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Nature Conservation Reserves in the Eastern Goldfields, Western Australia

(Southern Two Thirds of CTRC System 11)

N. J. Henry-Hall¹

with the assistance of

S.D. Hopper²

N.L. McKenzie²

G.J. Keighery²

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¹Aquila Biological Consultant
Box 238, Cottesloe, WA 6011

²Dept. of Conservation and Land Management
Western Australian Wildlife Research Centre
PO Box 51, Wanneroo WA 6065

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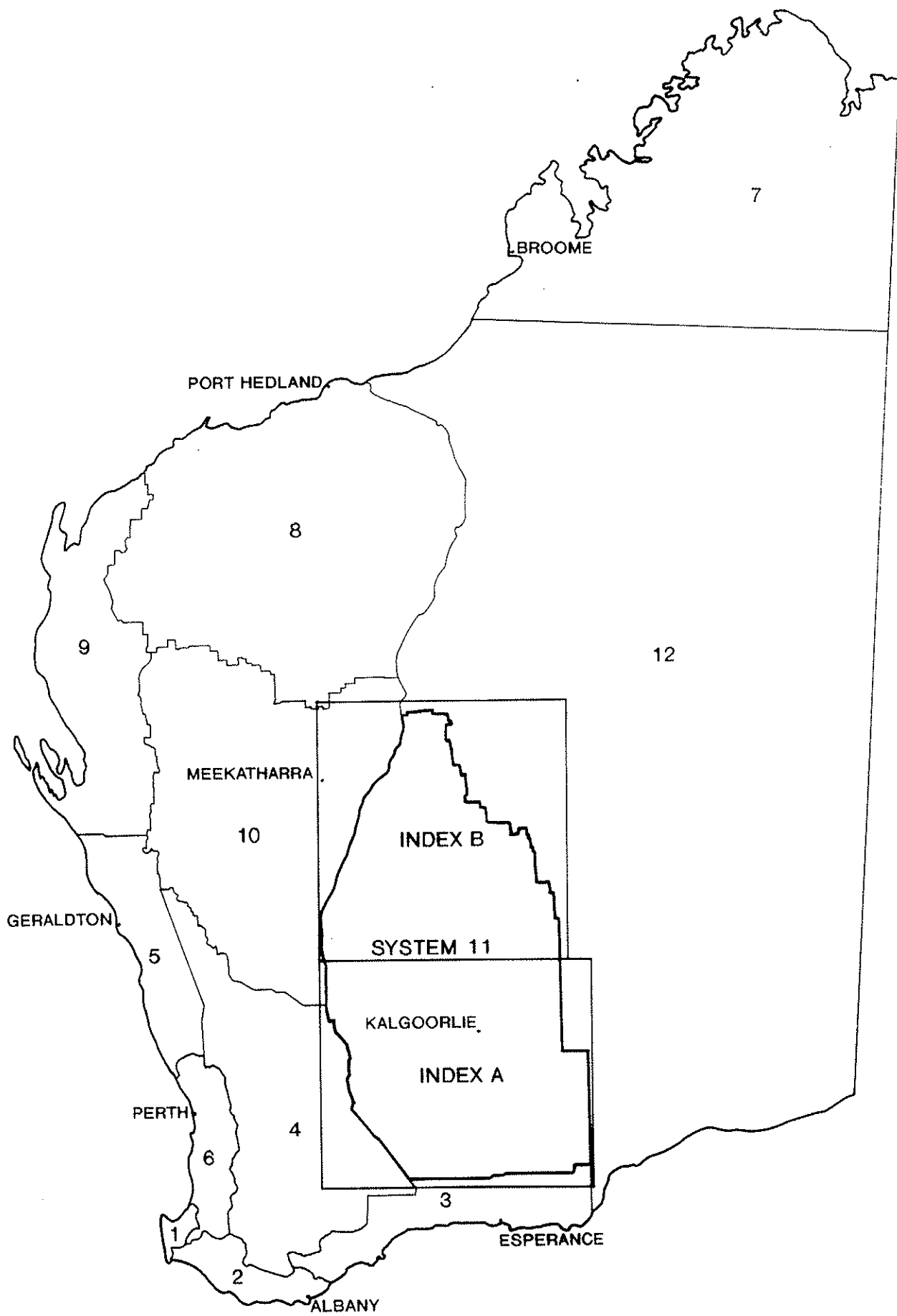
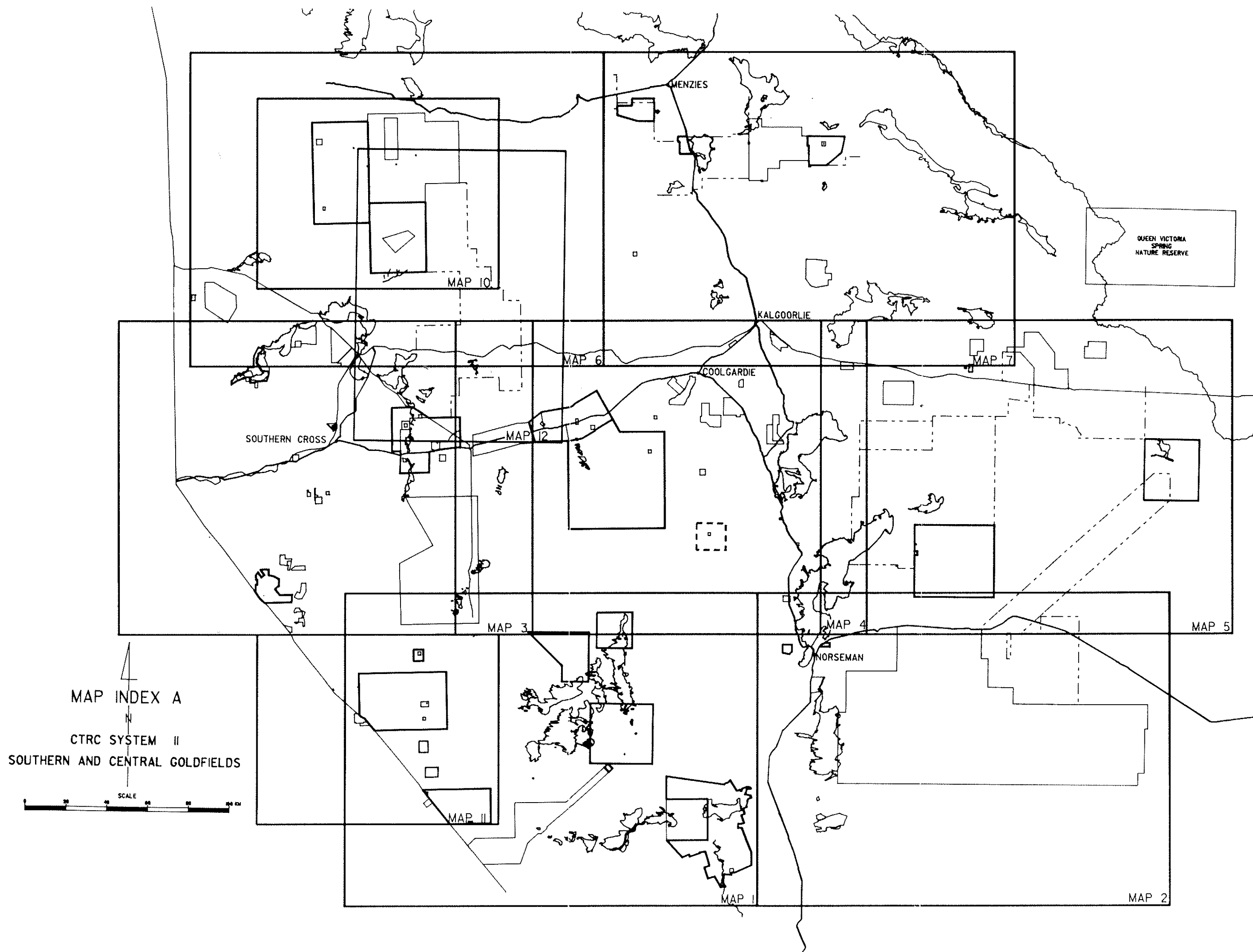
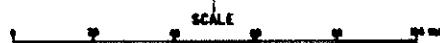


Figure 1. Locality map showing CTRC Systems



MAP INDEX B
CTRC SYSTEM II
NORTHERN GOLDFIELDS



WEEKATHARRA

WILUNA

MAP 9

SANDSTONE

LEINSTER

LAVERTON

LEONORA

MENZIES

MAP 8

Preface

RECOMMENDATIONS

Recommendations concerning existing and proposed nature conservation reserves in the Eastern Goldfields District, excluding the northern pastoral region, are presented in this report. Commissioned by the EPA Red Book Task Force to resolve outstanding recommendations in System 11 and represent biological diversity of the system as a whole, the report was compiled with technical support and assistance from CALM staff. The recommendations contained within this private consultant's submission to the Task Force have yet to be considered or endorsed by CALM.

ABBREVIATIONS

A number of names of committees and government departments are abbreviated throughout this report:

- Conservation Through Reserves Committee (CTRC)
- Biological Surveys Committee (BSC)
- Environmental Protection Authority (EPA)
- Department of Conservation and Land Management (CALM)

NOMENCLATURE

Maps contained in this report were compiled and drawn by Land Information Branch, CALM. Inclusion of a name on the following maps, however, does not imply its approval by the relevant nomenclature authority.

Acknowledgements

This report is based on "Conservation Reserves in Western Australia, Report of the Conservation Through Reserves Committee on Systems 1-5, 8-12 to the Environmental Protection Authority" and results from the "Biological Survey of the Eastern Goldfields, Western Australia". I am indebted to the authors of these documents.

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Introduction

In 1972, the Environmental Protection Authority (EPA) established the Conservation Through Reserves Committee (CTRC) to recommend a system of nature conservation reserves for Western Australia. Dividing the State into 12 "Systems" (see Figure 1), the CTRC Green Book (1974) made recommendations for reserves in 10 of these, including System 11 - the Eastern Goldfields. The EPA considered the CTRC's recommendations, endorsing most and modifying others in what is known as the EPA "Red Books".

The EPA Red Book (1975) made recommendations to Cabinet for reserves in Systems 4, and 8 to 12. Cabinet subsequently approved these recommendations on 9 February, 1976. Of the 11 Red Book recommendations in System 11, seven were implemented while four were delayed due to mining implications, consideration of wider issues involved or were awaiting the completion of biological surveys.

From 1983-88, the implementation of outstanding Red Book recommendations was suspended pending the findings of a number of Government reports. The Aboriginal Land Inquiry (Seaman Inquiry, 1984) and Committee on Exploration and Mining in National Parks and Nature Reserves (Bailey Report, 1986), in particular, had major implications for conservation reserves in the State.

In May 1988, the EPA's Red Book Task Force was established to accelerate the implementation of outstanding conservation reserve recommendations endorsed by Cabinet in 1976. This was one of the initiatives arising from the Government's published policy "Mining and the Environment: Balancing the Scales", developed from considerations of the Bailey Report, 1986. The Task Force requested a report to resolve Red Book recommendations for two specific areas in System 11, and to assess available biological data and recommend additional reserves to represent the biological diversity of the system as a whole.

Interim reports containing recommendations for appropriate nature conservation reserve boundaries for the Mt Manning Range and Lake Cronin areas were submitted to the Task Force during 1989. The present report is the outcome of the review of System 11.

This document revises and updates the CTRC System 11 report (1974), following the model established by CALM's submission to the Kimberley Region Planning Study on System 7 (see Burbidge, McKenzie and Kenneally, 1987). The CTRC report suggested that the existing larger conservation reserves in System 11 may not be sited in the best locations. In this context, the present review of the existing reserve system addresses the need to declare additional nature reserves, conservation parks and extensions to national parks and nature reserves.

Throughout the report, CTRC System 11 is referred to as the Eastern Goldfields District or Eastern Goldfields. For the purposes of this report, the Eastern Goldfields has been divided into three regions: the southern, central and northern goldfields. Figure 1 shows the boundaries of the Eastern Goldfields District (System 11) and the relative location of the southern and central goldfields (Map Index A) and northern goldfields (Map Index B).

A nature conservation reserve system for the southern and central goldfields is presented in this report. Existing and proposed reserves, and extensions are detailed for the southern goldfields (sections 1.1 to 1.14, Maps 1 to 5) and the central goldfields (2.1 to 2.4, Maps 6 to 7). No additions to the existing CTRC recommendations are proposed in the northern goldfields (3.1 to 3.2, Maps 8 to 9), as this is being dealt with by Government in another context.

The Eastern Goldfields District was identified as the priority CTRC System requiring biological survey. Reasons for selection included its location in the interzone between the mesic South-West and arid Eremaean regions; extensive areas of relatively unmodified vegetation, particularly the renowned goldfields woodlands; and the need to evaluate the adequacy of existing conservation reserve systems. The placement of a representative large reserve system in the southern and central goldfields has been based largely on results from this comprehensive survey (conducted from 1978 - 82) and subsequent specialist surveys by the Department of Conservation and Land Management (CALM).

The recent Goldfields Planning and Development Study (GPDS) provides an overview of the district, including physical features, social characteristics and economic activity. Detailed descriptions of the landforms, flora, vegetation and fauna can be found in the published and unpublished reports from the biological survey of the Eastern Goldfields (see Table 10).

The GPDS, published in 1989, preceded the reserve recommendations for the Eastern Goldfields presented in this report. The study, however, noted gaps in the representation of the existing reserve system, particularly the mulga and goldfields eucalypt woodlands. Suggesting that a good case for additional reserves can be made on numerous selection criteria, the study highlighted the Lake Johnston and Mt Manning Range areas (see 1.5 and 2.2).

The majority of the Eastern Goldfields is Crown land, although much of it is leased for pastoral purposes. The presence of Crown land not under pastoral lease in the southern and central goldfields provides an opportunity to establish a series of nature conservation reserves representative of the biological diversity of the Eastern Goldfields District.

Background

BIOLOGICAL SURVEY OF THE EASTERN GOLDFIELDS DISTRICT

Historical background

The Biological Surveys Committee (BSC) was established in 1977 to improve planning and coordination of district surveys. Forming the basis of a Biological Survey of Western Australia, district surveys aim to provide information on plant and animal distributions, population fluctuations, habitat requirements and the effects of humans on the environment. District surveys can also highlight species in danger of extinction or which need special conservation measures (BSC, 1984). In addition, these district-wide surveys are invaluable for the evaluation of the existing nature conservation reserve system.

The Eastern Goldfields District

The BSC decided to base its district surveys on the 12 systems defined in 1974 by the CTRC Green Book (see Figure 1). CTRC System 11 - the Eastern Goldfields was selected as the system most in need of survey for several reasons. These included the impact of active mineral exploration, agricultural pressure for land releases in the southern part of the district and the biogeographical significance of the Coolgardie Botanical District or South-western Interzone (Beard, 1980), which is entirely confined to the Eastern Goldfields District (see Figure 2).

The Eastern Goldfields District chosen for biological survey closely followed CTRC System 11 boundaries shown in Figure 1. A small area in the north around Wiluna was excluded from the survey to avoid the inclusion of an additional natural district, the Carnegie Salient of the Ashburton District (Beard, 1980). Roughly rectangular, the Eastern Goldfields District extends from 27°S to 33°S and 118°30'E to 123°45'E, covering an area of about 266,000km² (Figure 2).

Objectives

The BSC (1984) detail the broad objectives and aims for the biological survey of the Eastern Goldfields District, which were to establish a district data-base through the documentation of landforms, vegetation types, vascular flora and vertebrate fauna. Compilation of this inventory would then allow long-term changes in the district's biota to be monitored. Evaluation of the adequacy of the existing conservation reserves was also a primary goal of the survey. Those elements which were required for the rational placement of a nature conservation reserve system in the Eastern Goldfields District were built into the design (BSC, 1984).

Survey design

The need to complete a comprehensive survey of an area as large and diverse as the Eastern Goldfields District necessitated a systematic survey of selected groups of the biota at a few carefully chosen sites (BSC, 1984). The BSC divided the Eastern Goldfields into twelve "cells", based on the

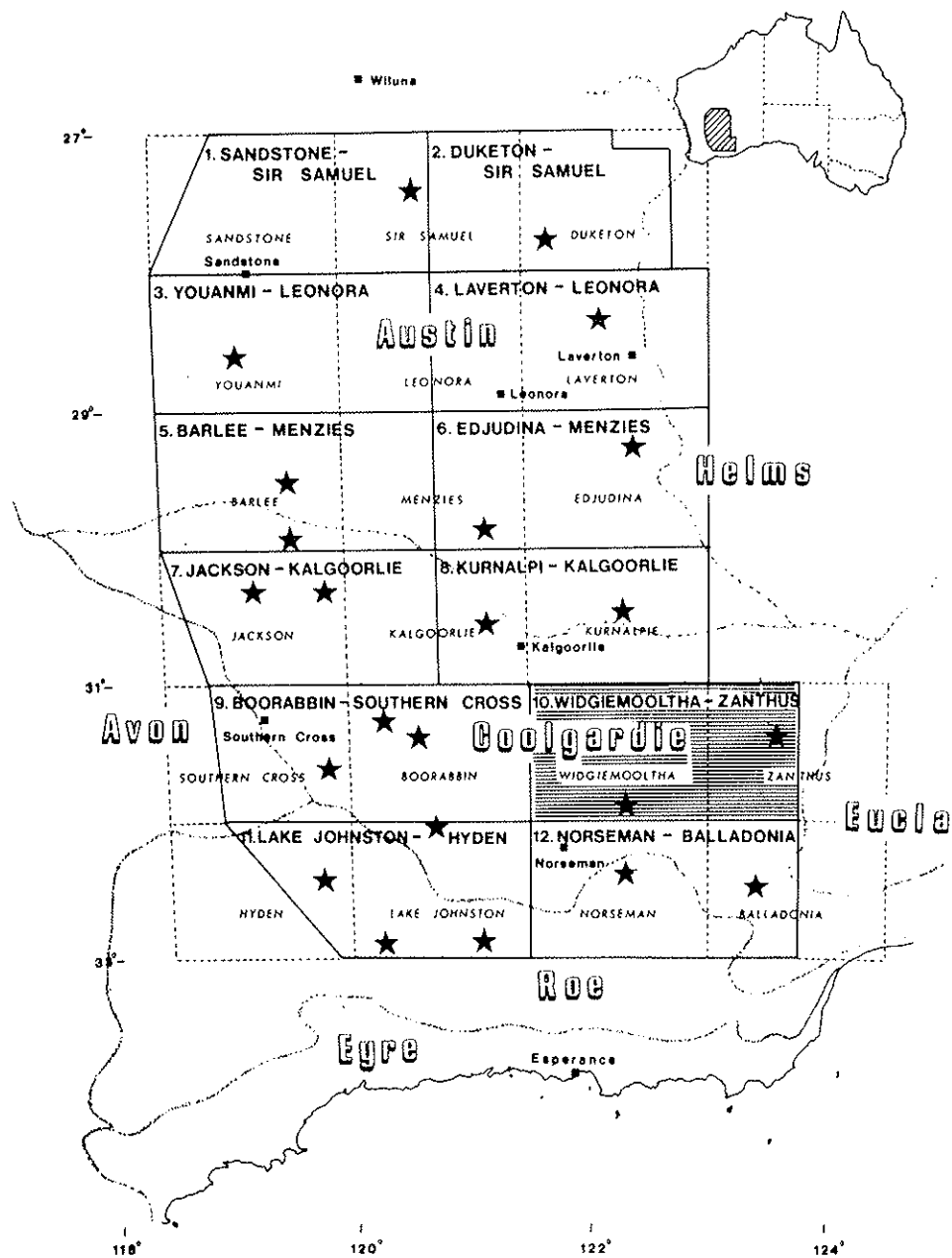


Figure 2. Map showing the boundaries of study areas and botanical districts in the biological survey of the Eastern Goldfields District. (★ indicates vertebrate survey sites)

1:250,000 topographic series (Figure 2), and selected vascular plants and terrestrial vertebrates for intense study.

Two teams, one from the WA Museum and the other from the WA Wildlife Research Centre, sampled the vertebrate fauna at these survey sites during three different seasons from 1977 - 81. (Table 1). The Wildlife Research Centre (now part of CALM) surveyed study areas 1, 4, 5, 8, 9 and 12 while the Museum sampled cells 2, 3, 6, 7, 10 and 11 (see Table 1). The fauna was also documented from three national parks in the district (cells 9 and 11). Sampling effort was increased in the complex south-western part of the district and correspondingly limited in the four less diverse northern cells (see Figure 1).

Vertebrate survey sites were selected to maximise coverage of major geomorphological and vegetation systems while representing the major soil and vegetation types of the landforms (BSC, 1984). The largest and most homogeneous area of habitat was selected for intensive systematic survey over three seasons. Sampling methods for floristics, vegetation and vertebrate animals are outlined in BSC (1984). Quadrat-based sampling allowed quantitative comparisons to be made both between and within the different community types, which was then used in the selection of representative reserves (see McKenzie *et al.*, 1989).

The BSC (1984) detail the selection and description of sample sites for vegetation and floristics. Two consulting botanists, A.V. Milewski and K.R. Newbey, with support from the WA Herbarium, documented the flora and vegetation of the Eastern Goldfields. Sites were selected subjectively so as to represent: the range of variation in vegetation structure and floristics, the geographic range of vegetation variation, mature stands of unmodified vegetation, and vegetation that was as floristically and structurally homogeneous as possible (BSC, 1984). In addition, the vegetation and flora of vertebrate survey sites was documented.

Precise locations of the long-term biological monitoring sites established in the Eastern Goldfields are detailed in Appendix 1. The majority of the survey sites in the southern (cells 9-12) and central (cells 5-8) goldfields are situated in existing or proposed conservation reserves. In contrast, the sites in the northern goldfields (cells 1-4) are located within pastoral boundaries. These are listed in Table 1 and their locations shown on Maps 8 and 9, except for two sites in cell 8, which are shown on Map 7.

Biological survey sites within existing reserves (nature reserves or national parks) are listed in Table 1. These are Lake Cronin Nature Reserve, Peak Charles National Park and Frank Hann National Park in cell 11 (Map 1); Dundas Nature Reserve in cell 12 (Map 2); Jilbadgi Nature Reserve (Map 3) and Boorabbin National Park (Map 4) in cell 9; Mt Manning Range Nature Reserve in cell 5 (Map 6); and Wanjarri Nature

Table 1

List of long-term biological survey sites established in the Eastern Goldfields District*.

Study areas ¹	Location of biological survey site ²	Date surveyed
1. Sandstone-Sir Samuel	Wanjarri NR	SU/79,A/80,W/81
2. Duketon-Sir Samuel	Banjawarn Station	A/79,SU/80,SP/81
3. Youanmi-Leonora	Yuinmery Station	A/79,SU/80,SP/81
4. Laverton-Leonora	Erlistoun Station	SU/79,A/80,W/81
5. Barlee-Menzies	Mt Manning Range NR	W/79,SP/80,SU/81
	Mt Elvire Station	"
6. Edjudina-Menzies	Comet Vale	SU/79,SP/80,W/81
	Yundamindra Station	"
7. Jackson-Kalgoorlie	Mt Jackson Station	SP/79,A/80,SP/81
	Bungalbin Hill	"
8. Kurnalpi-Kalgoorlie	Black Flag Station	SP/79,W/80,SU/81
	Kurnalpi	"
9. Boorabbin-Southern Cross	Jilbadgi NR	SU/80,A/81,SP/81
	Pidgeon Hole	"
	Boorabbin NP	W/80,SU/81
10. Widgiemooltha-Zanthus	Woodline Hills	SP/78,W/80,A/81
	Buningonia Spring	"
11. Lake Johnston-Hyden	Lake Cronin NR ³	SP/78,W/79,SU/81
	McDermid Rock	"
	Peak Charles NP	SU/80,SP/80,A/81
	Frank Hann NP	"
12. Norseman-Balladonia	Dundas NR (3 sites) ⁴	SP/77, A/78,SP/79
	Mt Willgonarinya	"
	Dingo Rock	"

KEY

* Monitoring sites where the vertebrate fauna (amphibians, reptiles, mammals, birds) was sampled in addition to flora and vegetation surveys.

SP Spring (September - November)

SU Summer (January - March)

A Autumn (April - mid-June)

W Winter (mid-June - August)

NR Nature Reserve

NP National Park

NOTES

¹ See Figure 2.

² For precise locations of vertebrate survey sites see Appendix 14.

³ Additional trip to Lake Cronin in Spring 1979 (How *et al.*, 1988).

⁴ Dundas area also sampled in Summer and Spring 1978 (N. McKenzie, pers. comm.).

Reserve in cell 1 (Maps 8,9). Those sites encompassed by extensions or proposed reserves are McDermid Rock in cell 11 (Map 1); Pidgeon Hole in cell 9 (Map 4); Woodline Hills and Buningtonia Spring (Map 5) in cell 5; Mt Jackson and Bungalbin Hill in cell 7 (Map 6,10); and Comet Vale in cell 6 (Map 7).

The design of a nature conservation reserve system also influenced site selection during the survey. Consideration was given to documentation of proposed and existing reserves as well as to vacant Crown land. In addition, particular areas in the Eastern Goldfields recommended for survey by the EPA (1975) were included in the district biological survey. These were Mt Manning and Mt Jackson (CTRC Recommendation 11.3-4) and Lake Cronin (11.10).

Results

The results of the biological survey of the Eastern Goldfields District were intended to be published in several series. The first, consisting of descriptions of the physical environment and biota for each of the 12 cells, has almost been completed (see below). The second will comprise detailed syntheses of the vegetation, flora and vertebrate fauna of the district as a whole, while the third will be an analysis of the conservation status of its animals and plants (BSC, 1984). Both the latter reports are awaiting the completion of the first series, which provides the inventory documented by the biological survey.

The present status of the first series, consisting of 13 parts, is as follows. Part I (BSC, 1984), the introduction and methods of the biological survey of the Eastern Goldfields, preceded the descriptions and documentation of the 12 study areas. Results have been published for cells 10 (Part 2, 1984), 7 (Part 3, 1985), 11 (Part 4, 1988) and 6 (Part 5, 1988). Cells 8, 3 and 4 are planned for publication in 1990. Inventories for the remaining cells (1, 2, 5, 9 and 12) have been compiled and descriptions are in preparation. References for these published and unpublished reports are included in Table 10.

FLORA AND VEGETATION OF THE EASTERN GOLDFIELDS DISTRICT

Surveys

The Biological Surveys Committee (BSC) noted that prior to the survey no systematic collecting of plants had been carried out in the Eastern Goldfields District. Available data, however, suggested that many plant species might have very restricted geographic distributions (BSC, 1984). This was confirmed by the findings of botanical surveys (see below).

Extensive collections and site descriptions were compiled by the two consulting botanists during the survey. Reports by Newbey and Hnatiuk (1984, 1985, and 1988); Newbey and Keighery (in press), Newbey (in prep.) and Mileweski and Keighery (1988; in prep.) document the flora and vegetation of the Eastern Goldfields. Also, numerous specialist botanical

surveys have been conducted since the survey. The references to these published and unpublished sources are listed under Area Descriptions and Recommendations.

Rare flora

Appendix 2 lists the Declared Rare Flora and Priority taxa present on existing and proposed reserves in the Eastern Goldfields District. This list incorporates taxa that are declared as Rare Flora under the Wildlife Conservation Act, or are included on CALM's Reserve Flora List for taxa which have been or are being considered for gazettal as Declared Rare Flora. Both formally described and undescribed taxa (see Taxonomy) are listed in Appendix 2.

The schedule of Declared Rare Flora used throughout this report was published in the Government Gazette No. 67 on 14 July 1989. It is reviewed annually, and taxa may be added to the schedule if the taxon (species, subspecies, variety) is well-defined, readily identified and represented by a WA Herbarium voucher specimen; and thorough botanical searches during the past five years have established that the plant in the wild is either rare, in danger of extinction or deemed to be threatened and in need of special protection.

CALM's Reserve Flora List appears in Appendices 2 and 3 in "*Western Australia's Endangered Flora*" (Hopper *et al.*, 1990). It includes taxa which have been or are being considered for gazettal as Declared Rare Flora. These taxa require further survey for addition to the Schedule, or have been adequately surveyed and are not considered to be under threat, but require monitoring to ensure that they do not become so. Five priorities have been assigned to taxa on CALM's Reserve List, with species in categories one to three being considered "poorly known".

Priority one and two includes high priority species that are under consideration for declaration but urgently require further survey as they are presently known from only one or a few localities. Priority one species are confined to lands under threat, while Priority two species occupy land not under immediate threat. Also under consideration for declaration and in need of further survey are Priority three taxa which are known from several localities, some of which are on lands not under immediate threat.

Priority four contains taxa presumed extinct while flora requiring high priority monitoring are included in Priority five. These taxa are considered to have been adequately surveyed and not endangered or in need of special protection, but could be if present circumstances change. These species are usually represented on reserves.

Taxonomy

Increased botanical collections in the Eastern Goldfields have contributed to the taxonomic revision of several groups, including the eucalypts and orchids. A large number of collected taxa, including species (sp.),

subspecies (ssp.) and variety (var.), have yet to be formally described. Undetermined taxa, represented by a voucher specimen in a State or National Herbarium, are identified by the collector's name and collection number. Initials are substituted for K.R. Newbey (KRN), S.D. Hopper (SDH) and A.V. Milewski (AVM) due to their extensive collections in the Eastern Goldfields. The abbreviation "aff." refers to the closest affinity of the taxa collected. The Herbarium voucher specimen collection number is sometimes replaced by "s.n." or by the date of the collection.

The taxonomy of several groups in the Eastern Goldfields is uncertain or presently undergoing revision. In the absence of positive field identification or collection, taxa are marked by "?" prior to the species names, while those marked *sens lat.* after the species name represent taxa requiring taxonomic revision.

Undergoing revision at present are *Eucalyptus* (see Eucalypts) and *Acacia* (B.R. Maslin, pers. comm.), the two dominant genera in the Eastern Goldfields (BSC, 1984). The widespread *Acacia aneura* occurred in many forms with two almost ecologically discrete life forms being recognised during the survey (Newbey and Hnatiuk, 1985). The tree form was referred to as *Acacia aneura* while the shrub form was recorded as *Acacia* aff. *aneura*.

Taxonomic changes since the biological survey include *Melaleuca* aff. *preissiana*, recorded in the Lake Cronin area (Newbey and Hnatiuk, 1988), which has recently been described as *Melaleuca strobophylla* (Barlow, 1988). *Conostylis argentea*, restricted to banded ironstone ranges in the Mt Jackson and Bungalbin Hill area, was originally recorded as *Conostylis androstemma* ssp. *argentea* (Keighery, 1980).

Few of the plants in the Eastern Goldfields have accepted common names. The exceptions include widespread species such as *Acacia aneura* (Mulga), *Melaleuca pauperiflora* (Boree), *Santalum acuminatum* (Quondong), *S. spicatum* (Sandalwood) and *Triodia scariosa* (Spinifex). Common names are widely used, however, for eucalypts (Appendix 3) and orchids (Appendix 4).

Eucalypts

Over 70 species of currently recognised eucalypts have been recorded on existing and proposed reserves in the Eastern Goldfields (Appendix 3). The renowned goldfields woodlands are largely confined to the South-western Interzone (Beard, 1981). Nowhere else in the world does such a variety of trees occur in an area of such low rainfall (BSC, 1984). No large areas of these typical eucalypt woodlands, however, are represented within the existing reserve system of the southern and central goldfields (CTRC, 1974).

The CTCRC reported that the greenstone areas of the Eastern Goldfields appear to carry the best example of goldfields woodland (CTRC, 1974).

Recent surveys of rare and poorly known eucalypts (Napier *et al.*, 1987; 1988) have confirmed the high conservation values of these woodlands (see Brooker and Kleinig, 1990). Woodland mosaics, particularly on greenstone, contain a diverse number of eucalypt species (S.D. Hopper, pers. comm.).

Several groups of eucalypts have undergone extensive taxonomic revision recently. Consequently, many of the species names of *Eucalyptus* referred to in the biological survey of the Eastern Goldfields have been revised. Table 2 lists the recent changes to eucalypt nomenclature that are used throughout this report. Names referred to as being ined. are unpublished manuscript names that have yet to be formally described. They are denoted by quotation marks, which are attached to the proposed manuscript name. Over 20 of these ined. names have been proposed by Brooker and Hopper for eucalypts occurring in the Eastern Goldfields. Most of these are included in the recent Field Guide to the Eucalypts of South-western and Southern Australia (Brooker and Kleinig, 1990).

This taxonomic revision has dramatically increased the number of *Eucalyptus* taxa recently recognised. The recently described *Eucalyptus hypochlamydea*, *E. kumarlensis*, *E. perangusta* and *E. salicola* all occur in the Eastern Goldfields (Brooker, 1988). Similarly, the revised *Eucalyptus* ser. *Levispermae* now contains 28 species (Brooker and Hopper, in press). The changes to eucalypt names reported in the biological survey (Newbey and Hnatiuk, 1984; 1985; 1988; Newbey, in prep.) are identified, where possible, in Table 2.

In addition, several unnamed species appear to have restricted distributions within the Eastern Goldfields. The Priority taxon *Eucalyptus* aff. *georgei* (S. van Leeuwen 390), reported as *E. georgei* in Newbey and Hnatiuk (1988), is restricted to the Lake Cronin area (see 1.1); *E. "rhomboidea"*, reported as *E. sp.* (KRN 5603) in Newbey and Hnatiuk (1988), is restricted to the Bremer Range area (see 1.5).

Orchids

Recent botanical surveys have extended the ranges of many orchids referred to in Hoffman and Brown (1984). Currently recognised orchids that have been recorded in the Eastern Goldfields District are listed in Appendix 4. Several groups of orchids are presently undergoing taxonomic revisions. The changes to orchid nomenclature will be incorporated into the second edition of the *Orchids of Western Australia* (Hoffman and Brown, in prep.). These changes, ined. taxa proposed by Hopper and Brown, and presently undescribed taxa are incorporated into Table 3. All orchids recorded in the Eastern Goldfields are listed in either Table 3 or Appendix 4.

There has been extensive revision of the *Caladenia* group, including the splitting of the *C. filamentosa* complex and creation of two new genera, "*Cyanicula*" and "*Drakonorchis*". The *Pterostylis* group requires revision,

Table 2

Recent changes of eucalypt names referred to in the report.

Name in Biological Survey*	Closest Affinity	Name in Brooker and Kleinig (1990)**
<i>E. aff. wandoo</i>		<i>E. "capillosa" ssp. "capillosa"</i>
<i>E. aff. wandoo</i>		<i>E. "capillosa" ssp. "polyclada"</i>
<i>E. aff. wandoo</i>		<i>E. "livida"</i>
<i>E. myriadena</i>		<i>E. myriadena ssp. "parviflora"</i>
<i>E. gracilis var. yilgarnensis</i>		<i>E. yilgarnensis</i> ¹
<i>E. foecunda</i>	<i>E. aff. leptophylla</i>	<i>E. hypochlamydea</i> ²
<i>E. leptophylla</i>		<i>E. "olivina"</i>
<i>E. aff. occidentalis</i>		<i>E. "sporadica"</i> ⁴
<i>E. occidentalis var. stenantha</i>		<i>E. "stenantha"</i> ⁴
<i>E. aff. decipiens</i>		<i>E. "obesa"</i>
<i>E. scyphocalyx</i>	<i>E. aff. cylindrocarpa</i>	<i>E. "exigua"</i>
<i>E. sp. (KRN 5603)</i>	<i>E. aff. oleosa</i>	<i>E. "rhomboidea"</i> ³
--	<i>E. aff. eremophila</i>	<i>E. "incerata"</i>
--	<i>E. aff. pileata</i>	<i>E. "tenuis"</i>
--	<i>E. aff. kondininensis</i>	<i>E. "polita"</i>
--	<i>E. aff. gracilis</i>	<i>E. "quadrans"</i>
<i>E. gardneri</i>	<i>E. aff. redunca</i>	<i>E. "densa" ssp. "densa"</i>
<i>E. redunca</i>		<i>E. "luteola"</i>
<i>E. redunca var. subangusta</i>		<i>E. "subangusta" ssp. "subangusta"</i>
<i>E. redunca var. oxymitra</i>		<i>E. "flavida"</i>
--	<i>E. aff. redunca</i>	<i>E. "subtilis"</i>
--	<i>E. aff. redunca</i>	<i>E. "phaenophylla" ssp. "phaenophylla"</i> ⁴
--	<i>E. aff. redunca</i>	<i>E. "histophylla"</i>

KEY

* Newbey and Hnatiuk (1984, 1985, 1988), Newbey (in prep.).

** Manuscript name (Brooker and Hopper ined.) in Brooker and Kleinig (1990) except for ^{1, 2, 3, 4}.

NOTES

¹ Brooker (1976)² Brooker (1988)³ Hopper ined.⁴ Brooker and Hopper ined.

Table 3

New names of orchids referred to in the report.

In Hoffman and Brown (1984)	In Hoffman and Brown (in prep.)*
<i>Caladenia</i>	
<i>C. filamentosa</i> complex	<i>C. "incensa"</i>
	<i>C. "microchila"</i>
	<i>C. "pulchra" ssp. "ochra"</i>
	<i>C. "polychroma"</i>
	<i>C. aff. "pendens"</i>
--	<i>C. "dimidia"</i>
	<i>C. "incrassata"</i>
<i>C. cairnsiana</i> (wheatbelt form)	<i>C. "pachychila"</i>
--	<i>C. "atingens" ssp. "gracillima"</i>
<i>C. flava</i>	<i>C. flava ssp. "flava"</i>
<i>C. hirta</i>	<i>C. hirta ssp. "rosea"</i>
<i>C. deformis</i>	<i>"Cyanicula" deformis</i>
<i>C. amplexans</i>	<i>"Cyanicula" amplexans</i>
<i>C. caerulea</i>	<i>"Cyanicula" caerulea ssp.</i>
	<i>"apertala"</i>
<i>C. barbarossa</i>	<i>"Drakonorchis" barbarossa</i>
	<i>"Drakonorchis" "mesocera"</i>
<i>C. menziesii</i>	<i>Leptoceras menziesii</i>
--	<i>C. "voigtii"</i>
<i>Acianthus</i>	
<i>A. reniformis</i> var. <i>huegelii</i>	<i>Cyrtostylis huegelii</i>
<i>A. reniformis</i> var. <i>reniformis</i> (W.A.)	<i>C. robusta</i>
<i>Diuris</i>	
<i>D. laxiflora</i>	<i>Diuris picta</i>
<i>D. longifolia</i>	<i>D. aff. corymbosa</i>
<i>Eriochilus</i>	
<i>E. dilatatus</i>	<i>Eriochilus dilatatus ssp.</i>
	<i>"multiflorus"</i>
<i>Prasophyllum</i>	
<i>P. macrostachyum</i> var. <i>ringens</i>	<i>Prasophyllum ringens</i>
<i>P. nigricans</i>	<i>Genoplesium nigricans</i>
<i>Pterostylis</i>	
<i>P. vittata</i> var. <i>vittata</i>	<i>Pterostylis aff. vittata</i>
<i>P. scabra</i> var. <i>robusta</i>	<i>P. aff. aspera</i>
<i>P. scabra</i> var. <i>scabra</i>	<i>P. scabra</i>
<i>P. nana</i>	<i>P. aff. nana</i> (2 spp.)
<i>Thelymitra</i>	
<i>T. nuda</i>	<i>Thelymitra aff. nuda</i>
<i>T. pauciflora</i>	<i>T. aff. pauciflora</i>
<i>T. macmillanii</i>	<i>T. x macmillanii</i> ¹

KEY

* Manuscript name (Hopper and Brown, ined.) in Hoffman and Brown (in prep.).

NOTES

¹ Refers to a hybrid.

particularly the *P. rufa* complex (A. Brown, pers. comm.). The complex incorporates several distinct species both named and unnamed, that occur in the Eastern Goldfields. Throughout this report both the named and unnamed taxa are referred to as *P. aff. rufa*. In addition, several genera have been reinstated including *Cyrtostylis*, *Genoplesium* and *Leptoceras* (Table 3).

FAUNA OF THE EASTERN GOLDFIELDS DISTRICT

Surveys

During the biological survey the vertebrate fauna (mammals, amphibians, reptiles and birds) was systematically sampled in a variety of landforms and vegetation types. Reports by Dell and How (1984; 1985; 1988A; in prep.), How *et al.* (1988a), McKenzie and Rolfe (in press; in prep.) and Burbidge *et al.* (in prep.) document the fauna of the Eastern Goldfields. The references to these published and unpublished sources are listed in Table 10.

In addition to an inventory of fauna, these reports detail the different community types sampled, the accumulation of species over the survey, and the relative efficacy of sampling. The species lists for proposed and existing reserves in the Eastern Goldfields used in this report are compiled from the sources listed above. Not evident in these lists is the species composition of assemblages or the variation of these assemblages between and within habitats sampled. Both are important factors to be considered when selecting representative reserves (see McKenzie *et al.*, 1987; 1989).

Rare fauna

The list of Declared Rare Fauna used throughout this report was published in the Government Gazette on 2 December 1988 under provisions of the Wildlife Conservation Act, 1950. It consists of two schedules, with the first listing fauna Declared Rare or Likely to Become Extinct, while the shorter Schedule 2 lists fauna Declared in Need of Special Protection. Six species that are on the list of Declared Rare Fauna are presently known to occur in the Eastern Goldfields or have recently been recorded in the district. These are the Chuditch or Western Native-cat (*Dasyurus geoffroii*), Freckled Duck (*Stictonetta naevosa*), Crested Shrike-tit (*Falcunculus frontalis*) and Lake Cronin Snake (*Denisonia atriceps*) on Schedule 1, and the Peregrine Falcon (*Falco peregrinus*) and Carpet Python (*Morelia spilota*) on Schedule 2.

The biological survey of the Eastern Goldfields recorded five of the species on the Declared Rare Fauna list. These included one of the State's rarest snakes, *Denisonia atriceps*, which was discovered during the survey (How *et al.*, 1988a). It is only known from three specimens and is endemic to the Lake Cronin area (Storr, 1980). Evidence collected during the survey suggested that populations of *Dasyurus geoffroii* still occurred in parts of the Eastern Goldfields (Dell and How, 1985; How *et al.*, 1988a). This has subsequently been confirmed by sightings and road kills in Frank Hann National Park and near Yellowdine (K. Morris, pers. comm.).

Taxonomy

Terrestrial vertebrates (including birds) were selected for intensive documentation during the survey because of the relatively advanced state of knowledge of their biology and taxonomy (BSC, 1984). Largely as a result of collections generated by the biological survey of the Eastern Goldfields, taxonomic revisions of several groups have resulted in the description of a number of new species.

The taxonomy used for mammals referred to in this report follows Strahan (1983), for amphibians, Tyler *et al.* (1984) and for birds, Storr and Johnson (1985). Reptile taxonomy follows the Western Australian Museum's series of field guides to the Reptiles of WA: Skinks (Storr *et al.*, 1981); Dragons and Monitors (Storr *et al.*, 1983); Snakes (Storr *et al.*, 1986); and Geckoes and Pygopodids (Storr *et al.*, 1990). New species have recently been identified or redescribed in the genera *Sminthopsis*, *Ningaui*, *Pseudomys* and *Eptesicus* (mammals); *Neobatrachus* (amphibians); *Gehyra*, *Diplodactylus* and *Phyllurus* (reptiles).

Common names are widely used for mammals, birds and snakes. Some amphibians and most reptiles, particularly recently described species, however, do not have accepted common names. Appendix 5 lists the common name, where known, of indigenous species referred to in this report (excluding birds). Introduced mammal species, which are widespread in the Eastern Goldfields, are listed with their common names in Table 4. Sources for common names used in this report were Strahan, 1983 (mammals); Tyler *et al.*, 1984 (amphibians); Storr and Johnstone, 1985 (birds); and Wilson and Knowles, 1988 (reptiles).

Table 4

Species list of introduced mammals recorded in the Eastern Goldfields District.

Species Name	Common Name
<i>Mus musculus</i>	House Mouse
<i>Oryctolagus cuniculus</i>	European Rabbit
<i>Canis familiaris</i>	Dingo and Wild Dog
<i>Vulpes vulpes</i>	Red Fox
<i>Felis catus</i>	Feral Cat
<i>Camelus dromedarius</i>	One-humped Camel
<i>Capra hircus</i>	Feral Goat
<i>Bos taurus</i>	Cow
<i>Ovis aries</i>	Sheep
<i>Equus asinus</i>	Donkey

Mammals

Incorporating results from the biological survey and other records, Table 5 lists a total of 63 indigenous mammals that have been recorded in the Eastern Goldfields District. This list includes species that are extinct, presumed to be extinct, currently restricted to off-shore islands or have declined in range (see Appendix 5). Only 33 of these species were recorded during the biological survey (Table 5). Native mammals present on existing and proposed reserves in the Eastern Goldfields are listed in Appendices 6 and 7.

Records from surface cave deposits and other sources suggest that up to 30 species are locally extinct in the Eastern Goldfields. The dramatic decline in the native mammal fauna of Australia has been discussed by Morton and Baynes (1985), Burbidge and McKenzie (1989) and Morton (in press). Burbidge and McKenzie (1989) determined that, throughout the continent, extinctions and declines are virtually confined to non-flying mammals in a critical weight range (CWR) of 35 to 5,500gm. Of the species no longer present in the Eastern Goldfields, 26 fall within this CWR, including seven mammals now extinct.

Reviewing the patterns in this modern decline of Western Australia's vertebrate fauna, Burbidge and McKenzie (1989) suggest that environmental changes since European settlement have emulated an increase in aridity by reducing the environmental productivity available to vertebrates. These include the diversion of environmental resources to humans and introduced species, a reduction in vegetative cover by exotic herbivores and changed fire regimes.

In a major ongoing study, A. Baynes is using identification of cranial material from surface cave deposits to reconstruct the original (pre-European) distributions of mammals in Western Australia (Baynes, 1984; Morton and Baynes, 1985). The Eastern Goldfields District contains part of the original boundary between south-western and arid zone mammal faunas (Baynes, 1987; A. Baynes, pers. comm.).

The contemporaneous occurrence of numerous locally extinct native mammals with species introduced since European settlement indicates the rapid decline in the original mammal fauna of the Eastern Goldfields in the last 100 years (How *et al.*, 1988b). The present fauna of the Eastern Goldfields is impoverished by over 20 species, in comparison to the original fauna (Appendices 12 and 13). The species list comprise four species of dasyurids, the numbat, four bandicoots, including the extinct *Chaeropus ecaudatus*; one possum, two bettongs, the extinct *Onychogalea lunata*, and seven native rodents, including the extinct *Leporillus apicalis*, *Notomys amplius* and *N. longicaudatus*. Sixteen species not recorded during the biological survey were present in the original fauna including 11 species in the Dundas area, 10 at Peak Charles and six in the Mt Manning Range area.

Table 5

Species list of indigenous mammals recorded in the Eastern Goldfields District (including records from biological surveys, surface cave deposits and other sources).

Species	Recorded during Biol. Survey ¹	Surface Cave Deposits ²	Other Sources ³
TACHYGLOSSIDAE			
<i>Tachyglossus aculeatus</i>	X		
DASYURIDAE			
<i>Antechinomys laniger</i>	X	X	
<i>Dasycercus cristicauda</i>		X	
<i>Dasyurus geoffroii</i>	X	X	X
<i>Ningauia ridei</i>	X		
<i>N. yvonneae</i>	X		
<i>Parantechinus apicalis</i>		X	
<i>Psuedantechinus woolleyae</i>	X	X	
<i>Phascogale calura</i>		X	
<i>P. tapoatafa</i>		X	
<i>Sminthopsis crassicaudata</i>	X	X	
<i>S. dolichura</i>	X		
<i>S. gilberti</i>	X		
<i>S. granulipes</i>	X		
<i>S. hirtipes</i>	X		
<i>S. macroura</i>	X		
<i>S. murina</i> 'complex'	?	?	
<i>S. ooldea</i>	X	X	
<i>S. psammophila</i>		X	
MYRMECOBIIDAE			
<i>Myrmecobius fasciatus</i>		X	X
PERAMELIDAE			
<i>Chaeropus ecaudatus</i>		X	X
<i>Isodon auratus</i>		X	
<i>I. obesulus</i>		X	
<i>Perameles bougainville</i>		X	X
THYLACOMYIDAE			
<i>Macrotis lagotis</i>		X	
PHALANGERIDAE			
<i>Trichosurus vulpecula</i>		X	X
BURRAMYIDAE			
<i>Cercartetus concinnus</i>	X	X	
TARSIPEDIDAE			
<i>Tarsipes rostratus</i>	X		
POTOROIDAE			
<i>Bettongia lesueur</i>		X	X
<i>B. penicillata</i>		X	
<i>Potorous platyops</i>		X	

Species	Recorded during Biol. Survey ¹	Surface Cave Deposits ²	Other Sources ³
MACROPODIDAE			
<i>Lagorchestes hirsutus</i>			X
<i>Lagostrophus fasciatus</i>		X	
<i>Macropus fuliginosus</i>	X		
<i>M. irma</i>	X		
<i>M. robustus</i>	X		
<i>M. rufus</i>	X		
<i>Onychogalea lunata</i>			X
<i>Petrogale lateralis</i>		X	
MURIDAE			
<i>Leporillus apicalis</i>		X	X
<i>L. conditor</i>		X	
<i>Notomys alexis</i>	X		
<i>N. amplus</i>		X	
<i>N. longicaudatus</i>		X	
<i>N. mitchellii</i>	X		
<i>Pseudomys albocinereus</i>	X		
<i>P. bolami</i>	X	X	
<i>P. australis</i>		X	
<i>P. desertor</i>		X	
<i>P. fieldi</i>		X	
<i>P. hermannsburgensis</i>	X	X	
<i>P. occidentalis</i>			X ⁴
<i>P. shortridgei</i>		X	
<i>Rattus fuscipes</i>		X	
<i>R. tunneyi</i>		X	
MOLOSSIDAE			
<i>Mormopterus planiceps</i>	X		
<i>Tadarida australis</i>	X		
VESPERTILIONIDAE			
<i>Chalinolobus gouldii</i>	X		
<i>C. morio</i>	X		
<i>Eptesicus regulus</i>	X		
<i>E. pumilus pumilus</i>	X		
<i>Nycticeius balstoni</i>	X		
<i>Nyctophilus geoffroyi</i>	X		
<i>N. major</i>	X		

KEY

? Yet to be determined (D. Kitchener, pers. comm.).

NOTES

1 Dell and How (1984, 1985, 1988); How *et al.*, (1988a); McKenzie and Rolfe (in prep.).

2 A. Baynes (1987; unpubl. data).

3 Table 5, unpubl. Kalgoorlie-Kurnalpi Manuscript (McKenzie and Rolfe, in press).

4 Kitchener and Vicker (1981).

Although documenting an impoverished fauna, the biological surveys have contributed important collections of mammals from the poorly known Eastern Goldfields. Two new species have been recognised and described from these collections, including *Ningauai yvonneae* (Kitchener *et al.*, 1983); and *Sminthopsis dolichura* (Kitchener *et al.*, 1984), while *Pseudomys bolami* has been redescribed (Kitchener, Adams and Baverstock, 1984).

The *Sminthopsis murina* complex (see Table 5, Appendices 12 and 13) has undergone extensive taxonomic revision with an additional four species, including *Sminthopsis dolichura* and *S. gilberti*, recognised in Western Australia. This, however, has tended to confound rather than clarify the situation, and a reappraisal of the Western Australian *Sminthopsis* complex is required (D. Kitchener, pers. comm.). The unusual problems of close resemblance have made these smaller dunnarts difficult to separate and a number of specimens collected during the biological survey yet to be determined (see Appendices 6 and 7).

Two pairs of remarkably similar species occur in the Eastern Goldfields. *Ningauai ridei* and *N. yvonneae* are sympatric at Bungalbin Hill and Buningonia Spring, while *Pseudomys bolami* and *P. hermannsburgensis* occur together near Woolgangie and at Comet Vale. *Ningauai yvonneae* has only been collected from habitat with spinifex on yellow or red sands in the Eastern Goldfields while *Pseudomys bolami* occupies the loams at lower levels of the landscape. The distribution of *Ningauai yvonneae*, restricted to the region of semi-arid mallee, extends across southern Australia and reaches its south-western limit at Lake Cronin.

Amphibians and reptiles

The 14 species of amphibians recorded on existing and proposed reserves in the Eastern Goldfields are listed in Appendices 8 and 9. Recent work has added two species to the list recorded during the biological survey. The range of the recently described *Neobatrachus kunapalari* (Mahony and Roberts, 1986) is restricted to the eastern and north-eastern wheatbelt with an extension east through the southern goldfields. To the north and north-east it is replaced by *N. centralis* with both species occurring north of Menzies (J.D. Roberts, pers. comm.). The specimens of *Neobatrachus centralis* recorded during the survey south of Menzies are referable to *N. kunapalari* (How *et al.*, 1988a).

An undescribed new species of *Neobatrachus* has a distinctive call and is morphologically distinct from its sympatric congeners *N. kunapalari* and *N. pelobatoides*. The species has a distribution centred on the south-eastern wheatbelt and has been recorded at Lake Cronin and Yellowdine (J.D. Roberts, pers. comm.). This area is also an important overlap zone where closely related species have overlapping ranges.

The 120 species of reptiles recorded on existing and proposed reserves in the Eastern Goldfields are listed in Appendices 8 and 9. The district includes species from both the south-west and the arid zone, as well as those restricted to the Eastern Goldfields. The species list comprises 22 geckoes, 8 legless lizards, 17 dragons, 45 skinks, 6 monitors and 22 snakes. Recent taxonomic work on geckoes includes the description of the new species *Gehyra purpurascens* and *Diplodactylus assimilis* from the Eastern Goldfields, and transfer of *Phyllurus milii* to the genus *Underwoodisaurus* (see Storr *et al.*, 1990).

Birds

The numbers of birds (non-passerines and passerines) recorded during the survey are listed under the area descriptions for existing and proposed reserves. All species recorded on quadrats and from opportunistic sightings are detailed in the reports listed in Table 10. The Eastern Goldfields is an interzone between the south-west and arid interior and the bird fauna contains both mesic Bassian and arid Eremaean elements.

Surveys in the adjacent wheatbelt indicated that woodlands were the most important habitats for birds and contained the richest bird assemblages (Kitchener *et al.*, 1982). A number of resident passerine species, restricted to native vegetation on isolated reserves in the wheatbelt, were identified. Seventeen of these species have been recorded on existing and proposed reserves in the Eastern Goldfields (Appendices 10 and 11). The presence of uncleared and unfragmented eucalypt woodland habitat in the southern and central goldfields is of great importance in conserving populations of birds whose conservation future is uncertain because of habitat destruction (How *et al.*, 1988b).

Invertebrates

Documentation of the invertebrate fauna of the Eastern Goldfields has been hampered by the lack of appropriate taxonomic expertise. Although invertebrates were widely collected during the biological survey, much of the material needs identification and often requires description.

Of all the animal species more than nine out of ten are invertebrates. Such a rich invertebrate fauna provides the food base for much of the diverse mammal, reptile and bird assemblages in the Eastern Goldfields. Documentation of selected components of the large invertebrate fauna has been incorporated into recent surveys of the Kimberley rainforest patches (see McKenzie *et al.*, in press), but there remains a need to identify the role and conservation status of invertebrates in the Eastern Goldfields.

The invertebrate fauna in the Eastern Goldfields contains at least 83 species of ants (26 genera), 216 species of beetles (112 genera), 10 species of scorpions (4 genera), 13 species of termites (7 genera), 10 species of centipedes (4 genera) and 13 species of wolf spiders (Lycosidae). Ants and termites together are numerically the most important components of the large invertebrate fauna (W.D. Humphreys in GPDS, 1989).

Invertebrates endemic to the Eastern Goldfields include bees of the genus *Ctenocolletes*, which occur widely throughout the district, and the recently described species of spiders, *Tamopsis pseudocircumvidens* (Araneae: Hersiliidae) and *Pardosa humphreysi* (Araneae: Lycosidae).

Jewel Beetles (Buprestidae), one of two groups of invertebrates Declared Protected under the Wildlife Conservation Act (1950), occur widely throughout the Eastern Goldfields. Most of the large jewel beetles belong to the genus *Stigmodera*, which is restricted to Australia, and contains many Western Australian endemics. *Stigmodera* buprestids are restricted to specific species of eucalypts, particularly *Eucalyptus "olivina"*, which serve as both food and host plants. The flowers attract the nectar-feeding adults while the roots support larvae through their extended feeding stage; it appears several species of jewel beetles may have co-evolved with their "host/food" plants (K.T. Richards, pers. comm.).

DESIGN OF A RESERVE SYSTEM IN THE EASTERN GOLDFIELDS

Reserve design

The rationale behind effective reserve design is summarised by Burbidge (1983) as "A reserve system representing a natural district of Western Australia comprises a number of large reserves spaced across the district and numerous small reserves, often duplicating the communities on the large reserves, but also preserving specialised habitats of relatively limited extent which fall outside the boundaries of larger reserves."

The large regional reserves, the foundation of the district's reserve system, should include substantial areas of representative communities of the region as well as a wide range of community types, thereby ensuring habitat heterogeneity and species richness (Burbidge, 1983). These large areas are complemented by smaller reserves that provide special protection to areas of high conservation value such as the specialised ecosystems of freshwater lakes, banded ironstone ranges and granite outcrops. They should also replicate as far as possible the habitat, floristic and geomorphological diversity of the region's communities.

Recent quantitative studies have attempted to optimise the design of reserve systems so that they will include and maintain as much as possible the biotic richness and variation of its region (Robinson *et al.*, 1987; McKenzie *et al.*, 1989). The procedure for selecting representative reserve systems, developed from the survey of the Nullarbor district (McKenzie *et al.*, 1987; 1989), has major implications for the design of reserves in the Eastern Goldfields. In addition to the biological survey of the Eastern Goldfields, surveys conducted in the adjacent wheatbelt for fauna (Kitchener *et al.* 1980a, b; 1982) are also relevant to reserve design of the Eastern Goldfields.

In the wheatbelt, Kitchener *et al.* (1982) proposed a system of subregional reserves, consisting of optimum areas of not less than 1500ha, that should retain the extant subregional assemblages of birds, lizards and mammals species (Kitchener *et al.*, 1980a, b). They suggested, however, that considerably larger reserves (not less than 40,000ha) may be required in the adjacent Eastern Goldfields to represent the major regional habitats.

One possible procedure for the selection of a network of reserves for the total biota, representing the biological diversity of a remote and biologically poorly known region, was developed from survey results in the Nullarbor (McKenzie *et al.*, 1989). Broad patterns in species composition gradients were identified and used to select optimum positions of reserves needed to represent the compositional diversity of each of the species assemblages.

Analysis of the data collected during the biological survey of the Eastern Goldfields has commenced. Based on results from two sites to the west and east of Kalgoorlie, McKenzie (1984) determined that mammals and reptiles were stable to substrate. Birds, due to seasonal effects and increased mobility, appeared less tied to surface type. The quantitative analysis of this quadrat based data will have implications for reserve design in the Eastern Goldfields.

Reserve system of the Eastern Goldfields

Based on the review of CTCRC System 7 (Burbidge *et al.*, 1987), this submission revises and updates CTCRC System 11. Using the reserve framework established by CTCRC (1974), a nature conservation reserve system is presented which represents the biota of the southern and central goldfields. Illustrated in Figure 3, the existing and proposed reserves are shown in detail in Maps 1-7.

The placement of a representative large reserve system in the Eastern Goldfields is based on extensions to the existing regional reserve network. The large regional reserves, containing a high diversity of representative samples of the variety of ecosystems in the region, are complemented by additional smaller, special purpose reserves to conserve the rare components and specialised ecosystems.

Two of the major botanical divisions in the State overlap in the Eastern Goldfields District. The South-West Botanical Province contains the Avon, Roe and Coolgardie Districts, while the Eremaean Botanical Province is represented by the Austin District (see Figure 2). The Coolgardie Botanical District or South-western Interzone is virtually confined to the Eastern Goldfields (Beard, 1980). These botanical districts contain a number of natural or physiographic regions. Comprising these natural regions and subregions are vegetation systems.

The placement of the reserve system in the Eastern Goldfields seeks to incorporate representative areas of these broad botanical, physiographic

and vegetation categories. Within these broad categories, however, vegetation, habitat and community types vary considerably. Species composition varies over geographic distance, particularly within sandplain heath communities, granite rock vegetation associations and eucalypt woodland mosaics (see Area descriptions for proposed and existing reserves).

Table 6 lists the nature reserves proposed in the Eremaean Botanical Province (central and northern goldfields) while the proposed conservation reserves in the South-West Botanical Province (southern goldfields) are listed in Table 7. The existing and proposed large regional nature conservation reserve system for the Eastern Goldfields District is detailed in Table 8.

Table 6

Nature conservation reserves proposed for the Eremaean Botanical Province.

Proposed Nature Reserve	Proposed area (ha)	Botanical District ¹	Physiographic Region ²	Physiographic sub-region ²
2.4 Comet Vale SW of Menzies	5,058 15,956	Austin Austin	Murchison Murchison	Barlee Barlee
3.2 Windich Spring	10,122	Ashburton	Gascoyne	Carnegie Salient

NOTES

¹ Austin and Ashburton botanical districts (Eremaean Botanical Province) after Beard (1980).

² Beard (1975, 1976, 1981).

RESERVE RECOMMENDATIONS FOR THE EASTERN GOLDFIELDS DISTRICT

The present recommendations for existing and proposed reserves in the Eastern Goldfields detail changes of tenure, vesting, purpose and classification. These recommendations are listed in the next section; they also appear within the area descriptions.

The tenure, security and purpose of the existing categories of reserves within the CALM Estate are outlined in the Draft South-Coast Management Plan (1989). Legislation presently before Parliament, however, proposes several amendments to the CALM Act, including the new category of Conservation Park (see 1.12, Cave Hill and Burra Rock). Recommendations presented in this report detail changes of purpose and vesting to either the National Parks and Nature Conservation Authority (NPNCA) or the Lands and Forests Commission (LFC).

Table 7

Nature conservation reserves proposed for the South-West Botanical Province.*

Proposed Nature Reserve	Area (ha)	Botanical District ¹	Physiographic (sub) Region ²	Vegetation Systems ²
1.2 Hatter Hill South Ironcap Middle Ironcap Mt Holland	43,340 2,940 2,465 2,637	Roe	Forrestania Tableland	Forrestania
1.5 Bremer Range	90,280	Coolgardie ³	Bremer Range Boorabbin Plat.	Bremer Range Cave Hill
McDermid Rock	30,770	Roe	Lake Hope Upl.	Lake Hope
Mt Day	44,960	Coolgardie Coolgardie	Boorabbin Plat. Bremer Range Boorabbin Plat.	Cave Hill Bremer Range Boorabbin
1.6 Jimberlana Hill NW of Norseman ⁵	390 1970	Coolgardie Coolgardie	Kalgoorlie Coolgardie Plat.	Fraser Range ⁴ Coolgardie
1.8 Holleton	16,698	Avon	Yilgarn Plateau	Skeleton Rock Yilgarn ⁶
Baladjie Lake	9,000	Avon Coolgardie	Yilgarn Plateau Boorabbin Plat.	Moorine Rock Jackson
1.9 Yellowdine	74,163	Coolgardie		Boorabbin
1.12 Cave Hill ⁷ Cardunia Rocks	18,496 726 ^E 97 ^W	Coolgardie Coolgardie	Boorabbin Plat. Kalgoorlie	Cave Hill Zanthus
1.13 Woodline Hills	134,630	Coolgardie	Kalgoorlie	Binneringie
1.14 Buningonia Spring	79,170	Coolgardie	Kalgoorlie	Fraser Range Zanthus

KEY

* See Table 8 for Mt Manning Range Nature Reserve.

E Eastern extension.

W Western extension.

NOTES

1 Roe and Coolgardie botanical districts (South-West Botanical Province) and Austin botanical district (Eremaean Botanical Province) after Beard (1980).

2 Beard (1975, 1976, 1981).

3 Or South-western Interzone (Beard, 1980).

4 Part of Fraser Range Vegetation System (outlying western area).

5 Proposed Timber Reserve.

6 Part of Yilgarn Vegetation System (outlying western area).

7 Proposed Conservation Park.

Table 8

Botanical districts, physiographic regions and vegetation systems of existing and proposed large (over 50,000ha) regional nature conservation reserves in the Eastern Goldfields District.

Reserve	Existing Area (ha)	Proposed Area (ha)	Botanical District ¹	Physiographic (sub) Region ²	Vegetation Systems ²
1.1 Lake Cronin NR*	1,016	113,250	Roe	Forrestania Tableland	Forrestania
1.3 Frank Hann NP	61,420	62,240	Roe	Lake Hope Uplands	Lake Hope, Hyden
1.4 Peak Charles NP	39,959	116,665	Roe	Lake Hope Uplands	Lake Hope
1.7 Dundas NR	780,883	--	Roe	Stirling (Esperance Mallee)	Clear Streak, Ridley
1.10 Jilbadji NR	208,866	--	Coolgardie ³	Kalgoorlie	Dundas, Harms Manambinia Parker
			Avon Roe	Yilgarn Plateau Hyden Plateau	Skeleton Rock
			Coolgardie	Forrestania Tableland Lake Hope Uplands Boorabbin Plateau Parker Hills	Forrestania Lake Hope Boorabbin Parker
1.11 Boorabbin NP* (Proposed Goldfields Woodlands NR)	26,000 --	59,192 223,590	Coolgardie	Boorabbin Plateau	Boorabbin

Reserve	Existing Area (ha)	Proposed Area (ha)	Botanical District ¹	Physiographic (sub) Region ²	Vegetation Systems ²
2.2 Mt Manning Range NR*	153,293	132,400 ^W 91,650 ^S	Coolgardie	Boorabbin Plateau	Jackson Die Hardy Bungabbin Kurnalpi
2.3 Goongarrie NP*	60,355	21,110	Austin	Bungabbin Ridges Murchison (Barlee)	
3.1 Wanjarri NR	53,248	--	Austin	Murchison (Wiluna)	--

KEY

* Large extensions to existing reserve proposed.

NR Nature Reserve

NP National Park

W Western extension.

S Southern extension.

NOTES

1 Roe and Coolgardie botanical districts (South-West Botanical Province) and Austin botanical district (Eremaean Botanical Province) after Beard (1980).

2 Beard (1975, 1976, 1981).

3 Or South-western Interzone (Beard, 1980).

Vesting of national parks and nature reserves is with the NPNCA, which replaces the previous vesting authorities, the Western Australian Wildlife Authority (WAWA) and the National Parks Authority (NPA). The purpose of vesting is either for National Park or the Conservation of Flora and Fauna. Timber reserves are vested with the LFC for the purpose of Conservation of Landscape, Flora and Fauna. Currently, the majority of sandalwood reserves in the Eastern Goldfields are unvested Lands Act reserves.

As part of the Bailey report on Exploration and Mining in National Parks and Nature Reserves, a review of existing B or C Class reserves within the existing CALM Estate is being undertaken. The status of these reserves has been evaluated using a number of selection criteria. CALM has recommended the upgrading of B and C Class nature reserves with high conservation values to Class A.

Existing reserves in the Eastern Goldfields District and their relevant map numbers are listed in Table 9. This listing includes the following reserves: National Park, Nature Reserve, Timber Reserve and Sandalwood Reserve. The majority of other reserves, such as Water Reserve and Common, are excluded from this selective list.

Table 9

List of existing reserves in the Eastern Goldfields District

	Reserve Name	No.	Map No.
1.1	Lake Cronin Nature Reserve	36526	1
1.3	Frank Hann National Park	27023	1
1.4	Peak Charles National Park	36004	1
1.6	Norseman Area		
	Brockway Timber Reserve	197/25	2
1.7	Dundas Nature Reserve	36957	2
	Dowak Nature Reserve	36608	2
	Nature Reserve	33113	2
	Nature Reserve	33501	2
1.8	Southern Cross Area		
	Welsh Nature Reserve	30305	3
	Neendojer Nature Reserve	34776	3
	Nature Reserve	37289	3
	Mt Bailey Nature Reserve	28323	3
	Mt Hampton Nature Reserve	32995/20526	3
	Timber Reserve	19923	3
	Jilbadgie Rocks Nature Reserve	20262/24944	3
	Nargalyerin Rock Nature Reserve	18773	3
	Wockallary Nature Reserve	29537	3
	Nurdungarra Rock Nature Reserve	2863	3
	Lake Koorkoordinate Nature Reserve	25801/1362	3
	Baladjie Rock Nature Reserve	1431	3
	Karolin Rock Nature Reserve	13230/28004	3

Reserve Name		No.	Map No.
1.9	Yellowdine Area		
	Duladgin Nature Reserve	3112/2179	3
	Weowanie Nature Reserve	3113	3
	Condarnin Rock Nature Reserve	29823	3
	Biljahnies Rocks Nature Reserve	29920	3
	Karalee Timber Reserve (GWS)	18966	3
	Mt Clara Common	1122	3
	Karalee Water Reserve	3531	3
1.10	Jilbadgi Nature Reserve	24049	3
1.11	Boorabbin Area		
	Boorabbin National Park	35004	4
	Woolgangie Timber Reserve (GWS)	10829	4
	Victoria Rock Nature Reserve	8480	4
1.12	Kalgoorlie Area		
	Cave Hill Nature Reserve	17804	4
	Burra Rock Nature Reserve	7038	4
	Dordie Rock Nature Reserve	3211	4
	Binaronca Rock Nature Reserve	32552	4
	25 Mile Rock Nature Reserve	8029	4
	Cardunia Rocks Nature Reserve	39148	5
	Kambalda Nature Reserve	33300	4
	Kurrawang Nature Reserve	35453	4,7
	Rowles Lagoon Nature Reserve	4274	7
	Clear and Muddy Lakes Nature Reserve	7634	7
	Kangaroo Hills Timber Reserve	198/25	4
	(includes Calooli Sandalwood Reserve)	19211	
	Kambalda Timber Reserve	199/25	4
	Majestic Timber Reserve	195/25	4,5
	Randell Timber Reserve	194/25	5
	Karramindie Forest	S.F. No. 8	4
	Lakeside Sandalwood Reserve	19214	4,7
	Scahill Sandalwood Reserve	19621	4
	Yallari Sandalwood Reserve	19212	4
	Wallaby Rocks Sandalwood Reserve	19764	5,7
	Coonana Sandalwood Reserve	19640	5
	Emu Rocks Sandalwood Reserve	19645	5
	Bullock Holes Sandalwood Reserve	19825	7
2.1	Walyahmoning Rock Nature Reserve	35752	6
	Koolyanobbing Nature Reserve	36918	6
	Kangaroo Rock Timber Reserve	30445	6
	Cowine Soak Water Reserve	1434	6
2.2	Mt Manning Range Nature Reserve	36208	6
	Jaurdi Pastoral Lease	3114/1072	12
2.3	Goongarrie National Park	35637	7
2.4	Menzies Area		
	Comet Vale Common	16153	7
3.1	Wanjarri Nature Reserve	30897	8
	Niagara Dam Nature Reserve	5062	8
	Malcolm Dam Nature Reserve	8946	8

Area descriptions and recommendations

SOURCES OF INFORMATION

The sources of information used for area descriptions of existing and proposed reserves in the southern, central and northern goldfields are detailed in Table 10. Published results and manuscripts in preparation (in prep.) or in press, from the biological survey of the Eastern Goldfields District, as well as unpublished reports (unpubl. reports) are referenced in the table. Extensive use has been made of information contained on CALM Departmental files and the unpublished field notes of Dr. S.D. Hopper, Senior Principal Research Scientist with CALM.

Table 10

Sources of information used for Area Descriptions.

No.	Locality	Sources of Information
1.1	Lake Cronin Area	GEN: CALM, EPA files GEO: Geol. Survey, (unpubl. Hydrology Report No. 1412, 1976); Chin <i>et al.</i> (1984); Newbey (1988) VEG: Newbey and Hnatiuk (1988); S.D. Hopper, field notes: 1978-89; How <i>et al.</i> (1988b) FAU: How <i>et al.</i> (1988a,b); J.D. Roberts (pers. comm.) HIS: How and Newbey (1988)
1.2	Forrestania Greenstone Belt	GEO: Chin <i>et al.</i> (1984) VEG: S.D. Hopper, field notes: 1978-89; Newbey and Hnatiuk (1988) HIS: How and Newbey (1988)
1.3	Frank Hann National Park	GEO: Gower and Bunting (1976); Monk <i>et al.</i> (1979) VEG: Monk <i>et al.</i> (1979); Newbey and Hnatiuk (1988); S.D. Hopper, field notes: 1978-89 FAU: How <i>et al.</i> (1988a) REC: CALM files
1.4	Peak Charles Area	GEO: Gower and Bunting (1976); Newbey (1988) VEG: Newbey and Hnatiuk (1988); S.D. Hopper, field notes: 1978-89; Burgman (1987b) FAU: How <i>et al.</i> (1988a,b); Hopper and Burbidge (1982); CALM files; Baynes (1987) HIS: Roe (1852) REC: CALM South-Coast Draft Management Plan (1989)
1.5	Lake Johnston Area	GEN: CTRC (1974); How <i>et al.</i> (1988b) GEO: Gower and Bunting (1976); CTRC (1974) VEG: Newbey and Hnatiuk (1988); S.D. Hopper, field notes: 1978-89 FAU: How <i>et al.</i> (1988a) HIS: How and Newbey (1988)

- | | | |
|------|-------------------------|--|
| 1.6 | Norseman Area | GEO: Doepel (1973); Gower and Bunting (1976)
VEG: S.D. Hopper, field notes: 1978-89; E.M. Sandiford (unpubl. report, 1989); Chippendale (1973, 1988); |
| 1.7 | Dundas Nature Reserve | GEN: N.L. McKenzie [Background Paper (1981), CALM files]
GEO: Newbey (in prep.); Doepel (1973); Doepel and Lowry (1970)
VEG: Newbey (in prep.); S.D. Hopper, field notes: 1978-89; M.A. Burgman (unpubl. report, 1985)
FAU: McKenzie and Rolfe (in prep.); CALM files |
| 1.8 | Southern Cross Area | GEN: CALM files
GEO: Geol. Survey maps: Gee (1982), Chin and Smith (1983); Newbey (in prep.)
VEG: K. Atkins (unpubl. reports, CALM files); S.D. Hopper, field notes: 1978-89; CALM files
FAU: CALM files |
| 1.9 | Yellowdine Area | GEN: CALM files
GEO: Gee (1982); CALM files
VEG: S.D. Hopper, field notes: 1978-89; Forests Dept. (unpubl. report, 1984)
FAU: CTRC (1974); J.D. Roberts (pers. comm.) |
| 1.10 | Jilbadgi Nature Reserve | GEN: CALM files
GEO: Geol. Survey map: Gee (1982); Newbey (1988; in prep.)
VEG: Newbey (unpubl. report, 1988); Newbey (in prep.); S.D. Hopper, field notes: 1978-89;
FAU: McKenzie and Rolfe (in prep.); Butler (unpubl. report, 1970) |
| 1.11 | Boorabbin Area | GEN: CALM files; Newbey and McKenzie (in prep.)
GEO: Newbey (in prep.); Geol. Survey map: Soufoulis (1963)
VEG: Newbey (in prep.); S.D. Hopper, field notes: 1978-89; Forests Dept. (unpubl. report, 1984); CALM files
FAU: McKenzie and Rolfe (in prep.); J. Dell (pers. comm.); Newbey and McKenzie (in prep.)
HIS: Newbey (in prep.); Brennan (1977); Beard (1976)
REC: CALM publication |
| 1.12 | Kalgoorlie Area | GEN: CALM files; I. Kealley (pers. comm.)
GEO: Newbey (1984; in prep.); Geol Survey maps: Soufoulis (1963, 1966), Williams (1970)
VEG: Chapman <i>et al.</i> (1989); Newbey (in prep.); Milewski and Keighery (in press); S.D. Hopper, field notes: 1978-89
FAU: Chapman <i>et al.</i> (1989) |
| 1.13 | Woodline Hills | GEO: Soufoulis (1966); Newbey (1984); Newbey <i>et al.</i> (1984)
VEG: Newbey and Hnatiuk (1988); G.J. Keighery, field notes: 1989
FAU: Dell and How (1984)
HIS: Hunter (1976); Newbey (1984) |
| 1.14 | Buningonia Spring | GEO: Newbey (1984); Wilson (1969); Doepel and Lowry (1970)
VEG: Newbey and Hnatiuk (1988)
FAU: Dell and How (1984) |

- | | | |
|-----|---|---|
| 2.1 | Walyahmoning
Rock
Nature
Reserve | GEN: CTRC (1974); EPA (1975)
GEO: Newbey (1985); Geol. Survey map: Chin and Smith (1983)
VEG: Newbey and Hnatiuk (1985); S.D. Hopper, field notes:
1978-89; CALM files
FAU: CTRC (1974); P. Kendrick, A. Baynes (pers. comm.) |
| 2.2 | Mt Manning
Range
Nature
Reserve | GEO: Newbey (1985); Chin and Smith (1983)
VEG: Newbey and Hnatiuk (1985); Milewski and Hnatiuk (in
prep.); S.D. Hopper, field notes: 1978-89; Keighery
(1980)
FAU: Dell and How (1985); Burbidge <i>et al.</i> (in prep.); C.R.
Dickman, field notes: 1987-89
HIS: Beard (1972); O'Connor and Quartermaine (1988) |
| 2.3 | Goongarrie
National
Park | GEO: Milewski (1988); Williams <i>et al.</i> (1976); Williams
(1970)
VEG: Milewski and Keighery (1988); Fox (1980); Beard (1975,
1978); CTRC (1974)
HIS: CALM files
REC: CTRC (1974) |
| 2.4 | Menzies
Area | GEO: Milewski (1988); Kriewaldt (1970)
VEG: Milewski and Keighery (1988); Dell and How (1988b);
S.D. Hopper, field notes: 1978-89; G.J. Keighery, field
notes: 1989
FAU: Dell and How (1988a,b); N.L. McKenzie, A.
Chapman and M. Brooker, field notes: 1989 |
| 3.1 | Wanjarri
Nature
Reserve | GEO: Milewski (in prep.); CALM files
VEG: Milewski and Keighery (in prep.); CALM files
FAU: McKenzie and Rolfe (in prep.) |
| 3.2 | Windich
Spring | GEN: CTRC (1974); CALM files
VEG: A.A. Burbidge (unpubl. report, 1980)
FAU: CTRC (1974)
HIS: A.A. Burbidge (unpubl. report, 1980); CALM files |

KEY

GEN General Reference
 GEO Geomorphology
 VEG Flora and Vegetation
 FAU Fauna
 HIS History
 REC Recreational Use and Potential

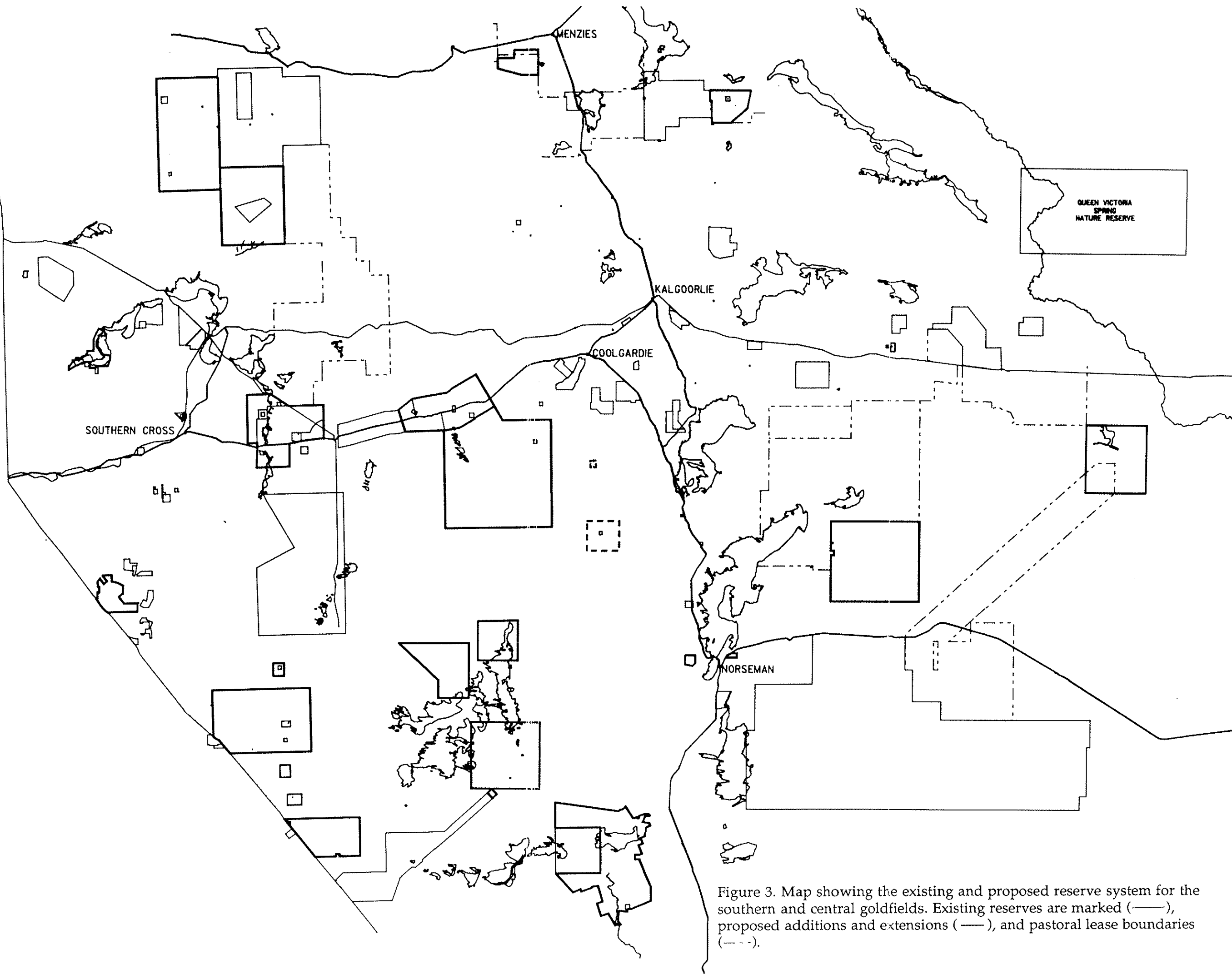
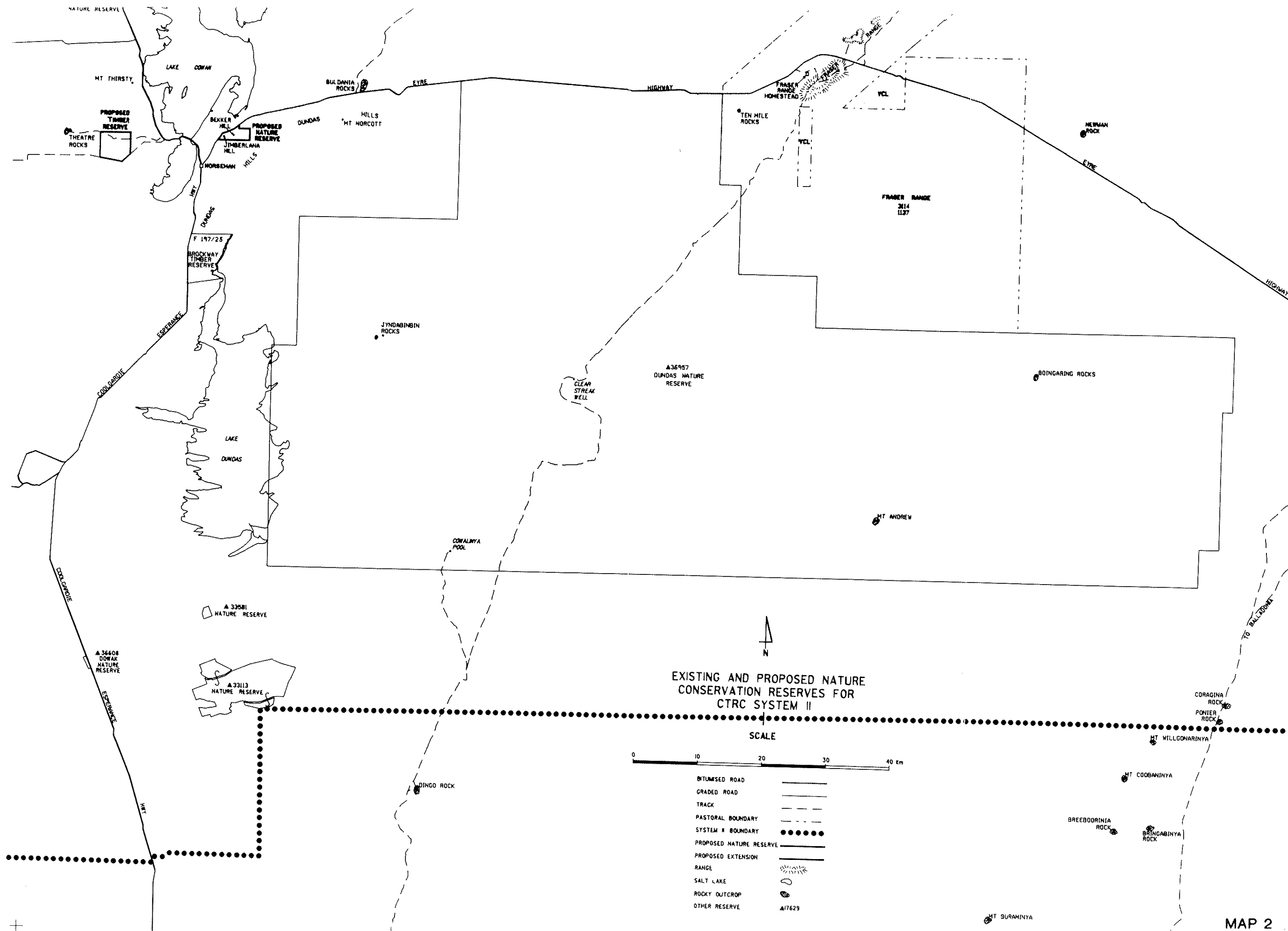
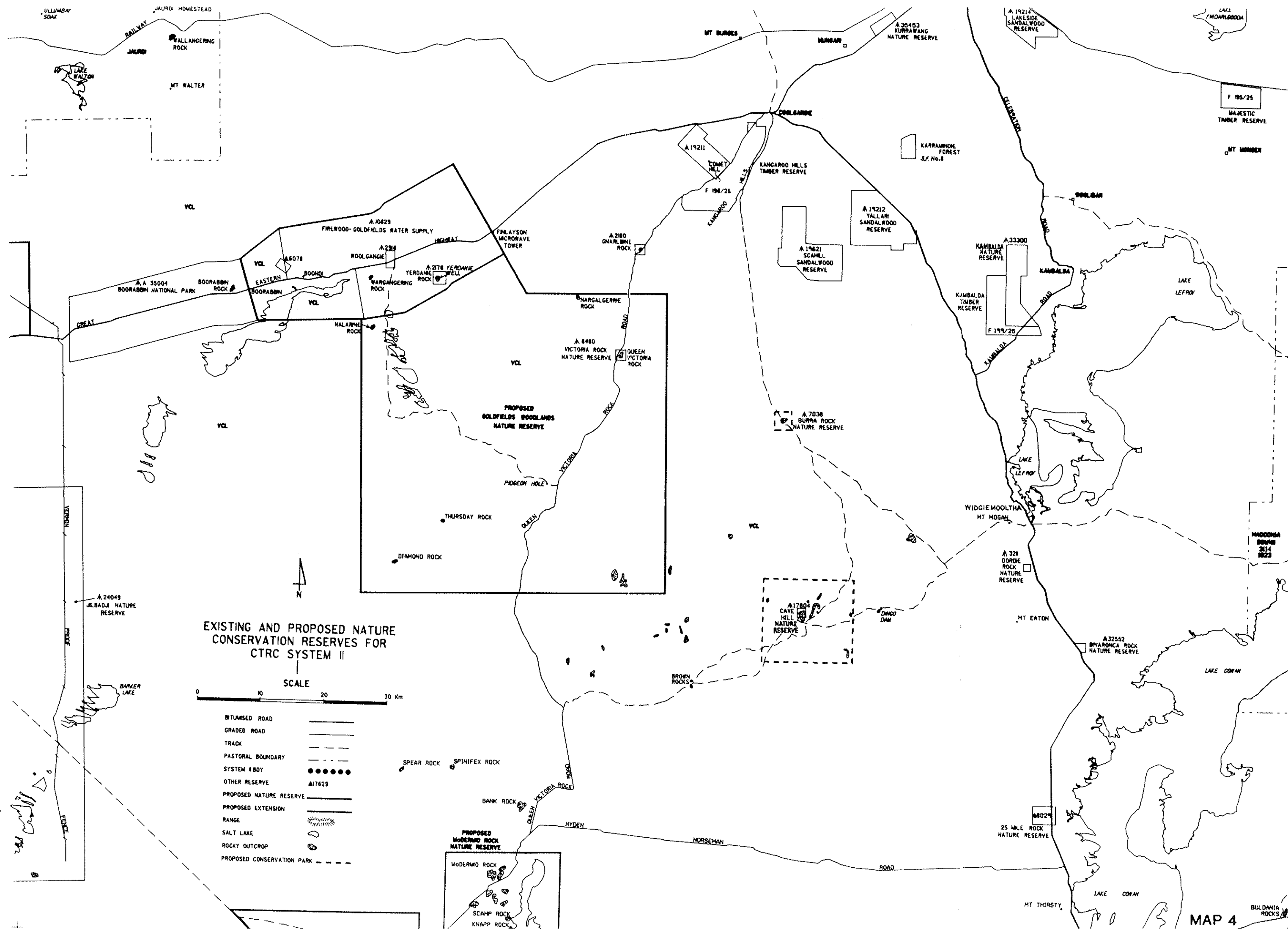
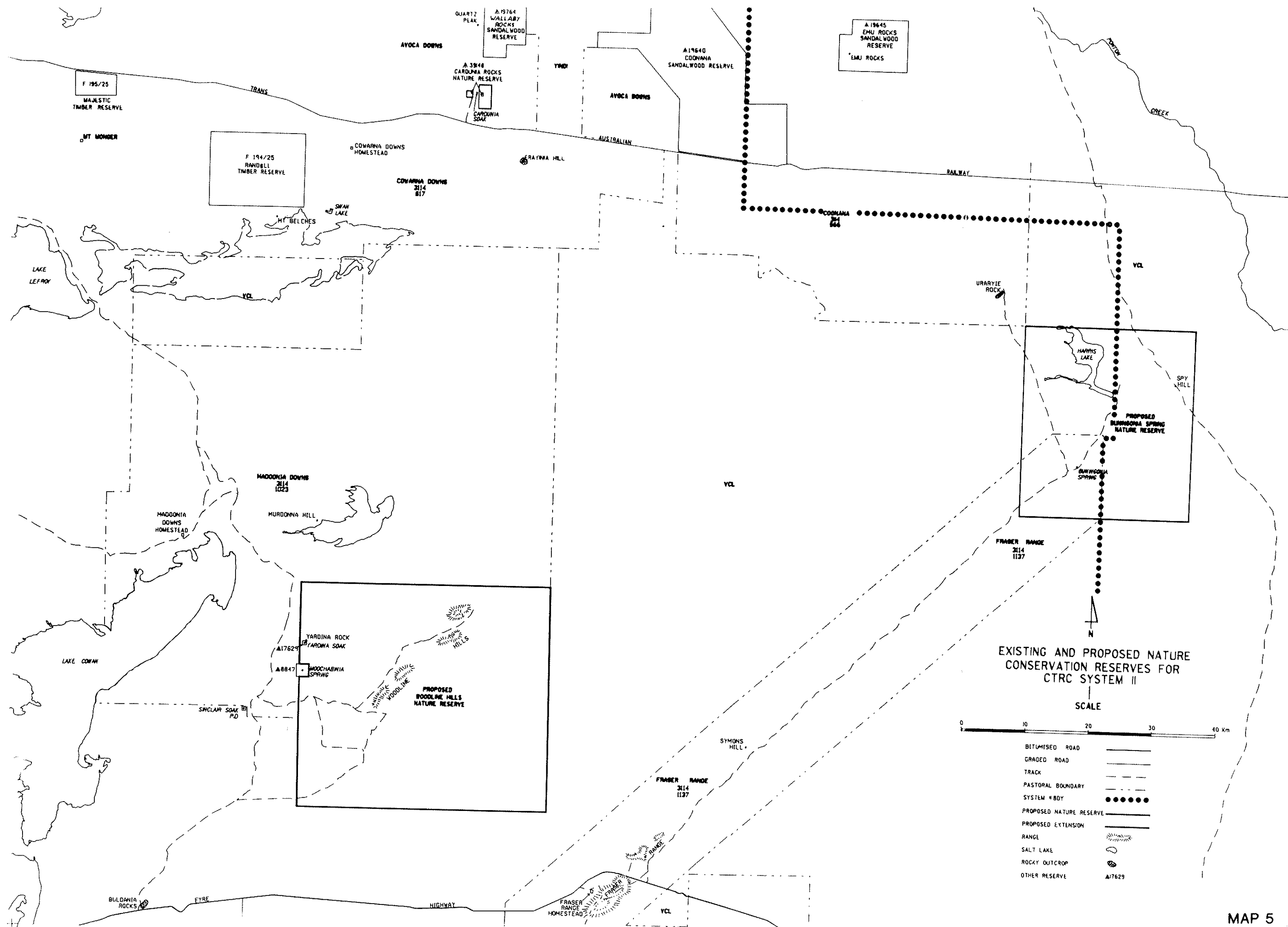
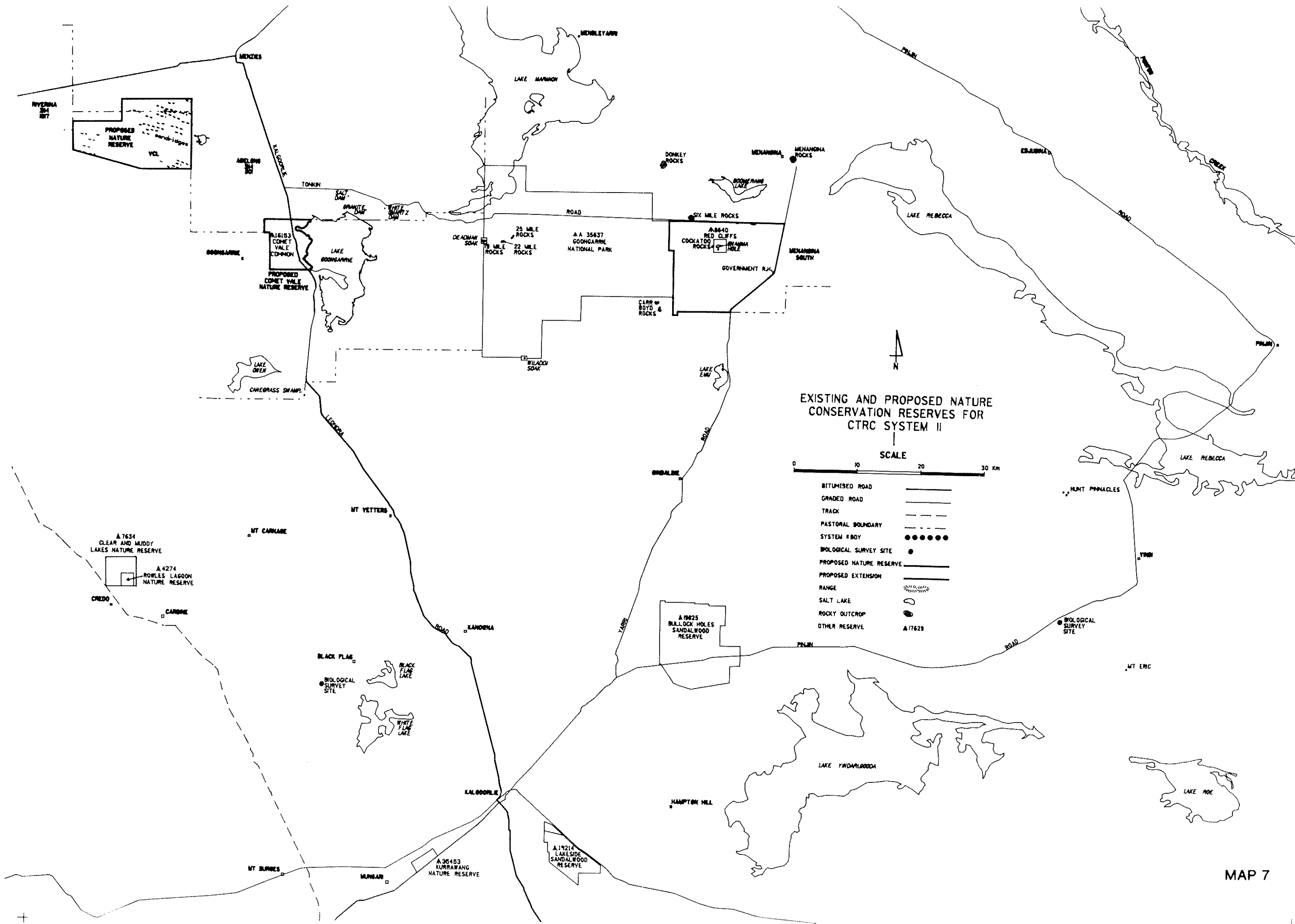


Figure 3. Map showing the existing and proposed reserve system for the southern and central goldfields. Existing reserves are marked (—), proposed additions and extensions (—), and pastoral lease boundaries (---).









LIST OF PRESENT RECOMMENDATIONS

A comparison between the CTRC, EPA and Present Recommendations for CTRC System 11 is presented in Appendix 14. This includes original CTRC areas (11.1 - 11.11) as well as additional areas proposed in this report. These present recommendations are listed in the following section.

This report does not address the issue of conserving areas presently within pastoral leases. The nature conservation reserve system presented concerns only the southern and central regions of the Eastern Goldfields District. The present report proposes no additions to the original CTRC (1974) and EPA (1975) recommendations in the northern goldfields.

1. SOUTHERN GOLDFIELDS

1.1 Lake Cronin Nature Reserve (Maps 1, 11)

Proposed Lake Cronin Nature Reserve extension

1. Recommendations for extension of the existing Lake Cronin Nature Reserve incorporates the CTRC (1974) and EPA (1975) recommendations for no land within a 10km radius of Lake Cronin to be alienated. Results from the biological surveys of the Eastern Goldfields District (How *et al.*, 1988b) confirm the importance of this area, and the need for protection of the biological diversity and catchment of the freshwater Lake Cronin and environs. A review of the adequacy of the present nature reserve system indicated the necessity of a large regional conservation reserve in the south-western region of the Eastern Goldfields.

2. The extension of the existing Class A Lake Cronin Nature Reserve No. 36526 (1,015.93ha) is defined as the area of 113,250ha bounded to the: west by 119°25', for 20km from the Vermin Proof Fence, to include The Basin; Sheoak and Native Rocks on the Holland's Track and unnamed rocky outcrops; north by 32°15', for 43km, to include Wattle Rocks on the Holland's Track; east by 119°52', for 28km, to include the entire drainage system of the salt lakes to the east of Lake Cronin; south by 32°30', for 35km to the Vermin Proof Fence, to include Reserve No. 13525 (Water Supply for Mines) of 231ha, the eucalypt woodland valleys drainage of The Basin while avoiding the Forrestania and Middle Ironcap mining areas; and south-west by the Vermin Proof Fence for 10km adjacent to Emu and Cockatoo Rocks (Reserve Nos. 2047, 9753).

1.2 Forrestania Greenstone Belt (Map 1)

Proposed Hatter Hill Nature Reserve

1. The proposed A Class Hatter Hill Nature Reserve, vested in the NPNCA for Conservation of Flora and Fauna, is defined as the area bounded to the: west by the Vermin Proof Fence for 20km; north by 32°46'S to include Jackson Rock and unnamed rocky outcrops; east by 120°05'E; and south by 32°55'S to include Mt Gibbs.

2. The following unvested reserves should also be incorporated into the proposed nature reserve: No. 19866 Timber for use of Agriculture

Department (unvested), 9926 Water Supply Rabbit Department, 13526 Water Supply Mines and part of 13527 Water Supply Mines.

3. Water Reserve No. 21168 (Minister for Water Resources) should remain a separate reserve for Conservation of Flora and Fauna and Water, vested in the NPNCA.

Proposed South Ironcap Nature Reserve

The proposed A Class South Ironcap Nature Reserve for the Conservation of Flora and Fauna, vested in the NPNCA, is defined as the area bounded to the: west by 119° 45'E for 6.0km; north by 32° 40'S for 6.3km; east by 119° 48'E for 6.0km; and south by 32° 43'S for 6.3km.

Proposed Middle Ironcap Nature Reserve

The proposed A Class Middle Ironcap Nature Reserve, to be vested in the NPNCA for the Conservation of Flora and Fauna, is defined as the area bounded to the: west by 119°43'E for 5.5km; north by 32°33'S for 4.5km; east by 119°46'E for 5.5km; and south by 32°36'S for 4.5km.

Proposed Mt Holland Nature Reserve

The proposed A Class Mt Holland Nature Reserve, for the Conservation of Flora and Fauna and vested in the NPNCA, encompassing the existing reserve No. 13524 (259ha) and the botanically rich surrounding area, is defined as the area bounded to the: west by 119° 42'E for 5.6km; north by 32° 08'S for 4.8km; east by 119° 45'E for 5.6km; and south by 32° 12'S for 4.8km.

1.3 Frank Hann National Park (Map 1)

Frank Hann National Park should be converted to the Frank Hann Nature Reserve, for the Conservation of Flora and Fauna, and upgraded to an A Class reserve vested in the NPNCA.

Proposed Frank Hann National Park extension

The northern section of the Frank Hann National Park consists of a 1.6km wide strip either side of the Lake King-Norseman Road. The proposed extension of 820ha would extend the boundary of the park by 2.5km to the north-east and retain the current width of 3.2km. The extension should be Class A for Conservation of Flora and Fauna, vested in the NPNCA and incorporated into the proposed Frank Hann Nature Reserve.

1.4 Peak Charles Area (Map 1)

Peak Charles National Park

Peak Charles National Park should be upgraded to Class A, vested with the NPNCA and retain the current purpose.

Proposed Peak Charles National Park extension

1. The proposed extension of Peak Charles National Park should be Class A, vested in the NPNCA, and is defined as the area of land bounded to the: west by 121°00'S; north by the Lake King-Norseman Road for

approximately 30km; east by the limit of agricultural land along the approximate line of 121°25'E; and south by the headwaters of the Lort River.

2. The vacant Crown land along the Lort River should be established as a linear nature reserve of Class A, vested in the NPNCA for the Conservation of Flora and Fauna, linking the proposed extension to Peak Charles National Park with Stokes National Park and the coast.

1.5 Lake Johnston Area (Map 1)

Proposed Bremer Range Nature Reserve

The proposed Class A Bremer Range Nature Reserve, vested in the NPNCA for the Conservation of Flora and Fauna, is defined as the area bounded to the: west by 120°36'E for 29km; north by 32°24'S for 31.5km; east by 120°56'E for 29km; and south by 32°40'S for 31.5km.

Proposed McDermid Rock Nature Reserve

The proposed Class A McDermid Rock Nature Reserve, vested in the NPNCA for the Conservation of Flora and Fauna, is defined as the area bounded to the: west by 120°39'E for 17km; north by 32°00'S for 18km; east by 120°50'E for 17km; and south by 32°08'S for 18km.

Proposed Mt Day Nature Reserve

The proposed A Class Mt Day Nature Reserve, for the Conservation of Flora and Fauna vested in the NPNCA, is defined as the area bounded to the: west by 120°28' 30"E for 7.5km to the junction of the Hyden-Norseman Road and the Baker - Mt Day Road; north-west along Road No. 14332 for 23km to the northern boundary; north by 32°05'S for 30km; east by 120°36'E for 24km; and south by 32°18'S for 13km.

1.6 Norseman Area (Map 2)

Proposed Jimberlana Hill Nature Reserve

The proposed Class A Jimberlana Hill Nature Reserve, for the Conservation of Flora and Fauna and vested in the NPNCA, is defined as the portion of existing Reserve No. 6043 that lies east of the Eyre Highway. Small areas south-west of Jimberlana Hill, north-west of Bekker Hill and to the west of Eyre Highway are not included in the proposed nature reserve.

Proposed Timber Reserve NW of Norseman

1. The reserve is proposed as an additional block to the existing Brockway Timber Reserve (F197/25), 20km to the south-east, vested in the Lands and Forests Commission for the purpose of Conservation of Flora, Fauna and Landscape.

2. The proposed Timber Reserve is defined as the area bounded to the: west by 121°36'30"E for approximately 4km; north by 32°8'30"S for approximately 5km; east by 121°39'30"E for approximately 3.5km; and

south by the Bronzite Ridge track for approximately 5km, including 1.5km to the south-west and 3.5km to the north-west along the track.

1.7 Dundas Nature Reserve (Map 2)

Dundas Nature Reserve (No. 36957) should be upgraded from Class B to Class A for Conservation of Flora and Fauna.

1.8 Southern Cross Area (Maps 3,6)

Proposed Holleton Nature Reserve

1. The proposed Class A Holleton Nature Reserve, vested in the NPNCA for the purpose of Conservation of Flora and Fauna, is defined as the area of vacant Crown land (16,698ha) bounded by the extent of agricultural land and by the Vermin Proof fence in the south-west.

2. The possibility of extending the boundaries of the proposed Holleton Nature Reserve, to incorporate the adjacent Timber Reserve No. 19923, should be examined.

3. All 12 reserves (Nos 24944, 20262, 28323, 30305, 37289, 2863, 29537, 34776, 25801, 18773, 20526 and 32995) should remain or become Class A reserves vested in the NPNCA for the Conservation of Flora and Fauna, taking into account the following recommendations.

4. Reserves Nos. 28323, 30305, 37289, 2863, and 29537 should be upgraded from Class C to Class A Nature Reserves, vested in the NPNCA, retaining their current purpose.

4. The possibility of removing Water from the purpose of Reserve No 18773 and changing vesting to the NPNCA should be examined.

5. Removal of Water from the purpose of Reserve No. 20526, and the subsequent incorporation into Class A Reserve No. 32995, should be investigated.

Proposed Lake Baladjie Nature Reserve

1. The proposed Class A Lake Baladjie Nature Reserve, vested in the NPNCA for the purpose of Conservation of Flora and Fauna, incorporates the southern and northern portions of Lake Baladjie, and vacant Crown land surrounding the lake to the north, west and south, linking the Karolin and Baladjie Rocks reserves with its southern boundary.

2. The existing reserves (Nos. 1431, 13230, and 28004) should be upgraded to Class A, for the Conservation of Flora and Fauna.

3. The possibility of removing Water from the purpose of Reserve Nos. 1431 and 13230 and changing the vesting to NPNCA should be examined.

1.9 Yellowdine Area (Map 3)

Proposed Yellowdine Nature Reserve

1. The proposed A Class Yellowdine Nature Reserve for the Conservation of Flora and Fauna, vested in the NPNCA, is defined as the area bounded to the: west by 119°36' for 21km; north by 31°05' 30"S for 10.5km to the Vermin Proof Fence; north-east by the Vermin Proof Fence for 9km, then by 31°08'S for 15km along the northern boundary of Reserve No. 18966; east by 119°57'E for 14.5km along the eastern boundary of Reserve No. 18966; south-east by the Great Eastern Highway for 15km, then by 119°48'E for 10km; south by 31°23'S for 14.5km to the old Marvel Loch-Yellowdine Rd; and south-west by the surveyed road No. 3042 for 9km to Yellowdine and for 1.5km north of Yellowdine, then 4km west along 31°.

2. The proposed Yellowdine Nature Reserve should incorporate the existing nature reserves of Duladgin, Weowanie and Condarnin (Nos. 2179, 3112-3, and 29823); the entire Karalee Timber Reserve for Goldfields Water Supply (No. 18966); the Mt Clara Common (Loc. 1122); the Karalee Water Reserve (No. 3531) and intervening vacant Crown land adjoining the south-eastern corner of Reserve No. 19866 and the Great Eastern Highway.

1.10 Jilbadgi Nature Reserve (Map 3)

Jilbadgi Nature Reserve (No. 24049) should be upgraded from Class C to Class A and retain the current vesting and purpose.

1.11 Boorabbin Area (Map 4)

Boorabbin National Park

1. Boorabbin National Park (No. 35004) should be converted to Boorabbin Nature Reserve, a Class A reserve for the purpose of Conservation of Flora and Fauna vested in the NPNCA.

2. The Boorabbin Nature Reserve should be extended eastward to incorporate vacant Crown land east of Boorabbin townsite (15,072ha) and the Woolgangie Firewood Reserve No. 10829 (44,110ha).

Proposed Boorabbin National Park Extension

1. The Boorabbin National Park extension should be a Class A Nature Reserve for the Conservation of Flora and Fauna, vested in the NPNCA, and is defined as that area bounded to the: west by the eastern boundary of the existing Boorabbin National Park; north, east and south by the current boundaries of the Woolgangie Reserve No. 10829; and by 31°15' S for 16km to the south-eastern corner of Boorabbin National Park.

2. Boorabbin National Park will be linked to the Woolgangie Reserve (No. 10829) by the incorporation of 15,072ha of adjacent vacant Crown land. The proposed extension should include Reserves Nos. 2178, 2918 and 6078, contained within the boundaries of Reserve No. 10829 (44,110ha).

3. The proposed extension to Boorabbin National Park should exclude Pumping Station No. 8 (Reserve No. 8232) and several service reserves for the Great Eastern Highway and Goldfields pipeline.

Proposed Goldfields Woodlands Nature Reserve

1. The proposed Goldfields Woodlands Nature Reserve should be Class A for the Conservation of Flora and Fauna, vested in the NPNCA, and is defined as the area bounded to the: west by 120°30' for 45km; north by the Woolgangie Reserve No. 10829 for 25km, then along a line for 7.3km to 31°12'30" for 22km; east by 121°00' for 49km; and south by 31°39' for 47km.

2. The reserve should be connected to the proposed Boorabbin National Park extension to form a large goldfields regional nature conservation reserve.

3. The boundaries should incorporate the existing Victoria Rock Reserve (No. 8480) of 258ha.

Victoria Rock Nature Reserve

1. The existing Victoria Rock Nature Reserve should retain its current A Class, vesting and purpose.

2. The reserve should be incorporated into the proposed Goldfields Woodlands Nature Reserve (Class A).

1.12 Kalgoorlie Area (Maps 4, 5, 7)

Proposed Cave Hill Conservation Park

1. The existing Cave Hill Nature Reserve should be converted to the Cave Hill Conservation Park and vested in the NPNCA.

2. The proposed Cave Hill Conservation Park is defined as the area bounded to the: west by 121°10'E for 13km; north by 31°37'S for 14.5km; east by 121°19'E for 13km; and south by 31°44'S for 14.5km.

3. In order to meet Conservation Park guidelines and regional management requirements at Cave Hill, modification of the proposed area of 18,496ha should be examined in the forthcoming Goldfields Management Plan.

4. Nature Reserve No 7038 (Burra Rock) should be converted to the Burra Rock Conservation Park, vested in the NPNCA, retaining the present boundaries.

5. Nature Reserves Nos. 3211 (Dordie Rock) and 8029 (25 Mile Rock) should be upgraded from Class C to Class A, and the possibility of changing vesting to the NPNCA and removing Water from the purpose should be examined.

6. Nature Reserve No. 32552 (Binaronca Rock) should be upgraded from Class C to Class A, vested in the NPNCA and retain the current purpose.

Proposed Cardunia Rocks Nature Reserve extension

1. Cardunia Rocks Nature Reserve should be upgraded to Class A, retain its current purpose and vesting, and both the existing eastern and western reserve boundaries should be extended.

2. The proposed eastern extension is defined as the area of 726ha bounded to the: west by 122°33'30"E for 3.5km; north by 30°55'S for 2km; east by 122°35'E for 3.5km along the Avoca Downs Pastoral Lease (3114/1089) boundary; and south by 30°57'S for 2km. The proposed western extension is defined as the area of 97ha bounded to the: west by 122°32'30"E (approx.) for 1km; north by 30°55'30"S for 1km along the current reserve boundary; east by 122°33'E (approx.) for 1 km excluding the existing quarry; and south by 30°56'S (approx.) for 1km.

3. Nature Reserves Nos. 7634 (Clear and Muddy Lakes) encompassing No. 4274 (Rowles Lagoon); 35453 (Kurrawang) and 33300 (Kambalda West) should be upgraded from Class C to Class A, vested in the NPNCA and retain their present purpose.

Proposed and existing timber reserves

1. Timber Reserve Nos. 198/25 (Kangaroo Hills), 199/25 (Kambalda), 195/25 (Majestic) and 194/25 (Randell), vested with the Lands and Forests Commission (LFC), should retain their current purpose of Conservation of Flora, Fauna and Landscape.

2. Sandalwood Reserve Nos. 19211 (Calooli), 19621 (Scahill), 19212 (Yallari), 19764 (Wallaby Rocks), 19640 (Coonana), 19645 (Emu Rocks) and 19825 (Bullock Holes) are recommended for upgrading from unvested Lands Act reserves to timber reserves vested with the LFC for the Conservation of Flora, Fauna and Landscape.

3. Sandalwood Reserve No. 19214 (Lakeside), currently a Lands Act Reserve vested in the Executive Director of CALM, should be vested with the LFC as a Timber Reserve for Conservation of Flora, Fauna and Landscape.

4. The adjacent Reserve Nos. 19211 and 198/25 should be joined to form the Kangaroo Hills Timber Reserve.

5. State Forest No. 8 (Karramindie) should retain its current tenure, vesting and purpose.

1.13 Proposed Woodline Hills Nature Reserve (Map 5)

The proposed Woodline Hills Nature Reserve should be Class A, for the purpose of Conservation of Flora and Fauna and vested in the NPNCA, and is defined as the area bounded to the: west by 122°17'E for 36km to

include Reserve Nos. 17629 (Yardina soak) and 8847 (Moochabinia Spring); north by 31°37'S for 38km; east by 122°42'E for 36km; and south by 31°56'S for 38km. The proposed area is bounded on the west and north by the Madoonia Downs pastoral lease (3114/1023).

1.14 Proposed Buningonia Spring Nature Reserve (Map 5)

1. The proposed Buningonia Spring Nature Reserve should be an A Class reserve, vested in the NPNCA for the purpose of Conservation of Flora and Fauna, and is defined as the area bounded to the: west by 123°28'E for 30km along the eastern boundary of Coonana Station (3114/566); north by 31°14'S for 27km to include Harris Lake; east by 123°45'E for 30km to include Spy Hill; and south by 31°30'S for 27km to incorporate the long-term flora and fauna monitoring quadrats established in the vicinity of Buningonia Spring.

2. The proposed area of 79,170ha incorporates 32,905ha of land from Dundas Shire and 46,265ha from Boulder Shire. An excision of 15,678ha from Fraser Range Pastoral Lease (3114/1137) is required.

2. CENTRAL GOLDFIELDS

2.1 Walyahmoning Rock Nature Reserve (Map 6)

1. Walyahmoning Rock Nature Reserve (No. 35752) should retain its current A Class, vesting and purpose.

2. Koolyanobbing Nature Reserve (No. 36918) should be upgraded to Class A, vested in the NPNCA, retaining its current purpose.

3. Based on a biological assessment of Reserve No. 30445 (Kangaroo Rock), the existing unvested C Class reserve should be converted and upgraded to a Class A Nature Reserve vested in the NPNCA for the Conservation of Flora and Fauna.

4. The possibility of incorporating Water Reserve No. 1434 (Cowine Soak) into proposed Class A Reserve No. 30445 by changing the purpose to Conservation of Flora and Fauna should be examined.

5. Biological surveys should be conducted to determine the conservation values of the vacant Crown land between Reserve Nos. 36918 and 30445, and the possibility of linking the two reserves into a single Class A Nature Reserve vested in the NPNCA for the Conservation of Flora and Fauna needs to be investigated.

2.2 Mt Manning Range Nature Reserve (Map 6, 10)

1. The Mt Manning Range Nature Reserve (No. 36208) should be upgraded from Class C to Class A, retaining the current vesting and purpose.

2. The Ministerial Temporary Reserve (1971H), encompassing the Mt Manning Range, should be cancelled and added to the nature reserve.

3. The Mt Manning Range Nature Reserve should be extended west to include Mt Jackson and the Die Hardy Range, and south to incorporate Bungalbin Hill and the Aurora Ranges.

4. The possibility of forming a contiguous reserve with the northern portion of the Jaurdi Pastoral Lease (3114/1072), should be examined.

Proposed Mt Jackson extension

1. The ellipse shown in Fig 11.0 (CTRC, 1974) should be squared up to incorporate Mt Jackson and the Die Hardy Range into the Mt Manning Range Nature Reserve (No. 36208). The proposed extension should be Class A, vested in the NPNCA for the Conservation of Flora and Fauna.

2. The proposed western extension is defined as that area bounded on the west by 119°14'E to include Marda Dam, Windarling Peak, Pigeon Rock, and Deception Hill; north by 29°50'S to include Chatarie Well, the entire Die Hardy Range and Yokradine Hills system, Olby Rock and vacant Crown land; east by the western boundary of the Mt Manning Range Nature Reserve; and south by 30°17'S to include Mt Jackson, Boondine, Muddarning and Yenyanning Hills.

3. The proposed western extension includes excisions of 37,450ha from Mt Jackson (3114/639) and 50,500ha from Diemals (3114/1110) pastoral leases.

4. The proposed extension should incorporate an additional block of vacant Crown land (3,200ha), adjacent to the north-west corner of the Mt Manning Range Nature Reserve, and the Water Reserves Marda Dam (17009), Pigeon Rock (9644), Chatarie Well (13468), and Olby Rock (13467).

Proposed Bungalbin Hill extension

1. The Mt Manning Range Nature Reserve (No. 36208) should be extended south to incorporate Bungalbin Hill, the Aurora and Helena Ranges (VCL Loc. 1426) and intervening vacant Crown land. The proposed extension should be Class A, vested in the NPNCA for the Conservation of Flora and Fauna.

2. The proposed southern extension is defined as the area bounded on the west by 119°31'S; north by the existing boundary of the Mt Manning Range Nature Reserve; east by the western boundary of the Jaurdi Pastoral Lease (3114/1072); and south by 30°30'S.

Jaurdi Pastoral Lease (Map 12)

1. Additional biological investigation is needed to identify potential areas of high conservation value that may warrant reservation as nature reserves.

2. The biological values of areas such as Kurrajong Rockhole, Pittosporum Rock, Hunt Range, Mt Dimer and the Yendilberin Hills need to be surveyed in detail.

3. Reserves should be contiguous with the existing Mt Manning Range Nature Reserve and proposed Bungalbin Hill extension.

2.3 Goongarrie National Park (Map 7)

1. Goongarrie National Park (No. 35637) should retain its current status, purpose and vesting.
2. The park should be extended eastwards following the boundaries defined for the proposed Goongarrie National Park extension.

Proposed Goongarrie National Park extension

The eastward extension of Goongarrie National Park, to be vested in the NPNCA, is defined as the area bounded to the: west by 121°44'30"E for 2km to the south-eastern corner of Goongarrie National Park; north by Tonkin Road for 18km to the junction with Yarri Road; east by Yarri Road for 8km to Government Rockhole; and south-east by Yarri Road for 9km; south by approximately 30°03'S for 10km.

2.4 Menzies Area (Map 7)

Proposed Comet Vale Nature Reserve

Comet Vale Common (Reserve No. 16153) should be upgraded to Class A and converted to a nature reserve for the purpose of Conservation of Flora and Fauna, vested in the NPNCA.

Proposed Nature Reserve SW of Menzies

The proposed nature reserve should be Class A for the purpose of Conservation of Flora and Fauna, vested in the NPNCA, and is defined as the area bounded to the: west by the eastern boundary of Riverina Pastoral Lease (3114/1017) along 120°46'E for 4.5km; north by 29°47'15"S for 7.5km, then along 120°50'30"E for 3.5km to 29°45'30"S for 11km; east by the Adelong Pastoral Lease (3114/801) boundary along 120°57'30"E for 11km; and south by 29°51'S for 8km and for 10.8km to join the western boundary.

3. NORTHERN GOLDFIELDS

The northern goldfields in this report refers to Crown land north of Menzies that is almost entirely under pastoral lease (see Maps 8 and 9). Of the Red Book recommendations in this region, Wanjarri is an existing A Class Nature Reserve (see this report) while Windich Spring remains a proposed National Park (see 3.2).

The CTRC Green Book (1974) highlighted the poor representation of typical mulga woodlands in the northern parts of the Eastern Goldfields and adjacent System 10 (Murchison). At present, a CALM Project Team is addressing the need for representative nature conservation in the pastoral areas of the State, including the northern goldfields. Recommendations from this review will be presented in a separate document.

General recommendations for the northern goldfields

1. A system ensuring representative nature conservation needs to be established in the northern goldfields.

2. Areas of representative community types and potential high conservation value, present on pastoral leases, need to be evaluated based on results from the biological survey and other sources.

3. The feasibility of reservation of these areas in the northern goldfields needs to be determined, particularly those areas contiguous with existing reserves.

3.1 Wanjarri Nature Reserve (Maps 8, 9)

1. Wanjarri Nature Reserve (No. 30897) should retain its current class, purpose and vesting.

2. Niagara Dam (No. 5062) should retain its current class, purpose and vesting in the NPNCA until more biological information is gathered regarding its status.

3. Malcolm Dam (No. 8946) should retain its current class and vesting in the Minister for Water Resources noting the values of Flora and Fauna in its purpose.

3.2 Proposed Windich Spring National Park (Map 9)

1. The proposed Windich Spring Nature Reserve should be Class A, vested in the NPNCA, for the purpose of Conservation of Flora and Fauna.

2. The proposed reserve of approximately 400ha, situated on Windich Spring within the CTRC recommended area of 10,300ha, will need to be fenced to exclude stock.

4. AREAS THAT REQUIRE ADDITIONAL INVESTIGATION

4.1 Granite rocks south of Balladonia (Map 2)

It is recommended that the Department of Conservation and Land Management investigate the conservation and recreational values of the series of granite rock outcrops south of Balladonia and make recommendations for nature conservation where appropriate. Both the recreational potential of the rocks as stop-over points along the road to Balladonia, and the conservation value of a corridor linking Dundas Nature Reserve with Cape Arid National Park, need to be addressed.

4.2 Granite rocks east of Lake Johnston (Map 1)

It is recommended that the Department of Conservation and Land Management conduct botanical surveys of the scattered and remote granite rock outcrops east of Lake Johnston and for nature conservation where appropriate.

4.3 Jaurdi Pastoral Lease (Map 12)

See recommendations under 2.2.

4.4 Parker Range (Map 3)

It is recommended that the Department of Conservation and Land Management investigate the conservation value of the Parker Range and make recommendations for nature conservation where appropriate.

4.5 Highclere Hills (Map 6)

It is recommended that the Department of Conservation and Land Management investigate the conservation value of the Highclere Hills and make recommendations for nature conservation where appropriate.

4.6 Fraser Range (Maps 2, 5)

It is recommended that the Department of Conservation and Land Management investigate the conservation and recreational values and, after consultation with the owners of the Fraser Range Pastoral Lease (3114/1137), make recommendations for nature conservation where appropriate.

4.7 Bronzite Ridge (Map 1)

It is recommended that the Department of Conservation and Land Management investigate the Bronzite Ridge area to determine its conservation potential and make recommendations for nature conservation where appropriate.

4.8 Mt Norcott and Buldania Rocks (Map 2)

It is recommended that the Department of Conservation and Land Management investigate the Mt Norcott and Buldania Rocks areas to determine their recreation and conservation potential and make recommendations for nature conservation where appropriate.






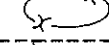


4.9 Vacant Crown land east of Lake Lefroy (Map 5)

It is recommended that the Department of Conservation and Land Management investigate the area of vacant Crown land south of Mt Belches and east of Lake Lefroy to determine its conservation potential and make recommendations for nature conservation where appropriate.

4.10 Swan Lake and Erayinia Hill (Map 5)

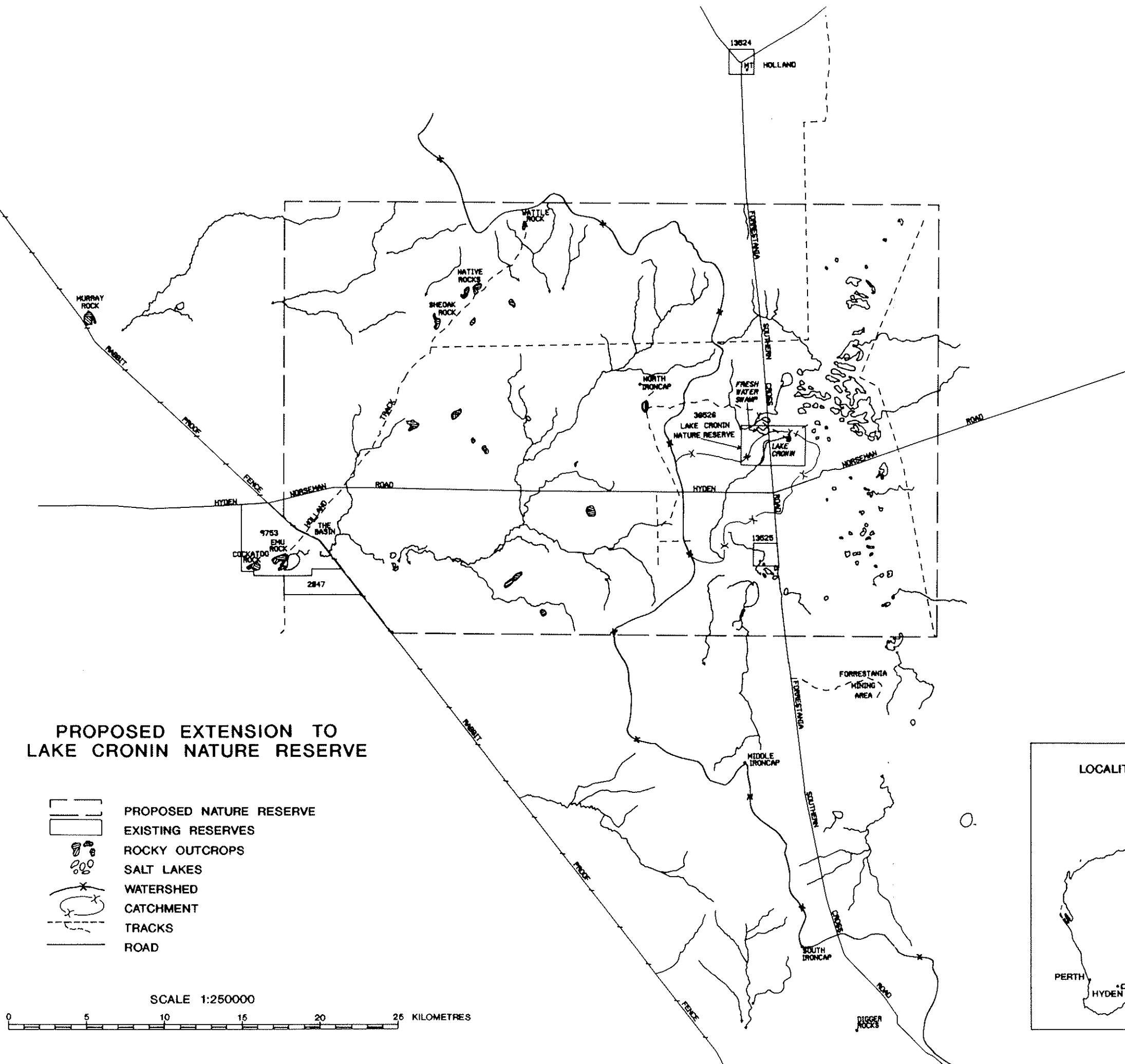
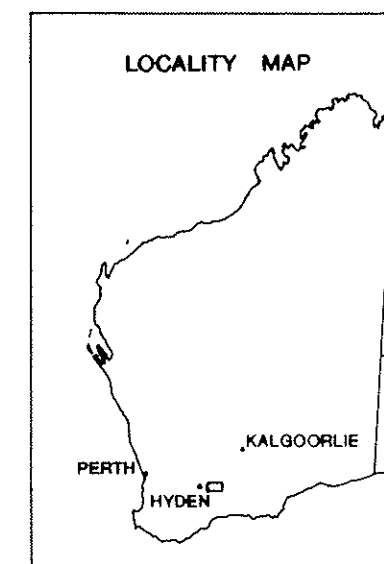
It is recommended that the Department of Conservation and Land Management investigate the conservation and recreational values and, after consultation with the owners of the Cowarna Downs Pastoral Lease (3114/617), make recommendations for nature conservation where appropriate.

PROPOSED EXTENSION TO LAKE CRONIN NATURE RESERVE

-  PROPOSED NATURE RESERVE
-  EXISTING RESERVES
-  ROCKY OUTCROPS
-  SALT LAKES
-  WATERSHED
-  CATCHMENT
-  TRACKS
-  ROAD

SCALE 1:250000

0 5 10 15 20 25 KILOMETRES



1.0 Southern Goldfields

1.1 LAKE CRONIN NATURE RESERVE

The CTRC Green Book (1974) and EPA Red Book (1975) contained recommendations concerning the Lake Cronin area. Lake Cronin, a unique, semi-permanent freshwater lake, is encompassed in a small nature reserve of 1016ha (see History).

PROPOSED LAKE CRONIN NATURE RESERVE EXTENSION

The proposal for a much enlarged nature conservation reserve at Lake Cronin addresses two priorities. One is the protection of land within a 10km radius of Lake Cronin, including its entire catchment. The second is the need for conservation of a large area representative of the south-western region of the Eastern Goldfields.

Biological surveys have documented the biological richness and diversity of the Lake Cronin area, and have resulted in recommendations for a large regional nature conservation reserve centred on Lake Cronin. The proposed extension takes into consideration the need to protect the lake's entire catchment, the high conservation values of the land within 10km of the lake, and the preservation of representatives of original vegetation patterns to the west of the Lake Cronin area.

LOCATION: Lake Cronin is on Crown land within the Kondinin Shire, 86km east of Hyden, just north-east of the Hyden-Norseman and Forrestania-Southern Cross crossroads. The proposed extension to the Lake Cronin Nature Reserve extends west to the Vermin Proof Fence and incorporates North Ironcap; The Basin; and Sheoak, Native and Wattle Rocks on Holland's Track.

MAP: 1 and 11.

AREA: 113,250ha.

CURRENT STATUS: Vacant Crown land; Lake Cronin Nature Reserve (1,016ha), Class A Reserve No. 36526 vested in the NPNCA for Conservation of Flora and Fauna; and Reserve No. 13525 (231ha), for Water Supply to Mines.

GEOMORPHOLOGY

The Lake Cronin area encompasses land within 10km of Lake Cronin to include the freshwater lake, swamp and dams in the existing nature reserve; the entire lake catchment; the extensive uncleared eucalypt woodlands and mallees of the Forrestania greenstone belt; the banded ironstone hill North Ironcap; and the salt lake system to the east of Lake Cronin. The land to the west of the Lake Cronin area is primarily sandplain mallees and heaths with dissecting woodland valleys; The Basin drainage area; and the granite rocks - Sheoak, Native and Wattle - along Holland's Track.

The geology of the Lake Cronin area has been mapped and described in detail by Chin *et al.* (1984). The following elements, however, are fundamental to understanding landscape development and associated vegetation in the Lake Cronin area (Newbey, 1988). The area is underlain by Archaean or Proterozoic granites, gneisses and associated rocks, which have been eroded into gently undulating plains and broad valleys. A narrow north-south belt of Archaean greenstone, known as the Forrestania Greenstone Belt, occurs between Mt Holland and Hatter Hill. Erosion and weathering have resulted in an irregular topography of valleys and slopes with the resistant banded ironstone Ironcaps (North, Middle and South) prominent above the landscape. A major watershed occurs along this greenstone belt, following the Ironcaps. Sandplains to the west are dissected by broad valleys containing indistinct drainage lines which flow for short periods following heavy rains. To the east of this watershed, however, the drainage lines have been largely filled with alluvium and colluvium, and contain salt lake systems.

A preliminary hydrological field study (Hydrology Report No. 1412) established that Lake Cronin owes its origin entirely to run-off from its catchment and direct rainfall on the lake, and is fresh due to leakage (Anon., 1976). The watershed, which lies along a series of low banded ironstone hills from North Ironcap through Middle and South Ironcaps, forms a major drainage divide. Close to this divide, recognisable closed drainages flow eastwards, some reaching a line of small dry salt lakes at distances of up to 17km east of the watershed. Lake Cronin is amongst the westernmost of these lakes and occupies an area of about 5,700m² when fully flooded, with a maximum depth of about 1.6m. A moderately well-defined drainage enters the lake on the west side.

The Hydrology Report proposed a catchment for Lake Cronin about 8km long and 3.5km wide with an extent of 20.29km². The catchment shown on Map 1, which follows the watershed closely and encompasses the entire drainage, indicates the total Lake Cronin catchment may be larger than the proposed area of 20,000ha.

FLORA AND VEGETATION

The flora of the Lake Cronin area is important for both rare and poorly known taxa, including four flora Declared Rare. The area around Lake Cronin is located within the Roe Botanical District of the South-West Botanical Province (Beard, 1980) and the vegetation is dominated by large tracts of eucalypt woodlands, which have been extensively cleared and fragmented in adjacent areas.

The Lake Cronin area contains four taxa declared as Rare Flora under the Wildlife Conservation Act: *Banksia sphaerocarpa* var. *dolichostyla*, *Eremophila inflata*, *E. racemosa* and *Eucalyptus steedmanii*. None of the known populations of these rare plants occur within existing nature reserves.

Banksia sphaerocarpa var. *dolichostyla* appears as a series of disjunct populations within the Forrestania greenstone belt from Mt Holland in the north to South Ironcap/Digger Rocks in the south. The proposed extension of the Lake Cronin Nature Reserve will incorporate three of the six populations known, including the large population occurring on North Ironcap.

Eremophila inflata and *E. racemosa* occur at scattered locations along the verge of the Forrestania-Southern Cross Road. Populations of both Declared Rare species are enclosed within the proposed extension to the Lake Cronin Nature Reserve.

Eucalyptus steedmanii, initially described in 1928, had not been located in the area since 1938, and was thought to be extinct until rediscovered in 1978. Surveys by CALM have since identified populations to the south-west and north-west of Lake Cronin. The proposed extension will incorporate the only known stands of *Eucalyptus steedmanii*.

Six taxa on CALM's Reserve Flora List are present within the proposed Lake Cronin Nature Reserve Extension. *Muelleranthus crenulatus*, a Priority One species, is known from a single location north of Middle Ironcap. *Stylidium* aff. *caricifolium* (D.J. Coates 4688) is also a Priority One species known only from the three Ironcaps and Hatter Hill, 50km south-east of Lake Cronin. It is endemic to the Forrestania greenstone belt and all known localities are on active mineral leases. As it occurs on lands under threat, it is under consideration for declaration but urgently requires further survey.

Acacia aff. *pachypoda* (KRN 5820) is a Priority Two species known from the Ironcaps and Mt Holland in the Lake Cronin area, and Lake Seabrook to the north. Although it is under consideration for declaration over some of its range, it occurs on land not under immediate threat. *Acacia kerryana* has a scattered distribution extending east to the Norseman area while *Eucalyptus* aff. *georgei* (S. van Leeuwen 390), also a Priority Two species, is known only from several localities in a small area to the east of Lake Cronin. Although not on land under active mineral lease, it is not represented in the existing Lake Cronin Nature Reserve.

Drosera aff. *bulbosa* (A.P. Brown 362), only discovered in 1986, is known from several localities in the Lake Cronin area and at Hatter Hill to the south. As it is endemic to the Forrestania greenstone belt, it is under consideration for declaration. *Sowerbaea multicaulis*, a Priority Four species, occurred in the Forrestania area, but is presumed extinct as no collections have been made over the past 50 years. How *et al.*, (1988b), on the basis of survey results, list 16 important flora collections from the Lake Cronin area. Other poorly known flora include *Boronia fabianoides*, previously known only from the Norseman area; *B. coerulescens* ssp. *spicata*; *Halgania* sp. (KRN 8307); and *Microcorys* sp. (10871), all of which are rarely collected.

The semi-arid eucalypt woodlands, which have been extensively cleared and fragmented in adjacent areas to the west of the Vermin Proof Fence, are of international interest (How *et al.*, 1988b) and have been the focus of detailed surveys (Napier *et al.*, 1987; S.D. Hopper field notes, 1978-1989). Over 20 species of eucalypts have been recognised in the Lake Cronin area, with many new undescribed taxa identified by Brooker and Hopper (Table 2). Several of these eucalypts - *Eucalyptus* "*densa*" spp. "*densa*", *E. "livida"*, and *E. "sporadica"* - have wider distributions overlapping Lake Cronin, while *E. "exigua"* and *E. "olivina"* are endemic to the Lake Cronin-Mt Day area. *Eucalyptus myriadena* ssp. "*parviflora*" has a restricted distribution centred on the salt lake system to the east and south of Lake Cronin, while *E. aff. georgei* only occurs at a few sites to the east of Lake Cronin. The granite endemic, *E. "stenantha"*, is at its western limit on Holland's Track.

Lake Cronin Nature Reserve, and the proposed extension, is located primarily within the restricted Forrestania vegetation system (228,000ha) that extends from Mt Holland in the north to Hatter Hill in the south. The Forrestania system, occurring on the Forrestania greenstone belt, comprises a variety of communities which are controlled by the underlying geology largely in a mosaic form (Beard, 1972). Within this complex mosaic, eucalypt woodlands broken up by numerous small salt lakes occur on the heavier soils, while areas of mallee form on the higher lateritic soils. In addition, there are ridges of banded ironstone which form the abrupt North, Middle and South Ironcap hills, with distinctive associations of heath and thicket. Sheoak, Native, and Wattle Rocks consist of granitoid rocks that weather into similar soil types supporting similar vegetation types, but with marked differences in species composition.

The catchment of the ephemeral freshwater Lake Cronin was sampled intensively during the biological survey of the Eastern Goldfields and several vegetation types were identified as unique to the area (Newbey and Hnatiuk, 1988). These included the vegetation complexes present on the banded ironstone North Ironcap and greenstone areas north of Lake Cronin; *Eucalyptus* aff. *georgei* low woodlands, *E. "exigua"* mallee associations and *Acacia jennerae* tall shrublands near Lake Cronin. tall shrublands of *Melaleuca strobophylla*, at Lake Cronin itself, are rare although also recorded to the south and west.

Lake Cronin was fringed by dense thickets and low woodlands of the paperbarks *Melaleuca strobophylla*, *M. uncinata* and *M. aff. cuticularis*. Growing under *Melaleuca strobophylla* tall shrubland were the low shrubs of *Goodenia viscida* and *Muehlenbeckia cunninghamii*; the annuals *Angianthus conocephalus*, *Calandrinia granulifera*, *Centrolepis polygyna*, *Crassula exserta*, *Glossostigma drummondii*, *Isolepis congrua* and *Myriocephalus nudas*; and the perennial grass *Eragrostis dielsii*. Mosses and liverworts collected in the waterlogged soil of the lake's edge include *Bryum*, *Funaria*, *Riccia* and *Tortula* spp.

Salt lakes to the east and south-east of Lake Cronin were surrounded by a mosaic of eucalypt woodland vegetation types including *Eucalyptus myriadena* ssp. "parviflora" and *E. flocktoniae* woodlands; *E. salmonophloia* and *E. longicornis* open woodlands; *E. cylindrocarpa*, *E. pileata* and *E. "olivina"* mallees. Salt lakes to the south of Lake Cronin are flanked by *Eucalyptus spathulata* var. *grandiflora* and *E. myriadena* ssp. "parviflora" mallees.

E. myriadena ssp. "parviflora" trees, with the smallest buds and flowers of any Western Australian eucalypt, were the dominant vegetation surrounding small salt flats to the north and east of Lake Cronin. Growing under *Eucalyptus myriadenia* ssp. "parviflora" was the mallee *E. cylindrocarpa* and tall shrub *Melaleuca pauperiflora*; and low shrubs of *Atriplex vesicaria* ssp. *variabilis*, *Eremophila decipiens* and *Halosarcia indica* ssp. *bidens*.

The *Halosarcia* Low Shrubland vegetation type formed a distinct pattern on salt lakes with the lake floor being bare and the remainder supporting mainly *Halosarcia syncarpa* but also including *H. indica* ssp. *bidens* and *H. pergranulata* ssp. *pergranulata*. A salt lake 2 km north of Lake Cronin had low shrubs of *Halosarcia* sp. on the lake floor with occasional trees of *Casuarina obesa* on sand patches of the lake's margin.

The Declared Rare Flora *Eucalyptus steedmanii* occurs on undulating plains and ridgelines in the greenstone belt to the south-west of Lake Cronin. Associated vegetation with *E. steedmanii* include woodlands of *E. cylindrocarpa*, *E. flocktoniae*, *E. salmonophloia* and *E. salubris* over an understorey of *Acacia acuminata*, *A. steedmanii*, *Allocasuarina acutivalvis*, *Callitris canescens*, *Drosera* aff. *bulbosa*, *Phebalium microphyllum*, *Santalum acuminatum* and *Stylidium* aff. *nungarinense*.

A dense seasonal cover of orchids present under *Eucalyptus steedmanii* included *Caladenia "dimidia"*, *C. saccharata*, *C. sigmoidea*, *C. "pulchra"* ssp. "ochra", *Pterostylis* aff. *nana*, *P. mutica*, *P. aff. vittata*, *P. sargentii*, *Genoplesium nigricans* and *Thelymitra* aff. *nuda*.

The eucalypt woodlands vary over the undulating terrain of the greenstone belt north of Lake Cronin. Occurring in depressions were mallees of *Eucalyptus cylindrocarpa* and *E. pileata* with emergent *E. eremophila* and *E. salmonophloia*. On the rises, trees of *E. "densa"* ssp. "densa" grew with *E. "livida"* and *E. rigidula* mallees over a thicket of *Allocasuarina campestris*, *A. acutivalvis* and *Dryandra*. *Eucalyptus flocktoniae* Low Woodland, the dominant vegetation type on greenstone, consisted of the tall shrub *Melaleuca pauperiflora*; and low shrubs of *Acacia pachypoda*, *Daviesia* sp. (KRN 9182), and *Eremophila densifolia*.

Occurring on a gently stony slope in the greenstone belt north-west of Lake Cronin was a restricted vegetation complex, important for two rare species previously known only from the Norseman area - *Acacia kerryana* and

Boronia fabianoides. The restricted vegetation complex on greenstone consisted of the mallee *Eucalyptus yilgarnensis* and tall shrub *Melaleuca cardiophylla* var. *parviflora*; low shrubs of *Acacia erinacea*, *A. kerryana*, *Boronia fabianoides*, *Hibbertia* sp. (KRN 10869) and *Trymalium* aff. *ledifolium*; and the sedge *Lepidosperma* sp. (KRN 5232).

North of Lake Cronin the Declared Rare Flora *Eremophila racemosa* occurs in very small numbers along the Southern Cross-Forrestania Road with adjacent vegetation of *Eucalyptus annulata*, *E. flocktoniae* and *E. salubris* over *Melaleuca* scrub, the low shrub *Dodonaea stenozyga* and the orchid *Pterostylis mutica*.

South of Lake Cronin, open woodlands of co-dominant *Eucalyptus salmonophloia* and *E. longicornis* tall trees (over 20m) occur with the mallees *E. celastroides* ssp. *virella*, *E. yilgarnensis* and *E. sheathiana* over *Melaleuca*-*Acacia* open low scrub. Open woodlands of *E. salmonophloia* consisted of the mallee *E. sheathiana* and tall shrubs of *Acacia hemiteles*, *A. nyssophylla*, *Eremophila ionantha*, *Exocarpos aphyllus* and *Melaleuca uncinata*.

Eucalyptus longicornis woodlands contained trees of *E. longicornis* and *E. salmonophloia*; mallees of *E. yilgarnensis* and *E. sheathiana*; tall shrubs of *Acacia hemiteles*, *A. merrallii*, *Eremophila ionantha*, *Exocarpos cupressiformis* and *Melaleuca pauperiflora*; low shrubs of *Eremophila decipiens*, *Olearia muelleri*, *Scaevola spinescens* and *Westringia rigida*. Low woodlands of *Eucalyptus longicornis* had a similar species composition with the addition of the restricted tall shrub *Daviesia* sp. (KRN 9182) and low shrubs of *Boronia inornata* ssp. *inornata* and *Halgania andromedifolia*.

To the east of Lake Cronin, the very restricted vegetation type of *Eucalyptus* aff. *georgei* woodlands only occurs in low lying depressions. Stands of 8-10m, narrow stemmed *E. aff. georgei* trees grow over the shrub *Daviesia* sp. (KRN 9182) with sedges of *Lepidosperma drummondii* and *L. aff. resinosum*; these are flanked by *E. yilgarnensis* and the endemic *E. "olivina"*.

Just east of Lake Cronin, *Acacia jennerae*, *Eucalyptus melanoxylon* trees, *Hakea trifurcata*, the orchids *Caladenia sigmoidea*, *C. "pulchra"* ssp. *"ochra"* and *Pterostylis mutica* were common; while *E. sheathiana* and the orchids *Thelymitra* aff. *nuda*, *Pterostylis* aff. *rufa* and *Genoplesium nigricans* were scarce. Other tall shrubs growing with *Acacia jennerae* were *Grevillea wittweri*, *Hakea trifurcata* and *Santalum acuminatum*; low shrubs of *Acacia acutata* and *Olearia revoluta*; the annual *Chrysocoryne pusilla*; and sedges of *Lepidobolus preissianus* and *Lepidosperma drummondii*.

In the vicinity of Lake Cronin, mallee woodlands of *Eucalyptus "exigua"*, *E. cylindrocarpa*, *E. "olivina"*, *E. sheathiana*, *E. aff. transcontinentalis* and

E. yilgarnensis occurred. Growing under mallees of *E. cylindrocarpa* and *E. yilgarnensis* were tall shrubs of *Melaleuca* cf. *cymbifolia*, *M. aff. cymbifolia*, *M. eleuterostachya* and *M. lateriflora*; and low shrubs of *Acacia intricata*, *A. nodiflora* var. *ferox* and *A. merrallii*.

Growing with the mallee *Eucalyptus "olivina"* were tall shrubs of *Acacia ixiophylla*, *A. jennerae*, *Callitris preissii* ssp. *verrucosa*, *Grevillea oncogyne* and *Melaleuca uncinata*; low shrubs of *Damperia tenuicaulis* ssp. *tenuicaulis*, *Eremophila biserrata*, *Hybanthus epacroides* and *Olearia revoluta*; the perennial grass *Triodia scariosa*; and sedges of *Gahnia ancistrophylla*, *Lepidosperma brunonianum*, *L. drummondii* and *Lepidobolus preissianus*. *Eucalyptus "olivina"* also occurred with tall shrubs of *Exocarpos cupressiformis*, *Melaleuca eleuterostrachya* and *M. uncinata*; low shrubs of *Cryptandra* aff. *miliaris* and *Grevillea pauciflora* ssp. *pauciflora*; and the sedges *Gahnia ancistrophylla* and *Lepidosperma drummondii*.

Occurring on the banded ironstone hill North Ironcap were low shrublands of *Allocasuarina campestris* ssp. *campestris* with emergent tall shrubs of *Allocasuarina acutivalvis*, *Acacia lasiocalyx* (west and south-west slopes), *Callitris canescens* (south-west slopes), *Grevillea pterosperma* (north slopes) and mallees of *Eucalyptus "livida"*. The dense low shrub heath included *Acacia steedmanii*, *A. sulcata* var. *platyphylla*, *Alyxia buxifolia*, Declared Rare Flora *Banksia sphaerocarpa* var. *doliochostyla*, *B. laevigata* var. *fuscolutea*, *Calothamnus quadrifidus*, *Dodonaea adenophora*, *D. amblyophylla*, *Dampiera obliqua*, *Hakea scoparia*, *H. subsulcata*, *Keraudrenia integrifolia*, *Leptospermum erubescens*, *Melaleuca cordata*, *M. uncinata*, *Gastrolobium parviflorum* var. *revoltum*, *Santalum acuminatum* and *Spyridium complicatum*.

Surrounding North Ironcap were the tall shrubs *Allocasuarina campestris* ssp. *campestris*, *Acacia assimilis*, *A. beauverdiana* and *Melaleuca uncinata*; and low shrubs of *Acacia sulcata* var. *platyphylla* and *Melaleuca cordata*. Also occurring on North Ironcap were the orchids *Caladenia "incrassata"*, *C. "pulchra"* ssp. *"ochra"*, *C. saccharata*, *Pterostylis* aff. *nana*, *P. aff. rufa*, *P. aff. vittata* and *Thelymitra* aff. *nuda*; the ferns *Cheilanthes austrotenuifolia*, *C. lasiophylla* and *Pleurosorus rutifolius*; the perennial grass *Spartochloa scirpoidea*; and the sedges *Lepidosperma drummondii* and *L. viscidum* var. *viscidum*.

On sandplains to the west of Lake Cronin, mallee heathlands contain *Eucalyptus leptopoda*, *E. "luteola"*, *E. "livida"*, *E. platycorys* and, *E. "sporadica"*; tall shrubs of *Acacia lasiocalyx*, *A. merinthophora* and *A. signata*; and low shrubs of *Hakea* cf. *falcata*.

Other mallees occurring with *Eucalyptus pileata* were *E. "sporadica"* and *E. aff. transcontinentalis*; low shrubs of *Boronia coerulescens* var. *spicata*, *Daviesia lancifolia*, *Grevillea oncogyne*, *Melaleuca lateriflora*, *M. pentagona* var. *pentagona* and *M. uncinata*; and sedges of *Gahnia*

ancistrophylla, *Lepidosperma brunonianum* and *L. drummondii*. Growing under *Eucalyptus "sporadica"* mallee were the low shrubs *Baeckea maidenii*, *Callitris canescens*, *Exocarpos aphyllus*, *Hakea scoparia*, *Melaleuca acuminata*, *M. adnata*, *M. lateriflora*, *M. aff. pungens* and *M. spicigera*.

Tall shrubs occurring with *Acacia signata* were *A. beauverdiana* and *A. assimilis*; the mallee *E. "livida"*; low shrubs of *Baeckea cf. crassifolia*, *Hakea aff. falcata*, and *Thryptomene kochii*; and the sedge *Lepidosperma drummondii*. Other low shrubs growing with *Hakea cf. falcata* include *Allocasuarina humilis*, *A. microstachya*, *Banksia audax*, *Daviesia rhombifolia*, *Dryandara aff. cirsioides*, *D. conferta*, *D. erythrocephala* and *Melaleuca scabra*; the sedges *Schoenus armeria* and *S. brevisetis*; and sedge-like flora *Conostylis argentea* and *Lomandra micrantha* var. *micrantha*.

A granite exposure 9km west of Lake Cronin was surrounded by a low woodland of *Allocasuarina huegeliana* with *Acacia lasiocalyx* over open scrub of *Acacia assimilis*, *Calytrix leschenaultii*, *Stackhousia monogyna*, *Santalum spicatum* and the sedge *Leptospermum erubescens*. A granite vegetation complex, comprising a wide variety of taxa, included the annuals *Actinobole uliginosum*, *Borya constricta*, *Dianella revoluta*, *Calandrinia prolifera*, *C. polyandra*, *Drosera macrantha*, *D. stolonifera* ssp. *rupicola*, *Helipterum demissum*, *Leptospermum erubescens*, *Levenhookia dubia*; and the orchids *Caladenia "pachychila"*, *C. "pulchra"* ssp. *"ochra"*, *C. flava* ssp. *"flava"*, *C. hirta*, *C. roei*, *"Cyanicula" deformis*, *Microtis unifolia*, *Prasophyllum ringens*, *Spiculaea ciliata*, *Thelymitra antennifera* and *T. aff. nuda*.

On sandplain further west, tall shrublands of *Grevillea eriostachya* ssp. *excelsior* included *Banksia elderiana*, *Calothamnus quadrifidus*, *Grevillea cagiana* and *G. pterosperma*; low shrubs of *Acacia acutifolia*, *A. andrewsiana*, *Allocasuarina campestris*, *Beaufortia micrantha* var. *micrantha*, *Borya constricta*, *Daviesia incrassata*, *Hakea cf. falcata*, *H. incrassata*, *H. platysperma*, *Melaleuca cordata*, *Scaevola restiacea*, *Verticordia endlicheriana* and *V. picta*; and the sedges *Lepidobolus preissianus*, *Mesomelaena stygia* ssp. *stygia*, *Schoenus brevisetis*.

On deep sands north of The Basin, mallees of *Eucalyptus rigidula* occur over shrubs of *Balaustion pulcherrimum*, *Baeckea aff. playtycephala* and *Hakea minyma*.

A series of granite exposures occur along the Holland's Track, each one having a different species composition. Sheoak Rock is surrounded by *Acacia lasiocalyx* and *Allocasuarina campestris* ssp. *campestris* thickets containing emergent *Eucalyptus occidentalis* var. *stenantha* mallees; shrubs of *Calothamnus quadrifidus*, *Callitris preissii* ssp. *verrucosa*, *Dodonaea adenophora*, *Drosera macrantha*, *Leptospermum erubescens*,

Melaleuca macrorychia, *Olearia muelleri*, *Santalum acuminatum*, *Stypantra glauca* and *Thryptomene australis*.

Present in soil pockets, and around the numerous pools on Sheoak Rock, were *Borya constricta*, *Drosera stolonifera* ssp. *rupicola*, *Melaleuca elliptica* and *Thryptomene australis*. The orchid flora include *Caladenia flava* ssp. "flava", *C. "pachychila"*, *C. radialis*, *C. saccharata*, *Pterostylis mutica*, *P. aff. nana*, *P. sargentii*, *P. aff. vittata*, *Prasophyllum ringens*, *Thelymitra antennifera*, *T. aff. nuda*, *Spiculaea ciliata* and *Microtis* sp., with *Elythranthera brunonis* occurring in the adjacent sandplain heath.

Native Rocks, 5km to the north-east of Sheoak Rock, are surrounded by an open woodland of *Eucalyptus salmonophloia* with mallees of *E. calycogona*, *E. eremophila* and *E. pileata* over shrubs of *Acacia hemiteles*, *Carpobrotus*, *Dodonaea*, *Exocarpos*, *Phebalium*, *Rhagodia* and *Santalum acuminatum*. Thickets of *Acacia lasiocalyx* and *Allocasuarina campestris* have emergent *E. occidentalis* var. *stenantha* mallees over shrubs of *Calothamnus quadrifidus*, *Dodonaea adenophora*, *Drosera stolonifera* ssp. *rupicola*, *Stypantra glauca* and *Thryptomene australis*. The fern-like *Isoetes australis*, *Borya constricta*, *Glossostigma* sp. and *Scaevola spinescens* occur in pools on the granite. Seasonal orchids include the same species as at Sheoak Rock, but also *Caladenia roei* and *Pterostylis recurva*.

FAUNA

Surveys in the Lake Cronin area have recorded 35 species of reptiles, including the Declared Rare elapid snake *Denisonia atriceps*, which is known only from the Lake Cronin area; nine species of amphibians, the richest frog community recorded during the survey of the Eastern Goldfields District; 97 species of birds, comprising 41 non-passerines and 56 passerines, including two species Declared Rare, the Crested Shrike-tit (*Falcunculus frontalis*) and the Freckled Duck (*Stictonetta naevosa*); and 13 species of native mammal, including three dasyurid marsupials, two native rodents, five bats and the Western Pygmy-possum (How *et al.*, 1988a). Species recorded at Lake Cronin and in the proposed extension are listed in Appendix 7 (mammals) and 9 (amphibians and reptiles).

The vertebrate fauna of the Lake Cronin area were surveyed by intensive sampling during three seasons, from 1978 to 1981 (How *et al.*, 1988a). Sites selected covered the major vegetation types and landforms of the Lake Cronin area. Vegetation types sampled within the existing Lake Cronin Nature Reserve included *E. salmonophloia* open woodlands, the mallees *Eucalyptus cylindrocarpa*, *E. "olivina"* and *E. "exigua"*, and *Melaleuca strobophylla* tall shrublands on broad valleys; *E. flocktoniae* low woodlands on greenstone and *Halosarcia* low shrublands on salt lake margins. Sites outside the nature reserve included the vegetation complex on the banded ironstone North Ironcap; *E. "olivina"* mallee to the north-east and *E. longicornis* open woodlands to the south of Lake Cronin; and

E. pileata mallee and *Hakea* cf. *falcata* low shrublands on sandplains to the west.

The extant mammalian fauna of the Lake Cronin area contains species with both south-western and arid zone affinities (How *et al.*, 1988b). The recently described southern Australian species of *Ningaui yvonneae* and south-western *Sminthopsis gilberti* both occur at their distributional range limits at Lake Cronin. *Sminthopsis gilberti*, centred on the mesic South-West and Wheatbelt, occurs at its north-eastern limit (Kitchener *et al.*, 1984) while *Ningaui yvonneae*, restricted to semi-arid mallees and *Triodia* communities, is at its south-western limit (Kitchener *et al.*, 1983). This distributional limit of *N. yvonneae* is concomitant with the edge of the spinifex (*Triodia scariosa*) in the Lake Cronin area (How *et al.*, 1988b).

The occurrence of the White-tailed Dunnart, *Sminthopsis granulipes*, in mallees and heaths on sandplain has important conservation implications. This species persists on small, fragmented isolates in the adjacent wheatbelt and has a restricted range in the south-western region of Western Australia (Kitchener, 1980b). The Declared Rare Chuditch (*Dasyurus geoffroyi*), although not recorded in the survey of Lake Cronin, has been reported to the south at Frank Hann National Park, to the south-west at Lake Grace, and to the north at Mt Holland and Yellowdine.

A total of 13 extant native mammals were recorded in the Lake Cronin survey area (How *et al.*, 1988a). The species list includes the dasyurid marsupials, the dunnarts *Sminthopsis gilberti* and *S. granulipes*, and *Ningaui yvonneae*; the Western Pygmy-possum (*Cercartetus concinnus*); the native rodents, Mitchell's Hopping-mouse (*Notomys mitchellii*) and the Ash Grey Mouse (*Pseudomys alboncinereus*); and five species of bat, the Little and White-striped Mastiff-bats (*Mormopterus planiceps* and *Tadarida australis*), Gould's Wattled Bat (*Chalinolobus gouldii*), the King River Eptesicus (*Eptesicus regulus*) and the Lesser Long-eared Bat (*Nyctophilus geoffroyi*).

The total amphibian fauna in the Lake Cronin area is nine species, with two additional species of frogs, *Pseudophryne guentheri* and an undescribed new species of burrowing frog (*Neobatrachus* sp. nov.), recorded since the biological survey (J.D. Roberts, pers. comm.). The richness and diversity (five genera) of this assemblage is undoubtedly related to the lake being both freshwater and semi-permanent (How *et al.*, 1988a).

At Lake Cronin, *Neobatrachus* sp. nov. is sympatric with *N. kunapalari*, a recently described species of burrowing frog (Mahony and Roberts, 1986), the Humming Frog (*N. pelobatoides*) and the Shoemaker Frog (*N. sutor*). The new species has a distinctive call and is morphologically distinct from its sympatric congeners. Lake Cronin is an important overlap zone, which is an area where closely related species have overlapping ranges, and is part of an ongoing study into hybridisation and the evolution of new call

structures or novel mating systems by Dr. J.D. Roberts of the University of Western Australia. In addition to the four species of burrowing frogs (*Neobatrachus*), the distribution of another two cogenetic species also overlap at Lake Cronin, with the south-western *Pseudophryne guentheri* occurring sympatrically with its arid zone congener *P. occidentalis*.

Two winter-breeding species, *Helioporous albopunctatus* and the Banjo Frog (*Limnodynastes dorsalis*), are at the inland extremes of their distribution while the summer-breeding *Neobatrachus kunapalari* and *N. sutor* are close to their southern limits. Breeding usually occurs in winter in *Crinia pseudinsignifera*, however, the population at Lake Cronin, which is genetically and physiologically distinct from nearby populations, breeds in summer (Main, 1965). The sympatry of species with such diverse breeding patterns highlights the importance of the Lake Cronin area with its predominantly winter rainfall but occasional summer storms (How *et al.*, 1988b).

The total of 97 species of birds recorded during the survey of Lake Cronin area (How *et al.* 1988a) included a non-passerine assemblage of 41 species, the highest recorded in the survey of the Eastern Goldfields District. The presence of the freshwater Lake Cronin and the seasonal flooding of nearby salt lakes accounted for the 14 species of wading and waterbirds recorded.

The Black-throated and Hoary-headed Grebes (*Podiceps novaehollandiae* and *P. poliocephalus*); the White-necked and White-faced Herons (*Ardea pacifica* and *A. novaehollandiae*); the Black Swan (*Cygnus atratus*), the Mountain Duck (*Tadorna tadornoides*), the Grey Teal (*Anas gibberifrons*), the Pink-eared Duck (*Malacorhynchus membranaceus*), the Coot (*Fulica atra*) and the Wood Duck (*Chenonetta jubata*) were recorded on Lake Cronin in the *Melaleuca strobophylla* tall shrubland vegetation type. Three species of wading bird - the Red-capped Plover (*Charadrius ruficapillus*), Sharp-tailed Sandpiper (*Calidris acuminata*) and Black-winged Stilt (*Himantopus himantopus*) - were recorded in *Halosarcia* low shrublands on salt lakes to the north and west of Lake Cronin.

Lake Cronin qualifies as a waterfowl refuge area with breeding reported for several species and sightings of large numbers of waterbirds after rains have filled the lake (CALM file). Over 300 Grey Teal (*Anas gibberifrons*) in 1976 and about 100 Hoary-headed Grebes (*Podiceps poliocephalus*) in 1981 have been reported. The Declared Rare Freckled Duck (*Stictonetta naevosa*) has been recorded from Lake Cronin, with a report of 20-30 pairs in 1971-72, after summer thunderstorms filled the lake (P. Kennington, CALM files). Lake Cronin, a semi-permanent freshwater body in a largely arid area, is surrounded by paperbarks (*Melaleuca strobophylla*) and may be a refuge area for the Declared Rare Freckled Duck. The RAOU Bird Atlas (1977-81) also recorded the Black Duck (*Anas superciliosa*) at Lake Cronin (Blakers *et al.*, 1984). More recently, the Chestnut Teal (*A. castanea*) has also been recorded (unpubl. RAOU records), as has the Hardhead

(*Aythya australis*) and Red-necked Avocet (*Recurvirostra novaehollandiae*) (A.H. Burbidge, pers. comm.).

In addition to the numerous waders and waterfowl not recorded elsewhere in the Eastern Goldfields, the Lake Cronin area had a particularly rich passerine fauna (How *et al.*, 1988a). Outlining the conservation status of wheatbelt birds, Kitchener *et al.* (1982) identified passerine species restricted to and resident in native vegetation on isolated reserves (Appendix 11). Fifteen of these species have been recorded in uncleared woodlands at Lake Cronin (How *et al.*, 1988a). Accordingly, these areas are of great importance in conserving populations of birds whose conservation future in the adjacent wheatbelt is uncertain because of habitat destruction (How *et al.*, 1988b).

These 15 species, recorded in eucalypt woodlands and mallees surrounding Lake Cronin, are the Jacky Winter (*Microeca leucophaea*), Yellow Robin (*Eopsaltria australis*), Golden Whistler (*Pachycephala pectoralis*), Grey Shrike-thrush (*Colluricincla harmonica*), Declared Rare Crested Shrike-tit (*Falcunculus frontalis*), Crested Bellbird (*Oreocia gutturalis*), Chestnut Quail-thrush (*Cinclosoma castanotum*), Southern Scrub-robin (*Drymodes brunneopygius*), Shy Hylacola (*Sericornis cautus*), White-browed Scrub-wren (*S. frontalis*), Field-wren (*S. fuliginosus*), Southern Emu-wren (*Stipiturus malachurus*), Blue-breasted Fairy-wren (*Malurus pulcherrimus*), Rufous Tree-creeper (*Climacteris rufa*) and White-eared Honeyeater (*Meliphaga leucotis*).

The 35 species of reptiles recorded at Lake Cronin and within the proposed extension includes the rare endemic elapid snake *Denisonia atriceps*, which is only known from this single area (Storr, 1980). The reptile assemblage comprises 7 species of geckoes, including *Diplodactylus spinigerus*; two legless lizards *Delma fraseri* and *Lialis burtonis*; six dragons, including *Tympanocryptis adelaidensis champani*; 13 species of skink, including *Lerista distinguenda* and *Tiliqua occipitalis*; the Bungarra (*Varanus gouldii*); and six species of snake.

The Lake Cronin area is also known for its large and diverse populations of jewel beetles (Buprestidae), one of the two groups of invertebrates Declared Protected under the Wildlife Conservation Act. Jewel beetles, or buprestids, are acclaimed world-wide for their beauty and are strikingly patterned in a myriad of bright metallic colours. The area surrounding Lake Cronin is unique in having over 20 different species from the *Stigmodera* group recorded. Over 12 species have been reported feeding on a single eucalypt south-west of Lake Cronin (K.T. Richards, pers. comm.).

HISTORY

The first European to explore this region was Lieutenant John Septimus Roe, the State's first Surveyor-General, who travelled to the east and west of the Lake Cronin area in 1848-49. In 1893 John Holland pioneered a track between Broomehill and Coolgardie to establish a link between the south

coast and the Coolgardie Goldfield. The portion of the Holland's Track that links the granite Sheoak, Native and Wattle Rocks still exists, but the majority of the track is now overgrown. Holland, like Roe before him, failed to enthuse about the agricultural potential of the area, and it was not until the 1920's that an attempt at land settlement was made (How and Newbey, 1988). In 1902-03, the Vermin Proof Fence (36km west of Lake Cronin) was constructed in an attempt to halt the invasion of rabbits from the east. At present, agricultural development is being held at the line of the Vermin Proof Fence due to doubts about rainfall, soils and salinity to the east (Beard, 1972). The Department of Agriculture conducted feasibility trials on sample plots 63km east of Hyden during the 1960's which have since been abandoned.

The discovery of gold in the Forrestania Greenstone Belt in 1915 led to gold mines being established in the Forrestania mining area, 15km south of Lake Cronin. Gold was extracted from mines such as Black Prince and Great Southern from 1917-23, but with the failure to locate any significant ore bodies, mining activity ceased until the 1960's (Chin *et al.*, 1984). The Margaret Ellen gold prospects, 2km north of Lake Cronin, were worked from 1961-63 (Sofoulis, 1962). The discovery, by Amax in 1969, of anomalous nickel and copper values in the Forrestania Greenstone Belt promoted intense exploration during the mining boom of the 1970's (Chin *et al.*, 1984). Field traverses and aerial photography illustrate the signs of extensive mineral exploration near Lake Cronin; South, Middle and North Ironcaps; Digger Rocks and Mt Holland with numerous cleared lines occurring throughout the area. The nickel deposits of Flying Fox and New Morning south of North Ironcap; Cosmic Boy and Liquid Acrobat at Middle Ironcap; and Digger Rocks are currently under active mining leases. During initial exploration in the early 1970's, Amax used water from Lake Cronin, but sub-artesian water now supplies the mining camp at Middle Ironcap.

During the 1920's the ill-fated "3500 farm scheme" for land settlement between Southern Cross and Salmon Gums resulted in farm blocks being surveyed in the Forrestania-Mt Holland area. When the scheme collapsed in 1929 due to the Depression and salt encroachment on land cleared near Salmon Gums, a start had been made on clearing parts of the vegetation in the Lake Cronin area (Teakle, 1938). During this period, several stone wall dams were constructed around Lake Cronin. One dam, in the centre of Lake Cronin, is still present, while another dam west of the lake and one south of the freshwater swamp are present but not maintained. The old Forrestania townsite, which once stood in the vicinity of these dams, consisted of a row of tents and corrugated iron buildings. Although the buildings are gone and regrowth has almost obliterated all signs of the town, the clearing where this makeshift town once stood is still visible on the west side of the road some 2km north of the crossroads (P. Lambert, CALM files). Evidence of land clearing camps from 1928 also exists on the nature reserve, to the west of the lake (J. Bertram, pers comm.).

Lake Cronin was initially recommended as a Class A reserve for the purpose of Water and Conservation of Flora and Fauna in 1962, following requests from the shires of Kondinin and Yilgarn. In 1973, the then WA Wildlife Authority concluded that the original proposal of 3,240ha was not sufficient to protect all the catchment of the lake. They recommended that Lake Cronin and a large surrounding area be made an A Class reserve to be vested in the WA Wildlife Authority.

In 1974, the CTRC Green Book for System 11 summarised the available biological knowledge for the Lake Cronin area. CTRC recommendation 11.10 indicated that, although Lake Cronin was a unique, semi-permanent freshwater lake in an arid region, the source of water in the lake was unknown and that it lay within a greenstone mineralised area. It concluded with concerns that any reserve around the lake should be large enough to ensure that future agricultural development would not cause the lake to become saline.

In 1975, the EPA Red Book endorsed the CTRC recommendations for 11.10, and emphasised the lake's high conservation value. Although precise boundaries were not defined, it was recommended that no land within a 10km radius of Lake Cronin be alienated. The EPA also recommended that the Geological Survey carry out studies to elucidate the origin of water in the lake and discern what measures were necessary to prevent increasing salinity. In response to the Geological Survey report, the WA Wildlife Authority recommended the proposed reserve be enlarged to protect the entire catchment of the lake. Although Lake Cronin was situated in the centre of the proposed 2x2km reserve, it was clear that a significant portion of the catchment remained outside. A south-western extension to the original proposal (3,240ha) proposed an addition of approximately 1,500ha. The Mines Department, however, opposed reservation of land located west of the Forrestania-Southern Cross Road due to the potential for nickel-copper mineralisation.

The period from 1976-1980 involved prolonged negotiation between the WA Wildlife Authority, EPA, the Mines Department and Kondinin Shire regarding the proposed Lake Cronin Nature Reserve. A southward extension, to incorporate the entire lake catchment, recommended by the WA Wildlife Authority and supported by the Kondinin Shire, was opposed by the Mines Department in view of the area's mineral potential. Lake Cronin Nature Reserve (No. 36526) was gazetted an A Class Nature Reserve vested in the WA Wildlife Authority (now the National Parks and Nature Conservation Authority) for the purpose of conservation of flora and fauna on 20 February, 1980. The area of 1,593ha was less than a third of the original 3,240ha and substantially smaller than subsequent proposals of 4,700ha based on the catchment of Lake Cronin.

RECREATIONAL USE AND POTENTIAL

The Lake Cronin area has the potential to be incorporated into long-term proposals for tourism along the Hyden-Norseman Road. Plans to upgrade

the road linking Hyden and Norseman as an alternative tourist route requires the placement of secure nature reserves as well as the provision of interest areas, such as tracts of natural eucalypt woodlands, the banded ironstone Ironcaps and granite outcrops. The pressure from the Kondinin Shire to facilitate tourist use of the Lake Cronin area would need to include environmental education on the fragile lake environment and importance of the lake as a waterbird refuge. The historical interest present in the area - the old Forrestania townsite, gold mines and evidence of the "soldier camps" and land clearing of the 1920's - could also be incorporated.

KEY FEATURES

- The richest amphibian and waterbird assemblages recorded during the survey of the Eastern Goldfields District.
- Three species of Declared Rare Fauna, including the Lake Cronin Snake, known only from the Lake Cronin area.
- A large concentration of important plants restricted entirely to the Forrestania greenstone belt, including three flora Declared Rare and several poorly known priority taxa.
- The vegetation complex on the banded ironstone North Ironcap.
- The large natural tracts of semi-arid eucalypt woodland, which have been selectively cleared and fragmented in adjacent areas.
- Biological surveys have provided costly base-line data that will be increasingly important in monitoring long-term changes in the flora and fauna of the region.
- Representatives of the unmodified landforms and community types of the south-western region of the Eastern Goldfields, including the extensive sandplain mallee heaths and granite vegetation complexes to the west of the Lake Cronin area.

CTRC RECOMMENDATIONS

1. The Committee strongly endorses the proposals for a reserve including Lake Cronin. Such a reserve should be of Class A, for the Conservation of Flora and Fauna, and vested in the Western Australian Wildlife Authority.
2. Before any reserve is declared, a study should be carried out by the Geological Survey of WA to elucidate:
 - a) The origin of the water in the lake and what measures are necessary to prevent increasing salinity; and
 - b) the value of mineral claims surrounding the lake.
3. When this information is available it should be submitted to the Environmental Protection Authority for a final recommendation.
4. In the meantime, conditions should be placed on mining tenements including and surrounding Lake Cronin to provide the maximum protection of the environment.

5. Until a reserve is declared, no land within a 10km radius of Lake Cronin should be alienated.

EPA RECOMMENDATIONS

The EPA recommends that the Geological Survey carry out studies to elucidate the origin of the water in the lake and what measures are necessary to prevent increasing salinity, and submit this information to the EPA.

The EPA gives notice to relevant authorities that subject to review of pending geological studies, it is sympathetic to the strong recommendations placed before it that Lake Cronin and an adequate area around the lake should be made a Class A reserve for the purpose of Conservation of Flora and Fauna, to be vested in the WA Wildlife Authority. Specifically, EPA recommends to the Department of Mines that conditions should be placed on mining tenements including and surrounding Lake Cronin to provided the maximum protection of the environment and, furthermore, recommends to the Department of Lands and Surveys that, until further notice, no land within a 10km radius of lake Cronin should be alienated.

PRESENT RECOMMENDATIONS

1. Recommendations for extension of the existing Lake Cronin Nature Reserve incorporates the CTRC (1974) and EPA (1975) recommendations for no land within a 10km radius of Lake Cronin to be alienated. Results from the biological surveys of the Eastern Goldfields District (How *et al.*, 1988b) confirm the importance of this area, and the need for protection of the biological diversity and catchment of the freshwater Lake Cronin and environs. A review of the adequacy of the present nature reserve system indicated the necessity of a large regional conservation reserve in the south-western region of the Eastern Goldfields.

2. The extension of the existing Class A Lake Cronin Nature Reserve No. 36526 (1,015.93ha) is defined as the area of 113,250ha bounded to the: west by 119°25', for 20km from the Vermin Proof Fence, to include The Basin; Sheoak and Native Rocks on the Holland's Track and unnamed rocky outcrops; north by 32°15', for 43km, to include Wattle Rocks on the Holland's Track; east by 119°52', for 28km, to include the entire drainage system of the salt lakes to the east of Lake Cronin; south by 32°30', for 35km to the Vermin Proof Fence, to include Reserve No. 13525 (Water Supply for Mines) of 231ha, the eucalypt woodland valleys drainage of The Basin while avoiding the Forrestania and Middle Ironcap mining areas; and south-west by the Vermin Proof Fence for 10km adjacent to Emu and Cockatoo Rocks (Reserve Nos. 2047, 9753).

1.2 FORRESTANIA GREENSTONE BELT

A series of small nature conservation reserves, encompassing banded ironstone outcrops, are proposed within the Forrestania greenstone belt.

Mt Holland, Middle and South Ironcaps, and Hatter Hill are areas of high conservation value containing endemic flora with geographically restricted distributions. The CTRC (1974), reviewing the South Yilgarn area (11.9), concluded that Class A reserves should be established when biological surveys determined adequate boundaries. Recommendation 11.9.3 sought protection of Mt Holland; North, Middle and South Ironcaps; Hatter Hill and adjacent land.

These prominent banded ironstone ridges contain unique mosaics of vegetation types and complexes which vary in species composition and also differ markedly from other banded ironstone formations in the Eastern Goldfields: Mt Day, Round Top Hill and Honman Ridge 80km to the east, and Koolyanobbing and Aurora Ranges 200km to the north (Newbey and Hnatiuk, 1985; 1988). Based on increased botanical knowledge, the proposed boundaries provide small buffer zones of uncleared greenstone vegetation around each prominent banded ironstone hill. These reserves will complement the large regional reserve proposed by the extension to the existing Lake Cronin Nature Reserve.

All the proposed reserve areas occur within active mineral leases. The Forrestania greenstone belt is a large high grade nickel sulphide resource. Proven reserves in known deposits include Cosmic Boy at Middle Ironcap, Digger Rocks near South Ironcap, and Flying Fox and New Morning in the Lake Cronin area (Chin *et al.*, 1984). New gold discoveries have been located at North Ironcap and Mt Holland. Notices of Intent to Mine at Digger Rocks and at Hatter Hill have been lodged. Although extensive mineral exploration has occurred throughout the area, Mt Holland and South Ironcap have been less affected than Hatter Hill and Middle Ironcap.

PROPOSED HATTER HILL NATURE RESERVE

The proposed Hatter Hill area has a diversity of community types, and also provides protection for several endemic and restricted plant species in the vicinity. Reservation of Crown land in the Hatter Hill area would incorporate surface types and associated plant communities of the Forrestania greenstone belt and granite outcrops not adequately represented on reserves in the south-western Eastern Goldfields District.

LOCATION: Hatter Hill is 40km north-east of Lake King and 110km south-east of Hyden in the Ravensthorpe Shire.

MAP: 1.

AREA: 43,340ha.

CURRENT STATUS: Vacant Crown land and Reserve Nos. 19866, 9926, 13526, 13527 and 21168.

GEOMORPHOLOGY

The greenstone Hatter Hill area represents a varied system characterised by ironstone outcrops, exposed weathered breakaways, slopes, low valleys and drainages. The undulating terrain around Hatter Hill (436m), which forms the southern end of the Forrestania greenstone belt that extends 80 km north to Mt Holland, contains lateritic breakaways and ironstone hills. Mt Gibbs (442m) and Jackson Rock (481m) are large granite outcrops. Unmodified sandplain vegetation associations and eucalypt woodlands on the broad valleys surround these outcrop areas.

FLORA AND VEGETATION

The Declared Rare Flora *Boronia revoluta*, originally collected from Hatter Hill in 1929, was rediscovered in October 1989. The only other known location of this rare plant is South Ironcap, 25km north of Hatter Hill. In addition, the botanically rich Hatter Hill area contains 14 taxa listed on CALM's Reserve Flora List. The rediscovery of *Boronia revoluta* during a botanical survey of the proposed mining area illustrates the need for a comprehensive biological survey of the Hatter Hill area.

The recently discovered *Drosera* sp. (G.J. Barrett 16.9.89) is currently known from a single population in the Hatter Hill area. *Melaleuca agathosmoides* has a very restricted distribution of 35km in the immediate vicinity of Hatter Hill. Endemic species that are restricted to the ironstone outcrops within the greenstone belt include *Drosera* aff. *bulbosa* (A.P. Brown 362), *Dryandra* aff. *horrida* (A.S. George 9446) and *Stylidium* aff. *caricifolium* (D.J. Coates 4688). Rarely collected flora include *Acacia binata* var. nov., *Logania* sp. (G.J. Keighery 901) and *Mirbelia densiflora*, known only from a single collection at Hatter Hill. *Acacia* sp. (KRN 6559) and *Latrobea* sp. (KRN 6532), are known only from a few localities including Hatter Hill.

Halgania tomentosa and *Levenhookia pulcherrima* are both known from only two localities, while *Gastrolobium rigidum* and *Pimelea graniticola* are granite endemics with a scattered distribution. *Acrotrichne patula*, a common South Australian species, is known only from two populations in Western Australia and probably represents a new subspecies or variety. *Eucalyptus deflexa*, a species for high priority monitoring, has been recorded to the south of Mt Gibbs.

Eucalypts recorded in the Hatter Hill area include *Eucalyptus annulata*, *E. flocktoniae*, *E. longicornis*, *E. salubris*, *E. salmonophloia*, *E. "densa" ssp. "densa"*, *E. conglobata*, and *E. aff. kondininensis*, *E. eremophila*, *E. "olivina"*, *E. loxophleba*, *E. "livida"*, *E. "luteola"*, *E. spathulata ssp. grandiflora*, *E. falcata*, *E. celastroides ssp. virella*, *E. "sporadica"*, *E. platycorys* and *E. grossa*.

Shrubs growing under eucalypts include the restricted *Melaleuca agathosmoides*, *Dryandra* aff. *horrida*, and *Acrotrichne patula* with

Banksia elderiana, *Callitris canescens*, *Dryandra* aff. *nivea*, *Grevillea insignis* and *Melaleuca uncinata*.

Orchid species recorded include the Spider orchids *Caladenia saccharata*, *C. sigmoidea*, *C. "pulchra"* ssp. *"ochra"*, *C. "pachychila"*, *C. "microchila"*; the greenhoods *Pterostylis mutica*, *P. aff. aspera*, *P. recurva*, *P. aff. nana*, *P. aff. vittata*; *Diuris* aff. *corymbosa* and *Thelymitra* aff. *nuda*.

A unique breakaway complex vegetation type which is endemic to the Hatter Hill area included mallees of *Eucalyptus "livida"*; tall shrubs of *Callitris canescens* and *Melaleuca uncinata*; low shrubs of *Acrotrichne patula*, *Phebalium microphyllum* and *Westringia cephalantha*; and the annual *Drosera* aff. *bulbosa*.

The mallees *E. celastroides* ssp. *viarella* and *E. "sporadica"* were recorded over low shrubs of *Melaleuca cardiophylla* var. *cardiophylla*, the restricted *M. agathosmoides* and *Acacia* sp. (KRN 6559) while *E. platycorys* and *E. grossa* occurred over *Logania buxifolia*.

Mt Gibbs, a large granite exposure 10km south of Hatter Hill, is fringed by low woodlands of *Acacia lasiocalyx* containing mallees of *Eucalyptus "stenantha"* over thickets of *Acacia saligna*, *Allocasuarina campestris* ssp. *campestris*, *Baeckea crispiflora*, *Grevillea paniculata*, *Melaleuca elliptica*, *Platysace effusa*, *Santalum acuminatum* and *Stypandra imbricata*. On the granite rock itself, the granite endemics *Pimelea graniticola* and *Gastrolobium rigidum* occur with *Acacia assimilis*, *Allocasuarina humilis*, *Calothamnus* sp., *Dodonaea* sp., *Drosera macrantha*, *Hakea* sp., *Kunzea pulchella*, *Persoonia tortifolia*, *Thryptomene australis*, *Wurmbea graniticola*, *W. sinora*; the perennial grass *Spartochloa scirpoidea*; and the sedges *Lepidobolus preissianus*, *Lepidosperma drummondii*, *Mesomelaena stygia* ssp. *stygia* and *Schoenus brevisetis*.

The rock supports a dense seasonal cover that includes the orchids *Caladenia "pachychila"*, *C. saccharata* and *C. "dimidia"*; the annuals *Chamaescilla corymbosa* and *Drosera macrantha*; while rock pools contain *Glossostigma* spp. and *Isoetes australis*.

Kwongan sandplain heath to the south of Mt Gibbs included shrubs of *Allocasuarina acutivalvis*, *A. campestris* ssp. *campestris*, *A. microstachya*, *Acacia diaphyllodinea*, *Hakea* cf. *falcata*, *Melaleuca scabra*, *Petrophile seminuda* and *Verticordia roei*.

Jackson Rock, 12km west of Hatter Hill, is surrounded by *E. eremophila*, *E. pileata*, *E. platycorys*, *E. "stenantha"* and scattered *E. salmonophloia* over thickets that include *Acacia lasiocalyx*, *Allocasuarina campestris*, *Callitris preissii* ssp. *verrucosa*, *Melaleuca elliptica*, *M. uncinata*, *Leptospermum erubescens*, *Santalum acuminatum* and *Stypandra glauca*. Also occurring on the granite rock are the orchids *Caladenia saccharata*, *C. "pachychila"*, *C. flava* ssp. *"flava"*, *C. "dimidia"*, *Cyrtostylis huegelii*, *Pterostylis* aff. *nana*,

P. aff. rufa, *P. recurva*, *P. aff. vittata*, *Eriochilus dilatatus* ssp. "*multiflorus*", *Lyperanthus nigricans*; the herbs *Borya constricta*, *B. sphaerocephala*, *Drosera macrantha*, and *Isoetes australis*; and the shrubs *Dodonaea viscosa* ssp. *angustissima*, *D. adenophora*, *Kunzea pulchella* and *Thryptomene australis*.

FAUNA

Although no major specific fauna collections have been conducted in the Hatter Hill area, the WA Museum has a specimen of the Declared Rare Western Mouse (*Pseudomys occidentalis*) from Hatter Hill (Kitchener and Vicker, 1981).

HISTORY

Gold, with silver as a by-product, had been produced from 1933-37 at the Hatter Hill Mining Centre, situated within the Forrestania greenstone belt in the Phillips River Goldfield. Disturbance from both historical mining activity and recent exploration is extensive in the Hatter Hill area. Currently, Notice of Intent to Mine gold at Hatter Hill has been lodged, with preliminary mining on a small scale being confined to previously disturbed areas. The rediscovery of the Declared Rare Flora *Boronia revoluta* during a botanical survey of the proposed mining area illustrates the need for a comprehensive biological survey of the Hatter Hill area (G.J. Barrett, in prep.).

RECREATIONAL USE AND POTENTIAL

At present there is little recreational use of the Hatter Hill area but potential exists for the granite rocks of Mt Gibbs and Jackson Rock. Rehabilitation of the extensive mining damage in the vicinity of Hatter Hill would be required if the Forrestania-Southern Cross Road was developed as a tourist route through the uncleared vegetation west of the Vermin Proof Fence.

KEY FEATURES

- Declared Rare Flora *Boronia revoluta* and 14 Priority species and restricted to outcrop areas within the Forrestania greenstone belt.

CTRC RECOMMENDATION

11.9.3 The Committee recommends that the EPA recommend to the Minister for Mines that conditions to protect the environment be placed on mining tenements on and adjacent to Mt Holland: North, Middle and South Ironcap; and Hatter Hill.

EPA RECOMMENDATION

The EPA recommends to the Minister for Mines that conditions to protect the environment be placed on mining tenements on and adjacent to Mt Holland: North, Middle and South Ironcap; and Hatter Hill.

PRESENT RECOMMENDATIONS

1. The proposed A Class Hatter Hill Nature Reserve, vested in the NPNCA for Conservation of Flora and Fauna, is defined as the area bounded to the: west by the Vermin Proof Fence for 20km; north by 32°46'S to include Jackson Rock and unnamed rocky outcrops; east by 120°05'E; and south by 32°55'S to include Mt Gibbs.

2. The following unvested reserves should also be incorporated into the proposed nature reserve: No. 19866 Timber for use of Agriculture Department (unvested), 9926 Water Supply Rabbit Department, 13526 Water Supply Mines and part of 13527 Water Supply Mines.

3. Water Reserve No. 21168 (Minister for Water Resources) should remain a separate reserve for Conservation of Flora and Fauna and Water, vested in the NPNCA.

PROPOSED SOUTH IRONCAP NATURE RESERVE

LOCATION: South Ironcap is situated 90km south-west of Hyden within Kondinin Shire. *east*

MAP: 1.

AREA: 2,940ha.

CURRENT STATUS: Vacant Crown land.

GEOMORPHOLOGY

South Ironcap constitutes both the highest and most extensive banded ironstone formation within the Forrestania greenstone belt. At 502m it is the highest point in the region with ironstone ridges extending southwards for over 3km. The proposed area incorporates this prominent outcrop sequence and surrounding undulating plains of greenstone.

FLORA AND VEGETATION

The South Ironcap area is the most botanically important of the series of proposed banded ironstone flora reserves. Three flora Declared Rare occur in the vicinity of South Ironcap. In addition seven Priority species from CALM'S reserve list are under consideration for gazettal as Declared Rare Flora.

The largest known population of Declared Rare *Banksia sphaerocarpa* var. *dolichostyla* occurs on South Ironcap. Two further populations occur on a smaller banded ironstone ridge south of the high point and in the vicinity of Digger Rocks to the south-east. These populations represent half of the known populations of this very restricted plant.

Boronia revoluta is Declared Rare and known only from two localities. It was recently discovered during a botanical survey of Hatter Hill and occurs on an area under Notice of Intent to Mine.

The Declared Rare *Eucalyptus steedmanii* has been reliably reported in the South Ironcap-Digger Rocks area. The largest populations of this eucalypt, rediscovered in 1978 after 40 years, occur to the south-west and north-west of Lake Cronin, within the proposed extension.

Two Priority One species are present within the proposed area. *Grevillea lullfitzii* and *Stylidium* aff. *caricifolium* (D.J. Coates 4688). The South Ironcap-Digger Rocks area is one of only two localities for both *Logania gracilis* and *Dryandra* aff. *horrida* (A.S. George 9446). All these priority species have restricted distributions on active mineral leases.

Drosera aff. *bulbosa* (A.P. Brown 362), recently discovered in 1986, is endemic to the Forrestania greenstone belt while *Acacia* aff. *pachypoda* (KRN 5820) is poorly known and in need of further survey. Digger Rocks is one of only three known localities for *Acacia* aff. *myrtifolia* (B.R. Maslin s.n.).

The vegetation of South Ironcap consists of *Eucalyptus rigidula*, *E. "phaenophylla"* ssp. *"phaenophylla"* and *E. aff. falcata* over a dense heath. In addition to the large population of Declared Rare *Banksia sphaerocarpa* var. *dolichostyla* the heath contains *Allocasuarina campestris*, *Acacia heterochroa*, *Adenanthos argyrea*, *Drosera macrantha*, *Dryandra* aff. *nivea*, *Drummondita hassellii*, *Gastrolobium spinosum*, *G. parviflorum*, *Hibbertia* spp., *Hakea subsulcata* var. *laevis*, *Keraudrenia integrifolia*, *Logania gracilis*, *Melaleuca cordata*, *M. uncinata* and *Persoonia tortifolia*.

Flanking South Ironcap were *Eucalyptus* open low woodlands over shrub and mallees of *Eucalyptus calycogona*, *E. conglobata*, *E. celastroides* ssp. *virella*, *E. flocktoniae* and *E. yilgarnensis*. Tall woodlands to the south-west consisted of *Eucalyptus annulata*, *E. longicornis*, *E. salubris* and *E. flocktoniae*.

Beneath the eucalypts over 10 species of orchids occurred including *Caladenia saccharata*, *C. sigmoidea*, *C. "pulchra"* ssp. *"ochra"*, *Pterostylis* aff. *nana*, *P. aff. rufa*, *P. mutica*, *P. recurva*, *P. sargentii*, *P. aff. vittata*, *Genoplesium nigricans* and *Thelymitra* aff. *nuda*.

The southern population of *Banksia sphaerocarpa* var. *dolichostyla* grew under *E. conglobata*, *E. aff. falcata*, *E. perangusta* and *E. "phaenophylla"* ssp. *"phaenophylla"* with *Dryandra* aff. *horrida*.

FAUNA

Although the fauna has not been surveyed, flora on the prominent ironstone ridges, with differing flowering periods from the adjacent vegetation, appear to be an important resource for the region's fauna. In particular, the large population of *Banksia* attracts a high number of passerine birds during flowering from February to May. Nectar use by the Western Pygmy-possum (*Cercartetus concinnus*) was also evident.

RECREATIONAL USE AND POTENTIAL

As the most prominent high spot in the region, South Ironcap at 502m affords extensive views of the surrounding landscape. Allowing for adequate protection of the important flora located in the vicinity, South Ironcap has considerable scenic appeal. Indications suggest that the Forrestania - Southern Cross Road will continue to be used increasingly as a north-south link through the uncleared vegetation west of the Rabbit Proof Fence. The proposed South Ironcap reserve, incorporating the impressive banded ironstone ridge top and associated flora and fauna, has potential as a scenic stop-over along this route.

KEY FEATURES

- Highest banded ironstone formation within the Forrestania greenstone belt.
- Three species of Declared Rare Flora, including large populations of *Banksia sphaerocarpa* var. *dolichostyla* and *Eucalyptus steedmanii*, and seven Priority species.

CTRC RECOMMENDATION

11.9.3 The Committee recommends that the EPA recommend to the Minister for Mines that conditions to protect the environment be placed on mining tenements on and adjacent to Mt Holland; North, Middle and South Ironcap; and Hatter Hill.

EPA RECOMMENDATION

11.9.3 The EPA recommends to the Minister for Mines that conditions to protect the environment be placed on mining tenements on and adjacent to Mt Holland; North, Middle and South Ironcap; and Hatter Hill.

PRESENT RECOMMENDATION

The proposed A Class South Ironcap Nature Reserve for the Conservation of Flora and Fauna, vested in the NPNCA, is defined as the area bounded to the: west by 119° 45'E for 6.0km; north by 32° 40'S for 6.3km; east by 119° 48'E for 6.0km; and south by 32° 43'S for 6.3km.

PROPOSED MIDDLE IRONCAP NATURE RESERVE

LOCATION: Middle Ironcap is situated 82 km west of Hyden within the Kondinin Shire. east.

MAP: 1.

AREA: 2,465ha.

CURRENT STATUS: Vacant Crown land.

GEOMORPHOLOGY

Middle Ironcap is one of a series of banded ironstone hills within the Forrestania greenstone belt. At 478m it is the second highest point in the region. The proposed area consists primarily of undulating plains underlain by greenstone.

FLORA AND VEGETATION

Middle Ironcap is botanically important because of the interesting species composition occurring on it that differs from the other banded ironstone hills in the region. Flora such as *Keraudrenia integrifolia*, *Melaleuca uncinata*, *Santalum acuminatum*, and Declared Rare *Banksia sphaerocarpa* var. *dolichostyla*, present on North and South Ironcaps and Mt Holland, are absent from Middle Ironcap. In contrast the eucalypts *Eucalyptus eremophila*, *E. pileata* and *E. "stenantha"* are found only on Middle Ironcap. Similarly *Hakea multilineata* is restricted to Middle Ironcap. In addition, the Declared Rare *Eremophila inflata*, known from only a few populations, occurs just to the east of Middle Ironcap on a road verge, within the proposed reserve area. The Priority One species, *Stylidium* aff. *caricifolium* (D.J. Coates 4688), a plant endemic to the Forrestania greenstone belt, is present on Middle Ironcap. The population of Declared Rare *Boronia revoluta* recorded from Middle Ironcap has not been collected recently and may be extinct.

The vegetation of Middle Ironcap consists of *Eucalyptus eremophila*, *E. pileata*, *E. "stenantha"* and a solitary emergent *Codonocarpus cotinifolius* over a scrub thicket including *Acacia lasiocalyx*, *A. steedmanii*, *Allocasuarina campestris*, *Banksia laevigata* ssp. *fuscolutea*, *Calothamnus quadrifidus*, *Dodonaea insignis*, *Drosera macrantha*, *Drummondita hassellii*, *Gastrolobium parviflorum*, *Hakea multilineata*, *H. subsulcata*, *Melaleuca cordata* and *Persoonia tortifolia*.

Eucalypt woodlands surrounding Middle Ironcap include *Eucalyptus celastroides* ssp. *virella*, *E. conglobata*, *E. flocktoniae*, *E. longicornis*, *E. salmonophloia* and *E. yilgarnensis*. Orchids recorded from the Middle Ironcap area include *Caladenia saccharata*, *Pterostylis* aff. *nana*, *P. mutica*, *P. sargentii*, *P. aff. aspera*, *P. recurva*, *P. aff. vittata* and *Thelymitra* aff. *nuda*.

FAUNA

Not studied.

RECREATIONAL USE AND POTENTIAL

At present a mining camp is situated at the southern base of Middle Ironcap. Extensive mineral exploration and construction including a landing ground, in the vicinity of Middle Ironcap, preclude recreational potential for the area.

KEY FEATURES

- One of a series of botanically significant banded ironstone hills.

CTRC RECOMMENDATION

11.9.3 The Committee recommends that the EPA recommend to the Minister for Mines that conditions to protect the environment be placed on mining tenements on and adjacent to Mt Holland; North, Middle and South Ironcap; and Hatter Hill.

EPA RECOMMENDATION

The EPA recommends to the Minister for Mines that conditions to protect the environment be placed on mining tenements on and adjacent to Mt Holland; North, Middle and South Ironcap; and Hatter Hill.

PRESENT RECOMMENDATION

The proposed A Class Middle Ironcap Nature Reserve, to be vested in the NPNCA for the Conservation of Flora and Fauna, is defined as the area bounded to the: west by 119°43'E for 5.5km; north by 32°33'S for 4.5km; east by 119°46'E for 5.5km; and south by 32°36'S for 4.5km.

PROPOSED MT HOLLAND NATURE RESERVE

LOCATION: Mt Holland is 87km north-east of Hyden within the Yilgarn Shire.

MAP: 1.

AREA: 2,637ha.

CURRENT STATUS: Mt Holland is contained within reserve No. 13524 of 259ha for Water Supply Mines and surrounded by vacant Crown land.

GEOMORPHOLOGY

Mt Holland is a banded ironstone hill within the northern portion of the Forrestania greenstone belt. The proposed area consists largely of sandplain with undulating plains underlain by greenstone occurring to the east of Mt Holland. A broad valley tongue intrudes into the south-west of the proposal. Mt Holland is a fairly extensive north-east trending ridge with a high point of 477m.

FLORA AND VEGETATION

The Mt Holland area is botanically important and the proposed reserve contains two flora Declared Rare and several taxa on CALM'S Reserve Flora List. *Banksia sphaerocarpa* var. *dolichostyla* and *Acacia lanuginosa* are on the schedule of Declared Rare Flora. The population of *Banksia sphaerocarpa* var. *dolichostyla*, on Mt Holland, represents the northernmost locality of this rare plant. *Acacia lanuginosa*, originally collected from Mt Holland in 1930, is presently known from only a few scattered localities.

Priority species are under consideration for gazettal and require additional survey. Several poorly known plants occur in the Mt Holland area. Priority One species in the vicinity are *Grevillea pilossa* ssp. *dissecta* and *G.*

lissopleura. Rediscovered in 1989 after 20 years, *Grevillea lissopleura* occurs both north and south of Mt Holland.

Acacia aff. *pachypoda* (KRN 5820) and *Logania gracilis*, Priority Two species, occur as disjunct populations on outcrops within the Forrestania greenstone belt. *Logania* sp. (G.J. Keighery 901) is a Priority Two species known only from four collections. Originally collected at Mt Holland in 1929, it was relocated north and south of Mt Holland in the 1970's.

Botanical collections of the Mt Holland area have been made since the 1920's. *Thomasia gardneri* has only been recorded once from Mt Holland in 1929, and is now presumed extinct. *Sowerbaea multicaulis* was last collected in 1931 in the area between Mt Holland and Lake Hope.

Woodlands of *Eucalyptus longicornis* fringe the northern slopes of Mt Holland. On Mt Holland mallees of *E. rigidula* occur over a dense shrubland that includes *Acacia acuminata*, *A. lasiocalyx*, *A. nigripilosa*, *A. steedmanii*, *Allocasuarina campestris*, *Alyxia buxifolia*, *Callitris canescens*, *Codonocarpus cotiniifolius*, *Grevillea pterosperma*, *Hakea subsulcata*, *Leptospermum erubescens*, *Melaleuca cordata*, *M. uncinata*, *Persoonia tortifolia*, *Phebalium microphyllum*, *santalum acuminatum* and *Scaevola spinescens*.

FAUNA

Not studied. The Declared Rare Chuditch or Western Native-cat (*Dasyurus geoffroii*) has been reported from an exploration camp near Mt Holland in the summer of 1984/85 (Kym Robinson, pers. comm.).

HISTORY

Mt Holland was named after John Holland who pioneered a track between Broomehill and Coolgardie in 1893. Holland's Track largely followed granite rock outcrops and is still visible linking Emu Rock with Sheoak, Native and Wattle Rocks. Most of the track to the north-east towards Mt Holland and on to Sandalwood Rocks is now overgrown. Mt Holland, like the granite rocks of the region, has been historically important for water. A tank is still present near Mt Holland, and the area is contained within a water supply for mines reserve.

RECREATIONAL USE AND POTENTIAL

The Mt Holland area has both historical and recreational values. Mt Holland at 477m is the prominent high point in the area commanding impressive views of the surrounding landscape. The lack of extensive mineral exploration in the immediate Mt Holland vicinity adds to its scenic appeal, especially if visitor use of the Forrestania-Southern Cross Road continues to increase. Educational facilities relating the history of Holland's Track could be developed at Mt Holland.

KEY FEATURES

- Declared Rare Flora and five Priority species restricted to surrounding area.
- Historical significance as part of Holland's Track.

CTRC RECOMMENDATION

11.9.3 The Committee recommends that the EPA recommend to the Minister for Mines that conditions to protect the environment be placed on mining tenements on and adjacent to Mt Holland; North, Middle and South Ironcap; and Hatter Hill.

EPA RECOMMENDATION

The EPA recommends to the Minister for Mines that conditions to protect the environment be placed on mining tenements on and adjacent to Mt Holland; North, Middle and South Ironcap; and Hatter Hill.

PRESENT RECOMMENDATION

The proposed A Class Mt Holland Nature Reserve, for the Conservation of Flora and Fauna and vested in the NPNCA, encompassing the existing reserve No. 13524 (259ha) and the botanically rich surrounding area, is defined as the area bounded to the: west by 119° 42'E for 5.6km; north by 32° 08'S for 4.8km; east by 119° 45'E for 5.6km; and south by 32° 12'S for 4.8km.

1.3 FRANK HANN NATIONAL PARK

The existing Frank Hann National Park is the subject of two recommendations. The first concerns converting the area to Frank Hann Nature Reserve, as it falls more strictly within the criteria for a nature reserve. Secondly, a small proposed northern extension is required to consolidate the conservation value of the existing reserve.

LOCATION: Frank Hann National Park stretches from the Vermin Proof Fence, 30km east of Lake King, for approximately 70km along the Lake King-Norseman Road. The majority of the park lies within the Ravensthorpe Shire.

MAP: 1.

AREA: 61,420ha.

CURRENT STATUS: Frank Hann National Park (No. 27023) is Class C vested in the NPNCA for National Park.

GEOMORPHOLOGY

Frank Hann National Park is dominated by high sandplain, particularly in the south-western and north-eastern parts of the park. Quaternary surfaces of low lying broad valleys and salt lakes occur in the central portion. The

overall topography is characterised by gentle undulations varying between 280m and 420m.

The western extremity of the park is situated on granites of the Yilgarn Block, the oldest of the Precambrian complexes of Western Australia (Gower and Bunting, 1976). The high ground in the south-western section represent areas where granitic residuals are exposed. A series of granite outcrops, including Lillian Stokes Rock, occur in this area. At the north-eastern boundary, near Ninety Mile Tank, the high ground overlies laterite of the old peneplain (Monk *et al.*, 1979).

The broad valley watercourses are all intermittent, narrow and shallow. Several drain towards salt lakes in the central area while others drain into the Lake Tay salt lake chain to the south-east of the park.

FLORA AND VEGETATION

Frank Hann National Park has been surveyed in detail by Monk *et al.* (1979) and Newbey and Hnatiuk (1988). Sandplain vegetation types dominate the south-western and north-eastern portions of the park while mixed eucalypt woodlands occupy the central area of Frank Hann.

The orchid *Caladenia "voigtii"*, listed on the schedule of Declared Rare Flora as *Caladenia* sp. (Esperance) D.R. Voight 36, has a distribution from south of Balladonia to Frank Hann National Park. It has been recorded within and just to the east of the park as well as near Ninety Mile Tank.

Three taxa on CALM's Reserve Flora List are present in Frank Hann National Park. The Priority Two species *Gastrolobium rigidum* is restricted to granites to the west of Frank Hann National Park. Within the park, *Halosarcia entrichoma* is known only from a single population surrounding a salt lake, 32km south-west of Ninety Mile Tank, on the Lake King-Norseman Road. A further two populations may occur at a small salt lake 9km north-east of Ninety Mile Tank, south of Bremer Range. *Eucalyptus deflexa*, which has been recorded in the south-western corner of the park, has a scattered distribution to the west of Frank Hann. All three taxa are poorly known and require high priority monitoring.

The *Eucalyptus "obesa"* mallee vegetation type occurred on small areas of high sandplain in the north-eastern section of the park. This site had a species richness substantially higher than any other recorded in the area during the biological survey of the Eastern Goldfields District (Newbey and Hnatiuk, 1988). Frank Hann is the only known location for *E. aff. "polita"* (SDH 7304). Other eucalypts with restricted distributions in the vicinity of Frank Hann National Park include *Eucalyptus "olivina"* and *E. "densa"* ssp. "*densa*" (S.D. Hopper field notes: 1978-89).

Sandplain mallee and heath formations dominate the south-western section of the park. Species recorded in kwongan heaths include *Banksia media*, *B. laevigata*, *Beaufortia micrantha*, *Callitris preissii*, *Calytrix*

brachyphylla, *Conostylis petrophiloides*, *Hakea falcata*, *Grevillea* sp., *Isopogon scabriusculus*, *Pimelia suaveolens*, *Stylidium breviscapum*, *S. squamellosum*, *Verticordia chrysantha* and *V. roei*.

Mallees of *Eucalyptus "luteola"*, *E. leptophylla*, *E. "olivina"* and *E. "sporadica"* occur over heaths of *Astartea ambigua*, *Callitris preisii* ssp. *verrucosa*, *C. roei*, *Calytrix leschenaultii*, *Dodonaea amblyophylla*, *Grevillea pauciflora* ssp. *pauciflora*, *Hakea* cf. *falcata*, *H. lissocarpa*, *H. marginata*, *Leptospermum erubescens*, *Melaleuca pentagona*, *M. uncinata*, *M. laxiflora*, *Phebalium microphyllum*, *Pultenaea verruculosa*, *Rinzia fumana* and *Verticordia densiflora* with sedges of *Gahnia ancistrophylla*, *Lepidobolus preissianus*, *Lepidosperma* aff. *resinosum* and *Loxocarya myrioclada*.

Eucalyptus transcontinentalis and *E. cylindriflora* mallees grow over *Melaleuca* thickets that included *Melaleuca* aff. *pungens*, *M. lanceolata*, *M.* aff. *cymbifolia*, *M. holosericea*, *M. lateriflora*, *M. cardiophylla* var. *parviflora*, *M. eleuterostachya*, *M. uncinata*, *M.* aff. *undulata* and *M. spicigera*.

Vegetation associated with granite exposures in the south-western area of the park comprised *Borya constricta*, *Calytrix brachyphylla*, *Dodonaea microzyga*, *Gahnia ancistrophylla*, *Lepidosperma resinosum*, *Melaleuca elliptica*, *Spartochloa scirpoidea* and *Thryptomene australis*. Orchids recorded near granite outcrops and low-lying areas of Frank Hann National Park include the Declared Rare species *Caladenia "voigtii"*, plus *C. "microchila"*, *C. "pachychila"*, *C. saccharata*, *Pterostylis mutica* and *P. sargentii*.

Eucalypt woodlands characterised the low lying broad valley area of the central portion of the park. Tall pure-stand woodlands of *Eucalyptus salmonophloia* consisted of *Atriplex vesicaria*, *Cassia nemophila*, *Eremophila glabra*, *Melaleuca cuticularis*, *Pittosporum phylliraeoides*, *Ptilotus spathulatum* and *Sclerolaena diacantha*. A low woodland of *Eucalyptus gracilis* had an understorey comprising *Melaleuca thyoides* over *Boronia inornata*, *Daviesia acanthoclona*, *Grevillea huegelii* and *Lepidosperma resinosum*.

Mixed eucalypt low woodlands were more common, however. *Eucalyptus transcontinentalis* occurred with *E. pileata* and *E. eremophila* over *Melaleuca pauperiflora*, *Boronia inornata* and *Olearia meulleri*. Growing under *Eucalyptus flocktoniae*, *E. sp.* (D. Monk 124) and *E. gracilis* were *Acacia camptoclada*, *Bossiaea leptacantha*, *Choretrum pritzelii*, *Eremophila decipiens*, *Melaleuca eleutherostachya* and *M. uncinata*.

A *Eucalyptus sheathiana* low woodland included mallees of *E. gracilis* and *E. celastroides* ssp. *virella* over *Melaleuca pauperiflora*, *Grevillea huegelii*, *G. oncogyne*, *Microcybe multiflora* var. *multiflora* and *Westringia rigida*.

Eucalypt mallee formations also occurred throughout the park. In the central portion *Eucalyptus celastroides* ssp. *virella* and *E. eremophila* grew with *Santalum acuminatum*, *Conospermum teretifolium*, *Hakea corymbosa* and *Loxocarya cinerea*.

Occurring with the mallee *Eucalyptus spathulata* ssp. *grandiflora* south of the Lake King-Norseman Road were mallees of *E. transcontinentalis* and shrubs of *Acacia enervia*, *Darwinia* sp. (KRN 5196), *Halosarcia lylei*, *Melaleuca pauperiflora*, *M. uncinata*, *M. aff. thyoides*, *M. thyoides*, *Microcybe multiflora* var. *multiflora* and *Phebalium filifolium*.

Growing under mallees of *Eucalyptus micranthera* were *Exocarpos sparteus*, *Gahnia polyphylla*, *Glischrocaryon roei*, *Goodenia watsonii*, *Lepidosperma resinosum*, *Melaleuca scabra*, *Pimelea sulphurea* and *Platysace maxwellii*. Mallees of *Eucalyptus* aff. *oleosa* occurred with *Acacia* spp., *Cryptandra glabriflora*, *C. tomentosa*, *Grevillea huegelii*, *Myoporum beckeri* and *Westringia rigida*.

Tall shrub thickets and low shrub formations occurred throughout the park, confined mostly to upland areas adjacent to the low lying woodlands. An exception was the thicket of *Melaleuca pauperiflora*, on clay surrounded by woodland, which contained only two other species of conspicuous perennials, *Olearia muelleri* and *Stipa elegantissima*.

Dense thickets of *Melaleuca uncinata* and *Acacia* sp. in the central portion included *Baeckea maidenii*, *Beyeria lechenaultii*, *Conospermum distichum*, *Conostephium drummondii*, *Eriostemon rhomboideus*, *Helichrysum apiculatum*, *Micromyrtus drummondii*, *Platysace effusa*, *P. maxwellii* and *Waitzea aurea*.

Tall shrubs of *Allocasuarina acutivalvis* grew in thickets with *Hibbertia* sp., *Melaleuca cordata*, *Micromyrtus drummondii*, *Persoonia tortifolia* and *Phebalium filifolium*. *Allocasuarina acutivalvis* also occurred as low shrubs over *Borya nitida*.

A mixed tall shrubland consisted of *Eucalyptus cylindriflora*, *Melaleuca acuminata*, *M. uncinata* and *Santalum acuminatum* over *Acacia multispicata*, *Baeckea maidenii*, *Danthonia setacea*, *Grevillea huegelii*, *Lepidosperma resinosum*, *Micromyrtus drummondii* and *Stipa elegantissima*. A low shrubland of *Allocasuarina acutivalvis*, *Melaleuca densa* and *Santalum acuminatum* occurred over *Eucalyptus pileata*, *Hakea falcata*, *Melaleuca uncinata* and *M. scabra*.

Several small salt lakes occur in the central portion of the park. The Lake King-Norseman Road bends around one of these lakes, which is surrounded by *Arthrocnemum lylei* and wind-blown dunes. A smaller salt lake, some 12km to the north-east, has a population of the restricted samphire *Halosarcia entrichoma*. Flanking the lakes are low woodlands of

Eucalyptus spathulata spp. *grandiflora*, *E. sheathiana*, *E. eremophila* and *E. ? gracilis*.

The majority of the north-eastern arm of Frank Hann National Park consists of sandplain. The *Eucalyptus "obesa"* mallee vegetation type was recorded in a confined area 20km south-west of Ninety Mile Tank. This site, on sandplain of 330-340m, was considered rare in the northern section of the park. Mallees of *Eucalyptus "obesa"*, *E. leptophylla* and *E. tetragona* occurred with an extremely species-rich heath of over 100 taxa (Newbey and Hnatiuk, 1988).

South-west of Ninety Mile Tank mallees of *Eucalyptus eremophila*, *E. "luteola"*, *E. pileata* and *E. platycorys* occur with *E. flocktoniae* and shrubs of *Callitris preissii*, *Exocarpos aphyllus* and *Melaleuca uncinata* over heath.

Shrubs present in the surveyed kwongan heath included *Acacia andrewsii*, *A. multispicata*, *A. leptoneura*, *Allocasuarina microstachya*, *Banksia elderiana*, *B. media*, *B. violacea*, *Boronia ramosa*, *B. crassifolia*, *Bossiaea leptacantha*, *Calectasia cyanea*, *Calothamnus gracilis*, *Cryptandra glabriflora*, *C. pungens*, *Chamaelaucium brevifolium*, *Daviesia uniflora*, *Eremaea pauciflora*, *Grevillea integerifolia* ssp. *incrassata*, *G. cagiana*, *G. eryngioides*, *G. teretifolia*, *Hakea incrassata*, *H. cf. falcata*, *Hibbertia verrucosa*, *Logania nuda*, *Leptospermum roei*, *L. spinescens*, *Melaleuca cuneata*, *Persoonia striata*, *P. trinervis*, *Pultenaea capitata* and *Sphaerolobium daviesioides*.

FAUNA

The native fauna of Frank Hann National Park includes populations of the Declared Rare Chuditch (*Dasyurus geoffroii*). A species list of 15 native mammals, 27 reptiles, five amphibians and 63 birds were recorded during surveys of the park (How *et al.*, 1988a). Species recorded in the park are listed in Appendix 6 (mammals) and 8 (amphibians and reptiles).

Vegetation types sampled for fauna within Frank Hann National Park included *Hakea* aff. *falcata* tall shrublands and mallee formations of *Eucalyptus transcontinentalis*, *E. "luteola"* and *E. "obesa"* on sandplains; *E. eremophila* flanking salt lakes and *E. salmonophloia* open woodlands with mallees of *E. pileata* and *E. transcontinentalis* on broad valleys (How *et al.*, 1988a).

Mammal species collected or sighted in the Frank Hann National Park include two marsupial dasyurids, *Sminthopsis granulipes* and *S. gilberti*, in addition to *Dasyurus geoffroii*; the Noolbenger or Honey-possum (*Tarsipes rostratus*); the Mundarda or Western Pygmy-possum (*Cercartetus concinnus*); the echidna (*Tachylossus aculeatus*); two macropods; five bats and two native rodents, *Notomys mitchellii* and *Pseudomys albocinereus*.

The five species of amphibian recorded in Frank Hann National Park were *Heleioporus albopunctatus*, *Limnodynastes dorsalis*, *Myobatrachus gouldii*, *Pseudophryne guentheri* and the recently described *Neobatrachus kunapalari*. The Turtle Frog (*Myobatrachus gouldii*), an endemic south-western species, is at its north-eastern distributional extremes at Frank Hann and Peak Charles National Parks.

The herpetofaunal assemblage consisted of six geckoes including *Diplodactylus spinigerus* and *Phyllodactylus marmoratus* ssp. *marmoratus*; six dragons, including *Ctenophorus maculatus griseus*; 11 species of skinks including *Egernia richardi*, *Hemiergis peronii*, *Lerista distinguenda*, *Tiliqua occipitalis* and *T. rugosa*; the monitor *Varanus rosenbergi*; and three species of snake.

Of the 63 species of birds recorded at Frank Hann National Park, 22 were non-passerines while 41 were passerines. Of the passerines recorded only in natural vegetation in the adjacent wheatbelt (Kitchener *et al.*, 1982), 10 species occurred in Frank Hann National Park (Appendix 10).

HISTORY

The park is named after the prospector-explorer Frank Hann who traversed the region in 1901 and named Lillian Stokes Rock. Frank Hann National Park was originally gazetted as a one-mile (1.6km) strip along the old Lake Grace-Norseman Road with an area of 26,100ha in 1970. A northern extension in 1973 (to protect an undescribed species of *Verticordia*) resulted in an area of 49,877ha. A southern extension of 11,543ha was proposed in 1976 to incorporate an area outside the reserve due to the realignment of the Lake King-Norseman Road. The present area of 61,420ha was gazetted in 1983.

RECREATIONAL USE AND POTENTIAL

Public use of the park is virtually restricted to through traffic on the Lake King-Norseman Road and to occasional visits by residents to the Lillian Stokes Rock area. The development of a low key facilities area including informative signs, similar to Peak Charles National Park, has been proposed for Lillian Stokes Rock (CALM files). Use of the road as an alternative route to Norseman and access to Peak Charles National Park has, however, increased considerably over recent years.

KEY FEATURES

- Kwongan sandplain heaths.
- The granite Lillian Stokes Rock.
- A unique salt lake vegetation type.
- Poorly known eucalypts requiring high priority monitoring.

CTRC RECOMMENDATION

One of the two existing conservation reserves in the South Yilgarn region is Frank Hann National Park, a Class C reserve (No. 27023) under the control of the National Parks Board.

EPA RECOMMENDATION

The EPA endorses the present vesting of the Frank Hann National Park, reserve 2023, as a Class C reserve under the National Parks Board.

PRESENT RECOMMENDATION

Frank Hann National Park should be converted to the Frank Hann Nature Reserve, for the Conservation of Flora and Fauna, and upgraded to an A Class reserve vested in the NPNCA.

PROPOSED FRANK HANN NATIONAL PARK EXTENSION

The proposed extension to the north-eastern boundary of Frank Hann National Park will incorporate a vegetation type poorly represented within the existing reserve. *Eucalyptus "obesa"* mallee is restricted to high sandplain and occurs over a kwongan heath community that is the most species-rich of any site recorded during the survey of the Eastern Goldfields District (Newbey and Hnatiuk, 1988).

In addition, the extension would create a corridor between Frank Hann National Park and the proposed Bremer Range Nature Reserve. Original proposals for the South Yilgarn (Figure 11.9) attempted to join the existing Frank Hann National Park with a proposed conservation reserve incorporating Bremer Range and Peak Charles (CTRC, 1974). The area of the resulting Peak Charles National Park was, however, much reduced and allowed for no connection between the reserves.

LOCATION: The proposed extension, centred on Ninety Mile Tank, is 115km south-west of Norseman on the Lake King-Norseman Road, within the Dundas Shire.

MAP: 1.

AREA: 820ha.

CURRENT STATUS: Vacant Crown land.

GEOMORPHOLOGY

Within the extensive sandplain unit identified during the biological survey (Newbey, 1988) small patches of colluvial deep sands occur in an undulating pattern ranging from 330m to 370m. The more extensive sandplain occurs lower in the landscape and consists of pebbles in a sand or loam matrix resulting in a gravel plain. The area adjacent to Ninety Mile Tank consists of high sandplain to the north-west with lower lying sandplain and broad valleys to the east.

FLORA AND VEGETATION

The *Eucalyptus "obesa"* community appears to have a very restricted distribution on small patches of high sandplain. The *E. "obesa"* vegetation complex, recorded in a confined area 20km south-west of Ninety Mile Tank was considered rare in the northern section of the park. The best

example of *E. "obesa"* mallees, however, occurs on deep sands higher in the landscape at 345-370m, just outside the reserve to the north-west of Ninety Mile Tank (S.D. Hopper, pers. comm.). An almost pure stand of *E. "obesa"* mallees reaching 6-7m occurs with occasional *E. ceratocorys* over an open scrub of *Acacia lasiocalyx*, *Banksia elderiana* and *B. media*. The species-rich low heath includes *Allocasuarina humilis*, *Calothamnus quadrifidus*, *Conostylis argentea*, *Grevillea hookeriana*, *G. pinifolia*, *Stylidium repens* and *Verticordia mitchelliana* and species of *Calothamnus*, *Conostephium*, *Hakea*, *Hibbertia*, *Leucopogon*, *Loxocarya*, *Melaleuca* and *Petrophile* (S.D. Hopper: field notes 1978-89).

Lower sandplain 1.5km east of Ninety Mile Tank supported tall shrublands of *Melaleuca* spp. a vegetation type rare within the Eastern Goldfields District (Newbey and Hnatiuk, 1988; How *et al.*, 1988b). The mallee *Eucalyptus spathulata* ssp. *grandiflora* grew over shrubs of *Astartea ambigua*, *Daviesia benthamii* ssp. *benthamii*, *Grevillea oncogyne* and *Melaleuca* species that included *Melaleuca holosericea*, *M. lateriflora*, *M. uncinata*, *M. aff. cuticularis*, *M. aff. pungens* and *M. aff. undulata*. The low shrub *Rinzia rubra* only occurred within a few kilometres of Ninety Mile Tank.

Low woodlands of *Eucalyptus diptera* occupied a broad valley 1km east of Ninety Mile Tank. Growing under *Eucalyptus diptera* were mallees of *E. pileata* sens. lat. and *E. "sporadica"*; shrubs of *Acacia mackeyana*, *Astartea ambigua*, *Melaleuca pauperiflora*, *M. sparsiflora* and *Olearia muelleri*; and 10 orchids including the Declared Rare species *Caladenia "voigtii"*, plus *C. "pachychila"*, *C. saccharata*, *Pterostylis mutica*, *P. aff. nana*, *P. aff. vittata*, *P. aff. rufa*, *Genoplesium nigricans* and *Thelymitra aff. nuda*.

FAUNA: Not studied.

RECREATIONAL USE AND POTENTIAL

Ninety Mile Tank, an extensive water catchment structure constructed of corrugated iron, has potential as a stop-over point providing water, shelter and placement of information displays along the Lake King-Norseman Road.

KEY FEATURES

- Restricted *Eucalyptus "obesa"* vegetation type.
- Species-rich kwongan sandplain heath.

CTRC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATION

The northern section of the Frank Hann National Park consists of a 1.6km wide strip either side of the Lake King-Norseman Road. The proposed extension of 820ha would extend the boundary of the park by 2.5km to the north-east and retain the current width of 3.2km. The extension should be

Class A for Conservation of Flora and Fauna, vested in the NPNCA, and incorporated into the proposed Frank Hann Nature Reserve.

1.4 PEAK CHARLES AREA

The CTRC made a general recommendation for the conservation reserves in the South Yilgarn that included the Peak Charles area. The Committee recommended that boundaries should be relocated through the application of further biological knowledge. In addition, the reserves should be made more secure by becoming Class A when adequate boundaries were determined (CTRC, 1974). The present recommendations for the Peak Charles National Park area concern upgrading the park's status and extending the boundary.

The existing area of Peak Charles National Park is much reduced from the original proposal that included Bremer Range and the salt lake system of Lake Tay and Sharpe to the west of the Fitzgerald Peaks (Anon., 1962). Incorporating parts of this original area, the proposed extension to the north, east and south will form a corridor with the south-coast along the Lort River.

PEAK CHARLES NATIONAL PARK

In line with the high conservation and recreational values of the park, it is recommended that Peak Charles National Park be upgraded to Class A. The biological survey of the Eastern Goldfields District documented the flora and fauna of the park (How *et al.*, 1988b). The increasing recreational use and potential for wilderness experience in the Peak Charles National Park area was highlighted by the CALM South-Coast Draft Management Plan (1989).

LOCATION: The Fitzgerald Peaks (Peak Charles and Peak Eleanora) are located 45km west of Salmon Gums within the Dundas Shire. Peak Charles National Park is 20km south of the Lake King-Norseman Road.

MAP: 1.

AREA: 39,959ha.

CURRENT STATUS: Peak Charles National Park (No. 36004) is a Class C reserve vested in the NPNCA for National Park and Water.

GEOMORPHOLOGY

The conspicuous Fitzgerald Peaks represent intrusions of Proterozoic bedrock, emergent above more recent sedimentary sand and clay. Peak Charles (658m) and Peak Eleanora (502m), rising about 300m above the surrounding broad valley floor, are basically conical in shape with the steeper slopes characterised by extensive areas of bare bedrock (Newbey, 1988). The Proterozoic intrusion, younger than the surrounding granitic bodies in the area, has been dated to 1670 m.y. (Gower and Bunting, 1976).

The peaks represent the highest forms of granite hills recorded during the survey of the Eastern Goldfields (How *et al.*, 1988b). Their resistance to erosion may be related to their syenitic composition which contrasts with the surrounding granitic batholith of biotite adamellite (Gower and Bunting, 1976). Dog Rock (299m), to the west of the prominent Fitzgerald Peaks, is formed from porphyritic granite.

The intrusive outcrop areas are surrounded by Quaternary sedimentary surfaces, grouped together into the broad valley landform unit, and include aeolian deposits of sand and silt. Reworked deposits and alluvium are marginal to salt lakes to the west and east of Peak Charles. The broad valleys containing the Lake Sharpe-Lake Tay chain are products of rivers that originally flowed into the Eucla Basin (Gower and Bunting, 1976).

Peak Charles National Park is dominated by low-lying broad valleys with salt lake surfaces being restricted to the west and north-east, while only small areas of Tertiary sandplain intrude into the northern portions of the park.

FLORA AND VEGETATION

The mosaics of vegetation types and complexes present on the granite hills of Peak Charles and Peak Eleanor are unique in the Eastern Goldfields District (How *et al.*, 1988b). Surveys recorded over 90 taxa in tall shrublands occurring on the peaks, including a rich annual flora (Newbey and Hnatiuk, 1988). In addition, the woodlands flanking the granite hills and salt lakes contain a wide variety of eucalypts, including several that are poorly known.

The Declared Rare Flora *Drummondita hassellii* var. *longifolia*, is presently known only from Peak Charles. Three Priority species on CALM's Reserve List occur in Peak Charles National Park. The Priority One taxa *Latrobea* sp. (KRN 6532) occurs to the west and south of the park while *Persoonia* sp. (KRN 5627) has a distribution restricted to Peak Charles. *Cryptandra miliaris* and *Pimelea graniticola*, Priority Two species, also occur to the west of the park. The largest populations of *Pimelea graniticola*, a poorly known species with a scattered distribution, have recently been recorded at Peak Charles (S.D. Hopper field notes: 1978-89). An undescribed species of *Tricoryne*, a plant with fleshy underground storage organs, is restricted to Peak Charles.

Eucalypts growing in the vicinity of Peak Charles included *Eucalyptus calycogona*, *E. celastroides* ssp. *celastroides*, *E. eremophila*, *E. gracilis*, *E. loxophleba*, *E. uncinata*, *E. aff. micranthera*, *E. "stenantha"* and *E. aff. occidentalis* (SDH 2266).

The species-rich tall shrublands on Peak Charles included tall shrubs of *Allocasuarina campestris* ssp. *campestris*, *A. humilis*, *Baeckea* aff. *behrii*, *Calothamnus tuberosus*, *C. quadrifidus*, *Leptospermum erubescens*,

Labichea lanceolata ssp. *brevifolia*, *Melaleuca uncinata* and *Thryptomene australis*.

Low shrubs present included *Borya constricta*, Declared Rare Flora *Drummonita hassellii* var. *longifolia*, *Leucopogon cuneifolius*, *Goodenia scapigera*, *Melaleuca fulgens*, *Opercularia vaginata* and *Stypandra imbricata*.

Over 30 taxa of annuals were recorded including *Brachycome pusilla*, *Centrolepis pilosa*, *Crassula exserta*, *Daucus glochidiatus*, *Drosera macrantha*, *Euphorbia drummondii*, *Goodenia havilandii*, *Isotoma hypocrateriformis*, *Poranthera microphylla*, *Stylidium calcaratum* and *Trachymene ornata* var. *ornata*.

The rich orchid flora of Peak Charles and adjacent Peak Eleanor is comprised of over 20 taxa including *Caladenia "attingens"* spp. "*gracillima*", *C. flava* ssp. "*flava*", *C. hirta* ssp. "*rosea*", *C. "microchila"*, *C. "pachychila"*, *C. "polychroma"*, *C. aff. "pendens"*, *C. saccharata*, *C. sigmoidea*, *C. roei*, "*Cyanicula*" *caerulea* ssp. "*apertala*", "*Cyanicula*" *deformis*, *Cyrtostylis "robusta"*, *Diuris* aff. *corymbosa*, *Eriochilus dilatatus* ssp. *multiflorus*, *Microtis unifolia*, *Genoplesium nigricans*, *P. ringens*, *Pterostylis allantoidea*, *P. mutica*, *P. sargentii*, *P. scabra*, *P. aff. vittata*, *P. aff. nana* (2 spp.), *P. aff. rufa* and *Thelymitra* aff. *nuda*.

The lower slopes of Peak Charles supported *Allocasuarina huegeliana* low woodlands which contained *Acacia lasiocalyx* and *Eucalyptus loxophleba* over tall shrubs of *Acacia acuminata*, *A. saligna*, *A. sp.* (KRN 6338), *Alyxia buxifolia*, *Calothamnus quadrifidus*, *C. tuberosus*, *Labichea lanceolata* ssp. *brevifolia*, *Melaleuca fulgens*, *M. uncinata*, *Pittosporum phylliraeoides*, *Santalum acuminatum*, *S. spicatum*, *Trymalium* aff. *ledifolium* and the sedge *Lepidosperma viscidum* var. *viscidum*.

Also present were low shrubs of *Borya constricta*, *Carpobrotus modestus*, *Cassia nemophila* var. *nemophila*, *Dodonaea ceratocarpa*, Declared Rare Flora *Drummondita hassellii* var. *longifolia*, *Halgania* sp. (KRN 6433), *Hibbertia pungens* sens. lat., *H. uncinata*, *Phyllanthus calycinus*, *Olearia revoluta*, *Rhagodia preissii* ssp. *preissii* and *Thomasia angustifolia*; the annuals *Euphorbia drummondii*, *Crassula exserta*, *Senecio lautus* ssp. *dissectifolius* and *Waitzia acuminata*; and the ferns *Cheilanthes austrotenuifolia* and *C. distans*.

In contrast, the *Allocasuarina huegeliana* low woodland 2km south-east of Peak Charles consisted of the tall shrubs *Acacia* aff. *cyclops*, *Calothamnus quadrifidus*, *Melaleuca fulgens*, *M. uncinata*, *M. glaberrima*, *Santalum acuminatum* and *Prostanthera grylloana*; low shrubs of *Dodonaea ceratocarpa*, *Guichenotia ledifolia*, *Persoonia diadema*, *Phyllanthus calycinus* and *Muehlenbeckia adpressa*; and the annuals *Actinobole uliginosum*, *Levenhookia pusilla*, *Lobelia rarifolia*, *Poa drummondiana*, *Trachymene pilosa* and *Waitzia acuminata*.

On the outer apron of a granite exposure, 4km south of Peak Charles, a *Melaleuca uncinata* tall shrubland contained the mallee *Eucalyptus celastroides* ssp. *celastroides* and shrubs of *Acacia leptoneura*, *A. saxatilis*, *A. sulcata* var. *platyphylla*, *Allocasuarina campestris* ssp. *campestris*, *Astartea ambigua*, *Beyeria lechenaultii*, *Melaleuca glaberimma*, *M. lateriflora*, *M. spicigera* and *M. aff. pungens* over the sedge *Lepidosperma drummondii*.

The granite hill of Peak Eleanor, 8km south of Peak Charles, supported a tall shrubland of *Allocasuarina campestris* ssp. *campestris* comprising trees of *Acacia lasiocalyx* and *Allocasuarina huegeliana*; mallees of *Eucalyptus grossa*, *E. celastroides* ssp. *celastroides* and *E. aff. occidentalis* over the tall shrubs *Acacia assimilis*, *A. jibberdingensis*, *A. saligna*, *A. sp.* (KRN 6338), *Calothamnus quadrifidus*, *C. tuberosus*, *Dodonaea ptarmicaefolia*, *Labichea lanceolata* ssp. *brevifolia*, *Leptospermum erubescens*, *Melaleuca elliptica*, *M. lateriflora*, *M. uncinata* and *Thryptomene australis*.

Low shrubs of *Borya constricta*, *Cryptandra* sp. (KRN 6395), *Dodonaea ceratocarpa*, *Melaleuca fulgens*, *Mirbelia microphylla* and *Opercularia vaginata* occurred over a wide range of annuals including *Actinobole uliginosum*, *Brachycome perpusilla*, *B. pusilla*, *Millotia tenuifolia* var. *tenuifolia*, *Plantago hispida*, *Senecio glossanthus*, *Trachymene ornata* var. *ornata* and *Waitzia acuminata*.

Flanking the granite Dog Rock, 13km south-west of Peak Charles, were *Eucalyptus "stenantha"*, a granite endemic, and *E. grossa* over shrubs of *Acacia saxatilis*, *A. nodiflorus* var. *ferox*, *A. sulcata* var. *platyphylla*, *Eremophila dichroantha*, *E. sp.* (KRN 6244), *Grevillea acuaria*, *Halgania andromedifolia*, *Melaleuca acuminata*, *M. lateriflora*, *M. cf. cymbifolia*, *Logania micrantha* and *Trymalium aff. ledifolium*.

Eucalypts recorded north of Peak Charles include *Eucalyptus calycogona*, *E. diptera*, *E. eremophila*, *E. flocktoniae*, *E. gracilis*, *E. longicornis*, *E. melanoxyton*, *E. pileata*, *E. salmonophloia*, and *E. transcontinentalis*. Low lying broad valleys south of Peak Charles support woodlands of *Eucalyptus salmonophloia* and mallee formations of *E. cylindriflora*, *E. gracilis*, *E. incrassata* and *E. tetragona*.

Growing under *Eucalyptus salmonophloia* was the mallee *E. gracilis* and shrubs of *Acacia erinacea*, *A. ixiophylla*, *A. nyssophylla*, *Alyxia buxifolia*, *Daviesia benthamii* ssp. *benthamii*, *Eremophila paisleyi*, *Grevillea huegelii*, *Melaleuca pauperiflora* and *Scaevola spinescens*.

Occurring with mallees of *Eucalyptus cylindriflora* and *E. celastroides* ssp. *celastroides* were the shrubs *Acacia saxatilis*, *A. cometes*, *Daviesia benthamii* ssp. *benthamii*, *Grevillea acuaria*, *Halgania* sp. (KRN 6433),

Melaleuca acuminata, *M. lateriflora*, *M. aff. pungens*, *Pultenaea arida* and *Wilsonia humilis*.

Shrubs growing under the mallees *Eucalyptus gracilis* and *E. celastroides* ssp. *celastroides* included *Acacia crassuloides*, *A. erinacea*, *A. saxatilis*, *Cassia nemophila* var. *nemophila* and *Grevillea acuaria*.

Other mallees with *Eucalyptus incrassata* were *E. uncinata*, *E. "luteola"* and *E. aff. occidentalis*. Shrubs recorded included *Acacia leptoneura*, *Banksia media*, *Beyeria lechenaultii*, *Calytrix* sp. (KRN 6458), *Callitris preissii* ssp. *verrucosa*, *Conostephium drummondii* sens. lat., *Hibbertia pungens* sens. lat., *Grevillea pauciflora* ssp. *pauciflora*, *G. aff. oncogyne*, *Leptospermum erubescens*, *Leucopogon* sp. (KRN 4082), *Melaleuca uncinata*, *Melaleuca* cf. *scabra*, *Petrophile* sp. (KRN 8756), *Phebalium filifolium* and *Spyridium* sp. (KRN 6718).

Mallees occurring with *Eucalyptus tetragona* were *E. incrassata* and *E. aff. decipiens* over shrubs of *Banksia elderiana*, *B. media*, *Beaufortia micrantha* var. *micrantha*, *Bossiaea leptacantha*, *Calothamnus gracilis*, *Calytrix* sp. (KRN 6458), *Conostephium drummondii* sens. lat., *Daviesia uniflora*, *Grevillea conccinea*, *Hakea corymbosa*, *H. obliqua*, *Leptospermum roei*, *Leucopogon fimbriatus*, *Lysinema ciliatum*, *Melaleuca* aff. *scabra*, *Verticordia insignis*, *V. roei* and the sedge *Restio sphacelatus*.

Eucalyptus tetragona mallee also occurred on sandplain to the north-west of Peak Charles. Shrubs growing with mallees of *E. tetragona* and *E. aff. decipiens* included *Acacia sulcata* var. *platyphylla*, *A. leptoneura*, *Beaufortia micrantha* var. *micrantha*, *B. shaueri*, *Calytrix sapphirina*, *C. sp.* (KRN 6458), *Cryptandra glabriflora*, *Grevillea integrifolia* ssp. *incrassata*, *G. cagiana*, *Leptospermum roei*, *Melaleuca scabra*, *Petrophile ericifolia* var. *ericifolia*, *P. sp.* (KRN 6497), *Platysace maxwellii*, *Verticordia endlicheriana*, *V. mitchelliana*, *V. picta*, *V. roei*, *V. aff. drummondii* over the sedges *Lepidobelus preissianus*, *Lepidosperma drummondii*, *L. viscidum* var. *viscidum* and *Schoenus brevisetis*.

Flanking the salt lake to the east of Peak Charles were low woodlands of *Eucalyptus* sp. (KRN 9710) comprising shrubs of *Acacia calcarata* sens. lat., *A. enervia*, *Bossiaea walkeri*, *Disphyma crassifolium*, *Frankenia pauciflora*, *Melaleuca pauperiflora*, *M. aff. thyoides*, *Olearia revoluta*, *Scaevola spinescens* and *Westringia rigida* over the perennial grass *Stipa juncifolia* and sedges of *Gahnia* aff. *australis* and *Lepidosperma brunonianum*.

Lake Sharpe, 10km south-west of Peak Charles, supported trees of *Eucalyptus* sp. (KRN 9710) on the outer margin over low shrublands of *Atriplex vesicaria* ssp. *variabilis* while *Halosarcia* spp. were continuous with the lake floor. Other shrubs recorded included *Cratystylis*

conocephala, *Disphyma crassifolium*, *Halosarcia syncarpa*, *H. indica* ssp. *bidens*, *Lawrencia squamata* and *Maireana glomerifolia*.

FAUNA

Species recorded in Peak Charles National Park include four amphibians, 35 reptiles, 59 birds and eight native mammals (How *et al.*, 1988a). A species list for the park is provided in Appendix 6 (mammals) and 8 (amphibians and reptiles).

The fauna of Peak Charles National Park was sampled intensively during the biological survey of the Eastern Goldfields District (How *et al.*, 1988a). Vegetation associations surveyed for fauna included *Allocasuarina huegeliana* and *A. campestris* ssp. *campestris* tall shrublands flanking Peak Charles and Peak Eleanor; low shrublands of *Atriplex vesicaria* ssp. *variabilis* on the margins of Lake Sharpe; and on broad valleys, open woodlands of *Eucalyptus salmonophloia* with mallee formations of *E. incrassata* and *E. tetragona*.

The herpetofaunal assemblage included the Turtle Frog (*Myobatrachus gouldii*), representing a north-eastern inland extreme for this endemic south-western species. A number of reptiles, including the skink *Hemiergis peronii*, the snake *Morelia spilota* and the monitor *Varanus tristis tristis*, were close to their distributional limits (How *et al.*, 1988a).

The herpetofauna also consisted of the Banjo Frog (*Limnodynastes dorsalis*), *Pseudophryne occidentalis* and the recently described burrowing frog (*Neobatrachus kunapalari*); five geckoes including *Crenadactylus ocellatus ocellatus* and *Gehyra variegata*; the legless lizards *Lialis burtonis* and *Pygopus lepidopodus*; six species of dragon including *Ctenophorus cristatus*, *C. ornatus* and *C. salinarum*; eight skinks including *Hemiergis initialis initialis*, *Lerista distinguenda* and *Morethia obscura*; the monitors *Varanus gouldii* and *V. rosenbergi*; and four species of snakes, including *Ramphotyphlops australis*, *Notechis curtus* and the Dugite (*Pseudonaja affinis*).

Additional species recorded during a short survey in 1984 were the geckoes *Phyllodactylus marmoratus marmoratus* and *Underwoodisaurus milii*; the dragon *Tympanocryptis adelaidensis chapmani*; the skinks *Egernia multiscutata bos* and *Morethia butleri*; the monitor *Varanus tristis tristis*; and the elapid snakes *Rhinoplocephalus gouldii* and *R. nigriceps* (CALM files).

The 59 species of birds recorded at Peak Charles National Park consisted of 21 non-passerines and 38 passerines. The Peregrine Falcon (*Falco peregrinus*), Declared in Need of Special Protection, was recorded at Peak Charles. The passerine list includes nine species of resident passerines only recorded by Kitchener *et al.* (1982) in natural vegetation in the adjacent wheatbelt (Appendix 10).

Preliminary observations on honeyeaters and their food plants by Hopper and Burbidge (1982) revealed a striking local abundance of honeyeaters in Peak Charles and adjacent areas. Eight species, including Purple-gaped (*Meliphaga cratitius*), White-eared (*M. leucotis*), Yellow-plumed (*M. ornatus*), Brown (*Lichmera indistincta*), Brown-headed (*Melithreptus brevirostris*), White-fronted (*Phylidonyris albifrons*), and Spiny-cheeked (*Acanthagenys rufogularis*) Honeyeaters were recorded coexisting in *Eucalyptus gracilis* low woodlands 10km north-east of Peak Charles, just outside the park. Although recent fires may have forced honeyeaters to congregate in unburnt areas at the time of observation, the number of species coexisting (8) was one of the largest observed in a single vegetation formation in the South-west (Hopper and Burbidge, 1982).

The eight species of native mammals recorded during the survey consisted of a dasyurid marsupial, the White-tailed Dunnart (*Sminthopsis granulipes*); the Western Pygmy-possum (*Cercartetus concinnus*); the Honey Possum or Noolbenger (*Tarsipes rostratus*); two native rodents, Mitchell's Hopping-mouse (*Notomys mitchellii*) and the Ash-grey Mouse (*Pseudomys albocinereus*); one macropod and two species of bat.

The present-day terrestrial mammalian fauna is, however, impoverished when compared to the sub-fossil fauna described by Baynes (1987). Fourteen native mammal species were collected from surface deposits in caves on Peak Charles (Appendix 12), including 10 species - two dasyurids, two bandicoots, a possum, two macropods and three native rodents - not recorded during the biological survey of the Eastern Goldfields District. (How *et al.*, 1988b). These were the Wambenger (*Phascogale calura*), Dibbler (*Parantechinus apicalis*), Western Barred Bandicoot (*Perameles bougainville*), Quenda (*Isodon obesulus*), Brushtail Possum (*Trichosurus vulpecula*), Woylie (*Bettongia penicillata*), Black-footed Rock-wallaby (*Petrogale lateralis*) and two native rodents (*Pseudomys shortridgei*, *Leporillus apicalis* and *Rattus fuscipes*).

HISTORY

The first European to explore the area was Lieutenant John Septimus Roe, during his journey from Albany to Russell Range in 1848-49. He recorded and named the Fitzgerald Peaks, including Peak Charles and Peak Eleanora (How and Newbey, 1988). Pastoral leases were granted in the Lake Sharpe area, and an old abandoned stone hut is still present, presumably the Orr Brothers' homestead (Esperance Bay Historical Society, CALM files). The vegetation sampled on the margins of Lake Sharpe showed evidence of sheep grazing more than 50 years ago (Newbey and Hnatiuk 1988).

RECREATIONAL USE AND POTENTIAL

Peak Charles, an outstanding natural feature of the region, is a granite hill standing some 300m above the surrounding plain. Its proximity to the graded Lake King-Norseman Road and Esperance (two hours' distance) has resulted in increasing local and regional use of the park. The CALM

South-Coast Draft Districtal Management Plan (1989) classified Peak Charles as a park with major wilderness potential that would provide for wilderness opportunity with the proposed development of low key facilities and park interpretation.

KEY FEATURES

- The prominent Peak Charles and Peak Eleanora, the highest granite hills in the eastern goldfields.
- The distinctive vegetation mosaics of the peaks.
- Eucalypt woodlands surrounding the Fitzgerald Peak area.

CTRC RECOMMENDATION

11.9.2 The committee recommends that a reserve be declared to include Peak Charles, Peak Eleanora and Dog Rock. The reserve should be 20km square (i.e. 400km²) with the south-eastern corner at 33°00'S, 121°00'E. The reserve should be of Class C for National Park, and placed under the control of the National Parks Board.

EPA RECOMMENDATION

The EPA recommends that a Class C reserve, for the purpose of "National Park", and vested in the National Parks Board, be established with an area of 20km square with the south-western (should read south-eastern) corner at 33°00'S, 121°00'E and including Peak Charles, Peak Eleanora and Dog Rock.

PRESENT RECOMMENDATION

Peak Charles National Park should be upgraded to Class A, vested with the NPNCA and retain the current purpose.

PROPOSED PEAK CHARLES NATIONAL PARK EXTENSION

It is proposed to extend Peak Charles National Park north to the Lake King-Norseman Road and east and south to the limit of agricultural land. The extension east will incorporate a large salt lake system, a series of floristically important granite rocks and tracts of uncleared eucalypt woodlands. The southern extension will provide a link to the proposed Lort River corridor reserve.

The Lort River is a well defined corridor of uncleared vegetation linking the west Esperance coastline with the Peak Charles area and southern goldfields. There is potential for a relatively wide vegetation corridor to link the uncleared area south of Peak Charles with the coastal reserve system by amalgamation of several existing reserves and vacant Crown land along the Lort River (CALM Draft Management Plan, 1989).

LOCATION: The proposed area extends to the Lake King-Norseman Road in the north, Geordie Rock in the east and to the Lort River in the south. The extension crosses the Dundas and Esperance Shire boundary.

MAP: 1.

AREA: 116,665ha. Dundas Shire (103,922ha) and Esperance Shire (12,743ha).

CURRENT STATUS: Vacant Crown land and The Cups, unvested Reserve No. 2786 (402ha).

GEOMORPHOLOGY

The proposed extension contrasts with Peak Charles National Park by incorporating extensive areas of sandplain and salt lakes, landforms poorly represented in the existing reserve. Although mainly Quaternary broad valley surfaces, the north-eastern portion of the proposed area contains a large salt lake system. The Lort River, south-east of Peak Charles National Park, consists mainly of saline lacustrine and fluvial deposits. Undulating Tertiary sandplain surfaces dominate the northern sections of the proposed extension while smaller areas of sandplain occur adjacent to the Lort River. A series of granite rocks are present throughout the proposed area, Ellison Rock (315m) in the north, Orchid Rock (256m) and Geordie Rock (266m) in the east and The Cups in the south-east.

FLORA AND VEGETATION

The proposed extension contains several priority taxa on CALM's Reserve Flora List. Priority One species occurring south-east of Peak Charles are *Leucopogon* spp. (M.A. Burgman 1476 and 1482), known only from single collections, and *Latrobea* sp. (KRN 6532), also collected from Hatter Hill to the west. Orchid Rock, 12km south-east of Peak Charles, is one of two locations for *Elachanthus pusillus*, a Priority Two species. Two eucalypts on the Priority list are *Eucalyptus* aff. *angustissima* (KRN 8183) and *E.* aff. *oleosa* (M.I.H. Brooker s.n. 7.87), both with scattered distributions overlapping the Peak Charles area.

The proposed area is important for the tracts of uncleared eucalypt woodlands that contain several poorly known eucalypts. These include *Eucalyptus angustissima*; *E.* aff. *salmonophloia*, known only from two locations south of Peak Charles National Park; *E. forrestiana* ssp. *dolichorhyncha*, known to occur over a geographical range of about 70km; *E. ovularis* which has a scattered distribution within a geographic range of some 260km; *E. "polita"*, *E.* aff. *platycorys* (SDH 2270) and the recently described *E. "subtilis"*.

As part of a study of scarcity in the southern Western Australian flora, Burgman (1987) surveyed the area between Peak Charles and the Lort River. Burgman intensively sampled the flora in kwongan sites (5) north-west of The Cups, salt lake sites (3) south of Peak Eleanora and mallee sites (11) throughout the area.

Kwongan heaths are present on sandplains north of Ellison Rock, north-east of Peak Charles, south of Geordie Rock and along the Lort River. Tall shrublands of *Grevillea eriostachya* occur in the extreme north-eastern

portion of the proposed extension. Over 80 taxa were recorded in several kwongan sites south of Peak Eleanora to the west of the Lort River.

Dominant species were *Eucalyptus* aff. *angustissima*, *E. eremophila*, *E. incrassata*, *E. tetragona*, *E. uncinata*, *Acacia assimilis*, *Allocasuarina acuarina*, *A. corniculata*, *A. microstachya*, *Banksia elderiana*, *B. violacea*, *Grevillea* aff. *treueriana*, *Hakea corymbosa*, *H. nitida*, *H. multilineata*, *H. subsulcata*, *Melaleuca scabra* and *M. uncinata*.

Other taxa recorded included *Baeckea latens*, *Beaufortia micrantha*, *B. schaueri*, *Cassytha micrantha*, *Crassula pedicellosa*, *Dillwynia uncinata*, *Drosera pycnoblata*, *Eriostemon fitzgeraldii*, *Gastrolobium reticulatum*, *Leptomeria pachyclada*, *Mirbelia depressa*, *Petrophile seminuda*, *Phebalium filifolium*, *Synaphea favosa*, *Verticordia brownii*, *V. chrysantha* and *V. plumosa*.

The extensive salt lake system east and south of Peak Charles National Park is flanked by mallees of *Eucalyptus* aff. *angustissima* (SDH 4696). Salt lakes and saline flats south of Peak Eleanora supported shrublands of *Halosarcia lylei*, *Atriplex vesicaria*, *Crassula sieberana*, *Disphyma crassifolium*, *Dodonaea amblyophylla*, *Geijera linearifolia*, *Frankenia desertorum*, *F. pauciflora*, *Hemichroa diandra*, *Maireana oppositifolia*, and *Rhagodia drummondii*.

Dominating the Lort River area were mallee formations containing mallees of *Eucalyptus* aff. *longicornis* (SDH 4695), *E. calycogona*, *E. conglobata*, *E. cylindriflora*, *E. diptera*, *E. eremophila*, *E. flocktoniae*, *E. gracilis* and *E. pileata*. A mallee site in the vicinity of The Cups contained five species of eucalypts over *Acacia lachnophylla*, *A. nodiflora* var. *ferox*, *Grevillea acuarina*, *G. oligantha*, *G. plurijuga*, *Melaleuca pauperiflora*, *M. uncinata* and *M. undulata*.

Other taxa recorded under mallees included *Cassytha melantha*, *Cryptandra parvifolia*, *Daviesia benthamii*, *Eremophila dichroantha*, *Exocarpos aphyllus*, *Phebalium lepidotum*, *Pultenaea adunca*, *P. conferta* and *Westringia dampieri*.

Orchids recorded by Burgman (1987) include *Lyperanthus nigricans*, *Paracaleana nigrita*, *Genoplesium nigricans*, *Pterostylis mutica* and *Thelymitra* aff. *pauciflora*.

A series of granite rocks are scattered throughout the proposed extension. These include Orchid Rock, Geordie Rock, Ellison Rock, The Cups and several unnamed outcrops. Orchid Rock was part of a survey of granite rocks in southern Western Australia (Burgman, 1987).

The rich orchid flora of Orchid Rocks includes *Caladenia flava* ssp. "*flava*", *C. "microchila"*, *C. saccharata*, *Cyrtostylis robusta*, *Diuris* aff. *corymbosa*, *Eriochilus dilatatus* ssp. "*multiflorus*", *Lyperanthus nigricans*,

Genoplesium nigricans, *Microtus unifolia*, *Prasophyllum ringens*, *Pterostylis allantoidea*, *P. mutica*, *P. recurva*, *P. sargentii*, *P. aff. vittata*, *P. aff. nana*, *P. aff. rufa*, *Thelymitra antennifera* and *T. aff. nuda*.

Species recorded on Orchid Rock included *Acacia acuminata*, *Allocasuarina campestris*, *Antherocercis genistoides*, *Borya sphaerocephala*, *Crassula sieberiana*, *Drosera macrantha*, *Leucopogon cuneifolius*, *Neurachne alopecuroides*, *Spartochloa scirpoidea*, *Stackhousia heugellii*, *Stypandra imbricata*, *Thysanotus patersonia*, *Triglochin minutissima*, *Thryptomene australis* and *Wurmbea sinora*.

Additional plants present were the sedges *Lepidosperma gracile*, *L. aff. resinosum*; the fern *Cheilanthes tenuifolia* and annuals of *Brachycome pusilla*, *Calandrinia calyptrata*, *C. eremaea*, *Chrysocoryne pusilla*, *Gnephosis pygmaea*, *Hydrocotyle diantha*, *Hypochoeris glabra*, *Millotia tenuifolia* and *Trachymene ornata* var. *ornata*.

FAUNA

Although the proposed area has not been sampled, the fauna list will be very similar to that obtained for the Peak Charles National Park (see Appendices 6, 8 and 10).

RECREATIONAL USE AND POTENTIAL

The increased area of Peak Charles National Park would contribute considerably to the wilderness opportunities provided by the park.

KEY FEATURES

- Unmodified vegetation and flora of eucalypt woodlands, salt lake systems and granite outcrops.

CTRC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATIONS

1. The proposed extension of Peak Charles National Park should be Class A, vested in the NPNCA, and is defined as the area of land bounded to the: west by 121°00'S; north by the Lake King-Norseman Road for approximately 30km; east by the limit of agricultural land along the approximate line of 121°25'E; and south by the headwaters of the Lort River.

2. The vacant Crown land along the Lort River should be established as a linear nature reserve of Class A, vested in the NPNCA for the Conservation of Flora and Fauna, linking the proposed extension to Peak Charles National Park with Stokes National Park and the coast.

1.5 LAKE JOHNSTON AREA

The three proposals for the Lake Johnston area represent the diversity of substrate-types and associated vegetation and animal communities found

in outcrop areas, especially in the vicinity of salt lake systems. The mosaic of landforms around Lake Johnston includes vegetation types characteristic of the South-Western Interzone, with tracts of eucalypt woodlands and endemic flora with restricted distributions occurring in the area. Surveys have revealed a blending of south-western and arid zone faunas.

The existing reserve system contains inadequate representation of the region's landforms and community types. Granite outcrops are only reserved in Peak Charles National Park; salt lakes and eucalypt woodlands on broad valley are poorly represented in Frank Hann and Boorabbin National Parks and Jilbadgi Nature Reserve; kwongan heaths on sandplain require wider representation due to marked differences in species composition; and banded ironstone hills and greenstone uplands are excluded entirely from the existing reserve system.

The boundaries of the proposed reserves incorporate representatives of the regional flora and fauna while protecting areas of high conservation value. The proposed Bremer Range Nature Reserve is centred on greenstone uplands, McDermid Rock is part of a complex of granite rock outcrops, and the proposed Mt Day area would reserve banded ironstone hills and undulating plains of greenstone. All three of the proposed reserves contain margins of salt lake systems and areas of woodland and kwongan sandplain heath.

PROPOSED BREMER RANGE NATURE RESERVE

The Bremer Range area was first proposed as a reserve in the Australian Academy of Science Sub-Committee's Report on National Parks (Anon. 1962). The CTRC System 11 report (1974) reviewed the Bremer Range Area under South Yilgarn (11.9, No. 3). The proposed reserve, located about 80km south-west of Norseman, covered an approximate area of 233,090ha. It abutted the existing Frank Hann National Park and included Peak Charles in the south-eastern corner. The north-western portion of the proposal incorporated a small part of the Bremer Range around Mt Glasse.

The report concluded that the whole Bremer Range area was floristically rich, and was noted especially for the number of eucalypts (CTRC, 1974). The biological survey of the Eastern Goldfields District highlighted Bremer Range as an important area not studied in sufficient detail (How *et al.*, 1988b). Recent botanical surveys of the area have confirmed the high conservation values of the entire Bremer Range uplands, particularly the diversity of eucalypt woodlands.

LOCATION: Bremer Range is located 100km south-west of Norseman and 110km north-east of Lake King, within the Dundas Shire. The range lies just south of Lake Johnston and east of Lake Hope.

MAP: 1.

AREA: 90,280ha.

CURRENT STATUS: Vacant Crown land.

GEOMORPHOLOGY

The proposed area is centred on the Bremer Range uplands. The outcrops Mt Gordon (451m), Burmiester Hill (432m), Mt Glasse (427m) and Tamar Hill (359m) occur within the north-west to south-east trending Honman and Glasse Greenstone Formations. The lack of marked relief throughout the low Bremer Range may be due to an ancient river crossing the greenstone belt (Gower and Bunting, 1976). A watershed divide separates the Lake Johnston-Lake Hope drainages from the southern Lake Tay-Lake Sharpe chain, and generally follows the southern boundary of the Bremer Range uplands.

The topography of the area is controlled by the underlying rocks, primarily Archaean ultramafic and mafic intrusions with clastic sedimentary beds and felsic volcanics (Gower and Bunting, 1976). The Honman Formation, which overlies the Maggie Hays Formation, forms an almost continuous banded ironstone horizon from Round Top Hill to the small salt lake north-east of Ninety Mile Tank. However, outcrop banded iron-formation is poor in the Bremer Range area, south of Honman Ridge. The Glasse Formation of fine-grained mafic rocks forms the stratigraphically highest Archaean greenstone formation.

The proposed boundaries incorporate the landforms that flank the central Bremer Range area. This greenstone upland area is bounded by Burmiester Hill in the west, Mt Gordon and Tamar Hill in the north, an unnamed outcrop (386m) in the east, and Mt Glasse to the south. The northern portion of the proposal includes Honman Ridge, which forms a divide between the contrasting salt lake systems of Lake Johnston and Lake Hope. A chain of smaller salt lakes stretches from Lake Medcalf to a small salt lake 9km north-east of Ninety Mile Tank, which forms the southern boundary. The eastern portions of Lake Hope effectively form the western boundary. Broad valleys fringe the upland area to the west and east while sandplain dominates in the south. A series of granite rocks and rock holes occur at the boundaries between the broad valleys and sandplains.

FLORA AND VEGETATION

The proposed reserve is centred on the eucalypt woodland mosaics of the greenstone Bremer Range. The species composition of these woodlands changes dramatically within the undulating landscape of the uplands. In addition to the wide variety of eucalypts recorded, several poorly known taxa on CALM's Reserve Flora List occur in the area.

Priority species are *Acacia kerryana*, presently known only from Lake Cronin to the west and Norseman to the east, and *Adenanthos gracilipes*. *Halosarcia entrichoma*, recorded on a salt lake south of Bremer Range, is a

rare samphire known elsewhere only from a single population in Frank Hann National Park. The presumed extinct *Sowerbaea multicaulis*, originally collected in 1891, was recorded in the Lake Hope-Bremer Range area in 1931 and 1964. Frequent searches since have failed to locate this strikingly beautiful plant.

The diverse eucalypt woodlands present on the Bremer Range uplands include the endemic *Eucalyptus "rhomboidea"* (Diamond Gum), a species restricted to the Bremer Range. In the vicinity of Burmiester Hill, *Eucalyptus "rhomboidea"* occurs with *E. salubris*, *E. flocktoniae*, *E. salmonophloia* and *E. cylindrocarpa* over an understorey of *Melaleuca* spp. In the Mt Glasse area, *Eucalyptus "rhomboidea"* was recorded with *E. salubris*, *E. gracilis*, *E. eremophila* and *E. "densa"* ssp. "*densa*" over mallees of *E. pileata*, *E. cylindriflora* and *E. aff. leptophylla* (SDH 7212).

Growing near the banded ironstone ridge (436m) north-east of Mt Glasse, were extensive mallees of *Eucalyptus "livida"* over a heath of *Calothamnus* and *Hakea*. Other eucalypts included *E. calycogona*, *E. flocktoniae*, *E. aff. kondininensis*, *E. "rhomboidea"*, *E. aff. diptera* (SDH 7215), *E. gracilis*, *E. pileata*, *E. eremophila* and *E. annulata*.

In the upland area, south-west of Lake Medcalf, woodlands containing *Eucalyptus melanoxydon*, *E. flocktoniae*, *E. aff. oleosa* (SDH 7182), *E. aff. salubris*, *E. cylindrocarpa*, *E. celastroides* occurred over *Allocasuarina campestris* ssp. *campestris*, *Acacia acuminata* and *Melaleuca uncinata* thickets with sedges of *Lepidosperma* sp.

Recorded in the Mt Gordon area were *Eucalyptus flocktoniae*, *E. aff. annulata* (SDH 7194), *E. salmonophloia*, *E. sheathiana*, *E. cylindrocarpa*, *E. aff. kondininensis* (SDH 7201), *E. transcontinentalis*, and *E. aff. eremophila* (SDH 7203) over *Melaleuca uncinata* and *Acacia rendelei*.

Tamar Hill supports an open woodland of *E. flocktoniae*, *E. longicornis*, *E. melanoxydon*, *E. aff. salubris*, *E. calycogona*, and *E. aff. kondininensis* over an understorey of *Melaleuca* spp., *Dodonaea stenozyga* and *Santalum acuminatum*.

The proposed boundaries are also designed to incorporate the contrasting vegetation associations of salt lake systems that surround the Bremer Range. The prominent, linear Honman Ridge occurs on a narrow land bridge separating Lake Johnston and Lake Hope. This low ridgeline is covered in part by material blown off both salt lakes (Newbey and Hnatiuk, 1988). It is flanked by woodlands of *Eucalyptus salmonophloia* and *E. "tenuis"* over *Atriplex* low scrub. Upslope on the rocky scree, *Eucalyptus "livida"* occurs with shrubs of *Allocasuarina* sp., *Acacia acuminata*, *Ptilotus obovatus*, *Dodonaea aff. adenophora* and *Leptospermum* sp.

The southern margins of Lake Johnston support *Eucalyptus salicola* and *E. melanoxyton* woodlands. The edge of the salt lake contained the samphires *Halosarcia doleiformis* and *H. syncarpa*, in addition to *Maireana glomerifolia* and species of *Frankenia* and *Lawrencina*. Occurring along creeklines running into Lake Johnston were *Eucalyptus "exigua"*, *E. salicola*, *E. aff. eremophila* (SDH 7195), *E. gracilis* with *Melaleuca* sp. (SDH 7198) and *Melaleuca aff. lanceolata* (SDH 7199).

In contrast, the north-eastern margins of Lake Hope had extensive lacustrine flats of *Halosarcia halocnemoides*, *H. pergranulata*, *Maireana appressa* and species of *Carpobrotus* and *Atriplex*. Recorded around the south-eastern areas of Lake Hope were *Eucalyptus "polita"*, *E. salmonophloia*, *E. salicola* and *E. aff. platypus* (SDH 2498) with *Eremophila calorhabdos* and *Adenanthos* sp.

Lake Medcalf is bordered by open woodlands of *Eucalyptus calycogona*, *E. salicola* and *E. melanoxyton* over *Melaleuca* spp. (SDH 7198-9), *Casuarina* spp. (SDH 7220-1), *Cratystylis* sp. and *Atriplex* sp. Fringing the lake floor were samphire flats of *Halosarcia pruinosa*, *H. lepidosperma* and *H. pergranulata* with *Dodonaea rigida*.

East of Lake Medcalf, broad valleys support mallees and spinifex on red clay. *Eucalyptus cylindrocarpa*, *E. oleosa* var. *oleosa*, *E. cylindriflora* and *E. aff. kumarlensis* (SDH 7222) grow over *Triodia scariosa*. The low lying valleys south-east of the Bremer Range uplands support *Eucalyptus sheathiana*, *E. oleosa* var. *oleosa*, *E. gracilis-vilgarnensis*, *E. cylindrocarpa*, *E. aff. diptera* and *E. calycogona* with *Acacia aff. ennervia* (SDH 7224) and *Conostephium* sp. (SDH 7226).

Sandplain heaths dominate the southern portion of the proposed reserve. Mallees of *Eucalyptus ceratocorys* and *E. perangusta* grow over dense heaths of *Allocasuarina* sp., *Acacia assimilis*, *Banksia elderiana*, *Callitris verrucosa*, *Hakea* sp., and *Melaleuca uncinata*. Dissecting valleys contain *Eucalyptus salmonophloia*, *E. sheathiana* and *E. eremophila*.

Several granite outcrops, such as Wellstead Rock, occur at the sandplain-broad valley margins to the south-east of Bremer Range. Fringing a granite rockhole were low woodlands of *Acacia acuminata* over dense thickets of *Acacia assimilis*, *A. neurophylla*, *Dianella revoluta*, *Leptospermum erubescens*, *Melaleuca uncinata*, *Phebalium tuberculatum*, *Santalum spicatum*, *Thryptomene australis*, and *Eremophila* sp. (SDH 7229) with species of *Dodonaea*, *Baeckaea*, *Carpobrotus*, *Leucopogon* and *Persoonia*.

A sheet granite area south-west of Mt Glasse was flanked by the granite endemic *Eucalyptus "stenantha"*; *Borya constricta* herbfields; *Acacia lasiocalyx* and *A. acuminata* low woodlands; and *Thryptomene australis* shrubland over sedges and perennial grasses of *Spartochloa scirpoidea*, *Lepidosperma* sp. and *Dianella revoluta*.

The small salt lake 9km north-east of Ninety Mile Tank marks the southern extent of the Bremer Range uplands. To the north, *Eucalyptus "rhomboidea"* occurs with *E. eremophila*, *Melaleuca pauperiflora*, *M. cardiophylla* var. *parviflora*, *Acacia erinacea*, *A. poliochroa* sens. lat., *A. rendlei*, *Eremophila caerulea* and *Westringia cephalantha*. Other eucalypts in this area include *Eucalyptus cylindriflora*, *E. "densa"* ssp. *"densa"*, *E. calycogona*, *E. salubris*, *E. "livida"* and *E. flocktoniae*.

The salt lake is flanked by *Eucalyptus salmonophloia*, *E. aff. diptera* and *E. pileata* over *Melaleuca uncinata* and *Acacia acuminata*. The samphire *Halosarcia entrichoma* (SDH 7236) occupies the majority of the lake floor. A low-lying claypan nearby supported a low shrubland of *Tecticornia verrucosa* and *Muehlenbeckia cunninghamii*, a vegetation type rare within the Eastern Goldfields District.

The western portion of the proposed reserve consists of kwongan sandplain heaths that include *Banksia elderiana*, *B. laevigata* and *Grevillea* spp. with broad valley woodlands between Lake Hope and the Bremer Range uplands. Eucalypts recorded include *Eucalyptus sheathiana*, *E. aff. diptera*, *E. eremophila*, *E. flocktoniae*, *E. salubris*, *E. aff. transcontinentalis* (SDH 7239), *E. cylindrocarpa*, *E. aff. "quadrans"* (SDH 7240) and *E. salicola*.

FAUNA: Not studied.

HISTORY

The first European to explore the area was Lieutenant John Septimus Roe, the State's first Surveyor-General. During his journey from Albany in 1848, he recorded and named the Bremer Range and its highest peak, Mt Gordon, after the naval officer Sir Gordon Bremer. In 1901 the prospector-explorer Frank Hann crossed the area from south-west to north-east, naming Lake Johnston, after the then Surveyor-General (How and Newbey, 1988).

The Bremer Range area had been frequented by gold prospectors prior to 1914, when the geologist C.S. Honman outlined the extent of the greenstone belt and commented on its mineral potential. Honman recorded evidence of activity in the Tamar Hill and Lake Medcalf areas. No gold production has been reported from the Bremer Range area, although iron ore samples have been made from Honman Ridge and Round Top Hill (Gower and Bunting, 1976).

The CTRC (1974) noted that the low Bremer Range had attracted the interest of prospectors, resulting in several mineral claims in the vicinity of Mt Glasse. Since then mineral exploration has increased with tenements and exploration licences covering much of the Bremer Range. Numerous cleared grid lines are present throughout the area.

RECREATIONAL USE AND POTENTIAL

Access into this relatively remote area has improved due to mineral exploration but there is little recreational potential for the proposed Bremer Range Nature Reserve at present.

KEY FEATURES

- A botanically important area, particularly the rich and diverse eucalypt woodlands of the Bremer Range uplands.

CTRC RECOMMENDATIONS

The Bremer Range Area was reported on as part of the South Yilgarn. A proposed reserve of 233,090ha included part of the Bremer Range in the north-west corner. The lack of detailed biological information and conflict with mining interests, however, restricted recommendation 11.9.2 to an area of 40,000ha in the south-eastern corner, encompassing Peak Charles.

EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATIONS

The proposed Class A Bremer Range Nature Reserve, vested in the NPNCA for the Conservation of Flora and Fauna, is defined as the area bounded to the: west by 120°36'E for 29km; north by 32°24'S for 31.5km; east by 120°56'E for 29km; and south by 32°40'S for 31.5km.

PROPOSED McDERMID ROCK NATURE RESERVE

LOCATION: McDermid Rock is situated on the Hyden-Norseman Road 100km west of Norseman and 125km south-west of Coolgardie, within the Dundas Shire, on the northern tip of Lake Johnston.

MAP: 1.

AREA: 30,770ha.

CURRENT STATUS: Vacant Crown land.

GEOMORPHOLOGY

The proposed reserve is centred on an extensive complex of granite rocks. Numerous unnamed rocky outcrops link McDermid, Scamp, Knapp and Plover Rocks. The northern portion of Lake Johnston, including the salt lake itself, is incorporated within the proposal. Scamp, Knapp and Plover Rocks occur on the margins of the salt lake.

FLORA AND VEGETATION

The proposed boundaries incorporate the different vegetation complexes occurring throughout the granite rock system, including the associated eucalypt woodlands. Botanical surveys indicate that each granite rock has a distinctive species composition (Newbey and Hnatiuk, 1988; S.D. Hopper, field notes: 1978-89).

McDermid Rock supported shrubs of *Acacia dempsteri* (a granite endemic), *A. lasiocalyx*, *A. neurophylla*, *Alyxia buxifolia*, *Borya constricta*, *Calothamnus tuberosus*, *Carpobrotus modestus*, *Drosera macrantha*, *Indigofera australis* var. *australis*, *Isotoma petraea*, *Keraudrenia integrifolia*, *Melaleuca elliptica* and *Muehlenbeckia adpressa*; annuals of *Actinobole uliginosum*, *Crassula exserta*, *Calandrinia calyptrata*, *Isolepis congrua*, *I. marginata*, *Millotia tenifolia* var. *tenifolia*, *Nicotiana rotundifolia*, *Trachymene ornata* var. *ornata*, *T. strigosa*, *Rutidosia multiflora* and *Waitzia acuminata*; the fern *Cheilanthes austrotenuifolia*; the perennial grass *Spartochloa scirpoidea*; and the sedge *Lepidosperma resinosum*.

Flanking McDermid Rock were mallees of *Eucalyptus loxophleba*, *E. "stenantha"* and *E. pileata*. The outer apron also contained *Cassia nemophila* var. *nemophila*, *Acacia beauverdiana*, *A. camptoclada*, *A. erinacea*, *A. jennerae*, *A. merrallii*, *Dodonaea stenozyga*, *Eremophila decipiens*, *E. dichroantha*, *E. pachyphylla*, *Santalum acuminatum*, *Scaevola spinescens* and *Westringia cephalantha*. Orchids growing in the vicinity of McDermid Rock included "*Cyanicula*" *amplexans*, *Diuris* aff. *corymbosa*, *Pterostylis* aff. *nana*, *P.* aff. *vittata*, *P.* aff. *rufa* and *Thelymitra* aff. *nuda*.

Scamp Rock, a large granite outcrop 7km south of McDermid Rock, was fringed by low woodlands of *Eucalyptus loxophleba*, *E. "stenantha"* and *Acacia lasiocalyx*. Shrub thickets that occurred at the base and on the slopes of Scamp Rock comprised *Acacia assimilis*, *A. acuminata*, *A. dempsteri*, *Acacia* sp. (SDH 7248), *Dodonaea viscosa*, *Leptospermum erubescens*, *Melaleuca uncinata*, *Spartochloa scirpoidea*, *Santalum acuminatum*, and *S. spicatum*. Other species recorded included *Allocasuarina campestris* ssp. *campestris*, *Alyxia buxifolia*, *Calothamnus quadrifidus*, *C. tuberosus*, *Dianella revoluta*, *Pittosporum phylliraeoides* and *Thryptomene australis*.

An unnamed granite outcrop, on the Hyden-Norseman Road to the south-west of McDermid Rock, is flanked by the granite endemic *Eucalyptus "stenantha"* with *E. loxophleba* over dense thickets of *Acacia acuminata*, *Calothamnus sanguineus* and *C. tuberosus*. Orchids recorded included *Caladenia "pachychila"*, *Diuris* aff. *corymbosa*, *Pterostylis* aff. *nana*, *P.* aff. *rufa* and *Prasophyllum ringens*.

An adjacent granite exposure contained thickets of *Allocasuarina campestris* ssp. *campestris*, *Acacia assimilis*, *A. sessilispica*, *A. beauverdiana*, *Borya constricta*, *Dodonaea adenophora*, *Lepidosperma drummondii*, *Melaleuca fulgens*, *Prostanthera semiteres* ssp. *semiteres*, *Persoonia coriacea* and *Thryptomene australis*.

Low broad valleys associated with the granite rock complex support eucalypt woodlands containing a wide variety of species. Two rare and poorly known eucalypts occur within the proposed boundaries. *Eucalyptus*

kumarlensis and *E. corrugata* have scattered distributions to the east and north, respectively, of McDermid Rock.

Eucalypt woodlands to the south of McDermid Rock contain *Eucalyptus salubris*, *E. salmonophloia*, *E. flocktoniae*, *E. yilgarnensis*, *E. loxophleba*, *E. transcontinentalis*, *E. calycogona* and *E. longicornis*.

Growing under *Eucalyptus salmonophloia* woodland were *Eremophila caerulea*, *E. ionantha*, *E. scoparia*, *Atriplex vesicaria* ssp. *variabilis*, *Acacia merrallii*, *A. nyssophylla*, *Cassia nemophila* var. *nemophila* and *Scaevola spinescens*.

Occurring under woodlands of *Eucalyptus longicornis* were *Melaleuca pauperiflora*, *Cratystylis conocephala*, *Eremophila caerulea*, *E. scoparia*, *Exocarpos aphyllus*, *Acacia merrallii* and *Santalum acuminatum*.

Low woodlands of *Eucalyptus salubris* had an understorey consisting of *Cratystylis conocephalus*, *Melaleuca quadrifaria*, *Alyxia buxifolia*, *Acacia lineolata*, *A. merrallii*, *A. nyssophylla*, *Atriplex vesicaria* ssp. *variabilis*, *Eremophila caerulea*, *E. decipiens*, *E. glabra*, *E. paisleyi*, *Lycium australe*, *Ptilotus obovatus*, *Rhagodia drummondii* and *Scaevola spinescens*.

The landscape rises to the west of the granite complex and eucalypts recorded include *Eucalyptus cylindriflora*, *E. cylindrocarpa*, *E. eremophila*, *E. leptopoda*, *E. "livida"*, *E. pileata*, *E. "subangusta"*, *E. aff. salubris* and *E. xanthonema*.

Sandplain, which occupies the western portion of the proposed nature reserve, was surveyed at one site. *Eucalyptus leptophylla* mallees occurred over tall shrubs of *Allocasuarina campstris* ssp. *campestris* and heaths of *Acacia assimilis*, *A. eremophila* var. *eremophila*, *Borya constricta*, *Baeckea leptophylla*, *Grevillea teretifolia*, *Melaleuca cordata*, *Platysace effusa* and *Triodia scariosa*.

Spinifex grass (*Triodia scariosa*) was common throughout the McDermid Rock area. On the western margins of Lake Johnston a tall shrubland of *Melaleuca uncinata* occurred with *Bossiaea walkeri*, *Calocephalus angianthoides*, *Disphyma crassifolium*, *Gunniopsis quadrifida*, *Hakea arida*, *Halosarcia halocnemoides* ssp. *halocnemoides*, *H. syncarpa*, *Frankenia cinerea* and *Maireana glomerifolia*.

FAUNA

The species list recorded during the survey of the proposed McDermid Rock Nature Reserve comprised 14 native mammals, three amphibians, 41 reptiles and 64 birds (How *et al.*, 1988a). Species recorded within the proposed reserve are listed in Appendix 7 (mammals) and 9 (amphibians and reptiles).

The McDermid Rock survey site, selected for its diversity of community types, was sampled intensively during the biological survey of the Eastern

Goldfields District (How *et al.*, 1988a). Vegetation associations on granite rocks, the salt lake margin, eucalypt woodlands and sandplain heath were surveyed. These included mallees of *Eucalyptus loxophleba* and tall shrublands of *Allocasuarina campestris* ssp. *campestris* surrounding granite rocks; *Melaleuca uncinata* tall shrublands flanking Lake Johnston and woodland mosaics comprised of *Eucalyptus longicornis*, *E. salmonophloia* and *E. salubris*.

The 14 species of extant native mammals recorded in the McDermid Rock area included the Echidna (*Tachyglossus aculeatus*); three dasyurid marsupials (*Ningui yvonneae*, *Sminthopsis crassicaudata* and *S. dolichura*); the Western Pygmy-possum (*Cercartetus concinnus*); two macropods; five bats; and two native rodents (*Notomys mitchellii* and *Pseudomys bolami*). The biogeographic significance of the area is illustrated by the arid zone affinities of *Ningui yvonneae*, *S. dolichura* and *P. bolami*; the latter reaches its south-western range limit at McDermid Rock.

The 41 reptiles recorded at the McDermid Rock survey site included five species at their distributional limits: three geckoes (*Diplodactylus pulcher*, *Heteronotia binoei* and *Phyllodactylus marmoratus*), the dragon (*Ctenophorus isolepis*) and the Ringed Brown Snake (*Pseudonaja modesta*). Several south-western species recorded at Lake Cronin, Frank Hann and Peak Charles are replaced by their arid zone counterparts in the McDermid Rock area. The skink (*Ctenotus xenopleura*), a species restricted to the Eastern Goldfields District, replaces *C. impar*.

Three amphibians were recorded (*Neobatrachus kunapalari*, *N. pelobatooides* and *Pseudophryne guentheri*). The reptile assemblage comprised 10 geckoes including *Diplodactylus pulcher*, *D. assimilis* and *D. maini*; two legless lizards, *Delma fraseri* and *Pygopus lepidopodus*; seven dragons including *Ctenophorus cristatus*, *C. ornatus* and *C. salinarum*; 15 skinks including *Ctenotus xenopleura*, *Lerista distinguenda*, *L. picturata* ssp. *picturata* and *Tiliqua rugosa*; the Bungarra (*Varanus gouldii*); and six snakes including *Pseudonaja modesta*, *Vermicella bertholdi* and *V. semifasciata*.

The 64 species of birds recorded included 17 non-passerine and 47 passerine species. The eucalypt woodlands in the McDermid Rock area were particularly rich in both bird species and number of individuals recorded. In addition, sandplain heaths to the west provided an important resource for nectar-feeding passerines attracted to flowering *Calothamnus* and *Prostanthera* spp.

Of the passerines recorded only in natural vegetation in the adjacent wheatbelt (Kitchener *et al.*, 1982), the McDermid Rock area has 11 species (Appendix 11). The presence of uncleared and unfragmented eucalypt woodland habitat, within the McDermid Rock proposed area, is important for conserving populations of these resident passerine birds.

HISTORY

A Pastoral Lease was granted in the Lake Johnston area in 1954-55. Despite the presence of extensive areas of suitable grazing country, the area was abandoned due to unreliable water for stock. The absence of underground freshwater and unreliability of runoff from the large granite rocks resulted in the lease being cancelled in 1958. The remains of a small dwelling near Knapp Rock and of a small dam constructed on McDermid Rock are presumably associated with the Pastoral Leases of J.O. Magee (How and Newbey, 1988).

RECREATIONAL USE AND POTENTIAL

The domed McDermid Rock, covering about 20ha, rises 20m above the surrounding landscape. Wave formations, some 4-5m high, occur on the southern and northern edges. With the planned upgrading of the Hyden-Norseman Road as an alternative tourist route there is potential for a scenic granite rock stop-over point at McDermid Rock. The proposed granite rock reserve is centrally placed between Kalgoorlie in the north-east, Norseman to the east and Lake Cronin in the west along this route.

KEY FEATURES

- A series of large granite rocks and rocky outcrops.
- Associated tracts of eucalypt woodlands.
- Quadrats established for long-term biological monitoring.
- Recreational potential of McDermid Rock as a tourist stop-over.

CTRC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATION

The proposed Class A McDermid Rock Nature Reserve, vested in the NPNCA for the Conservation of Flora and Fauna, is defined as the area bounded to the: west by 120°39'E for 17km; north by 32°00'S for 18km; east by 120°50'E for 17km; and south by 32°08'S for 18km.

PROPOSED MT DAY NATURE RESERVE

LOCATION: Mt Day is situated north of the Hyden-Norseman Road 145km east of Hyden and 120km west of Norseman. The proposed area is within the Dundas Shire on the north-west margins of Lake Johnston.

MAP: 1.

AREA: 44,960ha.

CURRENT STATUS: Vacant Crown land.

GEOMORPHOLOGY

The proposed area is centred on the south-east trending Maggie Hays and Honman Greenstone Formations. Contained within the undulating plains of greenstone are the prominent banded ironstone hills Mt Day

(497m) and Round Top Hill (453m). A lower banded ironstone outcrop, Maggie Hays Hill (368m), forms the south-eastern boundary of the proposed nature reserve. Flanking this central greenstone belt are broad valley and sandplain surfaces, while a series of granite outcrops occur to the north. The proposed areas includes narrow drainage lines (a landform rarely encountered in the Eastern Goldfields District) in the south, in the vicinity of Lake Johnston and Lake Hope.

FLORA AND VEGETATION

The Mt Day proposal incorporates Declared Rare Flora, the distinctive vegetation associations of the banded ironstone hills and extensive eucalypt woodlands. The Declared Rare Flora *Eucalyptus cerasiformis* is known only from the Mt Day area. All known populations are included in the proposed reserve. Poorly known species on CALM's Reserve Flora List includes *Allocasuarina globosa*, a Priority One species, which is known from only three populations. *Eucalyptus georgei* has a restricted distribution with the largest populations in the Mt Day-Maggie Hays Hill area. The poorly known *E. "incerata"* (Mt Day Mallee) has a sporadic distribution east of Hyden to the north-east of Mt Day.

A diverse range of eucalypts occur in woodlands on the undulating landscape of the Mt Day area. Recent botanical surveys have identified several new taxa and extended the distributions of other eucalypts. *Eucalyptus "livida"* represents the south-eastern limit of the Wandoo group while *E. "tenuis"* reaches its southern distributional limit at Honman Ridge. Woodlands of *E. dundasii*, usually located in the Norseman area, are restricted to greenstone in the Mt Day area and form a large south-western range extension.

In the southern portion of the proposed reserve, the Declared Rare *Eucalyptus cerasiformis* occurred with *E. cylindriflora* over *Melaleuca uncinata*, *Dodonaea stenozyga* and *Santalum acuminatum* heath. *Eucalyptus cerasiformis* also occurred with *E. aff. oleosa* on undulating greenstone, between *Allocasuarina* heath on crests and *E. flocktoniae* and *E. salubris* on lower slopes. Mallees and trees of *Eucalyptus calycogona*, *E. sheathiana*, *E. salmonophloia* and *E. dundasii* grew in the vicinity. *Eucalyptus dundasii* woodlands, representing an outlier vegetation type, consisted of *E. transcontinentalis* over *Melaleuca pauperiflora*, *Beyeria lechenaultii*, *Halgania adromedifolia*, *Eremophila caerulea*, *Scaevola spinescens* and *Westringia rigida*.

South of the Hyden-Norseman Road a variable woodland mosaic consisted of *Eucalyptus salmonophloia*, *E. salubris*, *E. flocktoniae*, *E. melanoxydon*, *E. "tenuis"*, *E. calycogona*, *E. yilgarnensis* and *E. dundasii*. Mallees of *Eucalyptus cylindrocarpa* occurred on rare drainage lines. Small banded ironstone ridgelines north-west of Maggie Hays Hill contained *Eucalyptus "livida"* and *E. aff. transcontinentalis* mallees with *E. cerasiformis* growing along the lower slopes.

The northern portion of Lake Hope, incorporated within the proposed Southern boundary, is flanked by woodlands of *Eucalyptus salicola* and *E. "tenuis"*. In the vicinity of Maggie Hays Hill the restricted *Eucalyptus georgei* occurs with *E. loxophleba* and *E. cylindrocarpa* over *Atriplex* low scrub. Associated vegetation includes *E. dundasii* woodlands, *E. calycogona*, *E. aff. transcontinentalis* (SDH 7242), *E. melanoxyton*, *E. aff. yilgarnensis* (SDH 7243) and *E. salmonophloia*.

Eucalypts in the vicinity of Round Top Hill included low woodlands of *Eucalyptus "tenuis"*, *E. yilgarnensis*, *E. flocktoniae*, *E. melanoxyton* and *E. dundasii*; and mallee associations of *E. leptophylla*, *E. aff. transcontinentalis* and *E. eremophila*.

On the slopes of Round Top Hill the Declared Rare *Eucalyptus cerasiformis* occurred with *E. aff. transcontinentalis* over heaths of *Dodonaea stenozyga* and *Melaleuca* spp., flanked by low woodlands of *E. salubris*. On the summit *E. loxophleba* was present while *E. "livida"* and *E. aff. oleosa* (SDH 7182) occurred on the upper scree slopes. The banded ironstone Round Top Hill is dominated by *Allocasuarina campestris* heath that included *Acacia lasiocalyx*, *Alyxia buxifolia*, *Dianella revoluta*, *Melaleuca uncinata*, *Olearia muelleri*, *Pleurosorus rutifolia* and *Santalum acuminatum*. In addition, *Hakea* sp. (SDH 7185), *Leucopogon* spp. (SDH 7183, 7186) and species of *Dodonaea*, *Calothamnus*, *Phebalium*, *Spyridium* and *Triodia* were represented.

Eucalypts flanking Mt Day include *E. calycogona*, *E. cerasiformis*, *E. dundasii*, *E. leptophylla*, *E. loxophleba*, *E. "livida"* and *E. "tenuis"*. To the north of Mt Day *E. annulata*, *E. "incerata"*, *E. "tenuis"* and *E. transcontinentalis* were recorded. South of Mt Day, *Eucalyptus georgei* occurred with *E. dundasii*, *E. flocktoniae*, *E. aff. transcontinentalis*, *E. salubris* and *E. salmonophloia*.

The western portion of the proposed reserve contained *Eucalyptus "incerata"* over a heath of *Banksia laevigata* ssp. *fuscolutea*. Other eucalypts included *E. calycogona*, *E. celastroides* ssp. *celastroides*, *E. pileata* and *E. sheathiana*. Scattered *Eucalyptus "livida"*, *E. eremophila* and *E. transcontinentalis* sens. lat. occurred over *Allocasuarina acutivalvis* heath.

Tall shrublands of *Allocasuarina acutivalvis* on sandplain included *Acacia acutifolia*, *Callitris preissii* ssp. *verrucosa*, *Melaleuca uncinata*, *M. scabra*, *Phebalium filifolium* and *Grevillea acuaria* over *Amphipogon turbinatus*, *Triodia scariosa*, *Lepidosperma drummondii* and *Schoenus brevisetis*.

FAUNA: Not studied.

RECREATIONAL USE AND POTENTIAL

The planned upgrading of the Hyden-Norseman Road by the Kondinin Shire as an alternative tourist route will increase the use of the region. Mt

Day and Round Top Hill, as the high points in the area, offer scenic views of the surrounding landscape including the impressive expanse of the salt Lake Johnston and large granite outcrops. The proposed Mt Day Nature Reserve has potential recreational values, in addition to its high conservation values.

KEY FEATURES

- Diversity and richness of the uncleared eucalypt woodlands.
- Distinct flora and vegetation of the banded ironstone hills.
- Recreational potential in the form of scenic view points along a planned tourist route.

CTRC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATIONS

The proposed A Class Mt Day Nature Reserve, for the Conservation of Flora and Fauna vested in the NPNCA, is defined as the area bounded to the: west by 120°28' 30"E for 7.5km to the junction of the Hyden-Norseman Road and the Baker - Mt Day Road; north-west along Road No. 14332 for 23km to the northern boundary; north by 32°05'S for 30km; east by 120°36'E for 24km; and south by 32°18'S for 13km.

1.6 NORSEMAN AREA

The Norseman area is the focus of two recommendations. A nature reserve is proposed to encompass Jimberlana Hill while the proposed timber reserve north-west of Norseman will complement the existing Brockway Timber Reserve. All three reserves contain eucalypts with restricted distributions and poorly known taxa on CALM's Reserve Flora List. The proposed Jimberlana Hill Nature Reserve also incorporates two species of Declared Rare Flora. Both areas, however, are within highly mineralised greenstone and subject to mining exploration.

PROPOSED JIMBERLANA HILL NATURE RESERVE

LOCATION: Jimberlana Hill is situated 6km north-east of Norseman along the Eyre Highway within the Dundas Shire.

MAP: 2.

AREA: 390ha.

CURRENT STATUS: Reserve No. 6043, an unvested Water Reserve (994ha), includes Reserve No. 17164 (4ha), encompassing Jimberlana Hill, vested in the Minister for Water Resources.

GEOMORPHOLOGY

Jimberlana Hill (399m) and Bekker Hill (355m) are prominent points within the Dundas Hills, which extend south and east of Norseman. Underlying the Dundas Hills is the Widgiemooltha Dyke Suite, an

unmetamorphosed Proterozoic intrusion of interesting composition consisting of norite, gabbro, bronzite and peridotite (Doepel, 1973). The Jimberlana Intrusion, which is the largest of this series of mafic dykes that intrude Archaean Rocks, extends from Mt Norcott and the Dundas Hills in the Norseman area to Bronzite Ridge and near Roundtop Hill west of Norseman (Doepel, 1973; Gower and Bunting, 1976). This geological formation is not represented in the existing Dundas Nature Reserve.

FLORA AND VEGETATION

The proposed Jimberlana Nature Reserve is a conservation priority area as it contains two flora Declared Rare. In addition, two poorly known taxa on CALM's Reserve Flora List occur within the proposed reserve. *Eucalyptus* aff. *diversifolia* (*Eucalyptus* sp. (Norseman), SD Hopper 2936) is Declared Rare as it is confined to Jimberlana Hill and Mt Norcott, a geographic range of about 18km. Also Declared Rare is the only known population of *Daviesia* sp. (Norseman) MD Crisp 5943, occurring 1km south-west of Jimberlana Hill, on a roadside verge along the Eyre Highway. Eucalypts with restricted distributions presently within the proposed reserve are *Eucalyptus* aff. *diptera* (A. Taylor 138), a Priority One species known only from a single record at Jimberlana Hill, and the Norseman endemic *E. brockwayi*.

Eucalyptus aff. *diversifolia* (Jimberlana Mallee) is an endemic eucalypt with a very restricted habitat and a closest affinity with *E. diversifolia*. This rare mallee grows with *Eucalyptus oleosa* in dark loam soils amongst noritic boulders on the rocky slopes of Jimberlana Hill and Mt Norcott (S.D. Hopper, field notes: 1978-89). *Eucalyptus* aff. *diptera* (A. Taylor 138), also confined to Jimberlana Hill, occurs with scattered *E. brockwayi*.

FAUNA: Not studied.

RECREATIONAL USE AND POTENTIAL

Jimberlana Hill, a prominent high point within the Dundas Hills, provides views of the surrounding country. The hill has some potential as a tourist stop-over point, being one of the most accessible viewing points along this section of the Eyre Highway. Any recreational development must be low-key, however, in order to be compatible with the protection of the rare flora restricted to the hill.

KEY FEATURES

- Two species of Declared Rare Flora confined entirely to the proposed reserve.
- Jimberlana Hill supports three eucalypts with very restricted distributions.

CTRC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATION

The proposed Class A Jimberlana Hill Nature Reserve, for the Conservation of Flora and Fauna and vested in the NPNCA, is defined as the portion of existing Reserve No. 6043 that lies east of the Eyre Highway. Small areas south-west of Jimberlana Hill, north-west of Bekker Hill and to the west of Eyre Highway are not included in the proposed nature reserve.

PROPOSED TIMBER RESERVE NORTH-WEST OF NORSEMAN

LOCATION: The proposed timber reserve is situated 15km west-north-west of Norseman and 5-10km west-south-west of Theatre Rocks, within the Dundas Shire. Brockway Timber Reserve is located 10-17km south of Norseman, to the east of the Coolgardie-Esperance Highway and west of Lake Dundas.

MAP: 2.

AREA: 1,970ha (vacant Crown land) and Brockway Timber Reserve (3,724ha).

CURRENT STATUS: Vacant Crown land, and Brockway Timber Reserve vested in the Lands and Forests Commission for the Conservation of Flora, Fauna and Landscape.

GEOMORPHOLOGY

The proposed Timber Reserve is on Archaean greenstones of the Mt Kirk formation, which includes the Mt Thirsty Beds (Doepel, 1973). Greenstones present in the proposed boundaries include gabbro, partly metamorphosed pyroxenite and metagabbro. Intruding these Archaean rocks are norites and noritic dolerites of the Jimberlana Intrusion (see Jimberlana Hill). Flanking this central greenstone belt are undulating plains comprised of weathered ultramafic rocks, alluvial and colluvial clay and boulder deposits, and Eolian deposits derived from sheet wash.

The Brockway Timber Reserve, situated to the south-east of the proposed area, incorporates several of the southern Dundas Hills, including Mt Deans (441m). The Dundas Hills south of Norseman are dominated by greenstones of the north-south striking Woolyeenyer Formation (Doepel, 1973). These include metamorphosed basaltic pillow lava, dolerite and gabbro with derived amphibole rocks and small areas of metamorphosed banded ironstone formations. This extensive greenstone belt, occurring on the western margins of Lake Dundas, is flanked by calcareous aeolian deposits containing nodular kankar.

FLORA AND VEGETATION

The proposed timber reserve has been identified as a potential conservation reserve for the protection of two locally endemic eucalypts. Recent surveys to determine the conservation status of *Eucalyptus*

brockwayi resulted in recommendations to reserve two areas north-west of Norseman (Sandiford, 1989). Although excellent stands of *E. brockwayi* also occur in the Mt Thirsty area, 25km north-west of Norseman, the proposed reserve incorporates populations of both *E. brockwayi* and *E. pterocarpa*.

Restricted to the Norseman area, *Eucalyptus brockwayi* is scattered throughout a range extending from Mt Thirsty in the north to the southern end of the Dundas Hills. Major concentrations of *E. brockwayi* occur in the north-west between Theatre Rocks and Mt Thirsty, and south-east in the vicinity of the Brockway Timber Reserve. Only scattered individuals are found east of the Lake Dundas drainage line (see Jimberlana Hill). The species has no known close relatives and is associated with soils derived from greenstone rock formations in the vicinity of Norseman. Associated vegetation includes *Eucalyptus dundasii*, *E. flocktoniae*, *E. griffithsii*, *E. lesouefii*, *E. pterocarpa*, *E. salmonophloia* and *E. yilgarnensis* (Chippendale, 1973).

Surveying the distribution of *Eucalyptus brockwayi*, Sandiford (1989) identified exceptional pure and mixed stands in the vicinity of Mt Thirsty and Theatre Rocks. In contrast to populations in the south-east around the Dundas Hills, *E. brockwayi* in this area was common on flat ground as well as on gentle to moderate slopes. Dense and extensive pure stands of pole and mature *E. brockwayi* occur within the proposed timber reserve boundaries to the east of Theatre Rocks.

Eucalyptus pterocarpa (formerly *E. aff. lesouefii*) has only been recorded from this confined area north-west of Norseman, and at a single locality to the west (see 4.7. Bronzite Ridge). Recently described, this eucalypt is a poorly known Priority species on CALM's Reserve Flora List, and appears to have a very restricted distribution (Napier *et al.*, 1987; Chippendale, 1988; Brooker and Kleinig, 1990). *Eucalyptus pterocarpa* grows as a small tree on gentle quartz slopes with *E. brockwayi*, *E. calycogona*, *E. dundasii*, *E. flocktoniae* and *E. salmonophloia*.

Over 16 vegetation associations have been identified within the Brockway Timber Reserve at the southern end of the Dundas Hills (Sandiford, 1989). The majority of the reserve is covered by woodlands with shrublands and low open woodlands occurring on hill tops and ridges. The shrubland associations of *Allocasuarina huegeliana* in the vicinity of Mt Deans are one of only two known localities of the Priority One species *Allocasuarina globosa*.

Woodlands comprising *Eucalyptus brockwayi*, *E. dundasii*, *E. flocktoniae*, *E. lesouefii*, *E. salmonophloia* and *E. salubris* occur on flat to gentle slopes, lower slopes and valley flats throughout the reserve. Open woodlands consisting of relatively small stands of pure *E. brockwayi* were present on slopes and ridges in the central and north-western areas of the reserve.

Low woodlands of *Eucalyptus flocktoniae*, *E. lesouefii* and *E. longicornis* occurred with scattered *E. salubris* and *E. transcontinentalis* on valley flats in the southern and south-western portions. *Eucalyptus torquata* low woodlands were restricted to rocky outcrops, ridges and creek-sides throughout the reserve, while low woodlands of *E. stricklandii* with scattered *E. lesouefii* were mainly restricted to ridges and slopes along the northern boundary.

Mixed low forest associations, representing sapling and pole growth stands of *Eucalyptus dundasii*, *E. flocktoniae*, *E. lesouefii*, *E. longicornis* and *E. transcontinentalis* are present in the south-eastern, north-eastern and western areas of the reserve.

Shrubs of *Melaleuca pauperiflora* and *M. sheathiana* were common in woodland associations throughout the reserve. Other dominant understorey species recorded included *Acacia merrallii*, *Atriplex vesicaria*, *Alyxia buxifolia*, *Cassia nemophila* var. *nemophila*, *Dodonaea microzyga*, *D. stenozyga*, *Eremophila dempsteri*, *E. ionantha*, *E. scoparia*, *E. pachyphylla*, *E. saligna*, *Halgania rigida*, *Santalum acuminatum* and *Scaevola spinescens*.

FAUNA: Not studied.

RECREATIONAL USE AND POTENTIAL

Very little potential exists for the proposed reserve although a track to Theatre Rocks, a well-used local recreation area, passes through the proposed reserve.

KEY FEATURES

- Two eucalypts endemic to the Norseman area, *Eucalyptus pterocarpa* and *E. brockwayi*, occurring within the boundaries of the proposed timber reserve.
- The geographically restricted *E. brockwayi* and Priority species *Allocasuarina globosa* within Brockway Timber Reserve.

CTRC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATIONS

1. The reserve is proposed as an additional block to the existing Brockway Timber Reserve (F197/25), 20km to the south-east, vested in the Lands and Forests Commission for the purpose of Conservation of Flora, Fauna and Landscape.

2. The proposed Timber Reserve is defined as the area bounded to the: west by 121°36'30"E for approximately 4km; north by 32°8'30"S for approximately 5km; east by 121°39'30"E for approximately 3.5km; and south by the Bronzite Ridge track for approximately 5km, including 1.5km to the south-west and 3.5km to the north-west along the track.

1.7 DUNDAS NATURE RESERVE

In response to CTTC and EPA recommendations, a biological survey was conducted in the Dundas area. The area of vacant Crown land delineated by the EPA (1975) extended south to 33°05'S, and five survey sites were sampled (see Table 1 and Appendix 1), including two near Mt Willgonarinya and Dingo Rock. However, only the northern half of this area was subsequently gazetted as a nature reserve in 1981 (CALM files). A series of granite rocks (Coragina Rock, Ponier Rock, Mt Willgonarinya, Mt Coobaninya, Breeboorinia Rock and Mt Buraminya) extend south from Dundas Nature Reserve along the Balladonia Road. The high conservation and recreational values of these outcrops need to be investigated (see 4.1).

LOCATION: Dundas Nature Reserve is a large area within the Dundas Shire, extending from the eastern margins of Lake Dundas to 150km east of Norseman and from the Eyre Highway to 60km south of Norseman.

MAP: 2.

AREA: 780,883ha.

CURRENT STATUS: Dundas Nature Reserve is a B Class Reserve vested in the NPNCA for the Conservation of Flora and Fauna.

GEOMORPHOLOGY

The large Dundas Nature Reserve includes a complete catenary sequence of landscape elements typical of the south-eastern portion of the South-western Interzone (McKenzie, unpubl. report). In addition, the reserve includes country representing the transition towards the Nullarbor landscape (see McKenzie *et al.*, 1987; 1989).

Wide expanses of calcareous plains dominate the entire reserve. The level surfaces of these extensive plains appear to have resulted from transgression by the Eocene Sea (Lowry, 1970). The influence of the Miocene limestone Nullarbor Plain is most apparent in the eastern portion of the reserve (Doepel and Lowry, 1970). The calcareous soils in some areas appear to have been formed from fine dust blown off the Nullarbor during Recent arid periods (Bowler, 1976).

Low elements in the Dundas landscape are the salt lake systems of the broad valley floors. Strings of small salt lakes are scattered throughout the reserve. Derived from the lakes are gypseous dunes and sandy aeolian deposits. A large number of granite outcrops occur within the reserve including Jyndabinbin Rock, Mt Andrew, Cowalinya Pool Rockhole and Boingaring Rocks.

FLORA AND VEGETATION

Dundas Nature Reserve contains the Priority species *Gnephosis intonsa*, which is only known from two localities. Over 20 eucalypts have been recorded from the reserve, including *Eucalyptus dundasii* and *E. fraseri*, which have distributions restricted to the Dundas and Fraser Range areas. The reserve also contains some areas of relatively undisturbed mature eucalypt woodlands. A number of undescribed eucalypts in the *Eucalyptus diptera* complex occur in the Dundas Nature Reserve (Burgman, 1987b).

Jyndabinbin Rocks, in the western portion of Dundas Nature Reserve, are fringed by shrubs of *Acacia acuminata* over *Lepidosperma drummondii* and *Prostanthera aspalathoides*. The granitic apron supports a rich and diverse flora that includes *Brachycome pusilla*, *Chrysocoryne pusilla*, *Chthonocephalus pseudevax*, *Drosera andersoniana*, *Millotia tenuifolia* and *Rutidosis multiflora*.

Calcareous plains in the vicinity of Jyndabinbin support low woodlands of *Eucalyptus dundasii*, *E. diptera*, *E. flocktoniae* and *E. oleosa*.

Growing with *Eucalyptus dundasii* are *Beyeria brevifolia*, *Daviesia benthamii*, *Eremophila caerulea*, *Santalum acuminatum* and *Olearia muelleri*. Low woodlands of *Eucalyptus diptera* contain mallees of *E. calycogona* with the shrubs *Beyeria brevifolia* var. *robustus* and *Dodonaea stenozyga*.

Shrubs of *Melaleuca lanceolata* dominate the understorey of *Eucalyptus flocktoniae* low woodlands. Growing with *E. oleosa* are mallees of *E. gracilis* and the shrubs *Geijera linearifolia* and *Melaleuca quadrifaria*.

Low woodlands of *Eucalyptus oleosa* to the west of Jyndabinbin contain shrubs of *Beyeria brevifolia*, *Eremophila paisleyi*, *Melaleuca lanceolata*, *Olearia muelleri* and *Santalum acuminatum*.

In the central portion of Dundas Nature Reserve, calcareous plains near Clear Streak Well support low woodlands of *Eucalyptus cylindrocarpa*, *E. flocktoniae*, *E. oleosa* and *E. transcontinentalis*.

Low woodlands of *Eucalyptus cylindrocarpa* are comprised of *E. gracilis* and *E. leptophylla* with the shrubs *Acacia erinacea*, *A. hemiteles*, *Daviesia benthamii*, *Eremophila ionantha*, *Santalum acuminatum*, *Sclerolaena diacantha* and *Westringia cephalantha* over *Triodia scariosa*.

Growing with *Eucalyptus flocktoniae* are mallees of *E. fraseri* with the shrubs *Acacia camptoclada*, *A. hemiteles*, *A. merrallii*, *A. pachypoda*, *Daviesia benthamii*, *Dodonaea busarifolia*, *Melaleuca eleutherostachya*, *M. lanceolata* and *Pultenaea arida*.

Low woodlands of *Eucalyptus oleosa* contain *E. flocktoniae* and *E. fraseri* over shrubs of *Cratystylis conocephala*, *Melaleuca lanceolata* and *M.*

quadrifaria. Occurring with *Eucalyptus transcontinentalis* are the mallees *E. eremophila* and *E. fraseri* and shrubs of *Daviesia benthamii* and *Melaleuca lateriflora*.

Low woodlands to the south of Clear Streak Well contain *Eucalyptus flocktoniae*, *E. eremophila* and *E. leptocalyx* over shrubs of *Boronia baeckeacea*, *Melaleuca eleutherostachya* and *Westringia cephalantha* while occurring under *Eucalyptus diptera* are *Dodonaea stenozyga* and *Eremophila paisleyi*.

Small salt lakes to the south and east of Clear Streak Well are flanked by *Eucalyptus leptophylla* over *Acacia camptoclada*, *Bertya cupressoidea*, *Daviesia benthamii*, *Grevillea pectinata* and *Phebalium filifolium*. Low shrubs fringing the lakes include *Disphyma crassifolium*, *Halosarcia doleiformis*, *H. peltata* and *H. pergranulata*.

During the survey of Dundas Nature Reserve, a vertebrate fauna sampling site was established 40km west of Boingaring Rocks. Calcareous plains in the vicinity support low woodlands of *Eucalyptus diptera*, *E. flocktoniae* and *E. oleosa*.

A mixed species woodland surrounding the survey site consists of *Eucalyptus diptera*, *E. eremophila*, *E. gracilis*, *E. longicornis* and *E. transcontinentalis* with the shrubs *Daviesia benthamii*, *Melaleuca lanceolata*, *M. uncinata* and *Santalum acuminatum*.

Growing with *Eucalyptus diptera* are the shrubs *Acacia erinaceae*, *Dodonaea stenozyga* and *Eremophila ionantha*. Low woodlands of *Eucalyptus flocktoniae* contain *E. annulata* and *E. fraseri* over *Atriplex vesicaria* and *Melaleuca lanceolata*.

Occurring in low woodlands of *Eucalyptus oleosa* are mallees of *E. gracilis* and shrubs of *Atriplex vesicaria*, *Cratystylis conocephala*, *Eremophila paisleyi*, *E. scoparia*, *Exocarpos aphyllus*, *Melaleuca lanceolata*, *Olearia muelleri* and *Sclerolaena diacantha*.

Also occurring in the area are mallee associations of *Eucalyptus cylindrocarpa*, *E. gracilis* and *E. leptophylla* over *Triodia scariosa*, and small salt lakes flanked by low shrublands. Shrubs recorded include *Disphyma crassifolium*, *Halosarcia peltata*, *H. pergranulata*, *H. syncarpa*, *Maireana appressa* and *Sclerolaena diacantha*.

Sandplain areas north of Mt Andrew, in the south-eastern portion of Dundas Nature Reserve, support mallee associations of *Eucalyptus balladoniensis*, *E. cylindrocarpa*, *E. gracilis* and *E. transcontinentalis*. Growing with the mallees are shrubs of *Acacia cometes*, *A. hemiteles*, *A. ixiophylla*, *A. merrallii*, *A. triptycha*, *Grevillea pectinata*, *Melaleuca acuminata* and *M. uncinata* over *Triodia scariosa*.

Boingaring Rocks in the north-eastern corner of Dundas Nature Reserve are flanked by *Eucalyptus celastroides* ssp. *celastroides* over tall shrublands comprised of *Acacia ixiophylla*, *Allocasuarina acutivalvis*, *A. campestris* ssp. *campestris*, *Beyeria lechenaultii*, *Dodonaea adenophora*, *Melaleuca acuminata*, *M. uncinata*, *Olearia axillaris* and *Thryptomene australis*.

The rich and diverse flora recorded at the granitic Boingaring Rocks include *Calandrinia eremea*, *Chrysocoryne pusilla*, *Dodonaea lobulata*, *Eragrostis dielsii*, *Eremophila alternifolia* var. *latifolia*, *Goodenia havilandii*, *G. krauseana*, *Helipterum demissum* and *Podolepis capillaris*. Orchids present are *Caladenia "microchila"*, *"Cyanicula" deformis*, *Diuris* aff. *corymbosa*, *Pterostylis* aff. *nana* and *P. aff. rufa*.

Flanking Boingaring Rocks are mallees of *Eucalyptus brachycorys*, *E. cylindrocarpa* and *E. transcontinentalis* with shrubs of *Acacia graffiana*, *Exocarpos aphyllus*, *Grevillea huegelii* and *Melaleuca eleutherostachya* over *Triodia scariosa*.

Calcareous plains in the vicinity of Boingaring Rocks support low woodlands of *Eucalyptus diptera*, *E. flocktoniae* and *E. oleosa*. Occurring with *E. diptera* are mallees of *E. calycogona* and shrubs of *Dodonaea stenozyga* and *Eremophila paisleyi*.

Low woodlands of *Eucalyptus oleosa* contain shrubs of *Atriplex vesicaria*, *Cratystylis conocephala*, *Eremophila scoparia*, *Geijera linearifolia*, *Melaleuca quadrifaria* and *Sclerolaena diacantha*. Dominating the understorey of *Eucalyptus flocktoniae* low woodlands are tall shrubs of *Melaleuca lanceolata*.

Salt lakes in the extreme north-eastern corner of Dundas Nature Reserve are flanked by *Eucalyptus longicornis* with *Dodonaea stenozyga*, *Disphyma crassifolium* and *Maireana georgei*. Shrubs recorded on the margins of the small lakes include *Atriplex nana*, *Bossiaea walkeri*, *Frankenia cinerea*, *Halosarcia peltata*, *H. syncarpa* and *Maireana glomerifolia*.

FAUNA

Biological surveys of Dundas Nature Reserve sampled the vertebrate fauna intensively at three sites near Jyndabinbin Rocks, Boingaring Rocks and 30km north of Clear Streak Well. The fauna was also systematically sampled at sites near Dingo Rock and Mt Willgonarinya, to the south of the reserve. These five sites are listed in Table 1 and Appendix 1.

Surveys of Dundas Nature Reserve compiled a species list of 16 native mammals, three amphibians, 43 reptiles and 70 birds (McKenzie and Rolfe, in prep.). Species recorded from Dundas Nature Reserve are listed in Appendix 6 (mammals) and 8 (amphibians and reptiles). One species of Declared Rare Fauna, the Crested Shrike-tit (*Falcunculus frontalis*), has been reported from reserve.

The mammalian species list, recorded during the survey, is comprised of the Echidna (*Tachyglossus aculeatus*), the Western Grey Kangaroo (*Macropus fuliginosus*), the Western Pygmy-possum (*Certartetus concinnus*), three dasyurids (*Ningaui ridei*, *Sminthopsis crassicaudata* and *S. dolichura*), two native rodents (*Notomys mitchellii* and *Pseudomys bolami*) and eight bats.

The three amphibians recorded in the Dundas Nature Reserve include *Crinia pseudinsignifera* while the species list of reptiles contains eight geckoes, three legless lizards, five dragons, 21 skinks, two monitors and four snakes. Records include the skinks *Ctenotus atlas*, *C. uber uber*, *Hemiergis initialis brookeri*, *Lerista frosti*, *L. picturata picturata* and *L. terdigitata*.

The avifauna contains 12 species of passerines identified by Kitchener *et al.* (1982) as habitat-specific residents recorded only in natural vegetation. These species include the Declared Rare Crested Shrike-tit (*Falcunculus frontalis*), Yellow Robin (*Eopsaltria australis*), Chestnut Quail-thrush (*Cinclosoma castanotum*), Shy Hylacola (*Sericornis cautus*), Blue-breasted Fairy-wren (*Malurus pulcherrimus*) and Rufous Tree-creeper (*Climacteris rufa*).

The original (pre-European) mammal fauna of Dundas Nature Reserve has been reconstructed from identification of cranial material collected from surface cave deposits at Mt Andrew and near Boingaring Rocks (Baynes, 1987). The present fauna, recorded during the biological survey of Dundas Nature Reserve, is impoverished by 10 species in comparison to the original fauna (Appendix 12). The species lost include the Chuditch (*Dasyurus geoffroii*), Dibbler (*Parantechinus apicalis*), Red-tailed and Brushtailed Wambengers (*Phascogale calura* and *P. tapoatafa*), Western Barred Bandicoot (*Perameles bougainville*), Woylie (*Bettongia penicillata*) Banded Hare-wallaby (*Lagostrophus fasciatus*) and Crescent Nailtail Wallaby (*Onychogalea lunata*).

Sites 30km east of Dundas Nature Reserve (Booanya Rock and Balladonia), added eight species to the original fauna of the area (Appendix 13). These species include the Dalgyte (*Macrotis lagotis*), Pig-footed Bandicoot (*Chaeropus ecaudatus*), Common Brushtail Possum (*Trichosurus vulpecula*) and Boodie (*Bettongia leseur*).

RECREATIONAL USE AND POTENTIAL

The lack of access into the large Dundas Nature Reserve has resulted in little disturbance or recreational pressure to much of the reserve.

KEY FEATURES

- Large area of the reserve includes representative landform and community types of the south-eastern region of the Eastern Goldfields.
- Close to the boundary between two natural districts, the South-Western Interzone and Nullarbor Plain.

- Extensive areas of undisturbed eucalypt woodlands.
- Series of granite rock outcrops supporting distinctive vegetation associations.
- A diverse fauna comprised of numerous assemblages.

CTRC RECOMMENDATION

The Committee recommends that the Environmental Protection Authority commission a biological survey of the Dundas area, with a view to creating a large flora and fauna reserve or national park in the region.

EPA RECOMMENDATION

The EPA recommends to the Department of Fisheries and Wildlife and to the National Parks Board that when resources permit, a biological survey should be carried out east of Lake Dundas to about 123°30'E and south from the Eyre Highway to about 33°05'S so as to determine whether the area should be declared a fauna and flora reserve or a national park, as envisaged by the Conservation Through Reserves Committee.

PRESENT RECOMMENDATION

Dundas Nature Reserve (No. 36957) should be upgraded from Class B to Class A and retain the current vesting and purpose.

1.8 SOUTHERN CROSS AREA

Reserves in the Southern Cross area, on the western edge of the Eastern Goldfields District, were not included in the CTRC review of System 11. The existing nature reserve system consists of 12 conservation reserves. Six small nature reserves are grouped approximately 70km south-west of Southern Cross with another group of five reserves 20-30km to the south-west and a single nature reserve is situated just outside Southern Cross. These small reserves consist of granite exposures surrounded by small areas of broad valley or sandplains; none of them were surveyed as part of the biological survey of the Eastern Goldfields District (Newbey and Hnatiuk, 1985; Newbey, in prep.). Major additions to the reserve system are the proposed Holleton Nature Reserve and proposed Lake Baladjie Nature Reserve. Both encompass areas of uncleared eucalypt woodlands. The Holleton area incorporates extensive mallee shrublands while the Baladjie area includes salt lake communities.

PROPOSED HOLLETON NATURE RESERVE

LOCATION: The proposed area is located 80km south-west of Southern Cross, to the east of the Vermin Proof Fence, within the Yilgarn Shire.

MAP: 3.

AREA: Proposed Holleton Nature Reserve: 16,698ha

Mt Hampton Nature Reserve (Nos. 32995 and 20526): 2,480ha

Mt Bailey Nature Reserve (No. 28323): 1,180ha

Neendojer Nature Reserve (No. 34776): 2,249ha
Welsh Nature Reserve (No. 30305) : 1,716ha
Nature Reserve No. 37289: 768ha
Jilbadgie Rocks Nature Reserve (Nos. 24944 and 20262): 1,435ha
Nargalyerin Rock Nature Reserve (No. 18773): 450ha
Wockallary Nature Reserve (No. 29537): 205ha
Nurdungarra Rock Nature Reserve (No. 2863): 810ha
Lake Koorkoordine Nature Reserve (No. 25801): 740ha
Timber Reserve (No. 19923): 3,091ha

CURRENT STATUS: Proposed Holleton Nature Reserve (vacant Crown land); Nos. A 32995, C 34776, C 25801, A 24944 and A 20262 Conservation Flora and Fauna (NPNCA); No. A 20526 Water and Conservation Flora and Fauna (NPNCA); No. C 28323 Protection Flora (unvested); Nos. C 30305 and C 37289 Conservation Flora and Fauna (WAWA); No. C 2863 and No. A 18773 Water and Conservation Flora and Fauna (Minister for Water Resources); No. C 29537 Conservation Flora and Fauna (unvested); and Timber Reserve No. 19923 Mining.

GEOMORPHOLOGY

The proposed Holleton Nature Reserve is dominated by extensive plains of lateritic sands over ironstone gravel. Associated areas of deep sands also occur throughout the proposed area. Drainage lines dissect the area forming scattered pockets with heavier soils of sandy to clay loams. These broad valley loams extend into the adjacent Timber Reserve on the southern boundary. In the western section of the reserve a number of granite outcrops occur.

The rest of the existing small reserves are centred on granite rock outcrops with only small areas of flanking sandplain and broad valley surfaces incorporated within the boundaries. Some of the larger granite rocks include Neendojer Rocks (456m), Mt Bailey (435m), Mt Hampton (457m), Frog Rock (428m) and Strawberry Rocks (407m). The small salt Lake Koorkoordine, north of Southern Cross, lies partly within a nature reserve.

FLORA AND VEGETATION

A comprehensive survey of the flora and vegetation of the proposed Holleton Nature Reserve recorded over 200 taxa including *Acacia intricata*, a geographically restricted species (K. Atkins, unpubl. report). The proposed area is dominated by mallee associations, shrublands and heaths on sandplain soils with woodlands being restricted to isolated pockets on heavier loam in the drainage lowlands.

Woodlands in the south-western corner of the proposed reserve were comprised of *Eucalyptus salmonophloia* and *E. salubris* over mallees of *E. myriadena* and *E. transcontinentalis*. Shrubs present included *Acacia erinacea*, *A. merrallii*, *Phebalium tuberculosum* and *Templetonia sulcata*.

Low lying valleys in the south-east supported open woodlands of *Eucalyptus salmonophloia* with mallees of *E. calycogona* over the shrubs *Acacia hemiteles*, *Daviesia benthamii*, *Grevillea huegellii*, *Melaleuca uncinata* and *M. viminea*. In the extreme south-eastern corner open woodlands of *Eucalyptus salmonophloia* occurred with *E. eremophila*, *E. loxophleba*, *E. sheathiana* and *E. yilgarnensis* over *Grevillea acuaria*, *Melaleuca lateriflora* and *M. uncinata*.

Along the southern boundary of the proposed reserve woodlands of *Eucalyptus longicornis* extend south into the adjacent Timber Reserve (No. 19923). Shrubs recorded included *Acacia hemiteles*, *Cassia nemophylla*, *Dodonaea stenozyga*, *Eremophila decipiens* and *Rhagodia preissiana*.

Also in the southern portion were transitional woodlands containing *Eucalyptus flocktoniae*, *E. longicornis*, *E. salubris* and *E. transcontinentalis* over shrubs of *Acacia intricata*, *Hakea commutata*, *Melaleuca adnata*, *M. pauperiflora* and *M. urceolaris*.

The central portion of the proposed reserve supported small areas of *Eucalyptus "capillosa"* low woodlands with *E. calycogona* and *E. eremophila*. To the south-west, *E. eremophila* and *E. salubris* occurred on slopes with *Astroloma serratophyllum*, *Grevillea huegellii* and *Phebalium filifolium*.

Shrubs common to the understorey of most woodlands sites sampled included *Eremophila drummondii*, *Exocarpos aphyllus*, *Melaleuca acuminata*, *Santalum acuminatum* and *Olearia muelleri*.

A variety of vegetation types were a transition between the woodlands present on heavier loams and the mallee shrublands on sandplain soils. Flanking woodlands areas, these sites included *Eucalyptus calycogona*, *E. eremophila*, *E. salubris*, *E. sheathiana* and *E. transcontinentalis*.

Shrubs recorded in these open mallee associations included *Acacia hemiteles*, *Callitris canescens*, *Daviesia benthamii*, *Melaleuca acuminata*, *M. lateriflora*, *M. laxiflora* and *Thryptomene australis*.

Mallee shrublands on sandplain soils and sandy loams over gravel dominated the proposed Holleaton Nature Reserve. Within this broad landform unit, changes in the soil composition influenced the structure of vegetation types markedly. Deeper yellow brown sands that lack gravel supported mallee associations over species-rich heaths, while lateritic and gravelly soils supported open mallee shrublands.

Occurring throughout the reserve were mallee associations of *Eucalyptus leptopoda* and *E. platycorys* over thickets of *Acacia beaverdiana*, *Allocasuarina acutivalvis*, *Calothamnus gilesii*, *Grevillea paradoxa*, *Hakea*

multilineata, *Hibbertia gracilipes*, *Melaleuca cordata* and *Phebalium tuberculosum*.

Flanking these extensive areas were sandplain sites that supported a diverse flora. Mallees of *Eucalyptus rigidula* were emergent above heaths comprised of *Allocasuarina corniculata*, *Callitris preissii* ssp. *verrucosa*, *Hakea falcata*, *H. platysperma*, *Leptomeria preissiana*, *Lysinema ciliatum*, *Melaleuca cordata*, *M. uncinata*, *Micromyrtus obovata* and *Verticordia chrysantha*.

White sands containing some laterite supported a similar vegetation with *Eucalyptus rigidula* occurring with the shrubs *Acacia signata*, *Allocasuarina corniculata* and *Grevillea cagiana* over a heath comprising *Adenanthos argyrea*, *Beaufortia micrantha*, *Baeckea maidenii* and *Drummondita hassellii*.

Lateritic sand sites supported mallee associations that included *Eucalyptus burracoppinensis*, *E. myriadena* and *E. aff. foecunda* with a variety of shrublands containing *Acacia rossei*, *Allocasuarina acutivalvis*, *Banksia laevigatum*, *Hakea multilineata* and *Melaleuca uncinata*. Low heaths included *Dryandra pteridifolia*, *Gastrolobium spinosum*, *Hakea platysperma*, *Isopogon polycephalus*, *Lysinema ciliatum* and *Regelia inops*.

Mallees were absent from tall shrublands comprised of *Allocasuarina acutivalvis*, *A. campestris* and *A. corniculata*. Other shrubs present were *Acacia dielsii*, *Beaufortia micrantha*, *Grevillea brachystachya*, *Hakea scoparia*, *H. sulcata*, *Hibbertia gracilipes*, *Isopogon scabriusculus*, *Melaleuca platycalyx*, *Verticordia chrysantha* and *V. roei*.

On lateritic rises, mallees of *Eucalyptus burracoppinensis* occurred over the shrubs *Allocasuarina acutivalvis*, *Beaufortia orbifolia*, *Banksia sphaerocarpa*, *Grevillea eriostachya* ssp. *excelsior*, *G. teretifolia*, *Hakea incrassata*, *H. scoparia*, *H. sulcata*, *Melaleuca cordata*, *Petrophile ericifolia* and *Verticordia acerosa*.

Several granite outcrops occur in the central western section of the proposed reserve. Supporting distinctive vegetation complexes these outcrops are fringed by a variety of associations, including low woodlands of *Allocasuarina huegeliana* and *Eucalyptus "capillosa"* with emergent *Callitris canescens*; dense thickets of *Allocasuarina campestris* with *Calothamnus gilesii*; and tall shrublands of *Acacia acuminata* and *A. lasiocalyx*.

Species recorded in these fringing vegetation types include *Calothamnus quadrifidus*, *Drosera macrantha*, *Grevillea paniculata*, *Melaleuca macronychia*, *Platysace effusa*, *Santalum acuminatum*, *Thysanotus patersonii* and the sedge *Ecdeiocolia monostachya*.

A granite rock near the south-western boundary of the proposed reserve was flanked by *Acacia lasiocalyx* and *Eucalyptus loxophleba* while soil pockets in the granite outcrops supported *Dianella revoluta*, *Dodonaea viscosa*, *Kunzea pulchella*, *Parantucellia latifolia* and *Stackhousia monogyna*.

The proposed Holleaton Nature Reserve contains scattered granite exposures surrounded by extensive mallee shrublands and eucalypt woodland areas. In contrast, the existing small reserves in the vicinity incorporate large granite outcrops and only small areas of flanking vegetation types. These reserves contain distinctive vegetation associations of high conservation value that are restricted to the granite rocks. Nurdungarra Rock Nature Reserve, 20km south-west of Southern Cross, supports populations of the Declared Rare Flora *Eucalyptus crucis* ssp. *crucis*.

The botanical knowledge available for these small reserves varies considerably (see CALM files). As part of the Bailey Report (1986) recommendations, a survey of existing B and C Class nature reserves was conducted by CALM staff. Reserves in the Southern Cross area included in this flora and vegetation survey were Nargalyerin Rock, and Mt Bailey nature reserves (S.D. Hopper, field notes: 1978-89).

Flanking the large granite Nargalyerin Rock are a variety of vegetation associations including eucalypt woodlands, tall shrub thickets and dense heaths. Eucalypts recorded in the woodlands and mallee formations were *Eucalyptus "capillosa" ssp. "capillosa"*, *E. burracoppinensis*, *E. calycogona*, *E. eremophila*, *E. loxophleba*, *E. salubris*, *E. salmonophloia*, *E. sheathiana* and *E. rigidula*.

Thickets fringing the granite outcrop areas included the shrubs *Acacia acuminata*, *A. assimilis*, *A. erinacea*, *A. hemiteles*, *A. lasiocalyx*, *A. saligna*, *Allocasuarina acutivalvis*, *Calothamnus quadrifidus*, *Eremophila clarkei*, *Leptospermum erubescens* and *Melaleuca macronychia*.

The granite rock supported a rich and diverse flora including the orchids *Caladenia "dimidia"*, *C. "pachychila"*, *C. roei*, *"Cyanicula " amplexans*, *Diuris* aff. *corymbosa*, *Pterostylis recurva*, *P. aff. nana* and *Thelymitra antennifera*.

The granite Mt Bailey is fringed by tall thickets containing *Acacia acuminata*, *A. lasiocalyx*, *Allocasuarina huegeliana*, *Eucalyptus petraea* and *Santalum spicatum*. Orchids recorded included *Caladenia "incensa"*, *C. "dimidia"*, *C. saccharata*, *Pterostylis* aff. *rufa* and *Thelymitra nuda*.

FAUNA

The fauna of the proposed Holleaton Nature Reserve has not been sampled systematically, although the fauna was documented 80km to the north-east during the biological survey of the Eastern Goldfields (McKenzie and

Rolfe, in prep.). The large size of the proposed reserve, in contrast with the existing small reserve network, should enable most of the area's fauna to be maintained in the long-term (CALM files). The presence of eucalypt woodlands within the proposed boundaries is significant for the conservation of passerine birds (see Kitchener *et al.*, 1982).

KEY FEATURES

- Large area of the proposed reserve.
- Representative vegetation and community types not reserved within the existing reserve system.
- Extensive mallee shrublands and areas of eucalypt woodland within the proposed reserve.
- Potential to incorporate extensive woodlands present within the adjacent Timber Reserve to the south.

CTRC/EPA RECOMMENDATIONS: None

PRESENT RECOMMENDATIONS

1. The proposed Class A Holleton Nature Reserve, vested in the NPNCA for the purpose of Conservation of Flora and Fauna, is defined as the area of vacant Crown land (16,698ha) bounded by the extent of agricultural land and by the Vermin Proof Fence in the south-west.
2. The possibility of extending the boundaries of the proposed Holleton Nature Reserve, to incorporate the adjacent Timber Reserve No. 19923, should be examined.
3. All 12 reserves (Nos 24944, 20262, 28323, 30305, 37289, 2863, 29537, 34776, 25801, 18773, 20526 and 32995) should remain or become Class A reserves vested in the NPNCA for the Conservation of Flora and Fauna, taking into account the following recommendations.
4. Reserves Nos. 28323, 30305, 37289, 2863, and 29537 should be upgraded from Class C to Class A Nature Reserves, vested in the NPNCA, retaining their current purpose.
4. The possibility of removing Water from the purpose of Reserve No 18773 and changing vesting to the NPNCA should be examined.
5. Removal of Water from the purpose of Reserve No. 20526, and the subsequent incorporation into Class A Reserve No. 32995, should be investigated.

PROPOSED LAKE BALADJIE NATURE RESERVE

LOCATION: Lake Baladjie is located 50km north-west of Southern Cross within the Westonia and Yilgarn Shires.

MAP: 3.

AREA: Proposed Lake Baladjie Nature Reserve: 9,000ha (approx.)
Baladjie Rock Nature Reserve (No. 1431): 547ha
Karolin Rock Nature Reserve (No. 13230): 259ha
Nature Reserve No. 28004: 225ha
Govt. Requirements. Reserve No. 22710: 7,405ha

CURRENT STATUS: The proposed Lake Baladjie Nature Reserve incorporates vacant Crown land and parts of unvested Reserve No. C 22710 (Government Requirements for State Alunite Industry), which covers Lake Baladjie. It links the existing reserves Nos. C1431, C13230 Water and Conservation of Flora and Fauna (Minister for Water Resources) and No. C28004 Conservation of Flora and Fauna (NPNCA).

GEOMORPHOLOGY

The proposed reserve boundaries incorporate extensive areas of Lake Baladjie, including the entire south-western section of the lake and parts of the northern portion. Peripheral dunes of sandy loams have formed on the margins of the bare saline lake bed. Flanking the marginal lake dunes are low lying broad valley surfaces comprised of heavier loams. Adjacent to the southern boundary of the proposed reserve are the large granite outcrops of Baladjie Rock and Karolin Rock. Low granite exposures are scattered throughout the proposed area to the west of the lake. A greenstone belt, extending north-west from Bullfinch to the Highclere Hills, flanks the eastern side of Lake Baladjie.

FLORA AND VEGETATION

The proposed Lake Baladjie Nature Reserve incorporates eucalypt woodlands flanking the western side of the lake, dunes on the margins of the lake that support *Eucalyptus salicola*, and large granite rock outcrops bordering the southern edge of the lake. The flora and vegetation of the proposed reserve have been surveyed by K.J. Atkins (unpubl. report, CALM files). Adjacent vegetation types on the southern edges of Lake Deborah West were sampled by Newbey and Hnatiuk (1985).

The entire south-western portion of Lake Baladjie, including the saline lake bed and fringing halophytic vegetation, is within the proposed boundaries. Along the southern margins of Lake Baladjie, a vegetation corridor containing woodland and lakeside dunes link the granite Baladjie and Karolin Rocks. Woodlands dominated by *Eucalyptus corrugata* are present along the eastern side of Lake Baladjie. Occurring on greenstone areas, this geographically restricted eucalypt intrudes into the proposed reserve in the extreme north-east (see also 4.5, Highclere Hills).

The northern boundaries of the proposed reserve incorporate the northern portions of Lake Baladjie, the drainage channel between Lake Baladjie and Deborah West Lake and a number of small salt lakes. A diversity of vegetation types, including flanking eucalypt woodlands and associations, occur on peripheral dunes and salt lake margins in this northern area.

The northern portions of Lake Baladjie are flanked by peripheral dunes supporting low woodlands of *Eucalyptus salicola* over shrubs of *Acacia ligulata*, *Dodonaea angustissima*, *Eremophila miniata*, *Rhagodia crassifolia*, *R. drummondii* and *R. preissii* ssp. *preissii*.

Flats bordering the north-eastern margins of Lake Baladjie and southern margins of Lake Deborah support tall shrublands of *Dodonaea angustissima* with *Acacia acuminata*, *A. ligulata*, *A. prainii* var. *linearis*, *Bossiaea walkeri*, *Callitris columellaris*, *Eremophila miniata*, *Grevillea sarissa* and *Rhagodia drummondii*.

To the south, red-brown loam soils on the western side of Lake Baladjie support woodlands comprised of *Eucalyptus longicornis*, *E. salmonophloia*, *E. salubris* and *E. yilgarnensis* over the shrubs *Acacia merrallii* and *Olearia muelleri*. Low woodlands on loam flats contain *Santalum spicatum* and *Eremophila* over *Lycium australe*. Common understorey shrubs include species of *Atriplex*, *Eremophila* and *Maireana*.

Open woodland mosaics flanking Lake Baladjie contain *Eucalyptus salmonophloia* with *E. loxophleba*, *E. salubris*, *E. transcontinentalis* and *E. yilgarnensis*. Shrubs recorded include *Acacia erinacea*, *A. jennerae*, *Allocasuarina acutivalvis*, *Cassia nemophila*, *Eremophila decipiens*, *Exocarpos aphyllus*, *Melaleuca uncinata*, *Olearia muelleri* and *Scaevola spinescens*.

Dunes on the margin of Lake Baladjie support open woodlands of *Eucalyptus salicola*, *E. loxophleba* and *E. yilgarnensis* with areas of *Callitris columellaris* and *Hakea preissii* over the shrubs *Bossiaea walkeri* and species of *Acacia*, *Atriplex*, *Eremophila* and *Maireana*. Fringing the lake along the southern margins were thickets of *Melaleuca uncinata* with occasional shrubs of *Eremophila miniata* over low shrublands containing species of *Halosarcia*, *Frankenia* and *Maireana*.

Scattered throughout the proposed reserve to the west of Lake Baladjie are areas of sheet granite supporting occasional *Brachychiton gregorii* over shrubs of *Acacia acuminata*, *A. tetragonophylla*, *Calycopeplus ephedroides*, *Melaleuca uncinata* and *Thryptomene australis*.

Large granite outcrops flank the southern portions of Lake Baladjie. Extending to the lake margins, the extensive Baladjie Rock area is flanked by *Eucalyptus loxophleba* with shrubs of *Acacia acuminata*. Thickets containing *Acacia acuminata* and *A. saligna* fringe the rock, which supports a number of shrubs including *Calycopeplus* sp. and *Kunzea pulchella*. Karolin Rock, situated 2-3km south of the lake, supports thickets of *Acacia acuminata*, *A. tetragonophylla*, *Melaleuca uncinata* and *Thryptomene australis*.

FAUNA

Although the fauna of the proposed Lake Baladjie Nature Reserve has not been systematically sampled, surveys have been conducted 70km to the north-east (see Dell and How, 1985). Sightings of a number of waterbirds including the Black Duck (*Anas superciliosa*) and Little Pied Cormorant (*Phalacrocorax melanoleucos*), have been reported from Lake Baladjie (CALM files).

KEY FEATURES

- Extensive uncleared eucalypt woodlands flanking Lake Baladjie.
- Dune systems and fringing halophytic vegetation on the lake margins.
- Incorporation of a representative large salt lake, a landform poorly represented in the existing reserve system.
- Formation of a vegetation corridor linking existing nature reserves to the south of the lake.
- The diversity of vegetation types within the proposed reserve buffered by areas of undeveloped Crown land surrounding the lake.

CTRC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATIONS

1. The proposed Class A Lake Baladjie Nature Reserve, vested in the NPNCA for the purpose of Conservation of Flora and Fauna, incorporates the southern and northern portions of Lake Baladjie, and vacant Crown land surrounding the lake to the north, west and south, linking the Karolin and Baladjie Rocks reserves with its southern boundary.
2. The existing reserves (Nos. 1431, 13230, and 28004) should be upgraded to Class A, for the Conservation of Flora and Fauna.
3. The possibility of removing Water from the purpose of Reserve Nos. 1431 and 13230 and changing the vesting to NPNCA should be examined.

1.9 PROPOSED YELLOWDINE NATURE RESERVE

Recommendations for the Yellowdine area (11.7) incorporated a series of small existing nature reserves, part of Timber Reserve No. 18966, and intervening vacant Crown land into a proposed conservation reserve (CTRC, 1974). The recommendation remains outstanding due to objections by the Mines Department to the inclusion of a narrow greenstone belt running north from High Rock to Duladgin Rock (CALM files, 1969-89).

Biological surveys have confirmed the high conservation values of the proposed Yellowdine Nature Reserve (S.D. Hopper, field notes: 1978-89). At present, portions of Duladgin, Condarnin and Weowanie Rocks lie outside existing reserve boundaries. The proposed reserve would encompass the entire areas of all three rocks. The restricted and contrasting floras of these granite outcrops would be connected by

intervening woodland mosaics and mallee heath formations. These vegetation types have been extensively cleared in the adjacent agricultural land of the Southern Cross area. Reservation priorities, in addition to the granite rocks, include the greenstone belt running along the western side of the salt lake system and the quartzite ridge south of Duladgin Rock.

In 1984, the unvested Reserve No. 18966, Timber-Goldfields Water Supply, was offered to the former Forests Department (CALM files). The Forests Department proposal, highlighting the numerous vegetation associations not adequately represented in the existing reserve system, recommended the area be set aside as the Karalee State Forest or Timber Reserve (CALM files, 1984). In 1986, CALM recommended that as Reserve No. 18966 adjoined three existing nature reserves, it would be more appropriate as a nature reserve (CALM files).

Both proposals sought to extend the CTRC/EPA Recommendation 11.7 for the Yellowdine area. The present recommendation includes the whole of Timber Reserve No. 18966, Karalee Rock Water Reserve No. 3531, Mt Clara Common (1122), and an area of vacant Crown land adjoining the south-east corner of Reserve No. 18966 and the Great Eastern Highway.

The proposed area contains a series of distinctive granite rock floras separated by intervening eucalypt woodlands and sandplain heaths; together with salt lake communities that are poorly represented in Jilbadgi Nature Reserve to the south. Also incorporated is a narrow greenstone belt with outcropping quartzite ridges that supports woodland mosaics and unique vegetation complexes. At present, greenstone areas are excluded from the existing nature conservation reserve system. The enlarged excision proposed by the Mines Department would exclude this greenstone belt from the proposed reserve.

The location of the proposed Yellowdine Nature Reserve is pivotal to the formation of two major conservation corridors. The reserve would link Mt Manning Nature Reserve and Jaurdi Pastoral Lease in the north (Map 12), with Jilbadgi Nature Reserve and the proposed extension to Lake Cronin Nature Reserve in the south (Map 1). In addition, a corridor would be formed along the Great Eastern Highway, extending east from Yellowdine through Boorabbin National Park to the proposed Woolgangie Timber Reserve extension and Goldfields Woodlands Nature Reserve (Map 4).

LOCATION: Yellowdine is situated 33km east of Southern Cross within the Yilgarn Shire.

MAP: 3.

AREA: Proposed Yellowdine Nature Reserve (74,163ha).

CURRENT STATUS: Vacant Crown land and the existing reserves: Duladgin Nature Reserve No. 2179 (1,360ha) for Conservation of Flora and Fauna (NPNCA) encompasses Reserve No. 3112 (259ha) (Minister for Water Resources); Weowanie Nature Reserve No. 3113 (259ha) for Water and Conservation of Flora and Fauna (Minister for Water Resources); Condarnin Nature Reserve No. 29823 (259ha) for Conservation of Flora and Fauna (NPNCA); Karalee Water Reserve No. 3531 (1,380ha); Karalee Timber-Goldfields Water Supply Reserve No. 18966 (38,443ha); and Mt Clara Common (Loc. 1122). An area of 200ha around Mt Clara has had some clearing for agricultural purposes.

GEOMORPHOLOGY

The proposed Yellowdine Nature Reserve incorporates virtually all of the landform features present in the Eastern Goldfields District. The central portion contains an extensive salt lake system flanked by broad valleys and a narrow greenstone belt that runs north from High Rock along the western side of the lakes. The northern portion includes outcropping quartzite ridges south of the granite Duladgin Rock, while the eastern arm incorporates the granites of Weowanie, Mt Clara and Karalee Rocks. Sandplain surfaces with dissecting broad valleys dominate the proposed reserve. Remnants of the extensive Tertiary sandplain intrude in the south-western, eastern and western sections (Gee, 1982).

A chain of salt lakes, within broad valleys, runs from south of High Rock to Lake Seabrook in the north. Peripheral gypsiferous dunes of sand and silt have formed on the eastern side of the playa lake deposits. Alluvial flats contain drainage lines north of Yellowdine, south of Weowanie Rock and north of High Rock. Flanking the salt lake system are colluvial deposits containing quartz fragments. Adjacent to Quarternary valleys and Tertiary laterised sandplain, a series of granite outcrops occur (Condarnin, Duladgin, Weowanie, Karalee and High Rock) with contrasting granitoid rock compositions (Gee, 1982).

A major Archean greenstone belt runs north-west from Toomey Hills through Marvel Loch and Southern Cross to Bullfinch. An ironstone gossan passing into a quartz vein extends to Duladgin Rock (CALM files). The belts occur at the margins of two underlying granitoid domes which are overlain by mafic and ultramafic volcanics (Gee, 1982). A narrow belt of strongly foliated greenstone, adjacent to the Ghooli Dome, runs north from Mt Caudan for 40km to Duladgin Rock. This narrow greenstone belt contains a metamorphosed banded ironstone formation, mafic and ultramafic amphibolite rocks. Although exposure north of Yellowdine is very poor (CALM files), a linear outcropping quartzite ridge extends for over 5km south of Duladgin. South of Yellowdine there are extensive outcrops, much gossanous rubble and several abandoned mines (Gee, 1982).

FLORA AND VEGETATION

Three taxa on CALM's Reserve Flora List occur in the proposed Yellowdine Nature Reserve. The priority species *Verticordia* aff. *penicillaris* (S.D. Hopper 6466) is restricted to Yellowdine and Duladgin Rock, while *Grevillea tetrapleura* also occurs to the north at Bungalbin Hill. *Eriostemon falcatus*, originally collected from Yellowdine, is now presumed extinct. Important populations of *Verticordia* aff. *penicillaris* occur in the vicinity of Condarnin Rock outside the existing reserve boundaries. Also, all the unique vegetation complexes and flora of the granite rock and associated quartzite ridges are not encompassed by Duladgin Rock Nature Reserve.

A survey of Reserve No. 18966 by the former Forests Department in 1984 highlighted the diversity of vegetation types including eucalypt woodlands, sandplain and salt lake communities. The reserve contains uncleared woodland and sandplain vegetation similar to the adjacent agricultural areas. The considerable variation within and between vegetation types throughout the reserve was confirmed by an intensive botanical survey of the proposed Yellowdine Nature Reserve (S.D. Hopper, field notes: 1988).

The Yellowdine area is important for several eucalypts, including the only known populations of *Eucalyptus orbifolia* ssp. nov. (SDH 6461) and the northern-most populations of *Eucalyptus cylindriflora* (S.D. Hopper, pers. comm.). The poorly known *E. corrugata*, which occurs on greenstone to the south-west (Marvel Loch) and north-west (Mt Jackson), intergrades with *E. griffithsii* around Duladgin Rock (Napier *et al.*, 1987). Excellent stands of *Eucalyptus wandoo* (now *E. "capillosa" ssp. "capillosa"*) were recorded by the Forests Department (CALM files, 1984).

The northern portion of the proposed reserve includes the contrasting floras of Duladgin and Weowanie Rocks divided by a series of salt lakes, while the central section incorporates eucalypt woodland mosaics on the greenstone belt, outcropping quartzite ridges and broad valleys that drain into the north-south chain of salt lakes.

The eastern portion incorporates the granite rocks of Mt Clara, Karalee, Caroling and Morlining and the extensive associated broad valley woodlands, while the southern section of the proposed nature reserve incorporates sandplain, salt lake and granite systems south of the Great Eastern Highway.

Duladgin Rock, a flat granite 16km north of Yellowdine, has a large number of endemic flora. Some are shared with Condarnin Rock and Weowanie Rock but several are not represented elsewhere on the proposed reserve. These restricted plants include *Calycopeplus ephedroides*, *Hakea recurva*, *Hibbertia glomerosa*, *Eremophila glabra*, *E. serrulata*, *Grevillea* sp. (SDH 6442), *Melaleuca radula*, *Persoonia striata*, and *Verticordia* aff. *penicillaris*. Important flora collections in the vicinity of

Duladgin Rock include the only known location of an undescribed species of *Acacia* (S.D. Hopper 6424) and a disjunct outlying population of *Conostylis argentea*.

Surrounding Duladgin Rock are open woodlands of *Eucalyptus salmonophloia* and *E. salubris* with mallees of *E. celastroides* ssp. *celastroides*, *E. yilgarnensis* and *E. loxophleba* over *Acacia hemiteles*, *A. erinacea*, *A. mackeyana* and *A. acuminata*. Flanking Duladgin Rock are mallees of *Eucalyptus loxophleba* over thickets of *Acacia acuminata*, *A. colletioides*, *A. hemiteles*, *A. prainii*, *Chamaexeros macranthera*, *Exocarpos aphyllus*, *Hakea recurva*, *Lomandra helmsii*, *Melaleuca uncinata*, *Persoonia striata*, *Santalum acuminatum*, *S. spicatum* and *Scaevola spinescens*.

Orchids recorded at Duladgin Rock include *Caladenia "dimidia"*, *C. "incensa"*, *C. roei*, "*Cyanicula*" *amplexans*, "*Drakonorchis*" *barbarossa*, *Diuris* aff. *corymbosa*, *Pterostylis* aff. *nana*, *P.* aff. *rufa*, *Prasophyllum ringens*, *Spiculaea ciliata*, *Thelymitra antennifera* and *T.* aff. *nuda*.

In addition to the endemic plants confined to Duladgin Rock, the associated quartzite ridgeline also supports mallees of *Eucalyptus petraea* over a scrub thicket that includes *Alyxia buxifolia*, *Exocarpos aphylla*, *Hibbertia eatoniae*, *Isotoma petraea* and *Ptilotus obovatus*. On the southern end of the ridge, a scrub-thicket of *Allocasuarina campestris*, *Calothamnus sanguineus*, *Grevillea paradoxa* and *Melaleuca fulgens* occurs over *Conostylis argentea*. The northern end is flanked by woodlands of *Eucalyptus "capillosa"* ssp. "*capillosa*" while the ridge supports mallees of *E. loxophleba* and thickets of *Acacia acuminata*.

To the south of the main ridge, thickets of *Acacia acuminata*, *A. beauverdiana*, *A.* aff. *resinomarginea*, *Melaleuca uncinata* and *Tryptomene* sp. occur. To the east, a dwarf scrub of *Grevillea* sp. (SDH 6442) and *Verticordia* aff. *penicillaris* grow over *Borya constricta* herbfields with scattered emergent *Brachychiton* sp., *Calycopeplus ephedroides* and *Hakea recurva*. To the west of the ridge, *E.* aff. *oleosa*, *E. griffithsii*, *E. loxophleba* and *E. sheathiana* occur over *Alyxia buxifolia*, *Acacia prainii*, *Olearia muulleri* and *Santalum spicatum*.

South of Duladgin Rock, a second linear outcrop of low granite occurs. Fringed by a *Eucalyptus "capillosa"* ssp. "*capillosa*" low woodland, the granite supports a scrub thicket of *Acacia neurophylla*, *A. steedmanii*, *Allocasuarina acutivalvis*, *Eriostemon brucei*, *E. coccineus*, *Phebalium* sp. and *Prostanthera aspalathoides* over *Conostylis argentea*.

Surrounding this outcrop, powdery dark soils with small white surface quartz stones support woodlands of *Eucalyptus salmonophloia* and *E. salubris* with mallees of *E. celastroides* over the restricted *Acacia* sp. (SDH 6437), *A. acuminata*, *A. erinacea*, *Daviesia* sp. and *Eremophila clarkei*.

North of Duladgin Rock, *Eucalyptus griffithsii* and *E. loxophleba* grow over thickets of *Acacia acuminata*, *A. colletioides*, *A. prainii*, *A. stereophylla*, *Eriostemon coccineus*, *Grevillea paradoxa*, *Chamaexeros macranthera*, *Phebalium* sp. and *Scaevola spinescens*.

East of Duladgin Rock, *Eucalyptus salmonophloia* grows with mallees of *E. celastroides*, *E. loxophleba* and *E. yilgarnensis* over *Acacia hemiteles*, *A. erinacea*, *A. mackeyana*, *Eremophila clarkei* and *Exocarpos aphyllus*. Also occurring are *Eucalyptus flocktoniae*, *Eremophila glabra*, *Grevillea acuaria*, *Melaleuca uncinata* and *Olearia muelleri*.

Weowanie Nature Reserve, 20km north-east of Yellowdine, encompasses Weowanie Rock. The vegetation complex present contrasts markedly with the flora of Duladgin Rock, only 8km to the south-west. A preliminary comparison of some 60 taxa showed there were significant differences, with only half the recorded flora common between the rocks (S.D. Hopper, field notes: 1978-89).

The northern edge of Weowanie Rock is flanked by mallees of *Eucalyptus loxophleba* over *Acacia acuminata*, *Lomandra effusa* and *Pittosporum phylliraeoides*. At the edge of the rock *Hibbertia glomerosa* occurred in a *Drosera* sp. herbfield with *Wurmbea tenella*. Present on the western edge were *Acacia lasiocalyx*, *Alyxia buxifolia*, *Grevillea paniculata*, *Hakea recurva*, *Isotoma petraea*, *Kunzea pulchella*, *Leptospermum erubescens*, *Thryptomene australis* and *Solanum orbiculatum*.

The southern fringes of the rock contained *Eucalyptus petraea*, *E. loxophleba*, *Acacia hemiteles*, *A. aff. resinomarginea* (SDH 6449), *A. nyssoophila*, *Chamaexeros macrantheros*, *Dianella revoluta*, *Allocasuarina huegeliana*, *Dodonaea* sp., *Santalum spicatum* and *Lepidosperma* sp.

The north-western slopes of Weowanie Rock were fringed by *Eucalyptus loxophleba*, *E. petraea*, *Acacia acuminata*, *A. lasiocalyx* and *Borya constricta*. The slopes contained *Isotoma petraea* and two species of *Solanum*. East of the rock, a flat granite sheet contained *Grevillea* sp. (SDH 6442), *Persoonia aff. striata* and *Olearia muelleri*.

Orchids present on the rock and in the vicinity included *Caladenia "incensa"*, *C. roei*, "*Cyanicula*" *amplexans*, "*C.*" *deformis*, "*Drakonorchis*" *barbarossa*, *Diuris aff. laxiflora*, *Pterostylis mutica*, *P. aff. nana*, *Prasophyllum ringens*, *Microtis* sp., *Thelymitra aff. nuda* and *Spiculaea ciliata*.

A large sheet granite, 5km east of Weowanie Rock, supports a dense *Thryptomene australis* heath with an occasional *Eucalyptus loxophleba*, *E. aff. oleosa*, *Acacia resinomarginea*, *Eremophila serrulata*, *Hibbertia glomerosa*, *Persoonia striata*, *Prostanthera baxteri* and species of *Dodonaea*, *Drosera* and *Baeckaea*.

The salt lakes dividing Duladgin and Weowanie Rocks are flanked by samphire flats dominated by *Halosarcia* spp. and low woodlands of *Eucalyptus salicola*. Present on interlacustrine rises were *E. sheathiana*, *Acacia lineolata* and *Santalum spicatum*. Thickets of *Melaleuca uncinata*, *Acacia* aff. *resinomarginea* (SDH 6449) and species of *Frankenia*, *Callitris* and *Stylidium* also lined the lakes. Low lying valleys to the east of the lakes supported *Eucalyptus salubris*, *Acacia nyssofila*, *Grevillea acuaria* and *Scaevola spinescens*.

The Vermin Proof Fence forms the north-eastern boundary of the proposed reserve. Occurring alongside the fence are *Eucalyptus* aff. *oleosa*, *E. loxophleba*, *E. leptopoda*, *E. eremophila*, *E. subangusta* ssp. "cerina" and *E. pileata* sens. lat. with *Acacia acuminata*, *A. resinomarginea*, *A. nyssofila*, *A. erinacea* and *A. hemiteles*.

Eucalypts present on broad valleys north of Yellowdine include tall mallees of *E. cylindrocarpa*, *E. leptophylla*, *E. loxophleba*, *E. sheathiana* and *E. yilgarnensis*. Woodlands of *Eucalyptus salmonophloia*, *E. salubris* and *E. yilgarnensis* are flanked by a variety of *Acacia* shrublands that include *Acacia colletioides*, *A. hemiteles*, *A. resinostipulea*, *A. resinomarginea* and *Acacia* spp. (SDH 6422, 6424, 6426-7, 6429). Associated eucalypts include *Eucalyptus* aff. *transcontinentalis* with mallees of *E. gracilis*, *E. loxophleba* and *E. sheathiana*.

On a hilltop north of Yellowdine, *Eucalyptus loxophleba* grew with *E. yilgarnensis* and *E. sheathiana* over shrubs of *Acacia acuminata*, *A. colletioides*, *Olearia revoluta*, *O. muellerii* and *Phebalium* sp. In a slight depression *Eucalyptus salmonophloia*, *E. salubris*, *E. yilgarnensis* and *E. loxophleba* occurred over *Acacia erinacea*, *Exocarpos aphyllus*, *Grevillea acuaria* and *Santalum acuminatum*. Shrubs of *Melaleuca uncinata* occurred over sedges of *Lepidosperma* and grasses of *Triodia scariosa* and as a dense thicket in a depression.

Open woodlands of *Eucalyptus salmonophloia*, *E. salubris* and *E. longicornis* are present to the south-east of Yellowdine. Also occurring are low woodlands of *E. sheathiana*, *E. salubris* and *E. yilgarnensis* with large *E. melanoxydon* trees flanked by *E. loxophleba* mallees.

Open woodlands occur to the west of the salt lake system that runs through the centre of the proposed reserve. They are comprised of *Eucalyptus salmonophloia*, *E. longicornis*, *E. flocktoniae* and *E. yilgarnensis* over *Acacia erinacea*, *A. colletioides*, *Alyxia buxifolia*, *Eremophila clarkei*, *Exocarpos aphyllus* and *Olearia muelleri*.

A greenstone rise on the margins of a salt lake supported a woodland of *Eucalyptus melanoxydon*, *E. longicornis* and *E. salubris* with mallees of *E. celastroides* ssp. *virella* over tall shrubs of *Acacia acuminata*, *A. erinacea*, *Alyxia buxifolia*, *Dodonaea* spp., *Eremophila clarkei*, *Ptilotus obovatus* and *Zygophyllum* sp.

An open mallee formation of *Eucalyptus loxophleba* over *Acacia mackeyana*, *A. resinostipulea*, *Grevillea acuaria* and *Wurmbea tenella* fringed a granitic flat that supported *Grevillea* sp. (SDH 6442) and *Prostanthera aspalathoides*. Nearby, mallees of *Eucalyptus rigidula* occurred on yellow sand over species of *Allocasuarina*, *Hakea* and *Leptospermum* with *Triodia scariosa*.

The Karalee area, 15-20km north-east of Yellowdine, contains a series of granite rocks. These include Morlining Rocks, Caroling Rocks, Karalee Rock, Mt Clara and associated rocky outcrops.

Hunts Dam, to the east of Karalee Rock, is surrounded by low woodlands of *Eucalyptus "capillosa" ssp. "capillosa"* over *Acacia acuminata*, *A. hemiteles*, *A. nyssofila* and herbs of *Lomandra effusa*. Karalee Rock is flanked by *Acacia lasiocalyx*, *Allocasuarina huegeliana*, *Eucalyptus loxophleba*, *Leptospermum erubescens* and *Kunzea pulchella*; extensive *Eucalyptus "capillosa" ssp. "capillosa"* low woodlands occur to the south. A sheet granite slope to the south-east supports the granite endemic *E. "stenantha"*.

Both rocks have an extensive orchid flora that includes *Caladenia saccharata*, *C. roei*, "*Cyanicula*" *amplexans*, "*C.*" *deformis*, *Pterostylis* aff. *nana*, *P.* aff. *rufa*, *Diuris* aff. *corymbosa*, *Prasophyllum ringens*, *Thelymitra antennifera*, *T.* aff. *nuda* and *Spiculaea ciliata*.

Mt Clara Common encompasses farm buildings, dams and Mt Clara itself, which is within a cleared crop paddock heavily grazed and infested by weeds (S.D. Hopper, pers. comm.). Mt Clara is flanked on the south side by *Eucalyptus petraea* with thickets of *Acacia lasiocalyx*, *Santalum spicatum* and *Pittosporum phylliraeoides* over *Alyxia buxifolia*, *Dianella revoluta*. Shrubs on the south-eastern slopes include the rare *Ricinocarpos velutinus* with *Solanum orbiculatum* and *Duboisia hopwoodii*.

The western edge of the rock is fringed by a dense thicket of *Acacia lasiocalyx*, *A. acuminata* and *Melaleuca macronycha* with a few emergent *Eucalyptus loxophleba* and *E. petraea*. On the north-western slopes a much dissected topography supports *Borya constricta*, *Isotoma petraea*, *Kunzea pulchella*, *Leptospermum erubescens*, *Ricinocarpos velutinus* and *Santalum spicatum*.

Present on the northern portions of Mt Clara are *Acacia lasiocalyx*, *Acacia* spp. (SDH 6422, 6429), *Hibbertia glomerosa*, *Keraudrenia integrifolia*, *Pleurosorus rutifolius*, *Stypandra glauca*, *Wurmbea tenella* and the fern *Cheilanthes austrotenuifolia*.

Sandplain areas nearby supported low woodlands of *Callitris verrucosa* with mallees of *E. rigidula* and *E. leptopoda* over *Acacia prainii* and *Triodia scariosa*. High yellow sandplain to the west of Mt Clara supported

E. aff. oldfieldii (SDH 6461-2), the only known location of this distinctive subspecies, and *E. leptopoda* over species of *Acacia*, *Grevillea* and *Melaleuca*. Also occurring in the vicinity of Mt Clara were *Eucalyptus sheathiana*, *E. eremophila*, *E. cylindriflora* and *Grevillea paradoxa*.

Near Caroling Rocks a low woodland of *Eucalyptus aff. transcontinentalis*, *E. pileata* and *E. salmonophloia* occurs over mallees of *E. yilgarnensis* and shrublands that include *Alyxia buxifolia*, *Acacia lineolata* ssp. nov. (SDH 6444), *Acacia* sp. (SDH 6464), *Eremophila clarkei*, *Exocarpos aphyllus* and species of *Daviesia*, *Halgania* and *Melaleuca*.

Condarnin Rock, a large granite outcrop 4km south of Yellowdine, has restricted flora also recorded on Duladgin Rock. These include *Verticordia aff. penicillaris*, *Eremophila serrulata*, *Grevillea* sp. (SDH 6442) and *Hibbertia glomerosa*. This southern population of feather flower (*Verticordia aff. penicillaris*), which extends east of Condarnin Rock, is particularly important. The distinctive and unusual *Stylidium choreanthum*, restricted to the Coolgardie-Yellowdine-Bullfinch area, is known from sandplain north of Condarnin Rock.

The Condarnin Rock summit is flanked by dense *Borya constricta* herbfields with *Stypandra glauca* and thickets of *Acacia acuminata*, *A. assimilis*, *A. lasiocalyx* and *A. aff. resinomarginea* to the north. Other shrubs recorded include *Alyxia buxifolia*, *Calothamnus quadrifidus*, *Drosera* sp., *Dianella revoluta*, *Grevillea paniculata*, *Kunzea pulchella*, *Persoonia striata*, *Thryptomene australis* and *Spartochloa scirpoidea*.

Vegetation near the summit includes *Melaleuca uncinata*, *Leptospermum erubescens*, *Lepidosperma* sp. and *Santalum spicatum*. An open low scrub of *Acacia lasiocalyx*, *Alyxia buxifolia*, *Calothamnus quadrifidus*, *Kunzea pulchella* and *Santalum acuminatum* over *Borya constricta*, *Chamaexeros macranthera* and *Drosera* sp. occurs on the summit.

East of the summit, rare trees of *Brachychiton gregorii* grew with *Allocasuarina huegeliana*, *Acacia acuminata*, *A. sp.* (SDH 6434), *Calothamnus sanguineus*, *Glischrocaryon aureum*, *Grevillea paniculata* and *Keraudrenia integrifolia*.

The eastern base of Condarnin Rock has large stands of *Eucalyptus petraea* with *E. leptophylla* over an understorey that included *Acacia* sp. (SDH 6453), *Cassia* sp., *Lomandra effusa*, *Melaleuca macronychia*, *Olearia revoluta* and *Wurmbea tenella*. Dense *Leptospermum erubescens* heaths up to 5m tall also occur.

North-east of the rock, *Eucalyptus petraea* mallees grew with thickets of *Acacia acuminata*, *A. hemiteles* and *A. nyssophila* over *Grevillea paniculata*, *Hibbertia* sp. (SDH 6465) with sedges of *Chamaexeros* and *Lepidosperma* spp.

An ephemeral creekline flowing east of Condarnin Rock supports shrubs of *Verticordia* aff. *penicillaris*. The extensive *Verticordia* aff. *penicillaris* population extends to a salt lake east of the rock. Also occurring in the quartzitic loam were *Eucalyptus loxophleba*, *Grevillea* sp. (SDH 6442) and *Melaleuca uncinata*.

Condarnin Rock, flanked by *E. loxophleba* and *Acacia acuminata*, extends to the salt lake margins which support *Halosarcia* spp. The salt flat is fringed by woodlands of *Eucalyptus salicola* with mallees of *E. celastroides*. Also occurring in the vicinity are *Acacia* aff. *resinomarginea* (SDH 6429), *Melaleuca uncinata*, *Persoonia striata* and *Prostanthera aspalathoides*.

Flora recorded on other parts of Condarnin Rock include the perennial grass *Aristida contorta* and the shrubs *Acacia beauverdiana*, *A. coolgardensis*, *Allocasuarina campestris* ssp. *campestris*, *Dampiera lavandulacea*, *Dodonaea boroniifolia*, *Kunzea sericea*, *Meuhlenbeckia adpressa*, *Persoonia coriacea*, *Stackhousia huegelii* and *Thryptomene australis*.

Orchids recorded were *Caladenia "dimidia"*, *C. "incensa"*, *C. roei*, *C. saccharata*, "*Cyanicula*" *amplexans*, "*Drakonorchis*" *barbarossa*, *Diuris* aff. *corymbosa*, *Pterostylis* aff. *nana*, *Thelymitra antennifera*, *T.* aff. *nuda*, *T.* aff. *pauciflora* and *Prasophyllum ringens*.

Other annuals present on Condarnin Rock included *Actinoble uliginosum*, *Blennospora drummondii*, *Calandrinia calyptrapa*, *C. granulifera*, *Crassula exserta*, *Drosera macrantha*, *Helichrysum lindleyi*, *Helipterum demissum*, *Millotia tenuifolia* var. *tenuifolia*, *Plantago debilis*, *Podolepis lessonii* and *Waitzia acuminata*.

North of Condarnin Rock *Eucalyptus eremophila*, *E. sheathiana* and *E. yilgarnensis* grow over dense heaths of *Acacia prainii*, *A. hemiteles*, *A. nyssoiphila*, *A. assimilis*, *A. erinacea*, *Melaleuca uncinata* and *Hibbertia eatoniae*. Sandplain heaths flanking the rock contained *Banksia elderiana*.

FAUNA

Although the fauna of the proposed nature reserve has not been sampled, surveys have been conducted at Boodarding Rock in Jilbadgi Nature Reserve to the south and Boorabbin National Park to the east (See Appendices 6 and 8). The Declared Rare Chuditch (*Dasyurus geoffroi*) has been recorded 5km west of Yellowdine (K. Morris, pers. comm.).

The Yellowdine area contains several species at their distributional limits (CTRC, 1974). The south-western amphibian *Pseudophryne guentheri* and its arid zone congener, *P. occidentalis*, have both been recorded from granite rocks in the area. Three sympatric species of burrowing frogs have also been recorded from the Yellowdine area: *Neobatrachus pelobatoides*, *N. kunapalari* and an undescribed species (*N.* sp. nov.). The proposed

reserve is part of an important zone where closely related amphibian species have overlapping ranges (J.D. Roberts, pers. comm.).

Many species of birds have been recorded in the vicinity of Condarnin Rock and in *Eucalyptus salmonophloia* woodlands north of the rock. The species list is comprised mainly of passerines and includes the Crested Bellbird (*Oreoica gutturalis*) and six species of honeyeaters (CALM files).

RECREATIONAL USE AND POTENTIAL

The proposed Yellowdine Nature Reserve would extend the area of sandplain kwongan heath reserved along the Great Eastern Highway. This would provide travellers with extensive spring wildflower displays from Boorabbin to Yellowdine. Recreational potential exists for the development of tourist stop-over points at granite rocks along the highway.

KEY FEATURES

- Pivotal location in the formation of two major conservation corridors.
- Greenstone outcrop areas including quartzite ridges in the vicinity of Duladgin Rock.
- Distinctive floras restricted to granite rocks isolated by intervening eucalypt woodland mosaics and mallee formations.
- Contains representative uncleared vegetation associations similar to adjacent agricultural land.

CTRC RECOMMENDATION

The Committee recommends that a Class C reserve for the Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority, be created in the Yellowdine area. It should include existing reserves Nos. 2179, 3112, 3113, 29823 and part of 18996, as well as the vacant Crown land between them.

EPA RECOMMENDATION

The Committee recommends that a Class C reserve for the Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority, be created in the Yellowdine area. It should include existing reserves Nos. 2179, 3112, 3113, 29823 and part of 18996, as well as the vacant Crown land between them.

PRESENT RECOMMENDATIONS

1. The proposed A Class Yellowdine Nature Reserve for the Conservation of Flora and Fauna, vested in the NPNCA, is defined as the area bounded to the: west by 119°36' for 21km; north by 31°05' 30"S for 10.5km to the Vermin Proof Fence; north-east by the Vermin Proof Fence for 9km, then by 31°08'S for 15km along the northern boundary of Reserve No. 18966; east by 119°57'E for 14.5km along the eastern boundary of Reserve No. 18966; south-east by the Great Eastern Highway for 15km, then by 119°48'E for 10km; south by 31°23'S for 14.5km to the old Marvel Loch-Yellowdine

Rd; and south-west by the surveyed road No. 3042 for 9km to Yellowdine and for 1.5km north of Yellowdine, then 4km west along 31°.

2. The proposed Yellowdine Nature Reserve should incorporate the existing nature reserves of Duladgin, Weowanie and Condarnin (Nos. 2179, 3112-3, and 29823); the entire Karalee Timber Reserve for Goldfields Water Supply (No. 18966); the Mt Clara Common (Loc. 1122); the Karalee Water Reserve (No. 3531) and intervening vacant Crown land adjoining the south-eastern corner of Reserve No. 19866 and the Great Eastern Highway.

1.10 JILBADGI NATURE RESERVE

LOCATION: Jilbadgi Nature Reserve is a large area extending 45-100km south-east of Southern Cross within the Yilgarn and Coolgardie Shires. The Vermin Proof Fence runs through the eastern section of the reserve.

MAP: 3.

AREA: 208,866ha.

CURRENT STATUS: Class C Reserve for the Conservation of Flora and Fauna vested in the NPNCA.

GEOMORPHOLOGY

Extensive upland sandplains dissected by low lying broad valley surfaces dominate Jilbadgi Nature Reserve. Small areas of undulating plains over greenstone intrude into the central western portion of the reserve while salt lakes are concentrated in the south-eastern corner. Granite rocks are scattered throughout the reserve with the most prominent being Split Rocks (in the south-west), Boodarding Rock (in the north) and Sandalwood Rocks (in the south-east).

The greenstone belt that extends south-east from Southern Cross and underlies the Parker Range and Toomey Hills, has been virtually excluded from the reserve. Small pockets of Archean greenstones, such as fine-grained amphibolites and chlorite tremolite rocks, intrude into the western edge of Jilbadgi Nature Reserve (Gee, 1982).

FLORA AND VEGETATION

Jilbadgi Nature Reserve contains a number of flora Declared Rare or listed on CALM's Reserve Flora List. The Declared Rare Flora *Myriophyllum petraeum* extends south-east to Cape Arid National Park, south of Dundas Nature Reserve. Disjunct populations have also been recorded at Split Rocks, in Jilbadgi Nature Reserve and north-east of Woolgangie. *Eremophila merrallii*, also Declared Rare, was reported on sandplains in the central portion of the reserve.

Surveys of the flora and vegetation of Jilbadgi Nature Reserve have been concentrated in the vicinity of Split Rocks and Boodarding Rocks (Newbey, in prep.). Over 280 taxa have been recorded in the reserve (Newbey, unpubl. report). Salt lakes in the south-eastern portion, containing restricted vegetation associations, have been inadequately surveyed.

The distribution of vegetation associations on landform units within Jilbadgi Nature Reserve was summarised by Newbey (unpubl. report, 1988). Extensive sandplain areas, supporting a variety of vegetation types, dominate this reserve. These included mallee associations of *Eucalyptus leptophylla* and *E. transcontinentalis*; thickets of *Acacia beauverdiana* and *Allocasuarina corniculata*; and shrublands of *Grevillea eriostachya* ssp. *excelsior*.

Dissecting broad valleys throughout the reserve support woodlands of *Eucalyptus salmonophloia* and *E. salubris*. The small area of greenstone within the reserve supports a woodland mosaic including *E. corrugata*, *E. longicornis* and *E. salubris*. Mallee formations of *E. leptophylla*, present on broad valleys, also flank salt lakes in the south-eastern section of the reserve.

The granite outcrops Split Rock and Boodarding Rocks supported vegetation complexes, and were flanked by *Acacia acuminata* thickets, low woodlands of *Allocasuarina huegeliana* and mallee associations of *Eucalyptus loxophleba*.

Small greenstone areas that intrude into the western edge of Jilbadgi Nature Reserve support eucalypt woodland mosaics on the ridges, slopes and colluvial flats. These woodlands include the geographically restricted *Eucalyptus corrugata* as well as *E. "incerata"*, *E. "livida"*, *E. salubris* and *E. yilgarnensis*.

Woodlands of *Eucalyptus salmonophloia* in the vicinity of Split Rocks, in the south-eastern section of the reserve, comprised mallees of *E. "exigua"* over shrubs of *Acacia hemiteles*, *A. merrallii*, *Eremophila decipiens*, *E. ionantha*, *Grevillea oncogyne*, *Melaleuca acuminata*, *Santalum acuminatum* and *Westringia cephalantha*.

North of Split Rocks, mallee associations of *Eucalyptus "exigua"* and *E. eremophila* contained the shrubs *Acacia eremophila*, *A. signata*, *Allocasuarina corniculata*, *Baeckea maidenii*, *Grevillea pterosperma*, *Melaleuca cordata*, *M. eleuterostachya*, *M. lateriflora*, *M. laxiflora*, *M. spicigera*, *M. uncinata*, *Persoonia coriacea*, *Phebalium filifolium* and *Stylidium breviscopum*.

South-east of Split Rocks, the mallees *Eucalyptus leptophylla* and *E. platycorys* occurred with shrubs of *Grevillea apiculoba*, *Hakea erecta*, *H.*

multilineata, *Leptospermum erubescens*, *M. pentagona* var. *pentagona*, *M. uncinata* and *Micromyrtus obovata*.

Woodlands in the vicinity of Boodarding Rocks, in the northern portion of Jilbadgi Nature Reserve, contained a variety of species including *Eucalyptus celastroides*, *E. gracilis*, *E. longicornis*, *E. salubris* and *E. transcontinentalis*. Shrubs recorded within these mixed woodlands included *Acacia merrallii*, *A. nyssophylla*, *Melaleuca lanceolata* and *Templetonia sulcata*.

Low woodlands north-east of Boodarding Rock comprised trees of *Eucalyptus eremophila* and *E. transcontinentalis* with mallees of *E. leptophylla* over the shrubs *Callitris preissii* ssp. *verrucosa*, *Daviesia obtusifolia* var. *minor*, *Melaleuca lateriflora* var. *lateriflora* and *M. uncinata*.

Sandplains north-east of Boodarding Rock supported tall shrublands dominated by *Acacia beauverdiana*. Other shrubs included *Allocasuarina corniculata*, *Baeckea ochropetala*, *Banksia elderiana*, *Callitris preissii* ssp. *verrucosa* and *Thryptomene kochii*.

Kwongan heaths on deep sands north of Split Rock contained a rich and varied flora. Tall shrubs of *Grevillea eriostachya* ssp. *excelsior* and *G. cagiana* occurred over heaths that included *Allocasuarina campestris* ssp. *campestris*, *A. microstachya*, *Banksia audax*, *Conospermum stoechadis*, *Daviesia croniniana*, *D. incrassata*, *Hakea erecta*, *H. platysperma*, *Leucopogon obtusatus*, *Micromyrtus obovata* and *Verticordia roei*.

Also occurring on these sandplains in the southern portion of the reserve were mallee associations comprised of *Eucalyptus burracoppinensis*, *E. "capillosa"* ssp. *"capillosa"*, *E. leptophylla* and *E. platycorys* with the shrubs *Chamelaucium pauciflorum*, *Conosperma spinosum*, *Conospermum brownii* and *Isopogon scabriusculus*.

Flanking Split Rocks were tall shrublands of *Acacia acuminata* containing mallees of *Eucalyptus loxophleba* emergent above the shrubs *Acacia sessilis*, *Leptospermum erubescens*, *Melaleuca uncinata*, *Platysace effusa* and *Santalum acuminatum*. Dominant annuals present were *Gnephosis pusilla* and *Podotheca angustifolia*.

Dense woodlands fringing Split Rocks were dominated by *Allocasuarina huegeliana*. The inner aprons of the rocks supported a granite vegetation complex of over 70 taxa that included the low shrubs *Borya sphaerocephala* and *Stackhousia muricata* over annuals of *Actinobole uliginosum*, *Brachycome perpusilla*, *Calandrinia granulifera*, *Centrolepis humillima*, *C. polygyna* ssp. *eremica*, *Chthonocephalus pseudevax*, *Crassula exserta*, *Helipterum pygmaeum*, *Hyalochlamys globifera*, *Nicotiana rotundifolia*, *Rutidosis multiflora* and *Toxanthes perpusillus*.

Boodarding Rocks, 40km to the north-east, were flanked by mallee associations of *Eucalyptus loxophleba* with *E. gracilis* and emergent trees of *E. salubris*. Also occurring on the outer apron were the shrubs *Acacia hemiteles*, *A. nyssophylla*, *Grevillea acuaria* and *Olearia propinqua*. The inner apron supported the shrub *Borya sphaerocephala* over annuals of *Actinoble uliginosum*, *Calandrinia calyptrapa*, *C. granulifera* and *Podolepis lessonii*.

FAUNA

An initial survey of the Barker Lake area, conducted in 1970, recorded a species list with over 10 mammals, 30 reptiles and 100 birds as well as three amphibians (W.H. Butler, unpubl. report). During the biological survey of the Eastern Goldfields, the fauna was sampled in the northern section of the reserve (McKenzie and Rolfe, in press).

The species list for Jilbadgi Nature Reserve consists of 11 native mammals, 34 reptiles, two amphibians and 64 birds. Appendix 6 lists the mammals recorded while Appendix 8 lists the amphibians and reptiles. A variety of vegetation types on different landforms, in the vicinity of Boodarding Rock, were sampled.

The species list of mammals contains five dasyurid marsupials, the Western Pygmy-possum, a single macropod, three native rodents, seven bats and the Echidna. The native rodent fauna may be increased to four species with the positive identification of *Pseudomys bolami* (A. Baynes, pers. comm.). Its strikingly similar congener, *P. hermannsburgensis*, has been recorded from sandplain sites within the reserve.

The dasyurid fauna included the Kultarr (*Antechinomys laniger*), which was only recorded elsewhere from Wanjarri Nature Reserve, the Goldfields Ningau (Ningau *yvonneae*); and three sympatric *Sminthopsis* dunnarts. A dunnart from the *Sminthopsis murina* complex, most likely *S. dolichura*, has yet to be determined.

The herpetofauna consisted of two species of amphibians (*Neobatrachus kunapalari* and *Pseudophryne guentheri*); 10 species of gecko including *Diplodactylus pulcher* and *Nephrurus stellatus*; seven dragons including *Ctenophorus maculatus griseus*, *C. salinarum* and *C. scutulatus*; 14 species of skinks including *Ctenotus pantherinus*, *C. xenopleura* and *Egernia carinata*; a single monitor and two species of snakes including *Demansia fasciata*.

The avifauna comprised 19 species of non-passerines, including the Peregrine Falcon (*Falco peregrinus*) which is Declared in Need of Special Protection, and 45 species of passerines. This rich passerine assemblage contained 10 species that in the adjacent wheatbelt were restricted to natural vegetation (Kitchener *et al.*, 1982). These included the Yellow Robin (*Eopsaltria australis*), Chestnut Quail-thrush (*Cinclosoma castanotum*) and Rufous Tree-creeper (*Climacteris rufa*).

RECREATIONAL USE AND POTENTIAL

There is little recreational use of Jilbadgi Nature Reserve at present.

KEY FEATURES

- Large area incorporating vegetation and community types representative of the region.
- Declared Rare Flora and Priority Species with restricted distributions.
- Extensive sandplains supporting mallees and kwongan heaths.
- Tracts of eucalypt woodlands including mosaics on small greenstone area.
- Granite vegetation complexes on Split and Boodarding Rocks.

CTRC RECOMMENDATION

The Committee recommends that the purpose of Reserve No. 24049 be altered from Flora and Fauna to Conservation of Flora and Fauna and that it be vested in the WA Wildlife Authority, for the present it should remain C Class.

EPA RECOMMENDATION

The EPA recommends to the Department of Lands and Surveys that the purpose of Class C reserve 24049, being the Lake Barker Wildlife Sanctuary, be altered from Flora and Fauna to Conservation of Flora and Fauna and that it be vested in the WA Wildlife Authority.

PRESENT RECOMMENDATION

Jilbadgi Nature Reserve (No. 24049) should be upgraded from Class C to Class A and retain the current vesting and purpose.

1.11 BOORABBIN AREA

The Boorabbin area is the focus of three recommendations. The first concerns converting Boorabbin National Park to Boorabbin Nature Reserve. A proposed extension eastward would incorporate eucalypt woodlands of the Woolgangie area that are poorly represented in the existing reserve. The proposed Goldfields Woodlands Nature Reserve would be linked to the park by the Woolgangie extension, forming a large regional nature conservation reserve.

BOORABBIN NATIONAL PARK

Boorabbin National Park and Frank Hann National Park (Map 1) are essentially road side reserves; major roads pass through the centre of each. Their present recreational use is confined to through traffic and stop overs at granite rocks such as Lillian Stokes and Boorabbin Rocks. The limited recreational potential of Boorabbin National Park and Frank Hann National Park results in both being more appropriately classified as nature reserves for the purpose of Conservation of Flora and Fauna.

LOCATION: Boorabbin National Park is located 70km east of Southern Cross and 90km west of Coolgardie within the Coolgardie Shire. The park follows the Great Eastern Highway for 30km from the Vermin Proof Fence to the old Boorabbin townsite and for a width of approximately 5km either side of the highway.

MAP: 4.

AREA: 26,000ha, excluding Water Reserve No. 2917 (248ha).

CURRENT STATUS: Boorabbin National Park (No. 35004) is an A Class reserve vested in the NPNCA for the purpose of National Park. Boorabbin Rock occurs on an enclave Water Reserve (No. 2917) within the park boundaries.

GEOMORPHOLOGY

The majority of Boorabbin National Park is high sandplain with small areas of dissecting broad valleys intruding into the northern and south-western sections of the park. Within the broad sandplain landform unit the topography undulates markedly. An extensive salt lake system occurs to the south and east of the park. Flanking these low lying salt lakes, a broad valley runs through the park's south-eastern area. Boorabbin Rock (462m) is the largest of a small number of granite outcrops present in the park.

FLORA AND VEGETATION

Boorabbin National Park encompasses one taxa of Declared Rare Flora, *Eremophila virens*, which occurs on Boorabbin Rock. Two Priority species, *Gnephosis intonsa* and *Lepidium genistoides*, have been recorded from the Boorabbin area. The vegetation type *Eucalyptus* cf. *pileata* mallee seems restricted to the Boorabbin area (Newbey, in prep.). The plants *Banksia audax* and *B. lullfitzii*, present on sandplains in the area, have restricted or scattered distributions. *Banksia lullfitzii*, in particular, appears to be a very rare plant (S.D. Hopper, pers. comm.). The vegetation of Boorabbin National Park was surveyed during the biological survey of the Eastern Goldfields District (Newbey, in prep.). Kwongan heaths and mallee formations dominate the park with eucalypt woodlands restricted to the south-eastern section of the park.

Present on the extensive sandplain landform were *Grevillea excelsior* tall shrublands and mallee formations of *Eucalyptus leptopoda* and *E. platycorys*.

The species-rich kwongan heaths included tall shrubs of *Grevillea excelsior*, *G. hookeriana* sens. lat., *G. filifolia*, *Acacia anfractuosa*, *Allocasuarina campestris* ssp. *campestris*, *Eremaea pauciflora*, *Hakea platysperma*, *H. aff. falcata*, *Leptospermum roei*, *Micromyrtus drummondii* and *Petrophile ericifolia* var. *scabriuscula*; low shrubs of *Allocasuarina microstachya*, *Borya sphaerocephala*, *Logania nuda*,

Melaleuca aff. *leptospermoides*, *Verticordia preissii* and *V. roei* over the sedges *Lepidobolus preissianus* and *Mesomelaena preissi*.

Also present on sandplains were tall shrublands comprising *Allocasuarina acutivalvis*, *A. corniculata*, *Acacia assimilis*, *Banksia elderiana*, *Callitris preissii* ssp. *verrucosa*, *Hakea morrisonii*, *H. aff. falcata*, *Leptospermum erubescens*, *Santalum acuminatum* and *Xanthorrhoea nana* with low shrubs of *Borya sphaerocephala*, *Calothamnus gilesii*, *Grevillea filifolia*, *Isopogon* aff. *teretifolius*, *Melaleuca cordata* and *Petrophile* aff. *seminuda* over *Triodia scariosa* and the sedges *Ecdeicola monostachya* and *Lepidobolus preissianus*.

Growing with *Eucalyptus leptopoda* was the recently described mallee *E. hypochlamydea* and tall shrubs of *Acacia anfractuosa*, *A. enervia*, *Allocasuarina corniculata*, *Banksia elderiana*, *Callitris preissii* ssp. *verrucosa*, *Grevillea filifolia*, *G. apiculoba*, *G. excelsior*, *G. hookeriana* sens. lat., *Leptospermum roei* and *Santalum murrayanum*; low shrubs including the rare *Banksia lullfitzii*, *Melaleuca cordata*, *M. leptospermoides* and *M. aff. leptospermoides* with sedges of *Lepidosperma drummondii* and *Schoenus brevisetis*.

Other mallees occurring with *Eucalyptus platycorys* were *E. hypochlamydea*, *E. sheathiana* and *E. aff. transcontinentalis* over tall shrubs of *Acacia coolgardiensis*, *A. signata*, *A. beauverdiana* and *Allocasuarina acutivalvis*; and the low shrubs *Astartea heteranthera*, *Beyeria calycina* var. *minor*, *Phebalium filifolium*, *Thryptomene kochii* and *Westringia cephalantha*.

Broad valleys in the south-eastern section of the park supported low woodlands of *Eucalyptus gracilis* and *E. salubris*, woodlands of *E. salmonophloia* and mallee formations of *E. gracilis*, *E. loxophleba* and *E. cf. pileata*. Low woodlands of *E. flocktoniae* occurred over a small area in the north of the park.

Occurring in *Eucalyptus gracilis* low woodlands were shrubs of *Atriplex vesicaria* ssp. *variabilis*, *Cassia artemisioides*, *C. nemophila* var. *nemophila*, *Exocarpos aphyllus*, *Olearia muelleri* and *Rhagodia crassifolia* over the annuals *Actinobole uliginosum*, *Erodium crinitum*, *Helipterum zacchaeus*, *Menkea australis* and *Pogonolepis stricta*.

Low woodlands of *Eucalyptus salubris* consisted of the mallee *E. calycogona*, shrubs of *Acacia colletioides*, *Cassia nemophila* var. *nemophila*, *Dodonaea stenozyga*, *Eremophila ionantha*, *E. oppositifolia* var. *angustifolia*, *Exocarpos aphyllus*, *Santalum acuminatum*, *Scaevola spinescens* and *Templetonia sulcata* over the annuals *Crassula exserta*, *Helipterum hyalospermum*, *H. zacchaeus* and *Stellaria filiformis*.

Growing under trees of *Eucalyptus salmonophloia* were the shrubs *Acacia nyssophylla*, *Atriplex vesicaria* var. *variabilis*, *Cassia artemisioides*, *C.*

nemophila var. *nemophila*, *Eremophila ionantha*, *Exocarpos aphyllus*, *Olearia muelleri*, *Rhagodia crassifolia* and *Sarcozona praecox*.

Other mallees occurring with *Eucalyptus gracilis* were *E. eremophila*, *E. loxophleba*, *E. transcontinentalis*, *E. yilgarnensis* and *E. aff. pileata* over shrubs of *Acacia nyssophylla*, *Atriplex vesicaria* ssp. *variabilis*, *Daviesia benthamii* ssp. *benthamii*, *Eremophila* aff. *drummondii*, *Melaleuca eleuterostachya* and *Podolepis capillaris* with the annuals *Actinobole uliginosum* and *Trachymene cyanopetala* var. *cyanopetala*.

The understorey of *Eucalyptus loxophleba* low woodlands was dominated by *Melaleuca uncinata*. Other shrubs present were *Acacia acuminata*, *A. colletioides*, *Alyxia buxifolia*, *Dodonaea busariifolia*, *Exocarpos aphyllus*, *Santalum acuminatum* and *Westringia cephalantha*. The dense cover of annuals included *Actinobole uliginosum*, *Brachycome pusilla*, *Daucus glochidiatus*, *Helipterum demissum*, *Hydrocotyle pilifera* var. *glaberata* and *Schoenia cassiniana*.

Growing with *Eucalyptus* cf. *pileata* were the mallees *E. gracilis* and *E. loxophleba* over shrubs of *Acacia westerii*, *A. erinacea*, *A. nyssophylla*, *Alyxia buxifolia*, *Beyeria leschenaultii*, *Daviesia benthamii* ssp. *benthamii*, *Exocarpos aphyllus*, *Eremophila* aff. *drummondii* and *Santalum acuminatum* with the annuals *Helipterum hyalospermum* and *Waitzia acuminata*.

Low woodlands of *Eucalyptus flocktoniae*, present in the north-eastern section of the park, included trees of *E. salmonophloia*, mallees of *E. celastroides* ssp. *virella* and shrubs of *Acacia erinacea*, *A. merrallii*, *A. nyssophylla*, *Daviesia benthamii* ssp. *benthamii*, *Eremophila* aff. *drummondii*, *Exocarpos aphyllus*, *Melaleuca* aff. *pauperiflora*, *Scaevola spinescens* and *Templetonia sulcata*.

A small area of the salt lake chain intrudes into the extreme south-eastern corner of the park. A gentle slope to the salt lake, 6km south of Boorabbin, supported tall shrublands of *Dodonaea angustissima*. Other shrubs present were *Acacia lineolata*, *Atriplex nana*, *Exocarpos aphyllus*, *Frankenia cinerea*, *Halosarcia syncarpa*, *Lepidium genistoides*, *Lycium australe*, *Maireana oppositifolia* and *Rhagodia drummondii* over the annual *Calocephalus anginathoides* and perennial grasses of *Aristida contorta* and *Stipa eremophila*.

Occurring on peripheral dunes of 2-8m around the larger salt lakes were low woodlands of *Callitris columellaris* with shrubs of *Grevillea sarissa*, *Frankenia cinerea* and *Halosarcia syncarpa*. Low shrublands of *Halosarcia* were present on the lake floor margins and consisted of the shrubs *Disphyma crassifolium*, *Halosarcia undulata*, *H. halocnemoides* ssp. *halocnemoides*, *H. doleidormis*, *H. peltata* and *Maireana glomerfolia* over annuals of *Gunniopsis septifra*, *Cotula cotuloides*, *Hyalochlamys globifera*, *Menkea australis* and *Triglochin minutissima*.

Boorabbin Rock supported a population of Declared Rare Flora *Eremophila virens* and the orchids *Caladenia hirta*, *C. flava* ssp. "flava", *C. "dimidia"*, *C. "incensa"*, *C. radialis*, *C. roei*, *C. saccharata*, "*Cyanicula*" *deformis*, *Lyperanthus nigricans*, *Diuris* aff. *corymbosa*, *Leporella fimbriata*, *Microtis unifolia*, *Prasophyllum ringens*, *Spiculaea ciliata*, *Thelymitra* aff. *nuda* and *T. aff. pauciflora*.

A series of granite exposures south of Boorabbin were characterised by mallees of *Eucalyptus loxophleba* on the outer apron, tall shrublands of *Acacia acuminata* on the inner apron with a granite vegetation complex present on skeletal soil sheets of the rock itself.

Growing under *Eucalyptus loxophleba* mallees were shrubs of *Acacia acuminata*, *A. colletioides*, *Alyxia buxifolia*, *Cassia nemophila* ver. *nemophila*, *Eremophila granitica*, *E. ionantha* and *Scaevola spinescens* over the annuals *Asteridea athrixoides*, *Helipterum verecundum* and *H. hyalospermum*.

The understorey of *Acacia acuminata* tall shrublands consisted of the shrubs *Disphyma crassifolium*, *Hakea recurva*, *Gunniopsis glabra*, *Kunzea pulchella*, *Pittosporum phylliraeoides*, *Podolepis capillaris* and *Sarcozona praecox* with perennial grasses of *Aristida contorta*, *Eriachne ovata*, *Eragrostis dielsii*, *Stipa elegantissima* and *Tripogon loliiformis*.

The annuals recorded varied markedly for each granite surveyed (Newbey, in prep.). Present on a rock 4.5km south-southeast of Boorabbin were *Chrysocoryne pusilla*, *Calocephalus angianthoides*, *Hyalochlamys globifera*, *Chthonocephalus pseudevax*, *Erodium crinitum*, *Calandrinia polyandra*, *C. exserta*, *Crassula exserta*, *Gnephoss* aff. *pygmaea* and *Toxanthes perpusillus*.

A granite exposure 3.5km south-southeast of Boorabbin supported annuals of *Actinoble uliginosum*, *Calandrinia granulifera*, *C. porifera*, *Helipterum australe*, *Brachycome pusilla* and *Erodium crinitum*. A granite bordering onto a large salt lake supported the annuals *Angianthus tomentosus*, *Calandrinia porifera*, *Centrolepis humillima*, *Hyalochlamys globifera*, *Chrysocoryne uniflora*, *Gunniopsis intermedia*, *Nicotiana rotundifolia* and *Triglochin minutissima*.

FAUNA

The fauna of Boorabbin National Park was sampled intensively during the biological survey of the Eastern Goldfields District (McKenzie and Rolfe, in prep.). Several vegetation types on a variety of landform units were surveyed including tall shrublands of *Acacia acuminata* and *Eucalyptus loxophleba* mallee formations flanking granite exposures; *E. salmonophloia* woodlands and *E. salubris* low woodlands on broad valleys; sandplain mallee associations and heaths; and *Halosarcia* low shrublands on the margins of salt lakes.

The species list recorded at Boorabbin National Park consisted of four amphibians, 40 reptiles, nine native mammals and 50 birds. Species recorded in the park are listed in Appendix 6 (mammals) and 8 (amphibians and reptiles).

The native mammals included the Echidna (*Tachyglossus aculeatus*), one native rodent (*Pseudomys albocinereus*), the Western Grey Kangaroo (*Macropus fuliginosus*), three species of bat and three dasyurid marsupials. The dasyurid fauna was comprised of *Ningaui yvonneae* and the Fat-tailed Dunnart (*Sminthopsis crassicaudata*). An additional dunnart, from the *Sminthopsis murina* complex (most likely *S. dolichura*), has yet to be determined (D. Kitchener, pers. comm.).

The reptile assemblage recorded from the park comprised nine species of geckoes including *Diplodactylus assimilis*, *D. pulcher* and *Heteronotia binoei*; four legless lizards including *Delma australis* and *D. butleri*; nine species of dragons including *Ctenophorus isolepis citrinus* and *Tympanocryptis adelaidensis chapmani*; 13 skinks including *Ctenotus xenopleura*, which is restricted to the Eastern Goldfields District; the Bungarra, *Varanus gouldii*, and four species of snake.

The agamid assemblage of nine species, including six *Ctenophorus* dragons, was the richest recorded during the biological survey of the Eastern Goldfields District (McKenzie and Rolfe, in prep.). Eight species of amphibians and bats were recorded from granites south of Boorabbin, near Koorarwalyee (30km west of Boorabbin) and Boorabbin Rock. The four amphibians collected included three *Neobatrachus* species (*N. kunapalari*, *N. pelobatoides* and *N. sutor*) and the arid-zone *Pseudophryne occidentalis*.

The 50 species of birds recorded at Boorabbin National Park contained 12 non-passerine and 38 passerine species. The small non-passerine assemblage included two ducks, the Grey Teal (*Anas gibberifrons*) and Mountain Duck (*Tadorna tadornoides*). Of the 38 passerines, five species were identified by Kitchener *et al.* (1982) as being habitat-specific residents in a survey of the adjacent wheatbelt (Appendix 10).

HISTORY

Between 1864 and 1866 C.C. Hunt surveyed a trail from west of Southern Cross through Boorabbin to the Hampton Plains area east of Kalgoorlie. Hunt's Road, as it became known, followed a series of granite rocks roughly along the present Great Eastern Highway. Wells were established at suitable rocks to provide water for travellers and later gold prospectors (Beard, 1978; Newbey, in prep.).

RECREATIONAL USE AND POTENTIAL

Boorabbin National Park provides Eastern States' visitors with their first views of the floral wealth of the State (CTRC, 1974) with the spring wildflower displays of the kwongan sandplain heaths.

KEY FEATURES

- Kwongan sandplain heaths present along the Great Eastern Highway.
- The park encompasses the granite Boorabbin Rock and incorporates several other associated rocks.
- Declared Rare flora *Eremophila virens*, Priority species *Gnephosis intonsa* and *Lepidium genistoides*.
- The rare *Banksia lullfitzii* and restricted *B. audax*, present on sandplains.

CTRC RECOMMENDATION

The Committee recommends that a strip of country 10km wide and 30km long be reserved between Koorarawalyee and Boorabbin. The centre of the strip should be the Great Eastern Highway. The reserve should be Class A, for National Park, and be placed under the control of the National Parks Board Western of Australia.

EPA RECOMMENDATION

The EPA recommends that a strip of country 10km wide and 30km long, centred on the Great Eastern Highway between Koorarawalyee and Boorabbin, being vacant Crown land, be declared a Class A reserve for the purpose of National Park and vested in the National Parks Board.

PRESENT RECOMMENDATIONS

1. Boorabbin National Park (No. 35004) should be converted to Boorabbin Nature Reserve, a Class A reserve for the purpose of Conservation of Flora and Fauna vested in the NPNCA.
2. The Boorabbin Nature Reserve should be extended eastward to incorporate vacant Crown land east of Boorabbin townsite (15,072ha) and the Woolgangie Firewood Reserve No. 10829 (44,110ha).

PROPOSED BOORABBIN NATIONAL PARK EXTENSION

Woolgangie Timber Reserve (No. 10829), offered to the former Forests Department in 1984, forms the basis for the proposed Boorabbin National Park extension (CALM files). The CTRC Green Book, reviewing the vegetation of the Boorabbin area (11.8), noted that extensive woodlands dominate eastward of Boorabbin while tracts of sandheath were present to the west (CTRC, 1974).

A survey in 1984 by the former Forests Department highlighted several outstanding characteristics of the Woolgangie Reserve. As an excellent representative area of eucalypt sclerophyll woodland, typical of that west of Coolgardie, it was recommended as a State Forest or a Timber Reserve (CALM files, 1984). The proposed Woolgangie Forest or Timber Reserve,

while offering opportunities for interpretive facilities for inland woodlands, would have a primary objective of reservation of vegetation types. The conservation of regrowth woodlands, cut over for firewood to supply the pumping station on the Goldfields pipeline, was also a priority.

The proposed extension, encompassing the eucalypt woodlands of the Woolgangie area, would complement the kwongan sandplain heaths of Boorabbin National Park to the west. In addition, the extension forms part of a conservation corridor extending 70km along the Great Eastern Highway.

LOCATION: The proposed extension to Boorabbin National Park would extend the park 40km eastward to Finlayson Microwave Tower on the Great Eastern Highway.

MAP: 4.

AREA: Woolgangie Firewood Reserve (44,110ha) and vacant Crown land (15,072ha).

CURRENT STATUS: Woolgangie Timber (Firewood) Reserve (No. 10829) is vested in the Minister for Works for the purpose of Goldfields Water Supply and incorporates Water Reserves Nos. 2918 (404ha) and 6078 (163ha). Yerdanie Rock and Well are contained within Public Utility Reserve No. 2178 (404ha). Pumping Station No. 8 Reserve 8232 (33ha), located to the north-west of Finlayson Microwave Tower, is within Reserve No. 10829.

GEOMORPHOLOGY

In contrast to Boorabbin National Park, broad valleys dominate the proposed extension with sandplain confined to the eastern and north-western sections. The topography is generally undulating with a low-lying salt lake system occupying extensive areas in the south-western portion of the proposed extension. The proposed area also incorporates a large number of granite rocks including Wargangering Rock (399m), Woolgangie Rock (445m) and Yerdanie Rock (443m).

FLORA AND VEGETATION

Broad valleys supporting eucalypt woodlands are poorly represented in the existing Boorabbin National Park. Excellent woodlands run through the centre of the Woolgangie Reserve along either side of the Great Eastern Highway. Good communities of *Eucalyptus salmonophloia*, *E. salubris* and *E. sheathiana*, with aesthetic appeal, parallel the highway. Cut over areas of open woodlands contain excellent patches of thick eucalypt regeneration (CALM files, 1984).

A wide variety of eucalypts have been recorded within the extensive woodlands present in the Woolgangie area. The main vegetation types consists of stands of *Eucalyptus salmonophloia*, *E. salubris*, *E. sheathiana*,

and *E. loxophleba*. These are associated with *E. flocktoniae*, *E. celastroides* ssp. *celastroides*, *E. loxophleba* and *E. longicornis*.

Other eucalypts recorded include *Eucalyptus cylindrocarpa*, *E. gracilis*, *E. transcontinentalis* and *E. yilgarnensis*. Mallees present on sandplain areas were *Eucalyptus hypochlamydea*, *E. eremophila* and *E. leptopoda*.

Undulating sandplains supported low lying heaths comprised of *Allocasuarina acutivalvis*, *Acacia rossei*, *Banksia* spp., *Callitris preissii* ssp. *verrucosa* and *Hakea multilineata*. Low-lying areas are largely dominated by species of *Acacia*, such as *Acacia acuminata*, and *Eremophila* with *Santalum spicatum* and associated *Eucalyptus loxophleba*.

Sandalwood (*Santalum spicatum*) generally occurs in quantity where eucalypt woodlands and *Acacia acuminata* in low-lying country adjoins the sandplain (CALM files). Other species include good stands of *Melaleuca pauperiflora* and *Santalum acuminatum*.

Granite rock areas such as Yerdanie and Woolgangie Rocks are surrounded by patches of *Allocasuarina huegeliana*, *Acacia acuminata*, *Santalum acuminatum* and *S. spicatum*. Between the two rocks are woodlands of *Eucalyptus salubris* and *E. salmonophloia* with thickets of *E. sheathiana* and *E. loxophleba*.

Wargangering Rock, 5km south-west of Woolgangie, supports *Eucalyptus petraea*, *Acacia acuminata*, *Callistemon phoenocleios*, *Allocasuarina huegeliana*, *Kunzea pulchella*, and *Leptospermum erubescens* over the orchids *Caladenia saccharata*, *C. roei*, *Pterostylis* aff. *nana*, *P.* aff. *rufa*, *Prasophyllum ringens*, *Spiculaea ciliata*, *Thelymitra* aff. *nuda* and *T.* aff. *pauciflora*.

FAUNA

During the biological survey of the Eastern Goldfields District the fauna was sampled intensively by McKenzie and Rolfe (in prep.) at sites 30km to the west (Boorabbin National Park) and south of Woolgangie (Proposed Goldfields Woodlands Nature Reserve). Appendices 6 to 9 list the mammals, amphibians and reptile species recorded from these survey sites.

HISTORY

The Kalgoorlie-Mundaring water pipeline, completed in 1902, used wood fuel in boilers at eight pumping stations situated at intervals along the pipeline (Brennan, 1977). Pumping Station No. 8, near Finlayson Microwave Tower (88km west of Kalgoorlie), is contained within Timber Reserve No. 10829 for Goldfields Water Supply. Now powered by electricity, the station once used inland timbers from the eucalypt woodlands at a consumption rate of 10,000 tonnes annually. Woodlands were cut over in the Woolgangie area as well as south-east of Boorabbin in

the early 1900's (I. Kealley, pers. comm.). Woolgangie, on the Great Eastern Highway, was an old firewood settlement (CALM files).

RECREATIONAL USE AND POTENTIAL

Extension of Boorabbin National Park along the Great Eastern Highway, with the possible development of stop-over facilities at granite rock outcrops, would increase recreational potential for the area. Both Yerdanie Rock, a Public Utility Reserve containing Yerdanie Well, and Woolgangie, a Water Reserve with maintained dams, have considerable recreational values.

KEY FEATURES

- Eucalypt woodlands of the Woolgangie area.
- Salt lake system and a series of granite rocks (Woolgangie, Wargangering and Yerdanie Rocks).
- Recreational potential of Yerdanie and Woolgangie areas.
- Part of a conservation corridor that links Yellowdine and Boorabbin in the west with the proposed Goldfields Woodlands Nature Reserve to the south-east.

CTRC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATIONS

1. The Boorabbin National Park extension should be a Class A Nature Reserve for the Conservation of Flora and Fauna, vested in the NPNCA, and is defined as that area bounded to the: west by the eastern boundary of the existing Boorabbin National Park; north, east and south by the current boundaries of the Woolgangie Reserve No. 10829; and by 31°15' S for 16km to the south-eastern corner of Boorabbin National Park.
2. Boorabbin National Park will be linked to the Woolgangie Reserve (No. 10829) by the incorporation of 15,072ha of adjacent vacant Crown land. The proposed extension should include Reserves Nos. 2178, 2918 and 6078, contained within the boundaries of Reserve No. 10829 (44,110ha).
3. The proposed extension to Boorabbin National Park should exclude Pumping Station No. 8 (Reserve No. 8232) and several service reserves for the Great Eastern Highway and Goldfields pipeline.

GOLDFIELDS WOODLANDS NATURE RESERVE

The proposed Goldfields Woodlands Nature Reserve is one of a series of pivotal large regional conservation reserves required in the South-western Interzone. The large area proposed will incorporate representative vegetation associations, landforms and community types of the central-southern region of the Eastern Goldfields. Within the boundaries, all parts of the goldfields system, including sandplain heaths, eucalypt woodlands, granite rocks and salt lakes, are represented. The large size is consistent with the scale of the landscapes of the Eastern Goldfields District. In addition, the proposed reserve is integral in the formation of a nature

conservation corridor extending east and south-east from Boorabbin National Park.

Representation of the extensive eucalypt woodlands within the existing reserve system of the Eastern Goldfields District is clearly inadequate. At present, only small areas of these goldfields woodlands are reserved in a series of timber, sandalwood and nature reserves around Kalgoorlie and Coolgardie (Maps 4, 5, and 7). The proposed Goldfields Woodlands Nature Reserve encompasses sizable tracts of essentially unmodified eucalypt woodlands south of the Great Eastern Highway.

The proposed large area provides for both conservation and recreational opportunities. The wide range of scattered granite rocks will allow for recreation and environmental education in selected areas (see Victoria Rock Nature Reserve) while protecting the high conservation values of other areas.

LOCATION: The proposed Goldfields Woodlands Nature Reserve is a large area some 40-100km south-west of Coolgardie within the Coolgardie Shire.

MAP: 4.

AREA: 223,590ha.

CURRENT STATUS: Vacant Crown land and Victoria Rock Nature Reserve (A Class Reserve No. 8480).

GEOMORPHOLOGY

The proposed Goldfields Woodlands Nature Reserve contains representative areas of all the region's landforms, including small areas of greenstone. Encompassed within the proposed reserve are extensive areas of sandplain and broad valley surface types, a series of granite rocks and a salt lake system. Small areas of greenstone, present on the north-eastern boundary of the proposed reserve, are reserved in the Kangaroo Hills Timber Reserve. Broad valleys, along with granite rocks and salt lakes, are inadequately represented in the existing Boorabbin National Park.

Tertiary sandplain surfaces dominate the proposed Goldfields Woodlands Nature Reserve with Quaternary broad valleys dissecting the central portion and the north-east and north-west. Broad valleys, containing a chain of salt lakes south of Woolgangie, also extend south, east and west of Pidgeon Hole. The salt lakes and flanking valleys form a contiguous system with the proposed extension to Boorabbin National Park.

Granite rocks (Queen Victoria, Thursday, Diamond, Nalarine and Nargalgerrie Rocks) occur at the margins of the low lying broad valleys and higher sandplain landforms. Scattered throughout the proposed reserve are a large number of unnamed rocky outcrops. Extensive

sandplain areas extend north of Pidgeon Hole to Queen Victoria Rock and Yerdanie Rock, west of the salt lakes, north of Thursday Rock and south of Diamond Rock.

FLORA AND VEGETATION

The extensive tracts of eucalypt woodlands and the contrasting floras present on a series of granite rocks both have high conservation values. Eucalypt woodlands, poorly represented in the existing reserve system, are a reservation priority. Representative goldfields woodlands of *Eucalyptus salmonophloia*, *E. salubris*, *E. flocktoniae* and *E. transcontinentalis*, particularly in the central sections of the proposed reserve, are essentially unmodified. Surveys of the flora and surrounding vegetation of granite rocks have only been conducted at Queen Victoria Rock. However, each of the isolated granite rocks throughout the proposed area will support distinctive vegetation complexes (S.D. Hopper, pers. comm.).

Important flora collections from the proposed Goldfields Woodlands Nature Reserve include an undescribed species of *Xanthorrhoea* (D. Bedford and T. MacFarlane 73). This population, recorded from sandplains south of Queen Victoria Rock, appears to be an isolated arid zone remnant (G.J. Keighery, pers. comm.). Its closest affinity is with *Xanthorrhoea thortonii*, which has its southern limit 170km to the north.

The Declared Rare Flora *Daviesia purpurascens* has been collected on sandplain south of Gnarlbin Rock, just outside the proposed boundary. The Priority species *Gastrolobium graniticum* (formerly *Oxylobium graniticum*) is restricted to granite rocks in a confined area around Coolgardie (Sampson and Hopper, 1990). It has been recorded from Queen Victoria Rock and outside the proposed Goldfields Woodlands Nature Reserve from Gnarlbin Rock and Bullabulling (Sampson and Hopper, 1990).

The vegetation of the proposed Goldfields Woodlands Nature Reserve was sampled during the biological survey of the Eastern Goldfields District (Newbey, in prep.). Sandplains with *Allocasuarina acutivalvis*, *Callitris preissii* ssp. *verrucosa*, *Melaleuca uncinata* and *Acacia coolgardiensis* tall shrublands are dissected by broad valleys supporting low woodlands of *Eucalyptus salubris* and *E. transcontinentalis*, woodlands of *E. salmonophloia* and mallees of *E. hypochlamydea*.

The north-south trending salt lake chain, present in the north-western section, is flanked by eucalypt woodlands with a low shrubland of *Halosarcia* occurring on the salt lake floor. Shrubs recorded were *Atriplex nana*, *Disphyma crassifolium*, *Halosarcia syncarpa*, *H. undulata* and *Maireana glomerifolia*.

Growing under trees of *Eucalyptus salmonophloia* were *E. flocktoniae*, *E. loxophleba* and *E. salubris* over the shrubs *Acacia nyssophylla*, *Eremophila ionantha*, *Exocarpos aphyllus*, *Melaleuca pauperiflora*, *Olearia muelleri*,

Santalum acuminatum, *Scaevola spinescens* and *Templetonia sulcata*. A similar understorey occurred under low woodlands of *Eucalyptus salubris* with the addition of *E. gracilis* and *Eremophila scoparia*.

Low woodlands of *Eucalyptus transcontinentalis* consisted of *E. flocktoniae* with mallees of *E. yilgarnensis* over the shrubs *Beyeria calycina* var. *minor*, *Daviesia benthamii* ssp. *benthamii*, *Eremophila paisleyi*, *Grevillea oncoogyne* and *Melaleuca pauperiflora*.

Occurring on an aeolian sand sheet south of the salt lakes were mallees of *Eucalyptus hypochlamydea* over *Triodia scariosa*. Shrubs recorded included *Beyeria calycina* var. *minor*, *Callitris preissii* ssp. *verrucosa*, *Melaleuca eleuterostachya* and *Phebalium* aff. *microphyllum*.

On sandplains south of Queen Victoria Rock tall shrublands of *Callitris preissii* ssp. *verrucosa* contained mallees of *Eucalyptus hypochlamydea* and *E. leptopoda*; and the tall shrubs *Acacia signata*, *A. nigripilosa*, *Allocasuarina corniculata*, *Hakea* aff. *falcata*, *Leptomeria preissiana*, *Melaleuca cordata*, *M. scabra*, *M. uncinata*, *Phebalium filifolium*, *P.* aff. *microphyllum* and *Xanthorrhoea* sp. (D. Bedford and T. MacFarlane 73). Also recorded were low shrubs of *Astartea heteranthera*, *Micromyrtus drummondii* and *Verticordia insignis* over the perennial grass *Triodia scariosa* and sedges of *Lepidobolus preissianus*, *Lepidosperma drummondii*, *L. resinosum*, *Mesomelaena preissii*, *Schoenus brevisetis* and *S.* aff. *pleisotemoneus*.

Tall shrublands of *Melaleuca uncinata* contained the mallee *Eucalyptus uncinata* over shrubs of *Banksia elderiana*, *Callitris preissii* ssp. *verrucosa*, *Calothamnus gilesii*, *Grevillea apiculoba*, *G. filifolia*, *Melaleuca cordata*, *M. scabra*, *M. uncinata* and *Verticordia* aff. *plumosa* with the perennial grass *Triodia scariosa* and sedges of *Lepidosperma drummondii*.

Also recorded to the south of Queen Victoria Rock were *Banksia elderiana*, *Eucalyptus "livida"*, *E. "subtilis"* and the undescribed species of *Xanthorrhoea*. Other shrubs occurring with *Allocasuarina acutivalvis* were *A. corniculata*, *A. campestris* ssp. *campestris*, *Astartea heteranthera*, *Baeckea ochropetala*, *Grevillea paradoxa* and *Thryptomene kochii*.

Present on sandplains north of Queen Victoria Rock were tall shrublands of *Acacia coolgardiensis* containing the shrubs *Baeckea maidenii*, *Leptospermum roei*, *Phebalium canaliculatum*, *Prostanthera grylloana*, *Thryptomene kochii* and *Wehlia thryptomenoides*. Eucalypts recorded included *Eucalyptus gracilis*, *E. leptopoda*, *E. platycorys* and *E. rigidula*.

Woodlands and mallees north of Queen Victoria Rock contained *Eucalyptus cylindrocarpa*, *E. gracilis*, *E. eremophila*, *E.* aff. *flocktoniae* (SDH 4438), *E. pileata*, *E. sheathiana* and *E. yilgarnensis*.

FAUNA

The fauna of the proposed Goldfields Woodlands Nature Reserve was sampled intensively during the biological survey of the Eastern Goldfields District (McKenzie and Rolfe, in prep.). Vegetation types surveyed for fauna included tall shrublands of *Allocasuarina acutivalvis* and *Callitris preissii* ssp. *verrucosa* on sandplains south of Queen Victoria Rock; *Eucalyptus salmonophloia* and *E. salubris* woodlands west of Pidgeon Hole; and *Halosarcia* low shrublands in the salt lake system south of Woolgangie. Also sampled for fauna were mallee formations of *Eucalyptus hypochlamydea* and *E. transcontinentalis* low woodlands, south-west of the lakes.

The species list for the proposed reserve consists of 14 native mammals, two amphibians, 41 reptiles and 51 birds (McKenzie and Rolfe, in prep.). Species recorded during the survey are listed in Appendix 7 (mammals) and 9 (amphibians and reptiles). The record of the dragon *Ctenophorus caudicinctus* represents a southern range extension.

The native mammal fauna included four dasyurid marsupials, the Wongi Ningai (*Ningai ridei*), the Fat-tailed Dunnart (*Sminthopsis crassicaudata*), the Hairy-footed Dunnart (*S. hirtipes*) and a dunnart from the *Sminthopsis murina* complex, most likely *S. dolichura* (D. Kitchener, pers. comm.). Also recorded were three species of native rodents, Mitchell's Hopping Mouse (*Notomys mitchellii*) and the sympatric *Pseudomys hermannsburgensis* and *P. bolami*; and five species of bat.

The herpetofaunal assemblage comprised seven species of geckoes including *Crenadactylus ocellatus ocellatus*; four legless lizards; eight dragons, including *Ctenophorus caudicinctus*, *C. isolepis citrinus* and *C. reticulatus*; 15 species of skinks, including *Ctenotus pantherinus*, *Egernia carinata*, and *Lerista picturata picturata*; the monitors *Varanus gouldii* and *V. rosenbergi*; and five species of snakes.

The bird fauna recorded in the proposed Goldfields Woodlands Nature Reserve consisted of 11 non-passerine and 40 passerine species. The non-passerine assemblage, although similar in number to those found in Boorabbin National Park, contained several contrasting species. Nine of the resident passerines only recorded in natural vegetation in wheatbelt reserves to the west (Kitchener *et al.*, 1982), were present in the proposed reserve (Appendix 11). These species included the Shy Hylacola (*Sericornis cautus*), Blue-breasted Fairy-wren (*Malurus pulcherrimus*) and Rufous Tree-creeper (*Climacteris rufa*). The proposed reserve also contains excellent areas of habitat for passerines such as Gilbert's Whistler (*Pachycephala inornata*).

HISTORY

Following the discovery of gold at Coolgardie in 1892, John Holland pioneered a route from Broomehill near Katanning to Coolgardie. The northern portion of Holland's Track, from Pidgeon Hole to Queen

Victoria Rock and Coolgardie, has become a well-used graded road. The southern section, however, from Thursday Rock and Diamond Rock through to Mt Holland, has been lost (Beard, 1976).

The goldfields eucalypt woodlands have been cut over since the 1890's to provide mining timber and firewood for the goldfields and water pumping stations. Tram lines from the Goldfields Woodline reached Nargalgerrie and Queen Victoria Rocks. Woodlands surveyed by Newbey (in prep.) in the proposed Goldfields Woodlands Nature Reserve showed evidence of cutting over for mine materials.

RECREATIONAL USE AND POTENTIAL

Use of the graded Queen Victoria Rock Road through the proposed Goldfields Woodlands Nature Reserve continues to increase. Development of selected recreation areas along this route, linking Coolgardie with Hyden, are planned (see Victoria Rock Nature Reserve and the proposed McDermid Rock Nature Reserve). Tracts of relatively undisturbed eucalypt woodlands offer scenic appeal while Holland's Track, which includes the well-used section north of Pidgeon Hole and the lost southern portion, has historical significance.

KEY FEATURES

- A large area conserving community types representative of the region.
- Extensive unmodified goldfields eucalypt woodlands.
- Incorporation of long-term flora and fauna monitoring sites.
- Contrasting floras present on scattered granite rocks and unnamed rocky outcrops.
- Recreational potential along the Queen Victoria Rock Road.

CTPC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATIONS

1. The proposed Goldfields Woodlands Nature Reserve should be Class A for the Conservation of Flora and Fauna, vested in the NPNCA, and is defined as the area bounded to the: west by 120°30' for 45km; north by the Woolgangie Reserve No. 10829 for 25km, then along a line for 7.3km to 31°12'30" for 22km; east by 121°00' for 49km; and south by 31°39' for 47km.
2. The reserve should be connected to the proposed Boorabbin National Park extension to form a large goldfields regional nature conservation reserve.
3. The boundaries should incorporate the existing Victoria Rock Reserve (No. 8480) of 258ha.

VICTORIA ROCK NATURE RESERVE

LOCATION: Queen Victoria Rock, within the Victoria Rock Nature Reserve, is 48km south-west of Coolgardie in the Coolgardie Shire.

MAP: 4.

AREA: 258ha.

CURRENT STATUS: Victoria Rock Nature Reserve (No. 8480) is a Class A Reserve vested in the NPNCA for the Conservation of Flora and Fauna.

GEOMORPHOLOGY

The main feature of the reserve is the granite Queen Victoria Rock (475m) reaching 50m above the surrounding valley and covering an area of over 200ha (CALM files). The southern portions of the rock extend outside the present reserve boundaries. Surrounding the granite rock are low lying broad valleys, while an associated lower granite exposure lies 2km to the west of Queen Victoria Rock.

FLORA AND VEGETATION

Queen Victoria Rock is surrounded by open *Eucalyptus salmonophloia* woodlands, particularly to the south of the rock. Tall *Eucalyptus petraea* and *E. salmonophloia* are co-dominant on the western margins. A number of dense *Allocasuarina huegliana* woodlands are present as enclaves within Queen Victoria Rock. Fringing the rock are tall shrublands of *Acacia lasiocalyx* and *Leptospermum erubescens*.

Gastrolobium graniticum, a Priority Two species recorded from Queen Victoria Rock, is an extremely rare species presently known from less than 50 plants (Sampson and Hopper, 1990). Restricted to the Eastern Goldfields District, it is confined to granite rocks within a range of 100km near Coolgardie. As these small populations are highly susceptible to rapid extinction, *Gastrolobium graniticum* will be recommended for addition to the schedule of Declared Rare Flora (D. Coates, pers. comm.). The Priority species, *Eremophila veronica*, collected from Queen Victoria Rock, is known from only two localities. Other species recorded on and surrounding Queen Victoria Rock include *Callitris verrucosa*, *Dianella revoluta*, *Exocarpos aphyllus*, *Isotoma petraea*, *Kunzea pulchella*, *Melaleuca elliptica*, *Santalum acuminatum*, *S. spicatum* and species of *Persoonia*, *Pittosporum* and *Solanum*.

The impressive orchid flora recorded at Victoria Rock Nature Reserve comprises *Caladenia roei*, *C. saccharata*, *C. "dimidia"*, *"Cyanicula" amplexans*, *Diuris ? setacea*, *D. aff. corymbosa*, *Prasophyllum ringens*, *Pterostylis allantoidea*, *P. aff. nana*, *P. aff. rufa*, *P. aff. vittata*, *Spiculaea ciliata*, *Thelymitra antennifera*, *T. x macmillanii* and *T. aff. nuda*.

FAUNA

The fauna of the adjacent proposed Goldfields Woodlands Nature Reserve was sampled intensively during the biological survey of the Eastern Goldfields District (McKenzie and Rolfe, in prep.). These survey sites, 20-30km south and west of Queen Victoria Rock, however, did not include

any granite rocks. Appendix 7 (mammals) and 9 (amphibians and reptiles) list the species recorded from these sites.

Preliminary surveys of Victoria Rock Nature Reserve have recorded five species of small terrestrial native mammals (A. Chapman, pers. comm.). These include two dasyurid marsupials, *Ningaui yvonneae* and *Sminthopsis dolichura* and three native rodents, *Notomys mitchellii*, *Pseudomys albocinereus* and *P. bolami*. Other mammalian fauna reported from Queen Victoria Rock includes the euro (*Macropus robustus*), echidna (*Tachyglossus aculeatus*) and the bat, *Chalinolobus gouldii*.

The reptile fauna of Victoria Rock Nature Reserve includes the amphibian *Pseudophryne occidentalis*; the gecko *Gehyra variegata*; the Bungarra (*Varanus gouldii*); the dragons *Ctenophorus ornatus* and *Moloch horridus*; the skinks *Ctenotus schomburgkii*, *Cryptoblepharus plagiocephalus*, *Eremiascincus richardsonii*, *Tiliqua occipitalis* and *T. rugosa*; and the snakes *Demansia psammophis* and *Pseudechis australis* (A. Chapman, pers. comm.).

The bird list from the reserve comprises 37 passerine species and 17 non-passerines (CALM files; A. Chapman, pers. comm.). The rich passerine assemblage includes the Yellow Robin (*Eopsaltria australis*), Golden Whistler (*Pachycephala pectoralis*) and Blue-breasted Fairy-wren (*Malurus pulcherrimus*), which were only recorded in natural vegetation in the wheatbelt (Kitchener *et al.*, 1982).

HISTORY

Queen Victoria Rock, named in 1893, is linked to Holland's Track which follows a series of granite rocks some 500km to Coolgardie. John Holland pioneered the route in 1893 and may have named the rock (CALM files). During the period of the Goldfields Woodline, tram lines extended 90km from Kalgoorlie to both Queen Victoria Rock and the adjacent granite 2km to the west.

Victoria Rock Reserve was originally designated as an "Experimental Tree Plantation" in response to the timber demands of the gold mining operations of the Kangaroo Hills and Coolgardie area (CALM files). In April 1969, Victoria Rock Nature Reserve was vested in the WA Wildlife Authority for the purpose of Conservation of Flora and Fauna. The name "Victoria Rock Nature Reserve", approved by the Shire of Coolgardie and CALM, avoids confusion with Queen Victoria Spring Nature Reserve (Map Index A). In July 1989, the Class A Reserve was vested in the NPNCA, retaining the same purpose.

RECREATIONAL USE AND POTENTIAL

Queen Victoria Rock has been one of several areas in the vicinity of Kalgoorlie and Coolgardie that have received heavy local recreational use. Upgrading of the Queen Victoria Rock Road in the 1970's, along with promotion of the rock as a potential recreation area for visitors in various

tourist brochures resulted in increased use of the reserve. Recreation pressure continues to grow with the linking of the graded Hyden-Norseman and Queen Victoria Rock roads.

A recent CALM publication, "Recreation Sites of the Goldfields District", caters for both recreation and education activities at Queen Victoria Rock. Separate day-use and camping areas have been developed and information display panels will be established. An informative brochure compiled by the Goldfields Naturalists' Club is the guide for a walk trail which traverses the rock.

KEY FEATURES

- The large granite Queen Victoria Rock.
- Distinctive vegetation and flora of the rock area.
- Adjacent associated granite rock.
- Recreational use of the rock.

CTRC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATIONS

1. The existing Victoria Rock Nature Reserve should retain its current A Class, vesting and purpose.
2. The reserve should be incorporated into the proposed Goldfields Woodlands Nature Reserve (Class A).

1.12 KALGOORLIE AREA

The reserve system of the Kalgoorlie area is comprised of 10 nature reserves, four timber reserves, a single State forest and eight sandalwood reserves (Maps 4, 5, 7). Recommendations for the area detail the establishment of conservation parks at Cave Hill and Burra Rock; extension of Cardunia Rocks Nature Reserve; upgrading of existing nature reserves to Class A; and conversion of unvested sandalwood reserves to timber reserves.

PROPOSED CAVE HILL CONSERVATION PARK

Cave Hill, Burra Rock, Dordie Rock, Binaronca Rock and 25 Mile Rock are a group of small nature reserves located 70-135km south of Kalgoorlie (Map 4). All five reserves are small areas (120-1,020ha) encompassing granite rock outcrops. The three reserves along the Coolgardie-Esperance Highway are recommended for upgrading to Class A nature reserves.

Cave Hill and Burra Rock, granite rock areas that include dams and other historical features associated with the Goldfields Woodline, are both well used local recreation sites. Plans to upgrade the old Woodline track linking the two rocks will increase the recreational use of the two areas. The CALM Goldfields District has recommended that due to the difficulty

of managing Cave Hill and Burra Rock as nature reserves, they should be managed as conservation parks (Chapman *et al.*, 1989).

The appropriate category for Cave Hill and Burra Rock nature reserves would be as conservation parks, subject to legislation before Parliament during 1990. Under the proposed guidelines, relatively small areas that lack the national or international significance required for National Park status, yet still attract high levels of recreational use, would be classified as conservation parks.

The extended boundaries of the proposed Cave Hill Conservation Park would incorporate a series of associated granite outcrops. These scattered granite rocks, separated by eucalypt woodlands, each support distinctive vegetation complexes. Cave Hill is within an extensive area of vacant Crown land that has not attracted mineral exploration or grazing by stock (Newbey and McKenzie, in prep.).

LOCATION: All five granite rock areas are situated south of Kalgoorlie within the Coolgardie Shire, except for 25 Mile Rocks, which is in the Dundas Shire. Cave Hill (80km south of Coolgardie) and Burra Rock (50km south) lie within vacant Crown land to the south-west of Kalgoorlie. Dordie Rock (100km south of Kalgoorlie), Binaronca Rock (115km south), and 25 Mile Rocks (135km south) are situated alongside the Coolgardie-Esperance Highway.

MAP: 4.

AREA: Proposed Cave Hill Conservation Park: 18,496ha.
Cave Hill Nature Reserve (No. 17804): 202ha.
Burra Rock Nature Reserve (No. 7038): 809ha.
Dordie Rock Nature Reserve (No. 3211): 121ha.
Binaronca Rock Nature Reserve (No. 32552): 185ha.
25 Mile Rock Nature Reserve (No. 8029): 1,019ha.

CURRENT STATUS: Proposed Cave Hill Conservation Park (vacant Crown land); Nos. C 17804, C 7038, C 3211 and C 8029 Water and Conservation of Flora and Fauna (Minister for Water Resources); Reserve No. 32552 Conservation of Flora and Fauna (WAWA).

GEOMORPHOLOGY

Cave Hill (426m), a domed granite rock rising about 90m above the surrounding plains, is part of a granite complex that includes a large "fish hook" granite rock and several small associated outcrops. Only a portion of this complex is presently within the reserve boundaries. The proposed Cave Hill Conservation Park also incorporates several scattered granite outcrops to the north-west (436m), north-east (425m), east (410m) and south-east (372m). The intervening broad valley and sandplain surfaces are included within the extended boundaries.

Burra Rock (471m), Binaronca Rock (383m), Dordie Rock and 25 Mile Rock are granite outcrop areas flanked by broad valley and sandplain surfaces. The existing reserve boundaries exclude portions of all four granite complexes and include only small areas of the landforms surrounding the rocks. Binaronca Rock is one of a series of basic granulite outcrops of the Widgiemooltha Dyke Suite (Newbey, 1984).

FLORA AND VEGETATION

The existing Cave Hill Nature Reserve has high conservation values including *Eucalyptus "stenantha"*, a rare and poorly known granite endemic, and an outlying population of *Grevillea petrophiloides*, a species that usually occurs in the central wheatbelt (Newbey, in prep.). In addition, the granitic Cave Hill supports a wide range of plants. Over 65 species have been recorded on skeletal and shallow granitic soils on this large granite exposure (Newbey, in prep.). Only small areas of the vegetation flanking the rock, however, are contained within the present small reserve of 202ha.

The proposed Cave Hill Conservation Park would extend the current boundaries to incorporate surrounding woodland, mallee and sandplain community types. These include open woodlands of *Eucalyptus salmonophloia*; low woodlands of *E. flocktoniae*, *E. salubris* var. *glauca* and *E. salubris*; mallee associations of *E. eremophila*, *E. gracilis* and *E. loxophleba*; and *Allocasuarina corniculata* tall shrublands (Chapman *et al.*, 1989; Newbey, in prep.).

Vegetation fringing Cave Hill and adjacent rocky outcrops consists of dense thickets of *Allocasuarina huegeliana* and *Acacia acuminata* with occasional *Eucalyptus loxophleba* and *E. "stenantha"* over *Ptilotus obovatus* and *Solanum lasiopetalum*. Several major gullies drain from the rock. These drainage lines support *Eucalyptus loxophleba* with very dense thickets dominated by species of *Acacia*, *Allocasuarina* and *Eremophila*.

Transitional between the thickets flanking the rock and woodland areas were mallee formations of *Eucalyptus "livida"*. This vegetation type occurred on weathered granitic soils with numerous small breakaway outcrops. Growing with mallees of *E. "livida"* were *E. salubris* and *Acacia acuminata* with an understorey dominated by *Santalum acuminatum*.

The transition to heavier loams supporting woodlands is also marked by mallee associations of *Eucalyptus concinna*, *E. celastroides*, *E. eremophila*, *E. gracilis* and *E. loxophleba*. Occurring under the mallees were shrubs of *Acacia graffiana*, *Melaleuca pauperiflora*, and *M. uncinata* with scattered *Santalum spicatum*.

Recorded in a site flanking the south-eastern corner of the rock were mallees of *Eucalyptus loxophleba* over *Acacia acuminata*, *A. camptoclada*,

Eremophila oppositifolia, *Melaleuca acuminata*, *Olearia axillaris*, *Santalum acuminatum* and *Westringia cephalantha*.

Regrowth woodlands in the vicinity of Cave Hill included *Eucalyptus salmonophloia*, *E. flocktoniae*, *E. salubris* and *E. concinna* (Chapman *et al.*, 1989).

Open woodlands of *Eucalyptus salmonophloia* to the north-west of Cave Hill consisted of *Acacia acuminata*, *A. jennerae*, *Cassia nemophila*, *Exocarpos aphyllus*, *Maireana sedifolia*, *Olearia axillaris*, *Pittosporum phylliraeoides*, *Santalum acuminatum* and *Scaevola spinescens*.

Growing in low woodlands of *Eucalyptus flocktoniae* were scattered *E. concinna* and *E. salubris* over *Acacia merrallii*, *Alyxia buxifolia*, *Eremophila caerulea*, *E. oppositifolia*, *E. scoparia*, *Melaleuca pauperiflora* and *Maireana georgei*.

Broad valleys to the south-east of Cave Hill supported low woodlands of *Eucalyptus salubris* var. *glauca* over shrubs of *Eremophila caerulea*, *E. scoparia*, *Daviesia benthamii* ssp. *benthamii*, *Melaleuca pauperiflora* and *Scaevola spinescens*.

Present on sandplains to the north-west of Cave Hill, within the proposed boundaries, were tall shrublands of *Allocasuarina corniculata* with scattered *Eucalyptus leptopoda* over *Acacia coolgardiensis*, *A. signata*, *Baeckea maidenii*, *Beyeria lechenaultii*, *Callitris preissii* ssp. *verrucosa*, *Leptospermum roei*, *Melaleuca cordata* and *Wehlia thryptomenoides* and the perennial grass *Triodia scariosa* with sedges of *Schoenus brevisetis* and *Lepidobolus preissianus*.

Burra Rock Nature Reserve, 30km north of Cave Hill Nature Reserve, contains granite rock vegetation with fringing thickets and open mallee associations, *Eucalyptus salmonophloia* woodlands and sandplain mallee shrublands flanking the rock (Chapman *et al.*, 1989). Woodlands in the Burra Rock area were clearfelled about 60 years ago.

Surrounding the granite outcrops are thickets of *Acacia lasiocalyx* and *Allocasuarina huegeliana* that include *Acacia acuminata*, *Allocasuarina campestris* ssp. *campestris*, *Leptospermum erubescens*, *Thryptomene australis*, *Verticordia helmsii* and *Wehlia thryptomenoides*.

Mallees of *Eucalyptus loxophleba* and the poorly known granite endemic *E. "stenantha"* fringe the rock. Species recorded on Burra Rock include *Borya sphaerocephala*, *Dodonaea attenuata*, *Kunzea pulchella* and *Thryptomene australis*.

Flanking the rock are mallee formations dominated by *Eucalyptus eremophila* with shrubs of *Acacia acuminata*, *A. camptoclada*, *A. hemitels*,

A. linophylla, *A. prainii*, *Allocasuarina campestris* spp. *campestris* and *A. acutivalvis*.

Other species recorded under *E. eremophila* and several unidentified mallees include *Eremophila gilesii*, *E. ionantha*, *E. scoparia*, *Exocarpos aphyllus*, *Melaleuca lanceolatum*, *M. uncinata*, *Persoonia coriacea*, *Solanum lasiophyllum* and *Westringia cephalantha*.

Regrowth open woodlands of *Eucalyptus salmonophloia* consisted of *E. salubris* over *Acacia erinacea*, *A. tetragonophylla*, *Allocasuarina huegeliana*, *Alyxia buxifolia*, *Dodonaea lobulata*, *Eremophila glabra*, *E. oppositifolia*, *E. serrulata*, *Exocarpos aphyllus*, *Melaleuca lanceolatum*, *Olearia muelleri*, *Santalum spicatum* and *Scaevola spinescens*.

Sandplain areas in the northern portions of the reserve support mallee shrublands comprised of *Acacia acuminata*, *Allocasuarina acutivalvis*, *A. campestris* ssp. *campestris*, *Callitris columellaris*, *Dodonaea microzyga*, *Dianella revoluta*, *Melaleuca acuminatum*, *Prostanthera grylloana*, *Spartochloa scirpoidea* and *Thryptomene australis* over the perennial grass *Triodia scariosa*.

Dordie Rock Nature Reserve, 35km west of Cave Hill Nature Reserve, features small granite outcrops surrounded by regrowth eucalypt woodlands (Chapman *et al.*, 1989). Open mallee associations flank the granite rock areas while low eucalypt woodlands of mixed species occupy the northern and southern portions of the small reserve (121ha).

Fringing the rocks are mallees of *Eucalyptus griffithsii* (small fruited form) over shrubs of *Acacia acuminata*, *A. prainii* var. *linearis*, *Alyxia buxifolia*, *Beyeria lechenaultii*, *Cassia nemophila*, *Cryptandra nutans*, *Lepidosperma roei*, *Melaleuca uncinata* and *Prostanthera grylloana*.

Moving away from the outcrops, *Eucalyptus griffithsii* is replaced by mallees of *E. loxophleba* ssp. *lissophloia* along with *Acacia acuminata*, *Santalum acuminatum* and *S. spicatum* over shrubs of *Acacia prainii* var. *linearis* and *Dodonaea microzyga*.

Flanking the central granite rock vegetation types are low woodlands comprising *Eucalyptus flocktoniae*, *E. salmonophloia*, and *E. transcontinentalis*, with occasional *E. celastroides* and *E. lesouefii* over shrubs of *Acacia erinacea*, *Cassia nemophila*, *Eremophila caerulea*, *E. ionantha*, *Olearia axillaris* and *Sclerolaena drummondii*.

Common in low woodlands both north and south of the outcrop areas were pockets of *Melaleuca pauperiflora* over shrublands consisting of *Acacia hemiteles*, *A. tetragonophylla*, *Cratystylis conocephala*, *Eremophila scoparia*, *Exocarpos aphyllus*, *Santalum acuminatum* and *Scaevola spinescens*.

Binaronca Rock, 45km east of Cave Hill, rises about 30m from the surrounding plain and supports tall shrublands of *Acacia quadrimarginea* on its slopes and summit (Newbey, 1984). Mallees of *Eucalyptus oleosa* fringe the granite rock. Other shrubs recorded include *Acacia acuminata*, *Alyogyne hakeifolia*, *Beyeria lechenaultii*, *Dodonaea adenophora*, *Dampiera trigona* var. *latealata*, *Eremophila alternifolia*, *Ptilotus obovatus* var. *obovatus* and *Prostanthera wilkieana*.

FAUNA

Biological surveys to determine the conservation values of Cave Hill Nature Reserve recorded a fauna species list of five native mammals, 13 reptiles and 48 birds, comprising 19 non-passerines and 29 passerines (Chapman *et al.*, 1989). The species list included the Carpet Python (*Morelia spilota*), a snake Declared in Need of Special Protection, and the monitor *Varanus tristis*, near the southern edge of its distributional range.

Intensive fauna sampling over three different seasons as was employed during the biological survey of the Eastern Goldfields District has not been conducted at Cave Hill Nature Reserve. Native mammals recorded included the dunnart *Sminthopsis dolichura*, Western Pygmy-possum (*Cercartetus concinnus*) and echidna (*Tachyglossus aculeatus*). The macropods *Macropus fuliginosus* and *M. robustus* were sighted in regrowth woodlands near Cave Hill.

The reptile fauna comprised five geckoes, including *Crenadactylus ocellatus*, *Diplodactylus maini* and *Heteronotia binoei*; three species of dragons, including *Moloch horridus*; two skinks, *Lerista muelleri* and *Menetia greyii*; a single monitor and two species of snake, including *Pseudechis australis*.

The fauna species list from Burra Rock Nature Reserve comprised two native mammals, 11 reptiles, 41 birds (13 non-passerines and 28 passerines) and a single amphibian (Chapman *et al.*, 1989). Species recorded included *Sminthopsis dolichura*, good populations of Mitchell's Hopping Mouse (*Notomys mitchellii*), and the amphibian *Pseudophryne occidentalis*.

The reptile fauna comprised four geckoes, including *Diplodactylus assimilis* and *Underwoodisaurus milii*; four dragons, including *Ctenophorus ornatus*, *C. scutulatus* and *Pogona minor*; two skinks, including *Tiliqua occipitalis*; and the snake *Vermicella bertholdii*.

Surveys of Dordie Rock Nature Reserve revealed a fauna species list of four native mammals, 31 birds (6 non-passerines and 25 passerines) and eight reptiles. Species recorded included *Notomys mitchellii*, the Mallee Fowl (*Leipoa ocellata*), the gecko *Diplodactylus pulcher*, the skink *Egernia inornata* and the Bungarra (*Varanus gouldii*).

Passerines shared between Cave Hill and Burra and Dordie Rocks were the Crested Bellbird (*Oreocia gutturalis*) and White-eared Honeyeater (*Meliphaga leucotis*). Reptiles common to all three reserves were the geckoes *Diplodactylus maini* and *Gehyra variegata*, and the dragon *Ctenophorus cristatus*.

During a survey of reserves in the wheatbelt, Kitchener *et al.* (1982) identified habitat-specific passerines restricted to natural vegetation. Each of the three reserves surveyed in the Kalgoorlie area had five of these passerines recorded. These included the Chestnut Quail-thrush (*Cinclosoma castanotum*) at Dordie Rock and Cave Hill; Rufous Tree-creeper (*Climacteris rufa*) and Grey Shrike-thrush (*Colluricincla harmonica*) at Dordie Rock; Southern Scrub-robin (*Drymodes brunneopygius*) and Blue-breasted Fairy-wren (*Malurus pulcherrimus*) at Cave Hill and Burra Rock; and the Yellow Robin (*Eopsaltria australis*) at Burra Rock.

HISTORY

The Cave Hill and Burra Rock area were part of the historical Goldfields Woodline, with both rocks important sources of water. The large dam and catchment wall on Burra Rock and several small dams on Cave Hill were constructed to supply water for locomotives operating on the woodlines in the late 1920's. Woodlands in the area were clearfelled to supply structural timber and fuelwood for steam-driven engines for the goldmining industry. Regrowth woodlands and old Woodline camps are present throughout the area. A lease, established before Burra Rock was gazetted as a nature reserve, contains a small cleared area of 2ha in the vicinity of the rock.

RECREATIONAL USE AND POTENTIAL

Burra Rock and Cave Hill have historically been popular local recreation sites. Both rocks have dams, established during the Woodline days, that contain permanent water. The CALM publication "Recreation Sites of the Goldfields District" details recreation activities such as exploring the rocks and camping.

Within easy access from Kalgoorlie, Burra Rock is frequently used. Plans to upgrade the old Woodline track linking Burra Rock and Cave Hill will increase the pressure on both areas. Enormous educational and recreational potential exists with the establishment of a tourist loop from Kalgoorlie through Coolgardie to granite outcrops along the historical Goldfields Woodline to Widgiemooltha and the Coolgardie-Esperance Highway. Information displays and the maintenance of day use and camping areas would be required.

KEY FEATURES

- Distinctive vegetation associations of the granite Cave Hill, and Burra, Dordie, Binaronca and 25 Mile Rocks.

- High conservation values of Cave Hill, including the granite endemic *Eucalyptus "stenantha"*, outlying populations of *Grevillea petrophiloides* and the python *Morelia spilota*.
- The incorporation of the entire associated Cave Hill granite complex, scattered outcrops and intervening regrowth woodlands within the extended boundaries.
- Historical significance of Goldfields Woodline.
- Recreational use of Cave Hill and Burra Rock.
- Educational and recreational potential of linking Burra Rock and Cave Hill with Coolgardie and Kalgoorlie.

CTRC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATIONS

1. The existing Cave Hill Nature Reserve should be converted to the Cave Hill Conservation Park and vested in the NPNCA.
2. The proposed Cave Hill Conservation Park is defined as the area bounded to the: west by 121°10'E for 13km; north by 31°37'S for 14.5km; east by 121°19'E for 13km; and south by 31°44'S for 14.5km.
3. In order to meet Conservation Park guidelines and regional management requirements at Cave Hill, modification of the proposed area of 18,496ha should be examined in the forthcoming Goldfields Management Plan.
4. Nature Reserve No 7038 (Burra Rock) should be converted to the Burra Rock Conservation Park, vested in the NPNCA, retaining the present boundaries.
5. Nature Reserves Nos. 3211 (Dordie Rock) and 8029 (25 Mile Rock) should be upgraded from Class C to Class A, and the possibility of changing vesting to the NPNCA and removing Water from the purpose should be examined.
6. Nature Reserve No. 32552 (Binaronca Rock) should be upgraded from Class C to Class A, vested in the NPNCA and retain the current purpose.

PROPOSED CARDUNIA ROCKS NATURE RESERVE EXTENSION

An additional five nature reserves are scattered around Kalgoorlie: Cardunia Rock Nature Reserve (comprised of separate eastern and western reserves) to the east (Map 5); Clear and Muddy Lakes Nature Reserve encompassing Rowles Lagoon Nature Reserve to the north-west (Map 7); Kurrawang Nature Reserve to the west and Kambalda Nature Reserve to the south (Map 4).

With the exception of the small Cardunia Rocks reserves, these larger conservation reserves (621-3,680ha) incorporate representative areas of

goldfields woodlands and salt lake systems. Rowles Lagoon is a rare and important freshwater lake. Upgrading all five reserves to Class A nature reserves is recommended. Cardunia Rocks Nature Reserve consists of two small areas (29ha) encompassing granite outcrops. Proposed extensions will incorporate important populations of two restricted eucalypts.

LOCATION: Cardunia Rocks Nature Reserve, 110km east of Kalgoorlie just north of the Trans Australian Railway, and Clear and Muddy Lakes Nature Reserve with Rowles Lagoon Nature Reserve, 70km north-west of Kalgoorlie, are located within the City of Kalgoorlie-Boulder. Kurrawang Nature Reserve, situated 15km west of Kalgoorlie on the Great Eastern Highway, and Kambalda Nature Reserve, 50km south of Kalgoorlie, are within the Coolgardie Shire.

MAP: 4, 5, 7.

AREA: Proposed Cardunia Rocks Nature Reserve extension: 823ha.
[includes eastern (726ha) and western (97ha) extensions]
Cardunia Rocks Nature Reserve (No. 39148): 29ha.
[comprising Loc. 140 (west) 9ha and Loc. 141 (east) 20ha]
Clear and Muddy Lakes Nature Reserve (No. 7634): 1,926ha.
Rowles Lagoon Nature Reserve (No. 4274): 404ha.
Kurrawang Nature Reserve (No. 35453): 621ha.
Kambalda Nature Reserve (No. 33300): 3,680ha.

CURRENT STATUS: Proposed Cardunia Rocks Nature Reserve Extension (vacant Crown land); Nos. C 39148, C 35453 and C 4274 Conservation of Flora and Fauna (NPNCA); Nos. C 7634 and C 33300 Conservation of Flora and Fauna (WAWA).

GEOMORPHOLOGY

The small Cardunia Rock Nature Reserve (Map 5) is centred on a granite rock, while the three other areas encompass a variety of landforms present in the vicinity of Kalgoorlie. Only portions of the large Cardunia Rocks granite outcrop, however, are included within the existing reserve boundaries. The majority of the rock, including Cardunia Soak, separates the two halves of the reserves. Proposed extensions will incorporate additional areas of the granite rock, a lateritic breakaway system and flanking valleys.

Rowles Lagoon (Map 7), a small freshwater lake, is completely reliant on rainfall to maintain its level and freshness. The lagoon forms part of an associated chain of larger salt lakes that include Clear, Muddy and Carnage Lakes. These low lying saline areas, flanked by quartz sand dunes and sheets, are situated within alluvial deposits in old valleys. Kurrawang Nature Reserve (Map 4), on the Great Eastern Highway, has an undulating topography with areas consisting of quartz and ironstone alluvium dominating the reserve.

The large Kambalda Nature Reserve (Map 4), predominantly undulating plains, includes areas of Archaean greenstone. The topographically varied northern portion of the reserve contains undulating areas with slopes and colluvial flats, small rocky ridges and small conglomerate breakaways. The metasedimentary rocks underlying this area consist mainly of altered greywakes, sandstones and shales (Sofoulis, 1966). The less varied southern portion is dominated by low lying broad valleys.

FLORA AND VEGETATION

The Cardunia Rocks area, east of Kalgoorlie, supports populations of the restricted *Eucalyptus kruseana*, *E. "flavida"* and *E. brachyphylla*. Both *E. kruseana* and *E. brachyphylla* were included on the schedule of Declared Rare Flora for several years in the 1980's; the poorly known *E. kruseana* is still listed on CALM's Reserve Flora List as a Priority species for monitoring, while *E. brachyphylla* was taken off the schedule in 1987 as it appeared to be a hybrid

The Book-leaf Mallee (*Eucalyptus kruseana*), with a restricted distribution east and south-east of Kalgoorlie, has been recorded on Erayinia Hill and near Madoonia Downs Homestead (Napier *et al.*, 1988). Occurring in the vicinity of granite outcrops, it was removed from the Declared Rare Flora List with the reservation of a small area of its habitat at Cardunia Rocks in 1986. The largest populations of *E. kruseana*, however, are located north of the Trans Australian Railway to the east of Cardunia Soak, outside the present reserve boundaries (S.D. Hopper, pers. comm.).

Eucalyptus brachyphylla, also confined to the area between Lake Cowan and Cardunia Rocks, is believed to be a cross between the closely associated *E. kruseana* and *E. loxophleba*. It is known only from a small number of plants in the wild (Brooker and Kleinig, 1990). The undescribed *Eucalyptus "flavida"* (formerly *E. redunca* var. *oxymitra*) has a wider distribution, and is scattered from north-east of Kalgoorlie to south of Queen Victoria Spring (Napier *et al.*, 1988). The proposed extension to the eastern portion of Cardunia Rocks Nature Reserve will incorporate populations of this poorly known eucalypt.

Other eucalypts present in the vicinity of Cardunia Rocks were *Eucalyptus loxophleba* and *E. petraea* while shrubs recorded include *Acacia acuminata*, *A. tetragonophylla*, *Brachychiton gregorii* and *Pittosporum phylliraeoides* (S.D. Hopper, field notes: 1978-89).

Rowles Lagoon and three associated lakes (Clear, Muddy and Carnage) are flanked by dense stands of *Melaleuca*. The shore of the freshwater Rowles Lagoon is fringed by thickets of *Melaleuca* sp. (SDH 5889) up to 5m with *Eucalyptus cylindrocarpa*, *E. yilgarnensis* and *E. aff. cylindrocarpa* (SDH 5890). The adjacent Clear Lakes is a non-vegetated lake contiguous to Muddy Lake, which is bordered by *Eucalyptus* and *Melaleuca* associations (CALM files).

Kurrawang Nature Reserve, although only 621ha, has good representation of regrowth goldfields woodlands within its boundaries. Dominating the reserve are open woodlands of *Eucalyptus lesouefii*, *E. transcontinentalis* and *E. gracilis* with occasional *E. oleosa* that occur on the upper slopes and ridges in the central area.

Present on the mid-slopes in the eastern portion of the reserve are open woodlands consisting of *Eucalyptus griffithsii*, *E. loxophleba*, *E. lesouefii*, *E. oleosa*, and *E. transcontinentalis*. Woodlands of *E. salmonophloia* intrude into the north-western corner. A low lying area in the centre of the reserve supports a low woodland of *E. salubris*.

Shrubs recorded in the eucalypt woodlands include *Acacia erinacea*, *A. hemiteles*, *A. linophylla*, *A. tetragonophylla*, *Alyxia buxifolia*, *Atriplex nummularia*, *Cassia nemophila*, *Cratystylis subspinescens*, *Dodonaea lobulata*, *D. stenozyga*, *Grevillea nematophylla*, *G. sarissa*, *Halganina andromedifolia*, *Santalum acuminatum* and *S. spicatum*.

The shrub stratum was dominated by *Eremophila* species including *Eremophila altenifolia*, *E. glabra*, *E. ionantha*, *E. scoparia*, *E. serrulata* and *E. weldii*. Other shrubs comprising the understorey included *Atriplex vesicaria*, *Cassia artemisioides*, *Maireana georgei*, *M. pentatropis*, *M. radiata*, *M. sedifolia*, *M. tomentosa*, *Olearia muelleri*, *Ptilotus exaltatus* and *Scaevola spinescens*.

Other small areas flanking the woodlands were tall shrublands consisting of *Acacia acuminata*, *Casuarina cristata* and *Melaleuca uncinata* over *Enchyleana tomentosa* and *Ptilotus obovatus*. *Spinifex* (*Triodia scariosa*) was present throughout the reserve under woodlands of *Eucalyptus griffithsii*, *E. lesouefii* and *E. loxophleba*.

Kambalda Nature Reserve, to the west of Lake Lefroy, is dominated by low woodlands of *Eucalyptus lesouefii* and *E. salubris* in the north, and by *E. salmonophloia* woodlands in the south. *Eucalyptus stricklandii* was recorded along the Kambalda Road that runs through the south-eastern corner of the reserve (S.D. Hopper, field notes: 1978-89).

The floristics of Kambalda Nature Reserve were recorded during the biological survey of the Eastern Goldfields (Newbey and Hnatiuk, 1984). Over 90 taxa were recorded from the reserve. The shrubs noted were dominated by species of *Acacia* and *Eremophila*, including *Acacia acuminata*, *A. erinacea*, *A. hemiteles*, *A. jennerae*, *A. tetragonophylla*, *Eremophila alternifolia*, *E. decipiens*, *E. glabra*, *E. interstans*, *E. scoparia* and *E. serrulata*.

Other eucalypts recorded were *Eucalyptus griffithsii*, *E. gracilis* and *E. torquata*. Growing under low woodlands of *E. torquata* were shrubs of *Acacia resinomarginea*, *Atriplex nummularia*, *Dodonaea lobulata*,

Eremophila oppositifolia var. *angustifolia*, *Ptilotus obovatus* var. *obovatus* and *Santalum spicatum*.

FAUNA

Of the four reserves, fauna has been systematically sampled only at Kurrawang Nature Reserve (Chapman *et al.*, 1989). A bird list of 66 species has also been compiled for Rowles Lagoon Nature Reserve. A large number of waterbirds (over 30) have been recorded at Rowles Lagoon, due in part to the fact that the lagoon is freshwater. Also, the lagoon and connected lakes are fringed by dense thickets of *Melaleuca*, which provides ideal nesting habitat for waterbirds (CALM files). The Declared Rare Freckled Duck (*Stictonetta naevosa*) was reported breeding at Rowles Lagoon in 1973.

Waterfowl commonly recorded at Rowles Lagoon include the Hoary-headed Grebe (*Podiceps poliocephalus*), Black-throated Grebe (*P. novaehollandiae*), Little Black Cormorant (*Phalacrocorax sulcirostris*), Little Pied Cormorant (*P. melanoleucos*), Black Swan (*Cygnus atratus*), Mountain Duck (*Tadorna tadornoides*), Grey Teal (*Anas gibberifrons*) and Wood Duck (*Chenonetta jubata*).

Uncommon waterbirds include the Pacific Heron (*Ardea pacifica*), Great Egret (*Egretta alba*), Glossy Ibis (*Plegadis falcinellus*), Straw-necked Ibis (*Threskiornis spinicollis*), Yellow-billed Spoonbill (*Platalea flavipes*), Banded Plover (*Vanellus tricolor*), Black-fronted Plover (*Charadrius melanops*), Red-kneed Plover (*C. cinctus*), Greenshank (*Tringa nebularia*), Red-necked Stint (*Calidris ruficollis*), Red-necked Avocet (*Recurvirostra novaehollandiae*) and Black-tailed Native Hen (*Gallinula ventralis*).

The wading birds, Red-capped Plover (*Charadrius ruficapillus*) and Black-winged Stilt (*Himantopus himantopus*) are common at Rowles Lagoon while the Blue-winged Shoveler (*Anas rhynchotis*), Hardhead (*Aythya australis*), Blue-billed Duck (*Oxyura australis*), and Pink-eared Duck (*Malacorhynchus membranaceus*) are rarely sighted.

The 27 passerines recorded from Rowles Lagoon include the White-winged Fairy-wren (*Malurus leucopterus*), Grey Shrike-thrush (*Colluricincla harmonica*) and White-eared Honeyeater (*Meliphaga leucotis*), which were all identified as being restricted to natural vegetation in the wheatbelt by Kitchener *et al.* (1982).

The vertebrate fauna species list recorded at Kurrawang Nature Reserve comprises eight native mammals, 16 reptiles and 37 birds (Chapman *et al.*, 1989). The rich mammal fauna includes the Goldfields Ningau (Ningau *yvonneae*), Fat-tailed Dunnart (*Sminthopsis crassicaudata*), Mitchell's Hopping Mouse (*Notomys mitchellii*), Sandy Inland Mouse (*Pseudomys hermannsburgensis*) and the Western Pygmy-possum (*Cercartetus concinnus*).

The reptile fauna comprised seven species of gecko including *Diplodactylus assimilis* and *D. pulcher*, three dragons including *Ctenophorus fordi*, and six species of skink including *Tiliqua occipitalis* and *T. rugosa*.

The avifauna consists of 10 non-passerine species and 27 passerines. Comparisons with a bird list of 47 species compiled from Kurrawang in 1904 provides the opportunity to detect long-term changes in the area (see Chapman *et al.*, 1989). The passerine assemblage contained a number of birds restricted to natural vegetation in the wheatbelt (Kitchener *et al.*, 1982). These included the Splendid Fairy-wren (*Malurus splendens*) and Chestnut Quail-thrush (*Cinclosoma castanotum*).

RECREATIONAL USE AND POTENTIAL

Rowles Lagoon, as one of the few freshwater lakes in the Eastern Goldfields, has traditionally been a popular recreation site. Only 70km north of Coolgardie, the reserve caters for a range of activities, from day trips to extended camping with the provision of barbecues and picnic sites around the lake. The CALM publication "Recreation Sites of the Goldfields Districts" highlights the environmental significance of the area and the potential for bird watching at Rowles Lagoon.

Due to its proximity to Kalgoorlie, Kurrawang Nature Reserve has considerable potential for environmental education and interpretation (Chapman *et al.*, 1989). The historical Kurrawang Woodline and abandoned town of Kurrawang date to the early part of the century when regrowth woodlands in the area were cut over.

KEY FEATURES

- Important populations of three eucalypts with restricted distributions including *Eucalyptus kruseana* and *E. brachyphylla* at Cardunia Rocks.
- Unique freshwater Rowles Lagoon, a significant area for waterbirds that also receives heavy recreational use.
- Representative areas of goldfields woodlands in Kambalda and Kurrawang Nature Reserves.

CTRC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATIONS

1. Cardunia Rocks Nature Reserve should be upgraded to Class A, retain its current purpose and vesting, and both the existing eastern and western reserve boundaries should be extended.

2. The proposed eastern extension is defined as the area of 726ha bounded to the: west by 122°33'30"E for 3.5km; north by 30°55'S for 2km; east by 122°35'E for 3.5km along the Avoca Downs Pastoral Lease (3114/1089) boundary; and south by 30°57'S for 2km. The proposed western extension is defined as the area of 97ha bounded to the: west by 122°32'30"E (approx.) for 1km; north by 30°55'30"S for 1km along the current reserve boundary;

east by 122°33'E (approx.) for 1 km excluding the existing quarry; and south by 30°56'S (approx.) for 1km.

3. Nature Reserves Nos. 7634 (Clear and Muddy Lakes) encompassing No. 4274 (Rowles Lagoon); 35453 (Kurrawang) and 33300 (Kambalda West) should be upgraded from Class C to Class A, vested in the NPNCA and retain their present purpose.

PROPOSED AND EXISTING TIMBER RESERVES

An important part of the reserve system in the Kalgoorlie area is a series of State forests, timber and sandalwood reserves. Varying in size from 781ha to 37,061ha, they incorporate representative areas of goldfields eucalypt woodlands. Six of the reserves are grouped to the south-west of Kalgoorlie with another six scattered along the Trans Australian Railway to the south-east, while a single reserve is located north-east of Kalgoorlie. Although containing some modified community types, these reserves form a historical and integral component of the reserve system in the Eastern Goldfields District.

Karramindie Forest is a small area (781ha) vested with the Lands and Forest Commission (LFC) as State Forest No. 8. The four timber reserves (total area of 28,500ha), also vested with the LFC, have tenures similar to Class C nature reserves. Seven of the eight sandalwood reserves in the Kalgoorlie area are unvested Lands Act Reserves while one is a Lands Act Reserve vested in the Executive Director of CALM. All eight sandalwood reserves (total area of 83,000ha) are recommended for conversion to timber reserves vested with the LFC.

LOCATION: Located 25-50km to the south-west of Kalgoorlie are six reserves within the Coolgardie Shire (Map 4). Karramindie Forest, and Yallari and Scahill Sandalwood Reserves are grouped 20km south-east of Coolgardie. The Kangaroo Hills Timber Reserve complex, which includes the adjacent Calooli Sandalwood Reserve, is situated 5-20km south-west of Coolgardie along the Queen Victoria Rock Road. Kambalda Timber Reserve, adjacent to the Kambalda Nature Reserve, is 50km south of Kalgoorlie.

Six reserves within the City of Kalgoorlie-Boulder are situated along the Trans Australian Railway to the south-east of Kalgoorlie (Maps 4, 5, 7). Lakeside Sandalwood Reserve (15km from Kalgoorlie), and Majestic and Randell Timber Reserves (50 and 80km from Kalgoorlie, respectively), lie south of the Railway. Wallaby Rocks, Coonana and Emu Rocks Sandalwood Reserves are located 100-170km from Kalgoorlie to the north of the Railway. Bullock Holes Sandalwood Reserve, 40km north-east of Kalgoorlie along the Pinjin Road, is also within the City of Kalgoorlie-Boulder. (Map 7).

MAP: 4, 5, 7.

AREA: Kangaroo Hills Timber Reserve (No. 198/25): 6,600ha.
Calooli Sandalwood Reserve (No. 19211): 3,121ha.
Kambalda Timber Reserve (No. 199/25): 3,342ha.
Majestic Timber Reserve (No. 195/25): 2,226ha.
Randell Timber Reserve (No. 194/25): 16,350ha.
Karramindie Forest (S.F. No. 8): 781ha.
Lakeside Sandalwood Reserve (No. 19214): 3,787ha.
Scahill Sandalwood Reserve (No. 19621): 6,916ha.
Yallari Sandalwood Reserve (No. 19212): 6,102ha.
Wallaby Rocks Sandalwood Reserve (No. 19764): 4,556ha.
Coonana Sandalwood Reserve (No. 19640): 37,061ha.
Emu Rocks Sandalwood Reserve (No. 19645): 8,186ha.
Bullock Holes Sandalwood Reserve (No. 19825): 13,313ha.

CURRENT STATUS: Reserve Nos. 198/25, 199/25, 195/25, and 194/25 are vested with the Lands and Forest Commission (LFC) as Timber Reserves for the Conservation of Flora, Fauna and Landscape. S.F. No. 8 is vested with the LFC as a Sandalwood State Forest for the same purpose. Reserve Nos. 19211, 19621, 19212, 19764, 19640, 19645 and 19825 are unvested Lands Act Reserves for the purpose of Sandalwood Conservation. Reserve No. 19214 is a Lands Act Reserve, vested in the Executive Director of CALM, for Sandalwood Conservation.

GEOMORPHOLOGY

The 13 reserves incorporate a wide range of representative landforms from the south-west, south, north-east and west of the Kalgoorlie area, including undulating plains of greenstones, broad valleys, sandplain areas and granite outcrops. Reserves in the vicinity of Coolgardie and Kalgoorlie contain important areas of greenstone, a poorly represented landform unit in the existing reserve system.

The Kangaroo Hills and adjacent Comet Hill, south-west of Coolgardie, are comprised of Archaean greenstones such as fine- and coarse-grained amphibolites, altered dolomitic rocks, metadolomites and serpentine rocks. Small areas of these Archaean metamorphics also intrude into Scahill, Yallari and Kambalda Nature Reserves. Randell Timber Reserve, south-east of Kalgoorlie, includes metasedimentary rocks containing banded ironstone intrusions. These greenstone areas in the vicinity of Kalgoorlie are characterised by a varied topography of ridges, slopes and colluvial dips.

Flanking these undulating plains are Quaternary broad valleys comprised of alluvial deposits and sandy loam soils, usually with a calcareous subsoil. The granite outcrops of Horse Rock occur in the eastern portion of Yallari Sandalwood Reserve along with extensive Tertiary sandplains.

These two landforms, broad valleys and sandplains, dominate the reserves to the east of Kalgoorlie. Wallaby Rocks and the large Coonana

Sandalwood Reserves also incorporate extensive granite outcrop areas and lateritic breakaways.

FLORA AND VEGETATION

The State forests, timber reserves and sandalwood reserves in the Kalgoorlie area have not been systematically surveyed. During the biological survey of the Eastern Goldfields, however, sites adjacent to many of the reserves with comparable vegetation types were sampled. For reserves south-west of Kalgoorlie, see Newbey (in prep); reserves to the south and south-east, see Newbey and Hnatiuk (1984); and for reserves to the east, see Milewski and Keighery (in press).

The majority of the reserves incorporate representative areas of typical goldfields woodlands. The composition of these woodlands, which contain a diversity of eucalypts, varies considerably throughout their range. Species within these woodlands include *Eucalyptus celastroides*, *E. gracilis*, *E. griffithsii*, *E. lesouefii*, *E. longicornis*, *E. oleosa*, *E. salmonophloia*, *E. salubris*, *E. salubris* var. *glauca*, *E. transcontinentalis*, and *E. yilgarnensis*.

The majority of the reserves in the vicinity of Kalgoorlie support regrowth woodlands that were clearfelled for mining timbers and firewood in the early 1900's. Majestic and Randell Timber Reserves, however, incorporate representative areas of uncut eucalypt woodlands such as *Eucalyptus salmonophloia* open woodlands. The remote eastern sandalwood reserves (Wallaby Rocks, Coonana and Emu Rocks) contain areas representative of relatively undisturbed eastern goldfields woodlands. Reserves in the greenstone belt south of Kalgoorlie, although highly disturbed, include a wide range of eucalypt species.

The Kangaroo Hills Timber Reserve (including the adjacent Calooli Sandalwood Reserve) contains diverse mosaics of eucalypt woodlands present on greenstones throughout the reserve. Stony ridges of the Kangaroo Hills support *E. campaspe*, *E. celastroides*, *E. clelandii*, *E. calycogona*, *E. longicornis*, *E. loxophleba*, *E. oleosa* var. *obtusata*, *E. torquata*, *E. transcontinentalis* and *E. yilgarnensis*. In addition, the poorly known *Eucalyptus websteriana* has been recorded in the vicinity of Comet Hill.

Eucalypts recorded from Yallari Sandalwood Reserve include *Eucalyptus celastroides*, *E. lesouefii*, *E. longicornis*, *E. transcontinentalis*, *E. salmonophloia* and *E. yilgarnensis*. Present on hills within the reserve are low woodlands of *E. torquata*, while the granite outcrop of Horse Rocks supports the granite endemic *E. petraea* flanked by *Acacia acuminata*. Sandplains, which dominant the eastern portion of the reserve, have not been surveyed, but *Eucalyptus hypochlamydea* has been recorded just to the north-west.

The extensive Coonana Sandalwood Reserve, east of Kalgoorlie, contains representative areas of the eastern eucalypt woodlands. The poorly known

Eucalyptus woodwardii, recorded from Coonana Sandalwood Reserve and Queen Victoria Spring Nature Reserve has a very restricted distribution (Napier *et al.*, 1988). *Eucalyptus "flavida"*, *E. loxophleba* and *E. petraea* occurred on granite outcrop areas throughout the reserve while woodlands in the south-eastern corner contained *E. concinna*, *E. celastroides*, *E. "flavida"*, *E. oleosa*, *E. salmonophloia*, *E. salubris* var. *glauca* and *E. stricklandii*.

FAUNA

No systematic surveys have been conducted on the timber and sandalwood reserves in the Kalgoorlie area. The fauna, however, was sampled at sites near Black Flag and Mt Eric (Map 7) by McKenzie and Rolfe (in press) during the biological survey of the Eastern Goldfields. Other fauna comparisons are available for reserves to the south-west of Kalgoorlie (see Chapman *et al.*, 1989; McKenzie and Rolfe, in prep.); and to the east (Dell and How, 1984). A survey of Kangaroo Hills Timber Reserve planned for 1990 will include sampling of the vertebrate fauna (A. Chapman, pers. comm.).

HISTORY

Between 1925 and 1927, Assistant Forester J.H. Franks, stationed at Coolgardie, recommended that the sandalwood reserves in the Kalgoorlie area be reserved. Areas of land to be set aside for conservation of sandalwood were gazetted as unvested Lands Act Reserves in 1928 (CALM files). With a total area of over 83,000ha these reserves form a historical and important component of the reserve system in the region.

Although cut over in the early 1900's little timber cutting has occurred in the reserves since their reservation in 1928. Lakeside Sandalwood Reserve, part of the Kalgoorlie "greenbelt", containing some of the oldest regrowth woodlands in the area, was clearfelled around 1900. Lakeside, Bullock Holes and Calooli Sandalwood Reserves all contain research plots established from 1927 to measure sandalwood growth rates and effects of grazing (A. Chapman, pers. comm.). Grazing has occurred on Bullock Holes and Coonana Sandalwood Reserves, while the Kangaroo Hills area, and Yallari and Scahill Sandalwood Reserves have been affected by extensive mining exploration.

Karramindie Forest was gazetted as State Forest No. 8 in 1925, following recommendations by Forester Cusack (Kalgoorlie) in 1924 that an area of land be set aside for the purpose of establishing a sandalwood plantation (CALM files). Research plots were established for the long-term study of the growth of sandalwood. The four timber reserves in the Kalgoorlie area, with a total area over 28,000ha, were gazetted under Section 25 of the Forests Act in 1975 to protect remaining areas of uncut woodlands as well as regrowth woodlands.

RECREATIONAL USE AND POTENTIAL

Recreational use of the timber and sandalwood reserves in the Kalgoorlie area varies with their distance from population centres. The Kangaroo Hills area, near Coolgardie, a historically significant mining area containing several mines, has some tourist interest. Kambalda Timber Reserve receives recreational use from nearby Kambalda, and has potential for multiple use. Coonana Sandalwood Reserve, adjacent to the Coonana Aboriginal Community, also receives some local use. The majority of the reserves, particularly the more remote Wallaby Rocks and Emu Rocks Sandalwood Reserves, receive very little recreational use at present.

KEY FEATURES

- Reservation of representative areas of goldfields woodlands containing a diverse number of eucalypts.
- Both uncut and regrowth woodlands are reserved.
- Eucalypt woodland mosaics on greenstone within reserves south-west of Kalgoorlie.
- Important populations of restricted species, *Eucalyptus woodwardii* and *E. "flavida"* in Coonana Sandalwood Reserve.

CTR/C/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATIONS

1. Timber Reserve Nos. 198/25 (Kangaroo Hills), 199/25 (Kambalda), 195/25 (Majestic) and 194/25 (Randell), vested with the Lands and Forests Commission (LFC), should retain their current purpose of Conservation of Flora, Fauna and Landscape.
2. Sandalwood Reserve Nos. 19211 (Calooli), 19621 (Scahill), 19212 (Yallari), 19764 (Wallaby Rocks), 19640 (Coonana), 19645 (Emu Rocks) and 19825 (Bullock Holes) are recommended for upgrading from unvested Lands Act reserves to timber reserves vested with the LFC for the Conservation of Flora, Fauna and Landscape.
3. Sandalwood Reserve No. 19214 (Lakeside), currently a Lands Act Reserve vested in the Executive Director of CALM, should be vested with the LFC as a Timber Reserve for Conservation of Flora, Fauna and Landscape.
4. The adjacent Reserve Nos. 19211 and 198/25 should be joined to form the Kangaroo Hills Timber Reserve.
5. State Forest No. 8 (Karramindie) should retain its current tenure, vesting and purpose.

1.13 PROPOSED WOODLINE HILLS NATURE RESERVE

The proposed Woodline Hills Nature Reserve, on vacant Crown land south-east of Madoonia Downs Pastoral Lease, contains surface and community types not represented in nature reserves in the area. The existing conservation system consists of the large regional Dundas Nature Reserve, 30-100km to the south (Map 2); the small Binaronca and Dordie Rocks Nature Reserves, 70-80km to the west; and Kambalda Nature Reserve, 80km north (Map 4).

Given the size of Dundas Nature Reserve, boundaries of the proposed reserve have been selected to minimise the area while retaining regional representatives of essential vegetation types and landform features. The proposed area is centred on the quartzite Woodline Hills, a landform unique in the Eastern Goldfields District, which supports a distinctive vegetation complex (Newbey and Hnatiuk, 1984). The area is dominated by calcareous plains, a widespread surface type carrying eucalypt woodlands that is also present on Dundas Nature Reserve. In addition, the proposed nature reserve incorporates the vegetation associations of small salt lake systems and low granite exposures.

Long-term flora and fauna monitoring sites, established within the proposed reserve in 1979, will be increasingly valuable in measuring the changes in status of species in the region. The proposed nature reserve also incorporates evidence of the historical Goldfields Woodline with an extensive tramway system occurring throughout the area. The presence of the abandoned Woodline (that enabled cutting of the woodlands for timber until the 1950s) within the proposed reserve allows comparison of disturbed and undisturbed sites (Newbey *et al.*, 1984).

LOCATION: The Woodline Hills are located 95km south-east of Widgiemooltha and 100km north-east of Norseman, within the Dundas Shire.

MAP: 5.

AREA: 134,630ha.

CURRENT STATUS: Vacant Crown land.

GEOMORPHOLOGY

The proposed Woodline Hills Nature Reserve incorporates representative landform features of the south-eastern region of the Eastern Goldfields. Wide expanses of calcareous plains dominate the entire region. Their level surfaces appear to have resulted from transgression by the Eocene Sea (Lowry, 1970). Carboranate modules, usually present in calcareous earths, are known as kankar.

The Woodline Hills, rising 30-50m above the surrounding plains, have a high point of 406m in the north and a southern peak of 358m. The hills form a linear belt of Proterozoic quartzite, with numerous small exposures of bedrock, extending over 20km in a north-eastern direction (Newbey, 1984). The sequence, termed the Woodline Beds, refers to a mildly folded group of shallow water sediments consisting of a ripple-marked, blocky and bedded quartzites, commonly flat-lying. These overlie a thinly bedded succession of shales, locally altered to slates and phyllites (Sofoulis, 1966). Poorly preserved concentric structures of possible organic origin have been collected by Sofoulis (1966) from the quartzites in the upper part of the sequence. The Woodline Hills are thought to be Upper Proterozoic, capping Middle Proterozoic and Archaean sediments, and are a landform unique within the Eastern Goldfields District (Newbey *et al.*, 1984).

Flanking the Woodline Hills are a series of flat to low-domed exposures of granite bedrock. Granite exposures are mainly bare rock, but skeletal soil sheets accumulate in slight depressions, along faint drainage lines and on the apron (Newbey, 1984). A chain of small salt lakes flanked by extensive areas of saline flats in the southern portion of the proposed reserve represent a former drainage line (Newbey, 1984).

FLORA AND VEGETATION

The vegetation and flora of the proposed Woodline Hills Nature Reserve was sampled during the biological survey of the Eastern Goldfields District (Newbey and Hnatiuk, 1984). Important flora collections include *Brachycome billardierei*, a Priority One species on CALM's Reserve Flora List, known only from a single location; an undescribed species of *Baeckea* (KRN 7010), confined to the quartzite Woodline Hills; and *Grevillea* sp. (KRN 6905), a poorly collected species restricted to the area.

The poorly known *Eucalyptus websteriana* (Napier *et al.*, 1988) was recorded on the southern peak of the Woodline Hills, while the *E. carnei* low woodlands flanking the northern peak represents a southern range extension (Chippendale, 1973). The *Baeckea* sp. (KRN 7010) tall shrublands on the Woodline Hills is a distinctive vegetation type not recorded elsewhere during the survey of the Eastern Goldfields District (Newbey *et al.*, 1984). Many of the eucalypt woodland and low woodland sample sites surveyed within the proposed reserve have been cut-over from 1952-58 during the Woodline period (Newbey and Hnatiuk, 1984).

The southern peak of the Woodline Hills is flanked by woodlands of *Eucalyptus salmonophloia* and mixed-eucalypt low woodlands. The slopes and crest of the quartzite ridge support the distinctive vegetation type of *Baeckea* sp. (KRN 7010) tall shrubland.

Growing with *Baeckea* sp. (KRN 7010) was the mallee *Eucalyptus websteriana* and shrubs of *Acacia acuminata*, *A. quadrimarginea*, *Allocasuarina campestris* ssp. *grossa*, *A. helmsii*, *Cryptandra pungens*, *Grevillea* sp. (KRN 6905), *Melaleuca uncinata*, *M. fulgens*, *Prostanthera*

aspalathoides and *Trymalium* aff. *ledifolium* over annuals of *Drosera macrantha* ssp. *macrantha*, *Helipterum laeve*, *Senecio glossanthus*, and the sedge *Lepidosperma brunonianum*.

The lower slopes of the northern peak of Woodline Hills supported low woodlands of *Eucalyptus carnei* and tall shrublands of *Baeckea* sp. (KRN 7010) on the ridge (G.J. Keighery, field notes: 1989). Shrubs growing under *Eucalyptus carnei* included *Alyxia buxifolia*, *Dodonaea microzyga* and *Santalum acuminatum* over the sedge *Lepidosperma brunonianum*.

Emergent above shrubs of *Baeckea* sp. (KRN 7010), *Melaleuca uncinata* and *Prostanthera aspalanthoides* was the tall shrub *Acacia quadrimarginea*. Low shrubs, including *Beyeria lechenaultii*, *Dampiera trigona* and *Olearia muelleri*, grew over the sedge *Dianella revoluta*, ferns of *Cheilanthes austrotenuifolia* and *Pleurosorus rutaeifolius* with the annuals *Helipterum demissum* and *Thysanotus patersonii*.

Calcareous plains surrounding the Woodline Hills supported a variety of eucalypt woodlands that included *Eucalyptus dundasii*, *E. lesouefii*, *E. longicornis* and *E. salubris*; mallee formations of *E. cylindrocarpa* and *E. gracilis*; and woodlands of *E. salmonophloia*.

A mixed-eucalypt low woodland contained trees of *Eucalyptus campaspe*, *E. flocktoniae*, *E. fraseri*, *E. lesouefii*, *E. longicornis*, *E. salmonophloia* and *E. salubris* with the mallee *E. calycogona* over shrubs of *Beyeria lechenaultii*, *Eremophila caerulea*, *E. scoparia*, *Exocarpos aphyllus*, *Melaleuca* aff. *pauperiflora* and *Santalum acuminatum*.

Growing under *Eucalyptus dundasii* were the shrubs *Atriplex nummularia*, *A. vesicaria*, *Halgania rigida* and *Melaleuca* aff. *pauperiflora*. Shrubs occurring with *Eucalyptus lesouefii* included *Eremophila ionantha*, *E. scoparia*, *Exocarpos aphyllus*, *Geijera linearifolia*, *Melaleuca* aff. *pauperiflora*, *Olearia muelleri* and *Zygophyllum glaucum*.

Low woodlands of *Eucalyptus longicornis* had an understorey of *Cratystylis conocephala*, *Eremophila* sp. (KRN 6930), *E. scoparia*, *E. pachyphylla*, *Melaleuca* aff. *pauperiflora* and *Santalum acuminatum*. Growing under *Eucalyptus salubris* were *Atriplex vesicaria*, *Cratystylis conocephala*, *Frankenia cinerea*, *Melaleuca pauperiflora*, *M.* aff. *pauperiflora* and *Myoporum desertii*.

Also occurring with *Eucalyptus salubris* was the mallee *E. sp.* (KRN 6959), while a dense stand of immature *E. salubris* consisted of *Eremophila scoparia*, *E. veronica*, *E. ionantha* and *Melaleuca* aff. *pauperiflora*. Woodlands of *Eucalyptus salmonophloia* had an understorey comprised of *Atriplex vesicaria*, *Enchylaena tomentosa*, *Eremophila decipiens*, *Ptilotus obovatus* var. *obovatus* and *Sclerolaena diacantha*.

Mallees of *Eucalyptus cylindrocarpa* and *E. gracilis* grew over *Acacia merrallii*, *Cratystylis conocephala*, *Eremophila scoparia*, *Melaleuca pauperiflora*, *Scaevola bursariifolia* and the perennial grass *Triodia scariosa*. Occurring with *Eucalyptus gracilis* were *Bertya cupressoidea*, *Callitris preisii* ssp. *verrucosa* and *Cryptandra parvifolia*.

Granite exposures sampled to the south and east of the Woodline Hills supported *Eucalyptus grossa* and *E. loxophleba* mallee formations with tall shrublands of *Acacia* sp. (KRN 7568) and *A. acuminata* present on the outer aprons.

Shrubs growing under mallees of *Eucalyptus grossa* included *Beyeria lechenaultii*, *Dodonaea microzyga*, *Eremophila scoparia*, *Melaleuca uncinata* and *Trymalium* aff. *ledifolium*, with the annuals *Bulbine semibarbata*, *Calandrinia polyandra*, *Helipterum strictum*, *Stellaria filiformis* and *Stenopetalum filifolium*.

Mallees of *Eucalyptus loxophleba* occurred with shrubs of *Acacia acuminata*, *A. jennerae*, *Atriplex vesicaria*, *Eremophila decipiens*, *Myoporum desertii*, *Olearia revoluta*, *Pimelea microcephala*, *Pittosporum phylliraeoides* and *Rhagodia drummondii* over the annuals *Actinobole uliginosum*, *Calotis hispidula* and *Crassula exserta*.

Other shrubs growing with *Acacia* sp. (KRN 7568) were *Allocasuarina helmsii*, *Cryptandra parvifolia*, *Daviesia pachyloma*, *Melaleuca lateriflora* and *Prostanthera aspalathoides*. Tall shrublands of *Acacia acuminata* consisted of *Acacia* sp. (KRN 7568), *Allocasuarina campestris* ssp. *campestris*, *Baeckea carnosae*, *B. crispiflora*, *Grevillea* sp. (KRN 6905), *Melaleuca uncinata* and *Prostanthera aspalathoides* over *Drosera andersoniana*, and the sedge *Lepidosperma viscidum*.

A granite vegetation complex present on an exposure 5km south of the Woodline Hills consisted of *Acacia* aff. *duriuscula*, *A. acuminata*, *Dampiera trigona* var. *latealata*, *Dodonaea microzyga*, *Eremophila serrulata*, *Grevillea* sp. (KRN 6905), *Sarcozona praecox* and *Thryptomene australis* with a wide range of annuals, including *Arthropodium capillipes*, *Chthonocephalus pseudevax*, *Drosera macrantha* ssp. *macrantha*, *Gonocarpus nodulosus*, *Hydrocotyle* aff. *pilifera*, *Parietaria debilis*, *Schoenus sculptus* and *Waitzia aurea*.

Salt lakes to the south-east of the Woodline Hills were surrounded by *Halosarcia* low shrublands. Shrubs recorded included *Atriplex* sp. (KRN 6110), *Disphyma clavellatum*, *Halosarcia doleiformis*, *H. peltata*, *H. syncarpa*, *Lycium australe*, *Maireana glomerifolia* and *M. amoena*.

FAUNA

The fauna of the proposed Woodline Hills Nature Reserve was sampled intensively during the biological survey of the Eastern Goldfields District. The species list consists of three species of amphibians, 39 reptiles, 12

native mammals and 61 birds (Dell and How, 1984). Species recorded within the proposed reserve are listed in Appendix 7 (mammals) and 9 (amphibians and reptiles).

Several vegetation types on a variety of landforms were sampled systematically and opportunistically for fauna. Within the proposed reserve these included *Eucalyptus salmonophloia*, *E. longicornis* and *E. salubris* woodlands and low woodlands. Mallee formations of *Eucalyptus cylindrocarpa* and *E. gracilis* on calcareous plains, and *E. loxophleba* and *E. grossa* on granite exposures were also sampled (Dell and How, 1984).

The native mammal fauna comprises the echidna, two dasyurid marsupials, two species of macropods, a single native rodent and six species of bat. The congeneric *Sminthopsis crassicaudata* and *S. dolichura* were recorded together in mallees of *Eucalyptus cylindrocarpa* over *Triodia scariosa*, a vegetation type that also contained 19 species of reptiles.

Several species of reptiles recorded with the proposed Woodline Hills Nature Reserve were at the most inland extremes of their distribution range (Dell and How, 1984). These included the legless lizards *Delma fraseri* and *Pygopus lepidopodus*; the dragon *Tympanocryptis adelaidensis chapmani*; the skink *Egernia carinata* and Gould's snake (*Rhinoplocephalus gouldii*).

The herpetofaunal assemblage consisted of three amphibians (*Neobatrachus kunapalari*, *N. sutor* and *Pseudophryne occidentalis*) collected from granite exposures, and eight species of gecko that formed a major component of the fauna within eucalypt woodlands. Also recorded were four species of legless lizards, including *Delma fraseri* and *D. nasuta*; six dragons, including *Ctenophorus inermis* and *Tympanocryptis adelaidensis chapmani*; 16 skinks, including *Egernia carinata*, *E. multiscutata bos*, *Hemiergis millewae* and *Lerista terdigitata*; a single monitor; and four species of snake.

The 61 species of birds sighted within the proposed Woodline Hills Nature Reserve consist of 22 non-passerines and 39 passerines. Characteristic south-western species, recorded in the proposed reserve but not 100km north-east at the proposed Buningonia Spring Nature Reserve, included the Western Rosella (*Platycercus icterotis*), Brown-headed Honeyeater (*Melithreptus brevirostris*) and Red Wattlebird (*Anthochaera carunculata*). Nine species of passerines (Appendix 11), including the Blue-breasted Fairy-wren (*Malurus pulcherrimus*), were identified as habitat specific residents, recorded only in natural vegetation, during a survey of the wheatbelt (Kitchener *et al.*, 1982).

HISTORY

The proposed Woodline Hills Nature Reserve incorporates evidence of the historical Goldfields Woodlines. The Woodline Hills area forms the terminus of the Lakewood Railway line, which ran north-west past Lake

Cowan and Lake Lefroy to Kalgoorlie. Woodlands in the area were cut until the 1950's when the Woodline was replaced by road transport. See Hunter (1976) for a description of life on the Lakewood Woodline during this period.

The quartzite Woodline Hills have been a major source of freshwater for the Madoonia Downs station, and recently Western Mining have commenced a water drilling programme in the central portion of the hills (M. Cotter, pers. comm.).

RECREATIONAL USE AND POTENTIAL

Recreational and educational potential exists with the development of the "woodline story". Evidence of the historical Goldfields Woodline system occur throughout the area, with abandoned tramways and woodcutters' camps still present. The high northern peaks of the Woodline Hills offer panoramic views of the surrounding terrain.

KEY FEATURES

- The unique quartzite Woodline Hills.
- Recreational and educational potential of the historical Goldfields Woodline.
- Long-term flora and fauna monitoring sites.

CTRC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATION

The proposed Woodline Hills Nature Reserve should be Class A, for the purpose of Conservation of Flora and Fauna and vested in the NPNCA. It is defined as the area bounded to the: west by 122°17'E for 36km to include Reserve Nos. 17629 (Yardina soak) and 8847 (Moochabinia Spring); north by 31°37'S for 38km; east by 122°42'E for 36km; and south by 31°56'S for 38km. The proposed area is bounded on the west and north by the Madoonia Downs Pastoral Lease (3114/1023).

1.14 PROPOSED BUNINGONIA SPRING NATURE RESERVE

The proposed Buningonia Spring Nature Reserve straddles the CTRC System 11 and 12 boundaries (CTRC, 1974). It incorporates representative areas of unmodified vegetation patterns and community types in this transitional zone between the South-western Interzone of the mesic south-west and the arid Eremaean Botanical Province (Beard, 1980).

In addition, the proposed reserve includes the northern portions of the Fraser Range, a landform with characteristic vegetation associations not represented on existing reserves (Newbey *et al.*, 1984). The Fraser Range, primarily of basic granulite, is a landform unique to the Eastern Goldfields District. Low ridges and colluvial flats support a distinctive pattern of mallees, low woodlands, shrublands and herblands. The portion of the

range north of Symons Hill is least modified by grazing and has never been fenced (Newbey *et al.*, 1984).

The biogeographic significance of the proposed reserve reflects its position at the north-eastern margin of the South-western Interzone with many species at their eastern, southern and western distributional limits. Reptiles recorded in areas of mallee over spinifex form a south-westerly extension of the arid zone fauna. The vegetation is also part of a corridor around the north of the treeless Nullarbor Plain that provides a link with the semi-arid fauna of south-eastern Australia (Newbey *et al.*, 1984).

Long-term quadrats were established within the proposed Buningtonia Spring Nature Reserve in 1979 during the biological survey of the Eastern Goldfields District. The base-line data obtained will become increasingly useful in monitoring long-term changes to the region's flora and fauna.

The majority of the proposed area is vacant Crown land, however, a small portion incorporates Buningtonia Spring and Harris Lake on the Fraser Range Pastoral Lease (3114/1137). Although a Pastoral Lease since 1866, evidence from the survey of the Fraser Range indicates that the northern sections of the range were lightly grazed *circa* 35 years ago (Newbey and Hnatiuk, 1984). Presently, little use is made of the lease north of Symons Hill (G. Keighery, pers. comm.). A recent nickel discovery has been reported from the Buningtonia prospect of its Fraser Range project by Growth Resources (Quarterly Report, Nov. 1989).

LOCATION: Buningtonia Spring is located 190km north-east of Norseman within the Dundas Shire. Harris Lake and Spy Hill, some 30km south of the Trans Australian Railway, are in the Boulder Shire.

MAP: 5.

AREA: 79,170ha.

CURRENT STATUS: The majority of the proposed reserve is vacant Crown land, however, Buningtonia Spring lies near the north-eastern boundary of the Fraser Range Pastoral Lease (3114/1137).

GEOMORPHOLOGY

The proposed reserve is centred on the northern section of the Fraser Range, an eroded horst of Proterozoic basic granulite (Wilson, 1969). The range appears to have experienced uplift that increases from north-east to south-west. The complex bedrock has weathered at different rates and resulted in a crude well-spaced lattice of low and rounded hills (Wilson, 1969; Newbey, 1984). In the north-east, within the proposed area, the ridges are 1.5-2m high (Newbey, 1984). Spy Hill (242m), an isolated ridge 20km north-east of Buningtonia Spring, marks the northern extent of the Fraser Range. The ridges grade to 3-5m in the south-west and beyond Symons Hill (392m) the Fraser Range consists of large hills.

The Fraser Range is surrounded by calcareous plains of subdued relief. These flat plains, underlain by Archaean or Proterozoic gneisses and granites, have been eroded largely by the transgression of the Eocene sea and covered with Tertiary soils (Lowrey, 1970). These Deep Calcareous Earths appear in some areas to have been formed from fine dust blown off the Nullarbor Plain during Recent arid periods (Bowler, 1976). East of the Fraser Range is the Miocene limestone of the Nullarbor Plain (Doepel and Lowry, 1970).

Harris Lake lies in an ancient river valley, the western portion of which is now marked by Lake Lefroy (Doepel and Lowry, 1970). Remnants of this former major drainage line, now reduced to scattered strings of salt lakes and extensive areas of flats, occur to the south and east of Harris Lake. Peripheral dunes, 1-4m high, are present on the southern and western margins of the lake.

FLORA AND VEGETATION

The vegetation and flora of the proposed Buningonia Spring Nature Reserve was surveyed during the biological survey of the Eastern Goldfields District (Newbey and Hnatiuk, 1984). A number of vegetation types were sampled in the vicinity of Buningonia Spring, Harris Lake, Spy Hill and Uraryie Rock.

Included in the proposed reserve are parts of the northern section of Fraser Range, characterised by a lattice pattern of low ridges enclosing colluvial flats. The low ridges support mallees over perennial grasses of *Triodia scariosa* or *Chenopod* shrubs, or low woodlands, while the flats contain *T. scariosa* or herblands (Newbey and Hnatiuk, 1984). This northern portion of the range appears not to have been grazed for many years.

The distinctive vegetation patterns recorded on Fraser Range include *Eucalyptus griffithsii* and *E. uncinata* mallees. Growing with *E. griffithsii* were trees of *Casuarina cristata* ssp. *pauper* and shrubs of *Acacia acuminata*, *A. hemiteles*, *A. erinacea*, *Cassia nemophila* var. *nemophila*, *Eremophila paisleyi* sens. lat., *Olearia muelleri*, *O. revoluta* and *Pittosporum phylliraeoides* over *Triodia scariosa*.

Growing under mallees of *Eucalyptus uncinata* were shrubs of *Acacia acuminata*, *Cassia nemophila* var. *nemophila*, *Cratystylis conocephala*, *Dodonaea angustissima*, *D. stenozyga*, *Eremophila decipiens*, *E. dempsteri*, *Geijera linearifolia*, *Heterodendrum oleifolium*, *Lawrencia repens*, *Myoporum platycarpum*, *Pimelea microcephala*, *Pittosporum phylliraeoides*, *Ptilotus obovatus* var. *obovatus*, *Rhagodia drummondii*, *Sclerolaena diacantha*, *Solanum lasiophyllum*, *S. nummularium* and a form of *Atriplex vesicaria* over *Triodia scariosa*.

Annuals present include *Calandrinia polyandra*, *Crassula exserta*, *Brachycome iberidifolia*, *Daucus glochidiatus*, *Erodium crinitum*, *Eriochiton sclerolaenoides*, *Menkea australis*, *Senecio glossanthus*, *S. lautus* ssp. *dissectifolius*, *Stenopetalum lineare*, *Thysanotus patersonii* ssp. *patersonii*, *Tetragonia eremaea* and *Zygophyllum aurantiacum*.

Low woodlands of *Eucalyptus oleosa* and *E. salubris* were present on clacareous plains in the vicinity of Buningonia Spring. Growing under *E. oleosa* were the shrubs *Acacia hemiteles*, *Cassia nemophila* var. *nemophila*, *C. artemisiodes*, *Eremophila scoparia*, *E. decipiens*, *Exocarpus aphyllus*, *Heterodendrum oleifolium*, *Myoporum deserti*, *Maireana sedifolia*, *M. georgei*, *M. trichoptera*, *Rhagodia drummondii*, *Santalum spicatum* and *Scaevola spinescens* over the perennial grass *Stipa trichophylla*.

Occurring with *Eucalyptus salubris* were *E. oleosa* over shrubs of *Atriplex vesicaria* (a form), *Acacia nyssophylla*, *Cratystylis conocephala*, *Enchylaena tomentosa*, *Eremophila decipiens*, *E. scoparia*, *E. ionantha*, *Geijera linearifolia*, *Heterodendrum oleifolium*, *Maireana sedifolia*, *Rhagodia drummondii*, *Scaevola spinescens*, *Ptilotus holosericeus* and *Sclerolaena diacantha*.

Annuals recorded in low woodlands around Buningonia Spring include *Calotis hispidula*, *Calandrinia polyandra*, *Crassula exserta*, *Eriochiton sclerolaenoides*, *Helipterum pygmaeum*, *Isoetopsis graminifolia*, *Menkea australis*, *Tetragonia eremaea* and *Zygophyllum ovatum*.

A *Triodia scariosa* Hummock Grassland was confined to the northern third of Fraser Range. Shrubs of *Heliotropium asperrimum* over the annuals *Calandrinia polyandra*, *Calotis hispidula*, *Crassula exserta*, *Menkea australis* and *Wurmbea tenella* occurred with *Triodia scariosa*.

Surrounding a small granite exposure with an ephemeral rock pool, 12km north-west of Buningonia Spring, *Triodia scariosa* and low annuals dominated by *Tetragonia eremaea* and *Gnephosis burkittii* occurred alongside *Sclerolaena diacantha*, *Ptilotus obovatus* var. *obovatus*, *Myoporum platycarpum*, *Pittosporum phylliraeoides* and *Rhagodia drummondii*.

A salt lake ecotone present at the southern end of Harris Lake was an intricate mosaic of salt lake features supporting a number of low shrublands and a hummock grassland (Newbey, 1984). Shrubs recorded were *Cratystylis subspinescens*, *Maireana sedifolia*, *Atriplex vesicaria* (a form) on better-drained soils and *Sclerostegia disarticulata* on wetter areas grading into *Halosarcia* low shrublands on floors of salt lakes. Hummock grasslands consisted primarily of *Triodia scariosa* with a few low shrubs and annuals. Surrounding Harris Lake was a peripheral dune, 2-3m high, supporting mainly *Halosarcia indica* ssp. *bidens* and *Sclerostegia disarticulata*.

Tall shrublands of *Myoporum platycarpum*, commonly associated with large salt lake systems, were present to the south of Harris Lake. Other shrubs included *Atriplex vesicaria* (a form), *A. nummularia*, *Cratystylis subspinescens*, *Chenopodium curvispicatum*, *Dodonaea angustissima*, *Maireana pyramidata* and *Rhagodia crassifolia* over annuals of *Brachycome lineariloba*, *Calandrinia polyandra*, *Gnephosis pusilla*, *Erodium crinitum*, *Senecio lautus* ssp. *dissectifolius*, *Tetragonia eremaea* and *Triodia scariosa*.

On the floor of a small salt lake 10km north-east of Bunington Spring, a *Halosarcia* low shrubland consisted of *Halosarcia halocnemoides* ssp. *halocnemoides*, *H. doleiformis*, *H. peltata*, *Disphyma clavellatum*, *Brachycome iberidifolia*, *B. lineariloba*, *Frankenia cinerea*, *Maireana appressa*, *Sclerolaena eurotioides*, *Tetragonia eremaea*, *Triglochin centrocarpa* and *Zygophyllum compressum*.

Vegetation types recorded on substrate types present within the proposed reserve but sampled outside the boundaries include *Eucalyptus transcontinentalis* mallee and *Dodonaea lobulata* tall shrubland.

Calcareous plains, to the south-east of Bunington Spring, supported mallees of *Eucalyptus transcontinentalis* with *Acacia* aff. *eremophila*, *Daviesia benthamii* ssp. *benthamii*, *Eremophila dempsteri* and *Westringia rigida* over *Triodia scariosa*. Tall shrublands of *Dodonaea lobulata*, a rare vegetation type restricted to the north-eastern section of Fraser Range, consisted of *Acacia acuminata*, *Eremophila alternifolia*, *Maireana sedifolia* and *Myoporum platycarpum*.

FAUNA

The fauna was systematically sampled in the proposed Bunington Spring Nature Reserve during the biological survey of the Eastern Goldfields District. The species list recorded from the proposed reserve comprises 15 native mammals, a single species of amphibian, 43 reptiles and 63 birds (Dell and How, 1984). Appendix 7 (mammals) and 9 (amphibians and reptiles) lists the species recorded during the survey.

Vegetation types sampled for fauna included low woodlands of *Eucalyptus oleosa* and *E. salubris* in the vicinity of Bunington Spring and shrublands of *Halosarcia*, *Maireana sedifolia* and *Myoporum platycarpum* on the margins of Harris Lake. Within Fraser Range, mallee formations of *Eucalyptus griffithsii* and *E. uncinata* were surveyed along with hummock grasslands of *Triodia*.

The major differences in herpetofauna recorded in eucalypt woodlands and adjacent *Triodia*-dominated communities within the proposed Bunington Spring Nature Reserve reflects an important conjunction of arid and south-western faunas. A comparison of fauna lists from Queen Victoria Spring Nature Reserve, 110km to the north (Map Index A) and

the biological survey of the Nullarbor to the east also highlights the marked mixing of faunal elements in the proposed reserve (Burbidge *et al.*, 1976; Bosacci *et al.*, 1987; D. Pearson, pers. comm.)

In addition, the proposed Buningonia Spring Nature Reserve forms part of a corridor around the north of the treeless Nullarbor Plain. This corridor links the semi-arid fauna of south-eastern Australia and the South-western Interzone of Western Australia. The fact that the skink *Hemiergis millewae* and the dasyurid *Ningauia yvonneae* both occur in South Australia and western Victoria provides evidence for the link (Newbey *et al.*, 1984). The corridor is also important for birds (see below).

The fauna for the proposed Buningonia Spring Nature Reserve is notable for the many species of reptiles near the limits of their distribution. Species occurring at the most easterly inland extremes of their range were the gecko *Oedura reticulata*, the legless lizard *Delma australis*, and the skinks *Hemiergis initialis* and *Lerista terdigitata* (Dell and How, 1984). At its western limit is the gecko *Diplodactylus intermedius*, which is replaced by its congener *D. assimilis* to the north and west (Storr, *et al.*, 1990).

A group of six reptiles recorded in the Buningonia Spring area represent an arid element of the fauna which has extended southwards over the *Triodia*-dominated red sands. These are the gecko *Diplodactylus elderi*; the dragons *Ctenophorus inermis*, *C. isolepis*, *C. reticulatus* and *C. scutellatus*; and the snake *Rhinoplocephalus monachus*.

The full species list comprises the amphibian *Neobatrachus kunapalari*, nine geckoes, three legless lizards, eight dragons, seven snakes and 16 skinks. The skink assemblage includes *Ermiascincus richardsonii* and one of the only two localities in Western Australia (along with Woodline Hills 100km to the south-west) of *Hemiergis millewae*. This species was previously known only from the Eyre Peninsula in South Australia and from Western Victoria (Dell and How, 1984).

The native mammal fauna includes four species of dasyurids, three macropods (*Macropus fuliginosus*, *M. robustus* and *M. rufus*), the native rodent *Pseudomys hermannsburgensis* and seven species of bat. The proposed Buningonia Spring Nature Reserve represents one of only two localities where both *Ningauis*, *Ningauia ridei* and *N. yvonneae*, have been recorded together (the specific hummock grass habitats are circa 11km apart). The occurrence of *Sminthopsis crassicaudata* and *S. dolichura* brings the number of small dasyurids recorded within the proposed reserve to four.

The bird assemblage of the proposed Buningonia Spring Nature Reserve is comprised of 19 non-passerines and 44 passerines. As was the case with the herpetofauna, there was a mixture of south-western (Bassian) and arid (Eremaean) species. Birds with distributions centred on the south-west included the Grey-breasted White-eye (*Zosterops lateralis*), Yellow-plumed

Honeyeater (*Meliphaga ornata*) and Dusky Woodswallow (*Artamus cyanopterus*). Four arid country species were recorded in the proposed reserve (but not further south in the Woodline Hills area), the Australian Dotterel (*Peltohyas australis*), Southern Whiteface (*Aphelocephala leucopsis*), Samphire Thornbill (*Acanthiza iredalei*) and White-browed Tree-creeper (*Climacteris affinis*).

Six species of passerines (Appendix 11), including the White-winged Fairy-wren (*Malurus leucopterus*), were identified as habitat-specific residents in a survey of the wheatbelt (Kitchener *et al.*, 1982).

A number of species, recorded in eucalypt woodlands and mallee formations of south-western Australia and the Eyre Peninsula, also occurred in the corridor south of the Great Victoria Desert (Ford, 1971). Many of these species, including the Purple-crowned Lorikeet (*Glossopsitta porphyrocephala*) and Grey Currawong (*Strepera versicolor*), were recorded within the proposed reserve. This indicates the importance of the proposed Buningtonia Spring Nature Reserve, located at the eastern boundary of the South-western Interzone, in providing a range of habitats for south-western birds (Newbey *et al.*, 1984).

HISTORY

The first European exploration of the area was in 1863 by the Dempster brothers party who explored northward from the coast on to the Nullarbor Plain (Beard, 1975). Two of the Dempster brothers settled at Esperance Bay in 1866 and, exploring inland, they discovered the Fraser Range, where they established a station. The Elder Exploring Expedition of 1891, accompanied by a botanist, traversed the Great Victoria Desert and on to the Fraser Range (Beard, 1975). Other early European explorers were W.P. Goddard who travelled from Kalgoorlie to Fraser Range in 1890 and D. Lindsay who, during 1891-92, travelled from Coolgardie to Fraser Range. A well with a timbered shaft has been constructed at Buningtonia Spring (Dell and How, 1984).

RECREATIONAL USE AND POTENTIAL

Little use at present due to limited access and the Buningtonia Spring area being under Pastoral Lease. Recreational potential is not as great as would be for the higher southern hills of the Fraser Range.

KEY FEATURES

- The characteristic vegetation pattern of the unique Fraser Range.
- The long-term quadrats established during the biological survey of the Eastern Goldfields District.
- Biogeographical location in a transition zone between the south-west and arid zones.

CTRC/EPA RECOMMENDATIONS: None

PRESENT RECOMMENDATIONS

1. The proposed Buningonia Spring Nature Reserve should be an A Class reserve, vested in the NPNCA for the purpose of Conservation of Flora and Fauna, and is defined as the area bounded to the: west by 123°28'E for 30km along the eastern boundary of Coonana Station (3114/566); north by 31°14'S for 27km to include Harris Lake; east by 123°45'E for 30km to include Spy Hill; and south by 31°30'S for 27km to incorporate the long-term flora and fauna monitoring quadrats established in the vicinity of Buningonia Spring.
2. The proposed area of 79,170ha incorporates 32,905ha of land from Dundas Shire and 46,265ha from Boulder Shire. An excision of 15,678ha from Fraser Range Pastoral Lease (3114/1137) is required.

2.0 Central Goldfields

2.1 WALYAHMONING ROCK NATURE RESERVE

Walyahmoning Rock Nature Reserve is the largest of a group of three existing reserves located to the west of the Vermin Proof Fence. Close to the western boundary of CTRC System 11, the reserves incorporate representative vegetation associations present on granite outcrops, broad valleys and sandplain areas.

LOCATION: Walyahmoning Rock is situated 85km north-west of Southern Cross within the Westonia and Yilgarn Shires. The other two reserves lie between Lake Deborah West and Koolyanobbing, within the Yilgarn Shire.

MAP: 6.

AREA: Walyahmoning Rock Nature Reserve: 20,925ha.
Koolyanobbing Nature Reserve: 13,750ha
Timber Reserve (Kangaroo Rock): 8,814ha.

CURRENT STATUS: Walyahmoning Rock Nature Reserve (No. A 35752) and Koolyanobbing Nature Reserve (No. C 36918) for the Conservation of Flora and Fauna (NPNCA). Reserve No. C 30445, originally a Sandalwood Reserve known as Timber Reserve No. 62/25, is currently an unvested reserve for Timber. Water Reserve No. 1434 (Minister for Water Resources) at Cowine Soak is adjacent to the reserve.

GEOMORPHOLOGY

Walyahmoning Rock (483m), a large granite rock, and associated outcrops dominate the central portion of the reserve. Flanking the extensive granite areas are low lying broad valleys with sandplain soils of deep yellow and gravel sands, intruding into the eastern side of the reserve. The nature reserve west of Koolyanobbing contains a lateritic breakaway ridgeline that divides the area in two. North of the breakaway, sandplains dominate, while to the south broad valleys drain into Lake Deborah East. A granite outcrop area is present near the southern boundary. The timber reserve, centred on the granite Kangaroo Rock, is dominated by colluvial broad valley surfaces. The reserve boundaries include peripheral gypsiferous dunes which occur on the eastern margins of Lake Deborah West.

FLORA AND VEGETATION

The flora and vegetation of Walyahmoning Rock Nature Reserve were sampled during the biological survey of the Eastern Goldfields (Newbey and Hnatiuk, 1985). In addition, a number of surveys for rare and poorly known flora have been conducted in the reserve (CALM files).

A number of poorly known flora, endemic to granite outcrops, including eucalypts with restricted distributions and undescribed species, have been

recorded from the Walyahmoning Rock area. The Priority species *Pomaderris intangenda* is known from three disjunct populations at Walyahmoning Rock, Mt Ridley (north-east of Esperance) and Mt Walter on Jaurdi Pastoral Lease. *Lepidium genistoides*, a Priority Two species, occurs only to the south-east in the Boorabbin area, while the undescribed *Hybanthus* sp. (KRN 8668) has only been collected from three localities on breakaways in the area. Populations of the granite endemics *Eucalyptus caesia* ssp. *caesia* and *E. orbifolia* have been recorded from the rock. In addition, a poorly known undescribed species of *Baeckea* is known from just two collections, both on granite areas near Walyahmoning Rock (J. Alford, pers. comm.).

The vegetation of Walyahmoning Rock Nature Reserve is characterised by granite outcrop areas supporting distinctive complexes. These areas are fringed by tall shrublands which are comprised of numerous species. Flanking these granite exposures are eucalypt woodlands while mallee associations on sandplains are confined to the western portions of the reserve (Newbey and Hnatiuk, 1985). The reserve also lies close to the boundary of the Eremaean and South-West Botanical Provinces (CTRC 1974).

Recorded with *Eucalyptus caesia* ssp. *caesia* and *E. orbifolia* at Walyahmoning Rock were *Brachychiton gregorii* (to 15m), *Brachysema daviesioides*, *Calycopeplus helmsii*, *Codonocarpus cotinifolius*, *Dianella revoluta*, *Isotoma petraea*, *Keraudrenia integrifolia*, *Kunzea pulchella* and *Santalum acuminatum*. Orchids present on the rock are *Caladenia "incensa"*, *C. roei* and "*Cyanicula*" *deformis*.

Fringing Walyahmoning Rock are tall shrublands of *Acacia jibberdingensis* comprised of the shrubs *Acacia assimilis*, *A. lasiocalyx*, *A. neurophylla*, *A. restiacea*, *Calothamnus quadrifidus*, *Calycopeplus ephedroides*, *Grevillea paniculata*, and the Priority species *Pomaderris intangenda*.

Granite outcrops in the vicinity of Walyahmoning Rock support shrublands containing an unusually large number of tall shrubs (Newbey and Hnatiuk, 1985). Over 20 shrubs were recorded, including *Acacia acuminata*, *A. dentifera*, *A. ligulata*, *A. tetragonophylla*, *Allocasuarina campestris* ssp. *campestris*, *Alyogyne hakeifolia*, *Brachychiton gregorii*, *Calycopeplus ephedroides*, *Exocarpos sparteus*, *Leptospermum erubescens*, *Melaleuca hamulosa*, *M. macronychia*, *M. lateriflora*, *M. uncinata*, *Pittosporum phylliraeoides*, *Santalum spicatum* and *Thryptomene australis*.

Other shrubs recorded from granite exposures and surrounding areas include *Acacia prainii* var. *prainii*, *Baeckea grandibracteata*, *Dampiera spicigera*, *Grevillea integrifolia* var. *eremophila*, *Keraudrenia integrifolia*, *Kunzea pulchella*, *Melaleuca radula*, *Mirbelia microphylla*, *Phebalium canaliculatum*, *Pityrodia lepidota* and *Thryptomene kochii*.

Eucalypts recorded in woodlands flanking Walyahmoning Rock include *Eucalyptus "capillosa" ssp. "capillosa"*, *E. eremophila*, *E. salmonophloia* and *E. sheathiana*. Growing in low woodlands of *E. sheathiana* are shrubs of *Alyxia buxifolia*, *Dodonaea angustissima*, *D. bursarifolia*, *Daviesia benthamii* ssp. *benthamii*, *Grevillea huegellii*, *Melaleuca uncinata*, *Olearia revoluta*, *Westringia cephalantha* and *W. rigida*.

Sandplains in the north-eastern corner of the reserve support mallee associations of *Eucalyptus oldfieldii* and *E. hypochlamydea* with the shrubs *Acacia coolgardiensis*, *Allocasuarina corniculata*, *Baeckea carnosae*, *B. elderiana*, *B. maidenii*, *Callitris preissii* ssp. *verrucosa*, *Drummondita hassellii*, *Euphorbia calycina* var. *calycina*, *Hakea francisiana*, *Malleostemon roseus*, *Melaleuca cordata*, *M. uncinata*, *Phebalium brachycalyx* and *Thryptomene kochii*.

A lateritic breakaway runs through the centre of Koolyanobbing Nature Reserve, separating the eucalypt woodlands of the southern portion from the sandplain heaths and mallee associations in the north. Good stands of *Eucalyptus salmonophloia* woodlands occur south of the breakaway along with *Eucalyptus "capillosa" ssp. "capillosa"*, *E. longicornis*, *E. salubris* and *E. sheathiana*. An area of spinifex (*Triodia scariosa*) intrudes along the southern boundary while sandplain associations of *Acacia*, *Allocasuarina* and *Eucalyptus* mallees over heaths dominate the northern half of the reserve.

Little botanical information is available for the Timber Reserve (Kangaroo Rock), which was originally reserved for the conservation of sandalwood (*Santalum spicatum*). Broad valleys flanking the granite Kangaroo and Journalogwin Rocks support woodlands of *Eucalyptus loxophleba*, *E. longicornis*, *E. salubris*, *E. salmonophloia*, *E. sheathiana* as well as extensive stands of *Santalum spicatum*. These eucalypt woodlands extend east towards Koolyanobbing forming an unmodified vegetation corridor between the two reserves.

Cowine Soak, which lies within a reserve adjacent to the southern boundary, supports extensive woodlands of *Eucalyptus corrugata*, a poorly known and geographically restricted species (Napier *et al.*, 1988). The reserve borders the eastern margins of Lake Deborah West, which were sampled 12km to the south-west during the biological survey of the Eastern Goldfields (Newbey and Hnatiuk, 1985). Vegetation types recorded were low woodlands of *Eucalyptus salicola* on peripheral lake dunes, tall shrublands of *Acacia ligulata* around the lake margins, and *Dodonaea angustissima* tall shrublands on aeolian flats near the lake (see 1.8, Lake Baladjie).

FAUNA

The fauna has not been systematically surveyed at any of the three reserves. Opportunistic collections, however, have been made from

Walyahmoning Rock Nature Reserve. The CTRC report on the Walyahmoning Rock area (see 11.6) reported a record for a dunnart from the *Sminthopsis murina* complex (CTRC, 1974). Due to taxonomic problems, the specimen has yet to be determined (see Background section on fauna). Other mammals recorded from Walyahmoning Rock include the bats *Chalinolobus gouldii*, *Eptesicus regulus* and *Nyctophilus geoffroyi* (A. Baynes, pers. comm.).

Reptiles collected from litter in eucalypt woodlands flanking the rock include the skinks *Lerista macropisthopus*, *L. muelleri*, *Menetia greyii* and *Morethia butleri* (P. Kendrick, pers. comm.). Other reptiles recorded from Walyahmoning Rock Nature Reserve were the geckoes *Diplodactylus maini*, *Gehyra variegata* and *Heteronotia binoei*; the dragons *Ctenophorus cristatus*, *C. maculatus griseus*, *C. ornatus* and *C. scutulatus*; and Stimson's Python (*Morelia stimsoni*) (CTRC, 1974; P. Kendrick, pers. comm.).

A number of passerines with distributions centred on the south-west have been recorded in Walyahmoning Rock Nature Reserve (CTRC, 1974). These include the Grey Fantail (*Rhipidura fuliginosa*), Blue-breasted Fairy-wren (*Malurus pulcherrimus*), the Yellow-plumed and White-eared Honeyeaters (*Meliphaga ornata* and *M. leucotis*), and the Rufous Tree-creeper (*Climacteris rufa*).

RECREATIONAL USE AND POTENTIAL

There is little recreational use or potential for the three reserves due to limited access and their distance from populations centres or access to through traffic.

KEY FEATURES

- Priority species *Lepidium genistoides* and *Pomaderris intangenda* and other poorly known flora at Walyahmoning Rock.
- Distinctive vegetation complexes and associated fauna present on granite outcrops in the Walyahmoning Rock area.
- Representative areas of eucalypt woodlands present within all three reserves.
- Extensive lateritic breakaway ridge in Koolyanobbing Nature Reserve.
- The granite Kangaroo Rock and reservation of poorly represented salt lake margins within the Timber Reserve.

CTRC RECOMMENDATIONS

The Committee endorses the proposal for a reserve in the Walyahmoning Rock area and recommends that it be of Class A and vested in the West Australian Wildlife Authority.

EPA RECOMMENDATIONS

The EPA has received submissions on this area from the Shire of Westonia and has sought technical advice of the Department of Agriculture on the matters raised by the Shire, and the EPA accepts the technical advice received, and now recommends that a Class A reserve for the

Conservation of Flora and Fauna, vested in the WA Wildlife Authority with boundaries as shown in Fig. 11.5, be declared in the Walyahmoning Rock area.

PRESENT RECOMMENDATIONS

1. Walyahmoning Rock Nature Reserve (No. 35752) should retain its current A Class, vesting and purpose.
2. Koolyanobbing Nature Reserve (No. 36918) should be upgraded to Class A, vested in the NPNCA, retaining its current purpose.
3. Based on a biological assessment of Reserve No. 30445 (Kangaroo Rock), the existing unvested C Class reserve should be converted and upgraded to a Class A Nature Reserve vested in the NPNCA for the Conservation of Flora and Fauna.
4. The possibility of incorporating Water Reserve No. 1434 (Cowine Soak) into proposed Class A Reserve No. 30445 by changing the purpose to Conservation of Flora and Fauna should be examined.
5. Biological surveys should be conducted to determine the conservation values of the vacant Crown land between Reserve Nos. 36918 and 30445, and the possibility of linking the two reserves into a single Class A Nature Reserve vested in the NPNCA for the Conservation of Flora and Fauna needs to be investigated.

2.2 MT MANNING RANGE NATURE RESERVE

The CTRC Green Book (1974) for System 11 contained recommendations for Mt Jackson and Die Hardy Range (11.3), and the Mt Manning Range (11.4). Recommendation 11.3-4(1) resulted in Mt Manning Range Nature Reserve (No. 36208) being gazetted as a C Class Nature Reserve in 1979, with the exclusion of Mt Manning Range from the reserve. Recommendation 11.3-4(2), concerning the extension of the Mt Manning Range Nature Reserve to include Mt Jackson and the Die Hardy Range, was not implemented because it required the results of biological surveys.

LOCATION: The Mt Manning Range Nature Reserve encompasses land 10km west and north, 30km east and 20km south of the Mt Manning Range. The Menzies-Yilgarn Shire boundary crosses the reserve from south-east to north-west. Situated 150km north-east of Southern Cross, the Mt Manning Range is excluded from the nature reserve.

MAP: 6,10.

AREA: 153,293ha.

CURRENT STATUS: Class C Nature Reserve for the Conservation of Flora and Fauna, vested in the NPNCA.

GEOMORPHOLOGY

The predominant landscape of gently undulating laterite duricrust and elevated sandplain is interrupted by several banded ironstone systems with relief greater than the dissected surface (Chin and Smith, 1983). The Aurora Ranges (704m) and Bungalbin Hill (684m); South West Peak (647m) in the Mt Manning Range; the Die Hardy Range (643m), Yokradine Hills (629m) and Mt Jackson (615m) are the prominent high points in the region.

The bedrock of Archaean granites or gneisses underlying the Mt Manning Range area occurs as metamorphosed sediments in linear belts of two distinct types. Banded ironstone formations consist of more weather resistant iron oxides and quartz sands and usually occur as low ridges, hills or ranges. Greenstone consists of volcanic material less weather resistant than banded ironstone, causing the distinctive undulating plains (Newbey, 1985).

The topography of the lateritic duricrusted surface developed during the higher rainfall climate of the Early Tertiary, when it was dissected by sparse drainage lines (Chin and Smith, 1983). A major palaeodrainage watershed, separating the north-eastward Raeside system from the westward Avon network, occurs in the Mt Manning Range area. Under the succeeding dry climate the broad and shallow valleys became choked with colluvial, alluvial and aeolian deposits. In places strings of shallow salt lakes have replaced the drainage channels.

Low, flat outcrops of granite, weathered to expose the granite bedrock or intrusion with a surrounding apron of granitic soils, are common where the duricrust has been removed. Semi-permanent rock holes and gnamma holes (Pigeon Rock, Pittosporum Rock, Kurrajong Rockhole and Bulgine Rockhole) are rare. Granite exposures within the reserve, such as Wagling and Dooling Soaks, usually contain small depressions that hold up to 50cm of water following rain.

FLORA AND VEGETATION

A Priority species from CALM's Reserve Flora List, *Eucalyptus formanii* is endemic to the Mt Manning Range area and occurs in a restricted area west from the Mt Manning Range to the Die Hardy Range. *Grevillea georgeana*, a Priority Three species, has only been recorded from three localities while the shrub *Calycophyllum ephedroides* and perennial grass *Plectrachne* sp. (KRN 5925), both geographically restricted species, occur in the vicinity of the Mt Manning Range. With the exclusion of the range, these important species are not found within the nature reserve.

Dryandra arborea has its most inland record on the banded ironstone Mt Manning Range. The most inland member of this endemic south-western Australian genus, it has a restricted geographical distribution occurring in

the Koolyanobbing and Aurora Ranges to the south, Die Hardy Range to the west, and on Mt Dimer to the south-east.

Vegetation types were identified for all six landform units present in the Mt Manning Range Nature Reserve (Milewski and Hnatiuk, in prep.). Associated with the banded ironstone Mt Manning Range are *Acacia aneura* tall shrublands on the rocky slopes and crest; *Dryandra arborea* tall shrublands on the ridge crest; and *Eucalyptus ebbanoensis* low woodlands on the lower slopes.

Other tall shrubs growing with *Acacia aneura* are *Acacia tetragonophylla*, *A. quadrimarginea*, *Allocasuarina acutivalvis*, *Grevillea obliquistigma*, *G. georgeana*, *Melaleuca filifolia* and *Santalum spicatum*; low shrubs of *Baeckea elderiana*, *Calycopeplus ephedroides*, *Eremophila latrobei*, *Eriostemon brucei*, *Grevillea paradoxa* and *Scaevola spinescens*; the annuals *Cheilanthes sieberi*, *Trachymene ornata*, *Waitzia acuminata* and *W. citrina*; and the perennial grass *Plectrachne* sp. (KRN 5925).

Occupying lateritic patches on the ridge crest are tall shrublands of *Dryandra arborea* with *Acacia aneura*, *A. quadrimarginea*, *Allocasuarina acutivalvis*, *Calycopeplus ephedroides*, *Grevillea acuaria* and *G. obliquistigma*; low shrubs of *Alyxia buxifolia*, *Eriostemon brucei* and *Eremophila latrobei*; the annuals *Helipterum pygmaeum*, *H. oppositifolium*, *Stenopetalum filifolium*, *Trachymene ornata* and *Waitzia acuminata*; and the perennial grass *Plectrachne* sp. Other annuals or ephemerals, present in small populations of interesting composition, on the Mt Manning Range ridge-top include *Bellida graminea*, *Chthonocephalus pseudevax*, *Crassula sieberi*, *Helichrysum davenportii*, *Helipterum verecundum* and *Stenopetalum filifolium*.

Growing under *Eucalyptus ebbanoensis* low woodlands are *Acacia aneura* and *Brachychiton gregorii*; tall shrubs of *Acacia ramulosa*, *A. tetragonophylla*, *Eremophila oppositifolia* and *Santalum spicatum*; low shrubs of *Cassia artemisioides*, *C. nemophila*, *Eremophila latrobei*, *Olearia muelleri* and *Westringia cephalantha*; the annuals *Brunonia australis*, *Helipterum verecundum*, *Thysanotus patersonii*, *Trachymene ornata*, *Velleia rosea* and *Waitzia acuminata*; and the perennial grass *Plectrachne* sp.

Undulating plains of gently sloping ground at the base of the Mt Manning Range have *Casuarina cristata* low woodlands on the rises, *Acacia aneura* low woodlands on the colluvial slopes and *Eucalyptus salubris* low woodlands in the dips.

Growing with *Casuarina cristata* low woodlands is the mallee *Eucalyptus ebbanoensis*; tall shrubs of *Acacia tetragonophylla*, *Alyxia buxifolia*, *Cassia nemophila*, *Dodonaea lobulata*, *Eremophila alternifolia*, *E. decipiens*, *E. oldfieldii* ssp. *angustifolia* and *Santalum spicatum*; low shrubs of *Acacia erinacea* and *Ptilotus obovatus*; the annuals *Gnephosis skirrophora*,

Helipterum fitzgibbonii, *H. oppositifolium*, *Stenopetalum filifolium* and *Stipa trichophylla*; and the perennial grasses *Plectrachne* sp. and *Stipa elegantissima*.

Under *Eucalyptus salubris* low woodlands is a sparse tall shrub strata of *Acacia* and *Eremophila*; low shrubs of *Atriplex vescaria* and *Ptilotus obovatus*; the annuals *Calandrinia eremaea*, *Cephalipterum drummondii*, *Erodium crinitum*, *Helipterum strictum*, *H. tenellum*, *Ptilotus exaltatus* and *Sclerolaena dicantha*.

Occurring with *Acacia aneura* low woodlands are the trees *Eucalyptus ebbanoensis* and *Brachychiton gregorii*; tall shrubs of *Acacia ramulosa*, *Cassia nemophila*, *Eremophila latrobei* and *E. oppositifolia*; and a varied ephemeral cover including *Actinobole uliginosum*, *Bellida graminea*, *Chrysocoryne pusilla*, *Daucus glochidiatus*, *Helipterum verecundum*, *Podolepis canescens*, *P. lessonii* and *Velleia rosea*.

Eucalyptus formanii low woodlands, on broad valleys, have a fairly complex composition. Other trees occurring with *Eucalyptus formanii* are *E. concinna*, *E. ebbanoensis*, *E. aff. lesouefii*, *E. aff. oleosa*, *E. transcontinentalis* and *Callitris columellaris*; tall shrubs of *Acacia ramulosa*, *A. burkittii*, *A. colletiodes*, *A. tetragonophylla*, *Bossiaea walkeri*, *Eremophila scoparia*, *Exocarpos aphyllus*, *Grevillea acuaria* and *G. obliquistigma*; over 25 species of low shrubs including *Phebalium filifolia* and *Westringia cephalantha*; and the hummock grass *Plectrachne rigidissima*.

Granite exposures, on the plains surrounding the Mt Manning Range, generally consist of nearly level aprons with a complex vegetation distinguished by several types. *Casuarina cristata* low woodlands occupy stony rises on extensive granite exposures; *Acacia aneura* tall shrublands occur on low lying saline flats; *A. tetragonophylla* and *A. burkittii* tall shrublands occupy aprons of nearly flat granite exposures; and *Eucalyptus ewartiana* and *E. loxophleba* occur at the transition from granite exposures to broad valleys.

Acacia quadrimarginea tall shrublands on granite exposures consist of a wide variety of tall shrubs including *Acacia burkitti*, *A. tetragonophylla*, *A. ramulosa*, *Pittosporum phylliraeoides* and *Santalum spicatum*; and annuals of *Cephalipterum drummondii*, *Helichrysum davenportii*, *Podolepis canescens*, *P. lessonii*, *Schoenia cassiniana*, *Stenopetalum filifolium* and *Velleia rosea*.

Vegetation complexes occupy expanses of the bare granite rocks. Dooling Soak, south of Mt Manning Range, has a dense and seasonal cover of ephemerals including *Actinobole uliginosum*, *Angianthus burkittii*, *Aristida contorta*, *Chrysocoryne pusilla*, *Chthonocephalus pseudevax*, *Gnephosis aff. pygmaea*, *Helipterum australe*, *H. verecundum*, *Isoetopsis*

graminifolia, *Podolepis canescens*, *Toxanthes perpusillus* and *Tripogon loliiformis*.

On sandplains to the west of the Mt Manning Range mallee associations of *Eucalyptus leptopoda* occur with *Acacia resinomarginea*; tall shrubs of *Eucalyptus rigidula* and *Leptospermum roei*; low shrubs of *Baeckea muricata*, *Phebalium canaliculatum* and *Thryptomene urceolaris*; the perennial grasses *Plectrachne rigidissima* and *Triodia scariosa*. Other dominant sandplains species include *Allocasuarina acutivalvis*, *Callitris preissii* ssp. *verrucosa* and *Melaleuca unicata*.

As with granite exposures, salt lakes consist of a complex group of vegetation types in which dominance was ill-defined and patches varied greatly. These include low shrublands of *Atriplex* spp., *Cratystylis subspinescens*, *Eremophila miniata*, *Frankenia* spp., *Halosarcia* spp. and *Maireana* spp. Low woodlands of *Casuarina cristata* and *Dodonaea viscosa* ssp. *angustissima* tall shrublands occur on salt lakes surveyed to the east of Mt Manning Range .

Casuarina cristata low woodlands are dominated by *C. cristata* ssp. *pauper* and tall shrubs of *Dodonaea angustissima*, *Exocarpos aphyllus* and *Grevillea sarissa*; low shrubs of *Disphyma clavellatum*, *Gunniopsis quadrifida* and *Rhagodia drummondii*; and the annuals *Aristida contorta*, *Helipterum manglesii*, *Menkea australis* and *Podotheca gnaphalioides*.

Other tall shrubs with *Dodonaea viscosa* ssp. *angustissima* are *Acacia bukittii*, *A. ligulata*, *Bossiaea walkeri*, *Eremophila miniata* and *Grevillea sarissa*; low shrubs of *Ptilotus obovatus* and *Rhagodia drummondii*; and the annuals *Actinobole uliginosum*, *Aristida contorta*, *Chthonocephalus pseudevax*, *Erodium crinitum*, *Helipterum pygmaeum* and *Podolepis capillaris*.

FAUNA

The vertebrate fauna of the Mt Manning Range Nature Reserve was documented by intensive sampling over three seasons from 1979-81 (Burbidge *et al.*, in prep.). A total of 13 species of native mammals, 36 species of reptiles and 68 species of birds were recorded. Species recorded from Mt Manning Range Nature Reserve and both the proposed western and southern extensions are listed in Appendix 7 (mammals) and 9 (amphibians and reptiles).

Surveys were conducted in *Acacia aneura* tall shrublands and *Eucalyptus ebbanoensis* low woodlands on the banded ironstone Mt Manning Range; *Eucalyptus leptopoda* mallee on sandplains; *Eucalyptus salubris* low woodlands on undulating plains (greenstone) and *Eucalyptus formanii* low woodlands on broad valleys (Burbidge *et al.*, in prep.).

The mammalian fauna of the Mt Manning Range Nature Reserve includes three species of dasyurid marsupial, the Hairy-footed Dunnart

(*Sminthopsis hirtipes*), Dunnart (*S. dolichura*) and Wongai Ningau (Ningau *ridei*); three species of native rodent, the Spinifex Hopping-mouse (*Notomys alexis*), Ash-grey Mouse (*Pseudomys albocinereus*) and Sandy Inland Mouse (*P. hermannsburgensis*); the Euro (*Macropus robustus*) and Western Grey Kangaroo (*M. fuliginosus*); and the Echidna (*Tachyglossus aculeatus*). Five species of bat, Gould's Wattled Bat (*Chalinolobus gouldii*), Western Broad-nosed Bat (*Nycticeius balstoni*), Lesser Long-eared Bat (*Nyctophilus geoffroyii*), the Little and White-striped Mastiff-bats (*Mormopterus planiceps* and *Tadarida australis*, respectively), were recorded on granite exposures.

The reptile fauna of the Mt Manning Range Nature Reserve comprises 36 species with eight species of gecko, including *Diplodactylus assimilis*, *D. elderi*, *D. granariensis* and *D. pulcher*; two legless lizards, *Delma nasuta* and *Lialis burtonis*; eight species of dragons, including *Ctenophorus cristatus*, *C. fordi*, *C. ornatus* and *C. reticulatus*; 14 species of skinks, including *Cryptoblepharus carnabyi*, *Ctenotus xenopluera*, *Egernia formosa*, *Eremiascincus richardsonii*, *Lerista macropithopus* and *Omolepida branchialis*; two monitors, *Varanus gouldii* and *V. tristis*; and two species of snake, the blind snake (*Ramphotyphlops australis*) and *Demansita psammophis*.

The total of 68 species of birds recorded (including opportunistic sightings), comprises 24 non-passerine species and 44 species of passerines. The 24 non-passerine species include the Brown Quail (*Coturnix ypsilophora*), Little-button Quail (*Turnix velox*), Banded Plover (*Vanellus tricolor*), Black-winged Stilt (*Himantopus himantopus*), Mulga Parrot (*Platycercus varius*) and the rarely recorded Scarlet-breasted Parrot (*Neophema splendida*). The passerine assemblage is dominated by the Weebill (*Smicrornis brevirostris*), Crested Bell-bird (*Oreoica gutturalis*), Spiny-cheeked Honeyeater (*Acanthagenys rufogularis*) and the Red-capped Robin (*Petroica goodenovii*).

HISTORY

The original Aboriginal inhabitants of the Mt Manning Range area were part of the Western Desert social and cultural bloc. Although traditional social divisions have largely broken down (O'Connor and Quartermaine, 1988), a reconstruction of original linguistic distribution identifies the Kalamaia group as occupying the Mt Manning Range area. Archaeological material in this area is most likely to be located near sources of water, and near hills or rocky outcrops that may provide shelter or raw material for stone tool manufacture (O'Connor and Quartermaine, 1988). The presence of a camp and workshop at Bungalbin Hill (WA Museum Aboriginal Site No. SO537) confirms this. Aboriginal traditional religion is based on the land with its shrines, hymns and religious objects referring to topographic and other natural features. The regional mythology of the area, commemorated in song and story, include the Nganamarra or mallee fowl ancestor, a topography-creating being who circled the area (O'Connor and Quartermaine, 1988). The banded ironstone ranges and hills in the Mt

Manning Range area have both a high Aboriginal site discovery potential and mythological significance to the Aboriginal people of the region.

The first European exploration in the Mt Manning Range area was by the Gregory Brothers, who named Mt Jackson in 1846 while searching for good grazing country, but left disappointed with the area. Later explorers, Forrest (1869) and Giles (1875), avoided the largely waterless Mt Manning Range area, travelling to the west and north (Beard, 1972).

RECREATIONAL USE AND POTENTIAL

There is little recreational use of the Mt Manning Range Nature Reserve due to limited access. The main track into the reserve, from the Die Hardy Range to the west, is used for mineral exploration in the vicinity of Mt Manning Range. Tracks from the north (Johnson Rocks) and south (Kurrajong Rockhole) are seldom used.

KEY FEATURES

- Endemic *Eucalyptus formanii* vegetation type.
- Large area ensuring representation of the region's community types (with the exception of banded ironstone ranges).
- Extensive unmodified sandplains, contiguous to the south and west.
- Long-term biological monitoring sites, established in the reserve, will allow comparisons with the adjacent pastoral country.

CTRC RECOMMENDATIONS

The Committee recommends that the Mt. Manning Range area be declared a C Class reserve for the Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

EPA RECOMMENDATIONS

The EPA recommends that the Mt. Manning Range area be declared a C Class reserve for the Conservation of Flora and Fauna, vested in the Western Australian Wildlife Authority.

PRESENT RECOMMENDATIONS

1. The Mt Manning Range Nature Reserve (No. 36208) should be upgraded from Class C to Class A, retaining the current vesting and purpose.
2. The Ministerial Temporary Reserve (1971H), encompassing the Mt Manning Range, should be cancelled and added to the nature reserve.
3. The Mt Manning Range Nature Reserve should be extended west to include Mt Jackson and the Die Hardy Range, and south to incorporate Bungalbin Hill and the Aurora Ranges.
4. The possibility of forming a contiguous reserve with the northern portion of the Jaurdi Pastoral Lease (3114/1072), should be examined.

PROPOSED EXTENSIONS

The Mt Manning Range Nature Reserve is the pivotal reserve in the central-western region of the Eastern Goldfields. The opportunity exists to consolidate and increase the conservation value of the existing reserve with extensions to the west and south, which will ensure the conservation of restricted flora and poorly represented vegetation types, fauna habitats and landform units.

The Mt Manning Range area, located within the South-western Interzone between the South-West and Ermaean Botanical Provinces (Beard, 1980), is phyto-geographically noteworthy with interaction of wide-ranging mesic South-western and arid Eremaean plant species. The Mt Manning Range Nature Reserve straddles this major vegetation boundary - the so called mulga-eucalypt line - which marks the transition from low woodlands of *Acacia* to woodlands of *Eucalyptus*, effectively separating the drier northern and moister southern parts of the Eastern Goldfields District (Beard, 1980).

The rich and diverse fauna of the Mt Manning Range area also reflects this biogeographical location. A blending of arid zone and south-western species is common to birds, reptiles and mammals; the proposed extensions incorporate biologically critical areas where species overlap and are at the limits of their ranges.

The three vegetation systems recognised within the Mt Manning Range area are the Jackson, Bungalbin and Die Hardy systems (Beard, 1972). Vegetation type and species composition, however, vary greatly over geographical distance within these systems. The extensive Jackson system, which dominates the Mt Manning Range area, incorporates the vegetation associations found on sandplains and broad valleys, the variable woodland mosaics on greenstone, and the distinctive vegetation complexes of salt lakes and granite exposures.

The Bungalbin system, restricted to banded ironstone ridges, occurs as islands within the Jackson system. Each banded ironstone range or hill has its own vegetation types. These areas, supporting floristic elements associated with the South-West Botanical Province, also contain flora not occurring on the surrounding plains. The restricted vegetation types of the Bungalbin system are found on the southern banded ironstone Aurora and Helena Ranges, Mt Jackson hills and Windarling Peak; the Die Hardy system, distinguished by plains of *E. formanii*, occurs on the northern banded ironstone Die Hardy Range, Yokradine Hills and Mt Manning Range.

The area representation of the three vegetation systems is inadequate, with 90% of the extensive Jackson system, 95% of the restricted Bungalbin system and the majority of the Die Hardy system occurring outside Mt Manning Range Nature Reserve (Newbey, unpubl.data)

With the exclusion of Mt Manning Range from the nature reserve, reservation of banded ironstone becomes the conservation priority of the region. Requiring adequate representation within the Mt Manning Range Nature Reserve are the banded ironstone Mt Manning Range themselves; the Aurora and Helena Ranges to the south; the linear exposures linking the Helena Range to Mt Jackson; Mt Jackson, Boondine, Muddarning and Yenyanning Hills to the south-west; and the Die Hardy Range, Yokradine Hills and Windarling Peak to the west.

The only extensive area of undulating plains, also excluded from the nature reserve, occurs in the Mt Jackson area underlying banded ironstone hills. The high number of different vegetation associations on greenstone would be incorporated by the extension west. Given the extensive areas of sandplains and broad valleys in the region and their essentially unmodified state, both these landforms require greater representation. The extensions to the west and south allow for the consolidation of contiguous sandplains and dissecting broad valleys.

Granite rocks are likely to have rare or new species of flora and, due to the area's erratic rainfall, provide essential water for fauna of the area. The representation of granite exposures would be widened by incorporating granites to the north-east of Mt Jackson and in the Die Hardy Range area. Salt lakes are adequately represented in the Mt Manning Range Nature Reserve.

The existing land tenure of pastoral leases and mining reserves influences the proposed extensions to the west and south of Mt Manning Range Nature Reserve. The presence of several ministerial temporary reserves for iron ore in the area need to be balanced against the conservation value of these banded ironstone formations with their restricted flora and vegetation types. The proposed western and southern extensions would ensure representation of the unique banded ironstone ranges within the Mt Manning Range Nature Reserve.

Sandplains and broad valleys surrounding the Mt Manning Range and Aurora Ranges have poor access and limited water, both factors accounting for the relatively unmodified vegetation systems of the area (Beard, 1972). The low forage potential of the sandplains has resulted in these banded ironstone ranges being buffered by extensive tracts of land in excellent condition. That grazing has had little impact on the vegetation in most of the Mt Manning Range area becomes significant for the conservation of original vegetation types. The CTRC Green Book (1974) recommended that due to the scarcity of good ungrazed land in pastoral leases and the catastrophic effects of grazing on plant communities elsewhere, the Mt Manning Range area was a valuable yardstick against which pastoral use could be compared.

PROPOSED MT JACKSON EXTENSION

Several important flora populations potentially threatened with extinction by degradation of their specific habitat would be protected with the proposed western extension. These include Declared Rare Flora entirely confined to the banded ironstone hills in the vicinity of Mt Jackson, and restricted flora on the Die Hardy Ranges and Yokradine Hills. Nearby Pigeon Rock is the largest of a series of granite outcrops that support distinctive vegetation complexes including poorly known eucalypts and diverse orchids.

The restricted distributions of two rare eucalypts would also be incorporated by the proposed western extension. The *Eucalyptus formanii* vegetation type occurs only to the north and the south of the Die Hardy Range, and east towards the Mt Manning Range. Undulating plains in the greenstone Mt Jackson area support interesting *Eucalyptus* woodland mosaics, including *E. corrugata*.

LOCATION: Mt Jackson; Muddarning, Boondine and Yenyanning Hills are located 105km north of Southern Cross, on Mt Jackson Station. The Die Hardy Range and Yokradine Hills, on Diemals Station, are 40km north along the Bullfinch-Evanston Road.

MAP: 6,10.

AREA: 132,400ha.

CURRENT STATUS: Vacant Crown land (43,500ha) and Water Reserves Nos. 9644, 13467-8 and 17009. Excisions of 37,450ha from Mt Jackson (3114/639) and 50,500ha from Diemals (3114/1110) pastoral leases are proposed. The Windarling Peak/Muddanah Hill area is covered by TR1970H while Mt Jackson and the associated Yenyanning, Muddarning and Boondine Hills are covered by TR1969H.

GEOMORPHOLOGY

The key landform features of the proposed western extension are the banded ironstone formations present as hills underlain by greenstone in the Mt Jackson area; isolated peaks near Windarling Peak; and the associated Yokradine Hills and Die Hardy Ranges. Sandplain areas dominate the eastern section while Pigeon Rocks is the most prominent of a series of granite exposures, including Chatarie Well, Bulgine and Olby Rockholes.

FLORA AND VEGETATION

The Declared Rare Flora *Tetratheca harperi* and *Prostanthera magnifica* occur in the Mt Jackson area. *Tetratheca harperi*, entirely confined to banded ironstone hills around Mt Jackson, grows only within this restricted habitat over a small geographical range. The Priority One species *Leptospermum* sp. (J. Thompson s.n.) and *Lepidium merrallii* are rarely collected and poorly known. The collections of *Lepidium merrallii* and

Allocasuarina tessellata both represent considerable extensions of previously known ranges.

Other important flora with restricted distributions on banded ironstone include the Priority taxa *Grevillea georgeana*, known from only three locations; *Dryandra arborea*, which occurs north to the Die Hardy Range and east from Mt Jackson; and *Xerolirion divaricatum*, representing the most inland record for this endemic and monotypic genus; and the undescribed *Jacksonia* sp. (KRN 9302). The Priority species *Grevillea erectiloba* is known from sandplains in the Mt Jackson and Bungalbin Hill area.

The endemic *Eucalyptus formanii*, with the narrowest leaves of any eucalypt, occurs only to the north and south of the Die Hardy Range, and east towards the Mt Manning Range. The rare and poorly known eucalypts *Eucalyptus corrugata* and *E. orbifolia* have scattered distributions on greenstone and granite outcrops, respectively (Napier *et al.*, 1988). The population of *Isotoma petraea* at Pigeon Rock is believed to have been central to the origin of complex chromosomal hybridity (James, 1965), while the collection of the orchid *Microtus parviflora* extended its known range 170km. Other granite exposures in the area, such as Olby Rock, also support distinctive vegetation complexes.

During the biological survey of the Eastern Goldfields District vegetation types, broadly classified on vegetation structure and plant species, were identified and typical sites correlated with landform units (Biological Surveys Committee, 1984). In the immediate vicinity of Mt Jackson several distinct vegetation types occur on banded ironstone, including *Eucalyptus ebbanoensis* and *E. loxophleba* mallee associations, and *Acacia aneura* low woodlands (Newbey and Hnatiuk, 1985).

Other mallees growing with *Eucalyptus ebbanoensis* are *E. corrugata* and *E. leptopoda*; tall shrubs of *Acacia acuminata*, *Allocasuarina campestris* ssp. *eriochlamys*, *Eremophila oppositifolia* var. *angustifolia*, *Phebalium canaliculatum*, *Santalum spicatum* and *Westringia cephalantha*; low shrubs of *Acacia erinacea*, *Eremophila clarkei* sens lat., *Halgania viscosa*, *Hibbertia eatoniae*, *Jacksonia* sp. (KRN 9302), *Olearia muelleri*, *Prostanthera grylloana* and *Scaevola spinescens*; the annuals *Calocephalus angianthoides*, *Gilruthia osbornii*, *Helipterum fitzgibbonii*, *H. laeve*, *H. roseum*, *Myriocephalus gracilis*, *Vellia rosea* and *Waitzia acuminata*; and the perennial grasses *Danthonia caespitosa*, *Stipa elegantissima* and *S. eremophila*.

Occurring with *Eucalyptus loxophleba* is the mallee *E. corrugata*; tall shrubs of *Acacia acuminata*, *Brachychiton gregorii* and *Eremophila* aff. *drummondii*; low shrubs of *Cassia nemophila* var. *nemophila* and *Prostanthera baxteri*; and the annuals *Gilruthia osbornii*, *Helipterum laeve*, *H. roseum*, *Vellia rosea* and *Waitzia acuminata*. Low woodlands of *Acacia aneura* included the mallee *Eucalyptus corrugata*; tall shrubs of

Acacia acuminata, *A. coolgardiensis* and *Hakea minyma*; the low shrub *Prostanthera baxteri*; the annuals *Gilruthia osbornii*, *Myriocephalus gracilis*, *Vellia rosea* and *Waitzia acuminata*; and the perennial grass *Danthonia caespitosa*.

Additional surveys of the Mt Jackson and Muddarning Hill area by S.D. Hopper (field notes: 1978-89) have recorded *Dryandra arborea*, *Eucalyptus ewartiana*, *E. petraea*, *E. plenissima*, the Declared Rare Flora *Prostanthera magnifica* and *Tetratheca harperi*. Orchids recorded include *Caladenia "incensa"*, *C. "incrassata"*, *C. roei*, *C. saccharata* and *C. sigmoidea*, "*Cyanicula*" *amplexans*, "*Drakonorchis*" *barbarossa*, *Diuris* aff. *longifolia*, *Prasophyllum ringens*, *Pterostylis* aff. *nana*, *P.* aff. *rufa*, *P. sargentii*, *Thelymitra* aff. *nuda* and *T. sargentii*.

Unnamed banded ironstone peaks 7km north of Windarling Peak support *Dryandra arborea* tall shrublands on steeper slopes, *Acacia* aff. *aneura* tall shrublands on lower slopes, and *Eucalyptus* aff. *oleosa* low woodlands on subdued foothills. Also occurring are the tall shrubs *Acacia tetragonophylla* and *Eremophila oldfieldii* var. *angustifolia*; low shrubs of *Eremophila latrobei*, *Olearia stuartii* and *Scaevola spinescens*; the annuals *Gilruthia osbornii*, *Goodenia berardiana* and *Waitzia acuminata*. A yet to be determined species of *Tetratheca* has also been collected from the peaks (J. Alford, pers. comm.).

On undulating plains in the Mt Jackson area, low woodlands of *Eucalyptus clelandii* and *Casuarina cristata* ssp. *pauper* occur on low stony ridges with *Eucalyptus salmonophloia* woodland and *E. salubris* low woodlands present on the colluvial flats.

Growing in *E. clelandii* low woodlands are *E. longicornis*, *E. salubris* and the mallee *E. celastroides*; tall shrubs of *Acacia tetragonophylla*, *Dodonaea stenozyga*, *Eremophila interstans*, *E. ionantha* and *Halgania rigida*; low shrubs of *Atriplex vesicaria* spp. *variabilis*, *Maireana radiata* and *Olearia muelleri*; the annuals *Eriochiton sclerolaenoides* and *Zygophyllum ovatum*; and the perennial grass *Stipa trichophylla*.

Small patches of *Casuarina cristata* ssp. *pauper* low woodlands consist of *Eucalyptus corrugata* and the tall shrub *Eremophila oldfieldii* var. *oldfieldii*; low shrubs of *Ptilotus obovatus* var. *obovatus*, *Rhagodia drummondii* and *Sclerolaena diacantha*; and annuals of *Menkea australis* and *Zygophyllum ovatum*.

Growing under *Eucalyptus salmonophloia* woodland are *E. corrugata* and tall shrubs of *Atriplex nummularia* ssp. *spathulata* and *Eremophila scoparia*; low shrubs of *Atriplex vesicaria* ssp. *variabilis* and *Olearia muelleri*; the annuals *Erodium crinitum* and *Gnephosis skirrophora*; and the perennial grass *Stipa trichophylla*.

Eucalyptus salubris low woodlands contain *E. corrugata* and tall shrubs of *Acacia tetragonophylla*, *Atriplex nummularia* ssp. *spathulata* and *Eremophila paisleyi*; low shrubs of *Maireana triptera*, *Sclerolaena diacantha* and *S. drummondii*; the annuals *Cephalopterum drummondii*, *Erodium crinitum*, *Gnephosis skirrophora*, *Helipterum pygmaeum*, *Pogonolepis stricta*, *Stellaria filiformis* and *Zygophyllum ovatum*; and the perennial grass *Stipa trichophylla*.

The *Eucalyptus corrugata* low woodlands occurring on broad valleys, 16km south of Mt Jackson, have no dominant shrubs but consist of the annuals *Chrysocoryne pusilla*, *Goodenia berardiana*, *Helipterum zacchaeus* and *Waitzia acuminata*; and the perennial grass *Triodia scariosa*.

Acacia aff. *aneura* tall shrublands on sandplains 18km south of Mt Jackson consist of other tall shrubs of *Eriostemon desertii*, *Malleostemon roseus* and *Phebalium canaliculatum*; low shrubs of *Baeckea elderiana* and *Whelia thryptomenoides*; the annuals *Chrysocoryne pusilla*, *Helipterum roseum*, *Myriocephalus gracilis* and *Waitzia acuminata*; and the perennial grass *Danthonia caespitosa*.

The presence of the rare and poorly known *Eucalyptus formanii* on the broad valleys and undulating plains around the Die Hardy Range distinguishes these banded ironstone ridges from those around Mt Jackson and Windarling Peak. Surveys of the Die Hardy Range have recorded *Eucalyptus formanii* occurring as a mallee over tall shrublands of *Acacia* and *Allocasuarina* with *Eucalyptus leptopoda* over *spinifex*. Other vegetation associations of the Ranges include *Eucalyptus oldfieldii* ssp. nov. over a thicket of *Acacia acuminata*, *Brachychiton gregorii*, *Dryandra arborea* and *Santalum spicatum*; *Eucalyptus leptopoda* ssp. nov. and *E. ewartiana* over low shrubs of *Acacia* and *Grevillea*. *Dryandra arborea* occurs on rocks along the crest of the Die Hardy Range. Additional flora recorded in the area include *Acacia tetragonophylla*, *Eucalyptus plenissima* and the orchids "*Cyanicula*" *amplexans*, *C. "incrassata"*, *Pterostylis* aff. *nana* and *P. aff. rufa*.

Mt Jackson and the Helena Ranges are contiguous by low banded ironstone rises containing *Eucalyptus petraea* and *Dryandra arborea* over thickets of *Acacia*, *Allocasuarina* and *Exocarpos*, with Declared Rare Flora *Prostanthera magnifica* and the orchids "*Cyanicula*" *amplexans*, *Pterostylis* aff. *nana*, *Thelymitra* aff. *nuda*, occurring on rocky areas. Present on the flats are mixed *Eucalyptus* woodlands of *Eucalyptus celastroides*, *E. ebbanoensis*, *E. ewartiana*, *E. griffithsii*, *E. loxophleba*, *E. salmonphloia*, *E. salubris*, *E. salubris* var. *glauca*, *E. sheathiana* and *E. transcontinentalis*.

Drainage line - a landform unit rarely encountered during the biological survey of the Eastern Goldfields District - sampled near Marda Dam in the Mt Jackson area carries an open low woodland of *Eucalyptus "capillosa"* ssp. "*capillosa*" over *Acacia steedmanii*, *Leptospermum roei*, Declared

Rare Flora *Prostanthera magnifica* and *Ptilotus obovatus* with the orchids "*Cyanicula*" *amplexans*, *C. "incensa"*, *Prasophyllum ringens*, *Pterostylis* aff. *nana*, *P. aff. rufa* and *Thelymitra* aff. *nuda*.

Pigeon Rock, a large granite outcrop west of the Die Hardy Range, has a complex vegetation on the apron and the rock itself. Vegetation associations and flora recorded include thickets of *Calycopeplus ephedroides* and *Kunzea pulchella* over sedges of *Lepidosperma longitudinale*; the rare and poorly known *Eucalyptus orbifolia*; and the important population of *Isotoma petraea*. The extensive seasonal orchid flora includes *Caladenia "incrassata"*, "*Cyanicula*" *amplexans*, "*Drakonorchis*" *barbarossa*, *Diuris* aff. *longifolia*, *Microtus parviflora*, *Prasophyllum ringens*; *Pterostylis* aff. *nana*, *Thelymitra antennifera* and *T. aff. nuda*.

The area surrounding Pigeon Rock contains several low granite exposures and supports *Eucalyptus ewartiana*, *E. formanii*, *E. loxophleba*, *E. longicornis* and *E. orbifolia*. Other species recorded include *Acacia tetragonophylla*, *Brachychiton gregorii*, *Callitris glauca*, *Melaleuca radula*, *Pittosporum phylliraeoides*, *Santalum acuminatum* and *S. spicatum*.

FAUNA

A total species list of 15 native mammals, two amphibians, 42 reptiles and 83 birds were recorded in the Mt Jackson survey area (Dell and How, 1985). Species recorded from Mt Manning Range Nature Reserve and the proposed western and southern extensions are listed in Appendix 7 (mammals) and 9 (amphibians and reptiles).

The vertebrate fauna was documented by intensive sampling of different landform units and vegetation associations in the Mt Jackson area over three seasons during 1979-81 (Dell and How, 1985). Mallee associations of *Eucalyptus ebbanoensis* and *E. loxophleba* on banded ironstone, the *Eucalyptus* woodlands on undulating plains (greenstone), tall shrublands on sandplains and the *Eucalyptus* low woodlands on broad valleys were surveyed.

The 15 native mammal species comprise five species of marsupials, seven bats, two native rodents and one monotreme. These are two species of dasyurid marsupial, the Fat-tailed Dunnart (*Sminthopsis crassicaudata*) and *S. dolichura*; Western Pygmy-possum (*Cercartetus concinnus*); the Euro (*Macropus robustus*) and Western Grey (*M. fuliginosus*); Sandy Inland Mouse (*Pseudomys hermannsburgensis*) and Mitchell's Hopping-mouse (*Notomys mitchellii*); the Echidna (*Tachyglossus aculeatus*); and seven species of bat: the Little and White-striped Mastiff-bats (*Mormopterus planiceps* and *Tadarida australis*), Gould's Wattled Bat (*Chalinobius gouldii*), King River Eptesicus (*Eptesicus regulus*), Western Broad-nosed Bat (*Nycticeius balstoni*), Lesser and Greater Long-eared Bats (*Nyctophilus geoffroyii* and *N. major*).

Reptile species recorded from the proposed Mt Jackson extension include the records for the gecko *Nephrurus vertebralis* and the monitor *Varanus giganteus* (Perentie) both of which represent large range extensions. Amphibians collected were *Pseudophryne occidentalis*, and an additional species, *Neobatrachus pelobatoides*, reported by Tyler *et al.* (1984). The reptile fauna comprises 10 species of gecko, including *Nephrurus vertebralis*; four legless lizards including, *Lialis burtonis* and *Pygopus nigriceps*; six species of dragons; 14 skinks, including *Ctenotus mimetes*, *Egernia depressa*, and *Lerista gerrardii*; three monitors, including the Bungarra (*Varanus gouldii*); and five species of snake, including Rosen's Snake (*Denisonia fasciata*), the Monk Snake (*Rhinoplocephalus monachus*), and Stimson's Python (*Morelia stimsoni*).

The bird list of 83 species, comprising 29 species of non-passerine and 54 species of passerines, includes the Peregrine Falcon (*Falco peregrinus*) which is Declared in Need of Special Protection. The proposed western and southern extensions to Mt Manning Range Nature Reserve contain 14 species of passerines identified by Kitchener *et al.* (1982) as habitat-specific residents recorded only in natural vegetation (Appendix 11). The large passerine assemblage of 54 species at Mt Jackson, including the Splendid Fairy-wren (*Malurus splendens*) and White-winged Fairy-wren (*M. leucopterus*), is richest in the *Eucalyptus* woodland sites on greenstone, highlighting the vital importance of these woodlands for passerine birds (Dell and How, 1985).

HISTORY

In 1888, the Yilgarn Goldfield was declared and leases granted in the Mt Jackson area. By 1894 two gold mines were operating at the Jackson Centre, near Mt Jackson, and were also producing small quantities of silver as a by-product (Chin and Smith, 1983). In 1910 gold-bearing reefs were discovered at Marda and later at Allens, Atkinsons and Riedels Finds. Iron ore production in the Koolyanobbing Range (to the south-east) commenced in 1950 but closed down in 1983. In the 1960's other iron ore deposits were located and tested in the Bungalbin Hill/Aurora Ranges area, the Mt Jackson area, and north of Windarling Peak. Several ministerial temporary reserves now exist in the area, on both pastoral leases and vacant Crown land, covering these banded ironstone formations. Active mining exploration continues in the Mt Manning Range, Mt Jackson-Helena Range area, Hunt Range and to the east of the Aurora Range, with live tenements covering most of the area.

RECREATIONAL USE AND POTENTIAL

Though little recreational use occurs in the area, there is vast potential for the Die Hardy Range and Yokradine Hills area. The scenic pass between these ranges looks out over extensive eucalypt woodlands. Seasonally flowering south-western flora such as orchids and the Yilgarn Dryandra, occur on these banded ironstone ranges. There has been little use by stock though past mining activity is still evident in some areas. The Die Hardy

Range area is accessible via the sealed road from Southern Cross to Bullfinch and the graded Bullfinch-Evanston Rd.

KEY FEATURES

- Restricted vegetation types and flora of the banded ironstone ranges and hills.
- Declared Rare Flora *Tetratheca harperi* and *Prostanthera magnifica*.
- The endemic *Eucalyptus formanii* and several Priority taxa on CALM's Reserve Flora List.
- The eucalypt woodland mosaics found on greenstone in the Mt Jackson area.
- The unique vegetation complexes on granite rocks such as Pigeon Rock.
- The recreational potential of the scenic Die Hardy Range area.

CTRC RECOMMENDATIONS

The Committee recommends that the Western Australian Wildlife Authority be asked to examine the possibility of extending the boundaries of the proposed Class C reserve in the Mt Manning Range area to include Mt Jackson and the Die Hardy Range.

EPA RECOMMENDATIONS

The EPA recommends that the WA Wildlife Authority examine the possibility of extending the boundaries of the proposed Class C reserve in the Mt Manning Range area to include Mt Jackson and the Die Hardy Range.

PRESENT RECOMMENDATIONS

1. The ellipse shown in Fig 11.0 (CTRC, 1974) should be squared up to incorporate Mt Jackson and the Die Hardy Range into the Mt Manning Range Nature Reserve (No. 36208). The proposed extension should be Class A, vested in the NPNCA for the Conservation of Flora and Fauna.
2. The proposed western extension is defined as that area bounded on the: west by 119°14'E to include Marda Dam, Windarling Peak, Pigeon Rock, and Deception Hill; north by 29°50'S to include Chatarie Well, the entire Die Hardy Range and Yokradine Hills system, Olby Rock and vacant Crown land; east by the western boundary of the Mt Manning Range Nature Reserve; and south by 30°17'S to include Mt Jackson, Boondine, Muddarning and Yenyanning Hills.
3. The proposed western extension includes excisions of 37,450ha from Mt Jackson (3114/639) and 50,500ha from Diemals (3114/1110) pastoral leases.
4. The proposed extension should incorporate an additional block of vacant Crown land (3,200ha) adjacent to the north-west corner of the Mt Manning Range Nature Reserve, and the Water Reserves Marda Dam (17009), Pigeon Rock (9644), Chatarie Well (13468), and Olby Rock (13467).

PROPOSED BUNGALBIN HILL EXTENSION

In view of recent biological data, the southern extension of Mt Manning Range Nature Reserve to incorporate the banded ironstone Bungalbin Hill area and surrounding sandplains becomes imperative. The proposed southern extension would provide protection for several Priority taxa, including Declared Rare Flora confined entirely to the Aurora Range. Some of these important flora populations are geographically restricted but locally abundant. In addition, the vegetation mosaic found on sandplain north-east of Bungalbin Hill contains important collections of rare and poorly known flora.

With the proposed southern extension, the opportunity also exists to conserve the reptile and small mammal fauna of the Bungalbin Hill area. This virtually undisturbed habitat contains a rich fauna including five dasyurid marsupial species; and 51 species of reptiles that includes 13 geckoes, the highest number recorded for any surveyed site in the Eastern Goldfields District.

Keighery (1980) and Dell *et al.* (1985) have advocated a southern extension to conserve both the restricted banded ironstone flora, and the rich and diverse fauna. The Survey and Mapping Group (1989) supported this proposed extension for protection of sandplain vegetation threatened by the development of the Waste Disposal Site, 50km to the east of Bungalbin Hill.

LOCATION: Bungalbin Hill, the Aurora and Helena Ranges are situated 100km north of Southern Cross within vacant Crown land.

MAP: 6,10.

AREA: 91,650ha.

CURRENT STATUS: Vacant Crown land, including Yilgarn Loc.1426 (7936ha) encompassing Bungalbin Hill, the Helena and Aurora Ranges, a ML 2SA Reserve leased by BHP for 50 years from 1969 .

GEOMORPHOLOGY

The banded ironstone Aurora Ranges, with a high point of 702m, are the most prominent landform feature of the proposed southern extension. The ranges, rising 300m above the surrounding plains, extend over 13km from Bungalbin Hill(686m), the western high point. A series of low jasperlite rises extend west from the associated Helena Range to the Mt Jackson area. Low lying broad valleys flank these banded ironstone ranges while extensive areas of sandplain, occurring to the north-east of the ranges, are contiguous with sandplains of the Mt Manning Range Nature Reserve.

FLORA AND VEGETATION

The banded ironstone Aurora Range contains the Declared Rare Flora *Tetratheca aphylla*, an isolated unique species confined entirely to this single range with a geographical range of little more than 10km. If mining operations commenced in the Aurora Range some populations of this rare species would be threatened with extinction. Rarely collected flora and undescribed species restricted to banded ironstone in the Bungalbin Hill area include the Priority species *Acacia* aff. *kochii* (A. Brown 112), *Grevillea georgeana* and *G. tetrapleura*; *Conostylis argentea*, the most inland member of this genus; and the perennial grasses *Plectrachne* sp. (KRN 5925) and *Mirbelia* sp. (KRN 8949).

Dryandra arborea, the most inland member of this endemic south-western Australian genus, is confined to the banded ironstone ranges of the Mt Manning Range area. It occurs as a series of disjunct populations from Mt Jackson to the Die Hardy Range, with the largest populations occurring in the Mt Jackson-Aurora Ranges, which are contiguous by low jasperlite rises. The major vegetation type of the Bungalbin Hill area, mallee woodlands of *Eucalyptus ebbanoensis* and *E. cylindrocarpa*, is an extremely attractive and rare association which needs adequate protection (Keighery, 1980).

The vegetation mosaic found on sandplains near Bungalbin Hill, an important inland extent of the principally Myrtaceous-Proteaceous heaths common on sandplains in the south-west, contains important collections of rare, poorly known and undescribed flora. These include the Priority taxa *Calytrix creswellii* and *Grevillea erectiloba*; *Wehlia grandiflora*, the undescribed *Baeckea* sp. (KRN 9418), *Darwinia* sp. (KRN 9414), *Leucopogon* sp. (KRN 8697), *Logania* sp. (KRN 9428), *Mirbelia* sp. (KRN 10834), and *Verticordia* sp. (KRN 9436). *Epacridaceae* genus novum, an undescribed genus, has a restricted distribution on sandplain while the collection of the rare *Banksia lullfitzii* represents a notable range extension.

The vegetation survey of the banded ironstone Aurora Range, surrounding broad valleys and sandplains, revealed a complex mosaic of vegetation types (Newbey and Hnatiuk, 1985). On the Aurora Range, the steep slopes support *Dryandra arborea* tall shrublands while the upper and lower slopes support *Eucalyptus ebbanoensis* mallee associations. Low woodlands of *Acacia aneura* and *E. aff. oleosa* mallee formations occur on the pediment.

Growing with *Dryandra arborea* are the other tall shrubs *Acacia quadrimarginea*, *Allocasuarina acutivalvis*, *Calycopeplus ephedroides*, *Grevillea obiquistigma*, *Melaleuca leiocarpa*, *M. filifolia* and *Mirbelia* sp. (KRN 8949); low shrubs of *Eriostemon brucei* ssp. *brucei* and *Ptilotus obovatus* var. *obovatus*; the annuals *Blennospora drummondii*, *Heliptherum strictum*, *H. laeve* and *Waitzia acuminata*; and the perennial

grasses *Plectrachne* sp. (KRN 5925), *Stipa trichophylla*, and *S. elegantissima*.

Eucalyptus ebbanoensis mallee growing on erosional slopes and pediment has tall shrubs of *Alyxia buxifolia*, *Calycopeplus ephedroides*, *Dryandra arborea*, *Dodonaea lobulata*, *Eremophila oppositifolia*, *E. alternifolia*, *Grevillea georgeana* and *Melaleuca leiocarpa*; low shrubs of *Acacia erinacea*, *Olearia muelleri*, *Ptilotus obovatus* var. *obovatus*, *Scaevola spinescens* and the Declared Rare Flora *Tetratheca aphylla*; the annuals *Helipterum fitzgibbonii*, *Calotis hispidula* and *Waitzia acuminata*; and the perennial grasses *Plectrachne* sp. and *Stipa trichophylla*.

At the base of Bungalbin Hill is an area of *Acacia aneura* low woodlands consisting of the tall shrubs *Acacia tetragonophylla*, *Dodonaea lobulata* and *Eremophila alternifolia*, low shrubs of *Prostanthera campbellii* and *P. grylloana*; the annuals *Bellida graminea*, *Helipterum roseum*, *H. strictum* and *Podolepis canescens*.

Flanking the hill are mallee associations of *Eucalyptus* aff. *oleosa* and *E. loxophleba*; tall shrubs of *Acacia quadrimarginea*, *Allocasuarina acutivalvis*, *Dodonaea inaequifolia*, *Eriostemon brucei* ssp. *brucei* and *Grevillea obliquistigma*; low shrubs of *Hibbertia pungens* sens lat., *Ptilotus obovatus* var. *obovatus* and *Scaevola spinescens*; and the annuals *Erodium crinitum*, *Helipterum laeve*, *H. strictum* and *Waitzia acuminata*.

Additional surveys by S.D. Hopper (field notes: 1978-89) of the banded ironstone Aurora Range have documented the following flora and vegetation associations. Mallee associations of *Eucalyptus ebbanoensis* and *E. griffithsii* occur over *Alyxia buxifolia*, *Dryandra arborea*, *Exocarpos aphylla* and *Olearia muelleri*, while *Eucalyptus "capillosa"* ssp. *"capillosa"* low woodlands consist of *Acacia acuminata* and *Dryandra arborea*.

The Declared Rare Flora *Tetratheca aphylla* occurs on steep slopes of bare rock while *Chaemaexeros fimbriata* and *Conostylis argentea* occupy crevices on bare rock. Also found amongst banded ironstone rocks are the mosses *Desmatodon*, *Funaria*, *Tortula* and *Weissia*. Other flora of the range include the Priority species *Acacia* aff. *kochii*; and the spider orchids *Caladenia "incrassata"*, *C. sigmoidea*, *"Cyanicula" amplexans*, *Pterostylis* aff. *nana* and *Thelymitra* aff. *nuda*.

The nearby Helena Range was only sampled on the eastern end where *Melaleuca filifolia* tall shrublands occur with the mallees *Eucalyptus ebbanoensis* and *E. oleosa* var. *oleosa*; tall shrubs of *Acacia* aff. *aneura*, *Calothamnus gilesii*, *Calycopeplus ephroides*, *Dryandra arborea*, *Grevillea georgeana*, *G. obliquistigma*, *Melaleuca filifolia* and *Mirbelia* sp. (KRN 8949); low shrubs of *Baeckea elderiana*; the annuals *Bellida graminea*, *Helipterum laeve*, *Millotia myosuroides*, *Myriocephalus gracilis* and *Waitzia acuminata*; and the perennial grass *Plectrachne* sp.

On broad valleys surrounding the Aurora Range a wide range of *Eucalyptus* low woodlands occur, including *Eucalyptus longicornis*, *E. salubris* and *E. transcontinentalis*. Mixed *Eucalyptus* low woodlands consist of a complex mosaic of *Eucalyptus celastroides*, *E. salubris*, *E. longicornis* and *E. salmonophloia*; the tall shrub *Eremophila scoparia*; and low shrubs of *Atriplex nummularia* spp. *spathulata*, *A. vesicaria* spp. *variabilis*, *Sclerolaena diacantha* and *S. drummondii*.

Growing under *Eucalyptus salmonophloia* woodlands are *E. transcontinentalis* and the mallee *Eucalyptus yilgarnensis*; tall shrubs of *Atriplex nummularia* spp. *spathulata*, *Eremophila* aff. *drummondii*, *E. oppositifolia* var. *angustifolia* and *E. scoparia*; the annuals *Atriplex vesicaria* spp. *variabilis*, *Olearia muelleri*, *Ptilotus exaltatus* var. *exaltatus* and *Zygophyllum ovatum*; and the perennial grass *Stipa trichophylla*.

Mallees of *Eucalyptus cylindrocarpa* grow with *Eucalyptus yilgarnensis*; shrubs of *Muehlenbeckia cunninghami* and *Atriplex vesicaria* spp. *variabilis*; and the annual *Gnephosis skirrophora*.

Growing with *Eucalyptus loxophleba* mallee associations are the tall shrubs *Acacia nyssophylla* and *Exocarpos aphyllus*; low shrubs of *Acacia erinacea*, *Cassia nemophila* var. *nemophila*, *Olearia muelleri* and *Scaevola spinescens*; the annuals *Actinobole uliginosum*, *Chthonocephalus psuedevax*, *Helipterum demissum*, *H. pygmaeum*, *H. strictum*, *Schoenia cassiniana* and *Waitzia acuminata*; and the perennial grass *Stipa eremophila*.

Sandplains to the north-east of Bungalbin Hill consist of tall shrublands of *Acacia coolgardiensis* and *Banksia elderiana* with mallee associations of *Eucalyptus leptopoda*.

Other tall shrubs occurring with *Acacia coolgardiensis* tall shrublands are *Callitris preissii* ssp. *verrucosa*, *Hakea francisiana*, *Grevillea filifolia*, *G. nematophylla* and *Phebalium filifolium*; low shrubs of *Baeckea maidenii*, *Calytrix cresswellii*, *Thryptomene kochii*, *Verticordia* sp. (KRN 9436) and *Wehlia thryptomenoides*; the annual *Waitzia acuminata*; perennial grasses *Stipa eremophila* and *Triodia scariosa*; and the sedge *Lepidosperma viscidum*.

Banksia elderiana tall shrublands consist of the shrubs *Baeckea* sp. (KRN 9418), *Calytrix cresswellii*, *Conospermum stoechadis*, *Darwinia* sp. (KRN 9414), *Epacridaceae* genus novum (KRN 9429), *Daviesia hakeoides*, *Grevillea filifolia*, *Logania* sp. (KRN 9428), *Mirbelia* sp. (KRN 10834), *Pachynema junceum*, and *Wehlia grandiflora*; the perennial grass *Triodia scariosa*; and the sedges *Lepidobolus preissianus* and *Lepidosperma resinosum*.

Growing with *Eucalyptus leptopoda* mallee formations are the tall shrubs *Acacia coolgardiensis*, *A. signata*, *Allocasuarina acutivalvis*, *A.*

corniculata, *Callitris preissii* ssp. *verrucosa*, *Calothamnus gilesii*, *Grevillea teretifolia*, *G. apiculoba* and *Leptospermum roei*; low shrubs of *Baeckea maidenii*, *Calytrix cresswellii* and *Conospermum stoechadis*; and the perennial grass *Triodia scariosa*.

On sandplains to the west of the Helena Ranges, scattered *Eucalyptus leptopoda*, *E. oldfieldii* and *E. rigidula* occur over shrubs of *Allocasuarina acutivalvis*, *Balaustion pulcherrimum*, *Callitris preissii* and *Calothamnus gilesii* along with species of *Acacia*, *Calytrix*, *Daviesia*, *Grevillea*, *Isopogon* and *Verticordia*; and the orchid *Thelymitra sargentii*.

FAUNA

Fauna recorded within the proposed Bungalbin Hill extension include 20 species of native mammals, two species of amphibians, 51 species of reptiles and 67 species of birds (Dell and How, 1985; C.R. Dickman, field notes: 1987-89). Appendix 7 (mammals) and 9 (amphibians and reptiles) list species recorded from the Mt Manning Range Nature Reserve, and the proposed southern and western extensions.

The highest number of gecko species recorded for any survey area in the Eastern Goldfields District is 13 at Bungalbin Hill, and includes six species of congeneric *Diplodactylus* geckoes. This also represents one of the most diverse recorded gecko assemblages in the world (C.R. Dickman, pers. comm.). In addition, the occurrence of five species of dasyurid marsupials, three dunnarts and two ningauis together on the sandplains is of great zoological interest (Dickman, 1989).

At the Bungalbin Hill survey site vertebrate fauna was sampled in *Eucalyptus ebbanoensis* mallee on the banded ironstone Aurora Range; *Eucalyptus salmonophloia* woodlands and *Eucalyptus loxophleba* mallee on broad valleys surrounding the range; *Acacia coolgardiensis* tall shrublands, *Banksia elderiana* tall shrublands and *Eucalyptus leptopoda* mallee on sandplains to the north-east (Dell and How, 1985).

The tall shrublands and mallee vegetation mosaics on sandplains north-east of Bungalbin Hill have an extremely high diversity of both reptiles and small mammals. Occurring together on sandplains are five species of dasyurid marsupials, including three congeneric *Sminthopsis* dunnarts (and one of the few known localities where *Ningauis ridei* and *N. yvonneae* occur sympatrically); the Western Pygmy-possum; four species of native rodent and 29 species of reptiles. Additional survey work by the University of Western Australia has increased the reptile fauna from 42 recorded species to 51 (C.R. Dickman, field notes: 1987-89), confirming the value of long-term monitoring in detecting additional species (Dell *et al.*, 1985).

The sandplains north-east of the Aurora Range are the type locality for the endemic skink *Ctenotus xenopleura*, confined to the Eastern Goldfields District. This geographically restricted species is locally abundant on

sandplain sites in the Bungalbin Hill area. An isolated inland population of the skink *Lerista elegans*, previously recorded only on the west coast of WA, represents a huge range extension.

The rich small mammal fauna found on these sandplains contains five species of dasyurid marsupials including three dunnarts - the Fat-tailed Dunnart (*Sminthopsis crassicaudata*), Hairy-footed Dunnart (*S. hirtipes*) and *S. dolichura* - and two ningauis, the Wongai Ningai (*Ningai ridei*) and Goldfields Ningai (*N. yvonneae*); four species of native rodent, the Ash-grey Mouse (*Pseudomys albocinereus*), Sandy Inland Mouse (*P. hermannsburgensis*), the Spinifex Hopping-mouse (*Notomys alexis*) and Mitchell's Hopping Mouse (*N. mitchellii*); and the Western Pygmy-possum (*Cecartetus concinnus*)

The reptile fauna recorded on sandplains comprises seven species of gecko, including *Diplodactylus assimilis*, *D. elderi*, *D. pulcher*, *D. stenodactylus*, *Nephrurus stellatus*, and *Rhynchoedura ornata*; one legless lizard, *Delma nasuta*; five species of dragon, including *Ctenophorus fordi*, *C. isolepis*, and the moloch (*Moloch horridus*); six species of skinks, including *Ctenotus atlas*, *C. schomburgkii*, *C. xenopleura*, and *Tiliqua occipitalis*; and the Bungarra (*Varanus gouldii*).

A long-term study conducted by the University of WA has added nine species of reptiles from the sandplain north-east of Bungalbin Hill: three legless lizards, *Delma butleri*, *Lialis burtonis* and *Pygopus nigriceps*; three skinks, *Ctenotus pantherinus*, *Lerista elegans* and *Morethia obscura*; the monitor *Varanus tristis*; and two snakes, the Ringed Brown Snake and Gwardar (*Pseudonaja modesta* and *P. nuchalis*). The total reptile fauna now recorded from the sandplain sites is 29 with an additional 22 species recorded in adjacent *Eucalyptus* vegetation associations.

The mallee associations on the banded ironstone Aurora Range had 18 species of reptiles recorded with a single amphibian, the Shoe-maker Frog (*Neobatrachus sutor*). The fauna comprises seven species of gecko, including *Diplodactylus granariensis*, *D. maini*, *Gehyra variegata*, *Heteronotia binoei* and *Oedura reticulata*; three dragons, including *Tympanocryptis cephalo*; five species of skinks, including *Cryptoblepharus carnabyi*, *Ctenotus uber* and *Omolepida branchialis*; the Perentie (*Varanus giganteus*); and the Blind Snake (*Ramphotyphlops australis*).

The broad valley *Eucalyptus* woodlands and mallees flanking the range contain 24 species of reptiles comprised of nine species of gecko, including *Crenadactylus ocellatus*, *Diplodactylus pulcher* and *Underwoodisaurus milii*; one legless lizard, *Delma australis*; two species of dragons, *Ctenophorus cristatus* and *C. scutulatus*; eight species of skinks, including *Cryptoblepharus plagiocephalus*, *Egernia inornata*, *Hemiergis initialis*, *Lerista muelleri* and *Morethia butleri*; two Blind Snakes, including *Ramphotyphlops hamatus*, and the Southern Shovel-nosed Snake (*Vermicella semifasciata*).

Although the Bungalbin Hill area remains relatively unmodified, evidence of the rapid changes that have already occurred to the native mammals comes from cranial records collected from surface cave deposits (see Appendix 12). The Lesser Stick-nest Rat (*Leporillus apicalis*), which once inhabited the cliffs and caves of the banded ironstone ranges, is extinct, while the Brushtail Possum (*Trichosurus vulpecula*), Black-footed Rock-Wallaby (*Petrogale lateralis*), and the Chuditch (*Dasyurus geoffroii*) no longer occur in the Mt Manning Range area. These changes to the original distributions illustrate the devastating impact of Europeans over the past 100-150 years (see also Table 5).

The Peregrine Falcon (*Falco peregrinus*), Declared in Need of Special Protection, was recorded in the Aurora Range. The passerine assemblage include 14 passerines, identified by Kitchener *et al.* (1982) in the adjacent wheatbelt, as residents dependent solely on natural vegetation. The 14 species were recorded in both the proposed southern and western extensions to the Mt Manning Range Nature Reserve (Appendix 11).

RECREATIONAL USE AND POTENTIAL

Recreational potential exists for the scenic Aurora Ranges and surrounding eucalypt woodlands. These aesthetic banded ironstone ranges contain many cliffs and caves, and are the highest in the region, rising some 300m from the surrounding plains. The vegetation in the Bungalbin Hill area is in virtually pristine condition, being unmodified by grazing. The proximity of this extremely scenic area to Perth, via sealed roads to Koolyanobbing and mining access tracks, gives it vast recreational potential.

KEY FEATURES

- Restricted vegetation types and flora of the banded ironstone ranges.
- Declared Rare Flora confined to the Aurora Range.
- Five Priority species from CALM's Reserve Flora List.
- The sandplain vegetation representing an important inland extent of south-western sandplain heaths.
- Ungrazed eucalypt woodlands surrounding the ranges.
- The diverse reptile and small mammal fauna of the Bungalbin Hill area containing extremely rich dasyurid marsupial and gecko assemblages.
- The recreational potential of the highest banded ironstone ranges in the region.

CTR/C/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATIONS

1. The Mt Manning Range Nature Reserve (No. 36208) should be extended south to incorporate Bungalbin Hill, the Aurora and Helena Ranges (VCL Loc. 1426) and intervening vacant Crown land. The proposed extension should be Class A, vested in the NPNCA for the Conservation of Flora and Fauna.

2. The proposed southern extension is defined as the area bounded on the: west by 119°31'S; north by the existing boundary of the Mt Manning Range Nature Reserve; east by the western boundary of the Jaurdi Pastoral Lease (3114/1072); and south by 30°30'S.

Jaurdi Pastoral Lease

The northern portion of Jaurdi Pastoral Lease is adjacent to the Mt Manning Range Nature Reserve and the proposed Bungalbin Hill extension (Maps 6,10,12). The conservation value of the existing reserve would be considerably consolidated by the addition of areas such as the granites Pittosporum Rock and Kurrajong Rockhole; the banded ironstone Mt Dimer and Yendilberin Hills; and the greenstone Hunt Range.

LOCATION: Jaurdi Pastoral Lease extends over 100km north from the Vermin Proof Fence and Lake Seabrook to the Hunt Range. The Perth-Kalgoorlie Railway crosses the southern portion of the station.

MAP: 12.

AREA: 321,180ha.

CURRENT STATUS: Jaurdi Pastoral Lease (3114/1072) was purchased by the Department of Conservation and Land Management in 1989.

GEOMORPHOLOGY

The lease is dominated by extensive broad valley surfaces. Banded ironstone formations, such as the high points Mt Finnerty, Mt Dimer and Mt Walton, and subdued ranges like the Yendilberin and Watt Hills, are prominent above these low lying broad valleys. Mt Walter, in the south-east corner, is a quartz hill flanked by undulating plains of greenstone. A series of granite outcrops, such as Pittosporum, Seventy One Mile, Gnoledgin, Wallangering, Ive and Darrine Rocks, are scattered throughout the lease. Areas of greenstone underlie the Jaurdi homestead in the south and form the low Hunt Range in the north. A chain of salt lakes including Lake Walton and Eva Lake dominate the south-western portions of the station while a large breakaway system is present to the north of the Jaurdi homestead.

FLORA AND VEGETATION

As part of the biological survey of the Eastern Goldfields District, the flora and vegetation of Jaurdi Station were sampled in the south-eastern and northern sections (Newbey and Hnatiuk, 1985). The lease is largely covered by extensive tracts of eucalypt woodlands that have been heavily grazed by sheep only in the southern sections (Newbey, in prep.).

Undulating plains in the greenstone Hunt Range, 30km north-east of the Aurora Ranges, were only sampled in one area where low woodlands of *Eucalyptus clelandii* occur with *Eucalyptus longicornis* and *E. salubris*; the

mallee *E. celastroides*; tall shrubs of *Acacia tetragonophylla*, *Dodonaea stenozyga*, *Eremophila glabra*, *E. interstans*, *E. ionantha* and *Halgania rigida*; low shrubs of *Atriplex vesicaria* sp. *variabilis*, *Maireana radiata* and *Olearia muelleri*; the annuals *Eriochiton sclerolaenoid*, and *Zygopyllum ovatum*; and the perennial grass *Stipa trichophylla*.

At Pittosporum Rock, 5km west of the Hunt Range, the vegetation on the deep granitic soils of the outer apron is *Acacia* aff. *aneura* tall shrublands with other tall shrubs of *Acacia acuminata*, *A. jennerae*, and *A. tetragonophylla*; low shrubs of *Prostanthera campbellii* and *Scaevola spinescens*; the annuals *Chrysocoryne pusilla*, *Helipterum manglesii*, *Millotia tenuifolia*, *Schoenia cassiniana* and *Waitzia acuminata*; and the perennial grass *Danthonia caespitosa*. A granite complex, present on skeletal sheets of granitic soils, consists mainly of annuals except for the occasional shrubs *Eremophila granitica* and *Isotoma petraea*. The most common annuals of the 60 taxa present are *Actinobole uliginosum*, *Aristida contorta*, *Chthonocephalus pseudevax*, *Eriachne ovata*, *Helipterum australe*, *Myriocephalus gracilis*, *Rutidosis multiflora*, *Stipa trichophylla*, *Tripogon loliiformis* and *Toxanthes perpusillus*.

Several granite outcrops areas are located within the Jaurdi Pastoral Lease. The granite Seventy One Mile Rocks support an outlying population of the Priority species *Wurmbea murchisoniana*. Granites such as Gmoladgin, Wallangering and Darrine Rocks, however, have yet to be surveyed.

Mt Walter, a quartz hill, rises about 65m above the surrounding greenstone plains and is flanked to the south by low woodlands of *Eucalyptus longicornis*. Mallee associations of *Eucalyptus griffithsii* occur at the base of Mt Walter while the middle and upper slopes support *Allocasuarina acutivalvis* tall shrublands with scattered mallees of *Eucalyptus loxophleba* and *E. petraea*. The Priority species *Pomaderris intagenda* has been collected from Mt Walter. The main species recorded include tall shrubs of *Eriostemon brucei* ssp. *brucei* and *Grevillea obliquistigma*; low shrubs of *Hibbertia glomerosa* and *Thryptomene australis*; and the annual *Millotia myosuroides*.

Low dunes of aeolian sands on the margins of Lake Walton support mallee associations of *Eucalyptus foecunda* (now *E. hypochlamydea*) that include shrubs of *Acacia densiflora*, *Grevillea* aff. *concinna* and *Melaleuca uncinata*. Closer to the lake floor, on sub-saline alluvial soils, are tall shrublands of *Melaleuca* aff. *cuticularis* over low shrubs of *Disphyma crassifolium*, *Halosarcia peranulatum* ssp. *peranulatum* and *H. indica* ssp. *bidens*.

FAUNA

The fauna recorded from the low-domed Pittosporum Rock, which contained a natural rockhole, and the surrounding vegetation comprises 14 reptile species and seven species of bat (Dell and How, 1985). The reptile assemblage contains the amphibian *Neobatrachus sutor*; six species of

gecko, including *Heteronotia binoei* and *Rhynchoedura ornata*; one dragon, *Ctenophorus reticulatus*; five species of skink, including *Cryptoblepharus plagiocephalus*, and *Ctenotus leonhardii*; and Jan's Banded Snake (*Vermicella bertholdii*). The seven species of bat are the White-striped Mastiff-bat (*Tadarida australis*), Gould's Wattled Bat (*Chalinolobus gouldii*), the Chocolate Wattled Bat (*C. morio*), King River Eptesicus (*Eptesicus regulus*), Western Broad-nosed Bat (*Nycticeius balstoni*), and Lesser and Greater Long-eared Bats (*Nyctophilus geoffroyi* and *N. major*).

Seventy-two species of birds were recorded from Jaurdi Pastoral Lease (B. Newbey, pers. comm.). The 27 non-passerine species include the Peregrine Falcon (*Falco peregrinus*), which is Declared in Need of Special Protection. The large, passerine assemblage of 45 species includes seven species identified by Kitchener *et al.* (1982) as habitat-specific residents, recorded only in natural vegetation in the wheatbelt. These include the Jacky Winter (*Microeca leucophaea*), Grey Shrike-thrush (*Colluricincla harmonica*), Splendid Fairy-wren (*Malurus splendens*), Chestnut Quail-thrush (*Cinclosoma castanotum*) and Rufous Tree-creeper (*Climacteris rufa*).

HISTORY

Aboriginal history

An archaeological site has been reported from the western side of Ive Rock near Wallangie Soak (O'Connor and Quartermaine, 1988). The surface artefact scatter consists mainly of chalcedony quartz and banded ironstone flakes, adze slugs and scrapers (see also Mt Manning Range Nature Reserve).

KEY FEATURES

- The extensive tracts of eucalypt woodlands.
- The distinctive vegetation associations present on the banded ironstone Yendilberin Hills and Mt Dimer; the series of granite rocks including Pittosporum Rock, Kurrajong Rockhole and Seventy One Mile Rocks; the greenstone Hunt Range; and quartz Mt Walter.
- The salt lake system of Lake Walton and Eva Lake and the breakaways north of Jaurdi homestead.

CTRC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATIONS

1. Additional biological investigation is needed to identify potential areas of high conservation value that may warrant reservation as nature reserves (see 4.3).

2.3 GOONGARRIE NATIONAL PARK

LOCATION: Goongarrie National Park is situated 50km south-west of Menzies and 90km north of Kalgoorlie, within the Menzies Shire.

MAP: 7.

AREA: 60,335ha.

CURRENT STATUS: Goongarrie National Park (No. 35637) is Class A vested in the NPNCA for National Park, and includes former Water Reserve Nos. 4015 (Nineteen Mile Rocks) and 3002 (Wiladdi Soak).

GEOMORPHOLOGY

Extensive Quaternary colluvial and alluvial surfaces, grouped together in the landform unit of broad valley, dominate the Goongarrie National Park. Large areas of Tertiary sandplain extend throughout the southern sections, while granite rocks occur at the margins of the broad valley and sandplain landforms. The southern portions of Lake Marmion intrude into the north-western corner of Goongarrie National Park.

The western section of the park contains colluvial flats of deep calcareous earths and scattered aeolian loams on the slightly raised plains adjacent to the granite rocks Nineteen Mile, Twenty Two Mile and Twenty Five Mile Rocks (Milewski, 1988). In the extreme north-west the salt playa of Lake Marmion is bordered by saline alluvium and aeolian deposits. Non-saline swamps and claypans are also present.

The southern portion of the park is dominated by undulating sandplain dissected by alluvial valleys consisting of wash from the sandplain. Wongi and Wiladdi Soaks are granite exposures adjacent to sandplain while Carr Boyd Rocks, a series of granites, occur just to the south of the park boundary. Adjoining the sandplains in the northern sections are small areas of gravel plain comprised of ironstone gravel nodules within a sand matrix (Williams, 1970).

In the north-eastern section of Goongarrie National Park, the broad valley landform consists largely of colluvial flats and reworked sandplain dissected by alluvial valleys of gilgai that contain most of the present-day drainage (Williams *et al.*, 1976). A small area within broad valley in the north-eastern corner of the park represents the calcareous plain landform. Although its origin is obscure it may have been a poorly developed calcrete valley fill, a southern outlier of the type more common in northern parts of the Eastern Goldfields District (Milewski, 1988).

FLORA AND VEGETATION

Prior to the biological survey of the Eastern Goldfields District, the vegetation of Goongarrie National Park was known only from the brief summary provided by the CTRC (1974) and the broad vegetation associations identified by Beard (1975, 1978). The south-western section of the park contained mixed woodlands of Sheoak with Mulga and Eucalypt while the north-eastern area consisted of Sheoak and Mulga woodlands (Beard 1975; 1978). Dominant species include *Acacia aneura* (Mulga), *A.*

acuminata, *A. linophylla*, *A. tetragonophylla*, *Casuarina cristata* (Black Sheoak), *Eucalyptus concinna*, *E. loxophleba* and *E. oleosa* (CTRC, 1974).

During the biological survey of the Eastern Goldfields District the vegetation of Goongarrie National Park was sampled intensively (Milewski and Keighery, 1988). The following is taken directly from that report.

Goongarrie National Park consists mainly of broad valley with various combinations of *Acacia aneura*, *Casuarina cristata* and, in places, *Eucalyptus* spp. Much of the area comprises gentle parallel rises about 2km apart separated by shallow troughs. In addition to broad valley, Goongarrie National Park contains patches of sandplain with *Eucalyptus leptopoda* over *Triodia*, a few granite exposures with *Acacia quadrimarginea* (on rocks) or *Eucalyptus loxophleba* (on colluvial soil), and small areas of salt lake features and calcareous plain.

One area of outwash plains associated with granite exposure supports scattered trees of *Acacia aneura*, *Hakea suberea* and *Eucalyptus* sp., over succulent steppe of *Maireana sedifolia*, some *M. pyramidata* and some *Atriplex*, and occasional *Frankenia*.

A soak on the western edge of Goongarrie National Park is typical of salt lake feature. *Atriplex vesicaria* ssp. *variabilis* and *Frankenia* sp. are codominant on gently sloping ground with crusted loam soils containing a significant clay content. The only other perennials are species of *Maireana* and *Sclerolaena*, such as *M. glomerifolia* and *S. eurotioides*, *Solanum lasiophyllum*, *Podolepis capillaris* and a few sparse low grasses (*Eragrostis*). Occasional small clumps include *Cassia nemophila* var. *nemophila*, *Eremophila scoparia*, *E. decipiens*, *Cratystylis subspinescens*, *Heterodendrum oleaefolium*, *Pittosporum phylliraeoides*, *Santalum acuminatum*, *Grevillea sarissa* and *Hakea arida* with *Acacia aneura* and *Casuarina cristata* on nearby sandy rises. At least 20 species of herbaceous plants are evident, including the ephemerals *Helipterum roseum*, *Senecio* spp., *Chthonocephalus pseudevax*, *Eragrostis dielsii*, *Maireana carnosae*, *Gnephosis burkittii*, *Erodium* spp., *Crassula* sp., *Stenopetalum robustum*, *Centrolepis polygyna*, and *Gnephosis macrocephala* as well as the geophyte *Wurmbea tenella*.

A nearby gypseous dune bears *Acacia aneura* and *Eremophila miniata* with a few plants of *Atriplex* sp. and *M. pyramidata*. Tall shrubs of *Pittosporum phylliraeoides* and low shrubs of *Gunniopsis* sp., *Ptilotus obovatus* and *Salsola kali* are present. *Atriplex* sp. dominates on the swale immediately adjacent with the annual herb *Senecio* sp. and a few tufts of the grass *Monachather paradoxa*. The dune supports a dense carpet of ephemerals despite its loose, sandy surface. *Erodium* and Goodeniaceae are common among these; complemented by *Gnephosis macrocephala*, *Calandrinia* sp., *Ptilotus polystachyus*, *Plantago* sp., *Stenopetalum*

robustum and other members of the Brassicaceae, and the geophyte *Wurmbea tenella*.

A small area on the opposite border of Goongarrie National Park, referable to calcareous plain, has nutrient-poor but base-rich soil with a scatter of pavement of limestone on the surface, pinker and more compact than the soil of adjacent broad valley. The vegetation is dominated by 7-9m trees of *Casuarina cristata*. *Acacia aneura* is rare and represented by shrubs only, but there is a sparse stratum of tall shrubs noticeably clumped under trees (*Acacia hemiteles*, together with *Scaevola spinescens*, *Cassia nemophila* var. *nemophila*, *Alyxia buxifolia*, *Heterodendrum oleaefolium*, *Exocarpos aphyllus*, *Santalum spicatum*, and *Dodonaea lobulata*). *Maireana sedifolia* is present but uncommon. Low shrubs are confined to *Ptilotus obovatus* var. *obovatus*, *Olearia muelleri* and sparse *Solanum* spp., *Maireana* spp., and *Atriplex vesicaria*. Herbaceous plants consist mainly of semi-annual *Stipa trichophylla* and a few *Sclerolaena* sp., and the sparse ephemerals are *Zygophyllum* spp., *Crassula* sp. and about 10 other species. This vegetation resembles that on undulating plain and salt lake feature in some respects but the dominance of *Casuarina cristata* is distinctive.

Typical of sandplain in Goongarrie National Park is a site with sandy loam or loamy sand overlain by a patchy crust and a uniform sprinkling of fine grit. Mallees of *Eucalyptus leptopoda* are present in small quantities only. The main ground cover comprises a mixture of *Triodia scariosa* and the relatively soft tuft grasses *Amphipogon caricinus* and *Eragrostis eriopoda*. An admixture of shrubs consists of *Acacia* sp., *A. longispinea*, *A. ramulos*, *A. hemiteles*, *Grevillea didymobotrya* and *Hakea multilineata*. Sparse low shrubs consist of *Thryptomene* spp., *Baeckea* sp., *Wehelia thryptomenoides*, *Keraudrenia integrifolia*, *Prostanthera baxteri* and a few examples of *Eremophila decipiens*. The only geophyte noted is *Thysanotus patersonii*. *Waitzia acuminata*, found among leaf litter, is the main ephemeral. The only other ephemerals are *Brunonia australis* and a few *Helipterum verecundum*, *Crassula* sp., *Chrysocoryne pusilla* and *Goodenia* sp.

Elsewhere on sandplain there are local stands of *Melaleuca uncinata* or *Allocasuarina* sp. The south-eastern sector of the boundary track runs through sandplain of relatively high elevation, with *Eucalyptus oldfieldii* and *Callitris preissii* ssp. *verrucosa* over *Triodia scariosa* and *Amphipogon caricinus* and patches of trees of *Acacia aneura*. *Eucalyptus transcontinentalis* occupies a few areas on discrete pediments of recently redistributed sandy soil associated with sandplain.

Typical of broad valley in Goongarrie National Park is a soil type consisting of loam 40cm deep over a lime hardpan. The dominant plant, *Acacia aneura*, grows to 6m with scattered *Eucalyptus* ? *longicornis* emerging to 8m. Shrubs higher than 2m form a relatively dense stratum of *Acacia ramulosa*, *A. burkittii* and *A. tetragonophylla*. Shrubs 1m high consist of *Cassia nemophila* var. *nemophila*, *Eremophila granitica*, *E.*

decipiens, *Scaevola spinescens* and *Dodonaea rigida*, and low shrubs and perennial grasses consist of *Solanum lasiophyllum*, *Ptilotus drummondii*, *Maireana triptera*, *Amphipogon caricinus*, *Stipa elegantissima*, *Monachather paradoxa*, *Eragrostis eriopoda* and occasional *Triodia scariosa*. Ephemerals consist of *Goodenia havilandii*, *Velleia rosea*, *Brunonia australis*, *Waitzia acuminata*, *Chrysocoryne pusilla*, *Helipterum craspedioides* and *Chthonocephalus pseudevax*.

A variant of mixed low woodland over scrub, intermediate to sandplain, occurs on soils of sandy loam. Tree species present are *Eucalyptus hypochlamydea* (9m), *E. concinna* and uncommon *Acacia aneura* (7m). Shrubs consist of *Dodonaea* spp., *Eremophila paisleyi*, *Acacia ramulosa*, and *A. tetragonophylla*. Low shrubs consist of *Cassia nemophila*, *Eremophila latrobei*, *E. platythamnus*, *Scaevola spinescens*, *Ptilotus drummondii*, *P. obovatus* var. *obovatus*, *Solanum lasiophyllum* and *S. nummularium*. Several species of *Olearia*, *Eremophila oldfieldii* spp. *angustifolia*, *Acacia jennerae* and *A. hemiteles* are rare but present. *Maireana* spp. are virtually absent, while *Triodia scariosa*, together with less conspicuous grasses (*Monachather paradoxa*, *Stipa elegantissima*) are scattered throughout.

A sprinkling of perennial herbaceous plants comprises *Zygophyllum* sp., *Aristida contorta*, *Podolepis capillaris* and *Ptilotus exaltatus* var. *exaltatus*. Ephemerals include the common *Waitzia acuminata*, and *Brunonia australis*, *Goodenia* spp., *Helipterum fitzgibbonii* and *Chrysocoryne pusilla*, with *Calandrinia lehmannii* on open ground and *Calotis hispidula*, *Plantago* sp. and about five other species restricted to patches of litter. The dwarf ephemerals *Chthonocephalus pseudevax* and *Actinobole uliginosum* are also rare.

Other areas of broad valley feature stands of 9m *Casuarina cristata*, a species found particularly on the rises in the park. In one extensive stand of *Acacia aneura* and *Casuarina cristata*, there are few rises but the soil remains compact and lime is present at depth as evidenced by roadside spoil. On the other hand, some relatively sandy surfaces in broad valley in the park are marked by the occurrence of an understorey with *Eremophila leucophylla* and grasses.

At the time of the vegetation survey of Goongarrie National Park, the area was recovering from a mosaic burn. Fires had affected most of the lower-lying portions but the rises were largely unburnt. Fox (1980) has studied regeneration of vegetation after fire in Goongarrie National Park and adjacent areas. A number of sample plots were located within the park boundaries in the north-eastern section.

Species recorded were *Acacia aneura*, *A. acuminata*, *A. hemiteles*, *A. tetragonaophylla*, *Cassia nemophila*, *Casuarina cristata*, *Cephalopterum drummondii*, *Codonocarpus cotinifolius*, *Duboisia hopwoodii*, *Leichardtia australis*, *Pterigeron cylindriceps* and *Solanum lasiophyllum* (Fox, 1980).

Five metre high *Codonocarpus cotinifolius*, a post-fire species, was common throughout the burnt areas at the time of the survey (Milewski and Keighery, 1988).

FAUNA

The fauna of a site 30km west of Goongarrie National Park was systematically sampled during the biological survey of the Eastern Goldfields District. The fauna of Goongarrie National Park was, however, sampled opportunistically while the vegetation survey of the park was being conducted (Dell and How, 1988a). All reptile species from the park, except the gecko *Diplodactylus strophurus*, were also recorded in the Comet Vale area (Appendix 9). A full species list from Goongarrie National Park is provided in Appendix 6 (mammals) and 8 (amphibians and reptiles).

A total of 20 reptile species were recorded from Goongarrie National Park consisting of seven geckoes, four dragons, seven skinks, one monitor and a single snake (Dell and How, 1988a). The gecko *Diplodactylus strophurus*, recorded in shrubs surrounding Deadman Soak just inside the western boundary, is at its southern distributional limit in the park. Species observed include the geckoes *Diplodactylus maini* and *D. pulcher*; the dragons *Ctenophorus cristatus*, *C. reticulatus* and *C. scutulatus*; the skinks *Ctenotus atlas*, *C. leonhardii*, *C. uber* and *Morethia butleri*; the monitor *Varanus caudolineatus* and the snake *Pseudonaja modesta*.

A bird list of 74 species was compiled during the survey of Goongarrie National Park (Dell and How, 1988a). Some 68 of these were recorded at survey sites to the immediate west and 100km north-east of the park. The 33 species of non-passerines include the White-faced Heron (*Ardea novaehollandiae*), Boobook Owl (*Ninox novaeseelandiae*), Tawny Frogmouth (*Podargus strigoides*) and Fairy Martin (*Hirundo nigricans*). Major components of the non-passerine assemblage are raptors, with eight species, including the Collared Sparrowhawk (*Accipiter cirrocephalus*) and the Spotted Harrier (*Circus assimilis*); and seven species of parrot, including Bourke's Parrot (*Neophema bourkii*).

The 41 species of passerines include four species not recorded in adjacent areas during the survey; these were the Samphire Thornbill (*Acanthiza iredalei*), Brown Songlark (*Cincloramphus cruralis*), Brown Honeyeater (*Lichmera indistincta*) and White-browed Woodswallow (*Artamus superciliosus*). Five passerines recorded in the park, including the Splendid Fairy-wren (*Malurus splendens*) and the White-winged Fairy-wren (*M. leucopterus*), were identified by Kitchener *et al.*, (1982) as habitat-specific residents restricted to natural vegetation, in a survey of the wheatbelt (Appendix 10).

The only native mammals sighted in Goongarrie National Park were the macropods (*Macropus fuliginosus* and *M. rufus*), however, seven species of small terrestrial mammals were recorded at survey sites 30km west and

100km north-east (Dell and How, 1988a). These include three dasyurid marsupials (*Ningauia ridei*, *Sminthopsis crassicaudata* and *S. dolichura*); and the native rodents *Notomys alexis*, *N. mitchelli*, *Pseudomys bolami* and *P. hermannsburgensis*.

RECREATIONAL USE AND POTENTIAL

Considerable recreational potential exists for Goongarrie National Park with the development of environmental education and interpretation facilities. Goongarrie is one of the most accessible national parks in the arid zone, with Tonkin Road, a well-graded road passing through the park, linking the sealed Kalgoorlie-Leonora Highway with Yarri Road. The CTRC (1974) highlighted the potential for tourist use of this loop from Kalgoorlie to Goongarrie National Park via Kanowna and Gindalbie, returning through Menzies, Comet Vale and Broad Arrow. A place of historical interest is Deadman Soak, on the western boundary of the park, where the grave of a young European who was speared by Aborigines in 1896 is still present (CTRC, 1974).

KEY FEATURES

- Arid zone flora and fauna north of the mulga-eucalypt line.
- The park, surrounded by pastoral leases, contains vegetation types that have not been affected by grazing.

CTRC RECOMMENDATION

The Committee recommends that the Goongarrie area be declared a Class A reserve for National Park, and placed under the control of the National Parks Board of Western Australia.

EPA RECOMMENDATION

The EPA recommends that:

1. The Goongarrie area of approximately 60,000ha be declared a Class A reserve for the purpose of National Park and be vested in the National Park Board;
2. The Department of Mines be asked to advise the National Park Board and the EPA on the desirable location of the southern boundary of the proposed reserve.

PRESENT RECOMMENDATIONS

1. Goongarrie National Park (No. 35637) should retain its current status, purpose and vesting.
2. The park should be extended eastwards following the boundaries defined for the proposed Goongarrie National Park extension.

PROPOSED GOONGARRIE NATIONAL PARK EXTENSION

The proposed eastward extension of Goongarrie National Park would ensure increased representation of the transitional mulga-eucalypt woodlands that occur north of Kalgoorlie. Following the addition of a

south-eastern extension to the park in 1984, the present proposal would further consolidate the conservation value of the reserve.

LOCATION: The proposed area is bounded by Tonkin Road to the north and Yarri Road to the east. Cockatoo Rocks are located 80km south-east of Menzies.

MAP: 7.

AREA: 21,110ha.

CURRENT STATUS: The area is part of Menangina South Pastoral Lease (Nos. 3114/741 and 398/567) and incorporates Red Cliffs Gnamma Hole, Water Reserve No. 8640 (405ha), just east of Cockatoo Rocks.

GEOMORPHOLOGY

The proposed extension contains representatives of all the region's major landform units except for undulating plain over greenstone. Sandplain, contiguous with Goongarrie National Park, occupies the western portions while the extensive broad valley surface types occur in the southern, eastern and northern sections. Adjacent to the sandplain in the north-east are the granite exposures of Cockatoo Rocks with a series of small salt lakes and low-lying saline flats present to the east of the rocks.

To the south-east of Boomerang Lake, a small area of alluvial calcareous plain, a southern outlier of calcrete valleys common to the north, occupies the north-eastern portion of the proposal. Contiguous with Quaternary surfaces of Goongarrie National Park, the broad valleys of the proposed extension consist of reworked sandplain, dissecting alluvial valleys and low-lying colluvial clays and loams flanking aeolian saline and dune deposits (Williams *et al.*, 1976).

The extensive granite breakaway complex of Cockatoo Rocks is the largest of a series of granite rocks present in the park to the west. High cliffs border a swale of aeolian sands and the associated Red Cliffs Gnamma Hole lies 3km to the east. Comparable granite outcrops systems of Carr Boyd Rocks, to the south, and Six Mile Rocks and Donkey Rocks, to the north, are excluded from Goongarrie National Park.

FLORA AND VEGETATION

As part of the comprehensive vegetation survey of Western Australia, Beard (1975) mapped broad vegetation associations at a scale of 1:250,000. The area east of Goongarrie National Park consists of mixed mulga (*Acacia aneura*) and Black Sheoak (*Casuarina cristata*) dissected by mulga and saltbush (*Atriplex* sp.) on salt lake feature. Also identified at this scale is a small area of mallee (*Eucalyptus* sp.) and spinifex (*Triodia* sp.) south-west of Government Rockhole. Six Mile Rocks, a similar granite outcrop system 5km north of Cockatoo Rocks, supports open low mulga on stony hills of granite (Beard, 1975).

During the biological survey of the Goongarrie area, Milewski and Keighery (1988) tabulated the relationship between landform, geology, soils and vegetation. The salt lake system occurring in the northern sections supports *Halosarcia* and *Atriplex* low shrublands flanked by low woodlands of *Acacia aneura*. Present on the inner apron of Cockatoo Rocks is a granite vegetation complex with tall shrublands of *A. aneura* on the outer apron. The aeolian sand surfaces, bordered by Cockatoo Rocks, support *A. aneura* low woodlands. These two landforms, salt lake feature and granite exposure, however, are most likely to provide additional flora species with further botanical surveys (Dell *et al.*, 1985).

The study by Fox (1980) into the effects of fire on mulga communities include sample plots within the proposed extension to Goongarrie National Park. The plots are located on Quaternary broad valley surfaces in the north-eastern section of the proposed area, close to the junction of Tonkin and Yarri Roads (Fox, 1980).

The dominant species recorded were *Acacia aneura*, *A. ramulosa*, *Casuarina cristata*, *Cassia nemophila*, *C. pleurocarpa*, *Codonocarpus cotinifolius* and *Scaevola spinescens*. Other regenerating perennials include *Acacia acuminata*, *A. hemiteles*, *A. murrayana*, *A. tetragonophylla*, *Alyxia buxifolia*, *Canthium lineare*, *Cassia artemisioides*, *Dodonaea filifolia*, *Leichardtia australis*, *Santalum spicatum*, *Solanum lasiophyllum*, and *S. orbiculatum*. Also recorded were undescribed species of *Eucalyptus*, *Grevillea* and *Hakea* with the herbs *Brunonia australis*, *Helichrysum apiculatum* and *Wurmbea tenella*.

The flora and vegetation of the proposed area, east of Goongarrie National Park, will be surveyed in late 1990.

FAUNA

In conjunction with the flora and vegetation survey, the fauna of the proposed extension will also be documented in late 1990. Terrestrial mammals, reptiles and amphibians will be sampled along with opportunistic sightings of birds.

HISTORY

The area surrounding Goongarrie National Park has been stocked for over 65 years (CTRC, 1974). In 1983, due to the amendment to the boundaries of Gindalbie (3114/409) and Menangina (3114/697) Pastoral Leases, an area of land north of Carr Boyd Rocks and east of Wongi Soak became vacant. As the land was adjacent to the south-eastern boundary of the existing Goongarrie National Park, its inclusion was of significant benefit for the reserve (CALM files). In July 1984, the Class A Reserve No. 35637 was extended by 10,477ha to its present area of 60,355ha.

In February 1985, the lessee of Menangina Station applied for approval to surrender a portion of lease 398/567 (21,110ha) adjoining the eastern

boundary of Goongarrie National Park. Although suitable for inclusion into a Class A Reserve, the area has yet to be surrendered from the lease as the Department of Mines has objected to any alteration in the tenure of the land to be included. At present, the inclusion of the proposed extension is unlikely until the Department of Mines lifts its objection (CALM files).

RECREATIONAL USE AND POTENTIAL

The proposed eastward extension of Goongarrie National Park would incorporate Tonkin and Yarri Roads, forming a potential tourist loop from Kalgoorlie through the park (see Goongarrie National Park).

KEY FEATURES

- Poorly reserved transitional eucalypt-mulga woodlands.
- Community types contiguous with Goongarrie National Park.
- Extensive granite breakaway complex of Cockatoo Rocks.
- Potential for recreational and educational use of an arid zone reserve via a route linking Kalgoorlie with the park and Menzies.

CTRC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATIONS

The eastward extension of Goongarrie National Park, to be vested in the NPNCA, is defined as the area bounded to the: west by 121°44'30"E for 2km to the south-eastern corner of Goongarrie National Park; north by Tonkin Road for 18km to the junction with Yarri Road; east by Yarri Road for 8km to Government Rockhole; and south-east by Yarri Road for 9km; south by approximately 30°03'S for 10km.

2.4 MENZIES AREA

Recommendations for the Menzies area propose the establishment of two new nature reserves. This area is part of the Austin Botanical District, one of the most poorly reserved in the State. Goongarrie National Park (see 2.3) is the only substantial reserve (60,335ha) in the eastern central goldfields region. The proposed nature reserves, south-west of Menzies and the Comet Vale Common, incorporate landforms and community types not represented in Goongarrie National Park.

Both proposed reserves include areas of dunefield, a landform rarely encountered to the south during the biological survey of the Eastern Goldfields District (Newbey, 1984, 1985, 1988). The extensive system of sandridges south-west of Menzies, however, contrasts with the lakeside dunes east of Comet Vale. The rich flora and fauna, associated with the dunefields of the proposed areas, includes south-western floristic elements and diverse assemblages of small mammals and reptiles (Dell *et al.*, 1988b). In addition, small areas of greenstone on the western margins of Lake Goongarrie are contained within the proposed Comet Vale Nature Reserve.

PROPOSED COMET VALE NATURE RESERVE

Comet Vale Common, originally proposed as a Timber Reserve in the early 1970's, incorporates areas of poorly represented greenstone (CALM files). Results from the biological survey of the Eastern Goldfields, highlighting the high conservation values of the area, have resulted in recommendations for a proposed nature reserve. Notable fauna species include two native hopping mice, two dasyurids, two fairy-wrens, an outlying population of an arid zone skink, and the Scarlet-chested Parrot. Important flora records include three mallees with restricted ranges centred on the Comet Vale area.

During the survey, long-term biological monitoring sites were established in the Comet Vale area in 1979. The majority of these survey sites are located to the south-west of Salt Dam, on the southern portion of Jeedamyra Pastoral Lease, outside the proposed nature reserve. These sites will become increasingly important in monitoring changes in the region's flora and fauna, particularly the changes in land under pastoral use.

LOCATION: The abandoned Comet Vale townsite is situated 28km south of Menzies and 104km north of Kalgoorlie along the Kalgoorlie-Leonora Road, within the Shire of Menzies.

MAP: 7.

AREA: 5,058ha

CURRENT STATUS: Comet Vale Common (Reserve No. 16153) is an unvested C Class reserve.

GEOMORPHOLOGY

The main landform elements of the proposed Comet Vale Nature Reserve correspond to those described for Goongarrie National Park, 30km to the east (see 2.3). The proposed area, however, includes a narrow belt of greenstone, a landform unit entirely absent from Goongarrie National Park, and most of the existing reserve system. In addition a series of dunes associated with sandplain intrude into the north-eastern corner of the proposed reserve.

An ultramafic intrusive complex of Archaean greenstones (serpentine, jasper and amphibole) has been exposed along the western margins of Lake Goongarrie (Kriewaldt, 1970). Small areas of ultramafic rocks (altered gabbro and dolerite) occur 2km to the west of Comet Vale. This narrow greenstone belt, with a high point of 414m, extends 10-12km south from Comet Vale.

The majority of the proposed area is dominated by extensive colluvial broad valleys of loam containing regular nodular kankar (Milewski, 1988). A small salt lake, 3km south-west of Comet Vale, forms part of a chain linking Lake Owen, Goongarrie and Marmion with the ancient shallow

valley of Lake Ballard and Lake Rebecca. The western side of the Lake Goongarrie playa, contrasting with the alluvial and aeolian deposits on the eastern margins, is characterised by eroded alluvial pediment and exposed fresh or deeply weathered bedrock (Kriewaldt, 1970).

An area of sandplain, extending north and west of Comet Vale, dominates the northern portion of the proposed reserve. Upland dunefields, associated with the sandplain, intrude into the extreme north-eastern corner. A small number of isolated dunes, separated by wide interdunal areas, extend in a north-western direction near the margins of Lake Goongarrie. These dunes, although adjacent to the lake, contrast with the lowland dunefields associated with salt lakes to the north-east (Milewski and Keighery, 1988).

FLORA AND VEGETATION

The flora and vegetation of the proposed Comet Vale Nature Reserve has been surveyed by Milewski and Keighery (1988) and S.D. Hopper (field notes: 1978-89). The proposed reserve includes populations of three eucalypts with restricted distributions centred on Comet Vale. The mallee *Eucalyptus jutsonii* is a Priority Two species on CALM's Reserve Flora list. This rare and poorly known eucalypt has a very restricted range and is only known from the Comet Vale area and east towards Carr Boyd Rocks. The sandplain mallee *Eucalyptus ceratocorys* has a restricted distribution extending from red sand areas in the northern wheatbelt to the western part of the Great Victoria Desert (Brooker and Kleinig, 1990). Recently rediscovered near Comet Vale, *E. comitae-vallis* is now believed to be synonymous with *E. brachycorys*. During the biological survey of the Eastern Goldfields, *Eucalyptus comitae-vallis* was included with *E. concinna* (Milewski and Keighery, 1988).

All three mallees, including the recently described *Eucalyptus hypochlamydea* (formerly *E. foecunda*), have been recorded on dunes and sandplain in the vicinity of Comet Vale. Sandplain, containing dunes of red sands, occurs in the northern portion of the proposed reserve and also extends 5km northwards.

The proposed Comet Vale Nature Reserve is within the transition zone where the South-Western Phytogeographic Interzone meets the southern part of the Austin Botanical District of the Eremaean Botanical Province (Beard, 1980). The Comet Vale area consists of elements of characteristic south-western vegetation (eucalypt woodland and shrub-mallee) as well as typical Eremaean vegetation (*Acacia aneura* and *Casuarina cristata* woodlands).

Recorded north of Lake Goongarrie were *Acacia stowardii* tall shrublands and low woodlands of *Acacia aneura*, *Casuarina cristata* and *Eucalyptus clelandii* (associated with breakaways near Salt Dam). The survey noted that these flora and fauna sites, located in the vicinity of Salt Dam and south of Granite Dam, are all subject to sheep grazing as they occur on the

Jeedamya Pastoral Lease (Dell and How, 1988b). The sites adjacent to the proposed reserve, however, are south-west of the station boundary fence. Grazing does not appear to occur within the sandplain mallee formations of *Eucalyptus concinna*, *E. leptopoda* and *E. oldfieldii*.

Mallees of *Eucalyptus jutsonii* have been recorded on red sandhills, with the mallees *Eucalyptus ebbanoensis*, *E. concinna* and *E. transcontinentalis*. Also present in the same area are open mallee formations of *Eucalyptus jutsonii*, *E. leptopoda*, *E. oldfieldii* and *E. rigidula*; *E. ceratocorys* (formerly *E. angulosa* var. *ceratocorys*) associated with mallees of *E. ebbanoensis* and *E. oldfieldii*.

The understorey of *Eucalyptus leptopoda* mallee formation consists of *Acacia aneura* and *Melaleuca uncinata* over low shrubs of *Baeckea* aff. *cryptandroides*, *B. ochropetala*, *Hemigenia divarcata*, *Phebalium canaliculatum*, *Thryptomene aspera* and *T. urceolaris* with the hummock grass *Amphipogon caricinus*. Growing under mallees of *Eucalyptus oldfieldii* are shrubs of *Callitris preissii* ssp. *verrucosa* over *Acacia ligulata*, *Baeckea muricata*, *Grevillea juncifolia*, *Hakea arida* with the hummock grasses *Amphipogon caricinus* and *Triodia scariosa*.

A dune slope, 2km north-west of the edge of Lake Goongarrie, supports tall shrublands of *Acacia coolgardiensis* and the mallees *Eucalyptus leptopoda*, *E. oldfieldii* and *E. rigidula*. Other shrubs present include *Baeckea ochropetala*, *Callitris preissii* ssp. *verrucosa*, *Calytrix stipulosa*, *C. watsonii*, *Leptospermum roei*, *Thryptomene aspera*, *T. urceolaris* and *Verticordia helmsii* over an undescribed new species of *Triodia* (G. Keighery 9427).

The *Eucalyptus concinna* mallee formation, although sampled just outside the northern boundary, extends into the proposed reserve. The vegetation type is characterised by tall mallees over sparse *Acacia* with low shrubs and large but low rings of *Triodia scariosa* to 3m in diameter on the ground. Mallees associated with *Eucalyptus concinna* are *E. jutsonii*, *E. leptopoda* and *E. transcontinentalis*. The sparse shrub stratum is comprised of *Acacia aneura*, *A. ligulata*, *A. jennerae*, *A. longispinea* and *A. tetragonophylla* over low shrubs, including *Duboisia hopwoodi* and *Olearia exiguifolia*.

FAUNA

During the biological survey of the Eastern Goldfields District, the fauna was sampled over an area extending 10km north-east from the abandoned Comet Vale townsite (Dell and How, 1988a). Within the proposed Comet Vale Nature Reserve the fauna was surveyed in mallee formations of *Eucalyptus leptopoda*, *E. oldfieldii* and *E. rigidula* on dunes and sandplain. North of Lake Goongarrie, community types such as *Eucalyptus concinna* mallee that extend into the proposed reserve were sampled for fauna. Additional fauna survey sites were within the vicinity of Salt, Granite and White Quartz Dams.

The fauna species list of the proposed Comet Vale Nature Reserve comprises seven native mammals, 26 reptiles, two amphibians and 64 birds. This includes a mallee site with one of the richest reptile assemblages (19 species of reptiles and three species of snakes) recorded during the biological survey of the Eastern Goldfields District (Dell and How, 1988a). The species recorded from the proposed reserve are listed in Appendix 7 (mammals) and 9 (amphibians and reptiles).

The biogeographic location of the Comet Vale area contributes to a rich and diverse fauna. This location, within the transition zone between eucalypt and mulga woodlands, increases the heterogeneity of community types sampled (R. How, pers. comm.). The Comet Vale area consists of elements of vegetation characteristic of both the Eremaean and the South-west Botanical Provinces (Dell and How, 1988a). In addition, species replacement occurs in this ecotone with both south-western and Eremaean elements present in the fauna (Dell and How, 1988a).

The reptile assemblage consists of two species of amphibian, six geckoes, a single species of legless lizard, five dragons, eleven skinks and three snakes. The gecko *Gehyra purpurascens*, revealed as a new species during the survey, has its type locality between mallees of *Eucalyptus concinna* and Lake Goongarrie, just outside the proposed reserve. The sand dunes and adjacent mallee sites in this north-eastern corner have particularly high numbers of the gecko *Nephrurus laevis* and the dragon *Ctenophorus fordi* recorded.

Several species are at the extremes of their known ranges in the Comet Vale area. The geckoes *Diplodactylus intermedius* and *D. maini* are at their inland and north-easterly limits, while the skink *Lerista macropisthopus* and the gecko *Nephrurus laevis* are at the south-eastern and south-western edges of their distributions respectively. The record of the frog *Neobatrachus wilsmorei* is a significant south-easterly extension of its known range. The population of the skink *Ctenotus brooksi*, on sand dunes within the proposed reserve, represents a south-western isolate of this Eremaean species.

Native mammals recorded within the proposed Comet Vale Nature Reserve include three species of dasyurids and three species of native rodents. A single bat (*Tadarida australis*) was collected in the proposed reserve, although an additional five species were recorded in the vicinity of Salt, Granite and White Quartz Dams. Two species of *Pseudomys* occur in the Comet Vale area, but they occupy different substrates (Kitchener *et al.*, 1984). *Pseudomys bolami* was recorded in low-lying loams in the vicinity of Salt Dam, while *P. hermannsburgensis* occurs on sandy soils of dunes and higher sandplain (Dell and How, 1988a).

The sympatric occurrence of several small terrestrial mammals within the proposed reserve is noteworthy (Dell and How, 1988b). Five species were

recorded in the same habitat (mallee over *Triodia*) on sandplain dunes. This assemblage comprises three native rodents, *Notomys alexis*, *N. mitchellii* and *Pseudomys hermannsburgensis* with two dasyurids, *Sminthopsis crassicaudata* and *Ningaui ridei*. In addition, the dunnart *Sminthopsis dolichura* was recorded in adjacent sandplain. The congeneric *Notomys alexis* and *N. mitchellii*, including some specimens having intermediate characteristics, occur together on and adjacent to an isolated sand dune in the north-eastern corner of the proposed reserve.

The bird species list recorded comprises 26 non-passerines and 38 passerines. An additional 11 species, including two herons and several species of ducks and wading birds, are associated with semi-permanent water in the vicinity of Salt, Granite and White Quartz Dams (Dell and How, 1988a). The proposed Comet Vale Nature Reserve is located close to the climatically determined Eucalypt-Mulga line, a major boundary determining bird distributions (Serventy and Whittell, 1967).

Passerines recorded in vegetation characteristic of the South-West Botanical Province include three species of Honeyeater, Brown (*Lichmera indistincta*), Yellow-plumed (*Meliphaga ornata*), Brown-headed (*M. brevirostris*) and the Australian Raven (*Corvus coronoides*). In contrast, typically Eremaean species recorded at Comet Vale are the White-tailed Fantail (*Rhipidura albicauda*), the White-browed Tree Creeper (*Climacteris affinis*), the Pied Honeyeater (*Certhionyx variegatus*), Yellow-fronted Honeyeater (*Meliphaga plumula*), the Masked Woodswallow (*Artamus personatus*), the White-browed Woodswallow (*A. superciliosus*) and the Australian Crow (*Corvus orru*).

Appendix 11 lists six passerine species, including two species of Malurid Fairy-wrens recorded within the proposed reserve, which were identified as habitat specific residents restricted to natural vegetation in the wheatbelt (Kitchener *et al.*, 1982). The Splendid Fairy-wren (*Malurus splendens*), the Blue-breasted Fairy-wren (*M. pulcherrimus*) and the Scarlet-chested Parrot (*Neophema splendida*), an infrequently recorded species, all occur in habitat on dunes and adjacent sandplain in the northern portion of the proposed area.

HISTORY

The Comet Vale townsite, established in 1898, was abandoned in 1951. Comet Vale Common incorporates a series of small reserves including a cemetery and rifle range. The Comet Vale siding, on the Kalgoorlie-Leonora Railway, and town cemetery are still present. Several mines were sited in the greenstone within the Common, including Comet Vale and Lake View, and the Battery Sands operations of Gladsome and Sand Queen (Kriewaldt, 1970). Mineral exploration still occurs in the area (I. Kealley, pers. comm.). Comet Vale Common is bounded by Goongarrie Pastoral Lease (3114/929) to the west, south and east; Jeedamya (3114/1121) to the north and Adelong (3114/801) to the north-west.

RECREATONAL USE AND POTENTIAL

There is limited recreational potential for the Comet Vale area as it is surrounded by pastoral leases. Present use is restricted to through traffic on the main Kalgoorlie-Leonora Road, and local use of the Tonkin Road 10km to the north.

KEY FEATURES

- The rich flora and fauna present on a series of sandplain dunes in the north-eastern corner of the proposed reserve.
- Three eucalypts with restricted distributions, including the Priority species *Eucalyptus jutsonii*, occurring on sandplain in the area.
- Long-term monitoring sites established within the proposed reserve and on the adjacent Jeedamya Pastoral Lease.
- The inclusion of the poorly reserved greenstone landform, present along the western margins of Lake Goongarrie.

CTRC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATIONS

Comet Vale Common (Reserve No. 16153) should be upgraded to Class A and converted to a nature reserve for the purpose of Conservation of Flora and Fauna, vested in the NPNCA.

PROPOSED NATURE RESERVE SOUTH-WEST OF MENZIES

LOCATION: The proposed nature reserve is located 10-30km south-west of Menzies.

MAP: 7.

AREA: 15,956ha.

CURRENT STATUS: The majority of the proposed area is within vacant Crown land, however, a small portion of Adelong Pastoral Lease (3114/801) is included.

GEOMORPHOLOGY

The proposed nature reserve has been selected to incorporate a representative dunefield system. This extensive sandplain area, with associated dunes, contrasts with the small dunefields to the south-east, in the vicinity of Comet Vale. The proposed boundaries, reflecting the natural borders of the sandplain, include the full extent of the dune system.

The dunefield, extending 15-18km, consists of a large number of high sandridges and low interdune flats. The dunes, with an average height of 15m, parallel each other in a north-westerly direction. Several individual dunes extend 6-8km. The flat interdunal areas vary in width throughout the system, as does the height and length of the dunes. Where the dunes occur in association, however, they are characterised by narrow interdune

swales. These upland sandplain dunes consist of yellowish-red loamy sands that have uniform texture and colour to great depth (Milewski and Keighery, 1988).

Contrasting with the extensive dune system, several small low lying pans consisting of alluvial and aeolian deposits are scattered throughout the proposed reserve. In addition, Quaternary broad valleys of alluvial and colluvial sands intrude into the western portion (Kriewaldt, 1970).

FLORA AND VEGETATION

A preliminary flora and vegetation survey confirmed the floristic importance of the sandplain dune systems in the Menzies area (G.J. Keighery, field notes: 1989). The biological survey of the Comet Vale area 25km to the south-east highlighted the distinctive south-western floral elements present on isolated sand dunes (Dell and How, 1988b). The extensive dunefield south-west of Menzies, however, appears more diverse than the small dune system near Comet Vale (G. Keighery, pers. comm.).

The proposed nature reserve south-west of Menzies contains both flora recorded at Comet Vale and several additional species. Representatives of the Comet Vale flora include *Calytrix watsonii*, *Eucalyptus ceratocorys* and *Triodia* sp. nov. (G.J. Keighery 9427). The presence of *Acacia* aff. *jutsonia* (G.J. Keighery 11219), *Banksia elderiana*, *Stylidium humphresii* and *Xanthorrhoea thortonii* contributes to the diversity of the proposed reserve. In addition, new species collected are *Tricoryne* sp. nov. (G.J. Keighery 11230) and *Acacia* sp. nov. (G.J. Keighery 11217).

Many interesting south-western species occur at the inland margins of their range within the proposed reserve. These include *Caustis* ?*dioica*, *Hybanthus floribundus* and *Lechenaultia brevifolia*. The record of *Chamelaucium ciliatum* is the only collection within the Austin Botanical District. *Eucalyptus ceratocorys* (formerly *E. angulosa* var. *ceratocorys*) was also recorded on sandplain dunes in the area (G. Keighery, pers. comm.)

The flora and vegetation of representative dunes were sampled only in the eastern portion of the proposed reserve. Dune slopes, adjacent to the small salt lake just outside the eastern boundary, support tall shrublands of *Callitris preissii* ssp. *robusta* and mallees of *Eucalyptus gracilis*. Other tall shrubs include *Acacia* sp. nov. (G.J. Keighery 11217) and *Grevillea didymobotrya* over the low shrubs *Calytrix watsonii* and *Eremophila exotrachys*.

Other species present are the shrubs *Anthotroche walcottii*, *Dodonaea viscosa* ssp. *angustissima*, *Halgania viscida*, *Olearia subspicata*, *Rhagodia eremaea*, *Santalum acuminatum*, *Scaevola* cf. *oxyclona* and *Verticordia helmsii*. Also recorded were *Helichrysum davenportii*, *H. semipapposum*, *Glissrocharyon aureum*, *Ptilotus stirlingii* and *Thysanotus manglesii*.

The crest of a dune, west of the salt lake, supports a shrubland with emergent *Eucalyptus rigidula*. The wide variety of shrubs includes *Callitris preissii* ssp. *verrucosa*, *Chamelaucium ciliatum*, *Grevillea juncifolia*, *Hakea multilineata*, *Hybanthus floribundus*, *Leptospermum roei*, *Newcastelia insignis*, *Phyllota luehmanii*, *Thryptomene aspera* and *Wehlia thryptomenoides* over the sedge *Caustis dioica* and *Lepidobolus preissiana*.

The adjacent interdune area contains mallees of *Eucalyptus rigidula* over *Triodia* sp. nov. (GJ 9427). Also present on the sandplain flats are the tall shrubs *Acacia* aff. *jutsonii* (GJ 11219), *Callitris preissii* ssp. *robusta*, *Calytrix watsonii*, *Grevillea didymobotrya* and *Melaleuca uncinata* over a dense cover of *Triodia* sp. nov.

Low shrubs recorded include *Allocasuarina corniculata*, *Alyxia buxifolia*, *Chamelaucium ciliatum*, *Mirbelia seorsifolia*, *Persoonia* aff. *coriacea*, *Phyllota luehmanii*, *Thryptomene urceolaris* and *Xanthorrhoea thortonii*. The perennial herb flora contains an undescribed species of *Tricoryne* and also *Stylidium humphresii*.

A dune north-west of the salt lake supports the mallees *Eucalyptus burracoppinensis* and *E. ceratocorys* over *Triodia* sp. nov. Shrubs growing under the mallees are *Callitris preissii* ssp. *verrucosa*, *Cryptandra* cf. *leucophracta*, *Dodonaea viscosa*, *Grevillea didymobotrya*, *G. juncifolia*, *Hakea multilineata*, *Hemigenia divaricata* and *Wehlia thryptomenoides*.

Recorded under *Eucalyptus burracoppinensis* and *E. ceratocorys* in the narrow interdune was a shrub understorey comprised of the additional species *Allocasuarina corniculata*, *Alyxia buxifolia*, *Melaleuca uncinata*, *Phebalium cannaliculatum*, and species of *Acacia*, *Olearia* and *Spyridium* over the sedge *Dianella revoluta* and the perennial herb *Ptilotus stirlingii*.

FAUNA

A preliminary fauna survey in 1989 compiled a species list that consisted of four native mammals, 15 reptiles and 26 birds (N. McKenzie and A. Chapman, field notes: 1989). A variety of habitats including lakeside dune slopes, interdunes and dune crests were sampled. The small fauna recorded is consistent with the preliminary nature of the survey and short duration of sampling. Recent biological survey work in the Eastern Goldfields and Nullarbor has demonstrated the relative efficacy of fauna sampling (Dell and How, 1984, 1985; Bosacci *et al.*, 1987). Dell and How (1988a) document the accumulation of fauna species over sampling time for the Comet Vale area.

The three species of small terrestrial mammals, recorded on and adjacent to sandplain dunes, include the dasyurid *Ningaui ridei* and two native rodents, *Notomys alexis* and *Psuedomys hermannsburgensis*. The reptile assemblage comprises five species of geckoes, a single dragon, seven

species of skink and two snakes. Appendix 9 lists the species of reptiles recorded within the proposed reserve.

Three species of reptile were recorded close to their distributional limits. The populations of the skinks, *Ctenotus brooksi* and *C. leae*, represent south-western isolates of eremaeian species (Dell and How, 1988a). The gecko *Nephrurus laevissimus*, recorded in large numbers at Comet Vale and this site, is at the south-western edge of its range.

All species recorded in the proposed reserve are also present to the south-east in the Comet Vale area, with the exception of the snake *Vermicella semifasciata* and the skink *Ctenotus leae*. In particular, the record of *C. leae* is notable as they are rare in collections (L. Smith, pers. comm.). Previously recorded as far west as Queen Victoria Spring (270km to the east) this population may represent an isolated western population.

Three species were collected from a small breakaway area that supported *Eucalyptus* spp. over soft kankar outcrops. Two species of gecko and the skink *Lerista muelleri* were not recorded in the surrounding sand dunes. The gecko *Gehyra purpurascens*, a recently described species from the Eastern Goldfields, also occurs sympatrically with the more widespread *G. variegata* to the east at Comet Vale and Goongarrie National Park (Dell and How 1988a).

An additional three species of non-passerines and 13 passerines have recently been recorded from the eastern edge of the proposed reserve in the vicinity of the salt lake (M. and K. Brooker, pers. comm.). The total of 42 species, comprising 12 non-passerines and 30 passerines, includes the Blue-breasted Fairy-wren (*Malurus pulcherrimus*) and Splendid Fairy-wren (*Malurus splendens*).

HISTORY

The proposed reserve is located within a block of vacant Crown Land surrounded by Adelong, Riverina, Goongarrie and Credo pastoral leases. The area, predominantly sandplain, appears never to have been stocked. Little use is presently made of the area with the boundary fence of Adelong Station located to the east of the small salt lake. Tracks into the southern portion of the proposed reserve revealed by air photography flown in 1959, have virtually disappeared with lack of use.

RECREATIONAL USE AND POTENTIAL

The proposed reserve, at present, is virtually inaccessible, with no established tracks providing access into the area.

KEY FEATURES

- Representative dunefield surrounded by sandplain.
- Most extensive system of dunes in the area.
- Reptile and small mammal fauna associated with the dunes.

CTRC/EPA RECOMMENDATIONS: None.

PRESENT RECOMMENDATION

The proposed nature reserve should be Class A for the purpose of Conservation of Flora and Fauna, vested in the NPNCA, and is defined as the area bounded to the: west by the eastern boundary of Riverina Pastoral Lease (3114/1017) along 120°46'E for 4.5km; north by 29°47'15"S for 7.5km, then along 120°50'30"E for 3.5km to 29°45'30"S for 11km; east by the Adelong Pastoral Lease (3114/801) boundary along 120°57'30"E for 11km; and south by 29°51'S for 8km and for 10.8km to join the western boundary.

3.0 Northern Goldfields

3.1 WANJARRI NATURE RESERVE

LOCATION: Wanjarri Nature Reserve is situated 60km north of Leinster (Map 8) and 90km south-east of Wiluna (Map 9), to the east of the Kalgoorlie-Meekathara Road, within the Leonora Shire. Niagara Dam, 55km north-east of Menzies, is within the Menzies Shire, while Malcolm Dam, 20km south-east of Leonora, is in the Leonora Shire.

MAP: 8, 9.

AREA: Wanjarri Nature Reserve (No. 30897): 53,248ha.
Malcolm Dam Nature Reserve: 400ha.
Niagara Dam Nature Reserve: 477ha.

CURRENT STATUS: Wanjarri Nature Reserve is a Class A Nature Reserve for the Conservation of Flora and Fauna, vested in the NPNCA. Niagara Dam (No. 5062), vested in the NPNCA, and Malcolm Dam (No. 8946), vested in the Minister for Water Resources, are both reserved for Conservation of Water, Flora and Fauna.

GEOMORPHOLOGY

Broad valley surfaces dominate the Wanjarri Nature Reserve while small areas of dunefields, granites, drainage lines, breakaways and sandplains are represented within the reserve. A narrow north-south greenstone belt intrudes into the western edge of the reserve.

A number of breakaways, characterised by bluff faces with scree slopes and colluvial soils at the base, are scattered throughout the reserve. Granite rockholes are present along the northern and eastern boundary while Coondine Soak is in the south-eastern corner of the reserve.

FLORA AND VEGETATION

A variety of vegetation types are represented within Wanjarri Nature Reserve (Milewski and Keighery, in prep.). The reserve is dominated by *Acacia aneura* formations occurring on different landforms. Low woodlands of *A. aneura* are present on broad valleys, sandplains, granite exposures and small areas of undulating plain. Breakaways, broad valleys and granite outcrop areas support tall shrublands of *A. aneura*.

Other vegetation types recorded in Wanjarri Nature Reserve include *Eucalyptus camaldulensis*, *E. oleosa* and *E. gongylocarpa* low woodlands; mallee associations of *E. kingsmillii*; *Acacia pruinocarpa* and *Callitris columellaris* low woodlands; and tall shrublands of *Acacia quadrimarginea*.

Broad valley surfaces within Wanjarri Nature Reserve support low woodlands of *Acacia aneura*, which contain the shrubs *Acacia tetragonophylla*, *A. craspedocarpa*, *Dianella revoluta*, *Eremophila*

leucophylla, *E. latrobei*, *Santalum spicatum* and *Spartothamnella teucრიiflora* over perennial grasses of *Eragrostis eripoda*, *Monacather paradoxa* and *Solanum lasiophyllum*.

Dominant annuals present under *Acacia aneura* low woodlands are *Aristida contorta*, *Brachycome ciliocarpa*, *Cephalopterum drummondii*, *Erodium cygnorum*, *Myriocephalus rhizocephalus*, *Ptilotus gaudichaudii* and *Quinqueremula linearis*. Other ephemeral species recorded include *Actinobole uliginosum*, *A. condesatum*, *Calocephalus knappi*, *Calandrinia polyandra* and *Helipterum charsleyae*.

In the western sections of Wanjarri Nature Reserve, rocky slopes within undulating plains support low woodlands of *Acacia pruinocarpa*, which contain the shrubs *Acacia aneura*, *A. tetragonophylla*, *Eremophila oldfieldii* ssp. *angustifolia*, *E. scoparia* and *Santalum spicatum* over annuals of *Asteridia athrixoides*, *Enneapogon caerulescens*, *Ptilotus aervoides* and *Salsola kali*.

Breakaways present in the Wanjarri Nature Reserve support low woodlands of *Acacia aneura* at the bases with *A. aneura* tall shrublands occupying the flats on the top. Shrubs present at the base of breakaways are *A. quadrimarginea*, *A. tetragonophylla*, *Eremophila fraseri*, *E. longifolia*, *Gastrolobium laytonii*, *Hakea suberea* and *Rhagodia spinescens*.

A rich annual flora occupies the drainage channels from the breakaway. Dominant species recorded were *Calotis hispidula*, *Eragrostis dielsii*, *Helipterum charsleyae*, *H. craspedioides* and *H. maryonii*. Other ephemerals include *Angianthus strictus*, *Chenopodium melanocarpum*, *Calotis multicaulis*, *Euphorbia drummondii*, *Eriachne pulchella* and *Stenopetalum anfractum*.

Shrubs occurring with *Acacia aneura* on the tops of breakaways include *A. quadrimarginea*, *Canthium latifolium*, *Dodonaea petiolaris*, *Eremophila glutinosa*, *E. latrobei* and *Sida calyxhymenia* over the annuals *Angianthus burkittii* and *Stenopetalum anfractum*.

The banks of larger drainage lines in Wanjarri Nature Reserve support *Eucalyptus camaldulensis* low woodlands with shrubs of *Acacia acuminata*, *A. craspedocarpa*, *Cassia artemisioides*, *Eremophila longifolia*, *E. serrulata*, *Gastrolobium laytonii*, *Glycine clandestina* and *Pimelea microcephala*.

The ephemeral community under these woodlands is diverse and extremely mixed. Taxa recorded include *Anagallis arvensis*, *Brachycome ciliocarpa*, *Calotis multicaulis*, *Helipterum maryonii*, *H. propinquum*, *H. tenellum*, *Podolepis kendallii* and *Stenopetalum filifolium*.

Low granite outcrop areas within Wanjarri Nature Reserve are flanked by tall shrublands of *Acacia quadrimarginea* with *Acacia aneura*, *Dodonaea*

petiolaris, *Eremophila exilifolia*, *Ptilotus obovatus*, *Santalum spicatum* and *Solanum lasiophyllum*. These granite exposures also support a rich annual flora that includes *Angianthus strictus*, *Helipterum craspedioides*, *Chthonocephalus pseudevax* and *Ptilotus gaudichaudii*.

Sandplains in Wanjarri Nature Reserve support low woodlands of *Eucalyptus gongylocarpa* over a dense ground cover of *Triodia basedowii*. Other shrubs recorded were *Acacia aneura*, *Cassia nemophila* and *Ptilotus obovatus*.

Niagara Dam, a small reserve 250km south-east of Wanjarri Nature Reserve, contains a series of breakaways at the base of which are small areas of open woodlands that contain *Eucalyptus carnei*, *E. longicornis* and *E. salubris*. In addition, the Priority one species, *Eremophila* sp. (J. Elliot 127), has been collected from Niagara Dam.

FAUNA

The fauna of Wanjarri Nature Reserve was documented during the biological survey of the Eastern Goldfields District (McKenzie and Rolfe, in prep.). The species list from the reserve consists of 18 native mammals, four amphibians, 36 reptiles and 60 birds. The species recorded in Wanjarri Nature Reserve are listed in Appendix 6 (mammals) and 8 (amphibians and reptiles).

The small dasyurid fauna comprises five species, including the recently described *Pseudantechinus woolleyae*. Also recorded were the Kultarr (*Antechinomys laniger*), Wongi Ningau (*Ningau ridei*) and three sympatric *Sminthopsis* dunnarts. Both the Stripe-faced Dunnart (*S. macroura*) and Ooldea Dunnart (*S. ooldea*) were only recorded within the existing reserve on Wanjarri Nature Reserve.

Populations of the Red Kangaroo (*Macropus rufus*) and the Euro (*M. robustus*) are concentrated along breakaways and near granite rockholes such as the Coondine Soak area. Other mammals recorded from the reserve include two native rodents (*Notomys alexis* and *Pseudomys hermannsburgensis*) and seven species of bat. The unidentified species of *Eptesicus* is most likely the recently described *E. finlaysoni* (D. Kitchener, pers. comm.).

The herpetofauna of Wanjarri Nature Reserve contains representatives of the arid zone fauna not recorded elsewhere in the existing reserve system of the Eastern Goldfields. These species include three amphibians (*Cyclorana maini*, *C. playtcephalus* and *Neobatrachus centralis*) and 15 reptiles.

This principally arid zone assemblage of 15 species consists of the gecko *Diplodactylus conspicillatus*; the legless lizard *Delma grayii*; four dragons (*Caimanops amphiboluroides*, *Ctenophorus caudicinctus*, *C. inermis* and *C. isolepis gularis*); eight skinks (*Ctenotus ariadnae*, *C. calurus*, *C. grandis*,

C. helenae, *C. quattuordecimlineatus*, *Egernia depressa*, *Lerista bipes* and *Tiliqua multifasciata*); and the monitor *Varanus panoptes rubidus*.

The avifauna also contains arid zone representatives such as Bourke's Parrot (*Neophema bourkii*), Budgerigar (*Melopsittacus undulatus*), Cockatiel (*Nymphicus hollandicus*) and Zebra Finch (*Poephila guttata*). A number of waterbirds were recorded at granite soaks and bores within the reserve, including the Banded Plover (*Vanellus tricolor*), Bush Stone-curlew (*Burhinus grallarius*), Red-necked Avocet (*Recurvirostra novaehollandiae*), Pacific Heron (*Ardea pacifica*) and Blue-winged Shoveler (*Anas rhynchotis*).

Records of bird sightings have been kept since 1940 and over 110 species of birds have been recorded from Wanjarri Nature Reserve (Moriarty, 1972). The reserve lies in a zone where bird species with predominantly southern distributions or northern and eastern distributions overlap (CTRC, 1974). Species recorded during the survey close to the northern limits of their range include the Regent Parrot (*Aprosmictus erythropterus*), Mallee Fowl (*Leipoa ocellata*) and Grey Currawong (*Strepera versicolor*). Bird species listed by Moriarty (1972) that are near the western or south-western limits of their distribution include the Princess Parrot (*Polytelis anthopeplus*), Rufous-crowned Emu-wren (*Stipiturus ruficeps*), Striated Grass-wren (*Amytornis striatus*) and Spotted Bowerbird (*Ptilonorhynchus maculatus*).

Over 13 species of waterbirds have also been reported from Malcolm Dam, near Leonora. These include the Grey Teal (*Anas gibberifrons*), Mountain Duck (*Tadorna tadornoides*), Hoary Headed Grebe (*Podiceps poliocephalus*), Black-throated Grebe (*P. novaehollandiae*), Wood Duck (*Chenonetta jubata*), Pink-eared Duck (*Malacorhynchus membranaceus*) and large number of the Black-tailed Native Hen (*Gallinula ventralis*).

RECREATIONAL USE AND POTENTIAL

There is limited recreational use of Wanjarri Nature Reserve at present. In contrast, Niagara Dam and Malcolm Dam receive heavy recreational use, mainly swimming and picnicking.

KEY FEATURES

One of the few conservation reserves in the pastoral zone. Contains representative vegetation and community types of the poorly reserved Austin Botanical District. Vegetation associations present on breakaways and drainage lines. Fauna containing arid zone assemblages and species not recorded elsewhere on the existing reserve system in the Eastern Goldfields.

CTRC RECOMMENDATION

The Committee endorses the status, purpose and vesting of the Wanjarri Wildlife Sanctuary.

EPA RECOMMENDATION

The EPA endorses the present status of Wanjarri Wildlife Sanctuary as a Class A reserve (A 30897) for the purpose of Conservation of Flora and Fauna vested in the WA Wildlife Authority.

PRESENT RECOMMENDATIONS

1. Wanjarri Nature Reserve (No. 30897) should retain its current class, purpose and vesting.
2. Niagara Dam (No. 5062) should retain its current class, purpose and vesting in the NPNCA until more biological information is gathered regarding its status.
3. Malcolm Dam (No. 8946) should retain its current class and vesting in the Minister for Water Resources noting the values of Flora and Fauna in its purpose.

3.2 PROPOSED WINDICH SPRING NATURE RESERVE

The CTRC (1974) report recommended a reserve at Windich Spring (11.1) of about 10,000ha, incorporating part of the Canning Stock Route between 25°30'S and 120°46'E, for the Conservation of Flora and Fauna. The EPA (1975) Red Book, in endorsing Recommendation 11.1, changed the purpose to National Park. Subsequent negotiations resulted in a reduced reserve of only 144ha.

Recommendations by Dr. A.A. Burbidge in 1980 proposed a reserve of 337ha to incorporate both Windich Spring and the western pool (Little Windich Spring). Lack of agreement with the lessee of the adjoining Cunyu Pastoral Lease, however, effectively blocked reservation of the proposed reserve (EPA files).

In 1989, the transfer of Cunyu Pastoral Lease resulted in renewed negotiations with the new lessees for a conservation reserve at Windich Spring. Suitable boundaries for a reserve are currently being determined based on recommendations made in 1980 (CALM files, 1990).

LOCATION: Windich Spring is located 130km north-east of Wiluna, along the Canning Stock Route, within the Wiluna Shire.

MAP: 9.

AREA: The proposed Windich Spring Nature Reserve (approx. 400ha) will be established within the area proposed by the CTRC in 1974 (10,300ha).

CURRENT STATUS: Windich Spring lies within the Canning Stock Route Reserve, encompassed by Cunyu pastoral Lease (3114/1049).

GEOMORPHOLOGY

Windich Spring is a freshwater pool within Kennedy Creek. A smaller freshwater pool (known as Little Windich Spring) lies in a western branch of Kennedy Creek.

FLORA AND VEGETATION

Windich Spring and the western pool are flanked by Red River Gums (*Eucalyptus camaldulensis* var. *obtusa*).

FAUNA

Although no species lists have been compiled for the Windich Spring area, numerous mammal and bird species use the natural freshwater pools as a drinking place. Over 60 species of birds have been reported (CTRC, 1974). Windich Spring also contains the most isolated populations of the Dinner Plate Tortoise (*Chelodina steindachneri*).

HISTORY

The natural freshwater pools at Windich Spring were important sites to Aboriginal groups, with artefact scatters reported from between the two pools (P. Fuller, pers. comm.). Windich Spring was named in 1874 by John Forrest, the first European to see it. The area later became an important watering point on the Canning Stock Route.

RECREATIONAL USE AND POTENTIAL

There is little recreational use of the area at present due to its remote location on a pastoral station. Increased use of the Canning Stock Route by travellers, however, will place pressure on the freshwater pools at Windich Spring. The site is also known to be culturally significant to Aboriginal groups living in the area (EPA files).

CTRC RECOMMENDATION

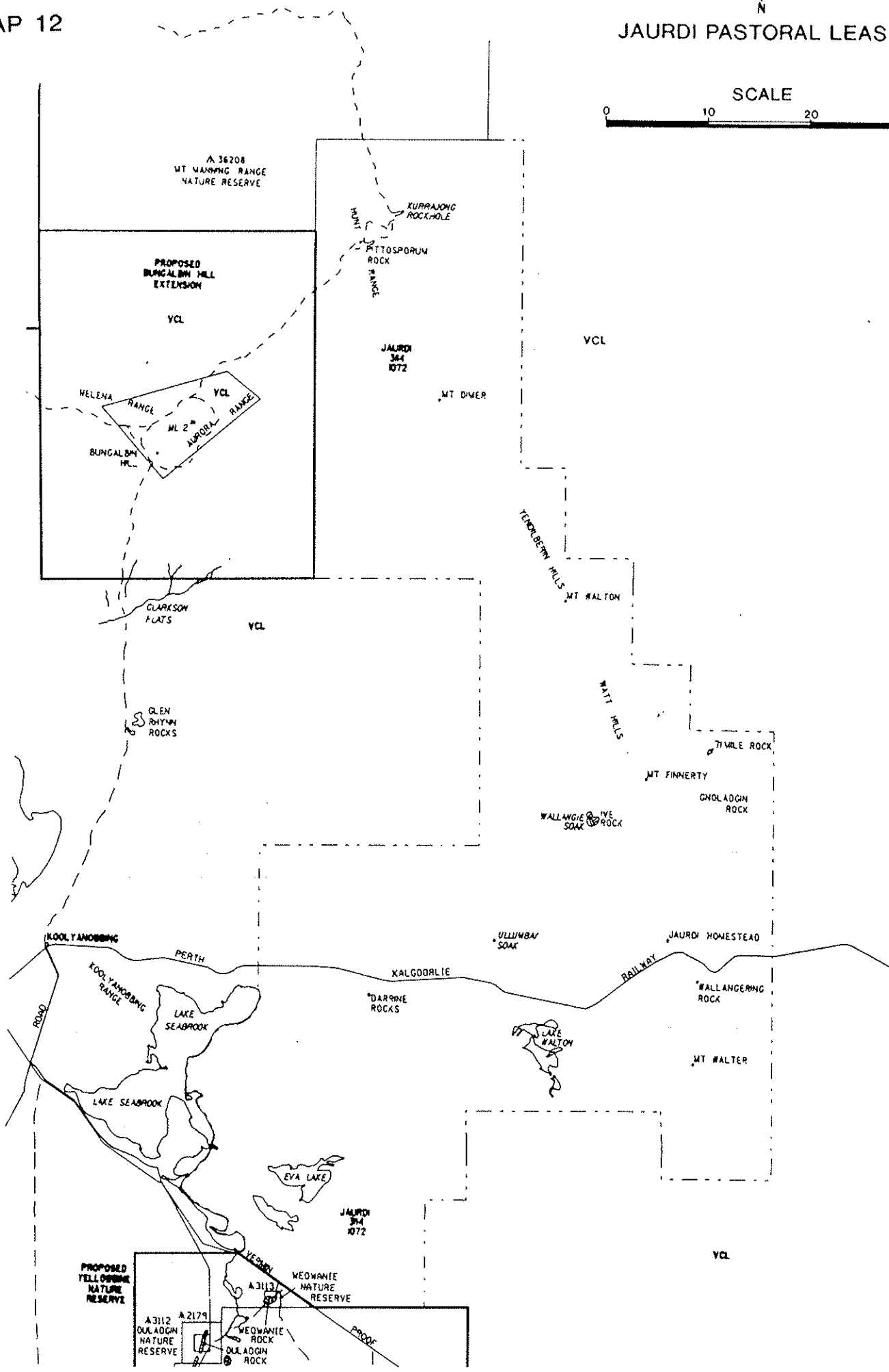
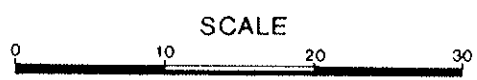
The Committee recommends that Windich Spring be declared a Class A reserve for the Conservation of Flora and Fauna, vested in the WA Wildlife Authority. The reserve should be defined as that part of the Canning Stock Route lying between latitude 25°30'S and longitude 120°46'E.

EPA RECOMMENDATION

The EPA recommends that Windich Spring be declared a Class A reserve for the purpose of National Park vested in the National Park Board. The Windich Spring reserve is defined as that section of the Canning Stock Route bounded on the north by 25°30'S and on the west by 120°46'E.

PRESENT RECOMMENDATION

The proposed Windich Spring Nature Reserve should be Class A, vested in the NPNCA, for Conservation of Flora and Fauna, and situated within the CTRC recommended area of 10,300ha.



4.0 Areas Requiring Additional Investigation

There is insufficient information available to make definite recommendations concerning some areas that have potential for reservation as nature reserves. Preliminary biological surveys of these areas indicate that they require additional investigation to determine their conservation values. Located within the southern and central goldfields, the majority of the areas are situated on vacant Crown land with the exception of Fraser Range, Swan Lake and Erayinia Hill (pastoral leases); Parker Range, Highclere Hills and Mt Norcott (historical or active mining leases); and Jaurdi Pastoral Lease (purchased by CALM). The ten areas are discussed briefly below.

4.1 GRANITE ROCKS SOUTH OF BALLADONIA

Botanical surveys of Coragina Rock, Ponier Rock, Mt Willgonarinya, Mt Coobaninya, Breeboorinia Rock and Mt Buraminya (Map 2) have established that these granite outcrops and some of the intervening terrain have high conservation values. A major nature reserve is needed to encompass these outstanding areas and form a conservation corridor linking Dundas Nature Reserve with Cape Arid National Park (see 1.7). Many differences in communities occur even between adjacent rocks which contain several rare or poorly known plants not recorded in existing conservation reserves in the region. These include the Declared Rare Flora *Caladenia "voigtii"*, Priority species *Eremophila denticulata* ssp. nov., undescribed *Hydrocotyle* sp., and *Myriophyllum balladoniensis*. Several fauna species, collected in the vicinity of Ponier Rock, were not recorded on Dundas Nature Reserve to the north. These include the amphibian *Limnodynastes dorsalis*, the dragons *Ctenophorus maculatus dualis* and *C. mckenziei*, and the snake *Denisonia masteri*.

PRESENT RECOMMENDATION

It is recommended that the Department of Conservation and Land Management investigate the conservation and recreational values of the series of granite rock outcrops south of Balladonia and make recommendations for nature conservation where appropriate. Both the recreational potential of the rocks as stop-over points along the road to Balladonia, and the conservation value of a corridor linking Dundas Nature Reserve with Cape Arid National Park, need to be addressed.

4.2 GRANITE ROCKS EAST OF LAKE JOHNSTON

Preliminary botanical surveys in the proposed McDermid Rock Nature Reserve and of Disappointment Rock, indicate that nature reserves are needed to encompass the major granite outcrops east of Lake Johnston, such as Alice Rock, Taylor Rock, Wheeler Rock, Red Roo Rock and Disappointment Rock (Map 1). These rocks have great diversity in communities, with major changes in floristics from rock to rock, and many rare or poorly known plants on them.

Surveys of Disappointment Rock, 22km south-east of McDermid Rock, recorded the granite endemic *Eucalyptus "stenantha"* (S.D. Hopper, field notes: 1978-89). A preliminary comparison was made of floras from Disappointment Rock and Scamp Rock, on the western margins of Lake Johnston within the proposed McDermid Rock Nature Reserve. Of the 46 species recorded, over half (25 species) are not shared between the two rocks (S.D. Hopper, pers. comm.). Twelve species recorded at Disappointment Rock, including *Borya constricta*, *Callitris verrucosa*, *Hakea trifurcata* (SDH 7246), *Astroloma* sp. (SDH 7250) and *Leucopogon* sp. (7249) are absent from Scamp Rock, 18km to the north-west (see 1.5).

Fringing the rock are dense thickets of *Allocasuarina campestris* ssp. *campestris* and *Leptospermum erubescens* flanked by mallees of *Eucalyptus grossa* with dense heaths of *Melaleuca uncinata* over scattered *Triodia scariosa*. Present in soil pockets on sheet granite are *Acacia dempsteri*, *A. neurophylla* and *Calothamnus tuberosus*.

PRESENT RECOMMENDATION

It is recommended that the Department of Conservation and Land Management conduct botanical surveys of the scattered and remote granite rock outcrops east of Lake Johnston and for nature conservation where appropriate.

4.3 JAURDI PASTORAL LEASE

Jaurdi Pastoral Lease (3114/1072) is an integral part of the reserve system of the Eastern Goldfields District. Forming an extensive vegetation corridor (321,180ha) it links the existing Mt Manning Range Nature Reserve with the proposed Yellowdine Nature Reserve (Map 12). The conservation value of the existing Mt Manning Range Nature Reserve would be considerably consolidated by the incorporation of the northern portion of Jaurdi Pastoral Lease. Poorly represented areas such as Mt Dimer and the Hunt Range form a contiguous system with the proposed Bungalbin Hill extension (see 2.2).

Additional biological investigation is needed to identify potential areas of high conservation value that may warrant reservation as nature reserves. These include the granite rocks of Pittosporum Rock, Kurrajong Rockhole and 71 Mile Rocks; the banded ironstone Yendilberin Hills and Mt Dimer; the greenstone Hunt Range; the quartz Mt Walter; the salt lake system of Lake Walton and Eva Lake; and the breakaways north of Jaurdi Homestead.

The lease, now under CALM management, will be classified as either a Timber Reserve or State Forest, with some areas to be proposed as nature reserves. Interim management guidelines for Jaurdi Pastoral Lease are currently being drawn up by the Goldfields District.

PRESENT RECOMMENDATION

It is recommended that the Department of Conservation and Land Management identify possible areas within the Jaurdi Pastoral Lease that could be reserved to protect representative areas of the communities that occur there, and that these areas be examined for their biological values. Potential areas of high conservation value such as Kurrajong Rockhole, Pittosporum Rock, Hunt Range, Mt Dimer and the Yendilberin Hills need to be surveyed in detail. Preferably, any reserves should be contiguous with the existing Mt Manning Range Nature Reserve and proposed Bungalbin Hill extension or the proposed Yellowdine Nature Reserve.

4.4 PARKER RANGE

The Parker Range greenstone belt, south of Marvel Loch, includes the Toomey Hills and Mt Caudan (Map 3). During the biological survey of the Eastern Goldfields District, the Parker Range was identified as an area worthy of further study (Newbey and McKenzie, in prep.). Undulating plains of greenstone support a distinctive vegetation pattern that is restricted to the Parker Range. Low woodlands of *Eucalyptus corrugata*, *E. conglobata*, *E. longicornis* and *E. salubris* occur on the slopes and colluvial flats while *Hakea* sp. (KRN 9218) tall shrublands are present on the gossanous caps of some ridges (Newbey, in prep.).

The rare *Eucalyptus conglobata* low woodlands vegetation type has also been recorded on the greenstone belt from Mt Holland to Hatter Hill to the south (Map 1). The vegetation associations present on the greenstone of the Parker Range area however, differ markedly from the low woodlands of mainly *Eucalyptus flocktoniae* of the Forrestania greenstone belt (Newbey and Hnatiuk, 1988).

Tall shrublands of *Hakea* sp. (KRN 9218) are a vegetation type unique to the Eastern Goldfields District and entirely confined to the gossanous caps of the higher ridges of the Parker Range, such as Mt Caudan (Newbey and McKenzie, in prep.). Other species present include trees of *Eucalyptus "capillosa" ssp. "capillosa"* with shrubs of *Calothamnus gilesii*, *Dodonaea inaequifolia*, *Grevillea paradoxa*, *Phebalium filifolium* and *Trymalium aff. ledifolium* over annuals of *Angianthus tomentosus*, *Millotia myosuroides* and *Parientaria debilis*.

Present on slopes in the vicinity of Mt Caudan are low woodlands of *Eucalyptus conglobata* comprised of *E. annulata* and *E. longicornis* over shrubs of *Acacia nyssophylla*, *A. merrallii*, *Melaleuca pauperiflora* and *Templetonia sulcata*. Flanking woodlands of *Eucalyptus longicornis* (15-20m trees) are dominated by an understorey of *Melaleuca pauperiflora*.

The Parker Range-Yilgarn Hills greenstone belt, extending north and south of Marvel Loch, is significant as the inland barrier to several plant species of the South-West Botanical Province. These include *Acacia flavopila*, *A. pulchella* var. *subsessilis* and *Kennedia prostrata*. The

undulating topography and ridges of the Parker Range area provide both scenic appeal and a diversity of vegetation including eucalypt woodlands and rich annual flora (G. Keighery, pers. comm.).

At present, only about 10% of the unique Parker Range Vegetation System is reserved within the Jilbadgi Nature Reserve (Newbey, unpubl. data). Parker Range, however, is within a Mineral Field and has been subject to historical mining operations and active exploration. The only conservation reserve within the Parker Range area is Reserve No. 16347, 10km south-east of Marvel Loch on Burbidge Road. Set aside in 1916, the reserve has been highly disturbed by mining activities, and was cancelled as a "Timber Reserve" in 1989 (CALM files).

PRESENT RECOMMENDATION

It is recommended that the Department of Conservation and Land Management investigate the conservation value of the Parker Range and make recommendations for nature conservation where appropriate.

4.5 HIGHCLERE HILLS

The Highclere Hills, a series of low greenstone outcrops, extends from a high point of 460m north of Lake Deborah west to Mt Correll on the Vermin Proof Fence (Map 6). These hills support mainly low woodlands of *Eucalyptus corrugata* on low stony ridges with *E. salmonophloia* woodlands, and low woodlands of *E. salubris* on the colluvial flats. Several notable extensions of range were recorded for flora in the Highclere Hills, including *Hakea* sp. (KRN 9589) and *Leptosema chambersii* ssp. nov. (Newbey and Hnatiuk, 1985).

The vegetation patterns present on the undulating plains of the Highclere Hills differ from those of the Parker Range and Forrestania Greenstone Belt to the south (Newbey and Hnatiuk, 1988; Newbey, in prep.). The rare and poorly known *Eucalyptus corrugata*, common on the Highclere Hills, has a restricted distribution from Mt Jackson to Marvel Loch (Napier *et al.*, 1988). Low woodlands of *Eucalyptus corrugata* in the vicinity of Mt Correll are comprised of the shrubs *Acacia acanthoclada*, *A. tetragonophylla*, *Atriplex nummularia* ssp. *spathulata*, *Dodonaea inaequifolia* and *Olearia muelleri*.

PRESENT RECOMMENDATION

It is recommended that the Department of Conservation and Land Management investigate the conservation value of the Highclere Hills and make recommendations for nature conservation where appropriate.

4.6 FRASER RANGE

The Fraser Range is a landform unique within the Eastern Goldfields District (Newbey, 1984). The range, extending 120km north-east from the Eyre Highway to Spy Hill, is highest in the southern section near the

Fraser Range Homestead (Map 5). It is encompassed by the Fraser Range Pastoral Lease (3114/1137) which is contiguous with the Dundas Nature Reserve (Map 2). The range supports a distinctive vegetation pattern of mallees and low woodlands, interspersed with herblands (Newbey *et al.*, 1984).

The Fraser Range is a horst of Proterozoic basic granulite that has eroded into a crude and well-spaced lattice of low and rounded ridges (Wilson, 1969). Ridges of 3-5m are present south of Symons Hills while a few low hills in the vicinity of Eyre Highway rise to 579m (Newbey, 1984). The geomorphology of the Fraser Range is outlined in the proposed Buningonia Spring Nature Reserve (see 1.14).

The botanical significance of the Fraser Range has been known since the Elder Exploring Expedition of 1891, which traversed the Great Victoria Desert to the Fraser Range (Beard, 1975). Plant collections made by Helms contained several important first records, including *Geococcus pusillus* (G. Keighery, pers. comm.).

During the biological survey of the Eastern Goldfields District several poorly known species were recorded from the Fraser Range (Newbey and Hnatiuk, 1984). *Lasiopetalum* aff. *ogilvieanum* (KRN 7101) was first collected on the southern section of Fraser Range. The collections of poorly known flora, including *Prostanthera serpyllifolia* ssp. *serpyllifolia* and *Limosella curdieana* (an aquatic) from the Fraser Range area, suggests it may be an important outlier for some Eastern States species. Records of notable extensions of distribution from the Fraser Range include *Helipterum tietkensii*, *Menkea lutea* and *Brachysema daviesioides*.

The Fraser Range is an important area for several eucalypts. The undescribed *E. fraseri* ssp. nov. has a very restricted occurrence in the Fraser Range (Napier *et al.*, 1987). Other eucalypts with restricted distributions in the area include the recently described *Eucalyptus balladoniensis* and *E. fraseri* (Brooker, 1976) and the undescribed *E. "histophylla"* (Brooker and Kleinig, 1990).

Species reaching their range limits in the Fraser Range area include *Eucalyptus lesoueffi*, at its eastern distributional limit, and the skink *Diporiphora reginae*. Also recorded at Buningonia Spring, *D. reginae* has a distribution restricted to a small part of the arid southern interior of Western Australia (see 1.14).

The vegetation pattern of the Fraser Range varies from north to south in relation to rainfall and the degree of grazing by sheep, rabbits and kangaroos. The vegetation and flora of the northern sections of the Fraser Range are detailed in the proposed Buningonia Spring Nature Reserve (see 1.14). In general, low woodlands tend to replace the scattered mallees on the low ridges of the southern sections. Very little natural vegetation, however, remains on the southern sections of the Fraser Range (Newbey

and Hnatiuk, 1984). The flats and low hills support stands of introduced weeds dominated by noxious weeds such as Double Gee (*Emex australis*). The few remaining shrubs on stony hills in this badly degenerated vegetation indicate that their original vegetation was tall shrublands of *Dodonaea microzyga* (Newbey and Hnatiuk, 1984).

The colluvial flats of the Fraser Range appear to have experienced frequent burning in the past as part of the grazing management by pastoralists (Newbey and Hnatiuk, 1984). The flats, with a high clay content, support herblands dominated by *Menkea lutea*, *Gnephosis burkitti* and *Cephalipterum drummondii*. Frequent burning, and possibly over-grazing, may have contributed to the present herblands of the southern Fraser Range (Newbey *et al.*, 1984). The original vegetation, prior to leasing for grazing stock, consisted of low woodlands of *Eucalyptus salubris* and *E. oleosa* with some small areas of *E. lesouefii* (Newbey and Hnatiuk, 1984).

PRESENT RECOMMENDATION

It is recommended that the Department of Conservation and Land Management investigate the conservation and recreational values and, after consultation with the owners of the Fraser Range Pastoral Lease (3114/1137), make recommendations for nature conservation where appropriate.

4.7 BRONZITE RIDGE

Bronzite Ridge, located 45km west of Norseman, supports a population of the priority taxon *Eucalyptus pterocarpa* (Hopper *et al.*, 1990). The ridge (32°11'S, 121°17'E), rising to 393m, is formed by the Jimberlana Intrusion of the Widgiemooltha Dyke Suite (Gower and Bunting, 1976). The eastern areas of this intrusion, the Dundas Hills, contain vegetation of interesting composition including Declared Rare eucalypts with restricted distribution (see 1.6 and 4.8).

Although exposure is poor in comparison with the Dundas Hill, a preliminary survey of Bronzite Ridge identified the Priority Two species *Eucalyptus pterocarpa*. This poorly known eucalypt was previously confined to a small area north-west of Norseman (Napier *et al.*, 1987; Chippendale, 1988). Other eucalypts recorded in the vicinity of the ridge include *Eucalyptus calycogona*, *E. diptera*, *E. eremophila*, *E. flocktoniae*, *E. leptophylla*, *E. longicornis*, *E. "livida"*, *E. pileata*, *E. salmonophloia* and *E. "tenuis"* (N. Henry-Hall, field notes: 1989). Broad valleys flanking Bronzite Ridge support low woodlands of *Eucalyptus* aff. *foecunda* (Newbey and Hnatiuk, 1988).

PRESENT RECOMMENDATION

It is recommended that the Department of Conservation and Land Management investigate the Bronzite Ridge area to determine its

conservation potential and make recommendations for nature conservation where appropriate.

4.8 MT NORCOTT AND BULDANIA ROCKS

Mt Norcott (421m) is within the Dundas Hills, 23km north-east of Norseman (Map 2). It is one of the only two known localities of Declared Rare Flora *Eucalyptus* aff. *diversifolia* (*Eucalyptus* sp. Norseman, SD Hopper 2936). The other locality is Jimberlana Hill, 18km to the west (see 1.6). Mt Norcott represents the eastern extent of the 200km long Jimberlana Intrusion of the Widgiemooltha Dyke Suite (Gower and Bunting, 1976). This mafic dyke, composed of unmetamorphosed norite, gabbro, pyroxenite and noritic dolerite (Doepel, 1973), is not represented in the existing reserve system.

In the vicinity of Mt Norcott, 5km to the north-east, are Buldania Rocks, a granite outcrop area just north of the Eyre Highway (Map 2). Only 30km east of Norseman, the area is a popular camping and stop-over point. Extending over 5ha, the granite is flanked by low woodlands of *Acacia acuminata*; mallees of *Eucalyptus loxophleba* and *E. salmonophloia* woodlands. The flat granite rock supports an excellent cover of annuals including *Gonocarpus nodulosus*, *Hyalospermum glutinosum* ssp. *glutinosum* and *Toxanthus perpusillus*. Orchids recorded at Buldania Rocks were "*Cyanicula*" *deformis*, *Diuris* aff. *corymbosa* and *Pterostylis* aff. *nana* (S.D. Hopper, field notes: 1978-89).

PRESENT RECOMMENDATION

It is recommended that the Department of Conservation and Land Management investigate the Mt Norcott and Buldania Rocks area to determine their recreation and conservation potential and make recommendations for nature conservation where appropriate.

4.9 VACANT CROWN LAND EAST OF LAKE LEFROY

A block of vacant Crown land incorporates an extensive area of the Lake Lefroy salt lake system (Map 5). The land, south of Cowarna Downs (3114/617) and north of Madoonia Downs (3114/1023) pastoral leases, has little pastoral or mining potential. The large unnamed salt lake east of Lake Lefroy is known locally as Lake Randall (CALM files).

At present, large salt lakes are poorly represented within the existing reserve system of the Eastern Goldfields District. Only small areas of the halophytic plant associations of Lake Gilmour (Dundas Nature Reserve), Lake Sharpe and Tay (Peak Charles National Park) and Lake Marmion (Goongarrie National Park) are currently reserved (see Fig. 3, page x). Representation of a wide range of the goldfields salt lake systems has been incorporated into the design of a reserve system (see 1.4, 1.5, 1.9, 1.11, and 1.14).

A preliminary survey of the extensive salt lakes of the Eastern Goldfields District highlighted the variation between lake systems (S. Halse, pers. comm.). Sampling of flora, invertebrate fauna and saline water was conducted at Lakes Dundas, Cowan, Lefroy, Johnston and Hope in the southern goldfields; and at Lakes Yindarlgooda, Goongarrie, Ballard and Barlee in the central goldfields (S. Halse, field notes: 1989).

During the biological survey of the Eastern Goldfields District, the easternmost salt lake of the Lake Lefroy chain (Lake Randall) was sampled along the northern margins, 3km south of Swan Lake (see 4.10). Flanking the lake are tall shrublands of *Melaleuca* spp. and low shrublands of *Atriplex vesicaria*. Other shrubs include *Disphyma clavellatum*, *Frankenia cinerea* and *Halosarcia pruinosa*. Dunes peripheral to the salt lake support mallees of *Eucalyptus gracilis* with shrubs of *Darwinia diosmoides*, *Melaleuca* aff. *pauperiflora* and *M. uncinata* over *Triodia scariosa* (Newbey and Hnatiuk, 1984).

PRESENT RECOMMENDATION

It is recommended that the Department of Conservation and Land Management investigate the area of vacant Crown land south of Mt Belches and east of Lake Lefroy to determine its conservation potential and make recommendations for nature conservation where appropriate.

4.10 SWAN LAKE AND ERAYINIA HILL

Both Swan Lake and Erayinia Hill are located to the east of Kalgoorlie on Cowarna Downs Pastoral Lease (Map 5). Swan Lake (31°06'S, 122°19'E) is one of the few areas of semi-permanent freshwater in the Eastern Goldfields District (Newbey *et al.*, 1984). Extending over 125ha, the lake contains three islands and is fringed by dense thickets of *Melaleuca pauperiflora* with occasional *Eucalyptus celastroides* (CALM files). Swan Lake and a smaller (25ha) adjacent freshwater lake are contained within a sheep grazing paddock.

Swan Lake was proposed as an important waterbird area in the Eastern Goldfields District by the RAOU [B.D. Wilson (W.A. Group) CALM files, 1986]. Newbey *et al.* (1984) recorded nine species of waterbirds including the Grey Teal (*Anas gibberifrons*), Black Duck (*A. superciliosa*), Pink-eared Duck (*Malacorhynchus membranaceus*), Mountain Duck (*Tadorna tadornoides*), Coot (*Fulica atra*), Black Swan (*Cygnus atratus*) and the waders Black-winged Stilt (*Himantopus himantopus*) and Common Sandpiper (*Tringa hypoleucos*). Both the *Cygnus atratus* and *Anas gibberifrons* have been reported to breed at Swan Lake (CALM files).

Swan Lake is a vital semi-permanent freshwater lake that persists when similar water bodies in the Eastern Goldfields District have dried up under drought conditions (see 1.1). The lake has been reported to have dried up completely only about three times in the past 20 years (CALM files). The

lake is also an important source of water for stock on Cowarna Downs Station (Newbey *et al.*, 1984).

Erayinia Hill (419m), 30km to the north-east of Swan Lake, is a large granite hill rising above the surrounding plains (Map 5). The closest other granite hills are the Fitzgerald Peaks of Peak Charles and Eleanora, 250km to the south-west (Map 1). Recorded from Erayinia Hill is the Priority species *Eucalyptus kruseana*, in addition to *E. brachyphylla* and *Melaleuca coccinea* (A. Chapman, pers. comm.).

The hill appears to have only been lightly grazed by stock and supports a diverse flora of over 90 species, as well as the Splendid Fairy-wren (*Malurus splendens*). Growing on the slopes of Erayinia Hill are tall shrublands of *Acacia quadrimarginea* with emergent *Eucalyptus petraea* over *Acacia tetragonophylla*, *Dodonaea lobulata*, *Eremophila clarkei* sens. lat. and *Melaleuca fulgens* (Newbey and Hnatiuk, 1984).

PRESENT RECOMMENDATION

It is recommended that the Department of Conservation and Land Management investigate the conservation and recreational values and, after consultation with the owners of the Cowarna Downs Pastoral Lease (3114/617), make recommendations for nature conservation where appropriate.

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Appendix 1

Locations of long-term biological survey sites established in the Eastern Goldfields District.

Study Area ¹	Location of campsites ²
1. Sandstone-Sir Samuel	27°23'S, 120°38'E (near Mt Keith)
2. Duketon-Sir Samuel	27°47'S, 121°39'E (on Banjawarn Station)
3. Youanmi-Leonora	28°33'S, 119°05'E (on Yuinmery Station)
4. Laverton-Leonora	28°18'S, 122°08'E (on Erlistoun Station)
5. Barlee-Menzies	29°59'S, 119°36'E (near Mt Manning Range)
	29°30'S, 119°30'E (near Lake Barlee)
6. Edjudina-Menzies	29°55'S, 121°08'E (near Lake Goongarrie)
	29°18'S, 122°25'E (near Mt Linden)
7. Jackson-Kalgoorlie	30°15'S, 119°16'E (near Mt Jackson)
	30°19'S, 119°44'E (near Bungalbin Hill)
8. Kurnalpi-Kalgoorlie	30°34'S, 121°14'E (near Black Flag Homestead)
	30°28'S, 122°21'E (near Mt Eric)
9. Boorabbin-Southern Cross	31°36'S, 119°48'E (near Boodarding Rock)
	31°25'S, 120°40'E (near Pidgeon Hole)
10. Widgiemooltha-Zanthus	31°54'S, 122°24'E (near Woodline Hills)
	31°26'S, 123°33'E (near Buningonia Spring)
11. Lake Johnston-Hyden	32°23'S, 119°45'E (near Lake Cronin)
	32°01'S, 120°44'E (near McDermid Rock)
	32°53'S, 112°06'E (near Peak Charles)
	between 32°41' to 33°01'S and 119°58' to 120°43'E
12. Norseman-Balladonia	32°28'S, 123°22'E (near Boingaring Rocks)
	32°24'S, 122°17'E (near Jyndabinbin Rocks)
	32°27'S, 122°54'E (near Mt Andrew)
	32°59'S, 123°18'E (near Ponier Rock)
	33°02'S, 122°17'E (near Dingo Rock)

NOTES

¹ See Figure 2.

² Vertebrate fauna sampled within 7-15km of campsites.

Appendix 2

Declared Rare Flora and Priority Taxa from CALM's Reserve Flora List present on existing and proposed reserves in the Eastern Goldfields District.

No.	Locality	Declared Rare Flora ¹	Priority Taxa on CALM's Reserve Flora List ^{2, 3}
1.1	Proposed Lake Cronin Nature Reserve extension	<i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i> <i>Eucalyptus steedmanii</i> <i>Eremophila inflata</i> <i>E. racemosa</i>	<i>Muelleranthus crenulatus</i> , <i>Stylidium</i> aff. <i>caricifolium</i> (D.J. Coates 4688), <i>Acacia</i> aff. <i>pachypoda</i> (KRN 5820), <i>A. kerryana</i> , <i>Eucalyptus</i> aff. <i>georgei</i> (S. van Leeuwen 390), <i>Drosera</i> aff. <i>bulbosa</i> (A.P. Brown 362).
1.2	Proposed Hatter Hill Nature Reserve	<i>Boronia revoluta</i>	<i>Drosera</i> sp. (G.J. Barrett 16.9.89), <i>Halgania tomentosa</i> , <i>Latrobea</i> sp. (KRN 6532), <i>Melaleuca agathosmoides</i> , <i>Mirbelia densiflora</i> , <i>Stylidium</i> aff. <i>caricifolium</i> (D.J. Coates 4688), <i>Acrotrichne patula</i> , <i>Gastrolobium rigidum</i> , <i>Levenhookia pulcherrima</i> , <i>Pimelea graniticola</i> , <i>Logania</i> sp. (G.J. Keighery 901), <i>Drosera</i> aff. <i>bulbosa</i> (A.P. Brown 362), <i>Dryandra</i> aff. <i>horrida</i> (A.S. George 9446), <i>Eucalyptus deflexa</i>
	Proposed South Ironcap Nature Reserve	<i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i> <i>Boronia revoluta</i> <i>Eucalyptus steedmanii</i>	<i>Grevillea lullfitzii</i> , <i>Stylidium</i> aff. <i>caricifolium</i> (D.J. Coates 4688), <i>Logania gracilis</i> , <i>Dryandra</i> aff. <i>horrida</i> (A.S. George 9446), <i>Drosera</i> aff. <i>bulbosa</i> (A.P. Brown 362), <i>Acacia</i> aff. <i>pachypoda</i> (KRN 5820), <i>A. aff. myrtifolia</i> (B.R. Maslin s.n.)
	Proposed Middle Ironcap Nature Reserve	<i>Eremophila inflata</i>	<i>Stylidium</i> aff. <i>caricifolium</i> (D.J. Coates 4688)
	Proposed Mt Holland Nature Reserve	<i>Acacia lanuginosa</i> <i>Banksia sphaerocarpa</i> var. <i>dolichostyla</i>	<i>Grevillea pilosa</i> ssp. <i>dissecta</i> , <i>G. lissopleura</i> , <i>Acacia</i> aff. <i>pachypoda</i> (KRN 5820), <i>Logania gracilis</i> , <i>Logania</i> sp. (G.J. Keighery 901)

No.	Locality	Declared Rare Flora ¹	Priority Taxa on CALM's Reserve Flora List ²
1.3	Frank Hann National Park	<i>Caladenia "voigtii"</i>	<i>Gastrolobium rigidum</i> , <i>Halosarcia entrichoma</i> , <i>Eucalyptus deflexa</i>
1.4	Peak Charles National Park	<i>Drummondita hassellii</i> var. <i>longifolia</i>	<i>Latrobea</i> sp. (KRN 6532), <i>Persoonia</i> sp. (KRN 5627), <i>Cryptandra miliaris</i> , <i>Pimelea graniticola</i>
	Proposed Peak Charles National Park Extension	--	<i>Leucopogon</i> spp. (M.A. Burgman 1476 and 1482), <i>Latrobea</i> sp. (KRN 6532), <i>Elachanthus pusillus</i> , <i>Eucalyptus</i> aff. <i>angustissima</i> (KRN 8183), <i>Eucalyptus</i> aff. <i>oleosa</i> (M.I.H. Brooker s.n. 7.87)
1.5	Proposed Bremer Range Nature Reserve	--	<i>Acacia kerryana</i> , <i>Adenanthos gracilipes</i> , <i>Halosarcia entrichoma</i> , <i>Eucalyptus "rhomboidea"</i>
	Proposed Mt Day Nature Reserve	<i>Eucalyptus cerasiformis</i>	<i>Allocasuarina globosa</i> , <i>Eucalyptus georgei</i>
1.6	Proposed Jimberlana Hill Nature Reserve	<i>Daviesia</i> sp. (M.D. Crisp 5943) <i>Eucalyptus</i> aff. <i>diversifolia</i>	<i>Eucalyptus</i> aff. <i>diptera</i> (A. Taylor 138), <i>Acacia kerryana</i>
	Proposed Timber Reserve NW of Norseman	--	<i>Eucalyptus pterocarpa</i>
	Brockway Timber Reserve	--	<i>Allocasuarina globosa</i>
1.8	Nurdungarra Rock Nature Reserve	<i>Eucalyptus crucis</i> ssp. <i>crucis</i>	--
1.9	Proposed Yellowdine Nature Reserve	--	<i>Grevillea tetrapleura</i> , <i>Verticordia</i> aff. <i>penicillaris</i> (SDH 6466)
1.10	Jilbadgi Nature Reserve	<i>Eremophila merrallii</i> <i>Myriophyllum petraeum</i>	<i>Grevillea lissopleura</i> , <i>Logania gracilis</i>
1.11	Boorabbin National Park	<i>Eremophila virens</i>	<i>Gnephosis intonsa</i> , <i>Lepidium genistoides</i> ,

No.	Locality	Declared Rare Flora ¹	Priority Taxa on CALM's Reserve Flora List ²
	Victoria Rock Nature Reserve	--	<i>Eremophila veronica</i> , <i>Gastrolobium graniticum</i>
1.12	Proposed Cardunia Rocks Nature Reserve Extension	--	<i>Eucalyptus kruseana</i>
	Kurrawang Nature Reserve	--	<i>Eremophila</i> sp. (R.J. Chinnock 7292)
1.13	Proposed Woodline Hills Nature Reserve	--	<i>Brachycome billardierei</i>
2.1	Walyahmoning Rock Nature Reserve	--	<i>Pomaderris intangenda</i> , <i>Lepidium genistoides</i>
2.2	Mt Manning Range Nature Reserve	--	<i>Eucalyptus formanii</i> , <i>Grevillea georgeana</i>
	Proposed Mt Jackson Extension	<i>Prostanthera magnifica</i> <i>Tetratheca harperi</i>	<i>Lepidium merralli</i> , <i>Leptospermum</i> sp. (J. Thomson s.n.), <i>Grevillea erectiloba</i> , <i>Grevillea georgeana</i> , <i>Eucalyptus formanii</i>
	Proposed Bungalbin Hill Extension	<i>Tetratheca aphylla</i>	<i>Acacia</i> aff. <i>kochii</i> (A. P. Brown 112), <i>Calytrix creswellii</i> ; <i>Grevillea tetrapleura</i> , <i>Grevillea erectiloba</i> , <i>Grevillea georgeana</i>
2.4	Proposed Comet Vale Nature Reserve	--	<i>Eucalyptus jutsonii</i>
3.1	Niagara Dam Nature Reserve	--	<i>Eremophila</i> sp. (J. Elliot 127)

NOTES

- ¹ Schedule of Declared Rare Flora, Government Gazette No. 67 (14 July, 1989).
- ² CALM's Reserve Flora List as Appendix Nos. 2 and 3 in Hopper *et al.*, 1990.
- ³ KRN (K.R. Newbey) and SDH (S.D. Hopper), see Background.

Appendix 3

Common names of eucalypts referred to in the report*.

Species Name	Common Name
<i>E. angustissima</i>	Narrow-leaved Mallee
<i>E. annulata</i>	Open-fruited Mallee
<i>E. balladoniensis</i>	Balladonia Mallee
<i>E. brockwayi</i>	Dundas Mahogany
<i>E. burracoppinensis</i>	Burracoppin Mallee
<i>E. calycogona</i>	Red Mallee
<i>E. camaldulensis</i> var. <i>obtusa</i>	River Red Gum
<i>E. campaspe</i>	Silver Gimlet
<i>E. carnei</i>	Carne's Blackbutt
<i>E. concinna</i>	Victoria Desert Mallee
<i>E. conglobata</i>	Port Lincoln Mallee
<i>E. celastroides</i> ssp. <i>celastroides</i>	Mirret
<i>E. celastroides</i> ssp. <i>virella</i>	
<i>E. cerasiformis</i>	Cherry-fruited Mallee
<i>E. ceratocorys</i>	
<i>E. clelandii</i>	Cleland's Blackbutt
<i>E. corrugata</i>	Rough-fruited Mallee
<i>E. cylindrocarpa</i>	Woodline Mallee
<i>E. cylindriflora</i>	White Mallee
<i>E. deflexa</i>	
<i>E. diptera</i>	Two-winged Gimlet
<i>E. dundasii</i>	Dundas Blackbutt
<i>E. ebbanoensis</i>	Sandplain Mallee
<i>E. effusa</i>	Rough-barked Gimlet
<i>E. eremophila</i>	Tall Sand Mallee
<i>E. ewartiana</i>	Ewart's Mallee
<i>E. falcata</i>	Silver Mallee
<i>E. flocktoniae</i>	Merrit
<i>E. formanii</i>	
<i>E. forrestiana</i> ssp. <i>dolichorhyncha</i>	
<i>E. fraseri</i>	Blackbutt
<i>E. gongylocarpa</i>	Baarla Marble Gum
<i>E. gracilis</i>	Yorrell
<i>E. grossa</i>	Coarse-leaved Mallee
<i>E. griffithsii</i>	Griffith's Grey Gum
<i>E. georgei</i>	Hyden Blue Gum
<i>E. incrassata</i>	Ridge-fruited Mallee
<i>E. jutsonii</i>	Jutson's Mallee
<i>E. kingsmillii</i>	Kondinin Blackbutt
<i>E. kondininensis</i>	
<i>E. kruseana</i>	Bookleaf Mallee
<i>E. kumarlensis</i>	
<i>E. longicornis</i>	Red Morrel
<i>E. leptopoda</i>	Tammin Mallee
<i>E. leptophylla</i>	Narrow-leaved Red Mallee
<i>E. lesouefii</i>	Goldfield's Blackbutt
<i>E. loxophleba</i>	York Gum
<i>E. melanoxylon</i>	Black Morrel
<i>E. micranthera</i>	
<i>E. oleosa</i>	Red Mallee

Species Name	Common Name
<i>E. ovularis</i>	Small-fruited Mallee
<i>E. occidentalis</i>	Flat-topped Yate
<i>E. oldfieldii</i>	Oldfield's Mallee
<i>E. orbifolia</i>	Round-leaved Mallee
<i>E. perangusta</i>	
<i>E. pileata</i>	Capped Mallee
<i>E. platycorys</i>	Boorabbin Mallee
<i>E. pterocarpa</i>	
<i>E. petraea</i>	Granite Rock Box
<i>E. platypus</i>	--
<i>E. plenissima</i>	Oil Mallee
<i>E. rigidula</i>	Stiff-leaved Mallee
<i>E. salicola</i>	Salt Gum
<i>E. salubris</i>	Gimlet
<i>E. salmonophloia</i>	Salmon Gum
<i>E. sheathiana</i>	Ribbon-bark Mallee
<i>E. steedmanii</i>	Steedman's Gum
<i>E. spathulata</i> ssp. <i>grandiflora</i>	Swamp Mallett
<i>E. tetragona</i>	Tallerack
<i>E. transcontinentalis</i>	Redwood
<i>E. uncinata</i>	Hook-leaved Mallee
<i>E. websteriana</i>	Webster's Mallee
<i>E. xanthonema</i>	--
<i>E. yilgarnensis</i>	Yorrell
<i>E. salubris</i> var. <i>glauca</i>	Silver-topped Gimlet

KEY

* Currently recognised taxa (Chippendale, 1988; Brooker and Kleinig, 1990).

Appendix 4

Common names of orchids referred to in the report*.

Species Name	Common Name
<i>Caladenia</i>	Spider Orchids
<i>C. hirta</i>	Sugar-Candy Orchid
<i>C. latifolia</i>	Pink Fairies
<i>C. radialis</i>	Drooping Spider Orchid
<i>C. roei</i>	Clown Orchid
<i>C. saccharata</i>	Sugar Orchid
<i>C. sigmoidea</i>	--
<i>Cyrtostylis</i>	Mosquito Orchids
<i>C. huegelii</i>	Mosquito Orchid
<i>C. robusta</i>	Large Mosquito Orchid
<i>Diuris</i>	Donkey Orchids
<i>D. laxiflora</i>	--
<i>D. picta</i>	--
<i>Elythranthera</i>	Enamel Orchids
<i>E. brunonis</i>	Purple Enamel Orchid
<i>Genoplesium</i>	Pygmy Prasophyllums
<i>G. nigricans</i>	Pygmy Prasophyllum
<i>Microtus</i>	Mignonette Orchids
<i>M. parviflora</i>	--
<i>M. unifolia</i>	Common Mignonette
<i>Leporella</i>	Hare Orchids
<i>L. fimbriata</i>	Hare Orchid
<i>Leptoceras</i>	Rabbit Orchids
<i>L. menziesii</i>	Rabbit Orchid
<i>Lyperanthus</i>	Beak Orchids
<i>L. nigricans</i>	Red Beaks
<i>Paracaleana</i>	Flying Ducks
<i>P. nigrita</i>	Flying Duck
<i>Prasophyllum</i>	Leek Orchids
<i>P. parvifolium</i>	Autumn Leek Orchid
<i>P. ringens</i>	Laughing Leek Orchid
<i>Pterostylis</i>	Greenhoods
<i>P. allantoidea</i>	Shy Greenhood
<i>P. mutica</i>	Midget Greenhood
<i>P. recurva</i>	Jug Orchid
<i>P. sargentii</i>	Frog Greenhood
<i>P. scabra</i>	Bronze Shell Orchid
<i>Spiculaea</i>	Elbow Orchids
<i>S. ciliata</i>	Elbow Orchid
<i>Thelymitra</i>	Sun Orchids
<i>T. antennifera</i>	Lemon Scented Sun Orchid
<i>T. sargentii</i>	Freckled Sun Orchid

KEY

* Currently recognised taxa (Hoffman and Brown, 1984).

Appendix 5

Common names of indigenous mammals, amphibians and reptiles referred to in the report**.

Species Name	Common Name
MAMMALS	
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna
<i>Antechinomys laniger</i>	Kultarr
<i>Dasyercus cristicauda</i> *	Mulgara
<i>Dasyurus geoffroii</i>	Chuditch or Western Native-Cat
<i>Ningaui ridei</i>	Wongai Ningau
<i>N. yvonneae</i>	Goldfields Ningau
<i>Parantechinus apicalis</i>	Dibbler
<i>Pseudantechinus woolleyae</i> *	--
<i>Phascogale calura</i> *	Red-tailed Wambenger
<i>P. tapoatafa</i> *	Brush-tailed Wambenger
<i>Sminthopsis crassicaudata</i>	Fat-tailed Dunnart
<i>S. dolichura</i>	--
<i>S. gilberti</i>	--
<i>S. granulipes</i>	White-tailed Dunnart
<i>S. hirtipes</i>	Hairy-footed Dunnart
<i>S. macroura</i>	Stripe-faced Dunnart
<i>S. ooldea</i>	Ooldea Dunnart
<i>S. psammophila</i> *	Sandhill Dunnart
<i>Myrmecobius fasciatus</i> *	Numbat
<i>Chaeropus ecaudatus</i> (E)	Pig-footed Bandicoot
<i>Isodon auratus</i> *	Golden Bandicoot
<i>I. obesulus</i> *	Quenda or Southern Brown Bandicoot
<i>Perameles bougainville</i> (D)	Western Barred Bandicoot
<i>Macrotis lagotis</i> *	Dalgyte or Bilby
<i>Trichosurus vulpecula</i> *	Common Brushtail Possum
<i>Cercartetus concinnus</i>	Western Pygmy-possum or Mundarda
<i>Tarsipes rostratus</i>	Honey-possum or Noolbenger
<i>Bettongia lesueur</i> (D)	Boodie or Burrowing Bettong
<i>B. penicillata</i> *	Woylie or Brush-tailed Bettong
<i>Potorous platyops</i> (E)	Broad-faced Potoroo
<i>Lagorchestes hirsutus</i> (D)	Rufous or Western Hare-wallaby
<i>Lagostrophus fasciatus</i> (D)	Banded Hare-wallaby
<i>Macropus fuliginosus</i>	Western Grey Kangaroo
<i>M. irma</i>	Brush Wallaby
<i>M. robustus</i>	Euro
<i>M. rufus</i>	Red Kangaroo
<i>Onychogalea lunata</i> (E)	Crescent Nailtail Wallaby
<i>Petrogale lateralis</i> *	Black-footed or Brush-tailed Rock Wallaby

Species Name	Common Name
<i>Leporillus apicalis</i> (E)	Lesser or White-tipped Stick-nest Rat
<i>L. conditor</i> (D)	Greater Stick-nest Rat
<i>Notomys alexis</i>	Spinifex Hopping-mouse
<i>N. amplus</i> (E)	Short-tailed Hopping-mouse
<i>N. longicaudatus</i> (E)	Long-tailed Hopping-mouse
<i>N. mitchellii</i>	Mitchell's Hopping-mouse
<i>Pseudomys albocinereus</i>	Ash-grey Mouse
<i>P. bolami</i>	--
<i>P. australis</i> *	Plains Mouse
<i>P. desertor</i> *	Desert Mouse
<i>P. fieldi</i> (E)	Alice Springs Mouse
<i>P. hermannsburgensis</i>	Sandy Inland Mouse
<i>P. occidentalis</i> *	Western Mouse
<i>P. shortridgei</i> *	Shortridge's Native Mouse
<i>Rattus fuscipes</i> *	Southern Bush Rat
<i>Zyzomys pedunculatus</i>	Central Rock-Rat
<i>Mormopterus planiceps</i>	Little Mastiff-bat
<i>Tadarida australis</i>	White-striped Mastiff-bat
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat
<i>C. morio</i>	Chocolate Wattled Bat
<i>Eptesicus regulus</i>	King River Eptesicus
<i>E. pumilus pumilus</i>	Little Cave Eptesicus
<i>Nycticeius balstoni</i>	Western Broad-nosed Bat
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat
<i>N. major</i>	Greater Long-eared Bat
AMPHIBIANS	
<i>Cyclorana maini</i>	Main's Frog
<i>Limnodynastes dorsalis</i>	Banjo Frog
<i>Myobatrachus gouldii</i>	Turtle Frog
<i>Neobatrachus centralis</i>	Trilling Frog
<i>N. pelobatoides</i>	Humming Frog
<i>N. sutor</i>	Shoemaker Frog
<i>N. wilsmorei</i>	Goldfields Bullfrog
REPTILES	
<i>Crenadactylus ocellatus ocellatus</i>	Clawless Gecko
<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko
<i>D. elderi</i>	Jewelled Gecko
<i>D. spinigerus</i>	Western Spiny-tailed Gecko
<i>Gehyra purpurascens</i>	Tree Dtella
<i>Herteronotia binoei</i>	Bynoe's Gecko
<i>Oedura reticulata</i>	Reticulated Velvet Gecko
<i>Phyllodactylus marmoratus marmoratus</i>	Marbled Gecko
<i>Rhynchoedura ornata</i>	Beaked Gecko
<i>Underwoodisaurus milii</i>	Barking Gecko
<i>Lialis burtonis</i>	Burton's Snake Lizard
<i>Pygopus lepidopodus</i>	Common Scaly-foot
<i>P. nigriceps</i>	Hooded Scaly-foot

Species Name	Common Name
<i>Ctenophorus caudicinctus</i>	Ring-tailed Dragon
<i>C. cristatus</i>	Crested Dragon
<i>C. fordi</i>	Mallee Dragon
<i>C. isolepis</i>	Military Dragon
<i>C. ornatus</i>	Ornate Dragon
<i>C. reticulatus</i>	Western Netted Dragon
<i>C. salinarum</i>	Salt Lake Dragon
<i>C. scutulatus</i>	Lonzenge-marked Dragon
<i>Moloch horridus</i>	Thorny Devil or Moloch
<i>Pogona minor minor</i>	Western Bearded Dragon
<i>Egernia depressa</i>	Pygmy Spiny-tailed Skink
<i>E. inornata</i>	Rosen's or Desert Skink
<i>Eremiascincus richardsonii</i>	Broad-banded Sand-swimmer
<i>Tiliqua multifasciata</i>	Centralian Blue-tongued Lizard
<i>T. occipitalis</i>	Western Blue-tongued Lizard
<i>T. rugosa</i>	Bob-tail
<i>Varanus caudolineatus</i>	Stripe-tailed Monitor
<i>V. giganteus</i>	Perentie
<i>V. gouldi</i>	Bungarra or Gould's Goanna
<i>V. rosenbergi</i>	Rosenberg's Monitor
<i>V. tristis tristis</i>	Black-headed or Freckled Monitor
<i>Morelia stimsoni</i>	Stimson's Python
<i>M. spilota</i>	Carpet Python
<i>Demansia psammophis</i>	Yellow-faced Whip Snake
<i>Denisonia atriceps</i>	Lake Cronin Snake
<i>D. fasciata</i>	Rosen's Snake
<i>Notechis curtus</i>	Barduck
<i>N. scutatus</i>	Western Tiger Snake
<i>Pseudechis australis</i>	Mulga Snake
<i>Pseudonaja affinis</i>	Dugite
<i>P. modesta</i>	Ringed Brown Snake
<i>P. nuchalis</i>	Gwarder or Western Brown Snake
<i>Rhinoplocephalus gouldii</i>	Gould's Snake
<i>R. monachus</i>	Monk Snake
<i>R. nigriceps</i>	Black-backed or Short-tailed Snake
<i>Vermicella bertholdii</i>	Jan's Banded Snake
<i>V. bimaculata</i>	Black-nosed Snake
<i>V. fasciolata</i>	Narrow-banded Burrowing Snake
<i>V. semifasciata</i>	Southern Shovel-nosed Snake

KEY

- * Not recorded in the Eastern Goldfields District during biological survey.
- ** Only widely accepted common names, where known, are listed.
- E Extinct or presumed extinct (Strahan, 1983; Burbidge and McKenzie, 1989).
- D Declined. Extinct on mainland and restricted to offshore islands (Strahan, 1983).

Appendix 6

Species list of mammals recorded on existing reserves in the Eastern Goldfields.

	Frank Hann NP	Pk Charles NP	Dundas NR	Jilbadji NR	Boorabbin NP	Mt Manning Range NR	Goongarrie NP	Wanjarri NR
TACHYGLOSSIDAE								
<i>Tachyglossus aculeatus</i>	X		X	X	X	X		X
DASYURIDAE								
<i>Antechinomys laniger</i>				X				X
<i>Dasyurus geoffroii</i>	X							
<i>Ningaui ridei</i>			X			X		X
<i>N. yvonneae</i>				X	X			
<i>Pseudantechinus woolleyae</i>								X
<i>Sminthopsis crassicaudata</i>			X	X	X			
<i>S. dolichura</i>			X	?	?	X		
<i>S. gilberti</i>	X							
<i>S. granulipes</i>	X	X		X				X
<i>S. hirtipes</i>						X		X
<i>S. macroura</i>								X
<i>S. ooldea</i>								
BURRAMYIDAE								
<i>Cercartetus concinnus</i>	X	X	X	X				
TARSIPEDIDAE								
<i>Tarsipes rostratus</i>	X	X						
MACROPODIDAE								
<i>Macropus fuliginosus</i>	X	X	X	X	X	X	X	
<i>M. irma</i>	X							
<i>M. robustus</i>						X		X
<i>M. rufus</i>							X	X

	Frank Hann NP	Pk Charles NP	Dundas NR	Jilbadji NR	Boorabbin NP	Mt Manning Range NR	Goongarrie NP	Wanjarri NR
MURIDAE								
<i>Notomys alexis</i>						X		X
<i>N. mitchellii</i>	X	X	X	X		X		
<i>Pseudomys albocinereus</i>	X	X		X	X			
<i>P. bolami</i>			X	?				
<i>P. hermannsburgensis</i>				X		X		X
MOLOSSIDAE								
<i>Mormopterus planiceps</i>	X		X	X		X		X
<i>Tadarida australis</i>	X	X	X	X	X	X		X
VESPERTILIONIDAE								
<i>Chalinolobus gouldii</i>	X		X	X	X	X		X
<i>C. morio</i>	X		X	X				
<i>Eptesicus regulus</i>	X	X	X	X	X			
<i>E. sp.</i>								X
<i>Nyctophilus geoffroyi</i>			X	X		X		X
<i>N. major</i>			X	X				X
<i>Nycticeius balstoni</i>			X			X		X

KEY

NR Nature Reserve
NP National Park
? Yet to be determined

Appendix 7

Species list of mammals recorded on proposed reserves and extensions in the Eastern Goldfields.

	Lake Cronin		McDermid Rock		Goldfields Woodlands		Woodline Hills		Buningonia Spring		Mt Manning Range		Comet Vale	
	Ext	NR	Ext	NR	Ext	NR	Ext	NR	Ext	NR	Ext	NR	Ext	NR
TACHYGLOSSIDAE														
<i>Tachyglossus aculeatus</i>	X		X		X		X				X			
DASYURIDAE														
<i>Ningaui ridei</i>					X				X		X		X	
<i>N. yoonneae</i>	X		X						X		X			
<i>Sminthopsis crassicaudata</i>			X		X		X		X		X		X	
<i>S. dolichura</i>			X		?		X		X		X		X	
<i>S. gilberti</i>	X													
<i>S. granulipes</i>	X													
<i>S. hirtipes</i>					X						X			
BURRAMYIDAE														
<i>Cercartetus concinnus</i>	X		X		X						X			
MACROPODIDAE														
<i>Macropus fuliginosus</i>	X		X		X		X		X		X			
<i>M. robustus</i>			X				X		X		X			
<i>M. rufus</i>									X		X			

	Lake Cronin		McDermid Rock		Goldfields Woodlands		Woodline Hills		Buningonia Mt Spring		Manning Range		Comet Vale	
	NR	Ext	NR	Ext	NR	Ext	NR	Ext	NR	Ext	NR	Ext	NR	Ext
MURIDAE														
<i>Notomys alexis</i>											X		X	
<i>N. mitchellii</i>	X		X		X						X		X	
<i>Pseudomys albocinereus</i>	X				X						X			
<i>P. bolami</i>			X		X		X							
<i>P. hermannsburgensis</i>					X				X		X		X	
MOLOSSIDAE														
<i>Mormopterus planiceps</i>	X		X		X				X					
<i>Tadarida australis</i>	X				X		X		X				X	
VESPERTILIONIDAE														
<i>Chalinolobus gouldii</i>	X		X		X		X		X		X			
<i>C. morio</i>					X		X		X		X			
<i>Eptesicus regulus</i>	X		X				X		X		X			
<i>Nycticeius balstoni</i>			X				X		X		X			
<i>Nyctophilus geoffroyi</i>	X		X				X		X		X			
<i>N. major</i>							X		X		X			

KEY

NR	Nature Reserve
NP	National Park
Ext	Extension
?	Yet to be determined.

Appendix 8

Species list of amphibians and reptiles recorded on existing reserves in the Eastern Goldfields.

	Frank Hann NP	Pk Charles NP	Dundas NR	Jilbadji NR	Boorabbin NP	Mt Manning Range NR	Goongarrie NP	Wanjarri NR
HYLIDAE								
<i>Cyclorana maini</i>								X
<i>C. platycephalus</i>								X
LEPTODACTYLIDAE								
<i>Crinia pseudinsignifera</i>			X					
<i>Heleioporus albopunctatus</i>	X							
<i>Limnodynastes dorsalis</i>	X	X						
<i>Myobatrachus gouldii</i>	X	X						
<i>Neobatrachus centralis</i>								X
<i>N. kunapalari</i>	X	X	X	X	X	X		
<i>N. pelobatoides</i>					X			
<i>N. sutor</i>					X			X
<i>Pseudophryne guentheri</i>	X							
<i>P. occidentalis</i>		X	X	X	X			
GEKKONIDAE Geckoes								
<i>Crenadactylus ocellatus ocellatus</i>			X	X	X			
<i>Diplodactylus assimilis</i>		X	X	X	X	X		
<i>D. ciliaris</i>								X
<i>D. conspicillatus</i>						X		X
<i>D. elderi</i>						X		
<i>D. granariensis</i>	X	X	X	X	X		X	
<i>D. maini</i>	X	X	X	X	X		X	
<i>D. pulcher</i>				X	X	X		X
<i>D. spinigerus</i>								
<i>D. strophurus</i>	X						X	X

	Frank Hann	Pk NP	Charles NP	Dundas NR	Jilbadji NR	Boorabbin NP	Mt Manning Range	Goongarrrie NR	Wanjarri NR
<i>Gehyra purpurascens</i>								X	
<i>G. variegata</i>	X		X	X	X	X	X	X	X
<i>Heteronotia binoei</i>				X	X	X	X	X	X
<i>Nephurus stellatus</i>					X				
<i>Oedura reticulata</i>	X		X	X	X	X	X		
<i>Phyllodactylus marmoratus marmoratus</i>	X		X	X					
<i>Underwoodisaurus milii</i>			X		X	X	X		
<i>Rhynchoedura ornata</i>								X	X
PYGOPODIDAE Legless Lizards									
<i>Delma australis</i>				X		X			
<i>D. butleri</i>						X			X
<i>D. grayii</i>				X			X		X
<i>D. nasuta</i>				X		X	X		
<i>Lialis burtonis</i>			X			X			
<i>Pygopus lepidopodus</i>			X			X			
AGAMIDAE Dragon Lizards									
<i>Caimanops amphiboluroides</i>									X
<i>Ctenophorus caudicinctus</i>									X
<i>C. cristatus</i>	X		X	X	X	X	X	X	
<i>C. fordi</i>									
<i>C. inermis</i>									X
<i>C. isolepis citrinus</i>						X			
<i>C. isolepis gularis</i>							X		X
<i>C. maculatus griseus</i>	X		X		X				
<i>C. ornatus</i>	X		X			X			
<i>C. reticulatus</i>					X	X	X	X	X
<i>C. salinarum</i>	X		X	X	X	X			X
<i>C. scutulatus</i>					X	X	X	X	

	Frank Hann NP	Pk Charles NP	Dundas NR	Jilbadji NR	Boorabbin NP	Mt Manning Range NR	Goongarrie NP	Wanjarri NR
<i>Moloch horridus</i>		X	X	X	X	X		X
<i>Pogona minor minor</i>	X	X	X	X	X	X	X	X
<i>Tympanocryptis adalaidensis chapmani</i>	X	X	X		X			
SCINCIDAE Skinks								
<i>Ctenotus ariadnae</i>								X
<i>C. atlas</i>			X		X	X	X	
<i>C. calurus</i>								X
<i>C. grandis</i>								X
<i>C. helenae</i>								X
<i>C. impar</i>	X	X						
<i>C. leonhardii</i>							X	X
<i>C. pantherinus</i>				X	X			X
<i>C. quattuordecimlineatus</i>				X	X	X	X	X
<i>C. schomburgkii</i>	X	X	X	X	X	X	X	X
<i>C. uber uber</i>				X	X	X		
<i>C. xenopleura</i>				X	X	X		
<i>Cryptoblepharus carnabyi</i>								
<i>C. plagiocephalus</i>	X	X	X	X		X	X	
<i>C. virgatus clarus</i>			X					
<i>Egernia carinata</i>			X	X				X
<i>E. depressa</i>								X
<i>E. formosa</i>						X		
<i>E. inornata</i>			X	X	X			
<i>E. multiscutata bos</i>		X	X	X				
<i>E. richardi</i>	X				X			
<i>Eremiascincus richardsonii</i>						X		
<i>Hemiergis initialis brookeri</i>			X					
<i>H. initialis initialis</i>		X	X	X		X		
<i>H. peronii</i>	X	X	X					
<i>Lerista bipes</i>								X
<i>L. distinguenda</i>	X	X						

	Frank Hann NP	Pk Charles NP	Dundas NR	Jilbadji NR	Boorabbin NP	Mt Manning Range	Goongarrie NP	Wanjarri NR
<i>L. frosti</i>			X					
<i>L. gerrardii</i>				X				
<i>L. macropisthopus</i>						X		
<i>L. muelleri</i>			X	X	X	X		
<i>L. picturata picturata</i>			X					
<i>L. terdigitata</i>			X					
<i>Menetia greyii</i>	X	X	X		X	X	X	X
<i>Morethia butleri</i>	X	X	X		X	X	X	X
<i>M. obscura</i>	X	X	X	X	X			
<i>Orolepida branchialis</i>			X	X	X	X		
<i>Tiliqua multifasciata</i>	X							X
<i>T. occipitalis</i>	X		X	X				
<i>T. rugosa</i>	X		X		X			
VARANIDAE Monitors								
<i>Varanus caudolineatus</i>							X	X
<i>V. giganteus</i>						X		
<i>V. gouldii</i>		X	X	X	X	X		
<i>V. panoptes rubidus</i>								X
<i>V. rosenbergi</i>	X	X	X					
<i>V. tristis tristis</i>		X				X		
TYPHLOPIDAE Blind Snakes								
<i>Ramphotyphlops australis</i>		X	X					
<i>R. hamatus</i>								X
BOIDAE Pythons								
<i>Morelia spilota</i>		X						

	Frank Hann NP	Pk Charles NP	Dundas NR	Jilbadji NR	Boorabbin NP	Mt Manning Range NR	Goongarrie NP	Wanjarri NR
ELAPIDAE Front-fanged Snakes								
<i>Demansia psammophis</i>						X		
<i>D. fasciata</i>				X				
<i>Notechis curtus</i>	X	X			X			
<i>N. scutatus</i>					X			X
<i>Pseudechis australis</i>					X			
<i>Pseudonaja affinis</i>	X	X					X	
<i>P. modesta</i>								
<i>P. nuchalis</i>			X					X
<i>Rhinoplocephalus gouldii</i>		X	X		X			
<i>R. nigriceps</i>		X						
<i>Vermicella bertholdi</i>	X				X			
<i>V. semifasciata</i>			X	X				

KEY

NR Nature Reserve
NP National Park

Appendix 9

Species list of amphibians and reptiles recorded on proposed reserves and extensions in the Eastern Goldfields.

	Lake		McDermid		Goldfields		Woodline		Buningonia		Mt Manning		Comet		SW of	
	Cronin	Ext	NR	Rock	Woodlands	NR	Hills	NR	Spring	NR	Range	Ext	Vale	NR	Menzies	NR
LEPTODACTYLIDAE																
<i>Crinia pseudinsignifera</i>	X															
<i>Heleioporus albopunctatus</i>	X															
<i>Limnodynastes dorsalis</i>	X															
<i>N. kunapalari</i>	X		X				X		X		X					
<i>N. pelobatoides</i>	X		X								X					
<i>N. sutor</i>	X						X				X					
<i>N. wilsmorei</i>						X							X			
<i>N. sp. nov.</i>	X															
<i>Pseudophryne guentheri</i>	X		X													
<i>P. occidentalis</i>	X					X		X			X					
GEKKONIDAE Geckoes																
<i>Crenadactylus ocellatus ocellatus</i>	X		X		X						X					X
<i>Diplodactylus assimilis</i>			X		X		X				X					
<i>D. elderi</i>									X		X					
<i>D. granariensis</i>	X		X		X		X		X		X		X			
<i>D. intermedius</i>									X		X					
<i>D. maini</i>	X		X		X		X		X		X		X			
<i>D. pulcher</i>			X				X		X		X					
<i>D. stenodactylus</i>																
<i>D. spinigerus</i>	X															
<i>Gehyra purpurascens</i>													X		X	
<i>G. variegata</i>	X		X		X		X		X		X		X		X	
<i>Heteronotia binoei</i>			X		X		X		X		X					
<i>Nephurus laevisimus</i>													X			X

	Lake Cronin		McDermid Rock		Goldfields Woodlands		Woodline Hills		Buningonia Mt Spring		Manning Range		Comet Vale		SW of Menzies	
	Ext	NR	Ext	NR	NR	NR	NR	NR	NR	NR	Ext	NR	NR	NR	NR	NR
<i>N. stellatus</i>											X					
<i>N. vertebralis</i>											X					
<i>Oedura reticulata</i>	X		X		X		X		X		X					
<i>Phyllodactylus marmoratus marmoratus</i>			X													
<i>Underwoodisaurus milii</i>	X		X		X		X		X		X					
<i>Rhynchoedura ornata</i>											X		X			X
PYGOPODIDAE Legless Lizards																
<i>Delma australis</i>					X				X		X					
<i>D. butleri</i>											X					
<i>D. fraseri</i>	X		X				X									
<i>D. nasuta</i>					X		X		X		X		X			
<i>Lialis burtonis</i>	X				X		X		X		X					
<i>Pygopus lepidopodus</i>			X		X		X									
<i>P. nigriceps</i>											X					
AGAMIDAE Dragon Lizards																
<i>Ctenophorus caudicinctus</i>					X											
<i>C. cristatus</i>	X		X		X		X		X		X		X			
<i>C. fordi</i>											X		X		X	
<i>C. inermis</i>							X		X							
<i>C. isolepis citrinus</i>			X		X						X					
<i>C. isolepis gularis</i>			X						X							
<i>C. maculatus griseus</i>			X													
<i>C. ornatus</i>			X													
<i>C. reticulatus</i>									X		X					
<i>C. salinarum</i>	X		X		X		X		X					X		
<i>C. scutulatus</i>									X		X					
<i>Diporiphora reginae</i>									X							
<i>Moloch horridus</i>	X		X		X		X				X		X			

	Lake		McDermid		Goldfields		Woodline		Buningonia		Mt Manning		Comet		SW of	
	Cronin	Ext	NR	Rock	Woodlands	NR	Hills	NR	Spring	NR	Range	Ext	Vale	NR	Menzies	NR
<i>Pogona minor minor</i>	X			X	X		X		X		X		X			
<i>Typanocryptis adelaidensis chapmani</i>	X						X									
<i>T. cephalus</i>											X					
SCINCIDAE Skinks																
<i>Ctenotus atlas</i>	X			X	X		X		X		X		X		X	
<i>C. brooksi</i>													X		X	
<i>C. impar</i>	X															
<i>C. leae</i>															X	
<i>C. leonhardii</i>								X			X					
<i>C. mimetes</i>									X		X					
<i>C. pantherinus</i>					X			X			X					
<i>C. schomburgkii</i>	X			X	X		X		X		X		X		X	
<i>C. uber uber</i>											X					
<i>C. xenopleura</i>				X							X					
<i>Cryptoblepharus carnabyi</i>											X					
<i>C. plagiocephalus</i>	X			X	X		X		X		X		X			
<i>Egernia carinata</i>					X		X						X			
<i>E. depressa</i>											X		X			
<i>E. inornata</i>				X	X		X		X		X		X		X	
<i>E. multiscutata bos</i>	X			X			X									
<i>E. richardi</i>	X			X												
<i>Eremiascincus richardsonii</i>									X							
<i>Hemiergis initialis initialis</i>	X			X			X		X		X					
<i>H. millewa</i>					X		X		X							
<i>Lerista distinguenda</i>	X															
<i>L. elegans</i>											X					
<i>L. gerrardii</i>											X					
<i>L. macropisthopus</i>											X		X			
<i>L. muelleri</i>				X	X		X		X		X		X			
<i>L. picturata picturata</i>				X	X		X		X		X		X		X	

	Lake	McDermid	Goldfields	Woodline	Buningonia	Mt Manning	Comet	SW of
	Cronin NR	Rock	Woodlands	Hills	Spring	Range	Vale	Menzies
	Ext	NR	NR	NR	NR	Ext	NR	NR
<i>L. terdigitata</i>				X	X			
<i>Menetia greyii</i>	X	X	X	X	X	X	X	X
<i>Morethia butleri</i>	X	X	X	X	X	X		
<i>M. obscura</i>	X	X	X	X		X		
<i>Orolepida branchialis</i>	X	X	X	X	X	X	X	
<i>Tiliqua occipitalis</i>	X					X	X	
<i>T. rugosa</i>		X	X	X	X			
VARANIDAE Monitors								
<i>Varanus giganteus</i>						X		
<i>V. gouldii</i>	X	X	X	X		X		
<i>V. rosenbergi</i>			X					
<i>V. tristis tristis</i>						X		
TYPHLOPIDAE Blind Snakes								
<i>Ranphotyphlops australis</i>	X	X	X		X	X		
<i>R. bituberculatus</i>				X		X		
<i>R. hamatus</i>								
BOIDAE Pythons								
<i>Morelia stimsoni</i>						X		
ELAPIDAE Front-fanged Snakes								
<i>Demansia reticulata</i>					X		X	
<i>Denisonia atriceps</i>	X		X			X		
<i>D. fasciata</i>	X				X			
<i>Pseudechis australis</i>	X		X					
<i>Pseudonaja affinis</i>	X	X	X		X	X	X	
<i>P. modesta</i>		X						
<i>P. nuchalis</i>						X		
<i>Rhinoplocephalus gouldii</i>	X			X				

	Lake Cronin	McDermid Rock	Goldfields Woodlands	Woodline Hills	Buningonia Spring	Mt Manning Range	Comet Vale	SW of Menzies
	Ext	NR	NR	NR	NR	Ext	NR	NR
<i>R. monachus</i>					X	X	X	
<i>Vermicella bertholdi</i>		X	X	X	X	X		
<i>V. bimaculata</i>	X	X						
<i>V. fasciolata</i>								X
<i>V. semifasciata</i>		X		X	X	X		X

KEY

- NR Nature Reserve
- NP National Park
- Ext Extension

Appendix 10

Habitat-specific passerine birds recorded on existing reserves in the Eastern Goldfields*.

Species Name (Common Name)	Frank Ham NP	Pk Charles NP	Dundas NR	Jilbadji NR	Boorabbin NP	Goongarrie NP	Comet Vale NR
<i>Microeca leucophaea</i> (Jacky Winter)	X		X	X	X	X	X
<i>Eopsaltria australis</i> (Yellow Robin)	X		X	X			
<i>Pachycephala pectoralis</i> (Golden Whistler)	X	X	X	X			
<i>Colluricincla harmonica</i> (Grey Shrike-thrush)	X	X	X	X	X	X	X
<i>Falcunculus frontalis</i> (Crested Shrike-tit)			X				
<i>Oreocica gutturalis</i> (Crested Bellbird)	X	X	X	X	X	X	X
<i>Cinclosoma castaneotum</i> (Chestnut Quail-thrush)		X	X	X			X
<i>Drymodes brunneopygius</i> (Southern Scrub-robin)	X	X	X	X			
<i>Sericornis cautus</i> (Shy Hylacola)	X	X	X		X		
<i>S. frontalis</i> (White-browed Scrub-wren)		X					
<i>S. fuliginosus</i> (Field-wren or Calamanthus)	X						
<i>Stipiturus malachurus</i> (Southern Emu-wren)							
<i>Malurus pulcherrimus</i> (Blue-breasted Fairy-wren)		X	X	X		X	X
<i>M. leucopterus</i> (White-winged Fairy-wren)						X	X
<i>M. splendens</i> (Splendid Fairy-wren)						X	
<i>Climacteris rufa</i> (Rufous Tree-creeper)	X		X	X			
<i>Meliphaga leucotis</i> (White-eared Honeyeater)	X	X	X	X	X		X

KEY

* Species recorded only in natural vegetation on wheatbelt reserves (from Kitchener *et al.*, 1982).

NR Nature Reserve

NP National Park

Appendix 11

Habitat-specific passerine birds recorded on proposed reserves and extensions in the Eastern Goldfields*.

Species Name (Common Name)	Lake		McDermid		Goldfields		Woodline		Buningonia		Mt Manning	
	Cronin	NR	Rock	NR	Woodlands	NR	Hills	NR	Spring	NR	Range	NR
Ext	Ext	Ext	Ext	Ext	Ext	Ext	Ext	Ext	Ext	Ext	Ext	Ext
<i>Microeca leucophaea</i> (Jacky Winter)	X		X		X		X		X		X	
<i>Eopsaltria australis</i> (Yellow Robin)	X		X				X				X	
<i>Pachycephala pectoralis</i> (Golden Whistler)	X		X				X				X	
<i>Colluricincla harmonica</i> (Grey Shrike-thrush)	X		X		X		X		X		X	
<i>Falcunculus frontalis</i> (Crested Shrike-tit)	X											
<i>Oreoca gutturalis</i> (Crested Bellbird)	X		X		X		X		X		X	
<i>Cinclosoma castaneotum</i> (Chestnut Quail-thrush)	X		X		X		X				X	
<i>Dryinodes brunneopygius</i> (Southern Scrub-robin)	X		X		X						X	
<i>Sericornis cautus</i> (Shy Hylacola)	X				X						X	
<i>S. frontalis</i> (White-browed Scrub-wren)	X											
<i>S. fuliginosus</i> (Field-wren or Calamanthus)	X		X						X		X	
<i>Stipiturus malachurus</i> (Southern Emu-wren)	X											
<i>Malurus pulcherrimus</i> (Blue-breasted Fairy-wren)	X		X		X		X				X	
<i>M. leucopterus</i> (White-winged Fairy-wren)									X		X	
<i>M. splendens</i> (Splendid Fairy-wren)											X	
<i>Climacteris rufa</i> (Rufous Tree-creeper)	X		X		X		X				X	
<i>Meliphaga leucotis</i> (White-eared Honeyeater)	X		X		X		X		X		X	

KEY

* Species recorded only in natural vegetation on wheatbelt reserves (from Kitchener *et al.*, 1982).

NR Nature Reserve

Ext Extension

Appendix 12

Comparison between indigenous mammal faunas recorded from biological surveys and surface cave deposits in the Eastern Goldfields on existing and proposed reserves.

	Pk Charles NP ¹		Dundas NR ¹		Mt Manning Range NR Ext ²	
	Biol. Surveys	Cave Surface	Biol. Surveys	Cave Surface	Biol. Surveys	Cave Surface
<i>Tachyglossus aculeatus</i>		X	X	X	X	
<i>Dasycercus cristicauda</i>						cf.
<i>Dasyurus geoffroii</i>				X		X
<i>Parantechinus apicalis</i>		X		X		
<i>Phascogale calura</i>		X		X		
<i>P. tapoatafa</i>				X		
<i>Ningauia ridei</i>			X		X	
<i>N. yvonneae</i>				X	X	
<i>Sminthopsis crassicaudata</i>			X		X	
<i>S. dolichura</i>			X		X	
<i>S. granulipes</i>	X					
<i>S. hirtipes</i>					X	
<i>S. sp. (murina complex)</i>		X		X		
<i>Isoodon obesulus</i>		X				
<i>Perameles bougainville</i>		X		X		
<i>Trichosurus vulpecula</i>		X				X
<i>Cercartetus concinnus</i>	X	X	X	X	X	
<i>Tarsipes rostratus</i>	X					
<i>Bettongia penicillata</i>		X		X		
<i>Potorous platyops</i>				X		
<i>Lagostrophus fasciatus</i>				X		
<i>Macropus fuliginosus</i>	X	X	X		X	
<i>Onychogalea lunata</i>				X		
<i>Petrogale lateralis</i>		X				X
<i>Leporillus apicalis</i>		X		X		X
<i>L. conditor</i>				X		
<i>Notomys mitchellii</i>	X		X		X	
<i>N. alexis</i>					X	
<i>Pseudomys albocinereus</i>	X				X	
<i>P. bolami</i>			X	X		
<i>P. hermannsburgensis</i>					X	
<i>P. shortridgei</i>		X				
<i>Zyzomys pedunculatus</i>						??
<i>Rattus fuscipes</i>		X				

KEY

cf. Probable record NR Nature Reserve
 ?? Possible record NP National Park

NOTES

¹ Baynes (1987); How *et al.* (1988a); McKenzie and Rolfe (in prep.).

² A. Baynes (unpubl. data); Dell and How (1985).

Appendix 13

Indigenous mammals recorded from surface cave deposits in the Eastern Goldfields District, outside the existing and proposed reserve system.

Species	30km E Dundas NR ¹	70km NW MMR NR ²	50km N Goongarrie NP ³	90km SW Wanjarri NR ⁴
<i>Antechinomys laniger</i> *	X	X	X	X
<i>Dasyercus cristicauda</i>	X	X	??	X
<i>Dasyurus geoffroii</i>	X			
<i>Ningaui</i> sp.*		X		X
<i>Pseudantechinus woolleyae</i> *		X		X
<i>Phascogale calura</i>	X	X	X	X
<i>P. tapoatafa</i>	X			
<i>Sminthopsis crassicaudata</i> *	X	X		
<i>S. dolichura</i> *	cf.	cf.	cf.	
<i>S. ooldea</i> *			X	X
<i>S. psammophila</i>		X		
<i>S. sp. (large)</i>		?? ⁵		
<i>Myrmecobius fasciatus</i>			X	
<i>Chaeropus ecaudatus</i>	X	X		X
<i>Isodon auratus</i>				X
<i>Perameles bougainville</i>	X	X		
<i>Macrotis lagotis</i>	X			
<i>Trichosurus vulpecula</i>	X		X	
<i>Cercartetus concinnus</i> *	X			
<i>Bettongia lesueur</i>	X		cf.	
<i>B. penicillata</i>	X			
<i>Onychogalea lunata</i>	X		X	
<i>Leporillus apicalis</i>	X	X	X	X
<i>L. conditor</i>	X	X	X	X
<i>Notomys amplius</i>		X		X
<i>N. longicaudatus</i>			cf.	X
<i>N. sp. (small)</i>	X	X	X	X
<i>Pseudomys australis</i>	X			
<i>P. bolami</i> *	X	X		X
<i>P. desertor</i>	X	X		X
<i>P. fieldi</i>	X	X	X	X
<i>P. hermannsburgensis</i> *		X	X	X
<i>Rattus tunneyi</i>				X

KEY

cf. Probable record

?? Possible record

* Recorded during the biological survey

MMR Mt Manning Range

NR Nature Reserve

NP National Park

NOTES

- 1 (Baynes, 1987): Balladonia, Booanya Rock.
- 2 (A. Baynes, unpubl. data): Diemals.
- 3 (A. Baynes, unpubl. data): Yerilla, Yowie Hill, Menzies, Callion.
- 4 (A. Baynes, unpubl. data): Pinnacles.
- 5 possible *Sminthopsis longicaudata* (A. Baynes, pers. comm.).

Appendix 14

Comparison between CTRC, EPA and Present Recommendations for the Eastern Goldfields District (CTRC System 11).

Present No.	CTRC/EPA No.	Locality	CTRC/EPA Recs.	Present Recs.
1.1	11.10	Lake Cronin	NR(A)	NR(Ext,A)
1.2	11.9.3	Forrestania Greenstone	- ¹	NR(4)
1.3	11.9	Frank Hann NP	NP(C)	NR*(Ext,A)
1.4	11.9.2	Pk Charles Area	NP(C) ²	NP(Ext,A)
1.5	11.9	Lake Johnston Area	- ²	NR(3)
1.6	-	Norseman Area	-	NR(1), TR(1)
1.7	11.11	Dundas NR	- ³	NR(A)
1.8	-	Southern Cross Area	-	NR(2), NR(A)
1.9	11.7	Yellowdine Area	NR(C)	NR ⁴ (A)
1.10	11.9.1	Jilbadgi NR	NR(C)	NR(A)
1.11	11.8	Boorabbin Area	NP(A)	NR*(Ext), NR(1)
1.12	-	Kalgoorlie Area	-	CP(2), NR(Ext), NR(A), TR ⁵
1.13	-	Woodline Hills	-	NR(1)
1.14	-	Buningonia Spring	-	NR(1)
2.1	11.6	Walyahmoning Rock	NR(A)	NR(A)
2.2	11.3-4.1	Mt Manning Range NR	NR(C)	NR(Ext), NR(A) ⁶
2.2	11.3-4.2	Mt Jackson and and Die Hardy Range	NR(Ext,C)	(Ext,A) ⁷
2.3	11.5	Goongarrie NP	NP(A)	NP(Ext,A)
2.4	-	Menzies Area	-	NR(2)
3.1	11.2	Wanjarri NR	NR(A)	NR(A)
3.2	11.1	Windich Spring	NP(A)	NP(A)
4.1	-	Granite Rocks S of Balladonia	-	S
4.2	-	Granite Rocks E of Lake Johnston	-	S
4.3	-	Jaurdi Pastoral Lease	-	S ⁸
4.4	-	Parker Range	-	S
4.5	-	Highclere Hills	-	S
4.6	-	Fraser Range	-	S
4.7	-	Bronzite Ridge	-	S
4.8	-	Mt Norcott and Buldania Rocks	-	S
4.9	-	VCL E of Lake Lefroy	-	S
4.10	-	Swan Lake and Erayinia Hill	-	S

KEY

NR	Nature Reserve
NP	National Park
CP	Conservation Park
TR	Timber Reserve
(A)	Recommended as Class A
(C)	Recommended as Class C
S	Recommended for biological survey
NR(A)	Recommended upgrade of nature reserve(s) to Class A
(Ext)	Recommended extension to existing reserve
*	Recommended conversion from National Park to Nature Reserve
NR(1)	Number of new Class A reserves proposed

NOTES

- 1 EPA recommendations to Mines Dept. for placement of conditions to protect the environment (EPA, 1975).
- 2 Discussed in 11.9 as proposed reserve in Bremer Range Area (CTRC, 1974).
- 3 EPA recommendations for a biological survey of the Dundas Area to 33°05'S.
- 4 Present recommendations extend 11.7 and upgrade to Class A.
- 5 Present recommendations upgrade existing Sandalwood Reserves to Timber Reserves.
- 6 Present recommendations upgrade Mt Manning Range Nature Reserve and extensions to Class A.
- 7 Present recommendations extend Mt Manning Nature Reserve west and south.
- 8 Pastoral lease purchased by CALM.