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SOILS OF ROSEBANK RESEARCH STATION

LONGREACH, QUEENSLAND

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Table of Contents

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

The soils of Rosebank Research Station, Longreach are described and mapped at 1:25 000 scale. The report draws together information on the climate, landform, geology and vegetation of the region. The morphology and distribution of the soils are discussed with reference to usage and management considerations. The survey shows the property comprises 70% rolling downs with minor gidgee and boree communities. The remaining portions are associated with the drainage lines of Elibank and Wellshot creeks. Soils of the rolling downs are moderately deep cracking clays with strongly self-mulching surfaces. Colluvial soils adjoin the stream channels. The channel benches, backplains and braided drainage depressions are a complex of cracking and non cracking clays and duplex soils. The soils generally are alkaline and calcareous.

Figure 1. Locality map Rosebank Research Station

1. INTRODUCTION

Rosebank Research Station is a 6795 hectare property located on the Jundah road, five kilometres south of Longreach, Central Queensland (Figure 1). The property was purchased in 1987 by the Queensland Department of Primary Industries in conjunction with the establishment of the Arid Zone Institute at Longreach. The property will service the needs of the Institute as a research facility for this important pastoral region.

As part of the establishment of the Arid Zone Research Institute and associated facilities, a detailed physical survey of the property was requested, as a base to formulate a development plan for the property. Basic data on climate, geology and landform, groundwater, vegetation and soils, as provided in this publication, can be utilised for experimental design purposes.

This report documents the findings of a soil survey of Rosebank at 1:25 000 scale for the following portions:

Freehold	1302 ha, Parish of Longreach, Portions 16V, 17V, 18V, 22V 23V, 24V, 32V, 33V, 58V.
Leasehold	5493ha, Parish of Longreach GF11224, Por. 45V, GF11272, Por 32V, 39V, 43V, 75; PLS Por 78V.

2. CLIMATE

Summary statistics for climatic conditions at Longreach are presented in Table 1. Average rainfall for the region is 400 mm with 73% of the rainfall recorded between the summer months of October and March. Thirty nine rain days are the average for the year. Evaporation in the area is extremely high, with an average class A pan potential evaporation of 2482 mm per annum being recorded.

The longest average day length is 13.8 hours in December which also has the highest average monthly maximum temperature of 37.6°C. The coldest month is July with 6.9°C, while the shortest average day length is recorded in June at 10.9 hrs. Temperatures usually range between -2°C and 46°C, though temperatures outside this range have been recorded. Heat wave conditions (>40°C) are not uncommon in the area, with January recording the highest number of days (22). Frosts commonly occur in June, July and August. These extremes of temperature are important considerations for animal husbandry and potential cropping practices. Droughts are also commonplace, with Longreach Shire being drought declared for 57% of the time between 1966 and 1989.

Table 1. Climate averages for Longreach (23°27'S, 144°15'E, 192 m a.s.l.)

(a) General data

Month	Day length (hours)	Radtn ($MJ/d/M^2$)	VPress (mbar)	Tmax (°C)	Tmin (°C)	Average rain (mm)	Median rain (mm)	Epan (mm/day)	Rain (days)
Jan	13.6	27.5	21.2	37.4	23.0	71	47	11.5	6
Feb	13.1	25.4	21.1	36.0	21.6	85	46	10.0	6
Mar	12.4	22.6	17.6	34.4	16.1	62	38	8.3	4
Apr	11.8	20.2	14.8	31.0	15.3	28	13	6.8	2
May	11.2	16.9	11.8	26.9	11.3	24	6	4.9	2
Jun	10.9	14.7	10.6	23.6	8.2	20	7	4.0	2
Jul	11.1	15.7	9.5	23.0	7.0	9	2	4.2	1
Aug	11.5	19.3	9.5	25.6	8.2	12	2	5.5	2
Sep	12.1	23.0	10.9	29.7	12.1	24	14	7.6	3
Oct	12.8	26.2	13.2	33.7	16.4	27	17	10.0	4
Nov	13.4	28.2	16.6	36.1	19.8	54	44	10.9	5
Dec	13.8	28.6	19.3	37.6	21.9	435	407	11.6	39
AVERAGE	12.3	22.3	14.6	31.2	15.0	399	6.8	7.9	6.0

Source: Post Office records 1957-1973

(b) Humidity data

Month	9 am DRY B	9am WET B	9 am DEWPT	9 am %REL HU	3 pm DRY B	3 pm WET B	3 pm DEWPT	3 pm %REL HU
Jan	29.5	21.6	17	47	36.1	22.4	14	27
Feb	28.9	21.6	17	50	35.6	22.7	15	29
Mar	26.8	20.0	16	51	33.6	21.3	13	30
Apr	23.5	16.8	12	48	30.6	18.9	10	28
May	17.9	12.8	8	52	25.8	16.0	7	31
Jun	14.3	10.4	6	58	23.4	14.5	6	33
Jul	13.0	8.6	3	51	22.7	13.3	3	28
Aug	16.1	10.3	4	43	25.2	14.2	3	23
Sep	21.1	13.3	6	36	29.1	16.0	3	19
Oct	26.1	16.7	9	34	33.1	18.3	6	18
Nov	29.0	18.6	11	33	35.6	19.8	7	18
Dec	29.6	20.5	15	40	36.0	21.2	11	22
AVERAGE	23.0	15.9	10	45	30.6	18.2	8	26

Source: Post Office records 1957-1973

(c) Rainfall distribution

	Jan (mm)	Feb (mm)	Mar (mm)	Apr (mm)	May (mm)	Jun (mm)	Jul (mm)	Aug (mm)	Sep (mm)	Oct (mm)	Nov (mm)	Dec (mm)	Total (mm)
100% of yrs	0	0	0	0	0	0	0	0	0	0	0	0	108
90% of yrs	10	8	*	0	0	0	0	0	0	0	0	3	220
80% of yrs	18	13	3	0	0	0	0	0	0	1	3	11	250
70% of yrs	29	20	9	*	1	1	0	0	0	4	7	16	310
60% of yrs	40	35	25	5	3	4	1	0	1	7	11	33	343
50% of yrs	47	45	38	13	6	7	6	2	4	14	17	44	403
40% of yrs	61	58	45	24	13	15	16	5	8	20	23	53	475
30% of yrs	96	103	73	36	25	21	23	8	12	28	30	71	509
20% of yrs	110	146	106	54	57	36	36	13	21	40	45	92	544
10% of yrs	143	217	162	86	74	54	67	32	34	68	66	117	717
0% of yrs	403	405	379	176	175	126	114	70	122	139	163	232	1076
Mean	71	84	62	28	24	20	20	9	12	24	27	54	435
Median	47	45	38	13	6	7	6	2	4	14	17	44	403
Std.dev	72	96	77	37	35	27	29	14	21	30	33	47	202
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	108
Maximum	403	405	379	176	175	126	114	70	122	139	163	232	1076
No of yrs	93	93	92	92	92	92	92	92	92	92	92	92	92

* % years with ranifall greater than or equal to the indicated amount.

Source: Post Office records 1957 - 1973.

(d) Frost Days (<°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Post Office records (1957-1973)													
Average	0	0	0	0	0	1	2	0	0	0	0	0	3
Highest	0	0	0	0	2	6	7	3	1	1	0	0	-
Australian Bureau of Meteorology (1966-1987)													
Average	0	0	0	0	0	2	4	2	0	0	0	0	8
Highest	0	0	0	0	1	11	11	15	1	0	0	0	-

Note: Post Office records are reported for the period 1857-73. The Bureau of Meterology (AMO) established an office in 1966, records at the Post Office continued until 1973.

(e) Heat Wave conditions Longreach

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Days > 40'C													
Post Office 1957-1973													
Average	8	4	1	0	0	0	0	0	0	1	5	7	26
Highest	22	10	6	0	0	0	0	0	0	5	12	19	-
AMO 1966-1987													
Average	7	3	0	0	0	0	0	0	0	1	4	8	23
Highest	17	14	4	0	0	0	0	0	0	4	11	21	-
Days > 35'C													
Post Office 1857-1973													
Average	25	22	16	3	0	0	0	0	2	13	21	24	126
Highest	31	28	25	10	1	0	0	1	5	21	27	30	
AMO 1966-1987													
Average	22	16	14	3	0	0	0	0	2	10	20	25	112
Highest	31	8	26	9	1	0	0	1	8	19	27	30	

3. GEOLOGY AND LANDFORM

Rosebank is located on rolling downs underlain by Cretaceous sediments. Sedimentary rocks occasionally outcrop as rubbly exposures in extensive, soil-covered, gently undulating plains. The sedimentary rocks are part of the Winton Formation (Kw) comprised of labile sandstone, siltstone, mudstone, intraformational conglomerate and are, in part, calcareous. The sedimentary rocks of the Winton Formation contain shelly faunas and are richly fossiliferous (Vine 1970).

Two streams are found on the property: Elibank and Wellshot creeks. These streams are ephemeral. The stream channels are reticulated and form part of a strongly anastomosing regional drainage system of the Thompson River. Stream drainage on Rosebank is in a north westerly direction. The flood plains associated with the drainage lines are Quaternary alluvium (Qa) overlying the Cretaceous Winton Formation (Vine 1970).

4. GROUNDWATER

Rosebank is directly underlain by shales and minor sandstones which form part of the Winton/Mackunda Formations. Small pumped supplies of water in the vicinity of 0.5 l/sec are generally available from jointed and/or porous sandstone layers within the underlying sediments. Because these zones are usually small and discontinuous in nature, the depth of the bores varies greatly from site to site.

In most cases, the supplies are struck above 210 metres depth which is the recommended maximum depth for drilling in the Winton/Mackunda Formation. It appears that water beds are most frequently intersected within the interval, 100 to

210 m below ground level. Water quality also varies. The water is often too saline for drinking water, but may be suitable for other domestic purposes, for irrigating salt tolerant plants and for stock use. The quality of any water encountered within the first 100 metres is expected to be very salty and may require cementing off to protect the casing, and prevent pollution of better quality water supplies at depth.

At a much greater depth, supplies are available from sediments associated with the Great Artesian Basin. On Rosebank, a bore to a depth 780 to 850 m is expected to tap the Hooray Sandstone and a very small flow of less than 0.2 l/sec should be obtained. This bore could be expected to have a small closed pressure of less than 80 kps. The water temperature of this aquifer is approximately 60°C.

The quality of water drawn from the Hooray Sandstone is generally suitable for stock watering and other domestic purposes. Some water could be unsuitable for drinking by humans and young stock because of the fluoride content.

5. VEGETATION

Four vegetation associations are found on Rosebank. The associations comprise: Mitchell grass communities on the open downs, Coolibah communities on the stream channels, the wooded downs (Boree communities) adjacent to the stream channels and the Gidgee communities. Herbaceous plants are common throughout the four communities and some are toxic to hungry stock.

At the time of the survey, the area was severely droughted and many plants known to the area were absent. A detailed vegetation survey of the property is planned when seasonal conditions are favourable. A list of plant species known to occur in the area are presented in Appendix I.

5.1 Mitchell Grass community

Astrebla species are the dominant grasses on the open downs. The *Astrebla* genus is comprised of Bull Mitchell (*A. squarrosa*) frequently found in gilgai and other depressions, Hoop Mitchell (*A. elymoides*) on the more finely structured surfaces (ashy downs) while Barley Mitchell (*A. pectinata*) and Curly Mitchell (*A. lappacea*) favour the firmer soils. All four grasses commonly occur together and in summer are the dominant grass species. Many other annual and perennial grasses occur in association, particularly in winter. Both annuals and perennials occupy the areas between the Mitchell grass tussocks. The perennials include Queensland blue grass (*Dichanthium sericeum*), Desert blue grass (*Bothriochloa ewartiana*), Feathertop (*Aristida latifolia*) and Neverfail (*Eragrostis setifolia*). The genus *Panicum* and *Digitaria* are also common.

Ephemerals are common and particularly luxuriant after rain. These plants mature rapidly with many disappearing within a few days of rainfall. The Flinders grasses (*Iseilema* spp.) are one of the more persistent annuals. This species is excellent fodder when green, however it also rapidly dries out and subsequently loses

its nutritional value.

Trees in the open downs were few and tended to be confined to drainage lines, crests and ridges. Trees were found to be useful indicators of soil type. The three most common trees occurring on the open downs are whitewood (*Atalaya hemiglauca*), the vine tree (*Ventilago viminalis*) and boree (*Acacia cana*). Whitewood is almost exclusively found on non cracking highly calcareous clays.

The most common shrub is mimosa (*Acacia farnesiana*), found mainly in drainage depressions, ridges and crests.

5.2 Coolibah community

Eucalyptus microtheca is the dominant tree species found along stream channels. These require periodic flooding and are therefore useful indicators of inundation. Other tree and shrub species include: gidgee (*Acacia cambagei*), boree, river wattle (*Acacia stenophylla*), *Thysiolphyllum glivum*, *Capparis mitchellii*, lignum (*Meuhlenbeckia cunninghamii*) and creek wilga (*Eremophila bignoniiflora*). Grasses include *Leptochloa digitata* and button grass (*Dactyloctenium radulans*). Herbage includes rattlepod (*Crotalaria dissitiflora*), *Glycine falcata, Tribulus terrestris, Boerhavia diffusa, Euphorbia drummondii, Portulaca oleracea.* The annual salt bush (*Atriplex muelleri*) is also very common along stream edges and levees.

5.3 Wooded downs community

Boree is the most common tree species, and densities range from one to about twenty five trees per hectare. The density of the trees is usually low enough to allow adequate grass growth. On the lower slopes seasonal scalding is evident though generally not extensive. Other trees include *Lysiphyllum carronii, Heterodendron oleifolium* and *Archidendropsis basaltica* though these are not common. Shrubs include creek wilga and false sandalwood (*Eremophila mitchellii*) with lignum occuring occasionally on the lower slopes. Grasses include *Aristida latifolia, Astrebla* spp., *Enneapogon avenaceus*, and *Sporobolus actinocladus* and *Dactyloctenium radulans*. Herbaceous plants include, *Solanum esuriale, Atriplex lindleyi* and *A. muelleri, Boerhaavia diffusa, Calotis hipsidula.*

5.4 Gidgee community

Gidgee is the dominant tree species and forms very dense stands, limiting grass growth. The soils are yellowish brown with extensive silcrete cover. False sandlewood, unless cleared, is a relatively common shrub fringing this community. Grasses were sparse at the time of sampling in this community and only a few sparsely scattered dead tussocks could be found which could not be identified. Sampling occurred just after rain and a few herbaceous plants were present. These included *Atriplex muelleri, Solanum esuriale, Euphorbia drummondii* and *Sida* spp..

6. SURVEY METHODOLOGY

6.1 Soil Methodology

Soils on the research station were described and classified at 202 sites. A free survey method was employed with limited grid traverses. The density of ground observations varied according to the complexity of soil distribution. The survey work was co-ordinated with 1:50 000 B&W stereo air photos enlarged to 1:25 000. The soils map is presented at a scale of 1:25 000.

Data collection methodology was based on McDonald *et al.* (1984) and soil classification followed Northcote *et al.* (1979). Profile data (collected from soil cores) and site description are recorded in code (Mc Donald *et al.* 1984). These data are stored on computer and are available through the Queensland Department of Primary Industries.

Laboratory analysis were carried out on 10% of the profiles using the methods of Bruce and Rayment (1982). These profiles considered representative of the 13 profile classes, were analysed at three depths intervals, 0-20 cm, 30-60 cm and 60-120 cm for pH; EC; Cl; CEC and Exch. cations (Ca, Mg, Na, K). The surface soil (0-20 cm) was also tested for fertility characteristics (Org C, Bicarb P, Fe, Mn, Cu and Zn). This is an extremely limited sampling intensity and should be used with this limitation in mind. The sampling is sufficient to show general trends for the soils of this landscape.

6.2 Land Unit Mapping Methodology

The data collected in this survey has been organised according to the principles of Unique Mapping Areas (UMA), which results in land units corresponsing to land suitability (Land Resources Branches staff 1990).

Each area delineated as a UMA is distinct from contiguous areas on the map (a map unit with a closed boundary) and is described in terms of its resource information. Information recorded for each UMA is briefly listed in Table 2. UMA boundaries represent changes in soil suitability class or limitations. The proforma records and their description is included in Appendix II. This data is also available on computer though the Land Resources Branch of QDPI. The study area contains 13 land units (Table 4).

Table 2. Information recorded for each UMA

Identity	-	UMA Number
Location	-	Air Photo reference
Land Resources	-	Geology
	-	Landform
	-	Dominant soil PPF
	-	Resource interpretation related to:
		- slope
		- drainage
		- texture
		- pH
		- depth
		- colour
		- carbonate
		- aspect
		- stone
		- substrate
		- rock outcrop
		- drainage
		- erosion
		- microrelief
	-	point data within UMA by soil horizons
		- soil texture
		- soil pH
		- soil depth
		- soil colour
		- soil carbonate

7. SOILS

7.1 Morphology and distribution

The landform pattern of Rosebank is an undulating plain of extremely low relief (<9 m). The plain is broken by widely spaced, moderately deep, reticulated, ephemeral streams which have been gently aggraded by unchannelled overbank stream flow. The landform elements include crests, ridges, benches, slopes, flats, drainage depressions, levees and stream channels.

Three markedly different soil types occur in the reticulated drainage system. A non cracking clay intermixed with duplex soils, occurs as a complex and is found on the levees between the stream channels. Intergrade cracking clays with weakly self mulching surfaces are scattered throughout the levees in relict stream channels. Deep grey and brown cracking clay soils formed on colluvium occur on lower slopes and flats abutting the stream channels which are moderately calcareous and are medium to medium heavy clays with strong self mulching surfaces.

Highly calcareous non cracking clays occur on ridges, benches and crests. These soils are shallow and sparsely vegetated. Whitewood (*Atalaya hemiglauca*) is a reliable indicator plant for this soil type. These soils only cover small areas, though are sufficient in size to influence stocking rate.

Yellowish brown clays occur in the gidgee communities. These soils display incipient cracking and a relatively massive surface covered with silcrete stones. The silcrete stone cover may be as high as 80%. The soils are highly calcareous and limited stone occurs throughout the profile. These soils fail to qualify as cracking clays (Northcote 1979), but as a group they should be regarded as intergrades between cracking and non cracking clays.

The most widely distributed soils belong to the rolling downs group. These soils are grey or brown and are cracking clays with strongly self-mulching surfaces. Gilgais are common, though generally incipient. Normal gilgais are found in areas of lower relief with linear gilgais commons on the upper slopes. Surface texture is marginally heavier in the depressions and carbonate nodules commonly occur on the surface of the mounds. The vertical interval is generally less than ten centimetres and the wave length varies between 5 and 30 metres. Sandstone outcrops are common with silcrete stone cover varying from 1-5%.

7.2 Soil groups used in this study

The landscape units used in this report refer to natural units of land with a particular soil association or complex of soils. As soils are dynamic three dimensional bodies, it can be expected that a range of horizon depths and attributes occur in each grouping.

The classifications for this study were based on the consistency of soil attributes within a limited range of landform elements and native vegetation communities. The soil types or soil profile classes presented here are the most homogeneous grouping of the described profiles.

Thirteen soil types have been identified and are described in detail in Appendix III.

7.3 Soil Fertility

The following description of soil fertility of Rosebank should only be used as a general overview. Only 10% of the 200 profiles described had labratory nutrient analyses performed. This represents only a limited sample in terms of the 6 795 hectares which form Rosebank. Persons interested in more detailed information are encouraged to undertake further analysis and to use this information as a soil fertility guide for the area.

Results of the laboratory analyses are presented in tabular form at the end of this section (Table 3). In addition to the 13 representative soil profiles, a bulk sample (0-20 cm) was taken from a site displaying efflorescence of salt (M1*).

7.3.1 pH

All soils of Rosebank are characterised by a strongly alkaline pH. Soil pH is generally greater than 8.5 and commonly exceeds 9.0. The pH increases slightly toward the B horizon then decreases marginally with increasing depth. High levels of calcium carbonate are common and the pH levels may be a reflection of the carbonate and bicarbonate levels. At these high pH levels, nutrient availability of nitrogen and phosphorus are reduced and deficiencies of iron, zinc and manganese could occur. In the B horizon high pH values >8.5 tend to indicate high exchangeable sodium.

7.3.2 Chloride

At the surface of vegetated areas, chloride levels are low while in the B horizon they range from high to very high. The concentration of chloride in the B horizon is possibly a function of leaching. However owing to the solubility of chloride it may accumulate anywhere in the profile especially at or near the surface in areas where drainage is imperfect and soil water evaporates. In the scalded and degraded areas saline crusts are evident (Table 3, M1*). Where gilgai microrelief are present, concentrations of chlorides tend to be found in the depressions.

7.3.3 Electrical conductivity

Electrical conductivity is a useful indicator of the total soluble salts and the ionic strength of the soil solution (chloride often a major component). Electrical conductivity is low at the surface of all landscape units where there is no evidence of degradation (ie scalding, sheet wash or terracettes) and increases dramatically with soil depth. In the deep sub-soil, all landscape units have very high levels of electrical conductivity. Given these results, high salt levels are likely below 60 cm depth. In degraded and fragile areas such as the scalds, mid slope benches and crests, salt levels are high at the surface.

7.3.4 Cation Exchange Capacity (CEC)

CEC is a measure of the soil capacity to retain bases against leaching and is functionally related to the presence of organic colloids, sesquioxides and clay fraction in the soil. The higher the CEC is, generally the greater the potential fertility of the soil. A high CEC means that a soil has a strong ability to fix or hold added fertilisers against leaching. The CEC levels on Rosebank are relatively uniform and adequate for pasture production. Their ability to hold additional inputs of fertiliser is limited. This could be improved by building up the organic matter in the soil. The CEC levels recorded are typical for expanding clay lattices which are found in the area. Organic carbon levels are generally low and, as such, are not contributing to the CEC. CEC was lowest in the stream channel areas, possibly associated with the higher silt and sand content, which have a lower cation exchange capacity.

7.3.5 Exchangable Calcium (Ca)

Exchangeable calcium levels are very high and uniform throughout Rosebank. The levels reflect the calcareous nature of the soils of the area. Carbonate nodules are found throughout the profiles. Gypsum crystals are found in the lower levels of the B horizon and are common on the surface of gilgai mounds.

7.3.6 Exchangeable Magnesium (Mg)

Exchangeable magnesium levels are high to very high throughout the area. Consequently magnesium is not likely to be directly limiting to plant growth, despite the fact that the high pH lowers the availability.

7.3.7 Exchangeable Sodium (Na)

Exchangeable sodium levels are relatively low in most surface soils in the area, but increase markedly with depth. High levels of sodium are associated with poor soil physcial condition and with an excess of chloride ions. The latter adversely affects plant metabolism, so that deep rooted plants throughout the area could experience problems. The problem would be accentuated in the scalded areas where there are surface salt crusts.

The Exchangable Sodium Percentage (ESP) is a measure of the sodicity of the soil. With the exception of the colluvial areas, the sodicity of the surface soil (0-20 cm) of the rolling downs group (RD) is low (<3%). However, in the colluvium (RD_4), ESP is approximately 7% and is considered sodic. Sodicity of the surface soils of the wooded downs group is low and comparable to the rolling downs, with the exception of the gidgee areas (W_5) which are sodic at the surface with saline subsoils. The crests and ridges (C) and the seasonally scalded channel benches and backplains (S_1) also have moderately high ESP in the surface soils. The salt puffs of the scalds are extremely sodic and saline and this has resulted in a collapsing of the soil structure.

7.3.8 Exchangeable Potassium (K)

Potassium levels are generally quite adequate for pasture production throughout the area and no plant or animal dietary deficiences are probable. The mobility of K suggests that efficient nutrient cycling is probably responsible for the slightly higher levels in the surface soils.

7.3.9 Organic carbon

Organic carbon levels ranged from 0.3 to 0.6%. These are regarded as low to very low. The low levels recorded at the time of sampling were probably partially due to the prolonged drought being experienced. Levels would expect to improve in favourable seasons through cyclic increases in plant production and general biological activity.

7.3.10 Bicarbonate extractable phosphorus (Bicarb P)

Phosphorus levels are low to very low in the region. The levels may be further limited by the high pH. Phosphorus should be regarded as a major limiting nutrient in the area generally. The lowest P levels were recorded in the undulating plains and the channel benches and drainage depressions. Highest levels were recorded on the colluvial flats, crests and benches.

7.3.11 Extractable Iron (Fe)

Iron levels in the area are low. pH in the area is high and is likely to further limit the availability of iron for plant uptake. The degree of iron shortages in the area is not known and futher information is required of the effect on both plant growth and animal nutrition.

7.3.12 Manganese (Mn)

Manganese is quite high over all landscape units and while high pH is usually associated with deficiencies, the availability of manganese increases again as pH exceeds 8.7. Veins of manganese were recorded in the deep subsoil of the colluvial flats suggesting a possible maximum wetting front over the soil forming period. Plants have the ability to adjust their manganese intakes within limits and manganese is not expected to be limiting in the area.

7.3.13 Copper (Cu)

Copper is generally only required by plants in very small amounts. Copper in the area is in reasonable levels and is regarded as a adequate. The high pH levels however may be limiting the availability of this element. Isolated reports of copper deficiencies in sheep have been reported in the area though the symptoms are often not detected.

7.3.14 Extractable Zinc (Zn)

Zinc levels are very low and Zn availability is lower at higher levels of pH. The zinc levels are relatively uniform across the landscape units and zinc as a trace element is considered quite limiting. Interactions are likely between zinc and copper and responses to one with or without the other will differ. That is plants may respond to zinc if copper is given, but not if it is withheld.

Table 3. Laboratory analysis of representative soils of each soil group found on Rosebank Station (Longreach).

Soil profile class	Sample Depth (m)	pH 1:5	EC dS/m	Cl %	CEC m equiv	Exchangeable Cations Ca^{++} m equiv	Mg^{++} m equiv	Na^{++} m equiv	K^{+} m equiv	Org C %	Bicarb P ppm	Fe ppm	Mn ppm	Cu ppm	Zn ppm
RD1	0-0.2	9.0	0.12	0.006	36	34	2.4	1.2	0.70	0.5	8	10	10	0.60	0.20
	0.3-0.6	9.4	0.42	0.023	37	27	2.5	7.6	0.40						
	0.6-1.2	8.4	1.7	0.076	33	23	2.5	2.5	0.30						
RD2	0-0.2	9.0	0.13	0.001	31	30	1.7	-	1.10	0.6	12	6	26	0.70	0.30
	0.3-0.6	9.4	0.39	0.025	37	30	2.1	5.8	0.40						
	0.6-1.2	9.4	0.57	0.52	33	26	2.0	7.4	0.30						
RD3	0-0.2	8.5	0.17	0.005	39	34	3.4	1.2	1.2	0.6	18	8	55	0.90	0.30
	0.3-0.6	9.3	0.30	0.010	43	35	2.7	5.6	0.6						
	0.6-0.9	7.9	3.0	0.036	36	31	2.7	8.0	0.5						
RD4	0-0.2	8.8	0.19	0.006	42	32	5.4	2.5	1.1	0.5	18	9	30	0.7	0.3
	0.3-0.6	8.9	0.83	0.090	47	30	5.4	11	0.8						
	0.60-1.2	8.1	3.9	0.147	42	28	4.7	12	0.7						
W1	0-0.20	9.2	0.16	0.001	35	32	1.6	1.4	0.90	0.5	10	6	12	0.4	0.2
	0.3-0.6	9.5	0.40	0.022	38	30	1.9	7.8	0.40						
	0.60-1.2	9.4	0.83	0.067	36	24	2.0	11	0.30						
W2	0-0.20	8.7	0.09	0.001	38	33	4.2	1.2	1.1	0.4	13	5	32	0.6	0.3
	0.3-0.6	9.3	0.44	0.030	41	30	3.3	8.0	0.5						
	0.60-1.2	8.2	0.90	0.073	35	26	3.1	11	0.4						
W3	0-0.20	9.2	0.16	0.001	31	26	3.8	1.6	0.90	0.6	18	11	12	0.7	0.2
	0.3-0.6	9.2	1.2	0.137	33	18	3.6	12	0.50						
	0.60-1.2	8.6	2.6	0.195	26	14	3.5	11	0.40						

Table 3. Continued

Soil profile class	Sample Depth (m)	pH 1:5	EC dS/m	Cl %	CEC m equiv	Exchangeable Cations Ca^{++} m equiv	Mg^{++} m equiv	Na^{++} m equiv	K^{+} m equiv	Org C %	Bicarb P ppm	Fe ppm	Mn ppm	Cu ppm	Zn ppm
W4	0-0.20	8.6	0.11	0.001	42	36	4.1	1.3	0.80	0.4	9	7	15	0.7	0.2
	0.3-0.6	9.2	0.48	0.041	42	31	3.9	7.6	0.60						
	0.60-1.2	8.7	0.89	0.98	46	31	4.5	11	0.70						
W5	0-0.20	8.3	0.26	0.028	27	18	4.1	3.0	0.60	0.4	7	10	10	0.7	0.2
	0.3-0.6	8.1	2.5	0.352	30	18	5.7	7.7	0.40						
	0.60-1.2	8.3	2.5	0.324	27	16	5.2	7.3	0.50						
C1	0-0.20	8.3	0.27	0.003	33	26	4.2	1.8	1.2	0.4	21	8.0	12	0.8	0.2
S1	0-0.20	8.4	0.05	0.001	23	16	3.9	1.7	0.5	0.3	11	9	7	0.6	0.2
	0.3-0.6	9.4	0.41	0.025	25	17	3.2	5.4	0.4						
	0.60-1.2	8.0	2.3	0.049	23	17	2.9	6.8	0.4						
S2	0-0.20	9.0	0.13	0.007	27	21	3.4	1.0	1.0	0.3	15	4	14	0.6	0.2
	0.3-0.6	9.3	0.43	0.029	36	27	3.9	5.2	0.6						
	0.60-1.2	9.3	0.73	0.065	30	19	3.5	7.1	0.4						
M1	0-0.20	9.1	0.16	0.003	31	21	2.6	1.3	1.2	0.6	15	6	18	0.9	0.3
	0.3-0.6	8.7	2.0	0.256	33	22	2.0	9.6	0.5						
	0.60-1.2	8.1	4.5	0.267	33	22	3.3	11	0.4						
M1*	0-0.20	7.9	11	1.85	27	13	3.9	10	0.4	0.3	11	5	32	1.0	0.4

* This is a single bulk sample taken from a site displaying effloresence of salt.

8. DISCUSSION

The property of Rosebank has approximately 70 percent open mitchell grass plains. The remaining portion consists of drainage lines, gidgee and boree communities. To date the property has principally been used for grazing and is watered by dams on minor channels of Wellshot and Elibank Creeks, gully catchment dams and tanks.

Stocking rates for the mitchell grassland areas are of the order of 0.7 (dry sheep equivalent per hectare) (Table 4). The gidgee areas are generally too small for pasture improvement and in the unimproved state should be stocked at approximately 0.25 DSE/ha. Some of the gidgee areas are experiencing regrowth and treatment may prove necessary. The open boree areas (Wooded Downs) have an estimated carrying capacity of 0.6 DSE/ha. The drainage lines and associated alluvia are prone to seasonal scalding and estimated carrying capacities for these areas is 0.35 DSE/ha. The minor scalded areas represent only a small portion of the total property and where possible should be fenced and managed separately. If not reclaimed, carrying capacity will degenerate to less than 0.2 DSE/ha. Both the seasonally scalded and scalded areas would benefit from water ponding. Success however will be dependant on the ability to remove grazing animals entirely until the soil surface structure is improved and perennial grasses re-establish.

Two major sites are potentially suited to water harvesting or fodder cropping. The two sites are the deep colluvial clays on the lower slopes and flats adjoining the south western side of Wellshot Creek (RD_4). The preferred site, due to relief and uniformity, is located near the western boundary.

Existing fencing on the property does not adequately consider land unit differences. Wherever possible, changes to fencing should attempt to separate major land units. Where this is not feasible, general management and in particular experimental design, should consider these differences. The different land units have marked differences in productivity and degradation risks (Table 4). Owing to the unique requirements of individual experiments, no general recommendations are made.

Table 4 Land unit condition and grazing characteristics

Mapping Units	Natural Stability	Condition	Estimated Grazing Capacity*	Comment
RD1	Stable	Fair to good	0.7 DSE/ha	Productive mitchell grass open tussock grassland. Mitchell grass stands over well in dry times. Shade trees limited.
RD2	Slightly unstable	Fair downward trend	O.6 DSE/ha	Generally stable mitchell grass open tussock grassland. Pastures susceptible to overgrazing.
RD3	Stable	Fair to good	0.7 DSE/ha	Productive mitchell grass open tussock grassland. Mitchell grass stands over well in dry times. Shade trees limited.
RD4	Stable	Good	0.8 DSE/ha	Highly productive mitchell grassland. Mitchell grass stands over well in dry times. Shade trees limited.
W1	Stable	Fair to good	0.6 DSE/ha	Productive, well shaded land unit capable of high levels of production in good seasons. Mitchell grass stands over well.
W2	Stable	Fair to good	0.6 DSE/ha	Productive, well shaded land unit capable of high levels of production in good seasons. Mitchell grass stands over well.
W3	Unstable	Poor to fair downward trend	0.4 DSE/ha	Degrading woodland, seasonally flooded, capable of producing useful ephemeral pastures in good seasons. Overstocking during dry periods results in severe scalding.
W4	Unstable	Poor to fair downward trend	0.4 DSE/ha	Semi open woodland, sensitive to erosion though slightly protected by stone cover, useful ephemeral pastures in good seasons.
W5	Stable	Poor to fair	0.25 DSE/ha	Low carrying capacity; regrowth problem; produces useful ephemeral pastures in good seasons; stone cover limits susceptibility to erosion.

Table 4 continued

Mapping Units	Natural Stability	Condition	Estimated Grazing Capacity*	Comment
C1	Unstable	Fair downward trend	0.35 DSE/ha	Sparse mitchell grasses with ephemeral ground cover; usually low; erosion prone; sensitive to sheet wash susceptible to overgrazing and easily degraded.
M1	Unstable	Poor	0.0 DSE/ha	Scalded areas with saline crusted surface; no perennial vegetation; extremely low productivity; high runoff.
S1	Moderately	Poor to fair	0.35 DSE/ha	Periodic innundation produces useful unstable seasonal ephemeral pastures. Seasonal scalding is widespread if overgrazed.
S2	Moderately	Fair	0.5 DSE/ha	Mitchell grass drainage lines; subject unstable to minor scalding. Useful shade belts subject to overgrazing.

* Derived from consultation with graziers, Lands Department and officers of the Department of Primary Industries.

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APPENDIX I

Plant species of the Longreach area (rare species omitted)

ACANTHACEAE
Justicia procumbens

AIZOACEAE
Glinus lotoides
Trianthema galericulata
Trianthema triquetra

AMARANTHACEAE
Alternanthera nodiflora
Amaranthus mitchellii
Trichinium exaltatum
Trichinium obovalum

AMARYLLIDACEAE
Crinum angustifolium

APOCYNACEAE
Carissa lanceolata

ASCLEPIADACEAE
Marsdenia sp. (undescribed)

ASTERACEAE
Brachycome curvicarpa
Calotis hispidula
Calotis squamigera
Centipeda cunninghamii
Centipeda minima
Flaveria australasica
Gnaphalium indicum
Helipterum corymbiflorum var.
Helipterum floribundum
Minuria integerrima
Pterocaulon sphacelatum
Rutidosis helichrysoides
Sphaeranthus indicus
Villadinia pterochaeta
Xanthium pungens
Xanthium spinosum

BORAGINACEAE
Ehretia saligna
Heliotropium strigosum
Heliotropium tenuifolium

CAESALPINIACEAE
Lysiphyllum carronii
Lysiphyllum cunninghamii
Cassia circinnata
Cassia eremophila
Cassia occidentalis
Cassia oligophylla
Cassia phyllodinea
Cassia sturtii
Parkinsonia aculeata

CAMPANULACEAE
Wahlenbergia gracilenta

CAPPARIDACEAE
Apophyllum anomalum
Capparis lasiantha
Capparis loranthifolia
Capparis mitchellii
Capparis nummularia
Polanisia viscosa

CHENOPODIACEAE
Atriplex lindleyi
Atriplex muelleri
Atriplex sp.
Sclerolaena bicornis var. horrida
Sclerolaena echinopsila
Sclerolaena lanicuspis
Sclerolaena quinquecuspis

Chenopodium auricomum
Chenopodium cristatum
Chenopodium pseudomicrophyllum
Chenopodium pumilio
Enchylaena tomentosa
Mairenna coronata
Mairenna dichoptera
Rhagodia linifolia
Salsola kali
Senniella spongiosa
Threlkeldia proceriflora

COMMELINACEAE
Aneilema gramineum
Commelina undulata

CONVOLVULACEAE
Convolvulus erubescens
Cuscuta australis
Evolvulus alsinoides
Ipomoea brassii
Ipomoea coptica
Ipomoea lonchophylla
Ipomoea plebeia
Ipomoea polymorpha
Ipomoea spp. (undescribed)
Ipomoea turpethum
Polymeria longifolia
Polymeria marginata

CRUCIFERAE
Capsella bursa-pastoris
Lepidium spp.
Sisymbrium orientale

CURCURBITACEAE
Citrullus colocynthis
Cucumis myriocarpus
Cucumis trigonus
Mukia micrantha

CYPERACEAE
Cyperus aristatus
Cyperus difformis
Cyperus exaltatus
Cyperus gilesii
Cyperus iria
Cyperus pygmaeus
Cyperus retzii
Cyperus victoriensis
Eleocharis pallens
Fimbristylis microcarya

ELATINACEAE
Bergia ammanioides

EUPHORBIACEAE
Andrachne decaisnei
Euphorbia drummondii
Euphorbia mitchelliana
Phyllanthus maderaspatansus
Phyllanthus simplex
Phyllanthus thesioides
Phyllanthus sp. (undescribed)

FABACEAE
Aeschynomene indica
Alysicarpus rugosus
Archidendropsis basaltica
Crotolaria dissitiflora
Crotolaria linifolia
Crotolaria medicaginea
Desmodium campylocaulon
Desmodium muelleri
Glycine falcata
Indigofera linifolia
Indigofera parviflora
Indigofera subulata
Indigofera viscosa
Psoralea cinerea
Psoralea patens
Rhynchosia minima
Sesbania benthamiana
Swainsona campylantha
Trigonella suavissima
Vigna lanceolata var. latifolia

FRANKENIACEAE
Frankenia serpyllifolia

GOODENIACEAE
Goodenia strangfordii
Goodenia subintegra

HALORAGACEAE
Haloragis glabrescens

LAMIACEAE
Basilicum polystachyon
Mentha australis
Ocimum sanctum
Teucrium integrifolium

LILIACEAE
Bulbine bulbosa

LORANTHACEAE
Amyema miraculosum var. boormannii
Amyema quandang
Loranthus mitchellianus?
Lysiana exocarpi

LYTHRACEAE
Ammania multiflora
Lythrum hyssopifola

MALVACEAE
Abutilon calliphyllum
Abutilon fraseri
Abutilon malvifolium
Hibiscus brachysiphonius
Hibiscus ficulneus
Hibiscus trionum
Malvastrum spicatum
Sida corrugata
Sida fibulifera
Sida goniocarpa
Sida speniceriana
Sida spinosa
Sida trichopoda
Sida sp.

MARSILEACEAE
Marsilea hirsuta

MIMOSACEAE
Acacia cambagei
Acacia cana
Acacia farnesiana
Acacia stenophylla
Acacia sutherlandii
Acacia victoriae
Neptunia gracilis
Neptunia monosperma

MYOPORACEAE
Eremophila longifolia
Eremophila mitchellii
Eremophila maculata
Eremophila polyclada

MYRTACEAE
Eucalyptus camaldulensis
Eucalyptus microtheca
Eucalyptus terminalis
Melaleuca linariifolia var. trichostachya

NYCTAGINACEAE
Boerhavia diffusa
Boerhavia diffusa var. paludosa

OLEACEAE
Jasminum lineare

PAPAVERACEAE
Argemone mexicana

PLANTAGINACEAE
Plantago varia

POACEAE
Aristida latifolia
Astrebla elymoides
Astrebla lappacea
Astrebla pectinata
Astrebla squarrosa
Astrebla spp.
Bothriochloa ewartiana
Brachiaria windersii
Brachyachne convergens
Chloris sp. (undescribed)
Chloris pectinata
Chrysopogon fallax
Dactyloctenium radulans
Dichanthium superciliatum
Dichanthium sericeum
Digitaria sp. aff. divaricatissima
Digitaria ctenantha
Diplachne muelleri
Echinochloa turnerana
Enneapogon avenaceus
Enneapogon oblongus
Enneapogon polyphyllus
Eragrostis cilianensis
Eragrostis japonica
Eragrostis leptocarpa
Eragrostis setifolia
Erichloa australiensis
Erichloa crebra
Erichloa mucronata
Eulalia aurea
Iseilema membranaceum
Iseilema vaginiflorum
Iseilema windersii
Leptochloa digitata
Panicum buncei
Panicum decompositum
Paspalidium gracile var. rugosum
Paspalidium jubiflorum
Pseudoraphis spinescens
Sehima nervosum
Sporobolus actinocladus
Sporobolus caroli
Sporobolus mitchellii
Sporobolus pulchellus
Themeda triandra
Tragus australianus
Tripogon loliiformis
Triraphis mollis

POLYGALACEAE
Polygala gabrielae

POLYGONACEAE
Muehlehbeckia cunninghamii
Polygonum attenuatum
Polygonum plebeium
Rumex crystallinus

PORTULACACEAE
Portulaca oleracea

PROTEACEAE
Grevillea striata
Hakea cunninghamii

RHAMNACEAE
Ventilago viminalis

RUBIACEAE
Canthium oleifolium
Oldenlandia polyclada

SANTALACEAE
Santalum lanceolatum

SAPINDACEAE
Atalaya hemiglauca
Heterodendrum oleifolium

SCROPHULARIACEAE
Morgania floribunda
Morgania glabra

SOLANACEAE
Datura leichhardtii
Nicotiana megalosiphon
Solanum esuriale
Solanum nigrum

STERCULIACEAE
Melhania abyssinica

TILIACEAE
Corchorus trilocularis

TYPHACEAE
Typha angustifolia

UMBELLIFERAE
Daucus glochidiatus

VERBENACEAE
Verbena officinalis

ZYGOPHYLLACEAE
Tribulus terrestris
Zygophyllyum ammophilum

Modified after Davidson (1954)

APPENDIX II

Unique Map Area (UMA) data

The data described in this appendix are the data coded and held on computer for each UMA. The data can be used to construct maps for differing purposes.

Within areas of interest, the computer can be used to sort UMA's by attributes into those which satisfy a user requirements and those that do not. Major attributes should be sorted first followed by minor attributes. Listing of potential UMA's which satisfy requirements of end users can be presented in tabular form or plotted onto a base map.

It is important that users of the data provided by this study limit its use to the scale at which the data was intended. The intensity of sampling has been adequate for the publication of a map at the 1:25 000 scale. The data available is accurate for land assessment only at that scale. Any larger scale requirements should be accompanied by a higher intensity survey.

UMA's can be sorted according to any single or combination of the following attributes.

The description of the codes used on the unique map area data (Figure 3) are those of McDonald *et al.* (1984) and a full list of data stored for each UMA is given below (exceptions are treated in some detail).

Record 1

Column	Item
1:	Record type 1
3 to 4:	Survey Code - three letter code identifying the survey
5 to 8:	UMA Number - each UMA is identified by its own number
9 to 16:	Air Photo Film No. - used for UMA location
17 to 18:	Air Photo run number - used for UMA location
19 to 21:	Air photo frame number

22 to 32: Air Photo Eastings and Northings
- UMA Co-ordinates of a central labelling point expressed in mm from bottom left of air photo

33 to 34: AMG
- Australian Map Grid

35 to 37: Geology
- Geological formation underlying UMA

38 to 39: Substrate Material
- Substrate material of UMA

40: Proportion of UMA rock outcrop
- Percentage of UMA covered by rock outcrops

41 to 42: Lithology of Rock outcrop
- Type of rock in outcrop

43: Type of microrelief
- Type of microrelief found in UMA

44 to 47: Vertical and Horizontal interval
- Vertical interval and wave length of microrelief in metres

48 to 51: Surface coarse fragments and size.
- Percent of coarse fragments covering UMA and their size (mm)

52 to 53: Lithology
- Lithology of coarse fragments.

Record 2

1: Record type 2

2 to 8: as per record 1

9 to 11: Landform pattern
- Landform pattern in which UMA is located

12 to 14: Landform element
- Landform element of UMA

15: Aspect
- Aspect of UMA
  - O UMA is either level (<0.05% slope or has more than one aspect
  N 316 to 45° aspect
  E 46 to 135° aspect
  S 136 to 225° aspect
  W 226 to 315° aspect

16 to 24: Minimum, modal, and maximum slope
- minimum, modal and maximum slope percent of UMA

25 to 33: Erosion
- State type and degree
- Erosion status of UMA (three types can be recorded)

34 to 38: Drainage characteristics within the UMA
- drainage channels (depth width/depth ratio, spacing and class)

39 to 43: Flooding status and characterisation of UMA
- depth to standing water; frequency duration and depth of inundation and confidence of probability of inundation

44 to 45: Complex or Association
- Soil types within UMA expressed as a complex or association are grouped according to similarity

46 to 51: Dominant PPF
- The dominant principal profile form of soils found within the UMA (Northcote 1979); usually greater than 70% pure

52: Soil Colour
- Common term given to describe soil colour. Based on the dominant colour of the B horizon (Northcote 1979).
B = Brown
G = Grey

53 to 55: Soil Texture
- Three letter code for soil texture.

56: Soil depth
- Modal soil depth of UMA
1 < 30cm
2 30-60cm
3 60-90cm
4 90-120cm
5 120-150cm
6 150cm +

57: pH
- Modal Soil pH of UMA at 0-10cm depth

1 < 5.5
2 5.5 - 7.5
3 7.5 - 8.5
4 > 8.5

58: Calcareous
- Effervescence of carbonate in fine earth

Appendix III

Soil profile class descriptions

Soil profile class: RD1

Concept: Moderately deep, (0.6 to 1.2 m) grey to brown cracking medium clay with strongly self-mulching surface; incipient gilgai development on flats with weakly developed linear gilgai on slopes; silcrete stone cover 0 to 10%; minor sandstone outcrops; alkaline soil reaction trend; moderately calcareous

Substrate material: Sandstone of Winton Formation (Kw)

Landform pattern type: Gently undulating plains

Landform element type/s: Lower, mid and upper slopes

Slope: Min 0.5 % **Max** 3.0 % **Modal** 2.0 %

Vegetation:

Structure: Tussock grassland

Dominant species: *Astrebla squarrosa, A. elymoides, A. pectinata, A. lappacea, Iseilema* species, *Aristida* species

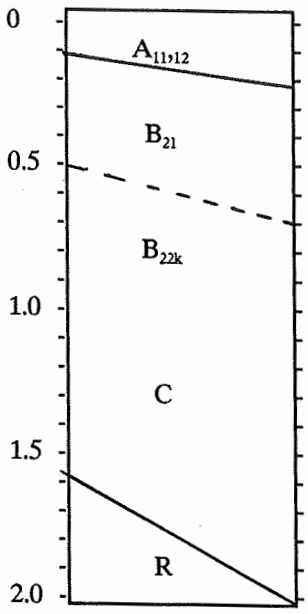
		Minimum	Maximum	Modal
pH at depth	**0 m**	7.5	9.0	8.5
	0.30 m	8.5	9.4	8.7
	0.60 m	8.5	9.3	8.7
	0.90 m	8.5	9.3	8.7

Principle Profile Form/s: Ug 5.22 Ug 5.32

Surface condition: Strongly self mulching

Microrelief: **type:** Incipient normal gilgai and linear gilgai

horizontal interval: 5 m **vertical interval:** 0.1 m



Horizon	Description:
A11	Brown or grey (10 YR 5/3 5/4 4/3 4/4) light to medium clay; moderately weak sub angular blocky structure 2-5 mm; carbonate nodules on mound surface; clear to -
A12	Brown or grey (10 YR 5/3 5/4 4/3 4/4) light medium to medium clay; moderately weak subangular blocky 5-10 mm; clear to
B21	Brown or grey (10 YR 5/3 5/4 4/3 4/2 4/4) medium to medium heavy clay moderate to strong subangular blocky 10-20 mm; carbonate nodules <2%; gradual to
B22k	Brown or grey (10 YR 5/3 5/4 4/2 4/3 4/4) medium to medium heavy clay; moderate to strong subangular blocky 10-20 mm; carbonate nodules >2%; clear to
C	Yellowish brown (10 YR 5/6 5/8 6/4 6/6 6/8) lightly to deeply weathered unconsolidated material layers of carbonate and gypseous material common and sedimentry laminae occur throughout
R	Sandstone

Soil profile class: RD2

Concept: Moderately deep, brown cracking light-medium clays (0.8 to 1.0 m) with incipient cracking gilgai mounds; sink holes and minor scalding; extensive sandstone outcropping; alkaline soil reaction trend; highly calcareous

Substrate material: Sandstone

Landform pattern type: Gently undulating Plains

Landform element type/s: crests and upper slopes

Slope: **Min** 1.0 **%** **Max** 2.0 **%** **Modal** 1.5 **%**

Vegetation:

Structure: Tussock grasslands

Dominant species: *Astrebla pectinata, A. lappacea, Aristida latifolia, Atalaya hemiglauca*

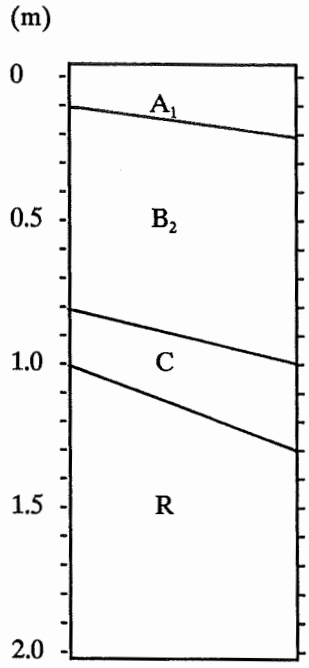
		Minimum	Maximum	Modal
pH at depth	**0 m**	8.0	8.7	8.5
	0.3 m	8.7	8.7	8.7
	0.6 m	8.7	8.7	8.7
	0.9 m	8.6	8.7	8.7

Principle Profile Form/s: Ug 5.32

Surface character: Incipient cracking mounds and self mulching surface

Microrelief: **type:** Incipient normal gilgai

horizontal interval: 5.0 m **vertical interval:** 0.1 m



Horizon	Description:
A1	Brown (10 YR 4/3) light clay; moderately weak subangular blocky 2-5 mm; highly calcareous; clear to -
B2	Brown (10 YR 4/3) light medium clay; moderate to strong subangular blocky 10-20 mm; highly calcareous; clear to -
C	Yellowish brown (10 YR 6/4 6/6) lightly weathered to deeply weathered unconsolidated material; layers of carbonate and gympseous material common; sedimentary laminae throughout -
R	Sandstone

Soil profile class: RD3

Concept: Moderately deep, brown cracking, medium clay (0.9 to 1.0 m) with strongly self-mulching surface; linear gilgai and sink holes throughout; carbonate segregations in deep subsoil; alkaline soil reaction trend; highly calcareous

Substrate material: Sandstone and Mudstone

Landform pattern type: Gently undulating plain

Landform element type/s: Upper slopes and mid slopes

Slope: Min 2.0 % **Max** 3.0 % **Modal** 2.5 %

Vegetation:

Structure: Tussock grassland

Dominant species: *Astrebla squarrosa, A. elymoides, A. pectinata, A. lappacea, Aristida* species

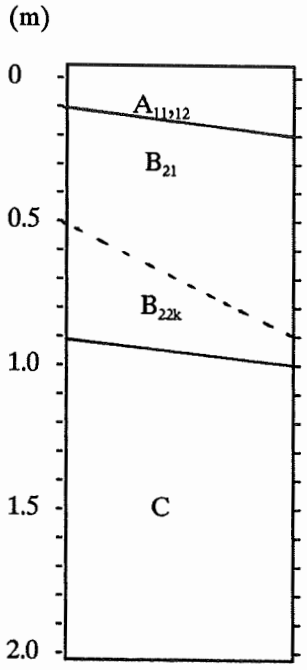
		Minimum	Maximum	Modal
pH at depth	**0 m**	8.0	8.0	8.0
	0.30 m	7.5	8.6	8.1
	0.60 m	8.1	8.5	8.3
	0.90 m	8.5	8.6	8.5

Principle Profile Form/s: Ug 5.32

Surface character: Strongly self mulching

Microrelief: **type:** Linear gilgai

horizontal interval: 5 m **vertical interval:** 0.2 m



Horizon	Description:
A11	Brown (10 YR 4/3, 4/4) light medium clay; strongly self mulching; moderately weak subangular blocky 2-5 mm; carbonate nodules on mound surface; clear and smooth to-
A12	Brown (10 YR (4/3) light medium clay moderately weak subangular blocky 5-10 mm; clear to -
B21	Brown (10 YR 4/3) medium clay; moderate to strong subangular blocky 10-20 mm; carbonate nodules <1%; gradual to -
B22k	Brown (10 YR 4/3) medium clay moderate to strong subanglar blocky 10-20 mm; carbonate nodules >2%; clear to
C	Yellowish brown (10 YR 6/3 6/8) lightly to deeply weathered unconsolidated material; layers of carbonate and gypsum crystals common

Soil profile class: RD4

Concept: Deep, brown medium-heavy clay (0.80 to 1.80 m) formed on colluvium with a strongly self-mulching surface; incipient normal gilgai; silcrete stone cover <10%; alkaline soil reaction trend, moderately calcareous

Substrate material: Sandstone

Landform pattern type: Gently undulating plain

Landform element type/s: Lower slopes and flats adjoining stream channels subject to periodic innundation

Slope: **Min** 0.0 % **Max** 1.0 % **Modal** 0.5 %

Vegetation:

Structure: Tussock Grassland

Dominant species: *Astrebla squarrosa, A. elymoides, A. pectinata, A. lappacea, Aristida* species

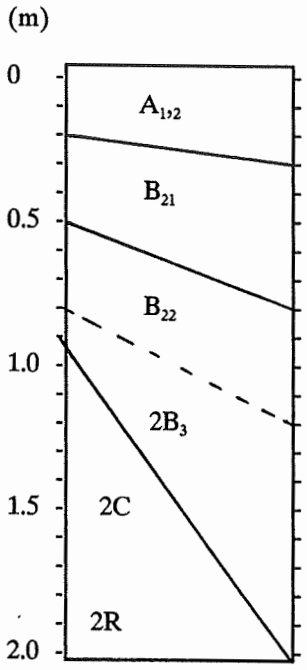
		Minimum	Maximum	Modal
pH at depth	**0 m**	7.0	8.0	7.5
	0.30 m	8.1	8.6	8.5
	0.60 m	8.5	8.7	8.5
	0.90 m	8.5	8.7	8.5

Principle Profile Form/s: Ug 5.32, Ug 5.34, Ug 5.3

Surface character: Strongly self mulching

Microrelief: **type:** Weakly defined normal gilgai

horizontal interval: 1.0 m **vertical interval:** 0.1 m



Horizon	Description:
A11	Brown (10 YR 4/4 4/3) light silty clay; moderately weak subangular blocky structure 2-5 mm; clear to -
A12	Brown (10 YR 4/4 4/3) light to medium clay; moderately weak subangular blocky 5-10 mm; clear to -
B21	Brown (10 YR 4/3) medium to heavy clay; subangular blocky 10-20 mm; clear to -
B22	Brown (10 YR 4/4) medium to medium heavy clay; subangular blocky 10-20 mm; carbonate nodules <2%; clear to -
2B3	Yellowish brown (10 YR 5/6) light clay; -
2C	Yellowish brown (10 YR 5/6) lightly to deeply weathered unconsolidated material; layers of carbonate and gypseous crystals; sedimentary laminae throughout
2R	Sandstone

Comments: The 2B3 may be layered alluvium or developed *in situ*

Soil profile class: W1

Concept: Deep, brown, light medium clay (0.70 to 1.80 m) with a fine granular self-mulching surface; gilgai; silcrete stone cover 1 to 10%; localised outcrops of sandstone; manganese and calcium carbonate material in the deep subsoil; alkaline soil reaction trend; highly calcareous

Substrate material:

Landform pattern type: Gently undulating plains

Landform element type/s: Lower, mid and upper slopes

Slope: **Min** 0.5 **%** **Max** 2.0 **%** **Modal** 1.0 **%**

Vegetation:

Structure: Open Woodland

Dominant species: *Acacia cana, Atalaya hemiglauca Acacia farnesiana, Astrebla* species, *Aristida* species

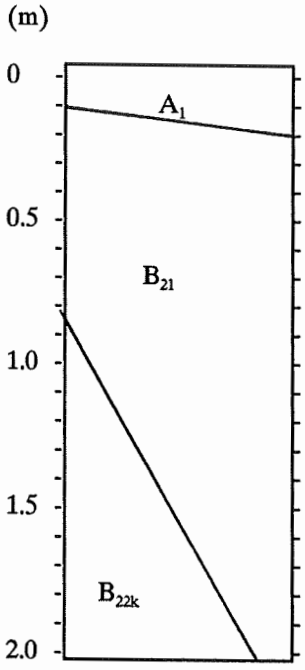
		Minimum	Maximum	Modal
pH at depth	**0 m**	7.0	7.8	7.5
	0.30 m	8.6	8.7	8.6
	0.60 m	8.6	8.6	8.6
	0.90 m	8.5	8.6	8.6

Principle Profile Form/s: Ug 5.34

Surface character: Self mulching

Microrelief: **type:** Normal gilgai

horizontal interval: 5 m **vertical interval:** 0.1 m



Horizon	Description:
A1	Brown (7.5 YR 4/4, 10 YR 4/4) light to light medium clay; moderately weak subangular blocky 2-5 mm; carbonate nodules on mound surface; clear to -
B21	Brown (10 YR 4/4, 7.5 YR 4/4) light medium clay moderately strong subangular blocky 10-20 mm; carbonate nodules <1%; clear to -
B22k	Dull yellowish brown (7.5 YR 5/4 10 YR 6/6) light to medium clay; moderately weak subangular blocky 10-20 mm; manganese and calcium carbonate material 2-10%

Soil profile class: W2

Concept: Deep, light to medium, grey clay to 1.70 m; weakly self-mulching granular surface; incipient gilgai with carbonate nodules on mound surface; silcrete stone cover <1%; alkaline soil reaction trend; highly calcareous; subject to periodic innundation

Substrate material:

Landform pattern type: Gently undulating plains

Landform element type/s: Lower slopes

Slope: **Min** 0.5 % **Max** 1.0 % **Modal** 0.5 %

Vegetation:

Structure: Open Woodland

Dominant species: *Acacia cana, Astrebla* species, *Aristida* species; *Acacia cambagei*

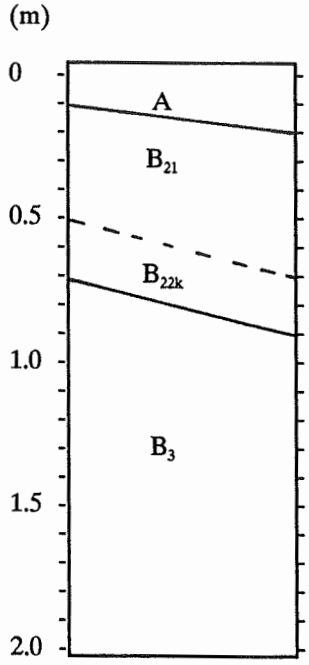
		Minimum	Maximum	Modal
pH at depth	**0 m**	7.0	8.8	7.8
	0.30 m	8.6	8.7	8.6
	0.60 m	8.5	8.6	8.6
	0.90 m	8.3	8.6	8.6

Principle Profile Form/s: Ug 5.24

Surface character: Self-mulching

Microrelief: **type:** Normal gilgai

horizontal interval: 10 m **vertical interval:** 0.2 m



Horizon	Description:
A	Dull yellowish brown (10 YR 5/4) light to light medium clay; moderately weak subangular blocky 2-5 mm; carbonate nodules on mound surface; clear to -
B2	Dull yellowish brown (10 YR 5/4) medium clay; moderately strong subangular blocky 10-20 mm carbonate nodules <1%; clear to -
B22k	Dull yellowish brown (10 YR 5/4) medium clay; moderately strong subangular blocky carbonate nodules >2%
B3	Bright yellowish brown (10 YR 6/5) light clay; carbonate and gypseous material throughout

Soil profile class: W3

Concept: Degraded, deep, brown and grey clay to 1.70 m; crusted to massive surface; minor losses of A horizon, seasonally scalded with pockets of self-mulching surface; incipient gilgai development; moderately calcareous at surface to highly calcareous at depth; carbonate segregations in the deep subsoil; alkaline soil reaction trend; subject to periodic innundation

Substrate material:

Landform pattern type: Gently undulating plains

Landform element type/s: Lower slopes and flats

Slope **Min** 0.0 % **Max** 0.5 % **Modal** 0.5 %

Vegetation:

Structure: Open Woodland

Dominant species: *Atriplex muelleri, Acacia cana, Meuhlenbeckia cunninghamii, Sclerolaena* species

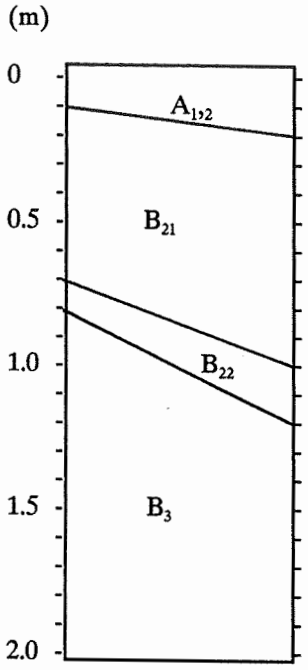
		Minimum	Maximum	Modal
pH at depth	**m**	7.5	9.2	8.0
	0.30 m	8.6	8.7	8.6
	0.60 m	8.5	8.7	8.6
	0.90 m	8.5	8.5	8.5

Principle Profile Form/s: Ug 5.24

Surface character: Seasonally scalded with pockets of self mulching surface

Microrelief: **type:** Incipient normal gilgai

horizontal interval: 10 m **vertical interval:** 0.1 m



Horizon	Description:
A11	Brown to yellowish brown (10 YR 4/4 5/4 5/3) seasonally scalded surface in part; some loss of A horizon; weak subangular blocky 2-5 mm; clear to -
A12	Dull yellowish brown light medium clay (10 YR 5/4 5/3); moderately weak subangular blocky 5-10 mm; clear to -
B21	Brown light medium to medium clay (10 YR 4/4); moderately strong subangular blocky structure 10-20 mm; carbonate nodules <1%; clear to -
B22	Dull yellowish brown (10 YR 5/3 4/4) light medium to medium clay moderately strong subangular blocky 10-20 mm; carbonate nodules (>2%); clear to -
B3	Bright yellowish to yellowish brown (10 YR 6/5 5/6); light medium clay carbonate layers common.

Soil profile class: W4

Concept: Moderately deep, grey, weakly self-mulching light medium clay (0.90 to 1.20 m); moderately calcareous throughout; gypsum in deep subsoil; incipient gilgai; silcrete stone cover 2 to 20%; alkaline soil reaction trend

Substrate material:

Landform element type/s: Hill slopes and hill crests

Landform pattern type: Gently undulating plains

Slope **Min** 1.0 % **Max** 3.0 % **Modal** 2.0 %

Vegetation:

Structure: Open Woodland

Dominant species: *Acacia cana, Atalaya hemiglauca, Eremophila mitchellii, Astrebla* species

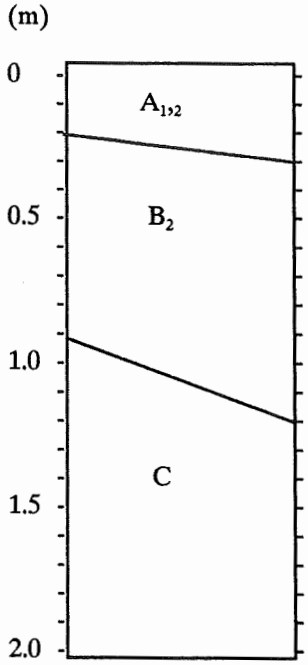
		Minimum	Maximum	Modal
pH at depth	**0 m**	7.5	7.8	7.8
	0.30 m	8.7	8.9	8.8
	0.60 m	8.7	8.7	8.7
	0.90 m	8.6	8.7	8.6

Principle Profile Form/s: Ug 5.22

Surface character: Weakly self mulching

Microrelief: **type:** Incipient normal gilgai

horizontal interval: 10 m **vertical interval:** 0.1 m



Horizon	Description:
A11	Dull yellowish brown (10 YR 5/4) light to light medium clay; moderately weak subangular blocky 2-5 mm; clear to -
A12	Dull yellowish brown (10 YR 5/3) light to light medium clay; moderately weak subangular blocky 2-5 mm; clear to -
B	Dull yellowish brown (10 YR 5/3 5/4) medium clay; moderately strong subangular blocky 10-20 mm; carbonate nodules <1%; clear to -
C	Yellowish brown (10 YR 5/6 5/5); lightly to deeply weathered layers of carbonate and gypseous material; sedimentary laminae throughout.

Soil profile class: W5

Concept: Weakly cracking and non cracking yellowish brown, light-medium clays (0.60 to 1.30 m); weakly granular self mulching surface silcrete stone cover 60 to 80%; carbonate segregations and gypsum crystals in the deep subsoil; alkaline soil reaction trend; very highly calcareous throughout

Substrate material: Sandstone

Landform pattern type: Gently indulating plains

Landform element type/s: Mid and lower slopes

Slope: **Min** 0.5 % **Max** 2.0 % **Modal** 1.0 %

Vegetation:

Structure: Woodland

Dominant species: *Acacia cambagei, Eremophila mitchellii*

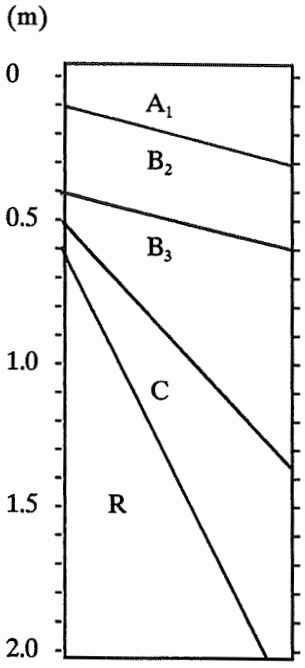
		Minimum	Maximum	Modal
pH at depth	**0 m**	8.5	8.7	8.6
	0.30 m	8.5	8.8	8.7
	0.60 m	8.6	8.8	8.7
	0.90 m	8.5	8.6	8.6

Principle Profile Form/s: Ug 5.32 Uf 6.31

Surface character: Granular self mulching surface with silcrete cover to 80%

Microrelief: **type:** absent

horizontal interval: **vertical interval:**



Horizon	Description:
A1	Brown (7.5 YR 4/4 10 YR 5/4) to yellowish brown light to light medium clay; moderately weak granular structure <2 mm; gradual to -
B2	Brown (7.5 YR 4/4 10 YR 4/4) light to medium clay; carbonate nodules <2%; moderately strong subangular blocky structure 10-20 mm; clear to -
B3*	Bright brown (10 YR 5/6) light to medium clay; carbonate nodules and gypsum crystals common; clear to -
C	Bright yellowish brown (10 YR 6/6) deeply weathered material; layers of carbonate and gypseous crystals throughout; sedimentary laminae present
R	Sandstone

* where present

Soil profile class: C1

Concept: Moderately shallow to shallow non-cracking brown light clay (0.20 to 0.90 m); very highly calcareous throughout; sandstone outcrops common with silcrete stone cover 1 to 50%; carbonate segregations and gypsum in the deep subsoil; alkaline soil reaction trend

Substrate material: Sandstone

Landform pattern type: Gently undulating plain

Landform element type/s: Crests, Ridges, Benches

Slope: **Min** 0.5 **%** **Max** 3.0 **%** **Modal** 2.0 **%**

Vegetation:

Structure: Tussock grassland

Dominant species: *Atalaya hemiglauca, Acacia farnesiana, Eremophila mitchellii, Astrebla* species, *Aristida* species

		Minimum	Maximum	Modal
pH at depth	**0 m**	8.5	9.2	9.0
	0.30 m	8.5	9.2	8.7
	0.60 m	8.7	9.2	8.7
	0.90 m	8.5	9.2	8.7

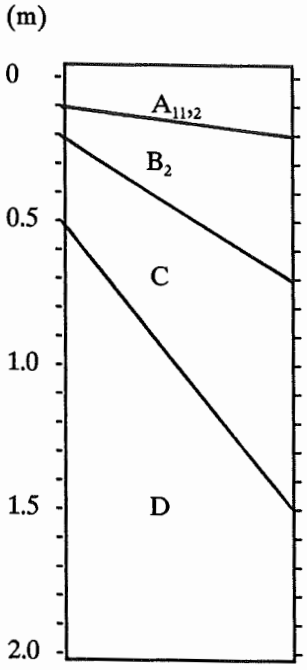
Comments: Minor intergrades of cracking clay may occur.

Principle Profile Form/s: Uf 6.31, Uf 6.12, Uf 6.33, Uf 6.34

Surface character: Firm to hard setting

Microrelief: **type:**

horizontal interval: **vertical interval:**



Horizon	Description:
A11	Dull yellowish brown to brown (10 YR 4/4, 5/4, 5/6) light clay; very highly calcareous; smooth or rough ped moderately strong 2-10 mm; clear to -
A12	Dull yellowish brown to brown (10 YR 4/4 5/4 5/6) light to light medium clay; very highly calcareous; smooth or rough ped; moderately strong 5-10 mm; clear to -
B2	Dull yellowish brown to brown (10 YR 4/4 5/4) light to light medium clay with 2-10% grey mottles (10 YR 6/2 6/3) common; highly calcareous; moderately strong smooth or rough peds 10-20 mm; clear to -
C	Yellowish brown (10 YR 5/6 6/6) lightly weathered unconsolidated material; layers of carbonate and gypseous material common; sedimentary laminae throughout
D	Sandstone

Soil profile class: M1

Concept: Brown, light medium clay (0.40 to 0.70 m) extensively scalded with saline, crusted or massive surface; silcrete stone cover 5 to 80%; A horizon eroded; moderately calcareous; alkaline soil reaction trend; gypsum common in deep subsoil

Substrate material:

Landform element type/s: Mid and lower slopes

Landform pattern type: Gently undulating plains - scalds

Slope: **Min** 0.5 **%** **Max** 2.0 **%** **Modal** 0.8 **%**

Vegetation: **Structure:** No perennial vegetation

Dominant species: Nil

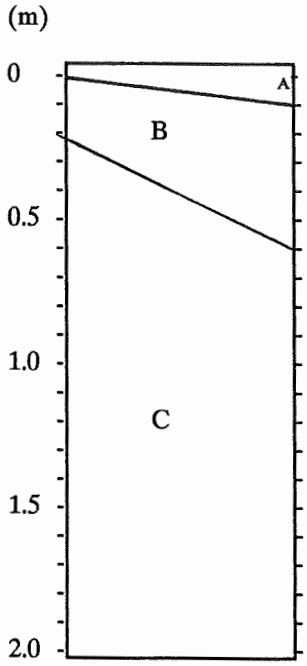
		Minimum	Maximum	Modal
pH at depth	**0 m**	6.5	8.5	7.0
	0.30 m	8.5	8.6	8.5
	0.60 m	8.5	8.5	8.5
	0.90 m	8.0	8.0	8.0

Principle Profile Form/s: Uf 6.31, Uf 6.34

Surface character: Saline surface crust

Microrelief: **type:**

horizontal interval: **vertical interval:**



Horizon	Description:
A	Dull yellowish brown (10 YR 5/4 5/5) light to light medium clay; salt puffs common on surface; surface bleach (10 YR 8/3); moderately calcareous; moderately strong subangular blocky 5-10 mm; clear to -
B	Dull yellowish brown to brown (10 YR 4/4 5/5) light medium clay; carbonate nodules and gypseous crystals throughout; subangular blocky 10-20 mm; clear to -
C	Bright yellowish brown (10 YR 6/6); deeply weathered unconsolidated material; carbonate and gypseous material common; sedimentary laminae throughout

Comments: Some loss of A horizon evident.

Soil profile class: S1

Concept: Deep to very deep, cracking to non cracking, silty, light, to light medium brown and grey clays (0.80 to 1.80 m) and texture contrast soil; extensive seasonal scalding and minor gilgai; seasonally flooded; slopes >1% development; carbonate segregations and gypsum in the deep subsoil; alkaline soil reaction trend

Substrate material: Sandstone/Mudstone

Landform pattern type: Alluvial plains

Landform element type/s: Channel benches, backplains and braided drainage depressions

Slope: **Min** 0.1 % **Max** 0.5 % **Modal** 0.5 %

Vegetation:

Structure: Open Woodland

Dominant species: *Eucalyptus microtheca, E. camaldulensis, Atriplex* and *Scleroleana* species

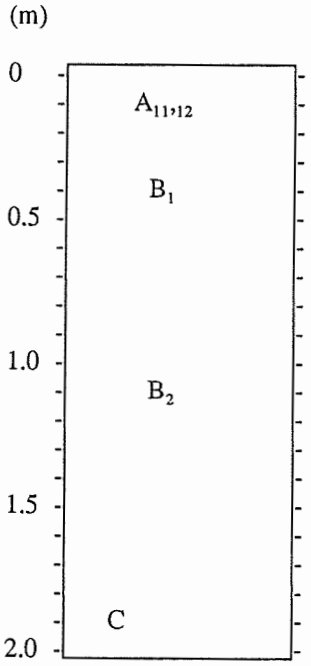
		Minimum	Maximum	Modal
pH at depth	**0 m**	7.0	7.5	7.5
	0.30 m	8.0	9.0	8.5
	0.60 m	8.5	9.1	8.5
	0.90 m	8.5	8.7	8.5

Principle Profile Form/s: Dy 4.13, Ug 5.24, Ug 5.34, Ug 5.22, Ug 5.32, Uf 6.31, Uf 6.33, Uf 6.34

Surface character: Seasonally scalded on channel benches and backplains and self mulching in relict stream channels.

Microrelief: **type:**

horizontal interval: **vertical interval:**



Horizon	Description:
A11	Dull yellowish brown to brown (10 YR 5/4 4/4) silty or sandy loam to light medium clay; moderately weak granular or subangular blocky 2-5 mm; gradual to -
A12	Dull yellowish brown to brown (10 YR and 7.5 YR 4/4 5/3) light to light medium clay; moderately weak subangular blocky structure 2-5 mm; clear to -
B1*	Greyish yellow brown to dull yellowish brown (10 YR 4/2 4/4 7.5 YR 4/4) light tolight medium clay; moderately strong subangular blocky structure 10-20 mm; gradual to -
B2	Greyish yellow brown to dull yellowish brown (10 YR 4/2 4/4 7.5 YR 4/4) light to light medium clay; moderately strong subangular blocky or lenticular structure; ferromagnesiam nodules common; clear to -
C	Bright yellowish brown (10 YR 6/6); deeply weathered unconsolidated material; carbonate and gypseous material common; sedimentry laminae throughout.

* where present

Soil profile class: S2

Concept: Moderately deep, brown and grey light medium to medium cracking clay 1.0 to 1.4 m with self-mulching surface; minor seasonal scalding, silcrete stone cover 1 to 10%; moderately calcareous throughout; carbonate segregations and gypsum in the deep subsoil; alkaline soil reaction trend

Substrate material: Sandstone

Landform element type/s: Drainage depressions; seasonally flooded

Landform pattern type: Gently undulating plains

Slope: **Min** 1.0 % **Max** 2.0 % **Modal** 2.0 %

Vegetation:

Structure: Tussock grassland

Dominant species: *Acacia cana, Eucalyptus microtheca, Acacia farnesiana, Astrebla* species

		Minimum	Maximum	Modal
pH at depth	**0 m**	7.5	8.5	7.6
	0.30 m	8.6	8.9	8.6
	0.60 m	8.5	8.7	8.6
	0.90 m	8.2	8.7	8.6

Rosebank Research Station
Land Resource Survey
Reference

Mapping Unit	Landscape unit	Landform element	Vegetation	Attributes of dominant soils	Dominant Principal Profile Forms
Rolling Downs					
RD_1	Gently undulating plains	Lower, mid and upper slopes; slopes < 3%	Mitchell grass open tussock grassland	Moderately deep, grey/brown cracking medium clays (0.60 to 1.2 m) with strongly self mulching surfaces; incipient gilgai development on flats with weakly developed linear gilgai on slopes; silcrete stone cover 0 to 10%; minor sandstone outcrops; alkaline soil reaction trend; moderately calcareous throughout	Ug 5.32
RD_2	Gently undulating plains	Upper slopes and crests; slopes 1-2%	Mitchell grass open tussock grassland	Moderately deep, brown cracking light-medium clays (0.80 to 1.0 m) with incipient cracking on gilgai mounds; sink holes and minor scalding; extensive sandstone outcropping; alkaline soil reaction trend; highly calcareous throughout	Ug 5.32
RD_3	Gently undulating plains	Mid to upper slopes; slopes 2-3%	Mitchell grass open tussock grassland	Moderately deep, brown cracking, medium clays (0.90 to 1.0 m) with strongly self-mulching surfaces; linear gilgai and sink holes throughout; highly calcareous throughout with carbonate segregations in deep subsoil; alkaline soil reaction trend	Ug 5.32

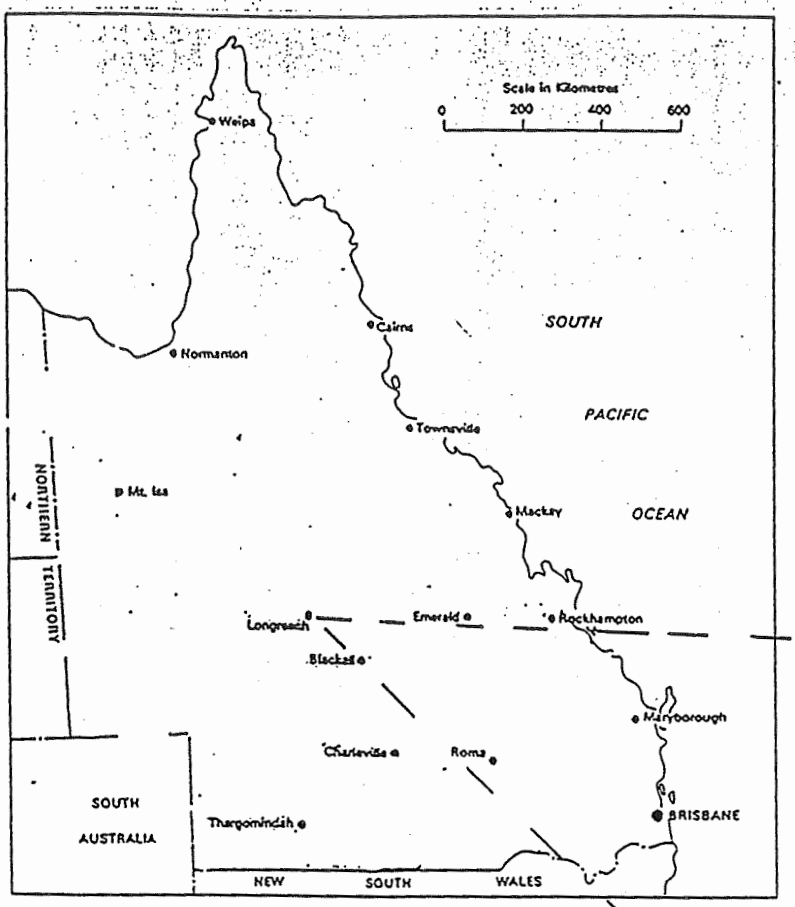
Mapping Unit	Landscape unit	Landform element	Vegetation	Attributes of dominant soils	Dominant Principal Profile Forms
RD_4	Gently undulating plains	Lower slopes and flats adjoining stream channels; slopes <1%; subject to periodic inundation	Mitchell grass open tussock grassland	Deep, brown cracking medium-heavy clays (0.80 to 1.80 m) formed on colluvium with strongly self-mulching surfaces; incipient normal gilgai; silcrete stone cover <10%; alkaline soil reaction trend, moderately calcareous	Ug 5.34
Woodlands					
W_1	Gently undulating plains	Lower, mid and upper slopes; slopes <2%	Open woodland of boree, whitewood, mimosa and false sandalwood	Deep, brown, light medium clay (0.70 to 1.80 m) with a fine granular self-mulching surface; gilgai; silcrete stone cover 1 to 10%; localised outcrops of sandstone; manganese and calcium carbonate segregations in the deep subsoil; alkaline soil reaction trend; highly calcareous throughout	Ug 5.34
W_2	Gently undulating plains	Lower slopes; subject to periodic inundation;	Open woodland of boree, gidgee, with Mitchell grass and saltbush	Deep, light to medium, grey clay to 1.70 m; granular weakly self-mulching surface; incipient gilgai with carbonate nodules on mound surface; silcrete stone cover <1%; alkaline soil reaction trend; highly calcareous	Ug 5.24
W_3	Gently undulating plains	Lower slopes; subject to periodic inundation;	Open woodland of boree, saltbush, lignum	Deep, brown and grey clays to 1.70 m; crusted to massive surface; evidence of soil loss, seasonally scalded with pockets of self-mulching surfaces; incipient gilgai development; moderately calcareous at surface to highly calcareous at depth; carbonate segregations in the deep subsoil; alkaline soil reaction trend	Ug 5.24

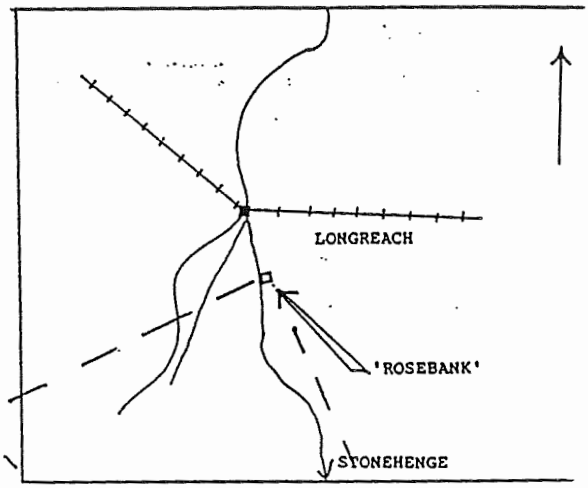
Mapping Unit	Landscape unit	Landform element	Vegetation	Attributes of dominant soils	Dominant Principal Profile Forms
W_4	Gently undulating plains	Hill slopes and hill crests; slopes <3%	Open woodland of boree, whitewood, false sandalwood	Moderately deep, grey, light medium clay (0.90 to 1.20 m); weakly self-mulching; incipient gilgai; gypsum in deep subsoil; silcrete stone cover 2 to 20%; alkaline soil reaction trend; moderately calcareous throughout	Ug 5.22
W_5	Gently undulating plains	Mid and lower slopes; slopes <2%	Tall scrubland to low woodland of gidgee and false sandalwood	Weakly cracking to non cracking yellowish brown, light-medium clay (0.60 to 1.30 m); weakly granular surface; silcrete stone cover 60 to 80%; carbonate segregations and gypsum crystals in the deep subsoil; alkaline soil reaction trend; very highly calcareous throughout	Uf 6.31

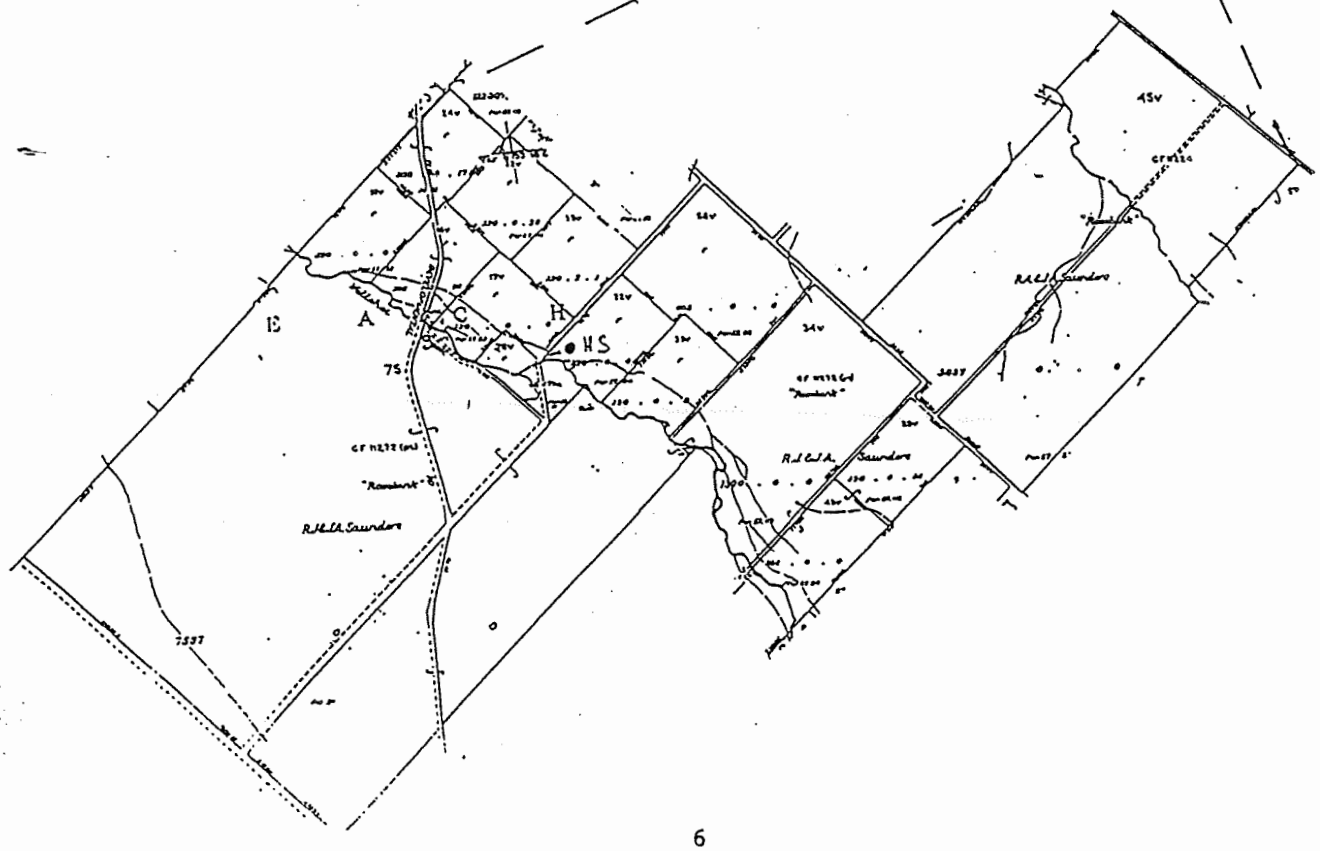
Mapping Unit	Landscape unit	Landform element	Vegetation	Attributes of dominant soils	Dominant Principal Profile Forms
Crests, Ridges and Benches					
C_1	Gently undulating plains - woodlands	Benches, crests and ridges; slopes <3%	Open woodland of whitewood, mimosa and false sandalwood	Moderately shallow to shallow, non cracking brown light clays (0.20 to 0.90 m); sandstone outcrops common with silcrete stone cover 1 to 50%; minor intergrades of cracking clays; carbonate segregations and gypsum in the deep subsoil; alkaline soil reaction trend; very highly calcareous throughout	Uf 6.31
Scalds					
M_1	Gently undulating plains - scalds	Mid and lower slopes; slopes <2%	No perennial vegetation	Brown, light medium clays (0.40 to 0.70 m) extensively scalded with saline, crusted or massive surfaces; silcrete stone cover 5 to 80%; A horizon eroded; moderately calcareous; alkaline soil reaction trend; gypsum common in deep subsoil	Uf 6.31

Mapping Unit	Landscape unit	Landform element	Vegetation	Attributes of dominant soils	Dominant Principal Profile Forms
Channel Benches and Drainage Depressions					
S_1	Alluvial plains	Channel benches, back plains and braided drainage depressions; seasonally flooded; slopes <1% development	Open woodland of coolibah, river red gums and bauhinia	Deep to very deep, complex or cracking and non cracking, silty, light, to light medium brown and grey clays (0.80 to 1.80 m) minor texture contrast soils; extensive seasonal scalding and minor gilgai; carbonate segregations and gypsum in the deep subsoil; alkaline soil reaction trend	Uf 6.31
S_2	Alluvial plain	Drainage depressions; seasonally flooded; slopes 1 to 2%	Mitchell grass open tussock grassland to open woodland of boree, coolibah and mimosa	Moderately deep, brown and grey light medium to medium cracking clay 1.0 to 1.40 m with self-mulching surface; minor seasonal scalding; silcrete stone cover 1 to 10% moderately calcareous throughout; carbonate segregations and gypsum in the deep subsoil; alkaline soil reactions trend	Ug 5.34

Figure 1. Locality map Rosebank Research Station







Rosebank Research Station

Land Resource Survey

Reference

Code	Landscape unit	Landform element	Vegetation	Attributes of dominant soils	Dominant Principal Profile Forms
Rolling Downs					
RD_1	Gently undulating plains - grasslands	Lower, mid and upper slopes; slopes < 3%	Mitchell grass open tussock grassland	Moderately deep, grey/brown cracking medium clays (60 to 120 cm) with strongly self mulching surfaces; incipient gilgai development on flats with weakly developed linear gilgais on slopes; silcrete stone cover 0 to 10%; minor sandstone outcrops; alkaline soil reaction trend; moderately calcareous	Ug 5.32
RD_2	Gently undulating plains - grasslands	Upper slopes and crests; slopes 1-2%	Mitchell grass open tussock grassland	Moderately deep, brown cracking light-medium clays (80 to 100 cm) with incipient cracking on gilgai mounds; sink holes and minor scalding; extensive sandstone outcropping; alkaline soil reaction trend; highly calcareous	Ug 5.32
RD_3	Gently undulating plains - grasslands	Mid to upper slopes; slopes 2-3%	Mitchell grass open tussock grassland	Moderately deep, brown cracking, medium clays (90 to 100 cm) with strongly self-mulching surfaces; linear gilgai and sink holes throughout; carbonate segregations in deep subsoil; alkaline soil reaction trend; highly calcareous	Ug 5.32
RD_4	Gently undulating plains - grasslands	Lower slopes and flats adjoining stream channels; slopes < 1%; subject to periodic inundation	Mitchell grass open tussock grassland	Deep, colluvial brown cracking medium-heavy clays (80 to 180 cm) with strongly self- mulching surfaces; incipient normal gilgai; silcrete stone cover < 10%; alkaline soil reaction trend, moderately calcareous	Ug 5.34

Woodlands

W_1	Gently undulating plains - woodlands	Lower, mid and upper slopes; slopes < 2%	Open woodland of boree, whitewood, mimosa and false sandalwood	Deep, brown, light medium clay (70 to 180 cm) with a fine granular self-mulching surface; gilgais; silcrete stone cover 1 to 10%; localised outcrops of sandstone; manganese and carbonaceous material in the deep subsoil; alkaline soil reaction trend; highly calcareous	Ug 5.34
W_2	Gently undulating plains - woodlands	Lower slopes; subject to periodic inundation;	Open woodland of boree, gidgee, Mitchell grass, saltbush	Deep, light to medium, grey clay to 170 cm; granular weakly self-mulching surface; incipient gilgai with carbonate nodules on mound surface; silcrete stone cover < 1%; alkaline soil reaction trend; highly calcareous	Ug 5.24
W_3	Gently undulating plains - woodlands	Lower slopes; subject to periodic inundation;	Open woodland of boree, saltbush, lignum	Degraded, deep, brown and grey clays to 170 cm; crusted to massive surface; seasonally scalded with pockets of self-mulching surfaces; incipient gilgai development; moderately calcareous at surface to highly calcareous at depth; carbonate segregations in the deep subsoil; alkaline soil reaction trend	Ug 5.24
W_4	Gently undulating plains - woodlands	Hill slopes and hill crests; slopes <3%	Open woodland of boree, whitewood, false sandalwood	Moderately deep, grey, weakly self-mulching light medium clay (90 to 120 cm); moderately calcareous throughout; gypsum in deep subsoil; incipient gilgai; silcrete stone cover 2 to 20%; alkaline soil reaction trend	Ug 5.22
W_5	Gently undulating plains - woodlands	Mid and lower slopes; slopes <2%	Tall shrubland to low woodland of gidgee and false sandalwood	Weakly cracking to non cracking yellowish brown, light-medium clay (60 to 130 cm); weakly granular surface; silcrete stone cover 60 to 80%; carbonate segregations and gypsum crystals in the deep subsoil; alkaline soil reaction trend; very highly calcareous throughout	Uf 6.31

Crests, Ridges and Benches

C_1	Gently undulating plains - woodlands	Benches, crests and ridges; slopes < 3%	Open woodland of whitewood, mimosa and false sandalwood	Moderately shallow to shallow, non cracking brown light clays (20 to 90 cm); very highly calcareous throughout; sandstone outcrops common with silcrete stone cover 1 to 50%; minor intergrades of cracking clays; carbonate segregations and gypsum in the deep subsoil; alkaline soil reaction trend	Uf 6.31

Scalds

M_1	Gently undulating plains - scalds	Mid and lower slopes; slopes < 2%	No perennial vegetation	Brown, light medium clays (40 to 70 cm) extensively scalded with saline, crusted or massive surfaces; silcrete stone cover 5 to 80%; A horizon eroded; moderately calcareous; alkaline soil reaction trend; gypsum common in deep subsoil	Uf 6.31

Channel Benches and Drainage Depressions

S_1	Alluvial plains	Channel benches backplains and braided drainage depressions;	Open woodland of coolibah, river red gums, bauhinia,	Deep to very deep, complex or cracking and non cracking, silty, light, to light medium brown and grey clays (80 to >108 cm) minor texture contrast soils; extensive seasonal scalding and minor gilgai flooded; slopes >1% development; carbonate segregations and gypsum in the deep subsoil; alkline soil reaction trend	Uf 6.31
S_1	Alluvial plain	Draingage depressions; seasonally flooded; slopes 1 to 2%	Mitchell grass open tussock grassland to open woodland of boree, coolibah, mimosa	Moderately deep, brown and grey light medium to medium cracking clay 100 to 140 cm with self-mulching surfaces; minor seasonal scalding; silcrete stone cover 1 to 10% moderately calcareous throughout; carbonate segregations and gypssum in the deep subsoil; alkaline soil reactions trend	UG 5.34