Purnululu (Bungle Bungle) National Park and Conservation Reserve

Draft Management Plan

April 1989

Department of Conservation and Land Management

PURNULULU (BUNGLE BUNGLE) NATIONAL PARK AND CONSERVATION RESERVE

DRAFT MANAGEMENT PLAN

APRIL 1989

Prepared by the CALM Project Team:
Mary Colreavy
(Co-ordinator)
Paul Frewer
Chris Done
with assistance from representatives of
Halls Creek Shire Council
WA Tourism Commission
Purnululu Aboriginal Corporation

Written submissions should be sent to the:

Executive Director
Department of Conservation and Land Management
PO Box 104
Como WA 6152

When this National Park and Reserve were declared, they were not officially named, although they were commonly referred to after the major feature of the Park, the Bungle Bungle massif. In this plan it is proposed that the area be named the Purnululu National Park and Conservation Reserve. The massif will continue to be known as Bungle Bungle. Whilst we gauge the public response to this proposal, throughout the draft plan the area will be referred to as the Purnululu (Bungle Bungle) National Park and Conservation Reserve, or more often simply as the Park.

CONTENTS

FIGURES

TABLES

BIBLIOGRAPHY 74

APPENDICES

PREFACE

The Department of Conservation and Land Management (CALM) is responsible for the management of all National Parks, Nature Reserves, Marine Parks, State Forest, timber reserves and any other land reserved under the Land Act and vested in the Lands and Forest Commission or the National Parks and Nature Conservation Authority (NPNCA).

The NPNCA is responsible for the preparation of management plans for all land which is vested in it. These plans are prepared through the agency of CALM on a regional and area basis. Sometimes, as in this case, State Cabinet directs that certain plans are prepared as a priority, and that certain provisions are made in these plans for the ongoing management of the area. The Government made a number of decisions with respect to the preparation of this plan, in particular to ensure the involvement of the traditional Aboriginal custodians in the ongoing management of the Park, but otherwise planning is generally in accordance with the objectives of all national parks, ie. conservation and such recreation as leaves the areas unimpaired for future generations to enjoy.

CALM and the NPNCA are very pleased to present this draft plan for public comment. In it we have made provisions for the Aboriginal people of the area to be involved in all aspects of management, from development of policy through to employment as Rangers and contract workers.

It is believed the involvement of Aboriginal people in the protection and management of these reserves will add a new cultural dimension to their management and enhance the Park visitor's enjoyment and appreciation of the area.

When this National Park and Reserve were declared, they were not officially named, although they were commonly referred to after the major feature of the Park, the Bungle Bungle massif. In this plan it is proposed that the area be named the Purnululu National Park and Conservation Reserve. The massif will continue to be known as Bungle Bungle. Whilst we gauge the public response to this proposal, throughout the draft plan the area will be referred to as the Purnululu (Bungle Bungle) National Park and Conservation Reserve, or more often simply as the Park.

1. INTRODUCTION

1.1 BACKGROUND

Until quite recently, a remote and rugged part of the Kimberley region remained largely hidden from the public eye. Prior to 1982 this place, now known colloquially as Bungle Bungle, was known only to the traditional Aboriginal people of the area and various pastoralists, stockmen, geologists, scientists and locals.

It is only since widespread media promotion in 1982-83 that the general public have become aware of the spectacular gorges and domes of the Bungle Bungle massif.

It was recognized right from the outset that there would need to be special recognition and management provided for the cultural heritage of this area and that these concepts would have to be incorporated into the usual model of a National Park as it is understood in Western Australia. A national park is an area of great beauty or special scientific, educative or recreative interest which is managed to allow such recreational use by the public as is consistent with the proper maintenance, restoration and protection of the environment. The significance of this area as a national park and its fulfilment of the dual criteria, conservation and recreation, is discussed below.

In response to the early demands for increased information and access to this remote area of the Kimberley, the Environmental Protection Authority convened an informal interdepartmental Working Group ..."to investigate and report on the status, vesting and purpose of Bungle Bungle and adjoining land". The Working Group prepared a report to the EPA which was presented for consideration by Government in October 1985 (Department of Conservation and Environment, Bulletin 261, May 1986).

1.1.1 Conservation Significance

A large portion of the Ord River Basin was reserved in 1967 for the purpose of stabilizing and regenerating vegetation on land which had been degraded by previous pastoral practices.

Following the Bungle Bungle Working Group report to the Environmental Protection Authority in 1985, part of this Ord River Regeneration Reserve was vested in the NPNCA for conservation and a further part for national park (see Secton 1.2).

Detailed biological survey information on the flora and fauna of the SouthEast Kimberley Region is very limited. However we do know from some studies already conducted that several species of plant exist in the Park which are previously not recorded in Western Australia or are of very limited occurrence. In particular, the sheltered, moist habitats of the Osmond Range and Bungle Bungle Gorges are of conservation significance. It was also noted in the Bungle Bungle Working Group Report (1986) that the tree savannah and tropical grassland ecosystems of this Park are important conservation features.

In addition to its biotic value, the Purnululu (Bungle Bungle) National Park and Conservation Reserve protect an ancient and remarkable geological feature and a diversity of landforms which provide a high degree of scenic attractiveness.

1.1.2 Recreation and Tourism Significance

The unusual shapes and colours of the Bungle Bungle Range have captured the imagination of the tourism industry and the visiting public.

This new park offers adventure and different cultures, as well as scenic beauty to the traveller. Adventurestyle holidays have become extremely popular with both Australian and overseas visitors and the WA Tourism Commission is predicting that the Purnululu (Bungle Bungle) National Park may become one of the State's premier attractions.

Discussion with representatives of the tourism industry corroborated opinions gathered during a visitor survey conducted in the park during 1987 (Colreavy & Cavana 1988). The overall aim of the management for this Park should be to maintain the remote wilderness/adventure type of experience which is gained from exploring the unusual landscape. Visitors should be able to access the Park by either light aircraft or fourwheel drive vehicle.

Strategies have been developed in this plan which provide for appropriate levels of use by residents and visitors whilst preserving the natural and cultural values of the National Park and Conservation Reserve.

1.1.3 Aboriginal Significance

The significance of the area to contemporary Aboriginal people, and its significance as a repository of at least 20,000 years of Aboriginal history, were recognised by the EPA Working Group. Despite disruptions which have occurred to traditional life during settlement by Europeans, there is clearly an integrated picture of Aboriginal life extending back thousands of years from the present day custodians.

This adds an undeniable dimension to the fabric of the national park as it has become understood over the last century. With careful consideration, this dimension can serve to enhance the perspectives of conservation and recreation bound into the culture of national parks throughout the world.

Detailed consideration of Aboriginal significance is discussed in Section 4.

1.1.4 Government Decisions

Since the Working Group report was prepared State Cabinet has discussed Bungle Bungle a number of times and issued several decisions regarding the reservation and future management of the area. This plan provides a framework for management consistent with the decisions given by Cabinet.

In April 1986, State Cabinet approved the vesting of two proposed reserves in the National Parks and Nature Conservation Authority (NPNCA). Reserve number 39897 was given the purpose of national park and includes the massif and those surrounding lands not then subject to mineral exploration licences. A second area, reserve number 39898, adjacent to the National Park, was given the purpose of conservation. The Government considered national park status was not appropriate for this second reserve because exploration licences, granted under the Mining Act, already existed over the area. This reserve can allow suitable management to be provided for the area surrounding the National Park whilst not preventing mineral exploration to continue. Gazettal of the two reserves took place on 6 March, 1987.

In April 1986, when endorsing the establishment of the proposed National Park and Conservation Reserve, Government also directed CALM to undertake the preparation of a management plan for the area. In doing so, the Government made these specific decisions with respect to Aboriginal interests:

- *the involvement of interested parties in the planning process, including Aboriginal people with traditional affiliation with the area, the Tourism Commission and Local Government;*
- *the development of a means of meaningful ongoing management input of Aboriginal people with traditional affiliation with land in the Park;*
- *that employment opportunities be provided for Aboriginals in the management and interpretation of the Park;*
- *that proposals be developed for Aboriginals with traditional affiliation to reside in the Park;*

  that an Aboriginal National Park Ranger Training Program be established.

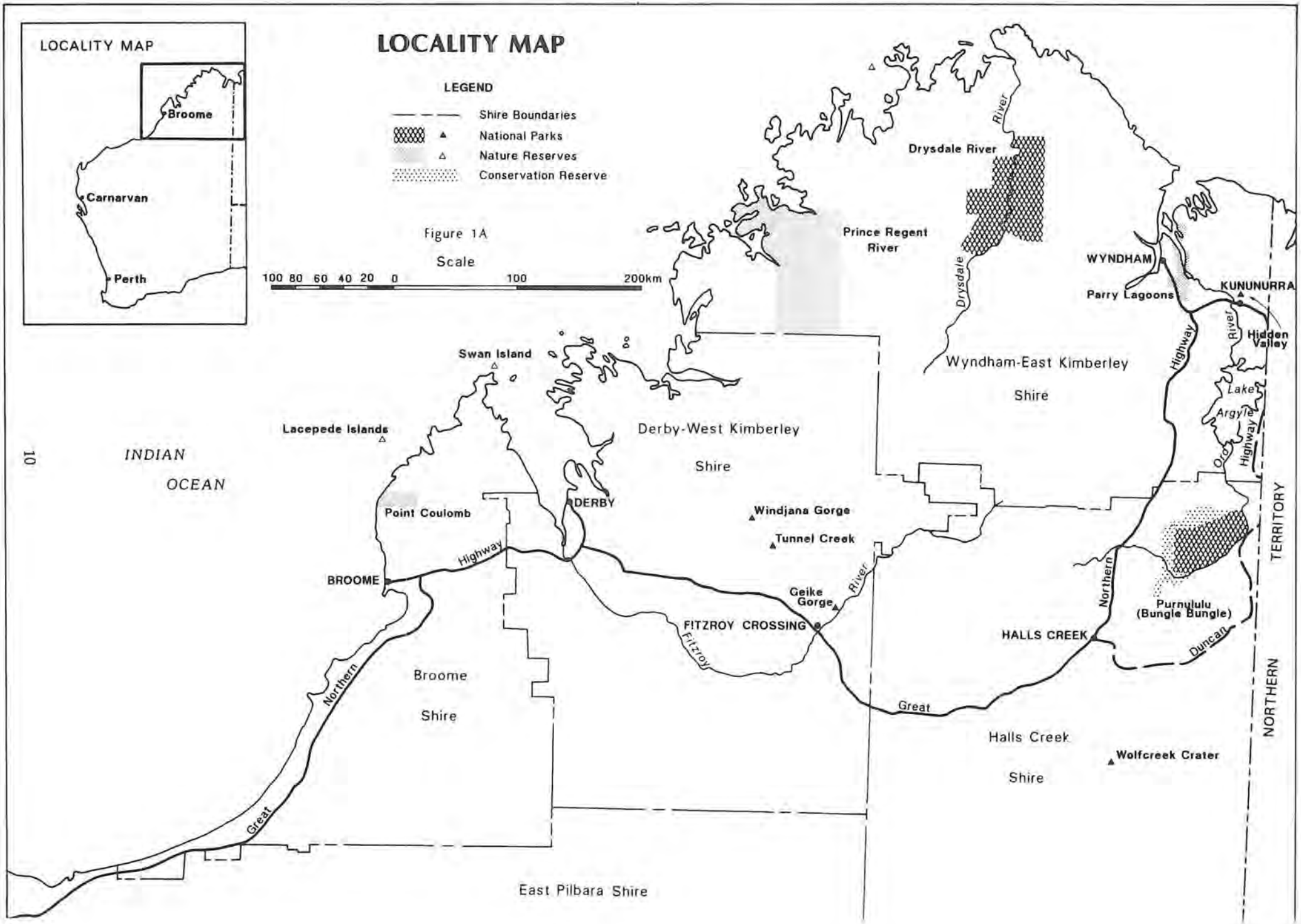
1.1.5 The Park Council

Another key initiative outlined in this plan is the establishment of the Purnululu Park Council. In 1987 Cabinet recommended this Council be established as a Ministerial Committee, constituted by a formal agreement between the Minister for Conservation and Land Management (CALM) and the Purnululu Aboriginal Corporation (PAC). The Council will have equal representation from CALM and PAC and will provide a forum for the development of policy in relation to Aboriginal interests in the Park. Further details of this Council are provided in Section 8.2.

1.2 THE STUDY AREA

The total area of land reserved as national parks or nature reserves in the Kimberley is 1,475,641 ha. This accounts for 3.5% of the Kimberley Region (see Figure 1a).

There will be increased pressure on these limited conservation areas as visitor numbers to the region escalate and as the resident population of the Kimberley increases. In the 5 year period from 1976-1981, the Kimberley population grew at a rate of 4.98% (Department of Regional Development and the North West, 1986). Greater leisure time and a better appreciation for the


LOCALITY MAP
Broome
Carnarvon
Perth
LOCALITY MAP
LEGEND
Shire Boundaries
National Parks
Nature Reserves
Conservation Reserve
Figure 1A
Scale
100 80 60 40 20 0 100 200km
Prince Regent River
Drysdale River
Drysdale River
WYNDHAM
Parry Lagoons
KUNUNURRA
Hidden Valley
Lake Argyle
Ord River
Highway
Wyndham-East Kimberley Shire
Swan Island
Lacepede Islands
INDIAN OCEAN
Derby-West Kimberley Shire
DERBY
Point Coulomb
Windjana Gorge
Tunnel Creek
BROOME
Highway
Geike Gorge
Fitzroy River
FITZROY CROSSING
Northern
Purnululu (Bungle Bungle)
HALLS CREEK
Duncan
Great
Broome Shire
Halls Creek Shire
Wolfcreek Crater
NORTHERN TERRITORY
East Pilbara Shire
10

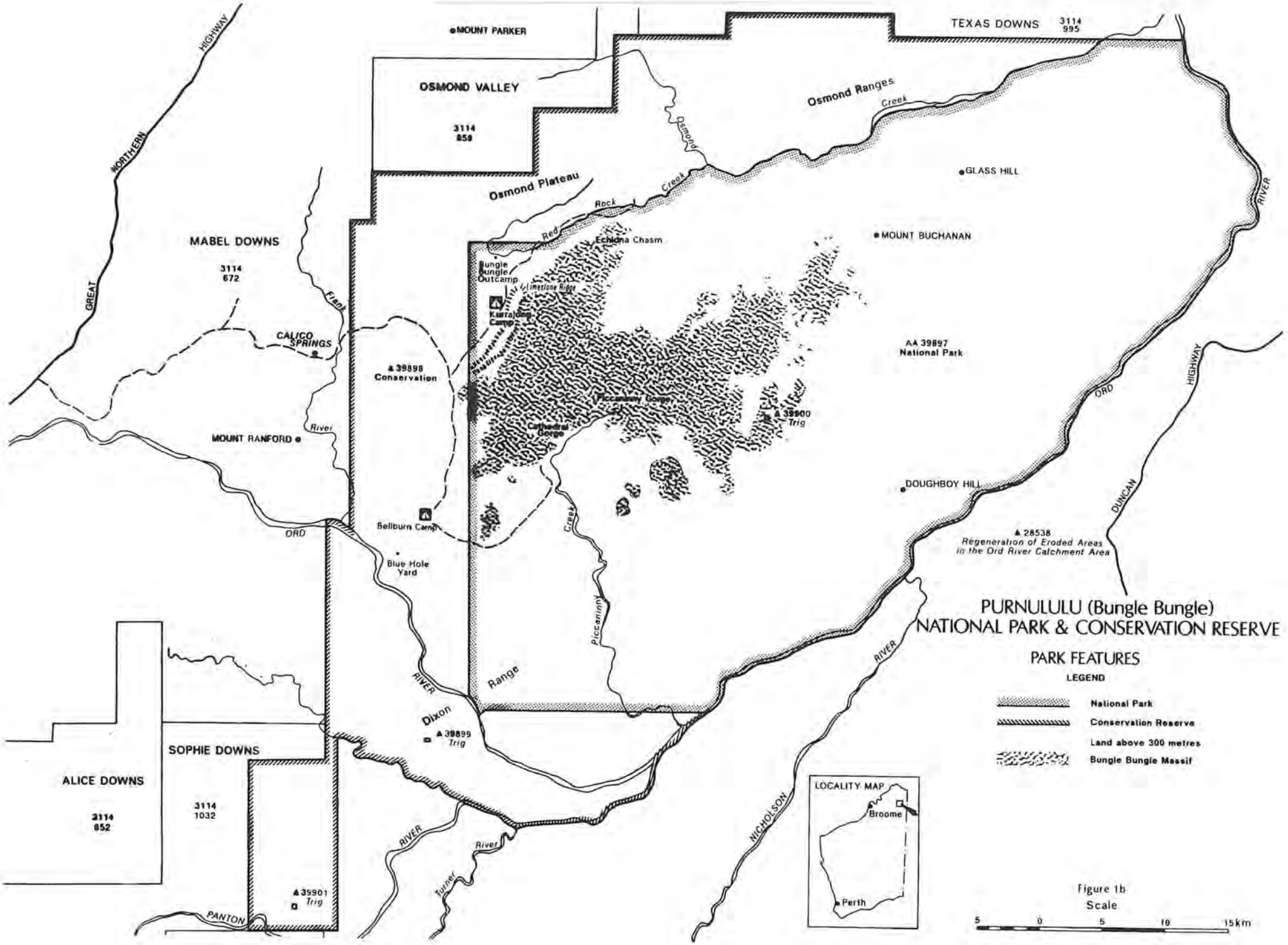


Figure 1b
Scale

natural environment has widened the horizon of the recreating public and increased the demand for public access to conservation reserves.

The Purnululu (Bungle Bungle) National Park and Conservation Reserve are located in the Kimberley Region within the Halls Creek Shire. The area of National Park totals 208,723 ha, the Conservation Reserve 110,602 ha and they are situated approximately 160 km south of Kununurra, 120 km north of Halls Creek and 50 km west of the Northern Territory Border. (See Figures 1a and 1b). The area of massif itself is approximately 45,000 ha.

Since the arrival of Europeans, the major influence in this country has been exerted by the pastoral industry. The lands in the Ord River valley were first stocked with cattle in the early 1880's. Under the open range cattle production system operating in the Kimberley, cattle concentrated on the major river and stream lines where surface water was available. It was noted very early that the good pastoral land along the rivers became overgrazed if the wet season was late. By the 1930's most of the more productive land along the Ord River was severely degraded and eroding (Department of Conservation and Environment, 1986).

In 1967, a large area of the Ord River catchment, including the lands which are now the Purnululu (Bungle Bungle) National Park and Conservation Reserve, was resumed for the purposes of stabilising and regenerating vegetation on lands degraded by previous pastoral practices. This reserve (Number 28538) was managed by the Department of Agriculture, which was responsible for removal of stock and rehabilitation of the catchment area.

The Park is bordered to the north by Texas Downs and Osmond Valley pastoral leases, to the west by Mabel Downs and Sophie Downs, with Alice Downs Station adjoining the southwest corner of the Conservation Reserve. The remaining boundaries, marked by the Panton and Ord Rivers, adjoin Reserve No. 28538.

1.3 PREVIOUS STUDIES

There have been a number of scientific studies of the area. The E.P.A. Working Group Report (1986) provides a good overview of resource data, and makes some general recommendations regarding future management of the area.

The major contributors prior to this were land resource studies initiated by CSIRO (Stewart et al 1986) and the W.A. Department of Agriculture (DeSalis 1982 unpubl). Simpkin-Brown (1985 unpubl) compiled a resource document for the area.

Geological studies have been broadly based and include work by Traves (1955) in the Ord-Victoria region, and Dow and Gemuts (1967, 1969) in the East Kimberley region. More recently, specific geomorphological studies have been undertaken by Young (1987).

Vegetation studies have been undertaken by Forbes and Kenneally (1985) and ethnobotanical studies were conducted by Scarlett (1984) and Rose (1984). Both these latter papers were produced as part of a much larger study called the East Kimberley Impact Assessment Project. This project examined the impact of various developments on Aboriginal communities in the East Kimberley region. Many of the papers produced in that study touch on matters relevant to the Park or its Aboriginal residents.

1.4 PUBLIC PARTICIPATION

In accordance with the recommendations of Cabinet, CALM formed a planning group comprising 3 CALM officers and representatives from the Shire of Halls Creek, the Tourism Commission, and the Purnululu Aboriginal Corporation (PAC). This planning group met a number of times.

PAC felt that this planning group did not adequately provide for their special interests. They employed the services of a planning consultant to assist with their participation in the plan. The planning consultant and representatives of PAC met often with CALM officers through the planning process. PAC prepared a detailed written submission, the contents of which have been drawn upon extensively for this plan.

In the preparation of this draft management plan, CALM officers continued to meet on an as required basis with representatives of the Shire of Halls Creek and the Tourism Commission.

Input has also come from a number of other sources:

a) Known interest groups were advised by mail and advertisements were placed in the press calling for written public submissions- 37 responses were received. These were collated and

analysed and key issues identified. The planning group also had access to written submissions made to the EPA Working Group.

b) Surveys were conducted during 1987 to ascertain visitor profiles, user patterns and visitor impressions of the Park. 900 replies were received from park visitors and 124 from aerial passengers. A summary of the findings of the Park survey is in Appendix 1.

c) Tourism forums were held in Perth and Kununurra to discuss future use of the Park. Members of the tourism industry attending these forums had opportunities to consider and comment upon options. In addition, a seminar/workshop was conducted in the Park early in 1988 during which tour operators and CALM staff discussed proposals for future park management.

2. MANAGEMENT GOALS AND OBJECTIVES

The CALM Act requires that all national parks be managed so as to provide for perpetuation and use. The perpetuation, or conservation of parks and their features is of paramount importance. However, it is these same features which make national parks so attractive for visitors; the more spectacular or unusual an area, the greater the demands placed upon it. Parks must therefore be managed to ensure that opportunities for use and access are provided in appropriate areas whilst retaining the integrity of the natural and cultural features.

Guidelines for the future use and management of the Purnululu (Bungle Bungle) National Park and Conservation Reserve are derived from a number of sources. These include:

i) **State Government decisions**- as explained in the Introduction, Cabinet has discussed Aboriginal involvement in the Park a number of times. Among its decisions, the Government has directed that CALM, through the management planning process, should ensure that employment opportunities be provided in the Park for Aboriginal people, that an Aboriginal National Park Ranger Training Program be established and that proposals are developed for Aboriginal people to reside in the Park. Cabinet also recommended the establishment of a Ministerial Committee, the Purnululu Park Council, to provide meaningful input for Aboriginal interests in relation to management of the Park.

ii) **The Conservation and Land Management Act, 1984**

iii) **CALM Policies and Management Guidelines** - CALM has prepared a series of major planning and policy statements relating to conservation, enviromental protection and recreation management (WA Dept. of CALM, 1987).

iv) **Public Consultation** - as described in Section 1.4, CALM has considered the comments of many individuals and groups in preparing this plan.

GOALS OF THE PLAN

It is proposed that both the National Park and the Conservation Reserve, should be managed according to the same goals and objectives. In some instances, however, the management objective for a particular issue will reflect the different purposes of the two reserves.

The primary goal for management of national parks, as defined in the CALM Act (1984), is:

'...to fulfill so much of the demand for recreation by members of the public as is consistent with the proper maintenance and restoration of the natural environment, the protection of indigenous flora and fauna and the preservation of any feature of archaeological, historic or scientific interest'.

The general goals for management of the Purnululu (Bungle Bungle) National Park and Conservation Reserve are:

1. To conserve, protect and restore areas of scenic beauty, natural landforms, ecosystems and areas of scientific or cultural importance.

2. To allow for traditional Aboriginal custodians to live in the National Park and maintain, where possible, traditional customs and practices.

3. To provide opportunities and facilities for appropriate public recreation, consistent with the protection of the natural environment and minimisation of conflict between uses.

4. To promote awareness and appreciation of natural processes and the natural and cultural attributes of the Park.

5. To protect the lives and property of neighbours and visitors to the Park.

6. To develop and maintain knowledge regarding the biological, physical and social environments of the Park to aid future management.

The objectives for management, as they relate to specific issues, are provided throughout the text of the plan.

3. MANAGEMENT OF THE NATURAL RESOURCES

3.1 CLIMATE

The Park has a typical dry monsoonal climate characterised by two distinct seasons; hot, wet summers (the wet season), and warm, dry winters (the dry season).

Specific data for temperatures, humidity and winds can be obtained from Turkey Creek, the closest meteorogical station to the study area.

The average daytime (maximum) temperatures during the dry season, April to October are approximately 35C, ranging from 29.1C in July to 39.1C in November. The temperature remains relatively high at night, however, frosts may occur during cooler months. After August, the temperature rise is accompanied by an increase in humidity, cloud cover, and the incidence of thunderstorms.

From December to March, temperatures are slightly lower; conditions are made uncomfortable with the high humidity which peaks at 60% daily mean in February.

The prevailing wind direction throughout the year is north-easterly with some easterly and south-easterly swings. Wind direction is most variable between December and March. Average wind speeds range from 1-10 km/h throughout the year, this is slightly less then experienced at Halls Creek.

The mean annual rainfall is about 600mm. Precipitation in the area is generally concentrated into a wet season, extending from November to March (see Figure 2). Of the total rainfall, 85% falls between December and March. Most of the rain is localised by thunderstorms. Cyclones do not usually reach this far inland, although associated depressions sometimes bring heavy rain. Rainfall in the region is intense and erratic, typically occurring in isolated events. For example, between 1897 and 1986 the mean number of raindays in Turkey Creek in the month of January was 13; the range of raindays, however, was 2-22. The occurrence of rainfall is also extemely variable from year to year. Fig. 2 shows the mean annual rainfall and mean number of raindays recorded at Turkey Creek over more than 60 years.

Rain falling in the December to March period is critical for plant growth: high temperatures and the sporadic nature of precipitation occuring outside the wet season means that vegetation derives little benefit from unseasonal rain. The effectiveness of rain in this area has declined over the years as vegetation and soils have deteriorated. Rain is lost in run off and evaporation, causing the environment to become more arid (Robinson 1970).

Implications for Management

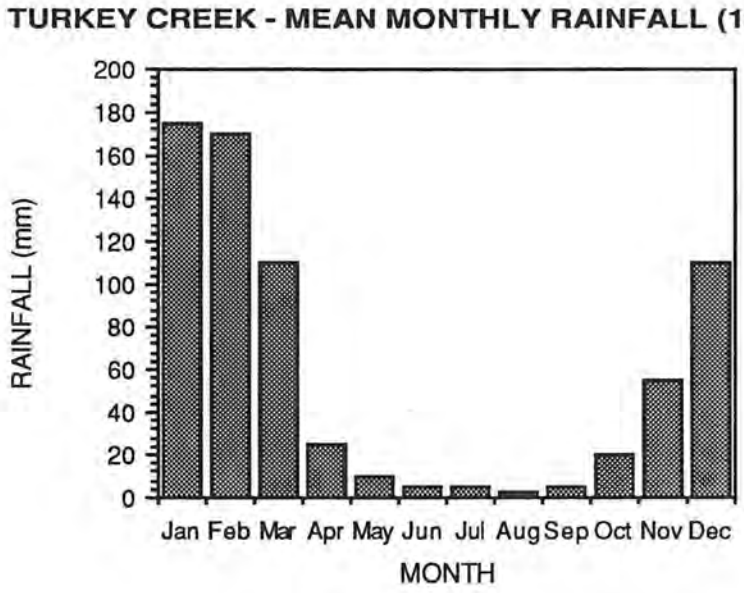
1. Many soils and surfaces in this area are highly susceptible to erosion by wind and water. This process may be accelerated by human activity or feral animals, eg. cattle, donkeys.
2. The peak tourist season in the Kimberley occurs between the months of May and October, but there will be an increase in 'wet season' travellers due to the sealing of the national highway, and the 'green season' promotion by the tourist industry.
3. Road access into the Park may be cut off at flooded creek crossings.
4. Fire occurrence is closely linked to climate; the highest risk of wildfire coincides with the peak visitor season.
5. High temperatures for much of the year will cause visitor discomfort and a potential safety hazard,

Objective

To ensure that all management activities take full account of the extreme climatic conditions.

Strategies

i) Park visitor information should include climatic data and warnings regarding the climatic hazards of the area eg. heat, flood potential, fire.



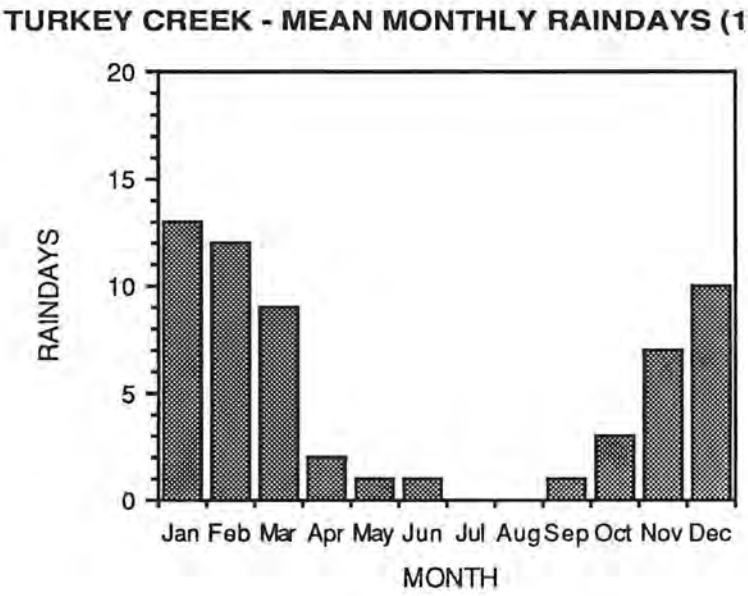


FIGURE 2. Mean Monthly Rainfall and Raindays for Turkey Creek (Met Station 002032)
Graphs show averages calculated over 70 years and 60 years.

ii) Vehicle and pedestrian movements within the Park should be restricted following heavy rainfall.

iii) Public vehicle access to the Park from Great Northern Highway should be closed with the onset of the wet season. Re-opening of the road should occur when conditions for safe access prevail.

iv) Feral animal populations should be reduced as discussed in Section 3.8.

3.2 GEOLOGY

Geology of the area has been described in detail by Traves (1955) and Dow & Gemuts (1967, 1969).

The Park is made up of two broad geological provinces. The ancient igneous, metamorphic and sedimentary rocks of the Halls Creek Mobile Zone have been intensly folded and faulted. This occurs in the western and northern parts of the Park. The second major province is the Hardman Basin which consists of Cambrian (500 million years ago) and Devonian (370 million years ago) sedimentary rocks. It is the latter rocks which make up the Bungle Bungle massif (see Fig. 3).

i) **Halls Creek Mobile Zone** This area has the oldest rocks in the Park. They probably date from Archaean times over 2500 million years ago. The rocks are greywacke, phyllite, conglomerate, limestone and dolomite which have been extensively folded, deformed and intruded with granite. These rocks form very rugged terrain. Structurally the area is bounded by a large fault to the east which forms the boundary of a structure called the Biscay Anticlinorium. Adjoining the fault line on the border of the Hardman Basin are the Antrim Plateau Volcanics which consist of basalts.

The Osmond Ranges to the north of the Park consist of Proterozoic (1500 million years old) quartz sandstones and conglomorates which have also undergone massive deformation and folding.

ii) **Hardman Basin** This basin was formed as an old sea bed during Devonian times. It is underlain by the Antrim Plateau Volcanics. There are several other bands of Cambrian rocks which overlay the volcanics, consisting of limestone, shale, siltstone and marl. The surrounding land uplifted and the Devonian Elder Sandstone was deposited 350 million years ago. This is made up of siltstone, claystone, sandstone and conglomerate beds. Erosion of this feature has led to the deposition of Cainozoic (since 25 million years B.P.) sand and gravel plains which surround the Bungle Bungle massif.

There is a large structure in the central part of the massif which has deformed the sandstone. This could be a meteor impact crater which has been extensively eroded (Beere, 1983).

3.2.1 Economic Geology and Mining

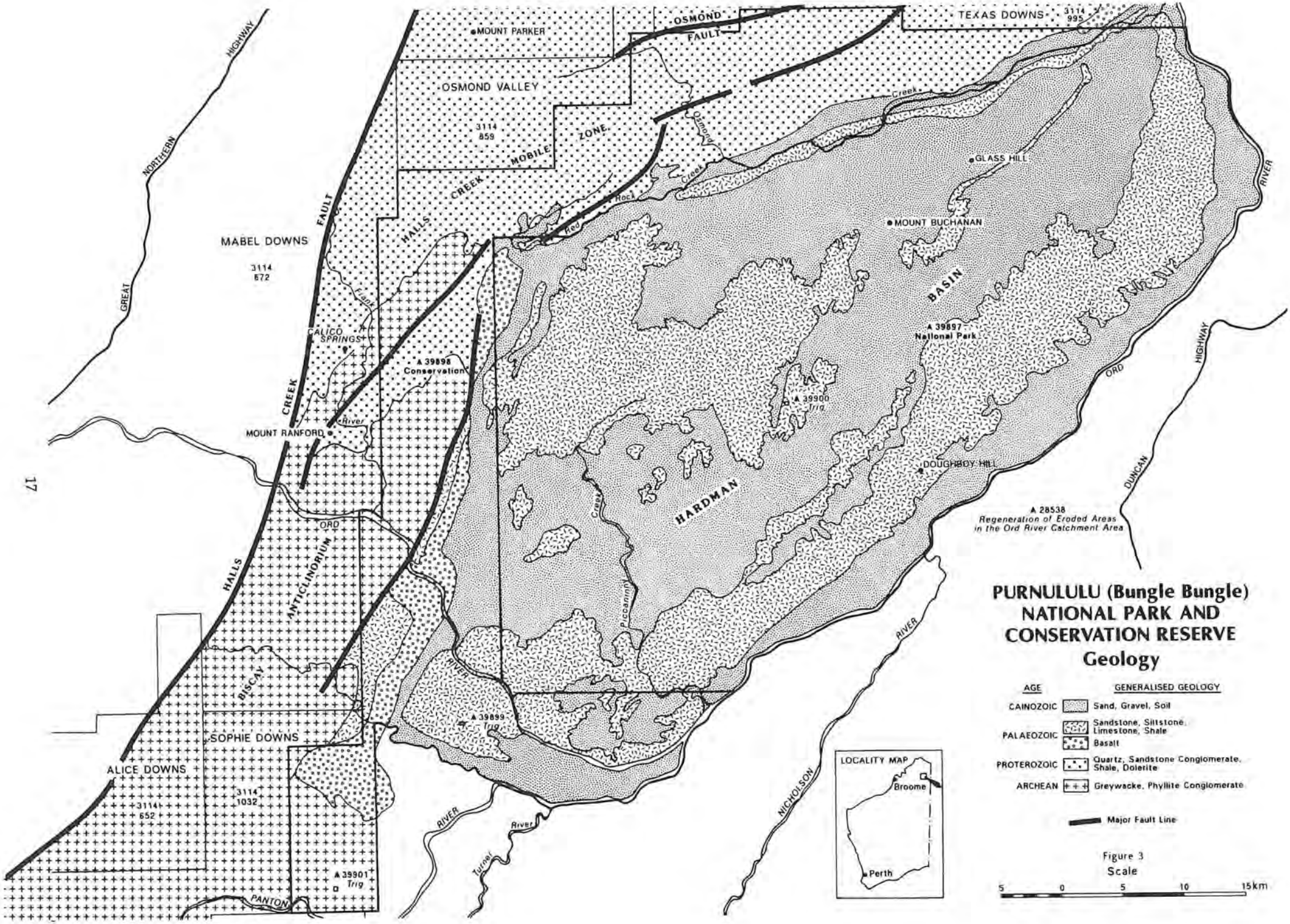
The complex history and the degree of metamorphism which has affected rocks in the area means that the mineral potential is high in the Halls Creek Mobile Zone, to the north and west of the massif. The main mineral potential is for copper, gold, platinum, diamonds and base metals.

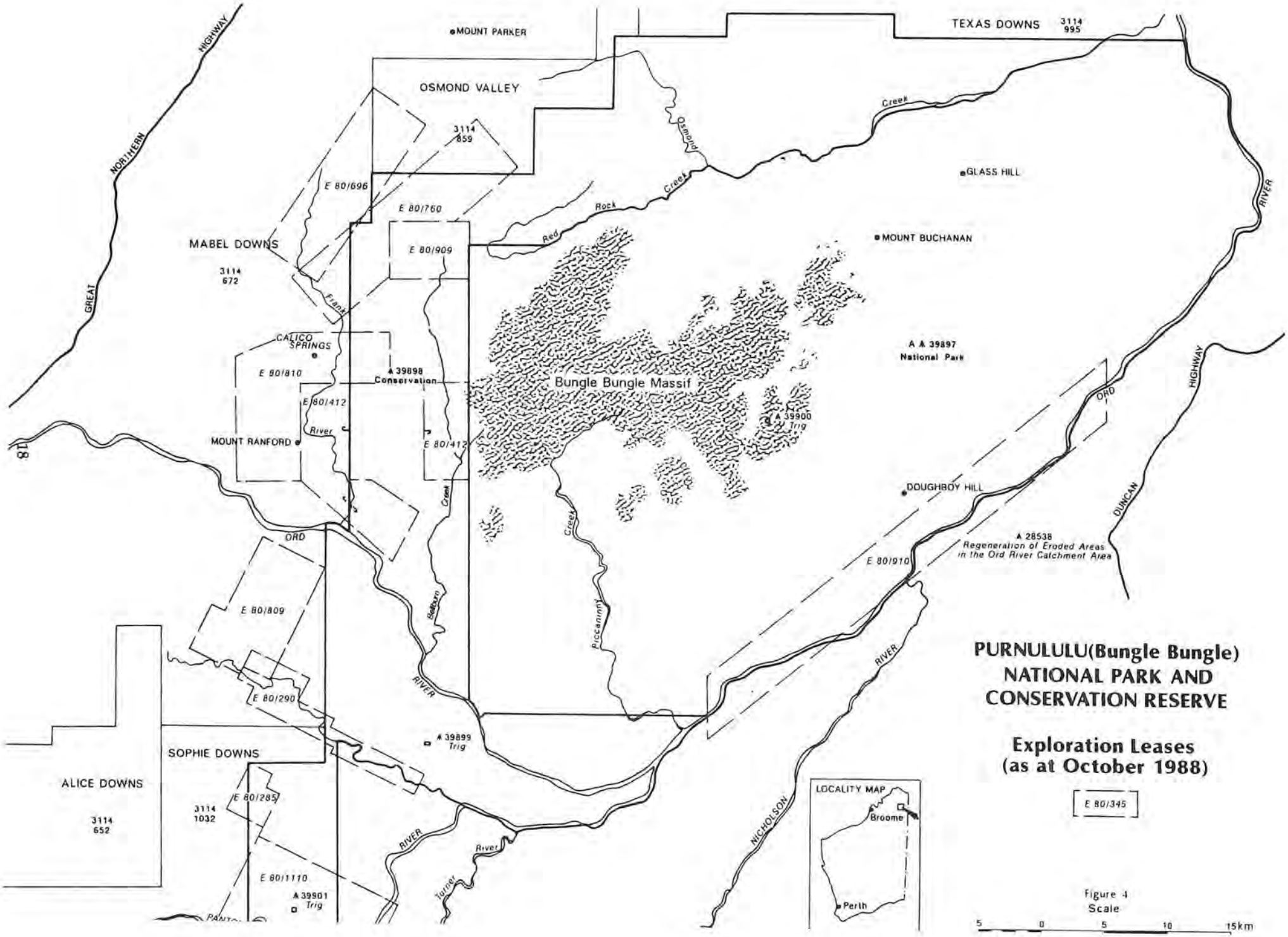
In defining interim boundaries for the reservation of the National Park and adjacent Conservation Reserve, the existence of a great many exploration licences in the area provided a major consideration (Fig. 4). The inner reserve boundary was established so that all areas of known mineral potential (including existing exploration licences) were retained outside the National Park but still provided with management and protection from unregulated use.

According to Government policy, (Mining and Environment, Balancing the Scales 1988) no exploration or mining will be permitted in the National Parks unless a specific part, after consideration by the Environmental Protection Authority, is declared open by the Government for exploration or mining. Areas of the highest biological or landscape value will remain closed.

In the case of the Conservation Reserve, the normal provisions of the Mining Act and Environmental Protection Act would apply.

All mining activity, including marking out and exploration is controlled by the Mining Act. Exploration licences may cover an area of up to 200 km^2. The initial area is reduced by half after the third year, and by half again after the fourth year. After five years, the licence is either terminated or application for a mining lease may be lodged. Mining leases are renewable after 21 years and are provided over a maximum area of 10km^2.


MOUNT PARKER
OSMOND FAULT
TEXAS DOWNS
3114
995
OSMOND VALLEY
3114
859
MOBILE ZONE
Osmond Creek
GLASS HILL
HALLS CREEK FAULT
Hoc Creek
Red
MOUNT BUCHANAN
MABEL DOWNS
3114
872
BASIN
A 39897
National Park
CALICO SPRINGS
A 39898
Conservation
A 39900
Trig
MOUNT RANFORD
River
ORD
HIGHWAY
DOUGHBOY HILL
HARDMAN
Creek
Piccaninny
A 28538
Regeneration of Eroded Areas
in the Ord River Catchment Area
DUNCAN
HALLS CREEK ANTICLINORIUM
BISCAY
SOPHIE DOWNS
ALICE DOWNS
3114
1032
3114
652
A 39899
Trig
A 39901
Trig
PANTON
RIVER
Turner River
NICHOLSON
LOCALITY MAP
Broome
Perth
PURNULULU (Bungle Bungle)
NATIONAL PARK AND
CONSERVATION RESERVE
Geology
AGE
GENERALISED GEOLOGY
CAINOZOIC
Sand, Gravel, Soil
PALAEOZOIC
Sandstone, Siltstone, Limestone, Shale
Basalt
PROTEROZOIC
Quartz, Sandstone Conglomerate, Shale, Dolerite
ARCHEAN
Greywacke, Phyllite Conglomerate
Major Fault Line
Figure 3
Scale
5 0 5 10 15km


MOUNT PARKER
TEXAS DOWNS 3114 995
OSMOND VALLEY
3114 859
Osmond Creek
GLASS HILL
MOUNT BUCHANAN
E 80/696
E 80/760
E 80/909
Red Rock Creek
MABEL DOWNS
3114 672
Frank
CALICO SPRINGS
E 80/810
A 39898 Conservation
E 80/412
River
MOUNT RANFORD
E 80/412
Bungle Bungle Massif
A A 39897 National Park
A 39900 Trig
DOUGHBOY HILL
ORD
HIGHWAY
DUNCAN
RIVER
A 28538 Regeneration of Eroded Areas in the Ord River Catchment Area
E 80/910
Creek
Piccaninny
Bellburn
Creek
ORD
E 80/809
E 80/290
RIVER
A 39899 Trig
SOPHIE DOWNS
ALICE DOWNS
3114 652
3114 1032
E 80/285
E 80/1110
A 39901 Trig
River
Turner
River
NICHOLSON
RIVER
GREAT NORTHERN HIGHWAY
LOCALITY MAP
Broome
Perth
PURNULULU(Bungle Bungle) NATIONAL PARK AND CONSERVATION RESERVE
Exploration Leases (as at October 1988)
E 80/345
Figure 4
Scale
5 0 5 10 15km

In observance of the Aboriginal Heritage Act, the Department of Mines recommends that all licence holders follow the detailed procedural guidelines they have prepared for consultation with traditional Aboriginal custodians.

3.2.2 Extraction of Road Building Material

Park operations will require materials such as gravel and limestone for road and building construction. Under section 9(2) of the Mining Act 1978, the Executive Director may authorize the extraction of these materials for purposes such as road making or building. Borrow pits will be identified for this purpose.

Implications for Management

1. The complex geology of the area and its rugged nature makes the construction of access roads very difficult.
2. There are areas in the Halls Creek Mobile Zone which are prospective for minerals such as copper, platinum, diamonds, gold and base metals.
3. River channels may have prospects for alluvial minerals.
4. Bungle Bungle massif appears to have no important mineral potential at present.
5. There are several exploration licences within the Conservation Reserve to the north and west of the massif.
6. Park management will require borrow pits for park operations.
7. The Purnululu (Bungle Bungle) National Park is, consistent with Government policy, closed to exploration and mining.

Objectives

i) To protect the National Park from the impacts of exploration and mining.

ii) To establish procedures for assessment of such proposals as may arise for exploration and mining within Reserve No 39898, adjacent to the Purnululu (Bungle Bungle) National Park.

Strategies

Exploration and Mining

i) The Purnululu (Bungle Bungle) National Park should remain closed to exploration and mining. These activities can only occur if the National Park is opened to mining with the consent of both Houses of Parliament, in accordance with procedures outlined in the Government Policy Report (Mining and the Environment. Balancing the Scales).

ii) Within the Conservation Reserve, exploration licences may be issued subject to strict guidelines established by CALM regarding access, erosion control, mining and rehabilitation. Consultation with the traditional custodians will be required.

iii) All applications for mining licences in the Conservation Reserve will be referred to the Environmental Protection Authority. If approved, strict conditions should be imposed on any mining operations to minimise impacts on the biophysical and cultural environment and to ensure effective subsequent rehabilitation.

iv) If economic mineral deposits are proven in the Conservation Reserve, then the NPNCA should make representation to the EPA to ensure that the intrinsic values of the area are preserved.

v) The boundary of the National Park should be extended to include areas of the Conservation Reserve as exploration licences lapse.

Extraction of Road Building Material

i) Where possible gravel pits should not be located within the viewshed of any major Park access road, living areas, facility areas or scenic viewpoints.

ii) Prior to opening of any borrow pit a survey should be undertaken to ensure that no rare, endangered or restricted species or associations of flora or fauna, or Aboriginal cultural sites will be disturbed.

iii) All gravel pits and associated access roads should be rehabilitated at the end of operations.

3.3 GEOMORPHOLOGY AND SOILS

Landforms of the National Park, and the surrounding area have been mapped by Stewart et al. (1970) and De Salis (1982). The studies were based on land systems which are areas of land which have a recurring pattern of physical and biotic characteristics. The Environmental Protection Authority Working Group summarised the information for land systems in the Park.

Broadly there are seven land systems within the Park, which can be amalgamated into four distinct areas;

a) Northern uplands
b) Western uplands
c) Massif and related outcrops
d) Plains

a) **Northern Uplands-** This consists of the Osmond Range, Osmond Plateau, and incised structurally controlled valleys. The Osmond Range and Plateau rise up to 400 metres above the plains to the south. The plateau is roughly oval in shape, surrounded by near vertical cliffs. It is incised by short valleys in the north, while in the west and south large folds have produced a dramatic series of steep rock faces, valleys and ridgelines. The rocks are Proterozoic siltstones, sandstones, shales and conglomerates up to 2500 million years old. The Osmond Ranges extend to the east of the plateau, and are a series of structural ridges bounded by faults.

The valleys in this area tend to be narrow "V" shaped or flat floored with steep walls. The exploitation of structural weaknesses in the rocks by streamflow has produced some spectacular scenery eg. Osmond Creek, Wade Creek, Red Rock Creek.

Soils are variable with stony, shallow soils on the upland areas, duplex soils mid slope, and alluvial tracts along stream beds and outwash fans.

b) **Western Uplands-** These are chains of folded hills and ridges, separated by broad undulating valley floors. The high ridges trend NNE-SSW in three main bands 5 km apart, rising over 200 metres from valley floors. The footslopes of the ridges are made up of tightly folded hills, particularly around Frank River and Bellburn Creek. The high ridges consist of conglomerates, sandstones, phyllites and limestone. Of particular note is the ridge of old marine limestone which rises up to 30 m above the plains west of the massif and runs for over 15 km, and the high sinuous ridge in the south west of the Park, rising up to 220 m and unbroken for over 12 km.

Soils vary from shallow stony soils on ridge tops to coarse sand and boulders on some footslopes. Gravelly soils occur on valley floors and low ridges, while fine clay soils occur in low, ephemeral wet areas on the periphery of creeklines. Areas of alluvium occur on levees along creeks.

c) **Massif and related outliers-** In geomorphic terms the Bungle Bungle massif is a large relatively homogenous plateau bounded by steep cliff faces and incised with a large number of joint bounded valleys. The beehive or dome forms which characterise parts of the massif are a result of leaching out of minerals within the sandstone, erosion of joints in the rocks and the subsequent development of convex upper slopes with near vertical sides.

The massif can be subdivided into separate landform units. These are:

i) Plateau- The plateau surface which lies generally some 200 metres above the surrounding plain, is relatively flat with distinct benches related to rock type and jointing. It is best developed in the central and western parts of the massif. Of particular interest is the "Piccaninny Structure" described by Beere (1983). In this area, deformation of rock structures, the alignment of joints and the mineralisation indicate possible impact by a meteorite.

ii) Incised valley forms- These are found mainly in the northeastern and western part of the massif. Stream dissection of this area has led to the development of narrow, sheer sided gorges and chasms, extending over a kilometre into the massif.

iii) Domes, towers and sinuous ridges- These are common in the southern and eastern areas of the massif. They occur as single dome forms, or as tiers, rising up to 150 metres. The ridges are formed by silicification of joints. Distinct orange and grey/black bands on the surface are silica and lichen skins. The underlying rock is very fine clay/siltstone.

iv) Cliff face- A linear sheer cliffed plateau edge runs along the western side of the massif. There are some small streams incised into the slightly dipping beds of the rock face.

v) Large incised valley forms- These are located on the south west and central south (Piccaninny Gorge). These features exhibit structural control along large fractures in the massif. These valleys are flat bottomed, several kilometres long, with sheer sides rising up to 200 m.

vi) Outliers- There are numerous outliers from the massif. These form large complex domes, tiers and cliffs. There are also small relict domes, sheets and stacks, which are in an advanced state of erosional decay.

d) Plains- Approximately two thirds of the National Park is made up of flat to undulating plains. There is little relative relief, but there is a gentle slope of 100 metres away from the massif toward the Ord River. A series of small escarpments and plateau remnants exist along the Ord River. Soils are variable with brown gravel and orange/red sand and clay/silts common. Black cracking clays are found in areas with poor drainage.

Implications for Management

1. Although the rocks of the massif vary, their resistance to erosion is generally very low; the domes are particularly susceptible once the surface layer is broken.

2. Rocks of the massif are at their weakest when saturated (Young, 1987). The soft rock surfaces may be easily damaged by vandals.

3. A long history of overgrazing by cattle and donkeys has resulted in degradation and erosion of soils in the Park.

4. Sheet and gully erosion are common on much of the plains, especially along the frontage plains of the Ord River, and the lower reaches of Bellburn Creek.

5. Black cracking clays have a high degree of shrink and swell. As such they should be avoided where possible for roads, tracks and structures.

6. Light clay and silt soils are highly susceptible to erosion when vegetation is removed.

7. The diversity of landform throughout the National Park results in a high degree of scenic attractiveness.

Objectives

i) To protect the surface of the Bungle Bungle massif from degradation.

ii) To ensure visitor use and park operations have a minimal effect on soil stability.

iii) To conserve the landscape features of the Park.

iv) To rehabilitate soils which are degraded as a result of past and present land uses.

Strategies

i) Public access should be provided to areas in the Park which show a wide range of landform types and scenic diversity, particularly around the massif.

ii) Feral animals should be reduced as discussed in Section 3.8 and degraded soils should be stabilised wherever possible with indiginous plant species.

iii) Provision of Park facilities should avoid areas of cracking clays and be established with great care on erosion-prone light soils.

iv) Walking or climbing on the towers of the massif should not be permitted except where defined walk trails have been provided on resistant surfaces.

v) Public access to gorges should avoid claystone/siltstone basement because of its fragile nature.

vi) Areas which are popular tourist destinations should be monitored to ensure that the impact of pedestrian and vehicle traffic does not cause degradation. Measurable criteria should be developed to ascertain the level of change which may occur.

vii) Park information should incorporate warnings about the softness of the rock surfaces, and potential danger from climbing. Visitors should be clearly warned how susceptible these rocks are to unintentional or deliberate damage.

3.4 HYDROLOGY

3.4.1 Surface Water

Five main river basins drain the East Kimberley region: the Ord, Pentecost, Fitzroy and Keep Rivers drain to the sea and the Sturt Creek inland. By far the largest system is the Ord River Basin, draining more than half of the East Kimberley.

A major dam, the Ord River Dam (Lake Argyle) was completed in 1972 to provide water for the irrigation of new agricultural areas. The northern boundary of the Park is about 60 km south and upstream of Lake Argyle. The Park lies entirely within the Ord Dam catchment, but comprises less than 7% of the total catchment area.

Although the area receives an annual rainfall of about 600mm, the evaporation rate is very high, at more than 2000 mm/year, (Slatyer, 1970) and run off is rapid. Consequently, there is very little permanent surface water in the area. All rivers contain running water for periods and many have underflow, but none flow continuously during the dry season. Throughout the dry, however, permanent and semipermanent pools of water do exist where groundwater flows from permeable and jointed rocks. Because of the sheltered nature of the terrain the narrow valleys of the massif also contain many permanent pools.

Pools and springs provide important refuge areas for flora and fauna in an otherwise seasonally dry landscape. The presence of water also enabled Aboriginal people to remain in this part of the country during the dry season. Several key surface water resources in the Park were traditional dry season camps and as such have special significance for people even today. The Osmond Creek system provided a safe route for long journeys, with reliable water at frequent intervals.

3.4.2 Ground Water

No detailed investigation of the groundwater resources of the Park has taken place, and what resources exist are likely to be limited and only of local significance (Water Authority of WA, pers. comm.). It can be expected, however, that suitable groundwater reserves exist to meet the demands of domestic and tourist needs in the Park.

Dow & Gemuts (1969) and Passmore (1964) investigated the hydrogeology of the region. From their research it is possible to predict the likely occurrence of groundwater resources in the Park. The presence of groundwater is dependant upon the local rock types and structural features and is influenced by the thickness and permeability of any overlying alluvium. The hydrological cycle is also affected by vegetation cover which may deplete surface and shallow underground water through transpiration. Table 1 summarizes the major rock types and their general hydrological properties.

Many of the producing wells and bores of the region draw water from alluvium. Recently, successful bores have been drilled at the Bellburn Creek campsite and at the Bungle Bungle Outcamp and further drilling is in progress. Other bores were operative during pastoral days eg. Piccaninny, Dry Swamp, Eaglehawk. Bores located in sandy alluvium should gain recharge during the wet from nearby sandstones.

Water supplies from bore sources could also be supplemented by roof catchments and tank storage from future buildings.

Implications for Management

1. Location of living areas and visitor facilities within the Park will depend on the availability of sustainable potable water resources.
2. Siting of bores should ensure that drawdown does not affect wetland areas and ephemeral wetland sites.
3. Permanent waterholes, springs and seeps give rise to important ecological islands in the area, and management should ensure that unnecessary disturbance does not occur. Access to these areas should be carefully managed.
4. Some margins of wetland areas have erosion problems because of feral animal movements and grazing.
5. Some wetland areas and creeklines are subject to infestation by weeds eg. *Parkinsonia.*

Objective

To conserve ground and surface water resources.

Strategies

i) Special consideration should be given to the management of wetland areas including fire protection.

ii) Prior to the establishment of any park management building, living area or visitor facility in the Park, an assessment of available water resources and the impact of use should be undertaken by the Water Authority of WA in consultation with CALM.

iii) Rehabilitation of the degraded margins of wetland areas should be undertaken urgently. Site access definition, exclusion fencing, revegetation and drainage may be required.

iv) Wetland and riverine habitats should be surveyed for floral, faunal and cultural significance.

v) Water quality of wetlands and riverine pools is variable. Visitor information should highlight the lack of potable water, and the suspect quality of standing water for drinking.

vi) Gathering and storage of drainwater from roof catchments should be incorporated in the design of future park buildings where appropriate.

TABLE 1 MAJOR ROCK TYPES AND HYDROLOGICAL PROPERTIES (adapted from Passmore, 1964)

Geological Era	Rock Type	Surface Water	Ground Water	Comments
Lower Proterozoic or Archaean	Halls Creek group and Lamboo Complex	Rare	Not common but may occur where strong jointing and faulting occurs	Ground water resources generally not predictable from surface indications. Water quality conc. dissolved salts.
Upper Proterozoic	Igneous	Rare	As for Lower Proterozoic.	May yield water from weathered material or large joints. Generally outcrop in rugged country; the hard rocks are
	Sedimentary	Plentiful	Good potential aquifers where jointed.	difficult to drill but water quality is very good.
Palaeozoic	Antrim Plateau Volcanics	Not Common	Usually present.	Good quality water should be obtainable from blocky joints.
	Negri group	Not Common	Present in joint and cavities in limestone beds.	Generally highly mineralized. Surface indication of ground water not obvious.
Devonian	Elder sandstone	None	Good potential	No bores have been drilled but could produce high quality water.
Cainozoic	Alluvium	Along drain age channels	Good potential	Successful bores exist, especially along drainage lines.

3.5 LANDSCAPE

A landscape character type is a broadscale area of land with common visual characteristics predominately based on landform, vegetation, and waterforms and the diversity of these characteristics. Eight landscape character types have been established for the Kimberley Region of Western Australia (Kimber, 1988 unpubl.). Two, the Uplands and Ord River Plains, are represented in the Bungle Bungle study area (Figure 5).

The Uplands Landscape Character Type

The Uplands extend in a broad band from the Dampier-Fitzroy Plains in the south western portions of the Kimberley Region to the Cambridge Gulf lowlands in the north east. It is geologically and topographically diverse but has common visual characteristics. Subtypes identified within this character type include the Osmond Ranges and the Bungle Bungle massif which each exhibit features common to the broadscale type, yet are marked by distinctive characteristics.

Osmond Range Subtype

The Osmond Range subtype is characterised by rugged ridges and severely dissected valleys. Vegetation cover varies from sparse spinifex islands clinging to steep rock faces to steppe woodland areas of *Eucalyptus collina, E. brevifolia* and *E. terminalis* to isolated remnant rainforest patches. Valley landscapes are of exceptional visual diversity and distinction with permanent streams, pools and swamps supporting a lush and unusual combination of species (colours, textures and forms). As most of this subtype is inaccessible, past land use has had little permanent impact on scenic quality with the exception of roads and localised erosion in valley areas.

Waterforms such as streams and pools, are of exceptional visual interest where present due primarily to their scarcity and combinations of unusual vegetation and landforms.

Bungle Bungle Massif Subtype

The Bungle Bungle massif subtype is characterised by a plateau landscape rising dramatically from the surrounding plain. The contrast between horizontal and vertical planes is emphasised by sheer sided walls rising to 300 metres, incised canyons and sandstone towers. Towers, which occur in clusters, ridges or free standing forms have become synonymous with common images of the Bungle Bungle landscape.

Incisions in the sandstone structures of the massif result in gorges and valleys of immense diversity and visual interest such as Piccaninny Gorge which dissects a large portion of the central plateau. Other dissections occur as narrow chasms. Where rock is more resistant to erosion, vertical faces and seasonal waterfalls result. A striking feature of the landform is its banded colour zones and textural patterns emphasised by light and shadow.

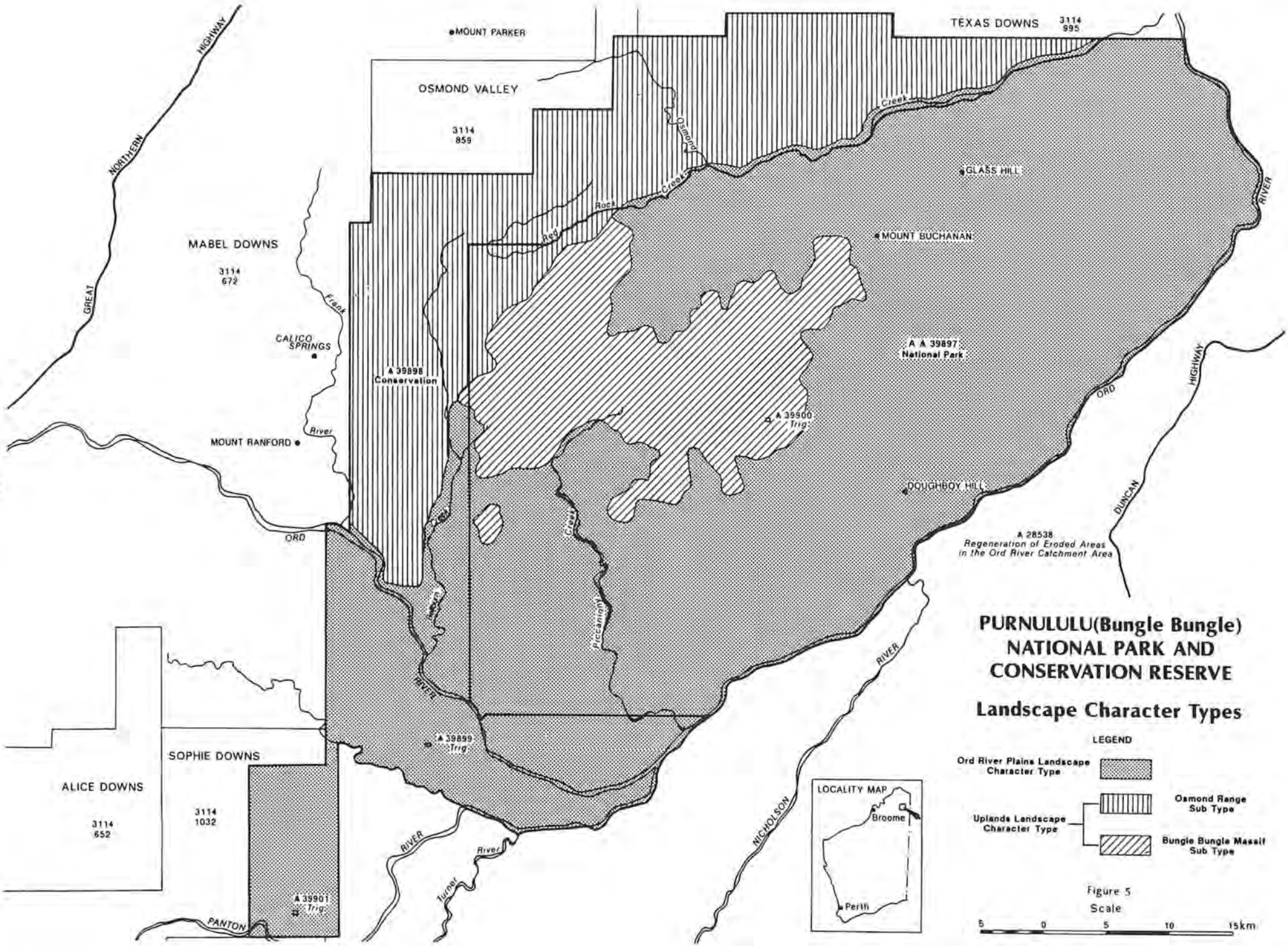
Ord River Plains Landscape Character Type

The second landscape character type represented in the study area is associated with the Ord River and its major tributaries. The area is underlain by volcanic rock, limestone, shale, siltstone and Elder Sandstone.

The Ord River system has formed low lying plains which are largely covered by residual and alluvial soils. Rock outcropping occurs sporadically to provide some interesting relief. The northern section of the type, beyond the National Park boundaries, has been inundated by Lake Argyle.

The landscape is characterised by extensive expanses of undulating sandy plain with low hills in association with the Ord River and its tributaries. Boulders and rock outcroppings are of special interest. Soils are red to yellow sands, often exposed due to sparse vegetation, drainage channels and areas of erosion. Black soil areas occur along some drainage lines. Vegetation patterns are diverse, ranging from dense streamside forests to uniform grass/shrub expanses. Vegetation cover is classified as steppe woodland with extensive areas of trees *(Eucalyptus)*, shrubs *(Acacia)* and grasses (Spinifex/bunch grass). Patterns are created by combinations of vegetation types either in clumps or singly across the landform. River fringing forests are well developed and sometimes multistoried, with river red gum and cadjiput trees.

Surface water occurs throughout the type in association with the Ord River and its tributaries such as Piccaninny Creek, Red Rock Creek and Osmond Creek. While most waterbodies are


MOUNT PARKER
TEXAS DOWNS
3114
995
OSMOND VALLEY
3114
859
Osmond Creek
Red Rock Creek
GLASS HILL
MOUNT BUCHANAN
RIVER
NORTHERN HIGHWAY
GREAT
MABEL DOWNS
3114
672
Fresh
CALICO SPRINGS
A 39898
Conservation
A A 39897
National Park
A 39900
Trig
MOUNT RANFORD
River
ORD
HIGHWAY
DOUGHBOY HILL
DUNCAN
A 28538
Regeneration of Eroded Areas
in the Ord River Catchment Area
Creek
Great
Precambrian
Ivanhoe
RIVER
A 39899
Trig
SOPHIE DOWNS
ALICE DOWNS
3114
652
3114
1032
A 39901
Trig
PANTON
RIVER
Turner
River
NICHOLSON
RIVER
LOCALITY MAP
Broome
Perth
PURNULULU(Bungle Bungle)
NATIONAL PARK AND
CONSERVATION RESERVE
Landscape Character Types
LEGEND
Ord River Plains Landscape
Character Type
Uplands Landscape
Character Type
Osmond Range
Sub Type
Bungle Bungle Massif
Sub Type
Figure 5
Scale
5 0 5 10 15km

ephemeral in nature, permanent pools such as Blue Hole and Fowl House do occur. Water, when present, becomes a dominant visual attraction.

The entire landscape type has had a long history of grazing, which has caused gully erosion, loss of vegetation and stream siltation. The visual legacy of this past land use is severe, with the worst affected areas adjacent to the rivers and permanent pools.

Scenic Quality Assessment

A descriptive method of landscape assessment has been used to enable the visual resources (scenic quality) of the Park to be taken into account in management planning.

The classification of landscapes by scenic quality is based on certain criteria, called frames of reference. The frames of reference are based upon the general assumption that scenic quality increases with:

- greater degrees of uniqueness,
- greater degrees of naturalness,
- greater degrees of topographic relief and ruggedness,
- greater degrees of landform and vegetation diversity,
- presence of water.

These assumptions are supported by perception studies conducted in Victoria and the U.S.A. (Williamson and Chalmers 1982).

Areas exhibiting the features and diversity normally present in the landscape character type are assessed as moderate scenic quality classification, while those with outstanding, unusual or diverse features are classified as high scenic quality, and those areas lacking in features and diversity are assigned a low scenic quality classification.

A high scenic quality class is assigned where one or more of the elements (landform, vegetation or waterform) is assessed as high (see Table 2).

Implications for Management

1. Landscape, or scenery, provides the major attraction for visitors to the Park.
2. Changes to landscape occur continually by both natural and human induced forces.
3. Landscape changes induced by people tend to appear more negative than natural changes, depending on the type of change incurred and on the particular characteristics of the affected landscape (eg. vegetation, soil and degree of slope).
4. The presence of feral animals in the Park has resulted in reduced landscape values, particularly along prime riverfront areas.

Objective

To conserve the landscape features of the Park.

Strategies

i) Alterations to natural landscapes should be subtle and complement the surrounding landscape in design, materials and colour.

ii) Prior to any landuse activity, the visual resources of an area should be assessed within the frames of reference detailed in Table 2.

iii) Areas of high scenic quality are a primary visual resource and extremely sensitive to alteration; essential changes should be conducted so they are not evident to the casual observer.

iv) Prior to any development or rehabilitation program being implemented, a site development plan should be completed and approved by the Regional Manager, or his representative.

v) Essential facilities not requiring high scenic quality should be accommodated whereve possible in areas of low scenic quality.

vi) All developments should be designed and sited to have minimal impact on scenic quality.

vii) Feral animal numbers will continue to be reduced and degraded areas rehabilitated.

TABLE 2a. UPLANDS LANDSCAPE CHARACTER TYPE SCENIC QUALITY CLASSIFICATION - FRAME OF REFERENCE

Description	Indicators of High Scenic Quality	Moderate Scenic Quality	Low Scenic Quality
Landforms	Peaks, ridges, domes or plateaux with distinctive form or colour which become focal points.	Undulating or rounded hills, ridges or peaks which are not usually distinctive or unusual.	Slightly undulating, rolling or flnear at terrain, lacking in visual interest in comparison to other landform common in the Character Type
	Sharply defined V-shaped valleys unusual in gorge depth, elevation, side wall striation or configuration of tributary valleys.	Dissections and valleys often broad, U-shaped and lacking distinctive configuration, depth, colour or forms. Lateral tributaries common, often similar to others in the surrounding landscape.	
	Isololated rock outcropping, cliffs, boulders or group of boulders	Rock outcroppings evident but indistinct OR subordinate to other elements in the landscape.	
Vegetation	Strongly defined patterns or pockets of vegetation often in combination with form, drainage basins or water.	Open, scattered or dense vegetation combined with natural openings, rock or some evident diversity.	Extensive areas of similar vegetation such as grassland, with very limited variation in colour or texture and few evident patterns.
	Vegetation unusual in species composition, density, growth habit, colour or texture in comparison to vegetation found commonly in the type.	Vegetation patterns evident due to species composition, layering colour or texture but common relative to the surrounding landscape character.	Vegetation absent
Waterforms	Permanent or nearly permanent pools, streams or swamps	Broad drainage basins which are evident but which lack distinctive stone patterns, configuration or fringe vegetation.	NOTE: Where present in this character type, waterforms rate no lower than moderate scenic quality.
	Stone bottomed water courses which are well defined by fringing vegetation.		

TABLE 2b. ORD RIVER PLAINS LANDSCAPE CHARACTER TYPE SCENIC QUALITY CLASSIFICATION - FRAME OF REFERENCE

Description	Indicators of High Scenic Quality	Moderate Scenic Quality	Low Scenic Quality
Landforms	Boulder and rock outcropping either singly or in clusters which become focal points due to contacts with surrounding landforms.	Undulating sandy plain or low hills with some topographic relief common to the character type.	Extensive areas of surface disturbance due to gully erosion.
	Stream courses whch when dry retain unique visual interest due to topographical variation, rock/sand combination or edge definition.		Extensive area of flat to slightly undulating' moderately dissected land with little evident special definition
	Well defined stream basins with edge tending toward gorges, often with rock out croppings.		
Vegetation	Vegetation pattern dominant due to diversity of species, age class, height or textural variation - usually found in association with stream courses.	Generally uniform vegetation cover with some evident pattern in species, colours and texture - but lacking uniqueness.	Extensive areas of sparse vegetation cover, often restricted to grasses with with little evident diversity or pattern.
			Areas devoid of vegetation
	Pockets or islands of vegetation which become focal points in comparison with surrounding vegetation cover.		
	Areas or pockets of vegetation of visual distribution due to seasonal variation - form, colours or texture.		
Waterform	Permanent, or nearly permanent pools, streams or swamps.	NOTE: When water is present in this character type, it rates no lower than High Scenic Qualtiy.	

3.6 FLORA

Although there has been no detailed or systematic study of the vegetation of the National Park or Conservation Reserve, a number of broadbased studies in the East Kimberley area have provided a reasonable descriptive data base.

Perry, in Stewart et al (1970), described the "Vegetation of the Ord-Victoria Area" as a part of the CSIRO Land Research Series. Beard (1979) subsequently described the Kimberley in his "Vegetation Survey of Western Australia" and De Salis (1982) gives an account of the vegetation in his report on the Ord River Regeneration Reserve. De Salis looks at the vegetation with respect to rangeland management, describing the major species composition of each of the land systems. A botanical survey of the Bungle Bungle and Osmond Ranges was undertaken by Forbes and Kenneally (1986) in which 18 vegetation types and an annotated list of 403 species were identified. Their survey provided great detail at a number of selected locations, but a large area of the Park has still not been traversed or surveyed.

Ethnobotanical reports by Rose (1984) and Scarlett (1984) described the plant resources known to the Kija people traditionally associated with Purnululu area. They recorded an extensive list of plants used for food, medicine, implements and other uses.

Regionally, the Park falls into an intermediate rainfall zone, characterized by sparse low woodlands and midheight grasslands (Beard 1979).

Using the various sources of information mentioned above, and a limited amount of aerial photointerpretation, the plant communities of the Park have been classified according to structure. The method was adapted from Beard (1979) and is based on the grass layer as the ecologically dominant structure. There are small isolated tracts of closed forest occurring in which grasses are virtually absent.

Three types of grassland are recognised (see Table 3). These are savanna, where the grass layer is closed and bunch grasses dominate and steppe, where the grass layer is open and "spinifex" (hummock) grasses dominate. The term "spinifex" refers to hummock grasses of the genera *Triodia* and/or *Plechtrachne*. A mosaic unit is recognised which is a mixture of both savanna and steppe grasses.

The plateau of the Bungle Bungle massif supports a sparse tree steppe with an upper storey of *Eucalyptus cliftoniana*, scattered *E. collina* and a sparse middle layer of *Grevillea* and *Acacia*. Ephemeral streams on the plateau support limited pockets of low open forest with a shrub understorey. The chasms and cliffs of the massif generally hold little permanent water and are therefore unable to support closed forests such as those found in Osmond Valley. These sheltered habitats, however, provide refuge for species from drought, climatic variation and fire. Creepers and ferns are common in damp areas and the undescribed palm *Livistona sp.* 'Victoria River' is characteristic of the gorges of the western massif. *Grevillea psylantha* is an endemic species known only from the Purnululu area (Forbes & Kenneally 1986).

The plains immediately surrounding the massif are mostly hummock grasslands supporting a sparse woodland with an overstory of *Eucalypts* and a middle storey of *Grevillea, Hakea* and *Acacia* spp.

The vegetation map (Fig. 6) shows that the National Park comprises a large area of spinifex (hummock) grassland associations surrounded by a narrow band of savanna woodland. An extensive area of savanna woodlands, shrublands and grasslands occurs to the south and east of the Park.

The frontage plains of the Ord River have been heavily degraded with extensive sheet and gully erosion resulting in minimal ground cover in places. The major vegetation of the interfluves is an association of introduced species of birdwood grass and kapok bush. In depositional zones, patches of more dense vegetation can be found, and around permanent pools such as Blue Hole, there is a small but significant area of closed forest.

Permanent and semipermanent streams in the Osmond Valley support the most southeasterly extension of well developed closed forest recorded for the Kimberley, and is therefore of regional significance and has special conservation value. Forbes and Kenneally (1986) recorded a number of rare and restricted species from this area, including a sedge, *Cyperus eleusinoides*, previously unrecorded for W.A.

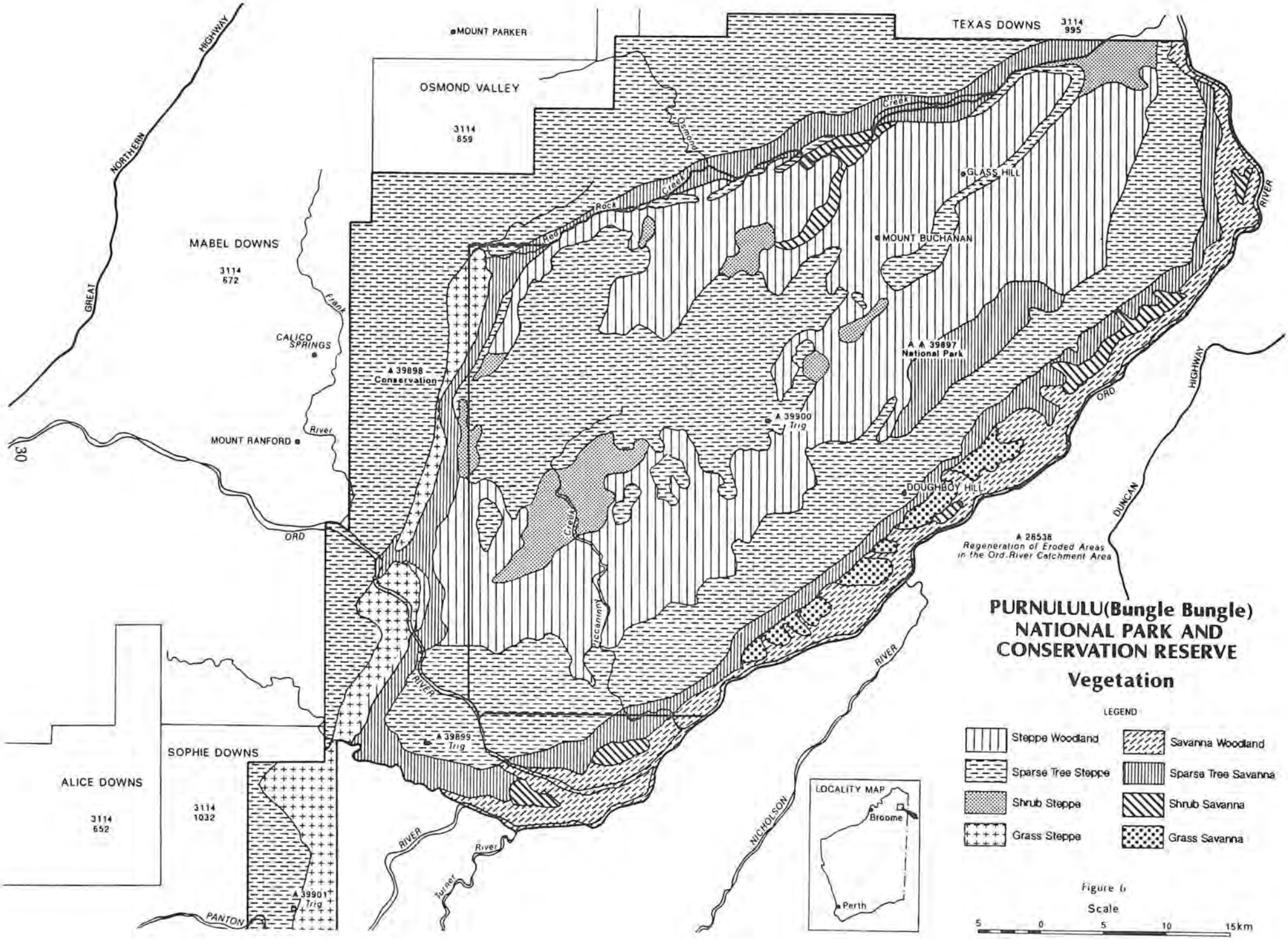

MOUNT PARKER
TEXAS DOWNS
3114
995
OSMOND VALLEY
3114
859
Osmond Creek
Rocky Creek
Red Rock Creek
GLASS HILL
MOUNT BUCHANAN
RIVER
MABEL DOWNS
3114
672
GREAT NORTHERN HIGHWAY
Ernest
CALICO SPRINGS
A 39898
Conservation
A A 39897
National Park
A 39900
Trig
MOUNT RANFORD
River
30
ORD
DOUGHBOY HILL
DUNCAN HIGHWAY
A 28538
Regeneration of Eroded Areas
in the Ord River Catchment Area
Creek
Ticcannny
RIVER
A 39899
Trig
SOPHIE DOWNS
3114
1032
ALICE DOWNS
3114
652
RIVER
River
Turner
A 39901
Trig
PANTON
NICHOLSON
RIVER
LOCALITY MAP
Broome
Perth
PURNULULU(Bungle Bungle)
NATIONAL PARK AND
CONSERVATION RESERVE
Vegetation
LEGEND
Steppe Woodland
Savanna Woodland
Sparse Tree Steppe
Sparse Tree Savanna
Shrub Steppe
Shrub Savanna
Grass Steppe
Grass Savanna
Figure 6
Scale
5 0 5 10 15km

TABLE 3 (after Beard 1979)
Classification of Vegetation Communities in the Purnululu (Bungle Bungle) National Park and Conservation Reserve.

Tree and ShrubLayer	Bunch Grassland	Spinifex (Hummock) Grassland	Mosaic Grassland Units	Grassland Absent or Virtually so
Trees and shrubs forming a closed canopy				Closed forest
Trees and shrubs forming a canopy which is generally open	Savanna Woodland	Steppe Woodland		
Trees scattered or sparse	Sparse tree Savanna	Sparse tree Steppe	Sparse trees with mixed bunch grass and spinifex	
Shrubs only	Shrub Savanna	Shrub Steppe	Shrub with mixed bunch grass and spinifex	
Trees and shrubs absent or virtually so	Grass Savanna	Grass Steppe		

In May 1988, two sites in the far south-east Kimberley along the northern face of the Osmond Range were visited by survey teams from CALM who were studying remnant rainforests of the Kimberley Region. Preliminary results from these sites show a number of rainforest plants were present as well as a few woodland species. The rainforest plants included some canopy trees and shrubs. The thickets depended on the presence of fresh water and were very small and isolated.

An isolated patch of taro, *Colocasia esculenta*, an important economic species throughout the humid tropics, is thought to be a valuable genetic resource. Scientists are currently studying samples of tissue from some of these plants to compare the population genetics with plants from other areas.

From the Osmond plateau, *Eucalyptus cupularis* was reported (C Done, pers comm). Hot springs surrounded by pockets of closed forest have been reported. From Winnima Gorge, north of Palms Yard, Forbes and Kenneally (1986) collected a number of important species including a new sedge for W.A., *Cyperus polystachyos*. They also recorded that the surrounding dry steppe woodland is equally significant and of high educational value.

It is apparent from talking to traditional custodians that there have been some dramatic changes to the vegetation of the Purnululu area since the onset of the pastoral era. Many of the traditional food sources which were once abundant are now scarce, expecially the root foods, seeds and lillies (Rose 1984).

Disturbance, including changes in burning practices and selective grazing by introduced animals appears to have affected some species on the sand plains, favouring the increased occurrence of Acacia sp. and also the bunch grass, *Heteropogon contortus* (Forbes & Kenneally 1986).

Lack of comprehensive biological survey data makes it difficult to plan for the management of the vegetation on a broad scale. Special areas requiring protection can be identified, such as the sheltered chasms and gorges of the massif and the semi permanent and permanent streams and waterholes. These areas will not withstand high-pressure use, such as camping. Ad hoc vehicular use of these areas, will also increase environmental damage.

Implications for Management

1. Few of the Park's vegetation associations have been adequately surveyed.
2. Some vegetation associations which are poorly represented or not represented in conservation reserves elsewhere are well represented in the Park.
3. Extensive areas on the Ord frontage plains, and the alluvial areas around creeks and rivers are degraded due to feral animal overgrazing. In some areas, the vegetation composition has altered in response to disturbance.
4. A number of restricted species of flora have been found in the Park and on adjacent land, particularly in the Osmond Valley. It is possible that further new species may be found in restricted habitats.

Objective

To restore and maintain as far as possible the variety of ecosystems of the Park with particular emphasis on conservation of rare, endangered and restricted vegetation associations and species.

Strategies

i) A biological survey should be undertaken to assess and define significant species and vegetation associations in the Park

ii) In the absence of a full survey, a preliminary assessment should be made of the conservation status of all areas proposed for recreation and/or Park management purposes, including the location of roads.

iii) The conservation values of the flora should be managed and maintained through the use of appropriate fire management practices.

iv) The conservation, scientific, cultural and scenic values of the closed forests and surrounding woodlands of Osmond Valley make this area extemely desirable for inclusion in the National Park.

v) A public education program should incorporate information regarding the significance of the sheltered habitats of the Park and the possible need for restricted access to some of these places.

vi) Research into traditional Aboriginal use and knowledge of the flora should be encouraged and facilitated wherever possible.

vii) Research should be investigated to determine the prepastoral vegetation associations in the area of the Park.

3.7 FAUNA

There is very little known about the fauna of the area as no surveys have taken place to date. Muir (1983) compiled an annotated list of birds and mammals recorded in the vicinity of Bungle Bungle Outcamp, and CALM staff have since been recording birds sighted in the Park. Muir's list together with a bird species list are included in Appendix 2.

At least three species of Macropod are thought to occur in the Park, the euro *(Macropus robustus)*, agile wallaby *(Macropus agilis)* and nailtail wallaby *(Onychogalea unguifera)*. Dingoes are common in the area and numerous tracks from small mammals and reptiles, as yet unrecorded, are found in sandy creek beds.

Some detailed fauna surveys have been undertaken in nearby areas. Kitchener (1978) reported on museum surveys of Lake Argyle in 1971 and 1972 and an area just south of Lake Argyle, near Lissadell Homestead, in 1976. McKenzie (1981) surveyed certain areas of the southwest Kimberley which is described as similar in both climate and habitat to the East Kimberley.

Kitchener (1978) noted the Ord River area does not appear to support any arid zone species. This survey found the East Kimberley relatively rich in bats but with fewer rodents than the North Kimberley. Notably absent from these collections were some arboreal species such as the sugar glider and scaly-tailed possum. The survey also failed to find any bandicoots or native cats, both of which were known to be in the area at the time of the first European settlement. Overall, the study area appeared low in both species and numbers.

It is reasonable to expect the sheltered moist habitats of the gorges and chasms provide refuge for a variety of fauna, just as they have been seen to protect significant flora (See section 3.6). In addition, some of the gorges may protect fire-sensitive species, as there are some areas which show no evidence of recent fire history, and may never have experienced fire.

15% of the Park comprises grass savannah which is one of the six ecosystem groups most critically in need of conservation on a world-wide basis (Conservation Through Reserves Committee, 1979). Unfortunately, this area also includes some of the most degraded parts of the Park (Section 3.8). It is encouraging to note that CALM staff have recently observed an apparent increase in the number of emus in this area, perhaps indicating some recovery in condition of the Ord frontage plains.

The presence of domestic pets, particularly dogs and cats, in National Parks has often been a controversial issue. Domestic pets may interfere with native wildlife and hence impede wildlife viewing by visitors; they can also be a general nuisance to visitors and in particular, foul camping and other visitor areas. In some circumstances, they may escape and become feral. Because of these problems, CALM does not generally allow unrestricted entry of domestic pets into conservation reserves. However, Departmental policy does allow for park residents to keep domestic pets if they are confined to residential areas.

Implications for Management

1.The current knowledge of the fauna of the Park is very limited.

2. Competition from feral animals appears to have suppressed populations of native species. The reduction of feral animal numbers since 1985 presents an opportunity for base line data to be gathered.

3. Increasing numbers of some species of fauna have been observed by CALM management staff.

4. Remnant vegetation provides specialised habitats for fauna, particularly sheltered, moist habitats in gorges and chasms of the Osmond Range, Bungle Bungle massif and Ord River.

5. Domestic pets may interfere with native wildlife or cause a general nuisance to visitors; they may in some circumstances escape and become feral.

Objectives

i) To restore and maintain as far as possible the fauna populations at pre-pastoral levels with particular emphasis on conservation of rare, endangered, and restricted species of fauna and their habitats.

ii) To reduce populations of feral animals.

Strategies

i) A survey should be undertaken to assess species, population levels and conservation status of fauna in the National Park and Conservation Reserve.

ii) Guidance should be sought from traditional custodians of species present in the pre-pastoral era but now absent.

iii) Research into traditional Aboriginal use and knowledge of the fauna should be encouraged and facilitated wherever possible.

iv) Feral animal populations should be reduced as discussed in Section 3.8.

v) Provision of future visitor information should incorporate details relating to Park fauna and its management.

vi) Domestic pets should only be allowed in the National Park under conditions of permit as provided by the Executive Director. Examples where permits may be provided are

.Park residents (who must undertake that pets are under strict control and confined to residential areas)

.Guide dogs

.Dogs associated with search and rescue operations

.Specific approved areas, as discussed (vii) below.

vii) The Executive Director may in the future designate an area in which

visitors may be permitted to camp with dogs under strict control. Dogs will not be permitted elsewhere in the Park, except in the case of a permit (as in (vi) above).

viii) CALM should also encourage the establishment of a kennel outside the Park for the temporary accommodation of pets carried by visitors.

3.8 REHABILITATION

Background

As a result of his explorations from 1876-79, Alexander Forrest prepared favourable reports on Kimberley pasture lands, leading to the introduction of cattle in 1884 from Queensland and New South Wales. A number of good seasons and plenty of surface water saw stock numbers increase rapidly to 673 000 head of cattle in 1918.

This enormous grazing pressure, together with periods of drought and a change in fire regime led to change of the fragile plains and river frontage ecosystems. Composition of the vegetation changed due to selective grazing and in some places vegetation disappeared altogether from large areas of land, leaving the unprotected soils to be eroded by wind and water. De Salis (1982) notes that erosion in the Ord River catchment was a subject of concern as early as the 1940's but no action was taken to arrest the damage until it was realised the enormous siltation could threaten the success of the Ord River Dam.

In order to curtail this situation, a large area of the Ord River catchment including the former Ord River, Turner and parts of Flora Valley, Elvire Downs and Ruby Plains pastoral leases were resumed by the Government. Control of these lands was vested in the Minister for Agriculture. The Department of Agriculture embarked on a regeneration program with extensive fencing and the mustering and removal of cattle in the Park area in 1985. Natural rehabilitation was slow to occur due to the extreme degradation of some areas and the lack of soil seed reserves. Strip contour cultivation and seeding with some exotic but hardy pioneer species, Buffel grass, *(Cenchrus ciliaris)*, Birdwood grass, *(C. setiger)* and Kapok bush *(Aerva javanica)* have been generally successful. Sloping areas (>5%) are not cultivated because of exacerbating erosion.

Most of the intensive regeneration effort in the first 20 years concentrated on an area to the south and east of the Ord River. Efforts to muster cattle and donkeys to the north and west of the Ord

were frustrated by the lack of access to this area for several months each year during and after the wet season.

A resource inventory and condition survey of the Ord River Regeneration Area was carried out by the Department of Agriculture in 1981. In that survey, the area was classified into land systems and land units and an assessment made of each unit, together with recommendations for future management (de Salis 1982).

Since 1985, the Department of Agriculture has turned its attention north and west of the Ord River, to the area which is now National Park and Conservation Reserve. Generally the worst degradation has occurred on the most productive pasture lands ie. areas with palatable grasses, close to water and good accessiblity. The main exception to this is the black soil plains which have been heavily overgrazed but have remained mainly free of erosion.

At the time of the 1982 Department of Agriculture survey, the total area of Park which was substantially affected by erosion amounted to about 14,000 ha. Whilst this is an enormous area to rehabilitate, it amounts to only 4.27% of the combined reserved lands. Those land units remaining in good condition tend to be the rugged upland or sandplain areas, generally not close to water and supporting vegetation which is unpalatable to stock.

Based on de Salis' results, the most degraded areas occur in the Antrim, Nelson and Elder land systems (see Table 4). 33.5% of the total erosion in the Park has occurred in the Antrim lowlands unit which is a narrow belt to the north and west of the massif with cracking clay soils and a sparse to open savanna woodland which has been heavily grazed.

The Nelson land system lies along both sides of the Ord River. The frontage land unit comprises the silts and loams of the Ord River flood plains and supports a fringing woodland over a ground storey of mixed perennial grasses. The area has suffered severe gully erosion and makes up about 30% of the total eroded area. The interfluve lower slopes of the Nelson land system have also suffered severe erosion. The calcareous soils form thin surface crusts but are friable and powdery if disturbed. Most of the vegetation has been removed from this land unit. The lower slopes of the Elder land system also has friable calcareous soils. The sparse vegetation has been heavily grazed, causing some gully and sheet erosion.

TABLE 4
LAND SYSTEMS AFFECTED BY EROSION IN THE PURNULULU (BUNGLE BUNGLE) NATIONAL PARK AND CONSERVATION RESERVE (Based on De Salis 1982)

	Sheet Erosion		Gully Erosion		TOTAL	
Land System	Area (ha)	% of total	Area (ha)	% of total	Area (ha)	% of total
Dockrell Uplands	46	0.9	98	1.1	144	1.0
Elder Cuestas	99	2.0	689	7.9	788	5.8
Elder Lower Slopes	693	14.0	1248	14.3	1941	14.2
Antrim Lowlands	2918	58.8	1674	19.1	4592	33.5
Nelson Interfluve Lower Slopes	1095	22.0	767	8.8	1862	13.6
Nelson Cracking Clay Plains			60	0.7	60	0.4
Nelson Frontage	114	2.3	3960	45.3	4074	29.7
	4965	100	8738	100	13703	100

Rehabilitation Programme

The aim of the existing rehabilitation program is to stabilise soils through the return of perennial vegetation. This requires a reduction in grazing pressure and reestablishment of vegetation by natural regeneration, cultivation and reseeding.

In early 1985, a 90 km stock fence was constructed between Osmond Creek in the north and Dixon Range in the south. This fence was to prevent movement of cattle toward the massif from the Ord River. During 1985 and 1986, approximately 15,000 head of cattle were mustered and removed from the Ord River frontage, Osmond Creek and Purnululu area. In addition, some 3,500 donkeys, 600 cattle and 9 camels were shot with the assistance of the Agriculture Protection Board. The program of feral animal control was continued in 1987, organised jointly between the Department of Agriculture, CALM and the Agriculture Protection Board. A total of 599 donkeys and 643 cattle were shot in the Park that season. Relatively few cattle or donkeys were found on the western side of the massif at that time, but the Osmond Creek and Ord River systems still support large numbers of animals. Dense vegetation and deep gorges provide safe refuge for stock and make mustering or shooting very difficult.

In order to reduce reinfestation of stock and confine those animals already in the area, a number of block fences have been constructed in 1987/8 (see Fig. 7).

Some monitoring points and trial plots for regeneration were established in 1986. These trial plots were subject to strip contour cultivation and a small percentage of the area was seeded with a mixture of introduced coloniser species. Early results indicate that this treatment has been very successful, even without seeding. In addition to the cultivated plots, some large scalded areas east of Blue Hole have quickly responded to the reduced grazing pressure and maintained a good cover of self-seeded, short, annual grasses over the 1987 dry season (see Figure 8).

Implications for Management

1. Large areas of land within the Park have been subject to overgrazing which has caused depletion of vegetation and soil erosion problems.
2. Continued cooperation between the Department of Agriculture, CALM and the Agriculture Protection Board is essential for the continuation of the rehabilitation and soil conservation program.
3. Feral animals must be controlled by suitable means.
4. Movement of people and vehicles in areas susceptible to erosion may exacerbate the existing and potential erosion problems and require control.
5. Regeneration of large areas of grassland and emergence of acacia thickets are creating new areas of high fire risk, especially where they coincide with visitor-use zones.
6. It would be preferable to stabilise soils in the Park with indigenous plant species rather than exotic herbs and grasses.

Objectives

i) To minimise erosion through effective Park management, in particular, through visitor control and reduction of feral animals.

ii) To rehabilitate areas which are degraded as a result of past and present land uses.

Strategies

i) An interagency agreement should be finalised between the Department of Agriculture and CALM defining responsibility for feral animal control and the rehabilitation of degraded areas in the Purnululu (Bungle Bungle) National Park and Conservation Reserve. This agreement will specify that operational plans are prepared in liaison between the Department of Agriculture and CALM, ensuring:

.annual cattle and donkey mustering and trapping

.annual donkey/cattle helicopter shooting

.annual report on expenditure, procedures and successes

.protrammes to control erosion by revegetation

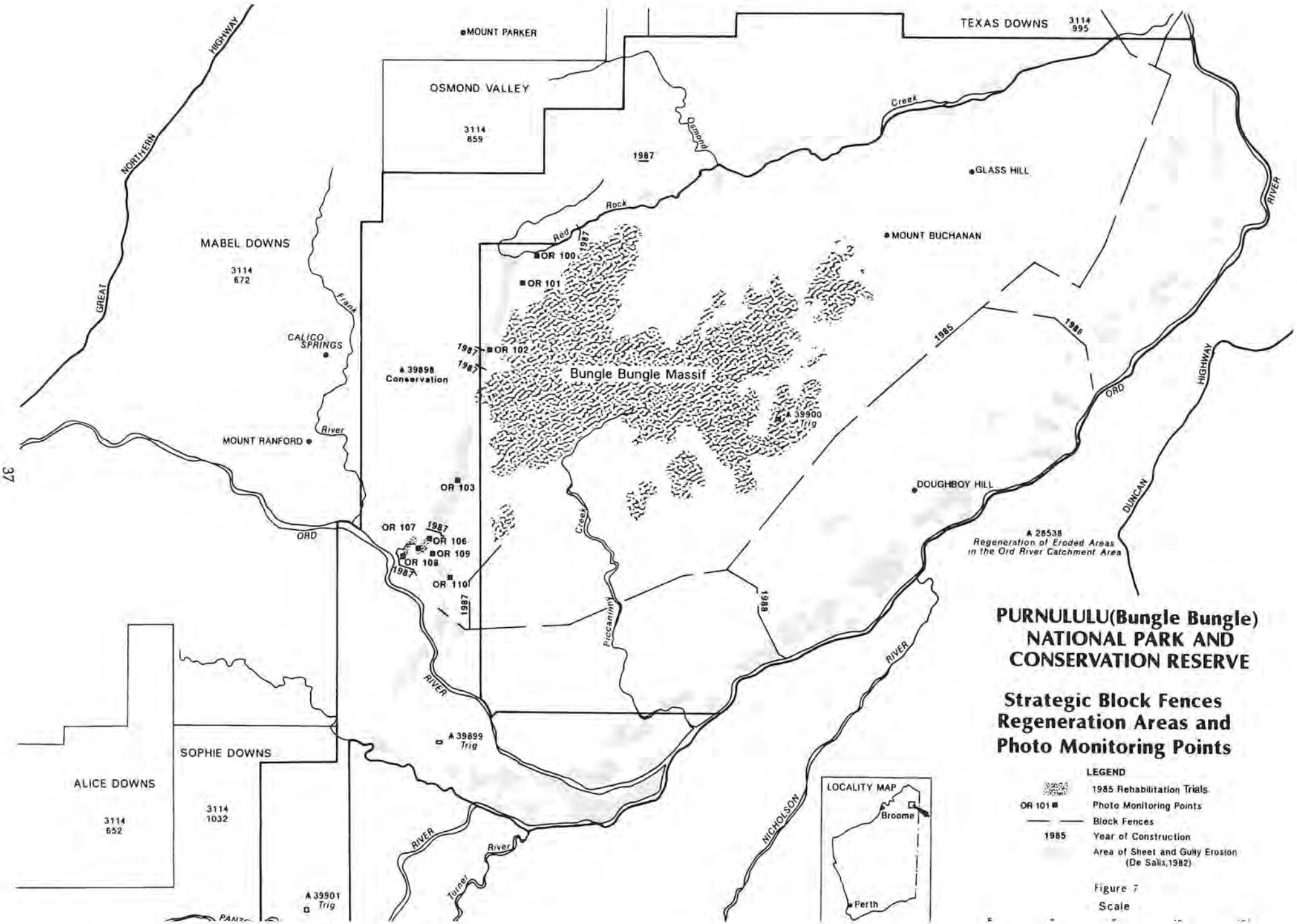

MOUNT PARKER
TEXAS DOWNS
3114
995
OSMOND VALLEY
3114
859
1987
Osmond Creek
GLASS HILL
MOUNT BUCHANAN
Red Rock
1987
OR 100
OR 101
MABEL DOWNS
3114
672
GREAT NORTHERN HIGHWAY
Frank
CALICO SPRINGS
1987
OR 102
1987
A 39898
Conservation
Bungle Bungle Massif
1985
1986
A 39900
Trig
MOUNT RANFORD
River
ORD
HIGHWAY
OR 103
DOUGHBOY HILL
OR 107
1987
OR 106
OR 109
OR 108
1987
OR 110
Creek
A 28538
Regeneration of Eroded Areas
in the Ord River Catchment Area
DUNCAN
1987
1988
Piccaninny
RIVER
RIVER
SOPHIE DOWNS
ALICE DOWNS
3114
652
3114
1032
A 39899
Trig
A 39901
Trig
RIVER
River
Turner
NICHOLSON
RIVER
LOCALITY MAP
Broome
Perth
PURNULULU(Bungle Bungle)
NATIONAL PARK AND
CONSERVATION RESERVE
Strategic Block Fences
Regeneration Areas and
Photo Monitoring Points
LEGEND
1985 Rehabilitation Trials
OR 101 Photo Monitoring Points
Block Fences
1985 Year of Construction
Area of Sheet and Gully Erosion
(De Salis,1982)
Figure 7
Scale

Figure 8: Photographs taken in 1986 and 1987 from monitoring site north-east of Blue Hole, showing regeneration of grasslands in response to reduced grazing pressure

.programmes to control gully erosion where feasible

.construction and maintenance of fences

.involvement of Aboriginal people where possible in feral animal control programs.

ii) Construction of strategic block fences should continue where appropriate to limit the movement of feral cattle and donkeys.

iii) Where it is economically viable, cattle should be mustered and removed from the area. Where mustering is not feasible, eradication of feral animals should continue through the organisation of largescale (aerial) shooting operations, the opportunistic culling by CALM staff where it is considered safe and appropriate, and by trapping.

iv) Cultivation of areas that fail to respond naturally to reduction in feral animal grazing pressure should continue. In particular, effort should be made to control gully erosion through the use of contour banks and other techniques as they are developed and where practicable.

v) Roads and tracks within the Park should be realigned to avoid areas susceptible to erosion following realignment. Existing eroded areas of tracks may require rehabilitation.

vi) Park facilities, living areas and recreation sites should be located in areas least susceptible to erosion.

vii) Fire management programs for the Park should take account of the sensitivity of regenerated areas, and attempt to maintain cover over these areas wherever possible.

viii) Where possible, regeneration trials should investigate the use of local indigenous species rather than introduced species.

ix) Regional staff should continue to monitor rehabilitation of degraded areas in the Park through the use of photo-points and ground traverses. Where necessary the program should be reviewed and upgraded in consultation with Environmental Protection Branch of CALM and the Rangeland Management Branch of the Department of Agriculture.

3.9 HUNTING AND GATHERING

Hunting and gathering of native food species is an important aspect of traditional Aboriginal relationship with the land. Religion, ceremony and sustenance are closely interwoven and the taking of native foods and products is fundamental to the maintenance of cultural heritage.

Between 1867 and 1900 legislation recognising Aboriginal rights to forage was enacted in Western Australia, Queensland, Victoria and South Australia. The intervening years have seen many amendments to the early legislation, with the rights of Aboriginal people to hunt and fish for food very often being considerably reduced in the process (Aust. Law Reform Commission, 1984).

In Western Australia the Wildlife Conservation Act 1950, contains general provisions relating to the taking of certain flora and fauna. Under Section 23, Aboriginal people are exempted from these provisions and may take flora and fauna for food from all land, including Crown Land, excepting a nature reserve or wildlife sanctuary; food so taken may be sufficient only for a person and family but not for sale and not if the species is likely to become unduly depleted. This exemption requires the consent of the occupier of that land.

National Parks, State forests and other lands managed by CALM are deemed to be 'occupied' for the purposes of this Act. It follows, therefore, that the consent of the Executive Director is required for Aboriginal people to hunt, fish or gather from the Purnululu (Bungle Bungle) National Park and Conservation Reserve.

In the Northern Territory, Aboriginal people have generally unrestricted rights to hunt for food and for ceremonial purposes (except for the purpose of sale). Provision has been made for hunting and foraging in Gurig, Uluru and Kakadu National Parks. In each of these Parks, the plans of management require that the effects of traditional use be monitored, and if any species or community is threatened by these practices, then controls may be established in consultation with traditional owners.

Similarly, in other countries such as Canada, Alaska, Finland, Nepal and New Zealand, native people pursue hunting and gathering activities in parks and reserves.

It has been suggested that modern technology such as guns and vehicles have upset the balance between hunting and conservation for Aboriginal people but there has been very little research to evaluate the impact of these practices. The Australian Law Reform Commission (1984) takes cognizance of these different viewpoints and acknowledges that no simple solution is possible. It suggests, however, that more equitable arrangements may take account of Aboriginal traditions and practices, of their relationship to the land, and the fact that cultures are dynamic and traditions change.

Implications for Management

1. Traditional practices, including hunting and gathering are an important element in the maintenance of Aboriginal cultural heritage.

2. Members of the Purnululu Aboriginal Corporation have requested that they be permitted to hunt and collect traditional bush foods within the Park by means including firearms, subject to agreeing that in some areas firearms would be prohibited.

3. According to the Wildlife Conservation Act, the Executive Director may consent to Aboriginal persons taking flora or fauna from the Park, sufficient only for food for themselves and their families, but not for sale.

4. None of the rivers or creeks in the Park flow continuously during the dry season. A few permanent and semipermanent pools exist which provide refuge for a variety of flora and fauna. These waterholes have traditionally provided refuge also for the Aboriginal people of the area.

5. The gathering of native honey (sugarbag) and the use of trees and other vegetation for production of tools and artifacts, construction of shelters and for firewood could cause impacts such as the localised depletion of vegetation, especially around living areas and along roads and tracks.

6. It is an offence to carry or discharge any firearm in a reserve without permission (National Park Regulations).

7. National Park Regulations stipulate that persons without authority may not drive a vehicle on any part of a reserve other than:

a) a formed road

b) a parking area

c) a track approved for vehicular use.

Objective

To provide for Aboriginal people to maintain their social, economic and religious practices in harmony with the conservation and management of the natural and cultural resources of the Park.

Strategies

i) Areas within the Park and Reserve should be designated for use by Aboriginal people for traditional activities such as hunting and gathering or ceremonies.

ii) Guidelines for Aboriginal hunting and gathering should be developed to ensure that:

a) natural resources do not become unduly depleted

b) such activities are not carried out in or near visitor-use areas

c) any firearms in the Park will be licensed and separately registered with CALM's District Manager and operated within strict safety procedures, as discussed in Section 8.6

d) suitable access is provided to areas established under (i) above for hunting and gathering.

e) The impact of these activities should continue to be monitored and the guidelines reviewed as necessary.

iii) Information known to Aboriginal people about the flora and fauna and its uses should be documented according to their wishes and used for the information of Park visitors.

iv) Research should be undertaken to provide a data base of the natural resources of the National Park and Reserve and a system of monitoring implemented so as to measure changes if they occur.

3.10 FIRE

Fire has always been a feature of the northern Australian environment. Natural fires, the result of lightning, often occur during the build up to the wet season around October/November. However, fire also occurs as a result of human activities and practices, and this has been the case thoughout the 20 000 or more years of Aboriginal occupancy of the Kimberley.

The usual pattern of traditional Aboriginal burning was to fire small strategic patches of country at different times, with occasional larger burns late in the season resulting in a complex mosaic of different fire ages (Haynes 1985, Kimber 1983, Lewis 1985). Other research indicates this patchy burning produces a mixture of open and dense vegetation which supports a range of animal species with different forage and shelter requirements (Burbidge 1985, Hallam 1985, Latz & Griffen 1978). Such a mosaic also provides an effective buffer against passage of wildfires.

Since the turn of the century burning practices have been greatly modified with the movement of the Aboriginal people from the bush to population centres. At the same time, throughout much of north-west Australia, pastoralists adapted the use of fire to promote the productivity of a single species, cattle. Information from local residents of the East Kimberley indicates that the general practice of pastoralists has been to fire the spinifex country to promote feed for cattle. Sometimes fire was also used to drive cattle. No detailed fire records have been kept, but it appears that pastoral fires were generally very extensive, unlike the traditional small patch burns of the Aboriginal people.

Selective grazing pressure and frequent widespread fire led to changes in the vegetation. The mosaic structures have mostly been destroyed and it is believed that this has played a major part in the disappearance or reduction of many plants and animals. Burbidge (1985) and others have noted a decline in the intermediate sized mammals (45gm-5kg) of the arid zone which seems to coincide with the cessation of traditional burning practice.

In recent years, since the resumption of pastoral lands as a regeneration reserve, fire has been rare in the Purnululu area. The continued grazing pressure kept vegetation to a minimum, at times removing it altogether. Reduction of feral animal numbers since 1985 has in places resulted in the rapid growth of some grasses and shrubs causing a build up of fuel.

A small scale trial burning program has commenced in the Park pending the development of a formal fire management program. This trial is aimed to reduce the risk of wildfire in the visitor areas of the Park, to monitor the effects of burning, and to protect regeneration areas. The subject of campfires is discussed in Section 5.3.1.

Implications for Management

1. Before the arrival of Europeans, Aborigines in the Purnululu area lit small patches of country at different times, creating a mosaic of vegetation at different stages of recovery from fire. This provided a range of habitat conditions for many animal species as well as maximum protection against intense wild fires.

2. Some moist sheltered areas of the National Park and Conservation Reserve appear to have never or rarely been burnt. These areas are likely to support fire-sensitive species of restricted distribution and may be of special conservation value.

3. Reduction of grazing pressure by removal of cattle and donkeys from the Park area since 1985 has allowed the rapid growth of grasses and shrubs thereby increasing the wild fire risk during the dry season.

4. Human activities, either deliberate or accidental, may result in wildfire.

5. Information about the long term effects of various fire regimes, including fire exclusion, is limited and any fire management policy must be under constant review and accompanied by research and monitoring programs.

6. Provisions of the Bush Fires Act and the CALM Act relating to fire prevention and control of wildfires on or near CALM lands should be complied with.

Objectives

i) To protect community and environmental values within the National Park and Reserve from damage or destruction from wildfire.

ii) To use fire as a management tool to achieve habitat diversity and other land management objectives.

Strategies

i) There is not enough information available at this time to produce a comprehensive fire management plan for the Park. However, a fire management plan should be prepared in about 3 years and published as an amendment to this management plan. So far as can be determined, the plan should be based on traditional burning regimes to restore and maintain a mosaic of vegetation ages and structure. The protection of life and property will be of the highest priority. The plan should provide a strategy for establishing and maintaining strategic low fuel buffers to protect high value areas in the Park and Reserve and to protect from wildfires those areas that should not be burnt too frequently.

ii) In the interim, until a fire management plan is prepared, the only prescribed burning which will be undertaken in the Park will be research/experimental fires and for the protection of life and property.

iii) CALM should ensure that traditional Aboriginal custodians are involved in the implementation of the Park fire management plan.

iv) Unplanned fires should be contained by the most appropriate means available, taking into consideration the values at risk and the impact of the supression activity on the environment, season, fire behaviour, access and resources available.

v) Prescribed fires should be used in accordance with the fire management plan to achieve a range of management objectives including fuel reduction, habitat management, regeneration and the management of scenic and cultural values.

vi) CALM officers should work together with members of the Purnululu Aboriginal Corporation to research traditional burning methods and trial experimental operations.

vii) Research programs should be implemented as soon as possible to assess the habitat requirements of fire-sensitive species of flora and fauna.

viii) Records should be kept of all fires in the Park, both planned and unplanned, and wherever possible, the effects of such fires should be monitored.

ix) CALM should participate in the preparation and implementation of regional fire strategies and interagency agreements with the Bush Fires Board and with neighbours.

x) CALM staff should be trained in fire suppression and management techniques. CALM's Protection Branch will assist in providing appropriate training and also will provide new information and technology to all staff and concerned organisations.

xi) CALM should promote public awareness on the effects of fire on the natural environment and the importance of prevention of wildfire.

4. MANAGEMENT OF CULTURAL RESOURCES

4.1 TRADITIONAL USE AND SIGNIFICANCE

The traditional Aboriginals of this region are river people. They are members of several major language groups, and most of them are multilingual, or at least bilingual. Their languages include Kija, Jaru, Malngin, and Miriwung.

In terms of the larger region of which Purnululu is part, the focus of Aboriginal life is a major river system-, the Ord River. In the local Aboriginal languages, place names refer to particular features of the Ord River and its tributaries: narrow gorges and large pools of water, rockholes or soaks in its upper reaches or tributaries where the flow is seasonal or intermittent, places where it flows over flat slabs of rock, and places where it fans out and forms a sandy bed are all features which may be named and serve as reference points for surrounding areas. The confluences and the rocks, trees, and other features are similarly named.

In this kind of landscape, features such as rocky outcrops, sandy areas, and stands of trees, are viewed in terms of their relation to rivers, creeks, streams, and their confluences. Thus the Bungle Bungle massif is described in relation to the Ord River and two of its tributaries, Osmond and Bellburn Creeks.

Occupation and Use

Places where people used to gather are located along rivers or creeks. Such places were hubs of economic activity including a widespread trading network, as well as social life. People gathered from a number of surrounding areas at a large water pool at the invitation of the head of the group owning the site to take part in joint harvests. They took a large quantity of fish, perhaps by stunning them with a toxic substance placed in the pools which was extracted from the leaves of certain bushes and plants (several could be used for this purpose), or by netting the fish in large rolls of spinifex pushed through the pool. Some fish might be dried on rocks or sheets of bark, and were sometimes salted in the drying process, then wrapped in bundles of paperbark. The heads of families from other areas taking part in the harvest would make gifts to the head of the local group before returning to their lands. The harvest might take four to five days and during this time people would also be busy with other activities such as arranging marriages and performing ceremonies, including those connected with rites of passage.

Middle-aged people of the current generation describe such gatherings, in which they took part during their childhood and early adulthood, with nostalgia. These places are still visited for fishing and harvesting of fruits, tubers, and other foods. They teach their children about the resources of the land and its religious meaning, and they tell stories of events, both in the lifetime of known generations and in the mythological era of 'Dreaming'. They also educate their children in their vast knowledge of the geological characteristics of the land, its waters, plants, and animals, and the use of fire to manage its resources.

In addition to the riverine environment, two other types of environment occur within the Purnululu area and were related to the seasonal patterns of traditional life: the sandplains which occur predominantly to the south and east of the massif and the uplands, or hills and ranges. In terms of their economic importance, the uplands can be further divided into plateau and fringe. The sandplain area and the margins of the upland zones, including the massif itself, were all of economic and spiritual importance. Areas of significance, sandstone overhangs with rock art, hand stencils, engravings and seed/ocre grinding marks occur at frequent intervales along the base of the massif. These sites are associated with water, although not all are permanent sources of water.

During periods of heavy rain, the run-off from the massif forms large, temporary pools of water around its perimeter. This run-off maintains a fringe woodland community dominated by *Eucalyptus collina*. This fringe was generally occupied and used by small groups of people for limited periods of time during and immediately after the heavy rains, when water is widely distributed throughout the landscape.

In addition, there is oral and archaeological evidence of Aboriginal use of the top of the massif. Oral accounts tell of small groups of people living there for short periods, and include descriptions of the means of their ascent and descent. In some places it was necessary to use a 'ladder' made by cutting notches in a pole. To ensure a descent by the same route stone trail markers were used.

Social Organisation

In the Purnululu area groups of people speaking a common language are the custodians of extensive areas of land. At that level, mythological accounts provide the basis for boundaries between groups. Within these large language-defined groups, individual or family groups are responsible for smaller areas on secondary drainage systems, with confluences and interfluves frequently serving as boundaries. These localised groups, while related by common language and much else, may also be distinguished by minor dialectal differences and localised mythological sites and events. Traditional Aboriginals refer to these named local areas in discussing the interests of individuals and families.

A senior man is head of each local group, and is responsible for organising its economic activities, including trading relations, settling disputes between people within his group or territory, arranging and participating in religious rituals, and managing and protecting the local area. He and his group share responsibility for the safety of all persons who are on their land; hence the importance of seeking appropriate permission before entering the land of another group, for any purpose, even to travel through it. Moral tales convey the warning that people

who enter others' land without appropriate permissions not only risk suffering severe sanctions themselves, but also put the custodians at risk.

A widespread exchange network, called *winan*, exists throughout the Kimberley. Much is known about the routes and extent of *winan* in the East Kimberley, including its links with similar networks in the Daly River and the Western Desert areas. Ritual plays a role and objects used in ceremonies are exchanged. Primary exchanges in the past appear to have been in economic commodities: tools, weapons, and raw materials, as well as foodstuffs (mostly prepared for long-term storage). This system of exchange was based on trading partnerships established between individuals of different and geographically separated groups. It was necessary to assure that obligations to one's primary trading partner were met, but exchange was not limited to that partner. Accounts of *winan* at places where large numbers of people gathered- for example on the Ord River- suggest comparisons with barter and exchange practices of societies in other parts of the world. These stories tell of large numbers of people meeting together, where the people came from, what they brought with them to trade, and how the trading was conducted.

Within the region of which Purnululu is a part, Aborigines may acquire proprietary interests in land in a number of ways but primarily through their father (and father's father), and through their mother (and mother's father). Interests in land may also be acquired through place of birth, place of conception, and through the sites of burial of close relatives.

Present Aboriginal Interest

Radiocarbon dating shows that Aboriginal people have lived in the region for at least 20,000 years and it is possible that further archaeological study will reveal earlier occupation. The present traditional Aboriginal custodians of Purnululu have maintained their continuous responsibility for it. Some were born in the area which is now a national park: close relatives as well as ancestors are buried there. Even children and young people who had yet to visit the area knew its features and its stories long before its 'discovery' by the media in 1982/83.

Middle-aged Aboriginal people, then living in Turkey Creek and surrounding areas, tell stories of how they helped pastoralists in the Purnululu area in the past, and remark that the cattle business could not have prospered without their knowledge of the country. They point out tracks they made for pastoralists vehicles and where they camped. Barely scratching the surface of the ground they reveal evidence of their earlier habitation and that of older generations: rusting tobacco tins and pannikins, parts of a child's toy constructed from tobacco tins and wire, as well as stone tools. Some of these things still lie undisturbed in remote rockshelters. Some people can point to the outlines of their hands on the walls of rockshelters, painted by their fathers with pipeclay or red ochre when they were children. Older men point out the ceremonial grounds where they were initiated, and name the people who attended, and where they were from.

Aboriginal people describe with sadness the changes to the land and the rivers since the arrival of Europeans in the Kimberley. The principal changes have resulted from overgrazing and subsequent soil erosion, once large and abundant water holes are now 'covered up' and have little or no water in them. Places they remembered as big, deep waters filled with fish bream, rock cod, perch, barramundi, catfish and crocodiles, water goannas, and turtles, are now stagnant shallows with few fish or other creatures in them.

Some 'bush tucker' is rare or no longer to be found. One such food was the formerly abundant seed of a grass that grew along creek banks and on the flats. Cattle quickly ate it out. Some animals once prized as food have also become locally extinct, or nearly so, in the Purnululu area. These animals include bandicoot and possum as well as kangaroo and emu. Some traditional custodians consider that these local extinctions and the present condition of the country result from the fact that they have been denied control of the area for nearly a century. They wonder if the 'Dreaming' took the plants and animals away because traditional Aboriginal people have been prevented from looking after the country by means such as planned burning and the performance of ceremony.

Purnululu is a rich area in the view of Aboriginal people, and they belong to it. It is country to which they have the strongest ties of spirit, family history, and personal identity. It is also country on which they pin their hopes to develop communities according to their own plans. Their plans include independence, based on creating appropriate educational and health facilities under their own direction and economic enterprises such as touristbased ventures: these all add

up to creating communities in which individuals are healthy and can develop with pride and independence their Aboriginal way of life. Aboriginal society is, like all others, continuously changing in response to changing circumstances.

The traditional Aboriginal custodians of Purnululu formed the Purnululu Aboriginal Corporation (PAC) in response to the changing social and political situation that resulted from the Western Australian Government's proposal to gazette the area as a national park. To accommodate both Aboriginal and European involvement in the area, the Aboriginal people have needed to adopt European mechanisms to ensure that they retain their traditional role of responsibility, and can maintain a continuing role in managing the land.

Consistent with the Government decisions described in Section 1.1.4, this plan provides for Aboriginal people to live in the Purnululu (Bungle Bungle) National Park. The concept of an inhabited national park is relatively new in Western Australia, but many successful models exist in other States of Australia and elsewhere around the world. An inhabited national park is one which makes provision for occupation by the traditional custodians, or indigenous people, of that land and integrates the protection of natural and cultural ecosystems. The International Union for Conservation of Nature and Natural Resources (an association of scientists and managers who draw up guidelines for nature conservation), endorses the concept of the occupation of traditional lands by indigenous people, and utilization of resources in a sustainable manner in harmony with their environment (IUCN, 1980).

The presence of Aboriginal people living on traditional land can substantially enhance the management of a national park. An Aboriginal Ranger Training Program is already underway in the Purnululu (Bungle Bungle) National Park and proposals have been developed for the establishment of living areas for Aboriginal residents.

4.2 PROTECTION OF ABORIGINAL SITES AND CULTURAL OBJECTS

Under Aboriginal customary law, the traditional Aboriginal custodians of the Purnululu region are responsible for country including the National Park and Conservation Reserve. In particular, they have responsibility and obligations in relation to the protection, preservation and management of areas and objects of Aboriginal significance associated with that country. These responsibilities and obligations are of continuing importance to the traditional custodians. It is important for CALM to facilitate the carrying out of these responsibilities and obligations.

Under the provisions of the Aboriginal Heritage Act (1972) all Aboriginal sites and Aboriginal cultural objects in Western Australia are protected. The Trustees of the Western Australian Museum advise and assist the Minister for Aboriginal Affairs and are responsible for the administration of the Act. The Trustees are responsible for the care and protection of Aboriginal sites and objects (as defined in the Act).

As of June 1988, research undertaken in the course of an Aboriginal cultural resources documentation programme instigated and coordinated by the Purnululu Aboriginal Corporation (PAC), has recorded over 250 areas of continuing significance to traditional custodians. A further 80 sites of archaeological and/or historical significance have been located within the National Park and adjacent Reserve. This research is continuing.

The management and protection of these areas and others yet to be recorded, is of vital concern to traditional custodians. There is an urgent need to establish an appropriate mechanism by which the development of park infrastructure can proceed without endangering the cultural heritage of Aboriginal people.

In recognition of this need, PAC has set up the Purnululu Cultural Heritage Committee (P.C.H.C.). The members of this committee comprise Aboriginal people with traditional responsibilities covering all areas of the National Park and Conservation Reserve. It is proposed that the Registrar of Aboriginal Sites be an ex officio member of this committee.

The functions of this committee will be to consider any proposals in relation to the National Park or Conservation Reserve which may affect the Aboriginal cultural heritage of the region, and to advise the Park Council and, where necessary, the Minister for Aboriginal Affairs as to any adverse impact.

Under the Aboriginal Heritage Act the Trustees, with the written consent of the Minister, may delegate their powers and duties in relation to certain sites and objects. PAC has applied to the

Trustees to give their authority to the P.C.H.C. to exercise and perform their statutory powers and duties in relation to Aboriginal sites and objects within the National Park and Conservation Reserve.

4.3 EUROPEAN HISTORY

The first European records of the East Kimberley area were made by Alexander Forrest who explored the area in the late 1870's. Land in the Kimberley was available for lease from 1880, and the lands along the Ord River were quickly stocked with cattle. The Bungle Bungle Working Group Report (1986) describes the pastoral history of the Park area including the various lessees.

As described in Section 3.8, a large area of the Ord River catchment including the present Park was resumed from pastoral use in 1967 for the purpose of regeneration. Very little management occurred in the vicinity of the Park until 1985, when an extensive stock fence was constructed and cattle mustering commenced.

A few signs remain in the Park of the early pastoral history: some old stock yards, derelict fence lines and the bare remains of an old camp as well as some disused bores.

The area has not been subject to much direct use, except for cattle grazing, apparently because of the very rough terrain. Until the recent interest in in the 1980's, it seems that the only other European people to visit this area were the occasional geological expeditions and mining exploration teams.

Implications for Management

1. Under the provisions of the Aboriginal Heritage Act, 1972, all Aboriginal sites and cultural objects in Western Australia are protected, including those sites and objects located within national parks and reserves.

2. Under Aboriginal customary law, traditional custodians continue to be responsible for protection and management of sites and objects of cultural significance occurring in the Purnululu area.

3. The Aboriginal cultural environment is best managed by the traditional Aboriginal custodians.

4. The Bungle Bungle massif and its immediate surrounds has been classified by the National Trust of Australia (WA) as being of heritage value.

Objectives

i) To recognise, protect and promote the cultural values in the National Park and Conservation Reserve.

ii) To ensure the protection, preservation and management by the traditional custodians of all Aboriginal sites and objects within the National Park and Conservation Reserve.

Strategies

i) All issues involving Aboriginal sites and objects will be referred to the Purnululu Cultural Heritage Committee (PCHC) which has been established by the Trustees of the Western Australian Museum.

ii) Sites of European historical interest should be recorded and where appropriate, site development plans should be prepared for approval by the Regional Manager or his representative.

5. MANAGEMENT FOR VISITORS

5.1 EXISTING VISITOR USE PATTERNS

Regional Patterns

The Kimberley Region is experiencing a major increase in visitor traffic. Tourism figures produced by the Australian Bureau of Statistics (Department of Regional Development and the North West 1986), based on commercial accommodation data, show an increase in visitor numbers to the Kimberley Region from 1980 to 1986 of almost 61% and an increase in tourism expenditure from 1984/85 to 1985/86 of 14.6%.

The Western Australian Tourism Commission has conducted research to identify market segments and preferences (WATC, 1987). The results of these studies attribute much of the increased tourism to the Region's diverse appeal. The Kimberley can offer visitors a wide range of attractions, including the "Australian outback"; the Region also has its own distinctive character for the visitor to experience.

The segmentation studies show that people's attitudes and preferences are different now from what they were a decade ago. More people now seek holidays which include adventure, different cultures, interesting landscapes and scenery as well as new experiences. An example of changing demand is the increased popularity of luxury camping with high quality catering in tent accommodation. The emphasis is on more information and education, smaller, more intimate developments and the need for an authentic Australian environment (WATC, 1987).

The tourism industry has responded rapidly to these demands and the Purnululu (Bungle Bungle) National Park is seen by many to increase the diversity, and perhaps provide the major attraction, of the Region.

The Kimberley is serviced by daily jet air services to Kununurra, Derby and Broome.

There is only one access road which joins Purnululu (Bungle Bungle) National Park to the main regional road, Highway 1 (now completely sealed), between Halls Creek and Kununurra. The Park access road passes through some extremely rugged terrain and crosses numerous creeks along the way. It is suitable only for four wheel drive, high clearance, vehicles.

Commercial tour operations to the Park have developed rapidly since the area's first promotion in 1982. In 1987, there were thirty eight tour operators, based either in Western Australia or interstate, with tour programs featuring the Bungle Bungle massif. Of these, there were three Kimberley based tour operators and six Kimberley air charter companies servicing the area. There are also at least two operators providing guided walks/hikes through the area.

All of the local air charter companies provide scenic flights over the Bungle Bungle massif. There is currently no authorised landing area in the Park. Each of the vehiclebased tour operators provide a four wheel drive camping holiday, usually featuring 2 to 3 nights in the Park.

Tourism Input to the Plan

A representative of the Western Australian Tourism Commission was appointed to the planning group to assist in preparation of this management plan. The Commission prepared and circulated a discussion paper on tourism in the Bungle Bungle area in 1987. Twenty four written responses were received from members of the tourism industry. Members of the industry and related groups were then invited to attend forums in either Perth or Kununurra to discuss the positions put forward in the submissions.

The discussion groups at each forum agreed that the remoteness and wilderness characteristics of the area comprise the principal attraction and that excessive commercialisation would spoil this. Group participants made constructive suggestions regarding such management issues as access, entrance fees, tourist services, park development, leases and permits and the formation of an advisory body.

Visitor Survey

Despite the rugged access and fairly hostile conditions, visitor numbers to the Bungle Bungle area have steadily increased since the early 1980's. No visitor statistics were recorded prior to 1986; in that year estimates were compiled from tour operators' data and projected figures from data collected by CALM staff. In 1987 and 1988 road traffic counters were used to count vehicle passage; daily records were also kept by Park Rangers.

According to a visitor survey conducted in the Park in 1987, only 16% of visitors went beyond existing recreation sites in the Park. Sixty seven percent of survey respondents indicated that they appreciated the experience of remoteness, but most people prefer to be directed to features of interest through signs, maps and information.

There were two campsites established at Bellburn Creek and Kurrajong on the western side of the massif during 1987. The Bellburn Creek campsite, has a water bore fitted with a hand pump, providing the only public water source in the Park. A Park Ranger base was also established at this site. According to the survey, 64% of visitors camped here under the shade of trees lining the

dry creek bed. 21% of respondents camped at Kurrajong, located just north of Three Ways. Pit toilets were provided at both of these campsites.

Smaller numbers of people made their own camps in the northern parts of the Park, perhaps because of the distance to travel back to Kurrajong or Bellburn, or perhaps because some prefered a more isolated location.

Despite the different origins and ages of visitors and regardless of their method or direction of travel, virtually all visitors to the Park in 1987 appreciated the intrinsic values of the natural environment, enjoying the camping and scenery and natural history.

There was a strong preference from Park visitors to retain the natural, unspoilt character of the area and protect it from degradation, misuse and overt commercialisation. Visitors indicate a desire to have a "wilderness" experience in this Park. The wilderness theme is complemented by the cultural heritage of the area. This heritage value has the potential to become a major attraction for visitors along with the obvious scenic values.

TABLE 5. Estimated Visitor Numbers to Purnululu (Bungle Bungle) National Park, 1986-88

	1986	1987	1988
On-ground Visitors (April/September)	2,350*	3,400#	3,643#
Air-tour Passengers (Annual)	4,690+	15,500+	

* Figure derived from Ranger observations and tour operators' data.

\# Figures derived from road traffic counter in Park.

\+ Figures derived from air tour operators data

5.2 ACCESS

5.2.1 Roads

Background

Road access to the Purnululu (Bungle Bungle) National Park is difficult because of the extremely rugged terrain and numerous creek crossings. During the wet season and at times of intermittent rainfall, the water level in the creeks may rise and flood very rapidly. Construction and maintenance of roads in the area is very costly.

The assistance of the Main Roads Department was sought early in the planning phase to advise on the selection of an access route into the Park. The Main Roads Department has now prepared a detailed road planning report (1988).

The Park is surrounded to the north and west by pastoral stations and to the south east by the Ord River Regeneration Reserve. The nearest major road is Great Northern Highway, which is 30 km to the west of the Park. To the east of the Park is Duncan Road which serves the pastoral stations along the Western Australia/Northern Territory border.

Existing Access Route

There is only one four wheel drive standard public access route currently in use, known as the Spring Creek Track. A second route via the Osmond Valley pastoral lease was also in use until early 1987 when it was closed by the lessee.

The Spring Creek Track commences 109 km north of Halls Creek on Great Northern Highway, just north of Spring Creek. It follows the Ord River valley east, then turns north-east towards Sally Melay Bore. It crosses some very rough terrain and major creeks; its winding path taking it 55 km in all before entering the National Park.

The main access route within the Park connects to a four wheel drive track which extends in an arc around the western face of the massif from Echidna Chasm to Piccaninny Creek. This track follows and crosses numerous creek beds. Access to the gorges is generally along stream beds which consist of cobbles and boulders. Where the track crosses the friable sand plain, areas of bull dust have developed.

Future Route Options

The selection of route options was governed by

i) management priorities

ii) terrain and drainage patterns.

The option of an access route from the Duncan Road was not explored as this would inevitably open public access to the Ord River Regeneration Reserve and the vast eastern part of the Park. The modest management structure envisaged for this section could not possibly cope with opening up this large area, nor is it seen as desirable to allow increased vehicle activity in the vicinity of the Ord frontage plains.

For these reasons, the preferred access corridor should connect Great Northern Highway with the western part of the Park. The presence of granite hills adjacent to the Highway limited the choice of commencement points to either the Turkey Creek area or near Spring Creek. These two alternatives were explored further by the Main Roads Department, together with the planning group, to define possible route options.

A single access road is preferred to dual or multiple points of access, because of:

i) the reduced development and maintenance costs

ii) more effective monitoring and control of vehicles and visitors;

iii) minimizing the number of vehicle tracks in this sensitive environment.

The preferred access route commences north of the Spring Creek Crossing of Great Northern Highway, not far from the present turn-off and follows the Ord River Valley on the north side. About 10 km from the Highway, the road deflects northwards, traversing the Black Hills, and continues in an overall north easterly direction toward those parts of the Park managed for visitor use and recreation.

This route offers a number of favourable points:

.it is the shortest of the available options, being only 42.3 km long, a considerable reduction when compared to the existing Spring Creek Track which is 55 km. This shorter distance offers a considerable saving in construction and maintenance costs as well as the time required to traverse the road.

.it requires less earthworks than any of the other available options.

.it has been designed to take optimum advantage of the high scenic values; in particular it offers a spectacular view of the massif from a ridge to the west as one enters the Park.

.while the preferred route passes through an active pastoral lease,

a great deal of the way is through country which was classified by Rangeland Management Branch (Department of Agriculture, 1985) as of very low potential or unsuitable for cattle production.

Road Standard

It is important that the access journey complements the nature of the visitor experience in the Park. As mentioned earlier (Section 5.1) an essential aim in the future management of this Park is to retain the feeling of remoteness. To complement this feeling, the access road should be low level 4 wheel drive standard.

The Main Roads Department study investigated the route options with the view of achieving:

i) a minimum horizontal design standard of 80km/hr in difficult terrain

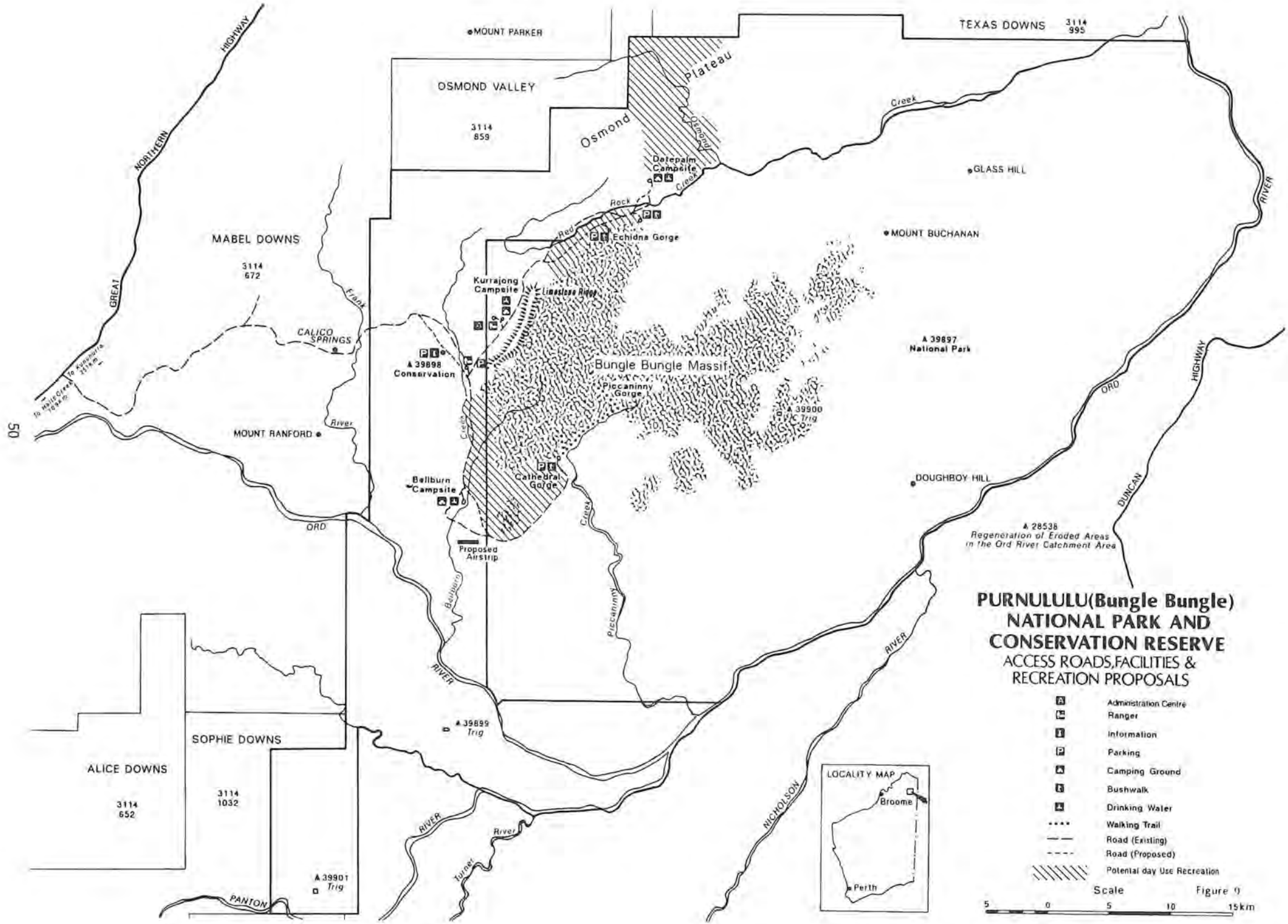
ii) maintaining the vertical alignment at a low standard

iii) creek crossings should be kept to a low standard with rubble crossings at stream bed level.

The staging of the road and track development is critical to Park management. It would degrade both the environment and the visitor experience to facilitate public access beyond the capability of on-ground management and infrastructure.

Internal Roads

An effective network of roads and tracks is needed within the Park to service the needs of visitors, park residents and management. In their study of the area the Main Roads Department also considered the realignment of roads within the Park. The final alignment will require ground survey but it aims to follow the northsouth arterial link, connecting major campgrounds


MOUNT PARKER
TEXAS DOWNS
3114
995
OSMOND VALLEY
3114
859
Osmond Plateau
Osmond Creek
Datepalm Campsite
GLASS HILL
MOUNT BUCHANAN
MABEL DOWNS
3114
672
GREAT NORTHERN HIGHWAY
Rock Creek
Red Creek
Echidna Gorge
Kurrajong Campsite
Limestone Ridge
Frank Creek
CALICO SPRINGS
To Halls Creek 163 km
To Kununurra 211 km
A 39898 Conservation
Bungle Bungle Massif
Piccaninny Gorge
A 39900 Trig
A 39897 National Park
MOUNT RANFORD
River
Bellburn Campsite
Cathedral Gorge
DOUGHBOY HILL
ORD HIGHWAY
DUNCAN
Proposed Airstrip
Bellburn Creek
Piccaninny Creek
A 28538
Regeneration of Eroded Areas in the Ord River Catchment Area
ORD RIVER
A 39899 Trig
SOPHIE DOWNS
ALICE DOWNS
3114
652
3114
1032
A 39901 Trig
PANTON RIVER
Turner River
NICHOLSON
LOCALITY MAP
Broome
Perth
PURNULULU(Bungle Bungle)
NATIONAL PARK AND
CONSERVATION RESERVE
ACCESS ROADS, FACILITIES &
RECREATION PROPOSALS
Administration Centre
Ranger
Information
Parking
Camping Ground
Bushwalk
Drinking Water
Walking Trail
Road (Existing)
Road (Proposed)
Potential day Use Recreation
Scale
5 0 5 10 15km
Figure 9

and the main access road. There should be feeder tracks to selected points of interest, mainly day-use sites, with car parking defined in suitable locations. Where appropriate, the feeder tracks could follow stony creek beds to points of interest.

The standard of the north-south internal track is intended to be similar to that of the access road. In some areas, because of the soil type and intensity of use it may be necessary to form and gravel surfaces to reduce the level of environmental impact.

Some additional tracks will be required for management purposes, such as fire management and access to rehabilitation areas and areas of cultural importance to traditional custodians if requested by the proposed Park Council. Access will also be required for the servicing of facilities, to the ranger station and to living areas within the Park.

Implications for Management

1. During periods of heavy rainfall creeks may rise and flood, cutting off road access within or to the Park.
2. The proposed access road passes through Mabel Downs pastoral lease for most of its journey.
3. Construction and maintainance of roads in this remote and rugged terrain is costly.
4. Both the main access route and internal tracks cross numerous creek beds and wide tracts of country which have high erosion potential
5. The tourism industry has sought alternative Park access roads for their operations.
6. Sites of cultural and biological significance may be at risk from visitor and vehicle impact.
7. Some sections of the road and carparks will require hardening with materials not available in the immediate vicinity.
8. In the visitor survey conducted during 1987, respondents generally liked the four wheel drive standard of access, although many (26%) suggested that some roadworks were necessary or desirable in the Park.

Objective

To provide access which is consistent with the maintenance of conservation and cultural values and the diverse range of user requirements.

Strategies

i) A single road is recommended to provide access from Great Northern Highway to the National Park, following the alignment shown in Figure 9.

ii) The overall standard of the main access road from Great Northern Highway should be low level four wheel drive standard, with creek crossings at stream bed level. The internal roads within the Park should be gradually improved to better than '4 wheel drive standard'.

iii) The Shire of Halls Creek and CALM should share responsibility for establishing and maintaining the Park access route, which traverses a private pastoral lease.

iv) A biological and cultural site survey should be carried out to ensure that the road works will not lead to disturbance of areas of significance.

v) The Park should be closed to general public access each year during the wet season when risk to visitors and damage to roads is likely.

vi) Roads and carparks should be surfaced and improved as necessary with materials obtained from strategically located borrow pits (see Section 3.2.2).

vii) Close monitoring of environmental impact of existing and proposed roads should be conducted for the next 3-5 years before any further track development or alternative exit route proposals are contemplated.

5.2.2 Aerial Access

Currently the most popular method of viewing the Park is from the air. Six Kimberley air charter companies conduct aerial tours over the Park, departing from Wyndham, Kununurra and Halls Creek. In 1987, an estimated 15,500 passengers were carried.

The rapid growth in demand for air tours to view the spectacular landforms has led to a degree of congestion over the massif during the peak viewing times of early morning and late afternoon during the dry season. The Civil Aviation Authority has issued an instruction to pilots designating flight patterns and procedures. The planes currently used for these flights are mostly 4-6

seaters. It is possible that use of larger aircraft may help reduce congestion of airspace over the massif.

Many tour holiday packages are now offering passengers the optional extra of a pre-booked flight over the Purnululu (Bungle Bungle) National Park. There is a great opportunity for air charter companies to link in with local or aroundAustralia bus tours, safari holidays or air package holidays.

Some of the air charter operators have expressed an interest in landing in the Park so that visitors may see it from both perspectives. This option requires a four wheel drive link-up in the Park. The provision of an airstrip would increase the range of visitor experiences, enhance emergency access and would service park management and residents requirements.

During the last 2 visitor seasons joy flights have been available by helicopter within the Park.

There is an emergency airstrip on the western side of the massif, sited within the viewshed of the main access route. This strip is aesthetically undesirable, and does not meet with Authorised Landing Area specifications. An alternative site is needed which meets air safety standards, is convenient to Park facilities and residents, but not intruding unnecessarily on the experience of people camping and walking in the Park.

Implications for Management

1. There is a demand for an aircraft landing facility in the Park. The location of a suitable site for such a facility will be determined by the following criteria:

   i) air traffic safety procedures;

   ii) minimising noise disturbance for Park visitors and residents, especially from aircraft landing and take-off;

   iii) proximity of airstrip to other facilities and Park attractions;

   iv) identification of any area with suitable biophysical attributes for airstrip construction;

   v) airstrip should provide minimal visual impact.

   vi) ensuring areas of biophysical and cultural significance are not disturbed.

2. Provision of landing facilities will undoubtably increase the number of visitors to the Park. These visitors are likely to have different facility requirements than other visitors in that both accommodation and transport will need to be provided by commercial operators.

3. Aircharter companies and ground tour operators will require guidelines for operating within the Park to ensure that their activities are safe and impacts on other Park users are minimised.

Objective

To provide aerial access consistent with the maintenance of conservation values and the diverse range of user requirements.

Strategies

i) An Authorised Landing Area (ALA) should be developed for use by charter operators, private individuals, the Purnululu Aboriginal Corporation and CALM.

ii) In construction, the aerodrome must satisfy the standards laid down for ALA's under the Civil Aviation Regulations. The aerodrome will thus take aircraft up to 5,700 kg.

The length of the runway should be governed by the minimum requirements for the RFDS aircraft in use in that region at the time.

iii) If the aerodrome is considered unserviceable (eg. due to wet weather) the runway should be marked with four unserviceability crosses along its length.

iv) The Park ALA should be licenced through the Civil Aviation Authority and covered by a clause in the notices for that aerodrome which requires prior permission to land.

v) The location of a suitable site for the Authorised Landing Area should be determined according to the necessary criteria as listed above, and subject to approval by the Civil Aviation Authority. The preferred location is to the south-west of the massif (see Figure 9).

vi) Operational guidelines and emergency procedures should be developed for all aircraft flying over the area, whether on scenic tours or those wishing to land or take off. In particular the effects of aircraft noise should be carefully controlled to ensure that its impact on Park visitors,

staff and residents is minimised. The regulation of flight times and frequency and the identification of flight corridors for both fixed wing and rotary wing aircraft may be necessary. If they are needed, these regulations should be developed in consultation with industry representatives.

5.2.3 Walk Trails

Bushwalking is an activity enjoyed by people of all ages and interests. In the visitor survey conducted in the Park during 1987, 92% of respondents indicated they had explored gorges, and almost 68% had been bushwalking. The two most popular areas visited were the Piccaninny area (87%) and Echidna Chasm (54%).

In order to preserve the remote, undeveloped character of the Park and to promote its appreciation, walk trails should be constructed to various points of interest. Whilst the needs of the elderly or disabled must be considered and provided for wherever possible, walking is the best method to fully appreciate the diversity and scale of the landscape of the Park. There are also many areas which are inaccessible by vehicle.

A small number of Park users seek a very remote experience, wanting to venture into the "wild" and navigate across country, but the majority of visitors are not equipped with these skills and prefer to follow marked trails to well-defined, or recognisable destinations.

Walk trails may vary greatly in difficulty and may be designed according to a wide range of characteristics. It is necessary, therefore, to provide a range of opportunities to meet the needs of the visiting public and to provide adequate protection for the Park.

Walk trails can vary according to length, construction or navigation andvisitor safety should be a priority in their planning and design. The repeated patterns of the domes, complex systems of gorges and creeks and harsh environmental conditions must all be considered in the choice of routes and provision of information.

Walking generally creates a fairly low impact on the environment, but problems may arise due to level of use and/or sensitivity of the site. Where a trail is intensively used, walking can lead to soil compaction and erosion and loss of vegetation.

The sandstone of the massif is extremely friable (see Section 3.3), especially once the surface skin is broken. These rocks are very susceptible to shear stress, and even rubber soled shoes will easily crush or break the surface layer. It has also been found that the sandstone is weakened when saturated and also by the effects of fire (Young, 1987).

High levels of use can also result in environmental impact through inadvertant or deliberate vandalism, such as escaped campfires, damage to cultural sites, disturbance of fauna and littering or polluting the environment.

These problems can usually be avoided or minimised through careful selection and design of trails and effective visitor information programs. Clear signs, interesting brochures and good trailhead information are all important. For some Park features, tour guides or rangers may provide the best means of interpretation; guides also afford a greater degree of protection for places which are especially sensitive or unsafe.

Implications for Management

1. Walking is one of the best ways for visitors to appreciate the diversity and scale of the landscape.

2. Some short/medium length walk trails (see Figure 9) have already proved very popular with visitors to the Park (Colreavy & Cavana 1988).

3. The vast area of the massif, the similarity of the terrain in places, and extreme climatic conditions pose a risk to the unwary or ill-prepared walker.

4. Visitors who are bushwalking or exploring gorges want the environment to appear as natural and undisturbed as possible.

5. Some areas in the Park are of special biological and/or cultural significance and visitor access may be restricted.

6. Rock surfaces in the Park, especially around the popular Piccaninny area, are highly susception to damage and accelerated erosion caused by visitors.

Objectives

i) To provide access options consistent with the maintenance of conservation and cultural values and the diverse range of user requirements.

ii) To provide recreation and tourist facilities which are compatible with the Park's environment.

Strategies

i) Areas of the Park which are suitable for visitor access should be identified. These areas may require varying levels of protection which could be necessary for reasons of cultural sensitivity, high biological value, landscape value or environmental management purposes.

ii) Site development plans should be prepared for those areas considered suitable for visitor access.

iii) Park staff should develop a system of walking trails which are compatible with the planning philosophy for this Park and which provide a diverse range of opportunities for visitors.

5.3 VISITOR MANAGEMENT

As described earlier (Section 5.1), the general theme for the Park is one of a remote unspoilt environment where visitors may seek a "wilderness" experience if they wish, and all may enjoy the natural and cultural features of the area. Whilst developments will be kept to a minimum in the Park, some visitor facilities are necessary to protect the environment and allow reasonable levels of visitor use.

Provision of recreation opportunities and facilities on conservation lands should be guided by the following principles, as outlined in CALM's recreation policy statement:

i) The values of the land as a whole should be maintained. The natural systems should be able to sustain the form of recreation, or its ancillary activity, which is proposed or occurring.

ii) Recreational activity should be compatible with the purpose of the land.

iii) The widest range of activities consistent with the purpose should be allowed, but uses which impair other forms of use, or jeopardise the safety of other users, should be controlled or eliminated.

iv) CALM should be capable of providing any necessary degree of supervision of the activity, particularly where land values may be impaired. If this is not possible, the activity should be restricted, relocated or eliminated.

With these guiding principles in mind, the general provisions for access and recreation management in this Park can be summarised as follows:

a) General vehicular access should be restricted to the western part of the massif, in an arc from Osmond Creek to Piccaninny Creek. Within this zone there may be areas which will be further restricted because of the presence of cultural sites, erosion potential and important biological features. This area will generally accommodate vehicular-based visitor access and be the focus of management.

b) The eastern section of the Park, including much of the massif, should have limited access for walkers. This may need to be regulated by a permit system, depending on demand. There will be a need for a limited number of "management only" tracks for regeneration, fire control purposes and cultural management.

c) Park facilities including an airstrip should be located in the western sector of the National Park.

d) Existing and potential regeneration areas should be recognised and duly protected with suitable access arrangements.

e) Throughout the Park there are sites and areas of cultural significance to Aboriginal people which should be given high priority for protection. Access by traditional custodians to these sites should be allowed along approved routes regardless of the zone in which they are located.

5.3.1 Camping

Camping is an essential part of the remote bush experience, and will be the major form of accommodation in the Park. The low-key nature of the area should be complemented by facilities and standards which do not intrude upon the landscape.

The two existing campsites are not adequate to cope with the demands of the future. Even during peak visitor periods in 1987, some crowding was evident, although improved organisation of campers has improved this situation in 1988. Vehicle based camping should be located away from the massif to maintain the feeling of remoteness and minimise visual intrusion in this area. Because of the relatively slow travel time and long distances to be covered between the northern and southern areas of the Park, it is proposed that campsites are needed to the north, west and south of the massif.

The criteria used for assessment of campsites should include:

i) Protection of sensitive areas
ii) Resistance to erosion
iii) Availability of shade
iv) Availability of water
v) Minimal visual impact
vi) Drainage
vii) Segregation from other users
viii) Access/circulation
ix) Visitor capacity.

Interest has been shown by a number of commercial operators in providing a semi-permanent (safari-style) camping facility. This sort of camping can be provided to a quite luxurious standard if required.

It is likely that a semi-permanent camp may be favoured by visitors who arrive by air. These visitors are generally unlikely to have their own camping equipment, and will therefore rely on commercial facilities. Some private travellers (vehicle-based) may also choose a commercial campsite for their visit.

It is possible that some fourwheel drive tour operators may also choose this style of accommodation for their clients, maybe for variety, however a recent preliminary survey by the WA Tourism Commission (pers comm.) indicated that most operators would prefer to use their own camping equipment.

It is important that a range of camping options are provided in the Park and that each type of camping is segregated. The different options can be summarised as:

semi-permanent camps
group tour camping
individual camping
remote (back-pack) camping.

Campfires are an important part of the bush experience. They provide warmth and cooking and become the focus of social gatherings.

Because of the sparse vegetation however, firewood is limited and to minimise adverse impacts on the Park environment, there is a need to reduce the use of woodfires and encourage the use of alternatives for cooking, such as gas stoves or barbeques.

Implications for Management

1. Provision of services in such a remote and rugged location is extremely costly.

2. Existing camping areas evolved from early ad hoc camping use. Bellburn campsite has some limitations, and is bordered by a degraded area. It has no further opportunity for expansion. Kurrajong campsite is located between a seasonal stream and a limestone ridge. It has some expansion potential which can be achieved through planned development.

3. The existing Piccaninny Creek and Echidna Chasm carparks are not suitable for vehicle based camping as they are too small, have insufficient shade and soils are vulnerable to erosion.

4. The "Date Palm" area in the north of the Park has good potential for camping. It has shade, stable soils, is adjacent to diverse and interesting landforms and is strategically located for visitors in the north of the Park.

5. There are increasing numbers of group tours as well as individual or private campers. These will need to be catered for in the planning and development of future camping areas.

6. Back-packers are making remote campsites of their own choosing. While this is acceptable for low levels of use, numbers will increase and it will be necessary to provide low-key campsites.

7. Campfires are generally popular with Park visitors, mainly for their social enjoyment but also for warmth and cooking. During 1987/88 CALM conducted a trial prohibition of woodfires. This trial attracted varying degrees of support and criticism from visitors. Most campers did appear to have alternative cooking facilities such as gas stoves.

8. Visitors to the Park have generally responded very well to the lack of rubbish disposal facilities, taking their rubbish out with them and leaving the Park remarkably free of litter. In the visitor survey conducted in 1987, 5% of respondents expressed their 'dislike' of this arrangement while another 5% praised the lack of rubbish.

9. Use of generators by some campers will disturb the peace and tranquility for others in the vicinity.

10. Interest has been shown by a number of commercial operators in providing a semipermanent (safari-camp) facility.

Objectives

i) To provide opportunities for a diverse range of visitor experiences in a remote area, consistent with the protection of sensitive biological and cultural sites, and the Park's landscape.

ii) To provide recreation and tourist facilities which are compatible with the Park's environment.

Strategies

i) The siting of future camping areas should initially be located in the northern, central and southern areas of the Park (see Figure 9).

The strategy should be:

a) Northern area- the landform of the lower Osmond Ranges has broad stable benches which provide good opportunities for different types of camping. This area should be developed for single and group sites, and sites where generators can be used. Initially approximately 30 sites should be developed.

b) Central area- Kurrajong campsite should be retained. The site should be redesigned and expanded to increase its capacity to approximately 20 sites. The main Park internal road should be re-routed as development occurs.

c) Southern area- A new site should be developed further north on Bellburn Creek which will initially accommodate 30 sites, both single and group. The existing site could be used for an overflow camp, by contract workers, or for management purposes. Expansion of the new area may be required and there is adequate scope to allow for this.

ii) During the term of the plan, with the increased demand for camping, further sites should be considered subject to appropriate site assessment, development, planning and approval. Further sites may also prove useful to allow rotation of camping areas.

iii) Site development plans will be required for all campsites.

iv) Commercial operations may proceed if the proposals fulfil the guidelines in the CALM r recreation policy and are acceptable to the NPNCA and Minister.

v) Low-key campsites with pit toilets should be designated for use by campers on extended walk trails. In particular, such a facility should be provided along the route to Piccaninny Gorge and also for other overnight trails as they are developed.

vi) Campfires should be permitted in designated fire places.

vii) Options for the provision of firewood or other fuel on a commercial basis should be investigated.

viii) A rubbish disposal facility will be developed within the Park; until this service is available, visitors will be required to take their rubbish out with them. In particular walkers will be required to ensure that litter is not left along walk trails.

ix) All visitors to the Park should be charged an entrance fee at a rate and with conditions determined by the Minister; payment of this fee will allow receipt holders to camp in the Park.

x) Visitors embarking on a long distance or overnight hikes, especially those on unmarked trails, should be required to register at the Ranger station, giving details of the planned walk and expected time of arrival at the given destination.

5.3.2 Day Use Sites

There are many sites within the Park to which visitors are attracted for recreation. In order to preserve the natural and cultural values of these places, it is necessary to prepare site management plans and in some way regulate visitor activity.

Implications for Management

1. About 87% of all Park visitors go to the Piccaninny Creek area. This place is very important to traditional custodians; there are places of spiritual significance as well as art and artifact sites.

2. In 1987, about 54% of all visitors went to Echidna Chasm and during 1988, it seems that nearly all visitors went to this place. Some important plant species and art sites have been recorded in this locality.

3. The main Park road follows the limestone ridge, crossing it several times. There are a number of good vantage points along this ridge from which to admire the scenery. There are, however, also many sites of Aboriginal cultural significance.

4. The rocks in the north and north-western part of the massif are conglomerate, and visually different to the patterned domes of the south. There are many sites of cultural significance in gorges of this area.

5. The Osmond Range provides spectacular scenery to the north of the Park. There are some semi permanent and permanent pools of surface water in this area. Surveys indicate there are areas of biological and cultural significance.

6. Outlying sandstone towers south of the massif provide interesting features with potential for carefully designed walk trails. The surface of these outliers are susceptible to damage, like the massif itself. There are known cultural sites in this area.

Objectives

1. To provide opportunities for a diverse range of visitor experiences in a remote area, consistent with the protection of sensitive biological and cultural sites, and the Park's landscape.

2. To provide recreation and tourist facilities which are compatible with the Park's environment.

Strategies

i) Those areas which are suitable for visitor access will be identified and investigation made of the level of protection required; areas to be examined include:

Piccaninny Creek
Cathedral Gorge
Echidna Chasm
Limestone Ridge
Northern gorges and the Western face of the massif
Osmond Creek system
Southern outliers.

In some circumstances public access will need to be directly supervised. Such protection may be necessary for reasons of cultural sensitivity, high biological value, landscape value or environmental management purposes.

ii) Site development plans should be prepared for each area considered suitable for visitor access.

iii) A system of walking trails, lookout points and other sites should be developed to provide a diverse range of recreation opportunities for visitors.

iv) A comprehensive visitor information program should be developed for the Park (see Section 5.5).

v) Until a rubbish disposal facility is established, visitors should be required to take their rubbish out of the Park.

vi) Pit toilets should be provided where possible at all key day-use sites.

5.4 COMMERCIAL OPERATIONS

There has been interest expressed by various parties wanting to provide commercial services within the National Park. Most of these proposals relate to provision of visitor accommodation and tour services.

Approved commercial operations should enhance the appropriate use and enjoyment of the Park and Conservation Reserve and reduce the impact of visitors.

The CALM Recreation Policy states that fees will be charged for concessions according to their classification into categories, eg.

i) Major facilities and services

ii) Minor facilities and services

iii) Guided leisure and instruction activities.

Generally, CALM is likely to undertake those commercial activities which are:

- environmentally or socially sensitive; or
- of important educative or interpretive value to visitors.

The Purnululu Aboriginal Corporation has indicated their desire to engage in commercial ventures relating to future tourist activities in the Park. These aspirations were also made known to the Bungle Bungle Working Group in 1985. In addition, Cabinet recommended in 1986 that CALM provide opportunities for employment of traditionally affiliated Aboriginal people within the Park.

Input from both the tourism industry forums, and the Purnululu Aboriginal Corporation submission highlight the importance of a carefully planned and coordinated approach to the development of tourism services, facilities and infrastructure. Those developments which are approved must be carefully staged and monitored to measure the effects of visitor impact on the physical and cultural environment of the Park as well as on the facility itself.

Implications for Management

1. CALM Recreation Policy allows commercial involvement in national parks.
2. Opportunities exist for commercial interest in several facets of Park management.
3. There have already been a number of proposals received from the Purnululu Aboriginal Corporation and other commercial interests.
4. Commercial operators and visitors need to be advised of regulations and guidelines which ensure the protection of environmental and cultural values of the Park.

Objectives for Management

i) To allow for the participation of commercial interests in the development of Park facilities and services which complement those facilities offered by CALM, and are consistent with the cultural and environmental values of the Park.

ii) To ensure appropriate and responsible use of the Park by commercial operators and visitors.

Strategies

i) Concessions which are consistent with the purpose of reservation and preservation of Park values may proceed if proposals fulfil the guidelines in the CALM recreation policy and are acceptable to the NPNCA and Minister.

Examples of concessions which may be considered suitable include commercial (safari-style) camping, tour-guiding, vehicle/air charter link services in the Park, helicopter joy flights.

ii) Fees charged for concessions will be set from time to time by the Minister in consultation with the Valuer-General, or the Treasury, as appropriate.

iii) Accommodation may need to be provided in the Park for commercial operators. Such accommodation would be subject to lease conditions consistent with other CALM residential leases. In the short term, a camping area will be provided for use by commercial operators.

iv) CALM should produce a Commercial Operator's Manual which provides information advice and regulations for operation in the National Park. This manual should be regularly reviewed and updated as necessary.

v) CALM should provide a commercial operators accreditation program, to ensure that all licence and lease holders meet certain minimum standards of operation and conform with Park regulations.

5.5 INFORMATION, EDUCATION AND INTERPRETATION

The dissemination of information is an integral part of CALM's role in the management of conservation areas. It informs the public of opportunities for recreation and services and provides information which assists management and improves understanding of conservation.

Many communication channels are available for visitor information, interpretation and community education. Visitor contact onsite is a most effective means of communicating to individuals and groups, but it is labour intensive and must be augmented by pre-visit brochures, publicity, advice, on-site signs and displays. Souvenir publications can provide effective post-visit information.

Despite the relatively low visitor numbers to the Park so far, there is an extremely high demand for information about this remote area. Promotion through the media and many commercial journals has developed the curiosity of travellers.

In the absence of a full interpretative program for the Park, interim information has been provided including a brochure, signs and information boards in the Park and in CALM's Regional Office in Kununurra. Public comment indicates that more information would be appreciated. Visitors to the Park require good quality information, signs and maps; they want to be able to learn about this unusual, different environment and they particularly appreciate meeting and talking with CALM staff. During the 1987 Visitor Survey a great many respondents complimented the courtesy and friendliness of CALM staff.

The naming of features and points of interest, and the provision of Park management information, is a matter of importance also to the Purnululu Aboriginal Corporation. It is often difficult or inappropriate to translate place names from Aboriginal languages to English, and in many cases it is culturally inappropriate. The naming of locations within the Park will therefore require consultation with traditional Aboriginal custodians.

Implications for Management

1. Information is presently provided but should be expanded to cover areas known to be inadequate at present, for example the cultural importance of the area to Aboriginal people.

2. Provision of interesting, relevant and useful information ensures a greater degree of public support and participation in implementing management controls.

Objectives for Management

To provide visitor information which will enhance their safety, knowledge, appreciation and enjoyment of the natural and cultural resources of the Park and the Region.

Strategies

i) An interpretative policy and program should be developed for use within the Park.

ii) A visitor information/orientation facility should be provided at a suitable location along the Park access route.

iii) Where it is appropriate, Aboriginal words and names should be used in Park interpretation. Parks signs and management information should reflect the Aboriginal cultural values of the area and conform with accepted orthographies.

iv) Information known to Aboriginal people about the flora and fauna and its uses should be documented according to their wishes and used for the information of Park visitors.

v) All Park signs should conform with the CALM sign manual as well as the park interpretative policy.

vi) Park Rangers and tour guides should be adequately trained and informed to provide effective visitor information programs. Guided tours should be provided to those places of interest which are suitable for public access but require a higher level of protection.

vii) Tour operators should be subject to an accreditation program conducted by CALM.

6. MANAGEMENT OF LIVING AREAS FOR ABORIGINALS

6.1 BACKGROUND

In April 1986, in response to representations by Aboriginal people with traditional affiliation to Purnululu, the Western Australian Government recommended that the Department of Conservation and Land Management develop proposals for Aboriginals with traditional affiliation to reside in the Park.

In 1986 an association called the Purnululu Aboriginal Corporation (PAC) was incorporated to represent the traditional owners of the Bungle Bungle area. Members of this association currently live as far afield as Halls Creek, Balgo, Lake Gregory and Mowanjum and many reside in East Kimberley communities such as Warmun, Frog Hollow, Glen Hill, Bow River Station, Kununurra, Wyndham and in the Park itself.

To date, three family groups from PAC have expressed a desire to live within the Park. It is not yet certain how many people will take up residence. Despite the obvious desire of many of these people to reaffirm links with their country, moving residence is a big step which requires a great deal of consideration and planning. All of these people have lived for many years now in other settlements and towns; most have houses with electricity and running water, their children attend schools and a number have permanent or casual employment. It is likely that the move to the National Park will be a gradual process for some, while for others it may always be a seasonal or occasional visit.

6.2 LIVING AREA LEASES

In accordance with Section 100 of the Conservation and Land Management Act, 1984, the Executive Director may, on such terms and conditions as he thinks fit, grant a lease of the National Park or Conservation Reserve provided it is in conformity with a management plan and with the approval of the Minister and the NPNCA.

At a meeting in July 1987 with representatives of PAC, the Minister for CALM agreed in principle to the establishment of residential lease areas under provisions of the Conservation and Land Management Act. These living areas should be similar to the excisions which have been negotiated on pastoral leases. At present there are proposals for three such living areas in the Park (see Figure 10). Any further leases would be subject to the approval of the Minister.

PAC has advised that they wish to have the leases formalised as a component of their agreement with the Minister for Conservation and Land Management in relation to their future involvement in the national park (see Sections 1 and 8.2).

Implications for Management

1. PAC has requested approval to establish residential areas in the Park.
2. According to the CALM Act, the Executive Director may grant leases on such terms and conditions as he thinks fit, with the approval of the Minister and the NPNCA.
3. The Minister has agreed in principle to the establishment of residential lease areas in the Park.
4. Aboriginal people residing in the Park will require appropriate access to their lease areas.

Objective

To provide suitable areas for Aboriginal people with traditional affiliations to live within the Park.

Strategies

i) Living areas should be established for traditional Aboriginal custodians within the Park (see Figure 10). With the approval of the Minister and the NPNCA, the Executive Director should grant leases for these living areas for the maximum permissable term under the CALM Act, at a nominal rent. The living area leases should address the following issues:

.the area of the land in question

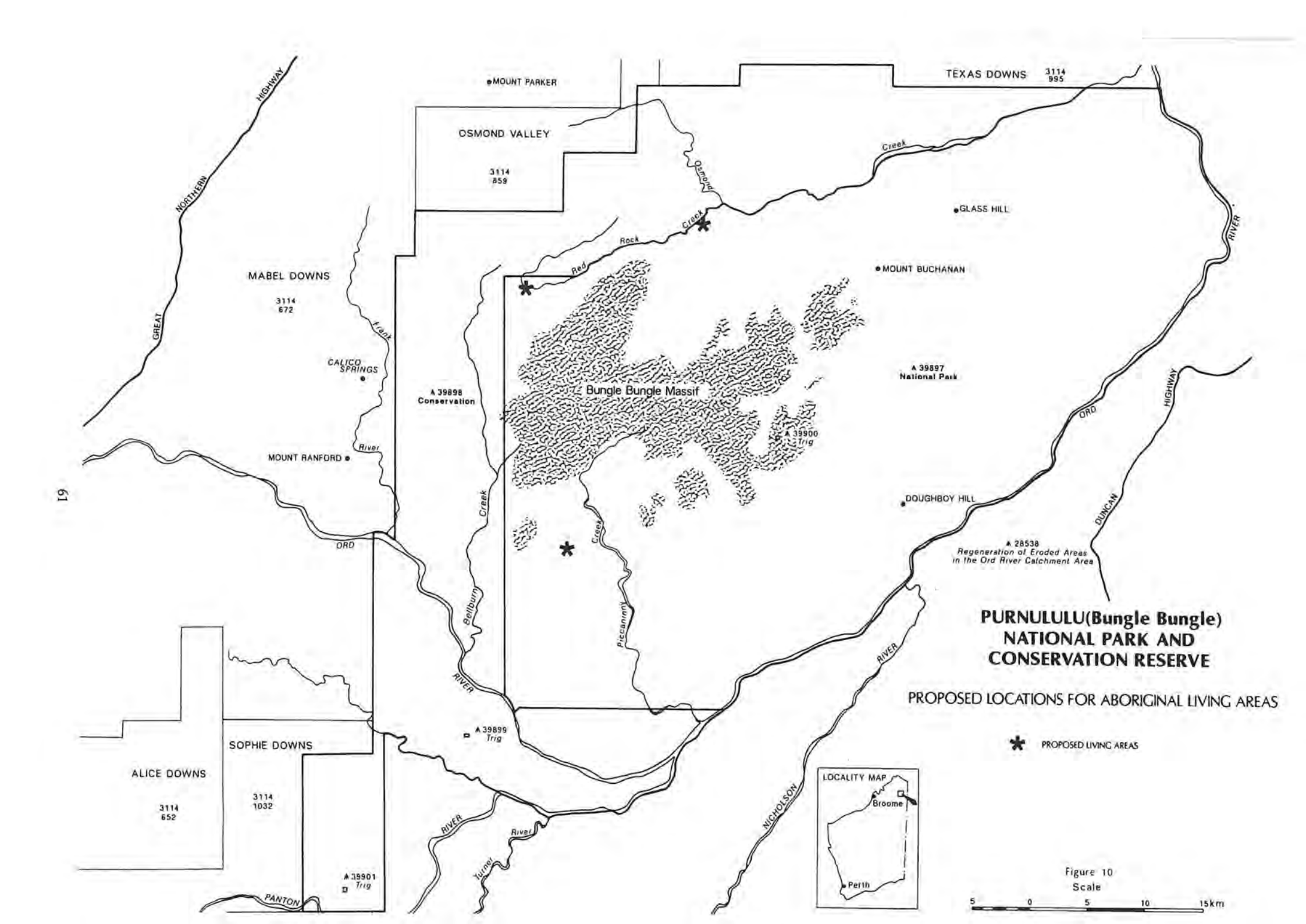
.the purpose of the lease

.fire protection and management

.protection of groundwater reserves from pollution

.suitable disposal of all rubbish, waste, litter and other refuse

.provisions for eradication/control of feral animals and noxious weeds


MOUNT PARKER
TEXAS DOWNS
3114
995
OSMOND VALLEY
3114
859
Osmond
Creek
GLASS HILL
Rock
Red
Creek
MOUNT BUCHANAN
RIVER
MABEL DOWNS
3114
672
GREAT NORTHERN HIGHWAY
Frank
CALICO SPRINGS
A 39898
Conservation
Bungle Bungle Massif
A 39897
National Park
A 39900
Trig
MOUNT RANFORD
River
ORD
HIGHWAY
DOUGHBOY HILL
Bellburn
Creek
Piccaninny
Creek
A 28538
Regeneration of Eroded Areas
in the Ord River Catchment Area
DUNCAN
RIVER
ORD
RIVER
A 39899
Trig
SOPHIE DOWNS
3114
1032
ALICE DOWNS
3114
652
RIVER
River
Turner
A 39901
Trig
PANTON
NICHOLSON
LOCALITY MAP
Broome
Perth
PURNULULU(Bungle Bungle)
NATIONAL PARK AND
CONSERVATION RESERVE
PROPOSED LOCATIONS FOR ABORIGINAL LIVING AREAS
PROPOSED LIVING AREAS
Figure 10
Scale
5 0 5 10 15km

.domestic pets

.cooperation with CALM and the Department of Agriculture in measures designed to lessen soil erosion.

.site planning and design criteria.

ii) Aboriginal residents should be allowed appropriate access to living areas.

6.3 HOUSING AND ESSENTIAL SERVICES

Essential services required as a first step in the development of living areas include finalisation of boundaries, housing, water, power, waste disposal and communication.

Some assistance (provision of a water bore and storage shed) has already been provided at one living area by the Argyle Social Impact Group. There is currently no permanent housing provided for Aboriginal people living in the Park. It is the aim of PAC to initiate community development and housing programs for the residential lease areas in a way which minimises impact on Park values.

Implications for Management

1. Transportation of building materials into the Park will depend on the condition of access roads.
2. Because there has often been inadequate understanding of residents' requirements, and often poor planning and materials, there has been a long history of unsuccessful Aboriginal housing projects, particularly in remote areas.
3. In this case housing and services will have to be appropriate to a national park setting as well as meeting resident's requirements.

Objective

To provide suitable housing and service arrangements to support the needs of the Aboriginal residents within the Park, consistent with other Park values.

Strategies

i) Community development plans should be produced by PAC to meet the special requirements for Aboriginal residents and staff. These plans should be compatible with the overall planning philosophy for the Park and sympathetic to environmental and cultural values.

ii) The implementation of community development plans, including provision of housing, facilities and other essential services should be carried out by PAC.

iii) CALM should support PAC in its effort to establish appropriate community facilities and should provide assistance in the implementation of their plans in landscape planning, safety, design and site suitability criteria.

iv) Transport of materials and carrying out of capital works programs should be at such a time and in such a manner as will minimise disturbance of vegetation and soil or cause other erosional effects.

6.4 COMMUNITY SERVICES

Health services are currently provided at Turkey Creek by the Kimberley Public Health Service. In addition, a doctor from Wyndham regularly visits Turkey Creek as part of the Royal Flying Doctor Service. Park residents have to travel to Turkey Creek for these services.

The possibility of medical emergencies in the National Park is of considerable concern due to the long, rough journey by road to Turkey Creek and the poor standard of the present emergency landing area in the Park.

Education facilities will be required for Park residents, both children and adults. A number of possible arrangements could meet the needs of the community, including an independent school. The Purnululu Aboriginal Corporation have taken steps to have a primary school established in the Park by 1990.

Aboriginal residents also require suitable communications facilities to be established for their use, including HF radios and telephone when it becomes available in the area.

Implications for Management

1. Medical emergencies in the National Park may pose serious problems due to the long rough road to the nearest medical centre.
2. Education facilities will be required for Park residents.
3. A telephone system may require the construction of towers and receiving dishes near the telephone service points.

Objective

To allow for the provision of adequate and suitable health, education and communication facilities for Park residents.

Strategies

i) Provision of all community services should be subject to landscape planning, safety, design and site suitability criteria, consistent with the cultural and environmental values of the Park.

ii) Decisions relating to the provision of community services, including health, education and communication facilities, should be resolved through the Purnululu Park Council.

iii) CALM should support PAC in its attempts to develop appropriate education facilities within the Park.

iv) Basic medical facilities should be provided in the Park, including a secure storage of medical supplies and Royal Flying Doctor radio service.

v) CALM should allow for the provision of a telephone service for Aboriginal residents.

vi) An Authorised Landing Area should be developed in the Park as discussed in Section 5.2.1.

7. PARK BOUNDARIES AND TENURE

The Park consists of two reserves 39387 "National Park" and 39388 "Conservation Reserve", vested in the National Parks and Nature Conservation Authority. The National Park became Class "A" on 13 September 1988.

When the Park and Reserve were declared, they were not officially named, although they were commonly referred to after the major feature of the area, the Bungle Bungle Massif. In the languages of the Aboriginal people of the middle Ord River system, Purnululu is the descriptive name given to an area dominated by friable sandstone features. It refers both to the major massif and to the area surrounding it, and is therefore an apt name for the area now gazetted as national park and conservation reserve. 'Bungle Bungle' appears to be the corruption of the Aboriginal name by early Europeans.

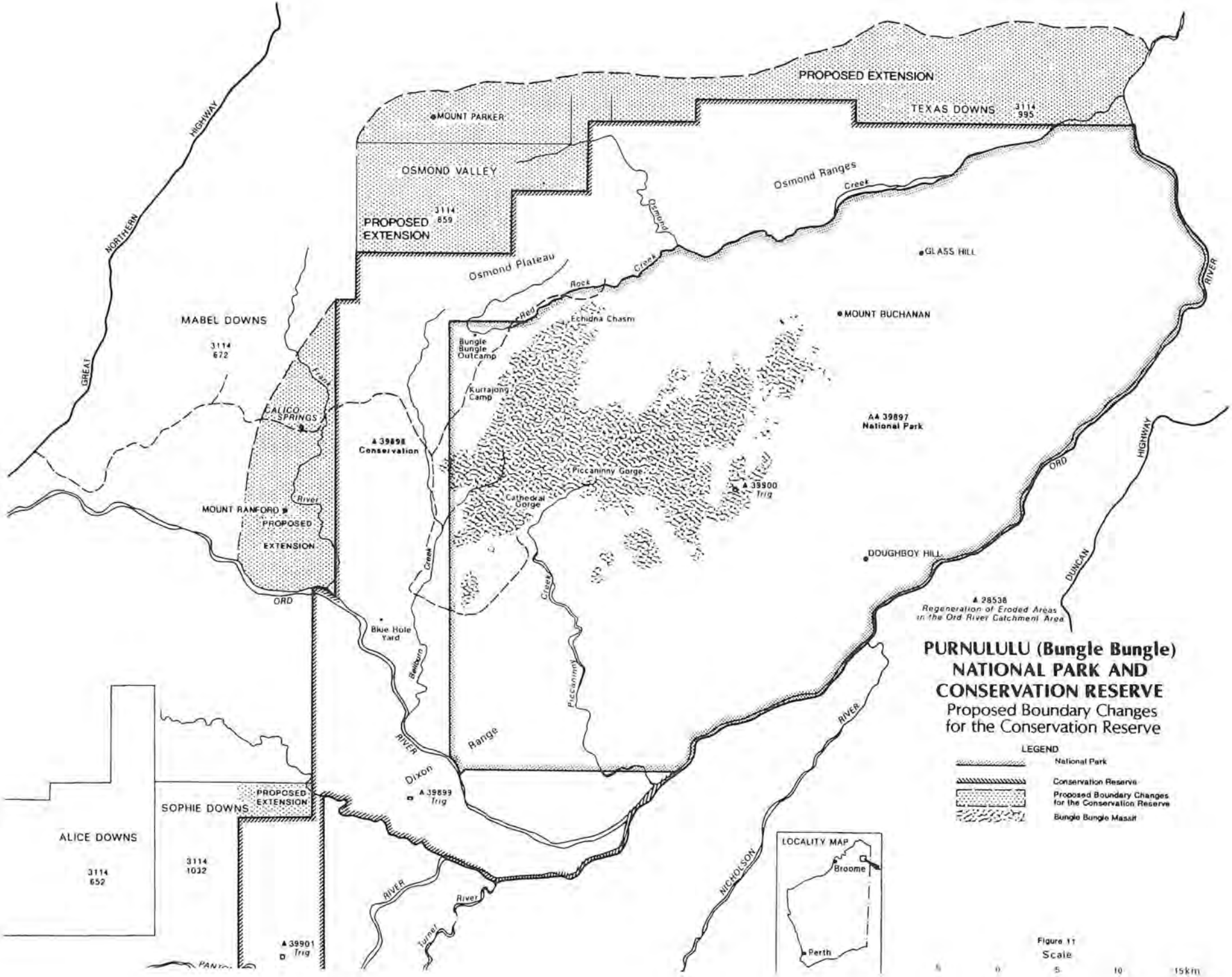
The Park is bounded to the north and west by pastoral leases and to the south and east by the Ord River Regeneration Reserve (see Section 1.1). The boundaries in some cases reflect cadastral rather than biophysical areas and hence in some places they are difficult to define on the ground or to manage.

The boundary between the National Park and Conservation Reserve was determined by preexisting mineral exploration leases over much of the area adjacent to the Park. These leases will be reduced to one quarter of their original size before finally expiring after 5 years (see Section 3.2).

At the time of gazettal of the Park, three onehectare reserves for the purpose of Trignometrical Stations were also gazetted. These reserves have historical value as they were monumented by surveyor Harry F. Johnston in 1883. They are, however, placed in culturally and environmentally sensitive locations.

Implications for Management

1. Cadastral boundaries do not reflect biophysical attributes or provide adequate protection for ecological or landscape units.
2. The National Park and Conservation Reserve have not yet been officially named.
3. There are some biologically important areas outside and adjacent to the current park boundaries, in particular the Osmond Valley and Osmond Range.
4. Definition of boundaries is difficult in some areas, exacerbating management problems such as uncontrolled vehicle movement and feral animal intrusion.


PROPOSED EXTENSION
TEXAS DOWNS 3114 995
MOUNT PARKER
OSMOND VALLEY
3114 859
PROPOSED EXTENSION
Osmond Ranges
Osmond Creek
GLASS HILL
Osmond Plateau
Rock Creek
Red
Echidna Chasm
MOUNT BUCHANAN
RIVER
GREAT NORTHERN HIGHWAY
MABEL DOWNS
3114 672
Bungle Bungle Outcamp
Kurrajong Camp
CALICO SPRINGS
A 39898 Conservation
A4 39897 National Park
Piccaninny Gorge
A 39900 Trig
Cathedral Gorge
MOUNT RANFORD
PROPOSED EXTENSION
River
Creek
ORD
DOUGHBOY HILL
HIGHWAY
DUNCAN
A 28538 Regeneration of Eroded Areas in the Ord River Catchment Area
Blue Hole Yard
Bellburn
Piccaninny
Creek
RIVER
Range
Dixon
A 39899 Trig
PROPOSED EXTENSION
SOPHIE DOWNS
3114 1032
ALICE DOWNS
3114 652
A 39901 Trig
River
Turner
RIVER
NICHOLSON
LOCALITY MAP
Broome
Perth
PURNULULU (Bungle Bungle) NATIONAL PARK AND CONSERVATION RESERVE
Proposed Boundary Changes for the Conservation Reserve
LEGEND
National Park
Conservation Reserve
Proposed Boundary Changes for the Conservation Reserve
Bungle Bungle Massif
Figure 11
Scale
5 0 5 10 15km

5. The current situation with respect to mining exploration in the Conservation Reserve allows new leases to be obtained as the old leases expire.

6. The existing trignometric sites are located in rugged terrain providing difficulty with respect to access and are also located in areas of Aboriginal significance.

Objective

To ensure the land tenure and park boundaries provide the best possible protection to the environmental and cultural values of the area.

Strategies

i) Reserve No. 39897 should be named the Purnululu National Park and the reserve No. 39898 should be named the Purnululu Conservation Reserve. The massif should continue to be known as the "Bungle Bungle Range".

ii) Where possible future boundaries should be defined according to major ridgelines and major stream or river beds as a second option. Areas suitable for inclusion in the National Park are, in order of priority:

Osmond Valley Station

Eastern section of Mabel Downs

Southeast portion of Texas Downs

Northeast portion of Sophie Downs

(see Figure 11)

iii) Adjacent lease holders should be consulted to determine preferred course of action for future management of lands listed in (ii) above.

Three possible courses of action to be considered are:

a) Government aquisition of portions of leases from current leaseholders

b) agreements for joint management as per Section 16 of the CALM Act

c) restructuring of boundaries with adjacent properties.

iv) Reserve No. 39897 should be extended on the western side to include the whole of the massif.

v) As current exploration leases over the reserve No. 39898 expire, this land should be transferred to the National Park.

vi) The historical and cultural values of the existing trignometric sites should be acknowledged, however due to difficulty of access, use of these sites will be generally restricted. Alternative trignometric sites should be sought by the Department of Land Administration in consultation with CALM and the Purnululu Aboriginal Corporation.

8. PARK ADMINISTRATION

8.1 CALM AND THE NPNCA

The Conservation and Land Management Act provided for the establishment of the National Parks and Nature Conservation Authority (NPNCA) in which the National Park and Conservation Reserve are vested. It also lists the functions of the Authority to include development of policies, provision of advice to the Minister and to monitor the carrying out of management plans by CALM.

The Department was established under this same Act and given a range of functions including the management of the land and its associated flora and fauna, and to assist the Authority in its functions. The Department is subject to the direction and control of the Minister, and its administrative structure is headed by an Executive Director. The Department has a Corporate Executive which meets on a regular basis.

The State is divided into eleven regions, each having a Regional Manager who responds to the Divisional Manager, Operations. Regions are responsible for the management of all departmental lands and waters and for conservation of flora and fauna within their boundaries.

The Kimberley Regional Office is located in Kununurra, about 160km by air from the Park. Communications to staff in the Purnululu (Bungle Bungle) National Park will be channelled through this office.

8.2 PURNULULU PARK COUNCIL

The Government and the Purnululu Aboriginal Corporation (PAC) are presently engaged in negotiating the terms of a formal agreement between the Minister for Conservation and Land Management and PAC. This agreement is intended to give effect to the Cabinet decision of August 1987, which approved the establishment of a Ministerial Committee to be known as the Purnululu Park Council.

State Government determined that this Council should comprise four representatives from the traditional custodians of the Purnululu area and four officers from CALM, one of whom shall be the Director of National Parks, who shall initially chair the Council's proceedings. The Council will report to the Minister for CALM as an independent committee.

Government also directed that the Purnululu Park Council should provide meaningful management input for Aboriginal interests in relation to the Park and be responsible for formulating its own procedural guidelines which reflect consensus as the basis for decision making.

In its decision of 21 August 1987, Cabinet approved that the function of the Council will be:

a) to prepare and advise proposals for the draft Plan of Management for the Park for the consideration of the Minister;

b) acknowledging the provisions of the existing Act, in association with CALM and subject to the Minister, to participate in the implementation of the Management Plan as so approved, including the development of Policy in relation to Aboriginal interests in the Park;

*c) to provide advice to the Minister in all matters relating to Abori*ginal involvement in the Park.

Implications for Management

1. The Purnululu Park Council is the first of its type in Western Australia, and will be considering many issues which relate to Aboriginal interests and are new to park management in this State, eg. Management of living areas within the Park, management of domestic pets, hunting and gathering, cultural sites, traditional burning and cross cultural interpretation for visitors.
2. The NPNCA and the Purnululu Park Council both provide advice to the Minister.
3. Policy guidelines are required which relate to matters of Aboriginal interest in the Park.

Objective

To provide meaningful management input for the Aboriginal interests in relation to the Purnululu (Bungle Bungle) National Park and Conservation Reserve.

Strategies

i) The Purnululu Park Council should be established as soon as possible, consistent with the principles and functions determined by State Cabinet in August 1987.

ii) The Purnululu Park Council will report directly to the Minister for Conservation and Land Management on matters of Aboriginal interest.

iii) The Council should meet not less than four times, and as required, in any year.

iv) The Purnululu Park Council should consider all issues affecting Aborignal interests in the Park and should develop policies for the guidance of Park management in relation to these issues.

v) In association with CALM, and subject to the Minister, the Purnululu Park Council should participate in the implementation of the management plan, as so approved.

vi) The Purnululu Park Council should make decisions by consensus of members present (subject to a quorum of 6).

vii) In relation to matters of Aboriginal interest of which a consensus decision cannot be reached, the matter should be referred to the Minister for direction.

viii) CALM representatives on the Purnululu Park Council should keep the NPNCA briefed on determinations and advice arising from the Council so that the NPNCA can consider such determinations and advise the Minister independently, as it sees fit.

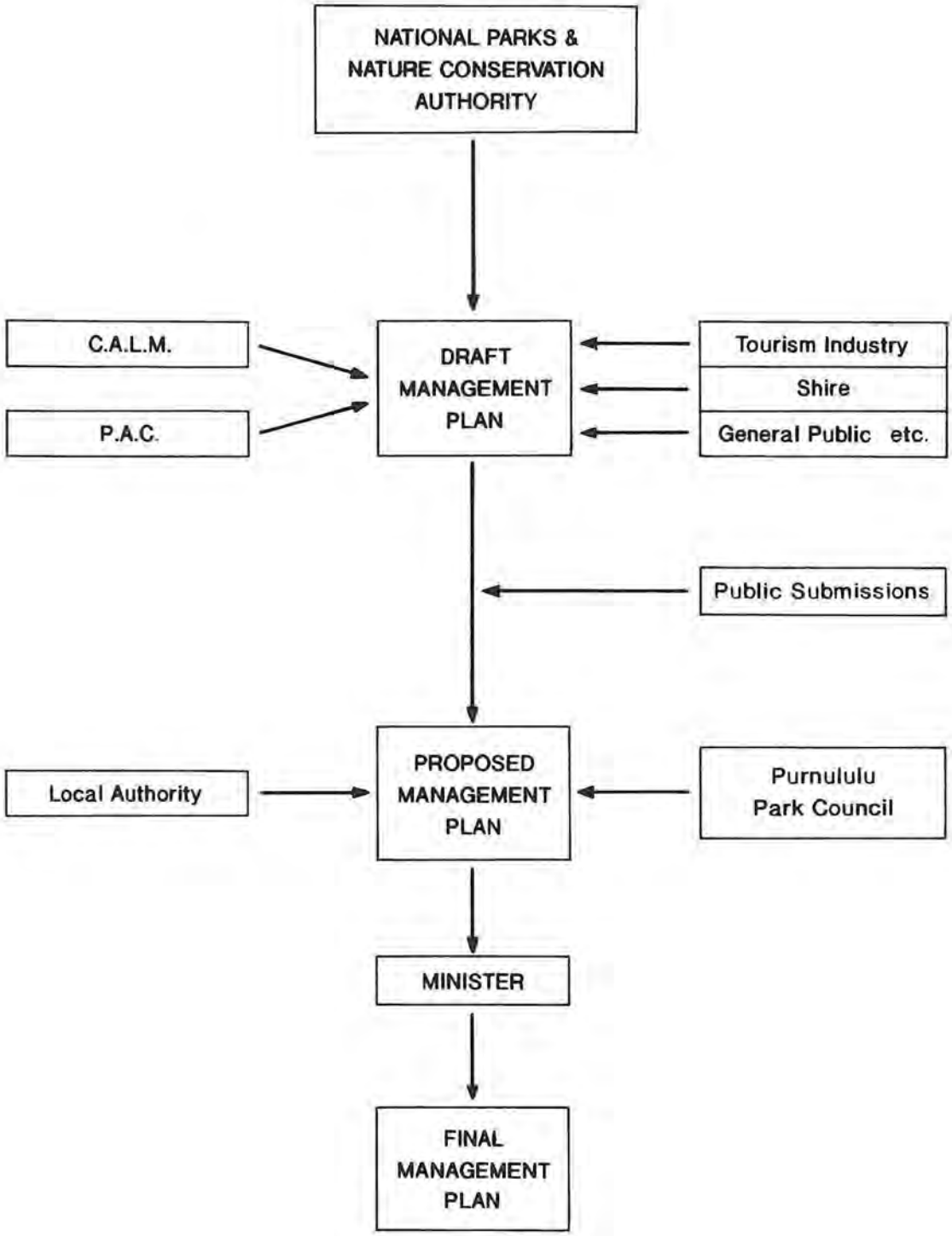


FIGURE 12. MANAGEMENT PLAN DEVELOPMENT FOR PURNULULU (BUNGLE BUNGLE) NATIONAL PARK AND CONSERVATION RESERVE

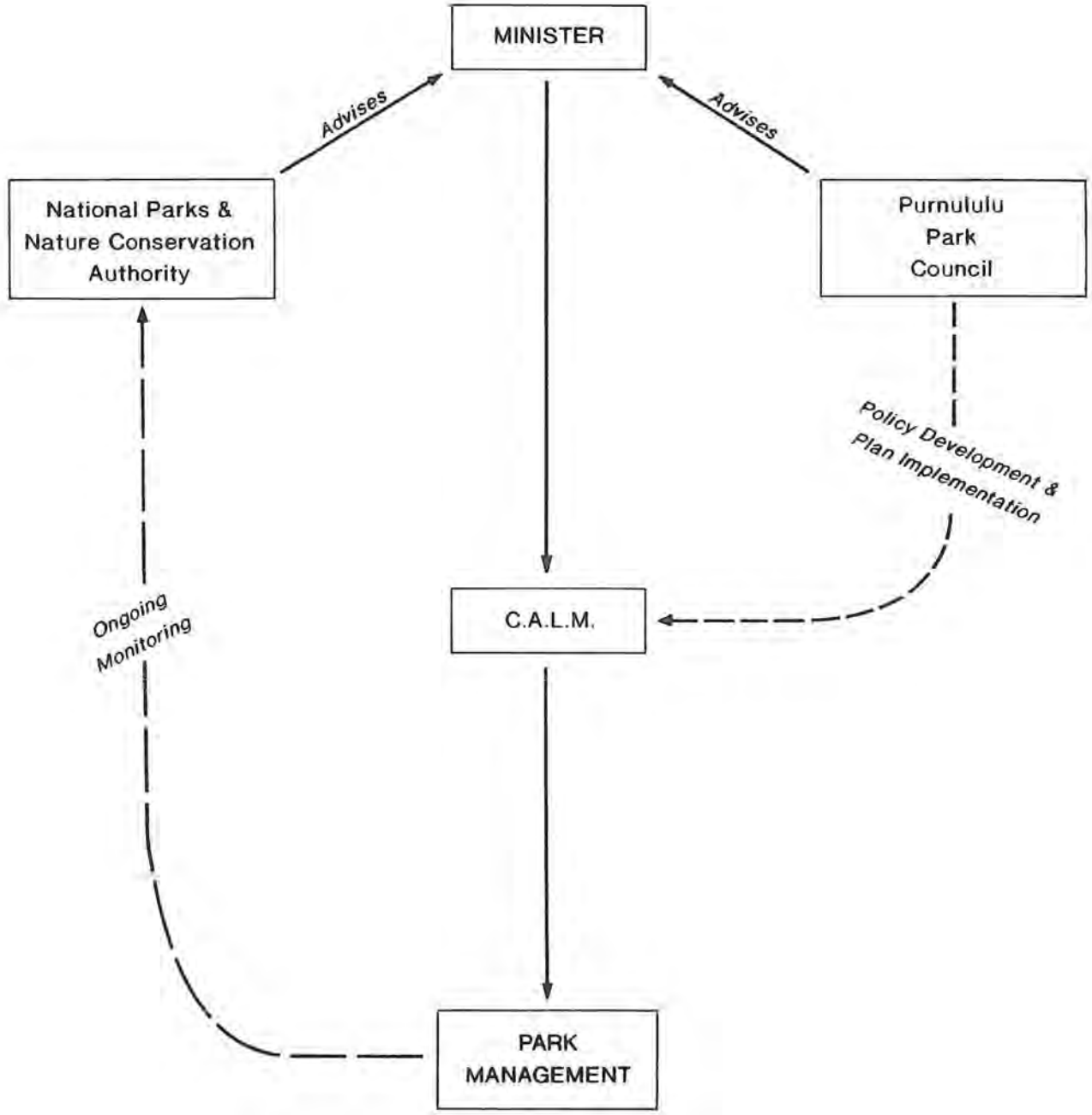


FIGURE 13. POLICY AND MANAGEMENT RELATIONSHIPS FOR THE PURNULULU (BUNGLE BUNGLE) NATIONAL PARK AND CONSERVATION RESERVE.

8.3 PARK ADMINISTRATION CENTRE

The administration centre is to be located in the western sector of the Park. Management facilities such as staff houses, vehicle compound, workshop and storage sheds should be located in this area.

Implications for Management

1. The establishment of the Park administration centre will be a major capital works development requiring reasonable access conditions for movement of machinery and materials.
2. The administration centre will need to be convenient to the main access road.

Objective

To plan and provide adequate facilities for Park staff, ensuring that developments are compatible with environmental and cultural values of the area.

Strategies

i) The Park administration facilities should be sited according to the following criteria:

.proximity of a reliable, potable water supply

.supply of power from a centralized power source

.impact of the developments on cultural and biological values

.consideration of various biophysical factors in determining site suitability for development

.strategic location with respect to Park access road, airstrip and internal road systems

.staff houses should afford privacy to residents whilst being convenient to the administration centre.

The preferred location for these facilities is in the Kurrajong area (see Figure 9).

ii) Site development plans should be prepared before the construction of management facilities in the Park.

iii) All buildings constructed in the Park should be visually compatible with the natural environment and should be designed according to low energy principles wherever possible.

8.4 STAFFING ARRANGEMENTS

The Park is currently managed by Regional staff, supplemented by mobile rangers during the peak visitor period, the dry season. A position of District Manager (Bungle Bungle) was recently advertised by CALM. The successful applicant will be responsible for the day to day management and administration of the Park. Staff should be present in the Park whenever vehicle access is possible to provide protection for the Park and visitors and to implement this plan. An Aboriginal Ranger Training Program is currently in progress in the Park. Successful graduates of this program will be eligible for employment by CALM.

It is important that a line of responsibility be maintained from the Regional Manager, based in Kununurra, through the District Manager, to the Park Rangers and contract workers.

It may be necessary to employ consultants from time to time to carry out specialist tasks, and many of the routine and/or labour-intensive jobs may be fulfilled by contract workers.

Implications for Management

1. Cabinet has directed CALM to provide meaningful management input for Aboriginal interests in relation to the Park as well as directing CALM to provide employment opportunities for Aboriginals.
2. Staff will be interacting with two cultures in this Park.

Objectives

i) To ensure that sufficient numbers of adequately trained staff are appointed to implement this plan.

ii) To provide opportunities for Aboriginal persons to be employed wherever possible and appropriate in the Park.

iii) To ensure that all Park staff demonstrate the interest and skill to work in a cross-cultural environment.

Strategies

i) The Regional Manager should maintain liaison with local government representatives, Kimberley Regional Development Advisory Committee, the Bush Fires Board and other State or regional bodies, as appropriate.

ii) The District Manager is responsible for day-to-day management of the Park, including supervision of rangers and contractors,liaison with commercial operators, neighbouring leaseholders and the Purnululu Aboriginal Corporation.

iii) Training programs will continue as necessary for training Aboriginal rangers with the objective that they should be eligible for employment in the Park.

iv) Staff requirements should be monitored by CALM to ensure adequate protection and management of the Park.

8.5 STAFF TRAINING

CALM is committed to maintaining a well-motivated and competent workforce. In order to provide satisfactory personal development as well as to maximize work performance, the Department is willing to provide relevant training for all personnel. In this Park exists a special situation in which two groups of people with very different cultural backgrounds are working together toward a common goal. To achieve the best possible outcome, all staff need to be trained in conventional park management skills and also in traditional Aboriginal land management skills; in addition, the park rangers are required to possess special interpretative skills.

Implications for Management

1. Staff in this Park have a special need for good communication skills, cultural awareness and interpretative ability.

2. Because of the remoteness of the Park from public facilities, a training venue will need to be developed.

Objectives

i) To develop the skills and attitudes of all Park staff to facilitate the implementation of this plan of management.

ii) To conduct ranger training programs in which both Aboriginal and nonAboriginal staff exchange their skills, knowledge and experience.

Strategies

i) Throughout all Aboriginal ranger training programs, training officers should consult with both traditional custodians and CALM to review objectives and assess progress of the trainees.

ii) The program should be flexible to take advantage of visiting experts who may be available and to cater for the special interests and particular skills of the participants. Twoway learning should be encouraged whenever possible.

iii) The program should train personnel to

a) work successfully in a crosscultural situation

b) carry out job prescriptions at their particular level of responsibility

c) improve themselves and their work performance.

iv) In addition to the Aboriginal ranger training program CALM has developed together with T.A.F.E. a general certificate course for all rangers which should enhance their job performance, job satisfaction and career path. Staff are encouraged to participate in training and personal development courses available on application through their supervising officer.

v) CALM should facilitate the construction of a training venue in the Park for the Aboriginal Ranger training program; this venue could also provide training and development opportunities for other park residents.

vi) The Commonwealth Government and State Government should continue to work together in Aboriginal training and community development programs for the Purnululu area.

8.6 SAFETY

CALM has a most effective safety and occupational health program, in which it emphasises that each individual has a responsibility to develop safe and healthy work practices and conditions. The program is regularly reviewed and modified to take account of changing requirements and to incorporate new technology.

All natural environments by their very nature pose certain risks for the unwary or ill-prepared. The remote and rugged Bungle Bungle terrain is an environment fraught with potential safety hazards both for visitors and for staff. The vast area of the Park, the complex gorge systems, and climatic conditions make search and rescue operations very difficult, and the distance from the nearest towns limit availability of medical aid and manpower in cases of emergency.

There have already been several emergencies in the Park. Fortunately, each of the these has been dealt with successfully by Park staff, despite adverse conditions.

Implications for Management

1. The unique landscape and rugged access and climatic conditions pose special risks and constraints in this Park.
2. Because of the remoteness of this large Park, any sick or injured persons are unlikely to receive early treatment.
3. Search and Rescue Operations are extremely costly, both in terms of manpower and actual financial costs incurred, especially when aircraft are employed.
4. Some people living in the Park may be permitted to possess firearms.
5. There is a high risk of wildfire occurrence in this Park with its extensive grasslands and long dry season.

Objective

To plan and provide for the health and safety of staff, residents and visitors.

Strategies

i) All Park staff should be trained in first aid, occupational safety, basic bushcraft and survival skills, radio communications, search and rescue, fire control, and safe use of firearms.

ii) Areas of the Park which are safe for access by visitors should be identified.

iii) Walking tracks and roads should be clearly signposted and marked for distances; further advice should be provided for visitors in brochures and notice boards.

iv) Procedural guidelines should be developed for civil or medical emergency situations to include liaison with Police, Department of Transport and State Emergency Service. These guidelines should be regularly reviewed to take account of new methods or new information about the Park and all Park staff and residents should be kept informed of procedures.

v) Any firearms in the Park should be licenced and registered with the CALM District Manager and operated within strict safety procedures.

vi) Staff should be trained in fire suppression and management techniques and the Department should undertake to promote public awareness on the effects of fire and the importance of prevention of wildfire.

8.7 COMMUNICATIONS

The Department has an extensive radio communications network providing communications throughout the State. High frequency (HF) radios are used in the North West Regions and all staff are trained in radio systems and procedures.

At present, the only radios in the Park are those fitted in Rangers vehicles. Receiving and transmitting of radio messages is often hindered and sometimes prevented by atmospheric conditions. There is no telephone line established to the Park.

Implications for Management

1. Until a telephone service is established this Park will rely entirely on radio communications to keep in touch with the rest of the region.
2. A telephone service has been requested for the Park.

3. A telephone system, when available, will require the construction of a tower and receiving dish in or near the National Park.

Objective

To provide and coordinate communication links which will assist the management of this Park in an effective and cost-efficient manner.

Strategies

i) All Park vehicles should be fitted with HF radios and Park staff should be trained in radio operations procedures, in accordance with Department of Communications Regulations and CALM operational procedures.

ii) The use of a VHF system in the Park should be investigated.

iii) Communication facilities should be constructed as soon as possible subject to appropriate site planning consistent with the cultural and environmental values of the Park.

iv) A radio should be installed in the Park administration centre when it is established.

v) A telephone link should be established to this Park as a matter of priority.

vi) In the planning and installation of communication facilities for management, CALM should also consider the communication needs of Aboriginal park residents (Section 6.4) and Park visitors.

9. PLAN IMPLEMENTATION

For the plan to be fully implemented requires increased staffing levels and a large financial allocation. There are a number of options available to help achieve the resulting works program.

i) **Park Council**- In association with CALM and subject to the Minister, the Purnululu Park Council will participate in the implementation of the management plan, as so approved, including the development of policy in relation to Aboriginal interests in the Park.

ii) **CALM budget**- an allocation is made to CALM each year in the State Budget based on Departmental work programs. A special grant has recently been provided to CALM for development of national parks, and some of this grant has been allocated to this Park pending approval of the final plan.

iii) **Fees**- CALM has commenced charging visitor entrance fees to the Park, and will also require commercial operators within the National Park to pay fees for concessions as set by the Minister.

iv) **Private investment**- opportunities should be provided for appropriate investment in the Park by private commercial interests.

v) **Commonwealth assistance**- the House of Representatives Standing Committee on Environment and Conservation in its report to the Commonwealth Parliament in March 1985 recommended that the Commonwealth provide assistance for the protection and management of the Bungle Bungle area (Parliament of the Comm. of Aust., 1985).

vi) **Advisory Committee**- should it become evident that the Park would benefit from an advisory committee with broad public representation, then CALM's Executive Director should establish such a committee in consultation with the Park Council and in accordance with established Departmental policy.

9.1 RESEARCH AND MONITORING

There has been very little scientific research undertaken within the Park and there is still a great deal to be learned about the natural and cultural resources of the area and how these are affected by management practices and visitor use.

Research will provide baseline data which is essential for sound management decisions. A program of monitoring will enable the continuous assessment of any change which may be observed relative to that baseline data.

Care is needed to ensure that research and monitoring programs do not themselves jeopardise Park values.

Implications for Management

1. There is a need to increase knowledge of the Parks' cultural and natural resources so that more effective management practices are developed.

2. It is likely that the proposals for research will exceed the resources or capabilities of the Department.

3. Some cultural information is extremely sensitive and cannot be available for unrestricted use.

Objective

1. To conduct research and monitoring programs which will enhance the knowledge and understanding of the Park and provide information relevant to management.

Strategies

i) Research and monitoring programs should be established for the Park. The results of all research conducted in the Park should be disseminated to appropriate persons; whenever this research concerns matters of cultural sensitivity, the CALM Regional Manager should consult with P.C.H.C. regarding the use or transmission of the information.

ii) When a research proposal is received from someone outside CALM, they should be required to apply for a permit; when matters of cultural significance are concerned, the advice of the Purnululu Cultural Heritage Committee will be sought.

9.2 TENURE OF THE PLAN

According to the Conservation and Land Management Act, this plan should be reviewed within ten years from the date of Ministerial approval of the final plan. Because it is a relatively new Park, and this is the first management plan, it is possible that unforeseen circumstances or new management issues may arise which require the public notification of an addendum to the final plan, or even an early review.

BIBLIOGRAPHY

Aboriginal Heritage Act (1972). Western Australian Government, Perth.

Beard, J.S. (1979). *The Vegetation of the Kimberley Area. Explanatory Notesto Map Sheet 1 of Vegetation Survey of W.A.* UWA Press, Nedlands.

Beere, G.M. (1983). The Piccaninny Structure: a cryptoexplosive feature in the Ord Basin, East Kimberley. *Geol. Surv. West. Aust. Rec.* 1983/6.

Burbidge, A.A. (1985). Fire and Mammals in Hummock Grasslands of the Arid Zone. IN: Ford, J. (ed). (1985). *Fire Ecology and Management in Western Australian Ecosystems.* Proceedings of May 1985 Symposium, WAIT Environmental Studies Group Report No. 14.

Colreavy, M. & Cavana, M. (1988). *Bungle Bungle National Park and Conservation Reserve. Visitor Survey. April -September, 1987.* Dept. Conservation and Land Management.

Conservation and Land Management Act (1984). No. 126 of 1984. Western Australian Government, Perth.

Department of Agriculture (1985). Maps showing Pastoral Potential in the Kimberley Region, Western Australia. 1:500,000 scale. 3 maps and notes. Rangeland Management Branch, Dept. of Agriculture.

Department of Conservation and Environment (1986). *Bungle Bungle Working Group. Final Report to the E.P.A.* Bulletin No. 261, Perth.

Department of Conservation and Land Management (1987). Strategies for Conservation and Recreation on CALM lands in Western Australia.

Department of Regional Development and the North West (1986). *Kimberley Regional Profile, Western Australia.* Dept. Regional Development and the North West.

De Salis, J. (1982), *Resource Inventory and Condition Survey of the Ord RiverRegeneration Area.* Western Australian Department of Agriculture. Unpublished Report.

Dow, D.B. (1967). 1:250,000 Explanatory Notes to the Dixon Range. Western Australia. *Geol. Surv. West. Aust.*

Dow, D.B. & Gemuts, I. (1969). Geology of the Kimberley Region, Western Australia; The East Kimberley. *Geol. Surv. West. Aust.* Bulletin 120.

East Kimberley Impact Assessment Project: A Joint Project of the: Centre for Resource and Environmental Studies, Australian National University, Australian Institute of Aboriginal Studies, Anthropology Department, University of Western Australia, Academy of the Social Sciences in Australia.

Environmental Protection Authority (1980). Conservation Through Reserves Committee. *Conservation Reserves in W.A.* Report on the Conservation Through Reserves Committee on System 7 to the E.P.A.

Forbes, S. & Kenneally, K. (1985). Bungle Bungle and its Surrounds: its Botanical Significance. *Environment WA* 7(2) : 8-11.

Forbes, S. & Kenneally, K. (1986). A Botanical Survey of Bungle Bungle and Osmond Range, South-Eastern Kimberley, Western Australia. *West. Aust. Nat. 16* 5-7

Hallam, S.J. (1985). The History of Aboriginal Firing. IN : Ford, J. (ed) (1985). *Fire Ecology and Management in Western Australian Ecosystems.* WAIT Environmental Studies. Group Report No.14.

Haynes, C.D. (1985). The Pattern and Ecology of Munwag: Traditional Aboriginal Fire Regimes in NorthCentral Arnhem Land. *Proc. Ecol. Soc. of Aust.* 13:203-204.

International Union for Conservation of Nature and Natural Resources (1980) World Conservation Strategy : Living Resource Conservation for Sustainable Development. Gland, Switzerland.

Kimber, P. (1988). *Landscape Character Types for the Kimberley Region, Western Australia.* Unpublished report.

Kimber, R. (1983). Black Lightning : Aborigines and Fire in Central Australia and the Western Desert. *Archaeology in Oceania, 18* : 38-44.

Kitchener, D.J. (1978). Mammals of the Ord River Area, Kimberley, Western Australia. *Rec. West. Aust. Mus. 6* (2).

Leonard, M. & Hammond, R. (1983). *Landscape Character Types of Victoria.* Forest Commission, Victoria.

Lewis, H.T. (1985). Burning the 'Top End' : Kangaroos and Cattle. IN : Ford, J. (ed) (1985). *Fire Ecology and Management in Western Australian Ecosystems.* WAIT Environmental StudiesGroup Report No. 14.

McKenzie, N.L. (1981). Mammals of the Phanerozoic South-west Kimberley, Western Australia Biogeography and recent changes. *J. Biogeog. 8* : 263-280.

Muir, B.G. (1983). *Annotated List of Birds and Mammals Recorded in the Vicinity of BungleBungle.* Unpublished Report.

Passmore, J.R. (1964). The Hydrology of the Cambridge Gulf, Lissadell and Dixon Range. *Geol. Surv. West. Aust. Rec.* 1964/2.

Perry, R.A. (1970). Pasture Lands of the Ord-Victoria Area. IN : Stewart, G.A. *et al* (1970).

Purnululu Aboriginal Corporation (1988). Management Plan Submission regarding Purnululu (Bungle Bungle) National Park and Conservation Reserve. Unpublished Report.

Robinson, C.S. (1970). *Ecology of the Hardman Basin, Northern Territory.* Animal Industry and Agriculture Branch, Northern Territory. Technical Bulletin No. 6.

Rose, B.D. (1985). *Preliminary Report : Ethnobotany in the Bungles.* East Kimberley Working Paper No. 5. Publ. by CRES, ANU.

Scarlett, N. (1985). *A Preliminary Account of the Ethnobotany of the Kija People of the Bungle Bungle Outcamp.* East Kimberley Working Paper No. 6. Publ. by CRES, ANU.

Simpkin-Brown, J. (1985). *A Resource Inventory of the Bungle Bungle Area, East Kimberley Region, Western Australia* Unpublished Report.

Slatyer, R.O. (1970). Climate of the Ord-Victoria Area IN : Stewart, G.A. *et al* (1970) p 62-74.

Stewart, G.A. *et al* (1970) *Lands of the Ord-Victoria Area; Western Australia and Northern Territory.* Commonwealth Scientific and Industrial Research Organisation. Land Research Series No. 28.

Traves, D.M. (1955). *The Geology of the Ord-Victoria Region of Northern Australia.* Bureau ofMineral Resources, Australia. Bulletin No. 27.

Western Australian Government (1988). *Mining and the Environment. Balancingthe Scales.* A Western Australian Government Policy Report.

Western Australian Main Roads Department (1988). Bungle Bungle National Park. Access Road Planning Report. August 1988. Report No. 0090P.

Western Australian Tourism Commission (1987). Submission to the Draft Plan of Management for the Bungle Bungle National Park. Unpublished Report.

Williamson, D.N & Chalmers, J.A. (1982). *Perceptions of Forest Scenic Quality in Northeast Victoria.* Forest Commission, Victoria.

Young, R.W. (1987). *Erodibility of Sandstone Surfaces of the Bungle Bungle, East Kimberley Region.* Report to the Heritage Committee of Western Australia.

APPENDIX 1

Conservation and Land Management

BUNGLE BUNGLE NATIONAL PARK

VISITOR SURVEY

SUMMARY OF RESPONSES

1. Where do you usually live?

Perth	20.3%	Interstate	55.4%
Kimberley Region	4.3%	Overseas	5.5%
Other WA	13.8%	Other	0.7%

2. How many persons in your party belong to each of the following age groups?

less than 16 years	13.5%	16 - 25 years	13.0%
41 - 60 years	30.6%	26 - 40 years	30.7%
61 years and over	12.2%		

3a. Is this your first visit to the Bungle Bungle National Park?

Yes 94.5% No 5.4%

b. If No, in what year did you first see Bungle Bungle? 19<u>86</u> (42.9%)

4. How long have you stayed in the Park this trip?

Day visit	6.2%	4 - 7 nights	14.0%
1 night	18.1%	More than 1 week	0.7%
2 - 3 nights	61.1%		

5. What method of transport did you use to visit the Park this trip?

Hire vehicle	5.0%
Private vehicle	74.1%
Commercial tour	17.1%

Other (Please specify) ..3.8%..Motorcycles..walkers.....

6. If a range of accommodation were available in the Park, would you choose to stay overnight at any of the following?

A basic campground with minimal facilities	75.6%
A commercial site with camping facilities provided	13.7%
Simple chalet-type accommodation	3.7%
An Hotel-resort	0.8%
None of the above	6.2%

7. In planning this trip to the Bungle Bungle National Park, did you obtain information from any of the following?

Travel Agent/Tour Operator	17.3%	Conservation and Land Management Office	15.4%
Kununurra Visitor Centre	26.6%	National Park Brochures	20.7%
Other Tourist Bureau	14.7%	None of these	39.5%

8. Which features of the Bungle Bungle particularly interested you?

Scenery	95.4%	Geology	61.8%
Animal/birdlife	52.4%	Aboriginal culture	16.4%
Plants	51.2%	Remoteness	67.2%

Other (Please specify) ...7.5%...Uniqueness, wilderness.....

9. In which activities did you participate during your visit to the Park?

Camping	90.8%	Sightseeing	85%
Exploring Gorges	92.3%	Bushwalking	67.7%
Nature Appreciation	71.3%	Off-road driving	45.4%
Photography	90.9%	Fishing	1.1%

Other (please specify) ..5.1%...Swimming..birdwatching.....

10. On the following map

(a) please circle the places you have visited on this trip.

(b) mark with an asterisk (*), as accurately as possible, where you have camped overnight.

(c) indicate with arrows (→) the direction you travelled on roads into and out of the park.

11. What did you like most about the Park?

1. Scenery, beauty 50.7%
2. Domes, formations, Gorges 47.2%
3. Remoteness, isolation 36.0%

12. What did you dislike about the Park?

1. Access road, tracks, creek crossings 26.4%
2. Insufficient signs, maps, information 14.5%
3. No campfires, BBQ's 13.9%

13. a. Do you intend to visit Bungle Bungle again?

Yes 84.2% No 15.8%

b. If yes, what method of transport are you likely to choose?

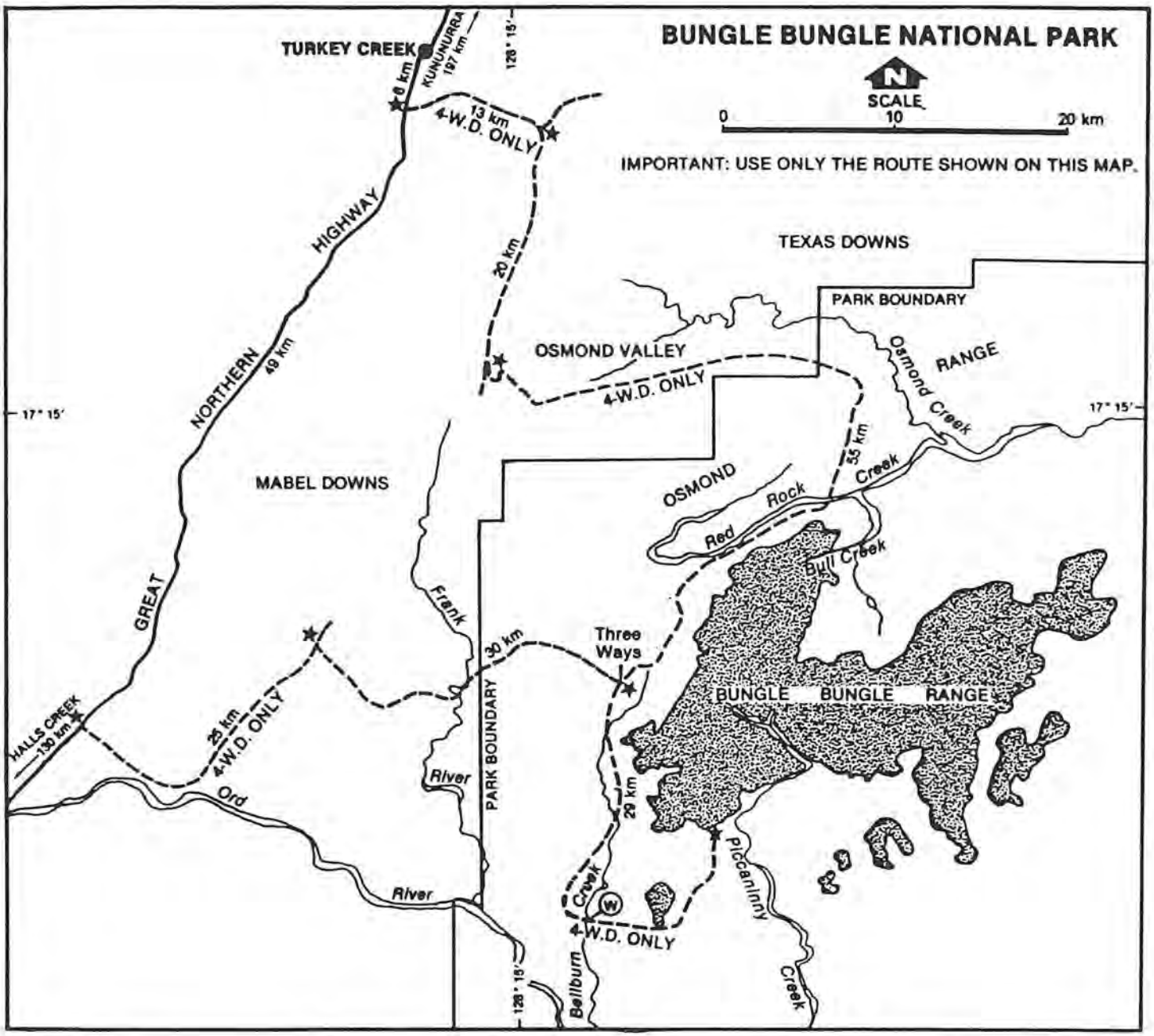
Charter Plane	14.4%	Hire vehicle	[5.1%
Helicopter	9.7%	Private vehicle	[59.7%
Commercial tour	6.9%	Other (please specify)	4.1% Motorcycle

14. Please indicate if you have visited any of the following National Parks of Western Australia or the Northern Territory.

	a) This Trip OR	b) Previously
Mirima (Hidden Valley)	33.6%	16.4%
Wolfe Creek Crater	40.9%	17.3%
Giekie Gorge	53.7%	27.2%
Windjana Gorge	56.1%	22.3%
Tunnel Creek	52.4%	20.6%
Keep River	20.2%	5.9%
Kakadu	35.5%	33.0%
Katherine Gorge	34.7%	42.6%
Kings Canyon	22.6%	31.7%
Uluru (Ayers Rock - Mt Olga)	31.2%	50.9%

15. Any further comments?

1. Retain in natural state, no development, commercialisation 22.8%
2. Some roadworks needed 11.4%
3. Information, signs, maps etc not satisfactory 10.1%
4. Thanked/liked Park rangers & spouses 8.9%
5. No improvement, keep 4WD 8.6%



(10) OFFICE USE ONLY								
a	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
b	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
c	[ ]	[ ]	[ ]					
d	[ ]	[ ]	[ ]					

TABLE 1.1 MOST POPULAR SITES VISITED IN THE PARK

AREA VISITED IN PARK	RELATIVE FREQUENCY (%)
Piccaninny Area	87
Echidna Chasm	54
Red Rock Creek Area	23
Bull Creek Area	18
Other Gorges/Areas	16
Wulwuldjii/Osmond Creek	11

TABLE 1.2 CAMPSITES USED WITHIN THE PARK

AREA CAMPED AT IN PARK	RELATIVE FREQUENCY (%)
Bellburn Campsite	64
Three Ways/Kurrajong	21
Spring Creek Track	17
Piccaninny Creek Area	14
Red Rock Creek Area	11
Date Palm/Wulwuldjii/Osmond Creek	8
Echidna Chasm	5
Bull Creek Area	3

TABLE 1.3 ACCESS ROUTES INTO AND OUT OF THE PARK

ENTRANCE/EXIT ROADS	RELATIVE FREQUENCY (%)
Route in	
Spring Creek Track	97.8
Osmond Valley Track	2.2
Route Out	
Spring Creek Track	95.4
Osmond Valley Track	4.6

CONCLUSION

The Bungle Bungle National Park with its spectacular scenery and remote location has captured the imagination of the travelling public. Relatively few people are actually getting into the Park at present, but those who have are so impressed that their word-of-mouth, together with increasing media attention, will guarantee greater visitor numbers in the future.

Those people who take the great trouble and effort required to reach the massif are vitally interested in its future management and protection. This is evidenced by the very high return rate (94%) of questionnaires and the great amount of detail and thought which were put into the comments.

Most visitors appear to be couples on extended holidays, probably travelling around Australia. Many visit other national parks on their trip. About 50% of visitors appear to travel up from the south, and about 30% across from the Northern Territory. More than half the visitors in 1987 were from interstate. Only 17% of respondents were on organized commercial tours, the rest were independent travellers.

The preferred style of accommodation is camping, with most people enjoying basic bush camping. Some visitors however, would appreciate the comfort of a commercial campsite with better facilities provided.

Virtually all visitors appreciated the intrinsic values of the natural environment, enjoying the camping and scenery and natural history. Most people visited "named" places, following well-established tracks and walk trails, but relatively few explored further afield or ventured into unmarked gorges.

Most visitors saw nothing of the Aboriginal cultural history of the Park, although many indicated an interest in finding out something. There was a general demand for information of all types in the Park, including maps, directional signs and interpretative information.

There is a potential challenge here for management to resolve: to maintain a natural, unspoilt, wilderness ambience, whilst providing suitable visitor facilities which enhance a safe, comfortable and informative trip.

From a management perspective, the major observations based on visitors' comments are:

1. Retain the Park in its natural state with no development nor commercialisation.
2. Some roadworks are required to reduce erosion of tracks.
3. More literature, information, maps and signs are needed.
4. Present campsites and facilities require improvement.
5. Increased involvement of Aboriginal people in park management will be appreciated.
6. Further road access and more walk trails are required.
7. Visitors enjoy a high level of contact with Park Rangers.

APPENDIX 2. ANNOTATED FAUNA LIST FOR THE PURNULULU (BUNGLE BUNGLE) NATIONAL PARK AND RESERVE.

Mammals (Source : Muir, 1983)

A collection of bone material and pellets were collected from a crevice in limestone near Bungle Bungle outcamp. Mr Alex Baynes has identifed the following.

Rodentia	*Pseudomys nanus*	Western Chestnut Mouse
	Pseudomys delicatulus	Delicate Mouse
	Leggadina forresti	Forrest's Mouse
	Rattus tunneyi	Pale Fieldrat
Dasyuridae	Genus and species not yet identified.	
Chiroptera	*Taphozous georgianus*	Common Sheathtailbat
	Eptesicus pumilus	Little Cave Eptesicus

Feral cattle and donkeys were ubiquitous.

Birds (Source : National Park Ranger, Bob Taylor)

Passerines	Williewag Tail	*Rhipidura leucophrys*
	Northern Fantail	*Rhipidura rufiventris*
	Grey Fantail	*Phipidura fuliginosa*
	Restless Flycatcher	*Myiagra inquieta*
	Leaden Flycatcher	*Myiagra rubecula*
	Grey Shrike Thrush	*Colluricincla harmonica*
	Sandstone Shrike Thrush	*Colluricincla woodwardi*
	Rufous Songlark	*Cinclorhamphus mathewis*
	Rufous Whistler	*Pachycephala rufiventris*
	White Winged Triller	*Lalage tricolor*
	Australian Pipit	*Anthus novaeseelamdiae*
	Australian Mudlark	*Cralline cyanoleuca*
	Australian Magpie	*Gymnorhina tibicen*
	Grey Crowned Babbler	*Pomatostomus temporalis*
	Great Bowerbird	*Chlamydera nuclalis*
	Olive Backed Oriole	*Oriolus sagittatus*
	Pied Butcher Bird	*Cracticus nigrogularis*
	Grey Butcher Bird	*Cracticus torquatus*
	Torresian Crow	*Corvus orru*
	Blackfaced Woodswallow	*Artamus cinereus*
	Masked Woodswallow	*Artamus personatus*
	White Browed Woodswallow	*Artamus superciliosus*
	Little Woodswallow	*Artamus minor*
	Little Friarbird	*Philemon citerogularis*
	Silver Crowned Friarbird	*Philemon argenticeps*
	Yellow Throated Minor	*Monorina flavigula*
	Yellow Tinted Honeyeater	*Lichenostomus flavescens*
	Grey Fronted Honeyeater	*Lichenostomus plumulus*
	White Gaped Honeyeater	*Lichenostomus unicolor*
	Singing Honeyeater	*Lichenostomus virescens*
	Brown Honeyeater	*Lichmera indistincta*
	Rufous Throated Honeyeater	*Conopophila rufogularis*
	White Throated Honeyeater	*Melithereptus albogularis*
	Banded Honeyeater	*Certhionya pectoralis*

	Golden Backed Honeyeater	*Melithreptus gularis*
	Mistletoebird	*Dicaeum hirundinaceum*
	Striated Pardolote	*Pardalotus striatus*
	Weebill	*Smicrornis brevirostris*
	Long Tailed Finch	*Poephila acuticauda*
	Masked Finch	*Poephila personata*
	Zebra Finch	*Taeniopygia guttata*
	Double Barred Finch	*Taeniophgia bichenovii*
	Crimson Finch	*Neochmia pheton*
	Painted Finch (firetail)	*Emblema picta*
	Pictorella Manikin	*Heteromunia pectoralis*
	Black Tailed Treecreeper	*Climacteris melanura*
	Varied Sittella	*Daphoenositta chrysoptera*
	Red Backed Fairywren	*Malurus melanocephalus*
	Vairegated Fairywren	*Malurus lamberti*
	Black Faced Cuckoo Shrike	*Coracina novaehollandiae*
	White Bellied Cuckoo Shrike	*Coracina papuensis*
	Ground Cuckoo Shrike	*Coracina maxima*
	Pallid Cuckoo	*Cuculus pallidus*
	Tawny Grassbird	*Megalurus timoriensis*
	Spinifex Bird	*Eremiornis carteri*
Non Passerines	Doller Bird	*Eurystomus orientalis*
	Large Egret	*Ardea alba*
	Pacific Heron	*Ardea pacifica*
	White Faced Heron	*Ardea novaehollandiae*
	Rufous Night Heron	*Nycticorax celedonicus*
	Black Bitten	*Ixobrychus flavicollis*
	Little Pied Cormorant	*Phalacrocorax melanoleucos*
	Darter	*Anhinga melanogaster*
	Black Necked Stork	*Ehhippiorhynchus asiatucus*
	Hoary Headed Grebe	*Poliocephalus poliocephalus*
	Burdekin Duck	*Tadorna radjah*
	Black Fronted Dotterel	*Elseyorinis melanops*
	Pelican	*Pelecanus conspicillatus*
	Tawny Frogmouth	*Podargus strigoides*
	Spotted Nightjar	*Caprimulgus argus*
	Boobook	*Ninox boobook*
	Barking Owl	*Ninox connivens*
	Bush Thick Knee	*Burhinus grallarius*
	Bustard	*Ardeotis kori*
	Emu	*Dromaius novaehollandiae*
	Tree Martin	*Hirundo nigricans*
	Fairy Martin	*Hirundo ariel*
	Channel Billed Cuckoo	*Scythrops novaehollandiae*
	Pheasant Coucal	*Centropus phasianinus*
	Wedgetailed Eagle	*Aquila audax*
	Little Eagle	*Hieraaetus morphnoides*
	Whistling Kite	*Milvus sphenurus*
	Black Kite	*Milvus migrans*
	Brown Falcon	*Falco berigera*
	Australian Hobby	*Falco longipennis*
	Brown Goshawk	*Accipiter fasciatus*
	Grey Goshawk	*Accipiter novaehollandiae*
	Spotted Harrier	*Circus assimillis*

Grey Falcon	*Falco hypoleucos*
Nankeen Kestrel	*Falco cenchroides*
Black Breasted Buzzard	*Hamirostra melanosternen*
Collard Sparrowhawk	*Accipiter cirrhocephalus*
Blue Winged Kookaburra	*Dacelo leachii*
Rainbow Bee eater	*Merops ornatus*
Red Backed Kingfisher	*Todiramphus pyrrhopygius*
Sacred Kingfisher	*Todiramphus sanctus*
Singing Bushlark	*Mirafra javanica*
Redtailed Black Cockatoo	*Calyptorhynchus banksii*
Sulphur Crested Cockatoo	*Cacatua galerita*
Little Corella	*Cacatua pastinator*
Galah	*Cacatua reseicapilla*
Redwinged Parrot	*Aprosmictus erythropterus*
Vaired Lorikeet	*Psitteuteles versicolor*
Redcollared Lorikeet	*Trichoglossus haematodus*
Northern Rosella	*Platycercus venustus*
Cockatiel	*Leptolophus hollandicus*
Budgerygah	*Melopsittacus undulatus*
White Quilled Rockpigeon	*Petrophassa albipennis*
Common Bronzewing	*Phaps chalcoptera*
Crested Pigeon	*Geophaps lophotes*
Spinifex Pigeon	*Geophaps plumifera*
Diamond Dove	*Geopelia cuneata*
Peaceful Dove	*Geopelia placida*
Barshouldered Dove	*Geopelia humeralis*
Brown Quail	*Coturnix australis*