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SOILS OF ROSEBANK RESEARCH STATION

LONGREACH, QUEENSLAND

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LAND RESOURCES BRANCH

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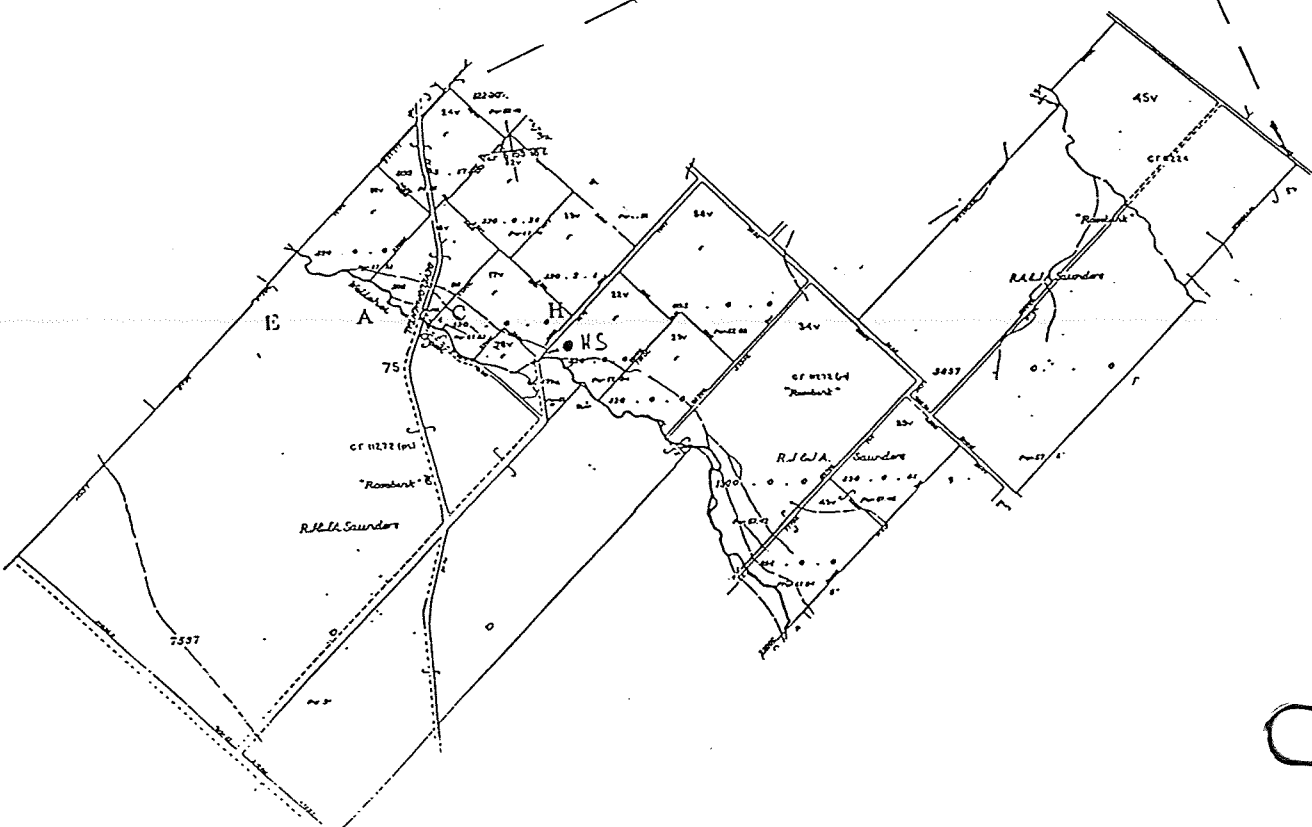
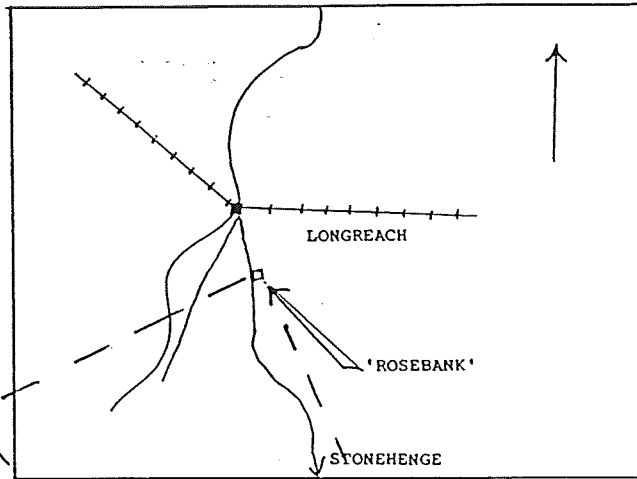
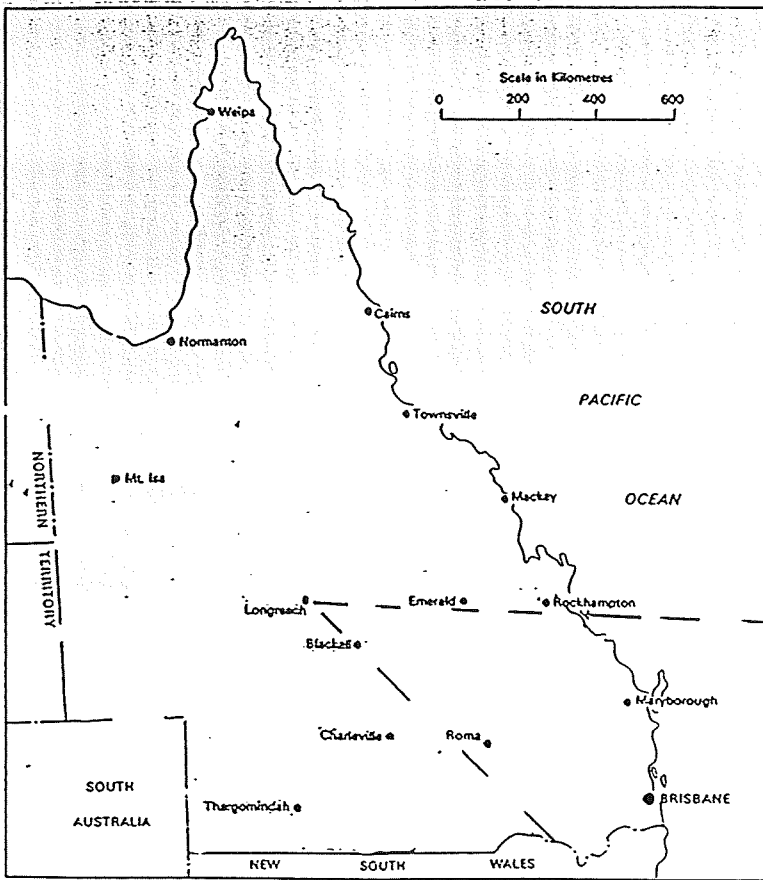
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ABSTRACT

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 soil is discussed with reference to the usage and management considerations. The survey has shown the property to comprise of 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 selfmulching 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 6 795 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 Research 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 basis to formulate a development plan for the property as well as providing data on the properties physical attributes 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 1,302 ha, Parish of Longreach, Portions 16V, 17V, 18V, 22V 23V, 24V, 32V, 33V, 58V.

Leasehold 5,493ha, Parish of Longreach GF11224, Por. 45V, GF11272, Por 32V, 39V, 43V, 75; PLS Por 78V. ^{34V}

Physical Resources

2.0 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 10.9hrs. 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) (Table 1). Frosts are also experienced with June and July commonly experiencing periods of frost (Table 1). These extremes of temperature are important considerations for husbandry and potential cropping practices. Droughts are also common place with Longreach shire being drought declared for 57% of the time between 1966 and 1989.

Probability distribution of rainfall for station
36030 LONGREACH POST OFFICE

% years with rainfall greater than or equal to the indicated amount. (mm)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Total
(mm) (mm) (mm) (mm) (mm) (mm) (mm) (mm) (mm) (mm) (mm) (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
Lowest rain	0	0	0	0	0	0	0	0	0	0	0	0	108
Highest rain	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

Frost Days Longreach (<°C)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Total

Post Office

1. 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	-

2. AMO
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	-

Heat Wave conditions Longreach

Days > 40°C													
Post Office	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
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													
Post Office	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
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													
Post Office	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1966-1987													
Average	22	16	14	3	0	0	0	0	2	10	20	25	
Highest	31	8	26	9	1	0	0	1	8	19	27	30	

1. Post Office records are reported for the period 1857 - 73.
2. The Bureau of Meterology established an office in 1966, records at the Post Office continued until 1973.

3.0 GEOLOGY/AND LANDFORM

Rosebank is located on rolling downs underlain by Cretaceous sediments. Sedimentary rocks crop out as rubbly exposures in extensive soil covered gently undulating plains. The Sedimentary rocks are part of the Winton Formation (Kw) and comprise of the labile sandstone, siltstone, mudstone, intraformational conglomerate and are, in part, calcareous. The sedimentary rocks of the Winton formation have 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).

4.0 GROUND WATER

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 litres/second 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 between the interval 100 -210 metres 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 suitable 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 - 850 metres, is expected to tap the Hooray Sandstone and a very small flow of less than 0.2 litres per second should be obtained. This bore could be expected to have a small closed pressure of less than 80 kilopascals. 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.

5.0 VEGETATION

Four vegetation associations are found on Rosebank. The associations comprise of the 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 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. The Pasture Management Branch of the Arid Zone Research Institute plan to undertake a detailed vegetation survey of the property when seasonal conditions are favourable and readers are referred to that document. A list of plant species known to occur in the area are presented in Appendix 1.

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 loose ashy areas while Barley Mitchell (A. pectinata) and Curly Mitchell (A. lappacea) favour the firmer soils. All four grasses commonly occur together and tend to form near mono-specific communities in Summer. Many other annual and perennial grasses occur in association. 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. One of the more persistent annuals are the Flinders grasses (Iseilema spp). This species is excellent fodder, 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 are 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 dogwood (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 (Acacia cana) 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 Albizia basaltica though these are not common. Shrubs include wilga (Eremophila bignoniiflora) false sandalwood (Eremophila mitchellii) and Meuhlenbeckia cunninghamii occurs 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 (Acacia cambagei) is the dominant tree species and forms very dense stands limiting grass growth. The soils are yellowish brown with extensive silcrete cover. Eremophila mitchellii 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 and these 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.

Survey 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 1:50000 B&W stereo air photos enlarged to 1:25000. The soils map is presented at a scale of 1:25000.

Data collection methodology was based on McDonald et al (1984) and Soil Classification followed Northcote et al (1970). Profile data and site description are recorded in code (Mc Donald et al 1984). These data are stored on computer and are available through the Land Resources Branch, DPI, Meiers Rd., Indooroopilly.

Approximately 10% of the profiles described were sampled for laboratory analysis. The method of Analysis is described by Bruce and Rayment (1982). Chemical analysis for the 0-20 cm zone include pH, EC, Cl, Org C, Cations, CEC, DTPA, Cu, Zn, Mn Fe, Bicarb P. All other depths pH, EC, Cl, Cations and CEC.

Data collected in this survey is available in two forms:

Coded site and profile description as described above; and

Unique mapping areas (UMA).

Each area delineated is distinct from contiguous areas on the map (a map unit with a closed boundary) is described in terms of its resource information. Information recorded for each UMA is briefly listed in Table

2. UMA boundaries represent changes in 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.

Table 2. Information recorded for each UMA

Information	Specific data
Identity	UMA Number
Location	Air Photo reference (Eastings & Northings)
Land Resources	Geology
	Landform
	dominant PPF
	dominant soil
Resource interpretation	
	slope
	drainage
	texture
	pH
	depth
	colour
	carbonate
	aspect
	stone
	substrate
	rock outcrop
	drainage
	erosion
	micro relief

7.0 SOILS

7.1 Morphology and distribution

The landform pattern of Rosebank is an undulating plain of extremely low relief (<9m). 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. Cracking clays with weakly self mulching surfaces are scattered throughout the levees in relict stream channels.

Deep grey and brown colluvial soils occur on lower slopes and flats abutting the stream channels. These are moderately calcareous and are medium to medium heavy cracking clays with strong self mulching surfaces. Owing to their low relief (<0.5%) these soils are potentially suited to water harvesting and irrigation though salting may prove a problem.

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 insipient 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 integrades between cracking and non cracking clays.

The major and dominant soils belong to the rolling downs group. These soils are grey or brown and are cracking clays with strongly self-mulching surfaces. Gilgai are common, though generally incipient. Normal gilgai are found in areas of lower relief with linear gilgai common 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 types/profile classes

The landscape units used in this report refer to natural units of land with a particular soil, association or complex of soils. The soils bear a constant relationship within a limited range of landform elements and native vegetation communities. In addition a similar drainage pattern exists throughout each soil landscape.

Soil types are dynamic three dimensional bodies within which similar numbers and types of horizons and attributes occur. These are primarily morphological and are within a defined range. The soil types 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 nutrient assays performed and represents only a limited sample in terms of the 6 795 hectares which Rosebank comprises. Persons interested in more detailed information are encouraged to undertake further analysis and to use this information as a guide.

Results of the laboratory analyses are presented in tabular form at the end of this section (Table 3)

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. The slight increase in pH with depth is possible suggesting a slight depletion of bases from the surface through leaching and is limited by nutrient cycling and wetting front. High levels of calcium carbonate are common and the pH levels may be a reflection of the carbonate levels and the high chloride values.

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 illuviation. Owing to the solubility of chloride they may be found anywhere in the profile especially at or near the surface as soil water evaporates. In the scalded and degraded areas chloride levels are high at the surface. 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. Electrical conductivity is low at the surface of all non degraded landscape units and increases dramatically with depth. In the deep sub-soil all landscape units have very high levels of electrical conductivity. 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 because of evaporation and capillary action.

7.3.4 Cation Exchange Capacity (CEC)

CEC is a measure of the soil capacity to retain bases against leaching and is function of organic colloids, sesquioxides and clay fraction in the soil. The CEC levels on Rosebank are relatively uniform and adequate for pasture production. The levels are typical for expanding clay lattices that 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 a function of the higher silt and sand content, which have a lower cation exchange capacity.

7.3.5 Exchangeable 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 and gypsum nodules and crystals are found throughout the profiles. Carbonate nodules are common on the surface of gilgai mounds.

Calcium has the effect of increasing pH to a maximum 8.5 (Northcote and Skene 1972) and reduces the availability of nitrogen and phosphorus and may cause a serious shortage of iron, zinc and manganese, which are not soluble at high pH values.

7.3.6 Exchangeable Magnesium (Mg)

Exchangeable magnesium levels are generally very high in all landscape units and are not seen as limiting under neutral to acid environments.

However at high pH the cation has lower availability. Magnesium is important in assisting the transportation of phosphorus to the plant and is an essential constituent of chlorophyll.

7.3.7 Exchangeable Sodium (Na)

The amount of sodium that is required by plants is generally unknown but desirable levels are considered to be small. The major concern with sodium is two fold. Firstly; sodium is commonly associated with the anion chloride as sodium chloride (salt). It is the excess chloride that affects plant metabolism. High salt levels were evident as surface crusts in the severely scalded areas indicating a potential salting problem in the area. The second; concerns problems with excess sodium on the soil CEC. Higher sodium levels affect the stability of the soil through soil dispersion. The Exchangeable Sodium Percentage (ESP) is a measure of the sodicity of the soil or the soil stability. The very low ESP in the area over all landscape units indicates a soil with little tendency for dispersion on all but the heavily degraded scalds. ESP increases with depth but levels in the deep sub soil are still quite low. The cation Ca is the major element responsible for the low ESP.

7.3.8 Exchangeable Potassium (K⁺)

Potassium levels are generally quite adequate for pasture production throughout the area and no plant or dietary deficiencies are likely. The mobility of K suggest that efficient nutrient cycling is probably responsible for the slightly higher levels in the surface soils. Soil pH may be limiting K availability.

7.3.9 Organic carbon

Organic carbon levels ranged from 0.3 to 0.6%. These are regarded as very low. Soil carbon levels affect nitrogen levels and the rate of nitrification depends on the carbon : nitrogen ratio. The more the plant material decomposes the lower are the levels of nitrogen due to the tying up of nitrogen by the decomposers. The low levels at the time of sampling were probably partially due to the prolonged drought at that time 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 are perhaps further limited by the high pH. Where pH exceeds 9.0 however, the access to the available P is seen as improving. 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 extent of the effect of iron shortages in the area is not known and further information is required 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 within limits have the ability to adjust their manganese intakes. 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 adequate. The high pH levels may be limiting the availability of this element.

7.3.14 Extractable Zinc (Zn)

Zinc levels are very low and interact very strongly with 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. IE Plants may respond to zinc if copper is given, but not if it is withheld.

Table 3 presents the results of the nutrient assay for the soil groups described.

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

Soil Complex	Sample Depth	pH 1:5	EC mS/cm	Cl %	Exchangeable Cations			Na ⁺⁺ m equiv	K ⁺ m equiv	Org C %	Extr P Bicarb	Fe ppm	Mn ppm	Cu ppm	Zn ppm
					CEC m equiv	Ca ⁺⁺ m equiv	Mg ⁺⁺ m equiv								
RD1	0-20	9.0	0.12	0.006	36	34	2.4	1.2	0.70	0.5	8	10	10	0.60	0.20
	30-40	9.4	0.42	0.023	37	27	2.5	7.6	0.40						
	70-90	8.4	1.7	0.076	33	23	2.5	2.5	0.30						
RD2	0-20	9.0	0.13	0.001	31	30	1.7	-	1.10	0.6	12	6	26	0.70	0.30
	30-60	9.4	0.39	0.025	37	30	2.1	5.8	0.40						
	60-95	9.4	0.57	0.52	33	26	2.0	7.4	0.30						
RD3	0-20	8.5	0.17	0.005	39	34	3.4	1.2	1.2	0.6	18	8	55	0.90	0.30
	30-60	9.3	0.30	0.010	43	35	2.7	5.6	0.6						
	70-90	7.9	3.0	0.036	36	31	2.7	8.0	0.5						
RD4	0-20	8.8	0.19	0.006	42	32	5.4	2.5	1.1	0.5	18	9	30	0.7	0.3
	30-60	8.9	0.83	0.090	47	30	5.4	11	0.8						
	60-120	8.1	3.9	0.147	42	28	4.7	12	0.7						
W1	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
	30-60	9.5	0.40	0.022	38	30	1.9	7.8	0.40						
	60-120	9.4	0.83	0.067	36	24	2.0	11	0.30						
W2	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
	30-60	9.3	0.44	0.030	41	30	3.3	8.0	0.5						
	60-120	8.2	0.90	0.073	35	26	3.1	11	0.4						
W3	0-20	9.2	0.16	0.001	31	26	3.8	1.6	0.90	0.6	18	11	12	0.70	0.20
	30-60	9.2	1.2	0.137	33	18	3.6	12	0.50						
	60-120	8.6	2.6	0.195	26	14	3.5	11	0.40						
W4	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
	30-60	9.2	0.48	0.041	42	31	3.9	7.6	0.60						
	60-120	8.7	0.89	0.98	46	31	4.5	11	0.70						
W5	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
	30-60	8.1	2.5	0.352	30	18	5.7	7.7	0.40						
	60-120	8.3	2.5	0.324	27	16	5.2	7.3	0.50						
C1	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	0-20	8.4	0.05	0.001	23	16	3.9	1.7	0.5	0.3	11	9	7	0.60	0.2
	30-60	9.4	0.41	0.025	25	17	3.2	5.4	0.4						
	60-120	8.0	2.3	0.049	23	17	2.9	6.8	0.4						
S2	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
	30-60	9.3	0.43	0.029	36	27	3.9	5.2	0.6						
	60-120	9.3	0.73	0.065	30	19	3.5	7.1	0.4						
M1	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
	30-60	8.7	2.0	0.256	33	22	2.0	9.6	0.5						
	60-120	8.1	4.5	0.267	33	22	3.3	11	0.4						
M1	0-20	7.9	11	1.85	27	13	3.9	10	0.4	0.3	11	5	32	1.0	0.4

8 DISCUSSION

The property of Rosebank comprises of 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 catchments dams and tanks.

Stocking rates for the mitchell grassland areas are of the order of 0.7 DSE/ha (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 (RD₄). 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. Where ever 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				
Land Unit	Natural	Condition ← Stability	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	Fair	0.6 DSE/ha	Generally stable mitchell grass unstable downward trend. 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	0.4 DSE/ha	Degrading woodland, seasonally flooded, downward trend capable of producing useful ephemeral pastures in good

				seasons. Overstocking during dry periods results in severe scalding.
W4	Unstable	Poor to fair	0.4 DSE/ha	Semi open woodland, sensitive to erosion downward trend 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.
C1	Unstable	Fair downward trend	0.35DSE/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	-	Scalded areas with saline crusted surface; no perennial vegetation; extremely low productivity; high runoff.
S1	Moderately	Poor to fair	0.35DSE/ha	Periodic inundation produces useful unstable seasonal ephemeral pastures. Seasonal scalding is widespread if overgrazed.
S2	Moderately	Fair	0.5DSE/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)
(modified after Davidson 1954)

POACEAE

Aristida latifolia
Astrebla squarrosa
Astrebla pectinata
Astrebla elymoides
Astrebla lappacea
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 polyphyllus
Enneapogon oblongus
Eragrostis setifolia
Eragrostis leptocarpa
Eragrostis japonica
Eragrostis cilianensis
Erichloa mucronata
Erichloa australiensis
Erichloa crebra
Eulalia fulva
Iseilema windersii
Iseilema vaginiflorum
Iseilema membranaceum
Leptochloa digitata
Panicum buncei
Panicum decompositum
Paspalidium jubiflorum
Paspalidium gracile var. rugosum
Pseudoraphis spinescens
Sehima nervosum
Sporobolus pulchellus
Sporobolus mitchellii
Sporobolus caroli
Sporobolus actinocladus
Themeda australis
Tragus australianus
Triopogon loliiformis
Triraphis mollis

SANTALACEAE

Santalum lanceolatum

LORANTHACEAE

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

CHENOPODIACEAE

Altriplex muelleri
Altriplex ? sp.
Altriplex lindleyi
Sclerolaena lanicuspis
Sclerolaena quinquecuspidata
Sclerolaena bicornis var. horrida
Sclerolaena echinopsila
Chenopodium pseudomicrophyllum
Chenopodium auricomum
Chenopodium pumilio
Chenopodium cristatum
Chenopodium auricomum
Enchylaena tomentosa
Kochia coronata
Kochia dichoptera
Rhagodia linifolia
Salsola kali
Senniella spongiosa
Threlkeldia proceriflora

AMARANTHACEAE

Alternanthera nodiflora
Amaranthus mitchellii
Trichinium exaltatum
Trichinium obovatum

CAPPARIDACEAE

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

MIMOSACEAE

Acacia farnesiana
Acacia cana
Acacia sutherlandii
Acacia victoriae

Acacia stenophylla
Acacia cambagei
Neptunia monosperma
Neptunia gracilis

FABACEAE

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

CAESALPINIACEAE

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

EUPHORBIACEAE

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

MALVACEAE

Abutilon calliphylloides
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.

OLEACEAE

Jasminum lineare

ASCLEPIADACEAE

Marsdenia sp. (undescribed)

MYOPORACEAE

Eremophila longifolia
Eremophila mitchellii
Eremophila maculata
Eremophila polyclada

LAMIACEAE

Basilicum polystachyon
Mentha australis
Ocimum sanctum
Teucrium integrifolium

RUBIACEAE

Canthium oleifolium
Oldenlandia polyclada

CYPERACEAE

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

AMARYLLIDACEAE

Crinum angustifolium

POLYGONACEAE

Muehlenbeckia cunninghamii
Polygonum attenuatum
Polygonum plebeium
Rumex crystallinus

AIZOACEAE

Glinus lotoides
Trianthema galericulata
Trianthema triquetra

PAPAVERACEAE

Argemone mexicana

SAPINDACEAE

Atalaya hemiglauca
Heterodendrum oleifolium

MARSILEACEAE

Marsilea hirsuta

TYPHACEAE

Typha angustifolia

LILIACEAE

Bulbine bulbosa

COMMELINACEAE

Aneilema gramineum
Commelina undulata

PROTEACEAE

Grevillea striata
Hakea cunninghamii

NYCTAGINACEAE

Boerhavia diffusa
Boerhavia diffusa var. paludosa

PORTULACACEAE

Portulaca oleracea

CRUCIFERAE

Capsella bursa-pastoris
Lepidium spp.
Sisymbrium orientale

ZYGOPHYLLACEAE

Tribulus terrestris
Zygophyllum ammophilum

POLYGALACEAE

Polygala gabrielae

RHAMNACEAE

Ventilago viminalis

TILIACEAE

Corchorus trilocularis

STERCULIACEAE

Melhania abyssinica

UMBELLIFERAE

Daucus glochidiatus

APOCYNACEAE

Carissa lanceolata

BORAGINACEAE

Ehretia saligna
Heliotropium strigosum
Heliotropium tenuifolium

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

SOLANACEAE

Datura leichhardtii
Nicotiana megalosiphon
Solanum esuriale
Solanum nigrum

SCROPHULARIACEAE

Morgania floribunda
Morgania glabra

ACANTHACEAE

Justicia procumbens

PLANTAGINACEAE

Plantago varia

CURCUBITACEAE

Citrullus colocynthis
Cucumis myriocarpus
Cucumis trigonus
Melothria micrantha

HALORAGACEAE

Haloragis glabrescens

VERBENACEAE

Verbena officinalis

CAMPANULACEAE

Wahlenbergia gracilentia

GOODENIACEAE

Goodenia strangfordii
Goodenia subintegra

ASTERACEAE

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

ELATINACEAE

Bergia ammanioides

FRANKENIACEAE

Frankenia serpyllifolia

LYTHRACEAE

Annonia multiflora
Lythrum hyssopifolia

MYRTACEAE

Eucalyptus camaldulensis
Eucalyptus microtheca
Eucalyptus terminalis
Melaleuca linariifolia var.
trichostachya

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 1:25000 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 (Fig 3) are those of McDonald et al (1984). Exceptions are described in detail below.

Record 1

Column	Item
1:	Record type - Two record types for each UMA, 1 & 2
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 micro relief
 - Type of micro relief found in UMA
- 44 to 47: Vertical and Horizontal interval
 - Vertical interval and wave length of micro relief 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
 - 0 UMA is either level (<0.05% slope or has more than one aspect
 - N 316 to 450 aspect
 - E 46 to 1350 aspect
 - S 136 to 2250 aspect
 - W 226 to 3150 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
- Flooding status and characterization of UMA

- 39 to 43: - 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 using

Appendix III

Soil profile class descriptions

Soil profile class: RD1

Concept: Moderately deep, (60 to 120 cm) 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

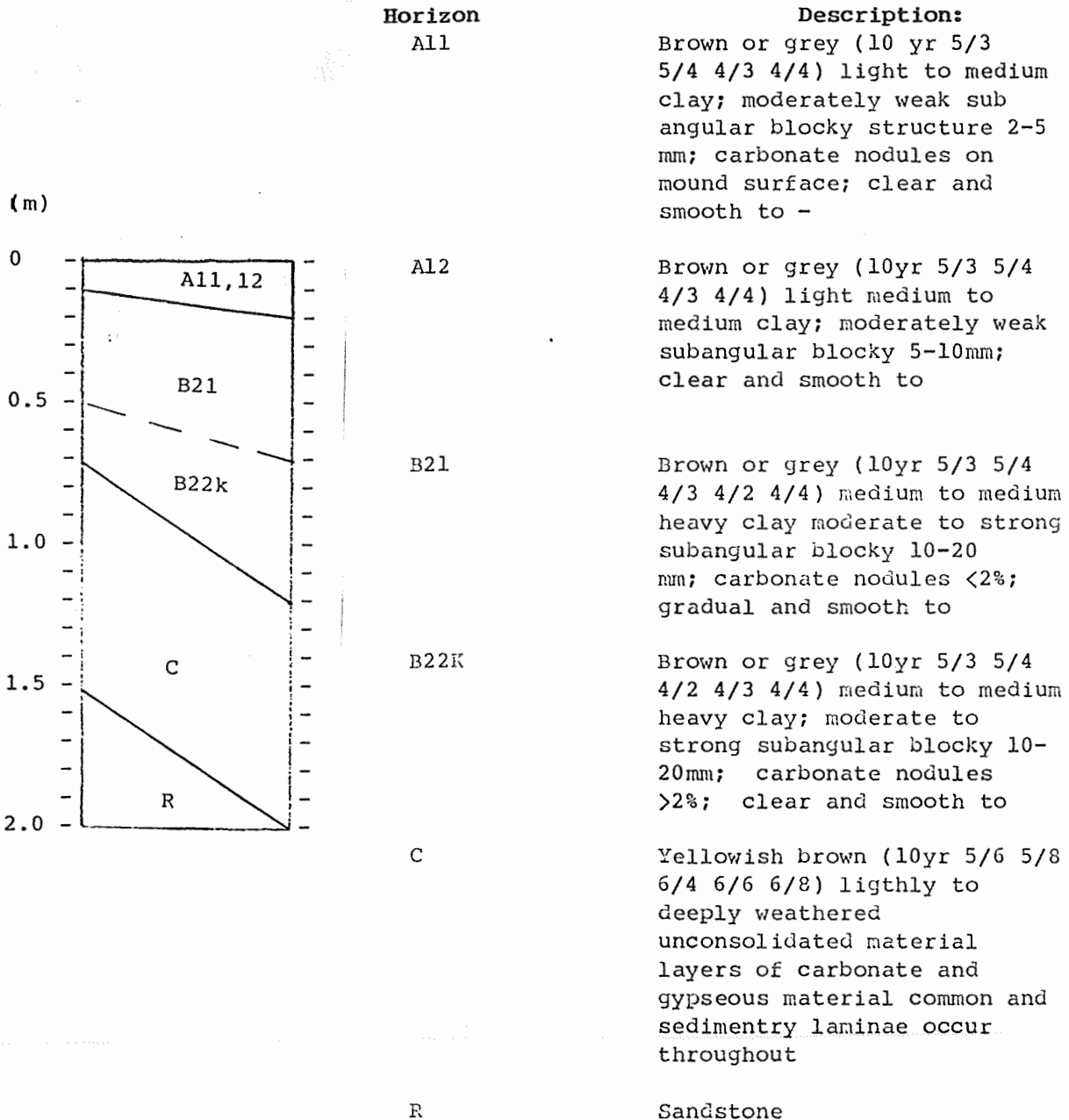
	Minimum	Maximum	Modal
pH at depth 0 cm	7.5	9.0	8.5
30 cm	8.5	9.4	8.7
60 cm	8.5	9.3	8.7
90 cm	8.5	9.3	8.7

Principle Profile Form/s: Ug 5.22 Ug 5.32

Surface condition: Strongly self mulching

Microrelief: Type: Incipient normal gidgee and linear gilgai

horizontal interval: 5m vertical interval: 0.1m



Soil profile class: RD2

Concept: Moderately deep, brown cracking light-medium clays (80 to 100 cm) 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

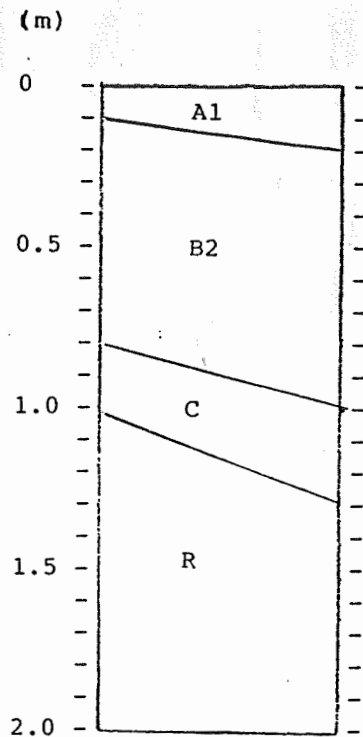
Dominant species: Astrebla pectinata, A. lappacea, Aristida latifolia, Atalaya hemiglauca

	Minimum	Maximum	Modal
pH at depth 0 cm	8.0	8.7	8.5
30 cm	8.7	8.7	8.7
60 cm	8.7	8.7	8.7
90 cm	8.6	8.7	8.7

Surface character: Incipient cracking mounds and self mulching surface

Microrelief: **Type:** Incipient normal gilgai

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



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

Soil profile class: RD3

Concept: Moderately deep, brown cracking, medium clay (90 to 100 cm) 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

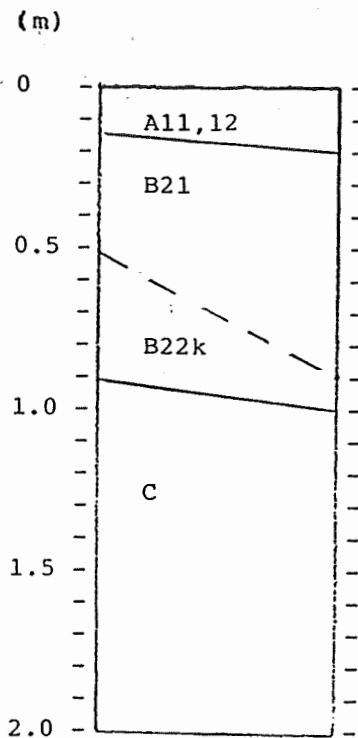
	Minimum	Maximum	Modal
pH at depth 0 cm	8.0	8.0	8.0
30 cm	7.5	8.6	8.1
60 cm	8.1	8.5	8.3
90 cm	8.5	8.6	8.5

Principle Profile Form/s: Ug 5.32

Surface character: Strongly self mulching

Microrelief: Type: Linear gilgai

horizontal interval: 5.0m vertical interval: 0.2m



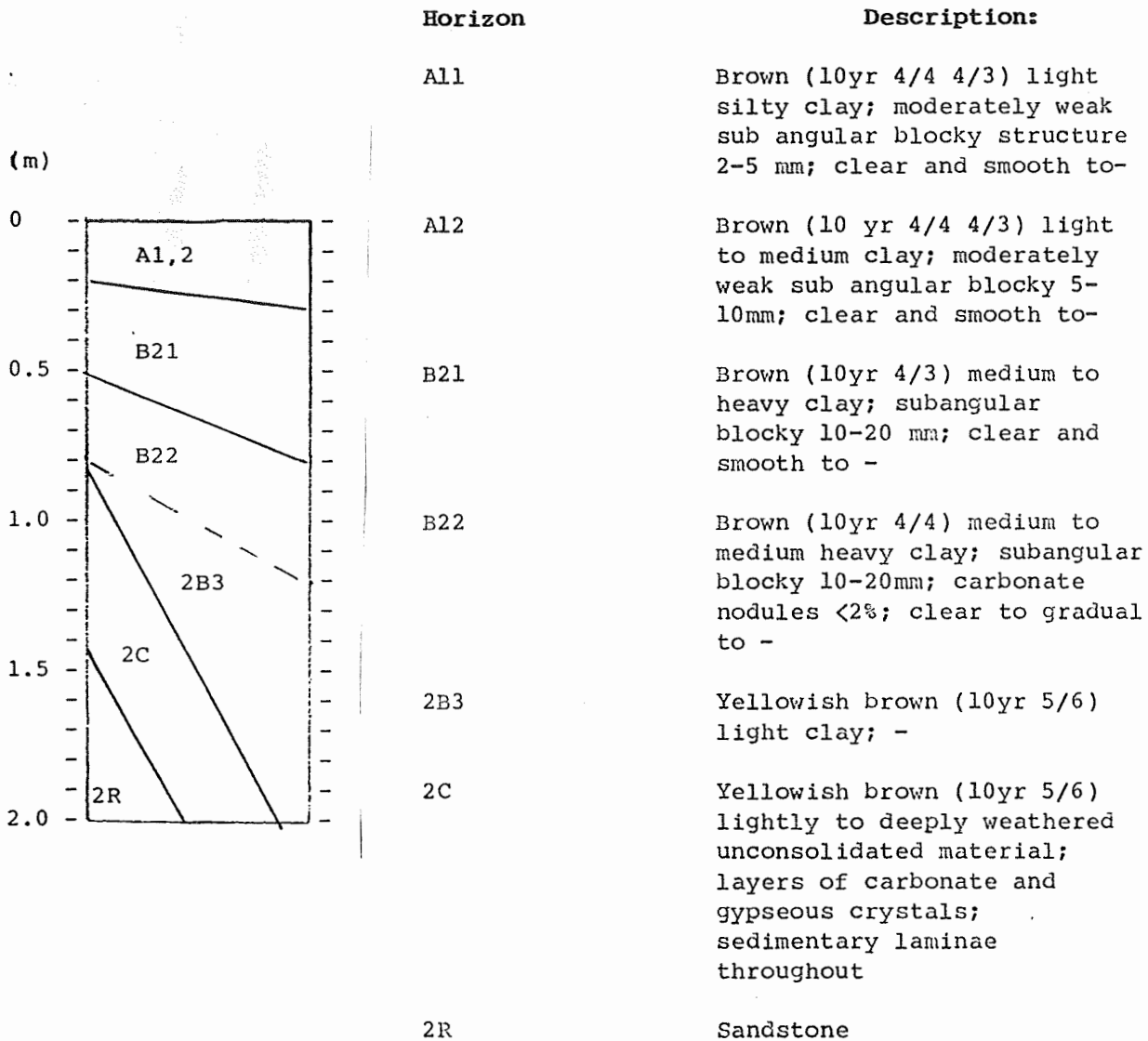
Horizon	Description:
A11	Brown (10yr 4/3, 4/4) light medium clay; strongly self mulching; moderately weak subangular blocky 2-5mm; carbonate nodules on mound surface; clear and smooth to -
A12	Brown (10yr (4/3) light medium clay moderately weak subangular blocky 5-10mm; clear and smooth to -
B21	Brown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

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: 1.0m vertical interval: 0.1m



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

Soil profile class: W1

Concept: Deep, brown, light medium clay (70 to 180 cm) with a fine granular self-mulching surface; gilgai; silcrete stone cover 1 to 10%; localised outcrops of sandstone; manganese and carbonaceous 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

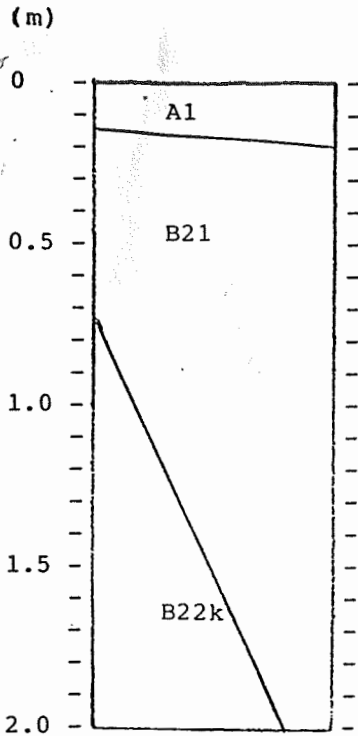
Dominant species: Acacia cana, Atalaya
hermiglauca Acacia
farnesiana, Astrebla species,
Aristida species

	Minimum	Maximum	Modal
pH at depth 0 cm	7.0	7.8	7.5
30 cm	8.6	8.7	8.6
60 cm	8.6	8.6	8.6
90 cm	8.5	8.6	8.6

Surface character: Self mulching

Microrelief: Type: Normal gilgae

horizontal interval: 5m vertical interval: 0.1m



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

Soil profile class: W2

Concept: Deep, light to medium, grey clay to 170 cm; 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 inundation

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

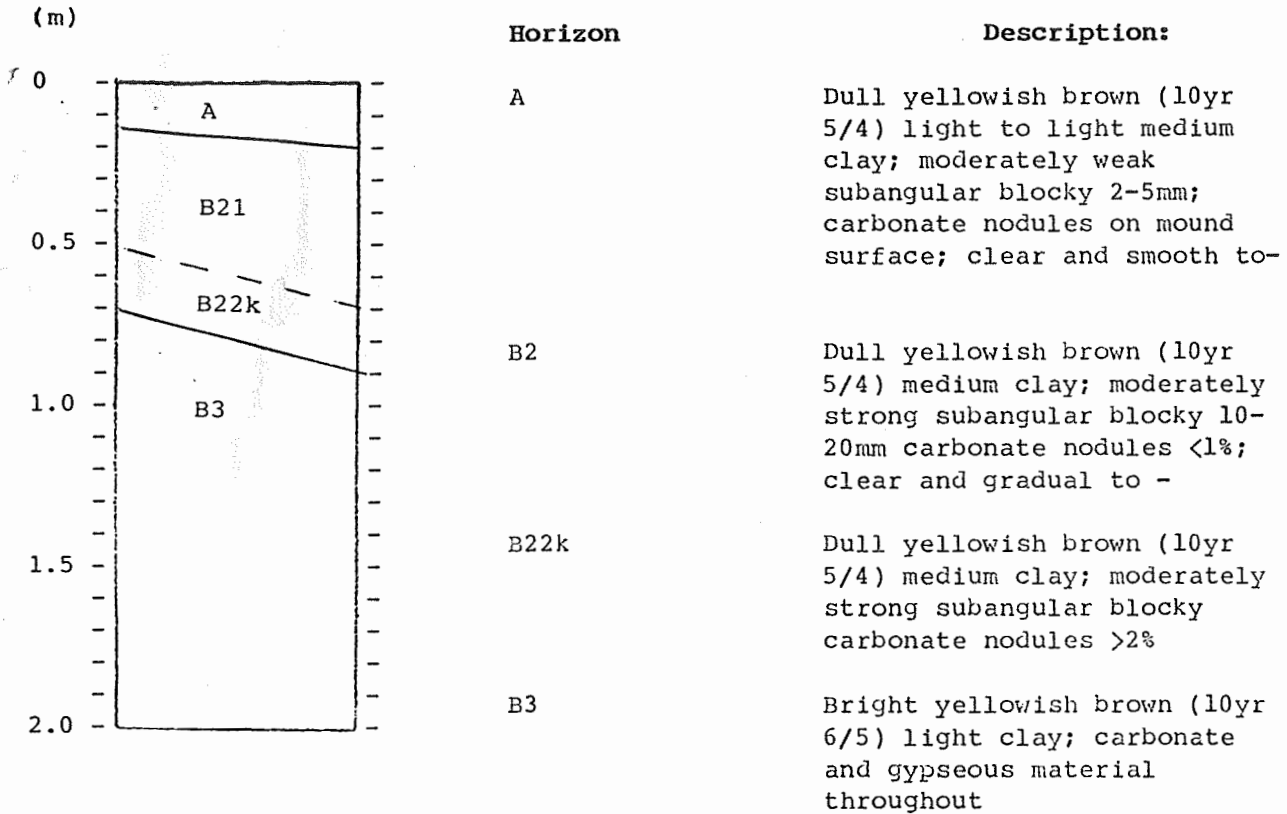
	Minimum	Maximum	Modal
pH at depth 0 cm	7.0	8.8	7.8
30 cm	8.6	8.7	8.6
60 cm	8.5	8.6	8.6
90 cm	8.3	8.6	8.6

Principle Profile Form/s: Ug 5.24

Surface character: Self-mulching

Microrelief: Type: Normal gilgai

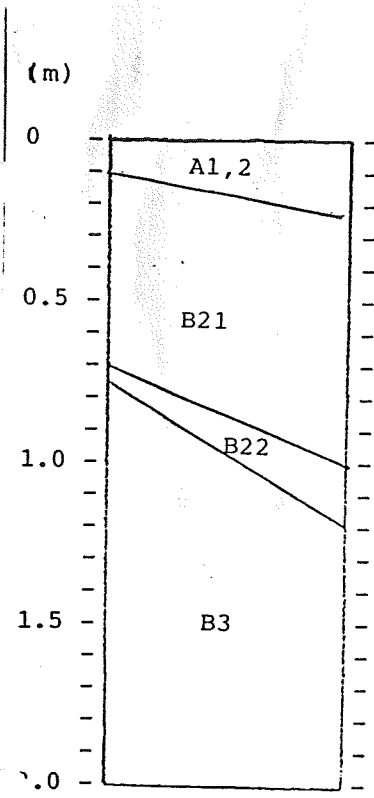
horizontal interval: 10m vertical interval: 0.2m



Surface character: Seasonally scalded with pockets of self mulching surface

Microrelief: Type: Incipient normal gilgai

horizontal interval: 10m vertical interval: 0.1m



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

Soil profile class: W4

Concept: 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

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

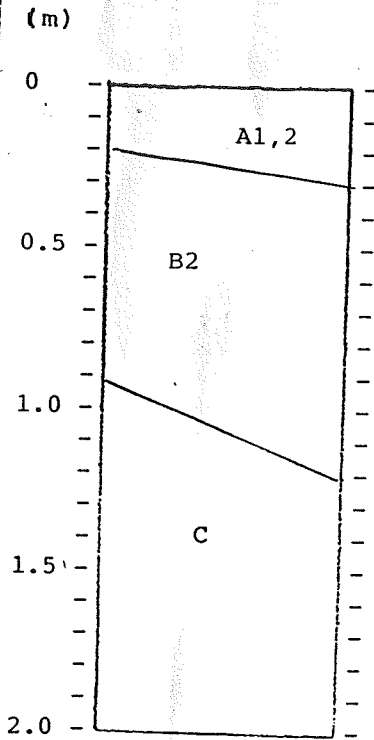
	Minimum	Maximum	Modal
pH at depth 0 cm	7.5	7.8	7.8
30 cm	8.7	8.9	8.8
60 cm	8.7	8.7	8.7
90 cm	8.6	8.7	8.6

Surface character: Weakly self mulching

Microrelief: Type: Incipient normal gilgai

horizontal interval: 10

vertical interval: 0.1



Horizon

Description:

A11	Dull yellowish brown (10yr 5/4) light to light medium clay; moderately weak subangular blocky 2-5mm; clear and smooth to
A12	Dull yellowish brown (10 yr 5/3) light to light medium clay; moderately weak subangular blocky 2-5 mm; clear and smooth to
B	Dull yellowish brown (10yr 5/3 5/4) medium clay; moderately strong subangular blocky 10-20 mm; carbonate nodules <1%; clear and smooth to
C	Yellowish brown (10yr 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 (60 to 130 cm); 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 undulating 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 cm	8.5	8.7	8.6
30 cm	8.5	8.8	8.7
60 cm	8.6	8.8	8.7
90 cm	8.5	8.6	8.6

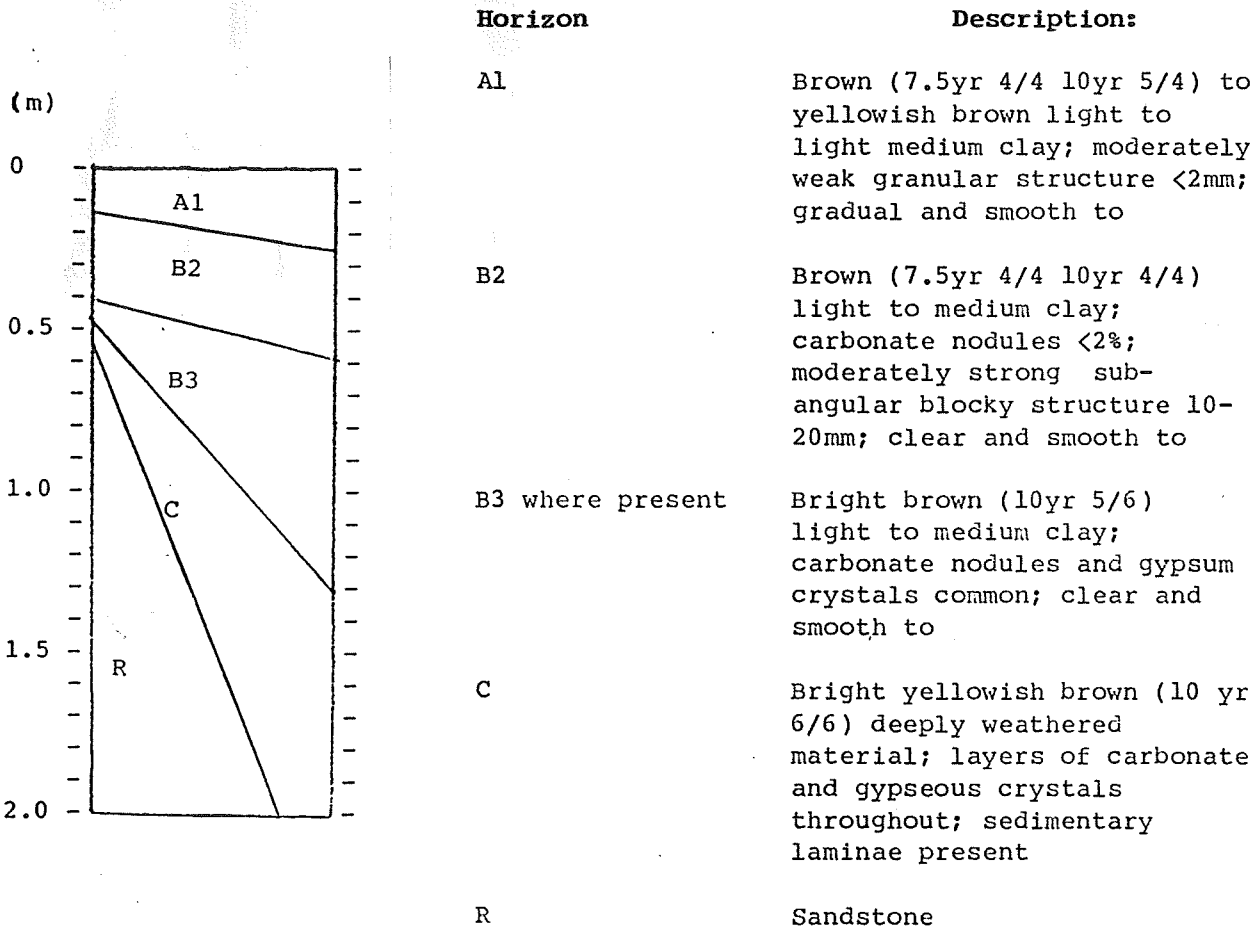
Principle Profile Form/s: Ug 5.32 Uf 6.31

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

Microrelief: Type: absent

horizontal interval:

vertical interval:



Soil profile class: C1

Concept: Moderately shallow to shallow non-cracking brown light clay (20 to 90 cm); 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 cm	8.5	9.2	9.0
30 cm	8.5	9.2	8.7
60 cm	8.7	9.2	8.7
90 cm	8.5	9.2	8.7

Comments: Minor intergrades of cracking clay may occur.

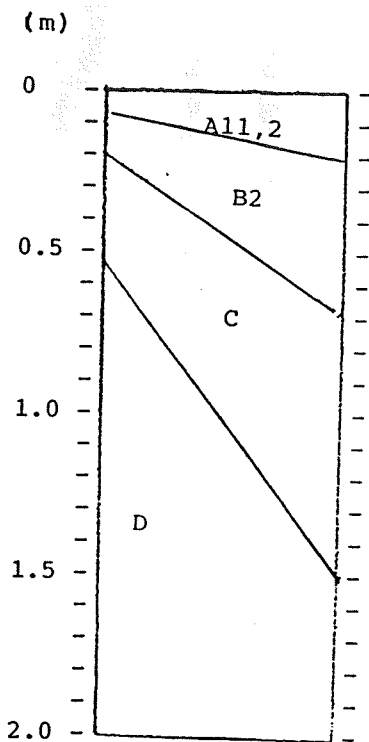
Principle Profile Form/s: Uf 6.31, Uf 6.12, Uf 6.33, Uf 6.34

Surface character: Firm to hard setting

Microrelief: Type:

horizontal interval:

vertical interval:



Horizon

Description:

A11

Dull yellowish brown to brown (10yr 4/4, 5/4, 5/6) light clay; very highly calcareous; smooth or rough ped moderately strong 2-10mm; clear and smooth to

A12

Dull yellowish brown to brown (10yr 4/4 5/4 5/6) light to light medium clay; very highly calcareous; smooth or rough ped; moderately strong 5-10mm; clear and smooth to

B2

Dull yellowish brown to brown (10yr 4/4 5/4) light to light medium clay with 2-10% grey mottles (10yr 6/2 6/3) common; highly calcareous; moderately strong smooth or rough peds 10-20mm; clear and smooth to

C

Yellowish brown (10yr 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 (40 to 70 cm) 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

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

Vegetation:

Structure: No perennial vegetation

Dominant species: Nil

		Minimum	Maximum	Modal
pH at depth	0 cm	6.5	8.5	7.0
	30 cm	8.5	8.6	8.5
	60 cm	8.5	8.5	8.5
	90 cm	8.0	8.0	8.0

Principle Profile Form/s: Uf 6.31, Uf 6.34

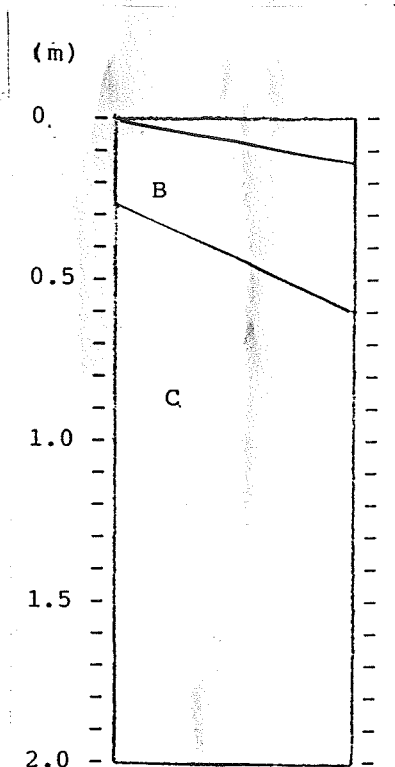
Surface character: Saline surface crust

Microrelief:

Type:

horizontal interval:

vertical interval:



Horizon

Description:

A

Dull yellowish brown (10yr 5/4 5/5) light to light medium clay; salt puffs common on surface; surface bleach (10yr 8/3); moderately calcareous; moderately strong subangular blocky 5-10mm; clear and smooth to

B

Dull yellowish brown to brown (10yr 4/4 5/5) light medium clay; carbonate nodules and gypseous crystals throughout; subangular blocky 10-20mm; clear and smooth to

C

Bright yellowish brown (10yr 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 (80 to >108 cm) 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 cm	7.0	7.5	7.5
	30 cm	8.0	9.0	8.5
	60 cm	8.5	9.1	8.5
	90 cm	8.5	8.7	8.5

Principle Profile Form/s:

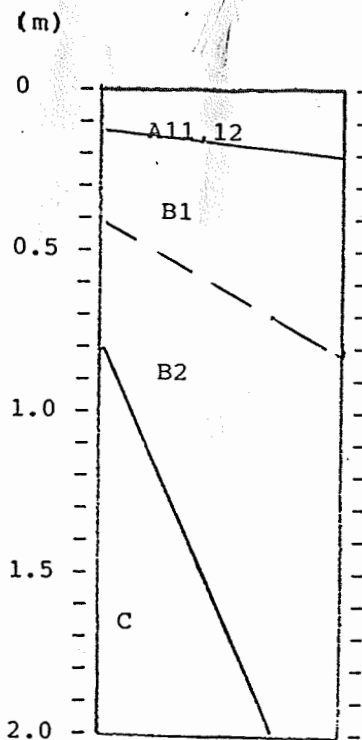
Dy 4.13, Ug 5.24, Ug 5.34, Ug 5.22, Ug 5.32, Uf 6.31, Uf 6.33, Uf 6.34

Surface character: Seasonally scalded channel benches and backplains and cracking clays in relict stream channels.

Microrelief: Type:

horizontal interval:

vertical interval:



Horizon

Description:

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

nSoil profile class: S2

Concept: Moderately deep, brown and grey light medium to medium cracking clay 100 to 160 cm 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

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 cm	7.5	8.5	7.6
30 cm	8.6	8.9	8.6
60 cm	8.5	8.7	8.6
90 cm	8.2	8.7	8.6

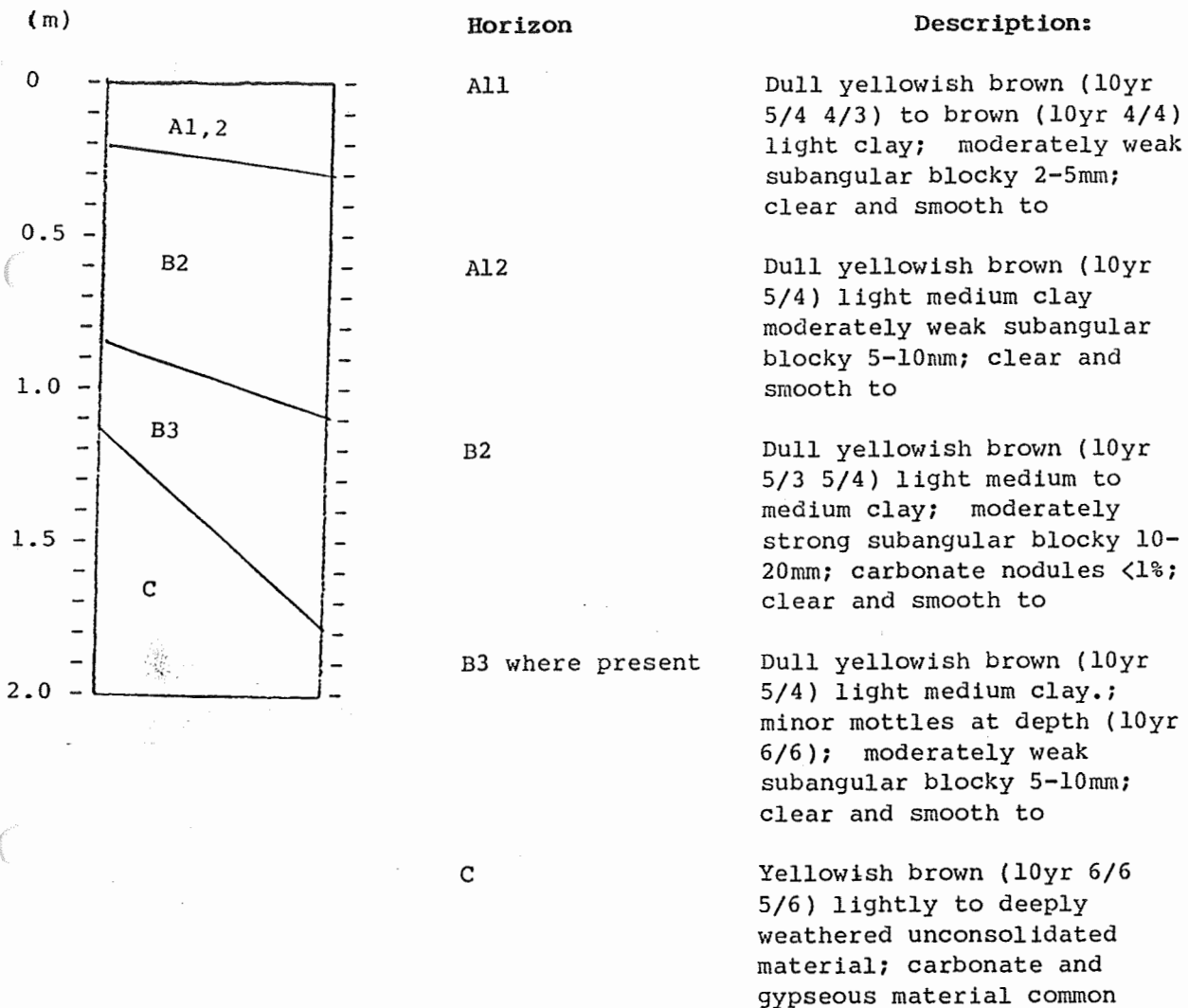
Surface character: Minor scalding, self mulching

Microrelief:

Type:

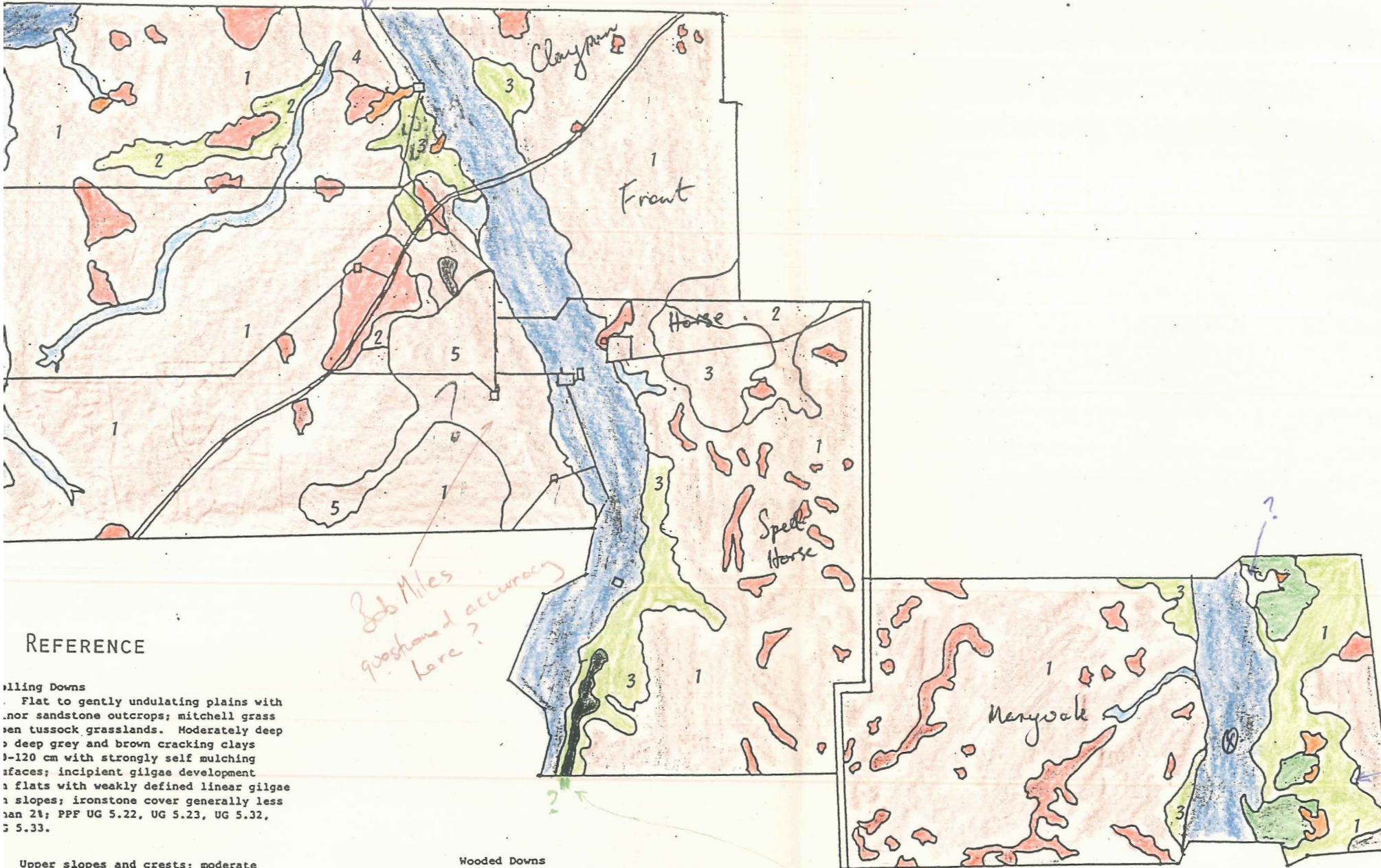
horizontal interval:

vertical interval:



ROSEBANK RESEARCH STATION

SOIL MAP



SCALE 1:50 000



REFERENCE

Willing Downs
 Flat to gently undulating plains with minor sandstone outcrops; mitchell grass open tussock grasslands. Moderately deep deep grey and brown cracking clays 80-120 cm with strongly self mulching surfaces; incipient gilgaa development on flats with weakly defined linear gilgaa on slopes; ironstone cover generally less than 20%; PPF UG 5.22, UG 5.23, UG 5.32, UG 5.33.

Upper slopes and crests; moderate incidence of sandstone outcrops; mitchell grass open tussock grasslands; moderately deep to deep cracking brown clays, 80-100 cm; highly calcareous with numerous sink holes and minor scalding; PPF UG 5.32.

Gently slopes; mitchell grass open tussock grasslands; deep brown cracking clays, 90-100 cm; linear gilgaa, vertical interval less than 25 cm; numerous sink holes; PPF 5.32.

Flat alluvial plains of very low relief; mitchell grass open tussock grasslands; deep grey cracking clays, 90-140 cm; strongly self mulching surfaces; subject to

- 1 **Wooded Downs**
 1. Undulating plains; boree, whitewood, mimosa, sandalwood; deep to very deep grey brown cracking clays, 60-120 cm; ironstone cover less than 30% with localised outcrops of sandstone; PPF UG 5.32, UG 5.22.
- 2 **Willing Downs**
 2. Flat plains subject to occasional flooding; boree, gidgee, coolibah, sandalwood; wooded (open) tussock grasslands; deep to very deep grey brown cracking clays, 60-120 cm; moderately calcareous ironstone gravel cover less than 1%; incipient gilgaa development; minor scalding; PPF UG 5.23, UG 5.32.
- 3 **Hills and rises; boree, whitewood,**

- Gidgee Lands**
 Flat to gently undulating plains; gidgee, sandalwood, tall shrubland to low woodland; deep brown cracking clays, 60-75 cm; highly calcareous throughout, weak gilgaa development; ironstone cover 30-70%. PPF 5.32.
- Stream channels and alluvium**
 Seasonally flooded alluvial plains of braided streams; Coolibah, red river gums, baubinia, occasional boree; complex of cracking and non cracking, deep to very deep brown and grey clays and minor texture contrast soils, 80-150 cm; extensive seasonal scalding and moderate gilgaa development PPF DY 4.13, UG 5.22, UG 5.23, UG 5.32, UG 5.33, UF 6.31, UF 6.33, UF 6.34.

- Crests and Ridges**
 Isolated crests and ridges; whitewood, vine tree, mimosa wooded (open) tussock grasslands. Shallow to moderately deep, brown non cracking clays to 60 cm; very highly calcareous; sandstone outcrops; ironstone cover 30-50%; PPF UF 6.31, UF 6.12.
- Scalds**
 Deflated ironstone covered scalds; no vegetation; brown clays 30-60 cm; some loss of A horizon; ironstone cover 35-80%; PPF UG 5.32.

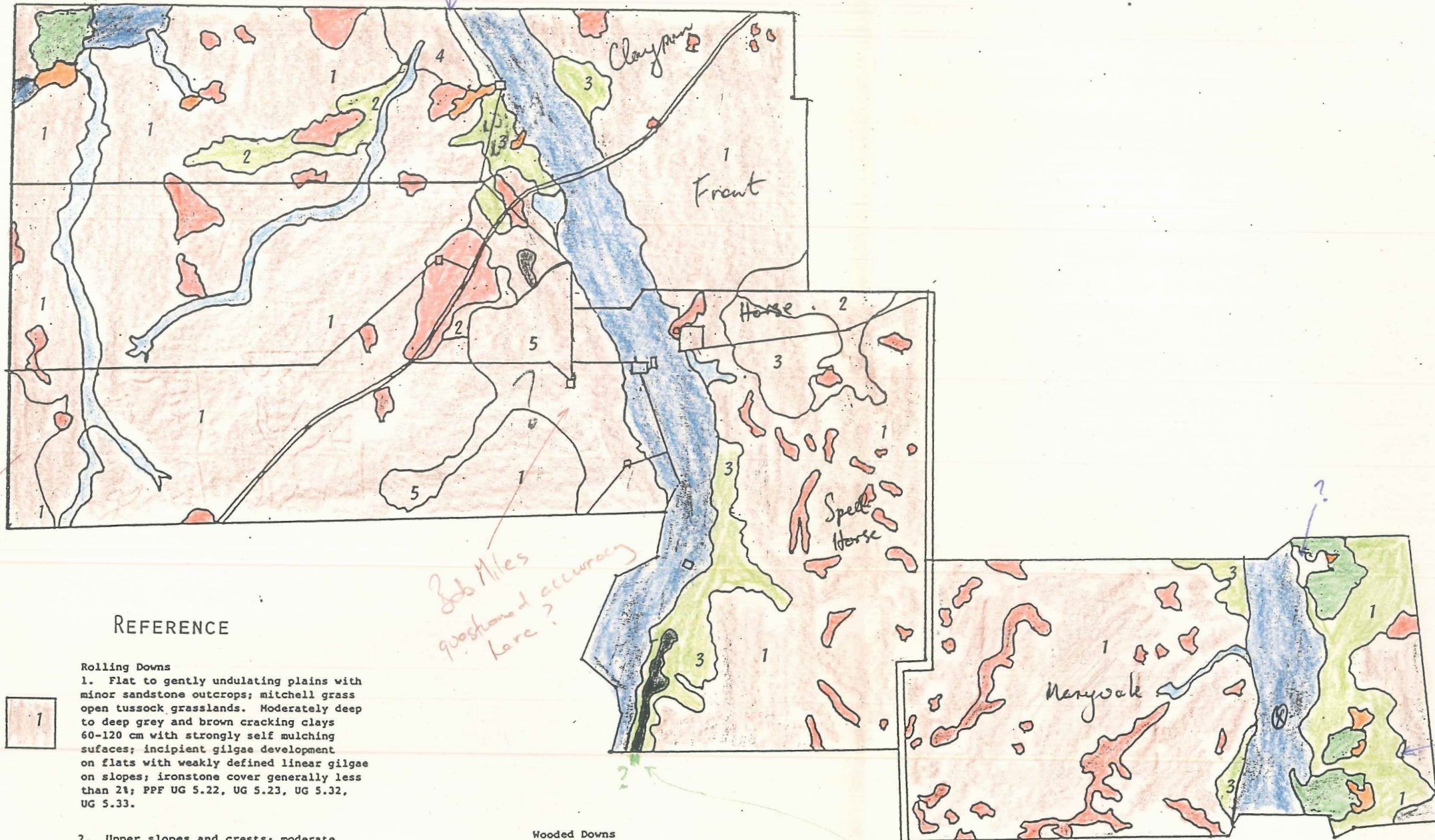
*Bob Miles
 questions accuracy
 here?*

? Not Coloured

ROSEBANK RESEARCH STATION

SOIL MAP

SCALE 1:50 000



REFERENCE

Rolling Downs

1. Flat to gently undulating plains with minor sandstone outcrops; mitchell grass open tussock grasslands. Moderately deep to deep grey and brown cracking clays 60-120 cm with strongly self mulching surfaces; incipient gilgae development on flats with weakly defined linear gilgae on slopes; ironstone cover generally less than 2%; PPF UG 5.22, UG 5.23, UG 5.32, UG 5.33.

2. Upper slopes and crests; moderate to high incidence of sandstone outcrops; mitchell grass open tussock grasslands; moderately deep to deep cracking brown clays, 80-100 cm; highly calcareous with numerous sink holes and minor scalding PPF UG 5.32.

3. Gently slopes; mitchell grass open tussock grasslands; deep brown cracking clays, 90-100 cm; linear gilgae, vertical interval less than 25 cm; numerous sink holes; PPF 5.32.

4. Flat alluvial plains of very low relief; mitchell grass open tussock grasslands; deep grey cracking clays, 90-140 cm; strongly self mulching surfaces; subject to

Wooded Downs

1. Undulating plains; boree, whitewood, mimosa, sandalwood; deep to very deep grey brown cracking clays, 60-120 cm; ironstone cover less than 30% with localised outcrops of sandstone; PPF UG 5.32, UG 5.22.

2. Flat plains subject to occasional flooding; boree, gidgee, coolibah, sandalwood; wooded (open) tussock grasslands; deep to very deep grey brown cracking clays, 60-120 cm; moderately calcareous ironstone gravel cover less than 1%; incipient gilgae development; minor scalding; PPF UG 5.23, UG 5.32.

3. Hills and rises; boree, whitewood,

Gidgee Lands

Flat to gently undulating plains; gidgee, sandalwood, tall shrubland to low woodland; deep brown cracking clays, 60-75 cm; highly calcareous throughout, weak gilgae development; ironstone cover 30-70%. PPF 5.32.

Stream channels and alluvium

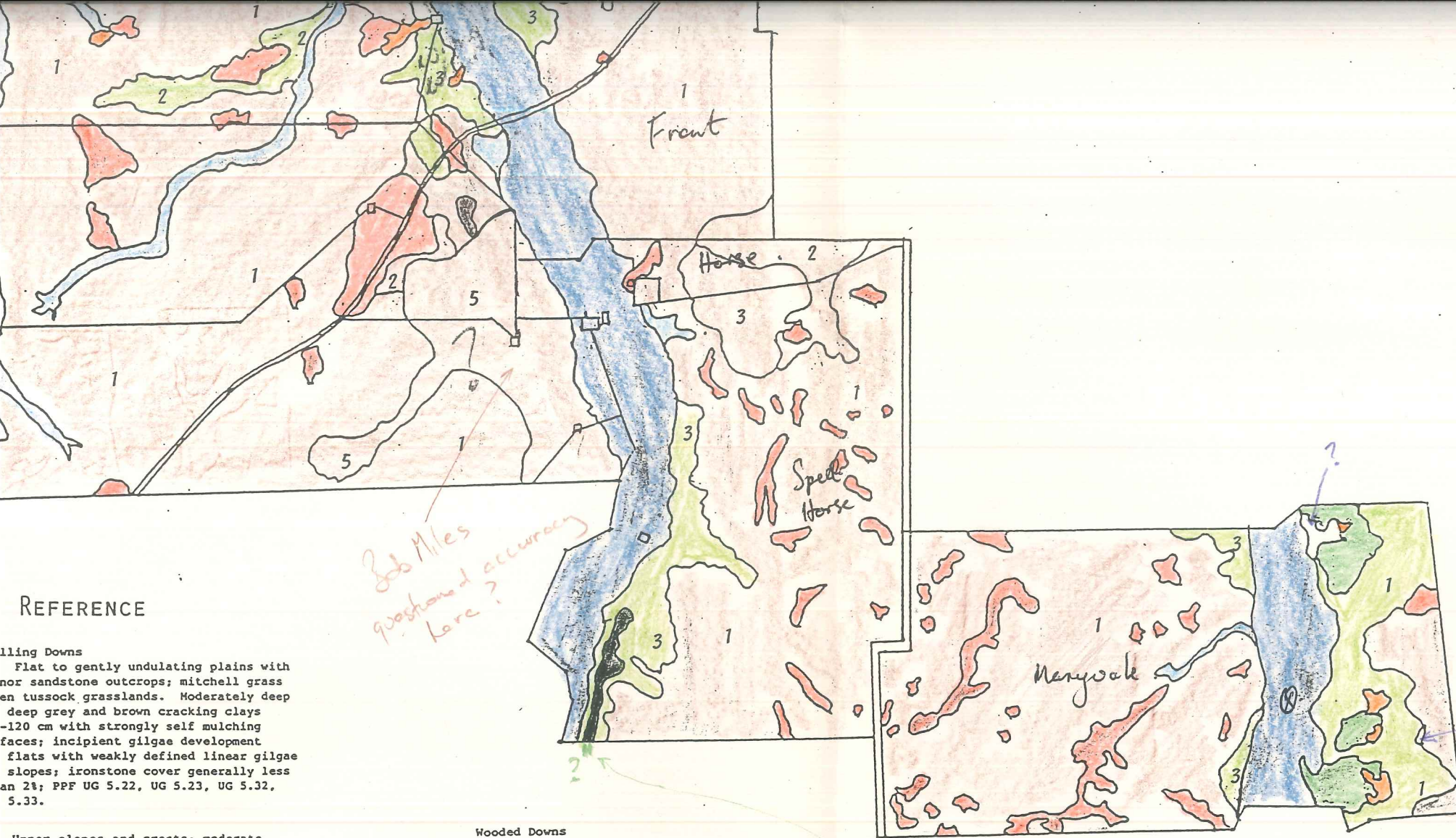
Seasonally flooded alluvial plains of braided streams; Coolibah, red river gums, bauhinia, occasional boree; complex of cracking and non cracking, deep to very deep brown and grey clays and minor texture contrast soils, 80-150 cm; extensive seasonal scalding and moderate gilgae development. PPF DY 4.13, UG 5.22, UG 5.23, UG 5.32, UG 5.33, UF 6.31, UF 6.33, UF 6.34.

Crests and Ridges

Isolated crests and ridges; white vinee, mimosa wooded (open) tussock grasslands. Shallow to moderate, brown non cracking clays to 60 cm; highly calcareous; sandstone outcrops; ironstone cover 30-50%; PPF UF 6.12.

Scalds

Deflated ironstone covered scalds; vegetation; brown clays 30-60 cm; loss of A horizon; ironstone cover 80%; PPF UG 5.32.



? Not Coloured

REFERENCE

Willing Downs
 Flat to gently undulating plains with minor sandstone outcrops; mitchell grass open tussock grasslands. Moderately deep deep grey and brown cracking clays -120 cm with strongly self mulching faces; incipient gilgae development flats with weakly defined linear gilgae slopes; ironstone cover generally less than 2%; PPF UG 5.22, UG 5.23, UG 5.32, 5.33.

Upper slopes and crests; moderate high incidence of sandstone outcrops; mitchell grass open tussock grasslands; moderately deep to deep cracking brown clays, 80-100 cm; highly calcareous with numerous sink holes and minor scalding; PPF UG 5.32.

Gently slopes; mitchell grass open tussock grasslands; deep brown cracking clays, 90-100 cm; linear gilgae, vertical interval less than 25 cm; numerous sink holes; PPF 5.32.

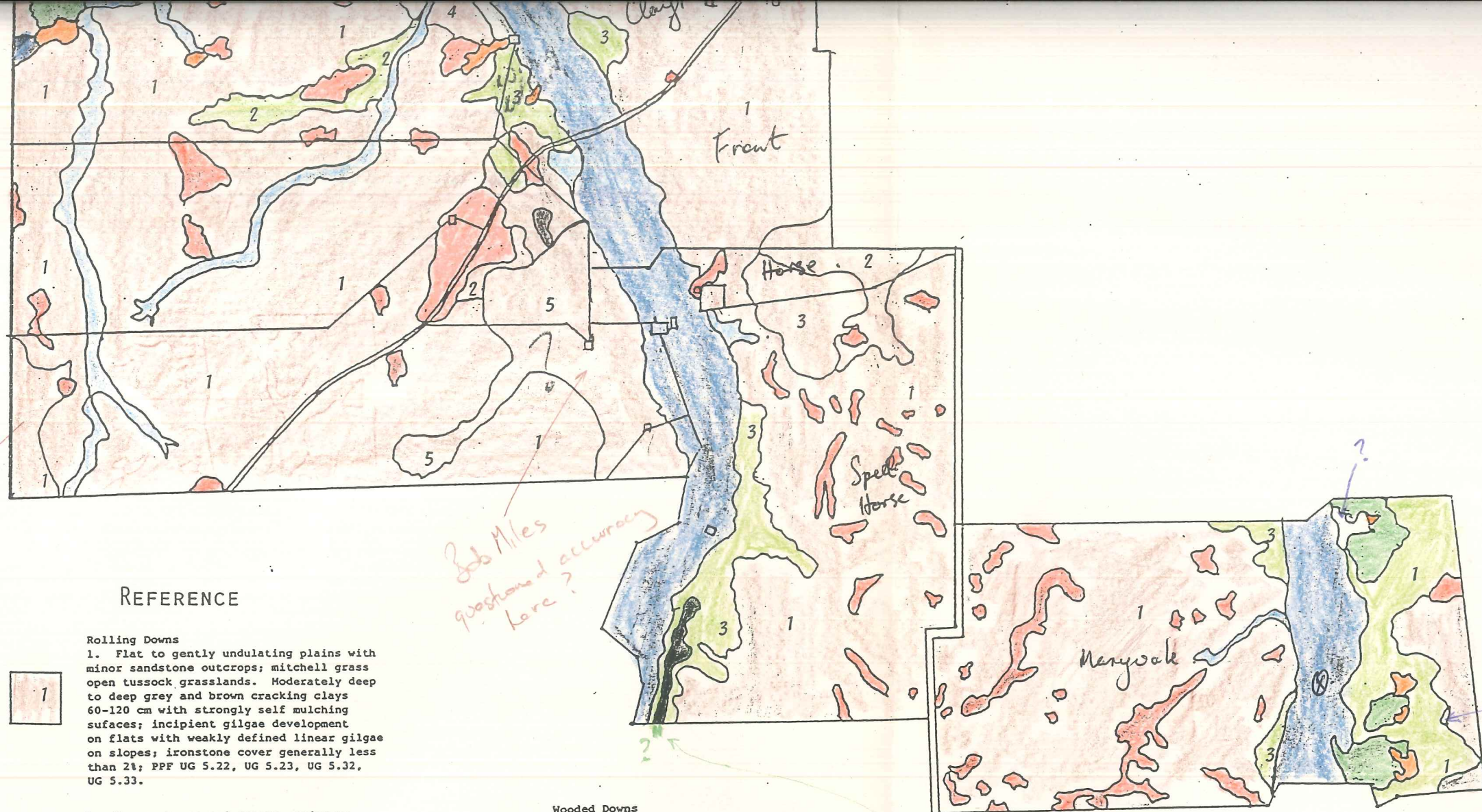
Flat alluvial plains of very low relief; mitchell grass open tussock grasslands; deep grey cracking clays, 90-140 cm; strongly self mulching surfaces; subject to occasional flooding; ironstone cover less than 5%.

Flat to gently undulating plains with minor sandstone outcrops; mitchell grass open tussock grasslands; moderately deep deep brown cracking clays; 60-120 cm; ironstone cover 5-35% isolated outcrops 60%; PPF UG 5.31, UG 5.32.

- 1 **Wooded Downs**
 1. Undulating plains; boree, whitewood, mimosa, sandalwood; deep to very deep grey brown cracking clays, 60-120 cm; ironstone cover less than 30% with localised outcrops of sandstone; PPF UG 5.32, UG 5.22.
- 2 **Willing Downs**
 2. Flat plains subject to occasional flooding; boree, gidgee, coolibah, sandalwood; wooded (open) tussock grasslands; deep to very deep grey brown cracking clays, 60-120 cm; moderately calcareous ironstone gravel cover less than 1%; incipient gilgae development; minor scalding; PPF UG 5.23, UG 5.32.
- 3 **Willing Downs**
 3. Hills and rises; boree, whitewood, sandalwood; woodland (open) tussock grassland; deep to very deep grey cracking clay, 60-120 cm; moderately calcareous to highly calcareous at depth; localised sandstone outcrop. Ironstone cover 10-50% PPF UG 5.22.

- Gidgee Lands**
 Flat to gently undulating plains; gidgee, sandalwood, tall shrubland to low woodland; deep brown cracking clays, 60-75 cm; highly calcareous throughout, weak gilgae development; ironstone cover 30-70%. PPF 5.32.
- Stream channels and alluvium**
 Seasonally flooded alluvial plains of braided streams; Coolibah, red river gums, bauhinia, occasional boree; complex of cracking and non cracking, deep to very deep brown and grey clays and minor texture contrast soils, 80-150 cm; extensive seasonal scalding and moderate gilgae development PPF DY 4.13, UG 5.22, UG 5.23, UG 5.32, UG 5.33, UF 6.31, UF 6.33, UF 6.34.
- Drainage Lines**
 Major drainage lines to stream channels. Boree, coolibah, Mimosa, mitchell tussock grasslands; deep to very deep cracking grey and brown clays, 80-140 cm; limited areas of ironstone cover, less than 10%; moderately calcareous throughout.

- Crests and Ridges**
 Isolated crests and ridges; whitewood, vinetree, mimosa wooded (open) tussock grasslands. Shallow to moderately deep, brown non cracking clays to 60 cm; very highly calcareous; sandstone outcrops; ironstone cover 30-50%; PPF UF 6.31, UF 6.12.
- Scalds**
 Deflated ironstone covered scalds; no vegetation; brown clays 30-60 cm; some loss of A horizon; ironstone cover 35-80%; PPF UG 5.32.



REFERENCE

Rolling Downs



1. Flat to gently undulating plains with minor sandstone outcrops; mitchell grass open tussock grasslands. Moderately deep to deep grey and brown cracking clays 60-120 cm with strongly self mulching surfaces; incipient gilgae development on flats with weakly defined linear gilgae on slopes; ironstone cover generally less than 2%; PPF UG 5.22, UG 5.23, UG 5.32, UG 5.33.



2. Upper slopes and crests; moderate to high incidence of sandstone outcrops; mitchell grass open tussock grasslands; moderately deep to deep cracking brown clays, 80-100 cm; highly calcareous with numerous sink holes and minor scalding PPF UG 5.32.



3. Gently slopes; mitchell grass open tussock grasslands; deep brown cracking clays, 90-100 cm; linear gilgae, vertical interval less than 25 cm; numerous sink holes; PPF 5.32.



4. Flat alluvial plains of very low relief; mitchell grass open tussock grasslands; deep grey cracking clays, 90-140 cm; strongly self mulching surfaces; subject to occasional flooding; ironstone cover less than 5%.



5. Flat to gently undulating plains with minor sandstone outcrops; mitchell grass open tussock grasslands; moderately deep to deep brown cracking clays; 60-120 cm; ironstone cover 5-35% isolated outcrops to 60%; PPF UG 5.31, UG 5.32.

Wooded Downs



1. Undulating plains; boree, whitewood, mimosa, sandalwood; deep to very deep grey brown cracking clays, 60-120 cm; ironstone cover less than 30% with localised outcrops of sandstone; PPF UG 5.32, UG 5.22.



2. Flat plains subject to occasional flooding; boree, gidgee, coolibah, sandalwood; wooded (open) tussock grasslands; deep to very deep grey brown cracking clays, 60-120 cm; moderately calcareous ironstone gravel cover less than 1%; incipient gilgae development; minor scalding; PPF UG 5.23, UG 5.32.



3. Hills and rises; boree, whitewood, sandalwood; woodland (open) tussock grassland; deep to very deep grey cracking clay, 60-120 cm; moderately calcareous to highly calcareous at depth; localised sandstone outcrop. Ironstone cover 10-50% PPF UG 5.22.

Gidgee Lands



Flat to gently undulating plains; gidgee, sandalwood, tall shrubland to low woodland; deep brown cracking clays, 60-75 cm; highly calcareous throughout, weak gilgae development; ironstone cover 30-70%. PPF 5.32.

Stream channels and alluvium



Seasonally flooded alluvial plains of braided streams; Coolibah, red river gums, bauhinia, occasional boree; complex of cracking and non cracking, deep to very deep brown and grey clays and minor texture contrast soils, 80-150 cm; extensive seasonal scalding and moderate gilgae development PPF DY 4.13, UG 5.22, UG 5.23, UG 5.32, UG 5.33, UF 6.31, UF 6.33, UF 6.34.

Drainage Lines



Major drainage lines to stream channels. Boree, coolibah, Mimosa, mitchell tussock grasslands; deep to very deep cracking grey and brown clays, 80-140 cm; limited areas of ironstone cover, less than 10%; moderately calcareous throughout.

Crests and Ridges



Isolated crests and ridges; white vine tree, mimosa wooded (open) tussock grasslands. Shallow to moderate brown non cracking clays to 60 cm; highly calcareous; sandstone outcrops; ironstone cover 30-50%; PPF UF 6.12.



Deflated ironstone covered scald vegetation; brown clays 30-60 cm; loss of A horizon; ironstone cover 80%; PPF UG 5.32.

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
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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
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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
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S ₁ 2	Alluvial plain	Drainage 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 gypsum in the deep subsoil; alkaline soil reactions trend	UG 5.34
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