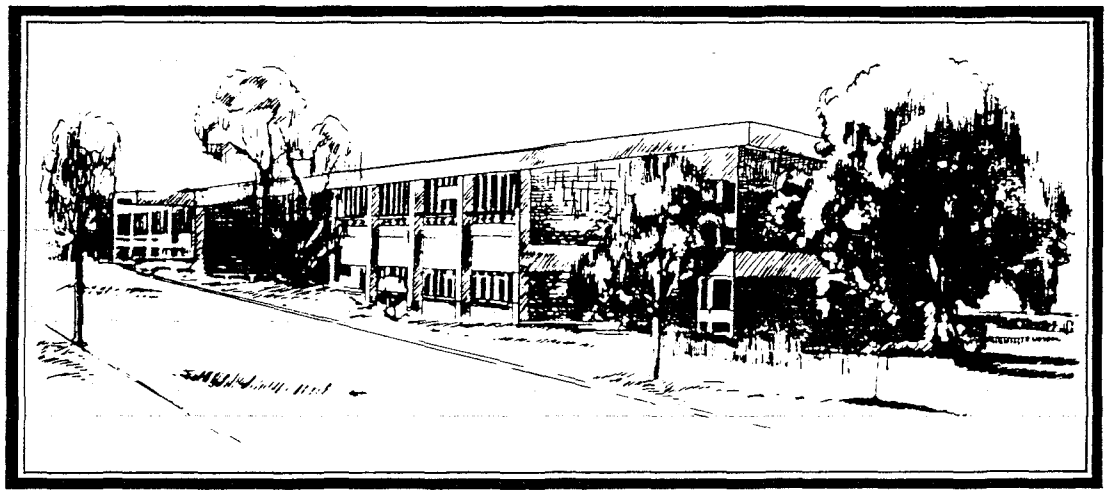
A LAND CLASSIFICATION of the HERMITAGE RESEARCH STATION



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Division of Land Utilisation

DEPARTMENT OF PRIMARY INDUSTRIES · QUEENSLAND ·

MARCH 1978

Queensland Government Technical Report

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Foreword

The Hermitage Research Station is located at Lat. 28° 12'S, Long. 152° 06'E and has an elevation of 470 m above sea level. It lies eight kilometres east of Warwick on the Southern Darling Downs (Figure 2) and has an area of 229 hectares.

The Station is involved in a wide range of research programs and is highly regarded as a centre for plant breeding and testing.

Agronomic research encompasses wheat, barley, grain and grazing sorghum, linseed, safflower, sunflower, soybean and more recently, peanuts and sesame. The effects of different fallow management techniques on soil fertility and crop performance are also being investigated.

Animal research is carried out on pigs, sheep and beef cattle. Pig breeding and selection for factors of economic significance is a producer oriented program welcomed by the pig industry. Sheep breeding is aimed at reducing losses due to blowfly strike and encouraging results have been obtained by crossing Merinos with Wiltshire Horns. Beef production systems involving the use of grain are being studied with emphasis on the efficiency of grain conversion.

Also on the Station, officers of the National Parks and Wildlife Service are involved in studies of marsupial reproduction and feeding habits.

This report has been produced in response to a request in September 1977 from Research Stations Board. The Board recognised that field officers of the Division of Land Utilisation were currently preparing a land classification bulletin on the surrounding Glengallan Shire and sought a specific report for the Hermitage Research Station.

A. Hegarty

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DIVISION OF LAND UTILISATION

Figure 1. Aerial view of the Hermitage Research Station looking N-W (Swan Creek in right foreground). A reproduction from a 35 mm infrared colour positive, taken at midday on 6 December, 1977 at a height of approximately 250 m.

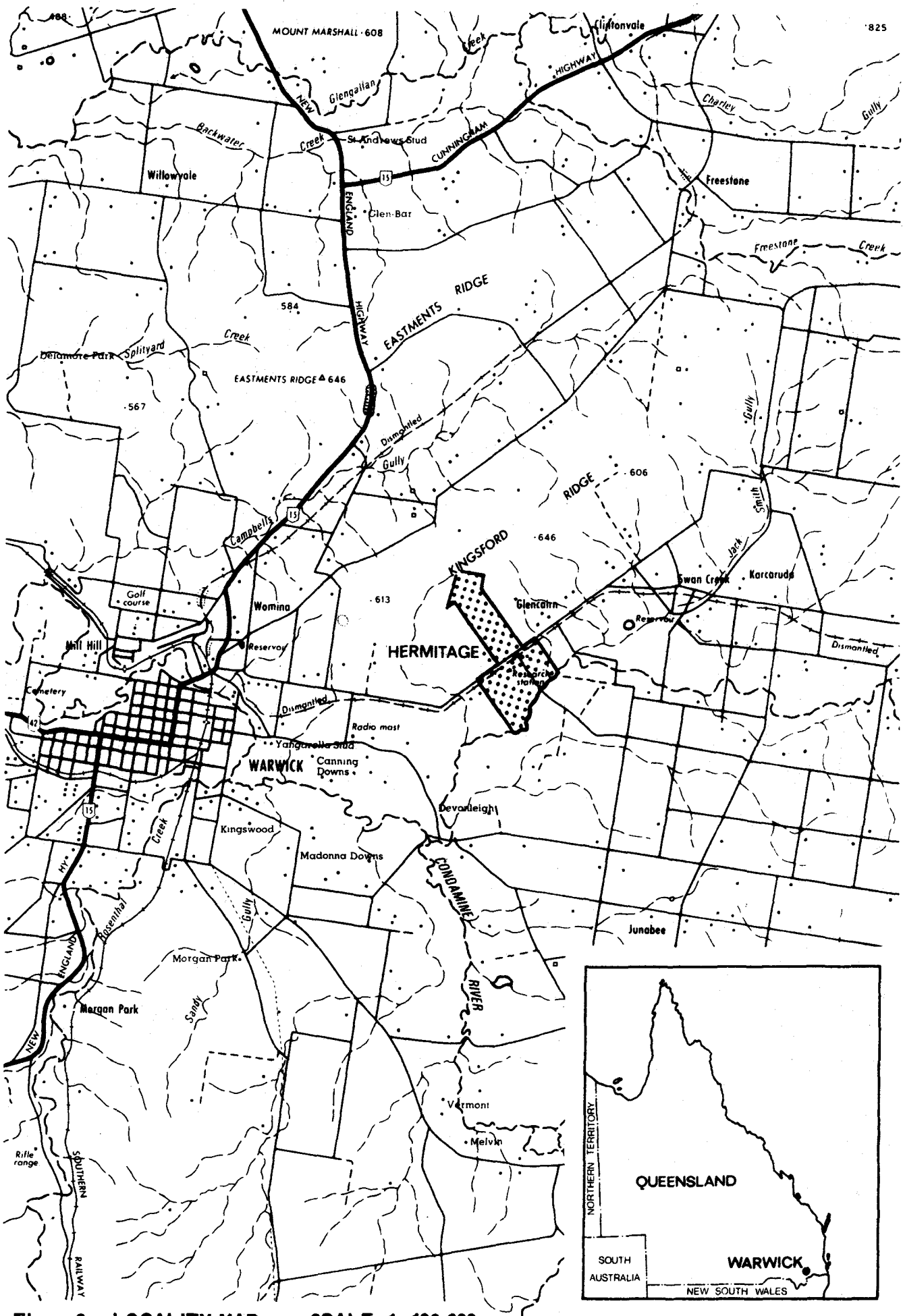

Figure 2 LOCALITY MAP SCALE 1 : 100 000

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1. INTRODUCTION

In recent years the Division of Land Utilisation has undertaken considerable land classification work on the Darling Downs associated with the declaration of several Eastern Darling Downs Shires as Areas of Soil Erosion Hazard in 1973.

The request for this report is indicative of a developing interest in the use of land classification data among farmers, Local Authorities, Government Departments, industry groups and the general public. Divisional publications have also stimulated this interest and requests for land classification information are constantly increasing.

The purpose of this study is to provide accurate physical information for use in the design and evaluation of on-station soil fertility trials, and for the testing of plant species and varieties. It facilitates the relating of Research Station results to district experience and further, to similar areas elsewhere on the Darling Downs.

The report is also intended to serve as a permanent record of the land classification of the Station and as a sample of the soils of this locality.

Site descriptions for each soil series/phase appear in Appendix I. For publication purposes, these can serve as a reference in the description of trial plots on the Station. Further, experiment results from other areas can be better assessed for local relevance where site description data of a similar nature are available.

The physical site and profile data appearing in Appendix I are taken from the field survey descriptions on the Station. Chemical data are from analyses of profiles at representative key reference sites in the region, except for the alluvial site for which on-station data are available. A study aimed at providing chemical and other analytical data for the soils on the Station is therefore required for a complete soils inventory of the Hermitage Research Station.

The co-operation and assistance from G.H. Allen, Executive Officer, Research Stations Board, R.N. Amos, Manager, Hermitage Research Station and officers of the Division of Land Utilisation and Plant Industry are gratefully acknowledged.

2. METHODS

(a) Data Sources

The land resource area survey of the Walloon Coal Measures and contiguous geological formations in Glengallan Shire (McKeown in prep.) was the major reference source for this report. Aerial photography of both the 1961 and 1974 series which included the Hermitage Research Station had been used for the mapping of tentative land resource area boundaries.

As part of the survey, a geological plan had been compiled by K.K. Hughes of Development Planning Branch and was used as a reference.

About 30 years ago F. Chippendale had conducted a soil survey of the Station. This was done on a 20m (1 chain) grid with soil profile and analytical data recorded for each site. The resultant map is available but the absence of the accompanying text precluded its use as a mapping base.

(b) Terminology

The classification system and terminology adopted is consistent with that used by Mullins (1978).

The definitions of key terms employed in the land classification are as follow:

A land resource area consists of a group of related soils developed on a common geology, with a similar vegetation community.

A soil series is a group of soils having soil horizons similar in differentiating characteristics and arrangement in the soil profile and developed from the same type of parent material (U.S.D.A. Handbook No. 18, 1951).

A soil phase has all the characteristics of a soil series but is more narrowly defined with regard to certain features of importance to soil use. Stony; shallow; eroded;and salt-affected are examples of commonly-occurring phases.

An agricultural management unit is a soil series or phase, or a group of soil series/phases that have similar agricultural and soil conservation management requirements.

(c) Survey Method

The 'free' survey technique employed involved the sampling and description of sites within each tentatively mapped land resource area occurring on the Station and also within the map units of Chippendale's map. With the exception of the alluvial area, sites were classified according to the soil series which have been named and described by Mullins *(op. cit.)*.

More detailed stereoscopic examination of 1961 aerial photographs (1:16 000) was used as an aid in the delineation of the soil series/phases boundaries which were subsequently finalised by field checking. These boundaries have been reproduced on an aerial photo base (1974 photos) at a scale of 1:7 920 (Fig. 5).

Within each land resource area those soil series/phases which respond in a similar manner to agricultural and soil conservation management practices were grouped into agricultural management units (Section 4).

The occurrence of soil series was related to geology and landform, using the Warwick 1:100 000 topographic sheet, the geological plan and field traverses. The landform was divided into seven discrete slope units and these were related to individual soil series (Section 3 (1) and Fig. 3).

A land capability classification (Rosser *et al*, 1974) was carried out on the agricultural management units (Section 4) and is reflected in current land use (Fig. 4).

The vegetation community descriptions were adopted from the Glengallan Shire Walloon survey (Section 3 (ii)).

3. LAND CLASSIFICATION

(i) Geomorphology

The soils of the surrounding area are derived from basalts, Walloon Coal Measures (labile sandstones), Marburg Formation (feldspathic sublabile sandstones) and alluvia. As these parent materials, excepting the Marburg Formation, are composed mainly of clay minerals, clay soils are predominant.

The oldest rocks are the Jurassic sediments. In this period the Marburg Formation was overlain by the Walloon Coal Measures. Both were then gently folded and eroded to a plain surface with scattered rises of the Walloon Coal Measures.

During the early Tertiary period, basalt flows covered part of this surface. The Station is situated just within the western extent of the basalt flows in this locality.

Erosion removed part of the basalt and cut into the softer Walloon sediments to leave basalt-capped ridges. The mass of the Marburg Formation extends to within approximately one kilometre of the Research Station on the western side.

However, approximately one kilometre on the eastern side of the Station, the Marburg Formation has been exposed by erosion in an anticlinal ridge.

In the Quaternary period drainage lines extended westwards from the upland basalt area and alluvia were deposited in these drainage lines. In this locality they cut into the relatively soft Walloon sediments and the Marburg anticline. The alluvia along Swan Creek comprises mainly basaltic material with some Walloon and minor Marburg material.

The occurrence of soils is related to the foregoing processes in the following manner. Skeletal soils have formed on the basalt-capped ridge (Kingsford Ridge) which is also the source of basaltic colluvial material. Shallow sedentary soils have formed on sandstone in the steeper areas below Kingsford Ridge. Farther downslope, deeper soils derived from Walloons extend over gentler slopes to the alluvials. Some Walloon slopes

are overlain by basaltic colluvium to varying degrees. This colluvium is shed downslope from Kingsford Ridge and is more concentrated near upper slope drainage lines, on flatter slopes and on concave slopes. Its influence diminishes with distance downslope, on convex and on steep slopes. Thus, soils on the slopes are derived either from a mixture of basalt and Walloons or from Walloons only.

On the flatter areas along Swan Creek the alluvia have formed deep clay soils which show considerable variation. The alluvia also overlie the adjacent Walloon foot slopes and contribute significantly to soil decomposition in this situation.

A diagrammatic cross-section representing the landform and component slope units of the Hermitage area appears in Fig. 3. The difference in elevation over the Station is about 100 metres from Kingsford Ridge to Swan Creek.

In interpreting the diagram, it should be noted that slope units 1, 2, 6 and 7 will be found in any cross-section, that either unit 3 or unit 4 occurs in any cross-section, and that unit 5 may or may not occur. The relationship of soil series and slope units is well illustrated when Figures 3 and 5 are considered conjointly.

(ii) Vegetation

Three vegetation communities namely the narrow-leaved ironbark, poplar box and grassland are represented in the Hermitage area.

The steeper areas of shallow soils on Kingsford Ridge support a community mainly of narrow-leaved ironbark *(Eucalyptus crebra)* which has its highest density at the top of the ridge.

As the slopes become gentler and the soils deeper, there is a transitional zone in which narrow-leaved ironbark, poplar box *(Eucalyptus populnea)* and gum-topped box *(Eucalyptus molucanna)* are the most common species. In this transitional zone hybrids of narrow-leaved ironbark and poplar box occur. Ground cover consists mainly of grasses of the Chloris, Aristida, Bothriochloa and Dichanthium genera.

The steep areas of narrow-leaved ironbark and the transitional zone with a combined area of 121 ha have been retained as timbered land and are used for grazing.

The poplar box community has been largely cleared for cultivation. It occupied an area between the transitional zone and the alluvial flats. The few remaining trees indicate that this community comprised poplar box interspersed with gum-topped box.

Other tree species occur very sparsely in the narrow-leaved ironbark community but increase in density through the transitional zone and were probably common in the poplar box community. These sub-dominant species are Queensland blue gum *(Eucalyptus tereticornis)*, Yellow box *(Eucalyptus melliodora)* and Tumbledown gum *(Eucalyptus dealbata)*.

Indications are that the poplar box community ended abruptly at the alluvial boundary.

Prior to cultivation the alluvial areas supported a grassland which probably consisted of Queensland blue grass *(Dichanthium sericeum)* and Wallaby grass *(Danthonia linkii)*. Broad-leaved apple *(Angophora subvelutina)* and Queensland blue gum were emergents in this community.

(iii) Land Resource Areas, Soil Series/Phases

From a consideration of geological and vegetation factors four land resource areas have been classified on the Station. Within each land resource area the component soil series/phases have been identified. The agricultural management units resulting from the soil series/phases groupings are defined and their management is described in Section 4. A tabulated summary of these relationships follows:

Land Resource Areas	Soil Series/Phases (Reference Site Nos.)	Agricultural Management Units
Poplar Box Walloons	Elphinstone clay (508) Elphinstone depositional phase (504) Elphinstone depositional phase (shallow) (505) Talgai clay (shallow phase) (501)	Elphinstone-Talgai
	Toolburra clay (502)	Toolburra
Alluvial	Alluvial clays (511)	Alluvial
Basalt	Kenmuir stony clay loam association	Kenmuir
Mixed Basalt and Walloon (Poplar Box)	Ellinthorp clay (503)	Ellinthorp

The four land resource areas and relevant soil series/phases are now described.

Poplar Box Walloons Land Resource Area

Two soil series and three soil phases of this land resource area occur on the Station. These are the Elphinstone and Toolburra soil series, the Elphinstone depositional phase, the Elphinstone depositional phase (shallow) and the Talgai shallow phase. The latter is a phase of the Talgai soil series which does not occur on the Station.

Alluvial Land Resource Area

Soil series which make up this land resource area in the region have not been classified as yet. One profile form (Site 511) is described for the Station, though it is recognized that considerable variation in soil profile characteristics occurs over the alluvial area.

Basalt Land Resource Area

The Kenmuir stony clay loam association represents this land resource area on the Station. The association very largely consists of the Kenmuir stony clay loam soil series with smaller areas of the following soil series which have been described by Mullins *(op. cit.)*.

Kenmuir gravelly clay loam
Mallard clay loam
Beauaraba clay
Purrawunda clay.

Mixed Basalt and Walloon (Poplar Box) Land Resource Area

Although originating from two distinct parent materials, the mixed Basalt and Walloon land resource area is a mappable entity with individual characteristics.

The area is represented on the Station by the Ellinthorp soil series which shows similarities to the Elphinstone (Poplar Box Walloon) and Irving (Basalt) soil series. Profile variation in the Ellinthorp soil series occurs from the top of a slope to the bottom due to the gradual reduction in basaltic influence down the slope.

4. AGRICULTURAL MANAGEMENT UNITS

The aggregation of soil series/phases into agricultural management units provides a classification for practical land use purposes. The five units determined for the Station are described and consideration given to factors of importance in management.

(i) Elphinstone-Talgai Management Unit

This unit contains a grouping of the Elphinstone soil series, its two phases and the Talgai shallow phase.

The major variation within this management unit on the Station relates to soil workability differences and these are due to differences in the surface soil structure of the various soil series/phases. These relationships are listed.

Soil Series/Phases	Surface Soil Structure	Workability
Elphinstone soil series	Moderate, medium angular blocky structure.	Tends to break into clods and is somewhat "puggy". Most difficult soil to work in this management unit.
Elphinstone depositional and shallow depositional phases	Moderate to strong, coarse granular structure.	Very well structured and cultivation in top 10 cm is comparatively easy.
Talgai shallow phase	Weak to moderate, medium angular blocky structure.	Not well structured and tends to be hard when dry. Intermediate in difficulty of working.

Land Capability Classification - Most of this management unit is contained within Class III of the classification, the major limitation being susceptibility to water erosion. A small amount of the unit below the National Parks and Wildlife Section is Class VI land.

Soil Fertility - The soils of this management unit are inherently very low in phosphorus and marginal in potassium. They become sodic at depths varying between 20 and 60 cm. If exposed by erosion, this sodic subsoil will disperse when wet.

Total available soil water capacity of an undisturbed Elphinstone clay profile is about 90 mm of water, 80 per cent of which is stored in the top 45 cm. The soil has an effective depth of 90 cm.

A Talgai clay profile stores about 150 mm of available moisture, with 65 per cent in the top 45 cm and 30 per cent between 45 and 90 cm. An undisturbed Talgai clay has an effective depth of 100-110 cm. These differences in available soil water capacity are not reflected in yield figures which have been recorded for these soil series.

Use and Management - This unit is suited to the production of a wide range of grain and forage crops such as grain sorghum, maize, sunflower, millet, barley, canary, linseed, forage oats and forage sorghum. Vegetables are grown successfully under irrigation where water of a suitable quality is available.

Phosphorus, potassium and when necessary, nitrogen fertilizers are recommended for cropping. In seasons with good moisture supplies, sulphur should also be applied where there is a need for nitrogen fertilizer.

This unit supports a productive native pasture while suitable introduced pasture species include green panic, Rhodes grass and Makarikari grass (cv. Bambatsi and Pollock). Suitable introduced legumes are snail and Jemalong barrel medics and Hunter River lucerne. Fertilizer applications are necessary on sown pastures to obtain the benefit of higher yield potential.

Soil Conservation - Soil erosion control measures are necessary to prevent land degradation in this unit where slopes greater than 2 per cent are used for cultivation. Construction of contour banks and waterways, contour cultivation, stubble mulching, reduced tillage, strip cropping and growing erosion resisting crops are among the soil conservation practices recommended.

Broad-based topside contour banks are the minimum bank specification due to the extent of soil cracking.

In farm dam construction, wet soil compaction methods should be used to prevent otherwise likely dam wall failure due to the dispersible nature of the subsoils in this unit.

(ii) Toolburra Management Unit

This unit contains only the Toolburra soil series.

The variations within this management unit on the Station are in topography, stoniness and soil depth. Site 502 (Appendix IE) is in

an area with the least capability limitations. Other sites are on slopes as high as 30 per cent (with up to 10 per cent cover of ironstone and sandstone up to 30 cm diameter) and soil profile depths as shallow as 30 cm.

Land Capability Classification - For agricultural management, this unit on the Station is contained within Class VII of the classification. The occurrence of this unit on the Station is atypical of that in the region, where it is usually classified as Class III.

Soil Fertility - This soil is very low in phosphorus. A typical profile as described at site 502 becomes sodic below 60 cm and the subsoil below this depth is therefore potentially dispersible.

Total available soil water capacity is about 120 mm with storage fairly evenly distributed throughout the profile. This represents an effective soil depth in a typical profile of 90 cm. However, in the areas of shallower soils available water capacity is much reduced.

Use and Management - On the Station, this management unit supports native pasture and semi-cleared woodland and is used for extensive grazing of sheep and cattle.

In other parts of the region this unit does not have the severe limitations of topography, stoniness and soil depth described above. It is usually suited to the production of a wide range of grain and forage crops, both summer and winter. It is also suitable for sown pasture establishment. Phosphorus, nitrogen and sulphur fertilizers are required.

Soil Conservation - In the case of the Station, grazing management designed to maintain an adequate vegetative cover is required to control soil erosion.

Where used for cultivation, narrow-based contour banks, waterways and crop management practices are recommended.

(iii) Alluvial Management Unit

In this region this unit is considered to be homogeneous over the whole Alluvial Land Resource Area.

This unit has a Class II land capability classification due to occasional erosive and depositional flooding, which result in changes in surface soil characteristics. The changes occur in colour, structure,

pH and inclusions and vary irregularly over the alluvial area with time.

Soil Fertility - The soil is high in phosphorus and potassium but becomes low in nitrogen with continual cropping. Observations indicate that total available soil water capacity is high.

Use and Management - The unit is suited to the intensive production of both summer and winter grain and grazing crops, lucerne and other sown pastures, and vegetable production.

Soil Conservation - Waterways and strip cropping only are required to conserve this management unit. The waterways are necessary to control the transport of water across the unit to Swan Creek, most of this being runoff from upslope. Strip cropping is desirable, to ameliorate the erosive effects of flooding.

(iv) Kenmuir Management Unit

This unit comprises the soil series of the Basalt Land Resource Area found on the Station.

Land Capability Classification - This unit falls into Class VII of the classification, although in other areas it may be a combination of Classes VI and VII. The major limitations to land use are topography, stoniness, susceptibility to water erosion and effective soil depth.

Soil Fertility - The soils in this unit have inherently high levels of phosphorus, nitrogen and potassium.

Total available soil water capacity is very low and this factor alone precludes cropping.

Use and Management - This unit is non-arable due to the limitations stated. Pasture production can be increased by introducing snail, cypress and Jemalong barrel medics. Suitable grasses include green panic and Rhodes grass. As it is not possible to use machinery, broadcast methods are used in the establishment of sown pasture.

Soil Conservation - Due to stoniness and shallow soil depth, the building of soil conservation structures is not practicable.

Recommended management procedures designed to safeguard the long-term productivity of this unit relate to timber clearing and ground cover maintenance. Tree clearing should be planned and generally be kept to a minimum. Because of the large variation in grazing capacity throughout the year provision for flexibility in stocking rates is required.

(v) Ellinthorp Management Unit

This unit contains only the Ellinthorp soil series.

Land Capability Classification - This unit has a Class III classification, the major limitation being susceptibility to water erosion.

Soil Fertility - Although chemical analyses of this soil series have not been done, productivity surveys have provided a guideline to soil fertility. These results indicate that major nutrient status and available soil water capacity values lie between those for the Elphinstone and Irving soil series.

Use and Management - This unit is suited to the production of a wide range of both summer and winter grain and forage crops. Under continual cropping, nitrogen and possibly phosphorus fertilizers would be required.

Native pasture of appreciable grazing value occurs on uncultivated areas. Suitable introduced pasture species include Rhodes and Makarikari grass (cv. Bambatsi and Pollock), with snail and Jemalong barrel medics and Hunter River lucerne being the best legumes for over-sowing.

Soil Conservation - Erosion can be adequately controlled with contour banks, waterways and agronomic practices such as stubble mulching. Broad-based topside contour banks are the minimum bank specification due to the extent of soil cracking. Grassed waterways should be maintained by fertilizing and controlled grazing or slashing to provide suitable water flow conditions and avoid waterway scouring or siltation.

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APPENDIX I

Soil Series/Phases - Descriptions and Analyses

Poplar Box Walloons

1.A Elphinstone clay

1.B Elphinstone depositional phase

1.C Elphinstone depositional phase (shallow)

1.D Talgai shallow phase

1.E Toolburra clay

Alluvial

1.F Alluvial clay

Basalt

1.G Kenmuir stony clay loam

Mixed Basalt and Walloon (Poplar Box)

1.H Ellinthorp clay

Explanatory Notes:

Reference Site locations appear on Fig. 5.

Slope Units are shown on Fig. 3.

Terminology used in reference site descriptions is derived from the following sources:

Great Soil Groups - Stace *et al* (1968).
Principal Profile Forms - Northcote (1974).
Colour Codes and Names - Oyama *et al* (1970).
Other Soil Profile Characteristics - Northcote (1974) and U.S.D.A. Handbook No. 18 (1951).

Soil Series - Elphinstone clay

Reference Site - 508

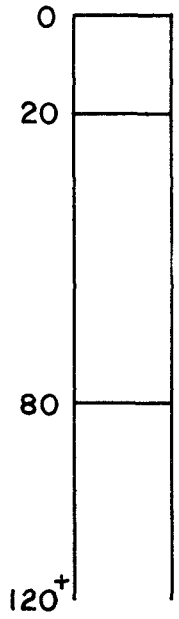
Mapping Symbol - Elp

Great Soil Group - Grey clay

Principal Profile Form - Ug 5.16

This site is on the lower section of Slope Unit 4 and has a slope of 4%. The profile is moderately well drained. The surface soil (cultivated) is cracking and weakly self-mulching. This soil is a linear gilgai complex and the depression profile is described.

Depression Profile



Description

0-20 Brownish black (10 YR 3/1) medium clay. Moderate, medium angular blocky structure. Hard consistence (dry); calcium carbonate concretions; pH 7.0. Diffuse change to -

20-80 Black (10 YR 1.7/1) heavy clay. Strong, medium to coarse angular blocky structure. Very hard consistence (dry); pH 7.5-8.5. Diffuse change to -

80-120+ Greyish yellow brown (10 YR 4/2) heavy clay. Strong, medium to coarse angular blocky structure. Very hard consistence (dry); calcium carbonate concretions; pH 9.0-9.5.

Fine sand occurs throughout the profile.

CHEMICAL DATA - McKeown (1978)

Depth cm.	pH 1:5	Elec. Cond. ms/cm	Cl^- %	Air Dry Moist. %	Org. C %	Tot. N %	Extr. P(ppm)		Repl. K meq%	Exch. Cations meq/100gm Soil					%Particle Size			
							Acid	Bicarb		CEC	Ca^{++}	Mg^{++}	Na^+	K^+	CS	FS	S	C
0-10	7·8	·17	·004	8·0	2·2	·19	13	11	0·80	45	28	7·9	0·7	·82	18	19	14	49
10-20	7·7	·12	·002		1·8	13	8	6	0·51									
20-30	7·9	·07	·002	9·9						42	28	8 6	1·6	·22	14	19	16	50
50-60	8·5	·13	·005	9·5						52	32	13	4·2	·36	10	16	18	55
80-90	9·0	·25	·013	9·3						49	27	13	6·2	·35	11	14	16	59
110-120	9·1	·37	·021	7·3						42	20	12	7 1	·38	23	14	15	49

Soil Series - Elphinstone depositional phase

Reference Site - 504

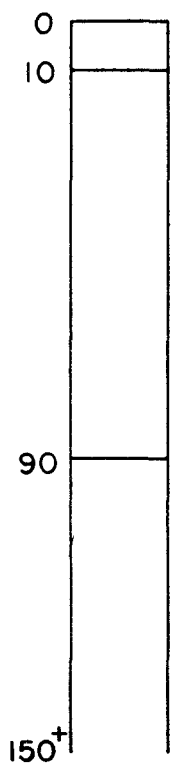
Mapping Symbol - Elp (dp)

Great Soil Group - Grey clay

Principal Profile Form - Ug 5.16

This site occurs on the upper section of Slope Unit 6 adjacent to the alluvial flats; it has a slope of 2% and the profile is moderately well drained. The surface soil (cultivated) is cracking and strongly self-mulching; the degree of swelling on wetting indicates a high montmorillonitic clay content. This soil is a linear gilgai complex.

Depression Profile



Description

0-10 Brownish black (10 YR 3/1) light clay.
Moderate to strong, coarse granular structure.
Hard consistence (dry); abundant calcium carbonate concretions; pH 9.0. Diffuse change to -

10-90 Brownish black (10 YR 3/1) medium to heavy clay.
Strong, medium angular blocky structure.
Firm consistence (moist); abundant calcium carbonate concretions; pH 9.0. Diffuse change to -

90-150+ Greyish yellow brown (10 YR 5/2) medium to heavy clay.
Strong, medium angular blocky structure.
Firm consistence (moist); abundant calcium carbonate concretions; pH 9.0.

Fine sand occurs throughout the profile, but in lesser amounts than in the Elphinstone clay.

No chemical data are available for the Elphinstone depositional phase. Field observations indicate that surface soil nutrient status is higher than in an Elphinstone clay due to the influence of alluvial deposition. Water holding capacity of the profile may also be higher.

Soil Series - Elphinstone depositional phase (shallow)

Reference Site - 505

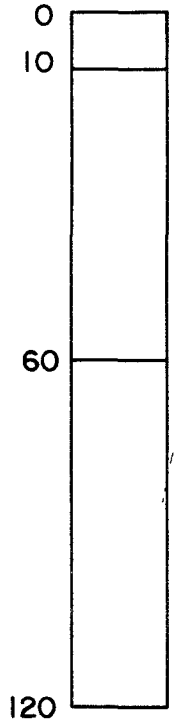
Mapping Symbol - Elp (sdp)

Great Soil Group - Grey clay

Principal Profile Form - Ug 5.14

This site occurs on the lower section of Slope Unit 6 adjacent to the alluvial flats; it has a slope of 4% and the profile is moderately well drained. The surface soil (cultivated) is cracking and moderately self-mulching; the degree of swelling on wetting indicates a high montmorillonitic clay content. This soil is a linear gilgai complex.

Depression Profile



Description

0-10 Brownish black (10 YR 3/1) light clay. Moderate, coarse granular structure. Hard consistence (dry); abundant calcium carbonate concretions; pH 9.0. Diffuse change to -

10-60 Brownish black (10 YR 3/1) medium to heavy clay. Strong, medium angular blocky structure. Hard consistence (dry); abundant calcium carbonate concretions; pH 9.0. Diffuse change to -

60-120 Dull brown (7.5 YR 5/4) medium to heavy clay. Strong, medium angular blocky structure. Hard consistence (dry); abundant calcium carbonate concretions; pH 9.0.

Decomposing sandstone is encountered at 120 cm.

Fine sand occurs throughout the profile, but in lesser amounts than in the Elphinstone clay.

No chemical data are available for the Elphinstone depositional phase (shallow).

Field observations indicate that surface soil nutrient status is higher than in an Elphinstone clay due to the influence of alluvial deposition. Water holding capacity of the profile is probably about the same as for the Elphinstone clay.

Soil Series - Talgai shallow phase

Reference Site - 501

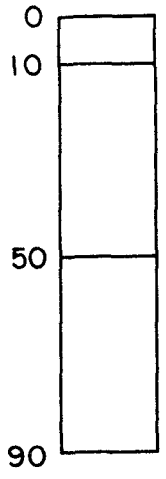
Mapping Symbol - Tal (sp)

Great Soil Group - Grey clay

Principal Profile Form - Ug 5.14

This site is on the upper section of Slope Unit 5 and has a slope of 2%. The profile is moderately well drained. The surface soil (cultivated) is cracking and weakly self-mulching. This soil is a linear gilgai complex.

Depression Profile



Description

0-10 Brownish black (10 YR 3/1) light clay. Moderate, fine angular blocky structure. Hard consistence (dry); ironstone gravel; pH 6.5. Diffuse change to -

10-50 Brownish black (10 YR 3/1) medium clay. Strong, medium angular blocky structure. Very hard consistence (dry); calcium carbonate concretions; pH 8.5. Diffuse change to -

50-90 Brownish grey (10 YR 4/1) medium to heavy clay. Strong, medium angular blocky structure. Very hard consistence (dry); abundant calcium carbonate concretions; pH 9.0.

Decomposing sandstone is encountered at 90 cm. Fine sand occurs throughout the profile.

CHEMICAL DATA - McKeown (1978)

Depth cm.	pH 1:5	Elec. Cond. ms/cm	Cl^- %	Air Dry Moist. %	Org. C %	Tot. N %	Extr. P (ppm)		Repl. K meq%	Exch. Cations meq/100gm Soil					%Particle Size			
							Acid	Bicarb		CEC	Ca^{++}	Mg^{++}	Na^+	K^+	CS	FS	S	C
0-10	6·8	·07	·001	7·5	3·0	·25	30	16	·85	30	19	7·2	·40	1·2	17	18	18	43
10-20	6·3	·05	·001		2·0	16	18	9	·30									
20-30	6·5	·04	·001	5·7						23	12	5·2	·80	·25	22	23	16	37
50-60	7·9	·20	·018	8·2						35	18	11	3·2	·34	14	15	10	57
80-90	9·0	·36	·029	7·0						27	17	10	3·3	·29	23	13	12	48

Soil Series - Toolburra clay

Reference Site - 502

Mapping Symbol - To

Great Soil Group - Brown clay

Principal Profile Form - Uf 6.31

This site occurs on Slope Unit 2, has a slope of 6% and, unlike most of this slope unit, has concave microrelief. Consequently, some basalt cobble occurs on the surface but has not influenced soil formation significantly. The surface is fairly stony (ironstone and sandstone cobble), while the surface soil condition is loose. The profile is well drained.

Profile Depth (cm)		Description
0	0-10	Brownish black (10 YR 3/2) light clay. Moderate, fine angular blocky structure. Hard consistence (dry); ironstone and sandstone gravel and cobble; pH 5.5. Diffuse change to -
10	10-40	Dull reddish brown (5 YR 4/4) medium clay. Strong, medium angular blocky structure. Hard consistence (dry); ironstone and sandstone gravel and sandstone cobble; pH 6.0. Diffuse change to -
40	40-90	Dull yellowish brown (10 YR 5/4) medium to heavy clay. Strong, medium angular blocky structure. Hard consistence (dry); ironstone and sandstone gravel and sandstone cobble; pH 8.5
90		

Decomposing sandstone is encountered at 90 cm. Finely divided carbonate occurs in trace amounts to 40 cm, then becomes more concentrated as depth increases.

CHEMICAL DATA - McKeown (1978)

Depth cm.	pH 1:5	Elec. Cond. ms/cm	Cl^- %	Air Dry Moist. %	Org. C %	Tot. N %	Extr. P(ppm)		Repl. K meq%	Exch. Cations meq/100gm Soil					%Particle Size			
							Acid	Bicarb		CEC	Ca^{++}	Mg^{++}	Na^+	K^+	CS	FS	S	C
0-10	6·0	·08	·003	6·4	2·5	·22	15	12	·90	27	9·3	6·6	·30	1·4	20	20	18	42
10-20	6·0	·06	·003		1·7	·12	8	8	·89									
20-30	6·3	·05	·002	10·1						23	7·3	6·6	·60	·51	14	15	11	58
50-60	6·8	·16	·015	12·8						31	12	11	2·5	·19	8	9	9	71
80-90	8·7	·47	·051	12·8						30	17	14	3·8	·14	11	10	9	70

Alluvial clay

Reference Site - 511

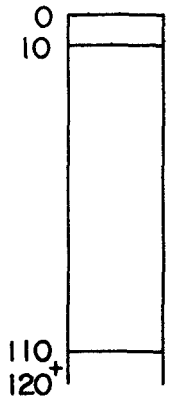
Mapping Symbol - All

Great Soil Group - Alluvial soils

Principal Profile Form - Ug 5.17

This site occurs on Slope Unit 7 which is flat or almost flat. The profile is moderately well drained. The surface soil (cultivated) is strongly cracking and self-mulching. The degree of swelling on wetting indicates a high montmorillonitic clay content.

Profile Depth (cm)	Description
0-10	Black (10 YR 2/1) light clay. Strong, coarse granular structure. Very firm consistence (moist); pH 7.0. Diffuse change to -
10-110	Black (10 YR 2/1) medium to heavy clay. Strong, coarse angular blocky structure. Very firm consistence (moist); pH 7.5. Diffuse change to -
110-120+	Brownish black (10 YR 3/2) medium to heavy clay. Strong, coarse angular blocky structure. Very firm consistence (moist); pH 8.5.



Calcium carbonate concretions occur sparsely to 110 cm, then are abundant below this depth. Fine sand and basalt gravel occur throughout the profile.

Core samples to 4.5 metres from profiles at nearby sites show layers of alluvial deposition which are significantly different, varying from very sandy to very clayey.

CHEMICAL DATA - Marley (pers. comm.)

Depth cm.	pH 1:5	Elec. Cond. ms/cm	Cl^- %	Air Dry Moist. %	Org. C %	Tot. N %	Extr. P(ppm)		Repl. K meq%	Exch. Cations meq/100gm Soil					%Particle Size			
							Acid	Bicarb		CEC	Ca^{++}	Mg^{++}	Na^+	K^+	CS	FS	S	C
0-15	7·3		·003		1·8	·07	170+		1·40	87					2·0	6·4	36·1	55·1
15-30	7·7		004		1·7	05	170+		1·11	73					1·2	8·4	37·4	53·6
30-60	8·2		007		1·6	05	170+		0·95	64					1·2	7·2	36·0	55·4
60-90	8·5		·036		1·4	·06	170+		0·82	60					1·2	7·6	37·9	53·1
90-120	8·5				1·2	·09	170+		0·79	58					2·0	8·0	38·7	51·4

Soil Series - Kenmuir stony clay loam

Mapping Symbol - KeIa

Great Soil Group - Lithosol

Principal Profile Form - Um 6.22

This soil series is found on most of Slope Unit 1 with slopes commonly 15-50%. The profile is well drained. The surface soil condition is loose.

Profile Depth (cm)		Description
0	0-10	Brownish black (7.5 YR 3/2) clay loam. Moderate, granular to crumb structure. Loose to friable consistence (moist); abundant basalt stone; pH 6.5
10	10-25	Dark reddish brown (5 YR 3/2) clay loam to light clay. Weak to moderate, fine angular blocky structure. Friable consistence (moist); abundant basalt stone; pH 7.0. This soil profile grades into weathering basalt which has clay pockets or veins through it. There is a gradual increase in clay with depth accompanied by minor changes in structure, colour and pH.
25		

CHEMICAL DATA - Mullins (1978)

Depth cm.	pH 1:5	Elec. Cond. ms/cm	Cl^- %	Air Dry Moist. %	Org. C %	Tot. N %	Extr. P(ppm)		Repl. K meq%	Exch. Cations meq/100gm Soil					%Particle Size			
							Acid	Bicarb		CEC	Ca^{++}	Mg^{++}	Na^+	K^+	CS	FS	S	C
0-10	6·6	·12	·003		3·1	·20	830	84	·70	36	13	7·0	·15	·80	37	14	25	23

Soil Series - Ellinthorp clay

Reference Site - 503

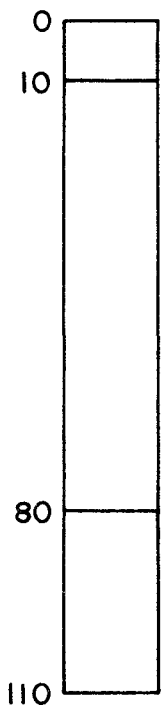
Mapping Symbol - Eln

Great Soil Group - Grey clay

Principal Profile Form - Ug 5.14

This site is on the mid-section of Slope Unit 3 which has concave microrelief. It has a slope of 4% and the profile is moderately well drained. The surface soil (cultivated) is cracking and self-mulching. This soil is a linear gilgai complex.

Depression Profile



Description

0-10 Brownish black (10 YR 3/1) light clay. Moderate, very fine angular blocky structure. Slightly hard consistence (dry); basalt gravel; pH 6.0. Diffuse change to -

10-80 Brownish black (10 YR 3/1) medium to heavy clay. Strong, medium angular blocky structure. Slightly hard consistence (dry); basalt gravel; pH 7.5-8.5. Diffuse change to -

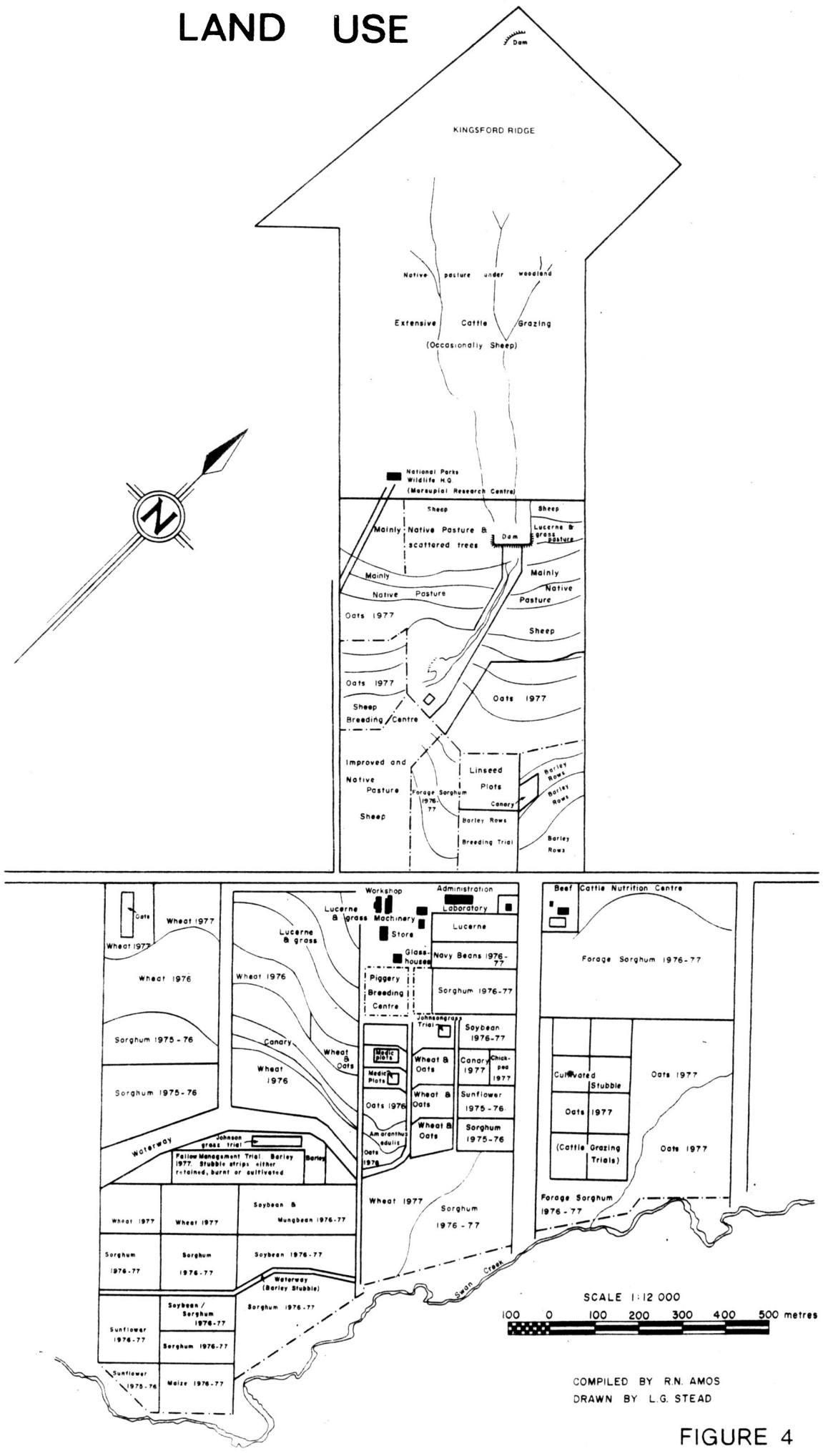
80-110 Greyish yellow brown (10 YR 4/2) medium to heavy clay. Strong, medium angular blocky structure. Slightly hard consistence (dry); basalt gravel and carbonate concretions; pH 9.0.

Fine sand occurs throughout the profile. Basalt gravel is not always present.

Decomposing sandstone is encountered at 110 cm.

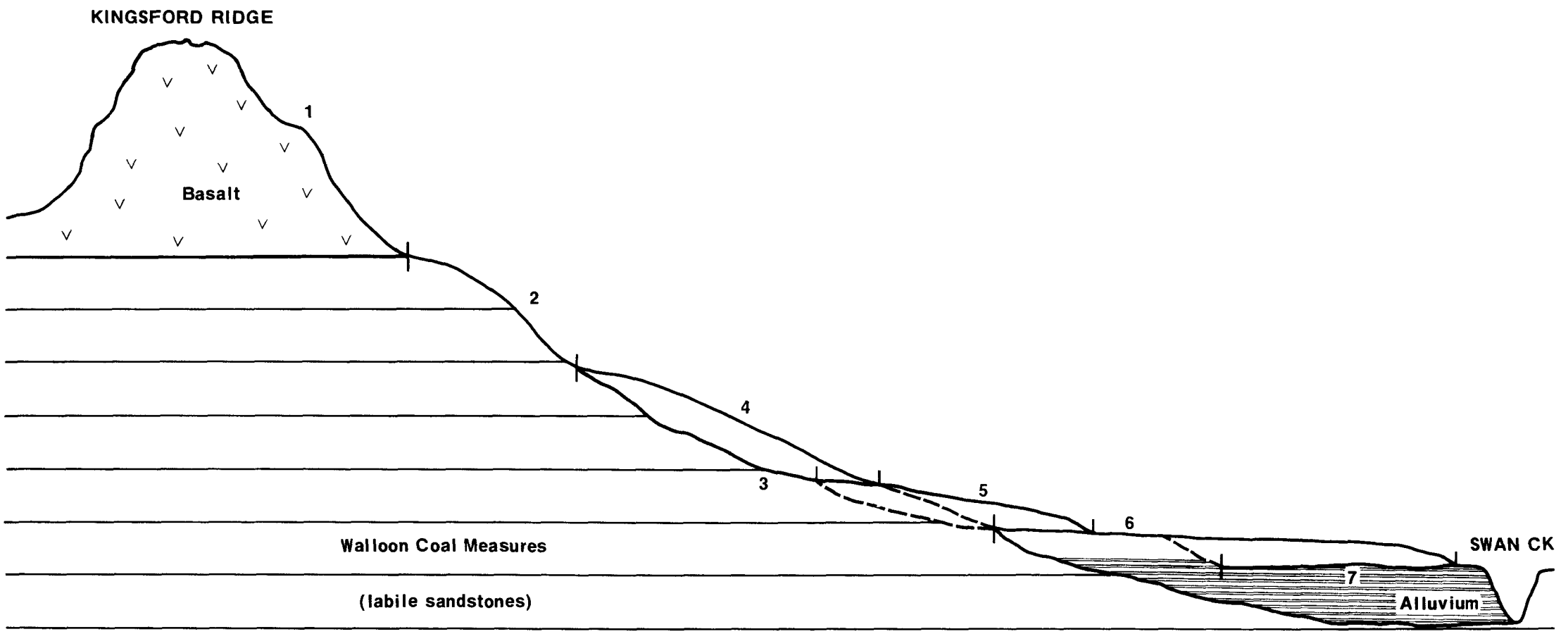
No chemical data are available for this soil series. Indications are that nutrient status and available soil water capacity values would lie between those for the Elphinstone and Irving soil series.

HERMITAGE RESEARCH STATION
LAND USE



COMPILED BY R.N. AMOS
DRAWN BY L.G. STEAD

FIGURE 4



LEGEND

1 Dissected plateau and scarp; skeletal basaltic clay loams - Kenmuir association.

2 Steep convex upper slopes; shallow sedentary clays on Walloons - Toolburra clay.

3 Concave colluvial mid-slopes; deep clays on mixed basalt-Walloons - Ellinthorp clay.

4 Convex mid-slopes; deep clays on Walloons - Elphinstone clay.

5 Convex lower slopes; shallower clays on Walloons - Talgai clay (shallow phase).

6 Low foot slopes; deep clays on mixed alluvia / Walloons - Elphinstone depositional phases.

7 Alluvial flats: deep cracking clays - Alluvial clay.

SCALE (approx.)

Horizontal 1 cm = 125 m.

Vertical 1 cm = 10 m.

Fig. 3 Landform and Slope Units in the Hermitage Area