THE VEGETATION, FLORA AND AVIFAUNA

OF

CHIDDARCOOPING NATURE RESERVE

Prepared for:

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ABSTRACT

Chiddarcooping, 75Km northeast of Merredin, has an area of 5,262ha and is one of the largest nature reserves in the wheatbelt. It is in the extra-dry mediterranean climatic zone and lies at the southern edge of an extensive elevated sandplain and gently undulating lateritic duricrust. A wide variety of habitats and plant communities have developed on the sandplains, valleys, duricrust, breakaways and extensive system of granite rocks and ridges encompassed by the reserve. Most of the communities can be grouped into associations, with one or more of the 24 dominants shown in Table 3 occurring singly or in combination. Many of the reserve's plant association are habitats for three gazetted rare species, Eucalyptus caesia, Eremophila viscosa and Eremophila virens, and at least 18 other species that must be considered to be rare or restricted, at least provisionally. One very rare, undescribed species, Acacia aff. ixiophylla, has outstanding importance for studies of speciation in the genus.

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PREFACE

The following statements describing the project to survey the vegetation of Chiddarcooping Nature Reserve and the aims of the project are taken from the Department of Fisheries and Wildlife's Consultancy Offer and Agreement.

PROJECT AIMS

The principal aim of the study was to provide baseline botanical data to be used in the development of a management plan for the reserve. Nomination of Chiddarcooping for placement on the Registrar of the National Estate and future modifications of the management plan would also utilise the baseline data.

PROJECT REQUIREMENTS

The requirements of the study were to include:

1. Production of a vegetation map for the reserve at the formation level, with each formation divided into associations described according to dominant species in the various strata; the descriptions to be based on the classification system devised by Muir (1977), and the map to show all firebreaks, stream lines and vegetation description sites (locations).

2. Provision of a series of association descriptions, also based on Muir (1977), which cover the range of associations found on the reserve. The site of each description should be recorded on the appropriate vegetation map.

3. Collection and identification of a representative sample of the flora of the reserve, and the lodging of voucher specimens of all species with the Reserve Management Section of the Wildlife Research Centre at Woodvale and the Western Australian Herbarium.

4. Compilation of a flora species list for the reserve.

5. Recording the identity, location and estimated population size of any (gazetted) rare plants which occur on the reserve.

6. Identification of habitats which are poorly represented on the reserve.

7. Identification of vegetation associations and habitats which, as a matter of priority, should remain undisturbed, with particular attention being given to identifying those areas from which fire should be excluded.

8. Identification of any habitats which would be susceptible to disturbance in the form of weed invasion, erosion or surface mining.

9. Identification of natural low fuel areas on the reserve.

The requirements of the study have been met in the following ways:

1. Three sets of maps are provided:
   a. One hand-drawn large scale vegetation map prepared to serve as a transparent overlay for use as a working map with the Department's 1:16,000 scale enlargement of photography flown at 1:80,000. The map also shows firebreaks, tracks, roads, stream lines and vegetation description (=field description) sites. Some of the vegetation boundaries differ from those shown on the two other sets of maps.
   b. The eight 1:75,000 scale maps in this report.
   c. A set of transparent overlays of the same eight maps.

2. Descriptions of representative or typical stands of vegetation, which are in Appendix A.

3. After the typing of labels is finished a complete set of the more than 700 specimens collected during the Chiddarcooping surveys will be lodged in the Herbarium as vouchers (typing of labels is nearing completion). A smaller but representative set of several hundred labelled specimens will be lodged with the Wildlife Research Centre. In addition, sets of specimens belonging to particular taxonomic groups are being sent to appropriate specialists.

4. A comprehensive vascular plant species list is in Appendix B. A table of the species and the habitats in which they are found is being compiled.

5. A preliminary list of rare plants and estimates of their population sizes in the reserve are presented in Table 11.

6. Poorly represented habitats and vegetation units are mentioned in various places in the report, especially Chapter 7 and Appendix A. The following list is not exhaustive but it does include the most distinctive and smallest poorly represented habitats in Chiddarcooping Nature Reserve. None of the habitats is included because it has rare or restricted species. All of these habitats should remain undisturbed.

HABITAT	LOCATION
Calycopeplus scrub/granite	Site 60 outcrop
Unburnt Hakea trifurcata	Site 59 area
Melaleuca viminea/meadow	Site 58
Eucalyptus erythronema	ca. Sites 61 &62
Species-rich site/stream	Site 56
Soak & pool (permanent?)/watercourse	E of Chiddar. Well
E. loxophleba-E. redunca/M. uncinata(sht ter)	Site 70
E. transcontinentalis	N of Site 30

7. The habitats of all potentially sensitive species in the reserve should be protected from fire as well as other types of disturbance at least until the responses of the sensitive species to fire are known. Slow growing granite outcrop vegetation, including Eucalyptus crucis, E. caesia and E. petraea dominated humus-rich should also be protected from fire and other disturbance. The E, salmonophloia woodlands should also be protected from disturbance, especially burning since the trees are killed by severe fire. Reasonably large representative stands of all other kinds of vegetation in the reserve should also have fire excluded from them.

8. Loamy soils and, in particular, soils on granite outcrops and on the skirts around the bases of them are the soils most susceptible to invasion by alien weeds, especially if the soil is disturbed or fertilised. The granite outcrops are replete with evidence of the enhancing effect of rabbit dung and diggings on on weed establishment. Weeds tend to follow burning as well as rabbits on these soils. Anagallis arvensis and other weeds are already established at Site 57 where the track crosses the creek; burning the vegetation there or grading the track could promote the spread of the

weeds. The woodlands in the valley where Sites 49 and 57 are located would probably be especially susceptible to weed establishment after disturbance; an alien weed, Micropterum papulosum, is already established at the western edge of the valley, a few hundred metres south of Site 50.

The susceptibility of clayey pediment soils, lighter soils in the woodland valleys and even sandy soils of the elevated sandplain to erosion is demonstrated by photographs in the report and elsewhere and by looking at tracks and firebreaks in the reserve. Slopes, such as those at Sites 56 and 64, are especially susceptible to erosion.

Any disturbance of the soil and clearing of its vegetation cover, including grading, bulldozing and surface mining increases the risk of erosion not only on the site disturbed but also downstream from it (one downstream effect is illustrated in Plate 1).

9. Bare surfaces of granite exposures are of course low fuel areas. In relation to low level fires most of the woodland areas and many of the mallee areas are also low fuel areas. In general, the most important factor contributing to fuel loading is not the depth of litter but the density and flammability of the shrub strata.

Although not included in the Department's list of project requirements, photographs of vegetation units described were also considered to be important. In addition, a bird species list that incorporates observations made during field work for this project into an existing list is included in the report. Photographs of representative vegetation units are also included in the report, as part of Appendix A.

SOURCES OF DATA

Most of the introductory and physical geography information and much of the vegetation classification presented in the report are based upon interpretation and organisation of aerial photographs, reports, maps and notes provided by Wildlife Research Centre staff, plus published (and unpublished) reports on other reserves and areas in the wheatbelt and goldfields. The flora descriptions and plant species list are based upon collections and observations made during five field trips between 6 September 1984 and 7 February 1985.

1.0 INTRODUCTION

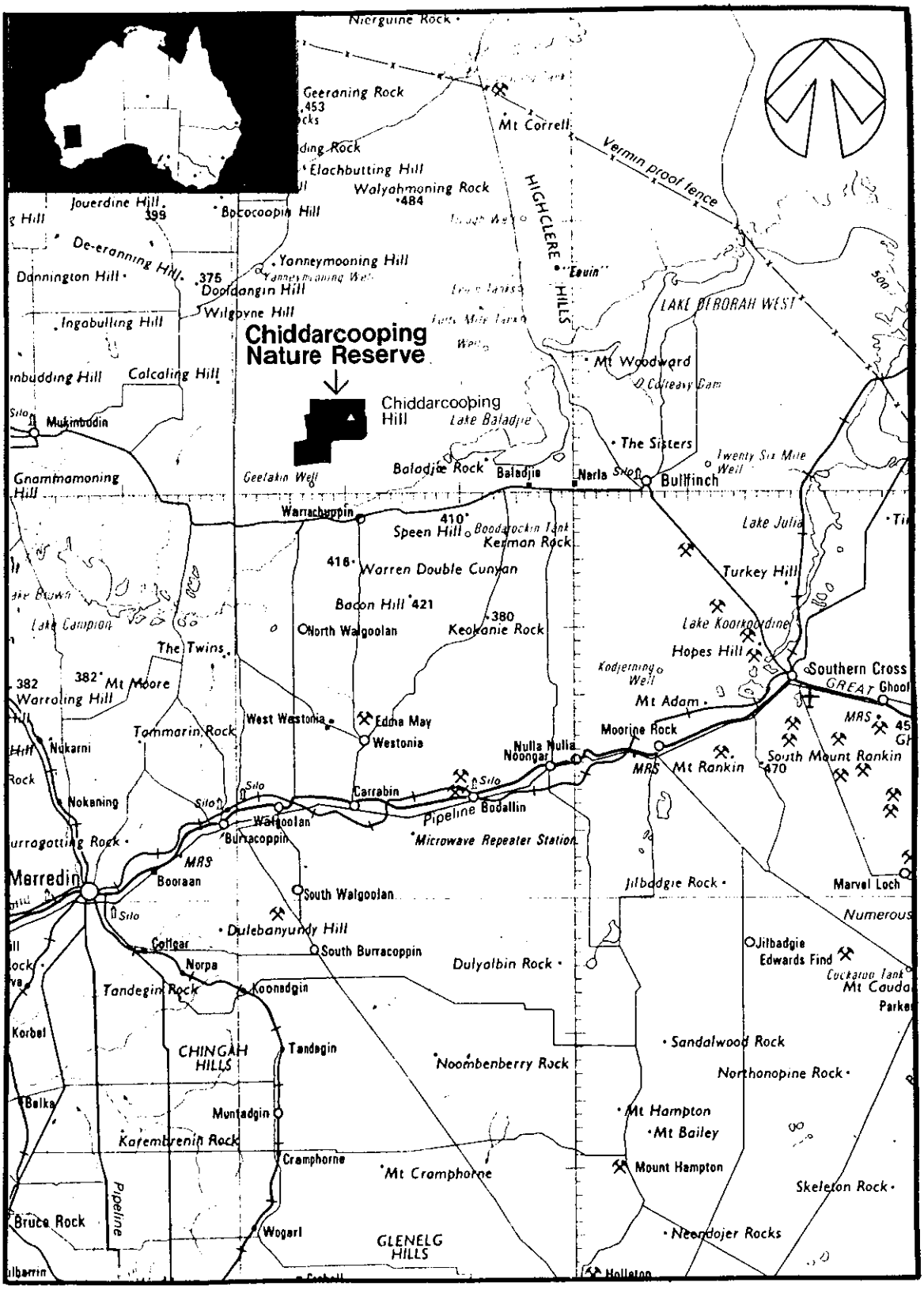
Chiddarcooping is a large nature reserve approximately 75km northeast of Merredin (Figure 1). It is in the Shire of Westonia, which lies in the eastern-central wheatbelt and has an area of 3267 km^2. The ten Nature Reserves within the Shire total 90 km^2 or approximately 2.8% of the area of the Shire. Of the land set aside for Nature Reserves over 50% is contained in the one reserve, Chiddarcooping (Reserve No. 19210), which, with an area of 5,262 ha, is one of the largest nature reserves in the wheatbelt.

Warrachuppin North Road runs along the eastern boundary of the reserve, and Warralakin North Road provides access to the reserve from the south, through a farmer's paddock. Morrison Road cuts through the northern part of the reserve and separates the 1.5 km wide section of northern elevated sandplain and eucalypt woodland north of the road from the larger, southern area of granite outcrops, gullies and alluvial valleys. This road, the irregular shape of the reserve and some of the existing firebreaks provide a basis for dividing Chiddarcooping into four or five geographical reference blocks (Figure 2) for convenience of describing locations in this report.

Chiddarcooping is part of the Moorine Rock system (Beard 1972), a vegetation system characterised by restricted remnants of large granite domes and sheet rocks. The valleys in the system have red loam soils and eucalypt woodlands. Thickets of various species of Acacia, Allocasuarina and Melaleuca predominate on the upland soils.

Chiddarcooping's granite rock areas are of particular interest because they support 26% of the known wild occurrence of Eucalyptus caesia, but the lowland valleys are also important for their eucalypt woodlands, a formation poorly conserved in most parts of the wheatbelt. Several rare species and an undescribed Acacia that has outstanding importance for the study of speciation in the genus are restricted to granite pockets, scarps, pediments and minor valleys in the reserve.

Chiddarcooping Nature Reserve is one of the most important nature reserves in the south-west of the State not only because it is relatively large and has these considerable biological values but also because the granite outcrops on which it is centred offer spectacular scenery and contain an as yet unresearched but apparently substantial set of remains of early aboriginal settlements.

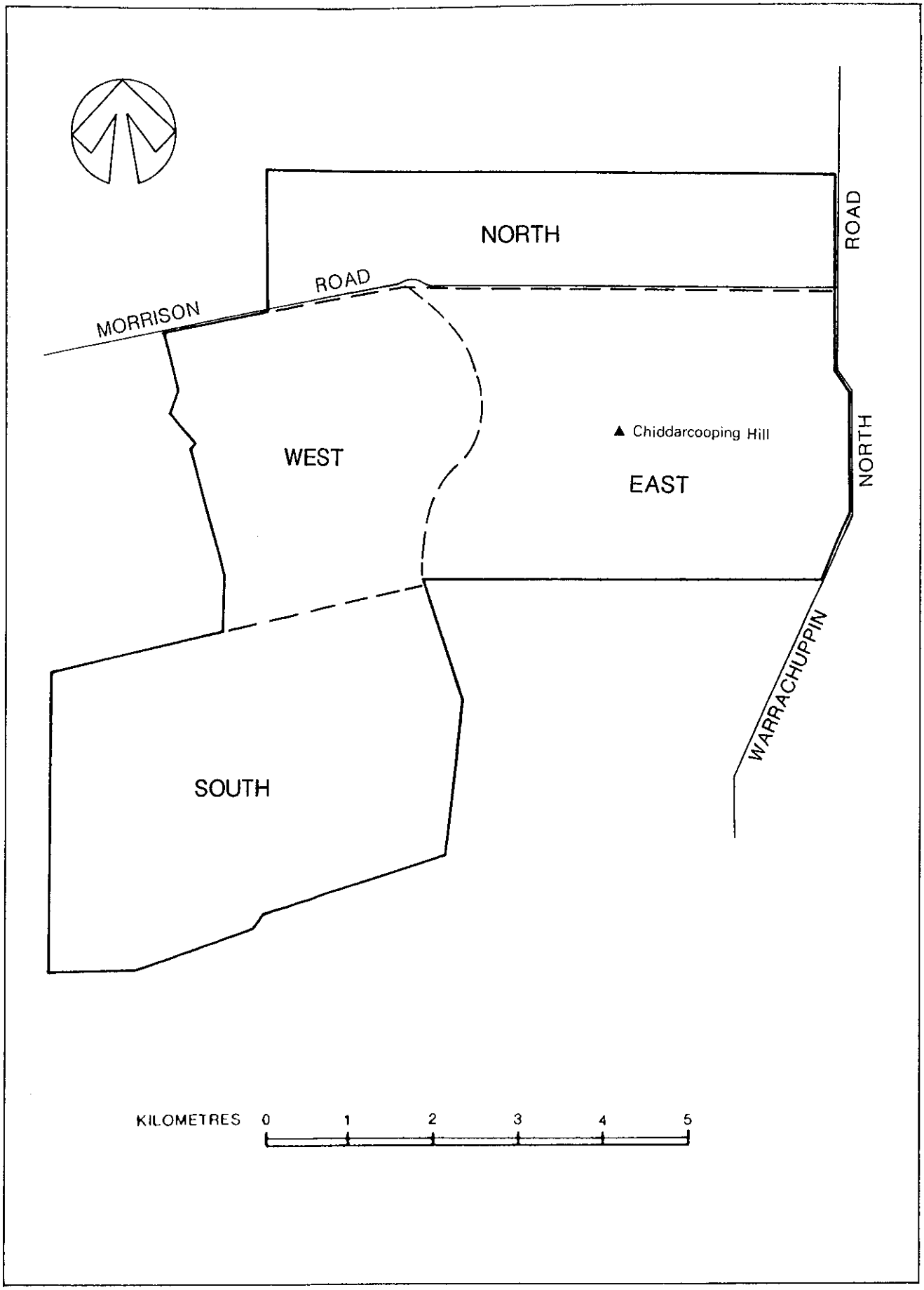


SOURCE Readers Digest Atlas of Australia, 1977.

KILOMETRES 10 5 0 10 20 30 40 50 60 70 80

Location plan

Figure 1



Geographical reference blocks

Figure 2

2.0 CLIMATE

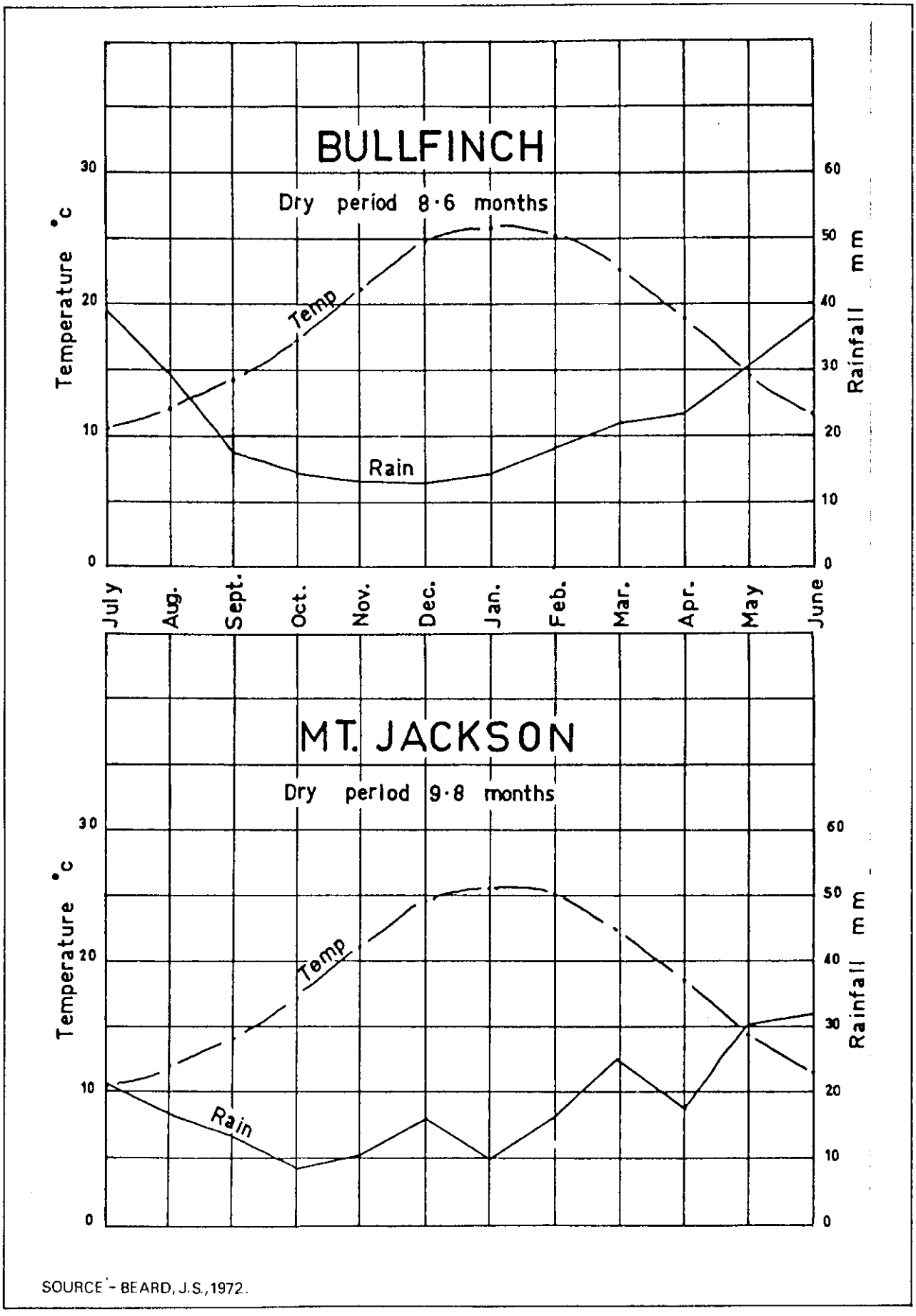
Chiddarcooping lies within the extra-dry mediterranean climatic zone near the zone's boundary with the semi-desert mediterranean climatic zone in the Bagnouls and Gaussen classification (Beard 1981a). This classification is based upon the number and seasonal distribution of months with effective rainfall as indicated in ombrothermic diagrams, which superimpose graphs of monthly temperature averages and monthly rainfall averages.

Ombrothermic diagrams for Bullfinch, a somewhat drier location approximately 40 km east-southeast of the reserve, and for Jackson are shown in Figure 3. The diagrams are reproduced from Beard (1972).

Chiddarcooping has a continental temperature pattern, with a relatively wide range of seasonal and diurnal temperatures.

Although the temperature values used in Figure 3 are for Southern Cross, not Bullfinch or Jackson, they are likely to be very close to those that would be recorded for both areas, and for Chiddarcooping, if there had been long-term recording there. Temperature graphs for the more distant locations of Kellerberrin, Coolgardie and Southern Cross are almost identical (Beard 1981, 1972). For example, the highest mean monthly temperatures for both Kellerberrin and Coolgardie lie between 33^0C and 34^0C and the lowest lie between 5^0C and 6^0C (in July). The highest temperatures for both sites are 46.5^0C and 46.1^0C; the lowest are -3.3^0C (Kellerberrin) and -1.7^0C (Coolgardie).

The average annual rainfall for Chiddarcooping is probably similar to or slightly higher than Bullfinch's 293mm. The 300mm rainfall line is, according to Beard (1972), generally considered to be the outer limit of the agricultural belt.



SOURCE - BEARD, J.S., 1972.

Ombrothermic diagrammes

Figure 3

3.0 PHYSIOGRAPHY

The predominant landscape of the area to the north and east of Chiddarcooping is gently undulating lateritic duricrust and elevated sandplain with an average height above sea level of approximately 400m (Chin and Smith 1981). In the Chiddarcooping area erosion is causing the duricrust to retreat, leaving younger, lower plains and slopes with granite monadnocks protruding above them.

The highest point in the reserve is 492m, a high point in the sandplain near Morrison Road. Approximately 10km^2 of the reserve's northwestern corner and two of the granite ridges are above the 460m contour. The bulk of the reserve ranges from 350m to 450m. Figure 4 shows the contours of the reserve at 20m intervals based on the 1984 NATMAP 1:100,000 scale Walyahmoning topographic map. It also shows creeks, all of which are intermittent.

The landforms of the reserve have been mapped at a scale of 40 chains to an inch by the Lands and Surveys Department as Classification 363 on Plan 54/80, E3 and 4. That map distinguishes granite rocks and ridges, prominent breakaways, creeks, sandy country, wells and, in some areas, dominant vegetation.

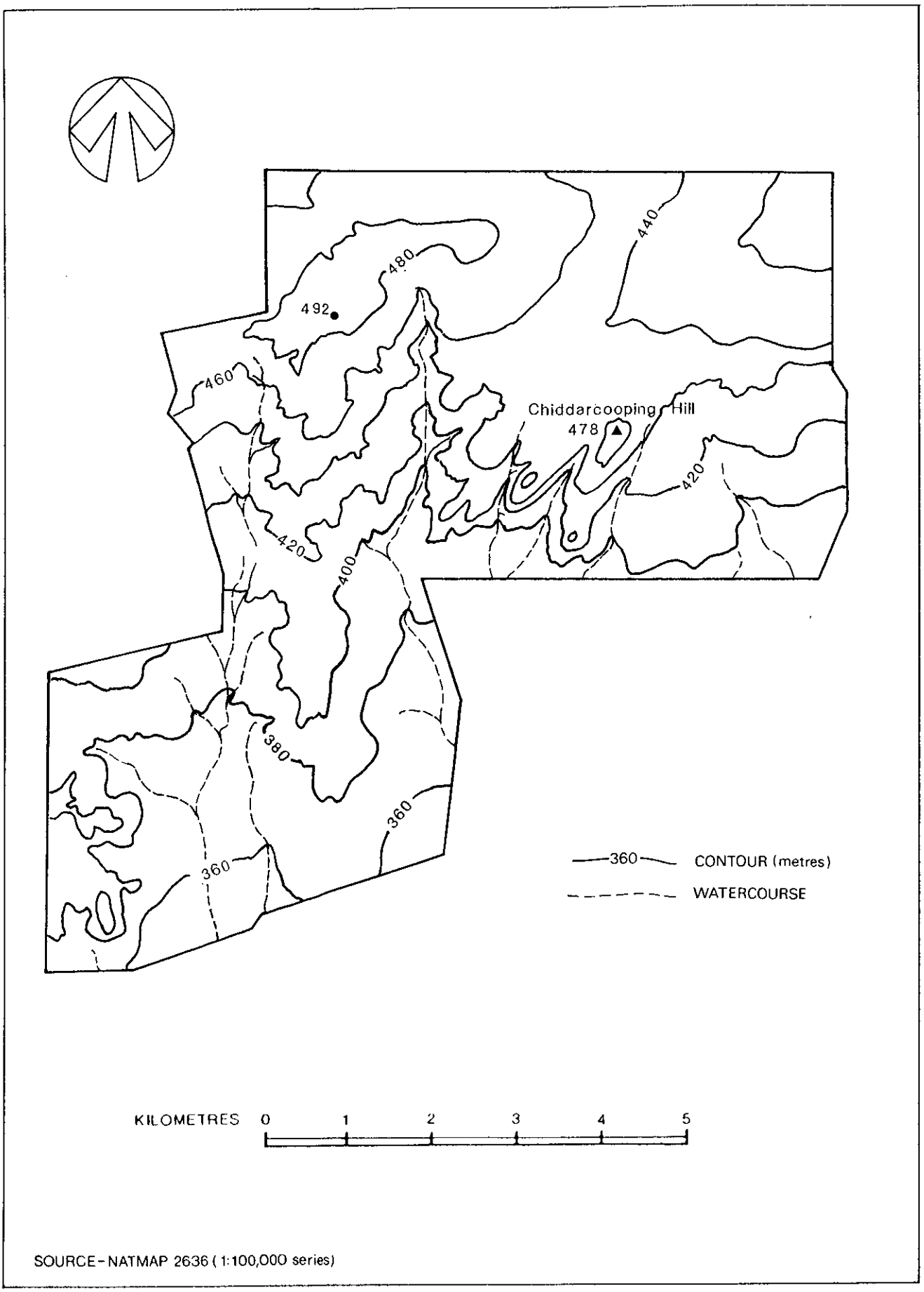
The laterite in the area is predominantly nodular and at Chiddarcooping was formed in situ by weathering of granitic rock during the higher rainfall climate of the Early Tertiary Period. The weathering profile, from a decomposed granite base to the surficial duricrust, is exposed by erosion at various sites in the reserve. One of these sites is shown in Plate 1a.

At the foot of some of the erosion scarps white to pale grey clayey material has developed from erosion of mottled-pallid zone material and provides the habitat of some rare and restricted plants. One of these habitats and one of the rare, restricted species growing on the pale grey clayey material are shown in Plate 2c.

The northwestern and central quarter of the reserve is lateritic duricrust with a mantle of yellow sand. This overlying sand is believed by Brewer and Bettenay (1972) to be derived from physical disintegration of the

laterite's mottled-pallid zone with colluvial transport over relatively short distances. A few granite outcrops appear as low islands in the duricrust, and small breakaways no more than a few metres in height are common.

Erosion of the lateritic duricrust in the southern two-thirds of the reserve is much more pronounced. Only remnants of the duricrust remain; the predominating feature is the extensive system of valleys and granite domes and ridges.



Contours and watercourses

Figure 4

4.0 GEOLOGY

The geology of Chiddarcooping is basically Archaean granitoid overlain by Tertiary laterite and remnant sandplain and by Quaternary alluvium and colluvium. It is described in more detail and mapped by Chin and Smith (1981) at a scale of 1:250,000 as part of the Jackson geology sheet. The Chiddarcooping part of the sheet has been redrawn by Wildlife Research Centre staff at a larger scale and is reproduced here as Figure 5. The Jackson sheet's reference key indicates that Chidddarcooping has the following five geological units:

Alluvium (Qa) - silt, sand and gravel in stream channels,

Colluvium (Qc) - silt, sand and gravel on slopes adjoining rock and laterite,

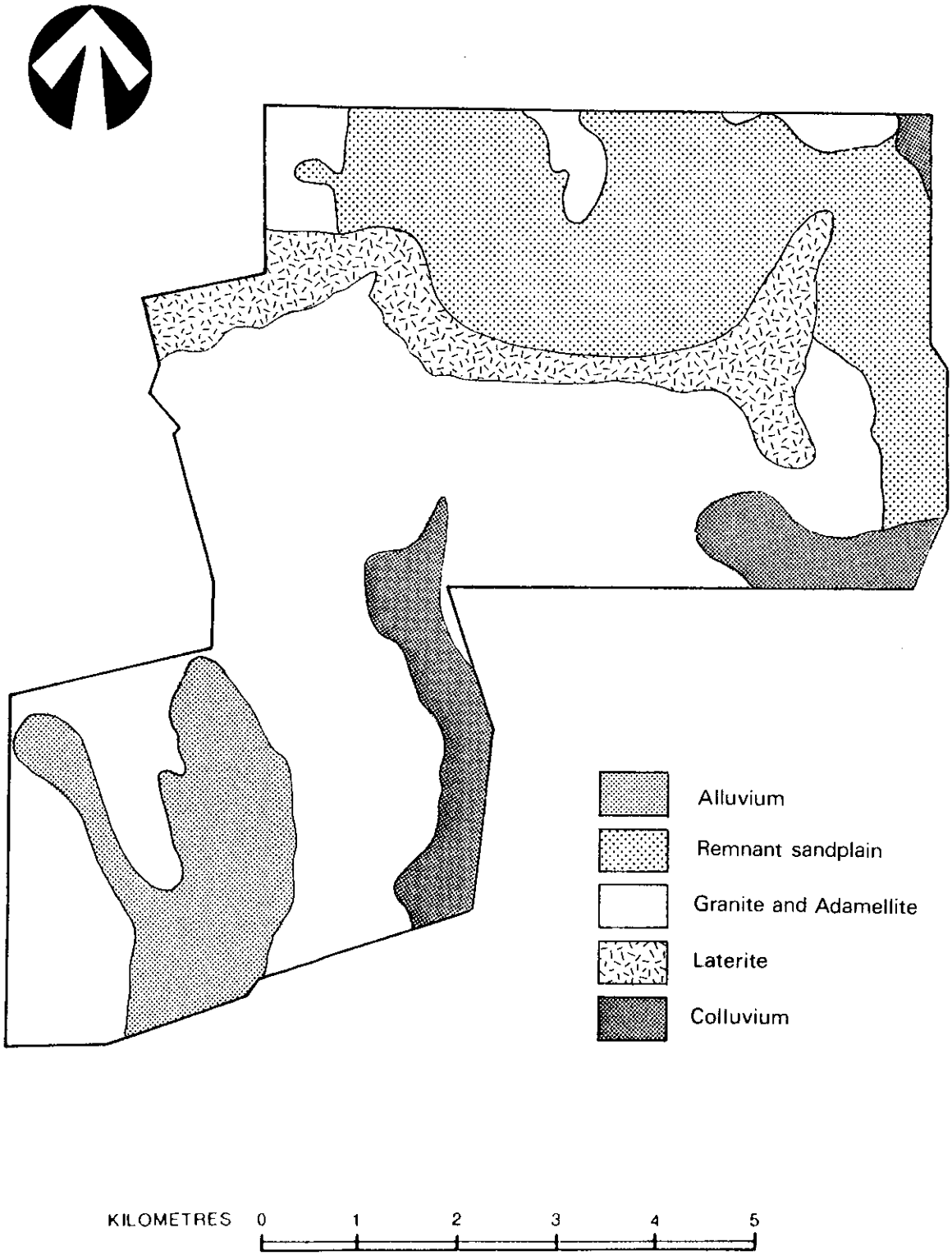
Remnant sandplain (Ts) - yellow to white sand containing locally abundant limonitic pebbles,

Laterite (Tl) - limonite-cemented duricrust overlying deeply weathered bedrock, and

Seriate Granite and Adamellite (Agv) - variably textured, medium and coarse-grained, seriate granite and adamellite; locally porphyritic.

Chin and Smith (1981) describe the granitoid rock of the Chiddarcooping area as "A large volume of medium and coarse-grained seriate granite and adamellite.....that is the most northeasterly occurrence of this granitoid, which extends throughout the Southwest Province. Textural variation is common even across a single outcrop. Although the texture is almost universally seriate, the size-range and abundance of potassic feldspar phenocrysts is highly variable. However, truly porphyritic types are rare."

Henceforth in this report, the term 'granite' is used in the generic sense to refer to both seriate granite and adamellite.



Geology

Figure 5

5.0 SOILS

The soils of the reserve are principally lithosols, gritty loamy sands, sandy loams and sands, with less extensive areas of clayey soils and decomposed granite. The soils of the area were mapped in 1978 by the Narrogin District Surveyor, R. Morland; his unpublished map is reproduced in this report as Figure 6, and the legend accompanying his map is presented here as Table 1.

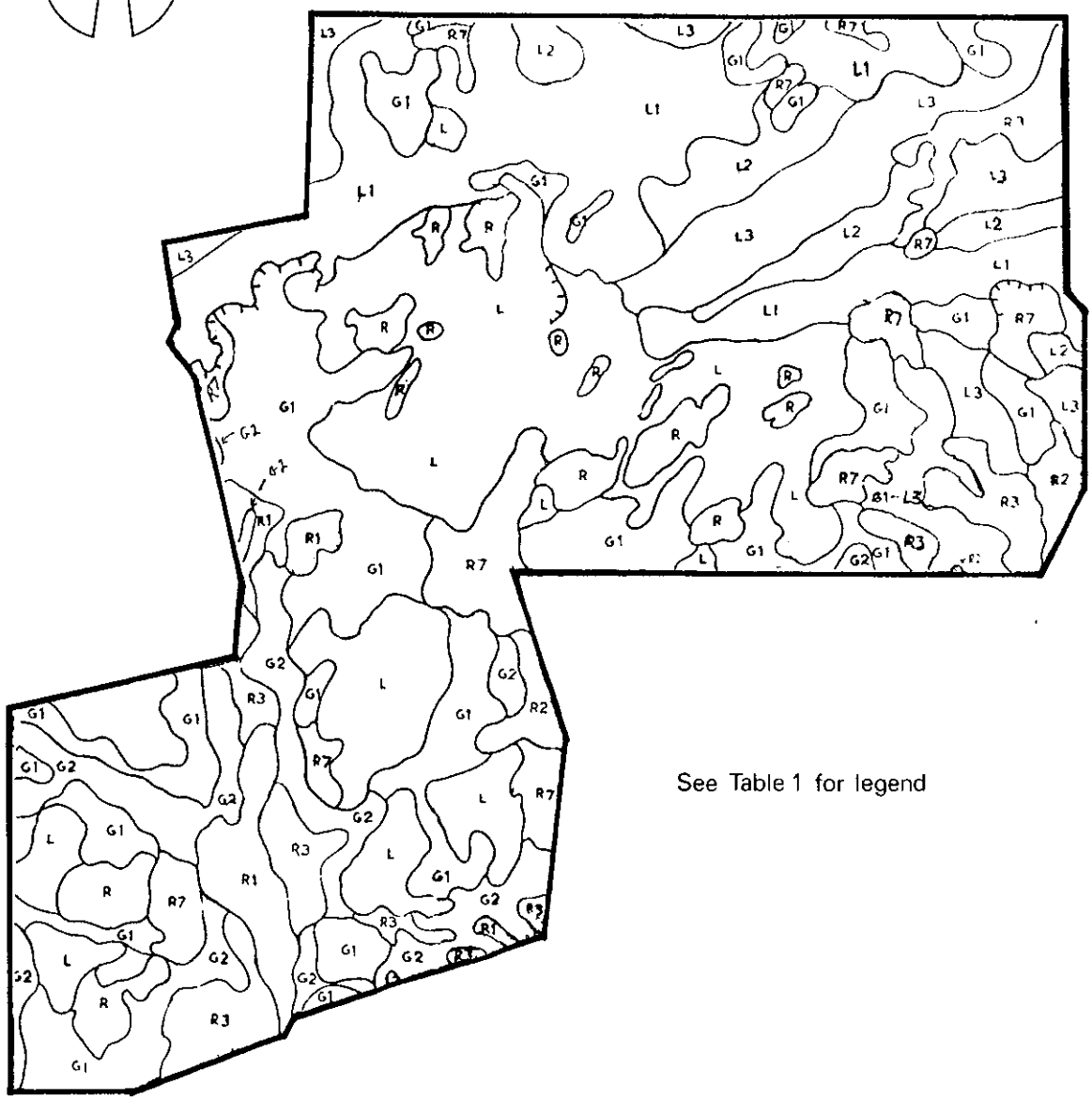
TABLE 1

CHIDDARCOOPING NATURE RESERVE
SOILS

R 1	Gritty Red. Brown Clay. Loam. +< Clay 3"
R 2	Gritty Red. Brown. Sandy Loam < Clay 12" + Decomposed Granite
R 3	Gritty Red. Brown. Sandy Loam < Clay 12"-24" Decomposed Granite 12"-24"
R7	Brown-Red Brown Clay Loam < Clay or Grit/Decomposed Granite
G 1	Gritty Yellow Brown-Brown Loamy Sand< Sandy Loam/Granite 6"-18"
G 2	Gritty Yellow-Brown Loamy Sand < Sandy Loam < Loamy Clay/ Ganite 18"+
L 1	Yellow Brown Sand < Sandy Loam on Gravel at 6"-24"
L 2	Yellow Brown Sand < Sandy Loam on Gravel at 18"-36"
L 3	Yellow Brown Sand - +36"
R	Rock outcrops
L	Lithosol

The pale gray to white clayey pediment soils on which a particularly interesting undescribed species of Acacia grows and some other soils of limited distribution were not mapped by the District Surveyor. The heavy pediment and valley soils are particularly susceptible to erosion.

Active erosion of two types of soil in two valley systems is shown in Plates 1a, 1b and 1c. The first two plates show the erosion of yellow sand from a firebreak on the elevated sandplain into the central watercourse system. Plate 1c shows the erosion of silty, clayey soils in the western system of watercourses. Other erosion is evident where tracks cross the major western watercourse and its tributaries, e.g. at Site 56.



See Table 1 for legend

KILOMETRES 0 1 2 3 4 5

SOURCE–MORLAND, 1978. (Unpublished)

Soils

Figure 6

6.0 DISTURBANCE HISTORY

The sources of information on past disturbance to the reserve are the Walyahmoning 1:100,000 topographic map, 1968 1:80,000 black and white aerial photographs, Lands and Surveys Department litho 363 (Plan 54/80E3 & 4) and field trips in 1984 and 1985. The topographic map appears to have been drawn from the 1968 aerial photographs, which seem to be the most recent available.

By 1968 all of the reserve's eastern boundary and several hundred metres of the eastern ends of the northern and southern boundaries bordered on cleared, agricultural land. Most of the South Block's eastern and western boundaries and about half of the reserve's southern boundary had also been cleared. Since then there has been additional clearing along the western and northern boundaries of the reserve, most significantly next to the northwest corner and much of it during this decade.

The only significant disturbances in the reserve in 1968 were Warrachuppin Road, a firebreak (or bulldozed boundary line) through the South Block, two wells, one in the central area and Chiddarcooping Well in the East Block, clearing near Chiddarcooping well, and a few rough tracks. Partial clearing and cutting of trees and mallees had been done in some of the woodlands; clearing patterns and stumps are still obvious near the eastern boundary of South Block. By the end of 1984 there were several other and more major disturbances in the reserve. The firebreak through South Block had overgrown, but a newer track replaced it to the east and several firebreaks additional to the perimeter system had been bulldozed into the reserve. The disturbances that are the most significant and longest-lasting are the widening and upgrading of Warrachuppin Road and the creation of Morrision Road across the centre of the remnant sandplain as a graded, gravelled major road.

Trees in the Warrachuppin Road verge immediately south of the reserve were bulldozed and burnt in November 1984, but the tree removal appears to have stopped short of the reserve.

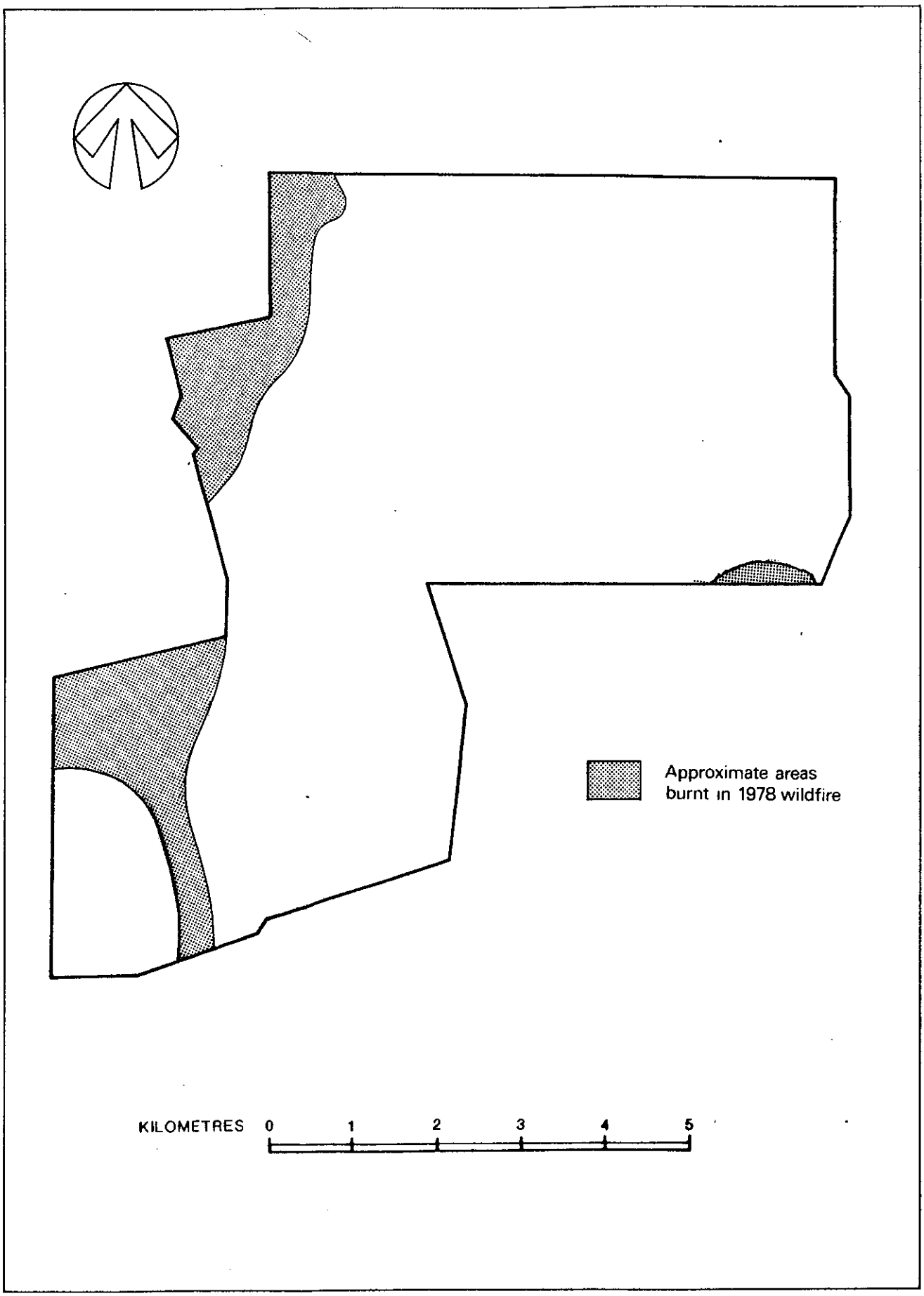
The obvious initial impact of the construction of Morrison Road on the reserve was the destruction of a wide belt of vegetation. There are, however, additional, continuing impacts less apparent to anyone driving along the road. Borrow pits off the road provided gravel for road construction, and gravel was still being taken from north of Morrison Road, illegally, as recently as early 1985. Access into the reserve made easy by the presence of Morrison Road also increases the risk of fires being started along the road. When firebreaks were put in on either side of Morrison Road two more belts of vegetation were cleared.

While it is obvious that parts of the reserve are burnt periodically it appears that fires have not been frequent or extensive.

Old burn patterns on the 1968 aerial photographs restricted to the upland remnant sandplain have been obscured by regrowth. There are no signs on the photographs of burning in the granite outcrop areas, and there are still many old-growth, never-burnt stands of Eucalyptus caesia and E. crucis, as well as a few stands of Hakea trifurcata and fire-sensitive species that are exceptional for their age and condition.

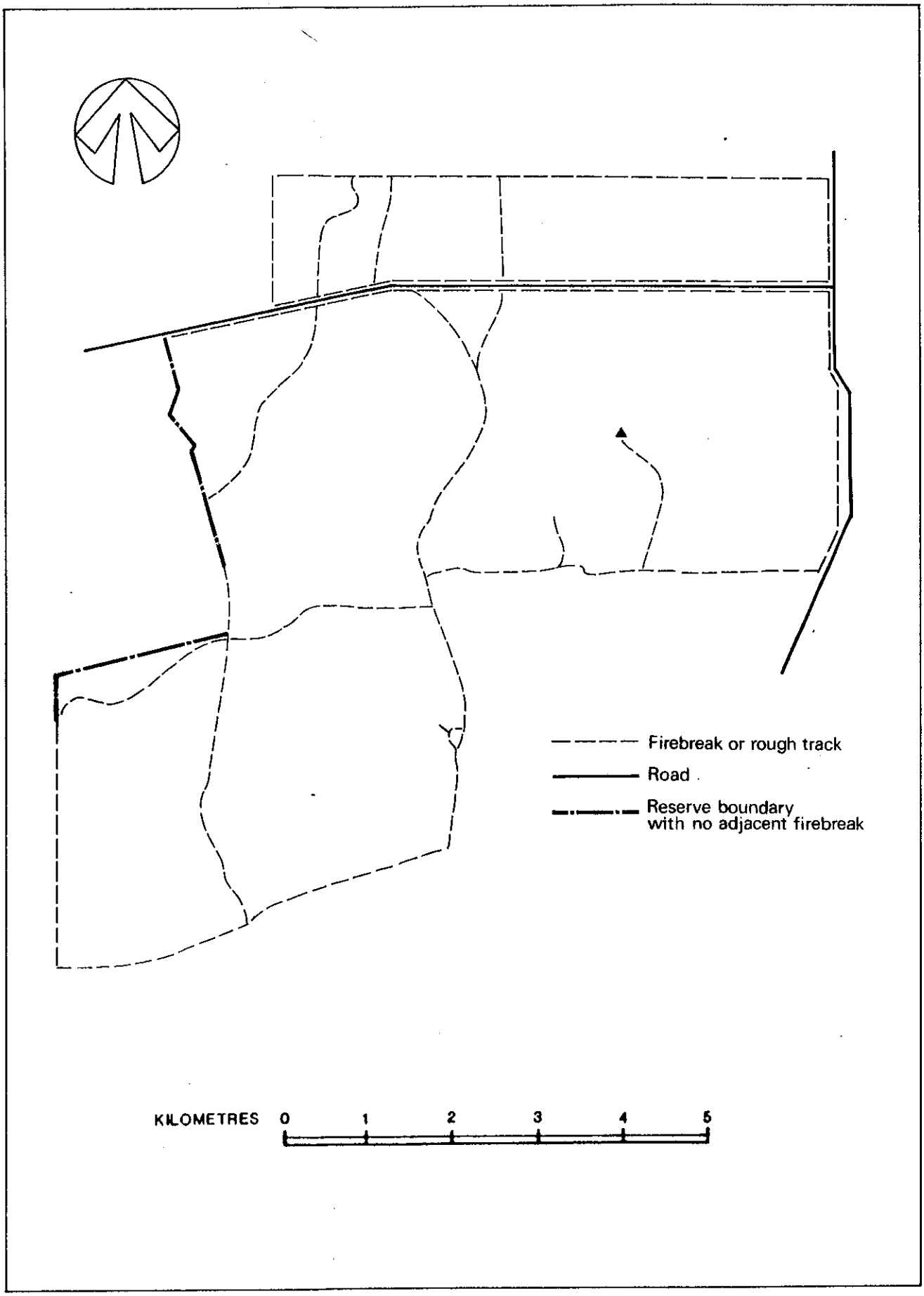
Several sections of shrubby vegetation on the western side of the reserve between the southern and northern boundary were burnt in 1978 (Moore, pers. comm.) (a few of the areas may have been burnt more recently) . The most extensive burns are on sandplains and granite blocks in the northwest corner of South Block and on either side of the west end of Morrison Road. Estimates of the areas burnt during the fires are shown in Figure 7.

Some of the 1978 burn was stopped by lack of fuel on granite outcrops but in the norhtern area it was stopped by some of the tracks and firebreaks shown in Figure 8, including ones that were cut for the specific purpose of stopping the fire.



Areas burnt

Figure 7



Firebreaks

Figure 8

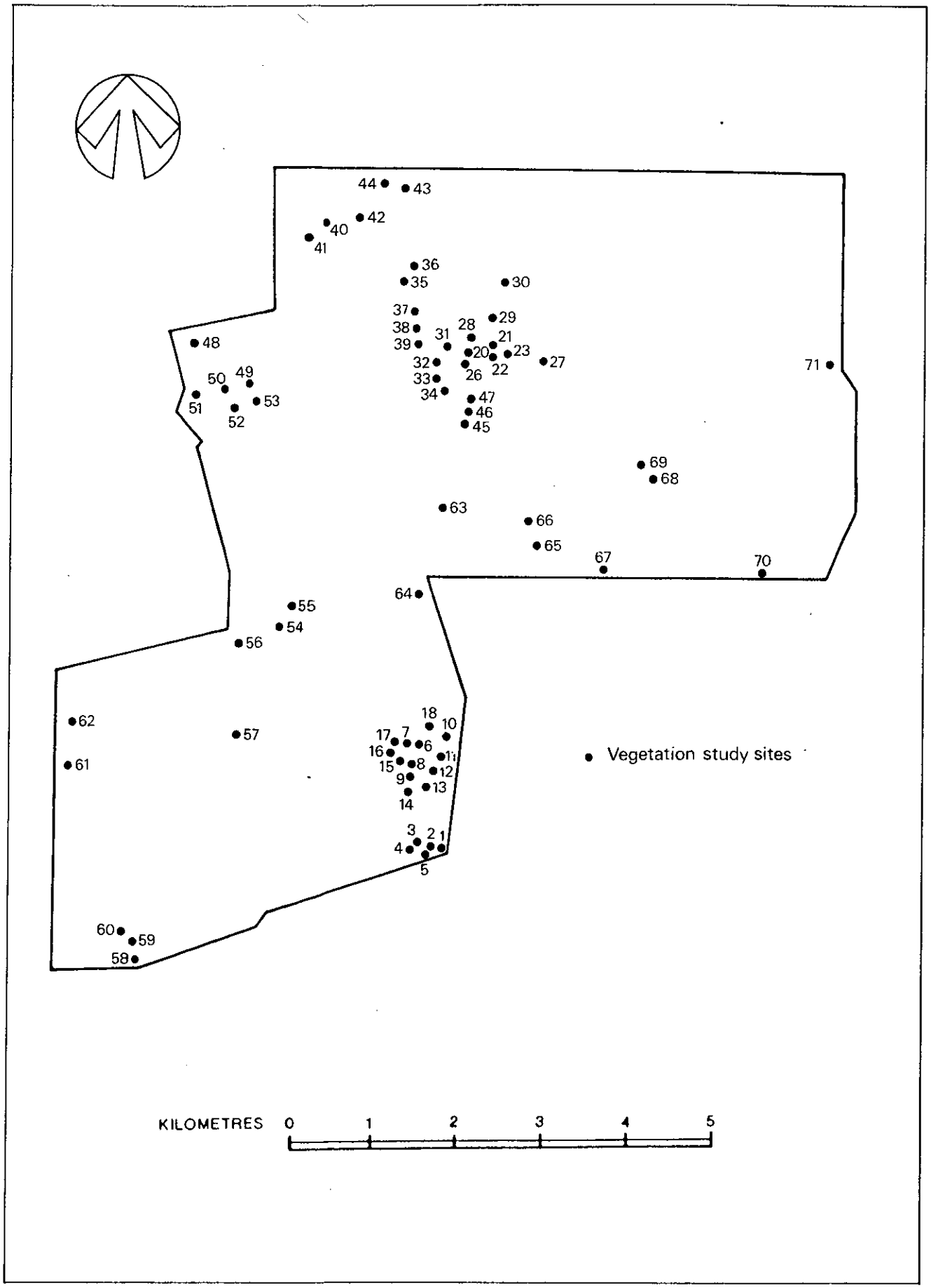
7.0 VEGETATION

The vegetation of the Chiddarcooping area has been mapped at scales of 1:3,000,000, 1:1,000,000 and 1:250,000 by Beard (1981a, 1981b, 1972). The vegetation of the nature reserve is described by Beard (1972) as belonging to the Moorine Rock System and is shown, at a scale of 1:250,000, as principally Acacia thickets on sandplains with more limited areas of salmon gum and gimlet sclerophyll woodlands and a few rock outcrops. Beard's small scale maps do not pick up the exceptional diversity and complexity of the reserve's vegetation, and there is no larger scale map or description that covers the reserve.

Ideally, for optimum accuracy, the maximum scale of a vegetation map should be no greater than half the scale of the aerial photographs from which the map is drawn (Kuchler 1967). Consequently, since the scale of the available aerial photographs covering Chiddarcooping is 1:80,000, the scale of the map drawn from them should be no more than 1:160,000, a scale not very much better than Beard's 1:250,000.

Mapping for the Chiddarcooping vegetation survey was done onto a 1:80,000 scale, black and white aerial photograph and was then transferred, with modifications, to a five times enlargement of the photograph; it was enlarged to scales of 1:75,000 and 1:16,000 but with no increase in accuracy. Mapped units were based on homogeneity of texture, tone and topography of images on the stereo pair of aerial photographs used (H50-12, Jackson, 18.3.1968, Run 8 (CAF 102), Photos 62 and 64) . The units were classified and described on the basis of field observations made along traverses over all roads and tracks and most firebreaks, made during transects walked through the bush, and made at 71 numbered sites during September, October and November 1984. The locations of the numbered sites are shown in Figure 9.

At each numbered site ('location' in Muir's terminology) the number of strata and the dominants and characteristic species of each stratum were recorded onto Vegetation Survey Pro Forma sheets, along with percent cover and height for each stratum and its dominants. Other information such as slope and aspect, litter depth and density, soil texture and colour were also noted. General descriptions were written for most sites, and species lists were compiled.



Site locations

Figure 9

Although each mapping unit is, in general, distinct, the actual vegetation covered by a unit is usually complex and heterogeneous in species and density. Furthermore, the vegetation is seldom divided into discrete stands or communities; there are zones of transition and overlap between communities.

The system used for classifying and describing Chiddarcooping's vegetation is a slight modification of the one developed by Muir (1977) and shown in Table 2.

7.1 MAJOR ASSOCIATIONS

The principal plant communities in the reserve are, in a broad sense, woodlands, mallee woodlands, mallee, tall kwongan, short kwongan and resurrection and herbaceous plant communities. Kwongan vegetation is more commonly referred to as shrubland, heathland, scrub and thicket, and resurrection plants are ferns, mosses, herbs and woody herbs or subshrubs whose foliage appears dead during the dry season but becomes green again after the rains begin. These principal communities are listed by their dominant species in Table 3 under the formations to which they belong. The site or location number for each is also given, and the site locations are numbered and shown in Figure 9. Descriptions of typical sites are summarised in Appendix 1, and plant community descriptions are summarised and discussed below.

7.1.1 FOREST AND WOODLAND FORMATIONS

Chiddarcooping's principal woodlands and forests are dominated by four species of eucalypts, a she-oak and a wattle. In many of the woodlands three of the eucalypts, E. salubris (gimlet), E. salmonophloia (salmon gum) and E. wandoo (wandoo), share dominance or replace each other as dominants in parts of the relatively extensive stands in which they occur. Allocasuarina huegeliana (she-oak) and Acacia lasiocalyx (wattle) also commonly share dominance in the more limited low forests that they form. The fourth eucalypt, E. transcontinentalis, and its woodlands are very poorly represented in the reserve; E. transcontinentalis woodland is restricted to only one or two small stands, surrounded by elevated sandplain north of Morrison Road or near the east end of North Block.

TABLE 2 VEGETATION CLASSIFICATION TO BE USED IN WHEATBELT SURVEY

LIFE FORM/HEIGHT CLASS	CANOPY COVER			
	DENSE 70-100% d	MID-DENSE 30-70% c	SPARSE 10-30% i	VERY SPARSE 2-10% r
T Trees >30m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
M Trees 15-30m	Dense Forest	Forest	Woodland	Open Woodland
LA Trees 5-15m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
LB Trees <5m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
KT Mallee tree form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
KS Mallee shrub form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
S Shrubs >2m	Dense Thicket	Thicket	Scrub	Open Scrub
SA Shrubs 1.5-2.0m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
SB Shrubs 1 0-1.5m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
SC Shrubs 0.5-1.0m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
SD Shrubs 0.0-0.5m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
P Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
H Hummock Grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
GT Bunch grass >0.5m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
GL Bunch grass <0.5m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
J Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
VT Sedges >0.5m	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
VL Sedges <0.5m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
X Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverwort	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

SOURCE Muir, B.G. 1977

Typically, the eucalypt woodlands in the reserve are long unburnt and have open understoreys, with poorly developed or patchy shrub strata. Eucalyptus salubris and E. salmonophloia woodlands occupy valleys and flats or depressions below escarpments, on soils that have high proportions of clay either on the surface or a few centimetres below it. Eucalyptus wandoo woodlands are more widespread and, though best-developed in valleys, tend to occur on shallow, lateritic soils at the top of scarps and on heavy, pediment soils below them. In general, all of these woodlands are naturally low fuel areas.

Allocasuarina huegeliana low forests and low woodlands are common on granite outcrops and on the shallow, gritty sandy loamy soils on granite sheets below the outcrops. The less common and generally somewhat shorter Acacia lasiocalyx often occurs as a codominant or subdominant with the Allocasuarina in narrow fringes at the bases of granite outcrops. Because there tend to be deep leaf and branchlet litter layers beneath stands of these species, along with many dead branches and fallen trunks in some stands, these low forests have moderately high fuel levels.

A typical woodland of the Eucalyptus salubris-E. salmonophloia type, such as the one at Site 5, is 6-8(-12)m tall and has a canopy cover in the lower part of the 30-70% range. There is no understorey layer well enough developed to be considered a stratum, but several legumes and chenopods are characteristic understorey species, along with Eremophila oppositifolia and Olearia muelleri. They include Daviesia nematophylla, Cassia nemophylla, Acacia prainii, A. erinacea, Maireana carnosa, M. marginata, M. trichoptera, M. georgei, Eriochiton sclerolaenoides and Sclerolaena diacantha.

The Eucalyptus wandoo woodland at Site 20 is a type typical of those occurring on the shallow, silty-clay soil and laterite duricrust on the tops of scarps (Plate 1d). The trees are 6-10m tall and provide 30-50% canopy cover. The cover values are highest for the younger, pole trees at the scarp's edge and lower for the mature trees a few metres from the edge. The understorey is discontinuous and variable but mostly open and not constituting strata. Neighbouring shrub and kwongan communities that overlap with the woodland contribute significantly to the composition of the understorey. The tallest understorey species, Allocasuarina acutivalvis and Callitris sp., reach heights of 3m, but all other understorey

plants are under 1.5m. These include Oxylobium parviflorum, Eremophila aff. drummondii, Dodonaea caespitosa, the widespread Astroloma serratifolium, Acacia andrewsii, Hibbertia exasperata and a few, scattered grasses. There is up to 60% cover of 1-4cm deep litter of leaves and twigs under the older trees.

Sites 24 and 25 wandoo woodland, on shallow, lighter soils about 50m east of the scarp, has distinct strata that are essentially neighbouring stands of shrubland that extend into the woodland. The dominant shrubs are Allocasuarina campestris, A. acutivalvis, Hakea francisciana and Hakea invaginata, all of them up to 3m tall.

The wandoo woodland at Sites 49 and 50 is on a pediment and upper valley below the western scarp. It has no continuous, consistent understorey strata but encompasses several small communities of shrubs. Three of the shrub species, Melaleuca aff. cuticularis, Acacia ixiophylla and Acacia sp. nov. aff. ixiophylla, are restricted to the white kaolinite soils at the bases of the scarp and, in the case of the Acacia sp. nov., to clayey soils nearby. The two acacias were found only in Site 49 and nearby. Eucalyptus eremophila is a common mallee associate of the wandoo and Melaleuca at other sites at the bases of scarps. Other species in the wandoo woodland at Sites 49 and 50 include Acacia densiflora, Daviesia nematophylla, Dodonaea inaequifolia, Atriplex nummularia, Disphyma crassifolia and Helipterum aff. tenellum.

Eucalyptus transcontinentalis woodland is, at 18m tall, the tallest woodland in the reserve, and one of the rarest. The only location in the reserve at which a stand of the woodland is definitely known to occur is north of Morrison Road and Site 30 along the north-south firebreak. In that stand, shown in Plate 1e, there is a tree stratum with 30-40% cover and a patchy Stratum 2 layer of Allocasuarina acutivalvis, Melaleuca uncinata and other shrubs that are continuous with the shrubland that borders the stand. Soils in the stand are sandy-loam and leaf litter is around 40% and up to 4cm deep under some trees.

The Allocasuarina huegeliana woodland at Site 6 is typical of the association on granite rock. The she-oaks are 4-5m tall and provide 40-50% cover, and 4m tall Acacia lasiocalyx, at the edge of soil pockets, provides 10% cover. Thickets of 2-3m tall Leptospermum roei and Acacia tetragonophylla provide up to 40% cover in a discontinuous Stratum 2. A Stratum 3 layer of 0.8-1.5m tall Boronia coerulescens and Dodonaea rigida and other species provide less than 20% cover.
Several species of herbaceous plant are common on the floor of the woodland.

The Site 63 Allocasuarina huegeliana stand on decomposing granite soils at the base of a granite outcrop is a low forest of mature tree 6-8m tall with around 70% canopy cover. The cover of the younger trees at Site 18 exceeds 70% and the decaying stand at Chiddarcooping Well has a much lower cover. There are no defined understorey strata in any of these stands, although Leptospermum roei and Acacia lasiocalyx provide more than 80% canopy cover around the stands' margins. Lomandra collina is an occasional, characteristic tussock plant in all of the stands, and Xanthorrhoea nana occurs in some of them.

7.1.2 MALLEES

Chiddarcooping's mallee communities occur on loamy-clay soils similar to those on which the eucalypt woodlands grow, and they frequently overlap with the woodlands. The mallee communities also frequently overlap with each other and often two or three species share dominance. The dominat mallees on clayey soils comprise E. loxophleba, E. sheathiana, E. redunca, E. eremophila, and E. erythronema. Representative stands of communities of the first three species are at Sites 53, 52 and 31.

Sites 52 and 53 adjoin each other and merge into Site 50 wandoo woodland. At Site 52 the dominant mallee, E. sheathiana, is 6m tall and provides 40% cover. Two other mallees, E. celastroides and E. yilgarnensis, are between 4m and 6m tall and provide 20% cover. Litter comprises many stems and a few leaves which cover about 50% of the ground to a depth of less than 3cm. The understorey is very open and unstratified. Daviesia nematophylla and Acacia erinacea are the most common shrubs, and Frankenia pauciflora is a common, low subshrub. Exocarpus aphylla, Stipa elegantissima and several chenopods are conspicuous but not common. The Site 53 mallee is denser than the Site 52 E. sheathiana mallee and merges with it. Five to six metre tall E. redunca and E. loxophleba mallees share dominance at Site 53, and, as at Site 52, E. celastroides is less abundant and is only about 4m tall. There is scarcely any understorey at Site 53.

Eucalyptus redunca is the dominant mallee at Site 31, where it is 4-5m tall and provides 30% cover. It is growing on a dense, grey, clay soil littered with many dead shrubs and branches. Melaleuca uncinata (terete) 2-3m tall produces a 30% cover in Stratum 2. Acacia erinacea 1m tall does the same in Stratum 3. Species of Crassula and other small annual herbs make up the ground layer.

Eucalyptus leptophylla mallee at Site 10 is a 6m tall stand with around 50% cover. The very open understorey has scattered low plants of Eremophila glabra, Dodonaea bursariifolia, Olearia revoluta, and Lomandra collina, and colonies of alien herbs on mounds of rabbit dung. The soil in the stand is gritty with partly decomposed granite. There is little litter except dropped branches and bark under the mallee and small patches of leaves where they have been blown together.

Eucalyptus eremophila generally occurs as an associate of wandoo, most commonly on pediment clay soils below scarps, seldom as a community dominant.

North and west of Site 61 Eucalyptus erythronema is the dominant, 7m tall tree or mallee, with a cover of 30-50%. It also occurs in the same stand as a 3-4m tall mallee with many thin stems per plant. The taller, presumably more mature plants have fewer, thicker stems. This species merges with what may be the largest stand of Eucalyptus stowardii in the reserve. Both of these stands have stratum-less, open understoreys. Eucalyptus stowardii also occurs at Site 28 and several other minor valleys or depressions in the reserve, as very small, often very dense stands. The dense stands have virtually no understorey; the open stands have understoreys that are continuous with the neighbouring vegetation. None of these stands are large enough to map.

Three other mallees that occur as dominants are also in stands too small to map, either on granite or close to it, usually on coarse-grained soils rich in organic matter or humus. These species are E. petraea, E. crucis and E. caesia. All three, but particularly the last two, are dominants of communities that are small but rich in species. Representative stands dominated by these species are at Sites 13, 8 and 38 respectively.

7.1.3 SHRUBLANDS AND HEATHLANDS

The most widespread vegetation formation in the reserve is shrubland, and almost all of the shrublands are dominated by species of Allocasuarina, Acacia and Melaleuca. Indeed, one species, Melaleuca uncinata sens. lat., is, in one or the other of its five or six forms, almost ubiquitous in the reserve. Although the types of shrublands appear uniform on the aerial photographs, they are, in fact, very diverse and variable. The most extensive shrublands, on the elevated sandplain, are dominated by Allocasuarina acutivalvis, Melaleuca uncinata and Acacia stereophylla,

with associates that vary both within and between stands. The heavier soils of the lower plains have superficially similar shrublands that are most commonly dominated by a flat-leafed form of Melaleuca uncinata, Allocasuarina campestris, Acacia acuminata, Acacia resinomarginea and often other species of Acacia and Melaleuca. The less extensive shrublands of the granite outcrops also comprise large numbers of species and encompass a great deal of variety. The most common dominant shrubs on granite outcrops are Allocasuarina campestris, Leptospermum roei and species of Baeckea and Malleostemon.

The Site 29 and Site 30 communities are typical of much of the heath and shrub vegetation of the elevated sandplains. The principal dominant species, Allocasuarina acutivalvis and Acacia stereophylla, are 2.5-3m tall and provide over 50% cover. Hakea pycnoneura, Melaleuca aff. uncinata and other species provide an additional 30-40% cover. Stratum 2 vegetation is 1-1.5m tall and has a 60% cover provided by Baeckea elderiana, Micromyrtus racemosa and Acacia neurophylla. There is virtually no ground layer, but other species in the stand include Hakea francisciana, Acacia aff. jutsonii, Micromyrtus obovata and species of Persoonia. Eucalyptus aldfieldii is an emergent at Site 30. The litter layer at Site 29 is thin but uniform; it is 2(-4)cm deep and covers about 90% of the ground. In other locations on the elevated sandplain Allocasuarina campestris replaces A. acutivalvis as a dominant, and E. leptopoda occurs as a 3-4m tall emergent. It also occurs as an emergent in the lowland kwongan along the southern boundary of East Block.

The shrub communities on yellow sand are particularly rich in species of Myrtaceae and Proteaceae and contain a number of species that have been found in only a few places in the reserve. Acacia steedmannii and A. signata are two such species that have been recorde only along the mid-eastern boundary and west of the northeast corner. Calytrix plumulosa has been found in two other places in the North Block. There are many other examples.

Where the mature elevated sandplain kwongan has been disturbed or removed by fire or grading, as in the northwest corner of West Block and along firebreaks, there are characteristic lower shrubs, subshrubs and herbaceous plants that are rare in mature kwongan. The taller species include Acacia anfractuosa, Grevillea aff. eriostachya and G. pterosperma. Smaller plants include Baeckea grandibracteata, Grevillea cf. biformis and several species of Dampiera and other members of Goodeniaceae.

Site 1, in the southeast corner of South Block, is as representative of lowland tall kwongan vegetation as any site. The kwongan at this site is a 2-3(-4)m tall thicket dominated by Melaleuca uncinata (flat), M. acuminata, M. eleuterostachya, Acacia acuminata and A. resinomarginea. Eucalyptus loxophleba is present as an emergent. There is no well-defined Stratum 2 except for an evanescent ground cover of around 50 species ofsmall herbs, mostly composites, that are under thickets and between them. The soil on which the kwongan is growing is gritty, reddish-yellowish brown loamy sand. Litter is sparse, about 20% cover of fallen branches and a few leaves.

The Site 1 community merges with other tall kwongan stands of M. hamulosa, M.? viminea, M. lateriflora, M. radula and Allocasuarina campestris. Allocasuarina acutivalvis occurs less commonly as a dominant than A. campestris. Melaleuca globerima and Hakea invaginata are dominants in tall shrublands lining at least one major creek.

7.1.4 GRANITE OUTCROP VEGETATION

Granite outcrop communities can be classified as low forests, low woodlands, tall shrublands and heaths, low shrublands and heaths, meadows, mats and pools, all largely restricted to the outcrops and too small and patchy in distribution to map seperately. Some of the eucalypt-dominated communities that also occur off of the granite have been described above.

Meadow and mat communities merge and differ largely in that the latter have Borya prominent among the smaller herbs and mosses and have emergent small shrubs. Sites 9 and 34 have typical mat and meadow communities, with Borya sp., Drosera subhirtella, Goodenia sp., Stackhousia monogyna, Drosera bulbosa and numerous species of minute crassulas, composites and centrolepidaceous plants.

Another community in the reserve that is restricted to granite outcrops is a suite of less than a dozen species of very small plants which are found on shallow, organic rich soils at the bottom of temporary, shallow pools on granite exposures. The suite of species comprises two species of Glossostigma, an Isoetes, a Centrolepis, at least one Crassula, all of which appear to be restricted to this habitat, and a few other, more wide-ranging species.

Shrub-dominated vegetation on granite outcrops covers a wide range of both height and density, with dominants most commonly being members of Acacia and the myrtaceous genera Baeckea, Melaleuca and Calothamnus. The ridge community at Site 46 is dominated by Melaleuca radula but also has a Grevillea and an unidentified, uncommon Eremophila of about the same height, 2.5m.

Site 46 and a large proportion of the mats, meadows and open, shrubby communities on granite outcrops show abundant signs of rabbits.

7.2 RARE, RESTRICTED AND OTHERWISE SIGNIFICANT COMMUNITIES

Rare, restricted and otherwise significant communities are of three basic types:

Communities that have dominants or forms that are unusual,

Communities that contain non-dominant species that are rare or restricted, and

Communities that are in a condition that is unusual.

The first type is represented in the reserve by the Eucalyptus erythronema, E. stowardii, E. petraea and E. caesia communites described above.

It is also represented by the Calycopeplus ephedroides shrub-dominated community at Site 60 that appears to be restricted in the reserve to the granite outcrop in the southwest corner. A form of Acacia chrysella is also found in the reserve only in this community and nearby, while Diplolaena microcephala is more common in the Site 60 community than elsewhere in the reserve.

There are several examples of the second type of unusual community in the reserve. Essentially any community that contains any of the species listed in Table 4 fits this category. The most significant Type 2 community, however, is at Site 56, the only place in the reserve where Eremophila viscida was found. The community is exceptionally heterogeneous in form, with no well-defined strata or dominants. The community is also exceptionally rich in species of perennial plants, possibly more so than any other site in the reserve; over fifty species were tallied at the site.

The wandoo woodland at Sites 49 and 50 described in the previous section is another outstanding Type 2 community because it is the habitat of the rare, significant, undescribed wattle, Acacia aff. ixiophylla.

Site 58, also in the southwest corner of the reserve, is an example of both the first type and second type of significant community. It is a meadow and scrub or open scrub dominated by Melaleuca viminea, a species not found elsewhere in the reserve. The meadow is the habitat of a rare form of the donkey orchid Diuris laxiflora.

Site 59, a Eucalyptus crucis community in the southwest corner between Site 58 and Site 60, has a population of Hakea trifurcata that is an example of the third type of significant community. Although Hakea trifurcata populations are widespread in the southwest corner of Australia, 2m to 3m tall, mature, unburnt stands like the one at Site 59 are rare.

7.3 VEGETATION MAP

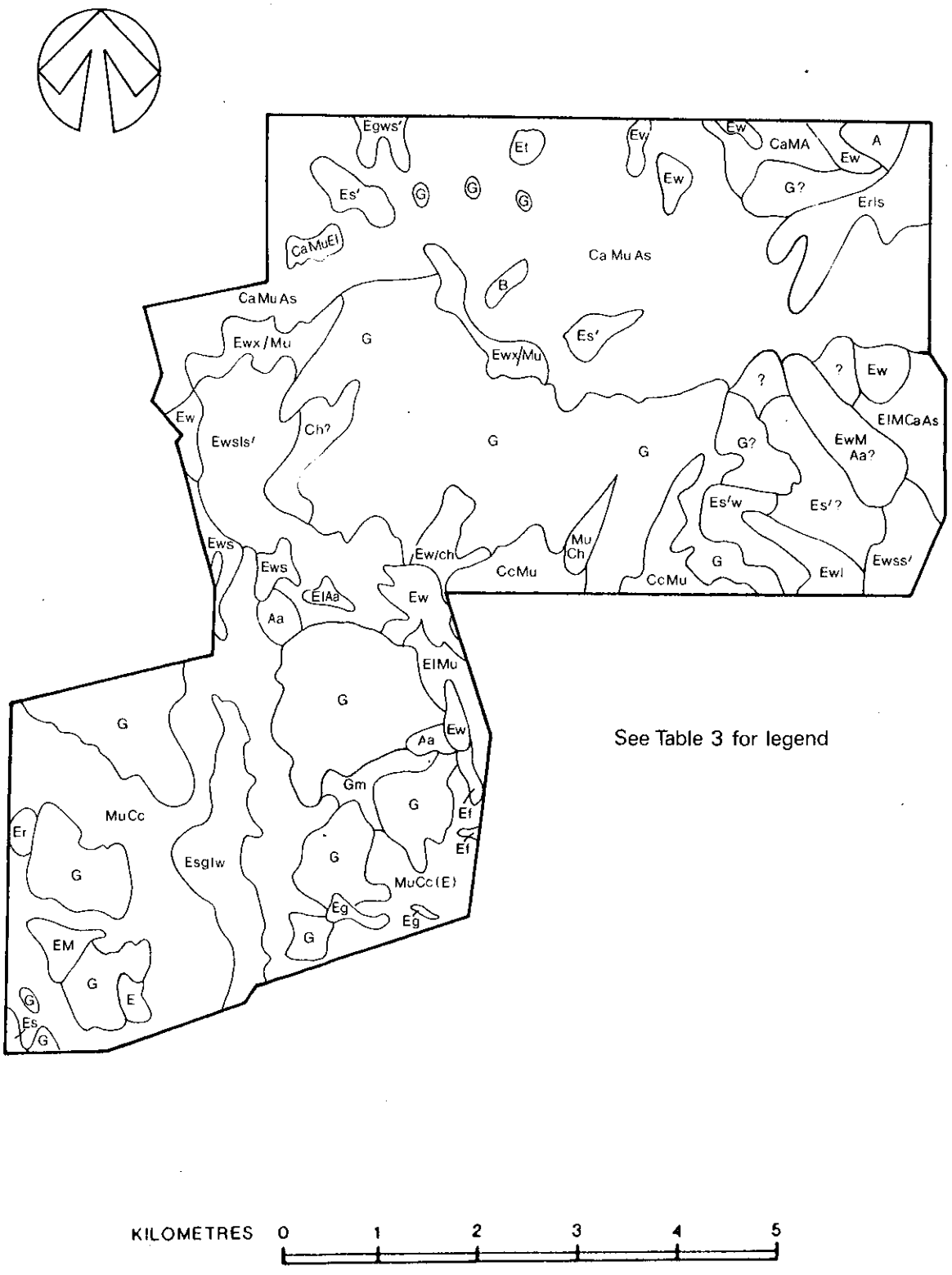
A vegetation map of the reserve drawn at a scale of 1:80,000 and enlarged to 1:75,000 is presented in Figure 10. The symbols used on the map to designate vegetation units are based on the system used on larger scale maps of vegetation of Tutanning Nature Reserve and Boyagin Nature Reserve. The basic symbols are defined in Table 3 and are combined in various ways to indicate codominance in the units.

TABLE 3

PRINCIPAL VEGETATION UNITS, CHIDDARCOOPING NATURE RESERVE

Formation Map Symbol	Dominant Species	Site
FORESTS AND WOODLANDS		
E	Eucalyptus species (various)	30
Eg	E. salubris (gimlet)	3, 5, 44
Es	E. salmonophloia	
Et	E. transcontinentalis	
Ew	E. wandoo	20,24,25,43,49, 50,64
Al	Acacia lasiocalyx (unmapped)	6
Ch	Allocasuarina huegeliana	6,7,16,33,54,65
Cg	Callitris ? columellaris (unmapp.)	42
MALLEES (sometimes with mixed dominants, e.g. Ers`)		
Ec	E. crucis	8, 59
Ee	E. erythronema (unmapped)	near 61
Ef	E. leptophylla	10
El	E. loxophleba	53,70,57
Ep	E. petraea	13,37
Er	E. redunca	31,61,40,70,53
Es`	E. sheathiana	27,40,52
Ez	E. stowardii (unmapped)	28
SHRUBLANDS AND HEATHLANDS (often with mixed dominants)		
A	Acacia species (various)	48
Aa	A. acuminata	19,55
As	A. stereophylla	22,29,30,36
Bc	Baeckea crispiflora (unmapped)	21,23
Ca	Allocasuarina acutivalvis	2,41,51
Cc	Allocasuarina campestris	62,69B,C,D
M	Melaleuca species (various)	4,11,46,58
Mu	Melaleuca uncinata	1,68,26,69A,68,56A
GRANITE ROCK COMMUNITIES (these & others occur on outcrops as small, unmappable enclaves or mosaics) ('G' refers to all surfaces & stands)		
	Eucalyptus caesia	38,39,66
	Mats & Meadows	9,14,16,32,34,47
	Pools	15,17
	Mixed & Miscellaneous	45,60
OTHERS		41,56,64,67,71

x=mixed; ( )=occasional; /=mosaic; ?=unknown or uncertain



KILOMETRES 0 1 2 3 4 5

Vegetation

Figure 10

PLATE 1

a. Wandoo woodland at head of gully below Morrison Road, with eroding pediment and breakaway capped by lateritic duricrust in background and sand-filled watercourse in foreground. The sand in the watercourse originates in the firebreak parallel to Morrison Road on the road's north side and washes across Morrison Road at Site 35 and into the creek.

b. Deep deposit of sand at Site 35 which has been washed down from the firebreak shown in the background.

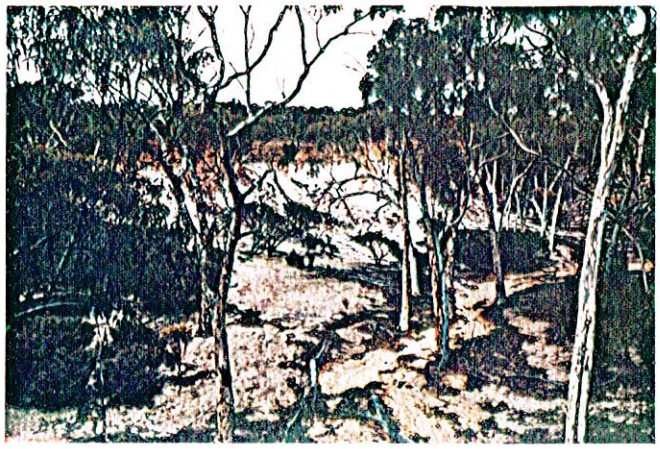
c. Deeply eroding major stream channel approximately 100m east of population of *Acacia* sp. nov. aff. *ixiophylla* near Site 49.

d. Wandoo woodland on duricrust at top of breakaway at Site 20. A Striated Pardalote is nesting in a hollow in the large branch in the top centre of the photograph.

e. Redwood (*Eucalyptus transcontinentalis*) woodland north of Morrison Road and Site 30, a small stand and the only one seen in the reserve.

f. Boulders and flowering wattles near Site 8 on one of the many granite outcrops in the reserve.

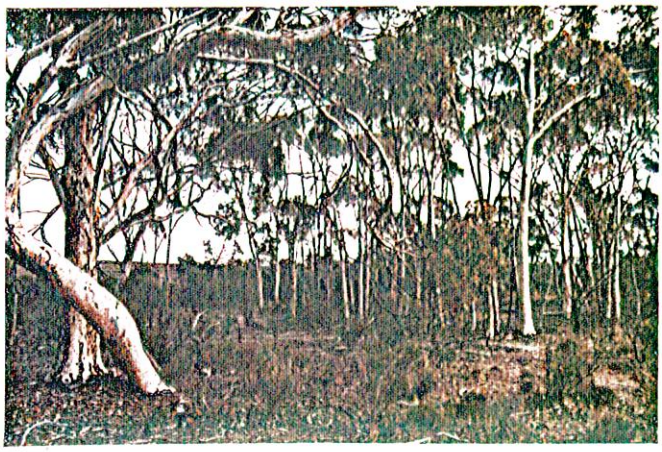
g. A large kurrajong tree (*Brachychiton gregorii*) near Site 63, one of the few in the reserve and the largest.



a

b

c



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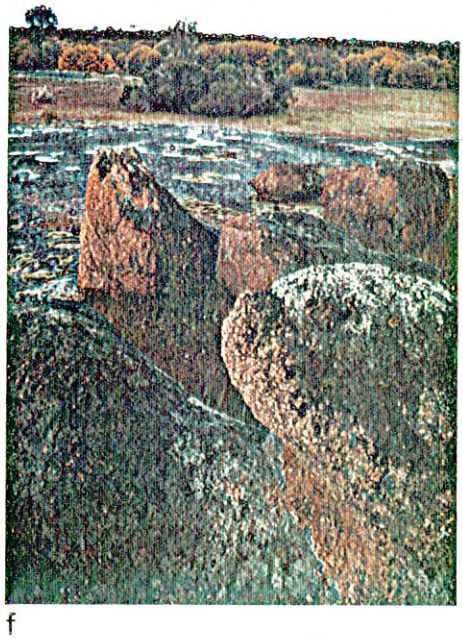

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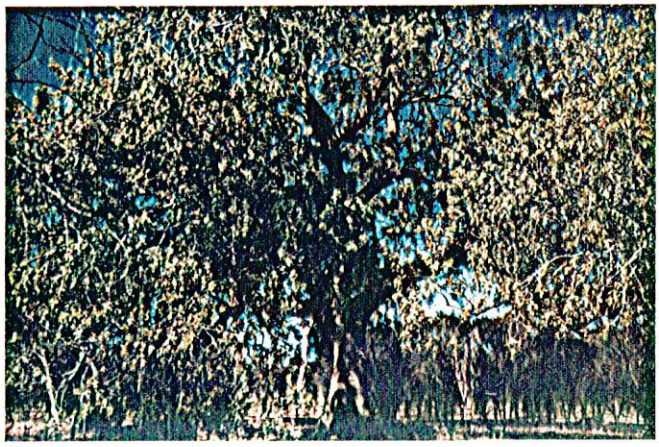

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PLATE 1

8.0 FLORA

Chiddarcooping Nature Reserve is in the Avon Botanical District of the Southwest Botanical Province a few kilometres west of the Southwestern Interzone's Coolgardie Botanical District, an area of floristic and vegetational transition between the Southwest Botanical Province and the Eremaean Botanical Province. The flora of the reserve has many floristic elements of the Coolgardie Botanical District as well as typically Avon District species.

8.1 VASCULAR PLANT SPECIES

There are approximately 530 species, subspecies and varieties of vascular plants currently listed for the reserve (Appendix 2), more than for any other Avon Botanical District or wheatbelt nature reserve except Tutanning and Wongan Hills. It is anticipated that the total number of species recorded for the reserve will, with further survey work and botanising, increase beyond 600. The best-represented genera in the reserve are Acacia, with about 35 species, Eucalyptus, with 19 species, and Melaleuca, with about 20 species.

8.2 RARE, GEOGRAPHICALLY RESTRICTED AND POORLY COLLECTED SPECIES

Chiddarcooping Nature Reserve also appears to be, for its location, exceptionally rich in rare and geographically restricted species. These species comprise gazetted Rare Flora, described species poorly represented in the Western Australian Herbarium collections, and undescribed species that also appear to be poorly represented in the collections.Three of the species recorded from the reserve are on the most recent list of gazetted Rare Flora Species: Eucalyptus caesia, Eremophila virens and Eremophila viscida.

Over half of all the known naturally occurring plants of E. caesia subspecies magna ("silver princess") are in Chiddarcopping Nature Reserve, in crevices or pockets in granite rock or at the edge of outcrops. The distribution and variation in Eucalyptus caesia are described by Hopper and Burgman (1983) and Moran and Hopper (1983).

One Eremophila virens plant was observed by Sue Moore and Judith Brown in the vicinity of Site 64 near the edge of a granite slope east of the central creek in the south central part of the reserve. According to Leigh, Boden and Briggs (1984, page 256), E. virens was known from only one colony of about 150 plants on private property before the Chiddarcooping plant was found. Millar (1982) also has references to the species and cites three locations where it occurs.

A small population of Eremophila viscida, the third gazetted rare species, was found and photographed ten metres east of the central South Block firebreak above a junction of creeks. This population of about four plants was the only one found in the reserve.

Photographs of Eucalyptus caesia and Eremophila viscida are presented in Plates 2a and 2b. Photographs of Eremophila virens are reproduced in Leigh et. al. Locations where these three species have been recorded in the reserve are shown in Figure 11.

One additional species found in the reserve, Calytrix plumulosa, is listed by Millar (1982) as having a geographically restricted distribution. It was found in two locations, with a total number of plants of about twelve.

One of the rarest, and most interesting, species in the reserve is a unique, undescribed species of Acacia. It is listed in Appendix B as Acacia sp.nov. aff. ixiophylla and is particularly interesting and unique because it appears to be intermediate between two main sections of the genus Acacia, Plurinervae and Phyllodinae (Uninervae). It also appears to be restricted to a small area below the scarp on the central west side of the West Block and above the scarp on freehold land next to the block. Vegetation on the freehold land has been rolled or chained, but the Acacia has regenerated.

Unnamed species do not normally qualify for inclusion in lists of rare and geographically restricted species, although in all other respects they, like the Acacia, may be exceptionally well-qualified. At least one other undescribed species, in the Acacia viscifolia group, appears to be restricted to the reserve.

Eucalyptus petraea is a species associated with granite outcrops that might have qualified for Millar's list except that it was not described or named until 1983 (Carr and Carr 1983), a year after Millar had completed her survey. Some old trees and excellent stands of the species are found in Chiddarcooping, particularly in the central valley.

Several other taxa collected in the reserve appear to be undescribed and represented among the Western Australian Herbarium collections by very few collections. Such species include Dicrastylis aff. parvifolia, Goodenia ? krauseana and a late-flowering form of Diuris laxiflora.

Some species collected in the reserve, such as the aquatic, Glossostigma trichodes, and the delicate fern, Anogramma leptophylla, were apparently neither recorded from the wheatbelt nor were in the Herbarium collections at the time Millar did her survey.

The localities in the reserve where Eucalyptus caesia, Eremophila virens, Eremophila viscida, Diuris laxiflora, Acacia sp. nov. aff. ixiophylla, Acacia 'viscifolia' and Calytrix plumosa have been found are shown in Figure 11. These species and others that are probably rare or geographically restricted are listed in Table 4.

The species listed in Table 4 are represented in the Western Australian Herbarium by eight or fewer collections, occur in restricted or sensitive habitats, have ranges of 160km (100 miles) or less, or are considered to be sensitive or vulnerable for other reasons. The species are listed in family order (Green 1981).

Determination of the specimens upon which several of the Table 4 listings are based require confirmation by taxonomic experts in the groups to which they have been assigned. It may turn out that a few of the species are not rare, restricted or vulnerable. But accurate identification of other collections from Chiddarcooping will undoubtedly lead to additions to the list.

TABLE 4

RARE AND RESTRICTED SPECIES, CHIDDARCOOPING NATURE RESERVE

Family	Species	EPS	Comments	MS
11	Anogramma leptophylla	50	<6	AL
40	Centrolepis aff. glabra	1000	<6	CG
66	Diuris laxiflora forma	50	1, AB	DL
106	Ptilotus exaltatus var. villosus	20	3	PV
163	Acacia sp. nov. aff. ixi.	30	<6, 1L, BRM	AI
163	Acacia sp. nov. cf. visc.	300	<6, 1L?, "	AV
163	Acacia sp. nov. cf. duri.	80	BRM	AD
226	Hibbertia sp. nov. (pung.)	30	<6, JW	HB
265	Pimelea sp. nov. ('densa')	10	<6, BR	PD
273	Calytrix plumulosa	40	4,	CP
273	Eucalyptus caesia ssp. magna	300	SDH	EC
273	Eucalyptus petraea	80	?	EP
288	Leucopogon aff. multiflorus	20	<6	LM
288	Leucopogon aff. planifolius	20	<6	LP
288	Leucopogon ? sprengelioides	40	<6	LS
311A	Dicrastylis aff. parvifolia	40	<6	DP
316	Glossostigma ? trichodes	800	1	GT
326	Eremophila virens	1	<6, 3-4L	EV1
326	Eremophila viscida	5		EV2
341	Dampiera scaevolina	50	<6	DS
341	Goodenia ? krauseana	20	<6	GK

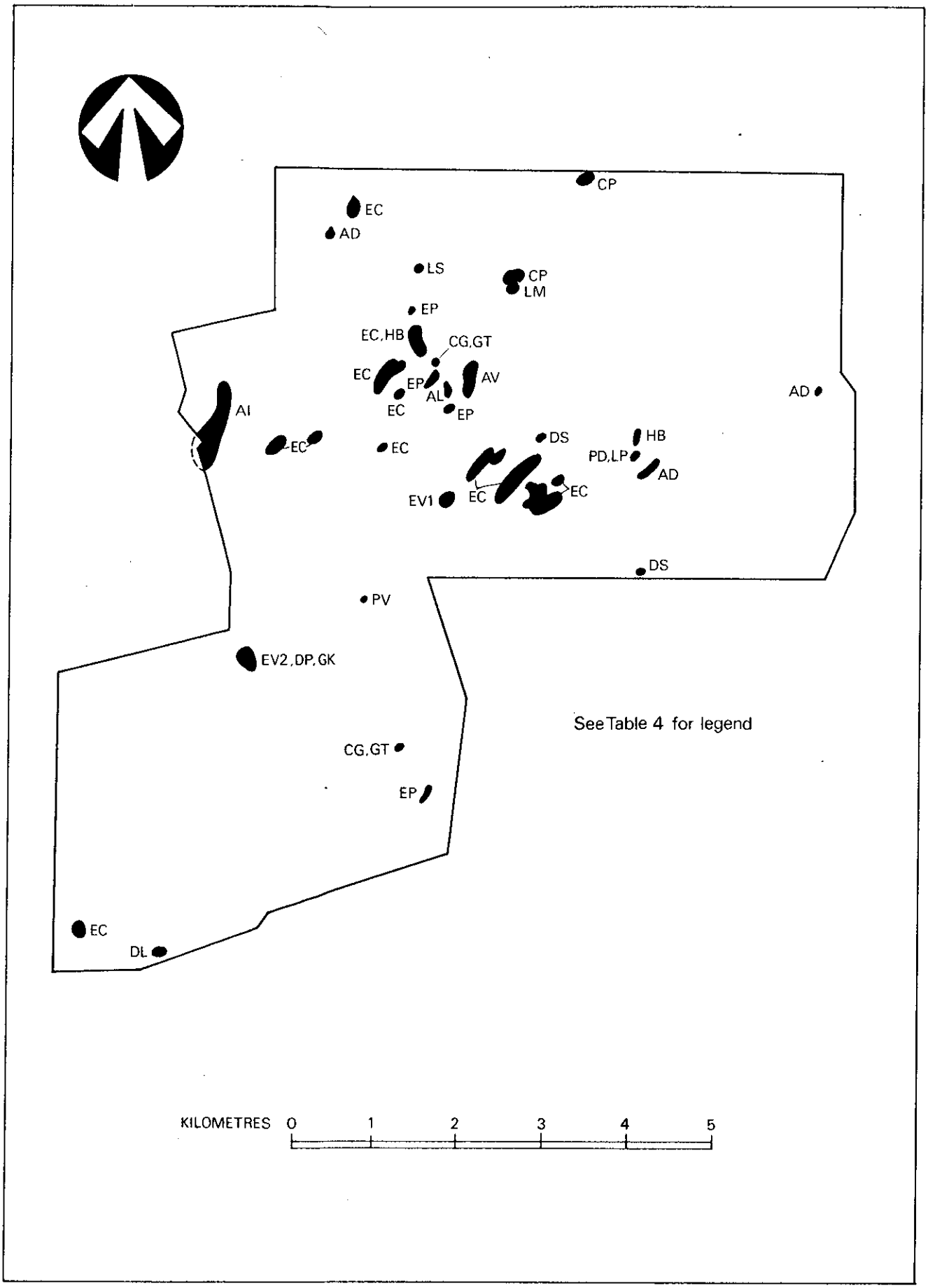
KEY

The family numbers are those used by Green (1981).

The first numbers in the Comments column refer to numbers of collections in the Western Australian Herbarium in May 1985.

Abbreviations

AB	Andrew Brown	Authority, pers. comm.
BR	Barbara Rye	Authority, pers. comm.
BRM	Bruce Maslin	Authority, pers. comm.
EPS	Estimated Population Size (total plants in reserve)	
JW	Judy Wheeler	Authority, pers. comm.
L	Locations	
MS	Map Symbol used in Figure 11	
SDH	Stephen Hopper	Authority, pers. comm.



Populations of sensitive species

Figure 11

9.0 AVIFAUNA

The importance of central wheatbelt granite rocks as winter habitats for honeyeaters has been recognised by Hopper, who observed ten species on 32 rocks in 1978 and 1979 (Hopper 1981). He recorded seven of the ten on Chiddarcooping granite. Only Boyagin Rock had more, a total of eight.

The observations of Stephen Hopper and his colleagues have been instrumental in the compilation of a bird species list for Chiddarcooping Nature Reserve. The current list, though already with 65 species, is not complete. During the vegetation survey field trips in September and October 1984, Anthony Bougher added 15 species to the previous list of 50 species, along with a few observations about habitats and nesting. The species list and observations are given in Appendix 3.

The most interesting additions to the list are the Crimson Chat and the Southern Scrub Robin, both of which were found nesting in the reserve. A Crimson Chat nest with eggs was in the middle of a dense, 50cm tall Baeckea crispiflora shrub in Site 23 at the edge of open Borya mat vegetation (Plate 2g). A Southern Scrub Robin nest with eggs was on the ground under Eucalyptus redunca mallee in the central valley at Site 31 (Plate 2h).

Other nests and eggs were found but, excepting one occupied by Tawny Frogmouths near Site 49, were not identified.

PLATE 2

a. Pendant Silver Princess (*Eucalyptus caesia* ssp. *magna*) branches and nuts at Site 66. More than half of all naturally occurring Silver Princess plants occur on the granite outcrops of Chiddarcooping Nature Reserve.

b. Flowers and leaves of *Eremophila viscida*, a gazetted rare species, at Site 56, near winter stream and northern part of track that runs from reserve's southern boundary north into reserve's woodlands.

c. One of the rarest and most interesting species in the reserve, a a unique, unnamed wattle related to *Acacia ixiophylla* that has been found only near the reserve's western boundary in the vicinity of Site 49.

d. Branches, leaves and flowers of the unique wattle.

e. A rare, undescribed species of Australian bush buttercup (*Hibbertia* sp.) that grows on Chiddarcooping Hill and other granite outcrops in the reserve.

f. A Pallid Cuckoo on branch of narrow-leafed red mallee (*Eucalyptus leptophylla*) at Site 10.

g. Nest and eggs of Crimson Chat in *Beechea crispiflora* shrub at Site 23.

h. Nest and egg of Southern Scrub Robin under black marlock (*Eucalyptus redunca* var. *subangusta*) at Site 31.

a

b

c

d

e

f

g

h

PLATE 2

10.0 MANAGEMENT

Chiddarcooping Nature Reserve is outstanding for the variety of its vegetation, diversity of its flora and richness of its avifauna. It has exceptional value as a refuge for native flora and fauna, some of which were once widespread in the wheatbelt but now, owing to extensive and continuing clearing, are uncommon or even rare. The reserve is small as nature reserves go but, being one of the largest in the wheatbelt, it has potentials not shared with the smaller reserves.

The size and diversity of the Chiddarcooping reserve and the fact that it contains stands of lowland tree and mallee communities poorly represented elsewhere in the nature reserve system and cleared outside of it, provide opportunities for unparalleled opportunities for studying their development in the absence of burning.

Long periods of fire-exclusion and, in some mallee, shrub and heath vegetation, periodic (but not frequent) burning appear to be essential for the full expression of total floras and complexity. However, work reported upon by Muir, by Hopkins, by Lamont and by Weston (WAIT 1985 Fire Symposium) indicate that even fire-adapted species are not lost (though they may not be visible) during fire-exclusion periods lasting decades or even centuries. Frequent burning, on the other hand, may lead to local loss or extinction of species (and growth forms). Consequently, the safest policy in situations where the biotic effects of fire are uncertain is to exclude burning. Probably no species will be lost, even if visual expression is delayed.

Given these conditions, best short-term fire management policy is to exclude fire until a detailed, well-researched, long-term fire management plan to preserve habitat, flora and fauna complexity is developed. Development of such a plan requires the accumulation and integration of more information about the reserve than is currently available (see, e.g., Kessell, Good and Hopkins 1984).

Management of any nature reserve must consider not only the inhabitants of the reserve itself but also its neighbours and visitors.

In terms of fire this obligation requires that any fire which starts in the reserve be prevented from spreading to neighbouring farmland as well as stopping fire from spreading from adjacent properties into the reserve. A peripheral firebreak supplemented by a minimal internal system of firebreaks appears to be basically essential. At Chiddarcooping an internal system that is more than basic is already in place and need not be added to. What exists could be maintained without causing more than a small amount of damage (mainly to fauna). The peripheral system still has a gap on the west side of West Block that needs completing, although a widened break outside the reserve boundary next to the fence is a recommended alternative, if an acceptable arrangement could be worked out with the property owner. The current system of tracks, roads and firebreaks is shown in Figure 9.

According to Crook(1984) a major important value of nature reserves is the appreciation by visitors of their beauty, variety and intricate interdependencies. Although this value is only beginning to be realised , it is becoming widely appreciated. Increased visitor use, and the appreciation of the reserve by neighbours, would be enhanced by printed information about the reserve (as for Moondyne Nature Reserve: Crook 1984), by self-guiding nature trails, by a management policy that is flexible within the limits of flora, fauna and habitat protection, and by keeping visual and actual disturbances, such as firebreaks, to a minimum.

Frequent burning, if any burning at all, existing and future roads, and additional and improved firebreaks are all incompatible with appropriate appreciation of the reserve and conservation in it.

11.0 RECOMMENDATIONS

This information presented in this report about the biota of Chiddarcooping Nature Reserve is adequate for the purpose of developing a conservative, short term management plan. A more detailed, imaginative, long-range management plan will require additional information and considerations. Consequently, it is recommended that:

1. The vegetation maps and descriptions be revised with the aid of stereo pairs of larger scale, preferably colour, aerial photographs (such as those available for Boyagin Nature Reserve) and field checking of boundaries and core areas.

2. Series of systematic flora surveys be undertaken from early winter until at least early summer. The surveys should include at least representative stands of all vegetation units and of all habitats likely to support rare, geographically restricted and vulnerable species. The current lists of vegetation units and vascular plant species are not definitive. Nor is there any list of non-vascular plants for the reserve.

3. Systematic fauna surveys be undertaken.

4. Consideration be given to development of a PREPLAN-type information system and management plan for Chiddarcooping and to collection of appropriate information.

5. Visits to the reserve by groups of naturalists be encouraged. Amateur naturalists, as well as professionals, can add significantly to the information pool on the reserve, as the Western Australian Naturalists Club is currently doing for Wongan Hills, the Darling scarp, Yorkrakine Rocks and other areas.

12.0 ACKNOWLEDGEMENTS

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APPENDIX A

DESCRIPTIONS AND PLATES

FIELD OBSERVATION SITES

CHIDDARCOOPING NATURE RESERVE

APPENDIX A

DESCRIPTIONS OF FIELD OBSERVATION SITES

Stands of vegetation typical of the units listed in Table 3 of the report are described below along with a brief description of the variability within each unit. Unusual plant communities and complexes, such as Site 56, are also described and discussed. The order in which the descriptions are presented in Appendix A follows the arrangement in Table 3, and the units are grouped under the same five formations and complexes: FORESTS AND WOODLANDS, MALLEES, SHRUBLANDS AND HEATHLANDS, GRANITOID ROCK COMMUNITIES and OTHERS. For ease of reference there is only one vegetation unit description per page.

Each site description begins with the map symbol and latin name of the site's dominant species, the site's number and approximate location, the plate in which it is illustrated, the Muir classification designation of its tallest stratum and its Muir code or notation. Photographs of the sites are presented in numerical order in Plates A1 through A9 following the section of site descriptions. The classification system and vegetation height and density code symbols are reproduced from Muir (1977) in Table 2 of the report. Each phrase in the code preceding the "/" and standing alone (e.g. eLAi) or separated from others by full stops (e.g. eKTc.nmSc.) describes one stratum. Commas separate members of a mosaic or mixture in a stratum. The lower case letter or letters at the beginning of each phrase, the floristic code symbols, designate dominant genera: a=*Acacia*, c=*Allocasuarina*, e=*Eucalyptus*, g=*Callitris*, m=*Melaleuca*, n=other genus, x=mixed species. The upper case letters indicate height class and the lower case letter following them denotes density class. The phrase following the "/" refers to soil texture, where a single letter or final letter is a noun (e.g. S=sand, SL=sandy loam) and: S=sand, L=loam, Si=silt, C=clay, F=fine, M=medium, H=heavy, K=gravel, R=lithosol or rock.

Information about the dominant species in each stratum, such as names, height range, cover canopy density range and dispersion, is given under 'Vegetation'.

The site descriptions also include observations of litter types, depths, densities and dispersions and subjectively estimated flammability ratings based primarily upon litter and understorey characteristics. Summary descriptions of vegetation at the sites and observations about fire effects and other disturbances are given under 'Comments'. Under 'Variability' information is given about geographic and edaphic ranges of the vegetation units and variations in their composition. All information given in the site descriptions, except attributed information under 'Variability', is based upon field observations made during the 1984 and early 1985 field trips to Chiddarcooping.

FORESTS AND WOODLANDS

Eg *Eucalyptus salubris*

Site 5 SE corner of South Block

Low Woodland A Plate: A1c

Vegetation: Muir Code: eLAi/CL

Stratum 1- *Eucalyptus salubris* mature trees and poles 6-8m or more tall (poles usually shorter) with a density approaching 30%; clumping slight.

Stratum 2- Generally absent except for scattered shrubs of *Eremophila oppositifolia* about 2m tall, with less than 1% cover, and scattered *Olearia muelleri* shrubs to 1m tall.

Stratum 3- A sparse herbaceous ground layer with species of *Ptilotus* and *Senecio* and a few subshrubs, mostly chenopodiaceous.

Litter: Sparse except for a few fallen trees and branches.

Flammability Rating: Low.

Soil: Hard, pale red-brown-grey or pinkish grey clayey loam.

Comments: Open stand of immature poles and mature trees with a variety of chenopods and a few species of annual herbaceous plants beneath. Apparently a climax stand, with no sign of fires during last fifteen years or more, and with low species richness value.

Variability: *Eucalyptus salubris* associations occur over a broad area in the wheatbelt and goldfields, on sandy loam to clayey soils, principally in depressions and on slightly sloping to flat landscapes (Chippendale 1973). Stands range from Low Woodlands to Low Forests, and domination is commonly shared with other eucalypts, such as *E. wandoo*, *E. salmonophloia*, *E. transcontinentalis*, *E. eremophila* and *E. celastroides*. The density, composition and species richness of lower strata in *E. salubris* associations are quite variable. Typical understorey species in Chiddarcooping stands include *Daviesia nematophylla*, *Cassia nemophila*, *Olearia muelleri*, *Acacia erinacea* and species of Chenopodiaceae.

Es *Eucalyptus salmonophloia*

Low Woodland A (to Woodland)

Comments: No field observation site was situated in a stand of *Eucalyptus salmonophloia* woodland, but several stands were observed during traverses and along transects. The principal dominant species, *E. salmonophloia*, is generally taller than either *E. wandoo* or *E. salubris*, with both of which it sometimes shares dominance in the reserve, and canopy cover is generally between 30% and 50%. The shrub strata densities range from very open (under 1%) to more than 30%, but the understories contain a few species that are poorly or not represented elsewhere in the reserve. These species include *Atriplex nummularia*, *Zygophyllum apiculatum* and *Lycium ? australe*.

Eucalyptus salmonophloia woodlands occur on reddish sandy loam or sandy clay loam soils, on slightly sloping terrain, generally in valleys. Litter layers are composed primarily of decaying fallen trunks and branches with 1cm to 2cm deep piles of leaves blown against them. Flammability rating of the woodlands is low, where the understorey is open, to moderate, where the understorey is densest. The woodlands do not appear to have been burnt for at least 15 years.

Variability: *Eucalyptus salmonophloia* woodlands are variable and often rich in terms of understorey species and were once abundant and widespread in the wheatbelt and the goldfields. The wheatbelt woodlands have, however, been largely cleared for agriculture and are now mostly restricted to roadsides and small reservations (Chippendale 1973). The Chiddarcooping stand in the South Block valley south of Site 56 is exceptionally weed-free and in particularly good condition.

Et *Eucalyptus transcontinentalis* (wheatbelt form)

Low Woodland A (to Woodland)

Comments: No field observation site was located in a stand of *Eucalyptus transcontinentalis* woodland but one stand was observed and photographed (Plate 1e) during traverses. This stand, the only one known to occur in Chiddarcooping Nature Reserve, is near the centre of the North Block (there may be another stand in the northeast corner of the same block). The stand is small and is dominated by trees 14m to 18m tall. It has a prominent 2m tall understorey of species of *Daviesia*, *Acacia* and *Melaleuca* which produce a canopy cover of between 10% and 30% and have slightly clumped distributions, and it overlaps with a stand of 3m tall *E. ? celastroides* mallee.

This isolated woodland is on an island of reddish-brown sandy loam that is surrounded by, for the most part, yellow sandy soils. The shrubland on the yellow sandy soils merges with the understorey of the woodland. The woodland has a litter layer composed of scattered fallen tree branches, dead branches under some shrubs and leaves that vary from scattered units in the open to wind-blown drifts up to 3cm deep next to debris and the trunks of trees and stems of shrubs. The woodland does not appear to have been burnt for at least 15 years, and its flammability rating is considered to be low to moderate.

Variability: *Eucalyptus transcontinentalis* woodlands are widespread through the wheatbelt and the goldfields, generally on sandy loamy soils or aeolian sand on flat country or in broad valleys (Chippendale 1973; Newby 1984). *Eucalyptus transcontinentalis* is often associated in the woodlands with *E. salmonophloia*, *E. salubris*, *E. celastroides*, *E. gracilis*, species of *Melaleuca* and species of *Atriplex*.

Ew *Eucalyptus wandoo*

Site 20 NW corner of East Block

Low Forest A (to Low Woodland A) Plate: A3c

Muir Code: eLAc.cSr.amnSBr.axSDr.xPr/R

Vegetation:

Stratum 1- *Eucalyptus wandoo* occurring as scattered mature trees and immature poles with a markedly clumped distribution, both types 6m to 10m tall; average canopy cover 30% to 40%.

Stratum 2- Scattered shrubs of *Allocasuarina acutivalvis* (less than 10% cover) and *Callitris ? canescens* (less than 1% cover).

Stratum 3- *Melaleuca uncinata* (ASW14068), *Acacia* sp. nov. aff. *viscifolia* and *Eremophila* aff. *drummondii*, each 1.5m tall, providing less than 10% cover and with a slightly clumped dispersion.

Stratum 4- *Acacia andrewsii*, *Oxylobium parviflorum* and *Hibbertia exasperata* group all under 50cm tall, moderately clumped and providing a total cover of about 10%.

Stratum 5- Over 90% bare rock and shallow soil but with *Borya* sp., *Stipa trichophylla* and *Danthonia caespitosa* providing about 5% cover.

Litter: Twigs, leaves and smaller branches to 4cm deep and covering up to 60% of the ground under the wandoo trees, sometimes in deeper drifts.

Flammability Rating: Moderate to Low.

Soil: Lithosol: bare lateritic duricrust at top of breakaway with pockets of shallow silty clay, clayey sands and quartzite gravel.

Comments: Narrow and variable belt of *Eucalyptus wandoo* low woodland restricted to top of breakaway and merging with Site 26 *Melaleuca-Acacia* shrubland on breakaway edge, with Site 21 *Baeckea crispiflora-Ecdeiocholea monostachya* vegetation on inland edge. No sign of any fire except campfires for at least 15 years.

Variability: *Eucalyptus wandoo* woodlands in Chiddarcooping Nature Reserve are, in terms of understorey and substrate, of four basic types which do, however, sometimes intergrade. These four types occur on lateritic duricrust on the tops of breakaways (e.g. Site 20), on kaolin and decomposing granitoid below breakaways (e.g. Sites 43 & 50), on loamy soils on the elevated sandplain (e.g. Sites 24 & 25) and on fine-textured soils in broad valleys below the breakaway complex (e.g. Sites 49 & 64).

Sites 24 and 25 woodlands have tall shrub and medium height shrub understoreys that have canopy densities of up to 80% locally, frequently have *Phebalium tuberculosum* and are rich in species of Proteaceae.

Sites 43 and 50 woodlands are characterised by thickets of 1.5m tall *Melaleuca* aff. *cuticularis* shrubs as well as their white clay substrates. Site 43 also has a few *E. eremophila* mallees, and near Site 50 there is a population of the apparently very restricted and taxonomically exciting undescribed species of *Acacia*, *Acacia* sp. nov. aff. *ixiaphylla* , as well as its two putative ancestors, *A. viscifolia* group (ASW14263) and *A. ixiaphylla* sens. lat.

Site 49 borders Site 50. It is in the *Eucalyptus wandoo* woodland that covers a large part of the major valley that runs from the scarp north of the site south to the southern boundary of the reserve. The dominant species in the 1.5m to 2m tall shrub understorey at Site 49 is strongly clumped *Acacia densiflora*, with an average canopy cover of less than 10%. The principal herbaceous species at the site, *Helipterum* aff. *tenellum* and *Disphyma crassifolium*, appear to be restricted in the reserve to this and similar types of open woodland. Elsewhere in the broad valley *E. wandoo* shares dominance with *E. salubris* and *E. salmonophloia* and gives way to mallee communities.

Site 64 *E. wandoo* woodland is similar to Site 49 in that it is in a broad valley south of the breakaway complex, but it is different in the form and species composition of its understorey.

A1 *Acacia lasiocalyx*

Low Forest B (to Dense Low Forest B)

Comments: *Acacia lasiocalyx* occurs in small, 4m to 5m tall stands with 50% to over 80% canopy cover near the bases of several of the granite outcrops. Frequently, the stands comprise fewer than a dozen trees. Commonly these stands merge into *Allocasuarina huegeliana* woodlands, as at Site 6.

Ch *Allocasuarina huegeliana*

Site 6 E Central side of East Block

Low Forest A and B Plate: A1d

Muir Code: cLA(B)c.1Sc.xsBi.xJGTi/SK

Vegetation:

Stratum 1- *Allocasuarina huegeliana* trees 4-5(-6)m tall with 40% to 60% canopy cover, and *Acacia lasiocalyx* trees to over 4m tall with less than 10% cover, neither with clumping.

Stratum 2- Primarily *Leptospermum rotei* to 3m tall and 40% cover and strongly clumped or rowed along drainage lines. Also *Acacia tetraganophylla* and *Alyxia buxifolia*, each about 2m tall and with less than 10% cover.

Stratum 3- *Dodonaea rigida* and *Baronia coerulescens* between 0.8m and 1.5m tall with cover up to 20%.

Stratum 4- *Lepidosperma viscidum* and *Spartochloa scirpoidea* bunch grasses or sedges in dense clumps to 0.5m tall and with densities approaching 100% form catenas with essentially bare ground that is seasonally covered with annual herbs.

Litter: Small branches and she-oak branchlets ('leaves') litter averaging 1cm-2cm depth and 80%-90% cover, and dispersed fairly uniformly.

Flammability Rating: Moderate, but site is surrounded by bare granitoid rock.

Soil: Shallow, sandy and gravelly, loose, dark brown and with high percentage of organic matter ('lithosol' according to Figure 6).

Comments: This *Allocasuarina huegeliana* woodland is one of many types of typical vegetation that has developed where there are pockets of soil and decomposing rock on the extensive areas of granitoid sheets in the reserve. The dispersion of understorey shrubs and herbs in this community is, as in many of the others, very patchy and overlapping (and Site 6 itself overlaps or borders Sites 7, 8 and 9). Alien weeds are relatively common at Site 6, as they tend to be on immature granitoid soils. There are several dead trees and parts of trees and shrubs at this site.

Variability: *Allocasuarina huegeliana* woodlands occur over most of the southwest, principally on granitoid outcrops and granitic soils but also, as in Boyagin Nature Reserve, on some sandy soils and as an understorey of *Eucalyptus wandoo* woodland. In Chiddarcooping Nature Reserve they are common as small stands on granitoid outcrops (e.g. Sites 6, 7 and 33) and as larger stands below the outcrops, particularly above Chiddarcooping Well (Site 65) and in the central valley (Site 63).

The Site 63 stand is typical in having a dense canopy cover (between 60% and 80%), tree heights ranging from 4m to 6m, little understorey and a several centimeter deep, more or less continuous litter layer of branchlets. Near the creek the woodland intergrades with *Eucalyptus* wandoo woodland, where it has a denser, variable understorey that includes a few trees to 8m tall of *Brachychiton gregorii*, a species that is very poorly represented in the reserve. This stand is also one of the few locations in the reserve where *Xanthorrhoea nana* occurs.

The Site 65 stand is similar to Site 63 in height and density of the overstorey, openess of the understorey and the presence of *Xanthorrhoea nana*, but it is in poorer condition. Parts of it have little live overstorey; in these parts most of the trees have fallen and are decaying. In these parts of the stand there are dense (over 70% canopy cover), 2m to 3m tall thickets of *Melaleuca hamulosa* and of *Leptospermum ? roei*. *Melaleuca uncinata* terete, late) is also conspicuous.

Cg *Callitris ? columellaris*

Site 42 NW corner of North Block

Low Forest B Plate: A5h

Muir Code: xcLBc (x= *Callitris ? columellaris*)

Vegetation:

Stratum 1- *Callitris ? columellaris* trees and *Allocasuarina acutivalvis*, each species 3.5m tall and together providing about 70% canopy cover.

Litter: Twigs and branchlets to depth of 2cm and over 50% cover.

Flammability Rating: Moderate; although the overstorey is moderately dense, the understorey is open.

Soil: Shallow silty sandy with quartzitic gravel and outcrops of granitoid rock.

Comments: Low forest with very little understory or plant cover on the ground. Scattered, 2.5m tall shrubs of *Acacia* sp. and *Melaleuca uncinata* (terete, late) and scattered 0.5m tall shrubs of *Astroloma serratifolium* practically the sole understorey. The stand does not appear to have been burnt for decades. Site 42 has the only stand of this type of vegetation seen in the reserve, and it appeared to be too small to map.

MALLEES

Ec *Eucalyptus crucis*

Site 8 SE corner of South Block

Tree Mallee Low Forest A Plate: A1f

Muir Code: eKTc,cLAc.xSc.xS-c.XGi,IVci/KS

Vegetation:

Stratum 1- *Eucalyptus crucis* spreading tree mallee to 8m tall with many large, spreading stems, and *Allocasuarina huegeliana* trees 6m to 8m tall, each of the two species furnishing about 30% cover. *Acacia ? lasiocalyx* provides less than 10% cover.

Stratum 2- *Leptospermum roei* and *Allocasuarina compestris* shrubs 2m to 3m tall, with about 10% cover; taller and providing most cover around margins of the stand and away from dominating influence of *E. crucis*.

Stratum 3- Several species, but none clearly dominant; dispersion patchy but not markedly clumped.

Stratum 4- *Lepidosperma viscidum* clumps and *Dodonaea* sp., the *Lepidosperma* being in dense belts around the margin of the soil pocket.

Litter: Leaf and twig litter varies from 1cm to 10cm, particularly under *E. crucis*, and to 20cm under *Grevillea* cf. *paniculata*, and it has a cover in excess of 80%. There are also a few tangles of fallen branches.

Flammability Rating: Moderate to moderately high; although the site is partially protected from fire by the bare granitoid rock surrounding it.

Soil: Lithosol, but under *E. crucis* the soil is dark brown or black with organic matter and humus.

Comments: Mixed thicket rich in species of shrubs on deeper, organic soil. The few species of herbaceous plants include three orchids: *Caladenia deformis*, *C. roei* and *C. amplexans*. Although there are some dead shrubs and branches, the stand is in good condition.

Variability: *Eucalyptus crucis* mallee thickets are common and widespread in Chiddarcooping Nature Reserve on deeper soil pockets on granitoid outcrops and on skirts of soils at the bases of some of them. In the reserve, as elsewhere, they are commonly associated with species of *Allocasuarina*, *Acacia* and *Calothamnus* (Chippendale 1973). The understoreys in the thickets are variable but generally rich in species. Chippendale describes the range of *Eucalyptus crucis* as being from Kununoppin and Kellerberrin to an area northeast of Southern Cross, one of the most restricted ranges of any species of eucalypt occurring in the reserve.

Ee *Eucalyptus erythronema*

Open Tree Mallee

Comments: No field observation site was situated in a stand of *Eucalyptus erythronema* tree mallee but one stand was observed during traverses along along the west boundary of South Block, between Sites 61 and 62. This small stand is the only one seen in the reserve, where it was close to or associated with stands of *E. redunca* and *E. stowardii*. It comprises small trees in places that show no signs of burning and slender-stemmed mallees in parts that appear to have been burnt within the last ten years. Understorey in both parts ofthe stand is largely restricted to small, scattered shrubs and herbaceous plants.

Variability: Chippendale (1973) records the occurrence of *E. erythronema* as being "from near Wongan Hills southward to the south-east of Corrigin, and eastwards to near Southern Cross" and usually on grey loamy soil in flat country, where it may be associated with *E. salmonophloia*, *E. wandoo* and other eucalypts.

Ef *Eucalyptus leptophylla*

Site 10 SE quadrant of South Block

Shrub Mallee Plate: A1h

Muir Code: eKSc/SL

Vegetation:

Stratum 1- *Eucalyptus leptophylla* (frequently referred to as *E. foecunda*) mallee shrubs to 6m tall and with up to 50% canopy cover and more or less uniform dispersion.

Litter: Little except dropped branches and bark under individual mallees and drifts of leaves where they have been blown into wind-protected hollows and under plants.

Flammability Rating: Low to medium.

Soil: Red-brown sandy loam gritty with partly decomposed granite.

Comments: Tall, thin-stemmed mallee with little understorey other than scattered *Olearia revoluta*, *Dodonaea bursariifolia*, *Rhagodia drummondii*, *Eremophila glabra*, *Acacia erinacea* and a few grasses and other herbaceous plants. Colonies of alien herbs grow on mounds of rabbit dung.

Although there is no sign of any fire in the mallee for at least the last fifteen years, there is little litter. There are, however, sets of tyre tracks that appear to be several years old; such disturbances last a long time.

Variability: The wheatbelt and goldfields mallee that has been treated as the transcontinental, variable *E. foecunda* is now regarded as a more restricted but still widely distributed distinct species, *E. leptophylla*, with its own subspecies and varieties (Hopper and Brooker, pers. comm.). *Eucalyptus leptophylla* occurs on sand and sandy loam soils with a variety of species, usually in shrublands or heathlands.

Eucalyptus leptophylla mallee seems to be rare in Chiddarcooping Nature Reserve, with Site 10 appearing to be the only stand large enough to map.

El *Eucalyptus loxophleba*

Site 53

Tree Mallee (to Dense Tree Mallee) W centre of West Block

Muir Code: eKTc/SiCL

Vegetation:

Stratum 1- *Eucalyptus loxophleba* tree mallee 6m tall and *E. redunca* mallee 5m to 6m tall, the two species providing a total of 60% to 80% canopy cover. *Eucalyptus celastroides* is a less common mallee in the stand, reaching 4m to 5m in height.

Litter: Little except for a few small drifts of leaves and occasional twigs and small branches under the mallees.

Flammability Rating: Low.

Soil: Grey-brown sandy to silty-clay loam.

Comments: Site 53 mallee is a relatively dense stand of mallee comprising three species ranging in height from 4m to 6m. There is practically no understorey in the stand and very little litter. There is no sign of any fire having burnt through the stand for at least fifteen years.

Variability: The *Eucalyptus loxophleba* in the reserve is a smooth-stemmed mallee, generally with many straight thin stems and quite different from the York Gum form in the western areas of the species' distribution (Chippendale 1973). In the reserve this mallee commonly occurs at the margins of other mallee associations (e.g. Site 40) and as an understorey or enclave in *Eucalyptus wandoo* woodland. At Site 53 it forms a dense mallee grove with a form of *Eucalyptus redunca* and with no understorey, but at Site 70, where it also occurs with *E. redunca*, the mallee is open and has definite, though clumped, understorey strata. At Site 57, *Eucalyptus loxophleba* lines the major creek in South Block. *Acacia acuminata* is a subdominant in the stand, which has a well-defined shrub understorey comprising *Callistemon phoeniceus* and other myrtaceous and proteaceous species.

Ep *Eucalyptus petraea*

Site 13 SE quadrant of South Block

Tree Mallee Plate: A2c

Muir Code: eKTc.nmSc.nSCr.nJc/SLK

Vegetation:

Stratum 1- *Eucalyptus petraea* trees or few-stemmed mallees to 8m tall and with 50% canopy cover in a belt about 15m wide. *Allocasuarina huegeliana* and *Acacia lasiocalyx* trees 4m to 6m tall are intermixed with the eucalypt and provide under 20% and 10% cover, respectively.

Stratum 2- *Leptospermum roei* and another species of *Leptospermum* plus *Melaleuca hamulosa* and *Melaleuca uncinata* (flat leaves) range in height from 0.5m to 3m and provide about 30% cover.

Stratum 3- Scattered 1m tall *Olearia revoluta* shrubs.

Stratum 4- *Spartochloa scirpoidea* bunch grass with a cover of about 50%.

Litter: Many dead, fallen branches and a few trunks, with leaf litter (and humus) 10 (-50)cm deep under some tree mallees.

Flammability Rating: Moderate to high.

Soil: Gritty sand with high proportion of gravel and, especially on top from decomposing litter, organic matter.

Comments: This *Eucalyptus petraea* tree mallee understorey is rich in species, including several species of alien herbs. The stand at Site 13 fringes the base of an outcrop of granitoid rock. It bears no sign of burning in the last 15 years or more, but there is a sawn stump in the stand, an indication of past cutting, tyre tracks come close to the stand and rabbit droppings are common around it. In spite of this degradation, the stand is in reasonably good condition.

Variability: *Eucalyptus petraea* stands are, according to Carr and Carr (1963), associated with granite rocks in the area between Lake Moore and Karonie. They generally occur below granite outcrops and boulders (e.g. Site 13 and below Site 34) but are sometimes found near summits of boulders or above granite outcrop surfaces (e.g Site 37).

Er *Eucalyptus reduncs*

Site 40 NW quadrant of North Block

Tree Mallee Plate: A5f

Muir Code: eKTc.eKTi/SiCL

Vegetation:

Stratum 1- *Eucalyptus reduncs* and *E. sheathiana*, both 5m to 6m tall and together providing about 40% canopy cover, but unevenly dispersed through stand.

Stratum 2- *Eucalyptus eremophila* and *E. celastroides*, both 3m tall and togeher providing about 10% cover, but clumping moderate and unevenly dispersed through stand.

Litter: Patchy, but mostly little. Some drifts of leaf litter against trunks and fallen stems and branches.

Flammability Rating: Low.

Soil: Grey gritty silty clay loam and small pieces of quartz.

Comments: Diverse and variable mallee vegetation comprising five species of eucalypts - *E. reduncs*, *E. sheathiana*, *E. eremophila*, *E. celastroides* and *E. loxophleba* - and occupying a short, shallow valley below an eroded breakaway. There is very little understorey, but scattered shrubs include *Acacia erinacea* and *Olearia muelleri*.

Variability: *Eucalyptus reduncs* mallee vegetation is common and widespread in the reserve on soils that range from silty and clayey to sandy soils over gravel. In some places the stands are moderately dense and have very little understorey (e.g. Sites 53 and 40). Elsewhere the stands are open and have distinct understoreys that may be extensions of neighbouring shrub communities (e.g. Sites 61 and 70). Several *Eucalyptus reduncs* mallee stands are situated close to *Eucalyptus wandoo* woodland on pediments below breakaways (Site 31 and near Site 49).

Es' *Eucalyptus sheathiana*

Site 52 W Centre of West Block

Shrub Mallee Plate: A7b

Muir Code: eKSc.aSCr.xPr/SiC

Vegetation:

Stratum 1- *Eucalyptus sheathiana* 6m tall with 40% canopy cover, *E. celastroides* 5m to 6m tall with 15% cover and *E. yilgarnensis* 4m to 5m tall with 10% cover. Slight to moderate clumping.

Stratum 2- *Acacia erinacea* 0.5m to 1.0m tall with approximately 10% canopy cover.

Stratum 3- Prostrate mats and ground covers of *Disphyma crassifolia* and *Frankenia pauciflora* with under 10% cover.

Litter: Many stems and fallen branches, which along with sparse leaf litter averages 50% cover and 2cm to 3cm in depth.

Flammability Rating: Moderate to low.

Soil: Grey, hard, silty clay.

Comments: Moderately dense mixed mallee dominated by *Eucalyptus sheathiana* with understoreys comprising *Atriplex nummularia, Daviesia nematophylla, Acacia erinacea, Frankenia pauciflora, Disphyma crassifolia, Exocarpus aphyllus,* several chenopods and a few other species. The stand appears to be climax, with no sign of fires during previous fifteen years or more.

Variability: Chippendale (1973) describes the geographic range of *Eucalyptus sheathiana* as lying between Wyalkatchem, Kellerberrin, the Bullfinch-Southern Cross area and Hyden. Although Chippendale states that the species is usually found in flat areas on sandy soil, lateritic sand and, sometimes, alluvial soil, in Chiddarcooping Nature Reserve *E. sheathiana* mallee vegetation is more commonly found on silty clayey soils, such as those at Sites 52, 40 and 27.

Ez *Eucalyptus stowardii*

Site 28 NW corner of East Block

Open Shrub Mallee Plate: A4b

Muir Code: eKSi.nSi.nSBc.nSCi/SiSL

Vegetation:

Stratum 1- Scattered *Eucalyptus stowardii* mallee 5m tall.

Stratum 2- *Hakea* sp. (ASW14115) and other species 2.5m tall with about 20% canopy cover.

Stratum 3- *Calothamnus* sp. (ASW14114A), *Acacia desertorum* group and other 1.5m tall shrubs with a total of 40% to 50% cover.

Stratum 4- *Melaleuca roseus*, *Phebalium tuberculosum* and other species of 0.5m to 1m tall shrubs with cover of up to 25% total.

Litter: Highly variable but to 4cm deep and with 90% cover under densest shrubs.

Flammability Rating: Moderate to moderately high.

Soil: Brown silty sandy loam

Comments: Scatterred mallees that are in a narrow band in a depression surrounded by *Allocasuarina-Melaleuca-Acacia* kwongan thicket that is also represented in the shrub mallee as part of the understorey.

Variability: *Eucalyptus stowardii* mallee in the reserve ranges in form from the open stands with moderately dense understorey of shrubs to dense stands such as those next to the *Eucalyptus erythronema* mallee between Sites 61 and 62 and in a granite outcrop depression north of Chiddarcooping Well. Both stands have little understorey and canopy densities of around 70%. Chippendale (1973) says that the mallee is usually found on granitic soil and sometimes on limestone.

SHRUBLANDS AND HEATHLANDS

Aa *Acacia acuminata*

Site 19 SE quadrant of South Block

Thicket Plate: A3b

Muir Code: aSc/SL

Vegetation:

Stratum 1- *Acacia acuminata* shrubs or small trees 3m to 5m tall and with over 50% cover; uniformly dispersed.

Stratum 2- A ground layer of herbaceous plants comprising a variety of species that are mostly annuals.

Litter: Leaves less than 2cm deep and scattered dead branches.

Flammability Rating: Low.

Soil: Sandy loam, possibly finer grained and with some clay. Red-brown.

Comments: Although *Acacia acuminata* is not rare or even uncommon in the southern part of the reserve monospecific stands like the ones at Sites 19 and 55 are. Both stands intergrade with neighbouring eucalypt communities. There is no sign that either stand has been burnt for at least fifteen years.

As *Acacia stereophylla*

Site 22 NW corner of East Block

Scrub Plate: A3f

Muir Code: aSc.nSBr.nSCc/SSiL

Vegetation:

Stratum 1- *Acacia stereophylla* 2.5m tall and *Melaleuca* aff. *uncinata* 2m tall, each species with about 20% canopy cover and occurring in broad belts between herbaceous plant communities at Sites 21 and 23.

Stratum 2- *Baeckea elderiana* 1m to 1.5m tall and with less than 10% cover.

Stratum 3- *Ecdeiocholea monostachya* tussocks 0.7m tall and providing 30% cover.

Litter: Very little, except under some *Acacia* shrubs where the leaf litter is 1cm deep and uniformly spread over 90% of the surface.

Flammability Rating: Moderate or higher.

Soil: Yellowish brown sandy silty loam; shallow and overlying rock.

Comments: *Acacia stereophylla* thicket overstorey with tussock sedgeland understorey that is a continuation of the neighbouring *Ecdeiocholea-Baeckea* tussock sedgeland and heath/dwarf scrub community. Many of the *Acacia* shrubs in the stand are dead, whether from drought, from dieback or from some other cause is neither known nor suspected. The stand does not appear to have been burnt for many years.

Variability: This elevated sandplain community is one point in a range of variation in *Melaleuca-Allocasuarina-Acacia* shrubland along gradients of height, density, floristic composition and species richness. Some of this variation is apparent along a transect north from Site 22 through Site 28 to Sites 29 and 30 at Morrison Road, where there is virtually no ground layer, where *Baeckea elderiana* is joined by other species of *Baeckea* and close relatives and where the community is much richer in species of myrtaceous and proteaceous shrubs.

At Sites 35 and 36, there is vegetation similar to Site 22's in terms of the dominant shrubs and the shallow, coarse, sandy rocky soil substrate, but the suite of understorey shrubs are, though also myrtaceous and proteaceous, mostly different, and *Allocasuarina acutivalvis* shares dominance with the *Melaleuca* and the *Acacia*.

Bc *Baeckea crispiflora*

Site 21 NW corner of East Block

Dwarf Scrub C Plate: A3d

Muir Code: nSCi.nPi/SiS

Vegetation:

Stratum 1- *Baeckea crispiflora* shrubs 0.7m tall with a canopy cover of 10% to 30% and 0.6m tall *Ecdeiocholea monostachya* tussocks with about the same cover, both species having moderately clumped dispersions.

Stratum 2- *Borya* sp. 10cm tall and also with 10% to 30% cover.

Litter: What little litter there is has been blown in from eucalypt woodlands nearby.

Flammability Rating: Low to moderate.

Soil: Red-brown silty sand that is, however, hard and probably shallow.

Comments: *Baeckea-Ecdeiocholea* dwarf scrub on enclaves of shallow hard fine-textured sandy soils associated with ground level rock exposures is common near the margins of the elevated sandplain.

Variability: Characteristically this type of dwarf scrub is species-poor in woody plants and lacks shrubs taller than 1m. Site 23, however, has scattered emergents of *Allocasuarina acutivalvis*, some of which are dead.

Cs *Allocasuarina acutivalvis*

Site 2 SE corner of South Block

Thicket (with emergent mallee) Plate: A1b

Muir Code: cSc/SL

Vegetation:

Stratum 1- Thickets of *Allocasuarina acutivalvis* over 3m tall and ranging in density from 40% to over 70%. Clumping slight.

Litter: Little; about 40% cover and less than 1cm in depth even under densest *Allocasuarina*.

Flammability Rating: Moderate because the thicket is dense and with branches near bases of shrubs.

Soil: Sandy clay loam to sandy loam; pale red-brown; very hard when dry.

Comments: This community occupies a narrow belt of what appears to be a slightly lower area between the *Melaleuca* thicket vegetation of Site 1 and the *Eucalyptus salubris* woodland vegetation of Site 3. There is very little growing under dense *Allocasuarina* shrubs but several orchids and other herbaceous plants are sparsely distributed between them. The stand appears to have been avoided by fires for at least fifteen years.

Variability: The Site 2 thicket is typical of *Allocasuarina acutivalvis* thickets on granite-derived soils on the lower plains of the reserve in its poverty of shrub species and the relative abundance of annuals and other herbaceous species in the stand. *Allocasuarina acutivalvis* thickets on the yellow sands of the elevated sandplain have more species of shrubs and fewer small-leaved herbaceous plants. The yellow sand communities also have better-defined pyroseres, as at Site 41, where many of the species now in evidence will have disappeared by the time the vegetation is mature. Site 51 is another upland *Allocasuarina acutivalvis* thicket that has a different suite of species after being burnt but on heavier, grey soil.

Cc *Allocasuarina campestris*

Site 69 Centre of East Block

Dense Thicket Plates: A9d, A9e, A9f

Muir Code: cSd.nJ,nGL,nVL/KSR

Vegetation:

Stratum 1- *Allocasuarina campestris* 2.5m to 3m tall and with canopy cover of 70% to more than 90%.

Stratum 2- *Spartochloa scirpoidea*, *Lepidosperma ? gracile* and *Amphipogon caricinus* with about 30% cover.

Litter: Branchlets 1cm to 3cm and about 60% cover.

Flammability Rating: Moderate to High, but with some buffering by bare rock surfaces nearby.

Soil: Shallow gravel and sand, bare rock and humus layer.

Comments: Site 69 has been divided into four landform types:
a. Slope with heavy soil and lots of gravel and quartzite,
b. Creek bed and banks; mostly lithosols, litter and humus,
c. Creek bank, and
d. Granite rock slope above creek.
Types b,c and d all have *Allocasuarina* dense thickets and Type a has *Melaleuca uncinata* thicket.

Variability: *Allocasuarina campestris* thickets are densest and most common on granite outcrops, but they also occur off the outcrops, and *A. campestris* often occurs with or instead of *A. acutivalvis* in thickets both on the elevated plain and elsewhere.

Mu *Melaleuca uncinata*

Site 1 SE corner of South Block

Thicket Plate: A1a

Muir Code: maSc/SL

Vegetation:

Stratum 1- Thicket of *Melaleuca uncinata*, *M. acuminata*, *M. eleuterostachya*, *Acacia acuminata* and *A. resinomarginea*, 2m-3m(-4m) tall with a total of 40% to 60% canopy cover. Clumping moderate.

Stratum 2- Around 50 spp of small herbs, most of them Composites but with a few other species of forbs plus a few small bunch grasses and species of *Stipa*.

Litter: Sparse; mostly fallen branches; few leaves, cover about 20%.

Flammability Rating: Moderate.

Soil: A gritty loam, colluvial granite soil that is hard when dry; pale red-brown.

Comments: The components of the thicket are variable in height and density and occur together as part of a mosaic with a *Eucalyptus loxophleba* Open Shrub Mallee and a *Eremophila* aff. *drummondii* - *Olearia pimelioides* Dwarf Scrub C.

Site 1 is next to the southern firebreak, which has abundant *Arctotheca calendula* in it. Rabbit diggings are common, especially in the more open areas. Weeds (aliens) are growing on the diggings and in disturbed areas along the firebreak as well as in the firebreak itself, but there are few weeds in the undisturbed areas. Some of the area around the site appears to have been cleared in the past but has regenerated.

Variability: *Melaleuca uncinata* sens. lat. is the most abundant and ubiquitous tall flowering shrub in the reserve, but this name, *Melaleuca uncinata* sens. lat., encompasses at least six distinct forms in terms of leaf shape and flowering time. The principal form on the lower granitic soil plains (e.g. Site 1) is the long flat-leaved form. The most common form on the breakaways and granite outcrops is the terete-leaved, late-flowering form. The short terete leaved, very late

flowering form was found only in *Eucalyptus laxophlebe* mallee at Site 70.

GRANITE ROCK COMMUNITIES

Most of the granite outcrop vegetation occurs as small islands surrounded by bare rock. When these islands of vegetation are very small they are more or less homogeneous; when they are larger they frequently comprise several merging units. Because the islands of vegetation and the heterogeneous merging units that are restricted to granite rocks are all too small to map individually none has been given map symbols in this report, except for the all-encompassing G that does not distinguish between vegetated granite outcrops and bare granite exposures.

Considered together and in a broad sense, the Chiddarcooping Nature Reserve granite outcrop vascular plant communities cover a greater range of vegetation structure than any other suite of the reserve's communities. They cover practically everything in Muir's vegetation classification (Table 2) except the taller tree formations and some of the mallees, but they cover them in miniature and in a great variety of combinations and mosaics.

Professor Robert Ornduff, who has a paper in press on mat plant and herbaceous plant communities on Boyagin Rock and selected other southwestern granite outcrops, uses a classification of these communities that should, in the future, be applicable to other outcrops.

A number of granite outcrop field observation sites that have tree and mallee communities have been described in previous sections of this appendix. This section presents site descriptions of types that have not been.

In relation to Flammability Rating, fire risk and fire management it should be noted that many stands of granite outcrop vegetation are at least moderately flammable but are protected from fires by the bare rock exposures around them that function as firebreaks.

Eucalyptus caesia

Site 38 — NE quadrant of West Block

Dense Low Forest A — Plate: A5d, A5e

Muir Code: eLAd/KR

Vegetation:

Stratum 1- A single large plant of *Eucalyptus caesia* between 5m and 6m tall that spreads its canopy over the entire soil pocket and its understorey community. (Can a single plant be considered a forest or a stratum?)

Litter: 100% cover of leaf and twig litter (and humus) that is more than 5cm deep and with seedlings of species of *Hakea* and *Acacia* growing in it.

Flammability Rating: Moderate to high, but fire risk is low due to the surrounding bare granite surface.

Soil: Lithosol and decomposing granite enriched by decaying organic matter.

Comments: Though small, Site 38 is floristically rich; it supports at least 25 species of vascular plants, most of them shrubs and larger herbaceous plants.

Variability: All of the Chiddarcooping Nature Reserve *Eucalyptus caesia* stands observed during the field trips had dense, heterogeneous understorey vegetation rich in species (Sites 38, 39 and 66 and elsewhere). Several of the species in the stands are uncommon in the reserve.

Eucalyptus caesia communities most commonly occur on terraces and in cracks on slopes of granite outcrops or at the base of granite slopes. The number of individual trees or mallees in a stand varies from one, as in Site 38, to a few, as in Site 39, or a few dozen, as in Site 66.

Zonation of Plant Communities on Granite Rock Slope

Site 12 SE quadrant of South Block

Plate: A2b

Zone 1: Code: nXJd (cracks & shallow sheets of soil on outcrop)
Herbaceous plants including *Isotome petraea*

Zone 2: Code: xS-SDc (shallow soil pockets at margin of outcrop)
Malleostemon tuberculatus 2-3m tall
Baeckea crispiflora 1m and 0.5m tall

Zone 3: Code: mSc (deeper, granite soil on apron of outcrop)
Melaleuca hamulosa 2-3m tall

Zone 3`: Code: cSc (on apron and extending beyond it)
Allocasuarina campestris thicket

Zone 4: Site 1 type *Melaleuca uncinata* thicket

Litter: Generally little except for piles of stems pushed up in windrows during track construction at edge of outcrop.

Flammability Rating: Low.

Soil: Ranges from bare granite exposure to gravelly, decomposing granite to sandy loam with high proportion of grit and gravel.

Comments: The outcrop is low, not more than 2m high at the highest point, slightly sloping, about 100m broad and with a narrow range of plant cover.

Borya sp.

Site 9 SE corner of South Block

Ferns, Mosses, Forbs and Small Grasses Plate: A1g

Muir Code: xJXc/K (or bMc)

Vegetation:

Stratum 1- *Borya* sp., *Drosera subhirtella*, *Lechenaultia* sp., *Stackhousia monogyna*, *Cheilanthes* sp. and several species of mosses.

Litter: None apparent. What little there is is probably mixed with living plants and is being incorporated into the soil.

Flammability Rating: Very Low.

Soil: Shallow sandy, gravelly soil with organic matter; pale brown and saturated with water at time of survey.

Comments: One of a wide range of varying but reasonably homogeneous very-small-plants communities on shallow sheets of soil on granite outcrops. This stand can be referred to as a meadow, as *Borya* mat community or as a resurrection plant community.

Macropod dung and copious rabbit dung were seen in the meadow; rabbits appear to relish the orchids in the meadow.

Virtually free of alien plants, unlike many similar pockets of vegetation.

Barya sp. and herbs

Site 16 SE quadrant of South Block

Drying Granite Meadow: Herbs and Mosses Plate: A2e

Muir Code: nXJdc/SKR

Vegetation: dense, herbaceous

Site 14 SE quadrant of South Block

Granite Meadow: Herbs and Mosses Plate: A2d

Muir Code: nXJdc/SKR

Vegetation: miniature herbs and mosses

Litter: Virtually none.

Flammability Rating: Low

Soil: Sand, gravel, decomposing granite, moss mat, organic matter

Isoetes australis

Site 17 — SE quadrant of South Block

Herbs — Plate: A2f

Muir Code: nJd(H20)

Vegetation:

Three species of rooted aquatic or semi-aquatic herbs in shallow, standing, but drying water in temporary pool: *Isoetes australis*, *Glossostigma ? trichodes*, *Centrolepis* aff. *glabra*.

Soil; Richly organic.

Site 15 — SE quadrant of South Block

Herbs — Plate: A2e

Muir Code: nJd(H20)

Vegetation:

Three species of herbs in dried granite pool: *Isoetes australis*, *Glossostigma ? drummondii*, *Crassula* sp.

Soil: Richly organic and with gravel.

OTHER

Mixed, Sandy Creek, Banks and Breakaway

Site 56 S of SW corner of West Block

Mixed Plate: A7e

Muir Code: ?

Vegetation:

Diverse array of shrubs ranging from 3m in height down to a few centimeters with species of sedges and other herbaceous most common along the channels. The tallest plants are species of *Acacia* and *Melaleuca*.

Litter: Not significant.

Flammability Rating: Low to moderate.

Soil: Generally sandy to silty loam in creek bed and banks and on southern side; lithosol and skeletal soil on breakaway on north side of creek.

Comments: This is one of the richest sites, if not the richest site, in terms of species numbers in the reserve. Several of the fifty -six species recorded there were found nowhere else in the reserve and one of them, *Eremophila viscida*, is a gazetted rare species.

Variability: No other site similar to Site 56 was found either in the reserve or outside of it.

APPENDIX A

PLATES

PHOTOGRAPHS OF FIELD OBSERVATION SITES

The nine sets of plates in this section present photographic prints of most of the field observation sites. The caption page facing each set of plates gives the Site number of each plate and either the dominant species at the site or another identifying feature.

PLATE A1

a	Site 1	*Melaleuca uncinata*; with firebreak in left foreground
b	Site 2	*Allocasuarina acutivalvis*
c	Site 5	*Eucalyptus salubris*
d	Site 6	*Allocasuarina huegeliana*
e	Site 7	Granite complex & *A. huegeliana*
f	Site 8	*Eucalyptus crucis*
g	Site 9	Granite mat & meadow
h	Site 10	*Eucalyptus leptophylla*

a

b

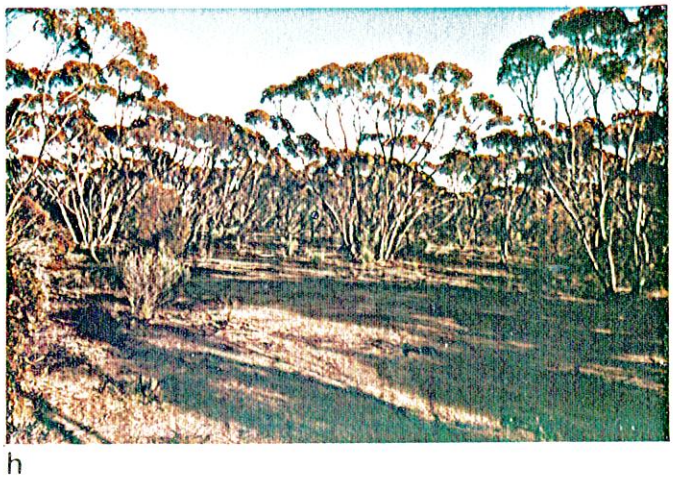
c

d

e

f

g

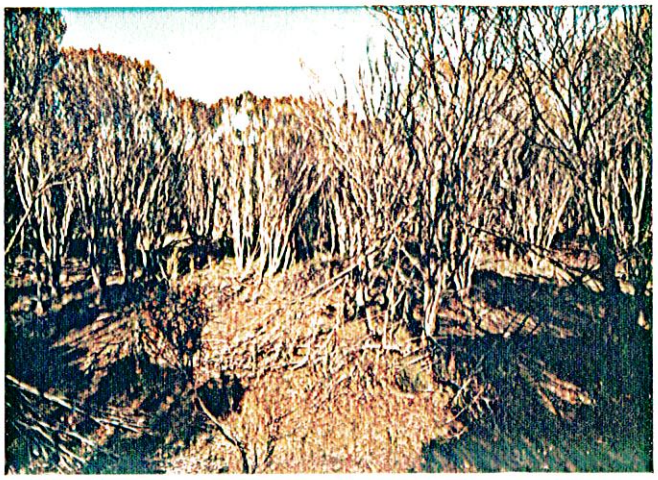


h

PLATE A1

PLATE A2

a	Site 11	*Melaleuca hamulosa*
b	Site 12	Granite outcrop zonation
c	Site 13	*Eucalyptus petraea*
d	Site 14	Granite mat & meadow
e	Site 15	Drying pool in foreground and centre
	Site 16	Moss bank on left
f	Site 17	Drying granite pool



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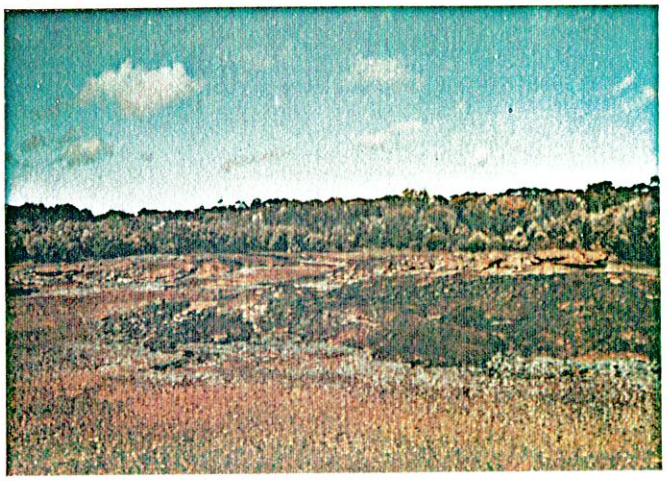

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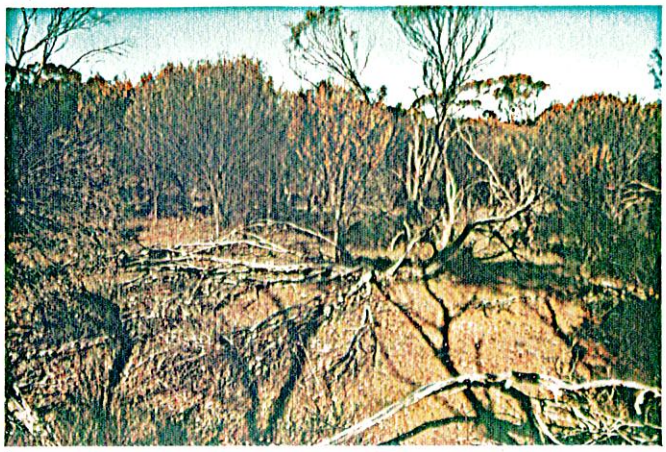
PLATE A2

PLATE A3

a	Site 18	*Allocasuarina huegeliana*
b	Site 19	*Acacia acuminata*
c	Site 20	*Eucalyptus wandoo*
d	Site 21	*Baeckea-Ecdeiocholea*
e	Site 21	Foreground
	Site 22	Background: *Acacia stereophylla*
f	Site 23	*Baeckea-Ecdeiocholea*
g	Site 26	From above; looking west
		Melaleuca uncinata
h	Site 26	From below; looking east

a



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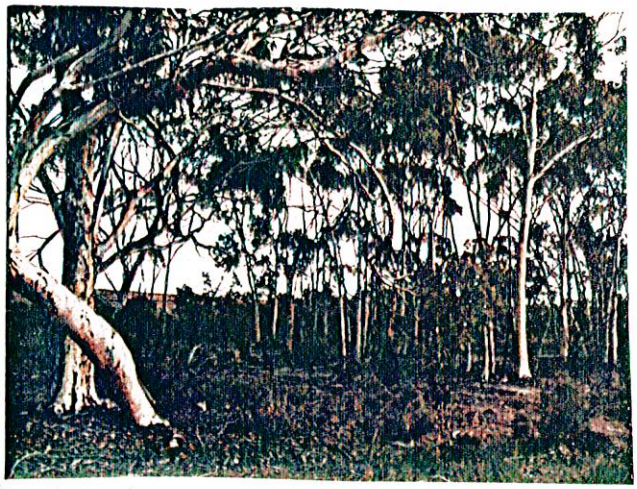

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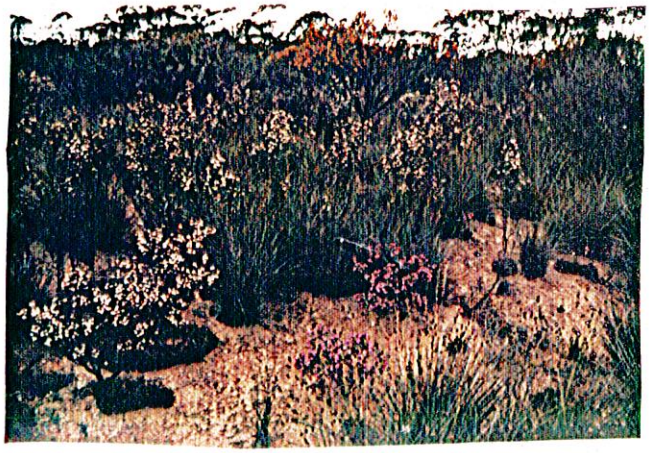

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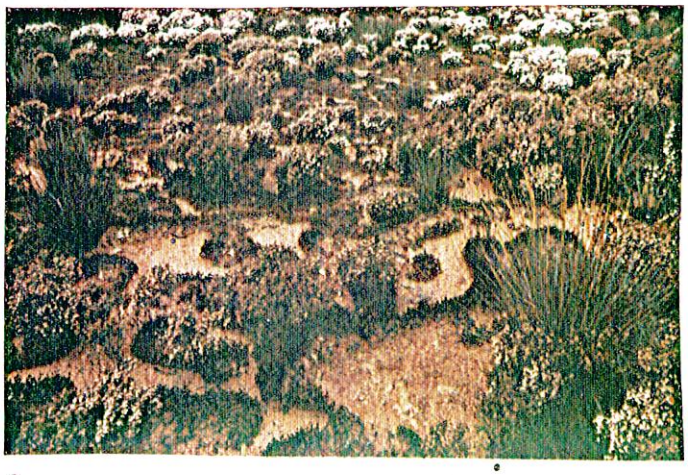

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PLATE A3

PLATE A4

a	Site 27	*Eucalyptus sheatheana*
b	Site 28	*Eucalyptus stawardii*
c	Site 29	*Acacia stereophylla*
d	Site 30	*Eucalyptus oldfieldii*
e	Site 31	*Eucalyptus redunca*
f	Site 32	Pool on granite
g	Site 33	Granite complex
h	Site 34	Boulders in background=Site 34

a

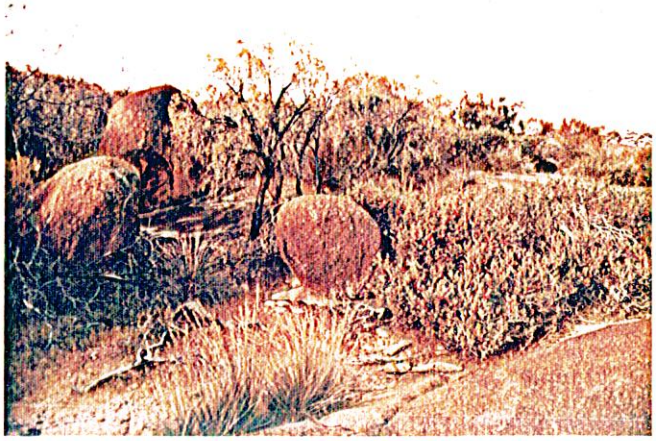
b

c

d

e

f



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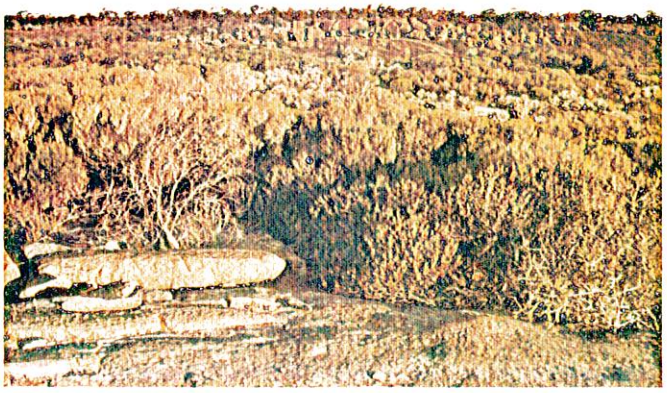
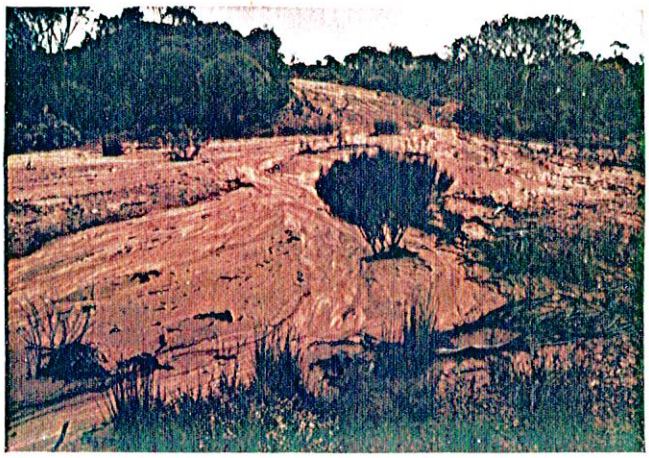


h

PLATE A4

PLATE A5

a	Site 35	Erosion next to Morrison Road
b	Site 36	*Melaleuca* aff. *uncinata*
c	Site 37	*Eucalyptus petraea*
d	Site 38	Right side: *E. caesia*
	Site 39	Left side: *E. caesia*
e	Site 38	*Eucalyptus caesia*
f	Site 40	*Eucalyptus redunca*
g	Site 41	Regenerating burnt *Allocasuarina-Melaleuca-Acacia* thicket
h	Site 42	*Callitris-Allocasuarina*



a

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PLATE A5

PLATE A6

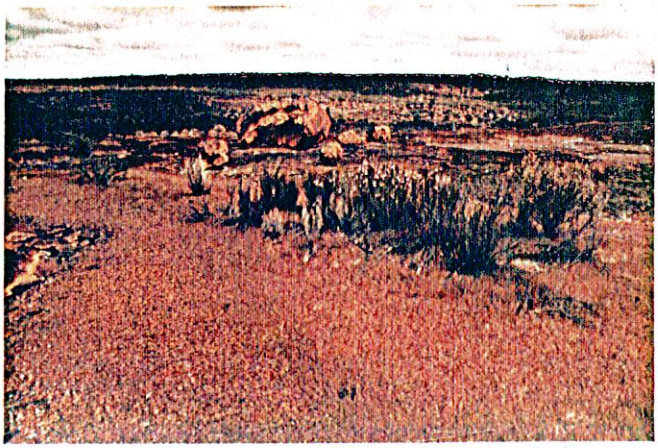
a	Site 43	*Eucalyptus wandoo*
b	Site 44	*Eucalyptus salubris*
c	Site 45	*Eriostemon-Eremophila*
d	Site 46	Granite ridge
e	Site 47	Granite meadow
f	Site 48	*Acacia anfractuosa* (Regen. burnt *A-M-A* thicket)
g	Site 49	*Eucalyptus wandoo*
h	Site 50	*Eucalyptus wandoo*

a

b

c

d



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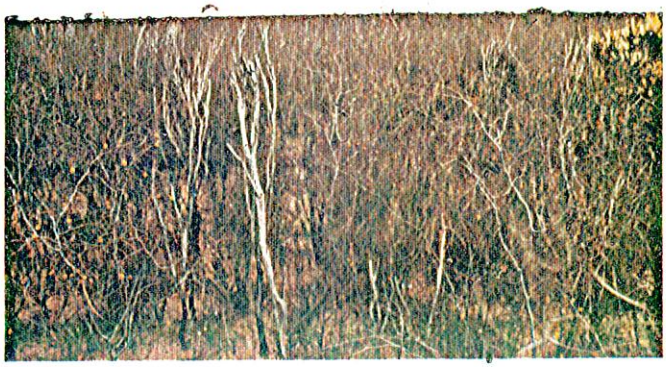

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PLATE A6

PLATE A7

a	Site 51	Regenerating burnt *A-M-A* thicket
b	Site 52	*Eucalyptus sheathiana*
c	Site 54	*Allocasuarina huegeliana*
d	Site 55	*Acacia acuminata*
e	Site 56	Mixed; species-rich; rare
f	Site 57	*Eucalyptus laxophleba*
g	Site 58	*Melaleuca viminea* meadow
h	Site 59	*Eucalyptus crucis*

a

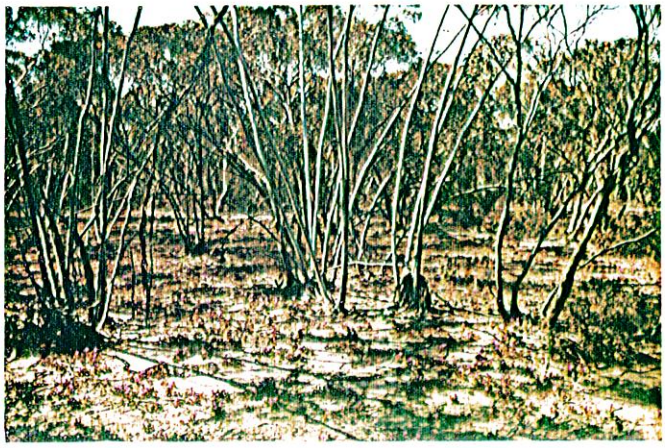

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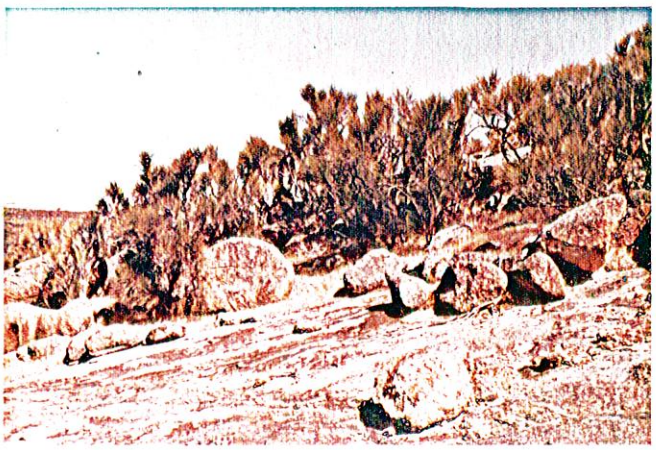
PLATE A7

PLATE A8

a	Site 60	*Calycopeplus ephedroides*
b	Site 61	*Eucalyptus redunca*
c	Site 62	Regen burnt *A-M-A* thicket
d	Site 63	Single dominant; open understorey *Allocasuarina huegeliana*
e	Site 63	Near creek; mixed; understorey
f	Site 64	Stream facet
g	Site 64	*Eucalyptus wandoo* facet
h	Site 65	Chiddarcooping Well: *Allocasuarina huegeliana*



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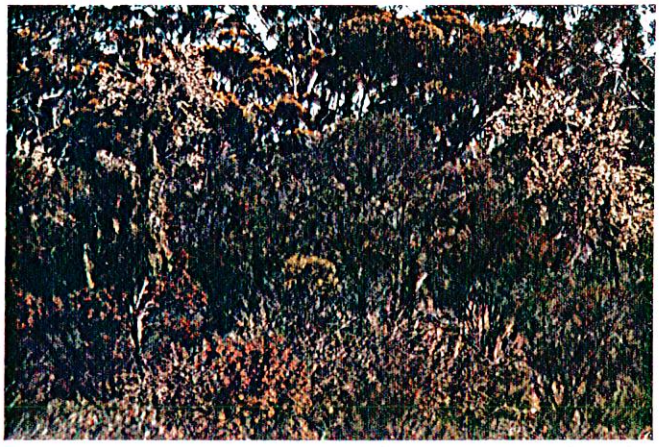

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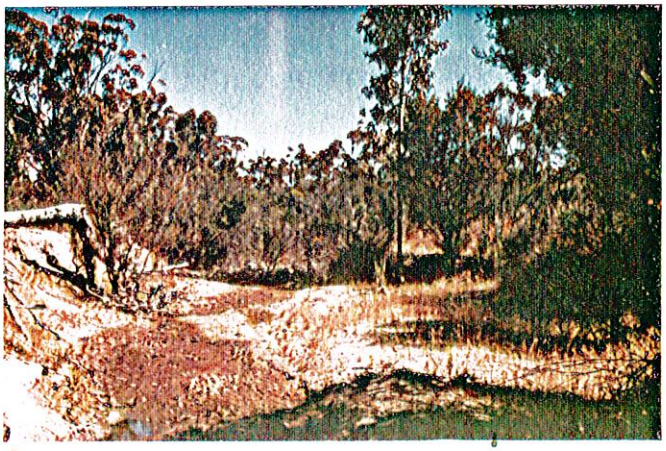

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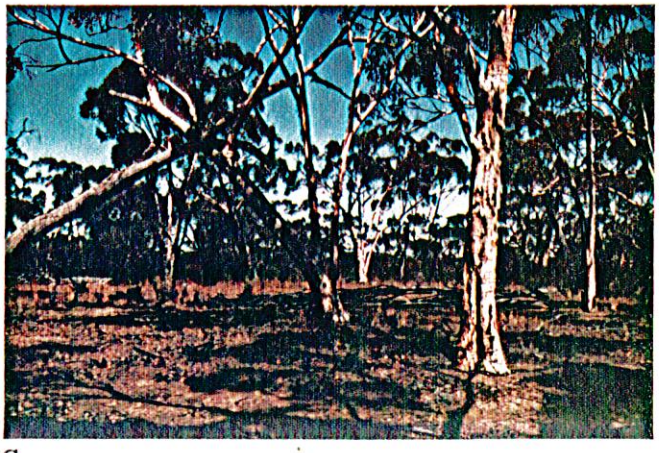

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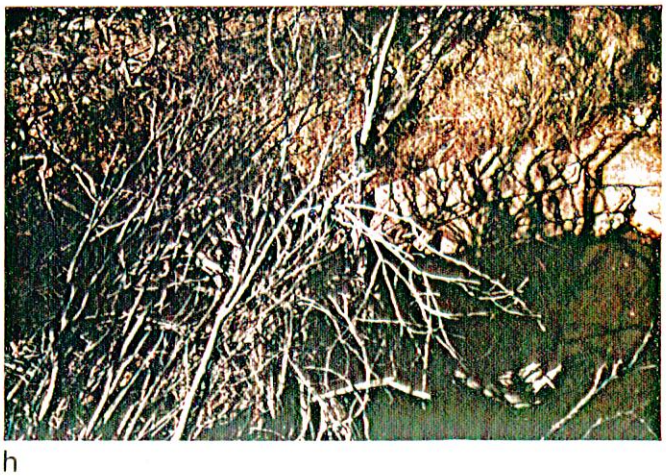
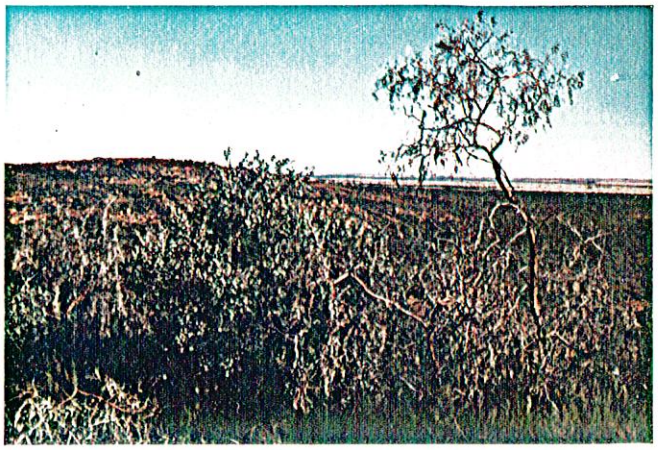


h

PLATE A8

PLATE A9

a	Site 66	*Eucalyptus caesia*
b	Site 68	*Melaleuca uncinata*
c	Site 69a	*Melaleuca uncinata*
d	Site 69b	*Allocasuarina campestris*
e	Site 69c	*Allocasuarina campestris*
f	Site 69d	*Allocasuarina campestris*
g	Site 70	*E. loxophleba, E. redunca*
h	Site 71	*Eucalyptus leptopoda* and thicket



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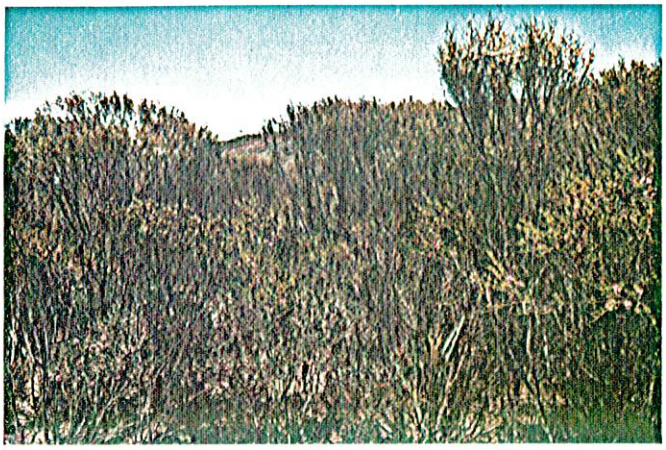

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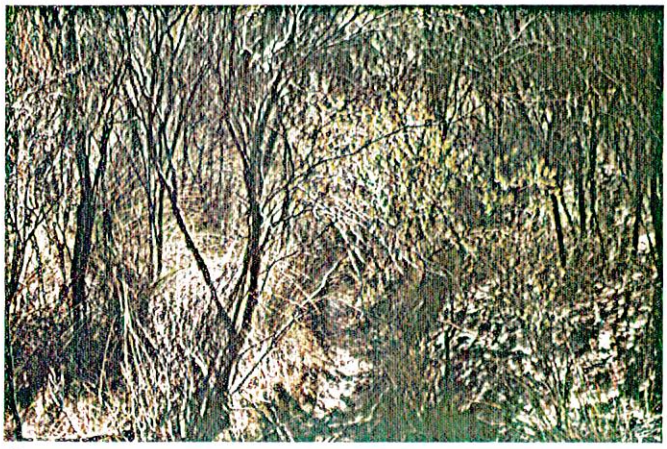

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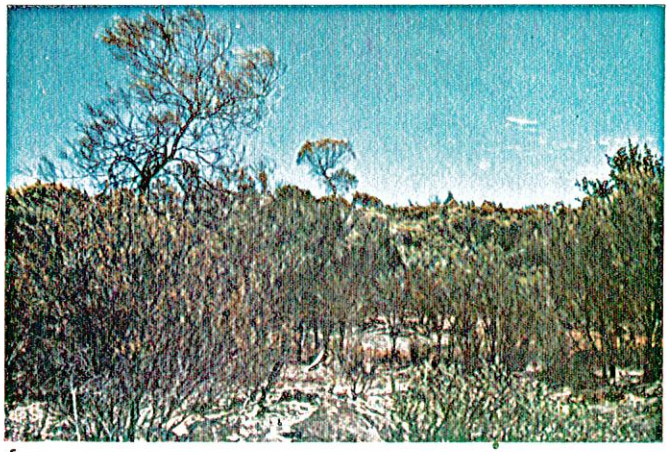

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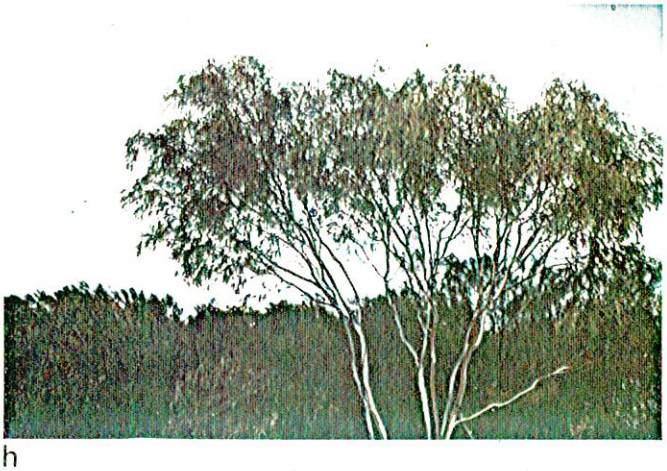

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PLATE A9

APPENDIX B

VASCULAR PLANT SPECIES LIST

CHIDDARCOOPING NATURE RESERVE

APPENDIX B

VASCULAR PLANT SPECIES LIST

Appendix B contains one list of the species of vascular plants recorded from Chiddarcooping Nature Reserve. The list, Table B-1, gives the collector and collection number(s) for each species on the list as well as a name or designatioin for every species recorded from the reserve. A second, still preliminary, list, Table B-2, will indicate the vegetation units in which species were recorded. In both tables families and their numbers are listed in numerical sequence according to the Census of Western Australian Plants (Green 1981), and species are listed alphabetically within families. The first draft of the second list will be completed after a series of field trips in Spring 1985 to confirm distributions.

Both lists can be modified and extended as more plants are collected in the reserve, identified and redetermined. Determinations for some groups of plants in the current list are tentative because, as in Proteaceae and Campanulaceae, the Western Australian Herbarium collections are away on loan to other herbaria. A.S.Weston Chiddarcooping specimens in these families and a number of others are being sent to experts for confirmation or determination or both.

It is imperative that collectors' names and their collection numbers be listed for all species in any species list that is to be kept accurate and up to date. Without voucher specimens there is no proof that a species name listed reflects a correct identification. For instance, two species of Hakea recorded by H. Shugg for the reserve, H. multilineata and H. subsulcata, probably do not occur there, but there are no voucher specimens to indicate which species Shugg did find. At the time Shugg made his observations two other species of Hakea similar to Hakea multilineata - H. francisciana and Hakea coriacea - were regularly identified as H. multilineata.

KEY TO ABBREVIATIONS AND SYMBOLS

BEFORE GENUS NAME

? Questionable determination to genus ('?' in middle of species name indicates that determination to species is questionable)

* Introduced species

AFTER SPECIES NAME

dd. Doubtful determination; probably is one of the other species on list. No voucher specimen found in W. A. Herbarium.

UNDER 'COLLECTION NUMBER' INDICATING COLLECTOR/OBSERVER, TABLE B-1

13--	A.S. Weston	SDH	Stephen Hopper
14--	A.S. Weston	AB	Andrew Brown
JB	Judith Brown	HS	Harry Shugg
SAM	Sue Moore	?	Collector/observer unknown

TABLE B-1

VASCULAR PLANT SPECIES

CHIDDARCOOPING NATURE RESERVE

SPECIES	COLLECTION NUMBER (ASW & others)
3 ISOETACEAE	
Isoetes australis Williams	13985, 13969
Isoetes sp.	13991
5 OPHIOGLOSSACEAE	
Ophioglossum lusitanicum L.	13804
9 DENNISTAEDTIACEAE	
Pleurosorus rutifolius (R.Br.)Fee	14144
11 ADIANTACEAE	
Anogramma leptophylla (L.)Link	14229
Cheilanthes austrotenuifolia Quirk & Chambers	13959, 14141, 13898
Cheilanthes lasiophylla Pichi-Serm.	14143
Cheilanthes ? sieberi Kunze	14146
Cheilanthes sp.	13851
18 CUPRESSACEAE	
Callitris canescens (Parl.)S.T.Blake	14295
Callitris columellaris F.Muell.	14517
26 JUNCAGINACEAE	
Triglochin calcitrapa Hooker	13980, 13987
Triglochin centrocarpa Hooker	14277B

31 POACEAE

Agrostis preissii (Nees)Vickery	13975
*Aira caryophyllea L. sens. lat.	14113,14214,14216B1,14234
Amphibromus neesii Steud.	14687
Amphipogon caricinus F.Muell.	13802, 14498
Aristida contorta F.Muell.	13884
*Avena sp.	------
*Briza maxima L.	------
*Briza minor L.	------
*Bromus spp.	------
Danthonia caespitosa Gaud.	14036, 14445
Eragrostis dielsii Pilger ex Diels & Pritzel	14473
Eriachne ovata Nees var. ovata	13964, 14351
*Hordeum ? leporinum Link	------
Neurachne alopecuroidea R.Br.	13927, 14041
*Pentaschistis airoides (Nees)Stapf	13899, 14214A, 14216B2, 14234A
Spartochloa scirpoidea (Steud.)C.E.Hubbard	14378, 14043,13886
Stipa elegantissima Labill.	13803, 14348
Stipa ? eremophila Reader	13801
Stipa hemipogon Benth.	14195
Stipa trichophylla Benth.	13832, 14037,14224
Triodia ? scariosa N.T.Burbidge	14658
Vulpia myuros (L.)Gmelin	13976, ?14038, 14217, 14227, 14235

32 CYPERACEAE

Chrysitrix distigmatosa C.B.Clarke	14520
Cyperus ? difformis L.	14680
Isolepis congrua Nees	13978, 14456A
Isolepis ? cyperoides R.Br.	14685
Lepidosperma costale Nees	14003
Lepidosperma drummondii Benth.	14371
Lepidosperma ? gracile R.Br.	14189
Lepidosperma scabrum Nees	14465
Lepidosperma viscidum R.Br.	13885, 14161
Schoenus hexandrus F.Muell. & Tate	14077, 14078
Schoenus humilis Benth.	14339, 13990
Schoenus nanus (Nees)Benth.	14058, 14355
Schoenus ? odontocarpus F.Muell.	14685

39 RESTIONACEAE

Ecdeiocholea monostachya F.Muell.	14016
Lepidobolus chaetocephalus F.Muell.	14382

40 CENTROLEPIDACEAE

Aphelia brizula F.Muell.	13972
Centrolepis aristata (R.Br.)Roemer & Schultes	14215, 14277G
Centrolepis glabra (F.Muell. ex Sonder)Hieron.	13991A, 14216,14277J
Centrolepis aff. glabra Hieron.	13977, 14148
Centrolepis pilosa Hieron.	14275, 14277D
Centrolepis polygyna (R.Br.)Hieron. sens. lat.	14277E, 14455
Centrolepis polygyna ssp. polygyna	13983
Centrolepis aff. polygyna Hieron.	14277F
Centrolepis strigosa (R.Br.)Roemer & Schultes	13966, 14456

52 JUNCACEAE

*Juncus bufonius L.	14338
Juncus caespiticius E.Meyer	14679
Juncus ? radula Buchenau	14452

54 LILIACEAE

Arthropodium curvipes S.Moore	14039
Arthropodium dyeri (Domin)N.H.Britton, ined.	14248, 14024
Borya ? constricta D.M.Churchill	14053
Borya ? scirpoidea Lindl.	13905, 13928,14140
?Borya sp.	14676
Bulbine semibarbata (R.Br.)Haw.	14354, 14025
Burchardia multiflora Lindl.	14429
Chamaescilla corymbosa (R.Br.)F.Muell. ex Benth.	14154, 13986
Chamaexeros fimbriata (F.Muell.)Benth.	13834
Dianella revoluta R.Br.	14056
Dichopogon fimbriatum (R.Br.)Macbride	14459, 14475, 14494
Laxmannia paleacea F.Muell.	14383
Lomandra collina (R.Br.)Ewart	14008, 14171, 13994
Lomandra effusa (Lindl.)Ewart	14007
Stypandra imbricata R.Br.	13907
Thysanotus dichotomus (Labill.)R.Br.	14163
Thysanotus patersonii R.Br.	13887

Thysanotus rectantherus N.H.Brittan	14533
Tricoryne humilis Endl.	14431
Xanthorrhoea nana D.A.Herbert	14395

66 ORCHIDACEAE

Caladenia amplexans George	13902
Caladenia barbarossa H.Reichenb. ssp. nov.	13962A, 13944
Caladenia cairnsiana F.Muell. ssp. pachychila Hopper	SDH 3821, 3820
Caladenia deformis R.Br.	13924
Caladenia denticulata Lindl. ssp. 'dimidia'	13852
Caladenia denticulata Lindl. ssp. 'deliquescens'	13852A, 13837A, SDH 3817
Calandenia denticulata Lindl. ssp. ? 'denticulata'	13912
Caladenia gemmata Lindl.	14359, 14321
Caladenia hirta Lindl.	AB
Caladenia radialis R.S.Rogers	13937, 13912B, 13993
Caladenia roei Benth.	13805, 14219
Caladenia saccharata H.Reichenb.	AB
Diuris laxiflora Lindl. (late-flowering form)	14353
Diuris longifolia R.Br.	14152
Leporella fimbriata (Lindl.)George	AB
Lyperanthus nigricans R.Br.	AB
Microtis unifolia (G.Forster)H.Reichenb.	14210
Prasophyllum cyphochilum Benth.	AB
Prasophyllum macrostachyum R.Br. var ringens (Reichenb.f.)George	14211, 13905, 14070A
Prasophyllum sargentii (Nicholls)George	AB
Pterostylis nana R.Br.	13913, 13900
Pterostylis recurva Benth.	AB
Pterostylis aff. rufa R.Br.	14406
Pterostylis sargentii C.Andrews	SDH 3818
Pterostylis vittata Lindl. var. vittata	14165, 14047
Spiculaea ciliata Lindl.	14361, 14212
Thelymitra antennifera (Lindl.)J.D.Hooker	14156
Thelymitra nuda R.Br.	14166
Thelmitra pauciflora R.Br.	14245, 14312B

70 CASUARINACEAE

Allocasuarina acutivalvis (F.Muell.)L.Johnson	14081, 13848
Allocasuarina campestris (Diels)L.Johnson	14071, 14142, 13915, 13952
Allocasuarina corniculata (F.Muell.)L.Johnson	14256

Allocasuarina huegeliana (Miq.)L.Johnson		13876, 13992

88 URTICACEAE

Parietaria debilis G.Forster		13895

90 PROTEACEAE

Grevillea acuaria (F.Muell.)Benth.		14309
Grevillea cf. biformis Meisn.		14126, 14377
Grevillea aff. eriostachya Lindl.		14250
Grevillea ? nana C.A.Gardner		14336, 14477, 14018
Grevillea cf. nematophylla F.Muell.		14251
Grevillea cf. paniculata Meisn.		13916, 14345
Grevillea paradoxa F.Muell.		14073, 14023
Grevillea ? pterosperma F.Muell.		14181
Grevillea yorkrakinensis C.A.Gardner		14054
Grevillea sp.		14344
Hakea franciscana F.Muell.		14076, 14124, 14291
Hakea invaginata B.L.Burtt		14079, 14342
Hakea laurina R.Br. (H. petiolaris ?)	dd.	SDH
Hakea ? lissocarpha R.Br.	dd.	?
Hakea ? morrisoniana W.V.Fitzg.	dd.	?
Hakea multilineata Meisn.	dd.	HS
Hakea petiolaris Meisn.		14167
Hakea pycnoneura Meisn.		14121
Hakea recurva Meisn.		14002, 14318, 14401
Hakea scoparia Meisn.		14129
Hakea subsulcata Meisn.	dd.	HS
Hakea trifurcata (Sm.)R.Br.		14169
Isopogon sp.		SDH 1862,14072
Persoonia ? diadena F.Muell.		14122
Persoonia cf. trinervis Meisn.		14129
Persoonia sp. nov.		14132, 14074
Persoonia sp.		14482
Petrophile sp.		14492

92 SANTALACEAE

Exocarpos aphyllus R.Br.		13866, 14000
Exocarpos sparteus R.Br.		13963
Leptomeria preissiana (Miq.)A.DC.		14084, 14296

Santalum acuminatum (R.Br.)A.DC.	13967
Santalum spicatum (R.Br.)A.DC.	13960

97 LORANTHACEAE

Amyema gibberulum (Tate)Danser var. tatei (Blakely)Barlow	14462
Amyema miquellii (Lehm. ex Miq.)Tieghem	14393
Lysiana casuarinae (Miq.)Tieghem	14394, 14001

103 POLYGONACEAE

Muehlenbeckia adpressa (Labill.)Meisn.	13909

105 CHENOPODIACEAE

Atriplex bunburyana F.Muell.	14300
Atriplex nummularia Lindl.	14264
Enchylaena lanata P.G.Wilson, ined.	13942
Enchylaena tomentosa R.Br.	14302
Eriochiton sclerolaenoides (F.Muell.)F.Muell. ex A.J. Scott	13869
Maireana carnosa (Moq.)P.G.Wilson	13868
Maireana georgei (Diels)P.G.Wilson	13870, 13834
Maireana marginata (Benth.)P.G.Wilson	13862
Maireana trichoptera (J.M.Black)P.G.Wilson	13867, 13833
Maireana triptera (Benth.)P.G.Wilson	JB 60
Rhagodia drummondii Moq.	13948
Rhagodia preissii Moq.	14311, 14110, 14109, 14392
Sclerolaena diacantha (Nees)Benth.	13871
Sclerolaena fusiformis P.G.Wilson	14458

106 AMARANTHACEAE

Amaranthus sp.	------
Ptilotus drummondii (Moq.)F.Muell. var drummondii	14442
Ptilotus cf. esquamatus (Benth.)F.Muell.	14364, 14450
Ptilotus exaltatus Nees var. villosus Benl	14319
Ptilotus holosericeus (Moq.)F.Muell.	13858, 14112
Ptilotus humilis (Nees)F.Muell. var. humilis	13949, 14194
Ptilotus obovatus (Gaud.)F.Muell. var. obovatus	13831, 13873
Ptilotus spathulatus (R.Br.)Poir.	13835
Ptilotus sp.	14222

108 GYROSTEMONACEAE

Codonocarpus cotinifolius (Desf.)F.Muell.	14496

110 AIZOACEAE

Carpobrotus modestus S.T.Blake	14472A
Disphyma crassifolium (L.)L.Bolus	14267
*Mesembryanthemum nodiflorum L.	14269, 14301
*Micropterum papulosum (L.f.)Schwantes	13838, 14225

111 PORTULACACEAE

Calandrinia cf. primuliflora Diels	14495
Calandrinia sp.	14050, ?14228
Calandrinia sp.	14242
Calandrinia sp.	13839

113 CARYOPHYLLACEAE

*Petrorhagia velutina (Guss.)P.W.Ball & V.H.Heywood	------

131 LAURACEAE

Cassytha glabella R.Br. f. dispar (Schltdl.)J.Z.Weber	13968, 14376,14381, 14667

135 PAPAVERACEAE

*Papaver hybridum L.	13829

138 BRASSICACEAE

*Brassica tournefortii Gouan	13962
*Sisymbrium sp.	------
Stenopetalum filifolium Benth.	13840, 13859

143 DROSERACEAE

Drosera andersoniana (W.V.Fitzg.)Ewart & White	13825, ?14247A
Drosera bulbosa Hooker	13835
Drosera glanduligera Lehm.	13826
Drosera macrantha Endl.	13850

Drosera subhirtella Planch. ssp. moorei (Diels)N.G.Marchant 13829
Drosera sp. 14357A, 14357B
Drosera sp. 14218F

149 CRASSULACEAE

Crassula colorata (Nees)Ostenf. 14051, 14231, ?14243
Crassula decumbens Thunb. 13988
Crassula ? exserta (Reader)Ostenf. 13979
*Crassula natans Thunb. var. minus (Eckl. & Zeyh.)Rowley 14356
Crassula sp. 13971
Crassula sp. 14230, ?14237
Crassula sp. 14147

152 PITTOSPORACEAE

Billardiera erubescens (Putterl.)E.M.Bennett 13918
Billardiera sp. ------
Bursaria occidentalis E.M.Bennett 14316, 14317
Pittosporum phylliraeoides DC. var. microcarpa S.Moore 14198

163 LEGUMINOSAE SUBFAM. MIMOSOIDEAE

Acacia acuminata Benth. 14159, 13995, 13792
Acacia acutata W.V.Fitzg. 14332, 14015
Acacia aestivalis E.Pritzel 14457
Acacia andrewsii W.V.Fitzg. 14034
Acacia anfractuosa Maslin 14137
Acacia assimilis S.Moore SDH 1874
Acacia bidentata Benth. sens. lat. 14289
Acacia chrysella Maiden & Blakely, variant 14558, 14665, 14666
Acacia colletioides Benth. 13799
Acacia coolgardiensis Maiden 13938, 14557
Acacia densiflora Morrison 14260
Acacia dentifera Benth. 14352, 14197, 14012
Acacia desertorum Maiden & Blakely group: 14388, 14186, 14116, 14531
Acacia erinacea Benth. 13860
Acacia fragilis Maiden & Blakely (A. assimilis?) dd. HS
Acacia hemiteles Benth. 13997, 14499, 14528
Acacia ixiophylla Benth. sens. lat. 14261, 14545
Acacia jibberdingensis Maiden & Blakely 14491
Acacia aff. jutsonii Maiden 14125, 14460, 14508

Acacia lasiocalyx C.Andrews		13878
Acacia multispicata Benth. (A. 'desertorum' ?)	dd.	HS
Acacia murrayana F.Muell. ex Benth.	dd.	?
Acacia neurophylla W.V.Fitzg.		14123
Acacia prainii Maiden		14327, 13853
Acacia resinomarginea W.V.Fitzg.		13791
Acacia restiacea Benth.		13923
Acacia saligna (Labill.)H.L.Wendl.		14365
Acacia sessiliceps F.Muell.		14446
Acacia signata F.Muell.		14507, SDH 1885
Acacia steedmanii Maiden & Blakely		14515, SDH 1884
Acacia stenoptera Benth.		?
Acacia stereophylla Meisn.		14390, 14063, 14133, 14505
Acacia tetragonophylla F.Muell.		13879
Acacia viscifolia Maiden & Blakely group:		14029, 14103, 14170, 14263, 14546, 14673
Acacia sp. (cf. A. hemiteles)		SAM 1
Acacia sp. nov. (cf. A. duriuscula)		14180, 14486, 14514
Acacia sp. nov. aff. ixiophylla		14262, 14547, 14663, JB 59
Acacia sp.		SDH 1887
Acacia sp.		SDH 1867

164 LEGUMINOSAE SUBFAM. CAESALPINIOIDEAE

Cassia cardiosperma F. Muell.	14310
Cassia nemophila A. Cunn. ex Vogel	14008A, 13856
Labichea punctata Benth. ssp. punctata	14464

165 LEGUMINOSAE SUBFAM. PAPILIONOIDEAE

Daviesia cf. longifolia Benth.	14098, 14552, 14009
Daviesia nematophylla F.Muell. ex Benth.	13855
Gastrolobium floribundum S.Moore	14135
Glycine clandestina Willd.	14202
Isotropis drummondii Meisn.	14358, 14454
Leptosema daviesioides (Turcz.)Crisp	14335
Mirbelia ramulosa (Benth.)C.A.Gardner	14199
?Mirbelia sp.	14325
?Mirbelia sp.	14173
Oxylobium parviflorum Benth. var. parviflorum	14030

167 GERANIACEAE

Erodium aureum Carolin	14204
Erodium cygnorum Nees	13828, 14199A

168 OXALIDACEAE

Oxalis perennans Haw.	14013

173 ZYGOPHYLLACEAE

Zygophyllum apiculatum F.Muell.	14274, 14550
Zygophyllum eremaeum (Diels)Ostenf.	14027, 14502

175 RUTACEAE

Boronia coerulescens F.Muell.	13863
Boronia ternata Endl. var. ternata	14136
Diploloena microcephala Bartl.	14366
Drummondita hasselii (F.Muell.)P.G.Wilson	14035
Eriostemon brucei F.Muell. var. brucei	14192
Phebalium filifolium Turcz.	14127, SDH 1864
Phebalium tuberculosum (F.Muell.)Benth.	14089A, 14085
Phebalium tuberculosum ssp. tuberculosum	14118
Phebalium tuberculosum ssp. aff. megaphyllum (Ewart)P.G.Wilson	14082

183 POLYGALACEAE

Comesperma integerrimum Endl.	13888
Comesperma volubile Labill.	14083

185 EUPHORBIACEAE

Beyeria lechenaultii (DC.)Baill.	14075
Calycopeplus ephedroides Planch. (=C. helmsii)	14022, 14367
Euphorbia drummondii Boiss.	14205
Monotaxis lurida (Muell.Arg.)Benth.	14168, 14509

202 STACKHOUSIACEAE

Stackhousia monogyna Labill. sens. lat.	13831

Stackhousia scoparia Benth.	14536

207 SAPINDACEAE

Dodonaea adenophora Miq.	14331
Dodonaea bursarifolia Behr. & F.Muell.	13946, 14662
Dodonaea caespitosa Diels	14032, 14470
Dodonaea inaequifolia Turcz.	14114, 13866
Dodonaea rigida J.G.West	13882
Dodonaea viscosa Jacq. ssp. spatulata (Smith) J.G.West	14190, 14189

215 RHAMNACEAE

Cryptandra leucophracta Schlechter	14080
Cryptandra parvifolia Turcz.	14089
Cryptandra sp.	14333
Trymalium daphnifolium Reiss.	14369

221 MALVACEAE

Alyogyne hakeifolia (Giord.)Alef.	14396
Sida calyxhymenia J.Gay ex DC.	14201, 14409

223 STERCULIACEAE

Brachychiton gregorii F.Muell.	14391
Guichenotia sarotes Benth.	14375
Hannafordia bissillii F.Muell.	14247
Keraudrenia integrifolia Steud.	13925
Lysiosepalum involucratum (Turcz.)C.A.Gardner	14096, 14290
Rulingia cuneata Turcz.	14513
Rulingia luteiflora E.Pritzel	13906
Thomasia rugosa Turcz.	14177
Thomasia sarotes Turcz.	14465

226 DILLENIACEAE

Hibbertia eatoniae Diels	14055
Hibbertia enervia (DC.)Hoogl.	14318A, JB72
Hibbertia exasperata (Steud.)Briq. group	14040
Hibbertia glomerosa (Benth.)F.Muell.	13904,14329,14158
Hibbertia polyclada Diel (cf. H. glomerosa) dd.	HS

Hibbertia rupicola (S.Moore)C.A.Gardner	13917
Hibbertia sp. nov. (pungent)	14162, 14493

233 CLUSIACEAE

Hypericum gramineum G.Forster	13989, 14453

236 FRANKENIACEAE

Frankenia pauciflora DC.	14102

243 VIOLACEAE

Hybanthus floribundus (Lindl.)F.Muell. ssp. floribundus	14164, 14097

263 THYMELAEACEAE

Pimelea aeruginosa F.Muell.	SDH 1871
Pimelea angustifolia R.Br.	14134, 14524
Pimelea imbricata R.Br.	14374
Pimelea microcephala R.Br.	13996, 14501
Pimelea sp. nov. (P. 'densa')	14511
Pimelea sp. nov. (P. 'avonensis')	14091

273 MYRTACEAE

Baeckea crispiflora F.Muell.	14067,14052,14095,13953, 13943,14315,14387
Baeckea elderiana E.Pritzel	14062,14151,14538
Baeckea grandibracteata E.Pritzel	14131
Baeckea maidenii Ewart & J.White	SDH 1870
Baeckea muricata C.A.Gardner	14540
Baeckea sp. nov. aff. behrii (Schlecter)F.Muell.	13903, 14451, SDH 1873,
Callistemon phoeniceus Lindl.	14271
Calothamnus gilesii F.Muell.	14251,14045A,14360,14021
Calothamnus cf. gilesii F.Muell.	14483
Calothamnus quadrifidus R.Br. var. G.	14139, 13881
Calothamnus sp.	14114A, 14254, 14530
Calytrix leschenaultii (Schauer) Benth.	14364, 13919
Calytrix plumulosa (F.Muell.)B.D.Jackson	14521, 14534
Chamelaucium ciliatum Desf. var. nov.	14334
Chamelaucium pauciflorum (Turcz.)Benth. ssp. pauciflorum	14405,14526,14257

Darwinia aff. purpurea (Endl.)Benth.	14458A, 14014
Eucalyptus caesia Benth. ssp. magna Brooker & Hopper	14463
Eucalyptus celastroides Turcz.	14307,14292, 14299, 14106, 14176
Eucalyptus crucis Maiden ssp. lanceolata Brooker & Hopper	13914
Eucalyptus eremophila (Diels)Maiden	14175,14187,14516,14661
Eucalyptus erythronema Turcz. var. erythronema	14370, 14668
Eucalyptus leptophylla F.Muell. var. floribunda Blakely	13945, 13875
Eucalyptus leptopoda Benth.	14476, 14670
Eucalyptus loxophleba Benth.	14305,14293,14647,14107, 14153, 14180A,13790
Eucalyptus oldfieldii F.Muell.	14126, SAM2
Eucalyptus petraea Carr & Carr	14157,13958,14448,14446
Eucalyptus redunca Schauer var. subangusta	14306,14368,14138, 14178,14171
Eucalyptus rigidula Cambage & Blakely	SAM 15
Eucalyptus salmonophloia F.Muell.	14562
Eucalyptus salubris F.Muell.	13861, 14188
Eucalyptus sheathiana Maiden	14298,14105,14179
Eucalyptus stowardii Maiden	14114, 14669,14553
Eucalyptus transcontinentalis Maiden (wheatbelt form)	14518
Eucalyptus wandoo Blakely ssp. 'pubescens'	14028, 14555
Eucalyptus yilgarnensis (Maiden)Brooker	14297, 14108
Kunzea pulchella (Lindl.)George	14444
Leptospermum erubescens Schauer	14019, 14093
Leptospermum erubescens Schauer 'stricta'	14320
Leptospermum cf. erubescens Schauer	14386, 14481
Leptospermum roei Benth.	13877
Malleostemon roseus (E.Pritzel)J.W.Green	14117,14400,14260A, 14512
Malleostemon tuberculatus (E. Pritzel) J.W. Green	JB66, 14160, 13796, 13933, 13922
Melaleuca acuminata F.Muell.	13794
Melaleuca conothamnoides C.A.Gardner	14343
Melaleuca aff. cuticularis Labill.	14100
Melaleuca eleuterostachya F.Muell.	13795, 14559
Melaleuca filifolia F.Muell.	14469, 14559
Melaleuca fulgens R.Br.	14468
Melaleuca aff. glaberrima F.Muell.	14249
Melaleuca hamulosa Turcz.	14092, 14324,13951
Melaleuca holosericea Schauer	14259
Melaleuca lateriflora Benth. var. lateriflora	13863, 14560
Melaleuca laxiflora Turcz.	14484

Melaleuca cf. laxiflora Turcz.	14341
Melaleuca macronychia Turcz.	13920, 14664
Melaleuca platycalyx Diels	14120
Melaleuca radula Lind.	14010
Melaleuca uncinata R.Br. (flat)	13793, 14561
Melaleuca uncinata R.Br. (short, terete, very late)	14554
Melaleuca uncinata R.Br. (terete, early flowering)	14389, 13800
Melaleuca uncinata R.Br. (terete, late flowering)	14086,14529,14469,14468
Melaleuca uncinata R.Br. (short, flat, late)	14500
Melaleuca aff. uncinata R.Br.	14060
Melaleuca viminea Lindl.	14350
Micromyrtus obovata (Turcz.)J.W.Green	14130
Micromyrtus racemosa Benth. var. racemosa	14067
Thryptomene australis Endl.	14239A, 14460
Thryptomene kochii E.Pritzel	14086, 14539
Thryptomene tenella Benth.	SDH 1860
Verticordia brownii (Desf.) DC.	14551
Verticordia chrysantha Endl.	14372,14094,14474,14523
Veticordia pholidophylla F.Muell.	14522
Verticordia picta Endl.	14258
Wehlia thryptomenoides F.Muell.	14064, 14020

276 HALORAGACEAE

Glischrocaryon aureum (Lindl.)Orchard var. ? angustifolium (Nees)Orchard	JB11
Glischrocaryon aureum (Lindl.)Orchard var. aureum	14185
Glischrocaryon flavescens (Drumm. ex Hooker)Orchard	13911, 14191
Gonocarpus confertifolius (F.Muell.)Orchard var. helmsii Orchard	14535
Gonocarpus nodulosus Nees	13845, 14155, 14232
?Myriophyllum sp.	14682

281 APIACEAE

Daucus glochidiatus (Labill.)Fisch., C.A.Meyer & Ave-Lall.	13872,14099,14145
Hydrocotyle alata R.Br. ex A.Rich.	14357
Hydrocotyle callicarpa Bunge	14066B
Hydrocotyle pilifera Turcz. var. glabrata Benth.	13849, 13896
Hydrocotyle rugulosa Turcz.	13896
Platysace effusa (Turcz.)Norman	14401, 14657, 14675
Trachymene cyanopetala (F.Muell.)Benth.	14044,14048, 13897,13981,13843

Trachymene ornata (Endl.)Druce	13844, 14066A
Trachymene pilosa Sm.	14044A

286 EPACRIDACEAE

Astroloma serratifolium (DC.)Druce	13926, 14033, ?14447
Leucopogon aff. multiflorus R.Br.	14542
Leucopogon aff. planifolius Sonder	14490
Leucopogon ? sprengelioides Sonder	14150

293 PRIMULACEAE

*Anagallis arvensis L.	------

302 LOGANIACEAE

Mitrasacme paradoxa R.Br.	14233, 14026A

303 GENTIANACEAE

*Centaurium spicatum (L.)Fritsch	14683
Sebaea ovata (Labill.)R.Br.	14174

304 APOCYNACEAE

Alyxia buxifolia R.Br.	13880

310 BORAGINACEAE

Halgania preissiana Lehm.	14326
Halgania viscosa S.Moore	14497

311A CHLOANTHACEAE

Cyanostegia angustifolia Turcz.	14182
Dicrastylis parvifolia F.Muell.	14519
Dicrastylis aff. parvifolia F.Muell.	14328
Mallophora rugosifolia Munir	14659, 14525
Pityrodia teckiana (F.Muell.)E.Pritzel	14312, 14445A, 14208
Pityrodia terminalis (Endl.)George	14373

313 LAMIACEAE

Hemigenia dielsii (Hemsley)C.A.Gardner	14252, 14537
Prostanthera aspalathoides A.Cunn. ex Benth.	14323
Prostanthera baxteri A.Cunn. ex Benth.	14556
Westringia cephalantha F.Muell.	14270, 14397,14441
Westringia rigida R.Br.	14340

315 SOLANACEAE

Anthocercis genistoides Miers	dd.	HS
Duboisia hopwoodii (F.Muell.)F.Muell.		14349
Lycium ? australe F.Muell.		14549
Nicotiana sp.		13910, 13961
Nicotiana sp.		14238
Solanum hoplopetalum Bitter & Summerh.		14363
Solanum lasiophyllum Dunal ex Poir.		13908, 14200
Solanum orbiculatum Dunal ex Poir.		13941

316 SCROPHULARIACEAE

Glossotigma ? drummondii Benth.	13970
Glossotigma ? trichodes F.Muell.	13984, 14149
*Parentucellia latifolia (L.)Caruel	14213

320 OROBANCHACEAE

Orobanche minor Sm.	14209

326 MYOPORACEAE

Eremophila aff. drummondii F.Muell.	13797, 14031
Eremophila glabra (R.Br.)Ostenf.	14285, 13854
Eremophila granitica S.Moore	14287, 14660,14504
Eremophila cf. granitica S.Moore	14193
Eremophila oppositifolia R.Br. ssp. angustifolia (S.Moore)Chinnock	14286, 13865
Eremophila virens C.A.Gardner	JB
Eremophila viscida Endl.	14322
Eremophila sp.	14503
Eremophila sp.	14196, 14017

329 PLANTAGINACEAE

Plantago hispida R.Br.	13846

331 RUBIACEAE

Opercularia vaginata Labill.	13921

339 CAMPANULACEAE

Wahlenbergia ? communis Carolin	14282
Wahlenbergia gracilis A.DC.	14246
Wahlenbergia sp. B.	13837
Wahlenbergia sp.	14236

340 LOBELIACEAE

Isotoma hypocrateriformis (R.Br.)Druce	14337, 14467
Isotoma petraea F.Muell.	13940, 14221
Lobelia gibbosa Labill.	14677
Lobelia winfridae Diels	14312A

341 GOODENIACEAE

Brunonia australis Smith	141203, 13836
Dampiera eriocephala Vriese	14184, 14510
Dampiera haemotricha Vriese ssp. dura (Benth.)Rajput & Carolin	13884
Dampiera cf. preissii Vriese	14272A
Dampiera ? restiacea E.Pritzel	14671
Dampiera saevolina Gardner ex Rajput & Carolin	14478, 14472
Dampiera stenostachya E.Pritzel	14380, 14183,14532
Dampiera wellsiana F.Muell.	144986, 14379
Goodenia ? berardiana (Gaud.)Carolin	14220, 14279,13841
Goodenia ? krauseana Carolin	14330
Goodenia spp.	14362, 14280, 14684, 14065, 14061, 14681
Scaevola cf. aemula R.Br.	14498A
Scaevola spinescens R.Br.	14273
Scaevola sp. nov.	14308
Scaevola sp.	14506
Velleia cycnopotamica F.Muell.	13842

Velleia discophora F.Muell.	14398

343 STYLIDIACEAE

Levenhookia dubia Sonder	13827, 14006,14240
Levenhookia leptantha Benth.	14042
Levenhookia stipitata (Sonder)F.Muell.	14059, 14278
Stylidium bulbiferum Benth.	14487
Stylidium calcaratum R.Br.	13965, 14068,14276
Stylidium dielsianum E.Pritzel	14284
Stylidium leptophyllum DC.	14066C, 14385,14346
Stylidium limbatum F.Muell.	14548
Stylidium aff. macranthum Carlquist	14090

345 ASTERACEAE

Actinobole uliginosum (A.Gray) Hj.Eichler	13815, 13818,14241
Angianthus strictus (Steetz)Benth.	14303
*Arctotheca calendula (L.)Levyns	------
?Angianthus sp.	13889, 14218E
Blennospora drummondii A.Gray	13889, 14218E
Brachycome ciliaris (Labill.)Less.	14272, 13814
Brachycome iberidifolia Benth.	13808, 14479
Brachycome perpusilla (Steetz)J.M.Black var. tenella (Turcz.)G.L.Davis	14005
Calocephalus multiflorus (Turcz.)Benth.	14267A
Calotis hispidula (F.Muell.)F.Muell.	14049
*Centaurea melitensis L.	13939
Ceratogyne obionoides Turcz.	14066
Chrysocoryne drummondii A.Gray	14070, 14218A
Chrysocoryne pusilla (Benth.)Endl.	13822
Chrysocoryne tridens P.S.Short	14294
*Dittrichia graveolens (L.)W.Greuter	14686
Gnaphalium sphaericum Willd.	14223
Gnephosis pygmaea (A.Gray)Benth.	13974, 13956
Helichrysum lindleyi Hj.Eichler	13893, 13807
Helichrysum tepperi F.Muell.	14005A
Helipterum australe (A.Gray)Druce	13954, 14283
Helipterum demissum (A.Gray)Druce	13817
Helipterum fitzgibbonii F.Muell.	14527
Helipterum hyalospermum F.Muell. ex Benth.	13813
Helipterum laeve (A.Gray)Benth.	13836
Helipterum pygmaeum (DC.)Benth.	13820

Helipterum rubellum (A.Gray)Benth.	13998
Helipterum spicatum (Steetz)Benth.	14004
Helipterum aff. tenellum Turcz.	14265, 14543
Helipterum verecundum S.Moore	13816, 14314
Helipterum zacchaeus S.Moore	13819
*Hypochoeris glabra L.	14155A,14206, 14218G,14226
Millotia myosotidifolia (Benth.)Steetz	13811
Millotia tenuifolia Cass.	13890
Myriocephalus rhizocephalus (DC.)Benth.	14281
Olearia muelleri (Sonder)Benth.	13857, 14101
Olearia pimeleoides (DC.)Benth.	14046, 13798
Olearia revoluta F.Muell. ex Benth.	13947
*Osteospermum clandestinum (Less.)T.Norlindh	13892
Podolepis capillaris (Steetz)Diels	13821, 14678
Podolepis lessonii (Cass.)Benth.	13812, 14069
Podotheca angustifolia Less.	13824, 13891
Podotheca gnaphalioides R.A.Graham	13890, 13847
Quinetia urvillei Cass.	13966A, 13973,14218D
Rutidosis multiflora (Nees)B.L.Robinson	14239, 13955,14218
Schoenia cassiniana (Gaud.)Steetz	13830, 13806
Senecio glossanthus (Sonder)Belcher	13823
Senecio lautus G.Forster ex Willd. ssp. dissectifolius	Ali 14011
*Sonchus oleraceus L.	13894, 14207
*Ursinia anthemoides(L.)Poir.	------
Waitzia acuminata Steetz	13809
Waitzia citrina (Benth.)Steetz	13810, ?14313

APPENDIX C

BIRD SPECIES LIST

CHIDDARCOOPING NATURE RESERVE.

BIRD SPECIES LIST

CHIDDARCOOPING NATURE RESERVE

SPECIES	OBSERVATIONS, A.BOUGHER & A.Weston (28.9.84 - 3.10.84)	
Emu	AB	
Square-tailed Kite	AB	
Wedge-tailed Eagle	-	
Brown Goshawk	-	
Spotted Harrier	-	
Nankeen Kestrel	AB	
Brown Falcon	-	
Grey Falcon	-	
Mallee Fowl	-	
*White-Faced Heron	AB	
Common Bronzewing	AB	
Crested Pigeon	AB	
Red-tailed Cockatoo	AB	
Galah	AB	
Regent Parrot	AB	
Port Lincoln Parrot	AB	
Mulga Parrot	AB	
*Pallid Cuckoo	AB	
Tawny Frogmouth	AB	
*Spotted Nightjar	AB	
Owlet Nightjar	-	
*Sacred Kingfisher	AB	
Australian Bee-eater	-	
Tree Martin	-	
Australian Pipit	AB	
Groundlark	-	
Magpie-lark	AB	
Black-faced Cuckoo-shrike	AB	
White-browed Babbler	AB	
Weebill	AB	
Broad-tailed (Inland) Thornbill	-	
Chestnut-rumped Thornbill	AB	
Yellow-rumped Thornbill	AB	
Red-throat	-	
*Crimson Chat	AB	Nest in *Beackea crispiflora.*

Brown Flycatcher	-
*Western Yellow Robin	AB
Red-capped Robin	AB
*Grey Fantail	AB
Willie Wagtail	AB
*White-winged Triller	AB - In flocks, up to 10.
Rufous Whistler	AB
Golden Whistler	-
*Blue-breasted Wren	AB
Western Shrike-thrush[1]	AB
*Crested Bellbird	AB
*Southern Scrub Robin	AB - Nesting in Mallee/Melaleuca (Site 27).
Sitella	AB
*Black Honeyeater	AB
Brown Honeyeater	AB
Brown-headed Honeyeater	AB
White-eared Honeyeater	AB
Singing Honeyeater	AB
*Tawny-crowned Honeyeater	AB
White-fronted Honeyeater	AB
Yellow-throated Miner	-
Spiny-cheeked Honeyeater	AB
Red Wattle-bird	AB
Black-faced Wood-swallow	-
*Striated Pardalote	AB
Pied Butcherbird	-
Grey Butcher-bird	-
Australian Magpie	AB
Grey Currawong	AB
*Little Crow	AB

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* New record for the reserve (there are 15 new records).

1. The Grey Shrike-thrush and Western Shrike-thrush have both been listed for the reserve, although probably only one should be. The latter is the western subspecies of the former.