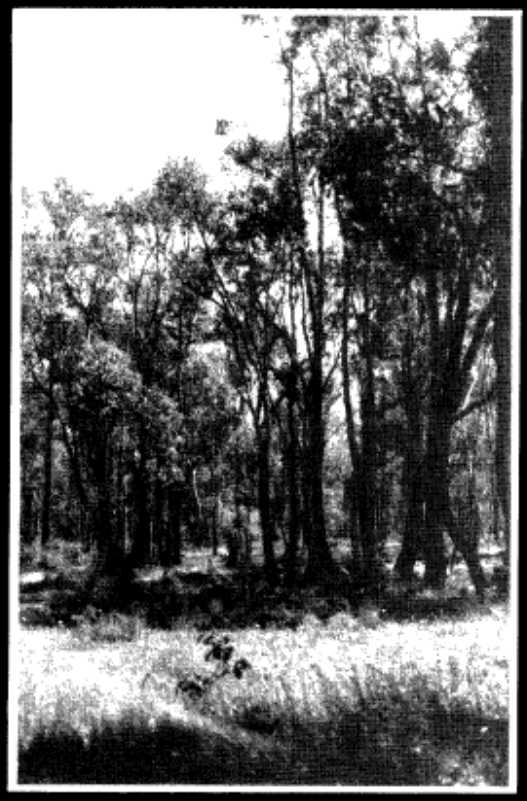
Department of Conservation and Land Management, W A

Mooradung Nature Reserve Management Plan



1985-1995

Management Plan No.1

MOORADUNG NATURE RESERVE

1985-1995

BY

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This management plan was prepared in accordance with Sections 53-61 of the Conservation and Land Management Act (1984).

The management plan was adopted by the National Parks and Nature Conservation Authority on 11 October 1985 and approved by the Hon. Ron Davies M.L.A., Minister for Conservation and Land Management, on 28 November 1985.

This management plan was endorsed by the Bush Fires Board, under the provisions of Section 34(l) of the Bush Fires Act (1954), on 18 November 1985; formalisation being dependent on approval by the Minister for Conservation and Land Management.

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ACKNOWLEDGEMENTS

Information supplied by reserve neighbours Messrs G. Batt, I.G. Batt and the late H. Carrots was helpful in providing background history for Mooradung Nature Reserve. Data collected by consultants from Worsley Alumina Pty Ltd contributed important biological information on the reserve, and the Company's help with plant identifications is also acknowledged.

The plan has been greatly improved by the comments of many of our colleagues, in particular Messrs Jim Lane, Kevin Vear, Roger Hearn, Sweton Stewart, Frank Batini, Rick Sneeuwjagt, Barry Wilson, Keiran McNamara and Jim Williamson. Submissions on the published draft were received from; State Government organisations, including the Bush Fires Board, Department of Agriculture, Department of Lands and Surveys and W.A. Museum; from conservation groups, such as the Tree Society and the W.A. Wildflower Society; and from the Boddington Shire Council and the Marradong Brigade. A joint submission was received from the following reserve neighbours -Messrs F.W. Stevens, I.G. Batt and G. Batt. These submissions included many helpful comments and suggestions, a number of which have been incorporated in the final plan.

Of great assistance was the expertise provided by those who identified wildlife species - their names are given in the text. Particular thanks are due to Mr Ken Atkins who identified many plant species. Mr Don Hart carried out field work necessary to establish the appropriate alignment for the proposed internal firebreak system, and in 1981 the Dwellingup Research Section of this Department tested field samples for the presence of Phytophthora cinnamomi. R.P. and R.M. Hart tested further sites in 1983.

Finally, I would like to acknowledge the work of Mrs Raelene Hick and Mrs Jill Pryde in typing the manuscript and Mr Malcolm Graham who drew all figures.

PREFACE

This management plan is part of the Management Plan series produced by the Department of Conservation and Land Management. Completion of each plan involves three stages. First, the plan is published as a draft, and members of the local community (particularly reserve neighbours), government departments, tertiary institutions, conservation groups and the general public are encouraged to submit comments. The draft is then reviewed in the light of these comments, and an amended draft and summary of public submissions produced. This is the second stage, with the published submissions and amended draft being submitted to the National Parks and Nature Conservation Authority (NPNCA), the Minister for Conservation and Land Management and the Bush Fires Board for approval. Once this approval has been obtained the third stage follows, with the plan being published in its final form. As such it constitutes a management plan in terms of Section 60 of the Conservation and Land Management Act (1984) and Section 34(l) of the Bush Fires Act (1954).

PART A

THE RESERVE

1. THE RESERVE - SUMMARY

Mooradung Nature Reserve (Reserve No. 32448, area 631.7 ha) lies near the eastern edge of the Darling Range in the Shire of Boddington (Fig. 1). -The reserve is sited about 12 km to the south-east of the town of Boddington with Lucey Road providing public access (Fig. 2,3). Privately owned land surrounds the reserve, and this is mostly cleared for agriculture (Fig. 4).

While small in area, Mooradung Nature Reserve is by far the largest nature reserve within the Shire of Boddington. However the Shire does contain extensive areas of forested land. The area of forest closest to the reserve, at Mount Saddleback, lies about 11 km to the south-west (Fig. 2).

The greater part of the reserve consists of upland country and its associated gravel soils. Jarrah (Eucalyptus marginata) woodland is the predominant vegetation with Wandoo (E. wandoo) occurriag along drainage systems and Marri (E. calophylla) scattered throughout. Small areas of granite rock and heath vegetation provide further diversity.

Mooradung Nature Reserve contains a range of flora and fauna and by virtue of its location, provides a sample of wildlife within the transition zone between the forested land of the Darling Range to the west and woodland in the lower rainfall areas to the east.

Species of particular note which have been recorded in the reserve include the Crested shrike-tit (Falcunculus frontatus) a bird which has been gazetted as rare and endangered; Grevillea cirsiifolia, a plant gazetted as rare and endangered; and the Slender Mallee (Eucalyptus decurva) which is regionally uncommon.

By virtue of its location and the diversity of wildlife it contains, the reserve is an important one.

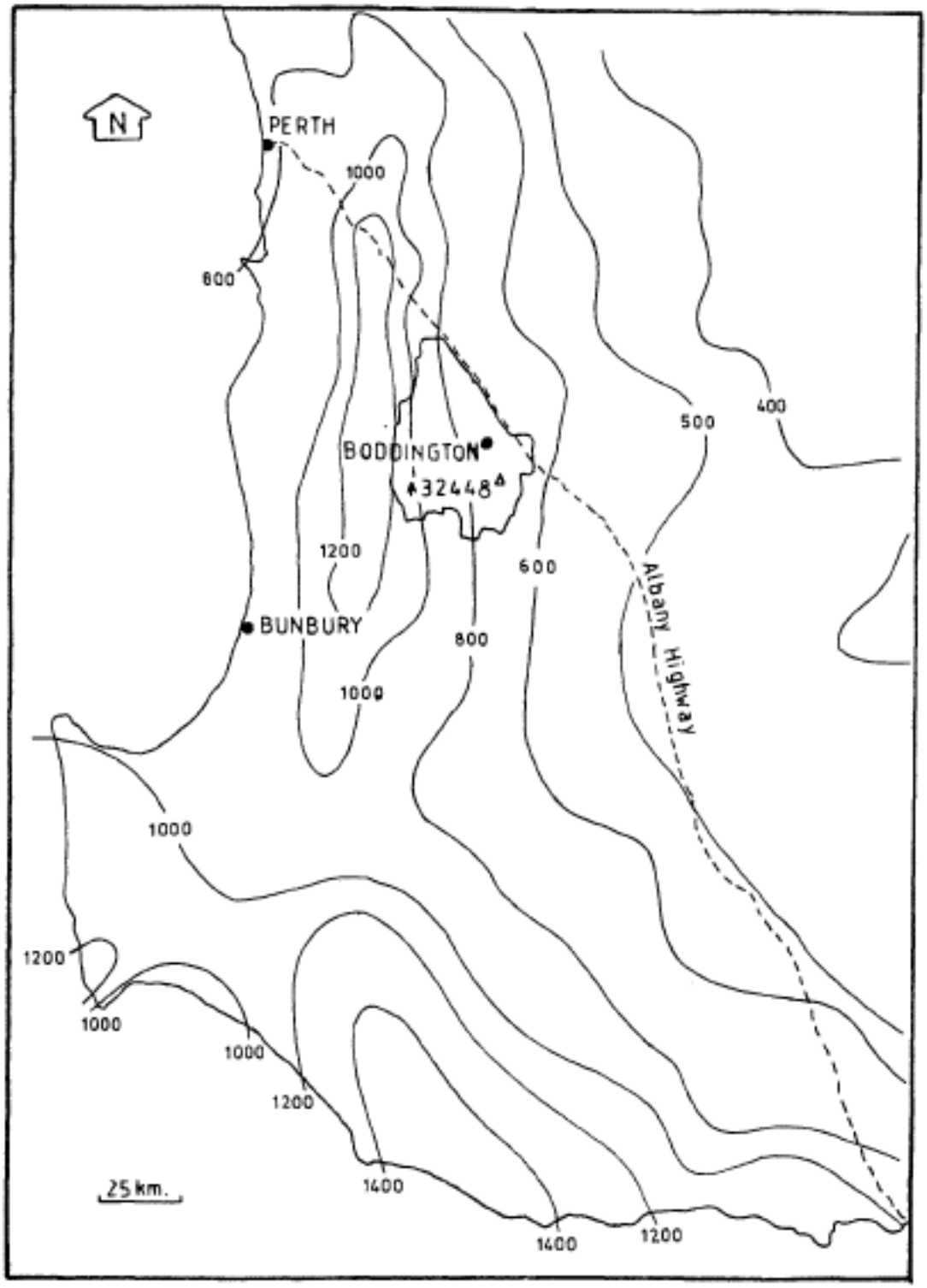


Figure 1: Location of the Shire of Boddington and Mooradung Nature Reserve (No. 32448), and their relationships to annual isohyets (mm) (Source: Department of Lands and Surveys, 1984 and Australian Bureau of Meteorology, 1984)

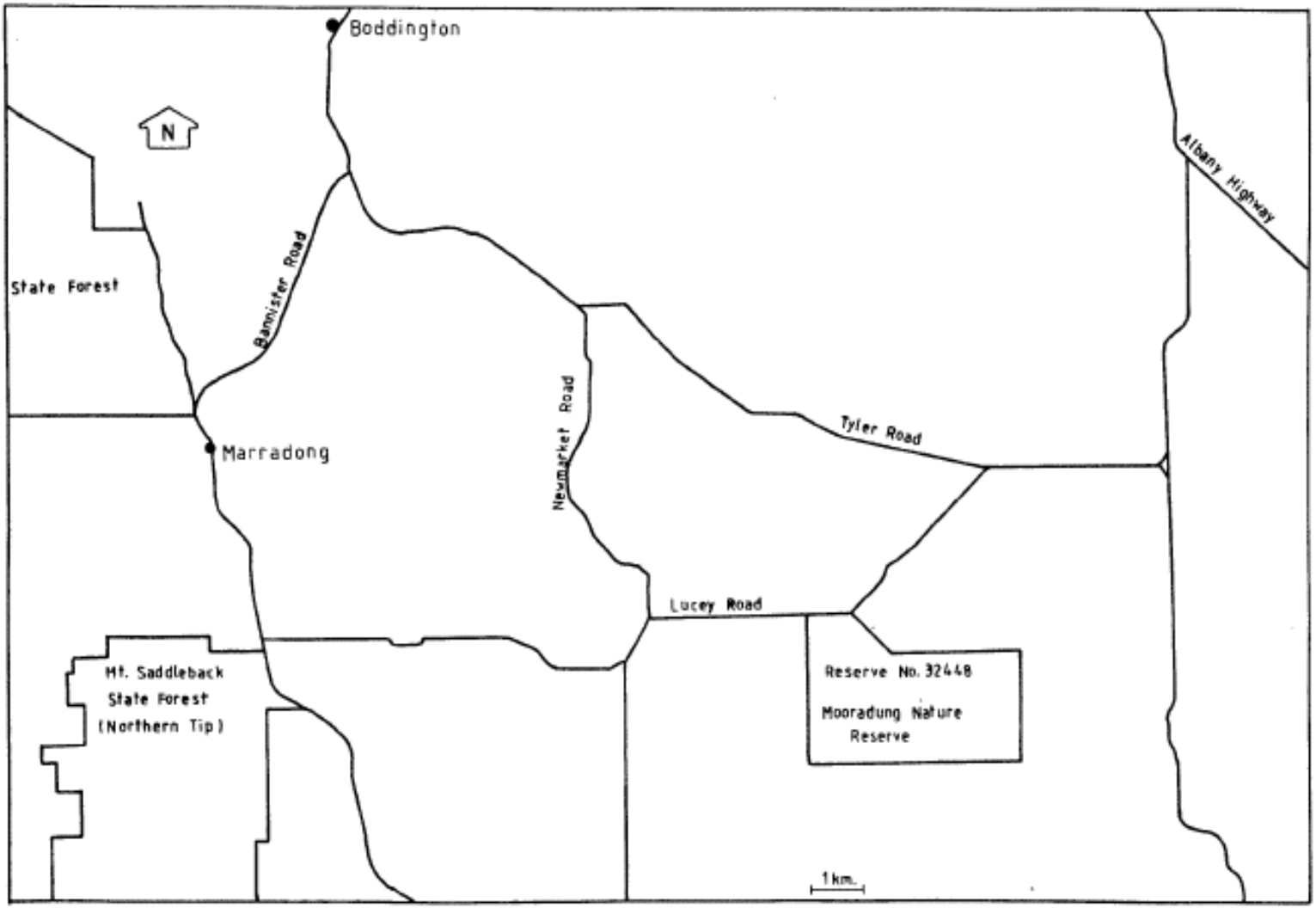


Figure 2: Mooradung Nature Reserve: locality (Source: Department of Conservation and Land Management 1:50 000 series)

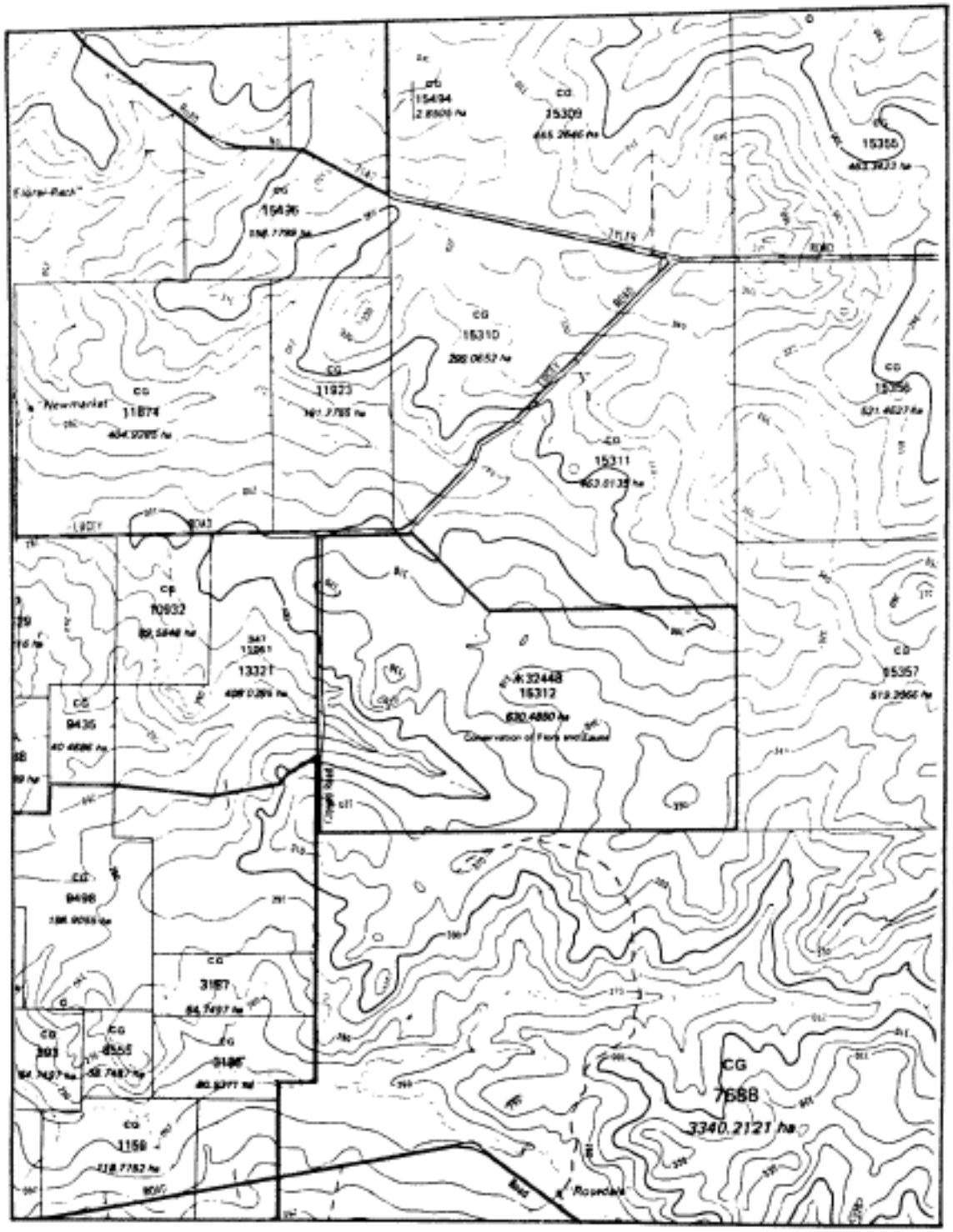


Figure 3. Mooradung Nature Reserve : cadastral information (Source: Department of Lands and Surveys 1:50 000 series 2232-III)

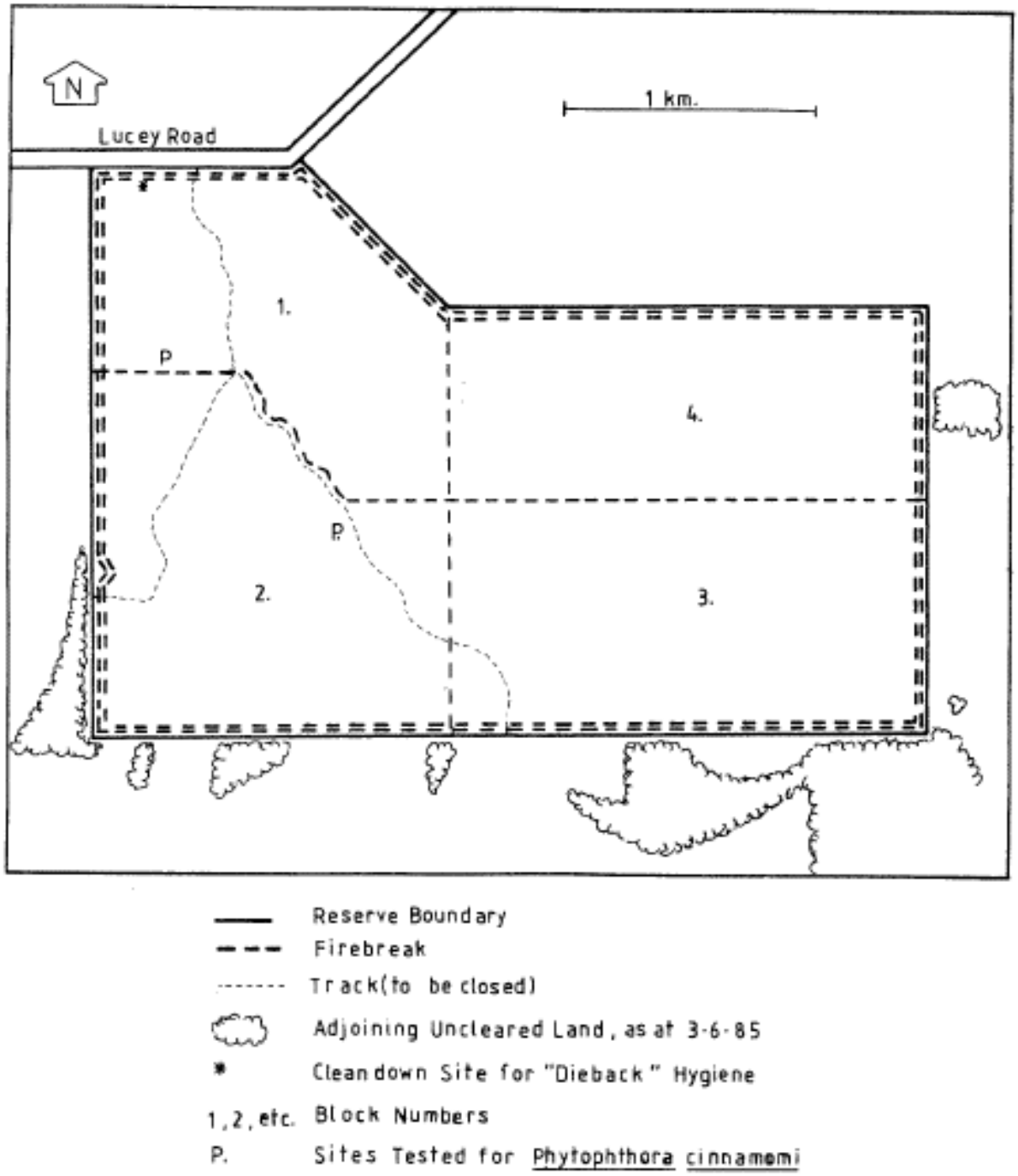


Figure 4. Mooradung Nature Reserve: firebreaks, tracks, proposed firebreaks, adjoining uncleared land and sites tested for Phytophthora cinnamomi (Source: Department of Conservation and Land Management, 1985)

2. HISTORY OF THE RESERVE

Mooradung Reserve was originally set aside for the purpose of "Protection for Agricultural Department (Research Station)". Prior to becoming a nature reserve, the area was extensively logged and some logging trails are still visible today.

District wildlife Officer D. Mell inspected the reserve in August 1973. In his departmental report he concluded that the reserve was an interesting piece of land for conservation by virtue of its size and diversity of wildlife.

Following this report, the purpose of the reserve was changed to Conservation of Flora and Fauna and the reserve was vested in the National Parks and Nature Conservation Authority. These actions appeared in the Government Gazette of March 7, 1984.

Boddington Shire Council opposed the gazettal of the- nature reserve and in a letter to the Department of Lands and Surveys written in March 1974, the Council stated that while they supported the preservation of flora and fauna, there were already large areas of State Forest within the Shire. On this basis the Council expressed strong opposition to Mooradung Reserve being retained for conservation and they suggested that the reserve be released for farming.

As a consequence of these objections, Chief Research Officer A.A. Burbidge inspected the reserve accompanied by Senior Technical Officer T. Evans during May 1974. In their Departmental report they noted that, while their inspection revealed few unique or outstanding plants and animals, the reserve provided protection for a typical range of the flora and fauna of the region. They also pointed out that State Forest is subject to disturbance in the form of timber felling and bauxite mining, and that the reserve is a most useful link between State Forest in the Darling Range and Dryandra to the east. As a result of this report the purpose and vesting of the reserve was retained.

In recent years concern has been expressed by some landholders adjoining the reserve concerning management of the area for fire protection. Consequently the Boddington Bush Fire Advisory Committee sought clarification of the Department of Fisheries and Wildlife's fire policy with respect to the reserve. Given this interest, together with its status as the only nature reserve in the Shire of Boddington, information has been collated in this document to detail the conservation values of the reserve and present a plan for management.

3. LOCATION AND PHYSICAL FEATURES

Mooradung Nature Reserve (33'06'S, 116*33'W) is situated in the Shire of Boddington and lies about 12 km to the south-east of the Town of Boddington and 12 km to the west of the Albany Highway. Access to the reserve is by Lucey Road (Fig. 2). The reserve is 631.7 ha in area and approximately rectangular in shape, being about 3.5 km east-west and 2.0 km north-south.

Farmland surrounding the reserve is used for cereal growing and as pasture for stock. Uncleared, privately owned land adjoining the reserve is shown in Figure 4.

Mooradung Nature Reserve lies between 280 and 340 m above sea-level (Fig. 5) and consists in the main of upland country formed by several laterite ridges and an area of exposed granite. Although dissected by three creek lines, no permanent water exists on the reserve.

Surface soils on the reserve range from sand and sandy loam to lateritic gravel, with most soils containing a gravel component. Darker coloured loams occur in the region of the granite outcrop.

The climate of the region is Mediterranean and the average annual rainfall at the nearest weather station, Marradong (Fig. 2), is 755 mm.

4. VEGETATION

Mooradung Nature Reserve lies in the Dale Sub-district of the Darling Botanical District as defined by Beard (1980). Beard described the vegetation and soils of the Dale Sub-district as being Jarrah

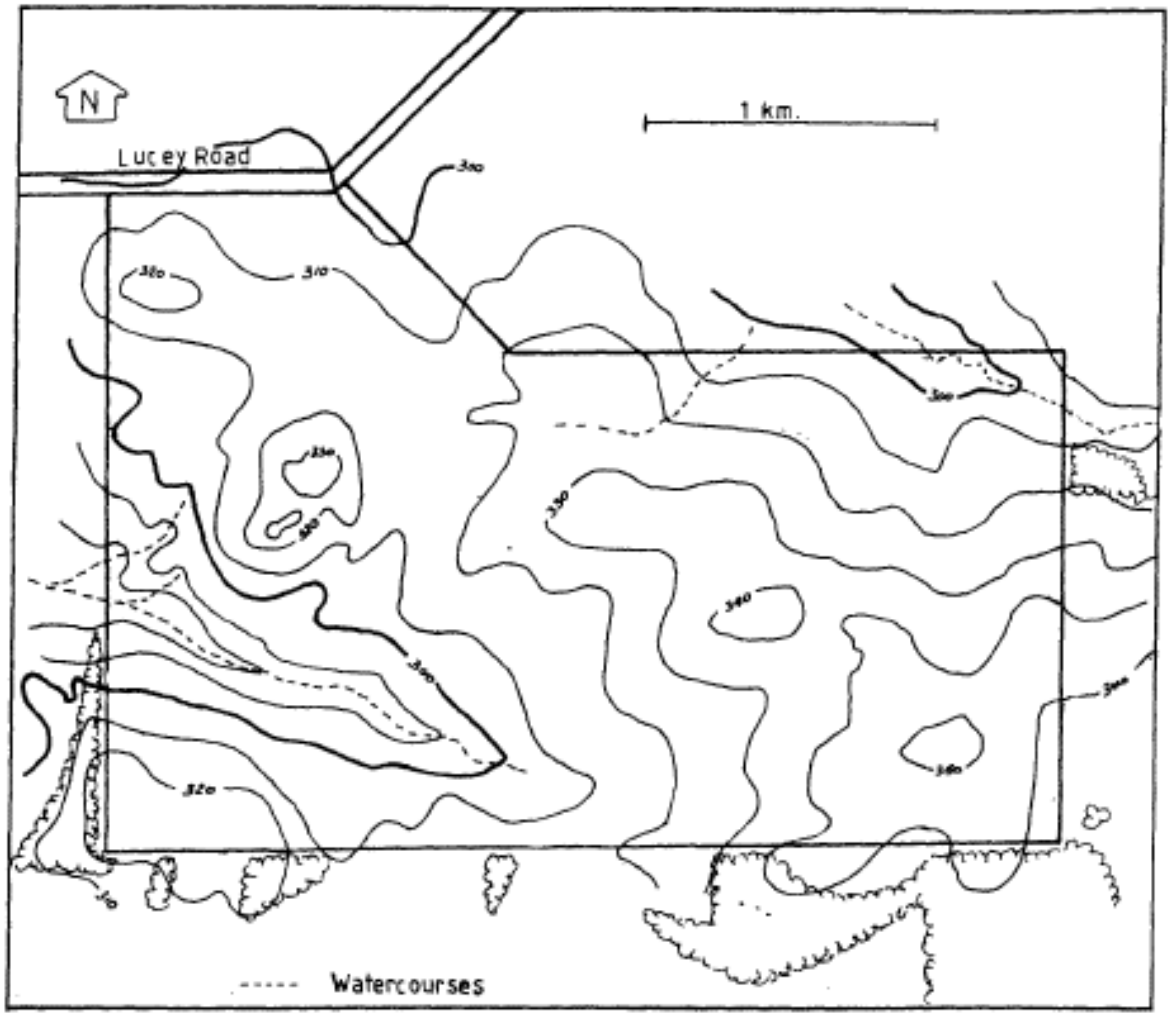


Figure 5. Mooradung Nature Reserve: topography and features (Source: Department of Lands and Surveys 1:50 000 series 2232-III).

(Eucalyptus marginata) forest on ironstone gravels with Marri-Wandoo (E. calophylla - E. wandoo) woodlands on loamy soils, both over sclerophyll understories. At a more regional level, Heddle et al. (1980) have described the Darling System which includes land about 10 km to the west of Mooradung Nature Reserve. From comparisons of their work it is apparent that the vegetation of the Mooradung Nature Reserve has affinities with the eastern section of the Darling Plateau and in particular the "Yalanbee and Dwellingup Complex in Low Rainfall".

The vegetation of Mooradung Nature Reserve has been mapped at a broad scale using aerial photography taken in January, 1973 (Fig. 6). Most of the vegetation boundaries shown have been examined on the ground. Work on the vegetation and floristics of the reserve was carried out by Ken Wallace between 1979 and 1981, with additional work in 1983.

Three vegetation formations occur on the reserve - woodland, heath and a granite complex. Of these by far the largest in area is woodland. Although the areas of heath and granite complex are much more limited in extent they contain a number of plant species not found elsewhere on the reserve and therefore make a significant contribution to the floral diversity.

WOODLAND

While the canopy within woodlands on Mooradung occasionally reaches densities which could be defined as forest within the classification system devised by Muir (1977, Appendix IA), the areas are predominantly woodland in character. The following woodland types have been described for the reserve.

1. Jarrah Woodland. Jarrah (Eucalyptus marginata) is the most common tree species on the reserve with Marri (E. calophylla) occurring sporadically throughout. Understories within the Jarrah woodlands vary considerably in composition depending on soils and topography. Higher in the landscape lateritic gravel soils carry, on some sites, a low woodland stratum of Bull Banksia (Banksia grandis) or sheoak (Allocasuarina fraserana) over a sparse shrubland. Tall shrublands of Parrot Bush (Dryandra sessilis) and Pingle (Dryandra carduacea) are also present at some sites. Lower in the landscape these strata disappear and are replaced by shrubs less than two metres in height. Scrub Sheoak (Allocasuarina humilis) is the most abundant understorey shrub in these areas with other common shrubs

being Bossiaea ornata, Daviesia spp, Couch Honeypot (Dryandra nivea), Grevillea sp., Honeypot (Hakea lissocarpha) and Buttercups (Hibbertia spp).

2. Wandoo Woodland: Two pure stands of Wandoo (E. wandoo) occur on the reserve. These woodlands are sited on more loamy soils along drainage lines and adjacent to the granite outcrop. Understories within Wandoo woodlands are varied and commonly include Bossiaea eriocarpa, York Road Poison (Gastrolobium calycinum) and Honeypot (Hakea lissocarpha).

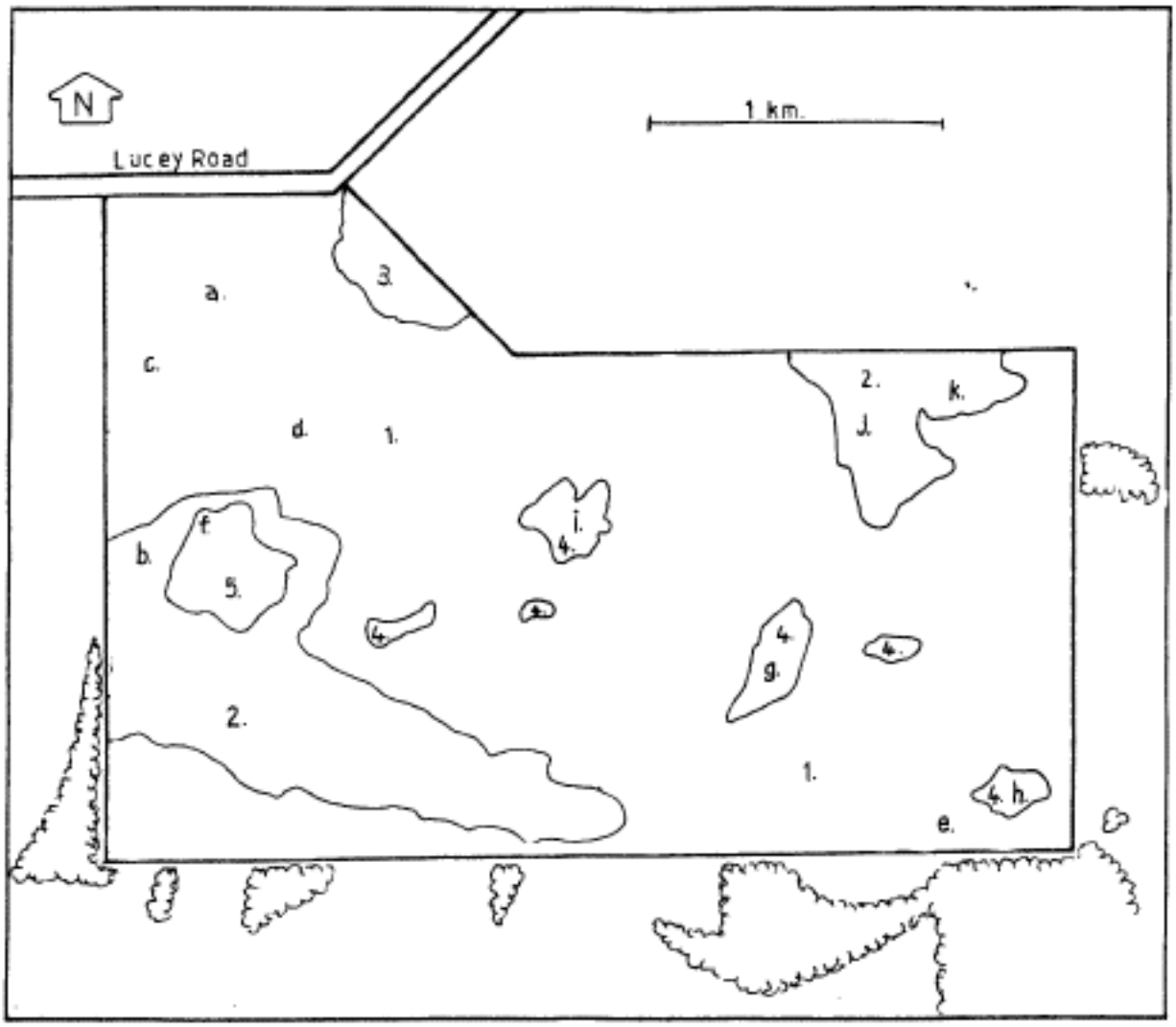
GRANITE COMPLEX

The granite exposure on the reserve is shown in Figure 6. While there is little exposed granite at the site some of the plant species which, occur there - such as sheoak (Allocasuarina huegeliana), Pincushions (Borya nitida) and Stypandra imbricata - are frequently found associated with granite. Jam (Acacia acuminata), a species common in the agricultural areas to the east, has only been recorded in association with the granite.

HEATHS

The heaths which occur are small in size however they contain 'species, such as Drummond's Gum (Eucalyptus drummondii), which have not been recorded elsewhere on the reserve.

Dominant species in heaths range from Scrub Sheoak (Allocasuarina humilis), to various combinations such as Scrub Sheoak with Prickly Dryandra (Dryandra armata), and Scrub Sheoak with H. trifurcata. The most floristically diverse area of heath occurs centrally in the reserve ("i" in Fig. 6).



1,	Jarrah Woodland.
2.	Wandoo Woodland.
3.	Jarrah-Marri-Wandoo Woodland.
4.	Heath.
5.	Granite Complex.
a,b etc.	Plant Association Survey Sites.

Figure 6. Mooradung Nature Reserve: vegetation (Source: Department of Lands and Surveys, January 1973 aerial photography - interpretation by the Department of Conservation and Land Management, 1983).

Descriptions were made by Ken Wallace, of vegetation associations at eleven sites on the reserve. While these provide a broad picture of the reserve's vegetation they do not detail all associations that are present. The association descriptions and a plant list for the reserve are given in Appendices IB and IC respectively.

PLANT SPECIES OF NOTE

Two of the plant species which have been recorded from the reserve are of particular interest. One, Grevillea cirsiifolia, is gazetted as rare and endangered. Of further note is the fact that the reserve is outside the previously known geographical range of this species (Rye and Hopper, 1981).

The second species of individual interest is the Slender Mallee (Eucalyptus decurva). This plant grows within two quite separate regions. The northern region is approximately bounded by a line connecting Mogumber, Brookton and Boddington; while the southern region is contained roughly in a region bounded by Hopetoun, Kalgan, and Geekabee Hill (east of Cranbrook). The Slender Mallee on Mooradung Nature Reserve is therefore a southern outlier of the northern populations of the species. It should be noted that a specimen lodged in the Western Australian Herbarium was collected from the Boddington area. Locality details with the specimen suggest that it was collected on or near the reserve. A local farmer has informed one of the authors of mallees growing on private property near the reserve, a matter for further investigation.

5. FAUNA

No detailed study has been made of the fauna of Mooradung Nature Reserve. The following account is based on Departmental reports by District Wildlife Officer D. Mell (August 1973), and Chief Research Officer A.A. Burbidge and Senior Technical Officer T. Evans (May 1974); a short survey by consultants employed by Worsley Alumina Pty Ltd (late Spring 1983); and opportunistic records by Ken Wallace from 1979 to 1983 inclusive. The common and scientific names used for mammals, reptiles and amphibians in this plan are those used by the Western Australian Museum.

MAMMALS

Live trapping for mammals, using pit fall and Elliot traps, was undertaken on the reserve by Ken Wallace during June and September 1980. Further live trapping was carried out during late Spring of 1983 by consultants employed by Worsley Alumina Pty Ltd. Neither of these surveys was intensive, nor was any attempt made to comprehensively assess all the habitats available on the reserve. Mammal species recorded from the reserve are shown in Table 1.

Table 1. Mammal species recorded from Mooradung Nature Reserve.

Species		Source (a)
Western Grey Kangaroo	Macropus fuliginosus	A,B,C,D
Brush Wallaby	Macropus irma	B,C,D
Dunnart (b)	Sminthopsis sp.	D
Bat (?Gould's Wattled Bat)	?Chalinolobus gouldii	B
Echidna	Tachyglossus aculeatus	D
European Fox (c)	Vulpes vulpes	B
Mouse (c)	Mus musculus	C,D
European Rabbit (c)	Oryctolagus cuniculus	B

(a) A = Mell; B Burbidge and Evans; C = Wallace; D = Worsley Alumina Pty Ltd
(b) Mummified juvenile remains;
(c) = Introduced species.

BIRDS

The 56 bird species which have been recorded from Mooradung Nature Reserve are listed in Appendix II. This number of species accords well with what would be expected to occur on an area of similar size in the wheatbelt (compare with Kitchener et al., 1982).

The bird species recorded from the reserve represent an excellent sample of the terrestrial birds of the region. While many of the species are either permanent residents of the reserve, for example the Golden Whistler, Jacky Winter and Splendid Wren; or regionally nomadic, for example the Red-capped Robin and White-cheeked Honeyeater; others are migratory. Included among the latter are the Rainbow Bee-eater, White-winged Triller, Pallid Cuckoo and Sacred Kingfisher.

Although Mooradung Nature Reserve does not lie at the extreme range of any bird species, the species list does to some extent reflect the location of the reserve between State Forest to the west and the wheatbelt to the east. The Red-capped Robin, Jacky Winter, White-winged Triller and Rainbow Bee-eater are all more common in bushland to the east and are not typical of State Forest to the west;

while the main populations of the Red-capped Parrot lie to the west of the reserve (Serventy and Whittell, 1976).

Of note is the record of the Crested Shrike-tit on the reserve, as this species is gazetted as rare and endangered.

REPTILES AND AMPHIBIANS

Apart from a short survey by representatives of Worsley Alumina Pty Ltd only opportunistic records have been made of the reptile and amphibian fauna of Mooradung Nature Reserve. Species recorded in the reserve are shown in Tables 2 (reptiles) and 3 (amphibians).

Table 2. Reptiles recorded on Mooradung Nature Reserve.

Species		Source (a)
Geckoes		
Phyllurus milii	Thick-tailed Gecko	D
Dragons and Monitors		
Pogona minor minor	Dwarf Bearded Dragon	D
Varanus gouldii	Gould's Goanna	C
Skinks		
Cryptoblepharus plagiocephalus		D,B
Ctenotus impar		D
Egernia napoleonis		D
Lerista distinguenda		D
Morethia obscura		D
Tiliqua rugosa rugosa	Bobtail	D
Snakes		
Pseudonaja affinis affinis	Dugite	D
Rhinoplocephalus gouldii		D

(a) B = Burbidge and Evans; C = Wallace; D = Worsley Alumina Pty Ltd

Table 3. Amphibians recorded on Mooradung Nature Reserve.

Species	Source (a)
Crinia georgiana	D
Heleioporus psammophilus	D
Pseudophyrne guentheri	B

(a) B = Burbidge and Evans; D = Worsley Alumina Pty Ltd

Of the reptile and amphibian species recorded in Mooradung Nature Reserve, two are worthy of further comment. The known distribution of Gould's Goanna (Storr, 1980) and Heleioporus psammophilus (Tyler et al. 1984) appear to lie largely outside the Darling Range including that part near Mooradung. While this may reflect lack of collecting, the reserve may also lie near the edge of part of the geographic range of these species.

6. CONSERVATION VALUES

The conservation values of Mooradung Nature Reserve are fourfold. Firstly, the reserve contains a representative sample of the upland flora and fauna (apart from mammals) of the region. Although areas of State Forest lie within 11 km of the reserve, it is important to note that the closest, at Mt Saddleback, does not include all the plant species recorded on the reserve. For example some 10% of the plant species occurring on the reserve have not been recorded at Mt Saddleback (data as at Spring 1983), an area which has been intensively studied by Worsley Alumina Pty Ltd. This emphasizes the need for a number of conservation areas within any given region if the full range of flora is to be conserved.

Secondly, the reserve provides a representative sample of the transition between the flora and fauna of the Darling Range and that of the wheatbelt. While the vegetation and landforms of the reserve are closely allied with those found on the eastern edge of the Darling Range, species occurring on the reserve such as Jam (Acacia acuminata), sheoak (Allocasuarina huegeliana), Red-capped Robin (Petroica goodenovii) and Jacky Winter (Microeca leucophaea) illustrate the fact that the reserve is influenced by its proximity to the wheatbelt. This function will be of increasing importance with the continued clearing and degradation of native vegetation on private land and road verges.

Thirdly, the reserve provides habitat for resident bird species as well as a variety of nomadic and migratory species. Reserves such as Mooradung provide "stepping stones" of natural habitat for the latter two groups.

Finally, the reserve contains two species which are gazetted as rare and endangered. These are the plant Grevillea cirsiifolia and the Crested Shrike-tit (Falcunculus frontatus). A third species, the Slender Mallee (Eucalyptus decurva), is regionally uncommon.

7. FIRE HISTORY

According to reserve neighbours, only one wildfire has occurred on the reserve since 1950. This started from a lightning strike to the north-west of the reserve in about 1961. Apparently this wildfire burnt all of the reserve with the exception of a section in the south-west corner. Apart from this fire, the whole reserve was lit by adjoining landholders in February or March 1973. Shortly after this fire the reserve, then a proposed nature reserve, was inspected by District wildlife officer D. Mell. From his report and comments by reserve neighbours it appears that 90% or more of the reserve was burnt.

Prior to 1973, and several times since, reserve neighbours have burnt sections of the reserve perimeter for fire protection purposes. Some of these burns extended well into the reserve.

In April 1981, officers from the Department of Fisheries and Wildlife carried out a prescribed burn on part of the reserve (Fig. 7) to reduce fuel levels. in May 1985 Block 3 was burnt (Fig. 4). This wildfire was not part of the program as detailed in the draft management plan. This management plan will prevent these type of events occurring in the future. Both the 1981 burn and the 1985 wildfire were of moderate intensity and about 70-80% of the litter and shrub layers were burnt.

8. PAST MANAGEMENT

In December 1972 a District Wildlife Officer was based at Waroona for the first time. From then until 1978 this officer was the sole regional representative of the Department of Fisheries and Wildlife working through the area within which Mooradung Nature Reserve is

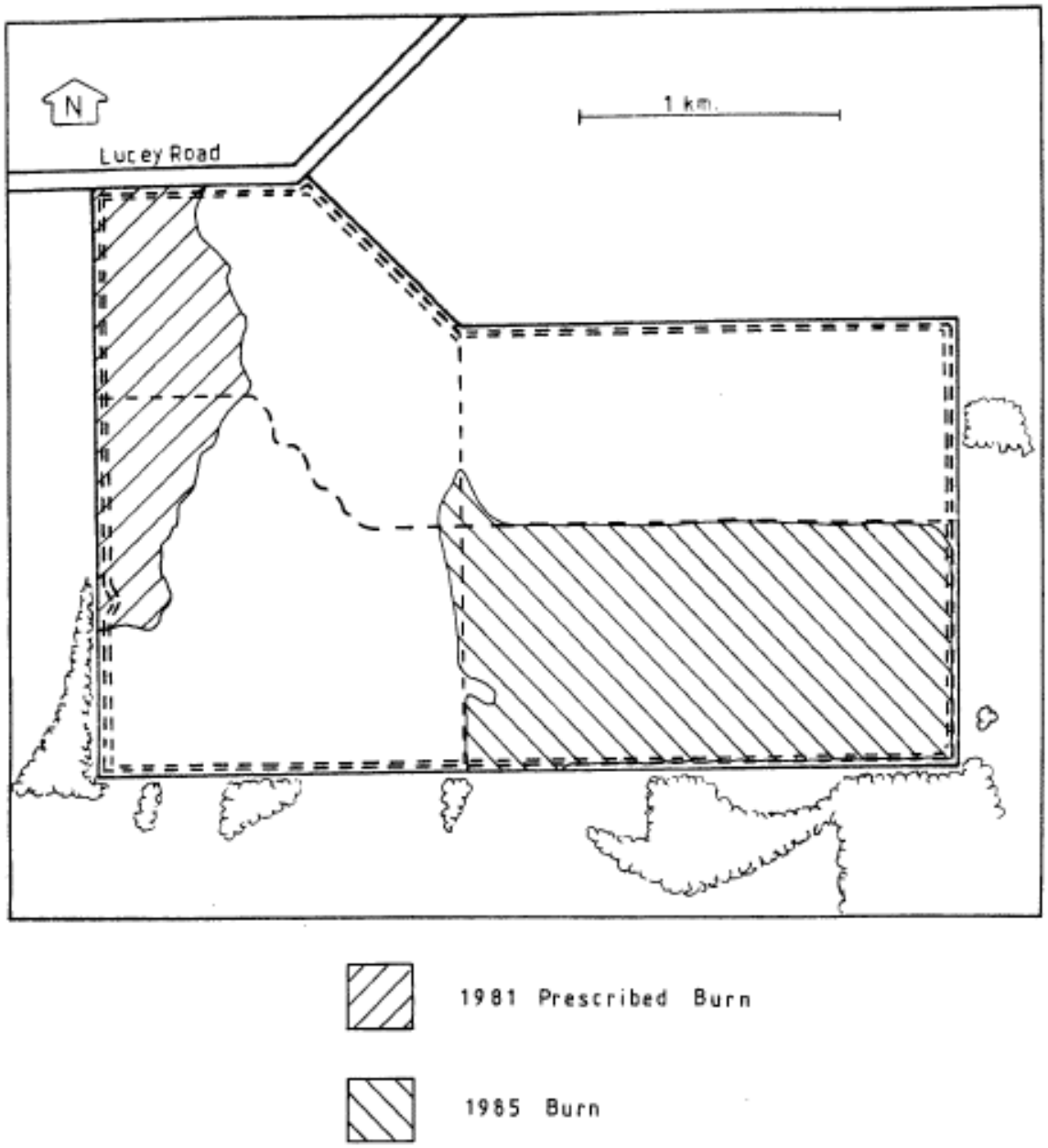


Figure 7. Mooradung Nature Reserve: recent fire history (Source: Department of Conservation and Land Management, 1985)

implement the enforcement and licencing provisions of the Conservation and Land Management Act and the Regulations of the Wildlife Conservation Act. However they are also involved in management activities.

Between 1974 and 1978 management of the reserve was largely restricted to enforcement and licencing work and since 1978, instances of rubbish dumping and timber cutting on the reserve have been investigated.

With the appointment of the Department of Fisheries and Wildlife's first reserve management team to Pingelly in 1978, the Pingelly Reserve Management Team (PRMT) became responsible for regional management of the reserve. The first involvement of this group with the reserve was in March 1979 when the PRMT assisted with a clearing burn on nearby private property.

A six metre firebreak was constructed by the PRMT around the perimeter of the reserve in December 1979. This firebreak has been maintained by an adjoining landholder under contract to the Department of Fisheries and Wildlife. As part of the firebreak maintenance program, officers from the PRMT sprayed eucalypt regrowth on the firebreaks with herbicide in 1981 and 1982. Early in 1985 internal firebreaks were surveyed and constructed by the PRMT. At the same time a narrow firebreak (3 m) was cut parallel to the boundary firebreak and 50 m into the reserve (Fig. 4). This break forms the inner edge of a buffer strip: a concept which is discussed in detail in Part B. Plan for Management.

Further management work undertaken on the reserve by the PRMT has included a biological survey, a prescribed burn in 1981, and the testing of two sites (Fig. 4) for Phytophthora cinnamomi ("jarrah dieback"). None of the samples taken from the reserve showed the presence of P. cinnamomi.

With the amalgamation of the Forests Department, the National Parks Authority and the Wildlife Section of the Department of Fisheries and Wildlife on the 22 March 1985, the management of Mooradung Nature Reserve became the responsibility of the Dwellingup District Manager (Department of Conservation and Land Management). With the merging of the three Departments District Wildlife Officers based in Perth, rather than Waroona, became responsible for enforcement and licensing work on and around Mooradung.

PART B

PLAN FOR MANAGEMENT

1. MANAGEMENT OBJECTIVES

The prime objective for the management of Mooradung Nature Reserve will be to maintain the wildlife (flora and fauna) conservation values of the reserve. The second objective of management will be to ensure, as far as is practicable, that the management of the reserve is compatible with that of adjoining agricultural lands.

To achieve these objectives, management will be required in the following fields during the term of this plan:

Protection from Fire

To protect the assets of both the reserve and the adjoining land, steps will he taken to minimise the occurrence and imp ac t of uncontrolled fires that may occur on the reserve and on adjacent lands.

Protection from Phytophthora cinnamomi

To prevent both the introduction of this fungus into the reserve and the possible transport of infected material into, from or within the reserve. Although no infection has been recorded, this does not preclude the possibility that undetected infections exist on the reserve.

Protection from Declared Plants and Animals

To eradicate or control animals or plants as may be declared from time to time under the provisions of the Agriculture and Related Resources Protection Act (1976,as amended).

Prevention of Misuse

To take measures as deemed necessary to prevent misuse (such as rubbish dumping and timber removal) of the reserve.

Management Records

To maintain a current system of records concerning the management activities undertaken on the reserve, including updated lists of the flora and fauna found on the reserve.

Public Use

To assist as far as is practicable, any person, either amateur or professional, who wishes to undertake research or educational activities on the reserve provided that these activities do not adversely affect the conservation values of the reserve. The reserve will also be available to the general public for use such as bushwalking and birdwatching, which do not contravene either the provisions of the Conservation and Land Management Act (1984, as amended) and the Regulations of the Wildlife Conservation Act (1950, as amended) or the provisions of this plan.

2. FIRE PROTECTION

Fire protection measures for the reserve will take into consideration both the conservation values of the reserve and the need to protect adjoining landholders from wildfires burning on the reserve. The fire protection program for the reserve will involve:

(a) maintenance of existing firebreaks;

(b) the construction and maintenance of an internal firebreak system;

(c) a programme of prescribed burning;

(d) establishment of procedures for notifying the Department of Conservation and Land Management of wildfires on or adjacent to the reserve; and

(e) involvement of the Department of Conservation and Land Management in suppression of wildfires on or adjoining the reserve.

INTERNAL FIREBREAK SYSTEM

Early in 1985, the system of internal firebreaks, including the narrow break on the inside edge of the perimeter buffer strip, was constructed This new system was installed as the existing two tracks were not well placed for prescribed burning and wildfire suppression (Fig. 4). Furthermore, the condition of the tracks was deteriorating due to both erosion and the regrowth of vegetation. For these reasons, the tracks will be closed and the ground ripped to encourage further regeneration of vegetation.

Given that the reserve is located within the geographical range of Phytophthora cinnamomi, it will be necessary to restrict vehicular use of the firebreak system during the currency of this plan (see Section 3). This will be achieved by the temporary closure of the internal firebreaks.

MAINTENANCE OF FIREBREAKS

Once constructed, all firebreaks will be kept free of fuel and in a condition which will readily permit four-wheel drive vehicles. The Dwellingup District Manager will be responsible for firebreak maintenance.

PRESCRIBED BURNING

Prescribed burning on nature reserves may be carried out either to reduce fuel levels to assist in the control of wildfires (abatement burning), or to alter habitat to favour particular species of wildlife (biological burning). Any burning carried out for biological reasons will also have an abatement function given that fuel loads will be reduced by such burning.

At present the relationships between fire and wildlife are not sufficiently understood to enable burning for biological purposes on Mooradung Nature Reserve. Consequently the prescribed burning which is undertaken will have the aim of reducing fuel levels on the reserve to assist in the control of wildfires either entering or leaving the reserve.

While the relationship between fire and wildlife is poorly understood, it is possible to burn native vegetation at a frequency which is detrimental to conservation values. For this reason it is important that a cautious approach be adopted in prescribed burning programs for the reserve, particularly with respect to the frequency with which fire is used.

External Buffer Strips

Given the need to adopt a cautious approach to the use of prescribed burning, and to protect the reserve and adjoining landholders from wildfires, a 50 m buffer strip has been established around the boundary of the reserve. This buffer strip includes the perimeter firebreak and an area of burnt bush. The internal edge of the buffer strip is defined by a single cut line constructed using a bulldozer. Where the topography of the reserve has not permitted a firebreak to be constructed 50 m inside the boundary, the internal edge of the buffer was placed deeper into the reserve where practicable.

Parts of each buffer will be burnt annually when fuel levels exceed 7-8 tonnes/ha. At these fuel levels or lower, wildfires under summer conditions can be successfully suppressed by direct attack (R. Sneeuwjagt, pers. comm., 1985). Thus, in the case of Mooradung, if the buffers are maintained in a low fuel condition they can be used as a safe front from which wildifes can be fought and back burns initiated. if the fuel levels are lower than 7-8 tonnes/ha, the fire will not run unless there are accompanying strong winds. Burning under these conditions markedly increases the risk of hop-overs and escapes. This work will be carried out in either spring or autumn when the adjacent land is in a low fuel state. Burning parts of the buffer will be the responsibility of the Dwellingup District Manager, however adjacent landholders are encouraged to contact the Dwellingup Office if they perceive that fuel levels in the buffer strip have reached unacceptable levels.

It must be stressed that the use of buffer strips may create management problems. For example, frequent buffer burning may promote the invasion into the reserve of exotic plants (e.g. wild oats), although it is thought that the predominantly gravel soils of the reserve will prevent this occurring. Given the problems associated with buffer strips, the buffer system established on the reserve will be experimental and its usefulness will be reassessed at the end of the term of the present plan.

To assess the changes which occur on the buffer strips during the life of this plan, Dwellingup Research (Department of Conservation and Land Management) will monitor fuel levels and vegetation characteristics at a minimum of three sites on the buffer strip. This will include monitoring of the rate of weed invasion into the reserve at several places along the buffer strip.

Block Burning

Other than within the buffer strip, prescribed burning on the reserve will have the following objectives:

(a) to reduce the fuel levels on the reserve with minimal damage to the conservation values of the area; and

(b) to establish, through the monitoring of specific sites on the reserve, an information base for future prescribed burning programs.

To achieve the monitoring objectives, at least one monitoring site will be established by Dwellingup Research within each block prior to its being burnt. The monitoring method used will incorporate measures of fuel levels, floristics and the reproductive responses of plant species to fire.

For the purposes of prescribed burning and wildfire control, the reserve will be divided into four compartments as shown in Figure 4.

Ideally the burning program would be based on a knowledge of the relationships through time between fuel levels, fire behaviour, and the life histories of wildlife. Given that this knowledge is not available, a fire frequency has been chosen which it is believed will achieve the aim of fuel reduction without detrimentally affecting wildlife. It is hoped that the monitoring work will indicate whether or not this burning program is appropriate.

The program for prescribed burns is shown in Table 4. All burns will be of moderate intensity and carried out in mid to late autumn depending on seasonal conditions. To provide an unburnt control area for the purpose of comparison with burnt areas, Compartment No. 4 will not be prescribed burnt during the currency of this plan. This block was chosen because it contains:

(a) representative samples of most of the vegetation types which occur on the reserve;

(b) a plant species (Eucalyptus decurva) which is poorly represented in the region;

(c) a plant (Grevillea cirsiifolia) which has been declared rare and endangered.

It should be noted that while the "year last burnt" for two of the compartments is given as 1973, all have been subject to edge burning since 1973. In some cases this burning has entered deep into the reserve.

Finally, before Compartment No. 1 is burnt in 1991, fuel levels will be assessed by the Department of Conservation and Land Management and a decision made at that time as to whether or not the

compartment should be burnt. This is necessary because the burn programmed for 1991 will be the beginning of a new cycle of burning. Similarly, the fuel levels in Compartment No. 3 will be assessed in 1995.

Table 4. Prescribed Burning Program, Mooradung Nature Reserve. Compartment numbers relate directly to those on Figure 4.

Compartment No.	Year Last Burnt	Proposed for Burning
1	part burnt 1981	1991, subject to assessment
2	1973	1988
3	1985	1995, subject to assessment
4	1973	Control - no burn

If any fires occur within the reserve which are not prescribed, then the burning program described here will cease and a new program written.

SUPPRESSION OF WILDFIRES

Fire-fighting

Under the terms of the Bush Fires Act and Regulations (1954, as amended), the area within which the reserve occurs is under the control of the local Bush Fire Control Officer during wildfires. However, if a Forest Officer is present, he takes charge of the fire situation (Sections 39(2)(a) and (b) and 45(a) and (b) of the Bush Fires Act 1954, as amended). In the event of a wildfire occurring on or adjacent to the reserve, the Dwellingup District Office of the Department of Conservation and Land Management is to be notified. Following notification, the Dwellingup District Manager, in conjunction with local brigades, will instigate the first attack. Co-ordination of this first attack and subsequent suppression will be formalised by an inter-agency agreement between the Department of Conservation and Land Management and the Marradong Brigade. Once a Forest Officer arrives, all personnel and units attending the wildfire will come under his control.

Notification of Wildfires

To ensure that officers from the Dwellingup District office of the Department of Conservation and Land Management are contacted in the event of a wildfire occurring on or adjoining the reserve, the Dwellingup District Manager will advise the Shire Clerk of Boddington and the captains of local

brigades of the procedure by which departmental officers may be contacted. Information sheets will be sent annually to the Shire Clerk for distribution to necessary people.

Notifiable Authority

The Department of Conservation and Land Management has taken the necessary steps to become a Notifiable Authority with respect to the reserve. Responsibilities concerning Notifiable Authorities are described in the Bush Fires Regulations. By becoming a Notifiable Authority, the Department of Conservation and Land Management must be informed prior to burns being carried out adjacent to the reserve during the prohibited and restricted burning periods.

Adequacy of Control Measures

With the acceptance of this plan by the Bush Fires Board, the powers of Bush Fire Control Officers and adjoining landholders to enter the reserve and carry out works under Section 34 of the Bush Fires Act (1954, as amended) will cease. Consequently during the life of this plan, reserve neighbours should draw the attention of the Executive Director of the Department of Conservation and Land Management to any inadequacies they perceive in the fire protection measures for the reserve. A joint inspection of the reserve will then be organised and any necessary action will follow.

3. CONTROL OF PHYTOPHTHORA CINNAMOMI

While the destructive effects of the fungus Phytophthora cinnamomi on jarrah (Eucalyptus marginata) have been well publicised, the broader effects of the fungus have not been emphasized in the media. Not only does the fungus destroy a great many native plants, it must also be expected that the disease will indirectly effect some animals through its impact on habitat.

Soil samples from two sites on Mooradung Nature Reserve were tested for Phytophthora cinnamomi in 1981. A further five sites were tested by R.P. and R.M. Hart in 1983. No evidence of the fungi was found on either occasion. Given the destructive nature of the fungus it will be necessary to prevent the transportation of infected material onto the reserve.

The most common means by which the fungus is transported is within soil adhering to vehicles. Therefore, it will be necessary to control the movement of all vehicles on the reserve by classing the firebreaks on the reserve as management access tracks which are only to be used by vehicles undertaking management work. All other vehicles will be prohibited under the Regulations of the Wildlife Conservation Act from using these tracks unless permission has been obtained from the Dwellingup District office. Only in the event of a wildfire occurring on or adjacent to the reserve may

restrictions on the movement of vehicles be suspended. However, permission must still be obtained from the Dwellingup District Office and dieback hygiene observed.

Officers carrying out management or research duties on the reserve will follow the operational procedures laid down in the departmental guidelines relating to Phytophthora cinnamomi (Dieback Policy 1982, Forests Department, Western Australia).

4. DECLARED PLANTS AND ANIMALS

Action will be taken by the Department of Conservation and Land Management to control plants and animals on the reserve which are "declared" under the Agriculture and Related Resources Protection Act (1950, as amended). The control of declared plants and animals will be undertaken in consultation with the Agriculture Protection Board officer based at Boddington. Where appropriate, the Department of Conservation and Land Management will contract the Agricultural Protection Board to carry out control measures.

In the case of native fauna, for example the Grey Kangaroo, primary responsibility for any control measures which might be used on or adjoining the reserve will be held by the District Wildlife officer based at Perth. In the case of the Grey Kangaroo, the Shire of Boddington is treated as an open season area. This means that owners or occupiers of land within the Shire may shoot Grey Kangaroos causing damage on their own properties without obtaining a permit. However, if the private landholder wishes to employ a licensed shooter, or wishes to sell carcasses and skins, then a Damage Licence must be obtained. Following inspection of a property a District Wildlife officer may, if necessary, prohibit the shooting of kangaroos on that property until the landholder has obtained a Damage Licence. These conditions for taking kangaroos may be varied from time to time by publication in the Government Gazette.

As with the provisions for fire protection, reserve neighbours are invited to comment on any inadequacies they perceive in the control of pests within the reserve. On receipt of comments the Executive Director will take the appropriate action.

5. RESEARCH AND MANAGEMENT RECORDS

Departmental Research

Departmental research planned for the reserve in the short term will include monitoring of the responses of fuel levels, vegetation structure and floristics to prescribed burning. The vegetation map of the reserve will also be upgraded, with each compartment being mapped by Dwellingup Research prior to prescribed burning.

Management Records

The Dwellingup District office will maintain accurate and current records of all management activities undertaken on Mooradung Nature Reserve. These records will include current inventories of the wildlife on the reserve.

6. PUBLIC USE

Public use of the reserve will remain conservative and will. be guided by Regulation 46 of the Regulations of the Wildlife Conservation Act (1950, as amended).

Access

Given the threat to the reserve posed by Phytophthora cinnamomi vehicular access within the reserve, except for management purposes, will be prohibited. Therefore, members of the public cannot take vehicles onto the reserve, although all of the reserve will remain open to members of the public on foot.

Use of Mooradung Nature Reserve for educational and research purposes, either amateur or professional, will be encouraged. The Dwellingup District Manager will assist as far as is practicable those wishing to undertake research or educational work on the reserve.

Signs

Signs identifying Mooradung Nature Reserve and explaining the access limitations will be placed at appropriate sites on the reserve. It is the responsibility of the Dwellingup District Manager to establish these signs and to ensure that they conform to the standard specifications for the Department of Conservation and Land Management nature reserve signs.

7. GENERAL

Uncleared, Public Road

The Department of Conservation and Land Management will approach both the Under Secretary for Lands and the Boddington Shire Council to have the uncleared public road along the western boundary of Mooradung Nature Reserve closed and included within the nature reserve. This closure is sought to facilitate the management of the reserve, particularly with respect to access, fire protection and the control of Phytophthora cinnamomi.

Term of the Plan

Unless superseded, the term of this plan will be 10 years. Its provisions will be effected as soon as possible following its approval by the Minister for Conservation and Land Management as a Management Plan under the provisions of the Conservation and Land Management Act (1984, as amended).

Naming

The name "Mooradung Nature Reserve" will be submitted to the Nomenclature Advisory Committee for gazettal as the official name.

Other Provisions

During the currency of this plan the Executive Director of the Department of Conservation and Land Management may, subject to the approval of the National Parks and Nature Conservation Authority, undertake any other work or research or institute any other provisions for management which may become necessary to properly promote the objectives of management stated in Section 1 of this plan. Members of the public are invited to comment upon the provisions of this plan at any time. The appropriate action will be taken where necessary.

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APPENDIXES

APPENDIX 1A: STRUCTURAL VEGETATION CATEGORIES (MUIR, 1977)

LIFE FORM/HEIGHT CLASS	CANOPY COVER			
	DENSE 70-100%	MID-DENSE 30-70%	SPARSE 10-30%	VERY SPARSE 2-10%
Trees >30m Trees 15-30m Trees 5-15m Trees <5m	Dense Tall Forest Dense Forest Dense Low Forest A Dense Low Forest B	Tall Forest Forest Low Forest A Low Forest B	Tall Woodland Woodland Low Woodland A Low Woodland B	Open Tall Woodland Open Woodland Open Low Woodland A Open Low Woodland B
Mallee Tree Form Mallee Shrub Form	Dense Tree Mallee Dense Shrub Mallee	Tree Mallee Shrub Mallee	Open Tree Mallee Open Shrub Mallee	Very Open Tree Mallee Very Open Shrub Mallee
Shrubs >2m Shrubs 1.5-2.0m Shrubs 1.0-1.5m Shrubs 0.5-1.0m Shrubs <0.5m	Dense Thicket Dense Heath A Dense Heath B Dense Low Heath C Dense Low Heath D	Thicket Heath A Heath b Low Heath C Low Heath D	Scrub Low Scrub A Low Scrub B Dwarf Scrub C Dwarf Scrub D	Open Scrub Open Low Scrub A Open Low Scrub B Open Dwarf Scrub C Open Dwarf Scrub D
Mat Plants Hummock Grass Bunch Grass >0.5m Bunch Grass <0.5m Herbaceous spp.	Dense Mat Plants Dense Hummock Grass Dense Tall Grass Dense Low Grass Dense Herbs	Mat Plants Mid-Dense Hummock Grass Tall Grass Low Grass Herbs	Open Mat Plants Hummock Grass Open Tall Grass Open Low Grass Open Herbs	Very Open Mat Plants Open Hummock Grass Very Open Tall Grass Very Open Low Grass Very Open Herbs
Sedges >0.5m Sedges <0.5m	Dense Tall Sedges Dense Low Sedges	Tall Sedges Low Sedges	Open Tall Sedges Open Low Sedges	Very Open Tall Sedges Very Open Low Sedges
Ferns Mosses, Liverwort	Dense Ferns Dense Mosses	Ferns Mosses	Open Ferns Open Mosses	Very Open Ferns Very Open Mosses

APPENDIX 1B: PLANT ASSOCIATIONS

Eleven descriptions of plant associations were made in September 1980. Some of these descriptions were re-assessed in June 1983.

The classification system used for all descriptions is that devised by Muir (1977) and the species nomenclature follows that of Green (1981). Letters with each description relate directly to those used on Figure 6.

a. Woodland of Eucalyptus marginata over Low Scrub B of Allocasuarina humilis over Dwarf Scrub D of Bossiaea ornata and Dryandra nivea over Herbs and Very Open Low Sedges.

b. Low Woodland A of Eucaluptus wandoo over a variety of sparse shrubs including Gastrolobium calycinum, Hibbertia aff. montana, Macrozamia riedlei, and Xanthorrhoea preissii over Herbs.

c. Woodland of Eucalyptus marginata over Open Low Woodland B of Banksia grandis over Open Dwarf Scrub C of Hakea lissocarpha over Low Heath D of Bossiaea ornata over Very Open Herbs and Very Open Low Sedges.

d. Woodland of Eucalyptus marginata over Scrub of Dryandra sessilis over Open Dwarf Scrub C of Allocasuarina humilis and Dryandra sessilis over Very Open Herbs and Very Open Low Sedges.

e. Woodland of Eucalyptus marginata over Low Woodland A of Allocasuarina fraseriana over Dwarf Scrub D of Hibbertia hypericoides over Very Open Herbs.

f. Lithic Complex: Species recorded here included the following Acacia acuminata, Borya nitida, Dryandra fraseri, Gastrolobium calycinum, Hakea lissocarpha, Hibbertia polystachya, Hypocalymma angustifolium, Neurachne alopecuroidea, Stackhousia pubescens, Stylidium sp., Stypandra imbricata and sedges.

g. Low Heath C of Allocasuarina humilis over Dwarf Scrub D of Dryandra armata over Very Open herbs. Other species recorded included Banksia sphaerocarpa, Hakea trifurcata, H. undulata, Hibbertia sp., Lechenaultia biloba, Leptospermum erubescens, and Patersonia sp.

h . Open Low Scrub B of Allocasuarina humilis and Hakea trifucata over Open Dwarf Scrub D of Hibbertia sp. over Very Open Low Sedges and Open Herbs of Borya nitida. Other species present included Leptospermum erubescens and ?Gastrolobium sp.

i. Low Heath D of Allocasuarina humilis and Dryandra armata over very Open Low Sedges and Open Herbs. This is a very floristically diverse heath, with various species being dominant in different parts of the heath. other species recorded included Banksia sphaerocarpa, Calothamnus sp., Calytrix sp., Conospermum sp., Dryandra bipinnatifida, Eucalyptus decurva, E. drummondii, Grevillea sp., Hakea incrassata, H. ruscifolia, Isopogon dubius, Melaleuca sp., Petrophile sp., P. serruriae., and Synaphea sp.

j. Low Woodland A of Eucalyptus wandoo over Dwarf Scrub D of Bossiaea eriocarpa, Gastrolobium calycinum, and Hakea lissocarpha over Herbs.

k. Open Low Woodland A of Eucalyptus wandoo over Low Heath C of Gastrolobium calycinum over Low Heath D of Hypocalymma angustifolium over open Herbs.

APPENDIX 1C: FLORA LIST FOR MOORADUNG NATURE RESERVE

All plants names used below follow those of Green (1981) except for the Casuarinaceae, which follow the revision of Johnson (1982).

As the means by which plant species are identified is useful information, the sources of each identification are listed against the relevant species. The codes used for identifying sources are explained below (Table 5).

Table 5: Sources for identification of species in flora list.

Code	Source	Further Information
1	Dr A.A. Burbidge	Field identification.
2	K.J.Wallace	Well known species, for example Jarrah (Eucalyptus marginata), were identified in the field. Other species were identified using the relevant published texts and journal reviews.
2a	K.J. Wallace	These species were checked against voucher specimens held by Worsley Alumina Pty Ltd.
3	W.A.Herbarium	Identifications of voucher specimens sent to the Herbarium.
4	Dr S.D. Hopper	
5	K.J. Atkins	As for K.J. Wallace (2 above) with the exceptionof Grevillea cirsiifolia which was compared with specimens at the W.A. Herbarium.
6	E. Griffin	
7	M.I.H. Brooker	
8	Worsley Alumina Pty. Ltd.	Identifications by botanical consultants to Worsley Alumina Pty Ltd.

	Source	Pingelly Herbarium Number
Adiantaceae		
Cheilanthes tenuifolia (N.L. Burman) Swartz	1	
Zamiaceae		
Macrozamia riedlei (Fisch. ex Gaud.) C.A. Gardner	2	
Poaceae		
*Briza maxima L.	2	
Neurachne alopecuroidea R.Br.	2,5	495
Poa drummondiana Nees	5	
Cyperaceae		
Lepidosperma angustatum R.Br.	1,5	
L. gracile R.Br.	5	
L. tenue Benth.	5	
Tetraria octandra (Nees) Kuekenthal	3	761
Restionaceae		
Loxocarya fasciculata (R.Br.) Benth.	5	
Liliaceae,		
Borya nitida Labill.	1,2	
Burchardia multiflora Lindl.	5	486
B. umbellata R.Br	5	534
Dianella revoluta R.Br.	5	
Laxmannia ramosa Lindl.	I	
Lomandra hermaphrodita (C. Andrews) C.A. Gardner	5	
L. micrantha (Endl.) Ewart	5	
L. spartea (Endl.) Ewart	5	
Sowerbaea laxiflora Lindl.	2a,5	555
Stypandra imbricata R.Br.	5	
Thysanotus tenellus Endl.	5	535,536
Tricoryne humilis Endl.	5	

Wurmbea dioica (R.Br.) F. Muell.	5	
Xanthorrhoea sp.	1,2	
Haemodoraceae		
Anigozanthos bicolor Endl.	1,2,5	493
A. manglesii D. Don	2,5	488
Conostylis serrulata R. Br.	2,4	539
C. setigera R.Br.	1,2	
Haemodorum laxum R.Br.	1	
Tribonanthes uniflora Lindl.	5	
Hypoxidaceae		
Hypoxis sp.	1	
Iridiaceae		
Orthrosanthus laxus (Endl.) Benth.	5	
Patersonia juncea Lindl.	5	
P. occidentalis R.Br.	5	
P. sericea R.Br. ex Ker-Gawl	5	
Orchidaceae		
Caladenia filamentosa R.Br.	2,5	550
C. flava R.Br.	2	
C. gemmata Lindl.	2,5	1021
C. patersonii R.Br.	2	
Diuris longifolia R.Br.	5	
Elythranthera emarginata Lindl.	235	1023
Eriochilus dilatatus Lindl.	1	
Prasophyllum macrostachyum R. Br. var. macrostachyum	4	
Pterostylis vittata Lindl.	2	
Thelymitra crinita Lindl.	4	
T. fuscolutea R.Br.	4	
Casuarinaceae		
Allocasurarina fraserana (Miq.) L. Johnson	1,2	
A. huegeliana (Miq.) L. Johnson	5,2	
A. humilis (Otto & Dietr.) L. Johnson	1,2	
A. microstachya (Miq.) L. Johnson	5	

Proteaceae

Banksia grandis Willd.	1,2	
B. sphaerocarpa R. Br.	1,2	
Conospermum stoechadis Endl.	2	
Dryandra armata R.Br.	2	
D. bipinnatifida R.Br.	2,6	1213
D. carduacea Lindl.	2	
D. fraseri R.Br.	1,2	
D. nivea (Labill.)R.Br.	2	
D. sessilis (Knight) Domin.	1,2	
Grevillea cirsiifolia Meisn.	5,4	1226
G. monticola Meisn.	5	
G. pilulifera (Lindl.) Druce	5	568
G. pulchella (R.Br.) Meisn.	I	
G. tenuiflora (Lindl.) Meisn.	2)5	553
Hakea incrassata R.Br.	2	
H. lissocarpha R.Br.	2,5	1227
H. prostrata R.Br.	I	
H. ruscifolia Labill.	2	
H. trifurcata (Sm.) R.Br.	1,2	
H. undulata R.Br.	2	
H. varia R.Br.	2,5	552
Isopogon dubius (R.Br.) Druce.	2	
I. teretifolius R.Br.	5	
Persoonia trinervis Meisn.	5	1200
Petrophile aff. media R.Br.	5	540,1211
P. serruriae R.Br.	2	
P. squamata R.Br.	2a.5	547
P. striata R.Br.	2,5	481,418
Synaphaea ?petiolaris R.Br.	5	

Santalaceae

Leptomeria cunninghamii Miq.	5	

Ranunculaceae

Clematis pubescens Huegel ex Endl.	1,2a,5	485

Droseraceae

Drosera bulbosa Hooker	3	1220

D. erythrorhiza Lindl.	2	
D. gigantea Lindl.	5	
D. leucoblasta Benth.	5	
D. menziesii R.Br.	5	1054
D. pallida Lindl.	5	
D. platystigma Lehm.	5	
D. stolonifera Endl.	2,5	567
Pittosporaceae		
Sollya heterophylla Lindl.	5	
Leguminosae Subfam. Mimosoideae		
Acacia alata R.Br.	5	
A. insolita E. Pritzel	6	
A. nervosa D.C.	2a	
A. pulchella R.Br.	2,5	484
A. willdenowiana H.L. Wendl.	5	489
Leguminosae Subfam. Caesalpinioideae		
Labichea punctata Benth.	8,5	546
Leguminosae Subfam. Papilionoideae		
Bossiaea eriocarpa Benth.	1 2	
B. ornata (Lindl.) Benth.	2a,5	549
Daviesia costata Cheel	2,5	541
D. decurrens Meisn.	5	548,467
D. preissii Meisn.	5	
Dillwynia cinerascens R.Br. ex Sims	2a,5	494
Gastrolobium calycinum Benth	1,2	
G. hookeri Meisn.	2,5	533,557
G. knightianum Lindl.	3 5	490,762
G. marginatum R.Br.	2a,5	565
G. microcarpum Meisn.	1	
Hovea chorizemifolia (Sweet)DC.	1,2,5	473
jacksonia sternbergiana Huegel	2,5	542
Kennedia coccinea Vent.	5	
K. prostrata R.Br.	1	
oxylobium drummondii Meisn.	5	543
Sphaerolobium medium R.Br.	5	482,483
Templetonia drummondii Benth.	5	

Rutaceae		
Boronia crenulata Sm.	2a,5	538
B. ramosa (Lindl.) Benth.	5	
Eriostemon nodiflorus Lindl.	5	
Tremandraceae		
Tetratheca hirsuta Lindl.	5	1024
Polygalaceae		
Comesperma calymega Labill.	5	
Euphorbiaceae		
Monotaxis grandiflora Endl.	5	
Phyllanthus calycinus Labill.	5	
Stackhousiaceae		
Stackhousia pubescens A. Rich	2,5	559
Rhamnaceae		
Cryptandra arbutiflora Fenzl	8,5	571
Spyridium complicatum F. Muelll.	5	
Trymalium ledifolium Fenzl	2,5	470
Sterculiaceae		
Thomasia sp.	5	
Dilleniaceae		
Hibbertia hypericoides (DC.) Benth.	2a,5	472,551
H. microphylla Steud.	5	
H. aff. montana Steud.	2a,5	561
H. polystachya Benth.	2a,5	560,570
Thymelaeacae		
Pimelia angustifolia R.Br.	5	767
P. aff. angustifolia R.Br.	5	1075
P. rosea R.Br.	2,5	491
P. suaveolens (Endl.) Meisn.	2,5	416,492

Myrtaceae		
Baeckea camphorosmae Endl.	1,2a,5	1161
Calothamnus preissii Schauer	5	
C. sanguineus Labill.	2,5	468
Eucalyptus calophylla Lindl.	1,2	
E. decurva F. Muell.	7	1210
E. drummondii Benth.	2,5	1209
E. marginata Donn ex sm.	1,2	
E. wandoo Blakely	1,2	
Hypocalymma angustifolium Endl	1,2,5	1055
Kunzea preissiana schauer	5	544
Leptospermum erubescens Schauer	2	
Melaleuca scabra R.Br.	2,5	
Haloragaceae		
Glischrocaryon aureum (Lindl.) Orchard	2,5	420
Gonocarpus cordiger (Fenzl) Endl. Ex Nees	5	
Apiaceae		
Pentapeltis peltigera (Hooker) Bunge	5	
Trachymene pilosa Sm.	2	
Xanthosia candida Benth.	5	
Epacridaceae		
Astroloma ciliatum (Lindl.) Druce	1	
A. pallidum R.Br.	5	564
Leucopogon capitellatus DC.	5	562
L. propinquus R.Br.	1,2,5	674
Leucopogon sp.	2,5	569
Leucopogon sp.	2,5	572
Styphelia tenuiflora Lindl.	1,2,5	562
Lamiaceae		
Hemiandra linearis Benth.	5	417
Hemigenia aff. dielsii (Hemsley) C.A. Gardner	5	
Scrophulariaceae		
*Parentucellia latifolia (L.) Caruel	5	556

Rubiaceae		
Opercularia vaginata Labill.	5	
Lobeliaceae		
Isotoma hypocrateriformis (R.Br.) Druce.	2,5	421
Lobelia rhombifolia De Vriese	5	
Goodeniaceae		
Dampiera ?cauloptera DC.	5	
D. linearis R.Br.	5	554
Lechenaultia biloba Lindl.	1,2,5	487
Scaevola striata R.Br.	5	766,1052
Velleia trinervis Labill.	5	
Stylidiaceae		
Stylidium amoenum R.Br.	5	
S. brunonianum Benth.	2,5	765
S. calcaratum R.Br	5	
S. ciliatum Lindl.	2,5	558,769
S. crassifolium R.Br.	5	
S. schoenoides DC.	2,5	545
S. unif lorum Sonder	1	
Asteraceae		
Craspedia uniflora G. Forster	5	
Helipterum manglesii (Lindl.) Benth.	5	
Lagenifera huegelii Benth.	5	
Olearia paucidentata (Steetz) Benth.	1,2,5	469,1224

*Introduced species

APPENDIX II: BIRD LIST FOR MOORADUNG NATURE RESERVE

Species nomenclature follows the list of recommended names by Anon. (1978).

Common Name	Scientific Name	Source/Breeding Information (a)
DUCKS (ANATIDAE)		
Maned Duck	Chenonetta jubata	D*
LARGE RAPTORS (ACCIPITRIDAE)		
Wedge-tailed Eagle	Aquila audax	C
BUTTON-QUAILS (TURNICIDAE)		
Painted Button-quail	Turnix varia	D
PIGEONS (COLUMBIDAE)		
Common Bronzewing	Phaps chalcoptera	C,D
COCKATOOS (CACATUIDAE)		
White-tailed Black-Cockatoo	Calyptorhynchus baudinii	C,D
PARROTS (PLATYCERCIDAE)		
Red-capped Parrot	Purpureicephalus spurius	C,D
Western Rosella	Platycercus icterotis	C
Port Lincoln Ringneck	Barnardius zonarius	C,D
CUCKOOS (CULCULIDAE)		
Pallid Cuckoo	Cuculus pallidus	B,C
Shining Bronze-Cuckoo	Chrysococcyx lucidus	D*
OWLS (STRIGIDAE)		
Southern Boobook	Ninox novaeseelandiae	B,D
FROGMOUTH (PODARGIDAE)		
Tawny Frogmouth	Podargus strigoides	B

KINGFISHERS (ALCEDINIDAE)		
Laughing Kookaburra	Dacelo novaeguineae	A,B,C
Sacred Kingfisher	Halcyon sancta	C,D
BEE-EATERS (MEROPIDAE)		
Rainbow Bee-eater	Merops ornatus	C,D
SWALLOWS (HIRUNDINIDAE)		
Tree Martin	Cecropis nigricans	C,D*
PIPITS (MOTACILLIDAE)		
Richard's Pipit	Anthus novaeseelandiae	C
CUCKOO-SHRIKES (CAMPEPHAGIDAE)		
Black-faced		
Cuckoo-shrike	Coracina novaehollandiae	C,D
White-winged Triller	Lalage sueurii	C,D
ROBINS, WHISTLERS, MONARCHS, FANTAILS (MUSCICAPIDAE)		
Scarlet Robin	Petroica multicolor	C5D*
Red-capped Robin	P. goodenovii	D
Western Yellow Robin	Eopsaltria griseogularis	A,B,C,D*
Jacky Winter	Microeca leucophaea	D
Crested Shrike-tit	Falcunculus frontatus	D
Golden Whistler	Pachycephala pectoralis	A,B,C,D
Rufous Whistler	P. rufiventris	C,D
Grey Shrike-thrush	Colluricincla harmonica	C~D
Restless Flycatcher	Myiagra inquieta	I A
Grey Fantail	Rhipidura fuliginosa	A,B,C,D*
Willie Wagtail	R. leucophrys	B
WRENS (MALURIDAE)		
Splendid Fairy-wren	Malurus splendens	C,D
THORNBILLS (ACANTHIZIDAE)		
Weebill	Smicrornis brevirostris	C,D
Western Gerygone	Gerygone fusca	B,C,D*
Inland Thornbill	Acanthiza apicalis	A,D

Western Thornbill	A.inornata	D*
Yellow-rumped Thornbill	A. chrysorrhoa	C,D*
SITTELLA (NEOSITTIDAE)		
Varied sittella	Daphoenositta chrysoptera	C
TREECREEPER (CLIMACTERIDAE)		
Rufous Treecreeper	Climacteris rufa	A
HONEYEATERS (MELIPHAGIDAE)		
Red Wattlebird	Anthochaera carunculata	D
Singing Honeyeater	Lichenostomus virescens	D
White-naped Honeyeater	Melithreptus lunatus	C,D
Brown Honeyeater	Lichmera indistincta	C,D
New Holland Honeyeater	Phylidonyris novaehollandiae	C
White-cheeked Honeyeater	P.nigra	C
Tawny-crowned Honeyeater	P.melanops	D*
Western Spinebill	Acanthorhynchus superciliosus	B,D
CHATS (EPHTHIANURIDAE)		
White-fronted Chat	Epthianura albifrons	C
MISTLETOEBIRD (DICAEIDAE)		
Mistletoebird	Dicaeum hirundinaceum	D
PARDALOTES (PARDALOTIDAE)		
Striated Pardolote	Pardalotus striatus	C,D
WHITE-EYES (ZOSTEROPIDAE)		
Silvereye	Zosterops lateralis	B
MAGPIE-LARKS (GRALLINIDAE)		
Australian Magpie-lark	Grallina cyanoleuca	B
WOODSWALLOWS (ARTAMIDAE)		
Dusky Woodswallow	Artamus cyanopterus	C,D*
MAGPIES, CURRAWONGS (CRACTICIDAE)		
Australian Magpie	Gymnorhina tibicen	A,B,C,D
Grey Currawong	Strepera versicolor	C

CROWS, RAVENS (CORVIDAE)

Australian Raven	Corvus coronoides	A,B,C,D

(a) = Source and breeding information
A = D. Mell
B = A.A. Burbidge and T. Evans
C = K.J. Wallace
D = Worsley Alumina Pty ltd
* = breeding activity