *Melaleuca* spp. open forests and low open forests

Microrelief: None

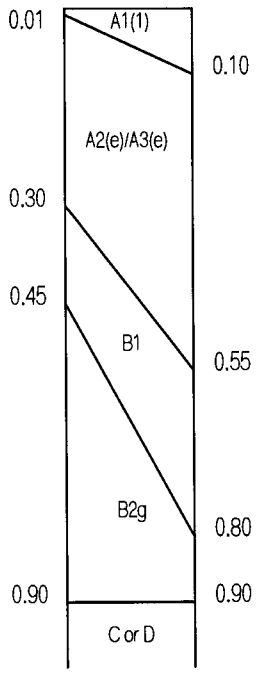
Surface condition: Soft

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C1), <35°C, >1500 mm (C2)
Moisture Supply:	100 - 140 mm/m (M2)
Fertility:	3-8 ppm P, <4 ppm SO_4 S (N6)
Wetness:	Very poorly drained, slowly permeable (W6s)
Flooding frequency:	Every year (F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	0-1%, stable (E1s)
Landscape complexity:	Unit size < 20 ha (X1), Unit size > 20 ha (X0)
Salinity:	Non-saline (Sn)

Soil Description:



A1(1)	0 - 0.03	Black or dark or grey (N 2/0 or 10YR 2-4/1); Fine sandy loam to silty clay loam (occasionally fibric); Massive to moderate 2-5 mm granular; Dry to moist, weak to firm; Field pH 4.5 to 6.5; Abrupt or gradual boundary to;
A12	0.03-0.15	(occasionally present) Black or dark (N 3/0 or 10YR 3/1); Fine sandy loam to clay loam; Massive to moderate 2-5 mm granular; Dry to moist, weak to firm; Field pH 4.5 to 6.5; Abrupt or clear boundary to;
A2(e)/ A3(e)	0.03-0.40	Occasionally conspicuously bleached - grey (2.5Y 5/1 or 10YR 5-6/1); Sandy clay loam to light clay fine sandy; Massive; Dry to moderately moist, weak to firm; Field pH 4.5 to 6.0; Clear boundary to;
B1	0.40-0.65	Grey (10YR 5-6/1); Few to many prominent yellow to orange mottles; Silty light medium clay to medium clay; Moderate 2-5mm sub-angular to angular blocky; Moderately moist to moist, firm to very firm; Field pH 4.5 to 5.5; Clear or gradual boundary to;
B2g	0.65-0.90	Grey or pale (N 4-5/0 or 10YR 5-7/1); Common to many fine to medium prominent yellow to orange mottles; Sandy light clay to medium heavy clay; Massive to strong 2-5 mm sub-angular blocky; Moderately moist to moist, weak to very firm; Field pH 4.5 to 6.0; Abrupt or gradual boundary to;
C or D	0.90 +	Grey mottled massive or structured coarse sand to sandy medium heavy clay.

Number of sites: 7

Name: Marina (Mn)

Concept: Very deep Uniform frequently cracking saline grey clays formed on marine plains

Classification:

Aust: Sodic-Acidic, Sodic or Salic Pedal or Massive Grey or Aquic Vertosol

GSG: Grey Clay

PPF: Ug5.24, Ug5.5, Ug5.29, Uf6.41, Uf6.42

Landform: Level to gently undulating plains on beach ridge or chenier plains

Geology: Quaternary coastal alluvium (Qac)

Vegetation: Tussock grasslands

Microrelief: Normal gilgai; vertical interval 0.2-0.3 m; horizontal interval 8-10 m

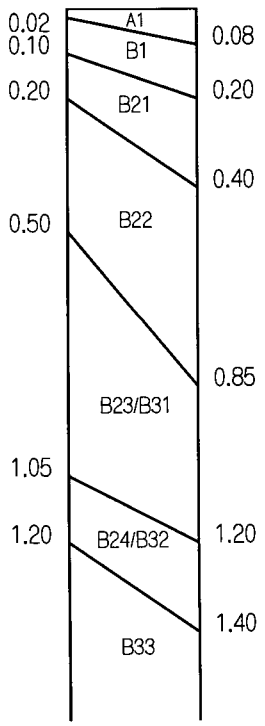
Surface condition: Hardsetting, and frequently cracking

Surface coarse fragments: None

Land Use Limitations

Climate:	>35°C, <1500 mm (C3), <35°C, >1500 mm (C1), <35°C, <1500 mm (C2)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	<3 ppm P, >4 ppm SO_4 S (N7)
Wetness:	Very poorly drained, very slowly permeable (W6v)
Flooding frequency:	Every year (F3)
Rockiness:	No rock (R0)
Topography:	Microrelief vertical interval 0.1 - 0.3 m (T2)
Soil physical condition:	Strongly adhesive soils, narrow moisture range, hardsetting (including large aggregates) (P8)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	1-3%, unstable (E2u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Naturally saline (Ss)

Soil Description:



A1	0 - 0.04	Dark or grey (10YR 3-4/1 or 2.5Y 4/1); Few to many fine distinct to prominent orange mottles; Light clay to light medium clay; Moderate 2-5 mm sub-angular blocky, occasionally massive; Dry, firm to strong; Field pH 4.0 to 6.0; Sharp or clear boundary to;
B1	0.04 - 0.15	Dark or grey (10YR 3-4/1 or 5/2); Common fine distinct orange or red mottles; Light clay to light medium clay; Moderate to strong 2-5 mm sub-angular or angular blocky; Dry to moderately moist, very firm to very strong; Field pH 5.0 to 6.0; Clear or gradual boundary to;
B21	0.15 - 0.30	Grey (10YR 4/1-2 or 5/1 or 2.5Y 3/1); Common to many fine to medium distinct to prominent orange or red mottles; Medium clay to medium heavy clay; Strong 2-10 mm sub-angular or angular blocky; Dry to moderately moist, very firm to strong; Field pH 5.0 to 6.0; Clear or diffuse boundary to;
B22	0.30 - 0.70	Grey (10YR 4-5/1-2 or 2.5Y 4/1-2); Few to many fine to medium distinct to prominent red mottles; Medium heavy clay to heavy clay; Moderate to strong 2-5 mm sub-angular blocky, angular blocky or lenticular; Moderately moist, very strong to moist, firm; Few 2-6 mm manganiferous nodules occasionally present; Field pH 5.0 to 8.5; Clear or gradual boundary to;
B23/ B31	0.70 - 1.10	Grey or yellow (10YR 5/1 or 6/6); Common fine prominent yellow mottles; Medium heavy clay; Strong 2-5 mm lenticular or angular blocky; Moderately moist, firm; Field pH 6.0 to 9.5; Clear to;
B24/ B32	1.10 - 1.30	Grey (10YR 5-6/1); Common fine prominent yellow mottles; Sandy light clay to medium clay; Massive to strong 2-5 mm lenticular; Moderately moist to wet, weak; Field pH 6.5 to 8.0; Clear boundary to;
B33	1.30 - 1.60	Grey (10YR 5/1); Light medium clay; Wet, weak; Field pH 8.5; Limit of augering

Number of sites: 15

Name: Merkunga (Mk)

Concept: Deep bleached Gradational or occasionally Duplex mottled grey soil formed on alluvia within the Rolling Downs Group

Classification:

Aust: Bleached or Bleached-Manganic Dermosolic Redoxic Hydrosol; Bleached-Mottled or Manganic or Mottled Mesotrophic Dermosol

GSG: Gleyed Podzolic Soil

PPF: Gn3.04, Dg2.41

Landform: Level to gently undulating alluvial plains

Geology: Quaternary alluvia (Qa), Rolling Downs Group (Klr) and Bulimba Formation (KTi)

Vegetation: *E. leptophleba* open woodlands and woodlands

Microrelief: None

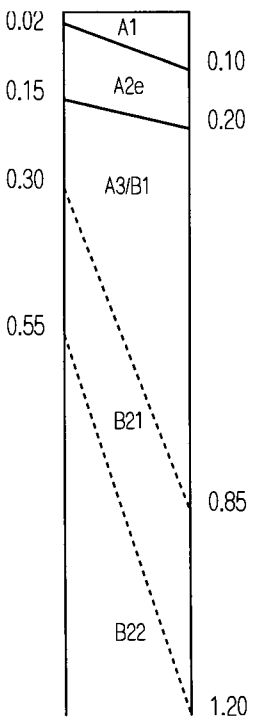
Surface condition: Hardsetting

Land Use Limitations

Climate:	<35°C, >1500 mm (C2), <35°C, <1500 mm (C1)
Moisture Supply:	80 - 100 mm/m (M3)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Poorly drained, moderately to slowly permeable (W5m, W5s)
Flooding frequency:	1 in 2-10 years to every year (F2,F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, hardsetting (including large aggregates) (P2)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	0-1%, stable (E1s)
Landscape complexity:	Isolated unit (Xi)
Salinity:	Non-saline (Sn)

Surface coarse fragments: None

Soil Description:



A1	0 - 0.05	Dark or grey (10YR 3-5/2); Fine sandy loam to clay loam; Massive; Dry, firm; Field pH 5.5 to 6.0; Abrupt boundary to;
A2e	0.05 - 0.15	Conspicuously bleached - grey or yellow-brown (10YR 5/2-3 or 6/2); Few to common fine faint yellow mottles; Fine sandy loam to clay loam; Massive; Dry, firm; Common 2-6 mm manganiferous nodules occasionally present; Field pH 5.5 to 6.0; Clear boundary to;
A3/ B1	0.15 - 0.50	Grey or pale or yellow-brown (10YR 6-7/2-4); Few to many fine distinct yellow to red mottles; Fine sandy clay loam to light clay; Massive; Dry, firm; Field pH 5.5 to 6.0; Gradual or diffuse boundary to;
B21	0.50 - 0.65	Grey or pale or yellow-brown (10YR 6/2-3 or 7/1-3); Many fine distinct yellow to red mottles; Light clay to light medium clay; Moderate 2-5 mm polyhedral to sub-angular blocky; Dry, firm to very firm; Few to many 2-6 mm manganiferous nodules; Field pH 5.5 to 6.0; Diffuse boundary to;
B22	0.65 - 0.90	Grey or pale (10YR 6-7/2); Many fine distinct orange mottles; Light clay to light medium clay; Moderate 2-5 mm polyhedral to sub-angular blocky; Moderately moist, firm; Common 6-20 mm manganiferous nodules; Field pH 5.5 to 6.0.

Limit of augering

Number of sites: 8

Name: Mitchell (Mc)

Concept: Deep Uniform or Gradational red, yellow or brown massive soils on terraces of major streams and rivers

Classification:

Aust: Haplic Mesotrophic Red, or Brown Kandosol

GSG: Red or Yellow Earth

PPF: Um5.52, Gn2.14, Gn2.21, Gn2.42

Landform: Terraced land

Geology: Quaternary alluvia (Qa)

Vegetation: *E. clarksoniana, E. novoguinensis* or *E. polycarpa* woodlands and open woodlands

Microrelief: None

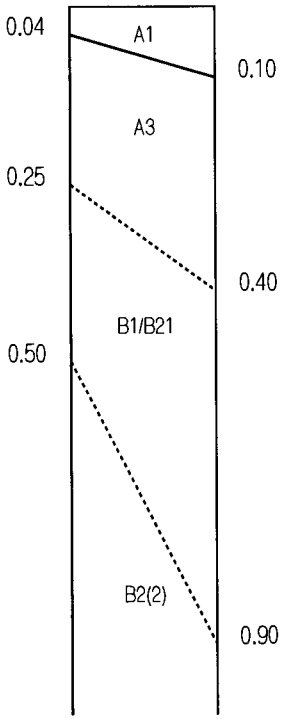
Surface condition: Firm to hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	>35°C, <1500 mm (C3), <35°C, >1500 mm (C1)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding to less than 1 in 10 years (F0, F1)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size < 20 ha (X1)
Salinity:	Non-saline (Sn)

Soil Description:



A1 0 - 0.08 Dark or grey (10YR 3/1-2 or 4/1 or 7.5YR 3/2); Fine sandy loam to fine sandy clay loam; Massive or moderate 2-5 mm cast; Dry, firm; Field pH 6.0 to 7.0; Abrupt or gradual boundary to;

A21 0.07 - 0.13 (frequently present) Brown or grey or red-brown (10YR 3/3 or 5/1 or 5YR 4/4); Fine sandy loam; Massive; Dry, firm; Field pH 6.0; Clear boundary to;

A22 0.13 - 0.25 (frequently present) Brown or yellow-brown (10YR 3/4 or 5/3); Fine sandy loam; Massive; Dry, firm; Field pH 6.0; Clear or gradual boundary to;

A3 0.07 - 0.35 Brown or yellow-brown or red-brown (10YR 4-5/3 or 7.5YR 4/3-4 or 5YR 4/6); Fine sandy loam to fine sandy clay loam; Massive; Moderately moist, firm; Field pH 6.0; Gradual boundary to;

B1/ B21 0.35 - 0.75 Yellow-brown or brown or red-brown or red (10YR 5/4-6 or 7.5YR or 5YR 3-4/4 or 2.5YR 3/6); Light fine sandy clay loam to fine sandy clay loam; Massive or weak 2-5 mm angular or sub-angular blocky; Moderately moist, firm; Field pH 6.0; Gradual boundary to;

B2(2) 0.85 - 1.20 Yellow or brown or red (2.5Y 5/5 or 7.5YR OR 5YR4/6 or 2.5YR 3/4-6); Light fine sandy clay loam to light clay fine sandy; Massive or weak 2-5 mm angular or sub-angular blocky; Moderately moist, firm; Field pH 6.0

Limit of augering

Number of sites: 12

Name: Moonlight (Mg)

Concept: Deep bleached Gradational yellow massive soil formed on alluvia within the Rolling Downs Group

Classification:

Aust: Bleached-Manganic Mesotrophic Yellow Kandosol

GSG: Yellow Earth

PPF: Gn2.94

Landform: Level to gently undulating alluvial plains

Geology: Rolling Downs Group (Klr)

Vegetation: *E. tetrodonta* woodlands

Microrelief: None

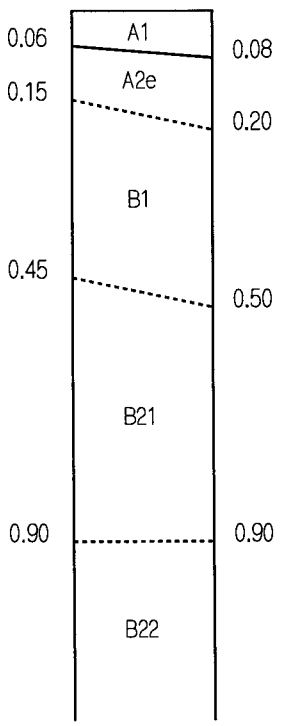
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C1)
Moisture Supply:	80 - 100 mm/m (M3)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, moderately permeable (W4m)
Flooding frequency:	Less than 1 in 10 years (F1)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	0-1%, stable (E1s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Non-saline (Sn)

Soil Description:



A1 0 - 0.07 Dark or grey (10YR 3-4/2); Fine sandy loam to loam; Massive; Dry, firm; Field pH 6.5; Abrupt boundary to;

A2e 0.07 - 0.20 Conspicuously bleached - yellow-brown (10YR 5/3-4 or 6/3); Few fine faint orange mottles; Fine sandy loam to loam; Massive; Dry, firm; Field pH 6.5; Gradual boundary to;

B1 0.20 - 0.50 Yellow or yellow-brown (10YR 5/5 or 6/6 or 6/4); Fine sandy clay loam heavy; Massive; Dry, firm; Field pH 6.0; Diffuse boundary to;

B21 0.50 - 0.90 Yellow or yellow-brown (10YR 5/5 or 6/6 or 6/4); Few fine faint orange mottles; Clay loam heavy; Weak 2-5 mm polyhedral; Dry, firm; Many 2-6 mm manganiferous or few 2-6 mm ferruginous nodules; Field pH 5.5; Diffuse boundary to;

B22 0.90 - 1.20 Pale (10YR 7/4); Many fine distinct orange mottles; Clay loam heavy to light clay; Weak 2-5 mm polyhedral; Dry, firm; Very many 2-6 mm manganiferous or many 2-6 mm ferruginous nodules; Field pH 5.5

Limit of augering

Number of sites: 6

Name: Morehead (Mh)

Concept: Deep brown recent alluvia derived from major streams and rivers

Classification:

Aust: Stratic Rudosol

GSG: Alluvial soil

PPF: No provision

Landform: Channel benches and terraces

Geology: Quaternary alluvia (Qa, Qra)

Vegetation: Gallery closed forests and *Melaleuca* spp. open forests

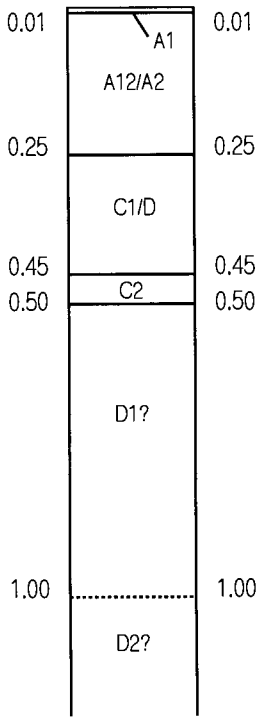
Microrelief: None

Surface condition: Soft

Surface coarse fragments: None

Land Use Limitations	
Climate:	<35°C, >1500 mm (C1), >35°C, <1500 mm (C3)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, highly permeable (W2h)
Flooding frequency:	Every year (F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Unit size < 20 ha (X1)
Salinity:	Non-saline (Sn)

Soil Description:



A11	0 - 0.01	Dark or brown (7.5YR 2/2 or 10YR 4/3); Fine sandy clay loam to clay loam fine sandy; Massive to moderate 2-5 mm granular; Dry, weak to firm; Field pH 6.0 to 7.5; Sharp or abrupt boundary to;
A12/ A2	0.01 - 0.25	Dark or yellow-brown (7.5YR 3/2 or 10YR 5/3); Light fine sandy clay loam to fine sandy clay loam; Massive to moderate 2-5 mm granular; Dry, very firm; Field pH 6.0 to 7.5; Clear boundary to;
C1/D	0.25 - 0.45	Brown (10YR 3/3 or 4/4); Coarse sand to light sandy clay loam; Single grain to massive; Dry, weak to firm; Field pH 7.0 to 7.5; Clear boundary to;
C2	0.45 - 0.50	Dark (7.5YR 3/2); Sandy clay loam; Massive; Dry, weak; Field pH 7.5; Clear boundary to;
D1	0.50 - 1.00	Brown (7.5YR 4/3); Loamy sand; Massive; Dry, very weak; Field pH 7.5; Diffuse boundary to;
D2	1.00 - 1.20	Brown (7.5YR 4/3); Sand; Single grain; Dry, very weak; Field pH 7.5;

Limit of augering

Number of sites: 2

Name: Myall (Ml)

Concept: Deep Uniform or Gradational mottled yellow structured clay soils formed on siltstone, mudstone or claystone

Classification:

Aust: Mottled or Ferric or Manganic Eutrophic Yellow or Brown Dermosol

GSG: Xanthozem

PPF: Uf6.41, Gn3.71, Gn3.91

Landform: Gently undulating plains, to undulating rises

Geology: Rolling Downs Group (Klr), Bulimba Formation (KTi) and Wolena claystone (Klo)

Vegetation: *E. chlorophylla, E. leptophleba* woodlands and open woodlands

Microrelief: Normal gilgai; vertical interval 0.3 to 0.6 m; horizontal interval 5 to 10 m

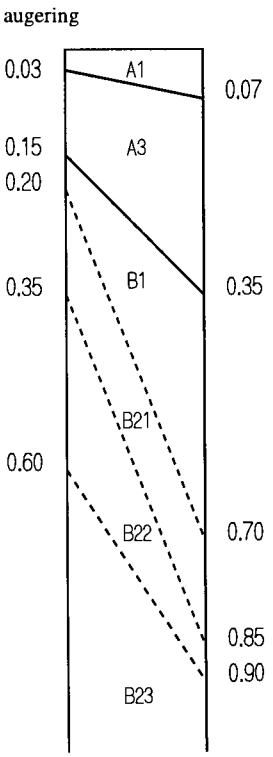
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C1)
Moisture Supply:	100 - 140 mm/m (M2)
Fertility:	3-8 ppm P, <4 ppm SO_4 S (N6)
Wetness:	Imperfectly drained, slowly permeable (W4s)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	Microrelief vertical interval 0.3 - 0.6 m (T3)
Soil physical condition:	Slightly to moderately adhesive soils, narrow moisture range, hardsetting (including large aggregates) (P4)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	High risk outflow zone (So3)

Soil Description:



A1 0 - 0.05 Dark or grey (10YR 3-4/1-2); Few fine faint yellow or orange mottles; Clay loam to light clay; Moderate 2-5 mm granular, cast or sub-angular blocky; Dry, firm to very firm; Few 2-6 mm manganiferous nodules; Field pH 5.5 to 6.5; Abrupt boundary to;

A3 0.05 - 0.20 Grey or yellow or yellow-brown or brown (10YR 4-5/2-5); Few to many fine, faint yellow, orange or brown mottles; Light clay; Moderate 2-5 mm polyhedral or sub-angular blocky; Dry, weak to very firm; Few to many 2-6 mm ferruginous or manganiferous nodules; Field pH 5.5 to 6.0; Clear or diffuse boundary to;

B1 0.20 - 0.35 Brown or yellow (10YR 4/4 or 5/4-6); Few to many fine faint to distinct yellow to red or grey mottles; Light clay to medium clay; Moderate to strong 2-5 mm polyhedral; Dry to moderately moist, firm to very firm; Few to common 2-6 mm manganiferous or ferruginous nodules; Field pH 5.5 to 6.0; Diffuse boundary to;

B21 0.35 - 0.50 Yellow-brown or yellow (10YR 5-6/4-6); Common to many, fine, faint to distinct red or grey mottles; Light clay to medium heavy clay; Moderate to strong 2-5 mm polyhedral or sub-angular blocky; Moderately moist, weak to very firm; Few to many 2-6 mm manganiferous or ferruginous nodules; Field pH 5.5 to 6.0; Diffuse boundary to;

B22 0.50 - 0.80 Yellow-brown or yellow (10YR 5-6/4-6); Few to many fine distinct yellow to red or grey mottles; Light medium clay to heavy clay; Moderate to strong 2-5 mm polyhedral, sub-angular blocky or lenticular; Moderately moist, weak to very firm; Few to many 2-6 mm manganiferous or ferruginous nodules; Field pH 5.5 to 6.0; Diffuse boundary to;

B23/ B3 0.80 - 1.10 Grey or yellow-brown (10YR 6/2-4); Common to many distinct red mottles; Medium heavy clay to heavy clay; Strong, 2-5 mm lenticular; Moderately moist, firm to very firm; Few 2-6 mm ferruginous to common 2-6 mm manganiferous nodules; Field pH 6.0 to 7.0

Number of sites: 31

Name: Nassau (Ns)

Concept: Moderately deep saline Duplex grey soils associated with saltpans on marine plains

Classification:

Aust: Sodic Mottled Hypersalic Hydrosol

GSG: Soloth

PPF: Dy3.41

Landform: Playa on marine plains

Geology: Quaternary coastal alluvium (Qac)

Vegetation: Low open woodlands and tall shrublands dominated by *Melaleuca* spp.

Microrelief: None

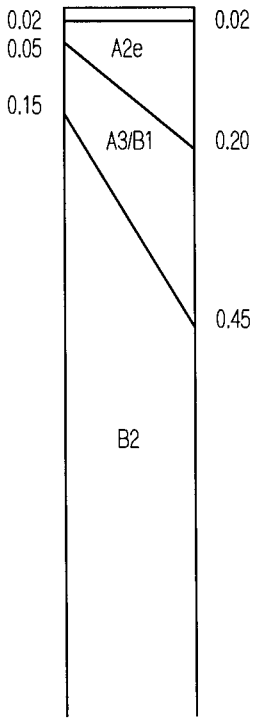
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1), <35°C, <1500 mm (C2)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, >4 ppm SO_4 S (N7)
Wetness:	Very poorly drained, very slowly permeable (W6v)
Flooding frequency:	Every year (F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	1-3%, unstable (E2u)
Landscape complexity:	Unit size < 20 ha (X1)
Salinity:	Naturally saline (Ss)

Soil Description:



A1 0 - 0.02 Grey (10YR 5/2 or 6/1); Few fine distinct orange mottles; Light fine sandy clay loam to sandy clay loam; Massive; Dry, very firm; Field pH 5.8; Abrupt boundary to;

A2e 0.02 - 0.10 Conspicuously bleached - grey (10YR or 2.5Y 6/1); Few fine distinct orange mottles; Light fine sandy clay loam; Massive; Dry, very firm; Field pH 5.5; Abrupt or gradual boundary to;

A3/B1 0.10 - 0.30 Grey (10YR 6/2); Many fine distinct yellow mottles; Fine sandy clay loam to sandy light clay; Massive; Dry, very firm to strong; Field pH 4.5 to 5.0; Clear boundary to;

B2 0.30 - 0.90 Grey (10YR 4-5/1 or 2.5Y 5/1); Many fine prominent red mottles; Light medium clay to medium heavy clay; Moderate 2-5 mm lenticular structure or strong 10-20 mm angular blocky; Moderately moist, very firm to strong; Field pH 4.5 to 5.0

Limit of augering

Number of sites: 3

Name: Norman (Nm)

Concept: Moderately deep Uniform cracking dark clays formed on footslopes of basalt flows

Classification:

Aust: Haplic Self Mulching Black or Brown Vertosol

GSG: Black Earth

PPF: Ug5.12, Ug5.13, Ug5.26, Ug5.32

Landform: Footslopes, drainage depressions

Geology: McLean Basalt (Cze)

Vegetation: Often cleared *E. leptophleba, E. platyphylla* or *E. erythrophloia* woodlands

Microrelief: Melonhole or normal gilgai; vertical interval 0.2-0.5 m; horizontal interval 10-20 m

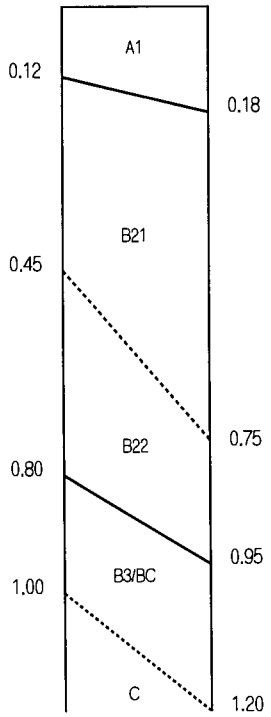
Surface condition: Cracking, self mulching

Surface coarse fragments: Very few to many 60-200 mm rounded basalt coarse fragments occasionally present

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	100 - 140 mm/m (M2)
Fertility:	8-20 ppm P, >4 ppm SO_4 S (N3)
Wetness:	Moderately well drained, very slowly permeable (W3v)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	Microrelief vertical interval 0.3 - 0.6 m (T3)
Soil physical condition:	Strongly adhesive soils, narrow moisture range, moderately hardsetting (P7)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	3-10%, unstable (E3u)
Landscape complexity:	Unit size < 20 ha (X1)
Salinity:	Low risk outflow zone (So1)

Soil Description:



A1 0 - 0.16 Dark (10YR 2-3/1-2); Medium clay to medium heavy clay; Moderate to strong 2-10 mm angular-blocky or granular; Dry, very firm to strong; Very few to few < 2 mm manganiferous nodules occasionally present; Field pH 6.0 to 6.5; Clear or gradual boundary to;

B21 0.16 - 0.55 Dark (10YR 3/1 or 2.5Y 3/2); Medium heavy clay; Weak to strong 10-20 mm lenticular; Moderately moist, firm; Very few < 2-6 mm manganiferous nodules occasionally present; Field pH 6.5 to 7.0; Gradual or diffuse boundary to;

B22 0.55 - 0.90 Dark (2.5Y 3/2-3); Medium heavy clay to heavy clay; Moderate 10-50 mm lenticular; Moderately moist, weak; Few 2-6 mm manganiferous nodules; Field pH 7.0 to 8.0; Clear boundary to;

B3/BC 0.90 - 1.10 Dark (10R 2/3); Medium clay to heavy clay; Very few to abundant 20-60 mm rounded basalt; Moderate 10-20 mm lenticular; Moderately moist, firm or moist weak; Common 2-6 mm carbonate nodules or < 2 mm soft manganiferous segregations; Field pH 7.0 to 8.5; Gradual boundary to;

C Rock

Phases: Shallow phase (NmSp): Depth to rock 0.40m. **Number of sites:** 1

Number of sites: 11

Name: Olive (Ol)

Concept: Deep bleached Gradational mottled grey soils with nodules, formed on alluvial plains

Classification:

Aust: Bleached-Manganic Kandosolic or Dermosolic Redoxic Hydrosol; Bleached-Ferric Mesotrophic Grey Kandosol

GSG: Gleyed Podzolic/NSG

PPF: Gn3.04, Gn2.94

Landform: Gently undulating alluvial plains

Geology: Quaternary alluvia (Qa)

Vegetation: *M. viridiflora* low open woodlands and woodlands

Microrelief: None

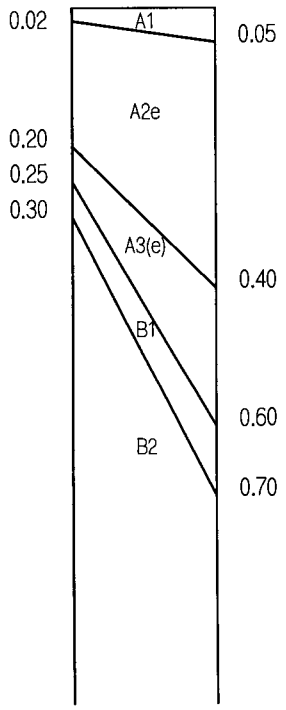
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	3-8 ppm P, <4 ppm SO_4 S (N6)
Wetness:	Poorly drained, moderately permeable (W5m)
Flooding frequency:	Every year (F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Non-saline (Sn)

Soil Description:



A1 0 - 0.03 Grey (10YR 3-4/2 or 5/1-2); Loamy sand to fine sandy loam; Massive; Dry, firm; Field pH 5.5 to 6.0; Abrupt boundary to;

A2e 0.03 - 0.25 Conspicuously bleached - grey or yellow-brown or pale (10YR 6-7/2 or 6/2-3); Loamy sand to fine sandy loam; Massive; Dry, firm to very firm; Field pH 6.0; Clear or gradual boundary to;

A3(e) 0.20 - 0.35 Occasionally conspicuously bleached - grey or pale or grey-brown or brown (10YR 5/2-3 or 7.5YR 6-7/2-3); Few to common fine distinct to prominent yellow to orange mottles; Sandy clay loam to fine sandy clay loam; Massive; Dry, very firm; Few to common 2-6 mm ferro-manganiferous or manganiferous nodules; Field pH 5.5 to 6.0; Clear or gradual boundary to;

B1 0.35 - 0.55 Grey or yellow-brown or pale (10YR 6/2-3 or 10YR or 7.5YR 7/2-3); Common fine distinct to prominent yellow to orange mottles; Sandy clay loam to light clay; Massive to weak < 2-5 mm sub-angular; Dry to moderately moist, firm to very firm; Common 2-6 mm ferruginous or ferro-manganiferous or manganiferous nodules; Field pH 5.5 to 6.0; Clear or gradual boundary to;

B2 0.55 - 1.00 Grey or pale or pale-yellow(10YR 6/1-2 or 7/1-4); Common to many fine distinct to prominent yellow to red mottles; Clay loam sandy to light medium clay; Massive to moderate 2-5 mm sub-angular or angular blocky; Dry to moderately moist, firm to very firm; Common to many 2-20 mm ferro-manganiferous or manganiferous nodules; Field pH 5.5 to 6.5;

Limit of augering

Number of sites: 21

Name: Orchid (Oc)

Concept: Deep Gradational red structured soils formed on granodiorite hillslopes

Classification:

Aust: Haplic Mesotrophic Red Dermosol

GSG: NSG Euchrozem

PPF: Gn3.12, Gn3.11

Landform: Gentle rises to steep hills

Geology: Flyspeck Granodiorite (SDf), Finlayson granite (Pgf), Wolverton Adamellite (Pw)

Vegetation: *E. leptophleba* open woodlands and woodlands

Microrelief: None

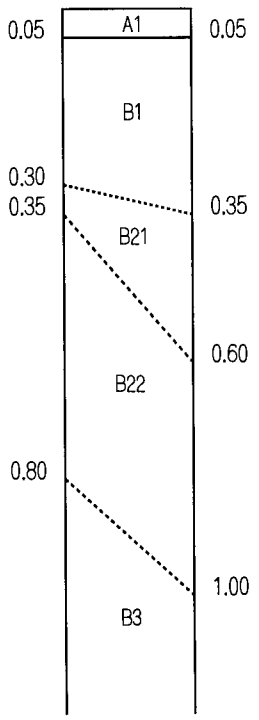
Surface condition: Hardsetting

Surface coarse fragments: Common 60-200 mm sub-rounded adamellite occasionally present

Land Use Limitations

Climate:	<35°C, >1500 mm (C1), <35°C, <1500 mm (C2)
Moisture Supply:	100 - 140 mm/m (M2)
Fertility:	3-8 ppm P, <4 ppm SO_4 S (N6)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Topography:	No microrelief (T0)
Rockiness:	No rock (R0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	10-32%, stable (E4s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk inflow zone (Si1)

Soil Description:



A1	0 - 0.05	Dark or brown (7.5YR 2/1 or 3/1-3); Clay loam to light clay; Massive to strong 2-5mm cast; Dry, weak; Field pH 5.5 to 7.0; Clear boundary to;
B1	0.05 - 0.30	Red or red-brown (2.5YR 3/3 or 5YR 3/6); Light medium clay to medium clay; Moderate to strong < 2-10 mm polyhedral or sub-angular blocky; Moderately moist, firm; Field pH 6.0 to 6.5; Gradual boundary to;
B21	0.30 - 0.60	Red (2.5YR 3/4-6 or 4/6); Medium clay; Very few to few 6-200 mm angular to sub-rounded granite coarse fragments. Strong < 2-5 mm sub-angular to polyhedral; Moderately moist, firm; Field pH 6.0 to 7.0; Gradual boundary to;
B22	0.60 - 0.90	Red (2.5YR 3/5-6); Medium clay to medium heavy clay; Few 6-20 mm angular granite coarse fragments; Strong < 2-5 mm sub-angular to polyhedral; Moderately moist, firm; Field pH 6.0 to 7.0; Diffuse boundary to;
B3	0.90 - 1.00	Brown (7.5YR 4/4); Light medium clay; Very few to few 6-200 mm angular or sub-rounded granite or adamellite coarse fragments; Moderate 5-10 mm sub-angular; Moderately moist, strong; Field pH 6.0;
	Limit of augering	

Number of sites: 3

Name: Pack (Pc)

Concept: Shallow Gradational or Uniform red massive soils on schist, phyllite, quartzite and gneiss

Classification:

Aust: Haplic Mesotrophic Red or Brown Kandosol

GSG: Red Earth

PPF: Gn2.12, Um5.51, Gn2.41

Landform: Undulating to steep rises to hills

Geology: Coen (Pc), Sefton (Ps) and Holroyd (Ph, Phg) Metamorphics, Normanby Formation (Pn)

Vegetation: *E. hylandii* or *E. tetrodonta* woodlands

Microrelief: None

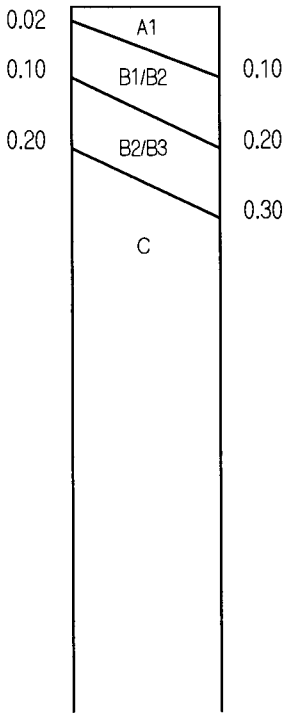
Surface condition: Hardsetting

Surface coarse fragments: Very many 60-200 mm schist occasionally present

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	3-8 ppm P, <4 ppm SO_4 S (N6)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Unit size < 20 ha (X1)
Salinity:	Non-saline (Sn)

Soil Description:



A1 0 - 0.05 Dark (7.5YR 3/1-2 or 10YR 2-3/1); Sandy loam to loam fine sandy; Many 20-60 mm schist or common 20-60 mm angular quartzite occasionally present; Massive; Dry, firm; Field pH 6.5; Abrupt boundary to;

B1 0.05 - 0.15 Dark or red-brown or brown (7.5YR 3/2 or 5YR or 10YR 3/3); Light sandy clay loam to clay loam fine sandy; Many 20-60 mm schist or common 20-60 mm angular quartzite occasionally present; Massive; Dry, firm to very firm; Field pH 6.5; Clear boundary to;

B2/B3 0.15 - 0.30 Red or brown (2.5YR 3/3 or 7.5YR 3/3-4 or 10YR 3/4); Sandy clay loam to clay loam fine sandy; Few 2-20 mm angular quartz or common 20-60 mm angular quartzite or many 20-60 mm schist; Massive; Dry to moderately moist, weak to very firm; Field pH 6.5; Clear boundary to;

C Rock

Number of sites: 5

Name: Packsaddle (Ps)

Concept: Shallow Gradational brown structured soils formed on lower slopes on schist, phyllite, quartzite, gneiss and greenstone

Classification:

Aust: Haplic Mesotrophic Brown Dermosol

GSG: Xanthozem

PPF: Gn3.22

Landform: Footslopes of undulating rises to rolling low hills

Geology: Holroyd Metamorphics (Ph, Phg)

Vegetation: *E. cullenii, E.crebra* or *E. persistens* woodlands and open woodlands

Microrelief: None

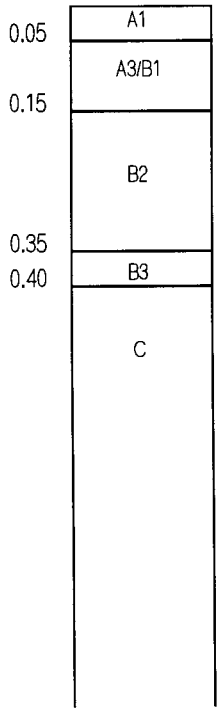
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	3-8 ppm P, >4 ppm SO_4 S (N5)
Wetness:	Imperfectly drained, moderately permeable (W4m)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size < 20 ha (X1)
Salinity:	Low risk outflow zone (So1)

Soil Description:



A1	0 - 0.05	Dark (7.5YR 2/1); Loam; Moderate < 2 mm granular; Dry, firm; Field pH 7.0; Abrupt boundary to;
A3/B1	0.05 - 0.15	Brown (7.5YR 4/3); Clay loam; Moderate < 2 mm sub-angular blocky; Dry, very firm; Field pH 7.0; Clear boundary to;
B2	0.15 - 0.35	Brown (7.5YR 3/4); Light clay; Moderate < 2 mm polyhedral; Moderately moist, very firm; Few 2-6 mm manganiferous nodules; Field pH 7.0; Clear boundary to;
B3	0.35 - 0.40	Brown (7.5YR 3/4); Medium clay; Common 6-20 mm angular quartz; Moderate 2-5 mm lenticular; Moderately moist, very firm; Field pH 7.5; Clear boundary to;
C		Rock

Number of sites: 1

Name: Picanninny (Pn)

Concept: Deep Uniform cracking brown or grey structured clay, formed on recent exposures of siltstones, claystones or mudstones

Classification:

Aust: Mottled Pedal or Crusty Brown or Grey Vertosol

GSG: Brown clay

PPF: Ug5.24, Ug5.34, Ug5.35

Landform: Level to gently undulating plains to undulating rises

Geology: Rolling Downs Group (Klr), Bulimba Formation(KTi) and Wolena claystone (Klo)

Vegetation: *E. leptophleba, E.chlorophylla* open woodlands or grasslands

Microrelief: Normal gilgai; vertical interval 0.2-0.4 m; horizontal interval 3-8 m

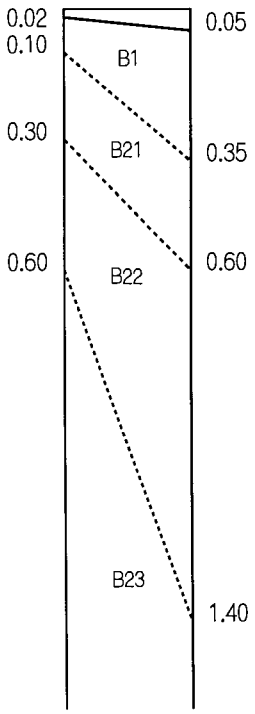
Surface condition: Cracking, hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C1)
Moisture Supply:	100 - 140 mm/m (M2)
Fertility:	3-8 ppm P, <4 ppm SO_4 S (N6)
Wetness:	Imperfectly drained, very slowly permeable (W4v)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	Microrelief vertical interval 0.1 - 0.6 m (T2, T3)
Soil physical condition:	Strongly adhesive soils, narrow moisture range, moderately hardsetting (P7)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	1-3%, unstable (E2u)
Landscape complexity:	Unit size > 20 ha (X0), Unit size < 20 ha (X1)
Salinity:	High risk outflow zone (So3)

Soil Description:



A1 0 - 0.03 Dark or grey (10YR 3-4/1-2); Few to common fine faint orange mottles; Light medium clay to medium heavy clay; Moderate 2-5 mm granular; Dry, firm to strong; Few to common 2-6 mm manganiferous or ferruginous nodules; Field pH 5.5 to 6.5; Abrupt or clear boundary to;

B1 0.03 - 0.25 Grey or brown (10YR 4/2-4); Common fine faint orange or brown mottles; Light medium clay to medium heavy clay; Moderate 2-5 mm lenticular or sub-angular blocky; Dry to moderately moist, firm to very firm; Few to many 2-6 mm manganiferous nodules; Field pH 5.5 to 6.5; Gradual or diffuse boundary to;

B21 0.25 - 0.40 Grey or yellow-grey (10YR 4/2 or 2.5Y 5/4); Common to many fine, faint to distinct grey or orange mottles; Medium clay to heavy clay; Moderate to strong 2-5 mm lenticular or sub-angular blocky; Moderately moist, firm to very firm; Few to common 2-6 mm manganiferous or ferro-manganiferous nodules; Field pH 6.0 to 6.5; Diffuse boundary to;

B22 0.40 - 0.80 Grey or yellow-grey (10YR or 2.5Y 5/2-3); Common to many fine faint or distinct, yellow, grey or red mottles; Medium heavy clay to heavy clay; Moderate to strong 2-10 mm lenticular; Moderately moist, very firm; Very few to few 2-6 mm manganiferous nodules; Field pH 5.5 to 7.0; Diffuse boundary to;

B23 0.80 - 1.50 Grey or yellow-grey (2.5Y4/2 or 10YR 5/4); Common to many fine faint to distinct orange or grey mottles; Medium heavy clay to heavy clay; Strong 5-10 mm lenticular; Moderately moist, firm to very firm; Few 2-6 mm manganiferous nodules; Field pH 7.0 to 7.5.

Limit of augering

Number of sites: 21

Name: Pinnacle (Pa)

Concept: Deep bleached Gradational grey massive soils derived from adamellites

Classification:

Aust: Bleached-Mottled Mesotrophic Grey Kandosol

GSG: Grey Earth

PPF: Gn2.94

Landform: Hillslopes on gently undulating plains to undulating rises

Geology: Aralba Adamellite (SDa)

Vegetation: *E. tetrodonta* woodlands

Microrelief: None

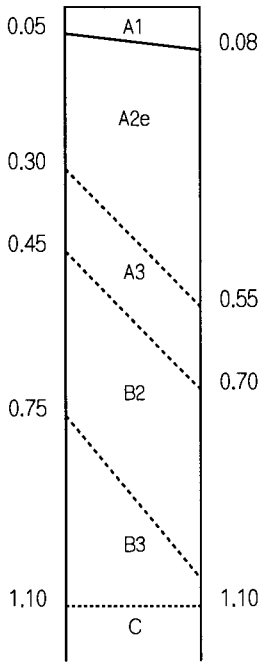
Surface condition: Loose to firm

Surface coarse fragments: Very few to common 2-6 mm sub-angular quartz

Land Use Limitations

Climate:	<35°C, <1500 mm (C1)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Poorly drained, slowly permeable (W5s)
Flooding frequency:	1 in 2-10 years (F2)
Topography:	No microrelief (T0)
Rockiness:	No rock (R0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	1-3%, unstable (E2u)
Landscape complexity:	Unit size >20 ha (X0)
Salinity:	Low risk inflow zone (Si1)

Soil Description:



A1	0 - 0.06	Dark or grey (10YR 3/1 or 4/2); Coarse sand to loamy sand; Common to many 2-6 mm sub-angular quartz; Single grain to massive; Dry, weak; Field pH 6.0; Clear boundary to;
A2e	0.06 - 0.40	Conspicuously bleached - yellow-brown or pale (10YR 5-7/3); Coarse sand to loamy coarse sand; Common to many 2-6 mm sub-angular quartz; Massive; Dry, weak to firm; Field pH 6.0 to 6.5; Gradual or diffuse boundary to;
A3	0.40 - 0.60	Pale (10YR 7/3); Loamy coarse sand to coarse sandy loam; Common to many 2-6 mm sub-angular quartz; Massive; Dry, firm; Field pH 6.0; Gradual boundary to;
B2	0.60 - 0.95	Pale (10YR 7/3); Common fine to medium distinct to prominent red mottles; Coarse sandy clay loam; Common to many 2-6 mm and few to common 20-60 mm sub-angular quartz; Massive; Dry to moderately moist, weak; Field pH 5.5 to 6.0; Gradual or diffuse boundary to;
B3	0.95 - 1.10	Pale (10YR 7/3); Coarse sandy loam; Many 20-60 mm sub-angular quartz; Massive; Dry to moderately moist, weak; Field pH 6.0; Gradual boundary to;
C		Rock

Number of sites: 2

Name: Poll (Pl)

Concept: Very shallow Uniform brown soils formed on schist, phyllite, quartzite, gneiss and greenstone

Classification:

Aust: Basic Lithic Orthic Tenosol

GSG: Lithosol

PPF: Uc2.12

Landform: Undulating rises to steep hills

Geology: Coen (Pc), Holroyd (Ph, Phg) Metamorphics

Vegetation: *E. hylandii* or *E. tetrodonta* woodlands

Microrelief: None

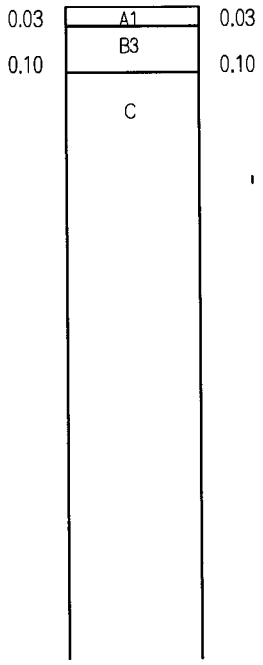
Surface condition: Hardsetting

Surface coarse fragments: Common 60-200 mm angular quartz

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, highly permeable (W2h)
Flooding frequency:	No flooding (F0)
Rockiness:	20-60 mm, 10-20% (Rg3)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	10-32%, unstable (E4u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)

Soil Description:



A1 0 - 0.03 Grey (10YR 4/2); Sandy loam; Many 20-60 mm angular quartz; Massive; Dry, weak; Field pH 6.0; Clear boundary to;

B3 0.03 - 0.10 Brown (10YR 4/3); Common fine distinct orange mottles; Sandy loam; Common 2-20 mm angular quartz; Massive; Dry, firm; Field pH 6.0; Clear boundary to;

C Rock

Number of sites: 1

Name: Quarantine (Qt)

Concept: Moderately deep Duplex sodic neutral to alkaline soils on lower slopes and fans derived from acid plutonic rocks

Classification:

Aust: Eutrophic Mottled-Subnatric or Subnatric Grey Sodosol; Sodic Sodosolic Redoxic Hydrosol

GSG: Solodic Soil

PPF: Dy3.42, Dy3.43, Dy4.42, Dy5.42

Landform: Drainage depressions to footslopes of plains to low hills

Geology: Kintore Adamellite (SDk), Finlayson Granite (Pgf), Lilyvale Beds (Tmpv)

Vegetation: *M. viridiflora* low open woodlands and woodlands

Microrelief: None

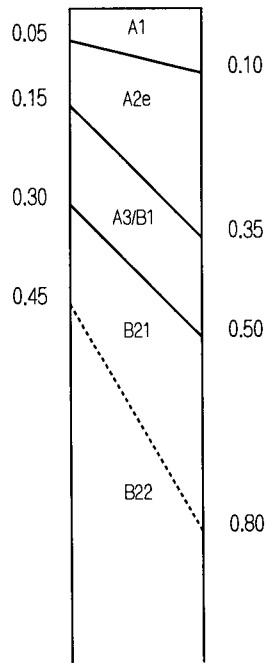
Surface condition: Firm to hardsetting

Surface coarse fragments: Few to many 2-20 mm angular quartz occasionally present

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	3 - 8 ppm P, >4 ppm SO_4 S (N5)
Wetness:	Poorly drained, slowly permeable (W4s)
Flooding frequency:	No flooding (F0)
Rockiness:	2-6 mm, 20-50% (Rf4)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardesetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, unstable (E3u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Moderate risk outflow zone (So2)

Soil Description:



A1 0 - 0.06 Dark or grey (10YR 3-5/1-2); Loamy sand to sandy loam, occasionally clay loam; Very few to common 2-6 mm angular quartz coarse fragments occasionally present; Massive; Dry, firm; Field pH 5.5 to 6.5; Abrupt or clear boundary to;

A2e 0.06 - 0.20 Conspicuously bleached - grey or yellow-brown or brown (10YR 4-6/2-3); Loamy coarse sand to sandy loam; Few to many 2-60 mm angular quartz coarse fragments; Massive; Dry, firm to very firm; Field pH 5.5 to 6.5; Sharp or clear boundary to;

A3/B1 0.20 - 0.40 Brown or yellow-brown or yellow (10YR 4-5/4-6 or 6/5-6); Few to many fine distinct yellow, orange or red mottles; Clayey coarse sand to coarse sandy medium clay; Few 2-6 mm angular quartz coarse fragments occasionally present; Massive to strong 2-5 mm angular blocky; Dry to moderately moist, firm to very firm; Field pH 6.0 to 7.0; Clear boundary to;

B21 0.40 - 0.60 Grey (10YR 4/1 or 6/2 or 2.5Y 4-5/2); Few to common fine distinct yellow to red mottles; Coarse sandy medium clay to coarse sandy medium heavy clay; Few to many 2-6 mm angular quartz coarse fragments occasionally present; Moderate to strong 2-10 mm angular-blocky; Dry to moderately moist, strong to very strong; Field pH 6.0 to 7.0; Gradual boundary to;

B22 0.60 - 0.85 Grey (10YR or 2.5Y or 5Y 4/2); Many fine distinct yellow to orange mottles occasionally present; Coarse sandy medium heavy clay to heavy clay; Common to many 2-6 mm sub-angular quartz coarse fragments; Moderate 2-10 mm angular blocky to strong 50-100 mm columnar; Moderately moist, strong to very strong; Field pH 7.0 to 9.5;

Limit of augering

Number of sites: 13

Name: Raymond (Rm)

Concept: Moderately deep Gradational red clay soils formed on dolerite intrusions

Classification:

Aust: Haplic Mesotrophic Red Dermosol

GSG: Red Podzolic Soil

PPF: Gn3.14

Landform: Gently undulating plains to rolling low hills

Geology: Dolerite (Po, CPo)

Vegetation: *E. hylandii* or *E. tetrodonta* woodlands

Microrelief: None

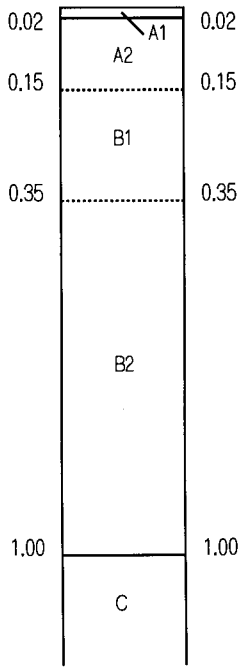
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1), <35°C, <1500 mm (C2)
Moisture Supply:	100 - 140 mm/m (M2)
Fertility:	3-8 ppm P, >4 ppm SO_4 S (N5)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Isolated unit (Xi)
Salinity:	Low risk intake zone (Si1)

Soil Description:



A1	0 - 0.02	Dark (5YR 2/2); Sandy clay loam; Massive; Dry, very firm; Very few 2-6 mm ferruginous nodules; Field pH 7.0; Abrupt boundary to;
A2	0.02 - 0.15	Red (2.5YR 3/3); Sandy clay loam; Massive; Dry, very firm; Very few 2-6 mm ferruginous nodules; Field pH 6.0; Gradual boundary to;
B1	0.15 - 0.35	Red (10R 3/3); Light clay; Moderate 2-5 mm sub-angular blocky; Moderately moist, very firm; Few 2-6 mm ferruginous nodules; Field pH 6.0; Diffuse boundary to;
B2	0.35 - 1.00	Red (10R 2/3); Light medium clay; Very few 6-20 mm angular quartz coarse fragments; Strong 2-5 mm sub-angular blocky; Moderately moist, very firm; Few 2-6 mm ferruginous nodules; Field pH 6.0; Clear boundary to;
C		Rock

Number of sites: 1

Name: Rokeby (Rb)

Concept: Moderately deep Gradational red or yellow massive soil with ferruginized sedimentary fragments

Classification:

Aust: Ferric Mesotrophic Red or Yellow Kandosol

GSG: Red or Yellow Earth

PPF: Gn2.21, Um5.51

Landform: Undulating plains to rises

Geology: Rolling Downs Group (Klr*)

Vegetation: *E. hylandii* or *E. tetrodonta* woodlands

Microrelief: None

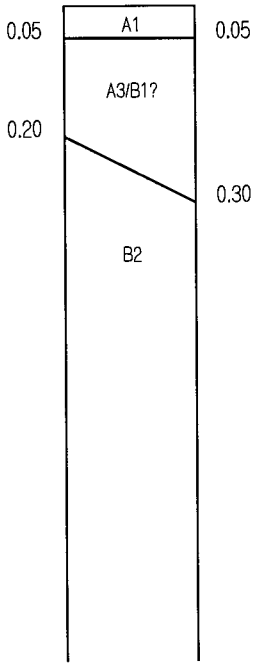
Surface condition: Hardsetting

Surface coarse fragments: Very many 6-20 mm sub-angular and sub-rounded ferruginized siltstone

Land Use Limitations

Climate:	<35°C, <1500 mm (C1)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Rockiness:	6-20 mm, > 50% (Rm5)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, unstable (E3u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	High risk inflow zone (Si3)

Soil Description:



A1	0 - 0.05	Dark (7.5YR 2/1 or 5YR 3/2); Sandy loam to fine sandy loam; Very many 6-20 mm sub-angular to angular ferruginized siltstone; Massive; Dry, weak; Field pH 6.0 to 7.0; Clear boundary to;
A3/ B1?	0.05 - 0.25	Red or yellow-brown (2.5YR 3/4 or 10YR 5/3); Light sandy clay loam to fine sandy clay loam; Very many 6-20 mm sub-angular ferruginized siltstone; Massive; Dry, weak; Field pH 5.5 to 7.0; Clear boundary to;
B2	0.25 - 0.35	Yellow-brown (7.5YR 5/5); Light clay; Abundant 2-6 mm angular ferruginized siltstone; Massive; Field pH 5.5
	Limit of augering	

Number of sites: 2

Name: Rule (Rl)

Concept: Deep Gradational or Uniform structured red clays derived from greywacke and slate

Classification:

Aust: Haplic Mesotrophic Red Dermosol

GSG: NSG

PPF: Gn3.11, Gn3.12, Uf5.22

Landform: Hillslopes on undulating rises to rolling hills

Geology: Hodgkinson Formation (D-Ch)

Vegetation: Closed forest of the Wet Tropics Region

Microrelief: None

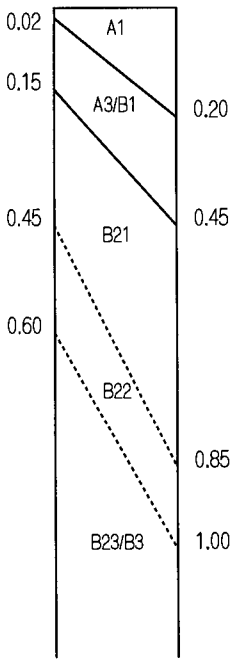
Surface condition: Firm, occasionally hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C2)
Moisture Supply:	> 140 mm/m (M1)
Fertility:	8-20 ppm P, >4 ppm SO_4 S (N3)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation a problem (Vc1e2)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk inflow zone (Si1)

Soil Description:



A1	0 - 0.07	Dark (7.5YR 2/2 or 7.5YR or 10YR 3/1-2); Light clay loam to light clay; Moderate to strong 2-5 mm cast; Dry to moderately moist, weak to firm; Field pH 5.5 to 7.0; Clear boundary to;
A3/B1	0.07 - 0.35	Brown or red-brown (7.5YR or 5YR 3/3 or 4/4); Clay loam to light medium clay; Moderate to strong < 2-5 mm sub-angular to polyhedral; Moderately moist, weak to firm; Field pH 6.0 to 7.0; Clear or gradual boundary to;
B21	0.35 - 0.55	Red or red-brown (2.5YR or 5YR 3/4-5 or 4/6); Light medium clay to medium clay; Strong 2-5 mm sub-angular to polyhedral; Moderately moist, firm to very firm; Field pH 6.0 to 7.0; Gradual boundary to;
B22	0.55 - 0.80	Red (2.5YR 3-4/6); Light medium clay to medium heavy clay; Strong 2-5 mm sub-angular; Moderately moist, firm; Field pH 6.0 to 7.0; Gradual boundary to;
B23/B3	0.80 - 1.20	Red (2.5YR or 7.5YR 4/6); Light medium clay silty to medium clay; Strong 2-5 mm sub-angular blocky; Moderately moist, firm; Field pH 6.0 to 7.0.

Limit of augering

Number of sites: 12

Name: Scorpion (Sp)

Concept: Deep Gradational or Uniform yellow massive soil with ferruginous or manganiferous nodules formed on laterised remnants of Bulimba Formation

Classification:

Aust: Ferric or Bleached-Ferric or Manganic or Bleached-Manganic Mesotrophic Yellow Kandosol; Ferric Mesotrophic Brown Kandosol

GSG: Yellow Earth

PPF: Gn2.24, Gn2.34, Gn2.64, Gn2.84, Um4.23, Um5.51, Um5.52

Landform: Gently undulating plains to undulating rises

Geology: Rolling Downs Group (Klr*)

Vegetation: *E. tetrodonta* woodlands and tall woodlands

Microrelief: None

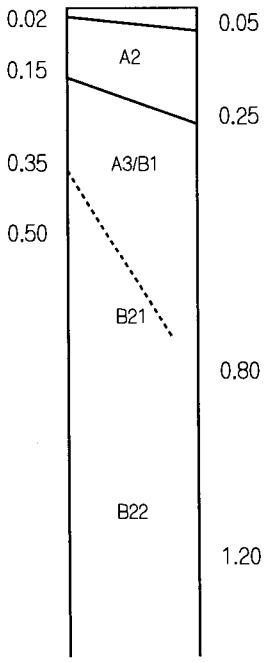
Surface condition: Hardsetting

Surface coarse fragments: Many 2-6 mm ferruginous nodules occasionally present

Land Use Limitations

Climate:	<35°C, <1500 mm (C1), <35°C, >1500 mm (C2)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Rockiness:	2-6 mm, 20-50% (Rf4)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Unit size < 20 ha (X1), occasionally > 20 ha (X0)
Salinity:	High risk recharge zone (Si3)

Soil Description:



A1	0 - 0.03	Dark or brown or grey (10YR 3/2 or 4/1-3); Loamy fine sand to fine sandy clay loam; Massive; Dry, firm to very firm; Few to very many 2-6 mm ferruginous nodules; Field pH 6.0 to 6.5; Abrupt boundary to;
A2	0.03 - 0.20	Grey or brown (10YR 4/2-4 or 7.5YR 4-5/4); Loamy fine sand to fine sandy clay loam; Massive; Dry, firm; Common to many 2-6 mm ferruginous or manganiferous nodules; Field pH 5.5 to 6.5; Clear or diffuse boundary to;
A3/B1	0.20 - 0.45	Brown or yellow-brown or yellow (10YR 4/5 or 5-6/6 or 7.5YR 5/6); Fine sandy clay loam to clay loam; Massive; Dry, weak to firm; Common to very many 2-6 mm ferruginous or ferro-manganiferous or manganiferous nodules; Field pH 5.5 to 6.0; Gradual or diffuse boundary to;
B21	0.45 - 0.60	Yellow-brown or yellow (7.5YR 5/6-8 or 10YR 6/6); Few to many fine distinct orange to red mottles; Fine sandy clay loam to clay loam heavy; Massive; Dry, weak to firm; Many to very many 2-6 mm ferruginous or ferro-manganiferous or manganiferous nodules; Field pH 5.5 to 6.0; Diffuse boundary to;
B22	0.60 - 1.20	Yellow-brown or yellow (10YR 6/4-6); Fine sandy clay loam to clay loam heavy; Massive; Dry, weak to firm; Very many 2-6 mm ferruginous or ferro-manganiferous or manganiferous nodules; Field pH 5.5 to 6.0;

Limit of augering

Number of sites: 21

Name: Shea (Se)

Concept: Moderately deep Gradational red massive soils formed on adamellite

Classification:

Aust: Bleached-Mottled or Haplic Mesotrophic Kandosol

GSG: Red Earth

PPF: Gn2.54, Gn2.12, Gn2.75

Landform: Hillslopes on undulating plains to undulating rises

Geology: Wigan (SDw) and Kintore (SDk) Adamellites

Vegetation: *E. tetrodonta* woodlands

Microrelief: None

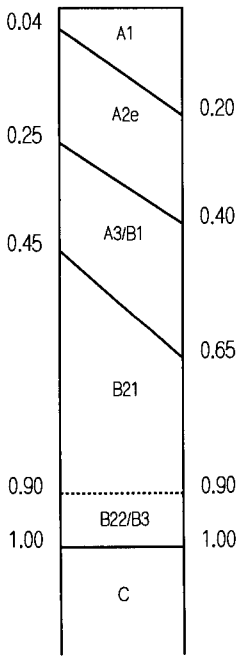
Surface condition: Hardsetting

Surface coarse fragments: Common 2-6 mm sub-angular quartz occasionally present

Land Use Limitations

Climate:	<35°C, >1500 mm (C1), <35°C, <1500 mm (C2)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Moderately well drained, moderately permeable (W3m)
Flooding frequency:	No flooding (F0)
Topography:	No microrelief (T0)
Rockiness:	2-6 mm, 20-50% (Rf4)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk inflow zone (Si1)

Soil Description:



A1	0 - 0.12	Dark or grey (10YR 3/1-2 or 4/2); Loamy coarse sand to coarse sandy loam; Very few to many 2-6 mm sub-angular quartz coarse fragments; Massive; Dry, firm; Field pH 6.0 to 7.0; Abrupt boundary to;
A2e	0.12 - 0.30	Conspicuously bleached - brown or yellow-brown (10YR 3/4 or 6/4 or 7.5YR 4/3 or 5/6); Loamy coarse sand; Many 2-6 mm sub-angular quartz coarse fragments; Dry, firm; Field pH 5.5; Clear or gradual boundary to;
A3/B1	0.30 - 0.50	Red or brown (5YR 3-4/3 or 5YR or 7.5YR 4/4 or 6/8); Loamy coarse sand heavy to light coarse sandy clay loam; Few to many 2-20 mm sub-angular quartz or granite coarse fragments; Dry to moderately moist, weak to firm; Field pH 5.5 to 7.0; Clear or gradual boundary to;
B21	0.50 - 0.90	Red or red-brown (2.5YR 3/5-6 or 5YR 5/6-8); Common fine faint to prominent yellow to red mottles; Coarse sandy clay loam to light clay coarse sandy; Few to many 2-6 mm sub-angular quartz or adamellite coarse fragments; Massive; Moderately moist, weak; Field pH 7.0; Gradual boundary to;
B22/B3	0.90 - 1.00	Red (2.5YR 3-4/6); Clay loam to light medium clay coarse sandy; Few to many 2-6 mm sub-angular quartz and occasionally few 2-6 mm sub-angular adamellite coarse fragments; Massive; Moderately moist, weak; Field pH 7.0; Clear boundary to;
C		Rock

Number of sites: 6

Name: Silver (Sv)

Concept: Deep Duplex sodic soils formed on colluvial plains derived from acid plutonic hillslopes

Classification:

Aust: Bleached-Sodic Sodosolic Oxyaquic or Redoxic Hydrosol;

GSG: Solodic Soil

PPF: Dy3.42, Dy4.42, Dy5.42, Dg3.42

Landform: Gently undulating to undulating plains on colluvial fans

Geology: Quaternary alluvia (Qa, Qpa, Qha), Lilyvale Beds (Tmpv), Falloch Beds (Tmph)

Vegetation: *M. viridiflora* low open woodlands and woodlands

Microrelief: None

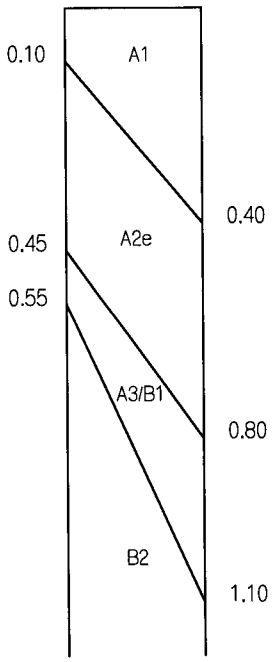
Surface condition: Loose to hardsetting

Land Use Limitations

Climate:	<35°C, >1500 mm (C1)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, >4 ppm SO_4 S (N7)
Wetness:	Poorly drained, slowly permeable (W5s)
Flooding frequency:	Every 2-10 years to every year (F2-F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	1-3%, unstable (E2u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk outflow zone (So1)

Surface coarse fragments: Common 2-6 mm sub-angular quartz occasionally present

Soil Description:



A1 0 - 0.20 Dark or grey (10YR 3-5/1 or 4-5/2); Coarse sand to loamy coarse sand; Very few 2-6 mm sub-angular quartz; Single grain to massive; Dry, very weak to firm; Field pH 6.0 to 6.5; Abrupt or clear boundary to;

A2e 0.20 - 0.60 Conspicuously bleached - grey or pale (10YR 6-7/2-3); Coarse sand to loamy coarse sand; Few 2-6 mm sub-angular quartz; Single grain to massive; Dry to moderately moist, very weak to firm; Field pH 6.0; Clear or diffuse boundary to;

A3/B1 0.60 - 0.80 Grey or yellow or pale (10YR 6/2-6 or 7.5YR 7/2); Few to common fine to medium faint to distinct orange mottles; Coarse sand to clayey coarse sand; Few to common 2-6 mm sub-angular quartz; Single grain to massive; Moderately moist to moist, very weak to firm; Field pH 6.0 to 8.0; Clear or diffuse boundary to;

B2 0.80 - 1.00 Grey or pale (10YR 6-7/2 or 7.5YR 7/1); Few to common fine to medium distinct to prominent yellow or orange mottles; Coarse sandy clay to coarse sandy medium clay; Few to common 2-6 mm sub-angular quartz; Moderate 2-10 mm angular blocky or lenticular; Moderately moist to moist, very weak to very firm; Field pH 6.0 to 7.5;

Limit of augering

Number of sites: 24

Name: Skardon (Sd)

Concept: Recent estuarine deposits under mangroves

Classification:

Aust: Arenaceous? Intertidal Hydrosol

GSG: No suitable group

PPF: No provision

Landform: Intertidal flats

Geology: Quaternary coastal alluvium (Qac)

Vegetation: Mangroves

Microrelief: None

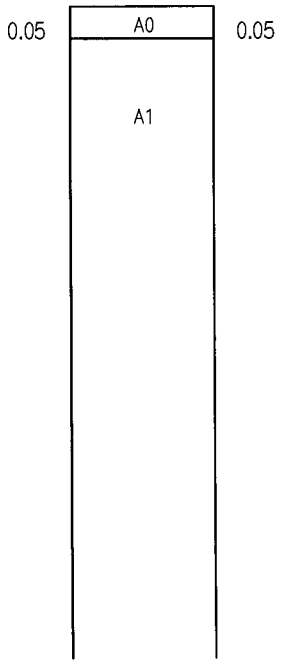
Surface condition: Soft

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C2)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Very poorly drained, moderately permeable (W6m)
Flooding frequency:	Every year (F3)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	0-1%, very unstable (E1u)
Landscape complexity:	Isolated unit (Xi)
Salinity:	Naturally saline (Ss)

Soil Description:



A0 0 - 0.05 Leaf litter (layered); Dark (7.5YR 2/2); Wet, weak; Field pH 6.0; Clear boundary to;

A1 0.05 - 0.30 Dark (10YR 3/1); Sandy loam; Wet, very weak; Field pH 6.0.

Limit of augering

Number of sites: 1

Name: Somerset (Ss)

Concept: Very deep Uniform coastal sands deposited on laterite and other surfaces

Classification:

Aust: Basic Regolithic Orthic Tenosol

GSG: Siliceous Sand/(Red) Earthy sand

PPF: Uc4.22, Uc5.11

Landform: Dunes, beach ridges

Geology: Quaternary younger dunes (Qd), Holocene (Qhm) and Pleistocene (Qpm) beach ridge deposits

Vegetation: *E. tetrodonta* woodlands and tall woodlands, open heaths and dwarf open heaths

Microrelief: None

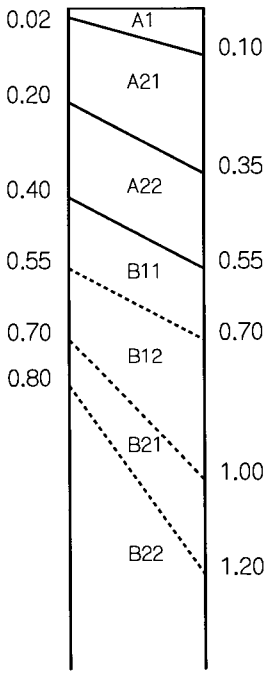
Surface condition: Loose

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C2)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Rapidly drained, highly permeable (W1h)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth control no problem, existing vegetation a problem (Vc1e2)
Erodibility:	1-3%, very unstable (E2u)
Landscape complexity:	Isolated unit (Xi)
Salinity:	Non-saline (Sn)

Soil Description:



A1 0 - 0.05 Dark (10YR 3/1-2 or 7.5YR 3/2); Sand to loamy fine sand; Single grain; Dry, loose; Field pH 6.0; Abrupt or clear boundary to;

A21 0.05 - 0.30 Dark or brown or grey-brown (5YR 3/2 or 7.5YR 4/2-4 or 3/4); Sand to loamy fine sand; Single grain; Dry very weak; Field pH 6.0 to 7.0; Clear or diffuse boundary to;

A22 0.30 - 0.45 Red-brown or brown (5YR 4/4 or 7.5YR 4/3); Sand to loamy fine sand; Single grain; Dry, very weak; Field pH 7.0; Clear or gradual boundary to;

B11 0.45 - 0.65 Red-brown or red (5YR 4/3 or 2.5YR 4/6 or 5YR 3/6); Sand to loamy fine sand; Single grain; Dry, very weak; Field pH 6.0 to 7.0; Diffuse boundary to;

B12 0.65 - 0.75 Red-brown or red (5YR 4/4 or 2.5YR 4/8 or 3/6); Sand to loamy fine sand; Single grain; Dry, very weak; Field pH 6.0 to 7.0; Diffuse boundary to;

B21 0.75 - 0.85 Red-brown or red (5YR 3/3 or 2.5YR 4/6); Sand to loamy fine sand; Single grain; Dry, very weak; Field pH 6.0 to 7.0; Gradual or diffuse boundary to;

B22 0.85 - 1.20 Red-brown or red (5YR 3/3 or 2.5YR 4/6). Loamy sand to loamy fine sand; Single grain; Dry, weak; Field pH 6.0 to 7.0.

Limit of augering

Phase: Ferric phase (SsFp): Abundant 6-20 mm ferruginous nodules in top 0.30 m; Depth to rock 0.45 m. **Number of sites:** 67

Number of sites: 5

Name: Strath (St)

Concept: Very deep Uniform red massive sands formed on residual sands

Classification:

Aust: Basic Regolithic Orthic Tenosol

GSG: (Red) Earthy Sand

PPF: Uc4.22, Uc4.21

Landform: Gently undulating plains to undulating rises

Geology: Tertiary and Quaternary colluvial sands (TQs), Tertiary sandstone (Tf)

Vegetation: *E. tetrodonta* woodlands and tall woodlands

Microrelief: None

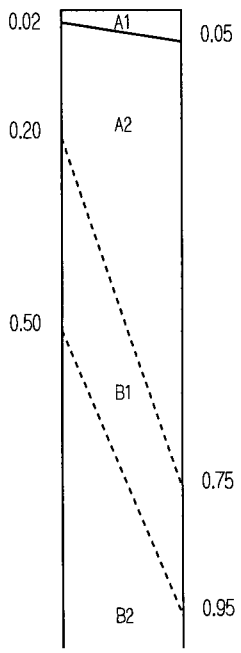
Surface condition: Loose to soft

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1), >35°C, <1500 mm (C3)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Rapidly drained, highly permeable (W1h)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	1-3%, unstable (E2u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)

Soil Description:



A1	0 - 0.03	Dark or brown (2.5Y 3/0 or 7.5YR 3/2 or 2/3); Sand to loamy sand; Single grain; Dry, very weak; Field pH 5.0 to 6.0; Abrupt or clear boundary to;
A2	0.03 - 0.30	Yellow-brown or red-brown (7.5YR 5/4-6 or 5YR 5/4-7); Sand to loamy sand; Single grain to massive; Dry, very weak; Field pH 6.5 to 7.0; Gradual boundary to;
B1	0.30 - 0.75	Red or red-brown (5YR 3/4-6 or 5/6); Loamy sand; Massive; Dry to moderately moist, very weak to weak; Field pH 6.0 to 6.5; Diffuse boundary to;
B2	0.75 - 1.50	Red (2.5YR 4/6-8 or 10R 4/8); Loamy sand to sandy loam; Massive; Moderately moist, weak; Field pH 6.0 to 7.0;
	Limit of augering	

Number of sites: 3

Name: Therese (Tr)

Concept: Deep Uniform red massive sands formed on sandstone

Classification:

Aust: Basic Regolithic Orthic Tenosol

GSG: (Red) Earthy Sand

PPF: Uc4.22

Landform: Gently undulating plains to undulating rises

Geology: Helby Beds, (JKb), Tertiary sandstone (Tf)

Vegetation: *E. tetrodonta* woodlands and tall woodlands

Microrelief: None

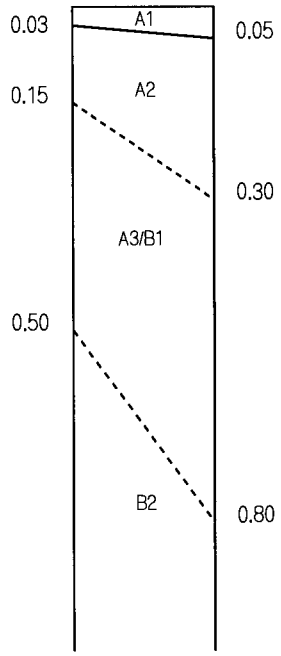
Surface condition: Loose to soft

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, >1500 mm (C1), <35°C, <1500 mm (C2)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, highly permeable (W2h)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	1-3%, unstable (E2u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)

Soil Description:



A1 0 - 0.05 Dark or grey-brown or grey (5YR 3/2 or 7.5YR 4/1 or 10YR 5/2); Sand to loamy sand; Single grain; Dry, loose; Field pH 5.5 to 6.0; Abrupt or clear boundary to;

A2 0.05 - 0.25 Red-brown or yellow-brown (5YR 4/3 or 7.5YR 5/6 or 10YR 5/3); Sand to loamy sand; Single grain; Dry, very weak; Field pH 6.0 to 7.0; Gradual boundary to;

A3/B1 0.25 - 0.70 Red or red-brown or brown (2.5YR 4/6 or 5YR 4/8 or 5/6-8 or 7.5YR 5/4); Sand to loamy sand; Massive; Dry, very weak; Field pH 6.0 to 6.5; Gradual or diffuse boundary to;

B2 0.70 - 1.50 Red or red-brown (10R 4/6 or 2.5YR 4/5-8 or 5YR 5/8); Loamy sand to sandy loam; Massive; Dry to moderately moist, weak; Field pH 7.0 to 7.5;

Limit of augering

Number of sites: 5

Name: Tozer (Tz)

Concept: Deep Duplex non-sodic brown soils formed on acid volcanic hillslopes

Classification:

Aust: Haplic Eutrophic Red Chromosol

GSG: NSG, affin. with Red Podzolic Soil

PPF: Dr4.11, Db3.11

Landform: Rolling to steep low hills

Geology: Janet Ranges Volcanics (Cpj)

Vegetation: Closed forests

Microrelief: None

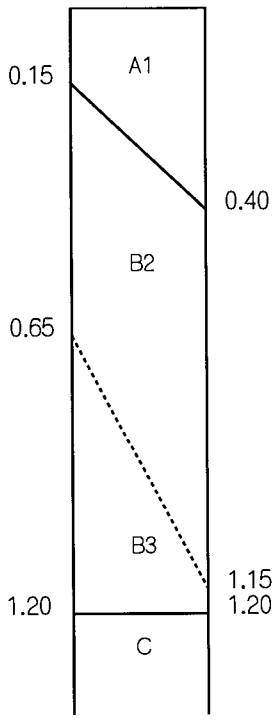
Surface condition: Soft to firm

Surface coarse fragments: Common 60-200 mm sub-rounded rhyolite

Land Use Limitations

Climate:	<35°C, <1500 mm (C2)
Moisture Supply:	80 - 100 mm/m (M3)
Fertility:	3-8 ppm P, <4 ppm SO_4 S (N6)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Rockiness:	60-200 mm, 10-20% (Rc3)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth control no problem, existing vegetation a problem (Vc1e2)
Erodibility:	10-32%, stable (E4s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)

Soil Description:



A1	0 - 0.15	Dark or grey (7.5YR 3/1 or 10YR 5/2); Loamy fine sand to light fine sandy clay loam; Common 60-200 mm sub-angular rhyolite? occasionally present; Moderate 2-5 mm cast; Dry, firm; Field pH 6.0 to 7.0; Gradual boundary to;
A3	0.15 - 0.25	Brown (5YR 6/4); Fine sandy clay loam; Massive; Incomplete description
B2	0.25 - 0.90	Brown or red (7.5YR 4/3 or 2.5YR 4/8); Light medium clay to medium clay; Moderate 5-10 mm sub-angular blocky; Moderately moist, very firm; Field pH 5.5; Gradual boundary to;
B3	0.90 - 1.20	Yellow-brown (7.5YR 5/6); Sandy light clay; Massive; Moderately moist, strong; Field pH 6.0; Clear boundary to;
C		Rock

Number of sites: 2

Name: Victor (Vc)

Concept: Very deep Duplex non-sodic red soils over saline horizons, formed on terraces of major streams and rivers associated with Hodgkinson Formation

Classification:

Aust: Haplic Eutrophic Red Chromosol

GSG: NSG affin. with Non-Calcic Brown Soil

PPF: Dr2.22, Dr3.43, Dr3.42

Landform: Terraced land

Geology: Quaternary alluvia (Qa)

Vegetation: *E. chlorophylla, E. microtheca* or *E. acroleuca* woodlands and open woodlands, *E. tetrodonta* woodlands

Microrelief: None

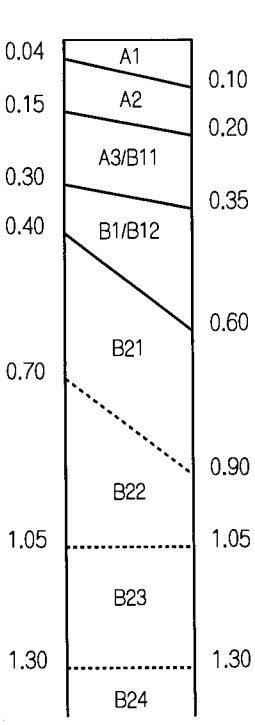
Surface condition: Hardsetting

Surface coarse fragments: None

Soil Description:

Land Use Limitations

Climate:	<35°C, <1500 mm (C1), >35°C, <1500 mm (C3)
Moisture Supply:	100 - 140 mm/m (M2)
Fertility:	<3 ppm P, >4 ppm SO_4 S (N7)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	Less than 1 in 10 years (F1)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	1-3%, unstable (E2u)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Naturally saline (Ss)



A1	0 - 0.04	Dark or occasionally grey (7.5YR or 10YR 3/2 or 4/1); Fine sandy loam to clay loam fine sandy; Massive; Dry, firm to moist, weak; Field pH 7.0 to 8.0; Abrupt or clear boundary to;
A2	0.04 - 0.15	Red-brown or yellow-brown (5YR 4/3-6 or 10YR 6/4); Fine sandy loam to fine sandy clay loam; Massive; Dry firm to moist weak; Field pH 6.0 to 7.5; Clear boundary to;
A3/B11	0.15 - 0.30	Red-brown or brown or occasionally yellow (5YR 3/4 or 4/5-6 or 7.5YR 4/3 or 10YR 6/5); Common fine faint yellow mottles occasionally present; Fine sandy loam heavy to light clay; Massive or weak 2-5 mm sub-angular blocky; Dry to moderately moist, firm to very firm; Field pH 6.0 to 7.5; Clear or gradual to ;
B1/B12	0.30 - 0.50	Red or red-brown or yellow (2.5YR 4/5 or 5YR 3/5 or 4/4 or 10YR 6/5); Common fine faint red mottles; Clay loam fine sandy heavy to light medium clay; Massive to moderate < 2 mm angular blocky; Moderately moist, firm to very firm; Field pH 6.5 to 7.5; Clear or gradual boundary to;
B21	0.50 - 0.85	Red or red-brown (2.5YR 3-4/7 or 5YR 3/6 or 4/4); Many fine distinct yellow mottles; Fine sandy light medium clay to medium heavy clay; Strong 2-5 mm sub-angular to angular blocky; Moderately moist, very firm; Field pH 6.5 to 7.0; Gradual boundary to;
B22	0.85 - 1.05	Red (2.5YR 3/5 or 4/7); Fine sandy light clay to light medium clay silty; Moderate 5-10 mm angular blocky to strong 2-5 mm angular blocky; Dry, strong to moderately moist, very firm; Field pH 7.0; Gradual boundary to;
B23	1.05 - 1.30	Red (2.5YR 4/6 or 5/7); Fine sandy light clay to light medium clay silty; Moderate 5-10 mm angular blocky to strong 2-5 mm angular blocky; Dry, strong to moderately moist, very firm; Field pH 7.0; Gradual boundary to;
B24	1.30 - 1.50	Red or red-brown (2.5YR 5/7 or 5YR 4/6); Fine sandy light clay to medium clay silty; Moderate 2-10 mm angular blocky; Dry, strong to moderately moist, very firm; Field pH 7.0;

Number of sites: 6

Name: Vrilya (Vy)

Concept: Very deep Uniform sands with minimal profile development, formed in foredunes

Classification:

Aust: Siliceous Arenic Rudosol

GSG: Siliceous Sand

PPF: Uc2.2

Landform: Foredunes

Geology: Quaternary younger dunes (Qd), Holocene (Qhm) beach ridge deposits

Vegetation: Bare or herblands

Microrelief: None

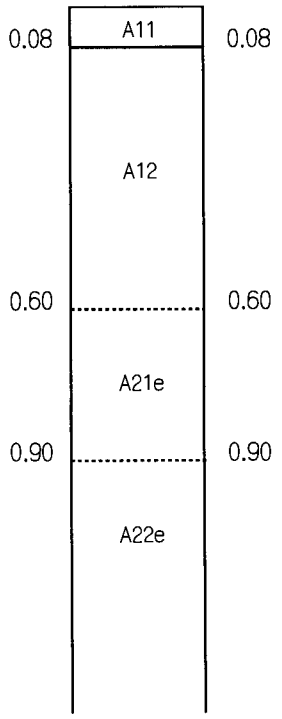
Surface condition: Loose

Surface coarse fragments: None

Soil Description:

Land Use Limitations

Climate:	>35°C, <1500 mm (C3), <35°C, <1500 mm (C2)
Moisture Supply:	< 40 mm/m (M6)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Rapidly drained, highly permeable (W1h)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	No restriction (P0)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	1-3%, very unstable (E2u)
Landscape complexity:	Isolated unit (Xi)
Salinity:	Non-saline (Sn)



Limit of augering

A11	0 - 0.08	Grey (10YR 4/1); Sand; Single grain; Dry, loose; Field pH 6.5; Clear boundary to;
A12	0.08 - 0.60	Dark (10YR 3/2); Sand; Single grain; Dry, loose; Field pH 6.5; Gradual boundary to;
A21e	0.60 - 0.90	Yellow-grey (2.5Y 5/3); Sand; Single grain; Moderately moist, loose; Field pH 7.0; Diffuse boundary to;
A22e	0.90 - 1.20	Yellow-grey (2.5Y 5/3); Sand; Single grain; Moist, loose; Field pH 7.5;

Number of sites: 1

Name: Wakooka (Wk)

Concept: Deep bleached Gradational non-sodic yellow soils formed on alluvial plains derived from greywacke and slate

Classification:

Aust: Bleached-Mottled or Bleached-Manganic or Bleached or Mottled Mesotrophic Yellow Dermosol

GSG: Yellow Podzolic

PPF: Gn3.84, Gn3.04

Landform: Gently undulating alluvial plains

Geology: Quaternary alluvia (Qa) and Pleistocene? and recent colluvia (Czx)

Vegetation: *E. clarksoniana, E. novoguinensis* or *E. polycarpa* woodlands and open woodlands

Microrelief: None

Surface condition: Hardsetting

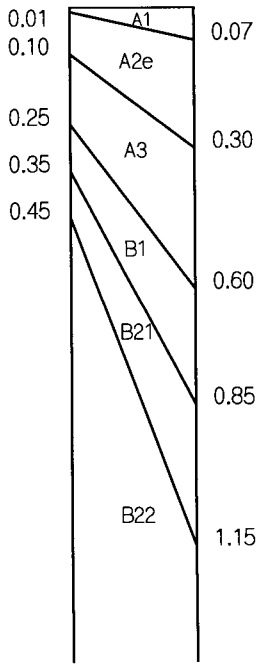
Surface coarse fragments: None

Soil Description:

Land Use Limitations

Climate:	<35°C, >1500 mm (C1), <35°C, <1500 mm (C2)
Moisture Supply:	80 - 100 mm/m (M3)
Fertility:	<3 ppm P, >4 ppm SO_4 S (N7)
Wetness:	Imperfectly drained, slowly to moderately permeable (W4s, W4m)
Flooding frequency:	Every year to 1 in 2-10 years (F3, F2)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth control no problem, existing vegetation no problem (Vc1e1)
Erodibility:	0-1%, stable (E1s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Non-saline (Sn)

Limit of augering
Number of sites: 19



A1 0 - 0.03 Dark or grey or brown (10YR 3-5/1-2 or 4/3); Fine sandy loam to fine sandy clay loam; Massive; Dry, weak to very firm; Field pH 5.5 to 6.5; Abrupt boundary to;

A2e 0.03 - 0.15 Conspicuously bleached - grey or yellow-brown (10YR 5-6/2-3); Few to common fine faint yellow to orange mottles; Fine sandy loam to fine sandy clay loam; Massive; Dry, firm to strong; Field pH 6.0 to 6.5; Clear boundary to;

A3 0.15 - 0.30 Yellow-brown or yellow (10YR 5-6/4-5); Common fine faint to distinct yellow to orange mottles; Fine sandy clay loam to clay loam heavy; Massive; Dry, firm to strong; Very few < 2 mm ferruginous, ferro-manganiferous or manganiferous nodules occasionally present; Field pH 6.0; Clear boundary to;

B1 0.30 - 0.40 Yellow-brown or brown or yellow (10YR or 7.5YR 5/4 or 6/6); Common to many fine faint to distinct yellow to red mottles; Clay loam heavy to light clay; Weak to moderate 2-5 mm angular to sub-angular blocky; Dry, firm to strong; Very few < 2-6 mm ferruginous or ferro-manganiferous or manganiferous nodules occasionally present; Field pH 5.5 to 6.5; Clear or diffuse boundary to;

B21 0.40 - 0.55 Yellow or yellow-brown or yellow-grey (10YR 5/5-6 or 6/4-6 or 2.5Y 6/4-6); Common to many fine faint to distinct red or grey mottles; Light clay; Moderate to strong 2-5 mm sub-angular blocky; Dry, firm to very firm; Very few < 2-6 mm ferruginous or ferro-manganiferous or manganiferous nodules occasionally present; Field pH 5.5 to 6.5; Clear or diffuse boundary to;

B22 0.55 - 1.10 Grey or yellow-brown or yellow or yellow-grey (10YR 5/2-4 or 6/5-6 or 2.5Y 6/3); Common to many fine to medium distinct to prominent red or grey mottles; Light clay to medium clay; Moderate to strong 2-10 mm sub-angular blocky to polyhedral; Moderately moist firm to very firm; Very few to common < 2-6 mm ferruginous or ferro-manganiferous or manganiferous nodules occasionally present; Field pH 6.0;

Name: Weipa (Wp)

Concept: Deep Gradational or Uniform red massive soil with aluminous concretions

Classification:

Aust: Bauxitic Dystrophic Red Kandosol

GSG: Red Earth

PPF: Gn2.14, Gn2.15, Um4.21, Um4.23

Landform: Level to gently undulating plains on plateaux

Geology: Tertiary and Quaternary aluminous laterite (T&Qa)

Vegetation: *E. tetrodonta* woodlands and tall woodlands

Microrelief: None

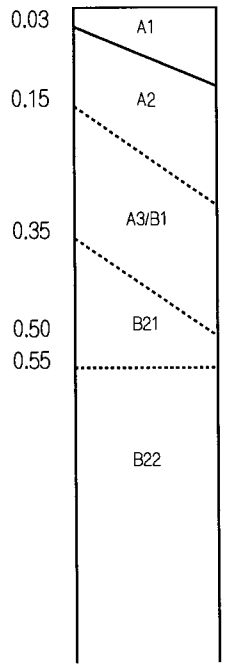
Surface condition: Hardsetting

Surface coarse fragments: Very many 2-6 mm aluminous concretions

Land Use Limitations

Climate:	<35°C, <1500 mm (C1), <35°C, >1500 mm (C2)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Rockiness:	2-6 mm, 20-50% (Rf4)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk inflow zone (Si1)

Soil Description:



Limit of augering

0.12	**A1**	0 - 0.08	Dark or grey or brown or red-brown (10YR 2-4/2; or 7.5YR 4/3-4; or 5YR 4/3); Loam to clay loam heavy; Massive or weak 2-5 mm sub-angular blocky or moderate 2-5 mm cast; Dry firm; Few 2-6 mm medium aluminous to ferruginous concretions; Field pH 6.0 to 7.0; Abrupt or clear boundary to;
0.30	**A2**	0.08 - 0.25	Grey or brown or red-brown (10YR 4/2-4; or 5YR 4/6 or 5/5); Clay loam sandy to clay loam heavy; Massive; Dry, firm; Very few to few 2-6 mm aluminous to ferruginous concretions; Field pH 6.0 to 6.5; Gradual boundary to;
0.50	**A3/B1**	0.25 - 0.35	Red or red-brown or brown (2.5YR 3/8 or 4/5; or 5YR 3/6 or 4/4 or 5/6-8; or 7.5YR 4/6); Sandy clay loam to clay loam; Massive; Dry, firm; Very few to common 6-20 mm aluminous to ferruginous concretions; Field pH 7.0; Gradual or diffuse boundary to;
	B21	0.35 - 0.55	Red or red-brown (2.5YR 3/8 or 4/6-8; or 5YR 4/6 or 5/8); Fine sandy clay loam to clay loam; Massive; Dry, weak to firm; Few to very many 6-20 mm aluminous concretions; Field pH 7.0; Gradual boundary to;
	B22	0.55 - 0.90	Red or red-brown (2.5YR 4/6 or 5YR 5/8); Fine sandy clay loam to light clay; Massive; Dry, weak; Very many 6-20 mm aluminous or ferruginous concretions; Field pH 7.0.

Number of sites: 10

Name: Weymouth (Wm)

Concept: Deep Gradational mottled yellow massive soils on colluvial fans derived from acid plutonic hillslopes

Classification:

Aust: Mottled Mesotrophic Yellow Kandosol

GSG: Yellow Earth

PPF: Gn2.65

Landform: Undulating colluvial plains

Geology: Yam Creek Beds (Czk), Tertiary and Quaternary colluvial sands (TQs)

Vegetation: *E. tetrodonta* woodlands, heath

Microrelief: None

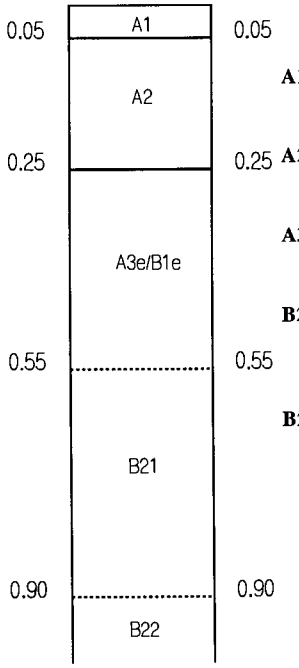
Surface condition: Firm

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C2)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Poorly drained, moderately permeable (W5m)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1) or a problem (Vc2e2)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk outflow zone (So1)

Soil Description:



	Limit of augering	
A1	0 - 0.05	Dark (2.5Y 2/1); Loamy coarse sand; Massive; Dry, weak; Field pH 6.0; Clear boundary to;
A2	0.05 - 0.25	Brown (10YR 4/3); Loamy coarse sand; Massive; Dry, weak; Field pH 6.0; Clear boundary to;
A3e/B1e	0.25 - 0.55	Yellow-grey (2.5Y 6/3); Coarse sandy loam; Massive; Moderately moist, weak; Few 6-20 mm plinthite; Field pH 6.5; Gradual boundary to;
B21	0.55 - 0.90	Yellow (2.5Y 6/5); Common fine prominent orange mottles; Coarse sandy loam; Massive; Moderately moist, weak; Few 6-20 mm plinthite; Field pH 7.5; Gradual boundary to;
B22	0.90 - 1.00	Yellow-grey (2.5Y 6/4); Common fine prominent yellow mottles; Coarse sandy loam; Massive; Moderately moist, weak; Field pH 7.0;

Number of sites: 1

Name: Wheeler (Wl)

Concept: Deep bleached Gradational mottled grey massive soils formed on alluvia within the Rolling Downs Group

Classification:

Aust: Bleached-Manganic or Bleached Mesotrophic Grey Kandosol

GSG: Grey Earth

PPF: Gn2.95, Gn2.94

Landform: Alluvia on gently undulating plains

Geology: Rolling Downs Group (Klr) and Bulimba Formation (KTi)

Vegetation: *E. tetrodonta* woodlands

Microrelief: None

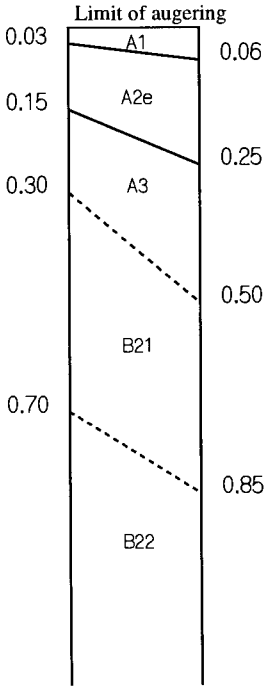
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C1)
Moisture Supply:	80 - 100 mm/m (M3)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Imperfectly drained, moderately permeable (W4m)
Flooding frequency:	1 in 2-10 years (F2)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	0-1%, stable (E1s)
Landscape complexity:	Unit size < 20 ha (X1)
Salinity:	Non-saline (Sn)

Soil Description:



A1 0 - 0.05 Dark or grey (10YR 3-4/1-2 or 5/2); Loamy fine sand to fine sandy clay loam; Massive; Dry, firm to very firm; Field pH 6.0 to 6.5; Abrupt or clear boundary to;

A2e 0.05 - 0.20 Conspicuously bleached - grey or yellow-brown (10YR 5/2-3 or 6/4); Loamy fine sand to fine sandy clay loam; Massive; Dry, weak to firm; Few 2-6 mm manganiferous nodules to very many 2-6 mm ferruginous nodules; Field pH 6.0 to 6.5; Clear boundary to;

A3 0.20 - 0.40 Pale or yellow-brown (10YR or 2.5Y 7/4, or 2.5Y or 10YR 6/3); Fine sandy clay loam; Massive; Dry, weak to firm; Very few to common 2-6 mm manganiferous nodules; Field pH 5.5 to 6.0; Diffuse boundary to;

B21 0.40 - 0.75 Pale (10YR 7/3-4 or 2.5Y 7/4); Common to many fine distinct orange to red mottles; Sandy clay loam to clay loam heavy; Massive; Dry, weak; Few to many 2-6 mm manganiferous or ferruginous nodules; Field pH 6.5; Diffuse boundary to;

B22 0.75 - 1.10 Pale-yellow or pale (2.5Y 7/4 or 8/3 or 10YR 8/4); Common to many fine distinct orange to red mottles; Clay loam to clay loam heavy; Massive; Dry, weak; Common to very many 2-6 mm manganiferous or ferro-manganiferous nodules; Field pH 6.5 to 7.0;

Number of sites: 5

Name: Witchura (Wu)

Concept: Moderately deep Gradational or Uniform red massive soils with ferruginous nodules

Classification:

Aust: Ferric or Haplic Mesotrophic Red Kandosol

GSG: Red Earth

PPF: Gn2.14, 2.12, Um5.52, Um4.12

Landform: Gently undulating rises to rolling low hills

Geology: Tertiary and Quaternary ferruginous laterite (T&Qf)

Vegetation: *E. tetrodonta* woodlands and tall woodlands

Microrelief: None

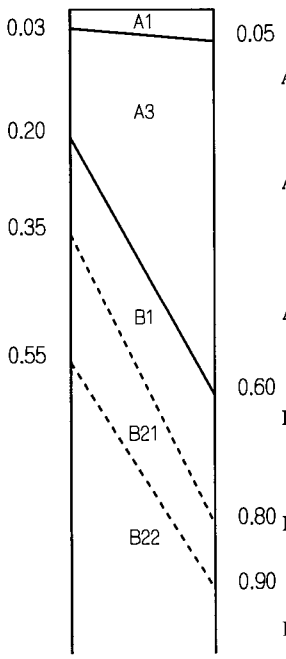
Surface condition: Hardsetting

Surface coarse fragments: Few to abundant < 2-6 mm sub-rounded ferruginous nodules

Land Use Limitations

Climate:	<35°C, <1500 mm (C2), <35°C, >1500 mm (C1)
Moisture Supply:	40 - 60 mm/m (M5)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Well drained, moderately permeable (W2m)
Flooding frequency:	No flooding (F0)
Rockiness:	6-20 mm, 20-50 % (Rm4)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation no problem (Vc2e1)
Erodibility:	3-10%, stable (E3s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk intake zone (Si1)

Soil Description:



Limit of augering

A1	0 - 0.05	Dark (7.5YR 3/1-2); Loamy sand to loam; Massive; Dry, weak to firm; Common to many 2-20 mm ferruginous nodules; Field pH 6.0 to 6.5; Abrupt or clear boundary to;
A2	0.05 - 0.15	(occasionally present) Red-brown or brown or yellow-brown (5YR 4/4 or 7.5YR 4-5/5); Loamy sand to sandy loam; Massive; Dry, weak; Common to many 2-20 mm ferruginous nodules; Field pH 6.0 to 6.5; Gradual boundary to;
A3	0.05 - 0.50	Red-brown or red (5YR 5/6-7 or 2.5YR 3/4); Sandy loam to sandy clay loam; Massive; Dry, firm; Common to many 2-20 mm ferruginous nodules; Field pH 6.0 to 7.0; Clear or gradual boundary to;
B1	0.50 - 0.60	Red or red-brown (2.5YR 4/6 or 5YR 4/3-6); Sandy loam to clay loam sandy; Massive; Dry to moderately moist, very firm; Many 2-20 mm ferruginous nodules; Field pH 6.0 to 7.0; Gradual boundary to.
B21	0.60 - 0.70	Red (2.5YR 3/6 or 4/5-6); Sandy clay loam to clay loam; Massive; Moderately moist, weak; Common to many 2-20 mm ferruginous nodules; Field pH 6.0; Gradual or diffuse boundary to;
B22	0.70 - 1.20	Red (2.5YR 3-4/6); Sandy clay loam to clay loam; Massive; Moderately moist, weak; Common to many 2-20 mm ferruginous nodules; Field pH 6.0 to 7.0;

Variants: Yellow variant (WuYv): As for Wu, but yellow-brown or yellow in B2. **Number of sites:** 2

Number of sites: 8

Name: Yam (Ym)

Concept: Deep Gradational yellow massive soils on colluvial fans developed from acid plutonic hillslopes

Classification:

Aust: Bleached-mottled Mesotrophic Grey or Yellow Kandosol

GSG: Yellow Earth

PPF: Gn2.94

Landform: Gently undulating colluvial plains

Geology: Yam Creek Beds (Czk)

Vegetation: Heath

Microrelief: None

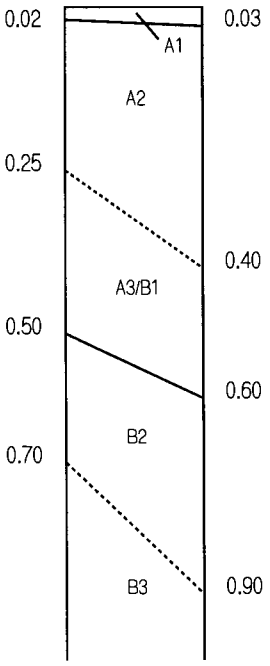
Surface condition: Hardsetting

Surface coarse fragments: None

Land Use Limitations

Climate:	<35°C, <1500 mm (C2)
Moisture Supply:	60 - 80 mm/m (M4)
Fertility:	<3 ppm P, <4 ppm SO_4 S (N8)
Wetness:	Poorly drained, moderately permeable (W5m)
Flooding frequency:	No flooding (F0)
Rockiness:	No rock (R0)
Topography:	No microrelief (T0)
Soil physical condition:	Slightly to moderately adhesive soils, moderate moisture range, moderately hardsetting (P1)
Vegetation factor:	Regrowth poses a problem, existing vegetation a problem (Vc2e2)
Erodibility:	1-3%, stable (E2s)
Landscape complexity:	Unit size > 20 ha (X0)
Salinity:	Low risk outflow zone (So1)

Soil Description:



A1	0 - 0.03	Grey (10YR 4/1-2 or 2.5Y 5-6/1); Sand to loamy sand; Very few 2-6 mm sub-angular quartz; Massive; Dry, firm; Field pH 6.0; Clear boundary to;
A2e	0.03 - 0.30	Conspicuously bleached - pale or grey (10YR 6/1 or 7/2-3 or 8/2); Sand to loamy sand; Few 2-6 mm sub-angular quartz; Massive; Dry, firm; Field pH 6.0; Gradual boundary to;
A3/B1	0.30 - 0.55	Grey or yellow-grey or pale or occasionally yellow (2.5Y 6/2-3 or 7/3 or 6/6); Common fine distinct yellow mottles; Sandy clay loam; Few 2-6 mm sub-angular quartz; Massive; Moderately moist, firm; Field pH 6.5; Clear or gradual boundary to;
B2	0.55 - 0.80	Yellow-grey or pale or yellow-brown (2.5Y 6-7/3 or 10YR 6/3); Many fine prominent yellow mottles and few fine prominent red mottles; Sandy clay loam to clay loam sandy heavy; Few 2-6 mm sub-angular quartz; Massive; Moderately moist, firm; Field pH 6.5; Gradual boundary to;
B3	0.80 - 1.00	Pale or yellow-brown (2.5Y 7/3-4 or 10YR 6/4); Many fine prominent red mottles; Sandy clay loam to sand light clay; Few 2-6 mm sub-angular quartz; Massive; Moderately moist, firm; Field pH 6.5;

Number of sites: 6

APPENDIX 2

MAP REFERENCE ASSOCIATED WITH 1:500 000 SOIL MAP

Dominant Soil		Concept[1]	Great Soil Group[2]	Australian Classification[3]	Landform[4]	Associated soils[5]
1. SOILS ON ACID IGNEOUS ROCKS (ADAMELLITES AND GRANITES)						
1a. Sedentary soils on plains and hillslopes						
(Am)	ALTANMOUI	Moderately deep Uniform brown coarse sands	Earthy Sand	Orthic Tenosol	Hillslopes	Dx, Dr
(Dr)	DROP	Moderately deep Gradational yellow soils	Yellow Earth/ Yellow Podzolic Soil	Yellow Kandosol or Yellow Dermosol	Hillslopes	Dx, Qt, Hs
(Dx)	DIXIE	Deep Uniform grey and yellow coarse sands with a bleached A2 horizon	Earthy Sand	Bleached-Orthic Tenosol	Hillslopes	Dr, Qt
(Hs)	HENDERSON	Moderately deep Duplex non-sodic red soils	Red Podzolic Soil	Red Chromosol	Hillslopes	Dr, Qt
(Oc)	ORCHID	Deep Gradational red structured soils	NSG, affinity with Euchrozem	Red Dermosol	Hillslopes	Qt, Dr
(Pa)	PINNACLE	Deep Gradational grey massive soils with a bleached A2 horizon	NSG	Grey Kandosol	Hillslopes, plains	Dx, Dr, Qt
(Qt)	QUARANTINE	Moderately deep Duplex sodic neutral to alkaline soils with a bleached A2 horizon	Solodic Soil	Grey Sodosol	Footslopes	Dr, Dx, Sv
(Se)	SHEA	Moderately deep Gradational red massive soils	Red Earth	Red Kandosol	Plains, hillslopes	Dr, Qt, Dx, At
1b. Associated colluvial/alluvial fans						
(At)	ATTACK	Deep Gradational mottled yellow massive soils with a bleached A2 horizon	Yellow Earth	Yellow Kandosol	Plains	Dx, Se, Gk
(Gk)	GEIKE	Deep Gradational mottled grey massive soils	NSG	Grey Kandosol	Plains	At
(Sv)	SILVER	Deep Duplex sodic soils with moderately deep coarse sandy A horizons with a bleached A2 horizon	Solodic Soil	Redoxic Hydrosol	Plains	Dx, Qt, Lv, Dr
(Wm)	WEYMOUTH	Deep Gradational mottled yellow massive soils	Yellow Earth	Yellow Kandosol	Plains	Dr, Gp, Dx, Sv
(Ym)	YAM	Deep Gradational yellow massive soils	Yellow Earth	Grey or Yellow Kandosol	Plains	Gp, Gv
2. SOILS ON ACID VOLCANIC ROCKS (RHYOLITE)						
2a. Sedentary soils on hillslopes						
(Dl)	DEL	Moderately deep Duplex sodic mottled grey soils with a bleached A2 horizon	Solodic Soil/Soloth	Grey Sodosol	Footslopes	Er, Gw
(Er)	EBORAC	Very shallow Uniform brown soils with a bleached A2 horizon	NSG, affinity with Lithosol	Bleached-Leptic Tenosol	Hillslopes	Tz, Gw, Dl
(Gw)	GALLOWAY	Moderately deep Gradational or Uniform red massive soils	Red Earth	Red Kandosol	Hillslopes	Er, Dl, Am
(Tz)	TOZER	Deep Duplex non-sodic brown soils	NSG, affinity with Red Podzolic Soil	Red Chromosol	Hillslopes	Gw, Er
2b. Associated colluvial/alluvial fans						
(Gp)	GAP	Deep Gradational yellow soils	Yellow Podzolic Soil	Oxyaquic Hydrosol	Plains	Dr, Wm, Ym, Gv
3. SOILS ON INTERMEDIATE AND BASIC VOLCANIC ROCKS (DOLERITE AND BASALT)						
Sedentary soils on plains and hillslopes						
(Bl)	BULL	Deep Uniform or occasionally Gradational non-cracking brown clays	Xanthozem	Brown Dermosol	Plains, hillslopes	Br, Nm, Gs
(Br)	BURN	Deep Uniform red structured clays with nodules (F or M)	Euchrozem/ Krasnozem	Red Ferrosol	Plains, hillslopes	Bl, Nm
(Ed)	ENDEAVOUR	Deep Gradational or occasionally Uniform red structured clays	Krasnozem/ Euchrozem	Red Ferrosol	Plains, hillslopes	Bl
(Nm)	NORMAN	Moderately deep Uniform cracking dark cracking clays	Black Earth	Black or Brown Vertosol	Footslopes	Bl, Br
(NmSp)	NORMAN SHALLOW PHASE	As for Nm, but shallow.	Black Earth	Black or Brown Vertosol	Footslopes	Nm, Bl, Br
(Rm)	RAYMOND	Moderately deep Gradational red clay soils	Red Podzolic Soil	Red Dermosol	Plains, hillslopes	Hv, Gl

4. SOILS ON METAMORPHIC ROCKS

4a. Sedentary soils on plains and hillslopes

Coen and Yambo Inliers (schist, gneiss, amphibolite, quartzite, greenstone)

(Cb)	CROSBIE	Moderately deep Uniform red structured clays	NSG, affin. with Euchrozem	Red Dermosol	Plains, hillslopes	Ps, Pc, Hv
(Cl)	CHLORY	Moderately deep Duplex sodic brown soils	Solodic Soil	Brown Sodosol	Hillslopes	Gl, Pl, Lk, Pc, Ps
(Gl)	GAIL	Shallow Gradational yellow massive soils	Yellow Earth	Yellow Kandosol	Hillslopes	Pc, Ps, Lk, Pl
(Hv)	HAVEN	Moderately deep Gradational yellow or brown massive soils with nodules (F)	Yellow Earth	Yellow Kandosol	Hillslopes, plains	Rm, Pl, Cl
(Lk)	LUKIN	Deep Duplex non-sodic red soils	Red Podzolic Soil	Red Chromosol	Hillslopes, plains	Gl, Pc, Pl, Cl
(Lm)	LAMOND	Deep Gradational brown structured soils	Xanthozem	Brown Dermosol	Hillslopes	Dr, Hs
(Pc)	PACK	Shallow Gradational or Uniform red massive soils	Red Earth	Red or Brown Kandosol	Hillslopes	Ps, Gl, Lk, Pl
(Pl)	POLL	Very shallow Uniform brown soils	Lithosol	Orthic Tenosol	Hillcrests, hill-slopes	Gl, Pc, Hv
(Ps)	PACKSADDLE	Shallow Gradational brown structured soils	Xanthozem	Brown Dermosol	Footslopes	Pc, Cb, Gl

Hodgkinson and Chillagoe Formation (greywacke, slate)

(Ck)	COOK	Moderately deep Duplex non-sodic red soils	Red Podzolic Soil	Red Chromosol	Hillslopes	Jn, Rl
(Ek)	EYKIN	Moderately deep Duplex sodic grey soils with a bleached A2 horizon	Solodic Soil	Grey Sodosol	Hillslopes	Jn, Hg
(Fl)	FAIRLIGHT	Moderately deep Gradational red structured soils	Terra Rossa	Red Dermosol	Hillslopes	Vc, Wc
(Hg)	HODGE	Very shallow to shallow Uniform or Gradational rocky brown soils with a bleached A2 horizon	Lithosol	Bleached-Leptic Tenosol or Brown Kandosol	Hillslopes, hillcrests	Jn, Ek, Gs
(Jn)	JEANNIE	Moderately deep Gradational or Uniform yellow soils	Yellow Earth/ Yellow Podzolic Soil	Yellow Dermosol or Brown Kandosol	Hillslopes	Ek, Hg, Wc
(Rl)	RULE	Deep Gradational or Uniform structured red clays	NSG	Red Dermosol	Hillslopes	Jn, Ck

4b. Associated colluvial plains and pediments

Hodgkinson Formation (greywacke, slate)

(Gs)	GIBSON	Deep Duplex sodic yellow or grey soils	Soloth/Solodic Soil	Yellow Sodosol or Redoxic Hydrosol	Footslopes	Kj, Jn, Ga
(Kj)	KINGJACK	Moderately deep Gradational non-sodic yellow soils	Yellow Podzolic Soil	Yellow Dermosol	Footslopes	Gs, Jn, Ar

5. SOILS OF THE ROLLING DOWNS GROUP (SILTSTONE, CLAYSTONE) AND LATERISED BULIMBA FORMATION (QUARTZOSE SANDSTONE)

5a. Sedentary soils on deeply weathered plateaus and remnants

(Ad)	ANDOOM	Very deep Uniform or Gradational yellow massive soils with concretions (A)	Yellow Earth	Yellow Kandosol	Plains, hillslopes	Wp, Mp
(Bt)	BERTIE	Deep Gradational or Uniform red massive soils with nodules (F)	Red Earth	Red Kandosol	Hillslopes, hill-crests	Sp, Ld
(Rb)	ROKEBY	Moderately deep Gradational red or yellow massive soils with ferruginized coarse fragments	Red or Yellow Earth	Red or Yellow Kandosol	Hillslopes	Bv, Bt, Wc
(Sp)	SCORPION	Deep Gradational or Uniform yellow massive soils with nodules (F, N, M)	Yellow Earth	Yellow Kandosol	Hillslopes,	Bt, Ld, Bv
(Wp)	WEIPA	Deep Gradational or Uniform red massive soils with concretions (A)	Red Earth	Red Kandosol	Plains	Ad, Mp

5b. Sedentary soils on level plains to undulating rises on weathered rock

(Bv)	BATAVIA	Deep Gradational mottled yellow soils with nodules (F, N, M)	Yellow Podzolic Soil	Yellow Dermosol	Hillslopes, plains	Ml, Ld, Pn, Sp, Bt, Hk
(BvRp)	BATAVIA ROCKY PHASE	Moderately deep Uniform soils with few grading to many coarse fragments	NSG, affin. with Yellow Podzolic Soil	Brown Dermosol	Hillslopes, hill-crests	Bv, Ml
(Ld)	LYDIA	Deep Gradational or Duplex mottled grey soils with a bleached A2 horizon and nodules (M, N, F)	Gleyed Podzolic Soil	Grey Dermosol or Redoxic Hydrosol	Plains, hillslopes	Bv, Sp, Hk

(LdRp)	LYDIA ROCKY PHASE	As for Ld, many ferruginized c.f. throughout	Gleyed Podzolic Soil	Grey Dermosol or Redoxic Hydrosol	Plains	Ld, Hk
(Ml)	MYALL	Deep Uniform or Gradational mottled yellow structured clays	Xanthozem	Yellow Dermosol	Plains, hillslopes	Pn, Bv, Hk, Sp, Cx
(Pn)	PICANNINNY	Deep Uniform cracking brown or grey structured clays	Brown Clay	Brown or GreyVertosol	Plains, hillslopes	Ml, Bv

6. SOILS ON SANDSTONE

6a. Sedentary soils on plains and hillslopes

(Ar)	AUDAER	Moderately deep Uniform mottled yellow massive soils	Yellow Earth	Yellow Kandosol	Hillslopes, foot-slopes	Wc, Jn, Bb
(Cm)	CAMP	Very shallow rocky Uniform sandy soils with a bleached A2 horizon	Lithosol	Bleached-Leptic Tenosol	Hillslopes, hillcrests	Dt, Tr, Em, Fd
(CmEv)	CAMP RED VARIANT	As for Wc but red-brown, and no A2 horizon	Lithosol	Orthic Tenosol	Hillslopes, hillcrests	Wc, Kl, Em
(Dt)[6]	DEIGHTON	Deep Uniform yellow massive sands	Earthy Sand	Bleached-Orthic Tenosol	Hillslopes, plains	Sh, Gg, Tr, St, Hn, Ct, Dx, GgRp
(DtCp)	DEIGHTON COARSE PHASE	As for Dt, but coarse throughout	Earthy Sand	Bleached-Orthic Tenosol	Hillslopes, plains	
(DtRp)	DEIGHTON ROCKY PHASE	As for Dt, but few, grading to common coarse fragments	Earthy Sand	Bleached-Orthic Tenosol	Hillslopes, plains	Dx, GgRp
(Em)	EMMA	Deep Gradational massive red soils	Red Earth	Red Kandosol	Plains, hillslopes	Hm, Jd, Gv, Wc, Gg, Dt, Tr
(Fd)	FORD	Moderately deep Gradational grey massive soils with a bleached A2 horizon and common coarse fragments throughout	NSG	Grey Kandosol	Hillslopes, footslopes	Wc
(Hm)	HARMER	Deep Gradational yellow massive soils with a bleached A2 horizon	Yellow Earth	Yellow Kandosol	Plains, hillslopes	Jd, Em, Gv Wc, Gg
(Ib)	ISABELLA	Deep Gradational red massive soils influenced by basalt	Red Earth	Red Kandosol	Plains, hillslopes	Em, Ed
(Jd)	JARDINE	Deep Uniform yellow massive sands with a bleached A2 horizon	Earthy Sand	Bleached-Orthic Tenosol	Footslopes, hillslopes	Gv, Hm, Em
(Tr)	THERESE	Deep Uniform red massive sands	Earthy Sand	Orthic Tenosol	Hillslopes, plains	Dt, Wc, Em

6b. Drainage depressions and associated alluvia

(Gv)	GREVIL	Deep Uniform sand over coffee rock, with a bleached A2 horizon	Podzol	Semiaquic Podosol	Drainage depress-ions, footslopes	Jd, Hm, Em
(GvCp)	GREVIL	As for Gv, but coarse throughout	Podzol	Semiaquic Podosol	Footslopes, plains	

7. SOILS ON DEEP REMNANT SANDS OF A FORMER SANDSTONE SURFACE

7a. Plains and hillslopes

(Bm)	BROM	Deep Gradational or Uniform mottled grey massive soils	NSG	Grey Kandosol	Hillslopes, plains	Sh, Hn, Mp, Gg
(BmCp)	BROM COARSE PHASE	As for Bm, but coarse throughout	NSG	Grey Kandosol	Plains, hillslopes	Bb, Sv
(Cr)	CLARK	Deep Gradational yellow massive soils with a bleached A2 horizon and nodules (F)	Yellow Earth	Yellow Kandosol	Hillslopes, plains	Hn, Dt, Hr, Ct, Bm, Mp
(CrCp)	CLARK COARSE PHASE	As for Shallow, but coarse throughout	Yellow Earth	Yellow Kandosol	Hillslopes	Sv, Qt
(Kl)	KOOL	Deep Uniform red massive soils	Red Earth	Red Kandosol	Plains, hillslopes	Sh, Hr, Hk, Em
(Kb)	KIMBA	Very deep Gradational massive red soils with a sandy surface	Red Earth	Red Kandosol	Plains, hillslopes	Sh, St, Kl, Wu, Hn, Gg, Dt
(KbRp)	KIMBA ROCKY PHASE	As for Hr, few, grading to many coarse fragments	Red Earth	Red Kandosol	Hillslopes	Vc
(St)	STRATH	Very deep Uniform red massive sands	Earthy Sand	Orthic Tenosol	Plains, hillslopes	Dt, Hr, Hn, Gg, Bb
(Wu)	WITCHURA	Moderately deep Gradational or Uniform red massive soils with nodules (F)	Red Earth	Red Kandosol	Hillslopes, plains	WuYv, Em, Sh
(WuYv)	WITCHURA YELLOW VARIANT	As for Wu, but yellow	Yellow Earth	Yellow Kandosol	Hillslopes, plains	Wu, Sh, Em

7b. Drainage depressions

(Bb)	BIMBUS	Deep Uniform sands over coffee rock with a bleached A2 horizon	Podzol	Semiaquic Podosol or Bleached Tenosol	Footslopes, drainage depressions	Hn, Dt, Ct, Sh
(Ct)	CITRI	Deep Duplex sodic soils with a very shallow bleached A2 horizon	Solodic Soil/Solodized Solonetz	Redoxic or Oxy-aquic Hydrosol	Drainage depressions	Hn, Gg, Sh, Mp
(CtCp)	CITRI COARSE PHASE	As for Ct, but coarse throughout	Solodic Soil/Solodized Solonetz	Redoxic or Oxy-aquic Hydrosol	Drainage depressions	Hn, Gg, Dx
(Gg)	GINGER	Deep Uniform grey massive sands with a bleached A2 horizon	Earthy Sand	Redoxic Hydrosol	Footslopes, drainage depressions	Bb, Hn, Dt, Ct
(GgRp)	GINGER ROCKY PHASE	As for Gg, common coarse fragments throughout	Earthy Sand	Redoxic Hydrosol	Hillslopes	Dt, Dx, DtRp
(Hn)	HANN	Deep Duplex, frequently sodic soils with a moderately deep bleached A2 horizon	Soloth/Gleyed Podzolic Soil	Redoxic Hydrosol	Drainage depressions,foot-slopes	Ct, Gg, Dt, Sh

8. SOILS OF THE ALLUVIAL PLAINS

8a. Plains

(Ab)	ANTBED	Deep Gradational or occasionally Duplex sodic mottled grey soils	Solodic Soil	Redoxic Hydrosol	Plains	Hn, Mc, Ae, Bn, Kd, Mp
(AbAv)	ANTBED ACID VARIANT	As for Ab, but acid	Soloth	Redoxic Hydrosol	Plains	Ab, Kd, Mc
(Bn)	BEND	Deep Gradational or Uniform grey or yellow-brown silty soils	NSG, affinity with Yellow Earth/Gleyed Podzolic Soil	Grey or Brown Dermosol or Kandosol	Plains	Kd, Mc, Ab
(Ga)	GREENANT	Deep Duplex sodic acid to alkaline yellow soils with a bleached A2 horizon	Solodic Soil/Soloth	Yellow, Grey, or Brown Sodosol or Redoxic Hydrosol	Plains	Wk, Vc, Gs
(Kd)	KENNEDY	Very deep Uniform or occasionally Gradational massive surfaced or cracking mottled grey clays	Grey Clay/NSG	Redoxic or Oxy-aquic Hydrosol or Grey or Aquic Vertosol	Plains	Mc, Mn, Bn, Ab
(LRC)	LOCKHART RIVER COMPLEX	Complex unit of alluvia, dominated by Kd, Ln, Mh, Lv		Mostly Hydrosols	Plains, levees, terraces	Sv, Gg
(Ol)	OLIVE	Deep Gradational mottled grey soils with a bleached A2 horizon	Gleyed Podzolic Soil/NSG	Redoxic Hydrosol	Plains	Sh, Hn
(Wk)	WAKOOKA	Deep Gradational non-sodic yellow soils with a bleached A2 horizon	Yellow Podzolic Soil	Yellow Dermosol	Plains	Ga, Kj

8b. Levees, terraces and prior streams

(Cx)	COX	Deep Uniform or Gradational red massive soils with nodules (F, N, M)	Red Earth	Red Kandosol	Terraces	Mg, Wl
(Ln)	LIONS	Deep Gradational grey massive soils	Yellow Earth/NSG	Brown Dermosol or Oxyaquic Hydrosol	Terraces, levees	Bn, Rl
(Lv)	LIVIS	Deep Uniform yellow-brown or brown coarse sands	Earthy Sand	Bleache-Orthic or Bleached Tenosol	Prior streams, levees	Sv, Kd, Mc
(Mc)	MITCHELL	Deep Uniform or Gradational yellow, brown or red massive soils	Yellow or Red Earth	Brown or Red Kandosol	Terraces	Ae, Ab
(Mg)	MOONLIGHT	Deep Gradational yellow massive soils with a bleached A2 horizon and nodules (M, F)	Yellow Earth	Yellow Kandosol	Terraces	Cx, Wl
(Mh)	MOREHEAD	Deep brown recent sandy alluvia	Alluvial Soil	Stratic Rudosol	Levees	W, Mc, Vc
(Mk)	MERKUNGA	Deep Gradational or occasionally Duplex mottled grey soils with a bleached A2 horizon and nodules (M)	Gleyed Podzolic Soil	Redoxic Hydrosol or Mesotrophic Dermosol	Terraces, levees	Wl, Mg, Cx, Ae
(Vc)	VICTOR	Very deep Duplex non-sodic red soils over saline structured mottled clay horizons	NSG affin with Non-Calcic Brown Soil	Red Chromosol	Terraces	Ga, Mc, Ae
(Wl)	WHEELER	Deep Gradational mottled grey massive soils with a bleached A2 horizon and nodules (M, N)	NSG	Grey Kandosol	Terraces	Mg, Cx

9. SOILS OF THE SWAMPS

(Hk)	HESKET	Deep Gradational mottled grey soils with a bleached A2 horizon and nodules (F)	Gleyed Podzolic Soil	Redoxic Hydrosol	Swamps, drainage depressions	Ld, Bv, Ml
(Mp)	MAPOON	Deep Duplex or Gradational soils with a dark loamy surface over a mottled grey clay	Humic Gley	Redoxic Hydrosol	Swamps, drainage depressions	Wp,Ad, Kd, Ab

10. SOILS OF THE COASTAL MARGIN

10a. Beach ridge and dune deposits

(Cv)	CARAVAN	Deep to very deep Uniform coloured sands	Earthy Sand	Bleached-Orthic Tenosol	Beach ridges	Mn, Vy
(CvCp)	CARAVAN COARSE PHASE	As for Cv, coarse throughout	Earthy Sand	Bleached-Orthic or Orthic Tenosol	Beach ridges	Mn
(CvDp)	CARAVAN DEEP PHASE	As for Cv, moderately deep A horizon	Earthy Sand	Bleached-Orthic Tenosol	Beach ridges	Mn
(Db)	DOUGHBOY	Very deep Uniform sands over coffee rock and occasionally orstein, with a bleached A2 horizon	Podzol	Semiaquic Podosol	Beach ridges, dunes	Vy, Dn
(Dn)	DAUNT	Giant Uniform sands over orstein with a bleached A2 horizon	Giant Podzol	Aeric Podosol	Dunes, longitudinal dunes	Db, W
(Ss)	SOMERSET	Very deep Uniform sands deposited on laterite and other surfaces	Earthy Sand	Orthic Tenosol	Beach ridges, dunes	Db
(SsFp)	SOMERSET FERRIC PHASE	As for Ss, abundant nodules (F)	Earthy Sand	Orthic Tenosol	Dunes	Ss
(Vy)	VRILYA	Deep Uniform sands with minimal profile development	Siliceous Sand	Arenic Rudosol	Foredunes	Db, Cv

10b. Estuarine and near coastal plains

(Go)	GEORGE	Moderately deep Uniform saline mottled clays	Solonchak	Supratidal Hydrosol	Tidal flats,playas	Sd, Ns, Mn
(Mn)	MARINA	Very deep Uniform frequently cracking saline grey clays	Grey Clay	Aquic or Grey Vertosol	Plains, tidal flats	Ns, Sd, Go, Kd
(Ns)	NASSAU	Moderately deep Duplex saline grey soils	Soloth	Hypersalic Hydrosol	Plains, playas, tidal flats	Go, Mn
(Sd)	SKARDON	Recent estuarine deposits under mangroves	NSG	Intertidal Hydrosol	Tidal flats, estuaries	Go, Mn

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1 Explanation of terms used in Concept

The following are definitions the terminology used in the concept statements. All other terms not described below are taken from McDonald *et al.* (1990.)

Example

Hk	Hesket	Deep[i] Gradational[ii] mottled grey soils with a bleached A2 horizon[iii] and nodules (F)[iv]	Gleyed Podzolic Soil	Redoxic Hydrosol	Swamps, drainage depressions	Ld, Bv, Ml

i Depth of solum (taken from Isbell, 1993)

Very shallow	<0.25 m
Shallow	0.25 - <0.25 m
Moderately deep	0.5 - <1.0 m
Deep	1.0 - <1.5 m
Very deep	1.5 - 5.0 m
Giant	>5.0 m

ii Profile texture trend (taken from Northcote, 1979)

Uniform	- profiles in which there is little, if any, change in texture with increasing depth
Gradational	- profiles in which the texture gradually becomes finer (more clayey), with increasing depth, such that there is a difference in texture between the upper and lower horizons
Duplex	- profiles with a marked texture increase between the upper an lower horizons

iii Horizonation (soil layers)

A1	- horizon at or near the soil surface with some accumulation of organic matter
A2	- horizon having, either alone or in combination, less organic matter, sesquioxides or silicate clay than the adjacent horizons. It is usually differentiated by its paler colour.

iv Segregations

A	- aluminous (bauxitic) nodules or concretions
F	- ferruginous nodules
M	- manganiferous nodules
N	- ferro-manganiferous nodules

2 Great Soil Group is derived from Stace *et al.* (1968)
NSG indicates "No Suitable Group"

3 Australian Soil Classification is derived from Isbell (1993). Only Suborder and Order are indicated.

4 Landform element terminology is derived from McDonald *et al.* (1990)

5 Associated soils are those soils most commonly occuring in conjunction with a given soil type. Although a particular soil e.g Dx, may be associated with another soil, e.g Am, it does not automically follow that Am is associated with Dx, as other soils e.g Dr, Qt, may occur mre often in conjunction with Dx.

6 Dt also occurs on 7. SOILS ON DEEP REMNANT SANDS OF A FORMER SANDSTONE SURFACE

APPENDIX 3

BROAD SOIL CATEGORIES BASED ON AUSTRALIAN CLASSIFICATION

Australian Classification (Isbell, 1993)	Percent of CYP	Soil types
Rudosols	0.16	Mh, Vy
Tenosols <1.0 m deep	6.03	Am, Cm, CmEv, Er, Hg, Pl, SsFp
Tenosols >1.0 m deep	7.90	Cv, CvCp, CvDp, Dt, DtCp, DtRp, Dx, Jd, Lv, Ss, SsFp, St, Tr
Podosols <5.0 m deep	1.90	Bb, Db, Gv, GvCp
Podosols >5.0 m deep	1.20	Dn
Kandosols <1.0 m deep	3.53	Ar, Fd, Gl, Gw, Hv, Pc, Rb, Se, Wu, WuYv
Kandosols >1.0 m deep	38.13	Ad, At, Bm, BmCp, Bt, Cr, CrCp, Cx, Em, Gk, Hm, Ib, Kb, KbRp, Kl, Mc, Mg, Pa, Sp, Wl, Wm, Wp, Ym
Dermosols <1.0 m deep	6.80	BvRp, Cb, Dr, Fl, Jn, Kj, Ps, Rm
Dermosols >1.0 m deep	10.63	Bl, Bn, Bv, Ld, , Lm, Ln, Ml, Oc, Rl, Wk
Ferrosols	0.32	Br, Ed
Vertosols	5.56	Kd, Mn, Nm, NmSp, Pn
Chromosols <1.0 m deep	0.32	Ck, Hs
Chromosols >1.0 m deep	0.51	Lk, Tz, Vc
Sodosols <1.0 m deep	1.48	Cl, Dl, Ek, Qt
Sodosols >1.0 m deep	0.92	Ga, Gs
Hydrosols	14.56	Ab, AbAv, Ct, CtCp, Gg, GgRp, Go, Gp, Hn, Hk, LdRp, LRC, Mk, Mp, Ns, Ol, Sd, Sv

APPENDIX 4

CHEMICAL ANALYSES

Explanatory notes

This appendix contains analytical data derived from two sources:

- Queensland Department of Primary Industries (QDPI)
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)[1]

Consequently, there is some disparity in both format of the results, and the analytical methods used. Descriptions of the analytical methods used on the QDPI samples can be found in Baker and Eldershaw (1993).

The CSIRO (T) sites have been sampled at 10 cm intervals. Codes used in the mineralogy sections are as follows:

Gt	Goethite
Il	Illite
Is	Interstratified clays
Ka	Kaolin
Qz	Quartz

The analyses are listed in alphabetical order, with regards to the soil name.

[1] These sites were generously provided by R.F Isbell, and the CSIRO

SOIL TYPE: ***Andoom* (Ad)**
SITE NO: 87
A.M.G. REFERENCE: 12 39 38 S 142 05 29 E
SUBSTRATE MATERIAL: Laterised sandstone (Aurukun Surface)
SLOPE: 0 %
GREAT SOIL GROUP: Yellow earth LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Um4.23 LANDFORM PATTERN TYPE: level plain <9m <1%
AUSTRALIAN SOIL CLASSIFICATION: Bauxitic Dystrophic Yellow/Red Kandosol
STRUCTURAL FORM: Tall open forest
DOMINANT SPECIES: *Eucalyptus tetrodonta, Eucalyptus nesophila, Heteropogon triticeus*

CONDITION OF SURFACE SOIL WHEN DRY: hardsetting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .05 m	Dark greyish yellow (2.5Y5/2); clay loam, sandy; massive parting to moderate 2-5mm cast; dry; very firm; few medium aluminous concretions. abrupt to-
A2	.05 to .18 m	Dull yellow (2.5Y6/3); clay loam, sandy; dry; very firm; few medium aluminous concretions. gradual to -
B1	.18 to .65 m	Bright yellowish brown (10YR7/5); sandy clay loam; massive; dry; moderately firm; few medium aluminous concretions. diffuse to-
B21	.65 to .85 m	Bright yellowish brown (10YR7/6); sandy clay loam; dry; many coarse aluminous concretions. diffuse to -
B22	.85 to 1.20 m	Orange (5YR6/6); many fine distinct red mottles; sandy clay loam; dry; very many medium aluminous concretions.

Depth	1:5 Soil/Water			Particle Size			pH 8.5 Cations				Total Elements			Moistures		Disp.Ratio		Exch ECEC		pH
	pH	EC	Cl	CS	FS	S C	Ca	Mg	Na	K	P	K	S	ADM 33* 1500*		R1	R2	Al	Acid	$CaCl_2$
metres		` dS/m @40°C	% 105°C	% @ 105° C			m.eq/100g @ 105° C				% @ 80° C			% @ 105° C		@ 40° C		m.eq/100g @ 105° C		@40°C
B 0.10	6.1	.02	.001																	5.0
0.10	6.0	.02	.001	45	24	1 29					.022	.021	.035	1.4	10	.32				5.3
0.30	6.0	.01	.001	40	25	3 33					.014	.017	.031	1.2	9	.01				5.5
0.60	5.7	.01	.001	36	22	3 40					.014	.022	.033	1.5	11	.01				5.6
0.90	5.7	.01	.001	36	24	3 36					.018	.026	.035	1.5	11	.01				5.6
1.20	5.9	.01	.001	41	25	4 29					.02	.029	.031	1.3						5.9

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr		DTPA-extr.				Extractable	P	Aqueous Cations			
metres	(W&B) % @105C	% @ 105C	Acid Bicarb mg/kg @ 105C	K meq% @ 105C	K mg/kg @ 105C	P	Fe mg/kg @ 105C	Mn	Cu	Zn	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC m.eq/100g @ 105C	Ca	Mg	Na	K
B 0.10	1.5	.05	2	.05			15	16	.05	.09	13						
0.10											13		1	.64	.67	.08	.04
0.30											51		1	.24	.64	.07	.01
0.60											87		1	.17	.90	.09	.01
0.90											83		1	0.2	.77	.08	.01
1.20											72		1	.19	.67	.06	.01

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Antbed* (Ab)**
SITE NO: 882
A.M.G. REFERENCE: 14 46 57 S 142 28 00 E
SUBSTRATE MATERIAL: Alluvia
SLOPE: 0 %
GREAT SOIL GROUP: No suitable group. Affinities with solodic LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Gn3.06 LANDFORM PATTERN TYPE: level plain <9m <1%
AUSTRALIAN SOIL CLASSIFICATION: Eutrophic Dermosolic Redoxic Hydrosol
STRUCTURAL FORM: Isolated trees
DOMINANT SPECIES: *Melaleuca viridiflora, Sorghum plumosum*
SURFACE COARSE FRAGMENTS: Few medium subrounded quartz pebbles

CONDITION OF SURFACE SOIL WHEN DRY: hardsetting, periodic cracking

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .03 m	Brownish grey (10YR4/1); Light clay silty; massive; dry; moderately strong. abrupt to-
A2e	.03 to .15 m	Greyish yellow-brown (10YR5/2); many fine distinct orange mottles; Light clay silty; massive; dry; moderately strong. clear to-
B1	.15 to .30 m	Dull yellowish brown (10YR5/3); few fine distinct grey mottles; Light medium clay silty; weak 2-5mm angular blocky; moderately moist; moderately firm. clear to-
B21	.30 to .45 m	Brownish grey (10YR5/1); common fine distinct orange mottles, few fine distinct brown mottles; medium clay; moderate 2-5mm angular blocky; moderately moist; moderately firm. gradual to-
B22	.45 to .60 m	Greyish yellow-brown (10YR5/2); common fine distinct grey mottles, few fine distinct orange mottles; medium heavy clay; strong 2-5mm angular blocky; moderately moist; very firm. gradual to-
B23	.60 to .95 m	Brownish grey (10YR5/0); many fine distinct orange mottles; sandy medium clay; strong 5-10mm angular blocky; moderately moist; very firm. diffuse to-
B24	.95 to 1.20 m	Dull yellow (2.5Y6/5); common fine distinct grey mottles; Medium heavy clay sandy; strong 2-5mm angular blocky; moderately moist; very firm. diffuse to-
B25	1.20 to 1.55 m	Dull yellowish brown (10YR5/5); medium clay sandy; moderate 2-5mm angular blocky; moderately moist; moderately firm.

Depth	1:5 Soil/Water			Particle Size		pH8.5 Cations				Total Elements			Moistures		Disp.Ratio		Exch ECEC		pH
metres	pH @ 40°C	EC dS/m 105C	Cl %	CS % @ 105° C	FS	S	C	Ca m.eq/100g @ 105° C	Mg	Na	K	P % @ 80° C	K	S	ADM 33* 1500* % @ 105° C		R1 @ 40° C	R2	Al m.eq/100g @ 105° C	Acid	$CaCl_2$ @40° C
B 0.10	6.	.02	.002																		4.3
0.10	6.0	.01	.001	12	31	10	46	9	1.2	1.3	.17	.24	.017	1.48	.027	1.3	14	.58			4.3
0.30	6.5	.01	.001	9	26	10	53	10	1.7	2.5	.57	.18	.013	1.51	.023	1.3	14	.61			4.4
0.60	7.0	.04	.002	9	30	11	50	10	2.6	4.3	1.1	.11	.012	1.47	.022	1.3	15	.98			5.3
0.90	7.9	.09	.001	36	24	3	36	8	2.1	4	2.1	.08	.013	1.26	.022	1.2	11	.95			6.3
1.20	9	.4	.055	18	38	8	6	7	1.6	3.4	3.3	.09	.013	1.22	.02	1.1	13	.99			7.7
1.50	9	.45	.064					6	.2	2.7	3.1	0.1									7.8

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.				Extractable	P	Aqueous Cations				
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe mg/kg @ 105C	Mn	Cu	Zn	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC m.eq/100g @ 105C	Ca	Mg	Na	K
B 0.10	.88	.06	1.1	.19		55	21	.84	.24	3						
0.10										3		4	1.4	1.7	.23	.23
0.30										1		6	1.7	3	.63	.18
0.60										1		8	2.2	4.4	1.4	.13
0.90										2		9	2.2	4.4	2.5	0.1
1.20										2		10	2	3.6	4.7	0.1
1.50										2		9	1.5	3	4.9	.11

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Batavia* (Bv)**
SITE NO:T124
Drainage : poorly drained
Locality : WEIPA

State : QUEENSLAND
Project : REG
Described by: RAY ISBELL
Date : 09/07/70

Latitude 1125500 S Longitude 1422300 E

LANDFORM
Relief Modal/Slope Class : gently undulating rises
9-30m 1-3%
Pattern type : rises
Element type : hillscrest
Slope : crest
Relief : 15 metres
Slope Category : level

CLASSIFICATION
Principal Profile Form : Gn2.64
Great Soil Group : YELLOW EARTH.
Aust. Class. Manganic Mesotrophic Brown Kandosol

VEGETATION
Tallest Stratum Form : Mid-high open woodland
Dominant Species : *Eucalyptus polycarpa, Eucalyptus tetrodonta, Eucalyptus confertiflora*
Ground Cover Species : *Sorghum plumosum, Themeda triandra*

SITE DISTURBANCE : no effective disturbance except grazing by hoofed animals

LOCATION :
17.6KM north west of Merluna:

CONDITION OF SURFACE SOIL WHEN DRY : hard setting

PROFILE MORPHOLOGY :

HORIZON	DEPTH	DESCRIPTION
A1	0 to .05 m	Very dark greyish brown (10YR3/2), (10YR4/2d) ; sandy loam; massive; very firm; clear change to -
	.05to 10 m	Dark yellowish brown (10Y4/4), (10YR6/6d); sandy loam; massive; moderately strong; <1 1-2mm macropores per 100m2; gradual change to -
	.10 to .20 m	Strong brown (7.5YR5/6), (10YR5/8d); sandy loam (heavy); massive; moist; moderately
A21	.20 to .30 m	Strong brown (7.5YR5/8), (10YR5/8d); sandy clay loam (light); massive; moist; very firm; gradual change to -
	.30 to .40 m	Strong brown (7.5Y56/6); clay loam (light); massive; earthy fabric; moist; very firm; gradual change to -
	.40 to .50 m	Strong brown (7YR5/7); <2% <5mm red(2.5YR4/8); mottles; clay loam; massive; earthy fabric; moist; very firm; 2.-10% 2-6mm ferromanganiferous nodules; gradual chage to -
	.50 to .60 m	Strong brown (7.5YR5/7), <2% <5mm red (2.5YR4/8); mottles; clay loam; massive; earthy fabric; moist; very firm; 2.10% 2-6mm ferromanganiferous nodules; gradual change to -
	.60 to .70 m	Strong brown (7.5YR5/7); 10-20% <5mm red (2.5YR4/8) mottles; clay loam; massive; earthy fabric; moist; very firm; 10-20% 2-6mm ferromanganiferous nodules; clear change to -
	.70 to .80 m	Yellowish brown (10YR5/8); 10-20% <5mm red (2.5YR4/8) mottles; light clay; massive; earthy fabric; moist; very firm; 20-50% 2-6mm ferromanganiferous nodules; gradual change to -
	.80 to .90 m	Yellowish brown (10YR5/8); 10-20% <5mm red (2.5YR4/8) mottles; light clay; massive; earthy fabric; moist; very firm; <50% 2-6mm ferromanganiferous nodules; gradual change to -
	.90 to 1.05 m	Yellow (10YR7/6); red (10YR4/8)mottles; medium clay; massive; earthy fabric; moist; very firm; >50% 2-6mm ferromanganiferous nodules; clear change to -
D1	1.05 to 1.20 m	Dark red (7.5R3/6); <5mm prominent grey (5YR6/1) mottles; medium clay; massive; moist very firm; gradual change to -
D1	1.20 to 1.40 m	Dark red (7.5R3/6); <5mm prominent grey (5YR6/) mottles; heavy clay; massive; moist very firm; gradual change to -
D1	1.40 to 1.50 m	Red (10R4/8); <5mm prominent grey (5Y6/1) mottles; heavy clay; massive; moist; very firm gradual change to -

D1	1.50 to 1.60 m	Red (2.5YR4/8); grey (5YR6/1) mottles; medium heavy clay; massive; moist; very firm clear change to -
D2	1.60 to 1.80 m	Yellowish brown (10YR5/8); light olive grey (5Y6/2) primary and yellowish red (5YR 6/2) primary and yellowish red (5YR5/8) secondary mottles; clay loam, fine sandy (light); massive; very weak; gradual change to -
D2	1.80 to 2.00 m	Yellowish brown (10YR5/8); light olive grey (5YR6/2) primary and yellowish red (5YR5/8) secondary mottles; clay loam, fine sandy (light); massive; very weak; gradual change to -

NOTE: 5-10CM A1 INTERMIXED IN A2:105-140CM PARALLELIPIPEDS WITH SLICKENSIDES COMMON:160-200CM FINE W'D SANDSTONE:

CHEMICAL ANALYSIS

Depth metres	1:5 1.5 ph	EC ms/cm	Org C %	Tot N %	Exch. Cations Ca meq	Mg meq	K meq	Na meq	Exh. Acid. meq	Sum. CEC meq	Aval P ppm	TOT Cu ppm	TOT Zn ppm	TOT. Mn ppm	TOT. Fe %	TOT. P %	TOT. K %1	TOT. S %
0.0 - .05	5.9	.038	0.88	0.08	2.0	0.96	0.12	0.09	3.4	6.6	4.2	9	9	230	1.81	.011	.05	.007
.05- .10	5.8	.02	0.62	0.07	1.2	0.66	0.07	0.08	3.5	5.5	<2	8	9	157	2.17	.009	.05	.007
.10- .20	5.8	.026	0.37		1.4	1.3	0.06	0.10	1.9	4.8	<2			112		.008	.04	.006
.20- .30	5.8	0.02	0.26		1.2	1.6	0.05	0.12	2.4	5.4	<2	9	9	45	3.10	.01	.05	.006
.30- .40	5.6	.098																
.40- .50	5.7	.023			0.64	1.7	0.03	0.18	6.2							.009	.06	.006
.50- .60	5.9	0.02																
.60- .70	5.8	.029																
.70- .80	5.9	.032			0.50	3.5	0.06	0.47	5.2	9.7						.026	.10	.005
.80- .90	5.7	.038																
.90-1.05	6.2	0.02			0.24	4.1	0.06	0.95	5.6	11								
1.05-1.20	6.1	.029																
1.20-1.40	6.0	.035			0.24	6.5	0.11	2.2	13.5	22.6								
1.40-1.50	5.7	.044																
1.50-1.60	6.0	.032																
1.60-1.80	6.5	0.02																
1.80-2.00	6.1	.032																

Depth metres	FREE Fe %	Particle Size GV CS FS S C	K20 %	Ex. Cap me%	C Fract Min 1 Type %-%	C Fract Min 2 Type	C Fract Min 3 Type %-%
0.0 - .05	1.10	0 7 76 5 12					
.05- .10	1.39	0 7 73 5 15	.24	21	Ka >80		Qz 1-5
.10- .20		0 7 67 5 21					
.20- .30	1.87	0 6 61 5 27					
.40- .50		3 6 53 6 36	.12	20	Ka >80		Qz 1-5
.70- .80		74 10 34 9 46	.16	28	Ka65-80	Is10-20	Qz 1-5
.90-1.05		64 13 26 12 49					
1.20-1.40		0 8 23 15 54					

SOIL TYPE: ***Bertie*** **(Bt)**
SITE NO: 116
A.M.G. REFERENCE: 13 12 35 S 142 5110 E
SUBSTRATE MATERIAL: Laterised sandstone (Bulimba Formation)
SLOPE: 1 %
GREAT SOIL GROUP: Red earth LANDFORM ELEMENT TYPE: hillcrest
PRINCIPAL PROFILE FORM: Gn2.14 LANDFORM PATTERN TYPE: gently undulating plains <9m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Ferric Mesotrophic Red Kandosol
STRUCTURAL FORM: Tall woodland
DOMINANT SPECIES: *Eucalyptus tetrodonta, Eucalyptus clarksoniana, Grevillea glauca, Heteropogon triticeus*

CONDITION OF SURFACE SOIL WHEN DRY: hardsetting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .03 m	Dark reddish brown (5YR3/2); clay loam; massive; dry; moderately firm; many fine ferruginous nodules, medium. abrupt to-
A2	.03 to .10 m	Dull reddish brown (2.5YR4/4); clay loam; massive; dry; moderately firm; many fine ferruginous nodules, medium. diffuse to-
B21	.10 to .50 m	Dark reddish brown (2.5YR3/6); light clay; massive; dry; moderately firm; many fine ferruginous nodules, medium. diffuse to-
B22	.50 to .65 m	Red (10R4/6); light clay; massive; dry; moderately firm; many coarse ferruginous nodules, fine.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	6.2 .02 .001							5.2
0.10	6.1 .03 .002	42 13 6 39		.036 .088 .031	3 12	.34		5.1
0.30	6.1 .01 .001	40 10 4 47		.031 .073 .025	2.5 13	.2		5.1
0.60	6.2 .01 .001	45 7 3 47		.03 .072 .024	2.5 13	.01		5.4

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	2.4	.03	2	.22		14 15 .29 .27	9		
0.10							9		6 2.9 2.9 .14 .31
0.30							16		4 1.2 2.4 11 .11
0.60							31		3 .96 2.3 .15 .08

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Bend* (Bn)**
SITE NO: 829
A.M.G. REFERENCE: 14 58 15 S 144 14 30 E ZONE
SUBSTRATE MATERIAL: Alluvia
SLOPE: 2 %
GREAT SOIL GROUP: No suitable group. Affinities with Xanthozem LANDFORM ELEMENT TYPE: terrace flat
PRINCIPAL PROFILE FORM: Gn3.92 LANDFORM PATTERN TYPE: gently undulating plains <9m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Sodic Eutrophic Brown Dermosol
STRUCTURAL FORM: Tall open woodland
DOMINANT SPECIES: *Eucalyptus leptophleba, Eucalyptus tessellaris, Planchonia careya, Heteropogon triticeus*

CONDITION OF SURFACE SOIL WHEN DRY: hardsetting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .02 m	Brownish black (10YR3/1); clay loam silty; weak 2-5mm cast; dry; moderately firm. abrupt to-
B1	.02 to .10 m	Brownish black (10YR3/2); light clay silty; weak <2mm subangular blocky; dry; very firm. gradual to-
B21	.10 to .30 m	Dull yellowish brown (10YR4/3); common fine faint red mottles; light clay silty ; moderate 2-5mm subangular blocky; moderately moist; very firm. gradual to-
B22	.30 to .45 m	Yellowish brown (2.5Y5/3); many fine faint red mottles; light medium clay silty; moderate 2-5mm subangular blocky; moderately moist; moderately strong. gradual to-
B23	.45 to .60 m	Yellowish brown (2.5Y5/3); many fine faint orange mottles, few fine distinct grey mottles; medium clay; strong 2-5mm subangular blocky; moderately moist; moderately strong.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
0.10	6.6 .03 .002	13 27 50 13		.06 1.35 .032	1.8 13	.69	12	5.6
0.30	6.7 .01 .001	10 25 32 35		.034 1.44 .024	1.8 14	.74	10	4.9
0.60	7.4 .02 .001	7 24 39 35		.023 1.58 .021	2 14	.89	12	5.7

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
0.10		.09	20 15	.42		51 122 1.9 2.1	6		12 5.9 5.1 .1 43
0.30									10 4.3 4.9 .35 .21
0.60							2		12 5.2 5.7 .83 .21

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Cox* (Cx)**
SITE NO: 77
A.M.G. REFERENCE: 12 51 16 S 142 2637 E
SUBSTRATE MATERIAL: Alluvia
SLOPE: 1 %
GREAT SOIL GROUP: Red earth LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Gn2.11 LANDFORM PATTERN TYPE: gently undulating plains <9m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Manganic Mesotrophic Red Kandosol
STRUCTURAL FORM: Tall open forest
DOMINANT SPECIES: *Eucalyptus tetrodonta, Eucalyptus nesophila Erythrophleum chlorostachys*

CONDITION OF SURFACE SOIL WHEN DRY: hardsetting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .06 m	Dark reddish brown (5YR3/2); clay loam; massive; dry; very firm; few fine manganiferous nodules. clear to-
A3	.06 to .30 m	Dark reddish brown (2.5YR3/3); clay loam; massive; dry; very firm; few fine manganiferous nodules. diffuse to-
B1	.30 to .60 m	Dark red (10R3/4); clay loam; massive; dry; moderately firm; few fine manganiferous nodules. diffuse to-
B21	.60 to 1.38 m	Dark reddish brown (10R3/3); light clay; weak 5-10mm subangular blocky; dry; moderately firm; few fine manganiferous nodules. abrupt to-
B22	1.38 to 1.50 m	Dark reddish brown (2.5YR3/4); few fine distinct yellow mottles; clay loam, sandy; massive; dry; moderately firm; very many medium manganiferous nodules.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @40C
B 0.10	6.2 .03 .002							5.4
0.10	6.3 .02 .001	8 57 3 33		.029 .075 .033	1.9 10	.24		5.4
0.30	6.1 .01 .001	6 46 1 49		.026 .074 .025	2.1 14	.16		5.3
0.60	5.9 .01 .001	4 36 1 61		.023 .081 .022	2.4 17	.01		5.5
0.90	6 .01 .001	4 29 1 68		.022 .098 .021	2.6 19	.01		5.6
1.20	6 .01 .001	1 33 1 65		.023 .103 .022	2.5			5.6
1.50	6 .01 .001							5.6

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	1.8	.07	3	0.2		20 184 .64 .23	9		
0.10							9		6 3.4 2.3 .09 .24
0.30							10		5 2.9 2.2 .05 .08
0.60							28		6 2.9 2.7 .07 .05
0.90							30		6 2.9 2.8 .13 .04
1.20							39		5 2.7 2.6 .13 .03
1.50									

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Clark* (Cr)**
SITE NO: 624
A.M.G. REFERENCE: 14 31 04 S 142 03 16 E
SUBSTRATE MATERIAL:
SLOPE: 3 %
GREAT SOIL GROUP: Yellow earth LANDFORM ELEMENT TYPE: hillslope
PRINCIPAL PROFILE FORM: Gn2.74 LANDFORM PATTERN TYPE: gently undulating rises 9-30m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Mottled Mesotrophic Yellow Kandosol
STRUCTURAL FORM: Tall woodland
DOMINANT SPECIES: *Eucalyptus tetrodonta, Erythrophleum chlorostachys, Grevillea glauca*

CONDITION OF SURFACE SOIL WHEN DRY: hardsetting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .10 m	Brownish grey (10YR4/1); loamy sand; massive; dry; moderately firm. clear to-
A21e	.10 to .35 m	Greyish yellow-brown (10YR5/2); loamy sand; massive; dry; moderately firm. gradual to-
A22e	.35 to .50 m	Greyish yellow (2.5Y6/2); loamy sand; massive; dry; moderately weak. gradual to-
B1	.50 to .75 m	Dull yellow (2.5Y6/4); light sandy clay loam; few small pebbles, subangular quartz; massive; moderately moist; moderately weak. diffuse to-
B21	.75 to 1.00 m	Bright yellowish brown (2.5Y6/6); few fine distinct orange mottles; sandy clay loam; massive; moderately moist; moderately weak.
B22	1.00 to 1.20 m	Light yellow (2.5Y7/5); common fine distinct yellow mottles, few fine prominent red mottles; sandy clay loam; massive; moderately moist; moderately weak.
B23	1.20 to 1.40 m	Light yellow (2.5Y7/4); many fine prominent red mottles, many fine prominent yellow mottles; sandy clay loam; massive; moderately moist; moderately weak.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	5.6 .01 .001							4.6
0.10	5.4 .01 .001	46 49 2 3		.011 .158 .021	.2 1	.88	0.1 0.1	4.5
0.30	5.3 .01 .001	49 45 3 4		.012 .175 .019	.2 1	.65	0.3 0.3	4.5
0.60	5.5 .01 .001	41 46 1 11		.012 .273 .019	.3 3	.77	0.2 0.3	4.5
0.90	5.4 .01 .001	40 35 1 25		.013 .452 .02	.5 8	.17	0.3 0.6	4.3
1.20	5.7 .01 .001	39 38 2 22		.013 .404 .018	.4		0.2 0.2	4.9
1.50	5.8 .01 .001							5.2

Depth	Org.C	Tot.N	Extra.P	HCl	CaC12 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	.62	.01	9 1.1	.05		17 6.1 .05 .06	2		1 .56 .44 .03 .07
0.10									2 .69 .52 .01 .05
0.30									2 .73 .77 .01 .11
0.60							3		2 .68 .91 .01 .11
0.90									2 .67 1.3 .02 .10

!* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Cox* (Cx)**
SITE NO: 77
A.M.G. REFERENCE: 12 51 16 S 142 2637 E
SUBSTRATE MATERIAL: Alluvia
SLOPE: 1 %
GREAT SOIL GROUP: Red earth LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Gn2.11 LANDFORM PATTERN TYPE: gently undulating plains <9m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Manganic Mesotrophic Red Kandosol
STRUCTURAL FORM: Tall open forest
DOMINANT SPECIES: *Eucalyptus tetrodonta, Eucalyptus nesophila Erythrophleum chlorostachys*

CONDITION OF SURFACE SOIL WHEN DRY: hardsetting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .06 m	Dark reddish brown (5YR3/2); clay loam; massive; dry; very firm; few fine manganiferous nodules. clear to-
A3	.06 to .30 m	Dark reddish brown (2.5YR3/3); clay loam; massive; dry; very firm; few fine manganiferous nodules. diffuse to-
B1	.30 to .60 m	Dark red (10R3/4); clay loam; massive; dry; moderately firm; few fine manganiferous nodules. diffuse to-
B21	.60 to 1.38 m	Dark reddish brown (10R3/3); light clay; weak 5-10mm subangular blocky; dry; moderately firm; few fine manganiferous nodules. abrupt to-
B22	1.38 to 1.50 m	Dark reddish brown (2.5YR3/4); few fine distinct yellow mottles; clay loam, sandy; massive; dry; moderately firm; very many medium manganiferous nodules.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @40C
B 0.10	6.2 .03 .002							5.4
0.10	6.3 .02 .001	8 57 3 33		.029 .075 .033	1.9 10	.24		5.4
0.30	6.1 .01 .001	6 46 1 49		.026 .074 .025	2.1 14	.16		5.3
0.60	5.9 .01 .001	4 36 1 61		.023 .081 .022	2.4 17	.01		5.5
0.90	6 .01 .001	4 29 1 68		.022 .098 .021	2.6 19	.01		5.6
1.20	6 .01 .001	1 33 1 65		.023 .103 .022	2.5			5.6
1.50	6 .01 .001							5.6

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	1.8	.07	3	0.2		20 184 .64 .23	9		
0.10							9		6 3.4 2.3 .09 .24
0.30							10		5 2.9 2.2 .05 .08
0.60							28		6 2.9 2.7 .07 .05
0.90							30		6 2.9 2.8 .13 .04
1.20							39		5 2.7 2.6 .13 .03
1.50									

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Dixie* (Dx)**
SITE NO: 836
A.M.G. REFERENCE: 14 45 54 S 143 31 19 E
SUBSTRATE MATERIAL: Adamellite
SLOPE: 3 %
GREAT SOIL GROUP: Yellow Earthy Sand LANDFORM ELEMENT TYPE: hillslope
PRINCIPAL PROFILE FORM: Uc2.23 LANDFORM PATTERN TYPE: undulating rises 9-30m 3-10%
AUSTRALIAN SOIL CLASSIFICATION: Basic Regolithic Bleached Tenosol
STRUCTURAL FORM: Tall open forest
DOMINANT SPECIES: *Eucalyptus tetrodonta, Parynaria nonda, Melaleuca spp. Xanthorrhoea* spp.

CONDITION OF SURFACE SOIL WHEN DRY: soft

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A11	0 to .02 m	Brownish black (10YR3/2); loamy coarse sand; few small pebbles, subangular quartz; massive; dry; moderately firm. abrupt to-
A12	.02 to .10 m	Brownish grey (10YR4/1); loamy coarse sand; very few small pebbles, subangular quartz; massive; dry; moderately firm. clear to-
A21e	.10 to .40 m	Greyish yellow-brown (10YR6/2); loamy coarse sand; very few small pebbles, subangular quartz; massive; dry; moderately firm. gradual to-
A3e	.40 to .75 m	Dull yellowish orange (10YR7/2); few fine faint yellow mottles; coarse sand; few small pebbles, subangular quartz; massive; dry; moderately firm. diffuse to-
B21	.75 to 1.25 m	Dull yellowish orange (10YR7/2); common fine distinct yellow mottles; coarse sand; common small pebbles, subangular quartz; massive; dry; moderately weak. diffuse to-
B22	1.25 to 1.40 m	Dull yellowish orange (10YR7/2); few fine distinct yellow mottles; coarse sand; common small pebbles, subangular quartz; single grain; moderately moist; very weak. gradual to-
B23	1.40 to 1.50 m	Light grey (10YR8/2); coarse sand; common small pebbles, subangular quartz; single grain; moderately moist; very weak.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	5.1 .01 .001							4.4
0.10	5 .01 .001	64 33 3 1		.013 .155 .021	.3 1	.99	0.2 0.4	3.8
0.30	5.4 .01 .001	66 29 3 1		.009 .149 .018	.1 1	.99	0.3 0.3	4.5
0.60	5.8 .01 .001	74 21 2 3		.008 .112 .018	.1 2	.85	0.1 0.1	4.8
0.90	5.6 .01 .001	76 20 1 1		.008 .082 .017	.1 1	.99	0.1 0.1	4.6
1.20	5.8 .01 .001	70 27 1 1		.008 .071 .016	.1		0.1 0.1	4.6
1.50	6.2 .01 .001							6

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	0.5	.01	20 1.1	.05		5.8 .62 .05 .06	2		
0.10									1 .58 .39 .03 .05
0.30									2 .84 .67 .01 .04
0.60							1		1 .54 .50 .01 .04
0.90									1 .57 .48 .01 .03
1.20									1 .63 .55 .01 .03
1.50									

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Emma*** **(Em)**
SITE NO:T136
Drainage : well drained
Locality : HEATHLANDS
Latitude 114600 S Longitude 1423000 E

State : QUEENSLAND
Project : REG
Described by: RAY ISBELL
Date : 15/07/70

LANDFORM

Relief Modal/Slope Class : rolling rises 9-30m
10-32%
Pattern type : rises
Element type : hillslope
Slope : mid-slope
Relief : 24 metres

CLASSIFICATION

Principal Profile Form : Gn2.44
Great Soil Group : RED EARTH.
Aust. Class. Mottled Dystrophic Red Kandosol

GEOLOGY
Geological Reference : JKb

VEGETATION
Tallest Stratum Form : Tall heathland
Dominant Species : *Grevillea glauca.*
Mid Stratum species: *Xanthorrhea johnsonnii*
Ground Cover Species : *Schizachrium* spp.

SITE DISTURBANCE : no effective disturbance except grazing by hoofed animals

LOCATION :
3.5km east of north line crossing road at homestead site: 2 KM east of bend in road:

CONDITION OF SURFACE SOIL WHEN DRY :firm

PROFILE MORPHOLOGY :

HORIZON	DEPTH	DESCRIPTION
A1	0 to .10 m	Dark brown (7.5YR3/24, (7.5YR5/4d) ; loamy sand; weak 10-20mm angular blocky; dry; very firm; few 1-2mm roots; gradual change to -
A2	.10 to .20 m	Yellowish red (5Y4/8), (5YR4/8d) loamy sa nd; weak 10-20m angular blocky; dry; very firm; gradual change to -
	.20 to .30 m	Red (2.5YR4/8), (2.5Y5/8d); <2% 5 - 15mm distinct brownish yellow; (10YR6/8) mottles ;sandy loam; massive; dry; very firm; gradual change to -
B1 .	30 to .40 m	Red (2.5YR4/8), (2.5YR5/8d); 2-10% 5-15mm distinct brownish yellow (10YR6/8) mottles; sandy loam; massive; dry; very firm; gradual change to -
	40 to .50 m	Red (2.5YR4/8), 2-10% 5-15mm distinct brownish yellow (10YR6/68); mottles; sandy loam; massive; dry; very firm; gradual change to -
	.50 to .60 m	Red (2.4YR4/8), 10-20% 5-15mm distinct brownish yellow (10YR6/8) mottles; sandy loam; massive; moderately moist; very weak; gradual change to -
	.60 to .75 m	Red (2.5YR4/8); 2-10% 5-15mm distinct brownish yellow (10YR6/8) mottles; sandy loam; massive; moderately moist; ery weak; gradual change to -
	.75 to .90 m	Red (10YR4/.8); 10-20% 5-15mm distinct brownish yellow (10YR6/8) mottles; sandy loam (heavy); massive; moderately moist; moderately weak; gradual changr to -
B2	.90 to 1.20m	Red (10YR4/8); 10-20% 15.-30mm distinct brownish yellow (10YR6/8) mottles; sandy clay loam (light); massive; moderately moist; moderately weak; gradual change to -
	1.20 to1.35 m	Red(10YR4/8); 10-20% 15-30mm distinct brownish yellow (10YR6/8) mottles; sandy clay loam; massive; moderately moist; moderately weak; gradual change to -
	1.35 to 1.50 m	Red (10YR4/8); 10-20% 15-30mm distinct brownish yellow (10YR6/8) primary and light red (2.5YR6/8) secondary-mottles; light clay; massive; moderately moist; moderately weak; gradual change to -
	1.50 to 1.80 m	Red (10YR4/8); 10-20% 15-30mm distinct light red (2.5YR6/8) primary and brownish yellow (10R6/8) secondary mottles; light clay; massive; moderately moist; moderately weak; gradual change to -

NOTE: 50-135CM ELONGATE MOTTLING HORIZONTALLY:
CHEMICAL ANALYSIS :

Depth metres	1:5 1.5 ph EC ms/cm	Org Tot C N % %	Exch Cations Ca Mg K Na meq meq meq meq	Exh. Acide. meq	Dir. Sum. CEC CEC meq meq	Aval P ppm	AD %	TOT TOT. TOT. TOT. TOT. Cu Zn Mn Fe P ppm ppm ppm % %
0.0 -.10	5.7 .032	0.73 O..05	C0.9 0.18 0.09 0.07	2.3	1.5 2.7	<2	2.0	6 5 1.21 .004
						<2		
.10- 20	5.6 .032						1.0	
.20- .30	5.8 .026	0.37 0.03	C0.04 0.10 0.11 0.05	2.1	1.1 2.4	< 2	2.0	6 4 1.54 .004
						<2		
.30- .40	5.9 .023						2.0	
.40- .50	6.0 0.021						1.0	
.50- .60	5.9 .026	0.10 <.01	C0.04 0.11 0.08 0.07	1.0	0.7 1.3	< 2	2.0	5 3 1.59 .004
.60- .75	5.9 .021						1.0	
.75- .90	5.8 .026						2.0	
.90-1.20	5.6 .032		C0.04 0.27 0.10 0.06	2.0	0.5 2.5	<2	2.0	4 5 2.99 .007
1.20-1.35	5.7 .026						2.0	
1.35-1.50	5.6 .032						1.0	
1.50-1.80	5.6 .032						2.0	
1.80-2.10	5.9 .017		C0.04 0.39 0.05 0.07	1.8.	0.6 2.4	<2	2.0	5 7 3.49 .007
2.10-2.40	5.8 .023						1.0	

Depth metres	TOT. TOT K S % %	FREE Fe %	Ext Al %	Particle Size GV CS FS S C % % % % %	K20 %	Ex Cap me%	C Fract Min 1 Type %-%	C Fract Min 2 Type %-%	C Fract Min 3 Type %-%
0.0 - .10	0.02 .007	0.80	0.14	0 25 63 1 11	.69	12	Ka >80	Qz 1-5	Gt 5-10
.10 - .20				0 23 63 1 13					
.20 - .30	0.02 .006	1.04	0.09	0 24 60 1 15					
.50 - .60	0.02 .005	0.99	0	0 23 60 1 16					
.75 - .90				25 56 1 19					
.90 -1.20	0.02 .007	2.04	0.06	0 22 45 1 32	.53	11	Ka >80		Gt 10-20
1.20-1.35				0 28 36 1 35					
1.35-1.50				0 20 41 1 38					
1.80-2.10	0.03 .017	2.77	0	0 21 38 2 39	.58	11	Ka >80		Gt10-20

SOIL TYPE: ***Endeavour* (Ed)**
SITE NO: 392
A.M.G. REFERENCE: 15 07 05 S 145 05 05 E
SUBSTRATE MATERIAL: Olivine basalt (Piebald Basalt)
SLOPE: 0 %
GREAT SOIL GROUP: Krasnozem LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Gn3.11 LANDFORM PATTERN TYPE: level plain <9m <1%
AUSTRALIAN SOIL CLASSIFICATION: Haplic Mesotrophic Red Ferrosol
STRUCTURAL FORM: Very tall closed forest
DOMINANT SPECIES:

CONDITION OF SURFACE SOIL WHEN DRY: firm

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A11	0 to .03 m	Dark reddish brown (2.5YR2/2); clay loam; strong 2-5mm granular; moderately moist; moderately weak. gradual to-
A3/B1	.03 to .10 m	Dark reddish brown (2.5YR2/3); light clay; strong <2mm polyhedral; moderately moist; moderately weak. diffuse to-
B21	.10 to .45 m	Dark reddish brown (10R3/3); light clay; strong <2mm polyhedral; moderately moist; moderately weak. clear to-
B22	.45 to 1.50 m	Very dark reddish brown (10R2/3); light clay; strong <2mm polyhedral; moderately moist; moderately weak. gradual to-

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	7.4 .17 .009							6.7
0.10	7.2 .13 .007	15 29 19 38		.092 .096 .081	2.8 24	.23		8.4
0.30	6.9 .05 .002	10 27 15 52		.076 .072 .055	2.1 21	.24		6
0.60	5.9 .03 .001	9 25 12 57		.06 .055 .067	1.8 21	.07	0.1 0.1	5
0.90	5.9 .02 .001	6 24 11 61		.059 .063 .038	1.8 22	.07	0.01 0.1	5
1.20	5.7 .02 .002	4 17 11 71		.063 .075 .041	2.1		0.01 0.01	5.3
1.50	5.6 .03 .003							5.4

Depth	Org.C	Tot.N	Extr. P	Hcl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	4.9	.33	3 3	1.2		15 154 5.2 1.1	20		
0.10									23 17 5.1 22 .79
0.30									10 6.9 2.2 .06 .45
0.60							280		3 1.4 1.8 .02 .16
0.90									3 1.6 1.5 .01 .11
1.20									3 1.4 1.1 .01 .28
1.50									

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Eykin* (Ek)**
SITE NO: 780
A.M.G. REFERENCE: 15 37 03 S 144 28 01 E
SUBSTRATE MATERIAL: Slate, greywacke (Hodgkinson Formation)
SLOPE: 3 %
GREAT SOIL GROUP: No suitable group. Affinities with Soloth LANDFORM ELEMENT TYPE: hillslope
PRINCIPAL PROFILE FORM: Dy3.12 LANDFORM PATTERN TYPE: undulating rises 9-30m 3-10%
STRUCTURAL FORM: Mid-high woodland
AUSTRALIAN SOIL CLASSIFICATION: Dystrophic Mottled-Subnatric Yellow Sodosol
DOMINANT SPECIES: *Melaleuca citrolens*
SURFACE COARSE FRAGMENTS: Many medium rounded quartz pebbles,

CONDITION OF SURFACE SOIL WHEN DRY: hard setting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .05 m	Olive brown (2.5Y4/3); clayey sand; few medium pebbles, subrounded quartz; massive; dry; moderately firm. abrupt to-
B1	.05 to .20 m	Dull yellowish orange (10YR6/4); common fine prominent red mottles; light clay; few medium pebbles, subrounded quartz; moderate <2mm angular blocky; dry; moderately firm. clear to-
B2	.20 to .45 m	Dull yellow (2.5Y6/4); common fine prominent red mottles; light medium clay; strong 10-20mm angular blocky; dry; very firm. clear to-
B3	.45 to .50 m	Light yellow (2.5Y7/3); few fine distinct red mottles; light medium clay; few small pebbles, subrounded quartz; dry; very strong.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	6.4 .01 .001							5.2
0.10	6.5 .02 .001	37 30 20 17		.017 .666 .025	.6 5	.78		5.1
0.20	6.5 .01 .001							5
0.30	6.5 .02 .001	20 16 15 51		.018 1.47 .024	1.9 13	.63		4.7
0.40	6.4 .03 .001							4.7
0.50	6.7 .02 .001	26 19 11 44		.016 1.41 .023	1.6 12	.82		4.7

Depth	Org.C	Tot.N	Extr. P	HCL	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	0.3	.02	4 1.1	.13		8.8 21 0.2 .14	4		
0.10									4 2 2.1 .14 .16
0.20									
0.30									10 2.1 7.2 .68 .21
0.40									
0.50							12		10 .86 8.0 .87 .18

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Gibson* (Gs)**
SITE NO: 820
A.M.G. REFERENCE: 15 41 51 S 145 07 49 E
SUBSTRATE MATERIAL: Colluvia derived from Hodgkinson Formation
SLOPE: 1 %
GREAT SOIL GROUP: Solodic LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Dg2.43 LANDFORM PATTERN TYPE: gently undulating plains <9m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Eutrophic Subnatric Grey Sodosol
STRUCTURAL FORM: Tall closed forest
DOMINANT SPECIES: *Eucalyptus platyphylla*

CONDITION OF SURFACE SOIL WHEN DRY: hard setting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .02 m	Silty clay loam; massive; dry;. abrupt to-
A2e	.02 to .20 m	Greyish yellow-brown (10YR5/2); few fine distinct orange mottles; silty clay loam; massive; dry; very firm. clear to-
B1	.20 to .30 m	Yellowish brown (2.5Y5/3); silty light medium clay; moderate 2-5mm angular blocky; moderately moist; very firm; few medium manganiferous nodules. clear to-
B21	.30 to .50 m	Greyish olive (5Y5/2); silty medium heavy clay; strong 5-10mm angular blocky; moderately moist; very firm. gradual to-
B22	.50 to .80 m	Greyish olive (5Y5/2); common fine distinct orange mottles; silty medium clay; strong 10-20mm prismatic; moderately moist; moderately strong. gradual to-
B23	.80 to 1.20 m	Grey (5Y6/1); few fine distinct orange mottles; silty medium clay; strong 10-20mm prismatic; moderately moist; moderately strong.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
	pH EC Cl	CS FS S C	CEC Ca Mg Na K	P K S	ADM 33* 1500*	R1 R2	Al Acid	CaCl2
metres	dS/m % @ 40C 105C	% @ 105C	m.eq/100g @ 105C	% @ 80C	% @ 105C	@ 40C	m.eq/100g @ 105C	@ 40C
B 0.10	6.1 .09 .009							5.1
0.10	6.3 .07 .007	7 13 42 40	14 3 3.7 .17 .57	.028 1.97 .033	1.4 14	.75		5.2
0.30	7.7 .05 .004	2 15 36 50	11 1.9 5.3 .44 .35	.014 2.12 .021	1.2 15	.92		6.1
0.60	8.9 .24 .022	3 12 29 57	14 2.3 9.5 1.6 .34	.013 2.56 .023	1.9 17	.83		7.8
0.90	9.2 .38 .033	2 9 32 54	13 2 8.2 1.8 .17	.012 2.48 .021	1.7 18	.8		8.1
1.20	8.7 .28 0.03	2 14 30 49	12 2 8.3 1.9 .09	.013 2.26 .019	1.7			7.7

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
	(W&B)		Acid Bicarb	K	K P	Fe Mn Cu Zn	SO4S	Buff Equil	CEC Ca Mg Na K
metres	% @105C	% @105C	mg/kg @ 105C	meq% @105C	mg/kg @105C	mg/kg @ 105C	mg/kg @ 105C	Cap ug/L @ 40C	m.eq/100g @ 105C
B 0.10	2.4	.14	16 15	.77		193 99 1.6 2.2	7		
0.10									9 4.3 4.2 .38 .60
0.30									9 2.4 6.0 .70 .39
0.60							3		16 3 10 2.3 .37
0.90									18 5.5 9.9 3 .24
1.20									14 2.2 9 2.9 .18

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Ginger* (Gg)**
SITE NO:T71
Drainage : well drained
Locality : DIXIE

State : QUEENSLAND
Project : REG
Described by: RAY ISBELL
Date : 18/07/68

Latitude 150215 S Longitude 1432910 E

LANDFORM
Relief Modal/Slope Class : gently undulating rises
9-30m 1-3%

Pattern type : alluvial plain
Element type : plain
Slope : ridge
Relief : 15 metres
Slope Category : very gently inclined

CLASSIFICATION
Principal Profile Form : Uc2.23

Great Soil Group:SILICEOUS SAND Affinities with. PODZOL
Aust Class: Basic Ferric Bleached Tenosol
SURFACE COARSE FRAGMENTS
10-20%, 6-20mm quartz

GEOLOGY
Substrate Material : gravel
Geological Reference : TQs
Depth to Parent Material : 1.4 metres

VEGETATION
Tallest Stratum Form : Tall woodland
Dominant Species : *Eucalyptus tetrodonta.*
Mid Stratum species: *Acacia* spp., *Melaleuca nervosa*?

SITE DISTURBANCE : no effective disturbance except grazing by hoofed animals

LOCATION :
1.2km east of Dixie on road to highway:

CONDITION OF SURFACE SOIL WHEN DRY :firm

PROFILE MORPHOLOGY :

HORIZON	DEPTH	DESCRIPTION
A1	0 to .10 m	Dark grey (10YR4/1), (10YR6/1d) ; sand; single grain; very weak; few roots; clear change to -
A21	.10 to .20 m	Grey (10Y5/1), (10YR7/1d); sand; single grain; very weak; few roots;-
A21.	20 to .30 m	Grey (10YR5/1), (10Y7/1d); sand; single grain; very weak; few roots; gradual change to --
A22.	.30 to .60 m	Grey (10YR6/1), (10YR8/1d); sand; single grain; very weak;
A22	.60 to 90 m	Grey (10YR6/1), (10YR8/1d); sand; single grain; very weak; clear change to -
B	.90 to 1.20 m	Grey (10YR6/1), (10YR8/1); 10-20% 15-30mm faint brown (10YR5/3) mottles; sand; single grain; very weak; 20-50% 20-60mm unidentified nodules; clear change to -
C	1.20 to 1.40m	Grey (10YR6/1); sand; 20-50% 6.-20mm, rounded quartz gravel 20-50% 6-20mm ferruginous nodules.

NOTE: UNABLE TO PENETRATE GRAVEL LAYER AT 140 CM:

CHEMICAL ANALYSIS :

Depth metres	1:5 ph	1.5 EC ms/cm	1.5 Cl %	Org C %	Tot N %	Exch. Cations Ca meq	Mg meq	K meq	Na meq	Aval P ppm	P RET %	TOT Cu ppm	TOT. Zn ppm	TOT. P %	TOT. K %	TOT. S %	Particle size GV %	CS %	FS %	S %	C %
0.0 -.10	5.9	<.01		.34	.016	.40	.25	.01	0.8	A3.2 B1	0	3	9	.005	.024	.004		90	8	0	2
.10- 20	5.9	<.01		.12.	.004	.15	.10	.01	0.3	A2.6 B1	.0	3	13	.005	.027	.003		34	14	2	2
.20 -.30	6.1	<.01																			2
.30 -.60	6.0	<.01			.008	.10	.10	.01	0.4		.0	3	14	.004	.026	.003	2	88	10	1	3
.60 - .90	6.0	<.01																			3
.90 -1.20	5.8	<.01			.017	.05	.10	.03	0.8		.0	3	18	.006	.063	.004	4	76	16	2	6
1.20 -1.40	6.0	<.01				.05	.10	.03	0.8		.0						4	76	16	2	6
1.20 -1.40	6.0	<.01																			73

SOIL TYPE: ***Greenant* (Ga)**
SITE NO: 781
A.M.G. REFERENCE: 15 23 41 S 144 26 12 E
SUBSTRATE MATERIAL: Alluvia derived from Hodgkinson Formation
SLOPE: 1 %
GREAT SOIL GROUP: No suitable group. Affinities with Solodic LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Gn3.85 LANDFORM PATTERN TYPE: gently undulating plains <9m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Bleached-Sodic Eutrophic Yellow Dermosol
STRUCTURAL FORM: Tall woodland
DOMINANT SPECIES: *Eucalyptus chlorophylla?, Erythrophleum chlorostachys, Themeda triandra, Heteropogon triticeus*

CONDITION OF SURFACE SOIL WHEN DRY: hard setting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .03 m	Brownish black (10YR3/2); very few fine faint orange mottles; silty loam; massive; dry; moderately firm. abrupt to-
A2e	.03 to .15 m	Greyish yellow-brown (10YR5/2); few fine faint yellow mottles; silty clay loam; massive; dry; moderately firm. clear to-
A3	.15 to .25 m	Dull yellow (2.5Y6/4); common fine distinct yellow mottles; silty clay loam; massive; dry; very firm. clear to-
B1	.25 to .35 m	Dull yellow (2.5Y6/4); common fine distinct orange mottles; light clay silty; moderate 2-5mm subangular blocky; moderately moist; very firm. clear to-
B21	.35 to .75 m	Dull yellow (2.5Y6/4); common fine distinct red mottles; light medium clay silty; strong 2-5mm angular blocky; moderately moist; very firm. clear to-
B22	.75 to .90 m	Dull yellow (2.5Y6/5); common fine distinct red mottles; medium clay; strong 5-10mm angular blocky; moderately moist; very firm; very few fine manganiferous. clear to-
B23	.90 to 1.20 m	Yellowish brown (2.5Y5/4); few fine faint red mottles; light medium clay fine sandy; strong 20-50mm prismatic; moderately moist; very strong.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	5.5 .01 .001							4.4
0.10	5.9 .02 .001	10 55 27 14		.019 .709 .023	.3 5	.83	0.1 0.1	4.9
0.30	5.8 .01 .001	8 39 27 28		.019 1.25 .023	.6 10	.75	0.8 0.9	4.7
0.60	6.4 .01 .001	5 24 25 50		.017 1.99 .021	1.2 14	.52		4.5
0.90	6.7 .03 .003	6 36 24 37		.018 1.73 .02	1 12	.73		5.1
1.20	7.2 .08 .009	11 52 15 23		.017 1.17 .019	.7			5.7

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	.61	.03	5 1.1	.11		37 16 .41 .14			
0.10							4		2 1.1 .97 .03 .18
0.30									5 1.2 2.3 .13 .12
0.60							11		6 1.2 4.8 .45 .14
0.90									8 1.1 6 1.1 .15
1.20									6 .93 3.8 1.6 0.1

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Grevil* (Gv)**
SITE NO:T76

State : QUEENSLAND
Project : REG
Described by: RAY ISBELL
Date : 23/07/68

Locality : WENLOCK R.

Latitude 130500 S Longitude 1425915 E

LANDFORM

Relief Modal/Slope Class :gently undulating rises
9-30m 1-3%
Pattern type : alluvial fan
Element type : plain
Slope : upper-slope
Relief : 15 metres
Slope Category : gently inclined

CLASSIFICATION
Principal Profile Form : Uc2.32
Great Soil Group : Podzol.
Aust. Class. Parapanic Humosesquic Semiaquic Podosol

SURFACE COARSE FRAGMENTS
10-20%, 2-6mm quartz

GEOLOGY
Substratae Material : unconsolidated material (unidentified)
Geological Reference : SDk

VEGETATION
Tallest Stratum Form : Tall woodland
Dominant Species : *Eucalyptus tetradonta.*
Mid Stratum species: *Melaleuca* spp., *Acacia* spp.

SITE DISTURBANCE : no effective disturbance except grazing by hoofed animals

LOCATION :
8.5km north along Iron Range Road from Wenlock River:

PROFILE MORPHOLOGY :

HORIZON	DEPTH	DESCRIPTION
A1	0 to .10 m	Dark grey (10YR4/1), (10YR5/1d) ; sand; single grain very weak few roots clear irregular change to -
A21	.10 to .20 m	Grey (10Y6/1), (10YR7/1d) sand; single grain; very weak; gradual change to -
A22	.20 to .30 m	Light Grey (10YR7/1), (10Y8/1d); sand; single grain; very weak; few root;
A22.	.30 to .60 m	Light Grey (10YR7/1), (10YR8/1d); sand; single grain; very weak; clear change to -
B	.60 to .90 m	Brown (10YR4/3); <2% strong brown (7.5YR5/6); mottles; loamy sand; massive; moderately strong; nodular continuous; gradual change to -
BC	.90 to 1.10.m	Pale brown (10YR6/3), loamy sand; massive; very weak; <2% other nodules; clear change to -
C	1.10 to 1.20 m	Very pale brown (10YR7/4); sand; single grain; moderately weak; 50-90% 20-60mm, rounded, quartz gravel; gradual change to -
C	1.20 to 1.50 m	Reddish yellow (7.5YR6/.5); <2% <5mm red (2.5YR5/8) mottles; coarse sand single grain; moderately weak; 20-50% 6-20mm, rounded, quartz gravel; gradual change to -
D	1.50 to 1.80m	Reddish yellow (7.5YR6/5); 2-10% red (2.5YR5/8) mottles; sandy loam (heavy); moderately firm; <2% 6-20mm, rounded, quartz gravel; gradual change to -
D	1.80 to2.00 m	White (10YR8/2); 15-30mm red (2.5YR5/8) mottles; light clay (heavy); very firm; <2% 6-20mm, angular, quartz gravel-

CHEMICAL ANALYSIS :

Depth metres	1:5 ph	1.5 EC ms/cm	1.5 Cl %	Org C %	Tot N %	Exch. Cations Ca meq	Mg meq	K meq	Na meq	Aval P ppm	AD %	P RET %	TOT Cu ppm	TOT. Zn ppm	TOT. P %	TOT. K %	TOT. S %
0.0 -.10	5.9	.006A	<.01	.31	.012	.70	.30	.02	.9	B <1 A 4.4	1.0	.0	4	5	.008	.219	.008
.10- 20	6.0	.004A	<.01	.16	.006	.25	.15	.02	.4	B <1 A 4.0	0.1	.0	3	5	.007	.208	.007
.20 -.30	6.1	.004A	<.01								1.0		3	5	.009	.300	.008
.30 -.60	6.2	.004A	<.01	.11	.001	.10	.15	.01	. 4	A 1.9	0.5	.0	4	8	.009	.330	.008
.60 - .90	6.4	.004A	<.01	.13	.013	.10	.10	.05	1.8	A 1.6	0.5	.0					
.90 -1.10	6.3	.007A	<.01								0.5						
1.10 - 1.20	6.5	.004A	<.01								0.5						
1.20 - 1.50	6.5	.004A	<.01							A 2.1	1.0	.0	3	9	.009	.346	.008
1.50 - 1.80	6.2	.002A	<.01								1.5						
1.80 - 2.00	6.12	.006A	<.01		.015	.10	1.5	.13	1.6	A 0.21	1.5	.0	5	14	.007	.554	.006

Depth metres	Particle Size GV %	CS %	FS %	S %	C %	C Fract Min 1 Type %-%	C Fract Min 2 Type %-%	C Fract Min 3 Type %-%
0.0 - .10	3 80	15	1		2	Ka30-40	Il30-40	Qz 1-5
.10 - .20	70	25	2		3			
.20 - .30	10							
.30 - .60	9 71	23	3		2			
.60 - .90	18 65	21	6		6	Ka50-65	Il40-50	Qz 1-5
.90 -1.10	20							
1.10 -1`.20	54							
1.20 -1.50	42 63	19	4		11			
1.50 -1.80	40							
1.80 - 2.00	28 66	9	2		22	Ka65-80	Il30-40	Qz 1-5

SOIL TYPE: ***Hann* (Hn)**
SITE NO: 835
A.M.G. REFERENCE: 14 45 47 S 143 31 24 E
SUBSTRATE MATERIAL:
SLOPE: 3 %
GREAT SOIL GROUP: Soloth LANDFORM ELEMENT TYPE: hillslope
PRINCIPAL PROFILE FORM: Dg3.41 LANDFORM PATTERN TYPE: undulating rises 9-30m 3-10%
AUSTRALIAN SOIL CLASSIFICATION: Sodic Sodosolic Oxyaquic Hydrosol
STRUCTURAL FORM: Tall open forest
DOMINANT SPECIES: *Eucalyptus clarksoniana ?, Melaleuca* spp. *Banksia* spp. *Grevillea* spp.

CONDITION OF SURFACE SOIL WHEN DRY: loose

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A11	0 to .03 m	Brownish black (10YR3/1); loamy fine sand; massive; dry; very weak. clear to-
A12	.03 to .25 m	Brownish grey (10YR4/1); loamy fine sand; massive; dry; very weak. gradual to-
A21e	.25 to .50 m	Greyish brown (7.5YR6/2); sand; massive; moderately moist; very weak. gradual to-
A22e	.50 to .80 m	Brownish grey (7.5YR6/1); coarse sand; single grain; moist; loose. gradual to-
A23e	.80 to 1.40 m	Brownish grey (7.5YR6/1); coarse sand; single grain; wet; loose. gradual to-
B2	1.40 to 1.60 m	Light brownish grey (7.5YR7/1); clayey coarse sand; common medium pebbles, subangular quartz; moderate <2mm subangular blocky; moist; moderately firm.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	5.4 .02 .002							4.1
0.10	5.6 .02 .001	25 70 4 1	.54 .58 .11 .07	.018 1.91 .026	.1 2	.83	0.3 0.3	4
0.30	5.6 .01 .001	47 49 4 1	.36 .39 .02 .05	.012 .816 .019	.1 1	.83	0.2 0.2	4.4
0.60	5.8 .01 .001	91 8 1 1	.48 .41 .01 .04	.009 .299 .019	.1 1	.89	0.01 0.1	5
0.90	5.7 .01 .001	94 5 1 1	0.7 0.6 .01 .03	.008 .239 .019	.1 1	.92	0.01 0.1	5.2
1.20	5.7 .01 .001	79 19 1 1	.65 .56 .02 .04	.011 .598 .018	.1		0.1 0.1	5.3
1.50	5.8 .01 .001							4.2

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	0.7	.01	7 1.1	.05		17 1 .05 .14	2		
0.10									2 25 70 4 1
0.30									1 47 49 4 1
0.60							1		1 91 8 1 1
0.90									1 94 5 1 1
1.20									1 79 19 1 1
1.50									

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Harmer* (Hm)**
SITE NO: T32
Drainage : imperfectly drained
Locality : GUNSHOT CK
Latitude 114600 S Longitude 1423000 E

State : QUEENSLAND
Project : REG
Date : 15/07/70

LANDFORM
Relief Modal/Slope Class : undulating rises 9-30m
3-10%
Pattern type : rises
Element type : hillslope
Slope : ridge
Relief : 15 metres
Slope Category : gently inclined

CLASSIFICATION
Principal Profile Form : Gn2.64
Great Soil Group : YELLOW EARTH.
Aust. Class: Bleached-mottled DystrophicYellow Kandosol

GEOLOGY
Substrate Material : sandstone
Geological Reference : JKb

VEGETATION
Tallest Stratum Form : Tall heathland
Dominant Species : *Grevillea glauca, Acacia* spp.
Ground Cover Species : *Xanthorrhea johnsonii*

SITE DISTURBANCE : no effective disturbance except grazing by hoofed animals

LOCATION :
5.4km south of Gunshot Creek on detour road:

CONDITION OF SURFACE SOIL WHEN DRY : soft

PROFILE MORPHOLOGY :

HORIZON	DEPTH	DESCRIPTION
A1	0 to .10 m	Dark greyish brown (10YR4/2), (10YR5/2d) ; loamy sand; weak 5-10mm angular blocky; dry; moderately firm; common 1-2mm roots; gradual change to -
	.10 to .20 m	Dark greyish brown (2.5Y4/2), (10YR6/2d); sandy loam; weak 5-10mm angular blocky; dry; moderately firm; common 2-5mm roots; gradual change to -
A21	.20 to .30 m	Yellowish brown (10YR5/4), (2.5Y6/4d); sandy loam; massive; dry; very firm; few 1-2mm roots;
	.30 to .40 m	Brownish yellow (10YR6/6), (10YR7/6d); sandy loam; massive; dry; very firm; few roots;
	.40 to .50 m	Brownish yellow (10YR6/5), (10YR7/6d); sandy loam; massive; moderately moist; very weak; 2.-10% 2-6mm calcareous concretions;
	.50 to .60 m	Brownish yellow (10YR6/6), (10YR7/6d); sandy loam; massive; moderately moist; very weak;
	.60 to .75 m	Brownish yellow (10YR6/6); sandy loam; massive; moderately moist; very weak; clear change to -
	.75 to .90 m	Reddish yellow (7.5YR7.8); faint yellow (10YR7.8) mottles; sandy loam (heavy); massive; moderately moist; very weak;
	.90 to 1.20	Reddish yellow (7.5YR7/8); 10-20% 5.15mm faint yellow (2.5YR7/6) primary and reddish brown (2.5YR5/4) secondary mottles; sandy clay loam (light); massive; moderately moist; very weak; 2-10% 6-20mm ferruginous nodules'
	1.20 to1.50 m	Reddish yellow (7.5YR6/7) 20-50% 15-30mm distinct brownish yellow (10YR6/8) primary and yellow (10YR8/8) secondary mottles; sandy clay loam; massive; moderately moist; very weak; 2-10% 6-20mm ferruginous nodules;
	1.50 to 1.80 m	Brownish yellow (10YR6/6); 10-20% 5-15mm distinct reddish yellow (5YR6/8) mottles; sandy clay loam; massive; moderately moist; very weak; 20-50% 6-20mm ferruginous nodules; clear change to -
	1.80 to 2.10 m	Brownish yellow (10YR6/6); 10-20% 5-15mm distinct reddish yellow (5YR6/8) primary and red (10R4/8) secondary mottles; clay loam (heavy); massive; moderately moist; very weak;

NOTE: 50-90CM A1 MATERIAL IN ROOT OR ANIMAL CHANNELS: 300-330CM POCKETS OF 2.5YR84 ARE SCL: 420-440CM SOFT W'D FINE SST:

CHEMICAL ANALYSIS :

Depth metres	1:5 1.5 ph EC ms/cm	Org Tot C N % %	Exch. Cations Ca Mg K Na meq meq meq meq	Exh. Acid meq	Comp Dir. Sum. CEC CEC CEC meq meq meq	Aval P ppm	ADM %	TOT. Cu ppm	TOT. Zn ppm	TOT. Mn ppm	TOT. Fe %
0.0 -.10	5.4 .029	1.68 0.09	0.16 0.11 0.07 0.07	4.6	1.2 5	A <2	1.0		6	4	15 0.76
						B <2					
.10- 20	5.4 .029						2.0				
.20- .30	5.4 .026	0.85 0.05	0.10 0.10 0.06 0.05	3.2	1.1 3.5	A 2	0.5		5	3	20 0.79
						B <2					
.30- .40	5.5 .032						1.0				
.40- .50	5/5 /035						0.5				
.50- .60	5.6 0.02	0.34 0.02	0.02 0.08 0.07 0.04		0.7	A 2	2.0				
.60- .75	5.4 .029						2.0		4	3	19 0.74
.75- .90	5.5 .035						1.0				
.90-1.20	5.5 .029		0.10 0.37 0.11 0.05	1.1	0.5 1.7	A <2	2.0		5	4	10 1.39
1.20-1.50	5.5 026						3.0				2.63
1.50-1.80	5.6 .029		0.10 0.52 0.14 0.07				2.0				
1.80-2.10	5.5 .034			1.6	1.82 0.4 2.4	A <2	3.0				6.14

SOIL TYPE: ***Kennedy* (Kd)**
SITE NO: 501
A.M.G. REFERENCE: 15 0943 S 144 20 03 E
SUBSTRATE MATERIAL: alluvia
SLOPE: 0 %
GREAT SOIL GROUP: Grey clay LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Ug3.2 LANDFORM PATTERN TYPE: gently undulating plains <9m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Endo-hypersodic Massive Grey Vertosol
STRUCTURAL FORM: Tall open woodland
DOMINANT SPECIES: *Eucalyptus tessellaris*

CONDITION OF SURFACE SOIL WHEN DRY: periodic cracking, hardsetting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .05 m	Brownish grey (10YR4/1); common fine prominent orange mottles; silty light clay; massive; dry; very firm. abrupt to-
A3j	.05 to .15 m	Dull yellowish brown (10YR4/3); common fine prominent pale mottles; silty light medium clay; massive; dry; very firm. clear to-
B21	.15 to .45 m	Greyish yellow-brown (10YR4/2); common fine faint orange mottles; medium clay silty; moderate <2mm polyhedral; moderately moist; moderately firm. gradual to-
B22	.45 to .90 m	Greyish yellow-brown (10YR4/2); common fine distinct grey mottles, common fine distinct orange mottles; medium clay silty; strong <2mm polyhedral; moderately moist; moderately weak. gradual to-
B23	.90 to 1.00 m	Brownish grey (10YR4/1); common fine distinct orange mottles, common fine distinct brown mottles; medium clay silty; strong <2mm polyhedral; moist;.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	5.6 .04 .003							4.4
0.10	5.5 .05 .004	3 7 52 38		.07 2.12 .027	2.4 15	.86	0.5 0.9	4.4
0.30	6.5 .06 .006	6 7 40 48		.051 2.19 .023	2.8 17	.88		4.2
0.60	7 .46 .070	4 23 35 38		.041 1.88 .022	2.6 15	.99		5
0.90	7.4 .78 .122	4 25 37 36		.056 1.8 .021	3.1 17	.97		6.4
1.20	5.5 .95 .167	4 7 37 51		.047 2.14 .022	4.8		0.2 0.9	4.8

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb. mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	1.4	.12	57 104	.54		276 82 3 3.7	4		
0.10									10 4.5 3.5 .36 .65
0.30									17 8.8 7 1.5 .26
0.60							1		19 7.3 6 6 .17
0.90									19 5 5 9 .6 .18
1.20									23 4.8 5.7 13 .19

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Kennedy* (Kd)**
SITE NO: 877
A.M.G. REFERENCE: 15 49 41 S 1 42 08 00 E
SUBSTRATE MATERIAL:
SLOPE: 0 %
GREAT SOIL GROUP: Grey clay LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Ug5.35 LANDFORM PATTERN TYPE: level plain <9m <1%
AUSTRALIAN SOIL CLASSIFICATION: Epihypersodic Pedal Grey Vertosol
STRUCTURAL FORM: Grassland
DOMINANT SPECIES: *Heteropogon triticeus*
TYPE OF MICRORELIEF: normal gilgai VERTICAL INTERVAL: .04 m HORIZONTAL INTERVAL: 6 m

CONDITION OF SURFACE SOIL WHEN DRY: hardsetting, periodic cracking

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .10 m	Dull yellowish brown (10YR5/3); common fine distinct orange mottles; light medium clay; moderate <2mm subangular blocky; dry; moderately strong. clear to-
B21	.10 to .35 m	Dull yellowish brown (10YR4/3); common fine distinct grey mottles; medium clay; very few medium pebbles, rounded quartz; strong <2mm angular blocky; moderately moist; very firm. gradual to-
B22	.35 to .60 m	Dark greyish yellow (2.5Y4/2); common fine faint orange mottles; heavy clay; very few medium pebbles, rounded quartz; strong <2mm angular blocky; moderately moist; very firm; few medium manganiferous nodules. diffuse to-
B23	.60 to 1.10 m	Dark greyish yellow (2.5Y4/2); many fine faint orange mottles; heavy clay; very few medium pebbles, rounded quartz; strong 5-10mm lenticular; moderately moist; very firm; few medium manganiferous nodules. diffuse to-
B24	1.10 to 1.35 m	Dark greyish yellow (2.5Y4/2); heavy clay; very few medium pebbles, rounded quartz; strong 5-10mm lenticular; moderately moist; very firm; few medium manganiferous nodules. gradual to-
B25	1.35 to 1.50 m	Greyish yellow-brown (10YR4/2); few fine distinct yellow mottles; medium heavy clay; few small pebbles, rounded quartz; strong 2-5mm lenticular; moderately moist; very firm.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	CEC Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	6 .02 .001							4.3
0.10	6.2 .02 .001	10 15 14 61	16 3.8 5 0.4 .33	.023 1.63 .025	2.1 15	.49	11	4.5
0.30	7.3 .05 .003	11 15 12 60	17 5.6 7.3 1.2 .18	.016 1.67 .022	2.4 16	.94	15	5.9
0.60	7.8 .27 .040	9 13 13 62	19 6.0 7.4 3.3 .22	.016 1.74 .022	2.5 18	.9	18	6.7
0.90	7.9 .66 .100	6 13 13 63	19 5.5 6.6 5.6 .27	.017 1.76 .022	2.4 19	.99	22	7.1
1.20	8.2 .82 .124	6 13 15 62	19 5.2 6.8 7 .29	.017 1.79 .022	2.4 20	.99	22	7.4
1.50	8.7 .56 .077		11 2.9 3.9 4.5 .17				14	7.6

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	0.7	.05	1.1	.30		103 47 2.7 1.3	3		
0.10							8		11 4 6.3 .53 .35
0.30							1		15 5.7 8 1.5 .24
0.60							2		18 6.4 8 4 .24
0.90							1		21 5.8 7.7 7.9. 29
1.20							1		21 4.5 6.5 9.8 0.3
1.50							2		14 2.9 4.0 6.8 .23

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Kimba* (Kb)**
SITE NO: 524:
A.M.G. REFERENCE: 1430 38 S 143 39 32 E
SUBSTRATE MATERIAL: Residual sand
SLOPE: 3 %
GREAT SOIL GROUP: Red earth LANDFORM ELEMENT TYPE: hillslope
PRINCIPAL PROFILE FORM: Gn2.14 LANDFORM PATTERN TYPE: undulating rises 9-30m 3-10%
AUSTRALIAN SOIL CLASSIFICATION: Haplic Mesotrophic Red Kandosol
STRUCTURAL FORM: Very tall open woodland
DOMINANT SPECIES: *Eucalyptus tetrodonta, Erythrophleum chlorostachys*

CONDITION OF SURFACE SOIL WHEN DRY: firm

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A11	0 to .04 m	Black (7.5YR2/1); sandy loam; massive; dry; moderately weak. clear to-
A12	.04 to .20 m	Brownish black (7.5YR3/2); sandy loam; massive; dry; moderately weak. gradual to-
A2	.20 to .55 m	Dull reddish brown (5YR4/4); loamy sand; massive; moderately moist; moderately firm. gradual to-
B1	.55 to .70 m	Reddish brown (2.5YR4/6); sandy loam; massive; moderately moist; moderately firm. gradual to-
B2	.70 to 1.20 m	Dark reddish brown (2.5YR3/6); sandy clay loam; massive; moderately moist; moderately firm.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
	pH EC Cl	CS FS S C	CEC Ca Mg Na K	P K S	ADM 33* 1500*	R1 R2	Al Acid	CaCl2
metres	dS/m % @ 40C 105C	% @ 105C	m.eq/100g @ 105C	% @ 80C	% @ 105C	@ 40C	m.eq/100g @ 105C	@ 40C
B 0.10	5.9 .03 .002							4.8
0.10	5.8 .02 .001	64 26 3 8		.016 .058 .029	.8 4	.67	0.1 0.3 5	4.6
0.30	6.1 .01 .001	58 31 3 8		.014 .099 .023	.5 3	.65	4	5
0.60	6.3 .01 .001	59 31 3 8		.011 .083 .019	.3 3	.72	2	4.9
0.90	6.3 .01 .001	54 26 3 18		.015 .086 .02	.4 5	.59	2	5.1
1.20	6.3 .01 .001	41 25 3 32		.016 .081 .022	.7		3	5.3

Depth	Org.C	Tot.N	Extr. P	Hcl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	2.4	.04	8 1.1	.05		32 6.6 .05 .11	3		
0.10									5 3 1.8 .02 .08
0.30									4 2 1.5 .01 .06
0.60							1		2 1 0.8 .02 .05
0.90									2 1.2 1.2 .03 .04
1.20									3 .96 1.8 .04 .03

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Kimba* (Kb)**
SITE NO: 837
A.M.G. REFERENCE: 15 17 32 S 143 5120 E
SUBSTRATE MATERIAL: Residual sand
SLOPE: 2 %
GREAT SOIL GROUP: Red Earth LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Gn2.12 LANDFORM PATTERN TYPE: gently undulating rises 9-30m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Haplic Mesotrophic Red Kandosol
STRUCTURAL FORM: Tall open forest
DOMINANT SPECIES: *Eucalyptus tetrodonta, Erythrophleum chlorostachys, Grevillea parallela, Heteropogon triticeus*

CONDITION OF SURFACE SOIL WHEN DRY: soft

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A11	0 to .03 m	Brownish black (7.5YR3/2); loamy sand; massive; moderately moist; moderately weak.
A12	.03 to .20 m	Brownish black (7.5YR3/2); loamy sand; massive; moderately moist; moderately weak. gradual to-
A3	.20 to .50 m	Dull reddish brown (2.5YR4/4); loamy sand; massive; dry; moderately firm. gradual to-
B1	.50 to .80 m	Reddish brown (2.5YR4/6); light sandy clay loam; massive; moderately moist; moderately firm. diffuse to-
B21	.80 to 1.25 m	Red (10R4/6); sandy clay loam; massive; moderately moist; moderately firm. diffuse to-
B22	1.25 to 1.50 m	Red (10R4/6); clay loam, sandy; massive; moderately moist; moderately firm.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	5.6 .02 .001							4.4
0.10	5.5 .02 .001	44 44 5 7		.015 .051 .024	.5 3	.09	0.4 0.4	4.3
0.30	5.7 .01 .001	46 44 4 9		.016 .068 .023	.5 3	.11	0.4 0.5	4.7
0.60	5.5 .01 .001	41 42 4 14		.018 .088 .022	.5 4	.63	0.4 0.4	4.4
0.90	5.8 .01 .001	35 46 5 14		.018 .108 .021	.4 5	.46	0.2 0.2	4.9
1.20	6 .01 .001	32 46 4 20		.019 .126 .021	.4			4.7
1.50	5.9 .01 .001							4.9

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	1.2	.02	7 1.1	.06		29 9.3 0.1 .14	2		
0.10									3 1.1 1.2 .04 .12
0.30									2 0.7 .84 .03 .08
0.60							2		2 .65 1.2 .03 .07
0.90									2 .58 1.2 .02 .05
1.20									2 .67 1.5 .04 .05
1.50									

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Kimba* (Kb)**
SITE NO: 840
A.M.G. REFERENCE: 15 34 46 S 143 40 31 E
SUBSTRATE MATERIAL:
SLOPE: 4 %
GREAT SOIL GROUP: Red earth
PRINCIPAL PROFILE FORM: Gn2.12
AUSTRALIAN SOIL CLASSIFICATION:
LANDFORM ELEMENT TYPE: hillslope
LANDFORM PATTERN TYPE: undulating rises 9-30m 3-10%
STRUCTURAL FORM: Tall woodland
DOMINANT SPECIES: *Eucalyptus tetrodonta, Eucalyptus hylandii, Grevillea glauca, Heteropogon triticeus*

CONDITION OF SURFACE SOIL WHEN DRY: soft

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .03 m	Dark reddish brown (5YR3/4); sandy loam; moist; moderately firm. clear to-
A3	.03 to .20 m	Dark reddish brown (2.5YR3/5); light sandy clay loam; massive; moist; moderately firm. gradual to-
B1	.20 to .65 m	Reddish brown (2.5YR4/6); sandy clay loam; massive; dry; moderately firm. diffuse to-
B21	.65 to 1.00 m	Reddish brown (2.5YR4/6); clay loam, sandy; massive; moderately moist; moderately firm. diffuse to-
B22	1.00 to 1.50 m	Red (10R4/6); clay loam; massive; moderately moist; moderately firm.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	6.2 .02 .001							5.1
0.10	6.3 .01 .001	55 26 6 16		.017 .045 .022	.8 7	.7	3	5.2
0.30	6.3 .01 .001	50 26 5 19		.018 .041 .022	.7 7	.44	3	5.2
0.60	6.2 .01 .001	48 24 5 26		.017 .035 .02	.7 9	.15	3	5.2
0.90	6.2 .01 .001	39 25 5 35		.016 .027 .02	.9 12	.12	3	5.5
1.20	6.2 .01 .001	33 25 5 40		.016 .033 .02	.9		3	5.6
1.50	6.2 .01 .001							5.6

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	1.3	.02	2 1.1	.05		14 5.2 .05 .12	4		
0.10									3 1.5 1.5 .03 0.1
0.30									3 0.9 1.9 .07 .06
0.60							8		3 .74 2.1 .03 .04
0.90									3 .49 2.3 .03 .03
1.20									3 .60 2.5 .04 .03
1.50									

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Kool* (Kl)**
SITE NO:T127

State : QUEENSLAND
Project : REG
Date : 15/07/70

Locality : DULHUNTY R.
Latitude 115700 S Longitude 1423100 E

LANDFORM
Relief Modal/Slope Class : rolling rises 9-30m
10-32%
Pattern type : rises
Element type : hillcrest
Slope : ridge
Relief : 30 metres
Slope Category : level

CLASSIFICATION
Principal Profile Form : Um4.2
Great Soil Group : RED EARTH.
Aust Class. Ferric Dystrophic Red Kandosol

GEOLOGY
Substrate Material : sandstone
Geological Reference : Klr

VEGETATION
Tallest Stratum Form : Tall woodland
Dominant Species : *Eucalyptus tetrodonta, Eucalyptus polycarpa*
Mid Stratum Species : *Acacia* spp.
Ground Cover Species : *Sorghum plumosum, Heteropogon triticeus*

SITE DISTURBANCE : no effective disturbance except grazing by hoofed animals

LOCATION :
5.6km south of Alice River on Moreton/McDonnel Telegraph line:

CONDITION OF SURFACE SOIL WHEN DRY : firm

PROFILE MORPHOLOGY :

HORIZON	DEPTH	DESCRIPTION
A1	0 to .10 m	Dark brown (7.5YR3/2), (7.5YR4/3d) ; loamy ; massive; dry very firm; gradual change to -
A1	.10 to .20 m	Dark brown (7.5Y3/2), (7.5YR4/3d); loam; massive; moist; moderately weak; gradual change to -
A12	.20 to .30 m	Dark reddish brown (5YR3/3); loam; massive; moist; moderately weak; gradual change to -
A2	.30 to .40 m	Dark red (2.5YR3/5); loam; massive; very weak; gradual change to -
A2	.40 to .50 m	Dark red (2.5YR3/5); loam (heavy); massive; very weak; gradual change to -
B1	.50 to .60 m	Red (2.5YR4/7), clay loam; massive; moderately firm; gradual change to -
	.60 to .75 m	Red (2.5YR4/7); clay loam; massive; moderately firm; gradual change to -
	.75 to .90 m	Red (2.5YR4.8); clay loam; massive; moderately firm; gradual change to -
	.90 to 1.05	Red (2.5YR4/8); clay loam; massive; moderately firm; gradual change to -
	1.20 to1.35 m	Red (2.5YR4/8) <2% <5mm distinct yellow (10YR7/6) mottles; clay loam; massive; moderatley firm; gradual change to -
	1.50 to 1.65 m	Red (2.5YR4/8); <2% <5mm distnct yellow (10YR7/6) mottles; clay loam; massive; moderately firm; <2% <5mm ferruginous nodules; clear change to -
	1.65 to 1.80 m	Red (2.5YR4/8); <2% <5mm distinct yellow (10YR7/6) mottles; sandy clay loam; massive moderately firm; 20-50% 6-20 mm ferruginous nodules;
	1.80 to 2.10 m	Red (2.5YR4/7); yellow (10YR7/6) mottles; sandy clay loam; massive; moderately firm; 20-50% 6-20 mm ferruginous nodules;
	2.10 to 2.40 m	Red (2.5YR4/7); yellow (10YR7/8) mottles; sandy clay loam (heavy); massive; moderately firm; 20-59% 6-20 mm ferruginous nodules;
	2.40 to 2.70 m	Red (2.5YR4/7); yellow 910YR7/6) mottles; sandy clay loam (heavy); massive; moderately firm; 20-50% 6-20mm ferruginous nodules;
	2.70 to 2.80 m	2.5 YR58(M):SL banded fabric:ferruginous SST and FE St. Frag

CHEMICAL ANALYSIS

Depth metres	1:5 1.5 pH EC ms/cm	Org Tot C N % %	Exch. Cations Ca Mg K Na meq meq meq meq	Exh. Acid. meq	Sum. CEC meq	Aval P ppm	TOT Cu ppm	TOT Zn ppm	TOT . Mn ppm	TOT Fe %	TOT P %	TOT K %	TOT S %
0.0 -.10	5.4 .038	0.95 0.16	0.30. 0.54 0.10 0.16	14.3	15.4	A <2	8	9	47	2.06	.19	.04	.012
.10- 20	5.5 .023	0.50 0.11	0.10 0.16 0.06 0.12	12.1	12.5	A 3.3					.016	.04	.011
.20- .30	5.6 .023	1.60	0.10 0.13 0.05 0.13	9.4	9.8	A 2.6		8	9	2.23	.017	.04	.009
.30- .40	5.7 .017												
.40- .50	5.6 0.02		0.10 0.20 0.04 0.13	6.0	6.5								
.50- .60	5.8 .014												
.60- .75	5.7 .017		0.10 0.34 0.03 0.13	2.4	3		6	9	43	2.39			
.75- .90	5.7 .017												
.90-1.05	5.3 .023		0.10 0.41 0.09 0.15	2.0	2.8		7	9	43	2.71			
1.05-1.20	5.5 .017												
1.20-1.35	5.6 .017		0.10 0.61 0.02 0.15	2.0	2.9	A <2				2.81	.015	.05	.006
1.35-1.50	5.8 .014												
1.50-1.65	5.6 .017												
1.65-1.80	5.8 .017		0.10 0.52 0.04 0.15	1.5	2.3								
1.80-2.10	5.8 .017		0.10 1.3 0.06 0.21	1.9	3.6								
2.10-2.40	5.9 0.02												
2.40-2.70	5.6 .026												
2.70- .0-	5.7 .029												

Depth metres	FREE Fe %	Ext. Al %	Particle Size GV CS FS S C %
0.0 - .10	1.61	1.56	0 3 76 3 18
.10- .20			0 4 73 7 16
.20- .30	1.56	1.44	0 3 74 5 18
.40- .50			0 3 75 2 20
.60- .75	1.80	0.62	0 2 75 2 21
.90-1.05	2.00	0.46	0 2 73 2 23
1.20-1.35	2.23		0 2 69 2 27
1.65-1.80			66 15 62 3 20

SOIL TYPE: ***Lydia* (Ld)**
SITE NO: 120
A.M.G. REFERENCE: 12 57 10 S 142 45 04 E
SUBSTRATE MATERIAL: Argillaceous sediments (Rolling Downs Group)
SLOPE: 1 %
GREAT SOIL GROUP: Gleyed podzolic soil LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Dg2.41 LANDFORM PATTERN TYPE: gently undulating plains <9m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Bleached-Mottled Mesotrophic Grey Dermosol
STRUCTURAL FORM: Tall open forest
DOMINANT SPECIES: *Eucalyptus clarksoniana, Petalostigma pubescens, Heteropogon triticeus*

CONDITION OF SURFACE SOIL WHEN DRY: hardsetting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .03 m	Brownish black (10YR3/2); loam, fine sandy; massive parting to weak 2-5mm cast; dry; moderately firm. abrupt to-
A2e	.03 to .25 m	Dull yellowish orange (10YR6/3); loam, fine sandy; massive; dry; moderately firm; few medium manganiferous nodules. gradual to-
B21	.25 to .70 m	Light grey (10YR7/1); many fine distinct orange mottles; light clay; moderate 2-5mm polyhedral; dry; moderately weak; many medium manganiferous nodules. diffuse to-
B22	.70 to 1.00 m	Dull yellowish orange (10YR7/2); many fine distinct red mottles, distinct orange mottles; light clay; strong 2-5mm polyhedral; moderately moist; moderately weak; very many medium manganiferous nodules. diffuse to-
B23	1.00 to 1.50 m	Dull yellowish orange (10YR7/2); many fine distinct red mottles, yellow mottles; medium clay; strong 2-5mm polyhedral; moderately moist; moderately firm; very few medium manganiferous nodules.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
0.10	5.8 .02 .001	2 60 32 14		.016 .059 .024	.8 4	.75	1	5.5
0.25	5.6 .01 .001	16 43 26 21		.021 .1 .026	1.5 8	.71	2	4.5
0.40	5.7 .01 .001						3	4.8
0.60	5.6 .01 .001	23 25 16 40		.034 .202 .027	2.6 13	.1	5	4.6
0.90	5.4 .01 .001	13 21 12 53		.03 .234 .023	2.9 16	.01	4	4.2
1.20	5.2 .02 .001	14 15 11 59		.025 .231 .026	3		3	4
1.50	5.1 .02 .001							3.9

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
0.10	1.1	.05	2	.05		22 36 .22 .16	7		1 .52 .66 .12 .06
0.25							26		2 .35 1.2 .15 .04
0.40							37		3 .78 2.3 .14 .05
0.60							32		5 .91 3.6 .19 .03
0.90							43		4 .64 3.3 0.2 .07
1.20							49		3 .23 2.3 .27 .05
1.50									

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Marina* (Mn)**
SITE NO: 887
A.M.G. REFERENCE: 143 730 S 1 435 756 E
SUBSTRATE MATERIAL:
SLOPE: 1 %
GREAT SOIL GROUP: Grey clay LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Ug5.29 LANDFORM PATTERN TYPE: level plain <9m <1%
AUSTRALIAN SOIL CLASSIFICATION: Episodic Pedal Aquic Vertosol
STRUCTURAL FORM: Grassland
DOMINANT SPECIES: *Panicum* spp. *Sorghum* spp.
TYPE OF MICRORELIEF: normal gilgai VERTICAL INTERVAL: .1. m HORIZONTAL INTERVAL: 5 m

CONDITION OF SURFACE SOIL WHEN DRY: periodic cracking, hardsetting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .08 m	Yellowish grey (2.5Y4/1); many medium prominent orange mottles; medium clay; strong 2-5mm angular blocky; moderately moist; moderately strong. clear to-
B21	.08 to .50 m	Grey (N5/0); many fine distinct red mottles; medium heavy clay; strong <2mm angular blocky; moist; moderately firm. gradual to-
B22	.50 to .85 m	Grey (N5/0); many fine prominent red mottles; heavy clay; strong 2-5mm lenticular; moist; moderately firm. gradual to-
B23	.85 to 1.05 m	Brownish grey (10YR5/1); common fine prominent red mottles; medium heavy clay; strong 2-5mm lenticular; moist; moderately firm. gradual to-
B24	1.05 to 1.20 m	Brownish grey (10YR5/1); common fine prominent yellow mottles; medium clay; strong 2-5mm lenticular; moist; moderately weak. clear to-
B31	1.20 to 1.30 m	Brownish grey (10YR5/1); many fine prominent yellow mottles; light clay; moderate 5-10mm lenticular; moist; moderately firm. clear to-
B32	1.30 to 1.40 m	Brownish grey (10YR6/1); common fine prominent yellow mottles; sandy light clay; massive; wet; moderately weak. clear to-
B33	1.40 to 1.60 m	Brownish grey (10YR5/1); light medium clay; wet; moderately weak.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	5.0 .41 .045							4.4
0.10	4.8 .91 .186	2 9 18 68		.023 1.50 .071	17	.62		4.3
0.30	5.2 1.3 .178	1 8 21 69		.021 1.56 .072	21	.77		4.7
0.60	5.4 2.0 .284	1 8 21 68		.024 1.57 .114	21	.99		4.8
0.90	5.4 1.6 .230	1 8 17 69		.026 1.68 .198	22	.99		4.9
1.20	6.5 1.6 .248	12 15 20 52		.028 1.73 1.07	19	.99		5.9
1.50	7.7 1.7 .269	35 13 13 38		.019 .824 .414	13	.99		7.1

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	1.6	.08	2.0	.37		68 5.1 .48 .23	114		
0.10							247		18 5.4 7.8 4.6 .68
0.30							366		22 5.0 7.7 8.7 .94
0.60							620		27 5.5 7.5 13 .98
0.90							480		25 4.9 7.1 12 1.1
1.20							299		22 4.2 6.2 11 .83
1.50							218		19 3.1 5.2 10 .57

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Myall*** **(MI)**
SITE NO: 133
A.M.G. REFERENCE: 12 58 14 S 142 19 14 E
SUBSTRATE MATERIAL: Argillaceous sediments (Rolling Downs Group)
SLOPE: 3 %
GREAT SOIL GROUP: Xanthozem LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Gn3.74 LANDFORM PATTERN TYPE: gently undulating plains <9m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Mottled Eutrophic Yellow Dermosol
STRUCTURAL FORM: Tall woodland
DOMINANT SPECIES: *Eucalyptus leptophleba, Eucalyptus clarksoniana, Heteropogon triticeus*
TYPE OF MICRORELIEF: normal gilgai VERTICAL INTERVAL: .40 m HORIZONTAL INTERVAL: 15 m

CONDITION OF SURFACE SOIL WHEN DRY: hard setting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .03 m	Brownish black (10YR3/2); light clay; moderate 2-5mm granular; dry; very firm; few medium manganiferous nodules. abrupt to-
A2	.03 to .15 m	Dull yellowish brown (10YR5/4); few fine faint orange mottles; light clay; moderate 2-5mm polyhedral; dry; very firm; few medium manganiferous nodules. clear to-
A3	.15 to .35 m	Yellowish brown (10YR5/5); few fine faint red mottles; light clay; moderate 2-5mm polyhedral; dry; moderately firm; common medium manganiferous nodules. diffuse to-
B1	.35 to .60 m	Yellowish brown (10YR5/6); many fine distinct yellow mottles; light clay; strong 2-5mm polyhedral; moderately moist; moderately weak; many medium manganiferous nodules. diffuse to-
B21	.60 to 1.10 m	Yellowish brown (10YR6/5); many fine distinct red mottles, yellow mottles; medium clay; strong 2-5mm polyhedral; moderately moist; moderately firm; many medium manganiferous nodules. diffuse to-
B22	1.10 to 1.30 m	Dull yellowish orange (10YR6/4); many fine distinct grey mottles, red mottles; medium clay; strong 2-5mm polyhedral; moderately moist; very firm; common medium manganiferous nodules. gradual to-
B23	1.30 to 1.50 m	Dull yellowish orange (10YR6/4), dull yellowish brown (10YR5/4); many fine prominent grey mottles; medium heavy clay; strong 5-10mm subangular blocky parting to weak 5-10mm lenticular; moderately moist; moderately strong; very few medium manganiferous nodules.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	5.7 .03 .002							4.6
0.10	6 .03 .002	5 23 11 57		.041 .127 .042	3.7 19	.23		4.9
0.30	6.2 .01 .001	9 15 9 69		.031 .13 .03	4 20	.21		5
0.60	6.2 .01 .001	15 16 10 62		.035 .137 .022	4.5 19	.3		5.1
0.90	6.5 .01 .001	12 21 11 58		.021 .141 .018	4 18	.35		5.4
1.20	6.6 .01 .001	12 21 11 58		.015 .14 .017	4.5			4.9
1.50	6.7 .01 .001							4.8

Depth	Org.C	Tot.N	Extr. P	HCL	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	2.0	.09	2	.13		38 25 .92 .56	16		
0.10							21		10 5.8 3.8 .18 0.2
0.30							14		9 4.9 4.0 .20 .08
0.60							8		10 5.4 4.7 .27 .08
0.90							6		10 5 5.3 .28 .08
1.20							4		12 5.1 7.0 .70 .07
1.50									

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Olive* (Ol)**
SITE NO: 828
A.M.G. REFERENCE: 15 12 24 S 144 23 11 E
SUBSTRATE MATERIAL: Alluvia/residual sand ?
SLOPE: 1 %
GREAT SOIL GROUP: Gleyed Podzolic Soil LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Dg1.4? LANDFORM PATTERN TYPE: gently undulating plains <9m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Eutrophic Chromosolic Oxyaquic Hydrosol
STRUCTURAL FORM: Tall open woodland
DOMINANT SPECIES: *Eucalyptus clarksoniana, Eucalyptus confertiflora, Melaleuca viridflora*

CONDITION OF SURFACE SOIL WHEN DRY: hardsetting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .01 m	Brownish grey (7.5YR4/1); loamy fine sand; massive; dry; moderately firm. sharp to-
A21e	.01 to .15 m	Brownish grey (7.5YR5/1); few fine faint orange mottles; loamy fine sand; massive; dry; moderately firm. gradual to-
A22e	.15 to .65 m	Greyish brown (7.5YR5/2); loamy fine sand; massive; dry; moderately firm. gradual to-
A23e	.65 to .75 m	Greyish brown (7.5YR5/2); loamy fine sand; massive; dry; moderately strong; few coarse ferromanganiferous nodules. clear to-
B1	.75 to .85 m	Greyish brown (7.5YR6/2); few fine distinct red mottles; clayey fine sand; moderate 10-20mm prismatic; dry; moderately strong; common coarse ferromanganiferous nodules.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	5.9 .03 .002							5.1
0.10	5.9 .07 .007	43 45 8 5		.013 .141 .024	.2 1	.94	0.1 0.I	5.2
0.30	6 .04 .004	45 44 10 4		.009 .111 .02	.2 1	.99		4.8
0.60	6 .01 .001	44 43 10 4		.011 .125 .019	.1 1	.99		5.3
0.85	6.8 .02 .002	45 38 11 7		.011 .171 .02	.2 3	.99		5.4

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metre	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	.75	.02	10 1.1	.05		27 14 .07 0.1	3		2 .86 .74 .28 .14
0.10									2 .89 .75 .16 .08
0.30									1 .66 .66 .05 .05
0.60							1		2 .66 1 .25 .08
0.85									

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Picanninny*** **(Pn)**
SITE NO: 42
A.M.G. REFERENCE: 12 42 24 S 142 27 33 E
SUBSTRATE MATERIAL: Argillaceous sediments (Rolling Downs Group)
SLOPE: 2 %
GREAT SOIL GROUP: Brown clay LANDFORM ELEMENT TYPE: hillslope
PRINCIPAL PROFILE FORM: Ug5.35 LANDFORM PATTERN TYPE: gently undulating plains <9m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Haplic Pedal Brown Vertosol
STRUCTURAL FORM: Mid-high open woodland
DOMINANT SPECIES: *Eucalyptus papuana, Eucalyptus leptophleba, Heteropogon triticeus*
TYPE OF MICRORELIEF: normal gilgai VERTICAL INTERVAL: .80 m HORIZONTAL INTERVAL: 8 m

CONDITION OF SURFACE SOIL WHEN DRY: periodic cracking, firm

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .03 m	Brownish black (10YR3/2); few fine faint orange mottles; light medium clay; moderate 2-5mm granular; dry; very firm; few medium manganiferous nodules. clear to-
B1	.03 to .25 m	Dull yellowish brown (10YR4/3); few fine faint orange mottles; medium heavy clay; weak 2-5mm polyhedral; moderately moist; very firm; few medium manganiferous nodules. diffuse to
B21	.25 to .60 m	Yellowish brown (2.5Y5/3); very few fine faint orange mottles; heavy clay; strong 2-5mm subangular blocky parting to weak 5-10mm lenticular; moderately moist; moderately firm; few medium manganiferous nodules. diffuse to-
B22	.60 to 1.40 m	Yellowish brown (2.5Y5/3); common fine faint orange mottles; heavy clay; strong 5-10mm lenticular; moderately moist; moderately firm; few medium manganiferous nodules. diffuse to-
B3	1.40 to 1.50 m	Dark greyish yellow (2.5Y4/2); few fine faint grey mottles; heavy clay; strong 5-10mm lenticular; moderately moist; very firm; few medium manganiferous nodules.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33*1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	5.7 .03 .002							4.6
0.10	6.2 .02 .001	4 31 10 54		.031 .49 .035	4.8 17	.22	20	5.1
0.30	6.5 .01 .001	8 27 11 56		.022 .471 .026	5.1 18	.31	21	5.3
0.60	6.9 .01 .001	8 26 12 56		.015 .462 .021	5.1 18	.41	23	5.3
0.90	7.4 .02 .001	6 26 11 57		.014 .461 .019	5.2 19	.49	24	5.8
1.20	7.5 .07 .006	5 25 10 59		.016 .462 .019	5.6		27	6.2
1.50	7.5 .23 .024							6.5

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Cap ug/L	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	1.7	.09	7	.40		97 100 2.5 1.6	12		
0.10							12		19 9.3 9.6 .14 .49
0.30							8		20 10 9.5 .29 .47
0.60							4		22 12 10 0.5 .38
0.90									23 13 10 0.9 .38
1.20							4		26 14 12 1.7 .33
1.50									

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Picanninny* (Pn)**
SITE NO: 852
A.M.G. REFERENCE: 15 30 30 S 144 17 42 E
SUBSTRATE MATERIAL: Argillaceous sediments (Wolena claystone)
SLOPE: 4 %
GREAT SOIL GROUP: Grey clay LANDFORM ELEMENT TYPE: hillslope
PRINCIPAL PROFILE FORM: Ug5.28 LANDFORM PATTERN TYPE: undulating rises 9-30m 3-10%
AUSTRALIAN SOIL CLASSIFICATION: Haplic Self-mulching Grey Vertosol
STRUCTURAL FORM: Tall open woodland
DOMINANT SPECIES: *Terminalia platyptera, Terminalia aridicola , Heteropogon triticeus*
TYPE OF MICRORELIEF: normal gilgai VERTICAL INTERVAL: .15 m HORIZONTAL INTERVAL: 8 m

CONDITION OF SURFACE SOIL WHEN DRY: periodic cracking, self-mulching

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A11	0 to .04 m	Brownish black (2.5Y3/1); light medium clay; strong 2-5mm granular; dry; moderately strong. clear to-
B1	.04 to .30 m	Dark greyish yellow (2.5Y4/2); light medium clay; strong 2-5mm angular blocky; dry; moderately strong. gradual to-
B21	.30 to .40 m	Olive black (5Y3/1); medium clay; strong 2-5mm lenticular; dry; moderately strong. diffuse to-
B22	.40 to .60 m	Olive black (5Y3/1); medium clay; strong 5-10mm lenticular; moderately moist; moderately strong; few fine calcareous nodules. diffuse to-
B23	.60 to 1.20 m	Dark greyish yellow (2.5Y4/2); medium heavy clay; strong 10-20mm lenticular; moderately moist; moderately strong; few fine calcareous nodules. diffuse to-
B24	1.20 to 1.50 m	Greyish olive (5Y4/2); medium heavy clay; very few medium pebbles, subrounded quartz; strong 10-20mm lenticular; moderately moist; very firm; few fine calcareous nodules.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	CEC Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	7.5 .07 .001							6.6
0.10	8.1 .09 .002	3 7 18 77	64 62 5 .24 0.8	.051 .939 .035	16.6 26	.43	70	7.2
0.30	8.5 .09 .001	4 6 14 75	61 58 4.9 .30 .60	.046 .934 .03	8.8 25	.38	65	7.5
0.60	8.6 .11 .001	5 5 15 73	58 54 5.0 .58 .55	.05 .959 .028	8.7 25	.39	67	7.6
0.90	8.8 .14 .001	4 5 13 75	57 50 6.3 2.4 0.5	.046 .963 .027	9.1 26	.49	67	7.7
1.20	8.9 .24 .005	5 5 12 75	58 49 7.4 4.1 .47	.048 .936 .025	8.7		68	7.8
1.50	8.6 .6 .057							7.8

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	1.7	.09	24 2	1.0		22 54 2.4 1.3	4		
0.10									60 54 5.1 .09 .83
0.30									60 54 5.5 .19 .68
0.60							1		62 55 5.9 .46 .69
0.90									61 51 7.2 2.2 .66
1.20									63 51 7.8 4.0 .55
1.50									

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Rule*** **(RI)**
SITE NO: 800
A.M.G. REFERENCE: 15 44 14 S 145 13 43 E
SUBSTRATE MATERIAL: Slate, greywacke (Hodgkinson Formation)
SLOPE: 5 %
GREAT SOIL GROUP: No suitable group LANDFORM ELEMENT TYPE: hillslope
PRINCIPAL PROFILE FORM: Gn3.11 LANDFORM PATTERN TYPE: undulating rises 9-30m 3-10%
AUSTRALIAN SOIL CLASSIFICATION: Haplic Mesotrophic Red Dermosol
STRUCTURAL FORM: Tall closed forest
DOMINANT SPECIES:

CONDITION OF SURFACE SOIL WHEN DRY: firm

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A11	0 to .10 m	Brownish black (7.5YR3/1); clay loam silty; strong 2-5mm cast; dry; moderately firm. clear to-
A12	.10 to .20 m	Brownish black (7.5YR3/2); clay loam silty; moderate 2-5mm cast; dry; moderately firm. gradual to-
A3	.20 to .40 m	Dark brown (7.5YR3/3);;clay loam silty; moderate 2-5mm cast; dry; moderately firm. gradual to-
B1	.40 to .60 m	Dull reddish brown (5YR4/4); light clay; moderate <2mm polyhedral; moderately moist; very firm. gradual to-
B2	.60 to 1.10 m	Reddish brown (5YR4/6); light medium clay; strong 2-5mm subangular blocky; moderately moist; very firm. gradual to-
B3?	1.10 to 1.50 m	Brown (7.5YR4/6); light medium clay; strong 2-5mm subangular blocky; moderately moist; very firm.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	6.1 .05 .003							5.2
0.10	6.1 .05 .003	4 .1 33 25		.052 1.42 .051	1.5 12	.43		5.2
0.30	6.1 .02 .001	2 44 29 30		.04 1.45 .035	1 11	.52		5.1
0.60	5.9 .01 .001	1 46 24 34		.039 1.34 .027	.9 12	.07	0.01 0.1	5.2
0.90	5.8 .01 .001	1 48 28 27		.038 1.25 .025	.8 11	.08	0.2 0.2	4.7
1.20	5.8 .01 .001	1 43 30 31		.036 1.43 .025	.8		0.3 0.3	4.6
1.50	5.8 .01 .001							4.8

Depth	Org.C	Tot.N	Extr. P	HCL	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	2.6	.13	57 1.1	.38		28 142 .84 1.1	9		
0.10									7 3.8 2.6 .14 .43
0.30									3 1.6 1.5 .05 .33
0.60							23		3 .77 1.9 .04 .11
0.90									3 .62 1.5 .06 .16
1.20									3 .41 1.6 .05 .19
1.50									

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Silver* (Sv)**
SITE NO: 542
A.M.G. REFERENCE: 13 34 55 S 143 29 04 E
SUBSTRATE MATERIAL: Colluvia derived from adamellite
SLOPE: 0 %
GREAT SOIL GROUP: Solodic LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Dg3.43 LANDFORM PATTERN TYPE: level plain <9m <1%
AUSTRALIAN SOIL CLASSIFICATION: Sodic Sodosolic Oxyaquic Hydrosol
STRUCTURAL FORM: Mid-high open forest
DOMINANT SPECIES: *Melaleuca viridiflora, Livistonia mulleri*
SURFACE COARSE FRAGMENTS: Many small subangular quartz pebbles,

CONDITION OF SURFACE SOIL WHEN DRY: surface crust

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .01 m	Brownish grey (10YR4/1); coarse sand; very few small pebbles, subangular quartz; single grain; moderately moist; moderately weak. sharp to-
A12e	.01 to .20 m	Greyish yellow-brown (10YR5/2); coarse sand; very few small pebbles, subangular quartz; single grain; moderately moist; moderately weak. clear to-
A21e	.20 to .25 m	Greyish yellow-brown (10YR6/2); coarse sand; few small pebbles, subangular quartz; single grain; moderately moist; moderately weak. clear to-
A22e	.25 to .45 m	Dull yellowish orange (10YR7/2); coarse sand; few small pebbles, subangular quartz; massive; dry; moderately firm. clear to-
A23e	.45 to .55 m	Greyish yellow (2.5Y7/2); few fine distinct orange mottles; coarse sand; few small pebbles, subangular quartz; massive; dry; moderately firm. clear to-
B1	.55 to .70 m	Greyish yellow (2.5Y6/2); few fine distinct orange mottles, few fine prominent pale mottles; clayey coarse sand; few small pebbles, subangular quartz; massive; moderately moist; moderately firm. clear to-
B21	.70 to .80 m	Greyish yellow (2.5Y6/2); coarse sandy light clay; common small pebbles, subangular quartz; weak 5-10mm lenticular; moderately moist; moderately firm; few medium manganiferous soft segregations. clear to-
B22	.80 to .95 m	Grey (N6/1); coarse sandy light medium clay; few small pebbles, subangular quartz; moderate <2mm subangular blocky; moderately moist; moderately firm; few medium manganiferous soft segregations. clear to-
B3?	.95 to 1.20 m	Grey (5Y6/1); coarse sandy light clay; few small pebbles, subangular quartz; weak 5-10mm lenticular; moderately moist; moderately firm.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	CEC Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	6 .02 .001							5.1
0.10	6.2 .01 .001	78 17 5 2	1 .94 .31 .09 .02	.014 .959 .021	.1 1	.99		5.4
0.30	5.8 .01 .001	77 16 6 2	2 0.3 .31 .09 .02	.014 1.13 .021	.2 1	.99	0.1 0.1	5.2
0.60	6.4 .04 .004	65 18 9 9	5 1.2 1.6 .37 .05	.014 1.11 .022	.7 4	.99		5.1
0.90	8.7 .55 .063	40 22 17 24	11 3.1 3.6 3.3 .08	.013 1.4 .026	1.5 9	.99		7.5
1.20	9.1 1 .140	48 17 12 26	15 4.3 4.3 5.6 0.1	.013 1.47 .048	2.7			8.2

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/ @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	0.4	.01	6 1.1	.05		17 2.6 .05 .24	3		
0.10									2 0.9 0.66 .04 .05
0.30									1 .43 .35 .04 .04
0.50							8		4 1.3 1.5 .71 .01
0.90									13 3.6 3.9 5.7 .14
1.20									23 8 5.5 9.8 .14

SOIL TYPE: ***Victor* (Vc)**
SITE NO: 841
A.M.G. REFERENCE: 15 53 08 S 143 29 46 E
SUBSTRATE MATERIAL: Alluvia
SLOPE: 1 %
GREAT SOIL GROUP: Red podzolic soil LANDFORM ELEMENT TYPE: terrace flat
PRINCIPAL PROFILE FORM: Dr2.22 LANDFORM PATTERN TYPE: gently undulating plains <9m 1-3%
AUSTRALIAN CLASSIFICATION: Haplic Eutrophic Red Chromosol
STRUCTURAL FORM: Tall open forest
DOMINANT SPECIES: *Eucalyptus cullenii ?, Eucalyptus chlorophylla ?, Eucalyptus hylandii,*

CONDITION OF SURFACE SOIL WHEN DRY: hardsetting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .04 m	Brownish black (7.5YR3/2); clay loam, fine sandy; massive; moist; moderately weak. clear to-
A2	.04 to .15 m	Dull reddish brown (5YR4/3); fine sandy clay loam; massive; moist; moderately weak. clear to-
A3	.15 to .30 m	Dull reddish brown (5YR4/5); fine sandy clay loam; massive; moderately moist; moderately firm. gradual to-
B1	.30 to .60 m	Reddish brown (2.5YR4/5); light medium clay silty; moderate <2mm angular blocky; moderately moist; moderately firm. gradual to-
B21	.60 to .80 m	Dark reddish brown (2.5YR3/6); light medium clay silty; strong 2-5mm angular blocky; moderately moist; very firm. gradual to-
B22	.80 to 1.05 m	Dark reddish brown (2.5YR3/5); light medium clay silty; strong 2-5mm angular blocky; moderately moist; very firm. gradual to-
B23	1.05 to 1.30 m	Reddish brown (2.5YR4/6); light medium clay silty; strong 2-5mm angular blocky; moderately moist; very firm. gradual to-
B24	1.30 to 1.50 m	Reddish brown (5YR4/6); medium clay silty; moderate 2-5mm angular blocky; moderately moist; very firm.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	6.4 .01 .001							5.2
0.10	6.8 .03 .002	6 59 25 15		.028 1.18 .031	1 15	.64	7	5.6
0.30	6.2 .01 .001	2 59 22 22		.021 1.47 .02	.8 12	.79	4	4.8
0.60	6.4 .01 .001	1 49 22 33		.022 1.8 .019	1.3 12	.72	6	4.8
0.90	6.4 .01 .001	1 44 27 33		.024 1.92 .018	1.6 12	.7	7	5
1.20	6.5 .01 .001	1 46 29 29		.022 2 .018	1.2		8	5.1
1.50	6.8 .01 .001							5.2

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	.95	.04	5 1.1	0.3		27 54 .72 1.9	2		
0.10									7 4.9 1.5 .01 .32
0.30									4 1.9 1.8 .03 0.2
0.60							1		6 2.5 3 .05 .21
0.90									7 3.5 3.9 .08 .19
1.20									8 3.3 4 .08 .18
1.50									

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Victor* (Vc)**
SITE NO: 886
A.M.G. REFERENCE: 153 624 S 1 442 746 E
SUBSTRATE MATERIAL: Alluvia
SLOPE: 1 %
GREAT SOIL GROUP: No suitable group. Affin. with Red podzolic soil LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Dr2.22 LANDFORM PATTERN TYPE: gently undulating plains <9m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Haplic Magnesic Red Chromosol
STRUCTURAL FORM: Tall closed forest
DOMINANT SPECIES: *Eucalyptus tetrodonta, Erythrophleum chlorostachys, Brachychiton* spp.

CONDITION OF SURFACE SOIL WHEN DRY: hardsetting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .10 m	Brownish black (7.5YR3/2); fine sandy clay loam; massive; dry; moderately weak. clear to-
A2	.10 to .30 m	Reddish brown (5YR4/6); fine sandy loam; massive; dry; moderately firm. gradual to-
B1	.30 to .60 m	Reddish brown (2.5YR4/6); fine sandy light clay; massive; dry; moderately firm. gradual to-
B21	.60 to .90 m	Reddish brown (2.5YR4/7); fine sandy light medium clay; weak 5-10mm angular blocky; dry; very firm. gradual to-
B22	.90 to 1.20 m	Reddish brown (2.5YR4/7); fine sandy light clay; moderate 5-10mm angular blocky; dry; moderately strong. gradual to-
B23	1.20 to 1.30 m	Reddish brown (2.5YR5/7); few fine prominent pale mottles; fine sandy light clay; moderate 5-10mm angular blocky; dry; moderately strong. gradual to-
B24	1.30 to 1.50 m	Reddish brown (2.5YR5/7); common fine prominent pale mottles; fine sandy light clay; moderate 5-10mm angular blocky; dry; moderately strong.
B25	2.30 to .0+ m	Dull brown (7.5YR5/4); many fine distinct red mottles; light clay; strong 5-10mm angular blocky; dry; moderately strong.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	6.8 .03 .001							6.0
0.10	7.0 .03 .001	32 47 11 10		.028 .618 .035	3	.99		6.2
0.30	7.2 .03 .001	29 48 11 12		.016 .726 .022	3	.99		6.0
0.60	6.8 .03 .001	27 42 10 20		.019 1.16 .026	5	.97		6.0
0.90	7.1 .01 .001	25 38 11 29		.023 1.62 .037	8	.62		6.0
1.20	5.9 .02 .001	25 33 15 20		.021 1.60 .020	6	.52		4.9
1.50	5.9 .02 .001	21 42 14 22		.021 1.71 .020	6	.81		4.8
2.50	4.6 3.7 .785	2 25 29 30		.019 2.64 .029	10	.95		4.5

Depth	Org.C	Tot.N	Extr. P	HCI	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	1.1	.03	3.0	.20		7.8 31 .36 .99	1.0		
0.10							1.0		7 5.6 .65 .04 .21
0.30							1.0		2 1.3 .28 .02 .13
0.60							1.0		2 1.7 .39 .03 .24
0.90							2.0		3 2.2 .83 .04 .26
1.20							4.0		2 .39 1.8 .11 .13
1.50							4.0		3 .29 2.0 .140 .13
2.50							81		27 2.8 14 9.6 .13

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Wakooka* (Wk)**
SITE NO: 817
A.M.G. REFERENCE: 15 32 13 S 145 14 13 E
SUBSTRATE MATERIAL:
SLOPE: 1 %
GREAT SOIL GROUP: Gleyed podzolic soil LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Gn3.04 LANDFORM PATTERN TYPE: gently undulating plains <9m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Bleached-Mottled Mesotrophic Yellow Dermosol
STRUCTURAL FORM: Mid-high open woodland
DOMINANT SPECIES: *Eucalyptus clarksoniana?, Melaleuca viridiflora?, Themeda triandra*

CONDITION OF SURFACE SOIL WHEN DRY: hardsetting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .01 m	Brownish black (10YR3/1); silty clay loam; massive; dry; moderately weak. sharp to-
A21e	.01 to .05 m	Greyish yellow-brown (10YR6/2); common fine distinct orange mottles; silty clay loam; massive; dry; moderately firm. clear to-
A22e	.05 to .20 m	Greyish yellow (2.5Y6/2); few fine distinct yellow mottles; silty clay loam; massive; dry; moderately firm. clear to-
A3e	.20 to .25 m	Greyish yellow (2.5Y6/2); many fine faint yellow mottles; silty light clay; massive; dry; very firm. clear to-
B21	.25 to .45 m	Yellowish brown (2.5Y5/5); common fine distinct orange mottles; light medium clay silty; moderate 2-5mm angular blocky; dry; very firm. gradual to-
B22	.45 to .65 m	Dull yellow (2.5Y6/5); common fine faint orange mottles; light clay silty; moderate 2-5mm angular blocky; dry; very firm.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
	pH EC Cl	CS FS S C	Ca Mg Na K	P K S	ADM 33* 1500*	R1 R2	Al Acid	CaCl2
metres	dS/m % @ 40C 105C	% @ 105C	m.eq/100g @ 105C	% @ 80C	% @ 105C	@ 40C	m.eq/100g @ 105C	@ 40C
B 0.10	6.1 .05 .004							4.9
0.10	6.3 .03 .003	2 40 42 23		.013 .818 .025	.8 7	.81		4.9
0.30	6.1 .02 .001	1 27 42 36		.011 1.26 .025	6.2 10	.67		4.8
0.60	6 .02 .001	2 24 38 38		.012 1.45 .026	.8 11	.27		4.9

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
	(W&B)		Acid Bicarb	K	K P	Fe Mn Cu Zn	SO4S	Buff Equil	CEC Ca Mg Na K
metres	% @105C	% @105C	mg/kg @ 105C	meq% @105C	mg/kg @105C	mg/kg @ 105C	mg/kg @ 105C	Cap ug/L @ 40C	m.eq/100g @ 105C
B 0.10	1.2	.05	8 1.1	.18		39 11 .32 .26	8		
0.10									4 1.3 2.2 0.2 .19
0.30									3 .70 2.4 .20 .15
0.60							49		4 .85 3 .23 .11

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Wheeler* (WI)**
SITE NO: 78
A.M.G. REFERENCE: 12 51 03 S 142 27 08 E
SUBSTRATE MATERIAL: Alluvia
SLOPE: 1 %
GREAT SOIL GROUP: Grey earth LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Gn2.95 LANDFORM PATTERN TYPE: gently undulating plains <9m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Bleached-Manganic Mesotrophic Yellow Kandosol
STRUCTURAL FORM: Tall open forest
DOMINANT SPECIES: *Eucalyptus tetrodonta, Eucalyptus clarksoniana, Erythrophleum chlorostachys,*

CONDITION OF SURFACE SOIL WHEN DRY: hardsetting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .03 m	Brownish black (10YR3/1); fine sandy clay loam; massive; dry; moderately firm. abrupt to-
A2e	.03 to .15 m	Dull yellowish brown (10YR5/3); fine sandy clay loam; massive; dry; moderately firm; few medium manganiferous nodules. clear to-
A3	.15 to .50 m	Light yellow (2.5Y7/4); fine sandy clay loam; massive; dry; moderately weak; common medium manganiferous nodules. diffuse to-
B21	.50 to .85 m	Light yellow (2.5Y7/4); common fine distinct orange mottles, few fine distinct red mottles; clay loam; massive; dry; moderately weak; very many medium manganiferous nodules. diffuse to-
B22	.85 to 1.50 m	Light yellow (2.5Y7/4); common fine distinct orange mottles, few fine distinct yellow mottles; clay loam; massive; dry; moderately weak; very many medium manganiferous nodules.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
metres	pH EC Cl dS/m % @ 40C 105C	CS FS S C % @ 105C	CEC Ca Mg Na K m.eq/100g @ 105C	P K S % @ 80C	ADM 33* 1500* % @ 105C	R1 R2 @ 40C	Al Acid m.eq/100g @ 105C	CaCl2 @ 40C
B 0.10	6.1 .04 .002							5.4
0.10	6.3 .02 .001	5 72 7 19		.018 .037 .028	1.2 6	.32		5.3
0.30	6.3 .01 .001	6 54 4 37		.016 .046 .021	1.6 11	.29		5.3
0.60	6.1 .01 .001	11 42 4 44		.015 .064 .02	2 14	.01		5.3
0.90	5.9 .01 .001	21 32 5 43		.02 .082 .021	2.5 15	.12		5.6
1.20	5.7 .01 .001	24 31 4 42		.035 .091 .022	2.9			5.2
1.50	5.5 .01 .001							4.5

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @105C	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	1.2	.04	2	.07		15 117 0.4.25	7		
0.10							7		3 1.8 1.4 .09 .08
0.30							8		4 1.7 1.9 .08 .22
0.60							17		5 1.9 2.5 .11 .02
0.90							24		5 2.3 2.9 0.1 .03
1.20							24		5 2.3 3.0 .16 .05
1.50									

!
* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

SOIL TYPE: ***Witchura* (Wu)**
SITE NO: 469
A.M.G. REFERENCE: 15 35 01 S 143 33 17 E
SUBSTRATE MATERIAL: Laterised sandstone
SLOPE: 1 %
GREAT SOIL GROUP: Red Earth LANDFORM ELEMENT TYPE: plain
PRINCIPAL PROFILE FORM: Gn2.14 LANDFORM PATTERN TYPE: gently undulating plains <9m 1-3%
AUSTRALIAN SOIL CLASSIFICATION: Ferric Mesotrophic Red Kandosol
STRUCTURAL FORM: Very tall open forest
DOMINANT SPECIES: *Eucalyptus tetrodonta, Erythrophleum chlorostachys, Grevillea glauca,*

CONDITION OF SURFACE SOIL WHEN DRY: hardsetting

PROFILE MORPHOLOGY:

HORIZON	DEPTH	DESCRIPTION
A1	0 to .05 m	Brownish black (7.5YR3/1); loamy sand; massive; dry; moderately weak; few medium ferruginous nodules. abrupt to-
A21	.05 to .15 m	Brown (7.5YR4/5); loamy sand; massive; dry; moderately weak; few medium ferruginous nodules. gradual to-
A22	.15 to .30 m	Dull brown (7.5YR5/5); loamy sand; massive; dry; moderately weak; common medium ferruginous nodules. gradual to-
A31	.30 to .60 m	Bright reddish brown (5YR5/6); sandy loam; massive; moderately moist; moderately weak; many medium ferruginous nodules. gradual to-
A32	.60 to .75 m	Bright brown (5YR5/7); many fine prominent red mottles; sandy loam; massive; moderately moist; moderately weak; many coarse ferruginous nodules. gradual to-
B1	.75 to .90 m	Reddish brown (2.5YR4/6); sandy loam; massive; moderately moist; moderately weak; many coarse ferruginous nodules. gradual to-
B21	.90 to 1.20 m	Dark reddish brown (2.5YR3/6); light sandy clay loam; massive; moderately moist; moderately weak; common medium ferruginous nodules. gradual to-
B22	1.20 to 1.50 m	Dark reddish brown (2.5YR3/6); sandy clay loam; massive; moderately moist; moderately weak; few medium ferruginous nodules.

Depth	1:5 Soil/Water	Particle Size	pH 8.5 Cations	Total Elements	Moistures	Disp.Ratio	Exch ECEC	pH
	pH EC Cl	CS FS S C	Ca Mg Na K	P K S	ADM 33* 1500*	R1 R2	Al Acid	CaCl2
metres	dS/m % @ 40C 105C	% @ 105C	m.eq/100g @ 105C	% @ 80C	% @ 105C	@ 40C	m.eq/100g @ 105C	@ 40C
B 0.10	6.6 .02 .001							5.3
0.10	6.6 .01 .001	46 38 6 12		.02 .032 .026	1.4 6	.42	5	5.2
0.30	6.4 .01 .001	42 41 5 13		.019 .074 .023	1 6	.51	3	5
0.60	6.5 .01 .001	50 33 4 13		.016 .047 .02	.9 6	.63	3	5.2
0.90	6.1 .01 .001	38 20 5 37		.015 .033 .02	1.2 12	.16	4	5.3
1.20	6.3 .01 .001	35 21 4 40		.014 .03 .021	1.2		4	5.4
1.50	6.3 .01 .001							5.5

Depth	Org.C	Tot.N	Extr. P	HCl	CaCl2 Extr	DTPA-extr.	Extractable	P	Aqueous Cations
metres	(W&B) % @105C	% @105C	Acid Bicarb mg/kg @ 105C	K meq% @105C	K P mg/kg @ 105	Fe Mn Cu Zn mg/kg @ 105C	SO4S mg/kg @ 105C	Buff Equil Cap ug/L @ 40C	CEC Ca Mg Na K m.eq/100g @ 105C
B 0.10	1.8	.05	5 1.1	.07		15 3.7 .05 .12	4		
0.10									5 2.4 2.3 .01 .12
0.30									3 .77 1.9 .01 .05
0.60							2		3 .72 1.8 .01 .04
0.90									4 .78 2.8 .01 .04
1.20									4 .80 2.9 .02 .04
1.50									

* -33kPa (-0.33bar) and -1500kPa (-15 bar) using pressure plate apparatus.

APPENDIX 5

RELATIONSHIP BETWEEN LAND USE LIMITATION LEVELS AND LIMITATION CLASSES FOR SIX LAND USES

This appendix provides an explanation of each of the limitations used in the study. For each limitation, there is a page of explanation of how it was assessed. This is followed by a table which shows how increasing levels of expression of the limitation affect each land use ie. the relationship between limitation level and limitation class.

CLIMATE (C)

Effect

High temperature can affect crop production. Poor pollination occurs in maize and sorghum when temperatures exceed 38°C. Rainfall influences plant growth by supplying the soils store of plant available moisture. This effect is dealt with under the moisture supply limitation (M).

Three climatic zones have been defined on the basis of rainfall and temperature differences, which have significant effects on plant performance.

Assessment

Crop tolerance information and local experience have been matched with climatic data to determine limitation classes.

Land Attributes

Mean monthly maximum temperature and mean annual rainfall .

Climatic zones

C1 mean monthly maximum temperatures less than 35°C, mean annual rainfall less than 1500 mm.
C2 mean monthly maximum temperatures less that 35°C, mean annual rainfall greater than 1500 mm.
C3 mean monthly maximum temperatures greater than 35°C, mean annual rainfall less than 1500 mm.

Land Attribute level		Limitation classes for selected land uses				
Temperature, Rainfall		**Low input pastures[1]**	**Medium input pastures[2]**	**High input pastures[3]**	**Maize, Sorghum**	**Peanuts**
C1	< 35°,< 1500 mm	1	1	1	1	1
C2	< 35°,> 1500 mm	1	1	1	1	1
C3	> 35°,< 1500 mm	1	1	1	3	1

1 *High input pastures* implies timber clearing, cultivation, fertilizer application, sown pasture.
2 *Medium input pastures* implies sown legume, native grass, fertilizer application.
3 *Low input pastures* implies sown legume, native grass, and possible P supplementation.

MOISTURE SUPPLY (M)

Effect

Plant yield will be decreased by periods of water stress particularly during critical growth periods. The supply of moisture to the plant seasonally or over a crop cycle depends on rainfall and stored soil moisture.

Assessment

Soil moisture storage has been determined by assessing plant available water capacity (PAWC) to the effective rooting depth[1]. PAWC is based on predicted values using Shaw and Yule (1978) and laboratory determinations of PAWC in similar soils in north Queensland.

Each soil is thereby allocated to one of six groups defined by a PAWC range[2].

Water balance modelling using PERFECT has then been used to determine, for each climatic zone, the relationship between PAWC and productivity of selected pasture and crop types. A minimum acceptable production level is selected and the equivalent PAWC value used to set the limitation class 3/4 boundary.

Land Attributes

PAWC to effective rooting depth within climatic zones.

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1 Effective rooting depth is assumed to be 1m or to the depth of shallower impermeable layers, rock or high salt concentrations.

2 For soils that occur in landscape positions affected by water tables, there is an increase in moisture supply to the root zone because of a capillary rise effect. This results in an extension of the period of adequate moisture supply following rainfall. The estimated PAWC of these soils has been increased accordingly.

Land Attribute level			Limitation classes for selected land uses				
	Annual Rainfall	**Soil PAWC**	**Low input pastures**	**Medium input pastures**	**High input pastures**	**Maize, Sorghum**	**Peanuts**
M1l	< 1500 mm	> 140 mm	1	1	1	1	1
	(Climatic zones C1, C3)						
M2l		100-140 mm	1	1	1	2	2
M3l		80-100 mm	1	1	1	3	3
M4l		60-100 mm	1	1	1	4	4
M5l		40-60 mm	1	1	3	4	4
M6l		< 40 mm	3	3	4	4	4
M1h	> 1500 mm	> 140 mm	1	1	1	1	1
	(Climatic zone C2)						
M2h		100-140 mm	1	1	1	1	1
M3h		80-100 mm	1	1	1	1	1
M4h		60-80 mm	1	1	1	2	2
M5h		40-60 mm	1	1	1	3	3
M6h		< 40 mm	2	2	3	4	4

SOIL NUTRITION (N)

Effect

Plants require adequate levels of nutrients for optimal growth.

Assessment

For crop production, all soils require fertilizer treatment. Soils with poorer natural fertility have been downgraded because they require more than standard application rates. For the various forms of pasture improvement, soils with high natural fertility do not require fertilizer, but poorer soils require some fertilizer treatment. Soils with very low natural fertility have not been recommended for pasture development.

Soil phosphorus and sulphur levels from a representative selection of soils have been used to determine fertility status.

Nutritional requirements of crop and pasture species, and local knowledge of cropping and pasture management practices, have been used to determine fertilizer requirements and set limitation class limits.

Land Attributes

Acid extractable P for acid soils and bicarbonate extractable P for neutral to alkaline soils are both reported in units of *ppm*. Extractable sulphur (sulphate sulphur), using a technique similar to Barrow (1967) is reported as mg S kg^{-1} soil.

Land Attribute level		Limitation classes for selected land uses				
		Low input pastures	**Medium input pastures**	**High input pastures**	**Maize, Sorghum**	**Peanuts**
N1	> 20 ppm P, > 4ppm SO4-S	1	1	1	1	1
N2	> 20 ppm P, < 4ppm SO4-S	1	2	2	1	1
N3	8-20 ppm P, > 4ppm SO4-S	1	1	1	2	2
N4	8-20 ppm P, < 4ppm SO4-S	2	2	2	2	2
N5	3-8 ppm P, > 4ppm SO4-S	2	2	2	2	2
N6	3-8 ppm P, < 4ppm SO4-S	2	2	2	2	2
N7	< 3 ppm P, > 4ppm SO4-S	4	4	4	2	2
N8	< 3 ppm P, < 4ppm SO4-S	4	5	5	2	2

WETNESS (W)

Effect

Waterlogged soils will reduce plant growth and hamper effective machinery operation.

Assessment

Internal and external drainage are assessed by examining soil morphology (such as texture, grade and type of structure, colour, mottles, segregations and impermeable layers) and position in the landscape. Vegetation is often an indicator of soil wetness. Limitation classes are determined by relating drainage class and soil permeability (McDonald *et al.*, 1990)[1], to crop tolerance information, local experience and the effect on machinery operations.

Land Attributes

Drainage class and soil permeability.
Landscape position.

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1 The codes from McDonald *et al.* (1990), have been modified as follows.

Limitation Class Code	McDonald *et al.*, (1990) Drainage Class
W1	6 Rapidly drained
W2	5 Well drained
W3	4 Moderately well drained
W4	3 Imperfectly drained
W5	2 Poorly drained
W6	1 Very poorly drained

Permeability codes
h - highly permeable
m - moderately permeable
s - slowly permeable
v - very slowly permeable

Land Attribute level		Limitation classes for selected land uses				
		Low input pastures	**Medium input pastures**	**High input pastures**	**Maize, Sorghum**	**Peanuts**
W1h	Rapidly drained, highly permeable	1	1	1	1	1
W2h	Well drained, highly permeable	1	1	1	1	1
W2m	Well drained, moderately permeable	1	1	1	1	1
W3h	Moderately well drained, highly permeable	1	1	1	1	2
W3m	Moderately well drained, moderately permeable	1	1	1	2	3
W3s	Moderately well drained, slowly permeable	1	1	1	3	4
W4h	Imperfectly drained, highly permeable	1	1	1	3	3
W4m	Imperfectly drained, moderately permeable	1	1	1	3	4
W4s	Imperfectly drained, slowly permeable	1	1	2	4	4
W4v	Imperfectly drained, very slowly permeable	1	1	2	4	5
W5h	Poorly drained, highly permeable	3	3	3	4	4
W5m	Poorly drained, moderately permeable	3	3	3	4	5
W5s	Poorly drained, slowly permeable	3	3	3	5	5
W5v	Poorly drained, very slowly permeable	3	3	3	5	5
W6h	Very poorly drained, highly permeable	4	4	3	5	5
W6m	Very poorly drained, moderately permeable	4	4	4	5	5
W6s	Very poorly drained, slowly permeable	4	4	4	5	5
W6v	Very poorly drained, very slowly permeable	4	4	4	5	5

FLOODING (F)

Effect

Yield reduction or plant death can be caused by high water temperatures and/or silt deposition during inundation, and physical removal or significant damage of plants can be caused by flowing water.

Assessment

Flooding frequency has been used to distinguish between suitable and unsuitable land only in extreme frequency situations or for intolerant crops. Where flood frequency is significant but not extreme the **"0"** symbol has been used to indicate the occurrence of flooding, but due to insufficient knowledge, it is not used to downgrade the suitability class.

Assessing the effects of flooding on an individual UMA is difficult. Flooding records, local experience, landscape position and flood debris have been used to distinguish affected areas.

Land Attributes

Flooding frequency.
Landscape position.

Land Attribute level		Limitation classes for selected land uses				
		Low input pastures	**Medium input pastures**	**High input pastures**	**Maize, Sorghum**	**Peanuts**
F0, F1	No Flooding or less than 1 in 10 years	1	1	1	1	1
F2	Flooding frequency of approximately 1 in 2-10 years	1	1	1	0	0
F3	Flooding frequency annually	1	1	3	4	5

ROCKINESS (R)

Effect

Coarse fragments[1] and rock in the plough zone will interfere with the efficient use of agricultural machinery. Surface rock in particular interferes with peanut harvester machinery.

Assessment

Visual assessment of the size, abundance (McDonald *et al.*, 1990) and distribution of coarse fragments and rocks in the plough layer. Limitation classes are determined by machinery tolerance as well as a knowledge of farmer tolerance to size and amount of coarse fragments and rock.

Local Attributes

Size and amount of coarse fragments and rock in the plough layer.

1 Coarse fragments are particles greater than 2 mm not continuous with underlying bedrock (McDonald *et al.*, 1990) and includes rock fragments and segregations. Rock is defined as being continuous with bedrock.

Land Attribute level			Limitation classes for various land uses				
			Low input pastures	Medium input pastures	High input pastures	Maize, Sorghum	Peanuts
Rf4	2-6 mm	20-50%	1	1	1	2	5
Rf5		> 50%	1	1	1	3	5
Rm3	6-20 mm	10-20%	1	1	1	2	5
Rm4		20-50%	1	1	1	3	5
Rm5		> 50%	1	1	2	4	5
Rg1	20-60 mm	< 2%	1	1	1	1	3
Rg2		2-10%	1	1	1	2	4
Rg3		10-20%	1	1	1	3	5
Rg4		20-50%	1	1	2	4	5
Rg5		> 50%	1	1	3	5	5
Rc1	60-200 mm	< 2%	1	1	1	2	4
Rc2		2-10%	1	1	1	3	5
Rc3		10-20%	1	1	2	4	5
Rc4		20-50%	1	1	3	5	5
Rc5		> 50%	1	1	4	5	5
Rs1	200-600 mm	< 2%	1	1	1	3	5
Rs2		2-10%	1	1	2	4	5
Rs3		10-20%	1	1	3	5	5
Rs4		20-50%	1	1	4	5	5
Rs5		> 50%	1	1	5	5	5
Ro1 or R1	> 600 mm or rock outcrop	< 2%	1	1	2	4	5
Ro2 or R2		2-10%	1	1	3	5	5
Ro3 or R3		10-20%	1	1	4	5	5
Ro4 or R4		20-50%	1	1	5	5	5
Ro5 or R5		> 50%	1	1	5	5	5

TOPOGRAPHY (T)

Effect

Microrelief can cause uneven and reduced plant productivity due to uneven water distribution, for example, waterponding in depressions, and can inhibit efficient machinery operations.

Assessment

The vertical interval of gilgai, channels and other microrelief dictates the amount of leveling required for efficient surface drainage or the efficient use of machinery. Limitation classes are determined by local experience and consultation.

Land Attributes

Vertical interval of microrelief.

Land Attribute level		Limitation classes for selected land uses				
	Vertical interval	**Low input pastures**	**Medium input pastures**	**High input pastures**	**Maize, Sorghum**	**Peanuts**
T0	No microrelief	1	1	1	1	1
T1	< 0.1 m	1	1	1	1	1
T2	0.1 to 0.3 m	1	1	2	2	3
T3	0.3 to 0.6 m	1	1	3	3	4

SOIL PHYSICAL CONDITION (P)

Effect

Germination and seedling development problems are associated with adverse conditions of the surface soil such as hardsetting, large aggregates and clays with strong consistency.

A narrow moisture range for cultivation can create difficulties in achieving a favourable seed bed condition (tilth).

Soil adhesiveness can cause harvest difficulties and affect the quality of subsurface harvest material, such as peanuts.

Assessment

The degree of hardsetting, coarse aggregation and soil consistency are assessed in relation to their effect on germination and seedling development for a range of seed sizes.

Hardsetting friable and heavy clays are associated with a narrow moisture range for cultivation.

Land Attributes

Texture, structure, consistence.

Land Attribute level		Limitation classes for selected land uses				
		Low input pastures	**Medium input pastures**	**High input pastures**	**Maize, Sorghum**	**Peanuts**
P0	No Restriction	1	1	1	1	1
P1	Slightly to moderately adhesive soils, moderate moisture range moderately hardsetting	1	1	1	1	2
P2	Slightly to moderately adhesive soils, moderate moisture range, strongly hardsetting and or large aggregates	2	2	2	2	3
P3	Slightly to moderately adhesive soils narrow moisture range, moderately hardsetting	2	2	2	3	3
P4	Slightly to moderately adhesive soils, narrow moisture range, strongly hardsetting and/or large aggregates	2	2	2	3	3
P5	Strongly adhesive soils, moderate moisture range, moderately hardsetting	2	2	2	1	2
P6	Strongly adhesive soils, moderate moisture range, strongly hardsetting and/or large aggregates	2	2	2	2	4
P7	Strongly adhesive soils, narrow moisture range, moderately hardsetting	2	2	2	3	4
P8	Strongly adhesive soils narrow moisture range, strongly hardsetting and/or large aggregates	3	3	3	3	4

VEGETATION (V)

Effect

Regrowth after clearing certain vegetation communities for improved pasture establishment may require cultivation or other methods of regrowth control and involve significant or prohibitive costs. Similarly, introduction of pasture species into certain vegetation communities may create regrowth problems due to modified management, for example, reduced or cool burning.

Very dense vegetation may be too costly to clear, or may restrict the benefits of introducing pasture species into native vegetation communities due to plant competition and stock handling problems. Clearing and regrowth are not considered problems for uses requiring regular cultivation.

Assessment

Vegetation types have been identified by Neldner and Clarkson (personal communication). Determination of limitation classes for each land use has been based on local experience and management inputs required for initial timber clearing and subsequent control of regrowth, and the vegetation types which may be subject to severe regrowth under changing fire management.

Land Attributes

Vegetation type, density and height.

Land Attribute level		Limitation classes for selected land uses				
		Low input pastures	**Medium input pastures**	**High input pastures**	**Maize, Sorghum**	**Peanuts**
Vc1e1	Regrowth no problem to control, existing vegetation no problem	1	1	1	1	1
Vc1e2	Regrowth no problem to control, existing vegetation a problem (rainforests, vine scrubs)	5	5	1	1	1
Vc2e1	Regrowth poses a problem, existing vegetation no problem (*E. tetrodonta* woodlands, *Melaleuca* low open woodlands)	3	3	2	1	1
Vc2e2	Regrowth poses a problem, existing vegetation a problem (*E. tetrodonta* tall woodlands, *Melaleuca* low woodlands, heath)	3	3	2	1	1
Ve3	Existing vegetation precludes development (cycads)	4	4	1	1	1

EROSION (E)

Effect

On and off-site land degradation and long term productivity decline will occur on unprotected cultivated land and overgrazed pasture land due to excess soil erosion.

Assessment

Soil loss will depend on soil erodibility and land slope for a particular land use and surface management system. For each soil there is a maximum slope above which soil loss cannot be reduced to acceptable levels by erosion control measures or surface management practices.

Slope limits are determined in consultation with soil conservation personnel, agronomists and local experience. The implication of the classes are:

Cropping land

Class 1	surveyed row direction required.
Class 2	conservational parallel structures required, or some surface management practices[1].
Class 3	class 2 measures and increased surface management practices.
Class 4 & 5	non-cultivated land.

Pasture land

Class 1.	Yet to be determined
Class 2	
Class 3.	
Class 4 & 5.	

Land Attributes

Soil type
Slope

1 Surface management practices are a range of options aimed at minimising soil disturbance, combined with the retention of harvest residue material as a surface cover.

Land Attribute level		Limitation classes for selected land uses				
	Slope %	**Low input pastures**	**Medium input pastures**	**High input pastures**	**Maize, Sorghum**	**Peanuts**
	Well drained and stable soils					
E1s	< 1	1	1	1	1	1
E2s	1-3	1	1	1	2	3
E3s	3-10	1	1	3	3	4
E4s	10-32	3	3	5	5	5
E5s	32-56	5	5	5	5	5
E6s	> 56	5	5	5	5	5
	Slowly drained clays, and unstable sodic soils (A horizon > 0.3 m)					
E1u	< 1	1	1	1	2	3
E2u	1-3	1	1	3	3	4
E3u	3-10	2	2	4	5	5
E4u	10-32	3	3	5	5	5
E5u	32-56	5	5	5	5	5
E6u	> 56	5	5	5	5	5
	Very unstable sodic soils (A horizons < 0.3 m)					
E1v	< 1	1	1	2	3	4
E2v	1-3	2	2	3	4	5
E3v	3-10	3	3	5	5	5
E4v	10-32	4	4	5	5	5
E5v	32-56	5	5	5	5	5
E6v	> 56	5	5	5	5	5

LANSCAPE COMPLEXITY (X)

Effect

An area of suitable land may be too small or too isolated to justify its development as an isolated production area for a particular land use. Additionally, small areas of suitable land surrounded by unsuitable lands occur in some map units due to dissected topography or soil complexity.

Assessment

Areas of suitable land that are too isolated to justify development have been flagged but not downgraded. Map units that have complex soil patterns or dissected topography have been downgraded if the contiguous area of suitable land is smaller than an acceptable minimum production area for the land use in question. This production area has been determined in consultation with local extension staff.

The "**0**" symbol indicates that information on the classes for other limitations, the size of units, distance and practicality of access need to be considered before development is undertaken.

Land Attributes

Suitability class.
Access distance and difficulty.
Area of contiguous suitable land.

Land Attribute level		Limitation classes for selected land uses				
	Production area (ha)	**Low input pastures**	**Medium input pastures**	**High input pastures**	**Maize, Sorghum**	**Peanuts**
X0	> 100	1	1	1	1	1
Xi	Isolated areas 20 - 100	1	1	0	4	4
X1	< 20	1	1	5	5	5

SALINITY (S)

Effect

Deep drainage from permeable soils, usually higher in the landscape (**intake zones**), may cause secondary salinisation downslope in **outflow zones.** Clearing of native vegetation can increase deep drainage.

Assessment

In areas associated with geological types that are possible sources of salinity, soil permeability, drainage class (McDonald *et al.*, 1990) and position in the landscape are used to determine intake zones that are linked to downslope outflow zones. High watertables may occur above areas where slowly permeable soils exist.

Any map unit with existing salinity is class 5 for any form of development. The suitability of intake, transmission and outflow zones is not downgraded. A value of **0** has been used to indicate that certain land management options are conditional on any development for a particular land use[1].

Land Attributes

Soil permeability and drainage class.

Landscape position.

Field and laboratory electrical conductivity measurements of selected soils.

1 Soil hydraulic conductivity, groundwater level and salinity measurements should be conducted prior to developing those soils indicated as having potential for secondary salinisation.

Land Attribute level		Limitation classes for selected land uses				
		Low input pastures	Medium input pastures	High input pastures	Maize, Sorghum	Peanuts
Si1	Intake zone - well drained, moderately to highly permeable soils in elevated landscape positions. Low risk geological unit	1	1	0	0	0
St1	Transmission zone - imperfectly drained, moderately to highly permeable soils in midslope positions. Low risk geological unit	1	1	0	0	0
So1	Discharge zone - imperfectly to poorly drained, slowly permeable soils in lower landscape positions. Low risk geological unit	1	1	0	0	0
Si2	Intake zone - well drained, moderately to highly permeable soils in elevated landscape positions. Moderate risk geological unit	1	1	0	0	0
St2	Transmission zone - imperfectly drained, moderately to highly permeable soils in midslope positions. Moderate risk geological unit	1	1	0	0	0
So2	Discharge zone - imperfectly to poorly drained, slowly permeable soils in lower landscape positions. Moderate risk geological unit	1	1	0	0	0
Si3	Intake zone - well drained, moderately to highly permeable soils in elevated landscape positions. High risk geological unit.	1	1	0	0	0
St3	Transmission zone - imperfectly drained, moderately to highly permeable soils in midslope positions. High risk geological unit.	1	1	0	0	0
So3	Discharge zone - imperfectly to poorly drained, slowly permeable soils in lower landscape positions. High risk geological unit	1	1	0	0	0
Sn	Non-saline areas	1	1	1	1	1
Ss	Naturally saline soils	5	5	5	5	5

APPENDIX 6

GIS SPECIFICATIONS

1. Details of the primary dataset (coverage and database files)

The name of the primary NR02 data set is **CYPSOIL**. It contains the following file groups:

- Arc specific data files
- Polygon specific data files
- soils and suitability related files
- other associated data files.

i) Arc specific files

CYPSOIL.AAT - this file contains the unique code for each arc. It is stored in the ITEM[1] CYPSOIL-ID.

CYPSOIL-ID codes	1	- Soil Boundaries
	5	- Uncertain Soil Boundaries
	99	- Coastline
	100	- Islands
	200	- Southern Study Boundary

ii) Polygon specific files

CYPSOIL.PAT - contains ITEMS specific only to the polygon as a whole, for example ITEM-POSH = e. POSH represents polygon shape and its value 'e' decodes to "elongated". The ITEM UMA is a unique identifier used in establishing a link to related data files.

The complete ITEM decode information for polygon and related data files is contained in an associated file called CYPSOIL.DCT. This file also contains a decode for each of the attributes[2] assigned to the ITEM.

iii) Related Databases

These databases can be used in relate environments or as independent databases. The relate ITEM is UMA.

a) Soils

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[1] A field in a database that contains a code value

[2] Code value for item

CYPSOIL.ST1	This database contains all attribute information relating to the dominant soil of the polygon located by its UMA (6074 records)
CYPSOIL.ST2	As per CYPSOIL.ST1 with information specific to the sub-dominant soil by UMA (3839 records)
CYPSOIL.ST3	As per CYPSOIL.ST2 with information specific to the third sub-dominant soil (1472 records)
CYPSOIL.SPC4	As per CYPSOIL.ST2 with information specific to the fourth sub-dominant soil (376 records)

b) Suitability

These files contain information relating to the suitability of the specific soil to the five nominated land uses.

CYPSOIL.LM1	This database lists, for each UMA, the limitation classes and suitability class of the soil in CYPSOIL.ST1 (the dominant soil) for all six land uses (6074 records)
CYPSOIL.LM2	As per CYPSOIL.LM1 with information specific to the second sub-dominant soil (3839 records)
CYPSOIL.LM3	As per CYPSOIL.LM2 with information specific to the third sub-dominant soil (1472 records)
CYPSOIL.LM4	As per CYPSOIL.LM2 with information specific to the fourth sub-dominant soil (376 records)

iv) Associated Databases

CYPSOIL.DCT	A database with one defined item which contains a text file with all information on attribute and item definition and coding for all the coverage and related datafiles.
CYPSOIL.TBA	Findar[1] produced databases providing information on CYPSOIL. ownership/copyright, standards, location of data, etc.
CYPSOIL.TBB	Contains brief descriptions of 8 items from the data files

[1] Findar - Information directory program from Queensland Land Inventory Council (QLIC)

CYPSOIL.REL A database with one defined item that contains information to establish a related database environment for all .ST and .LM files in ARCPLOT[1].

2. Details of the secondary dataset (coverage and database files)

The name of the secondary NR02 dataset is **CYPSITE.** It contains a point specific datafile and one associated datafile.

(i) Point specific file
CYPSITE.PAT contains the unique point identifier (site number) in the ITEM CYPSITE-ID.

(Ii) Associated database
CYPSITE.DAT is a database with one defined item containing a text file of the complete site description information. Each site has a unique identifier (site number) referring to the CYPSITE-ID in CYPSITE.PAT. The format of this identifier is CYP .

3. General specifications

The following indicates general cartographic sources used in NR02.

- coastline coverage supplied by AUSLIG at 1:100 000 scale
- Joint Operation Graphics (1:250 000) topographic maps were used as a stable base for artiscope work.
- the geographic reference system consists of latitude and longitude in units of decimal degrees
- all calculations were completed in a UTM Zone 54 projection
- the coverage is current as at October 1994

[1] ARCPLOT is a sub-program within ARCINFO