Lane Poole Reserve and Proposed Reserve Additions

Management Plan No. 68 2011

Department of Environment and Conservation

Conservation Commission WESTERN AUSTRALIA

LANE POOLE RESERVE AND PROPOSED RESERVE ADDITIONS

MANAGEMENT PLAN

2011

Department of Environment and Conservation

Conservation Commission of Western Australia

VISION

By 2021, the conservation of natural and recreational values of the planning area are in the same or better condition than in 2011. There will be a greater understanding of the threats and impacts on these values. The planning area will continue to support a wide range of nature-based recreational and outdoor education activities while preserving the integrity of the key values. The local community will highly value the area and will want to be involved in its protection and conservation. The Indigenous cultural heritage of the planning area will be continued and promoted by active and ongoing involvement of the Aboriginal traditional custodians.

Front cover images:
Main photo: Murray River at the Baden Powell recreation site, photo by Melissa Mazzella, DEC.
Other photos: Western Ringtail Possum, photo by Babs and Bert Wells.
Camping, photo by Tourism WA.

This management plan has been produced on recycled paper. http://www.dec.wa.gov.au

EXECUTIVE SUMMARY

The Department of Environment and Conservation (the Department) manages and prepares management plans for reserves vested in the Conservation Commission of Western Australia (Conservation Commission) under the provisions of the *Conservation and Land Management Act 1984* (CALM Act). The Conservation Commission issues draft plans for public comment and provides final plans for approval by the Minister for Environment.

The *Lane Poole Reserve and Proposed Reserve Additions Management Plan 2011* has been prepared by the Department on behalf of the Conservation Commission. As specified in the CALM Act, this plan provides a statement of policies and guidelines proposed to be followed and a summary of operations proposed to be undertaken. This management plan will replace the *Lane Poole Reserve Management Plan 1990-2000* (CALM 1990) and be complementary to the *Forest Management Plan 2004-2013* (FMP) (Conservation Commission 2004). Where there is conflict between this plan and the FMP, this plan will take precedence. The term of this management plan will be 10 years, or until the plan is superseded by a new management plan.

The Department and Conservation Commission recognise that effective management of the planning area depends on the support, cooperation and participation of the community and therefore seek to ensure that there is ample opportunity to be involved—both in the preparation of this management plan and as well as the ongoing management of the area. Strategies in this plan have been developed by taking into consideration comments received from the community and other key stakeholders during its preparation. This included input from the community advisory committee, submissions to a publicly released issues paper, 'Have Your Say' brochures, draft management plan, and consultation with key stakeholders.

The Conservation Commission and Department will seek to achieve the plan's objectives by implementing strategies within available resources. Reports by the Conservation Commission will show the progress of the implementation of the plan and will make it clear if any actions have not been progressed and for what reason.

This management plan is a values and issues based enabling document, with background information presented to provide context to management decisions. The planning area comprises Lane Poole Reserve (51,643ha) and the proposed additions (24,163ha).

The planning area (75,806ha) lies on the edge of the Darling Scarp, approximately 100km south-east of Perth. The nearest towns are Dwellingup to the north and Collie to the south. The planning area is located in the Northern Jarrah Forest subregion which forms part of the internationally recognised south-west WA biodiversity hotspot, one of 34 in the world and the only one in Australia. The area is particularly important because the Murray Valley is the last of the major valleys in the Northern Jarrah Forest not to be flooded for water supply.

Lane Poole Reserve is well known for its recreation and nature-based tourism opportunities but also high conservation values with the presence of rare and priority flora and fauna, significant habitats including old-growth forest, wandoo woodlands, riparian areas and wetlands. It contains a complex, diverse and interwoven ecosystem that provides suitable habitats for threatened species such as the noisy scrub bird (*Atrichornis clamosus*), western ringtail possum (*Pseudocheirus occidentalis*) and woylie (*Bettongia penicillata ogilbyi*) which have been translocated to the parts of the planning area.

There are many threats to the natural values within the planning area. This management plan identifies these threats and suggests management strategies to minimise or mitigate their impacts on the natural values. Threats in the planning area include environmental weeds, introduced and other problem animals (e.g. foxes and pigs), disease (e.g. *Phytophthora*) and inappropriate fire regimes.

As one of the highest visited natural areas (approximately 175,000 visitors annually) in the region, Lane Poole Reserve caters for many users groups, highlighted by the diverse facilities and opportunities the reserve provides. Camping, picnicking, canoeing and kayaking along the Murray River, swimming, fishing, marroning, bushwalking, mountain biking and scenic and recreational driving are activities regularly undertaken in the area.

This plan allows for an increase in the number of tent campsites through the expansion of existing camping grounds rather than the development of entirely new sites. This is with the exception of the relocation of the existing Baden Powell campsite. There will also be an expansion of existing day use sites to cater for the anticipated increase in day visitors to the planning area over the life of the management plan. The proposed changes to visitor use are presented in sections 30 – *Visitor Access*, 31.4 – *Day Use* and 31.5 – *Overnight Stays.*

Proposed changes to public access to the planning area aim to improve visitor access to key recreation sites and address visitor safety. Map 7 and Table 5 reflect the proposed changes to access to the northern recreational area of the planning area over the life of the management plan. These changes will provide an improved, organised and structured access that will assist in improving visitor experience, address safety concerns and reduce conflicts between users.

This plan also proposes to designate several recreation sites where dogs will be permitted. At these sites, dogs will continue to be allowed on a lead and restrained at all times. Dogs will not be permitted in rest of the planning area including Icy Creek, Chuditch Scarp Pool and Scarp Lookout recreation sites. Further research and monitoring over the life of the plan may determine that other recreation sites may be designated as areas where dogs are permitted or added to dog free areas. Designated areas will be sign posted and information provided to visitors. For further information see Section 34 – *Domestic Animals.*

There are two State Agreement Acts (*Alumina Refinery Agreement Act 1961* and the *Alumina Refinery (Worsley) Agreement Act 1973*) applicable in the planning area. Alcoa have identified areas west of Nanga Road in reserve 39827 that are scheduled for bauxite mining in 2009-18.

Changes since the previous management plan

The reserve has been managed according to the *Lane Poole Reserve Management Plan 1990-2000* (CALM 1990) since its gazettal.

Legislative or Policy Changes

- The Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* provides protection for threatened species and communities.
- Changes to the CALM Act in 2000 have replaced the National Parks and Nature Conservation Authority with the Conservation Commission as the controlling body for the terrestrial conservation reserve system in WA. This change has given the Conservation Commission responsibility for submitting management plans to the Minister for Environment and developing guidelines for monitoring and assessing the implementation of management plans. Consequently, management plans are now outcome-based in terms of performance assessment, and include Key Performance Indicators against which the Conservation Commission will assess performance.
- The *Regional Forest Agreement 1999* (RFA) promoted the cessation of timber harvesting in 100% of all old-growth forests and the protection of these areas in a comprehensive, adequate and representative reserve system involving the creation of new national parks within the south-west of WA. The FMP (Conservation Commission 2004) was gazetted to implement these tenure commitments. These documents have led to the proposed tenure changes and proposed reserve additions as identified in this management plan.
- The development of the updated Policy Statement No. 19 – *Fire Management* which includes 12 scientific principles which places a greater emphasis on biodiversity management and fire ecology.
- The development of the *Conservation and Land Management Regulations 2002* and a revised Policy Statement No. 18 – *Recreation, tourism and visitor services* and associated guidelines which reflect the new regulations, incorporates a wider range of recreational activities and clarifies issues with pre-existing uses that may not be necessarily permitted in national parks but have arisen from the creation of new national parks from State forests where these activities were formerly permitted.

Knowledge of the Values of the Planning Area

- Research and monitoring programs have improved the knowledge of the values of the planning area. In particular, knowledge has been gained on flora, fauna, habitats, visitor use, introduced animals and environmental weed control, disease management, fire management, rehabilitation techniques and resource use.
- An Interim Biogeographic Regionalisation of Australia (1995) was developed and followed by a biodiversity audit of WA's bioregions in 2003.
- Commonwealth Scientific and Industrial Research Organisation (CSIRO) and other climate change studies and projections for Australia were developed.
- The knowledge of the critical role of fire in biodiversity conservation has developed in recent years, and the Department now applies fire to not only reduce the negative impacts of bushfires on community values, but also to conserve biodiversity. A review of fire in ecosystems of the south-west of WA was undertaken in 2003.
- The *Environmental Weed Strategy for WA* (CALM 1999) rates weeds according to specific criteria to aid in determining priority for control.

- The *Western Shield* program (1996 to present) is the biggest wildlife conservation program in Australia involving aerial and ground baiting of more than 3.5 million hectares of land managed by the Department for the introduced predators, the fox and feral cat. Western Shield also involves translocations of significant fauna including western ringtail possum (*Pseudocheirus occidentalis*) and woylie (*Bettongia penicillata ogilbyi*) to fox-controlled areas within their former range.

Increased Demand and Use of the Planning Area

- There is a need to strengthen recreation management to preserve current recreation opportunities, maintain the quality of recreation facilities, to manage new and emerging recreational pursuits and to manage the impacts of visitor use.
- Trends show a migration away from traditional picnicking and barbequing, to a growing visitors demand in using day use sites to start a new activity (R. Annear *pers. comm.* 2006). Day use sites in the planning area have become the focus for other nature-based leisure activities such as canoeing, bushwalking, cycling, scenic and recreational driving and observing nature.
- The development of the Chuditch recreation site, the inclusion of the Icy Creek Environmental Education Facility (Icy Creek) and Baden Powell recreation site in the proposed reserves additions and various proposed site redevelopments/upgrades are proposed to accommodate increasing visitor use.

NOMENCLATURE

Inclusion of a name in this publication does not imply its approval by the relevant nomenclature authority.

The 'Department' or 'DEC' refers to the Department of Environment and Conservation.

The term 'Director General' refers to the Director General of the Department of Environment and Conservation. Under the CALM Act, the term Chief Executive Officer can include the term Director General.

The 'Conservation Commission' refers to the Conservation Commission of Western Australia, which is the controlling body for the terrestrial conservation reserve system in WA.

The 'planning area' refers to the existing Lane Poole Reserve and proposed reserve additions.

When 'south-west' is used it refers to the general south-west corner of Western Australia between Geraldton and Esperance.

The Department's regional boundaries for this area are referred to as either the 'Swan Region' or the 'South West Region'. The Department's district boundaries for this area are referred to as either the 'Perth Hills District' or the 'Wellington District'.

The word 'Nyoongar' can be spelt in numerous ways. The spelling of Nyoongar in this form should also be seen to encompass the Nyoongar, Nyungar, Noongah and Nyungah spellings.

ACKNOWLEDGMENTS

This management plan was prepared by the Lane Poole Reserve planning team: Melissa Mazzella (Planning Officer and management plan coordinator), Stefan de Haan and Drew Griffiths. Assistance and contributions were also provided by Paul McCluskey, Kathryn McGuane, Daryl Moncrieff, Mike Meinema, Rod Annear, Nathan Greenhill, Rohan Carboon, Alex Bowlay, Ingrid Hunt and David Hampton. The figures were prepared by Burke Stephens and Melissa Mazzella and the maps and figure 10 by Aaron Rivers.

Comment and advice during the preparation of this plan was provided by:

- Departmental staff—in particular staff of the Swan and South West Regions, Perth Hills and Wellington Districts and other specialist branches within the Department;
- the Department's Corporate Executive; and
- Conservation Commission—in particular representatives Peter Baldwin and Kathryn Allen.

Many other people, individuals and agency representatives made valuable contributions to the development of this document. The assistance of the Lane Poole Reserve Community Advisory Committee is especially acknowledged.

CONTENTS

APPENDICES

MAPS

TABLES

FIGURES

PART A. INTRODUCTION

1. BRIEF OVERVIEW

Lane Poole Reserve lies on the edge of the Darling Scarp, approximately 100km south-east of Perth (see Map 1). The nearest townships are Dwellingup to the north and Collie to the south. The reserve is vested in the Conservation Commission and is managed by the Department. Lane Poole Reserve was named after C.E. Lane Poole, the State's first Conservator of Forests and a devoted conservationist.

The reserve and proposed additions (the planning area) (see Section 3 – *Management Plan Area*) encompass 75,806ha, ranging from the steeply forested valley slopes and rock-rimmed pools of the Murray River near the Darling Scarp, to the more open, undulating jarrah forests and wandoo woodlands further east.

The planning area protects significant flora and fauna species and habitats, as well as landscapes that provide opportunities for conservation, education, interpretation, recreation, nature-based tourism, scientific research and potential climate change refuge areas. The major attraction to visitors is perhaps the Murray River, which flows through the northern part of the planning area and is the last of the major valleys in the Northern Jarrah Forest not flooded for water supply.

South-west WA is recognised as one of 34 international biodiversity hotspots, and the only one in Australia (Conservation International 2006). Covering an area of 356,717km^2, it contains numerous threatened and endemic species (Conservation International 2006). The additions to, and the proposed change in tenure to parts of the planning area (see Section 14 – *Existing and Proposed Tenure*) will aid in further protecting a portion of Western Australia's jarrah forest, wandoo woodlands and the biodiversity hotspot from the increasing pressures placed upon it.

A favourite destination for locals and residents from the Perth metropolitan area, the planning area provides opportunities for a range of recreation activities. Visitation to the planning area is expected to continue increasing in line with current trends, especially as the predicted population growth of the Peel Region is almost five percent per annum (see Section 2 – *Regional Context*). As visitation rises, a corresponding increase in recreational pressures on the planning area occurs, leading to greater impacts on the natural values and conflicts between user groups (see Part C – *Managing the Natural Environment* and Part E – *Managing Visitor Use*). Management strategies in this plan will aim to minimise these impacts.

The planning area is unique in the south-west because of a combination of key attributes including:

- it is within an easy one and a half hour drive from Perth and readily accessible to nearby communities including Bunbury, Mandurah, Pinjarra, Waroona, Dwellingup and Collie and is situated near the main travel route from Perth to the south-west of the State;
- the Murray River flows year-round through the northern part of the planning area, providing a platform for a diverse range of water-based recreation activities including canoeing and white water rafting (see Section 31 – *Visitor Activities*); and
- it contains sections of the Bibbulmun Track and the Munda Biddi Trail.

Given its location, attraction, expected population growth and an increase in the popularity and availability of nature-based tourism and recreation activities, there is an opportunity to raise community awareness of the natural values of the area. This in turn will provide a platform for stewardship and the community's understanding and appreciation of the key values of the planning area.

2. REGIONAL CONTEXT

The planning area is located across three Department of Local Government regions and six shires, namely:

- 'Peel' planning region including the shires of Boddington, Murray, Waroona;
- 'South West' planning region including the shires of Collie and Harvey; and
- 'Wheatbelt' planning region including the Shire of Williams.

The Peel Region has the third highest population of the State's regions, and has the fastest growing population in Western Australia, with a growth rate of 3.8% per annum between 1998 and 2009 compared to the State average of 1.9% (Peel Development Commission 2010). The estimated resident population of the Peel Region was 104,877 in 2010 (Peel Development Commission 2010).

The Peel Region's population is projected to grow by between 2-5.5% between 2009 and 2024, with the fastest growth in the shires of Serpentine-Jarrahdale and Murray (Peel Development Commission 2010). These increases are due to the Peel region's proximity to Perth, good housing affordability, lifestyle attractions and improved access because of the Kwinana Freeway extension, Forrest Hwy and the southern suburbs railway. Such population increases will only continue to add to the increasing pressures on the planning area.

The major urban centre of the Peel Region is Mandurah, followed by Pinjarra, Dwellingup, Serpentine and Jarrahdale. The region has a diverse economy based predominantly on mining and mineral processing (e.g. bauxite mining), although tourism, agriculture, timber production, fishing, manufacturing and construction also make valuable contributions (Peel Development Commission 2010).

The town of Dwellingup, located within the Peel Region, had a population of 345 in 2006 and is less than 7.5km from the northern section of the planning area (ABS 2007). This section of the planning area is the focus for most recreational activity. The town of Waroona with a population of 2478 in 2006 is also located near the northern section of the planning area (ABS 2007).

The South West Region covers 12 local government areas and is divided into three subregions Bunbury-Wellington, Vasse and Warren-Blackwood. The southern section of the planning area lies in the Bunbury-Wellington subregion, which is recognised by the diverse landforms of the Darling Plateau and Swan Coastal Plain and the richness of its biological and economic resources. A characteristic of the region is the complexity and intensity of land use, which can be attributed to its abundance of natural resources and proximity to markets in Perth and regional population centres. Important industries in the South West Region include mining (e.g. bauxite, coal and mineral sands), power generation, agriculture and tourism (SWDC 2010).

In 2005, it was estimated that approximately 157,000 people live in the South West Region, and with a growth rate of 2.2%, is above the State average (SWDC 2010). By 2027 it is anticipated that 216,000 people will make the region their home (SWDC 2010).

The town of Collie, located within the South West Region, had a population of 9332 in 2009, is approximately 12km from the southern section of the planning Area (SWDC 2010).

The Wheatbelt Region covers an area of 154,862km^2 and includes 43 local government areas (Department of Regional Development and Lands 2011). The region has a population of approximately 74, 900 which is expected to grow to 89,900 by 2031, centralised around the main service centres (Department of Regional Development and Lands 2011). Important industries in the Wheatbelt Region include agriculture, mining, retail turnover, manufacturing, building construction, tourism and fishing (Department of Regional Development and Lands 2011).

3. MANAGEMENT PLAN AREA

The area covered by this management plan applies to the existing Lane Poole Reserve and proposed reserve additions (see Map 1). The planning area stretches approximately 60km along the Darling Scarp sharing its boundary with State forest, timber reserve and freehold land. There are also internal enclaves of freehold land and two trigonometrical stations (Crown reserves 39843 and 39845). In total, the management plan covers 75,806ha.

Existing Reserve

Lane Poole Reserve currently comprises six class A reserves vested in the Conservation Commission and set-aside for the purposes as outlined in Table 1 (see also Map 2). The reserves were originally gazetted on 6 February 1987 and encompass an area of 51,643ha.

Table 1. Existing Reserves Comprising Lane Poole Reserve

Reserve No.	Tenure	Reserve Purpose	Area (ha)
39819	Conservation park	Conservation Park and the agreement defined in s 2 of the Alumina Refinery Agreement Act 1961	1755
39820	Conservation park	Conservation Park and the agreement defined in s 2 of the Alumina Refinery Agreement Act 1961	3028
39821	CALM Act section 5(1)(g) reserve	Conservation and the agreement defined in s 2 of the Alumina Refinery Agreement Act 1961	29,331
39822	Conservation park	Conservation Park and the agreement defined in s 2 of the Alumina Refinery Agreement Act 1961	2593
39823	Conservation park	Conservation Park and the agreement defined in s 2 of the Alumina Refinery Agreement Act 1961	2583
39827	CALM Act section 5(1)(g) reserve	Recreation and Enjoyment of the Natural Environment and the agreement defined in s 2 of the Alumina Refinery Agreement Act 1961	12,353

Proposed Reserve Additions

It is intended that the proposed reserve additions, as identified in Section 14 (see also Map 2 and Appendix 2) will come under the provisions of this management plan once changes in land tenure and purpose occur and lands not currently vested with the Conservation Commission become vested to them as class A reserves. The proposed additions include:

- land parcels identified in the Forest Management Plan (12 parcels totalling 24,084ha);
- Un-named reserve 47688 (79ha); and
- Crown reserve 6902 (0.3ha).

At the time of writing, the planning area consists of national park, conservation park and CALM Act section 5(1)(g) and (h) reserves, State forest, timber reserve, unallocated Crown land (UCL), miscellaneous reserve, other Crown reserves and Water Resources Ministerial Body freehold areas.

The proposed additions will increase the area of the existing reserve by 24,163ha.

The planning area should be managed (under the provisions of each tenure type) as if it were national park with the exception of mineral and petroleum exploration and development as outline in Section 37.

4. KEY VALUES

The key values of planning area include:

Natural

- Located within an internationally recognised ‘biodiversity hotspot’.
- A rich mosaic of significant habitats including un-dammed riparian areas and wetland (e.g. lakes Yourdamung and Nalyerin), granite outcrops, old-growth forests and wandoo woodlands.
- Populations of rare and priority fauna including Baudin’s cockatoo (*Calyptorhynchus baudinii*) and Carnaby’s cockatoo (*Calyptorhynchus latirostris*), quokka (*Setonix brachyurus*), western ringtail possum (*Pseudocheirus occidentalis*) and noisy scrub bird (*Atrichornis clamosus*); and rare and priority flora including the rare dwarf spider orchid (*Caladenia bryceana* subsp. *bryceana*).
- A diverse array of natural environments providing numerous research opportunities to increase knowledge associated with ecological, biological and physical processes, native flora and fauna and their habitats, the effects of threatening processes and for visitor research.

Recreational

- A terrestrial environment that provides opportunities for a diverse range of nature-based recreational tourism opportunities including recreational driving (e.g. Nanga Heritage Circuit), bushwalking (e.g. Bibbulmun

Track, King Jarrah Walk), recreation sites (e.g. Baden Powell, Chuditch) and mountain biking (e.g. Munda Biddi Trail).
- Un-dammed riverine environment of the Murray River, providing opportunities for canoeing, kayaking, rafting, swimming, fishing and marroning.

Cultural

- Indigenous sites, artefacts and landscapes of mythological, cultural and spiritual significance to Aboriginal people.
- Non-indigenous cultural heritage associated with early settlements and the timber industry.

Community

- Involvement of the local and wider community in management of the planning area (e.g. weed control programs).
- Opportunities for community involvement in activities and experiences in nature conservation and visitor services.
- Presence of three public drinking water source areas (i.e. Harris River, Samson Brook and Wellington Dam) and the Murray River water reserve.

Educational and Interpretation

- An extensive range of community educational and interpretation opportunities to describe the native flora and fauna, Indigenous and non-indigenous cultural heritage and the Department's management of the area.
- Opportunities for groups to use the Icy Creek Environmental Education Facility (Icy Creek).

Economic

- Mineral value (e.g. bauxite mining) to State and local economies.
- Tourism expenditure in local communities from visitors attracted by the natural, cultural and recreational values.
- Nature-based tourism opportunities, focussing on the wide range of natural, cultural and recreational values.

5. PUBLIC PARTICIPATION

This management plan has been developed in consultation with local communities, local government authorities, visitors and other interested parties in the following ways:

- distribution of 'Have Your Say' brochures to encourage individuals and organisations to register their interest in the planning process and identify issues to be considered during the development of this plan;
- distribution of an 'Issues Paper' to stimulate discussion, and inform and assist the public in participating in the management planning process;
- re-establishment of the Lane Poole Reserve Community Advisory Committee with local governments representatives, community members, Native Title Claimants, Conservation Council and the Department, meeting regularly to discuss key management issues and provide input during development of this plan;
- providing regular updates to keep interested parties informed of developments in the planning process (i.e. *The Planning Diary*);
- consulting government departments, including the Department of Indigenous Affairs, the Department of Regional Development and Lands, Department of Water (DoW), Water Corporation, Department of Fisheries (DoF), Department of Mines and Petroleum (DMP) and relevant local government authorities;
- conducting surveys of visitors to collect data on specific issues and visitor satisfaction; and
- inclusion of an article in the winter 2009 edition of *LANDSCOPE*; and
- release of the draft management plan for public comment.

PART B. MANAGEMENT DIRECTIONS AND PURPOSE

6. VISION

The vision of this plan is:

By 2021, the conservation of natural and recreational values of the planning area are in the same or better condition than in 2011. There will be a greater understanding of the threats and impacts on these values. The planning area will continue to support a wide range of nature-based recreational and outdoor education activities while preserving the integrity of the key values. The local community will highly value the area and will want to be involved in its protection and conservation. The Indigenous cultural heritage of the planning area will be continued and promoted by active and ongoing involvement of the Aboriginal traditional custodians.

The vision of this plan is derived from State legislation and policy, the policies of the Conservation Commission and the Department, and community input. The vision also reflects the key values of the planning area and the importance of sustainable management of those values (see Section 4 – *Key Values*).

7. LEGISLATIVE FRAMEWORK

Legislation

The CALM Act establishes the Conservation Commission and confers management of lands vested in the Conservation Commission with the Department. The CALM Act provides for the management of land and waters and imposes obligations relating to management planning of these areas. Sections 54-56 of the Act:

- specifies that the Conservation Commission is responsible for the preparation of management plans, through the Department, for all land vested in it;
- specifies that a management plan must contain a statement of policies or guidelines to be followed in the management of the area, and a summary of the operations proposed to be undertaken over the life of the plan; and
- defines management objectives for various categories of land (see Table 2 and Section 13 – *Land Tenure*).

In relation to management plans for the lands vested in it, the functions of the Conservation Commission under section 19(1)(g) of the CALM Act (see Section 10 – *Performance Assessment*) are:

- to develop guidelines for monitoring and assessing the implementation of management plans by the Department;
- to set performance criteria for assessing and auditing the performance of the Department in carrying out and complying with management plans; and
- to assess and audit the performance of the Department in carrying out and complying with management plans.

The procedure to make an amendment to a gazetted management plan is governed by section 61 of the CALM Act and involves a public consultation process.

The CALM Act also covers such matters as defining categories of lands and waters managed by the Department (see Section 13 – *Land Tenure*), establishing controlling bodies, establishing and defining the functions of the Department and the controlling bodies, management planning and auditing, permits, licences, contracts, leases, offences and enforcement.

The CALM Act also gives rise to the *Conservation and Land Management Regulations 2002* (CALM Regulations).

The Department is also responsible for administration of the *Wildlife Conservation Act 1950* (Wildlife Conservation Act) and associated regulations for the conservation and protection of indigenous flora and fauna on all lands and waters within the State.

The *Environmental Protection Act 1986* (Environmental Protection Act) provides for protection of the environment across the State. The Act provides for the development of environmental protection policies and the assessment of development proposals and planning schemes for potential environmental impacts. Significant development proposals may be referred to the Environmental Protection Authority (EPA) under the auspices of this Act. Of particular importance to this management plan is section 38, referrals for environmental assessment. This Act also gives rise to the *Environmental Protection (Noise) Regulations 1997* (Environmental Protection (Noise) Regulations).

There are a number of other Acts affecting the Department's activities or conferring specific powers on the Department. Some of these Acts are briefly described below. These and other statutory provisions of relevance to the planning area are referred to throughout this plan.

- *Aboriginal Heritage Act 1972* (Aboriginal Heritage Act). Under this Act the Department is required to report Aboriginal heritage sites and ensure that sites are protected.
- *Bush Fires Act 1954* (Bush Fires Act). This management plan is required to conform to this Act and satisfy the Fire and Emergency Services Authority (FESA) that adequate fire protection will be provided. Under section 34 (1a)(a) of the Act, management plans require approval from the FESA.
- *Mining Act 1978* (Mining Act). Section 4(1) of the CALM Act states that nothing in the CALM Act shall derogate from the operation of the Mining Act. This is also the case for State Agreement Acts of which the *Alumina Refinery Agreement Act 1961* (Alumina Refinery Agreement Act) and the *Alumina Refinery (Worsley) Agreement Act 1973* (Alumina Refinery (Worsley) Agreement Act) are applicable to the planning area.
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). This Commonwealth Act contains provisions relating to the protection of nationally-listed threatened species and ecological communities, listing of key threatening processes, heritage protection and will also apply to areas that become listed under the Ramsar Convention on Wetlands.

Policies

Departmental policies mentioned throughout this plan relate to the management of Department-managed land for matters such as weeds, fire, disease, rehabilitation, recreation and tourism, community involvement, flora, fauna, visual landscape and visitors.

Obligations and Agreements

Australia is a participant or signatory to a number of important conservation agreements, many of which affect the conservation estate managed by the Department, including the planning area.

Regional Forest Agreement for the South-West Forest Region of WA (RFA)

In 1992, State and Territory Governments agreed to the National Forest Policy Statement, which provides the framework for a long-term solution to the competing demands of conservation and industry on our forests. The National Forest Policy Statement set out the process for undertaking Comprehensive Regional Assessments of the natural, cultural, economic and social values of Australia's forests. These assessments formed the basis for the negotiation of RFA's in New South Wales, Victoria, Tasmania and Western Australia.

The RFA for the South-West Forest Region of WA was made on 4 May 1999 between the Commonwealth of Australia and the State of WA, and will remain in force for a minimum of 20 years. It established a framework for the management of forests, committing political parties to ensuring effective conservation forestry outcomes.

Convention on Biological Diversity

Australia signed the Convention on Biological Diversity at the United Nations Conference on Environment and Development (also known as the 'Rio Earth Summit') in 1992. The *National Strategy for the Conservation of Australia's Biological Diversity* was adopted in 1996 as the principal means for coordinated implementation of the convention in Australia. Its main goal is to protect biological diversity and maintain ecological processes and systems. To address this goal, there have been a number of significant changes to policy and legislation for

biodiversity conservation in Australia, strengthening regulatory and institutional mechanisms. This includes the EPBC Act and Caring for Our Country programs.

Australian International Council on Monuments (ICOMOS) Charter for the Conservation of Places of Cultural Significance (Burra Charter)

The *Burra Charter 1999* was adopted for the conservation of places of cultural significance. Setting the guidelines that include defining significance, establishing significance, conservation policy, and procedures for undertaking studies and reports, the Burra Charter can be applied to all types of places of cultural significance including natural, Indigenous and historic places with cultural values.

8. MANAGEMENT ARRANGEMENTS WITH ABORIGINAL PEOPLE

There is a strong interest by Nyoongar people to be involved in the management of the conservation estate in the south-west and to strengthen cultural ties to the land. Working together with Aboriginal people to care for the land will be beneficial to the preservation of natural and cultural heritage as well as for cross-cultural awareness.

Management arrangements with Aboriginal people may change over the life of this management plan. This may have implications for the day-to-day management of the planning area and the management of specific activities and use, especially with respect to access, camping, fishing and marroning, commercial use, reserve interpretation, traditional customary activities and the use of Aboriginal names (see also Section 36 – *Indigenous Customary Activities*). It may also involve special provisions for traditional owners that are additional to opportunities available to the general public. An operational plan, subsidiary to this management plan, may need to be prepared to facilitate the coordination of activities and guide ongoing development and management of such activities/use. Such a plan would be prepared in close consultation with the traditional owners and would be consistent with Department policy and the prescriptions contained within this management plan. Where the operational plan is inconsistent with Department policy and this management plan, an amendment to the management plan may be required.

A memorandum of understanding (MOU) is already in place between the Department and the South West Aboriginal Land and Sea Council Aboriginal Corporation, which is the representative Aboriginal body for the south-west of the State under the Native Title Act. This MOU sets out both principles and guidelines under which access and co-operative management agreements between the Department and Nyoongar may be established within the existing provisions of the CALM Act. During the preparation of this management plan, the native title representative Aboriginal body, as well as the native title claimants, were contacted and notified of the management planning process.

There is one registered native title claimant group in the planning area, Gnaala Karla Booja.

Existing reserves in the planning area have been created under the *Land Act* 1933 (Land Act), *Land Administration Act 1997* (Land Administration Act) or the CALM Act. Reserves vested before 23 December 1996 have had native title rights extinguished by the vesting process (Ward High Court decision August 2002). Reservation of Crown land which has not been subject to prior extinguishment (such as freehold land) will need to comply with the 'future acts' provisions of the Native Title Act.

Management of lands and waters by the Department will be within the limits of a reserve's purpose and in accordance with the Native Title Act. The Department's operations on parks and reserves are valid 'future acts' under the Native Title Act, with the requirement for native title claimants to be informed of proposed public works and management plans.

Irrespective of whether native title has been determined, Aboriginal people still have the right to access for sustenance, maintenance and protection of important places and paintings, and the inheritance of native title rights. Activities that can be undertaken include free movement, fishing, ceremonies, visiting and protecting important places.

9. MANAGEMENT PLANNING PROCESS

This management plan replaces the *Lane Poole Reserve Management Plan 1990-2000* (CALM 1990). The process of developing a management plan is outlined in Figure 1.

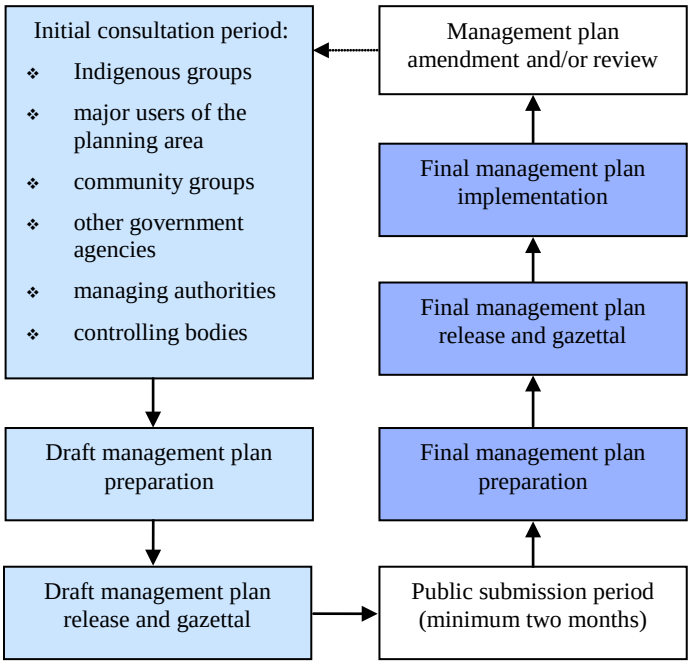


Figure 1. Management Planning Framework

10. PERFORMANCE ASSESSMENT

The Conservation Commission undertakes a number of types of performance assessments, including conservation reserve management plan performance assessments. The Conservation Commission will measure the success of this plan in accordance with its performance assessment function under section 19(1)(g)(iii) of the CALM Act by using performance indicators and other mechanisms as appropriate. It is not efficient to measure all aspects of management given resource and technical impediments—consequently, indicators will target key components of the plan.

Kanowski *et al.* (2001) defined key performance indicators when considering the conservation of biodiversity as:

> "the minimum set, which if properly monitored, provides rigorous data describing the major trends in, and impacts on, Australian biodiversity."

This includes evaluation of a measure and target, reporting requirements and a management response to any target shortfall. These components provide a basis for adaptive management, whereby management is altered if necessary to meet a desired outcome.

The Department is responsible for providing information to enable the Conservation Commission to assess the performance of the Department in carrying out and complying with management plans, such as in meeting targets specified in the Key Performance Indicators (KPIs). The frequency of reporting will depend upon the requirements of each KPI, the establishment of baseline information against which to assess performance, and any unforeseen changes to the environmental conditions. Where a report identifies a target shortfall, a response to the Conservation Commission may be required. The response may identify factors that have led to the target shortfall, and propose alternative management where appropriate.

The adequacy of the range of selected KPIs and management strategies will be reviewed following each Conservation Commission performance assessment. KPIs are identified in relevant sections throughout the plan and are also presented in a summary in Appendix 1.

The Conservation Commission will make the results of performance assessments available to the public.

11. ADMINISTRATION

For administrative purposes, the Department is currently structured into nine geographic Regions that are further sub-divided into Districts. The northern section of the planning area is in the Perth Hills District of the Swan Region, while the southern section is in the Wellington District of the South West Region. The operational management is the shared responsibility of the District Managers from both Districts.

12. TERM OF THE PLAN

The management plan for Lane Poole Reserve and proposed reserve additions will guide management of the planning area for a period of 10 years from the date the final management plan is gazetted. During this time, amendments to the final management plan are allowed under section 61 of the CALM Act. If an amendment is necessary, the proposed changes will be released for public comment. At the end of the 10-year period, the plan will be reviewed and a new management plan prepared if necessary. The new management planning process requires public consultation and approval from the Minister for Environment. The CALM Act also specifies the plan will remain in force in its original form unless it is amended, revoked by the Minister for Environment or a new plan is approved.

13. LAND TENURE

Land tenure, usually designated private land or Crown land, is used to describe the form of right or title to land. In Western Australia, the security of tenure of Crown reserves created under the Land Administration Act varies, depending upon whether the reserve is 'class A' or 'other than class A' (unclassified). This system therefore determines the degree of difficulty involved in changing the tenure of Crown reserves. Under the Land Administration Act, certain changes to class A reserves require agreement of both Houses of Parliament (e.g. cancellation or changes to the purpose of a reserve, or excision of part of a reserve).

Crown land managed by the Department fall into three broad categories:

- Crown reserves vested in the Conservation Commission, Marine Parks and Reserves Authority (MPRA) or Conservation and Land Management Executive Body as per s 36 of the CALM Act (CALM Executive Body);
- State forests and timber reserves which are vested in the Conservation Commission; and
- unvested and unmanaged Crown reserves and UCL.

Management by the Department is carried out according to Government policies and as specified in management plans submitted by the controlling bodies and approved by the Minister for Environment.

Land Categories

Section 5(1) of the CALM Act lists ten categories of lands and waters to which the Act applies. These are as follows:

(a) State forest;
(b) timber reserves;
(c) national parks;
(ca) conservation parks;
(d) nature reserves;
(e) marine nature reserves;
(f) marine parks;
(fa) marine management areas;
(g) any other land reserved under the Land Act and vested by order under that Act in the Conservation Commission, or the MPRA; and
(h) any other land, other than excluded waters, reserved under Part 4 of the Land Administration Act the care, control and management of which are placed by order under that Part with the Conservation Commission, or the MPRA.

Miscellaneous reserves are other reserves managed by the Department. These reserves are created through a management order issued under the Land Administration Act and are vested in the CALM Executive Body.

Land categories within the planning area vested in the Conservation Commission or the CALM Executive Body and managed by the Department are listed in Table 2. Additions to Lane Poole Reserve that do not fall under the categories listed in Table 2 are other Crown reserves not vested in the Conservation Commission or the CALM Executive Body. These reserves may be unvested or vested in other government departments.

Table 2. Land Category, Purpose, Class and Management Objective

Land Category	Purpose	Class	Management Objective
National park	National park under the Land Administration Act and/or CALM Act	Mostly class A	To fulfil so much of the demand for recreation 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 features of archaeological, historic or scientific interest. National parks have national significance for scenic, cultural or biological values, and can accommodate recreation that is consistent with maintaining these values
Conservation park	Conservation park under the Land Administration Act and/or CALM Act	Either class A or other than class A (unclassified)	Managed identically to national parks
CALM Act section 5(1)(g) or (h) reserves	Various	Usually unclassified	Reserves vested in or placed under the care, control and management of the Conservation Commission and managed for a variety of purposes including recreation and conservation. The reserves defined in section 5(1)(g) were created under the now repealed Land Act and section 5(1)(h) are created under the Land Administration Act
State forest	Various	Equivalent to class A	Managed for recreation and nature conservation, to protect water catchments and to provide for sustainable resource use. To achieve the optimum yield in production consistent with the satisfaction of long-term social and economic needs. Provides for exploitation of the area's natural resource and may allow some non-sustainable use (e.g. mining, beekeeping, flora harvesting)
Timber reserve	Various	Usually unclassified	Indigenous vegetation managed for purposes that include nature conservation and water catchment protection as well as other purposes prescribed by the regulations, which may include beekeeping
Miscellaneous reserves	Various	A, B or C	Managed for the purpose of the reserve

14. EXISTING AND PROPOSED TENURE

The status of existing terrestrial reserves and proposed reserve additions are described below.

Existing Reserve

The Reserve originally comprised nine class A CALM Act section 5(1)(g) reserves gazetted on 6 February 1987 and collectively named Lane Poole Reserve on 22 December 1989. All reserves were vested in the National Parks and Nature Conservation Authority (now the Conservation Commission) and comprised:

- five reserves (39819, 39820, 39821, 39822 and 39823) created with purposes of 'Conservation and the agreement defined in section 2 of the Alumina Refinery Agreement Act 1961';

- one reserve (39827) created with the purpose of 'Recreation and Enjoyment of the Natural Environment and the agreement defined in section 2 of the Alumina Refinery Agreement Act 1961'; and
- three reserves (39840, 39841 and 39842) created with purposes of 'Conservation'.

Reserves 39840, 39841 and 39842 ('Conservation') were subsequently cancelled and included in Reserve 31819 via the *Reserves Act 1992* (published in the Government Gazette 29 January 1993). At that time and following provision in the *Conservation and Land Management Amendment Act 1991* for the land category of conservation park, the purposes of Reserves 39819, 39820, 39822 and 39823 were also changed to 'Conservation Park and the agreement defined in section 2 of the Alumina Refinery Agreement Act 1961'. See Table 1 for a summary of the reserves currently comprising Lane Poole Reserve.

The creation and amendment of these reserves occurred in consultation with, and with the agreement of Alcoa, as the company holding a State Agreement Act mining lease over the areas.

Proposed Reserve Additions

Any conservation reserve creation is a matter for Government consideration and determination on a case by case basis. This management plan only governs CALM Act lands and cannot be binding in respect of proposed further reservations.

The components of the proposed reserve additions to Lane Poole Reserve have their origins in several earlier proposals including the *Northern Forest Region Regional Management Plan 1987-1997*, *Central Forest Region Regional Management Plan 1987*-1997, *Lane Poole Reserve Management Plan 1990-2000*, the RFA Process and the FMP. These proposals identified areas that would significantly contribute to improved protection of forested areas within the south-west. In consultation with relevant stakeholders, the proposed additions to Lane Poole Reserve total 24,163ha, comprising class A national park, conservation park and CALM Act section 5(1)(g) and (h) reserves. Appendix 2 and Map 2 identify the proposed additions.

The proposal to upgrade areas to national park includes FMP additions—IDs 63, 64, 65, 74, 75, 76, 77[1], 78, and 79 (see Figure 2 for location of the FMP IDs). FMP ID 74 and the western part of FMP ID 75 fall within the Surface Management Priority Area, listed on the Register of the National Estate. The 2007 amendments to the EPBC Act froze the Register of the National Estate and will remove its statutory basis from the EPBC Act after a period of five years. Pending resolution of this issue, the addition of FMP ID's 74 and 75 to Lane Poole Reserve can occur. Un-named crown 47688 (national park) is also proposed to be added to Lane Poole Reserve.

FMP ID 73 is proposed to be added to the reserve as conservation park.

FMP additions, ID 61 (reserve 5102) and 62 will be added to Lane Poole Reserve as outlined in the *Reserves (National Parks, Conservation Parks, Nature Reserves and Other Reserves) Act 2004*[2]. However, if any portion of the Murray Valley Pine Plantation that extends into the planning area (e.g. ID 61) is retained for pine production, then the tenure will need to be amended to other than conservation reserve (e.g. State forest) or the boundary of the reserve realigned (see Section 38 – *Forest Produce*). If the boundary is realigned, a similar area of suitable adjoining State forest will be added to Lane Poole Reserve.

Further to these proposed additions, there are some areas of adjoining freehold land which may be suitable for future incorporation into the reserve. Subject to an assessment of the values of these areas and their availability, consideration should be given to their acquisition and addition to Lane Poole Reserve. The acquisition of this land may facilitate management and in some cases add significantly to natural or recreation values. Adjoining areas of Department-managed land should also be considered for addition to Lane Poole Reserve, subject to an assessment of values. In the event that any of these areas are added to Lane Poole Reserve, they will be managed consistent with the principles of this management plan.

The proposed additions, once implemented, will come under the provisions of this management plan.

[1] FMP ID 77 includes reserves 39821.

[2] Section 32 of the *Reserves (National Parks, Conservation Parks, Nature Reserves and Other Reserves) Act 2004* provides for the addition of FMP IDs 61 and 62. Section 32 did not come into operation when the Act received the assent, and is to commence following its proclamation.

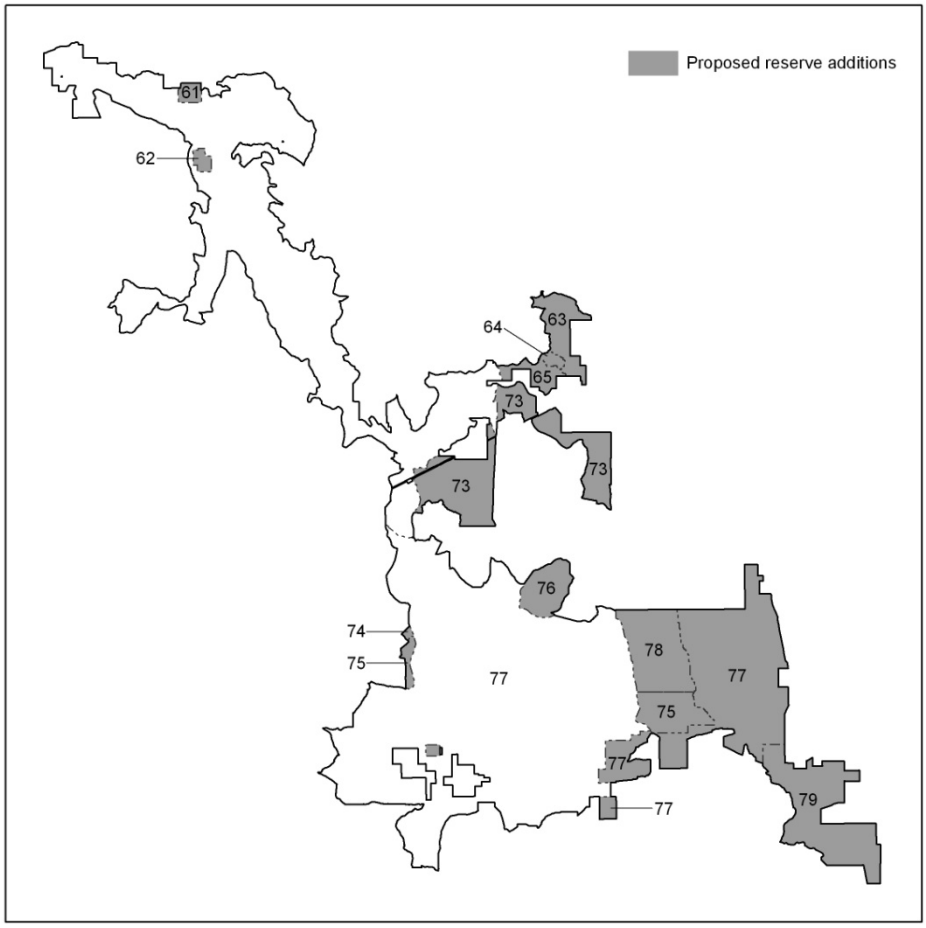


Figure 2. FMP ID Numbers

Other Proposed Tenure Changes

Further to the inclusion of the proposed additions and in consultation with key stakeholders, the planning area will be investigated for future upgrade to a national park as indicated in the FMP. These areas include the upgrade of reserves 39819, 39820, 39822 and the eastern part of 39823 from conservation park to national park (see Map 2).

Other areas that will be investigated for future upgrade to national park include reserves 39827 and the western part of reserve 39823 and FMP ID 73. These changes are likely to occur after mining in the area is complete, which is likely to be beyond the life of this plan.

These changes will contribute to achieving a CAR reserve system (see Section 15 – *Biogeography*) to aid in the protection of threatened and priority flora and fauna species and their habitats, and improve management.

14. Existing and Proposed Tenure

Key Points

- The planning area comprises the existing Lane Poole Reserve and the proposed additions (See Section 3 – *Management Plan Area*). The existing reserve comprises areas of conservation park and CALM Act section 5(1)(g) reserve and the proposed additions include areas of national park, State forest, timber reserves, miscellaneous reserve, UCL, Water Resources Ministerial Body freehold land and other crown reserves (see Appendix 2 and Map 2).
- Recommendations for changes in land purpose and vesting were made in the Lane Poole Reserve Management Plan 1990-2000, RFA process and FMP.
- The proposed additions, once implemented will come under the provisions of this management plan.

The objective is to protect conservation reserves of the planning area by providing maximum security of tenure, class and purpose.

This will be achieved by:

1. The Department and Conservation Commission initiating all tenure actions for which they are responsible for as identified in Appendix 2 and subject to usual Government consideration and determination.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
14.1 Tenure actions for which the Department and Conservation Commission are responsible	14.1 Complete all tenure actions for which the Department and Conservation Commission are responsible within the life of the management plan	Every 5 years

PART C. MANAGING THE NATURAL ENVIRONMENT

The CALM Act and the Wildlife Conservation Act confer responsibility on the Department for the conservation of biodiversity at ecosystem, species and genetic levels, and the sustainable management of the resources they provide. The Conservation Commission also has a role in biodiversity conservation through the development of policies "…for the preservation of the natural environment…" (section 19(1)(c) of the CALM Act) and the preparation of management plans. The Department is guided by a number of principles in fulfilling its responsibilities, foremost of which are that the diversity and health of ecological communities and native species throughout Western Australia will be maintained and restored, and the lack of scientific certainty shall not be used as a reason for postponing measures which seek to protect or restore the environment or prevent loss of biodiversity (DEC 2007a).

15. BIOGEOGRAPHY

The National Reserve System Program was adopted to establish a CAR system of protected areas to conserve Australia's natural biodiversity. The Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway and Cresswell 1995) was developed to provide a planning framework for selecting a CAR system of protected areas (and for bioregional planning more generally). The benchmark reservation level for a CAR reserve system is that at least 15% of each bioregion, and any subregions within it, should be managed as part of the public conservation estate (CALM 2003a).

In addition to using scientifically-based CAR criteria, areas that serve as buffers to marine or terrestrial reserves, protect threatened species or otherwise assist with conservation management are also commonly included in parks and reserves. Natural areas with spectacular landforms and scenery subject to high public use may also be included.

Bioregions

The IBRA divides Australia into 85 biogeographic regions, based on dominate landscape characteristics of climate, lithology, geology, landforms and vegetation. Western Australia contains 26 bioregions, each of which is ranked in terms of the priority (e.g. very high, high, low) for further reservation to meet major gaps in the reserve system at a national scale.

The planning area lies within the Jarrah Forest Bioregion (see Figure 3). As at June 2007, almost 13% (574,801ha) of the Jarrah Forest Bioregion are contained within a CAR conservation reserve. Should the proposed additions of the Jarrah Forest Bioregion eventuate, reservation will increase to 16% making the Jarrah Forest Bioregion one of the most highly reserved bioregions within the State.

The Jarrah Forest Bioregion is an 'island' of forest in the south-west of Western Australia, isolated by great distances from the nearest similar forests in eastern Australia and surrounded by cleared agricultural land. The bioregion is characterised by jarrah-marri forest on laterite gravels of the Yilgarn Craton and, in the eastern part, by marri-wandoo woodlands on clay soils. In areas of mesozoic sediments, jarrah forest occurs in a mosaic pattern with a variety of species-rich shrublands. Eluvial and alluvial deposits in the south support *Taxandria*[3] shrublands. Heath is often found on granitic rocks and as a common understorey for forests and woodlands in the north and east.

Very few plant or animal species whose range of occurrence is restricted to, or centred on the region, are know to have become extinct. The only likely mammalian extinctions have involved species on adjacent bioregions with ranges that extended into the periphery of the Jarrah Forest Bioregion. This includes species such as the dalgyte or bilby (*Macrotis lagotis*) and burrowing bettong or boodie (*Bettongia lesueur*) along the bioregion's eastern periphery and broad-faced potoroo (*Potorous platyops*) and the long-nosed potoroo (*P. tridactylus*) on the south-eastern periphery (McKenzie *et al.* 1996). Leeuwin's Rail (*Rallus pectoralis*) is the only bird thought to have vanished from the bioregion (McKenzie *et al.* 1996).

[3] *Taxandria* spp. is a nomenclatural synonym of *Agonis* spp.

By virtue of its close proximity to Perth and regional population centres, much of the northern portion of the Jarrah Forest Bioregion is in demand for the provision of recreation opportunities.

The Jarrah Forest Bioregion comprises two subregions: the Northern Jarrah Forest and the Southern Jarrah Forest (see Figure 3). The two subregions are differentiated principally by the slight variations in climate, geology and understorey species composition. The planning area lies wholly within the Northern Jarrah Forest subregion.

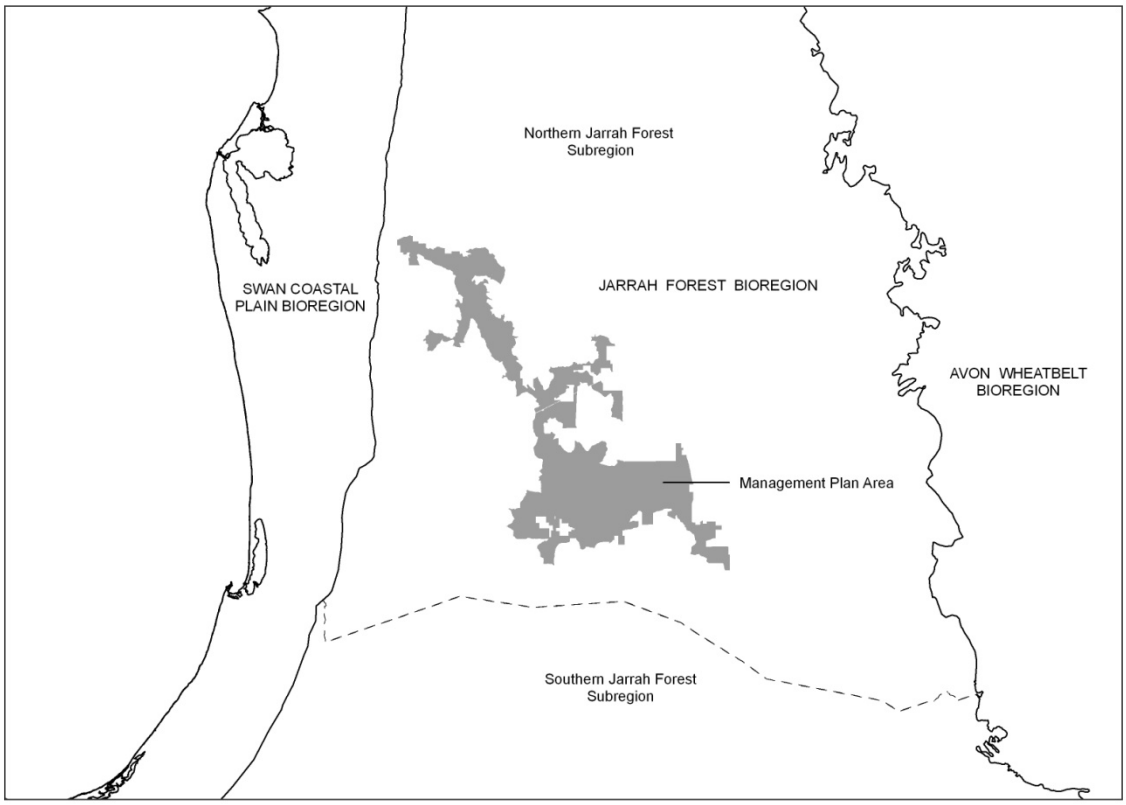


Figure 3. IBRA Bioregions and Subregions

Northern Jarrah Forest Subregion

The Northern Jarrah Forest subregion incorporates the area east of the Darling Scarp. It overlies Archaen granite and metamorphic rocks at an average elevation of 300m, is capped by an extensive lateritic duricrust, dissected by drainage and broken by granite hills.

Despite the geological and geomorphic uniformity and structural homogeneity of the jarrah forest environment, the area contains locally patchy biota, resulting in a number of endemic, relict and disjunct species. The locally patchy biota, when combined with disturbances caused by land clearing and the introduction of feral predators, has also meant that the subregion has become a refuge for many species of flora and fauna. An example of this is the remnant populations of several critical weight range mammals, which were once widespread but are now centred on this region.

Forest Ecosystems

In the south-west of the State, the RFA was initiated to provide a specific framework for managing the areas forests, recognising the need for a more in-depth analysis of environmental, social, economic and Indigenous heritage values. As such, 26 forest ecosystems were defined and used to assist in the establishment of a CAR conservation reserve system to protect the biodiversity of the south-west forest area. The definition of forest ecosystems is undertaken at a finer scale than that used to determine IBRA bioregion boundaries.

The reservation target for forest ecosystems was set at 15% of their pre-1750 distribution, except for some rare ecosystems where 100% of the extant distribution was the target. This ensures that viable examples of each

ecosystem are included in the protected reserve system. To assist in decisions on areas for reservation, information provided at a finer scale was also considered, including vegetation complexes, species richness, relictual and disjunct species and the presence or absence of mature growth vegetation.

The FMP added to the conservation reserve system proposed in the RFA. As the FMP is implemented it is significantly increasing the representation levels of many forest ecosystems.

Nine forest ecosystems occur in the planning area, four of which meet the target for the CAR reserve system: Jarrah Woodland; Rocky Outcrops; Shrub, Herb and Sedgelands; and Swamps (Conservation Commission 2004). Five forest ecosystems (Jarrah North East, Jarrah North West, Jarrah Sandy, Western Wandoo Forest and Western Wandoo Woodland) do not meet the CAR target for conservation reserves. However, proposed additions as outlined in the FMP will achieve the target for these forest ecosystems. Within the planning area, the North East and North West are the dominant forest ecosystems. The rocky outcrops and swamps are the least dominant, but still provide important habitat for a range of fauna species.

15. Biogeography

Key Points

- The National Reserve System Program was adopted to establish a comprehensive, adequate and representative (CAR) system of protected areas to conserve Australia's natural biodiversity.
- The FMP additions to the reserve system, it is aimed to reserve 15% of all forest ecosystems and thereby meet the nationally agreed criteria for a CAR reserve system.

The objective is to contribute to the establishment of a comprehensive, adequate and representative conservation reserve system.

This will be achieved by:

1. acquiring lands to deliver a reserve system that meets CAR criteria; and
2. implementing the Forest Management Plan.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

16. CLIMATE CHANGE

The climate of the south-west is Mediterranean and characterised by hot dry summers and cool wet winters. The planning area in particular receives on average between 500-800mm of rainfall per annum in the south-eastern section, increasing to more than 800mm per annum in the north-western section. The cooler months of the year (May-October) are also the wettest, when 85% of the annual average is received. Winter rainfall (June-August) accounts for more than 50% of annual rainfall. The summer months (December-February) receive less than 5% of the annual rainfall. The highest temperatures occur in January, increasing from west to east, reaching a mean temperature of 29ºC at Dwellingup. Lowest mean temperatures occur in July, when temperatures decrease from west to east across the planning area.

Observed and Projected Climate Change

The south-west of Western Australia has been identified as a region that is especially vulnerable to climate change (Pouliquen-Young and Newman 1999) and a priority area for developing climate change strategies within Australia. Rainfall, mainly winter and spring, in the area has significantly decreased by almost 24mm per decade since 1950 (CSIRO 2007).

Recent research on climate change suggests that:

- rainfall will continue to decline (by approximately 10% in winter and spring rainfall by 2030) and temperatures will continue to increase;
- river flows will decline as a result of decreased rainfall;
- weather events may be more extreme, with more frequent and prolonged drought;
- there will be an increase in the number of days of very high and extreme fire danger; and
- there maybe an increase risk of more frequent bushfires. (Source: CSIRO 2001, CSIRO 2007, Hughes 2003, Williams *et al*. 2001).

Impacts of Climate Change

The projected climate changes discussed above will have significant social, economic and ecological impacts on vulnerable systems. The Intergovernmental Panel on Climate Change (IPCC) suggest that some natural systems are especially vulnerable to climate change because of limited adaptive capacity and that while some species may increase in abundance and/or range, climate change will increase existing risks of extinction of some more vulnerable species and increase loss of biodiversity (IPCC 2001). Climate change presents an additional pressure for native species and ecosystems as well as exacerbating existing pressures such as habitat fragmentation/modification, competition by introduced species and altered fire regimes.

The *National Biodiversity and Climate Change Action Plan 2004-2007* (Department of the Environment and Heritage 2004) identifies potential impacts of climate change on Australian species and ecosystems, including:

- reductions in the geographic range of species;
- changes to the timing of species' lifecycles;
- changes to population dynamics and survival;
- changes in location of species' habitats;
- increases in the risk of extinction for species that are already vulnerable;
- increased opportunity for range expansion of invasive species;
- changes in the structure and composition of ecosystems and communities;
- changes in coastal and estuarine habitat due to rising sea levels; and
- changes in plant growth and ecosystem function arising from increased carbon dioxide concentration in the atmosphere.

Species and communities that are already located at the limit of their climatic ranges are likely to be more vulnerable than those located well within their climatic range. Other species and communities that may be more vulnerable to climate change include those with:

- very limited or restricted climatic ranges;
- limited dispersal ability;
- very specialised habitat requirements; and
- small populations and/or low genetic diversity (Department of Environment and Heritage 2004).

The planning area supports a number of species and communities that are endemic or at or near the limits of their range (see sections 19 – *Native Plants and Plant Communities* and 20 – *Native Animals and Habitats*) and which have the potential to be vulnerable to climate change. The potential impacts of projected changes on such species and communities are uncertain. Any reserve-specific research undertaken to improve understanding of potential climate change impacts on biodiversity should focus on these, along with any other species and communities of special conservation significance.

Climate change will also impact on recreation activities in the planning area (see Section 31 – *Visitor Activities*). The predicted decrease in rainfall may restrict activities relying on good river flows, such as white water rafting and canoeing (CALM 2005c).

Responses to Climate Change

On a national level, 'loss of climatic habitat caused by anthropogenic emissions of greenhouse gases' has also been identified as a key threatening process under the EPBC Act. At the State level, a new climate change adaptation and mitigation strategy is being developed. The Department has also commenced the development of:

- a biodiversity response model to investigate the potential vulnerability of Western Australia's plants and animals to climate change; and
- a climate-biodiversity strategy.

At individual reserve level, the implementation of strategies in this management plan aimed at the addition of conservation estate to the reserve, introduced animal and weed control, fire management and re-introduction programs will help improve the resilience of species and ecosystems and hence decrease their vulnerability to climate change. In addition, strategies in this plan that aim to rehabilitate vegetation, will also assist in increasing the amount of carbon that is sequestered in the land. There is a need for research and monitoring to

establish baseline data to enable measurement of changes over time. This will also enable managers to recognise when specific threatening climate circumstances are occurring and respond effectively.

Management responses to climate change as applied in the planning area will need to be considered and adapted as necessary in the context of the Statewide climate-biodiversity research outcomes and management approaches.

16. Climate Change

Key Points

- Climate change will have significant impacts on key values, particularly natural values, which in turn will impact on recreational values.
- There is limited knowledge of the resilience of natural systems to predicted climate changes and uncertainty on how to appropriately respond to the effects of climate change.
- Additions to the conservation reserve system, introduced animal control, weed control, fire management and re-introduction programs will help improve the resilience of the planning area's species and ecosystems and hence decrease their vulnerability to climate change.

The objective is to understand and adapt management response to the effects of climate change on the key values.

This will be achieved by:

1. continually reviewing and adapting management in response to new knowledge and understanding of climate change and its impact on biodiversity;
2. incorporating the potential for climate change impacts into recovery plans; and
3. limiting non-climate stresses (e.g. disturbance) for species and communities that are vulnerable to climate change.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

17. GEOLOGY, LANDFORMS AND SOILS

Geology

The planning area is situated within the Yilgarn Craton geological province. This is separated from the Perth Basin to the west by the Darling Fault. The western part of the Yilgarn Craton, in the vicinity of the planning area, consists of high-grade metamorphic belts partially enclosed by complex granite associations. The belts contain remnants of older sedimentary rock, volcanic rocks and metamorphosed granite rocks, upon which most of the southern section and approximately half of the northern section of the planning area lies. Granite outcrops occur sporadically in the northern part of the planning area and are important fauna habitats, providing areas of refugia particularly for small mammals and reptiles, and for flora species that are confined to such habitats. At the time of writing, these outcrops and associated fauna are poorly surveyed. Granite outcrops are easily damaged and it is important that visitors are managed so as to protect the outcrops. See also Section 19 – *Native Plants and Plant Communities* for more information on granite outcrops.

Over time, the Yilgarn Craton has been uplifted relative to the Perth Basin, resulting in rejuvenated drainage along joints and fractures and the erosion of more easily weathered rocks. The consequence of this geological activity was the formation of the Murray River and its valley.

Laterisation, which occurred on the western erosion slope of the Plateau and on the younger deposits of the western margin of the Yilgarn Craton, produced bauxite deposits, which occur as alumina-rich lenses within the lateritic uplands. Alcoa World Alumina Australia (Alcoa) has mined areas to the north and west of the planning area since 1972, and Worsley Alumina Pty Ltd (Worsley) the area east of the planning area since 1982.

There are no geoheritage sites listed within the planning area (I. Roberts, *pers. comm.* 2005).

Landforms and Soils

Three major landform types within the planning area: lateritic uplands, shallow valleys and deeper valleys as described by Churchward and Dimmock (1989) and McArthur *et al.* (1977). Within the lateritic uplands, there are three units dominated by duricrust, gravel and sand: Cooke, Dwellingup and Goonaping units. The Cooke unit are areas above the general elevation of the area, consisting mainly of granite outcrops and some areas of lithosols (gritty sandy loams) and lateritic gravels. The Dwellingup unit has an average elevation of 250-300m of gently undulating land and is dominated by duricrust, gravels and sand composed mainly of oxides of iron and aluminium. The Goonaping unit is characterised by grey gritty sandy soil, occurring at the heads of drainage lines and in the case of the planning area, as a part of the Collie River Catchment.

The deeper or major valleys landforms include the Murray and Helena units. The Murray unit is comprised of moderate to steep (10°-20°) slopes with a 90-120m relief with red and yellow 'earths' with duplex soils dominating. The Helena unit has steep (up to 30°) slopes with approximately 200m relief and is dominated by shallow red and yellow earths.

The shallow or minor valleys landforms included the Pindalup and Yarragil units. The Pindalup unit are valleys dominated by yellowish-brown sandy gravels and gravely yellow duplex soils. The Yarragil unit consists of sandy gravels slopes overlying duricrust or mottled clay and bright yellow-brown earths.

Erosion

There are two types of erosion occurring in the planning area: natural and accelerated. Natural erosion (or geological erosion) is that which occurs under natural conditions by wind, water and gravity, whereas accelerated erosion is that which occurs at a faster rate, in disturbed areas due to human activities. Examples of accelerated erosion in the planning area include that occurring along riparian zones as a consequence of visitors putting in and taking out canoes, kayaks and marron nets. Accelerated erosion also occurs along the roads, particularly where vegetation is removed or damaged and where soils are compacted. Four-wheel driving, the use of trails, picnic areas and campsites in the planning area can also cause soil disturbance resulting in erosion, compaction and degradation (see Part E – *Managing Visitor Use*).

An erosion hazard rating, which is a subjective assessment derived from interaction between a number of different components of the landscape, has been applied to the landforms of the planning area. According to Dames and Moore (1984), both Dwellingup and Yarragil landform units have a high erosion hazard rating, Murray (which encompasses much of the Murray Valley) and Helena have a moderate rating, and Goonaping and Pindalup are rated low.

Acid Sulphate Soils

Soils that contain iron sulphides within waterlogged sediments are known as 'potential acid sulphate soils'. When these iron sulphides are exposed to air (e.g. through decreases in the watertable), the minerals oxidise, producing large quantities of sulphuric acid and dissolved metals (e.g. iron, aluminium and occasionally manganese, cadmium and arsenic) when water is returned to the soil through rainfall or groundwater flow. Acid sulphate soils in the upper reaches of the catchment may influence the acidity in the planning area. With two-thirds of the south-west agricultural soils at risk of acidification, there is potential for waterways that flow through affected areas to also become acidic which in turn would affect waterways and riparian areas in the planning area (EPA 2007).

While there is a general trend for the probability of acid sulphate soils decreasing away from the coast, the planning area has not been surveyed for acid sulphate soils and as such there is a potential for its occurrence in the riparian zone along rivers and wetlands in the area (B. Degans *pers. comm.* 2005). Where acid sulphate soils are identified, management may be adapted to reduce disturbance to these areas.

17. Geology, Landforms and Soils

Key Points

- The planning area is located within the Yilgarn Craton geological province.
- Average elevation of the Darling Plateau is approximately 300m above sea level.
- Three main landform types found within the planning area are the lateritic uplands, shallow valleys and deeper valleys.
- Visitor activities can accelerate soil erosion.

- There is potential for acid sulphate soils to occur in the riparian zone along rivers and wetlands in the planning area.

The objective is to protect and conserve the geology, landforms and soils.

This will be achieved by:

1. providing opportunities for increased visitor awareness and appreciation of the planning area's geology;
2. improving river access (e.g. canoe launching facilities) and relocating sites away from the rivers edge, if necessary, to minimise river bank erosion and to protect riparian vegetation;
3. improving management of river-based activities to minimise bank erosion of rivers and to protect riparian vegetation;
4. undertaking research into granite outcrops and their associated flora and fauna;
5. protecting the vegetation on granite outcrops from damage caused by people (see Section 19 – *Native Plants and Plant Communities*); and
6. mapping the extent of potential acid sulphate soils within the planning area and ensuring any proposed developments or fire management activities do not result in acid sulphate soils.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

18. CATCHMENT PROTECTION

Hydrology

There are four catchment areas overlaying the planning area: Murray River, Harvey River, Collie River and Blackwood River (see Map 3). Within these catchments are a number of gazetted public drinking water source areas that occur on parts of the planning area. These include the Samson Brook, Harris Dam and Wellington Dam catchment areas. The planning area is also located within the Murray River Water Reserve which is currently not used as a drinking water source.

The Samson Brook Catchment Area and the Harris Dam Catchment Area are afforded greater protection because they are Priority 1 drinking water source protection areas, with reservoir protection zones[4] surrounding both water-bodies (see also Section 30 – *Visitor Access – Special and Restricted Access*, Section 42 – *Water Resources* and Map 3) (DoW 2007, WRC 2002). The Wellington Reservoir is not currently used for drinking water supply but could be reinstated as a drinking water supply source. If this was to occur, there may be some implications for the Departments management of the catchment area as outlined in the Wellington National park, Westralia Conservation Park and Wellington Discovery Forest Management Plan (DEC 2008c).

Rivers

The Murray River is the major river that flows through the northern part of the planning area eventually draining into the Peel Inlet near Mandurah. The two main tributaries of the Murray River are the Hotham and Williams rivers, which originate in cleared, agricultural areas east of the planning area. Two other main rivers that flow within the planning area are the Harris and Bingham rivers, which are tributaries of the Collie River.

These rivers have a peak flow during winter, with the Murray River, in particular, having an annual stream discharge at the Baden Powell monitoring site of 277,600 megalitres making it one of the largest rivers (by flow volume) in the south-west (DoE 2005a, DoE 2005b). Peak flow times in particular attract canoeing, kayaking and white water rafting enthusiasts to the area (see Section 31 – *Visitor Activities*). The Murray River is one of three rivers (the other two being the Avon and Swan rivers) in the Northern Jarrah Forest that is not dammed for water supply. The Harris and Bingham rivers have a much lower flow volume than the Murray River at 7000 and 7300 megalitres respectively (WRC 2001).

Lakes

There are two natural freshwater lakes within the planning area. Both lakes are located in the proposed national park area and are perennial water-bodies, evaporating to dryness during summer. Nalyerin Lake is situated in

[4] Reservoir protection zones are areas upstream and within 2 kilometres of the top water level of a reservoir within the reservoirs identified catchment area.

the Harris Dam Catchment Area and Yourdamung Lake in the Wellington Dam Catchment Area. The lakes are the only ones of their type in the Northern Jarrah Forest and as such are listed as wetlands of regional significance in the Perth to Bunbury region by the WA Water Resources Council (Hamilton 2002). These lakes also provide considerable research and ecological values for many species including the priority 3 species *Goodenia filiformis*.

The Department encourages and assists in the conservation and management of wetlands on private property, such as Yourdamung Lake, where part of the wetland extends outside the planning area.

Groundwater

Groundwater in the planning area is approximately 15-20m below the surface, with recharge ranging over the landscape from between one and nine percent of rainfall. In general, the capacity for groundwater recharge in the planning area is limited to the weathered layer of the soil profile (approximately 50m in depth).

Rising groundwater levels as a result of land clearing in combination with the rainfall levels in the area have resulted in saline groundwater discharging into the Murray River catchment (WRC 2003a). Groundwater salinity in the planning area is mainly between 500-1000mg/L TDS (total dissolved salts), ranging to 1000-3000mg/L TDS in the eastern parts (DoW 2006). DoW is responsible for the management of groundwater usage in Western Australia (see Section 42 – *Water Resources*).

Water Quality

The State Water Quality Management Strategy No. 1 (Government of Western Australia 2001), Samson Brook Catchment Area Water Source Protection Plan: Waroona and Hamel Town Water Supply and Integrated Water Supply Scheme (WRC 2002), Harris Dam Catchment Area Drinking Water Source Protection Plan: Great Southern Towns Water Supply Scheme Integrated Water Supply System (DoW 2007) together with the *Country Areas Water Supply Act 1947* (CAWS Act) and the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* give guidance and enforcement capabilities for the management of water quality within the planning area. DoW is the lead agency responsible for sustainable management of Western Australia's water resources. Within the planning area, DoW monitors water quality including pH, nutrient levels, colour, turbidity, salinity and dissolved oxygen in Murray River at the Baden Powell water spout (DoE 2004a). The Shire of Murray also monitors bacteria levels along the Murray River (Shire of Murray 2005).

Water quality monitoring in the planning area shows a decreasing trend in suspended solids, turbidity and nitrogen in the Murray River (EPA 2007). Even though parts of the Murray River flow through forested areas with healthy fringing vegetation, tributaries of the Murray River drain agricultural areas resulting in a moderate turbidity status (EPA 2007). The nutrient load for the Murray River (low nitrogen status) increases west of the planning area, where nutrient from the lower, mostly cleared catchment on the swan coastal plain enters the river through leaching and surface runoff adding to the nutrient load in the Peel Inlet and causing eutrophication of the River (A. Hams pers. comm. 2005, EPA 2007, South West Catchments Council 2005).

Salinity

Salinity of streams and waterways poses the greatest threat to water quality in the south-west of WA. It occurs when salt stored in the soil profile over thousands of years intersects the ground surface as a consequence of rising groundwater levels. Groundwater rise results from reduced water usage, and is caused primarily by the clearing of perennial native vegetation for agriculture purposes (Borg *et al.* 1988). The discharge of saline water at the ground surface eventually drains into streams, rivers and lakes and can degrade riparian habitats and water resources. The *State Salinity Strategy* (State Salinity Council 2000, under review) is one of the key Government policy documents used to tackle salinity in Western Australia.

Salinity is listed as a threatening process for the Murray River (CALM 2002a) with an assessment showing a rising (positive) salinity trend in the Murray River basin (DoE 2004b). This is mainly attributed to approximately 60% of the Murray River basin, upstream the Baden Powell waterspout, cleared mainly for extensive agriculture and townships (DoE 2005b). While the area of catchment remaining cleared has decreased by 15% since 1986 through catchment revegetation, the average annual salinity has increase in the Murray River by approximately 600mg/L TDS from 1983-1992 to an average of 2900mg/L TDS from 1993-2002, which moves on average 600 000 tonnes of salt each year (Government of Western Australia 2004, DoE 2005b). As such, the Murray River has a salinity status of moderately saline (DoE 2005b).

The Harris and Bingham Rivers are classified as fresh (<500mg/L TDS) (DoE 2005b). These waterways are located within a high rainfall area with little clearing occurring in their catchments (DoE 2005b).

Catchment Management

Catchment management is important to ensure that the health of rivers, swamps and estuaries is maintained or improved. The Department plays a key role in ensuring the natural values of catchments are protected and enhanced. Natural resource management (NRM) groups and catchment management groups. State Government initiatives such as the State Salinity Strategy and the Natural Resource Management Council ensure a cooperative approach between Government agencies, local governments and regional communities towards improving the conditions of waterways and catchments. For example, the South West Catchments Council's river salinity recovery program targets the Hotham, Williams and Murray rivers.

18. Catchment Protection

Key Points

- The Murray River is one of three rivers (together with the Avon and Swan) in the Northern Jarrah Forest that is not dammed for water supply.
- Salinity is listed as a key threatening process for the Murray River, with salinity levels in the river rising.
- The two lakes in the planning area, Nalyerin Lake and Yourdamung Lake, are of regional significance.
- There are three gazetted public drinking water source areas in the planning area (Samson Brook, Harris Dam and Wellington Dam catchment areas).

The objective is to protect and conserve the quality and quantity of water.

This will be achieved by:

1. protecting the water source, wetlands and hydrological processes within the planning area from damage or disturbance that may affect water quality or quantity;
2. engaging with relevant authorities (e.g. DoW, Water Corporation, NRM groups) and neighbouring land-holders regarding water quality and quantity to promote good neighbour relations and to provide advice and direction as necessary; and
3. supporting DoW to continue water quality monitoring of the Murray River, the Shire of Murray's monitoring of bacterial levels of the Murray River and the expansion of the Peel-Harvey Catchment Council's Murray River action plan further east.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

19. NATIVE PLANTS AND PLANT COMMUNITIES

The planning area lies within the Dale Botanical Subdistrict of the Darling Botanical District, a division of the South West Botanical Province (Beard 1980). This province represents one of many phytogeographic regions based on ecological, climatic, geological and soil characteristics within Western Australia. The rich diversity in floristic composition, adaptive characteristics displayed by plants, patterns of groupings and the structural features of plant communities coincides with changes in environmental conditions across the jarrah forest, principally variations in climate, topography and soil type. The South West Botanic Province is also recognised internationally as the only Australian representative area in the list of 34 biodiversity 'hotspots' in the world.

A rapid increase of land use demands and disturbance of the jarrah forest has occurred since the 1960s, resulting in greater conservation significance on those remaining species and communities in conservation reserves (McKenzie *et al.* 1996). The variety of vegetation types, wide range of habitats, presence of major river systems, scenic values and continuity with adjoining State forest make native plants and plant communities of the planning area significant for conservation and a valuable contribution to the CAR conservation reserve system (see Section 15 – *Biogeography*).

All flora which is native to Western Australia is protected under the Wildlife Conservation Act. Management direction for specially protected flora, fauna and ecological communities is provided through the Department's proposed Policy Statement No. 9 – *Conserving Threatened Species and Ecological communities* (subject to final consultation). While threatened species legislation is broadly similar across jurisdictions, there are differing

approaches to species listings and therefore inconsistencies exist between State and National threatened species lists. The Department and the Commonwealth Department of the Environment, Water, Heritage and the Arts are currently in partnership to align threatened species listed under the Wildlife Conservation Act with species listed under the Commonwealth's EPBC Act.

Native Plants

The planning area forms part of the Northern Jarrah Forest IBRA subregion and comprises a tall, open forest dominated by jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) complexes, and including important populations of fringing vegetation bordering the banks of rivers. It also contains densely vegetated *Taxandria* swamp thickets with sedge understorey to which forest populations of the quokka are restricted (Hayward *et al*. 2003), and which are the preferred habitat of the noisy scrub bird (A. Burbidge *pers. comm.*). Approximately 500 native flora species (including vascular plants, lichens, mosses and liverwort/hornworts) have been recorded in the planning area[5].

Rare and Priority Flora

The Wildlife Conservation Act provides for the special protection of native flora species that are likely to become extinct, are rare or otherwise in need of special protection. The Minister for Environment declares these species by notice in the Government Gazette. Declared rare flora are managed according to the Department's draft Policy Statement No. 9 – *Conserving Threatened Species and Ecological Communities* (subject to final consultation). A permit from the Minister for Environment is required before such flora can be 'taken' however, wildflowers cannot be taken from the planning area.

In addition to rare flora, the Department also refers to 'priority' species. These are species that may be rare but there is insufficient survey data available to accurately determine their true status, or which are rare but not currently threatened and hence are being monitored. There are five levels of priority flora. Although priority species do not have the same level of legislative protection as rare flora, the priority flora list is maintained as a mechanism to highlight flora of special conservation interest and encourage appropriate management activities in areas such as disease control (see Section 24 – *Diseases*), prescribed burning (see Section 25 – *Fire*), road construction and site development.

The planning area contains one species of declared rare flora, the dwarf spider orchid (*Caladenia bryceana* subsp. *bryceana*) for which an interim recovery plan is in place. There are 16 priority species, comprising three priority 2 species, two priority 3 species and 11 priority 4 species. These are detailed in Appendix 3.

Endemic, Disjunct and Relictual Flora

Despite the geological and geomorphic uniformity and structural homogeneity of the jarrah forest environment, the area contains locally patchy biota, resulting in a number of endemic, relict and disjunct species. In the planning area, there are a number of endemics and disjunct species that are also priority species (see Appendix 3). This includes locally endemic, priority 4 *Darwinia pimelioides* found in sandy loams and granite outcrops, and the disjunct, priority 4 *Calothamnus graniticus* subsp. *leptophyllus*. There are also a number of relictual and relictual monotypic species located within the planning area (see Appendix 3).

Plant Communities

Vegetation Complexes (or Associations)

The vegetation of the planning area has been mapped in a number of different surveys. As part of the RFA process, Mattiske and Havel (1998) classified the planning area into nine forest ecosystems. Their survey also identified at a finer scale twenty vegetation complexes across the planning area, the distribution of which is outlined on Map 4.

There are three complexes that are not adequately represented either in the planning area or in other formal or informal reserves vested in the Conservation Commission – Darkin 1, Darkin 2 and Williams. More than 90% of each of these complexes remains on lands not vested in the Conservation Commission.

[5] Records obtained from the Western Australian Herbarium 2006, Species and Communities Branch 2006 and District Records 2007. More recent records can be found on Naturemap – an online mapping program that consolidates many spatial records associated with the natural biodiversity across the State – http://naturemap.dec.wa.gov.au.

Old-growth Forest

The presence of mature forest is necessary to protect the full range of biodiversity values and sustain viable populations of fauna, especially species such as the western ringtail possum and cockatoos, which require large tree hollows. A reduction in suitable tree hollows caused by land clearing outside the planning area, and competition for hollows from introduced species such as the honeybee (*Apis mellifera*) and laughing kookaburra (*Dacelo novaeguineae*) (see Section 23 – *Introduced and Other Problem Animals*), highlights the habitat value of old-growth forest. Disturbance in these areas has the potential to limit the availability of tree hollows. Therefore, any disturbance activity within the planning area (e.g. recreational site re-development and fire) will be assessed for its impact on tree hollows.

Management of old-growth forests is guided by the FMP and the desire to maintain a mix of vegetation age classes to maximise structural and floristic diversity (see Section 15 – *Biogeography*).

There are significant areas of old-growth forest within the planning area (see Figure 4). These areas are noted for their proximity to Perth and for their quality, the importance of which was highlighted in the FMP.

Wetlands and riparian habitats

Important wetland and riparian habitats exist as seasonally or permanently inundated features along creek systems of the planning area. They are typically small and occur sporadically throughout the jarrah forest. Most of the wetlands contain fresh water originating from forested catchments and contain emergent vegetation that is waterlogged for most of the growing season. The main riparian habitat of the planning area occurs along the Murray, Harris and Bingham rivers and at Nalyerin and Yourdamung lakes, which provide valuable habitats and wildlife corridors.

The plant communities of wetlands vary quite significantly, ranging from *Banksia littoralis* woodlands, *Melaleuca rhaphiophylla* woodlands, *Dodonaea* thickets, *Taxandria* swamps and complex heaths (Muir 1986). This vegetation provides significant habitat for fauna species because of the reliable food supply and protection from predators, especially for small macropods such as the quokka and quenda.

Exotic plants, salinisation, eutrophication, climate change, unmanaged visitor access, introduced animals (e.g. feral pigs) and inappropriate fire regimes can impact upon wetlands and riparian habitats. Fire regimes appropriate to the maintenance of ecosystem function and the maintenance of biodiversity are necessary to protect wetland systems of the planning area (see Section 25 – *Fire*).

Figure 4. Old-growth Forest Distribution

Wandoo Woodland

Wandoo woodlands (*Eucalyptus wandoo*) provide important habitat for a range of fauna species including numbat (*Myrmecobius fasciatus*), chuditch (*Dasyurus geoffroii*) and Carnaby's cockatoo (F. Kirkpatrick *pers. comm*. 2007). These woodlands are sparser in vegetation cover, are drier than jarrah forest and are characterised by open grassy areas for fauna to forage and move around in, but providing enough shelter (e.g. tree hollows) for them to survive. As such, these areas tend to have greater species abundance than other locations in the planning area (I. Abbott & K. Morris *pers. comm.* 2007).

The health of wandoos has been in question for a number of years with crown decline[6] first formally recorded during the 1970's and 80's (White and Manning 2005). The Wandoo Recovery Group was formed in February 2003 to investigate the cause of crown decline and develop appropriate strategies and actions. The *Wandoo crown decline action plan* (Wandoo Recovery Group 2006) identifies wandoo research priorities. As part of this, the Department are carrying out wandoo crown decline surveys, including sites within the planning area, to determine the severity of the decline (F. Kirkpatrick *pers. comm*. 2007).

A number of factors are likely to be involved in wandoo crown decline. These include decreased rainfall, reduced soil water in forested areas and increasing salinity (DEC 2007d). Wandoo woodlands have different fire requirements and regimes than jarrah forests (see Section 25 – *Fire*).

[6] Crown decline is characterised by an initial browning off and death of the upper and outer twigs, known as 'flagging'. Epicormic shoots (new foliage) sprout along the lower limbs to replace the dead twigs, which may also die, resulting in a downward movement of the tree crown and redistribution of the canopy (White & Manning 2005).

Granite Outcrops

Small, isolated and disjunct granite outcrop plant communities are interspersed throughout the planning area, with the largest single outcrop located in reserve 39820. These outcrop communities provide a contrast to the surrounding forest in terms of species composition and vegetation structure as the conditions in these areas in terms of moisture, soil type and depth vary to that of the surrounding habitats (Hopper *et al.* 1997). These outcrops are significant to the region as they are geographically separated from similar outcrops, the nearest of which occurs in Wellington National Park, Shannon National Park and Monadnocks Conservation Park.

The evolution of a distinct suite of plant species associated with rock outcrops is probably due to a number of factors, including the diversity of microhabitats (alternatively extremely dry and wet), high light levels and a relatively longer interval between fire than the surrounding vegetation. The diversity of microhabitats and soil moisture regimes is likely to have facilitated the evolution of several endemic species in the south-west, and the persistence of refugial species beyond their main range (Hopper *et al.* 1997). Many of these endemic species are not found in surrounding habitats, although they may be found in granite outcrops over a wide geographical range.

Granite outcrop communities are fragile habitats, susceptible to weed invasion, grazing by feral animals, too frequent fire (see Section 25 – *Fire*), loss of shrub layer, salinity and the disease caused by *Phytophthora cinnamomi*. Disturbance by trampling can also lead to loss of vegetative cover, erosion and increases in weed invasion if not controlled. Further surveys are necessary to ascertain the significance of granite outcrops for refugial species and their response to fire.

19. Native Plants and Plant Communities

Key Points

- The planning area contains declared rare flora and threatened flora as well as many endemic, relictual and disjunct species.
- The planning area lies within the Dale Botanical Subdistrict of the Darling Botanical District, a division of the South West Botanical Province (Beard 1980).
- The planning area forms part of the Northern Jarrah Forest IBRA sub region and comprises a tall, open forest dominated by jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) complexes, and includes important populations of fringing vegetation bordering the banks of the Murray River.
- Significant plant communities in the planning area include old-growth forest, wetlands, wandoo woodlands and granite outcrops.
- Management of introduced species, disease and fire are particularly important in protecting native species and communities.

The objective is to protect and conserve native plants and plant communities.

This will be achieved by:

1. listing declared rare flora under the Wildlife Conservation Act and/or EPBC Act;
2. managing native plants and plant communities according to Department policies;
3. developing and implementing recovery plans for declared rare flora;
4. assessing proposed operations and developments (e.g. road construction/maintenance, facility development, prescribed burns) for potential impacts on declared, threatened rare and priority species;
5. identifying native plants and plant communities that may require special protection, and implementing appropriate strategies to minimise the impacts of threatening processes, such as climate change, introduced species, inappropriate fire regimes and visitor activities;
6. liaising with neighbouring land-holders to promote compatible management on adjoining lands; and
7. providing opportunities for visitors to improve awareness, understanding and appreciation about the importance of native plants and plant communities and impacts of threatening processes.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
19.1 The persistence and condition of populations of threatened species	19.1 Subject to natural variation, recovery and maintenance of viable populations of threatened flora	Every 5 years or as per recovery plans, if applicable

20. NATIVE ANIMALS AND HABITATS

The planning area supports an assemblage of native fauna species and associated habitats that are representative of the Northern Jarrah Forest. Within these habitats, there are several distinctive microhabitats: granite outcrops; wetlands (e.g. Yourdamung and Nalyerin lakes) and riparian zones along watercourses, adding to the diversity of species able to coexist in the area (Nichols and Muir 1989).

Species diversity of mammals and other large vertebrates, such as land birds, is low in the jarrah forest compared to other areas (e.g. the semi-arid zone) (Abbott 1998). However, species diversity of invertebrates and small vertebrates is high (McKenzie *et al.* 1996). The planning area is home to approximately 217 species of animals including 32 mammals, 42 reptiles, 16 amphibians, five fish and 122 birds.

Threatened and Other Specially Protected Fauna

The Wildlife Conservation Act provides for the Minister for Environment to declare species to be specially protected for the following reasons:

- they are rare or likely to become extinct (commonly referred to as 'threatened');
- they are presumed to be extinct but may be rediscovered;
- they are subject to the international agreement; or
- they are in need of special protection, other than for the above reasons (e.g. they are uncommon or have commercial value).

Management direction for specially protected fauna, flora and ecological communities is provided through the Department's proposed Policy Statement No. 9 – *Conserving Threatened Species and Ecological Communities* (subject to final consultation).

Within the planning area, there are 13 species of specially protected fauna gazetted in the Wildlife Conservation (specially protected fauna) Notice 2010 (see Appendix 4). Eleven of these are fauna that are rare or likely to become extinct (schedule 1 – S1) including the woylie, quokka, western ringtail possum, chuditch, numbat, Australian painted snipe (*Rostratula benghalensis australis*), Baudin's cockatoo, Carnaby's cockatoo, forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*), noisy scrub bird and brush-tailed phascogale (*Phascogale tapoatafa* ssp.). Two species: peregrine falcon (*Falco peregrinus*) and carpet python (*Morelia spilota imbricata*) are listed as specially protected fauna (schedule 4 – S4) because although currently not threatened, they are however, uncommon and due to their high commercial value they may be poached, making the species vulnerable.

The EPBC Act provides a listing of nationally threatened fauna species. The 'endangered' and 'vulnerable' vertebrate species listed under the Act that occur in the planning area are also listed as threatened under the State's Wildlife Conservation Act. The IUCN Red List categories and criteria have been adopted by the Commonwealth Government and have been used to rank threatened species in WA (see Appendix 4).

Priority Fauna

The Department also identifies 'priority' fauna that require additional research to determine their true conservation status. There are 13 priority fauna species within the planning area including one priority 2, one priority 3, nine priority 4 and two priority 5 (see Appendix 4). Threats to the priority mammal and bird species include fox predation, habitat loss/fragmentation/alteration, altered fire regimes and competition from introduced herbivores.

Endemic Fauna

There are at least 22 species endemic to Western Australia located within the planning area. Of these, there are a number of species that are regarded as threatened under the Wildlife Conservation Act including the specially protected Baudin's and Carnaby's cockatoos, quokka, western ringtail possum, noisy scrub bird and the priority 4 western brush wallaby.

Recovery Plans

The Department, often in collaboration with other State and Federal agencies and other parties, prepares recovery plans for the most threatened species. Species within the planning area that have recovery plans at the time of writing include the chuditch, woylie, noisy scrub bird, Baudin's cockatoo, Carnaby's cockatoo and forest

red-tailed black cockatoo. The western ringtail possum has an approved interim recovery plan. Recovery plans are also in preparation for the numbat and quokka.

Mammals

The planning area provides diverse and valuable habitats for approximately 32 species of mammal including several that are threatened or priority species. One of the key issues and challenges is to manage habitats and maintain their suitability for a range of fauna species. The size of the planning area, and the fact that it is surrounded by State forest, is advantageous for reducing edge effects and minimising disturbance to native fauna by providing a buffer for protection of many of the habitat values of the planning area.

The planning area is within the former geographic range of the western ringtail possum (*Pseudocheirus occidentalis*) and is currently listed as a threatened species under the Wildlife Conservation Act and the EPBC Act. Between 1996 and 1999 approximately 130 western ringtail possums were translocated to Lane Poole Reserve. Monitoring has suggested that the translocated possums have survived to produce young, establishing regular use of tree hollows and nests construction (de Tores *et al.* 2008). The translocation is now part of a larger study examining whether translocation is a viable management option for displaced western ringtail possums.

Given the extent of habitat fragmentation and population fragmentation elsewhere within the range of western ringtail possums, populations established within the planning area have the potential to be of major conservation significance for the species.

The planning area is within the former geographic range of the woylie. However, by the 1970s the species was restricted to three isolated locations: Perup Forest near Manjimup and two Wheatbelt reserves, Dryandra Woodland and Tutanning Nature Reserve. Initial woylie translocations began in the 1980s, with further translocations from 1995 as part of the Department's *Operation Foxglove*[7] to 19 sites in the Northern Jarrah Forest, including Lane Poole Reserve, as part of the Woylie Recovery Plan (Start *et al*. 1995, de Tores 1999).

Recent observations and initial research indicate a decline in woylie populations in the south-west (Dr A. Wayne *pers. comm.* 2007). At this stage the cause for the decline is unclear. Ongoing research is aimed at uncovering the cause and identifying future management strategies. This decline has resulted in the woylie being re-listed as a specially protected species.

The planning area contains a suite of habitats suitable for quokkas, which are endemic to the south-west of Australia and near the northern extent of the quokkas geographic range. Their distribution closely follows the limit of the 1000mm rainfall isohyet, reflecting their relatively high water requirements (de Tores *et al.* 2007). Quokkas are specially protected under the Wildlife Conservation Act and threatened under the EPBC Act.

Research has shown that quokkas have specific habitat requirements. Quokkas prefer a complex mosaic of recently burnt and mature (5-30 years old – but not senescing) swamp thickets usually dominated by *Taxandria linearifolia*, free of pigs and foxes (Burrows *et al.* 2005, de Tores *et al.* 2004). An adaptive fire management guideline for quokkas has been prepared, wherein fire is proposed as a tool to manipulate habitat to create a suite of sites supporting this preferred mosaic (see Section 25 – *Fire*).

Recovering populations of numbats (*Myrmecobius fasciatus*) are found within the southern parts of the proposed additions to the reserve (i.e. portions of Godfrey and Hillman forest blocks), which form a corridor to the Batalling forest block[8]. Numbats are also listed as a specially protected species, threatened by fox predation, altered fire regimes and habitat destruction. Translocations of numbats have also occurred in a number of places including the Karakamia Sanctuary, Stirling Ranges and Tutanning Nature Reserve.

The planning area also contributes to the conservation of the chuditch, which is under threat due to habitat alteration resulting from the wide-scale clearing for agriculture and the subsequent removal of suitable den logs and den sites. Other threatening processes to chuditch include introduced predators such as the fox and cat, competition for food, and frequent bushfire.

[7] A pilot trapping and telemetry monitoring study of foxes and cats within the unbaited and highest baiting frequency (six baitings per year) treatments of the Northern Jarrah Forest. The project involved fox and cat density estimates and survivorship and home range estimates in the presence of 1080 baiting within the Northern Jarrah Forest.

[8] Habitats in the Batalling forest block support a high abundance of fauna.

Birds

Approximately 123 species of native birds have been recorded within the planning area, which is comparable to the approximate 150 species known to occur across the entire jarrah forest (Nichols and Muir 1989). Distribution of species is generally attributed to structural differences rather than variations in floristics. A study by Wykes (1983) found that the greatest abundance of birds in the jarrah forest generally occurred along watercourses and adjacent vegetation, where food, shelter and water is available. Such habitats in the planning area include the riparian vegetation along the Murray and Harris rivers and adjoining creek systems, as well as Yourdamung and Nalyerin lakes.

The planning area also contains suitable habitat for the specially protected noisy scrub bird, which has been reintroduced to parts of Lane Poole Reserve and the surrounding forest. Noisy scrub birds were released in the planning area, on the southern end of King Jarrah Formation between 2000 and 2003, one of eight translocation sites in the Darling Range. Since 2000, six males and three females have been released at this site, but as yet there is no evidence of breeding. Fire is a key threatening process for the species as noisy scrub birds have a requirement for long unburnt habitat. The species remains extremely vulnerable to a single large bushfire and thus habitat protection and maintenance of appropriately aged vegetation is essential. Clearance of habitat could fragment and prevent the potential for dispersal of the species. Pigs (*Sus scrofa)* are also a threat to these birds in the planning area as they cause disturbance to swampy and riparian habitat areas, as are black rats (*Rattus rattus*), which predate on eggs and young.

Baudin's cockatoo, Carnaby's cockatoo and the red-tailed black cockatoo are specially protected species under the Wildlife Conservation Act as 'fauna that is rare or is likely to become extinct'. These species use tree hollows for nesting and making them vulnerable to land clearing and competition for tree hollows from introduced species. A recovery plan for the Carnaby's cockatoo has been prepared, which seeks to promote the maintenance of significant breeding areas adjacent to feeding areas.

The peregrine falcon has also been recorded in the planning area. It is specially protected under the Wildlife Conservation Act.

Reptiles and Amphibians

Reptiles and frogs of the south-west of Western Australia are distinct from the arid zone and temperate south-east Australia. Geographical factors distinguish species from these areas, with the composition of fauna being a blending of the arid adapted elements from the north and east and the meso-temperate elements from the extreme south-east of Australia (Storr 1964). Many reptiles with wide distributions in arid Australia extend well into but excluding the extreme south-west. Chapman and Dell (1985) noted that there was a hiatus line between Perth and Albany, where only 35 of the 109 species found to the north of this line extended further into the south-west. Agamids and geckos are particularly poorly represented south of this line. The geographic separation of the south-west corner of the State could account for speciation in both reptiles and frogs.

Approximately 42 species of reptiles are 16 species of amphibians have been recorded in the planning area. The most common reptiles in the planning area are skinks (14 species), snakes (11 species) and geckos (six species). This includes the specially protected carpet python and priority 4 Darling Range ctenotus (*Ctenotus delli*).

Moist environments, particularly along rivers and streams, swampy areas and the two natural lakes, Yourdamung and Nalyerin, provide important habitat for frogs. Many of the common frog species in the planning area appear to be tolerant of changes in their natural environment (Christensen *et al*. 1985). However, Jaensch (1993) identified the protection of wetlands and water quality as major management issues to preserve the suite of frog species present. The drying climate may also influence the distribution of amphibians and other species in the environment.

Fish

There are approximately five native fish species found within the planning area and a further four which are introduced species (see Section 23 – *Introduced and Other Problem Animals*). Native species recorded within the planning area include the western minnow (*Galaxias occidentalis*), western pigmy perch (*Edelia vittata*) and nightfish (*Bostockia porosa*), which are endemic to the south-west of Australia, as well as freshwater cobbler (*Tandanus bostocki*) and Swan River (or blue spot) goby (*Pseudogobius olorum*).

The Murray River dissects the northern section of the planning area and is very popular with recreational fishers (see Section 31 – *Visitor Activities*).

Invertebrates

Majer and Abbott (1989) considered soil and litter invertebrates of the Dale Botanical Subdistrict as one of the best-studied in Australia. Later surveys on arthropod fauna by Abbott *et al.* (1992) found 396 species in foliage of the jarrah forest, mostly leaf chewers, sapsuckers and predators. Abbott (1992) suggested that the total number of insect species alone in the south-west forests may be in the order of 15,000-20,000.

Aquatic Macroinvertebrates

Information on aquatic macroinvertebrate species in the planning area and wider region were collected by the Department as part of the river health sampling program that took place between 1994-1999. The general conclusions of this study were that sites in forested areas were in good condition with what appeared to be a natural invertebrate fauna, while sites in farmland (and in downstream parts of the catchment) were degraded. The rivers and streams of the Murray River Basin as a whole were rated as Band C[9] due to agricultural activities on the Swan Coastal Plain. However, all but one of the sites in the planning area were in 'good' or 'natural' condition and while there is occasionally localised impacts from pine harvesting and mining, the Northern Jarrah Forest sites overall are in good condition and most rate as Band A (S. Halse *pers. comm.* 2003).

Surveys have found that there are no invertebrate families of special importance in the Murray River or its tributaries. Providing that the fringing vegetation remains intact and that there are surrounding trees to provide shade, stabilise soil and drop leaves and branches into the waterway, water quality and macroinvertebrate life in forested parts of the Murray system, such as in the planning area, should continue to remain fairly natural (S. Halse *pers. comm.* 2003).

20. Native Animals and Habitats

Key Points

- The planning area supports an assemblage of native fauna species and associated habitats that are representative of the Northern Jarrah Forest.
- There are 13 species of specially protected fauna known to occur in the planning area including, ten that are threatened. A further 13 species are listed on the Department's priority list.
- The planning area contains suitable habitat for specially protected fauna with a number of reintroductions occurring in the past and some planned for the future.

The objective is to protect and conserve native animals and their habitats.

This will be achieved by:

1. protecting native animals and habitats from threatening processes (e.g. the spread of weeds and disease, introduced species, inappropriate fire regimes and human disturbance). Priority should be given to threatened species;
2. listing threatened fauna under the Wildlife Conservation Act and/or EPBC Act;
3. managing native animals and habitats according to Department policies;
4. developing and implementing recovery plans for specially protected species (e.g. chuditch, woylie, numbat, noisy scrub bird, Carnaby's black cockatoo, Baudin's black cockatoo, forest red-tailed black cockatoo and western ringtail possum);
5. considering the re-introduction of fauna to areas where they are known to have formerly occurred, where appropriate; and
6. providing opportunities for visitors to increase their knowledge and appreciation of the native fauna.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
20.1 Range and population size of threatened and other specially protected fauna	20.1 Subject to natural variation, recovery and maintenance of viable populations of threatened and other specially protected fauna	Every 5 years or as per recovery plans, if applicable

[9] Band scores: Band A: undisturbed, Band B: significantly impaired, Band C: severely impaired, Band D: extremely impaired (Halse *et al.* 2002)

21. THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

The Commonwealth's EPBC Act provides a listing of nationally threatened species and ecological communities. Western Australian listings under this Act are currently incomplete. The principles applied to Commonwealth listings are essentially the same as those used for listing taxa under the Wildlife Conservation Act although there is no provision under State legislation to recognise and protect threatened ecological communities. However, they may receive indirect protection under some other State acts, such as the Environmental Protection Act.

Possible threatened ecological communities that do not meet the survey criteria for the assessment of threatened ecological communities are added to the Department's priority ecological community list (as Priorities 1, 2 and 3). These three categories are ranked in order of priority for survey and/or definition of the community and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities.

At the time of writing, no threatened or priority ecological communities have been recorded in the planning area.

22. ENVIRONMENTAL WEEDS

'Environmental weeds' are plants that establish themselves in natural ecosystems and proceed to modify natural processes, usually adversely, resulting in the decline of the communities they invade (CALM 1999). Environmental weeds displace native plants, particularly on disturbed sites, by competing with them for light, nutrients and water. They can also have a significant adverse impact on other natural values by altering animal habitats, harbouring pests and diseases, and increasing the fire hazard (CALM 1999, Department of Agriculture 2001).

Environmental Weed Management

An integrated approach to environmental weed management was developed in the *Environmental Weed Strategy for Western Australia* (Environmental Weed Strategy) (CALM 1999). As part of this Strategy, environmental weeds are rated in terms of their environmental impact on biodiversity. The criteria used to determine the rating for each weed are:

- *Invasiveness* – ability to invade bushland in good to excellent condition or ability to invade waterways;
- *Distribution* – wide current or potential distribution including consideration of known history of wide spread elsewhere in the world; and
- *Environmental Impacts* – ability to change the structure, composition and function of ecosystems and in particular an ability to form a monoculture in a plant community.

The Department's proposed Policy Statement – *Environmental Weed Management* (subject to final consultation) is used in conjunction with the Environmental Weed Strategy to guide the approach and priority setting for the control of environmental weeds on Department-managed lands and waters. Priorities for action are to first control any weed that impacts on threatened or priority flora, fauna or ecological communities, or that occurs in areas of high conservation value, and then address high, moderate, mild and low rated environmental weeds in decreasing priority as resources allow.

The Australian Government listed 20 weed species as Weeds of National Significance. The State Government is responsible for managing occurrences of these species on crown land of which two weeds of national significance are found within the planning area.

The Department also has a legal responsibility to control declared weeds under Part V of the *Agriculture and Related Resources Protection Act 1976* (ARRP Act) where practical, and will be accountable for declared plant control under the *Biosecurity and Agriculture Management Act 2007* when the supporting regulations are put in place. Weeds are 'declared' under the ARRP Act when they are considered to pose a significant threat to agriculture.

Options for environmental weed management include prevention, eradication, control, containment, or do nothing. It is the preferred option to prevent the introduction of environmental weeds through appropriate management, as eradication is rarely feasible. Methods of control include managing disturbance, the use of herbicides, biological control, manual control and control through the application of fire (e.g. for blackberry).

Effective control programs encourage the growth of native plant species and the suppression of weeds with the overall aim of boosting the area's resilience to further weed invasion.

Problem Weeds

Approximately 45 introduced plant species have been recorded in the planning area including two weeds of national significance: bridal creeper (*Asparagus asparagoides*) and blackberry (*Rubus fruticosus*) which are also declared species under the ARRP Act. Including these two species, there are seven declared species recorded in the planning area (e.g. cotton bush), (see Appendix 5).

Environmental weed species identified in the Environmental Weed Strategy include four species rated as high: bulrush (*Typha orientalis*) located particularly around the lakes and wetlands, the bugle lily watsonia (*Watsonia meriana var. bulbillifera*) and the declared species arum lily (*Zantedeschia aethiopica*) and bridal creeper. According to the Environmental Weed Strategy, a further 21 weed species rated as moderate, three weed species rated as mild, nine weed species rated as low and a further four unrated species have been recorded in the planning area (see Appendix 5).

Blackberry, due to its invasiveness, is of concern in the planning area, particularly around recreation sites and in riparian areas. Numerous pasture species, particularly along boundaries are also of concern, as is the infiltration of wildlings of monterey pine (*Pinus radiata*) into native vegetation from plantation areas. Other weeds of concern are black wattle (*Acacia mearnsii*), *Watsonia* spp. and Mexican poppy (*Argemone ochroleuca*). Many of these weeds have been introduced into the planning area via rivers, adjoining freehold land, public roads or other areas of public use therefore control is difficult because of re-invasion. The main infested areas occur at susceptible areas such as old mills sites and settlements (e.g. Treesville), recreation sites and along utilities corridors.

22. Environmental Weeds

Key Points

- Environmental weeds displace native plants, particularly in disturbed sites, by competing with them for light, nutrients and water.
- The Environmental Weed Strategy provides an integrated approach to environmental weed management.
- Many of the weeds have been introduced into the planning area via the Murray River and its tributaries, adjoining freehold land, public roads or other areas of public use.
- Approximately 45 environmental weeds have been recorded in the planning area. Of these, there are four species listed as high under the Environmental Weed Strategy with seven declared species and two listed as weeds of national significance.

The objective is to minimise the impacts of environmental weeds on key values.

This will be achieved by:

1. considering the *Environmental Weed Strategy for Western* Australia and local knowledge to assess invasiveness, distribution and environmental impact;
2. managing environmental weeds according to relevant legislation and Department policies;
3. maintaining information on weeds including a register of weeds, details of distribution, relevant biological information and history of control;
4. developing and implementing a weed control plan that includes:
   - undertaking weed surveying and mapping;
   - prioritise environmental weeds by species, location and impacts on key values;
   - controlling weeds by appropriate mechanical, chemical or biological methods; and
   - eradicating new and emerging weeds before they become established;
5. liaising with relevant agencies, neighbouring land-holders and NRM and catchment management groups to facilitate effective and coordinated weed management in the planning area and surrounding areas;
6. providing appropriate information and interpretation on the adverse impacts of environmental weeds and their impacts on key values to promote awareness and understanding; and
7. limiting the opportunity for weeds to be introduced and established by:
   - applying appropriate hygiene practices as required to machinery entering the planning area; and
   - minimising disturbance of soil while carrying out management activities, particularly in areas

within or adjacent to weed infested areas.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
22.1 The extent of blackberry at priority locations such as recreation sites and riparian areas	22.1 Decrease in the extent of blackberry	Every 5 years

23. INTRODUCED AND OTHER PROBLEM ANIMALS

Introduced and other problem animals may be either introduced feral species that have become established as wild or naturalised populations, or native species, which for some reason, have altered their natural distribution and population to the detriment of other native species. Introduced animals have the potential to seriously impact on natural species and systems through direct effects such as predation, habitat destruction, competition for food and territory, introduction of disease, and environmental degradation by selective grazing, accelerating erosion and polluting waterways.

A primary objective of the Department is to achieve the systematic and safe control of introduced animals on lands and waters that it manages. The Department's proposed Policy Statement – *Management of Pest Animals on CALM Managed Lands* (subject to final consultation) provides guidance for this by identifying Statewide priorities and strategic approaches to management. The Department also has responsibilities for the control of declared animals (e.g. foxes and feral pigs) on the lands it manages under sections 39 to 41 of the ARRP Act where practical, and will be accountable for declared animal control under the *Biosecurity and Agriculture Management Act 2007* when the supporting regulations are put in place (see Appendix 6). The Northern Jarrah Forest, including the planning area, is included as one of the research areas in the partnership between the Department and the Invasive Animals Cooperative Research Centre. The objective of the research is to examine the interactions between native animal species and foxes, cats and rabbits, as well as to assess the role and damage caused by feral pigs (J. Asher *pers. comm.* 2005).

Introduced and other problem animals within the planning area are listed in Appendix 6.

Foxes and Cats

Many native mammal species have had their distributions severely reduced by introduction of predators such as the red fox (*Vulpes vulpes*) and feral cat (*Felis catus*). Similarly, competition between native and introduced animal species for food and/or territory often leads to drastic reductions of native animal populations. Foxes predating on native fauna have contributed to the widespread decline of critical weight range mammals (35 g to 5.5 kg) across Australia and continue to be one of the biggest threats to survival of the quokka, western ringtail possum, chuditch, woylie and numbat populations in the planning area (see Section 20 – *Native Animals and Habitats*) (Wyre 2004).

To combat the effects of foxes and cats predating on native animals, the Department initiated the experimental baiting program *Operation Foxglove* in the south-west in 1994. This saw the start of the aerial fox baiting trials in sections of the Northern Jarrah Forest, including Lane Poole Reserve (see Figure 5). The southern part of the reserve was left unbaited as an experimental control (Armstrong 2004a). The baiting program was expanded across the State in 1996 with the commencement of the *Western Shield* program (CALM 2003b). Western Shield also involves translocations of significant fauna (e.g. western ringtail possum and woylie) to fox-controlled areas within their former range. Baiting within the planning area occurs six times a year, except for the redefined control area used as part of Operation Foxglove remaining unbaited. The control area will be in place for ongoing research and monitoring while it is deemed necessary.

Predation by both foxes and cats are listed as key threatening processes under the EPBC Act. Both the fox and feral cat have five-year threat abatement plans providing national coordination, with the main emphasis on local control programs to ensure the recovery of endangered species.

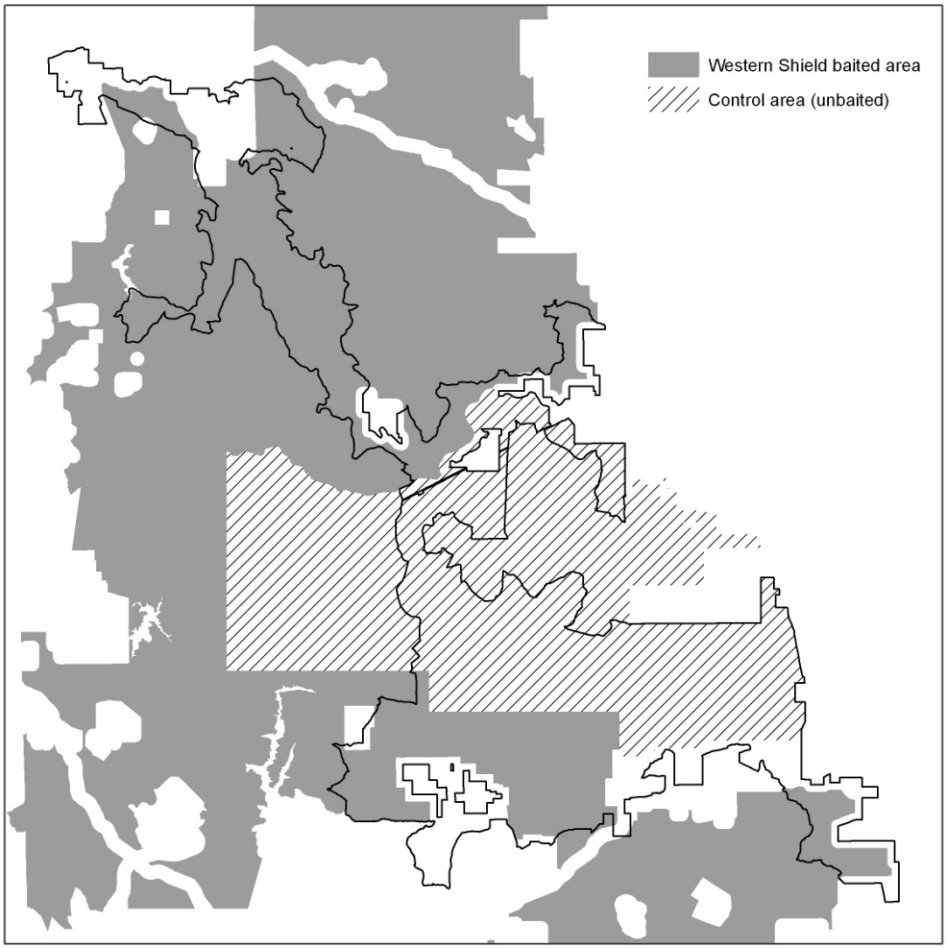


Figure 5. Western Shield Baiting Cells

Pigs

Feral pigs are having a serious impact on Australia's wildlife and habitats. They consume a wide range of native fauna and flora, such as reptile and bird eggs, frogs, earthworms, other invertebrates, roots and tubers. They compete with native fauna and cause considerable environmental degradation by changing the natural floristic composition, reducing the regeneration of plants, increasing the invasion and spread of weeds and causing damage such as erosion and destruction of habitats, particularly in riparian zones. Feral pigs have the potential to displace native animals of conservation significance including quokkas and woylies (CALM 2005a). They can also act as a reservoir for endemic and exotic diseases, and can aid in the spread of *Phytophthora cinnamomi*.

Guidance for management is provided by the draft *Feral Pig Management Strategy* (CALM 2005a), which outlines the approach and priority setting for control of feral pigs according to the protection of specific values. Feral pigs are a major threat to the values of the planning area, and in 2001 were listed under the EPBC Act as a key threatening process to the conservation of threatened species and ecological communities nationally (Department of the Environment and Heritage 2003). Following the listing, a national *Threat abatement plan for the predation, habitat degradation, competition and disease transmission by feral pigs* (Department of the Environment and Heritage 2005) was developed.

Feral pigs are illegally released into new areas (or restocked into existing areas) by recreational hunters, a fact proven through genetic studies (Hampton *et al.* 2004). This illegal pig releasing and hunting compounds the direct impacts of pigs and can further compromise key values and visitor safety. Within the planning area and surrounding State forest, feral pigs are controlled through a monitoring and trapping program (A. Wright *pers. comm.* 2006; F. Kirkpatrick *pers. comm.* 2007). Trapping is most successful in the summer months when pigs congregate around water sources (A. Wright *pers. comm.* 2006). Recreational shooting of feral pigs or any animal in the planning area is not permitted, however the Department's Director General may authorise recreational hunting by trapping, without the use of dogs, as guided by Policy Statement No. 18 – *Recreation,*

tourism and visitor services and the draft *Feral Pig Management Strategy*. Priority areas where feral pig management will be aimed at includes near recreation sites, riparian areas and where declared rare flora are located.

Introduced Inland Aquatic Species

There are a number of freshwater species that have been introduced to the waters of the planning area. These include redfin perch, trout, marron, yabbies and mosquito fish.

Redfin perch

Redfin perch (*Perca fluviatilis*) were introduced to Albany for recreational fishing in the 1890s and have since been spread throughout water-bodies and river systems of the south-west to facilitate recreational fishing. They are now targeted as a recreational species and are, on occasion, illegally reintroduced to river systems by recreational fishers.

Redfin perch are voracious predators that can rapidly invade and dominate a river or dam to the detriment of local species. They are bottom feeders that consume smaller animals including marron and gilgies and their diet also includes many of the fish species native to the south-west. A study by Hutchison (1991) suggested redfin perch was responsible for the local extinction of indigenous species, including the Western pygmy perch (*Edelia vittata*), from much of the Murray River.

There are no size or bag limits, or seasons imposed by DoF on redfin perch and recreational fishers are strongly encouraged to retain any caught redfin perch (C. Syers *pers. comm.* 2006).

Trout

Brown trout (*Salmo trutta*) were introduced into Western Australian as early as the 1870s, and rainbow trout (*Oncorhynchus mykiss*) in the early 1900s (DoF 2002). Both species of trout were originally introduced for recreational fishing. The Murray River was stocked regularly with trout from 1936 and in a program administered in accordance with the *Fish Resource Management Act 1994* by DoF, who are also responsible for the management of fish species (DoF 2002). However, since 2003 the Murray River has not been stocked with trout and is unlikely to be stocked in the foreseeable future (C. Syers *pers. comm.* 2006). This is because trout survivorship and productivity is low as the Murray River is near the northern range limit for the species and due to the presence of redfin perch (C. Syers *pers. comm.* 2006).

Trout are opportunistic feeders with a wide-ranging diet from decapod crustaceans (e.g. marron and gilgies) and native fish species to aquatic and terrestrial insects, amphibians and aquatic snails. Similar to redfin perch, trout predate and compete with native species, influencing their distribution (DoF 2002). However, subtle differences in habitat preferences indicate trout may be able to exist with native species without having major impacts (DoF 2002). In the planning area, redfin perch are considered a greater threat to native species than trout (DoF 2002).

The Minister for Fisheries established a sub-committee of the Recreational Fishing Advisory Committee in 2004 to develop a five-year strategy for the State's south-west recreational freshwater fisheries, including the development of future stocking strategies for the recreational trout fishery. The Department is represented on this committee. As part of this process, DoF is finalising a management plan for the translocation of trout into and within WA. This will assess the suitability of river systems across the south-west for stocking with trout, based on environmental and social factors, native fish distribution and historical trout stocking events. The Department and the Conservation Commission will also establish guidelines to assist in their assessment of trout stocking proposals on areas within the conservation estate. The guidelines will be applied with a view to providing information and advice on biodiversity conservation to DoF and other key stakeholders.

Marron

Smooth marron (*Cherax cainii*) are the third largest freshwater crayfish in the world and are endemic to WA but are not indigenous to the Murray River[10]. The section of Murray River dissecting the planning area is extremely popular for marron fishing (see Section 31.7 *–Recreational Fishing and Marroning*). Marron are predated by redfin perch and are affected by the rising salinity and water eutrophication. There is no data to suggest whether or not marron are detrimental to native fauna in streams where they did not previously exist.

[10] Marron were introduced to the Murray River in 1961 (C. Bird *pers. comm.* 2006).

Rabbits

Rabbits are not widespread throughout the planning area but their grazing pressure and destabilisation of the soil can have significant localised impacts. Rabbits only appear to reach significant numbers in forest areas where native vegetation has been cleared and annual grasses are prevalent. Rabbit numbers in the planning area seem to correspond to the periodic impact of myxomatosis and more lately, calicivirus. This has been an effective means of control within the planning area and as such action by the Department has not been necessary. However, controlled baiting or fencing options may be employed where natural values are threatened (e.g. populations of a rare flora species). A threat abatement plan for the competition and land degradation by rabbits has been prepared by the Department of Environment and Heritage.

Feral Honeybees

Self-sustaining, wild populations of feral honeybees (*Apis mellifera*) are established throughout most of the south-west, after being introduced from England in 1846 to pollinate plants grown by early settlers for food. Apiary sites for the production of honey exist in the planning area (see Section 40 – *Beekeeping*).

Feral honeybees may impact on the natural values of the planning area in the following ways:

- by competing for tree hollows (NSW National Parks and Wildlife Service 2002). Many birds and tree-dwelling mammals use tree hollows for breeding sites and shelter and are already a limited resource without the additional impact from feral honeybees where once occupied, feral honeybees can remain for 20–50 years. Feral bees have been recognised as a major factor affecting the breeding potential of all three species of black cockatoos (CALM and Water Corporation 2005);
- by competing for floral resources with native species, such as pollen and nectar. Feral and managed hive honeybees can remove 80% or more of the floral resources produced (NSW National Parks and Wildlife Service 2002);
- by affecting pollination and seed set of native species, due in part to inefficient transfer of pollen or the physical damage to flowers (Schwarz and Hogendoorn 1999); and
- by increasing seed-set in some weeds (Barthell *et al.* 2001).

Although feral honeybees have existed in the south-west for the last 150 years and consequently most impacts would have already occurred, the removal of feral colonies would still have nature conservation and recreation benefits. However, the feasibility of completely removing feral honeybees is low, as localised eradication would probably be followed by recolonisation from new swarms invading the area (Gross 2001). Feral populations can however, be temporarily eliminated from areas after unfavourable conditions, such as drought or fire, as long as there is not a constant supply of managed hive bees swarming into the wild (Scheltema 1981).

Until an effective means of control is found for feral honeybees, management will focus on controlling colonies/swarms around recreation sites, and managing the distribution and density of managed hives in areas of highest conservation value. To this end, managed hives may be excluded from areas where a reduction in feral honeybee density is feasible (see Section 40 – *Beekeeping*). Other areas may become available to utilise nectar and pollen resources where impacts are less likely.

Leafminer

The jarrah leafminer (*Perthida glyphopa*) and flooded gum (*Eucalyptus rudis*) leafminer (*Perthida* ssp.) are native species however, they have the potential to become ‘problem animals’ when the insects infest jarrah forests (Abbott *et al.* 1995). As their name suggests, these leafminers feed on the leaves of jarrah and flooded gums trees. Leafminers do not kill infested trees, they do however, damage leaves which can lead to premature leaf-fall. This results in a decrease in photosynthesis which inhibits growth, leading to permanent damage to the crowns of trees (Abbott *et al.* 1995, Beckmann 1986). This can lead to a change in species composition in the infested area with non-affected species such as marri (*Corymbia calophylla*) thriving in the area (Abbott *et al.* 1995).

Leafminers have been recorded in the planning area, particularly in some areas in the southern part where crowns of jarrah and flooded gums have a noticeable brown tinge. The distribution of leafminers is continuing to move northward and as such, control measures should be used to control outbreaks. Measures in infested areas may include disrupting the life cycle of leafminers by prescribed burning in autumn and ensuring leafminer resistant jarrah and flooded gum trees are retained during harvesting in surrounding State forest (Abbott *et al.* 1995).

23. Introduced and Other Problem Animals

Key Points

- There are a number of introduced animals within the planning area that can out-compete, prey on, or alter native animals or their habitats.
- The most significant introduced animals in the planning area are foxes and pigs.
- Jarrah leafminer and flooded gum leafminer are native insects considered to be 'problem animals' in the planning area.

The objective is to minimise the impacts of introduced and other problem animals on key values.

This will be achieved by:

1. managing introduced and other problem animals according to relevant legislation, Departmental policies and operational guidelines;
2. maintaining information on introduced and other problem animals including a register of animals, details of distribution, relevant biological information and history of control;
3. developing and implementing an introduced and other problem animals control plan that includes:
   - undertaking surveying and mapping of introduced and other problem animals;
   - prioritise introduced and other problem animals by species, location and impacts on key values;
   - controlling animals by appropriate methods (e.g. trapping or baiting) and adapting management in response new knowledge; and
   - preventing the establishment of new populations;
4. continuing to undertake appropriate fox and cat control as part of Western Shield to protect native fauna, particularly specially protected species, from introduced predators;
5. reviewing the need for the baiting control area (see Figure 5) once current research is completed;
6. liaising with relevant agencies, neighbouring land-holders and NRM and catchment management groups to facilitate effective, coordinated introduced and other problem animals management in the planning area and surrounding areas;
7. controlling feral bees that pose a risk to natural values (e.g. native birds and tree-dwelling mammals that use tree hollows for breeding sites and shelter);
8. monitoring jarrah for the presence of leafminer and managing to reduce its impacts as required;
9. providing appropriate information and interpretation on the adverse impacts of introduced and other problem animals and their impacts on key values to promote awareness and understanding;
10. undertaking research and monitoring of introduced animals and their effects and interactions with native species as part of Western Shield and adapting management accordingly; and
11. establishing guidelines, in consultation with the Conservation Commission, to assist in the assessment of trout stocking proposals on areas within the conservation estate. The guidelines will be applied with a view to providing information and advice on biodiversity conservation issues to the DoF and other key stakeholders (see also Section 31.7 – *Marroning and Fishing*).

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
23.1 Populations and area impacted by feral pigs in priority areas	23.1 No increase in the number of populations or area impacted by feral pigs in priority areas	Every 5 years

24. DISEASES

Plant Diseases

The south-western ecosystems are being impacted by a high number of active plant diseases (Shearer 1994, Wills and Keighery 1994). However, plant disease knowledge is still very rudimentary with much more work required on disease occurrence, the disease organism and impacts, the host and its susceptibility, and environmental processes that may facilitate spread.

Hopper (1994) suggests that there are four factors that in particular may have contributed to the susceptibility of the south-west flora to disease epidemics:

- a flat landscape with predominantly acidic, highly leached and nutrient deficient soils with slow drainage. Diseases such as *P. cinnamomi* thrive in acidic moist soils;
- a rich vascular flora that has been geographically isolated for a long time, with many adaptations for nutrient deficient soils, many involving symbiotic partnerships with micro-organisms such as fungi—consequently, a diverse range of vulnerable hosts for diseases;
- a climatic regime where drought is common; and
- the rapid and ongoing human development of the landscape following historic settlement including direct destruction or alteration of habitat by fragmentation, altered landscape processes and introduction of numerous weeds and pests.

The most frequently reported disease groups of the south-western native plant taxa include:

- pythiacious root rots (mostly *P. cinnamomi*, *P. megasperma* and *P. citricola*);
- rusts (mostly *Puccinia* spp. and *Uroycladium tepperianum* gall rusts of *Acacia* species);
- *Armillaria* root rots (*Armillaria luteobubalina*);
- stem cankers (*Botryospaeria* spp., *Zythiostroma* spp. and *Cryptodiaporthe* spp.);
- leaf spots and blights (Shearer 1994); and
- mundulla yellows.

Disease caused by *Phytophthora*

At present, the most significant disease threat to plants within the planning area is the disease known as 'dieback', caused by the introduced microscopic pathogen *Phytophthora*. There are several known species of *Phytophthora* occurring within the native plant communities of Western Australia, although it is recognised that *P. cinnamomi* is the most damaging, affecting approximately 24% of survey forested areas in the southwest (EPA 2007). Susceptible plants, once infested, are killed and in many cases those species are eliminated from the site, leading to dramatic and permanent changes to native plant communities and their dependent fauna.

Dispersal

Dispersal of *P. cinnamomi* occurs through its ability to move autonomously, producing small motile spores that are distributed over long distances through surface and sub-surface water or small distances to infect new roots, or by the growth between roots of mycelial threads. The most significant spread of the pathogen results from the movement of soil and plant material, by vectors such as humans, vehicles and animals (e.g. kangaroos and feral pigs). The pattern of *P. cinnamomi* distribution is strongly related to site factors such as the presence of watercourses, tracks/roads and trails, with infestation being most common where human activities and use have taken place in the absence of a strict hygiene regime.

Effects

The effect of *P. cinnamomi* upon the health of native plants and plant communities and varies greatly. In many places, lethal root-disease destroys the structure of many native plant communities, reduces their floristic diversity, decimates their primary productivity and destroys habitat for much dependant native fauna. In some places the pathogen causes little damage at all. Unfortunately in the south-west it is more common to find susceptible communities in vulnerable environments than not.

No simple or single relationship exists between the presence of *P. cinnamomi* and the development of the disease. This is because of the considerable variability that exists within and between native plant species in their responses to the presence of *P. cinnamomi*, and the complex influence of temporal and spatial variation in environmental forces.

However, it is now evident that among the varieties that occur within areas of the south-west receiving more than 800mm mean annual rainfall, there are four types of distinctive response to the pathogen as follows:

- *no apparent disease at all* - this includes those areas of karri and wandoo forest which contain no floristic elements of the dry sclerophyll (jarrah) forest type and to plant communities on the calcareous soils of the Spearwood and Quindalup Dune Systems and of the Swan Coastal Plain and pedogenically related landscapes;
- *an extremely destructive epidemic of root rot* - this applies within the highly susceptible understorey elements of the dry sclerophyll forest, in banksia woodland and in heathland on podsols, podsolic and lateritic landforms;

- *a variable epidemic* - this applies to the dominant jarrah tree component of the forest with all variants in the response of jarrah are coincident with, or preceded by, mass deaths in susceptible elements of the understorey; and
- *an 'endemic' pathogen* - where *P. cinnamomi* has been long established (some 50 years or more) in sites formerly dominated by jarrah/banksia forest and has been very heavily impacted *P. cinnamomi* behaves in a manner characteristic of endemic pathogen. The forest is often replaced by open woodland of marri/parrot bush (*Banksia sessilis*).

Each of these circumstances presents a different problem that requires a separate management response.

Jarrah forests and wetland habitats of the planning area that have been affected by *P. cinnamomi* include many members of the families Dilleniaceae, Epacridaceae, Proteaceae and Xanthorrhoeaceae such as the highly susceptible *Banksia* and *Leucopogon* genera. *P. cinnamomi*-induced death of these plants, which often dominate the jarrah forest understorey, continues to result in the irreversible decline in the diversity of plant communities within the planning area.

P. cinnamomi can also have a major impact on faunal habitats (see Table 3). Species such as the honey possum (*Tarsipes rostratus*) are dependent on plant communities such as the banksia woodlands, which are highly susceptible to diseases caused by *P. cinnamomi*. Such dependent species will have a correlating decline or will disappear from the local environment as the autonomous spread of *P. cinnamomi* continues. Impacts may be accelerated if the vectoring of the pathogen by humans into uninfested areas in the planning area is not minimised. Table 3 shows some effects that a pathogen can have on fauna.

Table 3. Possible Effects on Fauna Due to the Presence of a Plant Pathogen in a Plant Community

Effects on Vegetation	Effects on Fauna
Loss of susceptible plants in the understorey and midstorey	❖ Direct loss of food sources such as seeds, nectar, pollen; and ❖ indirect loss of food sources such as invertebrates
Decline in plant species richness and diversity	❖ Loss of food for species that prefer floristically rich vegetation; and ❖ loss of seasonal food
Decrease in plant cover, increase in bare ground, erosion	❖ Loss of habitat for species dependant on thick ground cover; ❖ Increased predation risk; and ❖ Changes to microclimate
Decrease in canopy cover	❖ Loss of food for arboreal species; and ❖ loss of habitat for arboreal species
Decrease in litter fall	❖ Decline in litter invertebrates; and ❖ decline in invertebrate food sources for insectivores
Post infection increase in frequency of resistant species	❖ Change of food resources

Source: based on Wilson *et al.* (1994).

Management

Management of *P. cinnamomi* within the planning area will focus on Disease Risk Areas (DRA) through managing access (see Section 30 – *Visitor Access – Special and Restricted Access*), applying forestry hygiene practices and identifying any significant uninfested areas also referred to as 'protectable areas'[11] and areas that are already infested but with significant residual natural values, such as for rare and priority flora (see Section 19 – *Native Plants and Plant Communities*). Management of these areas will aim to:

- reduction of both the rate of vectored spread and establishment of new centres of infestation within protectable reas;

[11] Areas likely to remain uninfested by the autonomous spread of the pathogen in the medium term.

- containment or retardation of further autonomous spread at the boundaries of existing infestation within any identified protectable areas; and
- progressively identify significant uninfested (protectable) areas.

Broadscale surveying for *P. cinnamomi* was undertaken before 1976 indicating expression of disease in native plants scattered throughout the planning area. More recent surveys within the planning area revealed further areas infested with *P. cinnamomi* however, the current extent of infested areas is unknown as the majority of the planning area has not been surveyed since 1976. Due to the high degree of visitor access through the area, further spread of *P. cinnamomi* is likely to be greater than indicated by previous surveys.

To accurately determine the extent of *P. cinnamomi* within the planning area and to identify any protectable areas, on-ground surveys are required. However, due to resource limitations, not all of the planning area can be intensely surveyed. Therefore, the first priority is to interpret aerial photographs and combine this with knowledge of the disease occurrence to map probable disease spread and protectable areas. On-ground surveys should then be prioritised according to the risk to natural values. This may include the following criteria:

- conservation significance on the area;
- susceptibility of plants and plant communities;
- intensity of human activity, either existing or projected;
- current and proposed access;
- climate, including the likelihood of summer rain and the degree of inundation;
- soil type and geomorphology; and
- current knowledge and experience.

In the case of areas that will, for the foreseeable future, remain unsurveyed, or are 'unprotectable' and uninfested, standard hygiene practices apply. In some cases, strict adherence to disease hygiene plans may be difficult (e.g. construction of emergency fire access tracks in bushfire situations). Bushfire suppression plans will need to include tactics to minimise this.

Management emphasis will be on reducing vectored spread and the human-assisted establishment (mainly by vehicles) of new centres of infestation within any identified significant or protectable uninfested areas (see Section 30 – *Visitor Access*). Where surveys for the occurrence of the pathogen reveal the presence of significant uninfested areas, disease management plans will be completed for new developments such as upgrading recreational facilities or realigning access roads, tracks and trails. Management actions will be developed in accordance with Policy Statement No. 3 – *Management of Phytophthora and disease caused by it*. Dieback disease caused by *P. cinnamomi* is listed as a key threatening process under the EPBC Act and a threat abatement plan has been prepared (Environment Australia 2001).

Large areas within the planning area have been designated as Disease Risk Areas under section 82 of the CALM Act (see Figure 6).

Other Plant Diseases

Rusts are the second most frequent pathogen on native plant taxa in the south-west (Shearer 1994). In contrast to *Phytophthora*, rust pathogens on native plants are most likely to be endemic and require living hosts for normal development. There is insufficient information on impacts of rusts on native plant communities.

Armillaria root disease occurs widely in the south-west and is caused by the soil-borne pathogen *Armillaria* luteobubalina. This endemic fungus is widespread in forests, woodlands and the coastal heath of the south-west, including parts of the planning area. Despite a prolific production of spores, the main mode of spread is by root-to-root contact between healthy and infected plants. The range of species susceptible to the fungus is very large and poorly defined (at least 50 families and more than 200 species), with very little information on the presence of resistant or tolerant species. The highest impact of the disease is in regrowth karri, marri and jarrah forests as a result of the harvesting and thinning operations which provide stumps that *A. luteobubalina* can readily colonise and then infect regrowth saplings and residual trees. Many species that resist infection by *P. cinnamomi* are susceptible to *A. luteobubalina* (Pearce *et al*. 1986,earer and Tippett 1988; Shearer *et al*. 1997a, 1997b, 1998).

Figure 6. Disease Risk Area

Mundulla yellows is a recently described disease thought to be an introduced virus or virus-like organism of unknown origin and is possibly spread by insects. It is a slow dieback disease of eucalypts (23 species in Western Australia are known to be affected) and may also affect sheoaks, banksias and wattles. The disease causes progressive decline, yellowing and then death of the trees. The disease occurs across a scattered distribution in Australia, mostly in coastal areas and in areas of high disturbance such as farmland, roadsides and urban parks (CSIRO 2000, Handol *et al*. 2002). Mundulla yellows is regarded as a potential threat to native tree species, including those in the planning area, but little is known about the cause or spread of the disease. There is no current known occurrence of Mundulla yellows in the planning area, however, there are known infected areas surrounding the planning area (M. Stukely *pers. comm.* 2006). General plant disease hygiene practices should be implemented to minimise the risk of spreading any new diseases into the planning area through human activity.

Animal Diseases

Animal diseases within the planning area are not widely reported, however there are a few diseases, which potentially affect animal populations including: toxoplasmosis in western ringtail possums and woylies and frog fungus. Hygiene controls also need to be considered during the translocation of animals into the planning area.

Toxoplasmosis is a parasitic disease mainly found in the host animal, cats. While this disease may be introduced to populations of native animals through cat faeces, it persists in populations of native animals through direct transfer from an infected mother to their offspring (vertical transfer) (A. Wayne *pers. comm.* 2007). Research is being carried out to determine the impact of toxoplasmosis on woylies and western ringtail possums.

The frog fungus (*Batrachochytrium dendrobatidis*) that lives as a parasite in the skin of frogs and other amphibians has been known internationally since 1996 and was confirmed in Western Australia in 1998 (although testing of historical material has shown the earliest occurrence of the fungus in the Albany region in 1985). The fungus can cause sporadic death in some populations and up to 100% death in others (Environment

Australia 2002). Studies have shown that there is a broad zone of infection from just north of Geraldton south to Augusta and east to Esperance but does not imply that all frog populations are infected within this zone (Aplin and Kirkpatrick 2001). Four species of frogs have been shown to be infected more frequently than most other species (Aplin and Kirkpatrick 2001). These species are all located within the planning area and are: the slender tree frog (*Litoria adelaidensis*), the banjo frog (*Limnodynastes dorsalis*), the moaning frog (*Heleioporus eyrie*) and the motorbike frog (*Litoria moorei*). Populations of these frogs should be monitored to detect any significant decline in numbers. The infection of amphibians with this fungus is a key threatening process under the EPBC Act and a threat abatement plan has been prepared.

24. Disease

Key Points

- *P. cinnamomi* is the most significant pathogen threatening native vegetation within the planning area and may kill susceptible plants, irreversibly changing the plant and fauna species and communities of the area. Other plant pathogens in the planning area include *A. luteobubalina*, rust and stem cankers.
- *P. cinnamomi* spreads by producing small spores that are distributed through surface, sub-surface and stream flows as well as transferring between plants via mycelium growth. It can also be spread by humans, vehicles and animals moving infested plant material and soil.
- Large areas within the planning area have been designated as Disease Risk Areas under section 82 of the CALM Act (see Figure 6).
- Animal viruses have the potential to impact on native animals found within the planning area including western ringtail possums, woylies and amphibians.

The objective is to prevent introducing plant and animal diseases into disease-free areas and minimise the spread or impact of plant and animal diseases where they are already present.

This will be achieved by:

1. managing plant and animal diseases according to Department policies and operational guidelines;
2. developing plant and animals disease control plans that:
   - undertakes surveys and mapping of diseases occurrences;
   - prioritises disease by species, location and impacts on key values; and
   - controls or minimises the spread of diseases by appropriate methods;
3. liaising with relevant agencies and neighbouring land-holders to facilitate effective, coordinated disease control;
4. ensuring Departmental and other operations (e.g. mineral exploration and development, pine harvesting etc.) follow forest hygiene protocols to minimise the spread of disease;
5. restricting access into DRA through the issuing of permits; and
6. providing opportunities for visitors to improve awareness, understanding and appreciation about the importance of disease control and their impacts on key values.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

25. FIRE

Fire is both an ancient ecosystem process essential to the conservation of biodiversity and a phenomenon capable of threatening biodiversity, life and community assets. As a result, the management of fire is integral to the Department's activities and a core management responsibility. The challenge for managers is to devise practical and feasible fire regimes that conserve biodiversity at appropriate spatial scales, and minimise the adverse impact of bushfires on cultural, economic and natural values.

The Department's management of fire, including the use of fire, fire suppression and bushfire prevention, is regulated by legislation (e.g. Bush Fires Act, CALM Act and precedents established under Common Law). It is also guided by the Department's Policy Statement No. 19 – *Fire Management* which includes a number of scientific principles and also the Department's Good Neighbour Policy (DEC 2007c).

This management plan provides the strategic framework the Department will use to develop ecologically-based fire regimes and regimes for strategic protection from bushfire. Ecological regimes will be based primarily on

vital attributes and life histories of key flora and fauna species, to ensure the protection of biodiversity. Regimes for strategic protection from bushfire will ensure the protection of life and community assets.

This management plan presents an adaptive management approach to fire where management policies and practices are continually improved by learning from the outcomes of operational programs, scientific research (e.g. on fire ecology) and monitoring. This acknowledges a level of uncertainty about what policy and practices are best, but consistent with adaptive management. This plan utilises best available knowledge to implement programs aimed at meeting specific management objectives. Monitoring, regular review, analysis of management outcomes and ongoing research are critical if fire management in the region is to continuously improve.

The plan recognises that fire regimes will need to consider the unique features of the planning area including:

- the Murray Valley and other riparian and wetland areas;
- threatened and priority fauna habitats;
- it is surrounded predominately by State forest and mining assets; and
- it is highly valued by the community, together with an increasing population growth in local population centres and high visitation.

Fire History

Fire patterns in the south-west forests have changed over time, influenced by climatic change and altering vegetation. Evidence of frequent fires has been documented dating to 2.5 million years in the south-west of Western Australia, indicating that fire has been a major evolutionary influence since at least that time (Dodson and Lu 2000, Dodson and Ramrath 2001, Hassell and Dodson 2003), and maybe as early as the mid Miocene, approximately 15 million years ago. The former date coincides with a major climatic change from subtropical to Mediterranean (i.e. warm/hot summers, summer droughts and cool winters), which is thought to have led to an associated increase in fire, as evidenced by charcoal in sedimentary deposits.

Human intervention within the last 60,000 years undoubtedly led to dramatic changes in fire patterns and the fire environment (Hallam 1975, Hallam 2002, Kershaw 1986, Hassell and Dodson 2003). Intervals between fire appeared to be much shorter in areas regularly occupied by Aboriginal people in contrast to some areas of the south-west that were historically unoccupied (e.g. offshore islands) (Hassell and Dodson 2003). These regimes presumably evolved with the economic and ecological needs of the people (Hassell and Dodson 2003), varying from group to group and for different localities and occasions. There is little doubt that Aboriginal people utilised fire to their advantage, opening up dense vegetation for ease of access, encouraging new plant growth to improve hunting and foraging opportunities, protection of camping spots and areas of high resource value, and for ceremonial purposes (Hallam 2002).

In 1953, limited prescribed burning under controlled conditions was introduced after 30 years of fire exclusion (Forest Department WA 1969, Crawford and Crawford 2003, Underwood and Christensen 1981), and adopted more widely after the severe bushfires burnt throughout much of the south-west in 1961 (Armstrong 2004b). In the planning area, the Dwellingup fires of January 1961 resulted from a number of lightning strikes, and in combination with an exceptionally dry six months leading up to the fires (32% below average rainfall) and cyclonic winds, covered an area of nearly 146,100ha, decimating the Dwellingup townsite and the mill settlements of Nanga Brook and Holyoake (Rodger 1961).

More recently, large fires in January 2006 (Talbot's Fire) and January 2007 (Dwellingup Fire) resulted in approximately 11,090ha and 13,700ha being burnt and the loss of assets including property loss and damage to the adjoining freehold blue gum plantation, infrastructure and recreation facilities. These bushfires highlight that given the right conditions, there is potential for bushfire to occur in the planning area and surrounds. The Talbot fire, in particular, traversed long unburnt areas with high fuel loadings. The fire highlighted that in the absence of fuel reduced areas (through prescribed burning) the landscape has potential for large intense fires during the summer months. This was further demonstrated when the spread of this fire was significantly restricted when it reaches a recently prescribed burnt area.

The regular use of low intensity prescribed fire to reduce fuel loads, which has consequently reduced bushfire severity (size and intensity), has continued to the current time. Since the 1960s, much of the forested region of the south-west has been regularly burnt using aerial and ground burning, although the interval and frequency of prescribed burns and bushfire, has been quite variable. This has been effective in reducing the occurrence of large, damaging bushfires.

Irrespective of the burning patterns of Aboriginal people, European settlers and forest managers environmental conditions have been altered to such a degree over the past 100 years that the application of historic fire regimes may no longer meet modern day fire management objectives. Factors such as the location of private property, towns and cities, fragmentation, farmland, weeds, introduced predators, climate change and contemporary natural values contribute to these changing conditions.

In response to this, the Department revised its Policy Statement No. 19 – *Fire Management* to protect and promote the conservation of biodiversity, while also providing for protection of human life and community assets. While knowledge of traditional Aboriginal use of fire is important in understanding the fire regimes under which ecosystems persisted for thousands of years, scientific evidence is also required to develop and implement ecologically appropriate fire regimes (see *Fire Research*). Although this knowledge is incomplete, it has advanced over several decades as a result of ongoing research.

Fire Ecology

Fire ecology is the study of the interaction between fire habitats, flora and fauna. Knowledge of the impacts of this interaction is integral in not only protecting biodiversity, but also life and community assets. While numerous studies report on the changing species assemblages, species diversity, vegetation composition and structure, and habitat characteristics in response to time since last fire, fire season, fire interval, or fire intensity, and on the ways in which fire can influence ecosystem processes, knowledge is incomplete but provides sufficient knowledge to effectively manage fire. Fire management will therefore continue to evolve with ongoing accumulated knowledge and management experience (Burrows 2004).

Adaptation of the Biota to Fire

Some biota survive and persist in fire prone environments by avoiding fire (e.g. they grow in low fuel areas or in very moist sites) or by developing adaptations that allow them to accommodate and utilise the occurrence of fire. These adaptations are often useful in dealing with periodic drought and poor nutrient status of many Australian environments. They also contribute to the 'life history strategies', that biota have employed to adapt to fire. These adaptive attributes, particularly in plants, are sometimes referred to as 'vital attributes'. Attributes such as the time it takes to flower after germination, the time to senescence and death, how a plant regenerates (from seed or re-sprouting or both), where the seed is stored (in the canopy or in the soil or both) and how this seed is triggered to germinate provide valuable clues to understanding what might be the most appropriate fire regime for that species in terms of fire frequency, intensity, season and scale. Determining vital attributes of species will enable fire regimes to be determined for their conservation.

For many species in the south-west, reproduction and regeneration are stimulated by fire, and for some plant communities, fire is necessary for the maintenance of floristic and structural diversity (Burrows and Wardell-Johnson 2003). However, no single fire regime is optimal for all species and while many species are resilient to a range of fire regimes, some species are vulnerable or sensitive to fire or have quite specific fire regime requirements (see Table 4). These fire sensitive species are referred to in this plan as key fire response species.

Examples of species with specific fire-regime requirements in the planning area include fauna species such as the quokka, noisy scrub bird, Baudin's cockatoo, Carnaby's cockatoo, tammar wallaby and woylie (which may require specialised habitats) for a species such as *Melaleuca rhaphiophylla* (paperbark) and *Eucalyptus wandoo* and communities such as granite outcrops and riparian zones and wetlands.

Table 4. Vital Attributes of Species Sensitive to Frequent Fire (Key Fire Response Species)

Fauna	Flora
Restricted, specialised habitats	Readily killed by fire
Have low fecundity	Have relatively short life spans
Exist as discrete dispersed populations	Long juvenile periods
Have low dispersal capacity	Canopy-stored seed
Require mature or late seral stage vegetation (relatively long unburnt)	Regenerate only from seed ('obligate' seeders)
Prone to predation	Require fire for successful regeneration

Source: Burrows and Friend 1998, Burrows and Wardell-Johnson 2003

Typically, fire sensitive species are generally confined to more mesic or less flammable parts of the landscape such as riparian zones, some wetlands granite outcrops and steep south facing slopes, where fire is less frequent (See *Managing Fire to Conserve Biodiversity*). Generally plant communities in the drier, upland areas of the forest are more drought-adapted and have a history of more regular fire, so display a greater resilience to fire (Burrows *et al.* 2008). However, even fire sensitive species require fire at some stage for their rejuvenation – an exception perhaps being peat swamps (Burrows and Wardell-Johnson 2003). Extreme regimes, such as sustained, very frequent burning or infrequent but large, intense fires, are more likely to be most damaging to biodiversity and environment than more moderate, intermediate regimes (Burrows and Friend 1998, Burrows and Wardell-Johnson 2003).

Vital Attributes of the Flora

The flora of the planning area possess a variety of traits that enable persistence in this fire-prone environment (Burrows and Wardell-Johnson 2003), including:

- soil protection of buried buds;
- bark protection of aerial buds;
- bud survival and sprouting;
- fire stimulated flowering;
- fire triggered opening of fruits and seed release (serotinous);
- fire-cued seed germination; and
- seed stored in the soil and in woody fruits.

Knowledge of the vital attributes of plants has assisted in defining fire regimes, especially minimum and maximum intervals between fires. The rate at which plant species produce adequate seed for regeneration after fire is an important consideration in determining the minimum inter-fire period. For example, Burrows *et al.* (1995) showed that the majority of understorey plants on upland, high-rainfall jarrah forest sites flower within three years of fire. On less flammable sites such as gullies and broad valley floors, some species may take five to six years to flower after fire but may not set adequate quantities of viable seed for several years after this (Burrows and Wardell-Johnson 2003). On the basis of current knowledge, doubling the juvenile period[12] of the slowest maturing fire sensitive species at a particular site provides a conservative minimum interval between lethal intensity fires and allows for adequate replenishment of seed banks (Dr N. Burrows *pers. comm.*). Populations will survive more frequent fires provided the intensity of the fire does not kill the entire cohort of parent plants.

The longevity of plant species (particularly fire sensitive obligate seeding species) helps define the maximum safe interval between fires before the seed bank is lost. While there is little information on the longevity of soil-stored seed banks, limited data suggests that for many south-west ecosystems, fire intervals in excess of 35-40 years are likely to result in decline and local extinction of some serotinous seeders that only regenerate effectively following fire.

The fire response patterns such as post-fire regeneration, the juvenile period and in some cases, longevity of some 700 species, has been collated into the Department's FIRERESPONSE database. The database indicates that approximately 97% of understorey species reach flowering age within three years of fire and all species reach flowering age within five to six years of fire. Burrows *et al.* (2008) also report that the 3% of species classified as 'fire sensitive', occur in more mesic or less flammable parts of the landscape (see above). Knowledge of the distribution and habitat preferences of these species can be used to develop and implement ecologically-based fire regimes using the vital attributes of species. This typically requires consideration of two landscape components: fire prone upland areas and fire sensitive habitats (e.g. wetlands, granite outcrops and valley floors), although this may vary depending on the fire response of flora and fauna species in the area.

An example of one possible fire regime based on the vital attributes of species is provided in *Managing Fire Based on the Vital Attributes of Key Response Species*.

Vital Attributes of the Fauna

Research indicates that the immediate impact of fire on fauna, and their recovery rate, is directly proportional to the scale, intensity, and patchiness of the fire and the interval between fires (Friend 1995, Burrows and Friend 1998, Friend 1999, Burbidge 2003, Friend and Wayne 2003). This impact will also depend on the presence of predators where displaced native species have to travel across open ground to find suitable habitat (Friend 1999).

[12] The juvenile period is defined as the time it takes for at least 50% of the population to reach flowering age.

For mammals at least, the post-fire response of populations is reasonably predictable and consistent (see Figure 7), and could be considered in terms of the their life history characteristics based on shelter, food and breeding requirements, and the scale, intensity and patchiness of the fire (Burrows *et al*. 1999, Friend 1999). Responses are largely dependent on vegetation structure and floristic composition, which simplifies the prediction of fire impacts (Friend 1999, Friend and Wayne 2003, Burbidge 2003, Bamford and Roberts 2003).

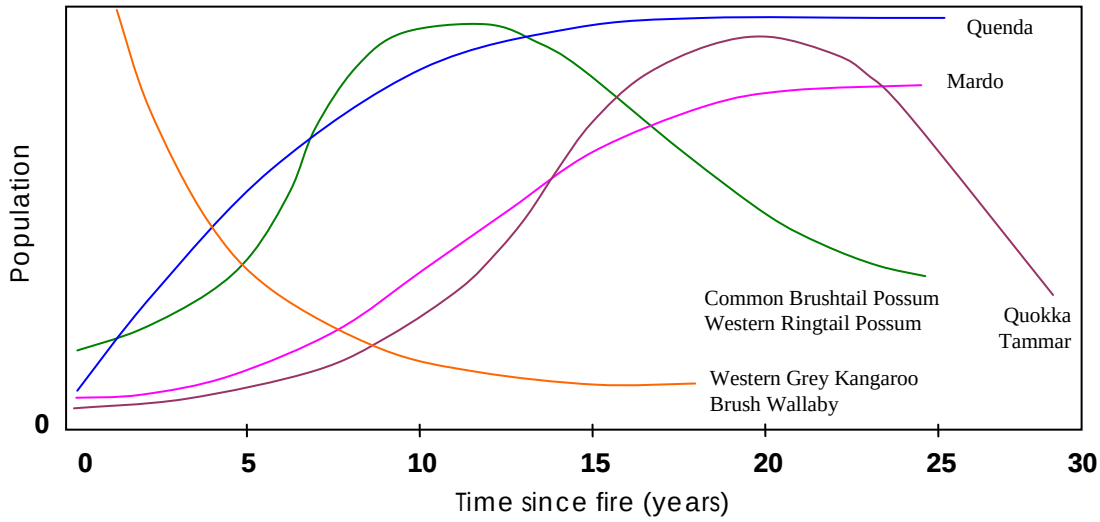


Figure 7. Idealised Relationship Between the Abundance of Various Mammal Species and Time Since Fire

Source: Dr N. Burrows *pers. comm.*

Ecosystem Health

Maintaining a diversity of post-fire fuel ages, seral stages or habitats through space and time, is fundamentally important for ecosystem health and benefits biodiversity. The process of post-fire vegetation change is continuous, and the rate of change will depend on the severity of disturbance events such as fire, local soil and climatic conditions. At least three broad post-fire seral stages can be recognised – early, intermediate and late, based on the rate of change of the understorey vegetation structure[13] and floristics. In any one landscape, all of these functional habitat characteristics and seral stages are desired. The relative proportion of each seral stage within the landscape is best determined by the theoretically-derived negative exponential distribution[14] (Weir *et al*. 2000, Tolhurst and Friend 2001) of vegetation/fuel age classes across an ecological unit within the landscape (Figure 8). This will guide decisions on where, how much and when to apply fire.

At the local scale, specific vegetation types and ecosystems (e.g. riparian zones and wetlands and granite outcrops) may have a different theoretical distribution to that of Figure 8. However, at present the knowledge to derive this distribution is limited, and is not practicable to apply across the landscape. Instead, the Department will seek to improve knowledge of the fuel age distributions for specific fire-sensitive ecosystems and use this to develop guidelines for their management. Should this knowledge become available in the future, and it is able to be applied practically, the Department may need to adapt its fire management accordingly.

[13] Forest overstorey species of the south-west are very resilient to fire so, stand replacement fires or fires that kill the overstorey, are relatively rare and most change in seral stage occurs in the understorey vegetation.

[14] The negative exponential distribution aims to produce disturbance-induced mosaic patterns across the landscape, which are thought to resemble those produced by natural disturbance events.

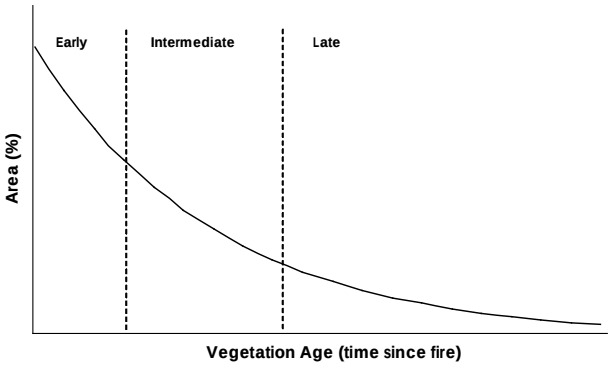


Figure 8. Theoretical Distribution of a Stable Time-since-fire Spatial Mosaic for an Ecological Unit

Scales of Fire Planning

The issue of the most appropriate scales at which to manage fire in the south-west is a complex one and will always be a trade-off between what is ecologically desirable based on best available knowledge and what is feasible and practical. This management plan recognises two spatial and temporal scales for fire planning—the Landscape (30,000 to 100,000ha) Scale and the Management Unit (500 to 5000ha) Scale. Landscape scale fire management is based around the 26 Landscape Conservation Units (LCUs) that have been identified in the south-west. These LCUs are derived from amalgamations of the 315 vegetation complexes, according to their fire response characteristics (Mattiske and Havel 2004). Objectives derived at the landscape scale will be used to guide prescribed burning at the more detailed and operational management unit scale.

Although planning at a finer scale is currently not feasible, it is possible that the scales of fire planning may change over the life of this plan.

Fire Management within the Planning Area

This management plan provides the strategic framework that the Department will use to develop ecologically-based fire regimes and regimes for the strategic protection from bushfire. Ecological regimes will be based primarily on vital attributes and life histories of key flora and fauna species to ensure ecosystem health and the protection of biodiversity. The main objectives of fire management within the planning area are to:

- protect and conserve biodiversity;
- reduce the of impact bushfire on life and community assets;
- increase knowledge through fire research, operational experience and monitoring;
- communicate with neighbours, the community and other stakeholders about fire management; and
- rehabilitate land disturbed during fire suppression activities (e.g. firebreaks) (see Section 39 – *Rehabilitation*).

The ‘master burn plan’ process identifies areas that are to be prescribed burned, the scheduling of these burns in the coming year and an indication of the schedule burning three years into the future. This allows sufficient lead-time for planning and preparing annual burn programs and specific burn plans well ahead of the operation, which enables time for surveys for dieback and threatened flora. This program also provides the public an opportunity to view what is planned for implementation and provide their input into program planning (see the Department’s website). Programs are based on regimes identified in this management plan and are updated twice each year on the basis of operational work and new information, such as bushfire occurrence and improving conservation knowledge (e.g. on vital attributes of species).

This management plan proposes that the overarching strategic framework for fire management of the planning area be divided into two areas to highlight the broad differing uses, values and assets of each area (see Figure 9). Using the Department’s Regional boundary, the northern part of the planning area (in Swan Region) which contains many recreation opportunities and as such many assets (e.g. recreation site, facilities, tracks and trails)

will focus on providing fire regimes that primarily deliver strategic protection from bushfire[15]. The southern part (in South West Region) which is noted for its natural values (e.g. old-growth forests, fauna habitats) will focus on primarily providing fire regimes that deliver ecologically-based outcomes[16]. Both frameworks will provide for the protection of life and community assets as identified in this plan and through the master burn plan process. This framework is conceptual with the finer detailed master burn plan process incorporating the surrounding State forest, freehold land and private assets to deliver fire management prescriptions.

Figure 9. Strategic Framework for Fire Management

Managing Fire to Conserve Biodiversity

There is often debate about the most appropriate fire regimes to conserve biodiversity. The scientific complexity of fire behaviour and ecology means there will continue to be uncertainty and risks surrounding ecosystem responses to fire (prescribed burns and bushfire) and the outcomes of various planned fire regimes. Fire managers recognise this uncertainty but also understand that it is not a valid reason to avoid taking action to conserve biodiversity and protect life and community assets from inappropriate fire regimes. Actively applying prescribed fire in managed ways can achieve many benefits for biodiversity that outweigh the risk of uncertainty of removing fire from a landscape and can also contribute to the better understanding of ecosystems over time.

This management plan adopts an adaptive approach to fire management, which in the long-term, seeks to devise, implement and monitor a range of fire regimes based on:

- vital attributes of threatened species and significant habitats and ecological communities;
- vital attributes of key fire response species;
- creating and maintaining diverse post-fire (seral) stages, or functional habitat types;
- managing fire to protect ecologically sensitive areas and niches; and

[15] The strategic protection of assets regime framework in no way precludes identifying areas requiring fire management prescriptions that would deliver ecological outcomes as ecological fire regimes may also deliver strategic protection from bushfires.

[16] The ecologically-based fire regimes may also need to consider fire management prescriptions that are required for the strategic protection of assets.

- fuel accumulation rates.

One or a combination of these factors is likely to apply to appropriate parts of the planning area. Knowledge of vital attributes of key fire response plant and animal species and habitats known or likely to occur within any LCU will be used to derive appropriate 'ecological' fire regimes for the planning area (see Figure 10). As there are gaps in current knowledge, management for biodiversity conservation will initially focus on the protection of threatened species and significant habitats that require specific atypical fire regimes. As more information on the vital attributes of species becomes available this will be incorporated into the prescribed burning program. Fire regimes have also been developed to protect life and community assets (see *Managing Fire for the Protection of Life and Community Assets*) and will complement ecological fire regimes where possible. Fire regimes for biodiversity conservation may also achieve a protection benefit.

The Department has developed a range of fire management guidelines to protect specific fire sensitive species and ecological communities. Several of these guidelines apply to parts of the planning area and will be used to guide fire management where applicable. These guidelines may be different from the general ecological fire regime and will inform fire planners and managers of strategies and tactics for a prescribed burn to accommodate the needs of 'fire regime specific' biota. The guidelines have been developed using the best available knowledge but further research, experimentation and subsequent adaptive management may be required to determine the most appropriate fire regimes for the species and habitats present in the planning area.

However, before applying fire management guidelines within the planning area, consistency and compatibility with other conservation, land management and fire management objectives must be checked to ensure the best possible outcome.

Managing Fire Based on the Vital Attributes of Threatened Species and Ecological Communities

There are several threatened species in the planning area that are prone to modification by fire (e.g. the rare dwarf spider orchid). There are no threatened ecological communities currently recorded in the planning area but several significant communities (e.g. granite outcrops, wandoo woodlands, wetlands and riparian areas) (see *Managing Fire to Protect Ecologically Sensitive Areas and Niches* and Section 19 – *Native Plants and Plant Communities*).

Threatened flora and fauna are protected by State and Commonwealth legislation and ecological communities by Commonwealth legislation, which impose requirements on how fire management activities are conducted. In many cases, it is appropriate to devise and implement fire regimes specific to these taxa to ensure their persistence (where the fire ecology of threatened species is well understood). Threatened species and ecological communities will also be protected from fire regimes that are known to or are likely to cause the decline of these species and communities. Threatening fire regimes may include long periods of fire exclusion, sustained frequent burning, large and intense bushfires and post-fire grazing. Where no fire ecology information exists for a threatened species, carefully monitored experimental burning might be considered. No discrete/isolated or sole population should be impacted upon by a single fire event where the consequences of fire are unknown. For the planning area, protection of threatened species and communities will take priority when devising fire regimes to conserve biodiversity. Often, prescriptions for threatened species management are developed as part of a flora or fauna recovery plan.

Adopting an approach based on threatened species is especially justified when the species is also a key fire response species, which means managing for this species is most likely to accommodate the needs of other species in the ecosystem. However, there are potential drawbacks in developing fire management based on single species ecology so this approach needs to be closely evaluated and monitored for possible adverse impacts on other species and communities.

For other species and communities of conservation significance (e.g. priority, endemic, relictual and disjunct species) where knowledge is limited, research should be a priority.

Managing Fire Based on the Vital Attributes of Key Fire Response Species

Scientific knowledge of vital attributes of selected plants (key fire response species) within ecosystems is being used to derive appropriate fire regimes, especially acceptable intervals between fires, for the planning area. Knowledge of the juvenile period, longevity and regeneration and establishment requirements of key fire response plant species are used to establish minimum and maximum fire intervals and the season and intensity of fire. Knowledge of the habitat requirements (seral stage) and dispersal capacity of key fire response fauna

species assists with determining fire interval and spatial scale or patchiness. Having devised appropriate 'ecological' fire regimes based on plant attributes, they can then be cross-checked for their efficacy against co-occurring key fire response fauna species. There are gaps in the knowledge of vital attributes of many species but consistent with an adaptive management approach, knowledge will be gained and fire management improved by on-going research and by monitoring of operational programs.

An example of one possible ecological fire regime based on the vital attributes of species is provided in Figure 10. Within any Landscape Conservation Unit (or Logical Burn Unit), there will be a variety of interlocking ecosystem components or habitats with different fire response patterns. For each Landscape Conservation Unit (or Logical Burn Unit), a standard ecological fire regime based on vital attributes of key fire response species is devised for the most fire-prone (least fire sensitive) components and to protect the least fire-prone (most fire sensitive) components. This typically requires consideration of two landscape components, although this may vary depending on the fire response of flora and fauna species in the area:

- the drier, more flammable fire regime tolerant habitats, which generally contain flora species that are mostly resprouters and have relatively short juvenile periods and fauna that do not require mature or medium to late successional state vegetation; and
- fire regime specific habitats (e.g. granite outcrops and valley floors) will generally contain flora that are fire sensitive with relatively long juvenile periods and fauna that prefer mature, medium to late successional stages of vegetation.

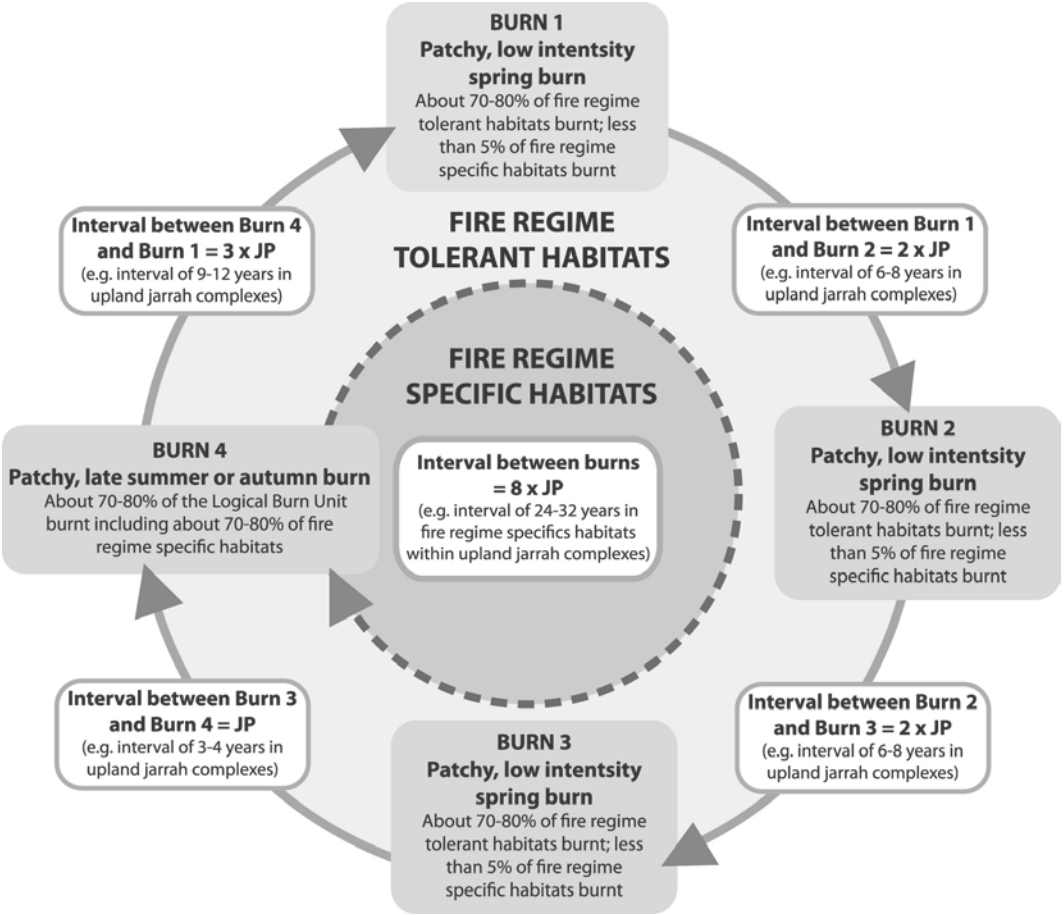


Figure 10. Example of an Ecological Fire Regime for Managing Ecosystems Based on Vital Attributes

(adapted from the example of a managed jarrah forest fire regime shown in Burrows 2008)
^{JP} = the juvenile period of the slowest maturing fire sensitive understorey species.

One species of the planning area that is identified as having particular fire requirements is the quokka (see Section 20 – *Native Animals and Habitats*). Quokkas require a structured habitat that is mature but not senescing (approximately between 5 – 30 years old) with a preference towards a mosaic of recently burnt and mature

vegetation, without the presence of foxes and pigs, in dense riparian or swamp vegetation (Burrows *et al*. 2005). Christensen (1997) noted that late successional species such as the quokka and mardo (*Antechinus flavipes*), both found within the planning area, can take 10 years or more to recover from the effects of bushfire. However, with a relatively small and at low-moderate intensity bushfire, where vegetation can recover quickly, quokkas can also quickly recolonise the area. For this to occur, it is critical that introduced animals such as foxes and pigs be controlled (G. Liddelow *pers. comm.*, Burrows *et al*.2005). A fire management guideline has been developed by the Department for the management of quokkas (and other riparian zone fauna) in southern forests.

Fire management guidelines have also been prepared for other mammals including western ringtail possum and honey possum.

Generally though, bird species and their habitats are relatively resilient to single fire events of a small scale and low to moderate intensity. The noisy scrub bird is one exception. These birds require habitats that have not been burnt for many years. A fire management guideline has been developed by the Department for noisy scrub birds.

The effects of fire on amphibians and reptiles is often complex and less predictable (Friend 1999, Bamford and Roberts 2003). At the time of writing there are no amphibians or reptiles that are known to require specific fire management.

Invertebrate fauna appears to be resilient to more regular and frequent fires (van Heurck and Abbott 2003). Invertebrate diversity however, is greatest where there is a wide range of post-fire successional stages in the landscape (van Heurck and Abbott 2003). Due to the limited knowledge of invertebrate taxonomy and ecology, a precautionary and adaptive approach to fire management, including a diversity of post-fire seral stages, is warranted.

Managing Fire for Diverse Post-fire (Seral) Stages

Maintaining a diversity of post-fire fuel ages, seral stages or habitats is fundamentally important for ecosystem health. However, there is insufficient information on the vital attributes of species within the planning area at present to accurately determine the required proportion of each seral stage in the theoretical negative exponential curve for the south-west. To determine the seral stage, species found within the planning area need to be cross-referenced to the FIRERESPONSE database. The Department will aim to approximate the theoretical negative exponential distribution for the south-west until this has occurred.

Managing Fire to Protect Ecologically Sensitive Areas and Niches

The Department has prepared specific fire management guidelines for fire sensitive/atypical habitats occurring across the landscape. These guidelines will be different to the standard ecological fire regime, and will inform fire managers of strategies and tactics for a prescribed burn to accommodate the needs of 'fire regime specific' biota. Initially they will be generic but will become more specific and give greater consideration to values/risks associated with the planning area as information becomes available.

Managing Fire to Protect Ecologically Sensitive Areas and Niches – Riparian Zones and Wetlands

Some fire regimes, coupled with the impacts of climate change, may have detrimental impacts on some riparian zones and wetlands. Since the late 1970s, winter rainfall in the south-west, particularly early winter from May to July, has declined by 15-20% (Indian Ocean Climate Initiative 2002). This has had the effect of a sharp fall in stream flow in the south-west, and drying out of some wetlands, organic-rich soils and riparian zones, predisposing them to fire for a longer period. As a result, these areas may burn earlier in spring, and remain drier for longer in autumn months. This has important implications for the protection of inland wetlands and riparian ecosystems. Frequent hot fires, or regimes that remove organic matter in some wetland environments, can also burn the soil and alter it by exposing anaerobic soils to air (Horwitz *et al*. 2003), which may increase the risk of acidification. High intensity fire may also impact on water quality in wetlands by increasing the amount of dissolvable and erodible residue finding its way into waterways (Horwitz *et al*. 2003).

The extent or patchiness of fire in riparian zones is important for fauna that persist in relatively small, linear habitats along these drainage lines. Large-scale fires that burn entire habitats could be detrimental to some species that utilise these corridors, particularly along major river systems such as the Murray, Harris and Bingham rivers. Too infrequent fire may result in some serotinous plant species completing their life cycle and dying, with a consequent loss of the seed bank. The impact of fire on tree species is also important in riparian areas as fire-formed tree hollows provide valuable fauna habitat. Fire can both destroy and create tree hollows

(Inions *et al*. 1989). Reed and rush habitats within wetlands also provide important habitats for a large diversity of species and are a significant breeding habitat for a number of fauna species including waterbirds, crustacea and frogs. Fire management guidelines have been prepared for the protection of these habitats.

Managing Fire to Protect Ecologically Sensitive Areas and Niches – Granite Outcrops

Although comprising a relatively small proportion of the total landscape, these biotic islands are important for biodiversity conservation on account of the uncommon habitat they afford due to the combined effects of biological isolation, soils, moisture regime and fire regime. Associated with this, are often unique assemblages of flora and fauna, including many fire sensitive species.

The fire frequency of granite outcrops is generally lower than the surrounding landscape (Hopper 2000, Yates *et al.* 2003). This is because the vegetation is often low in stature and biomass and fragmented by areas of sheet rock or boulders that provide a discontinuous fuel, thus limiting fire spread under mild/moderate conditions (Burrows 2005). Numerous small granite outcrops are scattered throughout the planning area with larger areas such as Tumlo Hill and Mount Keats in adjoining State forests acting as refuges for fire-sensitive species. However, many species on granite outcrops also require infrequent fire under certain conditions to regenerate. Hopper (2000) found a high number of fire-sensitive obligate seeders (77%) regenerating post-fire on a granite outcrop in the Wheatbelt, and suggested "…intervals between fires measured in decades are likely to be required to ensure an adequate seed bank is available and local extinction is averted." This may also be the case with granite outcrops within the planning area, although intervals of one to two decades (i.e. shorter interval) between fire are more probable due to the higher biomass in the forested regions (Dr N. Burrows *pers. comm.*).

To enable rock outcrops to function as fire refuges, and to decrease the probability of these fire refuges being damaged by large, intense bushfires that sweep onto and over them from the surrounding flammable forest, it is important that fuel build-up in the surrounding forests is managed. Prescribed fire can be introduced under mild conditions such that the rock outcrops do not entirely burn in any one fire event. A fire management guideline has been prepared for granite outcrops.

Managing Fire to Protect Ecologically Sensitive Areas and Niches – Wandoo Woodlands

Fire is an important component of wandoo woodlands. These woodlands have different fire requirements (e.g. fire intensity and frequency) than jarrah forests. As such, these fire requirements need to be incorporated into the master burn plans to ensure fire managed to protect and maintain the ecological integrity of wandoo woodlands. This may include aspects such as aiming to retain a mosaic age class of vegetation, fox baiting after burning and prescribed burns aimed at seed regeneration or providing ash beds for regeneration.

Information on wandoo woodlands is presented in Section 19 – *Plants and Plant Communities*.

Protecting Biodiversity by Managing Fire Based on Fuel Accumulation

In the past, fire management has been based around the manipulation of forest fuels as a means to protect life and community assets from large, damaging bushfires. Controlling the incidence of bushfire, or at least the impacts of such an event, is also important in managing the threat to biodiversity (e.g. old-growth forest, fire regime sensitive communities and species, and extant populations of threatened flora and fauna).

Fuel reduction burning, the practice of purposefully setting low intensity fires under defined conditions of fuel, weather and topography to consume a portion of the live and dead vegetation, is a fire management technique that aims to reduce the severity (scale and intensity) of bushfires. Fuel reduction burning rarely prevents bushfires, but where a significant proportion of the landscape is managed this way, bushfire severity, and consequently the impact on biodiversity, life and community assets can be significantly reduced. Fuel reduction as a mechanism to protect biological assets of the planning area is particularly important for areas surrounding recently rehabilitated after mining, granite outcrops, fauna translocation sites where bushfire could have detrimental impacts on populations of specific species and habitats.

To address these issues, the Department will seek to reduce the threat of bushfire to significant biological assets by:

- employing a mosaic of fuel age classes across the landscape or a system of fuel-reduced buffers, specifically managed to reduce fuels around biological assets;

- periodically undertaking strategic fuel reduction burning in and around the planning area to mitigate intense, large bushfires; and
- integrating fire management with adjoining State forest, freehold land and plantations and rehabilitated areas.

Managing Fire to Protect Life and Community Assets

The existence of towns and freehold land, plantations, mining operations and other developments, as well as the increasing use of natural areas for recreation, requires that the protection of life and community assets be considered in fire management for the planning area and surrounds.

Identifying fire vulnerable community assets within the planning area and adjacent areas, determining the risk, likelihood and consequences posed by bushfire to those assets will assist in managing the threat posed by high intensity bushfires. A list of life and community assets in and surrounding the planning area are identified in Appendix 7.

Many built assets including recreation sites (camping and day use sites) managed by the Department also receive high visitation which increases the needs to mitigate the risk of bushfire in the area to reduce visitor risk in the event of a bushfire. As a part of this, refuge areas and access to and from the planning area will be identified as part of the reserve closure plan (see Section 33 – *Visitor Safety*. For example, improving the access across the Murray River may be considered.

Strategies for Bushfire Mitigation

The Department recognises the significant bushfire threat in the land it manages and proposes the following strategies for bushfire mitigation in the planning area and surrounds:

- prescribed burning to decrease the intensity and rate of spread of bushfires;
- maintaining/improving the Department's current fire detection response capacity;
- liaising with local government authorities, FESA and local fire brigades;
- implementing relevant strategies in townsite protection plans;
- managing campfires (see Section 31.5 – *Overnight Stays – Campfires*);
- educating and communicating with the community and managing visitor use; and
- managing public access (see Section 30 – *Visitor Access*) and maintaining access for fire management purposes.

Education, Liaison and Community Involvement

Engaging with the public is vital if their understanding of the role and effects of fire, the application of planned fire and fire suppression operations are to be understood. There is interest in the community about the planning process and outcomes associated with prescribed fire management. The Department has made, and will continue to make, its planned burn programs publicly available, enabling the community to be kept informed.

The planning area adjoins State forest, some private freehold lands, pine and blue gum plantations and mining operations. For successful management of fire, and many other land management issues, the Department fosters and encourages good neighbour relations with adjoining land-owners, particularly to ensure complementary fire management with the Department to mitigate risk and the impacts of bushfire.

Engagement with local government, volunteer bush fire brigades, FESA and other State government agencies will be necessary to ensure effective fire management across jurisdictions. Fire management in the planning area will, as far as practicable, be integrated with fire management on adjoining lands.

Managing Access

Public access and visitor use, where possible, have been designed to minimise the impact of bushfire on visitors and to limit the sources of ignitions. A strategic public access network for the planning area is described in Section 30 – *Visitor Access*. The Department will maintain a strategic fire access network within the planning area that will comprise of public and management only access. This network may be maintained to ensure safe access for fire fighting vehicles and permit effective fire management. An annual road/track maintenance program will be developed, taking into consideration potential impacts on the natural, cultural and recreation values.

Where appropriate, fires may be contained within Management Units defined by existing roads, rather than by constructing new firelines around the perimeter of the fire. Where temporary roads, firebreaks or firelines are constructed during fire suppression activities, these should be rehabilitated after the fire event (see Section 39 – *Rehabilitation*) to minimise the threat of soil erosion, invasion and spread of weeds or spread of disease and unauthorised use of the access.

In the case of a bushfire, the Director General of the Department has the authority to close an area to reduce or remove the threat to visitor safety under the CALM Regulations (see Section 30 – *Visitor Access*).

Fire Research

Fire management and the development of ecologically-based fire regimes within the planning area should take into account all available knowledge and adapt to new knowledge gained through research, monitoring and experience, including unforeseen events such as bushfires. It is recognised that the knowledge about the science of fire and its interaction with the biota is incomplete and can be improved.

Other areas identified for research are classified as 'Conditional Burning Areas' (see Appendix 8). Of particular importance to research is the establishment of Fire Exclusion Reference Areas across the landscape, where fire is excluded to allow for a comparison to fire regimes under prescribed conditions. These areas have been selected across the south-west in accordance with a number of criteria which consider the ability to protect them from unplanned fire, minimising the risk these areas pose to adjacent life and community assets and coincide with biodiversity values and be broadly representative of major vegetation/landforms in the area. There are currently two Fire Exclusion Reference Areas in the southern part of the planning area, Yourdamung and Nalyerin.

In addition, the Department may initiate specific fire research/monitoring projects as opportunities arise, including pre and post-burn monitoring (e.g. surveys of threatened and priority flora and fauna and the presence of introduced animals and weeds). Consistent with principles of adaptive management, fire management will be reviewed and if necessary, adjusted in response to ongoing research and monitoring results.

25. Fire

Key Points

- Fire management within the planning area will focus on biodiversity conservation, life and community asset protection and fire research.
- Management for biodiversity conservation will be based on the vital attributes of the flora and fauna and will aim for a diversity of seral stages across the landscape.
- Diversity and variability in fire regimes at the landscape scale helps to maintain biodiversity. Patchiness of burning is important in providing environmental heterogeneity at a local scale.
- Fire sensitive species and ecosystems are most typically associated with wetlands, riparian areas and granite outcrops.
- Engagement with local government, volunteer bush fire brigades, FESA and other State government agencies will be necessary to ensure effective fire management across jurisdictions.
- Fire management in the planning area will, as far as practicable, be integrated with fire management on adjoining lands.

The objective is to conserve biodiversity across the landscape and to protect life and community assets in and near the planning area.

This will be achieved by:

1. continuing to implement fire plans according to the 'master burn plan' program and relevant fire management policies, guidelines and available knowledge, including fire history and response;
2. continuing to focus fire management on threatened species, communities of conservation significance and habitats requiring atypical fire regimes, and the protection of life and community assets;
3. maintaining a diversity of post-fire (seral) stages by approximating the theoretically-derived negative exponential distribution of fuel age classes across each LCU;
4. integrate fire management in the planning area with adjoining State forest and with neighbouring land-holders and local government;
5. conducting research on fire ecology, biological indicators and habitat requirements of vegetation communities and considering this in the preparation of annual fire plans;
6. continuing to liaise with local government, the WA Planning Commission, FESA, local bush fire

brigades, neighbouring land-holders and other appropriate authorities to encourage cooperative arrangements, ensure community protection from fire is at an appropriate level;
7. monitoring the results of prescribed burning activities and assessing against the objective for the prescribed burn;
8. monitoring the impacts of fire on key values;
9. promoting public education and awareness on the Department's fire planning and management, the effects of fire on the natural values, the need to prevent bushfires and the safety and survival of people and property;
10. providing opportunity for the public to have input into the master burn planning process; and
11. implementing recovery plans after bushfires.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
25.1 The impact of bushfire on life and community assets	25.1 No loss of life or serious injury, or significant community assets attributable to the Department's fire management	Annually
25.2 The extent of fire diversity measured by the diversity and scale of post-fire (seral) stages for theoretical negative exponential curve for the south-west	25.2 The distribution of post-fire fuel ages (time since fire) for theoretical negative curve for the south-west approximates a negative-exponential distribution (see Figure 8)	Annually
25.3 The persistence of threatened species within each LCU	25.3 No loss of populations or significant decline of threatened species at the LCU scale	Every 5 years

PART D. MANAGING OUR CULTURAL HERITAGE

In 1979 Australia, through Australia ICOMOS (Australia International Council on Monuments and Sites), the peak body of professionals working in heritage conservation, adopted the Burra Charter (Australia ICOMOS 1999). This provides for 'the conservation of places of cultural significance' and has a series of guidelines for managing cultural heritage.

Management and protection of Australia's heritage was further strengthened in 2004 by the introduction of a new heritage system under the EPBC Act. This system includes the National Heritage List and Commonwealth Heritage List. The Register of the National Estate is a record of natural, cultural and Indigenous heritage places of national value, but offers no statutory protection. The Register was frozen in February 2007 and is no longer updated. It will cease to be maintained in February 2012 and has been replaced by other heritage lists as a result of amendments to the EPBC Act.

There is one site in the planning area registered on the Register of the National Estate. The Surface Management Priority Area (place ID 9508) is approximately 15,000ha and is recognised for its natural values (e.g. old-growth forest). See Section 14 – *Existing and Proposed Tenure* for reference to FMP ID 74 and the western part of FMP ID 75.

The Western Australian Department of Indigenous Affairs administers the Aboriginal Heritage Act. The Aboriginal Heritage Act protects all sites and objects used by, or traditional to, Aboriginal people, including those not yet registered with Department of Indigenous Affairs. Section 15 of the Aboriginal Heritage Act places an obligation on all persons to report the location of anything to which the Aboriginal Heritage Act might apply. Under section 17 of the Aboriginal Heritage Act, it is an offence to excavate, destroy, damage, conceal or otherwise alter any Indigenous site unless authorised by the Registrar of Aboriginal Sites (s 16) or the Minister for Indigenous Affairs (s 18). Appropriate approvals under the Aboriginal Heritage Act are required before undertaking any works that may affect Indigenous heritage values.

The *Heritage of Western Australia Act 1990* provides for the registration and protection of places of historic interest on the 'Register of Heritage Places'. These places have statutory protection and must not be damaged or altered unless a permit to do so has been granted by the Heritage Council of Western Australia. The Act also requires local government authorities to maintain a 'Municipal Inventory' of significant heritage places in their jurisdiction. Under the provisions of the Heritage of Western Australia Act, State Government agencies and local government authorities are required to cooperate with the Heritage Council of Western Australia in protecting the cultural significance of places on the State and Commonwealth lists.

Policy Statement No. 18 provides guidance for managing Indigenous and non-indigenous cultural heritage. The policy recognises the importance of Indigenous heritage and identifies opportunities for Aboriginal involvement in the care of Department-managed lands. This may include such activities as interpretation of cultural history, and anthropological and archaeological survey and site assessment. It also recognises the need for liaison with appropriate Aboriginal Elders about management plans, public works, site management and heritage protection measures.

Policy Statement No. 18 also includes provision for recording and protecting non-indigenous sites with identified or potential heritage value. It recognises the role of interpretation in raising public awareness of such sites, their values and their need for protection. The Department's 'Recreation and Tourism Information System' (RATIS) database is used to record sites and places of cultural heritage significance.

26. INDIGENOUS HERITAGE

The planning area is in the region considered to be rich in Nyoongar culture and its importance for traditionally linked contemporary cultural activities is recognised. Once occupied by the Pindjarup and Wilmen, the Aboriginal population of the region is now concentrated in towns. However, there is evidence of artefact scatters and other remnants of former use present in the planning area.

At the time of writing there are 42 registered sites of Indigenous heritage significance within the planning area as listed on the register of the Department of Indigenous Affairs. These include both ethnographic (anthropological) and/or archaeological sites including mythological, artefacts, quarries and burial sites. Most of the sites recorded in the planning area are located among the margins of water sources. The same can also be said of the wider region (O'Connor *et al*.1989).

Some sites are not only significant to Aboriginal people, but also to the community as a whole in terms of recreation and nature-based tourism. Some of the mythological sites in the planning area associated with the dreamtime Wagul are also important for water-based recreation.

There are no Indigenous heritage sites in the planning area listed on the National Heritage List or Register of the National Estate at the time of writing.

The Department recognises that not all sites with Indigenous significance are listed on the Department of Indigenous Affairs' register. As such, assessments before operations may be necessary to determine if there is potential to inadvertently damage sites of Indigenous heritage. Appropriate notifications are also required under the Native Title Act for public works conducted in the planning area. Consent from the Minister for Indigenous Affairs is required under s 18 of the Aboriginal Heritage Act for developments (e.g. public works, mining operations) that are to impact on Indigenous sites.

There is one registered native title claimant group that covers the planning area, Gnaala Karla Booja.

26. Indigenous Heritage

Key Points

- There are a number of registered sites of Indigenous heritage significance within the planning area.
- The Aboriginal Heritage Act provides statutory protection for Indigenous cultural heritage in WA. Indigenous heritage sites must be managed in accordance with the Aboriginal Heritage Act.
- There is one registered native title claimant group that covers the planning area, Gnaala Karla Booja.

The objective is to protect and conserve the Indigenous cultural heritage in consultation with Aboriginal people.

This will be achieved by:

1. complying with Commonwealth and State legislation and Department policies before commencing operations that have the potential to impact on cultural heritage;
2. protecting and maintaining cultural heritage according to the Burra Charter;
3. consulting and involving local Aboriginal people and relevant organisations, and referring to the State Aboriginal Site Register and other relevant registers, to improve the protection and conservation of Indigenous cultural heritage;
4. managing threatening processes (such as fire, introduced plants and animals) and visitor activities to ensure Indigenous cultural heritage is not adversely impacted; and
5. providing culturally appropriate information and interpretation on Indigenous cultural heritage to promote awareness, appreciation and understanding.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
26.1 Protection of known or identifiable Indigenous heritage sites	26.1 No disturbance without formal approval and consultation	Every 5 years

27. NON-INDIGENOUS HERITAGE

Non-indigenous heritage in the planning area and broader region has a history relating to historic settlement and the timber industry. A number of historical features including historic infrastructure and constructions including railway formations, bridges, mills (e.g. Teddy Bear Mill), settlements (e.g. Nanga Townsite and Treesville) and names of historical significance (e.g. Baden Powell, Teesdale and Plavins) are located within or associated with the planning area.

Throughout the planning area are a number of historic remnants relating to previous land use associated with the timber industry. Some of the old disused railways and bridges, once used to transport timber to mill sites, now form part of the tracks and trails within the planning area (e.g. the trestle Asquith (Long Gully) Bridge now forms part of the Bibbulmun Track).

Historic and once thriving timber towns such as Nanga Townsite and Treesville now have little left in the way of historic features. In the case of Nanga Townsite, bushfire destroyed the timber town in 1961. Most of the area was later replanted with pines and today is a popular camping area.

Within the planning area there is only one non-indigenous site listed on the WA Register of Heritage Places, the Asquith (Long Gully) Bridge. This bridge is also included on the Shire of Boddington's Municipal Inventory. Teddy Bear Mill is a proposed site on the Shire of Collies Municipal Inventory (A. Watts *pers. comm.* 2007). There are no non-indigenous cultural sites listed on the World, National or Commonwealth Heritage Lists.

The Nanga Heritage Circuit is a four-wheel drive trail that takes in some of the heritage aspects of the planning area (see Section 31.1 – *Scenic and Recreational Driving*).

Some of the vegetation that was introduced to the planning area as part of historical use (e.g. in timber towns) may compromise the integrity of natural values, these plants may be removed and revegetated with native vegetation where appropriate. However, where there are heritage values and the natural values are not compromised, some areas containing trees of historic significance may be retained.

The Government Heritage Property Disposal Process for disposal or demolition of heritage places that meet the criteria needs to be observed, where appropriate.

27. Non-indigenous Heritage

Key Points

- Much of the non-indigenous heritage in the planning area relates to the timber industry.
- The Asquith (Long Gully) Bridge is the only non-indigenous site listed on the WA Register of Heritage Places.

The objective is to protect and conserve the non-indigenous cultural heritage.

This will be achieved by:

1. complying with Commonwealth and State legislation and Departmental policies before commencing operations that have the potential to impact on cultural heritage;
2. protecting and maintaining cultural heritage according to the Burra Charter;
3. managing and regularly monitoring threatening processes (such as fire, introduced plants and animals) and visitor activities to ensure cultural heritage is not adversely impacted;
4. consulting and involving the local community and relevant organisations and referring to the Register of Heritage Places and other relevant registers, to improve the protection and conservation of cultural heritage; and
5. providing information and interpretation on non-indigenous cultural heritage to promote awareness, appreciation and understanding.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
27.1 Protection of known or identifiable non-indigenous heritage sites	27.1 No disturbance without formal approval and consultation	Every 5 years

PART E. MANAGING VISITOR USE

Estate managed by the Department covers approximately 27 million ha of lands and waters, protecting unique landscapes, seascapes, geological formations, plants and animals, and cultural sites. The number of visitors to the Department managed estate has increased markedly over the past decade, from 8.7 million visits in 1998-99 to more than 14 million in 2008-09. Such significant growth and community interest highlights the growing eco and nature-based tourism sector, improved access and facilities, and enhanced interpretation and education opportunities (C. Ingram *pers. comm.* 2008).

It is recognised that the public conservation estate managed by the Department has the capacity to provide for significant portion of the public's growing demand for outdoor recreation and tourism, in particular 'nature-based' tourism. In doing so, the conservation estate contributes significantly to the social, psychological, physical and economic well-being of the community, with a subsequent benefit being that people develop greater attachment to, regard for and understanding of conservation areas by spending time in them.

Conserving these lands and waters for future generations and managing them for use by the present one is complex because public expectations for recreation and tourism are as diverse as the environments the Department manages. While the public conservation estate brings many benefits to the community as well as the environment, the desire to interact with these unique environments can lead to unacceptable impacts on the natural environment.

This part of the management plan addresses these issues, and at the same time ensures that visitors gain an awareness of the area's values which should, in turn, foster an appreciation and understanding of conservation. In the planning area, particularly the Murray Valley, the major foci for managing visitor use are to:

- maintain the existing character and experiences in the planning area and upgrade and enhance existing facilities as necessary;
- consolidate existing recreation and interpretive opportunities at existing day use and camping sites;
- improve visitor amenity, experience and environmental safeguards (e.g. at Nanga and Baden Powell);
- use the entry station as a focal point to provide information to visitors;
- relocate the entry point and amend the internal primary road network; and
- continue to implement the Departments visitor risk management program.

The provision of visitor services, facilities and experiences in the planning area is guided by the Department's Policy Statement No. 18 – *Recreation, tourism and visitor services*, which outlines the Department's principles, operational guidelines, procedures and administrative controls in relation to facilitating recreation and tourism on the public conservation estate. It should also be determined in the context of the range of opportunities available in neighbouring parks and reserves across the Department-managed land in the region and opportunities provided by neighbouring land-holders and tourism providers and be looked at in conjunction with local government initiatives such as the *Shire of Murray Tourism Strategy 2009-2014*.

Managing the way people use the planning area applies an adaptive management approach, where management policies and practices are continually improved by learning from the outcomes of operational programs, experience, research and monitoring.

28. VISITOR OPPORTUNITIES

Regional Context

The main attraction to the planning area is the Murray River, which provides opportunities for many water-based recreation pursuits, as well as camping and day use areas. The planning area is one of the few areas with sign-posted campsites in a river setting in the region, and hence is often in high demand, particularly at peak visitor periods (e.g. over the New Year period, Australia Day long weekend and Easter school holidays). The most popular sites are Baden Powell, Nanga Mill and Charlie's Flat, which, during peak times often reach capacity.

Visitors to the planning area participate in a variety of activities, most of which are nature-based. The most popular of these include camping, picnicking, canoeing and kayaking along the Murray River, swimming,

fishing, marroning, mountain biking, bushwalking and scenic and recreational driving (see Section 31 – *Visitor Activities*). Some of these recreational opportunities, including access, have become limited or restricted across the region, particularly in public drinking water source areas. This has the potential to increase the number of visitors to the planning area as these activities are widely available, placing greater pressure on the key values.

The Bibbulmun Track, which stretches almost 1000km from the Perth Hills to Albany on the south coast, traverses parts of the planning area. The Munda Biddi Trail, currently stretching 498km from Mundaring to Nannup also traverses the northern section of the planning area. The Bibbulmun Track and the Munda Biddi Trail are iconic and important access routes within the region, providing long distant recreational opportunities for users. There are also other forms of designated tracks and trails in the planning area including horse-riding and recreational driving (four-wheel driving), providing important recreational opportunities to people in the region (see Section 30 – *Visitor Access*).

Visitor Numbers and Trends

The Department's visitor statistics indicate interest in the forest environment has increased over the past decade. Observations by managers suggest particular growth in recreational activities such as recreational driving, mountain biking, camping in natural areas, marroning, fishing and canoeing, which are offered to some degree in planning area (Muench unpubl. 2001).

Although the visitation figures for the planning area have fluctuated over the past 10 years, visitation is quite strong. Lane Poole Reserve has one of the highest levels of visitation in the Region with approximately 175,000[17] people visiting the Murray Valley part of the planning area annually. Given the rising population trends for both Perth and nearby regional centres, visitation to the planning area is likely to increase.

The recreation opportunities provided by the Murray River are the key attraction to the planning area. Visitor feedback indicates most of the visitors to the planning area are from Perth (77.9%), with a further 11.8% of visitors from country WA (CALM 2005b). Visitor counters are used in the planning area to indicate the number of visitors using roads, tracks and trails. Vehicle counters used to calculate visitor numbers to the planning area are located at Nanga Road, Nanga Mill gate and Park Road. There are also pedestrian counters along the Bibbulmun Track and Munda Biddi Trail indicating the number of visitors using the track and hut facilities.

The main period of visitation is the warmer months between October and April, with peak visitation on certain holidays including the New Year break, Australia Day long weekend and Easter school holidays. At these times, and during long weekends and school holidays, the planning area is often filled to capacity, to the point where rangers turn visitors away to alternative sites in the region.

The change in the community's population dynamics, in combination with the changing climate, may alter the type of visitor, visiting the planning area in the future. This inturn will place greater demand and pressure on the key values of the planning area. Statistic from visitors surveys conducted in the planning area reflect Australia's aging population. When comparing the age demographic of visitors between 1984 and 2004, there is a trend towards older tourists visiting the planning area. For example, in 1984, 31.1% of those surveyed were aged 15 or under compared to only 12% of visitors in 2004 (Department of Sport and Recreation 1984, CALM 2004). The difference in older age groups is also quite marked with only 11.8% and 1.7% of 40-59 and 60+ age groups visiting in 1984 compared to 46% and 8% respectively in 2004 (Department of Sport and Recreation 1984, CALM 2004).

It is predicted that the water level of the rivers in the planning area will drop due to the predicted decrease in rainfall over the next 30 years (see Section 16 – *Climate Change*). This would result in reduced river levels and flow leading to increased siltation of rivers, which would inturn, affect recreational opportunities within and around the planning area, placing more pressure on for example, the Murray River. As such, this management plan, together with the Recreation Master Plan (see Section 29 – *Visitor Use Planning*) aims to take into account these changes and the continuing trend of increasing visitor numbers by counteracting the reduction in usable aquatic recreation sites by providing more land-based recreational opportunities.

Due to rising visitor numbers, the capacity for which many of the recreation facilities were designed is frequently exceeded. Visitor use planning (see Section 29) addresses this issue and will largely alleviate these problems through the upgrading of existing facilities and expansion of some sites where appropriate.

[17] Includes Scarp Pool visitation estimates.

Visitor satisfaction levels are monitored at selected sites throughout the planning area using the Department's standard Visitor Satisfaction Survey. This survey enables trends to be identified and satisfaction levels compared to other areas of the State. This is an ongoing process that can be used to plan for future visitor management.

28. Visitor Opportunities

Key Points

- The planning area is located within an easy one hour drive from Perth, and is also close to major regional centres including Mandurah and Bunbury.
- Lane Poole Reserve has one of the highest levels of visitation in the Region with approximately 175,000 people visiting the Murray Valley part of the planning area annually, with visitation predicted to increase, so too will the demand and pressure on the key values and resources.
- The change in the community's population dynamics, in combination with the changing climate will alter the type of visitor, visiting the planning area in the future.
- Some recreational opportunities, such as white water and flat water canoeing, have become limited or restricted across the region. This has the potential to increase the number of visitors to the planning area, placing greater pressure on the key values.

The objective is to provide a range of nature-based recreation and tourism opportunities based on visitor demand and trends while ensuring the impacts on key values are minimised.

This will be achieved by:

1. liaising with and including the provision and exchange of information with regional and local tourism organisations such as tourism associations and local government authorities;
2. recording visitor numbers and monitoring visitor satisfaction across a range of activities and sites;
3. undertaking social research including projects nominated through the Department's Nature Based Tourism Research Reference Group (see Section 46 – *Research and Monitoring*);
4. using data collected from visitor numbers and satisfaction surveys and social research, to improve management and minimise environmental, social and economic impacts across a range of sites in the planning area; and
5. encouraging major tourism infrastructure outside the planning area, focusing on providing opportunities within the planning area that cannot be catered for elsewhere.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
28.1 Visitor satisfaction levels of nature-based experiences	28.1 Visitor satisfaction levels of nature-based experiences are maintained or increased from 2011 levels	Every 5 years

29. VISITOR USE PLANNING

Recreation Planning Framework

Managing the way people use the planning area involves the management of recreation, commercial activities, public safety, visitor education, interpretation and information. Recreation and tourism planning considers a range of factors including visitor risk, environmental impacts, social benefit, equity, public demand and potential economic benefit. The recreation planning framework adopted in this plan uses both visitor management settings and a classification of recreation sites according to an established site hierarchy.

The provision of visitor services, facilities and experiences in the planning area should also consider the range of opportunities that are or may become available within the local region over the next 10-15 years and take into consideration evacuation in the case of bushfire.

Visitor Management Settings

As the use of natural areas increases, resource conditions can change until the character of the area has been modified to a point where it no longer has the attributes that originally attracted people to the area. As a

consequence, the initial users are displaced by people who are more tolerant of the changed resource conditions, with the process continuing until a uniform high level of services and facilities is provided within the natural area. This is the concept of 'recreational succession'—where the very conditions of an area that attract recreational use are inevitably changed by that use (Prosser 1986).

The Recreation Opportunity Spectrum (ROS) has been commonly applied as a standard planning tool in natural areas to address this issue (Clarke and Stankey 1979). The Department has adapted ROS and proposes the use of 'visitor management settings' to manage recreational succession in natural areas to provide the greatest range of recreation opportunities in a given area, while limiting unintended incremental development and minimising visitor impacts. The system is to guide the Department and the Conservation Commission in determining what sort of recreation development may be appropriate within the settings. The application of visitor management settings within a planning area is consistent with the Department's Statewide approach.

The five setting classes used are, from most to least developed: Highly Modified, Recreation, Natural-Recreation, Natural and Wilderness and these are applied according to assessment against six standard criteria (see Appendix 9). It should be noted that this system of visitor management settings in itself does not consider the impact of proposed recreation developments on the biodiversity and natural values of the planning area. It is also important to note that the allocation of a part of the planning area to a particular setting does not necessarily mean the full extent of the setting has to be met. Map 5 shows how these settings have been applied to the planning area.

Site Hierarchy

A recreation site hierarchy is used in conjunction with the visitor management settings where it is specifically desired not to develop all sites within an area to the full extent of the setting. It provides a controlled (site by site) mechanism to cap the level of development and maintain a diversity of experiences within a setting. The recreation site hierarchy divides sites into three categories – High, Medium and Low (see Map 6).

The draft *Recreation Master Plan* for the planning area has been prepared to document, assess and provide management direction of recreation use, the level of facilities, communication requirements and tourism development across the planning area. This plan proposes a system of management by zones, precincts and sites, each with recommendations compatible with the overall vision for the planning area and vision for each respective visitor management zone. The three primary components of the Recreation Master Plan include: recreation; communication; and tourism. The Recreation Master Plan is a non-statutory document and sits underneath this management plan. This management plan provides the broad strategic direction for the management of visitor services in the planning area, whereas the Recreation Master Plan provides a greater level of detail regarding development proposals within the planning area.

Site Recreation Planning

In the absence of clear guidelines from the visitor management settings and site hierarchical planning that has occurred as part of preparing a Recreation Master Plan, the Department applies a range of recreation planning principles and other factors. The Department aims to provide visitors with a wide range of nature-based experiences on public conservation estate, while ensuring that impacts on the environment are managed within acceptable limits. The Department's Policy Statement No. 18 outlines a number of techniques for managing visitor impacts under three categories:

- site management (e.g. hardening the site, channelling use, and developing facilities);
- direct regulation of use (e.g. increasing policy enforcement, the use of zones, restriction of the intensity of use and the restriction of activities); and
- indirect regulation of use (e.g. altering physical facilities, education and interpretation, advertising/marketing, setting eligibility requirements and through others).

Before the development of recreation sites, the Department uses a detailed process of planning and design to assess the potential visitor impacts on recreation sites. Proposed developments are assessed using a variety of environmental, social and cultural factors. The environmental factors include geological, topographic, soil condition and type, water (surface and groundwater) quantity and quality, vegetation cover condition and significance, other biota (such as flora and fauna and their significance) and visual quality. The social factors, including visitor satisfaction, are determined using questions relating to the condition of recreation sites found in the Department's Visitor Satisfaction Survey which is distributed to visitors at major recreation sites within the planning area. The cultural factors include Indigenous and non-indigenous heritage sites and artefacts.

This management plan allows for an increase in the number of tent campsites through the expansion of existing camping grounds rather than the development of entirely new ones. This is with the exception of the relocation of the existing Baden Powell campsite. There will also be an expansion of existing day use sites to cater for the anticipated increase in day visitors to the planning area over the life of the management plan. The proposed changes to visitor use are presented in sections 30 – *Visitor Access*, 31.4 – *Day Use* and 31.5 – *Overnight Stays*.

Recreation sites located near the Murray River are heavily degraded, with bank erosion and compaction and loss of vegetation evident. Some parts of the riverine environment are being impacted on by the location and design of recreation sites. To protect the fragile riverine environment, it may be necessary to redevelop or upgrade some of the recreation sites away from the rivers edge and provide improved river access points. If sites are moved away from the rivers edge, access to the river will still be provided to maintain the visitor experience. In addition, sites may need to be closed, redeveloped or rested for safety and environmental protection.

29. Visitor Use Planning

Key Points

- The Department aims to provide visitors with a wide range of nature-based experiences on public conservation estate while ensuring that impacts on the environment are managed within acceptable limits.
- The Recreation Opportunity Spectrum has been commonly applied as a standard planning tool in natural areas to address the issue of recreation succession (Clark and Stankey 1979).
- The Department proposes the use of 'visitor management settings' derived from the ROS principles, to manage for recreation succession in natural areas such as the planning area.
- A recreation site hierarchy is used in conjunction with the ROS where it is specifically desired not to develop all sites within an area to the full extent of the visitor management setting.
- This management plan and in conjunction with recreation planning; document, assess and provide direction for management of visitor recreation use and facilities across the planning area.
- This management plan allows for an increase in the number of tent campsites through the expansion of existing camping grounds.
- Some parts of the riverine environment are being impacted on by the location and design of recreation sites.

The objective is to provide visitors with a range of nature-based experiences while ensuring the impacts on key values are minimised.

This will be achieved by:

1. ensuring future recreational development and existing and future tourism developments and visitor activities are consistent with Department Policies, visitor management settings (see Map 5) and recreation site hierarchy (see Map 6);
2. assessing and minimising the environmental, visual, cultural and social impacts of recreational and tourism developments and visitor activities and ensuring these are consistent with visitor management settings for the area;
3. referring any future recreational developments that would be inconsistent with the visitor management setting to the Conservation Commission; and
4. ensuring recreation and tourism developments are designed and constructed and visitor activities are conducted in ways that minimise impacts on key values.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
29.1 The range of visitor management settings (i.e. from natural to highly modified)	29.1 Maintain visitor management settings over the life of the plan	Every 5 years

30. VISITOR ACCESS

Department-managed lands are generally available for a variety of visitor activities where natural and cultural values are not unduly compromised. Provision of access is the main management tool the Department uses to enable visitors to recreate on the land it manages. This can include access to reach a destination for recreation, or for the experience provided by the type of access itself (e.g. recreational driving, bushwalking).

Fully satisfying demand for access could compromise the values of the planning area (see Section 4 – *Key Values*). Therefore, access needs to be carefully managed, in consultation with key stakeholders and according to the visitor management settings to retain the qualities currently afforded to the planning area.

Public vehicle access for the planning area is shown in Map 7.

Demand for access to the planning area comes from a variety of sources:

- visitors who require reliable access to recreation sites and facilities and natural attractions;
- neighbours and local land-holders wanting access to their property;
- service providers and mining companies who require access to maintain infrastructure;
- different recreational users wanting different types of access; and
- managers who require access for management purposes.

The type of access provided to an area affects the level and nature of use. People are interested in using the planning area for a variety of activities, including scenic (two-wheel) and recreational (four-wheel) driving, bushwalking, mountain biking, canoeing, kayaking and horse-riding, with each of these activities requiring different standards or types of access. It is important to manage access to ensure that activities are undertaken in appropriate areas and are compatible with each other as to not create conflicts between users.

Types of Access

The planning area has a high level of accessibility, with public access available for two-wheel and four-wheel drive vehicles via sealed and unsealed public roads and tracks, bushwalking and cycling tracks and water access.

Vehicular Access

All motor vehicles accessing the planning area need to be registered under the *Road Traffic Act 1974* (Road Traffic Act) and all drivers must possess a current driver's licence. Vehicles are restricted to only roads and tracks that are open to public access. Driving off these roads and tracks is not permitted. Any vehicles registered under the *Control of Vehicles (Off-road Areas) Act 1978* are only permitted to operate in designated off-road areas and in accordance with the CALM Regulations, are therefore not permitted to be brought into the planning area.

Most visitors to the planning area arrive by car. The standard of vehicle access within the planning area varies from sealed roads, to tracks accessible only by four-wheel drive vehicles. Road design and standards within the planning area will be established by the Department in conjunction with Main Roads WA or local government authorities as outlined in Policy Statement No. 40 – *Road Management* (subject to final consultation).

The majority of the roads in the planning area are unsealed but suitable for two-wheel driving (see Map 7). Two-wheel drive access to the planning area focuses on the provision of safe and enjoyable access to major recreation facilities such as camping areas and day use areas. Brochures and signage are used to direct visitors to recreation sites.

The main entry point to the planning area is Nanga Road and Park Road in the north and Boundary Road in the south. Nanga Road is also part of a travel route between Collie and Dwellingup.

Existing public access roads may need rationalising to improve traffic management and visitor safety throughout the planning area. This may mean by realigning, closing and rehabilitating some roads or conversion of these to multi-use or single-use trails or management and emergency access tracks[18].

Use of some four-wheel drive routes in the planning area is dependent on road conditions. For example, Tom's Crossing is a four-wheel drive only access route that closes seasonally when high river levels make crossing hazardous and the Nanga Heritage Circuit route may be altered if conditions on the circuit are hazardous. The Department uses signage on site to detour vehicles away from these areas and provides altered 'trip notes' and accompanying maps for the Nanga Heritage Circuit to the public on the Department's website.

Specific scenic and recreational driving is discussed further in Section 31.1 – *Scenic and Recreational Driving*.

[18] Disused railway formations may also be converted to mountain bike trails, or four-wheel drive trails where it is appropriate to do so.

Other Access

Other forms of access to the planning area include pedestrian access, mountain biking, horse-riding and water access (see Map 8).

There are a number of walking tracks that provide pedestrian access in the planning area (see Section 31.2 – *Bushwalking*). The most recognised walking track that traverses the planning area is the Bibbulmun Track.

Access for off-road cycling is currently provided on the Munda Biddi Trail, which traverses a portion of the northern section of the planning area (see Section 31.3 – *Cycling and Mountain Biking*). The Munda Biddi Trail complements the Bibbulmun Track without the conflicts that may arise from dual or multi-use trails. Over the life of this management plan, the Munda Biddi Trail may be realigned due to mining operations in the area. This may result in more of the Munda Biddi Trail traversing the planning area. It is anticipated that future proposed cycling trails would link with this trail. Any decision to design and construct proposed new cycling trails will be based on an assessment of user demand and impacts on natural, recreational and cultural values. Design and construction will be required to conform to the standards and specifications detailed in the Department's *Mountain Bike Management Guidelines* (draft) (CALM 2006b) and Policy Statement No. 18.

Horse-riding access within the planning area is provided for in the northern section of the planning area on the Les Couzens Bridle Trail, which extends outside the planning area to the Dwellingup townsite, and along fire access tracks (see Section 31.9 – *Horse-riding*).

Water access in the planning area is mainly associated with the Murray River (see Section 31.6– *Water-based Activities*). There are a number of canoe launch sites at strategic points along the Murray River, however, most of these sites are in poor condition and are currently being reviewed to ensure they are appropriate, and satisfy safety and environmental considerations.

Access for Visitors with Disabilities[19]

The Australian Bureau of Statistics estimates that one in five or 20% of people in Australia in 1993 had a disability (ABS 2004). Based on these figures, it is likely that over a million visits per year are made to Department-managed land by people with some form of disability. Catering for visits by people with disabilities will also have subsidiary benefits to the aged, parents with small children and the carers of people with disabilities.

The Department is committed to improving access to its services, information and facilities for people with disabilities as outlined in the *Disability Access and Inclusion Plan 2007 - 2010* (DEC 2007b).

It is important that camping and day use sites within the planning area are inline with the ROS principles (see Section 29 – *Visitor Use Planning – Visitor Management Settings*). As such, the universal accessibility of some sites may be assessed where there is a need and appropriate to do so and keeping within the visitor management settings.

Currently, sites within the planning area do not fully provide universal access. For example, the Chuditch campsite has universally accessible sized toilets and camp kitchen but depending on people's ailments, they might need the aid of a carer or helper to get to and from the facilities (N. Greenhill *pers. comm.* 2006).

Existing and proposed facilities with the planning area may be reviewed over the life of the plan to determine the possibility of providing universal access, where appropriate. Sites of high priority include developing facilities at Driver Crossing, Bob's Crossing and Scarp Pool that assist visitors with disabilities in accessing and enjoying the river and developing trails and facilities accessible to more types of visitors at Baden Powell and Nanga.

Access for Management

Some access within natural areas may be closed to the public for management purposes. These roads and tracks are predominantly needed for fire management purposes or located within Disease Risk Areas but may also be used for flora monitoring, controlling introduced animals, water monitoring, access for maintenance, for weed control and as identified in the reserve closure plan in the case of an emergency . While further assessment is

[19] The *Disability Services Act 1993* defines disability as a condition that is attributable to an intellectual, psychiatric, cognitive, neurological, sensory or physical impairment.

required of access within Disease Risk Areas (see Section 24 – *Diseases*), management access is not likely to dramatically change from that existing at present.

Access that is closed to the public for 'management vehicles only' will be signposted on site and, if practical, a gate may be used. Often whenever public vehicle access to a track is removed, vandalism occurs to gates at newly closed tracks, or new tracks around barriers are formed. This issue needs to be considered and managed when amending access in the planning area.

Access to the existing public utilities and mining conveyer belts are required for management purposes. For example, access will be required by the Water Corporation to the water supply mains that traverse the south-east section of the proposed additions. Telstra also retain the rights over any assets and the right to maintain infrastructure under the Commonwealth *Telecommunications Act 1997*.

Special and Restricted Access

There are some areas where public access may need to be restricted either seasonally (e.g. along Coffs Form, Leppers Gully and Tom's Crossing), temporarily or permanently due to concerns over public safety, cultural sensitivity, disease control, protection of natural values, protection of water sources, mining operations and/or preservation of a particular recreational experience.

Under the CALM Regulations, regulation 44 states that the CEO of the Department has the direction to close an area to reduce or remove the threat if "there is a significant and imminent threat of loss or harm to the safety or health of persons or fauna, or of damage to property or any part of the environment" as in the case of a threat to visitor safety such as a bushfire.

Under section 62 of the CALM Act, a land classification system may be implemented to designate appropriate levels and types of use and access. Land vested in the Conservation Commission can be classed into various categories:

(a) wilderness area;
(b) prohibited area;
(c) limited access area;
(d) temporary control area;
(da) forest conservation area;
(e) recreation area for purpose specified in the notice; or
(f) such other class of area as the Minister for Environment, on recommendation of the Conservation Commission, thinks necessary to give effect to the object of this area.

Access may also be restricted in Disease Risk Areas designated under section 82 of the CALM Act, where part 16 of the *Forest Management Regulations 1993* – Control and eradication of forest disease, restricts access to reduce the risk of spread through anthropogenic means (see Figure 6 for the location of Disease Risk Areas). Visitors are able to request a permit from the relevant Department District Office if they require access into Disease Risk Areas. Signage and/or gates are in place in the planning area where restricted access is applicable.

DoW and the Water Corporation may also restrict access in public drinking water source areas and reservoir protection zones (see Section 18 – *Catchment Protection*) to prevent potential contamination risks such as pathogen contamination through direct contact with the water (e.g. humans and domestic animals) primarily though the transfer of faecal material, the use of bait for recreational fishing and marroning and litter, and indirectly through runoff transferring faecal material in the catchment. Turbidity can also cause erosion through the use of vehicles (DoW 2007). Guidelines for recreation in public drinking water sources areas on crown land is discussed in the DoW Statewide Policy Statement No. 13 (WRC 2003b) and relevant drinking water source protection plans. Signage by the relevant agencies has been placed in relevant areas informing visitors about public access in the area (see Section 30 – *Visitor Access*). Areas affected may also have gates and fences in place to restrict access.

Proposed changes to public access

Proposed changes in public access to the planning areas aim to improve visitor access to key recreation sites and address visitor safety. Map 7 and Table 5 reflect proposed changes to access to the northern recreational area over the life of this management plan. These changes will provide an improved, organised and structured access

that will assist in improving visitor experience, address safety concerns and reduce conflicts between users. These changes are consistent with the visitor management settings within the planning area.

Table 5. Proposed Changes to Public Access

Proposed Changes to Public Access	Comments
Realign Nanga Road and stop through traffic in the Nanga camping areas	❖ increase visitor safety; and ❖ increase area available for camping
Develop a spur road off the realigned Nanga Road, which will become the main access into the planning area	❖ provide easier access to facilities and recreation opportunities; and ❖ improve management
Develop a new entry station on the spur road	❖ improve management; ❖ as it is centrally located, it will aid in an equal disbursement of visitors to all recreation sites; and ❖ the current entry station site is not fulfilling present management needs because it: o cannot cope with the number of visitors during peak times; and o does not cover people who enter the planning area via Nanga Road
Establish Nanga Brook Road (from the new entry station to Nanga - currently Nanga Road) as the primary access to the Nanga camping area	❖ increase visitor safety; and ❖ make area available for camping
Develop a new road along the ridge, north from the new entry station to a new crossing over the Murray River. Options for crossing the river will be investigated to fulfil management needs	❖ give all weather access to Baden Powell; ❖ increase visitor safety; and ❖ provide better management options for the planning area
Realign Murray Valley Road up slope of its existing position, taking cars away from the rivers edge. Convert the existing Murray Valley Road alignment into a trail	❖ provide passive recreation (i.e. walking trail) opportunity along the rivers edge
Maintain an emergency exit at the Park Road and Nanga Road intersection	❖ operate as an emergency access point or as an alternative exit point in periods of high visitation

30. Visitor Access

Key Points

- Access provides for a number of visitor activities including scenic (two-wheel) and recreational (four-wheel) driving, bushwalking, mountain biking, canoeing, kayaking and horse-riding, with each of these activities requiring different standards or types of access.
- All motor vehicles accessing the planning area need to be registered under the Road Traffic Act and all drivers must possess a current driver's licence. Vehicles are restricted to only roads and tracks that are open public access.
- There is often a requirement for some access within natural areas to be temporarily closed to the public for management purposes such as fire management, disease management, flora monitoring, controlling introduced animals, water monitoring, access for maintenance, and for weed control.
- Access needs to be carefully managed, in consultation with relevant stakeholders, as to not compromise the visitor management settings and key values.
- Permits are required for visitors entering Disease Risk Areas.
- Proposed changes in public access to the planning area over the life of the management plan will aim to improve visitor access to key recreation sites and visitor safety (see Table 5 and Map 7).

The objective is to provide and maintain access that minimises impacts on natural, cultural and recreation values.

This will be achieved by:

1. providing access, as shown in Table 5 and Map 7**,** consistent with Department policies and the appropriate visitor management and in consultation with visitors and relevant stakeholders;
2. continuing to prohibit visitors driving off marked public access roads and tracks, except with the approval by the Regional/District Manager;
3. ensuring 'management vehicle' tracks are effectively closed to the public except with the approval by the Regional/District manager;
4. maintaining, upgrading, re-aligning, closing (including seasonal closures) or rehabilitating roads and tracks that are deemed unnecessary or if there is an adverse impact on the environment;
5. ensuring that stream crossings tracks are:
   - minimised;
   - are designed to reduce the possible impacts of erosion and hydrocarbon contamination;
   - maintaining public vehicle access roads to safe and appropriate standards; and
   - appropriately advise visitors of risks associated with crossing;
6. providing access consistent with the Department's *Disability Services and Inclusion Plan* (2007b) by improving access facilities and services for disabled visitors, where appropriate;
7. providing information to visitors on access within the planning area (including information on restricted areas e.g. accessing the water in the Samson Dam and Harris Dam public drinking water source areas to preserve water quality);
8. providing information to visitors on appropriate four-wheel drive techniques, such as the Department's 'Caring Code for the Bush' and the Western Australian Four-Wheel Drive Association Code of Ethics;
9. working with Leave No Trace Australia to encourage responsible outdoor recreation and travel throughout Departmental managed lands and waters and to increase public awareness of minimal impact behaviours;
10. implementing proposed changes to access consistent with this plan;
11. rationalising and evaluating the canoe launching facilities for appropriateness and safety and upgrading where appropriate;
12. continuing to provide access for horse-riding in the northern section of the planning area which will be monitored for demand and impacts on natural and recreational values; and
13. liaising with DoW and the Water Corporation in regard to future expansion of the Munda Biddi trail in the planning area in areas of PDWSA.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

31. VISITOR ACTIVITIES

31.1 Scenic and Recreational Driving

Scenic and recreational driving are popular activities within the planning area. Much of the experience and enjoyment that visitors gain from the natural environment is derived from two-wheel and four-wheel drive routes in areas of high scenic quality. It allows visitors to gain a greater understanding and appreciation of the intrinsic characteristics of natural areas. A recent survey of visitors[20] showed 30% of visitors came to the planning area for a scenic drive with 15% of visitors seeking a four-wheel driving experience. Much of the access in the planning area is suitable for two-wheel drive, however there are four-wheel drive only tracks available for recreational driving and areas which are for management only or require a permit (see Section 30 – *Visitor Access* and Map 7).

It is important that any driving within the planning area complies with the Road Traffic Act, Control of Vehicles (Off-road Areas) Act 1978 and the CALM Regulations to avoid damage to the environment, key values, reduce the risks to visitors and conflicts with other visitors (see Section 30 – *Visitor Access*). Vehicles are restricted to only roads and tracks that are open public access. Policy guidelines are identified in Policy Statement No. 18.

Three classes of scenic drives are recognised in WA: State Tourist Drives, local scenic drives and local tourist routes. State Tourist Drives are signposted and promoted on maps. However, it is likely they will be superseded by themed travel routes, similar to the 'Savannah Way' in the north of Australia and the 'Golden Pipeline' from Northam to Kalgoorlie (E. Stankevicius *pers. comm.*). Although there are no State Tourist Drives in the

[20] Visitor survey was Lane Poole Reserve specific and targeted visitors in the recreation area of the planning area between 18 February and 6 March 2006.

planning area, large numbers of visitors still experience the area and gain their enjoyment and appreciation of the natural environment through scenic driving.

Some four-wheel drive clubs volunteer their time to environmental projects in the planning area, such as rehabilitating tracks and removing litter and weeds where appropriate. The Department also promote the 'adopt a track' program where four-wheel drive clubs are encouraged to make a formal commitment in maintaining and ensuring the tracks' sustainability.

Unfortunately, there are still many recreational drivers that use the planning area who are not aware of, or ignore the need to minimise environmental and social impacts, including those that drive off designated tracks and illegal off-road driving (e.g. in the southern portion of the planning area where visitors enter areas without DRA permits). The Department patrols areas known for illegal off-road driving and carry out public information campaigns, encouraging visitors to observe and apply the Australian National Four-wheel Drive Council's *Code of conduct for off-road driving* and the *Tread Lightly* philosophy (Australian National Four-wheel Drive Council 2005, Tread Lightly! Australia Ltd 2006).

The Nanga Heritage Circuit is the most recognised four-wheel drive trail in the planning area. It starts and ends near Nanga Townsite and winds through the scenic jarrah forest and river valley, mainly along old railway tracks and past trestle bridges, taking in the key heritage interpretation points along the circuit. Trip notes and current track conditions for the circuit are available on the Department's website.

Increased pressure has been placed on four-wheel driving opportunities in the planning area including continued regional population growth and greater accessibility to the planning area from the metropolitan area. In addition, closures of four-wheel drive tracks in public drinking water source areas by the Water Corporation to protect the water quality of the community's drinking water sources has also placed increased pressure on tracks in the planning area. There is limited opportunity for more four-wheel drive trails in the planning area however, the Captain Fawcett Commemorative Track, a 105km easy-medium scenic heritage four-wheel drive trail that follows existing tracks was opened in May 2008. This trail has gone through a formal approval process where aspects such as need, land tenure, proximity to drinking water catchments and mining operations and potential to spread disease and weeds, damage or disturb rare and threatened flora, were assessed.

31.1 Visitor Activities – Scenic and Recreational Driving

Key Points

- Much of the access in the northern section of the planning area is suitable for two-wheel drive, however there are four-wheel drive only tracks available for recreational driving and areas which are not accessible to the public (see Section 30 – *Visitor Access* and Map 7).
- Driving within the planning area needs to comply with the Road Traffic Act, Control of Vehicles (Off-road Areas) Act 1978 and the CALM Regulations. Vehicles are restricted to only roads and tracks that are open public access.
- The Nanga Heritage Circuit is the most recognised four-wheel drive route in the planning area.

The objective is to provide opportunities for scenic and recreational driving while minimising impacts on the key values and conflict with other visitors.

This will be achieved by:

1. monitoring vehicle numbers and environmental impacts and, if required, developing alternative strategies to limit vehicle numbers and impacts;
2. providing information and educating four-wheel drivers, motorcyclists and those looking for 'challenging' driving experiences about the environmental impacts on the environment and actions that can be taken to minimise these impacts by encouraging the Australian National Four-wheel Drive Council's *Code of conduct for off-road driving* and the *Tread Lightly* philosophy;
3. continuing to work with local, State and national four-wheel drive clubs and associations to actively promote responsible use;
4. continuing to prohibit visitors driving off marked public access roads and tracks, except with the approval by the Regional/District Manager;
5. maintaining tracks to safe and appropriate standards and encourage the 'adopt a track' program; and
6. liaising with local shires to develop scenic and recreational driving routes.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

31.2 Bushwalking

Bushwalking can encompass everything from a short, leisurely stroll to a trek lasting days or even weeks, offering a different experience for visitors in comparison to motorised forms of access. Six categories of walking trails are recognised by Standards Australia (2001), from trails where there is no modification to the natural environment (Class 6) to broad, hard surfaced tracks suitable for wheelchair use (Class 1).

There are a number of walking tracks that provide access in the planning area (see Table 6 below and Map 8) with most tracks situated in the northern portion of the planning area. The most recognised is the Bibbulmun Track, but there are many other walking tracks provided within the planning area, ranging from short easy walks between recreation sites to an 18km hike along the King Jarrah Walk. Current Bibbulmun Track conditions and information about other walking tracks in the planning area are available on the Department's website. Walking trails in the planning area are described in Table 6 and shown in Map 8.

Some visitors to the planning area prefer 'free walks' that don't follow designated tracks but use a compass to guide to a destination. This is common among school groups. Other types of walking in the planning area include rogaining, orienteering and cross-country running (see Section 31.8 – *Adventure Pursuits*).

The impact of bushwalking on the physical environment, while generally low compared to other recreation activities, can vary depending on soil conditions, landform, vegetation type and intensity of use. Where use levels are high, bushwalking has the potential to lead to the loss of vegetation, spread of weeds and diseases such as *P. cinnamomi*, as well as localised soil compaction and erosion problems. Sensitive sites within the planning area such as granite outcrops and vegetation along riverbanks and wetland areas can be impacted by bushwalking. Usually these impacts can be effectively minimised through the sensitive location and design of paths as well as adopting environmental codes of conduct such as 'leave no trace' and minimal impact. The Department's 'Caring Code for the Bush' offers visitors a number of pre-trip safety guidelines, as well as guidelines during the trip, including rubbish disposal, toilet waste disposal and keeping to existing tracks.

There is potential to increase the number of walking tracks within the recreation area if demand warrants it (see Table 6 and Map 8). Proposed tracks include linking campsite and day use sites to other established tracks such as the Bibbulmun Track and King Jarrah Walk, redeveloping closed roads into walking tracks, developing shared trails within the planning area and upgrading some areas of tracks to wheelchair standards where appropriate. These options will be explored over the life of the plan and will aim to provide opportunities that currently do not exist in the planning area. Changes to existing trails and proposed walk trails will take into consideration the natural values, increased potential of spreading disease throughout the planning area, potential impacts on water quality and future maintenance of the trail.

Table 6. Existing and Proposed Walking Trails

Trail		Length (km)	Indicative Class (1-6)	Comments
Existing				
Bibbulmun Track	Swamp Oak to Murray	18.5	4	❖ the Bibbulmun Track stretches almost 1000km from the Perth Hills to Albany with various campsites along the way
	Murray to Dookanelly	17.7		
	Dookanelly to Possum Springs	19.3		
	Possum Springs to Yourdamung	18.6		
King Jarrah Walk		18	3	❖ is a 6-8 hour loop trail between starting at Nanga Mill along the North Junction formation, taking in the jarrah forest including a king jarrah tree and river views

Trail	Length (km)	Indicative Class (1-6)	Comments
Chuditch Walk Trail	3.8	3	❖ is a loop trail linking Nanga Mill and Nanga Townsite, passing Nanga Brook; and ❖ takes in the heritage aspects old mill and townsite
Proposed			
Murray Valley Trail	To be identified	To be identified	❖ trail to be converted from the existing Murray Valley Road alignment into a walking trail allowing passive recreation close to the river (see Table 5)

Policy guidelines for bushwalking in the planning area are identified in Policy Statement No. 18.

The Bibbulmun Track Foundation, a community based not-for-profit organisation, also provide an important support role to the Department in terms of management, track maintenance and marketing.

31.2 Visitor Activities – Bushwalking

Key Points

- There are a number of walking tracks of varying distance, time and standards in the planning area that enable the visitor to experience the natural environment at close quarters. The most recognised is the Bibbulmun Track, but there are many other walking tracks, ranging from short easy walks between day use and camping areas to an 18km hike along the King Jarrah Walk.
- Bushwalking tracks need to be designed and constructed to appropriate standards to minimise impacts on the local environment.
- The Department encourages environmental codes of conduct such as 'leave no trace' and minimal impact.
- Visitor activity trends in the planning area show a move away from water-based activities to terrestrial-based activities such as bushwalking which is already seeing a rise in participation (see Section 28 – *Visitor Opportunities*).

The objective is to provide opportunities for bushwalking while minimising impacts on key values and conflicts with other visitors.

This will be achieved by:

1. providing a range of bushwalking opportunities consistent with appropriate visitor management settings, as resources permit (see Table 6 and Map 8);
2. developing a trails plan that identifies appropriate location and design of future walking tracks;
3. designing and constructing walk trails according to Department policies;
4. undertaking risk assessment to identify and manage hazards on bushwalking trails;
5. maintaining bushwalking tracks according to the established standards;
6. introducing management controls including the issuing of permits, re-alignment or closure of tracks (temporary or permanently) for reasons of visitor safety, protection of threatened species, rehabilitation or impacts from fire;
7. providing information to visitors about bushwalking opportunities including:
   - ❖ a walk that best suits the needs and abilities of the visitors;
   - ❖ the degree of difficulty;
   - ❖ safety guidelines including party size and registration;
   - ❖ camping and campfire policy; and
   - ❖ code of conduct;
8. liaising with bushwalking interest groups (e.g. Bibbulmun Track Foundation) on development, monitoring and maintenance of walking trails; and
9. evaluate and classify existing walking trails within the planning area against Australian Standard AS2156.1-2001 as per Policy Statement No. 18.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

31.3 Cycling and Mountain Biking

Visitor activity trends indicate rapid growth in the popularity of cycling, particularly mountain biking, in and around the planning area (see Section 28 – *Visitor Opportunities*). This popularity has corresponded to an increased demand for new trails and the expansion of the current trail network on Department-managed lands (Goeft and Alder 2000).

The CALM Regulations permit cycling on public roads and vehicle tracks on lands managed by the Department, and on designated areas including bicycle paths and shared paths. On shared trails, conflicts can arise between walkers, cyclists and other track users. Such conflicts are likely to intensify as mountain biking increases in popularity and may require further management in the future. Mountain bikers generally prefer single-track trails as the narrow nature of these trails provide more opportunities for appreciation of the environment which the trail passes, and also for safety reasons by eliminating the potentially hazardous mix of vehicles and bikes and bikes and pedestrians (CALM 2006b).

There are a number of different types of mountain biking occurring in the planning area including touring, cross-country and downhill. Touring trails, such as the Munda Biddi Trail, offer long distance riding on a reasonably uniform surface conditions and manageable grades (CALM 2006b). Cross-country riding generally covers a minimum of several kilometres over varying grades. Downhill mountain biking, is a short, fast journey where vehicle ferrying is often used to take the mountain bikers back to the top of hill (CALM 2006b). In the planning area downhill mountain biking is common particularly in the Murray Valley Pine Plantation near Baden Powell and Toms Crossing. A new trail, near King Jarrah Form, is currently being developed.

The Munda Biddi Trail is Western Australia's first long distance off-road cycling trail and is quite popular among cyclists. The trail currently stretches between Mundaring and Nannup with the extension to Albany in planning. Current trail conditions and news is available on the Department's website. Similar to the Bibbulmun Track Foundation, the Munda Biddi Trail Foundation is a community based not-for-profit organisation that provides an important support role to the Department in terms of management, track maintenance and marketing of the Munda Biddi Trail.

The Department will explore options into providing access links from the Munda Biddi Trail to major recreation sites and areas of interest off the main track. For example, the Waterous Trail loops 61km off from the Munda Biddi Trail taking approximately two-days to complete, with an overnight stay at the Bidjar Ngoulin Campsite.

Any new cycling trails are to be developed using the standards detailed on the Department's Mountain Bike Management Guidelines (draft) based on the International Mountain Bicycling Association (IMBA) Standards, and guidelines provided in Policy Statement No. 18. New trails may also have a similar program to the four-wheel drive 'adopt a track' program where clubs are encouraged to make a formal commitment in maintaining and ensuring the tracks' sustainability.

Cycling and mountain biking can impact on the natural values by facilitating the spread of disease, destroying vegetation and causing soil erosion. However, confining cycling and mountain biking to roads and trails that are appropriately located, designed, maintained and managed will minimise the impacts on natural values. Due to its aggressive nature, downhill riding in particular needs to be located in areas where environmental impacts are manageable. The Department also encourages trail users to follow the 'leave no trace' and IMBA principles (available on the Department's website) when cycling in the planning area. This includes not building structures for mountain biking. Such structures create a visitor risk issue and are not permitted in the planning area.

31.3 Visitor Activities – Cycling and Mountain Biking

Key Points

- Cycling and mountain biking trails need to be designed and constructed to appropriate standards to minimise impacts on the local environment.
- The main types of mountain biking in the planning area are touring (e.g. the Munda Biddi Trail), downhill (e.g. in the Murray pine plantation near Baden Powell and Toms Crossing) and cross-country.
- Visitor activity trends for the region indicate an increase in terrestrial-based activities, such as mountain biking, which is already seeing a rise in participation in the planning area (see Section 28 – Visitor Opportunities).
- The Department encourages environmental codes of conduct such as 'leave no trace' and IMBA principles (available on the Department's website).

The objective is to provide opportunities for cycling and mountain biking while minimising impacts on the key values and conflicts with other visitors.

This will be achieved by:

1. developing a trails plan that identifies appropriate location and design of future cycling tracks;
2. providing a range of cycling opportunities consistent with appropriate visitor management settings and as resources permit;
3. locating, constructing and maintaining all tracks in accordance with established planning procedures, environmental controls and standards;
4. undertaking risk assessment to identify and manage hazard associated with cycling;
5. introducing management controls including the issuing of permits, re-alignment or closure of tracks (temporary or permanently) for reasons of visitor safety, protection of threatened species, rehabilitation or impacts from fire;
6. providing information to visitors about cycling opportunities including:
   - a cycle path that best suits the needs and abilities of visitors;
   - the degree of difficulty including party size and registration;
   - camping and campfire policy; and
   - the code of conduct;
7. educating and providing information for cyclists, particularly about the impacts on the environment and actions that can be taken to minimise these impacts through encouraging the 'leave no trace' and International Mountain Bicycling Association (IMBA) principles; and
8. liaising with cycling and mountain biking interest groups (e.g. Munda Biddi Trail Foundation) on development, monitoring and maintenance of cycling and mountain biking trails.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

31.4 Day use

A 'day use' area is any recreation site designed specifically for day visits. These sites usually provide opportunities for picnicking and barbequing, but can often have other facilities such as lookouts, interpretation and amenities such as toilets and rubbish bins. Since the release of the *Lane Poole Reserve Management Plan 1990-2000*, the focus of day use activities has changed, reflected in an altered utilisation of day use sites. Trends show a migration away from traditional picnicking and barbequing, to a growing visitor demand in using day use sites to start a new activity (R. Annear *pers. comm.* 2006). Day use sites in the planning area (see Map 6) have become the focus for other nature-based leisure activities such as canoeing, bushwalking, cycling, scenic and recreational driving and observing nature.

Some camping areas also have a day use function but catering for more than one use at some sites can occasionally lead to conflicts between visitors unless adequate provision is made for the different visitor types. Day use sites range from natural sites such as small clearings with little or no facilities to well-developed sites with many facilities that are generally provided in the more developed settings. Brochures (e.g. *Your guide to Lane Poole Reserve*) and 'Park Notes' provide information to visitors about the facilities available at day use and camping sites.

A variety of day use experiences are provided at a number of recreation sites in the planning area so that a wide range of visitors can appreciate the variety of natural values. Taking into consideration visitor use and any environmental constraints and concerns, the Department evaluates day use facilities at existing sites to see if they need to be expanded and/or upgraded, such as the Baden Powell day use area will be redeveloped and expanded. Any redevelopment of day use sites will take into consideration the visitor management settings, visitor activities, visitor safety (see Section 33 – *Visitor Safety*) and designing sites to minimise impacts on the environment. For example, a site that is adjacent to a relatively intact, rich natural area, such as Yarragil, will be designed to offer more of a remote, natural experience than a site such as Nanga Mill, which is easily accessible and has significant historic cultural heritage value. Visitors will be able to choose from sites in a variety of settings. All visitors will have an opportunity to choose a site that suits their preference. Day use sites will follow the guidelines identified in Policy Statement No. 18.

Some day use sites (e.g. Island Pool, south of the Murray River) are showing signs of degradation such as bank erosion and soil compaction as a consequence of high usage. Due to these impacts, the Island Pool day use site

on the southern side of the Murray River will be closed with an option to re-design and reconstruct a smaller day use facility in the future. To offset this, further development will occur at Island Pool day use site on the north side of the Murray River. Proposed changes to day use sites are identified in Table 7.

Table 7. Proposed Changes to Day Use Sites

Day Use Site[1]	Proposed Changes to the Existing Day Use Site[2]	Management Setting[3]
Baden Powell	❖ expand day use site utilising the area of the existing campsite; and ❖ develop controlled and hardened access points to the river	Highly modified
Island Pool	❖ rest the site south of the Murray River; ❖ improve river access points at the site north of the Murray River; and ❖ link to the Chuditch campsite	Recreation
The Stringers	❖ close this site to camping in the short term; and ❖ maintain as day use site	Recreation

[1] = only day use sites with proposed changes are listed in this table, see Map 6 for locations of all sites
[2] = proposed changes to day use sites will made in conjunction with proposed changes to adjoining campsites if applicable
[3] = refer to Appendix 9 for a description of the visitor management settings

The southern part of the planning area is mainly a Disease Risk Area (see Section 24 – *Diseases*) and with parts also a priority 1 public drinking water source area, visitor access and recreational opportunities to the area is restricted (see Section 30 – *Visitor Access*). There are a number of cultural sites in this part of the planning area such as old timber mills, settlements and water features (see Section 27 – *Non-indigenous Heritage*). While they do not offer facilities like those in the more developed northern section, they do offer unique cultural experiences. Access to sites in the Disease Risk Area requires a permit.

For information of campfires see Section 31.5 – *Overnight Stays*.

31.4 Visitor Activities – Day Use

Key Points

- A 'day use' area is any recreation site designed specifically for day visits and may provide opportunities for picnicking and barbequing, but can often have other facilities such as lookouts, interpretation and amenities such as toilets and rubbish bins.
- Any redevelopment of day use sites will take into consideration the visitor management settings, visitor activities, visitor safety (see Section 33 – *Visitor Safety*) and designing sites to minimise impacts on the environment.
- Table 7 summarises the proposed changes to the existing day use sites.
- Trends show a migration away from traditional picnicking and barbequing, to a growing visitors demand in using day use sites to start a new activity (R. Annear *pers. comm.* 2006). Day use sites in the planning area have become the focus for other nature-based leisure activities such as canoeing, bushwalking, cycling and observing nature.

The objective is to provide opportunities for visitors to stay during the day at sites that are appropriately designed, encourage visitor enjoyment whilst minimising impacts on the key values or cause conflicts with other visitors.

This will be achieved by:

1. designing and developing day use areas in accordance with Department policies, site capability, and in line with the visitor management setting of the area;
2. undertaking risk assessment to identify and manage hazards associated with day use;
3. maintaining day use areas according to the established standards, allowing resting of 'tired' sites; and
4. providing information to visitors about day use opportunities.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

31.5 Overnight Stays

Many people staying overnight on lands managed by the Department desire to stay in attractive surroundings with a survey showing 85.3% of visitors to the planning area camp overnight (CALM 2005b). Overnight stays may be catered for through the provision of camping facilities or by built accommodation. The Department's Policy Statement No. 18 provides detailed guidelines on accommodation and camping.

Local towns and some neighbouring land-holders provide various forms of built accommodation, ranging from bed and breakfasts, hotels, chalets and places able to accommodate large groups. Such places offer more conveniences and facilities than those provided for in the planning area. In the planning area the Department provides both areas with basic accommodation and camping facilities where visitors can stay overnight in natural settings.

Camping

Camping is a common and popular activity that provides a range of social benefits, including an awareness and understanding of the natural environment. The demand for camping within natural areas often varies from individuals seeking solitude, inspiration or self-reliant recreation to large semi-organised groups. Camping is often associated with nearby day use recreational activities or scenic attractions.

There are 15 sign posted camping areas within the planning area, providing different camping opportunities such as vehicle-based camping (10 areas) under the pines at Nanga Mill, near the river at Baden Powell to individual bush campsites at Chuditch, campsites accessible by walking (four sites along the Bibbulmun Track) and a campsite accessible by cycling (along the Munda Biddi Trail). All camping areas are heavily used and filled to capacity during peak periods such as over Easter, on long weekends and on weekends throughout summer. Numerous school groups also stay in the planning area for a week at a time all year-round.

The most used campsites are Baden Powell, Nanga Mill and Charlie's Flat followed by Stringers, Tony's Bend and then Yarragil (A. Bowlay *pers. comm.* 2005). Overuse from camping, in combination with other visitor activities is degrading the fragile riverine vegetation, particularly in the vicinity of camping and day use sites (e.g. at Charlie's Flat and Yarragil where erosion and soil compaction are evident). The existing camping areas have been heavily used throughout their lifetime. A strategic 'rotational' management program will be used to ensure that 'tired' camping areas will be rested and allowed to rejuvenate, upgraded or maintained to appropriate standards where necessary. In addition, proposed new developments at existing sites will assist in alleviating the pressure currently placed on high use sites such as Baden Powell and Nanga Mill and will add to the variety of experiences in the planning area (see Table 8).

Caravan camping is provided for at Nanga Townsite and in nearby townsites such as Dwellingup.

Various conditions can apply in camping areas including curfews for loud music and use of generators (DEC 2008a) and presence of dogs (see Section 34 – *Domestic Animals*). These will be considered for some of the camping areas over the life of the plan.

In addition to sign posted camping areas, there are opportunities for remote camping[21] in areas accessed by foot or canoe (i.e. not vehicle-based camping). Remote camping is permitted with the approval from the relevant District manager. This is to aid in management and for the safety of visitors, particularly during reserve closures (e.g. bushfire threat). Facilities (e.g. toilets, shelters) are not provided for remote camping and visitors are encouraged to 'leave no trace' as they are at all camping and day use areas. Further guidelines for remote camping are provided in Policy Statement No. 18.

Informal vehicle-based camping[22] is not permitted in the planning area as per the CALM Regulations. There are some instances where Department-approved informal vehicle-based camping can take place, however, there are numerous sign posted camping areas in the planning area where visitors can experience vehicle-based camping. At present, there is no booking system for campsites. Allocation is on a first come, first served basis, with the visitors turned away when the planning area is deemed to have reached capacity. During the life of the plan, it is intended that visitors will be able to book campsites by telephoning the Department's Dwellingup Office or via the Department's website. Visitors will have access to information on what accommodation is available and its location. Camping fees apply in the planning area.

[21] Remote camping is sometimes referred to as 'wild' or 'backpack' camping. This type of camping cannot occur within 2km of sign posted or designated camping areas and campfires are not permitted.

[22] Vehicle-based camping in areas that are not sign posted for camping or designated as camping areas.

In the planning area, huts are also provided for cyclists along the Munda Biddi Trail at the Bidjar Ngoulin Campsite and for walkers along the Bibbulmun Track at the Dookanelly, Swamp Oak and Yourdamung campsites, with the Possum Springs Campsite located on State forest adjoining the planning area between the Dookanelly and Yourdamung campsites.

It is also proposed that between Driver Rd and Scarp Pool campsites with Bibbulmun Track style huts/shelters and river access points for canoe based camping could be developed. Any new facilities would need to demonstrate that they would not negatively impact on the natural or cultural values of the planning area and be built and maintained in accordance with Department policy.

Table 8. Proposed Changes to Campsites

Campsite	Access	Proposed Changes to the Existing Campsite[1]	Management Setting[2]
Baden Powell	2WD	❖ develop a new camping area on the saddle above Baden Powell; and ❖ redevelop the present camping area as a day use area	Highly modified
Bidjar Ngoulin Campsite (Munda Biddi Trail)	Cycling	❖ re-design existing campsite to accommodate the increasing numbers of Munda Biddi Trail users, if demand warrants it	Recreation
Charlie's Flat	2WD	❖ close and rest this site after Yarragil has been redeveloped; and ❖ realign River Road upslope to create space for future expansion of the camping area	Recreation
Chuditch	2WD	❖ develop second camping loop to the north of Chuditch campsite	Highly modified
Dookanelly Campsite (Bibbulmun Track)	Walking	❖ re-design existing campsite to accommodate the increasing numbers of Bibbulmun Track users	Recreation
Icy Creek	2WD	❖ maintain the secluded character of Icy Creek and offer a range of styles of accommodation from tent sites to bush cabins as well as other support facilities such as showers, shelter and kitchen (see *Built Accommodation* subsection)	Highly modified
Murray Campsite (Bibbulmun Track)	Walking	❖ re-design existing campsite to accommodate the increasing numbers of Bibbulmun Track users	Recreation
Nanga Mill	2WD	❖ upgrade present camping opportunities and improve visitor safety; ❖ Poplars area: plant trees to extend shaded area; ❖ develop an open, social camping area; ❖ school site area: maintain camping opportunities; and ❖ re-design and redevelop camping area	Highly modified
Nanga Townsite	2WD	❖ plant trees to extend shaded area; and ❖ develop a large camping area in three parts	Highly modified
Swamp Oak Campsite (Bibbulmun Track)	Walking	❖ re-design existing campsite to accommodate the increasing numbers of Bibbulmun Track users	Recreation
The Stringers	2WD	❖ close this site to camping in the short term; and ❖ maintain as day use site	Recreation
Tony's Bend	2WD	❖ maintain camping area as at present; and ❖ close for rejuvenation period following the reopening of Charlie's Flat	Highly modified
Yarragil	2WD	❖ develop a large new camping area with	Recreation

Campsite	Access	Proposed Changes to the Existing Campsite[1]	Management Setting[2]
		'bushy' character	
Yourdamung Campsite (Bibbulmun Track)	Walking	❖ re-design existing campsite to accommodate the increasing numbers of Bibbulmun Track users; ❖ investigate creating an interpretive loop trail from the campsite to Yourdamung Lake and bird hide	Recreation

[1] = proposed changes to campsites will made in conjunction with proposed changes to adjoining day use sites, if applicable.
[2] = refer to Appendix 9 for a description of the visitor management settings.

Campfires

Campfires[23] provide a focal point for social interaction and too many visitors are traditional and valued parts of their camping experience. The weather in the planning area is often cold and wet with a campfire providing much wanted warmth and comfort to campers. However, the collection of firewood (see Section 38 – *Forest Produce*) and escapes from campfires (see Section 25 – *Fire*) are of particular concern for managers.

Within the planning area, fire rings and barbeque plates for campfires are available at most campsites. There are three campsites in the planning area at which visitors are not permitted to light campfires. Yourdamung Campsite along the Bibbulmun Track and Bidjar Ngoulin Campsite along the Munda Biddi Trail are 'no fire' site to reduce the fire risk of bushfire in the area, with visitors encouraged to bring their own fuel stove. This is also the case for remote camping. At the Chuditch camping area, campfires are also prohibited but there are free gas barbecues provided for visitors to use.

The lighting of campfires is subject to the relevant provisions of the Bush Fires Act, the CALM Act and CALM Regulations. Campfires within the planning area can only be lit in authorised fireplaces (i.e. fire rings provided in sign posted campsites or day use areas). Furthermore, an annual total fire ban prohibits the lighting of campfires in the planning area from 15 December to 15 March[24] inclusive, under the Prohibited Fire Regulations set by local shires. Low rainfall and/or hot conditions may see fire bans extended beyond these dates. Campers are encouraged to bring their own gas stoves during this period.

Built Accommodation

Built accommodation is provided within the reserve at the Icy Creek Environmental Education Facility (Icy Creek), which was purpose built to cater for environmental studies by schools and community groups. During the 2006/2007 financial year, Icy Creek accommodated approximately 5000 visitors, nearly 80% more than in 2000/2001. Icy Creek is unique in the planning area as it is a powered site that generates its electrical needs from solar power, supplemented by a diesel generator. Visitors, not limited to educational groups, can book Icy Creek accommodation by telephoning the Department's Dwellingup Office or in the future via the Department's website. Icy Creek also includes the residence for the Lane Poole Reserve Ranger.

Icy Creek will be impacted by the noise of nearby mining operations (see Section 37 – *Mineral and Petroleum Exploration and Development*). As such, built accommodation will be unavailable until mining in the nearby areas has concluded. Future development options for Icy Creek will be reviewed over the life of this management plan.

31.5 Visitor Activities – Overnight Stays

Key Points

- Camping areas within the planning area can reach capacity during peak times.
- Built accommodation in the planning area includes the Icy Creek Environmental Education Facility and huts along the Bibbulmun Track and Munda Biddi Trail.
- Table 8 summarises the proposed changes to the existing campsites.
- Camping fees apply in the planning area.
- Visitors are encouraged to 'leave no trace'.
- Within the planning area, fire rings and barbeque plates for campfires are available at most campsites and day use sites.

[23] The lighting of campfires is subject to section 25 of the Bush Fires Act.
[24] Note: dates subject to change – dependent on weather conditions.

- Yourdamung Campsite along the Bibbulmun Track and Bidjar Ngoulin Campsite along the Munda Biddi Trail are no fire sites (visitors are encouraged to bring their own fuel stove) and Chuditch campsite also prohibits campfires but provides free gas barbecues for visitors to use.
- Campfires within the planning area can only be lit in authorised fireplaces (i.e. fire rings provided in sign posted campsites or day use areas).
- An annual total fire ban prohibits the lighting of campfires in the planning area from 15 December to 15 March, inclusive, under the Prohibited Fire Regulations set by local shires.

The objective is to provide opportunities for overnight stays in appropriately designed built accommodation and campsites, while facilitating visitor enjoyment and minimising impacts on the key values and conflicts with other visitors.

This will be achieved by:

1. designing and developing camping areas and built accommodation in accordance with Department policies, site capability, and in line with the visitor management setting of the area;
2. providing a wide range of camping areas and built accommodation opportunities for individuals and groups consistent with the appropriate visitor management settings and resources;
3. undertaking risk assessment to identify and manage hazards associated with camping areas and built accommodation;
4. maintaining camping areas and built accommodation according to the established standards and allowing resting of 'tired' sites;
5. permitting camping in the designated sites shown in Table 8 and on Map 6 and upgrading/re-designing or closing sites according to current visitor needs, visitor safety, environmental impacts, rehabilitation or impacts from fire;
6. providing information to visitors about camping areas and built accommodation opportunities including:
   - location of camping areas, built accommodation and facilities available;
   - fees;
   - campfire policy; and
   - the code of conduct;
7. conducting social research to ensure that camping and built accommodation meets current and emerging visitor needs;
8. exploring the possibility of designating campsites as generator free areas and curfew areas;
9. implementing a booking system for campsites;
10. evaluating the remote campsites on their impact on the environment and managing as required (e.g. permits, closing impacted sites);
11. reviewing future development options for Icy Creek;
12. permitting campfires in designated fireplaces (i.e. provided fire rings) and only outside the total fire ban days and season;
13. encouraging the use of portable fuel stoves by campers;
14. replacing wood-fired barbecues with gas-fired facilities where appropriate; and
15. providing information on the use of campfires, including the environmental impacts of firewood collection and appropriate use during fire danger periods

Key Performance Indicators:
There are no Key Performance Indicators for this section.

31.6 Water-based Activities

The Murray River is a focal point for many of the recreational pursuits within the planning area, especially as the river is one of the few un-dammed major river systems in the Northern Jarrah Forest. It is predicted that the type of visitors to the planning area may change with the changing climate and reduced stream flows, moving away from water-based activities (see Section 28 – *Visitor Opportunities – Visitor numbers and Trends*).

Canoeing, kayaking and white, fast and flat water rafting is best in spring when water levels are high enough for easy passage. Commercial tourism operators also operate in the planning area, providing opportunities for visitors to partake in these activities. Power-boating is not permitted within the planning area, however, alternative areas are available to powerboat users outside the planning area.

Visitors are encouraged to use specified canoe launching sites along the Murray River to avoid degradation of the riverbank.
Canoe-based camping is also an activity gaining interest in the planning area. There is a proposal to develop a Murray River canoe trail in the future which would offer Bibbulmun Track style huts and river access points between Driver Road and Scarp Pool.

Swimming in the Murray River is one of the more popular recreational activities undertaken within the planning area and often associated with the camping and day use experience. There are many recreation sites that provide easy access to rivers where visitors can swim, with Baden Powell the most popular site for visitors.

Policy Statement No. 18 provides guidance for water-based activities on Department-managed lands. See also Section 33 – *Visitor Safety*.

31.6 Visitor Activities – Water-based Activities

Key Points

- The Murray River is a focal point for many of the recreational pursuits within the planning area, especially since the river one of only three major un-dammed river systems in the Northern Jarrah Forest.
- Visitors are encouraged to use canoe launching sites along the Murray River to avoid degradation of the riverbank.
- Power-boating is not permitted within the planning area however, alternative areas are available to powerboat users outside the planning area.
- Swimming in the planning area is one of the more popular recreational activities undertaken within the planning area as it is seen as an activity important to the camping and day use experience visitors seek.

The objective is to provide opportunities for recreational water-based activities while minimising impacts on the key values and conflicts with other visitors.

This will be achieved by:

1. prohibiting motorised boating;
2. providing information (e.g. signs and interpretation) to visitors about canoe launching sites, including information on visitor safety; and
3. rationalising and evaluating the canoe launching facilities for appropriateness and safety and upgrading where appropriate.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

31.7 Recreational Fishing and Marroning

Recreational fishing and marroning are two popular recreation pursuits in the planning area. The DoF regulate size, bag limits, gear controls, closed seasons and licensing in accordance with the Fish Resource Management Act. Recreational fishing licences from DoF are required by recreational fishers fishing for all freshwater fish in waters south of Greenough (29^{o}S) and above the tidal influences including all lakes, dams, rivers and their tributaries and for marroning (DoF 2005). The CALM Act, CALM Regulations and Policy Statement No. 18 provide management guidelines for recreational fishing in terrestrial reserves.

Recreational fishers in the planning area target introduced trout, redfin perch (see Section 23 – *Introduced and Other Problem Animals*) and the native freshwater cobbler. The Murray River is one of a few rivers open to trout fishing year-round however, trout fishing on the tributaries of the Murray River is prohibited during the closed trout fishing season (1 May – 30 August) (DoF 2005). In 2004/05, DoF issued 3469 specific freshwater angling licences in the Southern Inland Bioregion plus more than 13,000 umbrella licences[25] in WA (DoF 2006). Marroning at the time of writing is only permitted for 24 days of the year, spanning late January to early February, in the Murray River although illegal marroning out of season still occurs. In 2005 DoF issued 7040 specific marron licences in the Southern Inland Bioregion plus more than 13,000 umbrella licences (DoF 2006). The influx of people to the planning area during the marroning season can have a significant impact on the

[25] Umbrella licences is a combined licence that enables recreational fishers to participate in all five licensed recreation fisheries including rock lobster, abalone, netting, freshwater angling and marron.

riparian zone of the river, as people put in and retrieve their nets. Marron are not indigenous to the Murray River (see Section 23 – *Introduced and Other Problem Animals*).

In gazetted public drinking water source areas such as the Samson Brook Catchment Area and the Harris Dam Catchment Area, the CAWS Act by-laws provide for the prevention of pollution of water, which includes restricting fishing and marroning. Areas affected have signage and/or gates and fences to restrict access.

31.7 Visitor Activities – Recreational Fishing and Marroning

Key Points

- Recreational fishers in the planning area target introduced trout, redfin perch (see Section 23 – *Introduced and Other Problem Animals*) and the native freshwater cobbler species.
- Marroning is only permitted for 24 days of the year, spanning late January to early February.
- The DoF regulate size, bag limits, gear controls, closed seasons and licensing. Recreational fishing licences from DoF are required by recreational fishers fishing for all freshwater fish in the planning area.
- Fishing and marroning restrictions are in place in the Samson Brook and the Harris Dam catchment areas.

The objective is to allow sustainable recreational fishing and marroning while minimising impacts on the key values and conflict between visitors.

This will be achieved by:

1. allowing recreational fishing and marroning in accordance with Department policies and other relevant legislation (e.g. DoF regulations and the CAWS Act by-laws);
2. providing information to visitors about recreational fishing and marroning opportunities that provides:
3. the location of safe sites for recreational fishing and marroning; and
4. the code of conduct;
5. monitoring the impacts of recreational fishing and marroning on riparian vegetation and erosion of stream banks; and
6. liaising with DoF with regards to fishing and marroning.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

31.8 Adventure Pursuits

Adventure pursuits including geocaching, rogaining, orienteering, cross-country running are increasing in popularity around the State and in the planning area.

Geocaching is relatively new to Australia involving the use of a Global Positioning System (GPS) to locate hidden containers (caches). Individuals and organisations set up caches all over the world and share the locations of these caches on the internet where people can use coordinates to locate a cache. Problems associated with geocaching include localised environmental impacts when caches are hidden in sensitive locations and also when people damage vegetation of an area in hunt for the cache.

Rogaining is a long distance (approximately 12-24 hours in duration) cross-country navigation event including overnight camping. Participants on foot visit control points (varying in point value depending on difficulty in accessing the area) on a course in any order, the aim being to accumulate the highest number of points possible. As the event area is quite large and is only used once with participants spread over the area, the level of environmental impact is generally quite low.

Similarly to rogaining, orienteering is an organised activity that requires participants to visit, on foot, a number of control points, but in a given sequence in the shortest time. Cross-country running is also a foot race but along a marked course.

In accordance with the CALM Regulations it is an offence to, without lawful permission, organise, promote or conduct any event involving rogaining, orienteering and cross-country running in the planning area. Permission can be obtained from local Department Offices. Suitability of the area and activity will be considered before permission is granted based on the proposed intensity, frequency and timing of the event and impact on the

planning areas key values and visitor safety (also see Section 31.11 – *Non-commercial, Education and Not-for-profit Activities*).

Abseiling can involve large groups and is often used as a motivational or team building exercise. The participants do not necessarily have experience in abseiling and group instructors have a responsibility to ensure the safety of all members of the group. This requires certain minimum standards of experience and competency in instructors and acceptable student-to-instructor ratios.

People conducting commercial abseiling on Department-managed lands must obtain a commercial activity licence, requiring them to meet certain minimum standards of experience and competency in instructors. All commercial operators, as well as not-for-profit groups conducting abseiling with dependent participants (such as school groups, scout groups, community groups, or youth groups) must also use leaders who are registered under the National Outdoor Leader Registration Scheme or hold current equivalent accreditation recognised by the Department[26]. Under regulation 33 of the CALM Regulations, a person must not, without lawful authority, abseil on Department-managed land except in a designated area. There is potential for abseiling in the planning area down large trees, however, at the time of writing there are no designated abseiling sites in the planning area.

Policy guidelines for adventure pursuits in the planning area are identified in Policy Statement No. 18.

31.8 Visitor Activities – Adventure Pursuits

Key Points

- Adventure pursuits including geocaching, rogaining, orienteering, cross-country running and abseiling are increasing in popularity around the State and in the planning area.
- In accordance with the CALM Regulations it is an offence to, without lawful permission, to organise, promote or conduct any event involving rogaining, orienteering and cross-country running or to abseil. Permission can be obtained from local Department Offices.

The objective is to provide opportunities for adventure pursuits while minimising impacts on the key values and conflict with other visitors.

This will be achieved by:

1. continuing to allow rogaining, orienteering and cross-country running, subject to permission being obtained from the local Department Office; and
2. managing abseiling according to the abseil permit system, the Department's Policy Statement No. 18 and the CALM Regulations;
3. removing caches from environmental sensitive areas or in areas that have been significantly damaged by the activity. This would also include posting the removal of the cache on the geocaching website or sign-posting the area.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

31.9 Horse-riding

Horse-riding is another activity sought after in natural environments. However, horse-riding creates the potential for horses to spread and introduce weeds, parasites and diseases (e.g. *P. cinnamomi*); trample or graze on native flora; increase soil erosion; siltation or fouling of watercourses; disturbance of native fauna and the potential for conflicts with other visitors.

To minimise these risks, horse-riding is permitted in the planning area on the Les Couzens Bridle Trail (see Map 8) which extends outside the planning area to the Dwellingup Townsite, and on fire access tracks.

Policy Statement No. 18 provides guidelines on horse-riding on Department-managed lands.

31.9 Visitor Activities – Horse-riding

Key Points

[26] The Abseiling Instructors Certificate and Professional Association of Climbing Instructors schemes are currently regarded as equivalent to National Outdoor Leader Registration Scheme.

- Horse-riding is permitted on the Les Couzens Bridle Trail and on fire access tracks in the planning area.

The objective is to provide horse-riding opportunities while minimising impacts on key values and conflicts with other visitors.

This will be achieved by:
1. manage horse-riding so the activity does not impact greatly on the overall values of the planning area;
2. permitting horse-riding on designated trails; and
3. encouraging horse-riding in areas outside the planning area that are able to sustain this activity.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

31.10 Special Events

Requests for special events occasionally arise from a variety of organisations from school groups, clubs, community groups, and recreational and sporting associations. Special events often involve large groups of people who require accommodation, suitable access, an established network of tracks and adequate facilities, such as parking and toilets. In general, many group activities and events are an acceptable use of conservation estate, provided that they are:

- sensitively located to maintain values;
- properly planned and managed;
- do not unduly interfere with other forms of recreation; and
- are not resource-demanding on the Department.

Special events must be consistent with the Department's Policy Statement No. 18 and are subject to approval from the Department and, in some cases, the Conservation Commission. Other relevant authorities, such as the DoW and Department of Health, may also have an interest in an application, such as areas where the Statewide Policy 13 – *Policy and Guidelines for Recreation within Public Drinking Water Source Areas on Crown Land* (WRC 2003a) and relevant drinking water source protection plans may apply. Where requests are made to conduct special events for activities that are inconsistent with these policies, the event must be of national significance and approval is required from the Conservation Commission.

The suitability of any special event will be assessed on a case-by-case basis and considered against the following general criteria:

- protection of key values;
- susceptibility of soils to erosion and disturbance;
- safety and enjoyment of all visitors to the planning area as well as those who partake in the event;
- the availability of suitable facilities such as car parking areas, camping grounds, toilets, and barbeque areas;
- risk to water quality;
- potential to spread disease - strict hygiene controls must be enforced to eliminate the risk of disease spreading further in the planning area;
- the overuse of sensitive areas; and
- past history of use and compatibility with Departmental operations.

Where an event is approved, general conditions will require proponents to adhere to strict hygiene controls where appropriate to reduce the risk of spreading disease and weeds. At the completion of the event, proponents are also required to remove any temporary fixtures, signage or facilities constructed/installed for the event, and rehabilitate any areas of site disturbance (see Section 39 – *Rehabilitation*). Before events are approved, the availability of suitable areas outside the planning area will be considered. Limits or restrictions may be placed on events to assist in meeting the above criteria. This may result in an alternative location for the event, limitations on the number of events or participants, changes to the conditions of approval or prohibition of the event where its use is deemed inappropriate.

In the past, roads in the northern part of the planning area have been used for Rally Australia. Such activity may be inconsistent with the protection of natural values of these areas or with the enjoyment and safety of the public who visit these areas. While this activity is an exciting sport for competitors and spectators alike and has some social and economic benefits, the level of environmental impact needs to be considered. Competitive rallies and

other motor sports may be approved in CALM Act section 5(1)(g) and (h) reserves subject to assessment of the criteria stated above.

The Nanga Challenge (a triathlon-like event consisting of a paddle, mountain bike and run legs), Murray White Water Festival and enduro horse-riding are examples of special event held in the northern recreation section of the planning area.

31.10 Visitor Activities – Special Events

Key Points

- Requests may be made to the Department to undertake 'one-off' special events within the planning area, which require accommodation, suitable access, an established network of tracks and adequate facilities, such as parking and toilets.
- Special events will be assessed on a case-by-case basis and may be permitted in sections of the planning area subject to approval from the Department, other relevant authorities and where necessary, the Conservation Commission.

The objective is to provide opportunities for organised special events that facilitate visitor enjoyment, appreciation and understanding of the key values while minimising impacts on key values and conflicts with other visitors.

This will be achieved by:

1. assessing special events on a case-by-case basis and permitting them where the activity is consistent with Department policies and site capability. Applications, including the event status (club, State or national), timing, and the number of competitors and observers expected, should be of sufficient detail to enable thorough evaluation of environmental and social issues; and
2. undertaking environmental and social auditing after a special event to identify any environmental impacts or conflicts with other visitors.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

31.11 Non-commercial, Education and Not-for-profit Activities

Non-commercial, educational and not-for-profit groups have the potential to offer experiences and services to visitors that would not otherwise be available, and use the planning area on a regular basis to conduct bushwalking, camping, leadership, outdoor education and personal development programs. They may also be able to provide access to visitors with special needs (for example, visitors with physical disabilities), deliver interpretation and education messages that foster enjoyment, appreciation and understanding of the planning area, or assist with other Department operations. In the past, school groups have assisted in removing weeds from parts of the planning area.

The Department requires all organised non-commercial, educational and not-for-profit groups thoroughly plan their activities and gain permission from the local District office before undertaking their activities as per the guidelines set out in Policy Statement No. 18. Groups using the planning area range from well-organised, multi-national organisations that have trained staff and codes of practice to small school groups with varying levels of preparation and expertise. Areas within the planning area that offer the best conditions for such activities generally coincide with areas favoured by other visitor groups, which can lead to competition or conflict between groups wanting to use the same area, although some groups favour unhardened remote camping in natural areas with no facilities.

A number of groups (including school groups) rely on using parts of the planning area to facilitate their outdoor education program and other activities. Icy Creek and other local accommodation can also provide for non-commercial, educational and not-for-profit activities.

The Department is keen to continue building relationships with non-commercial, educational and not-for-profit groups.

Policy guidelines for non-commercial, education and not-for-profit activities in the planning area are identified in Policy Statement No. 18.

31.11 Visitor Activities – Non-commercial, Education and Not-for-profit Activities

Key Points

- Non-commercial, education and not-for-profit groups have the opportunity to provide visitors with experiences that would not be available otherwise.
- The Department requires all organised non-commercial, educational and not-for-profit groups to gain permission from the local district office before undertaking their activities.

The objective is to provide opportunities non-commercial, education and not-for-profit groups to undertake activities that do not adversely impact on the key values or cause conflict with other visitors.

This will be achieved by:

1. managing non-commercial, education and not-for-profit activities in accordance with Department policies and site capability;
2. providing group camping areas that cater for non-commercial, education and not-for-profit groups, as well as the general public and other visitor groups, as required;
3. introducing a booking system for non-commercial, education and not-for-profit groups to avoid overuse and conflict between other visitors; and
4. exploring opportunities for non-commercial, education and not-for-profit groups to contribute to management by organising or participating in service projects such as rehabilitation, weed control, rubbish collection, the delivery of education and interpretation programs or other activities.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

32. COMMERCIAL TOURISM OPERATIONS

Commercial concessions can help meet the rising demand for high quality recreation and tourism opportunities, facilities and services, while ensuring that financial contributions from tourism help the Department meet the costs of managing the natural resource. A commercial concession is a 'right granted by way of a lease, licence or permit for occupation or use under appropriate conditions, of an area of land or water managed by the Department for the purposes of the provision of appropriate facilities and services for visitors' use and enjoyment'. Commercial concessions must be consistent with the purpose of the reserve, the protection of its values and with the objectives of this plan. The Department's Policy Statement No. 18 governs conditions for commercial concessions.

Licences

Licences allow operators to access and use lands and waters managed by the Department. All private tour operators conducting commercial tourist activities on Department-managed land are required to obtain a licence in accordance with the CALM Act and CALM Regulations. Licensing enables the Department to monitor access and use of lands and waters under its control, and ensure that the key values of these areas are maintained.

The Department issues two types of licences, depending on the nature of the activity, the security of the resource, and the risk to the participants. 'T Class' licences are issued where environmental and visitor management objectives can be achieved through the implementation of licence conditions, and most commonly applies to low-impact vehicle-based operations, such as Commercial Tour Operators (CTOs). 'T Class' licences can be issued for one, three or five-year periods based on the level of registration with recognised accreditation tourism programs. 'E Class' licences are issued where there is safety, environmental or management concerns, and hence the number of licences needs to be restricted. Generally 'E Class' licences are issued following a formal 'Expression of Interest' process.

CTOs need to be licensed in order to take groups into the planning area for a number of different activities and experiences, ranging from canoeing and kayaking, to bushwalking and camping. Not all of the operators licensed to operate in the planning area actually run tours or activities in the area. In the planning area, all operators have standard T Class licences, except for one T+ licence for an operator that provides horse-riding tours subject to additional licence conditions.

The southern part of the planning area provides opportunities for undertaking guided tours. With restricted access due to the Disease Risk Area (see Section 24 – *Diseases*) and in public drinking water source areas, recreational opportunities are limited (see Section 30 – *Visitor Access*) but guided tours provided by a CTO would showcase this part of the planning area's natural (e.g. jarrah forest and water features such as Yourdamung and Nalyerin lakes) and cultural (e.g. old timber mills, settlements and bridges) attributes.

There may be a demand for an increase in services provided by commercial operators during the life of the management plan. However, they will not be permitted to the point where other users become excluded or compromised, or where they have an impact on the natural and cultural values of the planning area.

Conditions apply to all licences to minimise the environmental impacts of activities, or to aid in management of the value being appreciated by the public. Managers consider the following factors before issuing licences:

- infrastructure requirements of tour operations (e.g. adequate toilet facilities, access and parking for large vehicles);
- potential impacts to water quality;
- visitor safety;
- competence of group leaders;
- the potential damage to sensitive areas and wildlife; and
- the appropriateness of retail concessions in particular natural environments.

Guidance for the general conditions for tour operators on Department-managed lands is provided for in the Department's *Tour Operator Handbook* (DEC 2008b).

Leases

Leases are formal agreements that allow exclusive use of land. They are issued when the activity or land use involves significant infrastructure and/or retailing. A lease allows a lessee to occupy a particular area of land and hence provides security to protect significant investments.

There are two types of leases issued on lands and waters managed by the Department:

- forest leases granted under section 97 of the CALM Act; and
- leases for other lands and waters covered by the CALM Act, granted under section 100 of the CALM Act. This includes national parks, conservation parks and section 5(1)(g) and (h) reserves.

Leases may be up to 21 years with an option of a further lease up to 21 years, with the length of commercial leases (for tourism and recreation purposes) usually being proportional to the level of investment and the expected return on the investment.

Leases are usually issued or renewed on a case-by-case basis. If, on application, the operation has a commercial benefit (such as a caravan park), then establishment of a formal 'Expression of Interest' process for the lease is initiated. Apart from leases for tourism and recreation purposes, leases may included utilities, and rubbish disposal.

At the time of printing, there is no recreation or tourism lease issued in the planning area.

32. Commercial Tourism Operations

Key Points

- Commercial concessions can help meet the rising demand for high quality recreation and tourism opportunities, facilities and services, promote environmental awareness and generate income to help meet the costs of managing the natural resource.
- A commercial concession is a 'right granted by way of a lease, licence or permit for occupation or use under appropriate conditions, of an area of land or water managed by the Department for the purposes of the provision of appropriate facilities and services for visitors' use and enjoyment'.
- There are two types of licences: un-restricted 'T Class' licences and restricted 'E Class' licences.
- There are two types of leases issued on lands and waters managed by the Department:
  - forest leases granted under section 97 of the CALM Act; and
  - leases for other lands and waters covered by the CALM Act, granted under section 100 of the CALM Act.

The objective is to ensure commercial tourism activities are compatible with other management objectives and to extend the range of recreational experiences available through the involvement of private enterprise.

This will be achieved by:

1. evaluating proposals for licences and commercial tourism leases according to Department policies and permit their establishment where appropriate;
2. ensuring all commercial operations operate under a lease, licence or permit agreement with appropriate conditions that:
   - ensure the operation is consistent with other management objectives;
   - facilitate management; and
   - provide a service or facility to visitors that the Department would not otherwise be able to provide;
3. not providing concessions within the planning area if adequate facilities or services exist, or they can be developed outside the planning area that meet visitor needs;
4. ensuring any commercial recreation and tourism operations in the planning area are cost-neutral to the Department;
5. monitoring the level and impact of operator use to ensure it is sustainable;
6. encouraging Commercial Tour Operators that operate in the planning area to acquire quality assurance through industry accreditation and qualification programs; and
7. providing resources and training for the tourism industry in interpreting the Department's role and the planning area's natural and cultural values.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

33. VISITOR SAFETY

In addition to a genuine concern for visitor welfare, the Department has a legal responsibility, under the *Civil Liability Act 2002*, to consider the personal safety and welfare of visitors to Department-managed lands and waters. The Department's duty of care to visitors involves identifying and minimising potential dangers that might cause injury or misadventure in a manner that does not render the environment sterile or unnecessarily diminish visitor use and enjoyment in the process. To assist in minimising the incidence of injury to visitors, the Department has developed Policy Statement No. 53 – *Visitor Risk Management* providing the policy guidelines for the implementation of a visitor risk management program for the planning area. The program involves the identification of hazards, implementation of risk mitigation measures and ongoing monitoring. As part of the program, all designated recreation sites are routinely audited to identify visitor risks.

The Department also works closely with the State Emergency Service, the Western Australian Police, St Johns Ambulance, FESA and volunteer fire brigades in managing visitor risk within the planning area. In the event of an incident, the coordination of search, rescue or recovery operations is the responsibility of the Western Australian Police. However, where these occur on lands and waters managed by the Department, it is often the Department that organises the initial response.

The level of risk is part of the visitor experience and opportunities for risk taking are essential to many people's attraction to the outdoors. Some visitors to the planning area deliberately seek out activities because they involve risks, not despite them. These activities include mountain biking, white water rafting, abseiling and the use of rope swings and flying foxes. However, visitors are expected to take responsibility for their own safety, and the Department encourages visitors to use appropriate behaviour and safety precautions while undertaking recreational activities that involve risk.

Visitor Behaviour

The planning area is a high profile recreation area, with a high demand for, and use of, recreation facilities. There is a history of misuse by many visitors, with over-consumption of alcohol by some visitors leading to unsociable and antagonistic behaviour towards staff and other visitors, which has in some cases compromised the safety of staff and visitors. Damage to facilities, littering, theft and failure to control dogs has led to management introducing alcohol restrictions at peak visitor times.There are also issues relating to visitors

entering Disease Risk Areas, illegally hunting pigs, marroning out of season and lighting fires during total fire bans.

Strategies in the management plan aim to make the planning area more enjoyable for families to visit.

33. Visitor Safety

Key Points

- The Department has a moral and legal responsibility to minimise visitor risk, and under the *Civil Liability Act 2002* has a 'duty of care' for visitors to the planning area.
- As part of the visitor risk management program, the Department routinely assesses designated recreation sites to identify visitor risks.
- The Department seeks to encourage appropriate and safe visitor behaviour while undertaking recreational activities that involve risk.

The objective is to minimise risks to visitor safety and encourage appropriate visitor behaviour while maintaining a range of visitor experiences wherever possible.

This will be achieved by:

1. managing visitor risk in accordance with Department policies;
2. developing a visitor risk management plan that:
   - identifies and assesses the risk associated with all recreation sites;
   - implements a risk management program according to priority of risk;
   - maintains recreation sites to minimise visitor risk; and
   - monitors and regularly reviews visitor risk;
3. providing staff with appropriate training to undertake risk assessment;
4. providing information to highlight potentially hazardous areas and activities to enable visitors to modify their behaviour accordingly;
5. applying industry standards and utilising appropriate expertise in the safe design and construction of facilities;
6. adopting codes of safe conduct for popular activities (e.g. four-wheel driving, bushwalking, mountain biking, swimming, recreational fishing and marroning,) and promoting and publicising them as appropriate;
7. implementing the reserve closure plan (e.g. in the event of bushfire);
8. controlling feral bees that pose a risk to visitors in recreation areas; and
9. enforcing the CALM Regulations to influence appropriate and safe visitor behaviour (e.g. in relation to alcohol and drugs) when necessary.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
33.1 The proportion of accidents/incidents per visit reported annually to the Department	33.1 The proportion of accidents/incidents per visit reported annually to the Department remains stable or decreases from 2011 levels	Every 5 years
33.2 Reducing the proportion of reports of antisocial behaviour in the planning area	33.2 The number of reports of antisocial behaviour remains stable or decreases from 2011 levels	Every 5 years

34. DOMESTIC ANIMALS

Domestic animals such as dogs, cats and horses (see Section 31.9 – *Horse-riding*) are not permitted on the Bibbulmun Track or the Munda Biddi Trail and are generally prohibited from national parks and conservation parks. However, many people like to take their pets with them when they travel, including visitors commuting through or recreating within the planning area.

The presence of domestic animals presents a number of problems for managers, including:

- domestic dogs and cats can predate on native fauna (e.g. threatened species such as the quokka, western ringtail possum and noisy scrub bird);

- the lasting scent and presence of dogs and cats can impede the activity of and distress native fauna and can affect the opportunity for visitors to view wildlife;
- faeces from domestic animals can foul an area or watercourse and carry disease harmful to native wildlife and people;
- domestic animals can cause conflict with other visitors (e.g. noise, injury and interference with the enjoyment of the area by other visitors);
- dangers to pets arising from 1080 baits[27] used in feral animals control (see Section 23 – *Introduced and Other Problem Animals*); and
- domestic dogs are not always on a lead and can become separated from their owners.

Permitting dogs in designated areas of the Department-managed land under the CALM Regulations is an acknowledgment that dogs are important companions for many people and are often considered part of the family. Domestic dogs have been allowed[28] on a lead in most recreation sites of the planning area for many years. However, the presence of dogs in the planning area remains a contentious issue. Therefore it is proposed to continue to permit dogs within parts the planning area because:

- of long standing historical use;
- it is important to maintain community support for management;
- it is currently considered manageable in the planning area; and
- it is consistent with the reserves purpose.

A survey in 2006 revealed that 34% of the visitors (campers and day users) surveyed brought their pet dog with them. Twenty-one percent of visitors said that dogs should be excluded from the planning area, while 79% of visitors wanted dogs allowed. Of the 79%, the majority (>90%) suggested that dogs should be restricted or restrained.

This management plan proposes to designate several recreation sites where dogs will be permitted. At these sites, dogs will continue to be allowed on a lead and restrained at all times. Dogs will not be permitted in the rest of the planning area including Icy Creek, Chuditch, Scarp Pool and Scarp Lookout recreation sites. Further research and monitoring over the life of the plan may determine that other recreation sites may be designated as areas that permit dogs or added to dog free areas. Designated areas will be sign posted and information provided to visitors.

This management approach will ensure that there are recreation sites that are accessed by vehicles, where dogs will not be permitted, an experience that is not currently provided for in the planning area. Therefore visitors will be provided with opportunities to recreate without the potential of interacting with dogs. In addition, this approach will contribute to the protection of natural values and decrease the risk of other undesirable impacts as listed above.

The presence of domestic dogs within the planning area will be monitored and reviewed over the life of the management plan.

Guide and hearing dogs for visually and hearing impaired visitors and specially trained dogs for search and rescue operations may be allowed in all areas.

Due to their ability to prey on native fauna domestic cats are not permitted on Department-managed land.

34. Domestic Animals

Key Points

- Domestic animals not permitted on the Bibbulmun Track or the Munda Biddi Trail and are generally prohibited from national parks and conservation parks.
- Guide and hearing dogs for visually and hearing impaired visitors and specially trained dogs for search and rescue operations are allowed in all areas.
- Dogs can be permitted in the planning area under the CALM Regulations in 'designated areas'.
- Several recreation sites will be designated where dogs will be permitted. At these sites, dogs will continue to be allowed on a lead and restrained at all times. Dogs will not be permitted in the rest of the planning area including Icy Creek, Chuditch and Scarp Pool recreation sites.

[27] Domestic animals are susceptible to 1080 poison.
[28] Owners need to ensure that they comply with the *Dog Act 1976.*

- Domestic animals can predate on and disturb native animals, carry disease and interfere with the enjoyment of other visitors.

The objective is to protect natural values and visitors from the impacts of domestic animals.

This will be achieved by:

1. managing domestic animals in accordance with Department policies and relevant legislation;
2. prohibiting domestic animals within the planning area except for:
   - guide dogs for visitors with visual impairments;
   - animals required for emergency search and rescue purposed; and
   - in designated areas;
3. designating areas where domestic dogs on leads are allowed;
4. providing information explaining Department policy on domestic animals, their impact on natural values and promoting appropriate owner behaviour; and
5. monitoring the effects of domestic animals on the natural values and visitors.

Key Performance Indicators (see also Appendix 1):

Performance Measure	Target	Reporting Requirements
34.1 The number of dogs recorded outside of designated areas	34.1 A decreasing trend in the number of dogs recorded outside of designated areas from when sites are initially designated	Every 3 years

35. VISUAL LANDSCAPE

Visual landscape management is based on the premise that the visual quality of any landscape is a resource in its own right and can be assessed and managed in much the same way as other resource values, such as fauna, flora, water and recreation. The role of visual landscape management is to ensure that all uses and activities are planned and implemented to complement rather than detract from the inherent visual quality of the environments in which they occur.

In the context of this management plan, the term 'visual landscape' refers to the appearance or visual quality of an area. For many visitors, visual appearance is the most direct way they will experience an area and therefore, is often the criteria by which land management practices are judged (CALM 1994).

Landscape Character Types

Every landscape has an identifiable visual character determined by its context of geomorphology and soils (see Section 17 – *Geology, Landforms and Soils*), hydrology (see Section 18 – *Catchment Protection*), vegetation (see Section 19 – *Native Plants and Plant Communities*), land-use (see Section 13 – *Land Tenure*) and cultural heritage values (see Part D – *Managing Our Cultural Heritage*). According to these features, landscapes in Western Australia have been broadly identified and described as 'landscape character types' in order to assess their visual landscape values (CALM 1994).

The predominant landscape character type in the planning area is the Darling Uplands subtype of the Darling Plateau (see Map 9). The Darling Plateau is a deeply dissected, rolling landscape with a land surface cleaved by major V-shaped river valleys and studded by rough granite outcrops (CALM 1994). The Darling Uplands subtype is an undulating, dissected land surface dominated by extensive areas of tall forest of jarrah and marri. It is bordered to the west by the Darling Scarp, a rugged and rocky landscape that rises to a height of approximately 300m above sea level (CALM 1994).

The most visually significant landscape elements of the planning area are:

- undulating and steeply sloping escarpment;
- well defined and steeply incised valleys;
- permanent watercourses and perennial lakes;
- areas of remnant native vegetation;
- distinctive stands of vegetation; and
- granite domes and outcrops.

Visual Quality

Visual (or scenic) quality refers to the visual character of landscape based on physical elements, such as landform, vegetation patterns and waterform expressed as a measure of importance held by society after perceiving the landscape. In order to systematically classify degrees of visual quality within a character type, descriptive frames of reference provide indicators of high, moderate and low visual quality. These are typically based on diversity, uniqueness, prominence and naturalness of landform, vegetation and waterform (CALM 1994). Within each Landscape Character Type, the scenic quality has been classed as high, moderate or low. These are typically based on diversity, uniqueness, prominence and naturalness of landform, vegetation and water form (CALM 1994).

Visual Landscape Management

Visual landscape management involves maintaining, restoring or enhancing natural and cultural landscape values, as well as planning and designing land use activities and developments to provide diverse views and minimise negative impacts. Human imposed changes to the landscape should be subordinate to the established natural visual character.

Key factors to consider in visual landscape management include:

- visual changes to the landscape occur continually - natural changes are generally subtle, harmonious and occur very slowly (other than the impacts of fire), whereas human-imposed changes can visually dominate natural elements, appear discordant, foreign and can occur abruptly if not done well; and
- the ability of the landscape to absorb change without loss of scenic value, which depends on factors such as slope, soils, vegetation cover and scope of change.

Visual Landscape Management Zones

An assessment of the inherent visual landscape qualities, the level of visibility or seen area and public sensitivity within the planning area enables it to be classified into management priority zones (see Appendix 10 and Map 9). Such zones help identify areas of greatest and least visual concern and the appropriate level of management and potential modification.

Visual landscape management zones provide an indication of the relative level of concern for the visual landscape. Zone A has the greatest concern for the landscape values and the highest priority for management, followed by Zone B which has a moderate priority and Zone C which has a low priority. Specific guidelines for each zone are included in Appendix 10.

Guidelines for Management

Policy Statement No. 34 – *Visual Resource Management of Lands and Waters Managed by CALM* provides broad guidelines for landscape management, particularly the planning and implementation of new facilities, buildings, recreation sites, signs and infrastructure.

The relatively unspoilt nature of the planning area's landforms and vegetation of the Murray River valley contributes to a visual landscape that is highly sensitive to change. It is important to take advantage of all opportunities to minimise the visual impact from activities such as pine harvesting, mining operations and facility development such as campsites and associated infrastructure.

The portion of the planning area deemed to have the highest scenic quality is the Murray River valley. Its mature forests, thick riparian vegetation and stream sections with rapids and massive rock outcrops are a prominent feature. Other areas of high scenic quality include exposed water or water edge, valleys, steep slopes, isolated hilltops and areas where these elements combine with mature vegetation that offers scenic landscape viewing, along with the lakes in the southern section.

Pine plantations that are located both within, and adjacent to the planning area provide a different character to the native forest. However, pine harvesting (see Section 38 – *Forest Produce*) has resulted in short term negative impacts on the visual landscape, particularly along some of the access routes to recreation sites and also by restricting visitor access in some areas and creating noise. Effects on the visual landscape will gradually become less evident once new vegetation becomes established in the harvested areas. Future pine harvesting operations within the planning area should be managed in such a way to minimise any visual and environmental impacts and follow the guidelines of the *Murray Plantation Harvesting Operation – Visual Landscape*

Management Assessment (CALM 2006c). Where reasonable and practicable, operations (including mining) will be conducted in a manner that seeks to reduce or negate visual impacts.

Areas in the planning area of 'high' scenic quality (such as the Murray River and its riparian zone) are of greatest concern in terms of visual landscape management and are the most sensitive to alterations. Any changes should borrow from the natural established landscape character and not be noticeable to the casual observer. Changes to areas of 'moderate' scenic quality should borrow significantly from natural elements but may be apparent to the observer. Areas of 'low' scenic quality are of least visual concern and sensitivity to alterations. Changes should consider natural elements but may be dominant to the observer.

35. Visual Landscape

Key Points

- The planning area is characteristic of the Darling Uplands subtype of the Darling Plateau Landscape Character Type.
- The Murray River is deemed to have the highest scenic quality in the planning area, with mature forests, thick riparian vegetation and stream sections with rapids and massive rock outcrops the prominent feature.
- Visual landscape extends beyond the boundary of the planning area.

The objective is to protect and enhance the visual landscape qualities.

This will be achieved by:

1. encouraging sensitive management of visual resources along the access corridors, tourist destinations, features and areas of high scenic viewing, including pine harvesting and mining operations both within the planning area and on adjoining State forest;
2. applying the general management guidelines set out in Department policies in assessing any proposed management activities and development of facilities to determine their impact on visual landscape values;
3. providing access and recreational opportunities to areas of high visual landscape quality where this is environmentally sustainable, compatible with other values and in accordance with the visitor management settings;
4. liaising with relevant authorities (e.g. local and State government agencies (e.g. FPC, public utility providers) and mining companies) and neighbouring land-holders to ensure visual landscape is considered in development proposals and management practices, and providing advice upon request; and
5. planning fire management prescribed burning programs and pine harvesting to minimise negative visual impacts.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

PART F. MANAGING RESOURCE USE

36. INDIGENOUS CUSTOMARY ACTIVITIES

Traditional use and access is an important part of Aboriginal culture to maintain or re-establish their links with the land, share knowledge and partake in traditional practices (e.g. hunting, fishing, gathering of native foods and medicines and activities for law and ceremonial purposes) (see Section 26 – *Indigenous Heritage*). The Wildlife Conservation Act (section 23) permits Aboriginal people to hunt and fish for food on land and waters managed by the Department, but excluding nature reserves and wildlife sanctuaries, with the consent from the Department's Director General. Conditions associated with approval include:

- that the use of wildlife is does not result in a overall decline in the population;
- food is only taken by a cultural group associated with the planning area;
- special provisions may be applied to the taking of some species (e.g. specially protected species);
- the activity does not impinge upon the safety of others;
- food taken is not sold; and
- the activity is consistent with other land management objectives.

Under the Fish Resources Management Act, Aboriginal people are not required to hold a recreational fishing licence and may take fish from any waters in accordance with continuing Aboriginal tradition. This is provided the fish are taken for themselves or their family and not for a commercial purpose. Fishery restrictions still apply (e.g. season, size and bag limits).

It is also possible that, over the life of this management plan, the rights of Aboriginal people, including hunting and gathering, may change. The Department will ensure conformity with any changes to legislation or Government policy during the life of the plan.

36. Indigenous Customary Activities

Key Points

- Indigenous use of and access to the planning area is important in maintaining cultural links to the land.
- The Wildlife Conservation Act allows customary activities to occur provided certain conditions are met.
- Important cultural activities include hunting, fishing, gathering of native foods and medicines and activities for law and ceremonial purposes.

The objective is to enable Aboriginal people to pursue customary activities while protecting key values and the safety of other visitors.

This will be achieved by:

1. continuing to allow the traditional custodians of the area or others approved by them to take sufficient food for themselves and their family, provided it has been approved by the Gnaala Karla Booja and the Department's Director General, and is in accordance with s 23 of the Wildlife Conservation Act and any associated conditions;
2. ensuring that management adapts and conforms to any legislative or policy changes during the life of this plan; and
3. ensuring the collection of traditional foods does not impact on the safety of other visitors.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

37. MINERAL AND PETROLEUM EXPLORATION AND DEVELOPMENT

Legislation and Policy

Mineral and petroleum exploration and development on Department-managed land is subject to a number of Acts and regulations including the Mining Act, *Petroleum Act 1967*, Environmental Protection Act, Environmental Protection (Noise) Regulations, CALM Act and Wildlife Conservation Act. There are also two State Agreement Acts applicable in the planning area, the Alumina Refinery Agreement Act, the Alumina Refinery (Worsley) Agreement Act. The Mining Act and State Agreement Acts take precedence over the CALM Act (as per section 4(1) of the CALM Act) with the Environmental Protection Act taking precedence over all these acts.

Mining[29] in Western Australia is primarily administered by DMP through the granting of various tenements. The holders of tenements are required to meet conditions to retain the right to explore and develop. This includes the requirement that all development projects undergo environmental, heritage and native title assessments while addressing Government policy and guidelines such as the *Guidelines for Mineral Exploration and Mining within Conservation Reserves and other Environmentally Sensitive Areas* (Department of Minerals and Energy 1998), which sets out the basic procedures and conditions applied to applications for mining tenements.

Stringent conditions apply for mining to be undertaken in the following reserves in the South-west Land Division[30] (including the planning area). Specifically, the concurrence of the Minister for Environment and the consent of both Houses of Parliament are required. This applies to the following reserves in the planning area:

- national parks;
- class A conservation parks; and
- class A CALM Act section 5(1)(g) and (h) reserves.

The Conservation Commission provides advice to the Minister for Environment in regard to all mining tenement applications for all reserves under its control.

As per the EPA's released Position Statement No. 9 – *Environmental Offsets* (EPA 2006) should mining tenements be approved in proposed conservation estate, these should be subject to the principle of environmental offsets. In addition, there is an expectation under the Mining Act that areas disturbed by mining should be rehabilitated and it is the Department's position that the costs of rehabilitating mining activities should be borne by the organisation(s) responsible for the activity. If considered, there would be no presumption for approval and if approved, these applications would be expected to include contributions to reserve management in accordance with the net conservation benefit principles. Net conservation benefits are determined on a case-by-case basis, but could include land additions (e.g. a land swap where reserves of high mineral prospectively are exchanged for areas of significant natural values) or contributions to land management (e.g. environmental weed or introduced animal control, or land rehabilitation). In the case of the planning area, State Agreement Act leases have pre-eminence and rights under the Acts unless agreed otherwise.

Under the Memorandum of Understanding between DMP and the EPA, all mining proposals wholly or partly within two kilometres of, for example, a national park, nature reserve, State forest, timber reserve, CALM Act section 5(1)(g) and (h) reserves, proposed conservation reserve, or wholly or partly located within a declared water supply catchment area or groundwater protection area, must be referred to the EPA for assessment through section 38 of the Environmental Protection Act. DMP, the Conservation Commission, the Department and individuals can refer proposals that may potentially cause significant environmental impact to the EPA for assessment. During the assessment process, the Department has the opportunity to comment on the impact of the proposals. The Conservation Commission may also provide advice to the Minister for Environment on proposals to extract mineral resources. In addition, actions which may have a significant impact on matters of national environmental significance[31] may also require approval under the EPBC Act.

[29] Mining includes exploration, fossicking, prospecting and mining operations.
[30] South-west Land Division as described in Schedule 1 of the Land Administration Act, including the Shires of Esperance and Ravensthorpe.
[31] Under the EPBC Act matters of national environmental significance include, for example, National Heritage places, nationally listed threatened species and ecological communities and migratory species protected under international agreements.

Other Conditions

As Alcoa and Worsley mine in areas where the State Agreement Acts are applicable, they are required to submit mining plans indicating future mining activities (including rehabilitation commitments and environmental reports) to the Mining and Management Program Liaison Group (MMPLG) for Alcoa and the Environmental Management Liaison Group (EMLG) for Worsley. The MMPLG and EMLG, consist of representatives from the Department, DMP, DoW and the Water Corporation (MMPLG only) and the Department of Agriculture and Food (EMLG only) and are chaired by the Department of State Development. The MMPLG and EMLG monitor activities associated with mining in and around the planning area and providing advice to the Minister responsible for the Mining Act and the Minister for Environment on the environmental acceptability of proposed long-term mining projects within existing mineral leases. This is done following flora, fauna and indigenous heritage assessments, environmental impact assessment and community consultation.

Mining occurring in Disease Risk Areas has additional requirements that need to be considered during mineral and petroleum exploration and development to reduce the spread of disease. These include conducting operations under dry soil conditions and using plant disease hygiene practices. The CALM Act and *Guidelines for management of dieback disease in mineral exploration* (DoIR 1991) provide direction.

Mining operations are subject to the EP (Noise) Regulations where limits are placed on noise created by mining operations such as blasting, equipment and conveyer belts. Both Alcoa and Worsley use modelling to determine ways to lessen the noise disturbance to the community as a result of their activities.

It is also a requirement that post mining, the land is rehabilitated (see Section 39 –*Rehabilitation*).

Mining Tenements

There are a number of live and pending mining and petroleum tenements in the planning area. Worsley also have a special crown lease for their overland conveyer, which dissects the planning area south of Tumlo, connecting their Saddleback minesite to their refinery. The latest information on mining tenements in the planning area can be found on the Department of Mines and Petroleum's Tengraph database.

The majority of the planning area is covered by two State Agreement Acts (see Map 10). ML 1SA is held by Alcoa World Alumina Australia and was granted under the Alumina Refinery Agreement Act and extends over the existing reserve. ML 258SA is held by Worsley Alumina Pty Ltd and was granted under the Alumina Refinery (Worsley) Agreement Act and extends over some of the proposed additions to the planning area.

At the time of writing there is one petroleum exploration permit in the planning area.

Implication of Mining on Managing the Planning Area

State agreements between developers and the State are generally enacted for major resource projects (such as bauxite, coal and iron ore) that require large capital investments and usually significant infrastructure. These agreements are ratified by Parliament as State Agreement Acts and provide long-term security of title. Of relevance within planning area are the Alumina Refinery Agreement Act and the Alumina Refinery (Worsley) Agreement Act. Under a State Agreement Act, the Government cannot change land tenure within the mining lease that could prejudice the rights of the Agreement Act company, unless both parties agree. Consultation and agreement on the proposed additions and changes in tenure was reached with these stakeholders. Furthering this, the Department will continue exploring options with Alcoa and Worsley to upgrade more areas of Lane Poole Reserve to national park (see Section 14 – *Existing and Proposed Tenure*).

Under the terms and conditions set out in the Alumina Refinery Agreement Act, Alcoa cannot conduct mining operations in the 'conservation area' unless it is determined that there has been degeneration or deterioration in the natural values. Under the Act, Alcoa also reserve the right to access on, over or through conservation areas. However, Alcoa has made a commitment to not mine or have access through proposed national park areas or in the high use recreational areas and their view-sheds (Alcoa of Australia 1994, K. Horne *pers. comm.* 2004). As part of a five-year mining plan, Alcoa have identified areas in reserve 39827, west of Nanga Road, that are scheduled for bauxite mining in 2009-18.

In addition to the conservation areas, Alcoa has also undertaken to defer mining in certain parts of the planning area including reserve 39821, FMP IDs 63, 64 and 65 which have significant natural values and are proposed to become national park (see Section 14 – *Existing and Proposed Tenure*) (K. Horne *pers. comm.* 2004).

Mining activity including operational and blasting west of Icy Creek and Nanga Road may result in higher than the legally accepted limits outlined in the EP (Noise) Regulations. As such, built accommodation at Icy Creek will be unavailable when noise limits are likely to be exceeded (see Section 31.5 – *Overnight Stays*). The Department is in negotiations with Alcoa to develop protocols for mining activities in nearby areas.

Mining in the planning area has a number of implications for management. These included impacts on the natural values (e.g. loss of habitat, displacement of native fauna, turbid runoff from haul roads), recreation values (e.g. visitor access, noise disturbance, visual landscape) and general access for management within the area. The Department will liaise with tenement holders to lessen the effects of mining on these and other key values on Department-managed land, including the planning area.

An assessment and approval process developed in consultation with Alcoa, the EPA and the MMPLG for informal CAR reserves will be used where mining occurs in the planning area (S. Raper *pers. comm.* 2007). Mining and rehabilitation operations will be undertaken according to the Alcoa and Department's working arrangements (2005-2009) (S. Raper *pers. comm.* 2007).

Basic Raw Materials

In general, there is a presumption against accessing basic raw materials (BRM) (i.e. gravel, shale, clay, limestone and rock) from the conservation estate. Access will only be considered where BRM is for use within the reserve boundary and access to BRM is consistent with the relevant management plan and purpose of tenure. It is preferred that BRM is sourced from outside the planning area where practical.

Applications to access BRM from proposed national park and conservation park areas of the planning area requires referral to the Conservation Commission as per their Policy Statement No. 3 - *Basic raw materials: Government and local government access to conservation estate* (*national parks, nature reserves and conservation parks*) (Conservation Commission 2006). If supported in principle, proposals may be referred to the EPA to determine the level of assessment. Should proposals be approved, access to BRM may occur using notice of intended entry procedures under the Local Government Act. In all cases, quarrying should not be permitted in poorly represented vegetation complexes, landscape management zone A or in areas protectable from *P. cinnamomi*.

Access to BRM from State forest and timber reserves for use outside Department-managed estate is permitted provided that no alternative sources are available. In such instances, the proponent is required to fund future rehabilitation works (see Section 39 – *Rehabilitation*). Accessing BRM from these sources is preferred to the conservation estate.

37. Mineral and Petroleum Exploration and Development

Key Points

- Mineral and petroleum exploration and development on Department-managed land is subject to a number of Acts and Regulations including the Mining Act, Environmental Protection Act, EP (Noise) Regulations, CALM Act and Wildlife Conservation Act. There are two State Agreement Acts, the Alumina Refinery Agreement Act and the Alumina Refinery (Worsley) Agreement Act that are applicable in the planning area. The Mining and State Agreement Acts take precedence over the CALM Act with the Environmental Protection Act taking precedence over all these Acts.
- Mining in Western Australia is primarily administered by DMP through the granting of various tenements.
- Projects which may cause significant environmental impact will be referred to the EPA for assessment.
- Under the terms and conditions set out in the Alumina Refinery Agreement Act, Alcoa cannot conduct mining operations in the 'conservation area' unless it is determined that there has been degeneration or deterioration in the natural values.
- Alcoa reserve the right to access on, over or through the conservation area as per the Alumina Refinery Agreement Act, although Alcoa has made a commitment to not mine or have access through proposed national park areas.
- Where possible, BRM should be sourced from outside the planning area.

The objective is to minimise the impacts of mineral and petroleum exploration and development on key values.

This will be achieved by:

1. in conjunction with relevant Government agencies (e.g. DMP, EPA) evaluate likely impacts of proposed mineral and petroleum exploration and development within the planning area and adjacent areas that may be impacted by it;
2. referring mineral and petroleum exploration and development proposals that may adversely impact on the planning area to the EPA for their consideration of assessment under the Environmental Protection Act;
3. in conjunction with DMP, monitoring mineral and petroleum exploration and development activities that impact on the planning area and requesting DMP to take any necessary action where conditions are breached;
4. seeking direct and complementary offsets to counterbalance any adverse environmental impact due to mineral and petroleum exploration and development activities to achieve no net environmental loss, or preferably, a net environmental benefit outcome;
5. ensuring mining companies with tenements in the planning area consult with the Department and the Conservation Commission if they require access (e.g. a conveyer belt) through conservation areas;
6. liaising with mining companies to ensure mining operations are scheduled and carried out in such a way to minimise noise disturbance to visitors;
7. ensuring all mining activities adhere to Departmental hygiene standards; and
8. in accordance with Department and Conservation Commission policies, permitting access to basic raw materials when the material is used within the boundaries of the planning area where:
   - the use of the material assists in the protection and management of the area;
   - extraction is consistent with this management plan and purpose and tenure of the area;
   - it overlies bauxite deposits that are about to be mined; and
   - a more environmentally acceptable alternative is not available.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

38. FOREST PRODUCE

The taking or removal of forest produce[32] can have a number of environmental impacts including reducing the available seed stock and by reducing the numbers of flowers available for cross-pollination, reduce genetic diversity. It can also contribute to the spread of *P. cinnamomi* and weeds, and the trampling of vegetation. The CALM Act and Wildlife Conservation Act provide the legislative platform for the protection of forest produce protection.

Under the CALM Act, the management of forest produce varies depending on the category of land and the purpose of the reserve. Once all proposed additions have been added to Lane Poole Reserve, the categories in the planning area will consist of national park, conservation park and CALM Act section 5(1)(g) and (h) reserves. Section 99A(1) of the CALM Act enables the Director General to grant licences to take forest produce from land defined in Part VIII, Division 2 of the CALM Act provided it is:

- to remove exotic trees (e.g. pines), honey, beeswax or pollen (by apiary site permit);
- used for therapeutic, scientific or horticultural purposes (e.g. seed collecting for rehabilitation); or
- for essential works.

Essential works as defined in section 99A(2) includes works that are required to establish or re-establish access to land (e.g. removal of trees fallen across a road after a storm) or to provide fire containment lines. Forest produce, that is taken in connection with essential works can be sold by the Department (under section 99A(4) of the CALM Act). As such, introduced species within the planning area (e.g. pines) may be harvested and sold by the Department, through a specified purpose licence, as forest produce.

Under section 33(1)(cb) of the CALM Act, forest produce obtained through the carrying out of 'operations' can be used for the purpose of making improvements to the land. This includes the carrying out of necessary[33] (on

[32] 'Forest produce' includes trees, parts of trees, timber, sawdust, chips, firewood, charcoal, gum, kino, resin, sap, honey, seed, bees-wax, rocks, stone and soil as per section 3 of the CALM Act.

[33] Necessary operations are activities conducted by the Department that are necessary for the preservation or protection of persons, property, land, waters, flora or fauna, or for the preparation of a management plan.

nature reserves) or compatible[34] operations (on national parks or conservation parks) or operations in accordance with section 56 of the CALM Act (on State forest, timber reserves and CALM Act section 5(1)(g) and (h) reserves) where it is consistent with the reserve purpose. Forest produce obtained in this manner may be used by the Department for management purposes.

Under the CALM Act and relevant State Agreement Acts, holders of mining tenements may take forest produce from the planning area in areas about to be mined. In this respect, land clearing plans are submitted to the relevant District Manager, the MMPLG and EMLG before approval is recommended to the Department's Director General. After mining is completed the area must be rehabilitated (see Section 39 – *Rehabilitation*).

Any removal of forest produce must consider and apply, where necessary, hygiene standards to limit the spread of disease and environmental weeds in the planning area. Consideration must also be given and applied, where necessary to river and stream vegetation buffers when removal of forest produce may impact on water quality.

The planning area has a long history of timber utilisation and regeneration (see Section 27 – *Non Indigenous Heritage*) and pine plantation. Commercial timber harvesting of native vegetation no longer occurs in the planning area however, timber can be sold from land cleared for the purpose of mining (see above). There are also pockets of pine plantation currently in the planning area; part of the Murray Valley Plantation and the Tumlo Plantation. The Tumlo Plantation, located in reserve 39827 (CALM Act section 5(1)(g) reserve), has recently been harvested with the intent to rehabilitate this area to native vegetation.

The Murray Valley Plantation is situated mainly on State forest outside the planning area but extends into the planning area in the miscellaneous reserve 5102 (FMP ID 61) near Baden Powell and into reserve 39827 (CALM Act section 5(1)(g) reserve). It is proposed to continue harvesting the Murray Valley Plantation to supply plantation softwood in accordance with Government wood supply commitments. After harvesting, the land in the planning area will be rehabilitated to native vegetation. Consideration will be given to changing the boundary of the conservation reserve in the area north of the Murray River, with the effect that some of the existing pine plantation could be replanted to create a more manageable on-ground boundary, subject to the addition of a similar area to the conservation estate (see Section 14 – *Existing and Proposed Tenure*). It is further proposed that funds from the sale of harvested pine would contribute towards rehabilitating the harvested areas.

For information on rehabilitation, see Section 39 and see Section 35 for Visual Landscape.

Firewood Collection

Firewood collection is an issue in the planning area with campers, in particular, collecting firewood from adjacent forest. This is an ongoing problem because it impacts on fauna habitat, especially in the riparian zone of the Murray River, removes hollows and ground refuse used by fauna and potentially spreads disease.

The collection of firewood is prohibited within the planning area and firewood is not supplied. Visitors are encouraged to bring their own firewood, or purchase bagged dry wood in Dwellingup.

On a wider scale, illegal firewood collection for domestic or commercial use across Department-managed land is an ongoing problem. Areas of Department-managed land outside the planning area are identified within State forest and timber reserves as public firewood areas declared under Part 15 of the *Forest Management Regulations 1993*, enabling members of the public with permits (available through District Offices) to collect firewood.

38. Forest Produce

Key Points

- Management of forest produce varies depending on the category of land and the purpose of the reserve.
- The taking of forest produce is only permitted under certain conditions by licence issued by the Director General.
- Under the CALM Act and relevant State Agreement Acts holders of mining tenements may take forest produce from the planning area in areas about to be mined.

[34] Compatible operations are activities conducted by the Department that are approved by the Minister for Environment as being compatible with the purposes for which the park or management area is managed under the CALM Act.

- The pine plantations in the planning area will be harvested, which will result in short term negative impacts on the visual landscape, restrict visitor access in some areas and create noise.
- The collection of firewood is prohibited within the planning area. Visitors are encouraged to bring their own firewood, purchase bagged dry wood in Dwellingup.

The objective is to prevent the unauthorised removal of forest produce.

This will be achieved by:

1. permitting the taking or removal of forest produce in accordance with a licence issued by the Director General for:
   - removal of exotic plants (e.g. pines);
   - removal of honey, beeswax or pollen (by apiary site permit);
   - removal for therapeutic or horticultural purposes; and
   - essential works;
2. applying permit conditions to limit detrimental environmental impacts from the taking or removal of forest produce (e.g. hygiene consideration to visual landscape);
3. liaising with FPC with regard to pine harvesting, pine replanting and rehabilitating areas to native vegetation (see Section 39 – *Rehabilitation*);
4. supporting the gazettal of 'Firewood Collection Areas' in nearby State forest and timber reserves within the region; and
5. continuing to prohibit firewood collection and using public education to reduce the illegal collection of firewood within the planning area.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

39. REHABILITATION

Rehabilitation is the process of returning land to a predetermined stable, self-regulating ecosystem following disturbance, consistent with the purpose for which the area is managed. The Department's Policy Statement No. 10 – *Rehabilitation of Disturbed Land* and Fire Management Guideline No. G2 – *Fireline Stabilisation and Rehabilitation* provide guidance for the rehabilitation of lands managed by the Department based on the following principles:

- land should be managed as far as possible to avoid unnecessary disturbance;
- rehabilitation should be the last option in a series of management decisions designed to protect natural values after disturbance; and
- rehabilitation should aim to restore original values while allowing for other potential uses to occur and other values to be protected.

The necessity for, and complexity in the rehabilitation process can vary according to the type and extent of disturbance in an areas. Rehabilitation within the planning area may be necessary as a result of mining (including gravel pit works), road works, pine plantation harvesting, track closure, environmental weed removal (e.g. blackberry), recreation site resting or redevelopment, or activities associated with fire suppression.

To ensure that rehabilitation has the greatest degree of success, local native species must be used whenever possible. Rehabilitation techniques employed should also be adapted to site-specific conditions and future use (e.g. landscape, recreational use, local vegetation, fauna habitats) and once the vegetation is established, can include the use of fauna nesting boxes (e.g. for the threatened (S1) brush-tailed phascogale and fauna reintroductions to the area).

Areas that are rehabilitated, particularly in the initial stages, are susceptible to a number of external influences and as such, these sites need to be monitored (e.g. for presence of environmental weeds and introduced species) and protected from disturbance. This will identify any threats so measures can be taken if necessary to ensure the success of rehabilitation and to provide for adaptive management.

Rehabilitated areas need to be protected from fire for several years because the vegetation is particularly susceptible to fire in its early years. Access into these areas may also need to be restricted.

For disturbances such as mining, rehabilitation should also take into consideration any relevant fauna recovery plans (see Section 20 – *Native Animals and Habitats*).

In cases where other organisations (e.g. mining companies and FPC) are responsible for disturbance within the planning area, it is the responsibility of those organisations to rehabilitate the disturbed land to an acceptable standard agreed on in consultation with the Department. In such cases, the cost of rehabilitation will be borne by that organisation. With regard to Alcoa's mining activities, mining and rehabilitation operations will be undertaken according to the Alcoa and Department's working arrangements (S. Raper *pers. comm.* 2007). This includes the rehabilitation meeting criteria before it is considered successful (C. Grant *pers. comm.* 2007).

There are a number of rehabilitation projects recently completed, underway and proposed. This includes the rehabilitation of Lake Yourdamung (reserve 47688), a former freehold property which was cleared for agriculture. Another project is the rehabilitation of bushfire containment lines (e.g. those created for the suppression of the 2006 Talbot's fire and 2007 Dwellingup fire).

Consideration should also be given to the future use of the area to be rehabilitated. For example, if it is determined that the area (e.g. post mining) could be used for recreational purposes, then as part of the rehabilitation of the area, the contour of the land and should be considered and tailored to the future land use.

Rehabilitation operations provide a good opportunity for the Department to involve the community in management operations. In the past, school and community groups have assisted the Department in rehabilitating disturbed areas.

39. Rehabilitation

Key Points

- Rehabilitation within the planning area may be necessary as a result of mining (including gravel pit works), road works, pine plantation harvesting, track closure, environmental weed removal (e.g. blackberry), recreation site resting or redevelopment, or activities associated with fire suppression.
- Rehabilitation should aim to restore original values while allowing for other potential uses to occur and other values to be protected.

The objective is to rehabilitate disturbed ecosystems to a stable condition resembling as close as possible the natural ecosystem structure, function and/or process.

This will be achieved by:

1. rehabilitating disturbed areas in accordance with Departmental policies;
2. developing ecosystem rehabilitation working plans where necessary and allocating priorities for works based on the:
   - type and extent of the disturbance;
   - likelihood of natural regeneration;
   - existing and potential impacts on natural and visual landscape values;
   - availability of knowledge and resources;
   - level of participation of stakeholders; and
   - capacity for long-term monitoring;
3. ensuring local native flora and key ecological species are used in ecosystem rehabilitation schemes;
4. ensuring that all sites in which any mining activity occurs are rehabilitated according to the Department's rehabilitation standards and guidelines including defined completion criteria and monitoring;
5. protecting ecosystem rehabilitation areas from threatening processes (e.g. inappropriate fire regimes, environmental weeds, spread of disease and recreation impacts);
6. ensuring that, the cost of rehabilitation is borne by those responsible for the disturbance;
7. ensuring the aims of the rehabilitation are being achieved by undertaking post-rehabilitation monitoring and evaluation of the area;
8. involving volunteers, community groups and local governments in rehabilitation programs; and
9. liaising with Alcoa and FPC in providing opportunities, information and interpretation in relation to rehabilitation programs.

Key Performance Indicators (see also Appendix 1):		
Performance Measure	**Target**	**Reporting Requirements**
39.1 The area of disturbed ecosystems (e.g. from fireline construction, mining, pine harvesting) that have undergone rehabilitation	39.1 Increase in the area of disturbed ecosystems that have undergone rehabilitation	Every 5 years

40. BEEKEEPING

Commercial beekeeping is a small but significant industry in WA since the introduction of the honeybee (*Apis mellifera*) to Australia midway through the nineteenth century (see Section 23 – *Introduced and Other Problem Animals*). Commercial beekeepers (or apiarists) have traditionally relied on large areas of native vegetation for honey production and are increasingly dependent on lands managed by the Department. All apiary sites on Crown land in WA require a permit from the Department (see Section 38 – *Forest Produce*). Beekeepers are also required under the *Beekeepers Act 1963* to register with the Department of Agriculture and Food.

To provide industry input to the Department on beekeeping matters, the Beekeeping Consultative Committee was created to facilitate discussion and consultation between the Department, industry groups and other Government agencies. The *National Best Management Practice for Beekeeping in the Australian Environment* (DAFF and NSW DPI 2007) highlights 19 elements, outlining the guidelines for the management of honeybees in Australia.

Department Policy

General guidance for the management of beekeeping on Crown land is provided for by the Department's Policy Statement No. 41 – *Beekeeping on public land* (subject to final consultation). Under the draft policy, the Department will maintain (and renew) current apiary site permits on all classes (tenures) of land, but permit no additional apiary sites on land which is currently reserved or proposed to be reserved, primarily for nature conservation purposes[35], until a management plan has been prepared. In this instance, the Department, through the management planning process, will consider whether access for beekeeping is either retained at the current level, increased, decreased or phased out, based on appropriate ecological and management criteria (see Appendix 11). Thus the management planning process will identify suitable areas for beekeeping while minimising the potential impacts of managed honeybees.

Applying Department Policy to the Planning Area

While it is recognised that feral honeybees are more of a threat to the natural values of conservation reserves than managed honeybees (see Section 23 – *Introduced and Other Problem Animals*), there is little knowledge about the conditions under which honeybees leave the hive and become feral. Consequently, the Department will take a precautionary approach with regard to allowing beekeeping in conservation reserves.

When allowing an introduced pollinator to persist within a conservation reserve, the dynamics between the native pollinators (including mammals, birds and insects) and the native flora and dependent fauna need to be considered. The planning area was assessed using environmental and management criteria, adapted from the draft policy, in terms of the values that may be impacted by honeybees (see Appendix 11). Visitation by honeybees and any predicted impact on declared rare and priority flora and significant habitats and communities within the planning area was assessed by Departmental experts. As a result, the planning area can be categorised as either:

- 'suitable' for apiary sites;
- 'suitable but conditional'; or
- 'highly constrained'.

Some sites are not suitable for beekeeping because they do not meet management criteria (see Appendix 11). These unsuitable sites may include that they are highly susceptible to the spread of *P. cinnamomi* or are located too close to recreation areas such as the Bibbulmun Track, Munda Biddi Trail and camping and day use sites. There are seven existing apiary sites in the planning area that fall within areas assessed as being highly

[35] Lands reserved primarily for nature conservation includes national parks, conservation parks, nature reserves and 5(1)(g) and (h) reserves.

constrained. These sites will be cancelled and relocated to suitable or suitable but conditional areas. No new sites will be permitted within areas identified as highly constrained.

The majority of the planning area was assessed as being suitable but conditional. There are currently 38 sites located within this area. Conditions at these sites include seasonal restrictions, structural modifications to the hives to restrict the queen, increased disease hygiene control and/or regular monitoring of the apiary site.

There are six apiary sites that are located within the area assessed as being suitable for apiary sites.

Some apiary sites are within three kilometres of different permit holders. Where this occurs, and in consultation with permit holders, sites will need to be relocated.

Apiary sites adjoining the planning area may also impact on its natural values. Where these are located on lands managed by the Department, the criteria in Appendix 11 should be applied. Where sites are located on other lands and a significant environmental impact to recognised values may occur, such proposals may be referred to the EPA for assessment.

The methodology of categorising the planning area into classes of suitability will have to be adaptive over the life of this plan to ensure that the best available knowledge is used to apply the criteria of Appendix 11. Any change in the categories for beekeeping, criteria or values of the planning area should ideally coincide with the review of apiary permits. Further research is also required to quantify the impacts of managed honeybees on the natural environment.

40. Beekeeping

Key Points

- Commercial beekeepers have traditionally relied heavily on large areas of native vegetation, and are increasingly dependent on lands managed by the Department.
- Honeybees can affect biodiversity (including ecological processes such as pollination) and recreation values. Therefore, the Department will take a precautionary approach in regards to allowing beekeeping in the planning area.
- The planning area has been assessed as being either suitable, suitable but conditional, or highly constrained for apiary sites based on environmental and management criteria. Seven sites within the planning area were assessed as being highly constrained, 40 sites suitable but conditional and six sites as suitable (see Appendix 11).

The objective is to provide opportunities for commercial beekeeping that do not adversely impact the natural and recreation values or cause conflict with other visitors.

This will be achieved by:

1. managing apiary sites according to relevant Departmental policies;
2. reviewing the apiary analysis for the planning area every five years to determine whether access for beekeeping is either retained at the current level, increased, decreased or phased out based on the assessment criteria (see Appendix 11);
3. liaising with beekeepers, the Beekeepers Consultative Committee, and the Department of Agriculture and Food to ensure the most efficient and sustainable use of sites;
4. supporting research on the impact of beekeeping on biodiversity and adapting management accordingly; and
5. monitoring apiary use and any corresponding impacts within the areas identified as suitable but conditional, to aid in the review process.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

41. PUBLIC UTILITIES AND SERVICES

There are a number of existing public utilities and services either servicing or traversing the planning area including high voltage transmission lines[36], distribution powerlines[37], water pipelines, a conveyer belt and trigonometrical stations (see Map 10).

Two Crown reserves (39843 and 39845) with the purpose of 'trigonometrical stations' (control points on the ground used for mapping) are located on high points in the landscape in the northern section of the planning area (see Map 2). Access to these may occasionally be required. Under the Alumina Refinery Agreement Act, Alcoa may preserve sight lines from any trigonometrical reserves by clearing vegetation after consultation with the Conservation Commission.

The Muja-Boddington Terminal 81 (132 kV – proposed upgrade to 330 kV) and the Muja-Northern Terminal 91 (330 kV) transmission lines traverse the planning area. There is also a number of powerlines servicing domestic supply to private enclaves within the planning area. The Department should liaise with the network operator to ensure the effective management of vegetation near powerlines and transmission lines in accordance with the *Guidelines for the management of vegetation near power lines* (Energy Safety 2006).

Icy Creek has a solar power generating system that is used to produce some of the electricity needs for use at the site, including supplying power to the accommodation huts and kitchen, Rangers' house and telephone facilities.

Mining companies as per the State Agreement Acts are required to take measures such as removing debris and ignition sources from under and around conveyer belts and powerlines both within, and in areas adjacent to their lease or licence.

Proposed utilities or services are assessed on a number of criteria including:

- physical (e.g. soil erosion);
- biological (e.g. introduction and spread of weeds and disease such as *P. cinnamomi* and potential increase in pressure on threatened flora and fauna);
- visual (e.g. loss of visual amenity through clearing of native vegetation);
- operational (e.g. create additional access requiring management); and
- social impacts (e.g. potential to impact on recreation).

Any proposed utilities or services need to be located appropriately to minimise environmental impacts. To limit these impacts, it is preferable that utility infrastructure not servicing the planning area itself, be sited outside the area. When this is unavoidable, the use of already degraded areas, pre-existing corridors or co-location with existing infrastructure (i.e. clustering facilities), is preferred. However, it is important that utilities are sited to ensure that adverse impacts on natural and other values are kept to a minimum. Proposals likely to have a significant adverse impact on the environment will be referred to the EPA for environmental impact assessment.

If at any stage utilities and services are no longer required, the infrastructure will be removed and the land will be rehabilitated as per Section 39 - *Rehabilitation*.

41. Public Utilities and Services

Key Points

- There are a number of existing public utilities and services within the planning area including high voltage transmission lines, powerlines, water pipelines, a conveyer belt and trigonometrical stations.
- To minimise environmental impacts, the appropriate location of new corridors and infrastructure and the ongoing management of existing ones is necessary.
- Provision of utilities and services can impact on the key values of planning area if they are not located in appropriate areas, through the clearing of vegetation, the introduction and spread of weeds and disease and the destruction of important habitats.
- To limit impacts, it is preferable that utility infrastructure not servicing the planning area itself, be sited outside the area.

[36] Western Power transmission lines use a voltage between 66 kV and 330 kV.
[37] Western Power distribution powerlines use a voltage up to 33 kV.

The objective is to minimise impacts of public utilities and services on the key values.

This will be achieved by:
1. referring development proposals to the EPA for formal environmental impact assessment under the Environmental Protection Act;
2. permitting new utilities and services where there are no other viable alternative locations outside the planning area, and where they do not significantly impact on key values and are consistent with Government policy (e.g. within existing utility corridors or structures); and
3. liaising with utility and service providers to ensure that development proposals and subsequent construction and maintenance is in accordance with Departmental policies and requirements, including visual landscape protection and the rehabilitation of disturbed land, weed control, fire management and hygiene controls.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

42. WATER RESOURCES

The extraction of water within the planning area is regulated under the *Rights in Water and Irrigation Act 1914* (RIWI Act) and is administered by DoW, the agency responsible for the protection and management of water resources. Under the RIWI Act, proponents are required to obtain a licence from DoW to extract water in proclaimed groundwater[38] and surface water areas[39] in the planning area, to which conditions are applied.

Proponents extracting water from the planning area are also required to obtain a permit under sections 97A(2) and (6) (for section 5(1)(g) and (h) reserves) and Sections 101(1a) and (1e) (for national parks and conservations parks) of the CALM Act. These permits are subject to consideration by the Conservation Commission and approval by the Minister for Environment. These permits cannot limit the operation of the RIWI Act and need to be in accordance with a CALM Act management plan. Where infrastructure for water extraction is required, a lease may also be required. An assessment by the EPA may be required for projects that have potentially significant environmental impacts. Licences and permits for water extraction must ensure the maintenance of sufficient environmental flows to rivers in the planning area to minimise impacts on aquatic ecosystems.

Water extraction is also subject to relevant drinking water source protection plans (see Section 18 – *Catchment Protection*). See also Section 30 – *Visitor Access – Special and Restricted Access* for further information on access in public drinking water source areas.

There is one lease (1764/100) in the planning area for a waterhole.

42. Water Resources

Key Points
- The extraction of water within the planning area is regulated under the RIWI Act administered by DoW.
- Under the RIWI Act, proponents are required to obtain a licence to extract water in proclaimed groundwater and surface water areas in the planning area, to which conditions are applied.
- Proponents extracting water from the planning area are also required to obtain a permit under the CALM Act.
- Licences and permits for water extraction must ensure the maintenance of sufficient environmental flows to rivers in the planning area to minimise the impacts on aquatic ecosystems.
- Water extraction is also subject to relevant drinking water source protection plans (see Section 18 – *Catchment Protection*).

The objective is to minimise the impact of water extraction on the key values.

This will be achieved by:
1. as required, issuing licences under the CALM Act for water extraction from bored and other water sources located within the planning area;

[38] At the time of writing there are no proclaimed groundwater areas in the planning area.
[39] There are a number of proclaimed surface water areas covering the planning area.

2. following an appropriate level of assessment and approval by the Conservation Commission, the Minister for Environment, DoW and the Department may issue a Water Removal Permit for water extraction from the planning area, as required; and
3. referring any proposals for significant use of the water resources to the EPA for formal assessment where such proposals are likely to adversely affect the key values of the planning area.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

43. DEFENCE AND EMERGENCY SERVICES TRAINING

The Department of Defence, emergency service and other types of training are an acceptable use of some lands and waters managed by the Department. In the planning area, the Department of Defence sometimes undertakes training involving activities which can range from movements by individuals or small groups practicing survival techniques, to major operations involving one or more battalions. Possible activities include survival and navigation exercises, military training, driver training, leadership and search and rescue training (e.g. river rescue).

Management of the Department of Defence and emergency service training within the planning area is guided by Department Policy Statement No. 54 – *Defence force training on CALM managed lands and waters*. Proposals for the Department of Defence and emergency service training conducted in the planning area requires a written submission outlining proposal activities. Proposals are assessed against the criteria detailed in the policy to determine the likely impacts and whether any conditions need to be applied to minimise the impact on the key values of planning area and risk to other visitors.

Some activity types are not appropriate in certain categories of Department-managed lands and waters, such as national parks and nature reserves, due to potential for environmental damage or risks to visitors. In general, the following activities are not acceptable in the planning area:

- camping involving digging or soil disturbance, use of fire, rubbish disposal or construction of temporary toilets;
- damaging, cutting or destroying vegetation (e.g. for camouflage or concealment of personnel and equipment);
- carrying and use of firearms, ammunition or pyrotechnics;
- taking vehicles off roads and tracks (e.g. in deployment procedures);
- use of support or transport aircraft or powerboats;
- survival training involving collecting and consuming native plants and animals regarded as bush tucker;
- use of domestic animals (e.g. dogs or pack animals);
- entering DRA areas without employing forest hygiene protocols; and
- building fortifications, weapons pits or other structures.

However, the Department of Defence training with small numbers of personnel may be permitted to undertake some activities (e.g. camping) where natural values are not impacted and the activity does not conflict with other groups using the planning area.

43. Defence and Emergency Services Training

Key Points
- Department of Defence and emergency services training can sometimes have impacts on biodiversity, cultural and recreation values, and needs to be assessed accordingly.
- Not all the Department of Defence training activities will be appropriate in the planning area.

The objective is to minimise the impacts of the Department of Defence and emergency service training on the key values.

This will be achieved by:
1. continuing to liaise with the Department of Defence, Government Departments and other organisations likely to conduct training exercises in the planning area to:
   - ensure activities are carried out in accordance with relevant Departmental policies;

- ensure minimal impact techniques are adopted during training exercises; and
- encourage the use of alternative suitable venues outside the planning area; and

2. prohibiting training exercises in areas likely to cause unacceptable damage to the key values or risk and disturbance to visitors.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

PART G. INVOLVING THE COMMUNITY

Community involvement is one of the key values of the planning area and other parks and reserves managed by the Department. The Department actively seek to encourage the community to become involved in parks and reserves around the State. Community involvement also fosters a sense of community ownership by providing a platform for stewardship. This is done by providing information, interpretation and education programs as well as establishing community based groups to assist with management.

44. INFORMATION, INTERPRETATION AND EDUCATION

The planning area is one of the most visited reserves in the region. As such, it provides an important opportunity to inform and educate visitors about the key values and management of the planning area and other parks and reserves. Raising community awareness, appreciation and understanding of the values, fosters a sense of community ownership of the planning area, engenders support for management and encourages appropriate behaviour (e.g. leave no trace). Communication is also vital to managing visitor risk so visitors have safe, enjoyable experiences in the planning area.

Guidance for the provision of information, interpretation and education is provided through the Departments Policy Statement No. 25 – *Community Education and Interpretation*, Sign Manual, *Visitor Interpretation Manual* and Policy Statement No. 18.

Information

The Department provides information to visitors on the area's faculties, attractions, activities, access, regulations, code of care, cost and visitor safety through a variety of means including:

- printed and display material (e.g. brochures and 'Park notes'), distributed from the entry station, Department offices and local tourist bureaus;
- signage (e.g. orientation, interpretation or management) within the planning area;
- information on the Department's website;
- personal contact with Rangers and other Department staff;
- Icy Creek Environmental Education Facility;
- external sources including tour operators, the tourism industry and the Forest Heritage Centre in Dwellingup.

The delivery of consistent and accurate information by both internal and external providers is important in achieving effective communication. To this end, the Department provides advice, resources and training to operators and other information providers such as volunteers, to assist them in accurately reinforcing the Department's message to visitors.

Interpretation

Interpretation is the craft of enriching visitor experience and is an interactive process involving the visitor, the interpretive media and the setting. Interpretation is a process and an opportunity for translating stories of place, the biota and people in terms that motivate and inspire visitors to greater understanding and care.

Three topics and associated themes for interpretation identified in the *Lane Poole Reserve Interpretation Plan* include:

- camping softly, playing safely:
  - enjoy yourself and at the same time respect yourself, other visitors and the environment; and
  - the planning area is home to many plants and animals.
- four waves of human usage (Indigenous, timber industry, mining and recreation):
  - riverine environments were/are important to Nyoongar people;
  - Nanga was once a thriving timber town. It was burnt out by the 1961 Dwellingup fires;

- individuals have a marked impact in making the planning area what it is today;
- the mining industry co-exists with other forest uses; and
- visitors now come to the planning area to enjoy a variety of recreational pursuits.

- the forested ecosystem:
  - the forest is a rich and diverse ecosystem;
  - dead wood contains living things;
  - fire is a part of forest life;
  - many small animals live in the forest, even if you don't see them; and
  - the fragile riparian zone links the river to the forested uplands.

Within this framework, there is scope for developing further interpretation opportunities and facilities within the planning area, particularly along the trails, around camping and day use sites, at the old mill sites (e.g. Teddy Bear Mill, Trees Mill), Yourdamung Lake (e.g. bird hide and nature trail) in the southern section of the planning area and of Indigenous culture. The Department's *Nearer to Nature* environmental education program and Perth Hills National Park Centre may run interpretation programs from Icy Creek in the future for school and community groups (M. Meinema *pers. comm.* 2005). Initially the program will be run out of Icy Creek, but there is potential for the programs to be expanded to other parts of the planning area and to other target audiences, including the general public and other visitors (see Section 31.5 – *Overnight Stays – Built Accommodation*).

The Forest Heritage Centre located nearby in Dwellingup enhances interpretation of the planning area. It is used as an education centre for forest education and interpretation, and its proximity makes it an ideal place to inform people about the planning area. Local tourist bureaus also provide valuable pre-visit information to visitors to the planning area.

Education

Education is a series of linked learning programs with defined outcomes in mind. Education programs including presentations and organised field activities are targeted at specific user groups and facilitate learning and foster greater appreciation and understanding of the area's key values.

The planning area is already a popular destination for many school groups, with many keen to run outdoor education programs in a quality forest environment using the amenities provided by the Department (e.g. facilities at Icy Creek) or local businesses.

44. Information, Interpretation and Education

Key Points

- The planning area is one of the more visited areas in the region and as such provides an important opportunity to inform and educate visitors about the key values and management of the planning area and other parks and reserves.
- Raising community awareness, appreciation and understanding of the values fosters a sense of community ownership of the planning area, engenders support for management and encourages appropriate behaviour (e.g. leave no trace).

The objective is to promote community awareness, understanding and appreciation of the key values and to engender support for their protection and effective management.

This will be achieved by:

1. providing information to visitors on the key values and issues within the planning area and other topics such as recreational opportunities, visitor safety and appropriate visitor behaviour;
2. ensuring commercial operators and the tourism industry have relevant and factual interpretive material about the planning area;
3. expanding and implementing the Lane Poole Reserve Interpretation Plan to include the southern part of the planning area (e.g. Yourdamung Lake); and
4. working with other agencies, organisations and individuals (such as tourism agencies, tour operators, schools, museums, Dwellingup Information Centre, the Forest Heritage Centre, local government, Landcare, regional NRM groups and catchment groups) to ensure integration of education and interpretation programs, facilitate mutually beneficial partnerships and expand the range of nature-based tourism experiences offered.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

45. COMMUNITY INVOLVEMENT AND LIAISON

Community involvement is an integral component of the Department's operations, including the development and implementation of this management plan. Involvement by the community as groups or individuals in Department activities increases the works capabilities and skills base of the Department. A key objective for the Department is to develop community awareness and appreciation of the State's natural environment and biodiversity and promote community involvement in and support for its protection and conservation.

As part of the Department's *Community Involvement Program*, 3882 registered volunteers[40] in 2005-2006 contributed 470,600 hours of support to Department projects across WA (CALM 2006a). Training, such as basic wildlife rehabilitation and WILDCARE helpline is made available to volunteers to facilitate their involvement where necessary. The Department recognise and acknowledges the valuable work and support from its volunteers though awards such as Volunteer of the Year and Outstanding Service.

Ongoing community support is essential for the successful implementation of the approved final management plan. The involvement of Aboriginal people, neighbouring land-owners and managers, visitors, tour operators and interest groups is important to the conservation of the planning area's key values. This will enhance integrated land management, which is particularly important where management issues, such as fire, weeds, introduced animals and visual land management, go beyond the boundaries of reserves.

The Department's Good Neighbour Policy outlines several principles for effective neighbour relations and developing partnerships with the community. The Policy addresses cross-boundary issues such as fences adjacent to Department-managed lands, fire management, control of weeds and introduced animals, straying stock on Department-managed lands, access to Department-managed lands and communication.

Involvement can vary from aiding in on-ground management such as targeted weed removal, strategic involvement through advisory committees and through programs such as *Nearer to Nature* and *Healthy Parks, Healthy People*. The Departments also encourages community involvement through organisations such as the Bibbulmun Track Foundation, the Munda Biddi Trail Foundation, school groups, the Department of Corrective Services and through programs such as 'adopt a track' and the Mentored Aboriginal Training and Employment Scheme (MATES) program.

Community involvement in the planning process was formally facilitated through the Lane Poole Reserve Community Advisory Committee. Other input was facilitated through public participation such as visitor surveys, discussions with stakeholders and through submissions made on this plan (see Section 5 – *Public Participation*).

The Department also rely on Volunteer Bush Fire Brigades to aid in the suppression of bushfire. Their efforts are greatly appreciated by the Department and by the local communities for the community assets and natural values the collective efforts protect.

Working together with Aboriginal people to 'care for country' will assist heritage preservation and conservation of the environment, as well as enrich cross-cultural awareness. The future involvement of Aboriginal people in management of the planning area will be considered in light of the Government determining a policy position (see Section 8 – *Management Arrangements with Aboriginal People*).

Further guidance is provided in the Departments Policy Statement No. 18 and Policy Statement No. 15 – *Community Involvement (Public Participation and Volunteers)*.

45. Community Involvement and Liaison

Key Points

- Involvement by the community, as groups and individuals is encouraged in both planning and management and was an important component in the preparation of this management plan.
- Good neighbour relations are important for cross-boundary issues such as fences adjacent to

[40] There was a total of 8230 registered volunteers in 2005/2006.

Department-managed lands, fire management, control of weeds and introduced animals, straying stock on Department-managed lands, access to Department-managed lands and communication.

The objective is to facilitate effective community involvement in planning and management.

This will be achieved by:

1. managing community involvement and support, and effective neighbour relations in accordance with Department policies;
2. continuing to provide and promote opportunities for community involvement in land management programs;
3. continuing to liaise with local Aboriginal people, neighbouring land-owners and land managers, relevant government agencies and other stakeholders to enhance management; and
4. continuing to support volunteer involvement in Department programs.

Key Performance Indicators:

There are no Key Performance Indicators for this section.

PART H. RESEARCH

46. RESEARCH AND MONITORING

Research and monitoring are essential components of management, and are required to successfully implement this management plan. They increase the knowledge and understanding of the values of the planning area, aid in performance assessment and provide a scientific basis for improving and adapting future management to achieve best practices.

'Adaptive management' is a process of responding positively to change, where the management of complex natural systems builds on research, experimentation and monitoring by continually improving and adjusting management practices based on what is learnt. This plan utilises best available knowledge to develop practices aimed at meeting specific management objectives. Monitoring, regular review and analysis of management outcomes and ongoing research are critical if land management is to continue to improve.

While monitoring might be defined as an examination of performance, research is the acquisition of new knowledge. The Department conducts many different types of research and monitoring on the lands and waters it manages. These range from nature conservation studies such as fire ecology to social research including Visitor Satisfaction Surveys, the Visitor Statistics Program, and the Nature-based Tourism Research Reference Group. The latter focuses on developing relationships with universities to facilitate nature based tourism research.

Monitoring programs are necessary to measure changes over time. High visitation means it is crucial to identify, understand and manage impacts on the natural values and ecological processes of the planning area. Monitoring programs will allow earlier detection of detrimental changes (e.g. erosion, weed invasion, recreational succession), evaluate management practices and assist management to further prevent such occurrences.

Furthermore, research and monitoring projects can benefit from the involvement of volunteers, educational institutions and individual researchers as it can provide a platform for stewardship and a source of valuable information to the Department. Where practical, the Department should actively seek to collaborate with external research organisations and universities. The Department should also seek sponsorship or funding from external parties and grants where appropriate.

Inventory, research and monitoring projects should give priority to those values identified as being most at risk (sensitive to disturbance). Allocating priority for research and monitoring in the planning area should also take into consideration projects of relevance within the Northern Jarrah Forest outside the planning area and projects being conducted by parties other than the Department (e.g. research carried out by Alcoa and Worsley).

Research and monitoring itself has the potential to adversely impact upon the values of the planning area. Proposals for research should be assessed as to their suitability and be subject to appropriate conditions if necessary (see Section 47 – *Scientific and Research Use*).

Departmental research gives priority to:

- describing and documenting Western Australia's biological diversity;
- providing knowledge on how best to conserve the State's biodiversity;
- evaluating and minimising impacts of threatening processes on biodiversity assets; and
- increasing knowledge of visitor use patterns and profiles (e.g. demographics, level of use of recreation sites, visitor expectations and perceptions).

Allocating priority for research and monitoring may result in conducting programs that have relatively little direct management application to the planning area but significant application to the conservation estate and species or communities elsewhere.

Research Projects

The planning area offers many opportunities for research and is of interest to scientists because of the significant habitats (e.g. old-growth forests, granite outcrops, wetlands and riverine environments), threatened and priority

flora and fauna and threatening processes. The Department's Science Division undertakes research within the region either with assistance from Regional and District staff or as part of larger Statewide programs. There are also a number of discrete and ongoing Science Division research projects in the planning area including native flora, environmental weeds, native fauna (including fauna reintroductions), introduced animals, invertebrates, disease and fire studies.

Western Shield is a research and monitoring program conducted within the planning area and in other areas around the State (see Section 23 – *Introduced and Other Problem Animals*). As part of this program, control areas have been set aside for conducting native fauna studies in unbaited environments, aiding in assessing the effectiveness of the baiting program (e.g. the mesopredator release[41] project). Within the Western Shield study area, there are two control areas, one of these is located in the planning area (see Figure 5).

There are also a number of ForestCheck[42] monitoring grids in the planning area. The ForestCheck program provides a framework to quantify, record, interpret and report on the status of key forest organisms, communities and processes in response to both forest management activities and natural variations.

Other Government departments also have responsibility for monitoring in the planning area. For example, DoW monitors water quality and quantity of the Murray River.

Mining companies also conduct research and monitoring for fauna, flora, disease (e.g. spread of *P. cinnamomi*) both pre and post mining.

The planning area also provides unique opportunities for social research, in that the landscape provides for a wide range of recreation opportunities. This attracts many different types of visitors making it a key area for social and visitor research, examining visitor interactions and impacts of recreation use on the natural values. Social research such as Visitor Satisfaction Surveys and the Visitor Statistics Program assess the level of use of camping and day use sites, patterns of visitor use and associated activities, compliance with regulations and visitor perceptions. These programs provide useful information to managers as they put a quantitative measure on visitor usage and perceptions of which management techniques can be validated or they can highlight areas where improvements can be made.

46. Research and Monitoring

Key Points

- Research and monitoring are essential components of management, and are required to effectively implement and measure the success of this management plan.
- Research and monitoring increase the knowledge and understanding of the values of the planning area, aid in performance assessment and provide a scientific basis for improving and adapting future management to achieve best practices.

The objective is to increase knowledge and understanding of the key values and threats to these to provide for continual improvement in management practices through adaptive management, and allow assessment of this management plan.

This will be achieved by:

1. conducting integrated research and monitoring programs that facilitate management, that focuses on key issues and values identified in this management plan;
2. updating Department databases (e.g. Florabase and library) with information gained through research in the planning area and making the data or findings available through reports;
3. encouraging and supporting, wherever possible, external agencies, organisations, educational institutions and individuals where their research contributes directly to Department strategies or the implementing or auditing of this management plan;
4. ensuring that research and monitoring activities do not adversely impact on the values of the planning area;
5. applying information gained through research and monitoring, to adapt management practices to improve management;

[41] The mesopredator release study is the pattern of an increase in one or more subordinate predators (e.g. feral cats) after the removal or reduction in numbers of a dominated predator (e.g. foxes)

[42] ForestCheck is an integrated monitoring system that has been developed to provide information to forest managers in the south-west about any changes and trends in key elements of forest biodiversity associated with a variety of forest management activities.

6. applying the permit system for research proposals from outside the Department which specifies conditions under which work may be carried out and results disseminated;
7. proposing nature-based tourism research projects through the Nature-based Tourism Research Group; and
8. pursuing external funding sources to assist in achieving research and monitoring objectives.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

47. SCIENTIFIC AND RESEARCH USE

Scientific knowledge is essential to effectively plan and manage the planning area. As there are knowledge gaps and changing circumstances, it is important that new scientific research be conducted to close these gaps to gain a better understanding of the values and processes occurring in the planning area, which will enable more effective management to occur.

The natural, recreation and cultural values of protected areas make them highly desirable sites for research. Research activities undertaken by the Department or in partnership with external parties are supported where they contribute to the Department's understanding of ecological or social processes within the area, and where such activities do not themselves threaten or disrupt these processes.

Scientific research activity involving disturbance of flora or fauna requires a licence issued under the Wildlife Conservation Act by the Department. Similarly, a licence is required to remove or cause significant damage or disturbance to any naturally occurring feature on lands managed by the Department. Such licences will generally be subject to conditions, including that results/findings are forwarded to the Department.

The Department is working to further develop relationships with universities to conduct social research in the region, principally through the Nature-Based Tourism Research Reference Group. This group comprises representatives from the Department and all Western Australian universities. The group also assists Regions and Districts of the Department in finding student researchers to deliver management solutions to recreation and/or tourism issues. Projects are usually put forward by field staff and listed on the Department's webpage.

Section 46 – *Research and Monitoring* provides further information on the research requirements for the planning area.

47. Scientific and Research Use

Key Points
- Protected areas are a valuable resource for a wide range of research projects.
- Research within the planning area may require a permit from the Department for activities involving disturbance of wildlife.
- The Nature-based Tourism Research Reference Group provides a link between students and the Department in carrying out social research.

The objective is to ensure research will assist in achieving the objectives of this management plan or other Departmental objectives.

This will be achieved by:
1. assisting, wherever possible, external agencies, universities and individuals where their research contributes directly to Departmental strategies, output business plans and assessment of this management plan;
2. applying a permit/licence system for research proposals from individuals and organisations outside the Department by issuing permits specifying the conditions under which work may be undertaken, as appropriate; and
3. proposing nature-based tourism research projects through the Nature-based Tourism Research Group for listing on the Department's website.

Key Performance Indicators:
There are no Key Performance Indicators for this section.

GLOSSARY

1080	A naturally occurring toxin (sodium monofluoroacetate) found in many native south-west Western Australian plants known as 'poison peas' (*Gastrolobium* spp.). 1080 forms the toxin used in fox baits
Adaptive management	A process of responding positively to change. The term adaptive management is used to describe an approach to managing complex natural systems that builds on common sense and learning from experience, experimenting, monitoring and adjusting practices based on what was learnt
Anthropogenic	Relating to or resulting from the influence that humans have on the natural world
Aquatic	Living or growing in or on water
Autonomous	Existing or capable of existing independently
Biodiversity	The variety of all life forms: the different plants, animals and micro-organisms, the genes they contain and the ecosystems they form; often considered at three levels: genetic diversity, species diversity and ecosystem diversity
Biogeography	The study of both geography and biology including the relationships between plants, animals, soils, water, climate and humans
Bioregion	A land and water territory whose limits are defined not by political boundaries, but by geographical limits of human communities and ecological systems
Biotic	Of, or relating to living things; caused or produced by living organisms
Catchment	The surface area from which water runs off to a river or any other collecting reservoir
Channelling use	Encouraging visitors to use particular areas away from sensitive areas through techniques such as barriers, constructing paths, roads, trails or bridges
Class A reserve	Classification under the Land Administration Act 1997 reflects security of tenure, level of approval required to alter the reserve's area, purpose or classification
Comprehensive, Adequate and Representative (CAR) Reserve System	The terms comprehensive, adequate and representative together describe the attributes of an ideal reserve system. These terms are defined in the Australian and New Zealand Environment and Conservation Council's Guidelines for Establishing the National Reserve System as: ❖ comprehensiveness – inclusion of the full range of ecosystems recognised at an appropriate scale within and across each bioregion; ❖ adequacy – the maintenance of the ecological viability and integrity of populations, species and communities; and ❖ representativeness – the principle that those areas that are selected for inclusion in reserves reasonably reflect the biotic diversity of the ecosystems from which they derive. In addition to using the scientifically-based CAR criteria, spectacular landforms and scenery as well as natural areas of high public use are also commonly included in parks and reserves
Conservation	The protection, maintenance, management, sustainable use, restoration and enhancement of the natural environment
Critical weight range mammals	Mammals weighing between 35 grams and 5.5 kilos
Declared rare flora/fauna	Threatened flora or fauna gazetted under the Wildlife Conservation Act
Declared species	Either plants that are declared as weeds or animals that are declared as pests. A list of declared species, with their levels of declaration in various areas of the State is published annually in the Government Gazette pursuant to Section 37 of the *Agricultural and Related Resources Protection Act 1976*
Dieback	A disease of plants caused by the infection by the soil-borne fungal-like water mould of the genus *Phytophthora*
Disjunct	Separated or disjoined populations of organisms. Populations are said to be disjunct when they are geographically separated from the main range
Duty of care	Such care as in all the circumstance of the case is reasonable to see that the person will not suffer injury or damage by reason of any danger
Ecological community	An integrated assemblage of species that inhabit a particular area
Endemic	Flora or fauna that is confined in its natural occurrence to a particular region
Environmental weed	An unwanted plant species growing in natural ecosystems that modifies natural processes, usually adversely, resulting in the decline of the communities they invade; usually an introduced plant

Eutrophication	The enrichment of water by nutrients, such as compounds of nitrogen or phosphorus. It causes an accelerated growth of algae and higher forms of plant life. These consume more oxygen often leading to a oxygen deficit, which can have a major detrimental effect on the fish other aquatic organisms
Exotic	A species occurring in an area outside its historically known natural range as a result intentional or accidental dispersal by human activities
Experimental control	An experiment used to check another, to verify the result, or to demonstrate what would have occurred had the factor under study been omitted
Extant	Still existing
Fauna	The animals inhabiting an area; including mammals, birds, reptiles, amphibians and invertebrates. Usually restricted to animals occurring naturally and excluding feral or introduced animals
Feral	A domesticated species that has become wild
Fire regime	A fire regime is a description of fire in terms of its fire frequency (how often it occurs on a site), fire intensity (how hot it is), season (what time of year it occurs), scale (how big it is) and its spatial diversity (how patchy it is at both a landscape and local scale)
Fireline	A mineral earth break between the fire and the area you are trying protect
Flora	The plants growing in an area; including flowering and non flowering plants, ferns, mosses, lichens, algae and fungi (although fungi are strictly speaking not plants). Usually restricted to species occurring naturally and excluding weeds
Fungus	Saprophytic and parasitic spore-producing organisms usually referred to as plants that lack chlorophyll but actually a separate kingdom to plants and animals and include moulds, rusts, mildews, smuts, mushrooms, and yeasts
Genetic	To do with the hereditary units that are composed of sequences of DNA
Geoheritage	Statewide to nationally significant features of geology, including igneous, metamorphic, sedimentary, structural, palaeontologic, geomorphic, pedologic or hydrologic attributes that offer important information or insights into the formation or evolution of the continent; or that can be used for research, teaching or as a reference site
Geology	The study the history of the earth and its life especially as recorded in rocks
Geomorphology	The study of the earth surface features and their formation
Groundwater	All free water below the surface in the layers of the Earth's crust
Habitat	The place where an animal or plant normally lives and reproduces
Hardening the site	Making a site (e.g. a recreation site) more robust
Heritage	Something inherited from past generation that is valued
Host	The organism from which a parasite obtains its nutrition or shelter
Hydrology	The scientific study of the characteristics of water, especially of its movement in relation to the land
Indigenous	Native or belonging naturally (to a place)
Introduced species	A species occurring in an area outside its historically known natural range as a result intentional or accidental dispersal by human activities
Invertebrate	Animals without backbones, for example, insects, worms, spiders and crustaceans
Landform	All the physical, recognisable, naturally formed features of land having a characteristic shape; includes major forms such as a plain, mountain or plateau, and minor forms such as a hill, valley or alluvial fan
Landscape	Appearance or visual quality of an area determined by its geology, soils, landforms, vegetation, water features and land use history
Landscape character type	A broad scale area of land with common visual characteristics based on landscape
Locally endemic	Taxa with a distribution that ranges less than 150km
Macropod	A member of a superfamily which includes kangaroos, rat-kangaroos and wallabies
Mesic	Of, or adapted to, a temperate, moderately moist habitat
Mesopredator	Medium sized predator (e.g. feral cats)
Monotypic	Of a genus with one species or a family with one genus
Motile	Exhibiting or capable of movement
Nature-based tourism	Tourism that is dependent on the resources of the natural environment and incorporates a range of tourism experiences including adventure tourism, eco-tourism and aspects of cultural and rural tourism
Obligate	Restricted to a single mode of behaviour or environmental condition, such as an obligate aerobe that is dependent on the presence of molecular oxygen to breathe
Organic	Of, relating to, or derived from living organisms
Pathogen	Any organism (bacterium or virus) or factor that causes disease within a host
Potable	Suitable for drinking
Prescribed burning	The controlled burning of fuels to decrease the intensity and rate of spread of bushfires

Priority flora and fauna listings	❖ priority 1: Taxa with few, poorly known populations on threatened lands; ❖ priority 2: Taxa with few, poorly known populations on conservation lands; ❖ priority 3: Taxa with several, poorly known populations, some on conservation lands; ❖ priority 4: Taxa in need of monitoring; and ❖ priority 5: Taxa that are conservation dependent (i.e. their conservation status is dependent on ongoing active management)
Priority species	A Departmental term for flora and fauna that may be rare or threatened but for which there is insufficient survey data available to accurately determine their true status. Priority species also include rare species that are currently not threatened. Species are grouped from 1 to 5 according to the perceived urgency for further survey
Protectable area	An area within the vulnerable zone (predominantly the South-west Land Division) that is free of *P. cinnamomi*, of sufficient size (greater than 4ha and an axis of 100m), is positioned in the landscape so that it will not be engulfed by *P. cinnamomi* in the short term (a period of a few decades) and where human vectors of this disease are controllable
Public works	Include buildings of fixed structures, roads, railways, bridges, water bores, wells or any major earthwork
Recovery plan	A plan that describes the actions required to achieve the recovery of threatened species or ecological communities from the current threat of extinction or destruction
Recreation	Generally considered in this management plan to be the day use of the reserve by visitors
Rehabilitation	The process necessary to return disturbed land to a predetermined state, in terms of surface, vegetational cover, land-use and/or productivity
Relictual	A surviving individual, population, community or species that is characteristic of an earlier period in evolutionary history
Riparian	Relating to or growing on the bank of a natural watercourse
Sclerophyll forest	There are two types of sclerophyll forest, dry and wet, both of which have a canopy of eucalypts. Sclerophyllous plants have hard leaves with lignin which prevents the leaves from wilting in dry conditions. Dry sclerophyll are 10 to 30m tall and have a hard-leaved understorey, whereas wet sclerophyll forests are taller than 30m and have a soft-leaved understorey, such as tree ferns
Seral stage	Any stage in the development of a vegetation type between denudation and the stabilisation of a habitat
Soil erosion	A combination of processes in which soil is loosened, dissolved, or worn away, and transported from one place to another by climatic, biological or physical agents
Species richness	The number of different species in a community or other defined unit
Spores	Primitive, usually unicellular, reproductive body produced by plants and some micro-organisms and capable of development into a new individual either directly or after fusion with another spore
Statutory	Enacted or required by law
Swamp	A wetland often partially or intermittently covered with water
Symbiotic	A biological relationship which benefits both parties
Taxa	A defined unit (for example, species or genus) in the classification of plants and animals
Temperate	Of mild temperature, the Temperate Zone is the area or region between the tropic of Cancer and the arctic circle in the Northern Hemisphere or between the tropic of Capricorn and the Antarctic circle in the Southern Hemisphere
Threatened fauna listings	❖ Fauna declared under the Wildlife Conservation Act (WA) as likely to become extinct or rare, or otherwise in need of special protection: o Schedule 1 (S1): Fauna that is rare or likely to become extinct o Schedule 2 (S2): Fauna presumed extinct but might be rediscovered o Schedule 3 (S3): Birds protected under an international agreement o Schedule 4 (S4): Other specially protected fauna ❖ IUCN Red List categories used to rank threatened species in WA: o EX: Extinct (no reasonable doubt that the last individual has died) o EW: Extinct in the Wild (known only to survive in cultivation, in captivity or as a naturalised population/s well outside the past range) o CR: Critically Endangered (extremely high risk of extinction in the wild) o EN: Endangered(very high risk of extinction in the wild) o VU: Vulnerable (high risk of extinction in the wild) o NT: Near Threatened (likely to qualify for a threatened category in the near future) ❖ Under the Commonwealth EPBC Act, fauna listed under Section 179 may be: o EX: Extinct o EW: Extinct in the wild o CR: critically endangered o EN: endangered o VU: vulnerable o CD: Conservation dependent

Tourism	Generally considered in this management plan to be visitors from outside the area staying overnight in or adjacent to the reserve
Turbidity	Discolouration of water due to suspended silt or organic matter
Understorey	The shrubs and plants that grow beneath the main canopy of a forest
Vascular plants	Plants having a specialised conducting system that includes xylem and phloem
Vector	An organism that transmits a pathogen
Vertebrate	Animals that have a spinal column which includes fish, amphibians, reptiles, birds and mammals
Visual landscape	Appearance or visual quality of an area determined by its geology, soils, landforms, vegetation, water features and land use history
Wetland	Land or areas (as tidal flats or swamps) containing much soil moisture

ACRONYMS AND ABBREVIATIONS

ARRP Act	Agriculture and Related Resources Protection Act 1976
CALM Act	Conservation and Land Management Act 1984
CAR	Comprehensive, adequate and representative
CAWS Act	Country Areas Water Supply Act 1947
CTO	Commercial Tourism Operators
DEC	Department of Environment and Conservation
DMP	Department of Mines and Petroleum
DoF	Department of Fisheries
DoW	Department of Water
DRA	Disease Risk Area
EPA	Environmental Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
FESA	Fire and Emergency Services Authority
FMP	Forest Management Plan
FPC	Forest Products Commission
IBRA	Interim Biogeographic Regionalisation of Australia
IMBA	International Mountain Bicycling Association
IUCN	International Union for Conservation of Nature
KPI	Key performance indicator
LCU	Landscape Conservation Units
MMPLG	Mining and Management Program Liaison Group
NRM	Natural Resource Management
RFA	Regional Forest Agreement
RIWI Act	Rights in Water and Irrigation Act 1914
TDS	Total dissolved salts
UCL	Unallocated Crown land

REFERENCES

Abbott, I. (1992) Prodromus of the occurrence and distribution of insect species in the forested part of south-west Western Australia. *CALMScience* 1(4): 365-464.

Abbott, I. (1998) *Detecting areas with high levels of faunal species richness – a preliminary study*. A report prepared for the Regional Forest Agreement, Western Australia. Commonwealth & Western Australian Regional Forest Agreement Steering Committee.

Abbott, I., Burbidge, T., Williams, M. and Van Heurck, P. (1992) Arthropod fauna of jarrah (Eucalyptus marginata) foliage in Mediterranean forest of Western Australia: spatial and temporal variation in abundance, biomass, guild structure and species composition. *Aust. J. of Ecology* 17: 263-274.

Abbott, I., Van Heurck, P., Burbridge, T. and Wills, A. (1995) Cutting out the leafminer. *LANDSCOPE* 11(1): 43-47.

ABS (2004) *Disability, Ageing and Carers, Australia: Summary of Findings, 2003*. http://www.abs.gov.au/Ausstats/abs@.nsf/b06660592430724fca2568b5007b8619/c258c88a7aa5a87eca2568a9001393e8!OpenDocument. Australian Bureau of Statistics. Accessed 15 August 2006.

ABS (2007) *2006 Census Data*. http://abs.gov.au/websitedbs/D3310114.nsf/home/Census+data. Australian Bureau of Statistics. Accessed 25 November 2009.

Alcoa of Australia (1994) *Wagerup Alumina Refinery: Consultative Environmental Review – Expansion of Alumina Production to 3.3 Million Tonnes Per Annum*. WA.

Aplin, K. and Kirkpatrick, P. (2001) In the pursuit of the frog fungus. *LANDSCOPE* 16(3): Autumn 2001, 10-16. Department Conservation and Land Management, Kensington.

Armstrong, R. (2004a) Baiting operations: Western Shield review – February 2003. *Conservation Science Western Australia* 5(2): 31-50.

Armstrong, R. (2004b) Ecologically based fire management – integration of multiple land use objectives. *11th Annual AFAC Conference and Inaugural Bushfire CRC Conference*, 7-9 October, 2004, Perth.

Australia ICOMOS (2000) *The Burra Charter: the Australia ICOMOC charter for places of cultural significance*. Australia ICOMOS Incorporated.

Australian National Four-wheel Drive Council (2005) *Code of conduct for off-road driving.* http://www.anfwdc.asn.au/docs/CODOffRoadDriving.pdf. Accessed 26 July 2006.

Bamford, M.J. and Roberts, J.D. (2003) The impact of fire on frogs and reptiles in south-west Western Australia. In Abbott, I. and Burrows, N. (ed.) *Fire in ecosystems of the south-west of Western Australia: impacts and management*. Backhuys Publishers, Leiden: 349-361.

Barthell, J.F., Randall, J.M., Thorp, R.W. and Wenner, A.M. (2001) *Yellow star-thistle, gumplant, and feral honeybees on Santa Cruz Island: a case of invaders assisting invaders.* Fifth California Islands Symposium (2000).

Beard, J.S. (1980) *A New Phytogeographic Map of Western Australia*. Western Australian Herbarium Research Notes 3: 37 – 58.

Beckmann, R. (1986) Jarrah's native pest. *Ecos* 48, Winter 1986: 30-31.

Borg, H., Hordacre, A. and Batini, F. (1988) Effects of logging in stream and river buffers on watercourses and water quality in the southern forest of Western Australia. *Australian Forestry* 51(2): 98-105.

Burbidge, A.H. (2003) Birds and fire in the Mediterranean climate of south-west Western Australia. In Abbott, I. and Burrows, N. (ed.) *Fire in ecosystems of the south-west of Western Australia: impacts and management*. Backhuys Publishers, Leiden: 321-347.

Burrows, N., Wardell-Johnson, G. and Ward, B. (2008) *Post-fire Juvenile Period of Plants in Forests and Associated Ecosystems of South-west Western Australia and Implications for Prescribed Burning*.

Burrows, N.D. (2004) *Fire management strategies for a south west Australian biodiversity hotspot*. TNC, WWF, IUCN Global Fire Partnership Experts Workshop: Sigrisvil, Switzerland, 15-18 May 2004. Department of Conservation and Land Management, Western Australia.

Burrows, N.D. (2005) Burning rocks. *LANDSCOPE Special Fire Edition* 2: 26-33. Department of Conservation and Land Management Western Australia.

Burrows, N.D. (2008) Linking fire ecology and fire management in south-west Australian forest landscapes. *Forest Ecology and Management* 255(7): 2394-2406.

Burrows, N.D. and Friend, G. (1998) Biological indicators of appropriate fire regimes in south west Australian ecosystems. In T. Pruden and L. Brennan (ed.) *Fire in ecosystem management: shifting the paradigm from suppression to prescription.* Tall Timbers Fire Ecology Conference Proceedings, No. 20. Tall Timbers Research Station, Tallahasse.

Burrows, N.D. and Wardell-Johnson, G. (2003) Fire and plant interactions in forested ecosystems of south-west Western Australia. In Abbott, I. and Burrows, N. (ed.) Fire in ecosystems of the south-west of western Australia: impacts and management. Backhuys Publishers, Leiden: 225-268.

Burrows, N.D., Tillman, J. and Maxwell, M. (2005) *Implementation of adaptive fire management: Interim guidelines for forest populations of quokka; Presentation on prescribed burn outcomes at Mowen Block – Blackwood District (Setonix brachyurus)*. Department of Conservation and Land Management – 15/08/05.

Burrows, N.D., Ward, B. and Robinson, A.D. (1995) Jarrah forest fire history from stem analysis and anthropological evidence. *Australian Forestry* 58(1): 7-16.

Burrows, N.D., Ward, B. and Robinson, A.D. (1999) *The role of indicators in developing appropriate fire regimes*. Proceedings from the Australian Bush Fire Conference, 7-9 July 1999, Albury, Australia.

CALM (1990) *Lane Poole Reserve Management Plan 1990-2000*. Department of Conservation and Land Management, Perth.

CALM (1994) *Reading the remote: Landscape characters of Western Australia*. Department of Conservation and Land Management, Perth.

CALM (1999) *Environmental weed strategy for Western Australia*. Department of Conservation and Land Management, WA.

CALM (2002a) *A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002*. Department of Conservation and Land Management.

CALM (2003a) *Establishment of Comprehensive, Adequate and Representative Terrestrial Conservation Reserve System in Western Australia*. Department of Conservation and Land Management, Perth.

CALM (2003b) *Independent review of Western Shield: Report of the review panel*. Department of Conservation and Land Management, Perth, February 2003.

CALM (2004) *Lane Poole National Park Visitor Survey Program: December 2003 – January 2004 & March - April 2004*. A report on the findings of visitor survey feedback form. Department of Conservation and Land Management, WA.

CALM (2005a) *Feral Pig Management Strategy for Departmental Managed Land 2005-2009 (Draft)*. Department of Conservation and Land Management, Perth.

CALM (2005b) *Lane Poole Reserve visitor survey program: January 2005 – April 2005 – A report on the findings from the visitor feedback form*. Department of Conservation and Land Management, Perth.

CALM (2005c) *Swan Region Direction for Visitor Services 2005-2025*. Department of Conservation and Land Management. September 2005

CALM (2006a) *Conservation and Land Management Annual Report 2005-2006*. http://www.naturebase.net/component/option,com_docman/task,doc_download/gid,217/Itemid,711/

CALM (2006b) *Mountain Bike Management Guidelines – Draft*. Department of Conservation and Land Management, WA.

CALM (2006c) *Murray Plantation Harvesting Operation – Visual Landscape Management Assessment*. Department of Conservation and Land Management, WA. February 2006, revised from March 2005.

CALM and Water Corporation (2005) *Development of a Feral Bee Control Strategy for Western Australia*. http://www.naturebase.net/forest_facts/apiary/pdf/feral_bee_control_strategy.pdf.

Chapman, A. and Dell, J. (1985) *Biology and zoogeography of the amphibians and reptiles of the Western Australian wheatbelt*. *Rec. West. Aust. Mus.* 12(1): 1-46.

Christensen, P. (1997) *A review of the knowledge of the effects of key disturbances on fauna in the south-west forest region.* A report to the Commonwealth and Western Australian Governments for the Western Australian Regional Forest Agreement.

Christensen, P., Annels, A., Liddelow, G. and Skinner, P. (1985) *Vertebrate fauna in the southern forests of Western Australia – A Survey.* Forests Department of Western Australia, Bulletin 94.

Churchward, H.M. and Dimmock, G.M. (1989) The soils and landforms of the northern jarrah forest. In Dell, B., Havel, J.J. and Makajczuk, N. (eds) *The jarrah forest*. Kluwer Academic Publishers, Netherlands: pp13-21.

Clark, R.N. and Stankey, G.H. (1979) *The Recreation Opportunity Spectrum: A Framework for Planning, Management and Research.* US Department of Agriculture. Forest Service. General Technical Report PNW 9.

Conservation Commission (2004) *Forest management plan 2004-2013*. Conservation Commission of Western Australia, Perth.

Conservation Commission (2006) Policy Statement 3 - *Basic raw materials: Government and local government access to conservation estate (national parks, nature reserves and conservation parks)*. Conservation Commission of Western Australia, Perth, July 2006.

Conservation International (2006) Biodiversity hotspots – Southwest Australia – Overview. http://www.biodiversityhotspots.org/xp/Hotspots/australia/. Accessed 2 August 2006.

Crawford, I. and Crawford, P. (2003) *Contested Country: A history of the Northcliffe area, Western Australia*. UWA Press.

CSIRO (2000) *Diseases and Pathogens of Eucalypts*. Keane *et al*. (eds.) Commonwealth Scientific and Industrial Research Organisation, Victoria.

CSIRO (2001) *Climate Change: Projections for Australia*. Commonwealth Scientific and Industrial Research Organisation, Climate Impact Group, Aspendale, Victoria. www.dar.csiro.au/publications/projections2001.pdf.

CSIRO (2007) *Climate Change in Australia*. Commonwealth Scientific and Industrial Research Organisation and Bureau of Meteorology. Australia. Technical Report 2007.

DAFF and NSW DPI (2007) *National Best Management Practice for Beekeeping in the Australian Environment*. Australian Government Department of Agriculture, Fisheries and Forestry and New South Wales Department of Primary Industry.

Dames and Moore (1984) *Harris River Environmental Review and Management Program*. Dames and Moore job no. 8076-024-071. Appendices to Draft Plan.

de Tores, P. (1999) *1997-1998 Report to Environment Australia National Feral Animal Control Program ISF06638. Control and Ecology of the Red Fox in Western Australia - Prey Response to 1080 Baiting Over Large Areas.* Unpublished report prepared for Environment Australia, National Feral Animal Control Program. ISF06638. Department of CALM. Perth.

de Tores, P., Hayward, M.W. and Rosier, S.M. (2004) The western ringtail possum, Pseudocheirus occidentalis, and the quokka, Setonix brachyurus. Case studies for the February 2003 review of Western Shield. *Science Western Australia*. 5(2): 235-257.

de Tores, P., Hayward, M.W., Dillon, M.J. and Brazell, R. (2007) *Review of the distribution, causes for the decline and recommendations for management of the quokka, Setonix brachyurus (Macropodidae: Marsupialia), an endemic macropod marsupial from south-west Western Australia*. *Conservation Science Western Australia*. 6(1): 13-73.

de Tores, P., Rosier, S., Jackson, J., Clarke, J., Aravidis, L., (2008) Working to conserve the western ringtail possum. *LANDSCOPE*. 25(4) Winter 2008 55-61. Department of Environment and Conservation, Kensington.

DEC (2007a) *Corporate Plan 2007 – 2009*. Department of Environment and Conservation, Kensington.

DEC (2007b) *Disability Access and Inclusion Plan 2007 – 2010*. Department of Environment and Conservation, WA.

DEC (2007c) *Good Neighbour Policy*. Department of Environment and Conservation, WA, July 2007.

DEC (2007d) *Wandoo Crown Decline*. http://www.naturebase.net/content/view/2189/979/. Accessed 24/10/07. Department of Environment and Conservation, WA.

DEC (2008a) *Guidelines for Generator Use at Campsites*. Department of Environment and Conservation. Available http://www.dec.wa.gov.au/component/option,com_docman/task,doc_download/gid,2299/

DEC (2008b) *Tour operator Handbook: Terrestrial Amendments 2008*. Department of Environment and Conservation, WA.

DEC (2008c) *Wellington National park, Westralia Conservation Park and Wellington Discovery Forest Management Plan*. Department of Environment and Conservation, WA.

Department of Agriculture (2001) *A weed plan for Western Australia*. State Weed Plan Steering Group, October 2001. Perth, WA.

Department of Regional Development and Lands (2011) *Wheatbelt: A region in profile 2011*. Department of Regional Development and Lands, WA.

Department of Minerals and Energy (1998) *Guidelines for mineral exploration and mining within conservation reserves and other environmentally sensitive areas*. Department of Minerals and Energy, Perth.

Department of Sport and Recreation (1984) A survey of visitors to the Murray Valley, Western Australia during Easter, 1984. In *Lane-Poole Reserve Draft Management Plan, April 1986: Volume III Resource Document*. Department of Conservation and Land Management, Perth.

Department of the Environment and Heritage (2004) *National Biodiversity and Climate Action Plan 2004-2007*. http://www.deh.gov.au/biodiversity/publications/nbccap. Accessed June 2005.

Department of the Environment and Heritage (2005) *Threat Abatement Plan for Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs*. Canberra.

Dodson, J.R. and Lu, J.J. (2000). A late Holocene vegetation and environmental record from Byenup Lagoon, south-western Australia. *Australian Geographer* 31: 41-54.

Dodson, J.R. and Ramrath, A. (2001). An Upper Pliocene lacustrine environmental record from south-western Australia. *Palaeogeography, Palaeoclimatology and Palaeoecology* 167: 309-320.

DoE (2004a) *Statewide river water quality assessment*. http://apostle.environment.wa.gov.au/idelve/srwqa/index.html. Accessed 31/10/05. Department of Environment.

DoE (2004b) *Stream salinity in south-west Western Australia – still rising*. Department of Environment, Perth, Western Australia, November 2004.

DoE (2005a) *River monitoring stations in Western Australia*. http://203.20.251.100/waterinformation/telem/614006/HAN.htm. Accessed 8 November 2005. Department of Environment.

DoE (2005b) *Stream salinity status and trends in south-west Western Australia*. Salinity and land use impacts series, report no. SLUI 38. Natural Resource Management and Salinity Division, Department of Environment, Perth.

DoF (2002) *The translocation of brown trout (Salmo trutta) and rainbow trout (Oncorhynchus mykiss) into and within Western Australia*. Fisheries Management Paper No. 156. Department of Fisheries.

DoF (2005) Freshwater angling in the south-west of Western Australia. http://www.fish.wa.gov.au/docs/pub/FreshWaterAngling/index.php?0106. Accessed 21 July 2006. Department of Fisheries, Western Australia.

DoF (2006) *State of the Fisheries Report 2005/06*. Department of Fisheries, Western Australia.

DoIR (1991) *Guidelines for Management of Dieback Disease in Mineral Exploration*. Information Series No.9. Available http://www.doir.wa.gov.au/documents/mineralsandpetroleum/Info9(1).pdf

DoW (2006) *Hydrogeological Atlas*. http://portal.water.wa.gov.au/portal/page?_pageid=1318,5455960&_dad=portal&_schema=PORTAL. Accessed February 2006. Department of Water, WA.

DoW (2007) *Harris Dam Catchment Area Drinking Water Source Protection Plan: Great Southern Towns Water Supply Scheme Integrated Water Supply System*. Water Protection Series, Report No. 80, June 2007. Department of Water, WA.

Energy Safety (2006) *Guidelines for the management of vegetation near power lines*. Department of Consumer and Employment Protection, June 2006.

Environment Australia (2001) *Threat abatement plan for dieback caused by the root-rot fungus*. Environment Australia, Canberra.

Environment Australia (2002) C*ommonwealth Listing Advice on Infection of Amphibians with Chytrid Fungus resulting in Chytridiomycosis. E*nvironment Australia, Canberra.

EPA (2006) *Position Statement No. 9 – Environmental Offsets*. Environmental Protection Authority, Perth, Western Australia

EPA (2007) *State of the Environment Report: Western Australia 2007*. Environmental Protection Authority and Department of Environment and Conservation, Perth, Western Australia.

Forest Department WA (1969) *50 years of forestry in Western Australia*. Forests Department, supplement to the 1968/9 Annual Report, 90pp. Forest Department of Western Australia.

Friend, G. (1995) Fire and invertebrates : a review of research methodology and the predictability of post-fire response patterns. In McCaw, W. L., Burrows, N. D., Friend, G. R. and Gill, A. M. (eds) *Landscape fires '93: proceedings of an Australian bushfire conference.* CALMScience Suppl. No. 4, Department of Conservation and Land Management: 165-174.

Friend, G. (1999) Fire and faunal response patterns: a summary of research findings. In G. Friend, M. Leonard, A. MacLean and I. Sieler (eds) *Management of fire for the conservation of biodiversity: workshop proceedings.* Fire Ecology Working Group, Department of Natural Resources and Environment, Victoria.

Friend, G. and Wayne, A. (2003) Relationships between mammals and fire in south-west West Australian ecosystems: what we know and what we need to know. In Abbott, I. and Burrows, N. (ed.) *Fire in ecosystems of the south-west of Western Australia: impacts and management*. Backhuys Publishers, Leiden: 363-380.

Goeft, U. and Alder, J. (2000) Mountain bike rider preferences and perceptions in the south-west of Western Australia. *CALMScience* 3(2): 261-275.

Government of Western Australia (2001) *State water quality management strategy No. 1: Framework for implementation*. Government of Western Australia, Perth.

Government of Western Australia (2004) *State water quality management strategy No. 6: Implementation Framework for Western Australia for the Australian and New Zealand Guidelines for Fresh and Marine Water Quality and Water Quality Monitoring and Reporting*. Government of Western Australia, Perth.

Gross, C.L. (2001) The effect of introduced honeybees on native bee visitation and fruit-set in Dillwynia juniperina (*Fabaceae*) in a fragmented ecosystem. *Biological Conservation* 102: 89-95.

Hallam, S.J. (1975) *Fire and Hearth: A Study of Aboriginal Usage and European Usurpation in South-western Australia*. Australian Institute of Aboriginal Studies, Canberra.

Hallam, S.J. (2002) *Peopled landscapes in southwestern Australia in the early 1800s: Aboriginal burning off in the light of Western Australian historical documents*. Talk to the Royal Western Australian Historical Society.

Hamilton, B. (2002) *Waterways and Wetlands in the South West NRM Region*, Technical Report No. 1 - South West Regional Strategy for Natural Resource Management, South West Catchments Council, Natural Heritage Trust, Bunbury.

Hampton, J.O., Spencer, P.B.S., Alpers, D.L., Twigg, L.E., Woolnough, A.P., Doust, J., Higgs, T. and Pluske, J. (2004) Molecular techniques, wildlife management and the importance of genetic population structure and dispersal: a case study with feral pigs. Journal of Applied Ecology. 41: 735-743.

Handol, D., Stukely, M. and Randles, J.W. (2002) Mundulla yellows: A new tree-dieback threat. *LANDSCOPE* 17(4) Winter 2002 41-47. Department of Conservation and Land Management, Kensington.

Hassell C.W. and Dodson, J.R. (2003) The fire history of south-west Western Australia prior to European settlement in 1826-1829. In Abbott, I. and Burrows, N. (ed) *Fire in ecosystems of the south-west of Western Australia: impacts and management*. Backhuys Publishers, Leiden: 71-85.

Hayward, M., de Tores, P., Dillon, M. and Fox, B. (2003) *Local population structure of a naturally occurring metapopulation of the quokka (Setonix brachyurus Macropodidae: Marsupialia).* Biological Conservation 110, 343-355.

Hopper, S.D. (1994) Session 2: Impact on ecology. In: Plant diseases in ecosystems: Threats and impacts in south-western Australia. *Journal of the Royal Society of Western Australia* 77: 103-104.

Hopper, S.D. (2000) Creation of conservation reserves and managing fire on granite outcrops-a case study from Chiddarcooping Nature Reserve in the Western Australian Wheatbelt. *Journal of the Royal Society of Western Australia* 83(3): 173-186.

Hopper, S.D., Brown, A.P. and Marchant, N.G. (1997) Plants of Western Australian granite outcrops. *J. Roy. Soc of WA* 80:141-158.

Horwitz, P., Judd, S. and Sommer, B. (2003) Fire and organic substrates: Soil structure, water quality and biodiversity in far south-west Western Australia. In: Abbott, I. and Burrows, N. (eds). *Fire in Ecosystems of the South-West of Western Australia: Impacts and management*: 381-393.

Hughes, L. (2003) Climate change and Australia: Trends, projections and impacts. *Austral Ecology* 28: 423–443.

Hutchison, M. (1991) *The distribution of fishes in the Murray River (Western Australia) and its jarrah forest tributary streams: patterns and causes*. University of WA. Perth.

Indian Ocean Climate Initiative (2002) *Climate Variability and Change in the South West*. Indian Ocean Climate Initiative, Perth.

Inions, G.B., Tanton, M.T. and Davey, S. (1989) Effect of fire on the availability of hollows in trees used by the Common brushtail possum, *Trichosurus vulpecula* Kerr, 1792, and the Ringtail possum, *Pseudocheirus peregrinus* Boddaerts, 1785. *Australian Wildlife Research* 16: 449-458.

IPCC (2001) *Climate Change: Impacts, Adaptation and Vulnerability. S*ummary for Policymakers. Intergovernmental Panel on Climate Change. http://www.unep.ch/ipcc. Accessed June 2005.

Jaensch, R.P. (1993) *A Survey of frogs in wetlands on the south coast of Western Australia*. Department of Conservation and Land Management, Perth.

Kanowski, P.J., Cork, S.J., Lamb, D. and Dudley, N. (2001) Assessing success of off-reserve forest management in contributing to biodiversity conservation. In Raison, R.J., Brown, A.G. and Flinn, D.W. (eds) *Criteria and Indicators for Sustainable Forest Management*. IUFRO 7 Research Series. CABI Publishing, United Kingdom.

Kershaw, A.P. (1986) Climate change and Aboriginal burning in north-east Australia during the last two glacial/interglacial cycles. *Nature* 322: 47-49.

Majer, J.D. and Abbott, I. (1989) Invertebrates of the jarrah forest. In: Dell, B., Havel, J.J. and Malajczuk, N.(eds). *The Jarrah Forest*, 111-123.

Mattiske, E.M. and Havel, J.J. (1998) *Regional Forest agreement vegetation complexes.* Department of Conservation and Land Management.

Mattiske, E.M. and Havel, J.J. (2004) *Delineation of Landscape Conservation Units in Southwest Region of Western Australia*. Report prepared for the Dept of Conservation and Land Management WA.

McArthur, W.M., Churchward, H.M. and Hick, P.T. (1977) *Landforms and soils of the Murray River Catchment area of Western Australia*. Land Resources management Series No. 3, Division of Land Resources Management CSIRO, Melbourne.

McKenzie, N., Hopper, S. Wardell-Johnsons, G. and Gibson, N. (1996) Assessing the conservation reserve system in the Jarrah Forest Bioregion. In: *Journal of the Royal Society of Western Australia*, 79:241-248, 1996. Royal Society of WA, Perth.

Muench, R. (2001) *Southern Darling Range regional recreational study August 2001*. Unpublished report prepared for the Department of Conservation and Land Management, Water Corporation and Water and Rivers Commission.

Muir, B. (1986) Vegetation and flora of Lane Poole Reserve. *Lane Poole Reserve draft management plan: April 1986 volume III resource document*. Department of Conservation and Land Management, Perth, Western Australia.

Nichols, O.G. and Muir, B. (1998) Vertebrates of the jarrah forest. In Dell, B., Havel, J.J and Malajczuk, N. (eds). *The Jarrah Forest*, 133-153.

NSW National Parks and Wildlife Service (2002) *Competition from feral honeybees as a key threatening process – an overview*.

O'Connor, R., Quatermaine, G. and Bodney, C. (1989) *Report on an investigation into Aboriginal significance of wetlands and rivers in the Perth-Bunbury region*. Western Australian Water Resource Council.

Pearce, M.H., Malajczuk, N., and Kile, G.A. (1986) The occurrence and effects of *Armillaria luteobubalina* in the karri (*Eucalyptus diversicolor* F. Muell.) forests of Western Australia. *Australian Forest Research* 16: 243-259.

Peel Development Commission (2010) http://www.peel.wa.gov.au . Accessed 14 September 2010.

Pouliquen-Young, O. and Newman, P. (2000) *The implications of climate change for land-based nature conservation strategies*. Final report 96/1306. Australian Greenhouse Office, Environment Australia, Canberra; Institute for Sustainability and Technology Policy, Murdoch University, Perth.

Prosser, G. (1986) The Limits of Acceptable Change: An Introduction to a Framework for Natural Area Planning. Australian Parks and Recreation. 22 (2): 5-10, February.

Rodger, G.J. (1961) *Report of the Royal Commission: Appointed to enquire into and report upon the bush fires of December, 1960 and January, February and March, 1961 in Western Australia, the measures necessary or desirable to prevent and control such fires and to protect life and property in the future, and the basic requirements for an effective state fire emergency organisation*. Perth, WA.

Scheltema, M. (1981) *To bee or not to bee: honeybee utilisation of national parks in Western Australia.* Perth, Western Australia.

Schwarz, M.P. and Hogendoorn, K. (1999) Biodiversity and conservation of Australian native bees. In: Ponder, W. and Lunney, D. (eds). *The Other 99%: The Conservation and Biodiversity of Invertebrates*. Royal Zoological Society of New South Wales, Mosman.

Shearer, B.L. (1994) The major plant pathogens occurring in native ecosystems of south-west Australia. In: Plant diseases in ecosystems: Threats and impacts in south-western Australia. *Journal of the Royal Society of Western Australia* 77: 113-122.

Shearer, B.L. and Tippett, J.T. (1988) Distribution and impact of *Armillaria luteobubalina* in the *Eucalyptus marginata* forest of south-western Australia. *Australian Journal of Botany* 36: 433-445. CSIRO, East Melbourne.

Shearer, B.L., Byrne, A., Dillon, M. and Buehrig, R. (1997a) Distribution of *Armillaria luteobubalina* and its impact on community diversity and structure in *Eucalyptus wandoo* woodland of southern Western Australia. *Australian Journal of Botany* 45: 151-165.

Shearer, B.L., Crane, C.E., Fairman, R.G. and Grant, M.J. (1997b) Occurrence of *Armillaria luteobubalina* and pathogen-mediated changes in coastal dune vegetation of south-western Australia. *Australian Journal of Botany* 45: 905-917.

Shearer, B.L., Crane, C.E., Fairman, R.G., and Grant, M.J. (1998) Susceptibility of plant species in coastal dune vegetation of south-western Australia to killing by *Armillaria luteobubalina*. *Australian Journal of Botany* 46: 321-334.

Shire of Murray (2005) *Environmental Health*, http://www.murray.wa.gov.au/planning_building_health/environmental_health.html. Accessed 23/11/2005.

South West Catchments Council (2005) *South west regional strategy for natural resource management*. South West Catchments Council, Bunbury.

Standards Australia (2001) *Australian Standard Walking Tracks: Part 1 classification and signage.* AS2156.1-2001. Standards Australia, Sydney.

Start, T., Burbidge, A. and Armstrong, D. (2005) *Woylie Recovery Plan 1995*. Wildlife Management Program Series No. 16. Department of Conservation and Land Management.

State Salinity Council (2000) Natural resource management in Western Australia – the salinity strategy. Government of Western Australia.

Storr, G.M. (1964) Some aspects of the geography of Australian reptiles. *Senck. Biol.* 45: 577-589.

SWDC (2010) http://www.swdc.wa.gov.au . South West Development Commission. Accessed 14 September 2010.

Thackway, R. and Cresswell, I.D. (1995) *An interim biogeographic regionalisation of Australia: a framework for establishing the national system if reserves, version 4.0.* Australian Nature Conservation Agency, Canberra.

Tolhurst, K.G. and Friend, G.R. (2001) *An objective basis for ecological fire management.* Australian Bushfire Conference, 3-6 July 2001, Christchurch, New Zealand.

Tread Lightly! Australia Ltd (2006) *Leaving a Good Impression The Tread Lightly! Way.* http://www.treadlightlyaustralia.com.au/mission.htm. Accesses 26 July 2006.

Underwood, R.J. and Christensen, P.E.S. (1981) *Forest fire management in Western Australia*. Special Focus No. 1, Forests Department of Western Australia.

van Heurck, P. and Abbott, I. (2003) Fire and terrestrial invertebrates in south-west Western Australia. In Abbott, I. and Burrows, N. (eds.) *Fire in ecosystems of the south-west of Western Australia: impacts and management*. Backhuys Publishers, Leiden: 291-319.

Wandoo Recovery Group (2006) *Wandoo crown decline action plan*. Department of Environment and Conservation, WA.

Weir, J.M.H., Johnson, E.A. and Miyanish, K. (2000) Fire frequency and the spatial age mosaic of the mixed-wood boreal forests in western Canada. *Ecological Applications* 10: 1162-1177.

White, P. and Manning, L. (2005) Wondering about wandoo. *LANDSCOPE* 20(3) Autumn 2005, 17-21. Department of Conservation and Land Management, Kensington.

Williams, A.A.J., Karoly, D.J. and Tapper, N. (2001) The sensitivity of Australian fire danger to climate change. *Climatic Change* 49: 171-191.

Wills, R.T. and Keighery, G.J. (1994) Ecological impact of plant disease on plant communities. In: Plant diseases in ecosystems – Threats and impacts in south-western Australia. *Journal of the Royal Society of Western Australia* 77: 127-131.

Wilson, B.A., Newell, G., Laidlaw, W.S. and Friend, G. (1994) Impact of plant diseases on faunal communities. In: Plant diseases in ecosystems: Threats and impacts in south-western Australia. *Journal of the Royal Society of Western Australia* 77: 139-143.

WRC (2001) *A fresh future for water: Salinity situation statement for the Collie River Catchment – A summary*. Government of Western Australia, November 2001.

WRC (2002) *Samson Brook Catchment Area Water Source Protection Plan: Waroona and Hamel Town Water Supply and Integrated Water Supply Scheme*. Water Resource Protection Series No. WRP 50. Water and Rivers Commission.

WRC (2003a) *Water WA – A state of water resources report for Western Australia*. Hydrology & Water Resources Branch, Resource Science. Water and Rivers Commission.

WRC (2003b) *Policy and Guidelines for Recreation within Public Drinking Water Source Areas on Crown Land.* Statewide Policy No. 13. Water and Rivers Commission.

Wykes, B.J. (1983) *The Jarrah avifauna and its re-establishment after bauxite mining*. School of Biology, Institute of Technology, WA. Bulletin No. 11.

Wyre, G. (2004) Management of the Western Shield program: Western Shield review – February 2003. *Conservation Science Western Australia* 5 (2):20-30.

Yates, C.J., Abbott, I., Hopper, S.D. and Coates, D.J. (2003) Fire as a determinant of rarity in the south-west Western Australian global biodiversity hotspot. In Abbott, I. and Burrows, N. (eds) *Fire in ecosystems of the south-west of Western Australia: impacts and management*. Backhuys Publishers, Leiden: 395-420.

PERSONAL COMMUNICATIONS

Department of Environment and Conservation (formerly Department of Conservation and Land Management and the Department of Environment)

Dr Ian Abbott, Program Leader Science Applications and Senior Research Scientist, Science Division
Rod Annear, Parks and Visitor Services Coordinator, Perth Hills District, Regional Services Division
John Asher, Environmental Officer, Environmental Management, Nature Conservation Division
Alex Bowlay, Senior Ranger – Lane Poole Reserve, Perth Hills District, Regional Services Division
Dr Allan Burbidge, Senior Research Scientist, Woodvale Research, Science Division
Dr Neil Burrows, Director, Science Division
Nathan Greenhill, Landscape Architect, Recreational and Landscape Unit, Parks and Visitor Services
Dr Stuart Halse, Principal Research Scientist, Woodvale Research, Science Division
Colin Ingram, A/Assistant Director, Parks and Visitor Services Division.
Fiona Kirkpatrick, Assistant Nature Conservation Officer (Fauna), Wellington District, Regional Services
Graeme Liddelow, Senior Technical Officer, Manjimup, Science Division.
Mike Meinema, District Manager, Perth Hills District, Regional Services Division
Keith Morris, Principal Research Scientist, Science Division
Steve Raper, Regional Leader Sustainable Forest Management, Swan Region, Regional Services
Mike Stukely, Research Scientist, Kensington Research, Science Division
Dr Adrian Wayne, Research Scientist, Science Division
Alan Wright, Nature Conservation Officer, Perth Hills District, Regional Services Division

Alcoa

Carl Grant, Environmental Operations Manager
Kim Horne, Manager of Mines

Department of Environment

Brad Degans, Water Information Branch

Department of Mines and Petroleum (formerly the Department of Industry and Resources)

Ivor Roberts, Geological Surveys

Peel-Harvey Catchment Council

Alex Hams, Rivercare Officer

Department of Fisheries

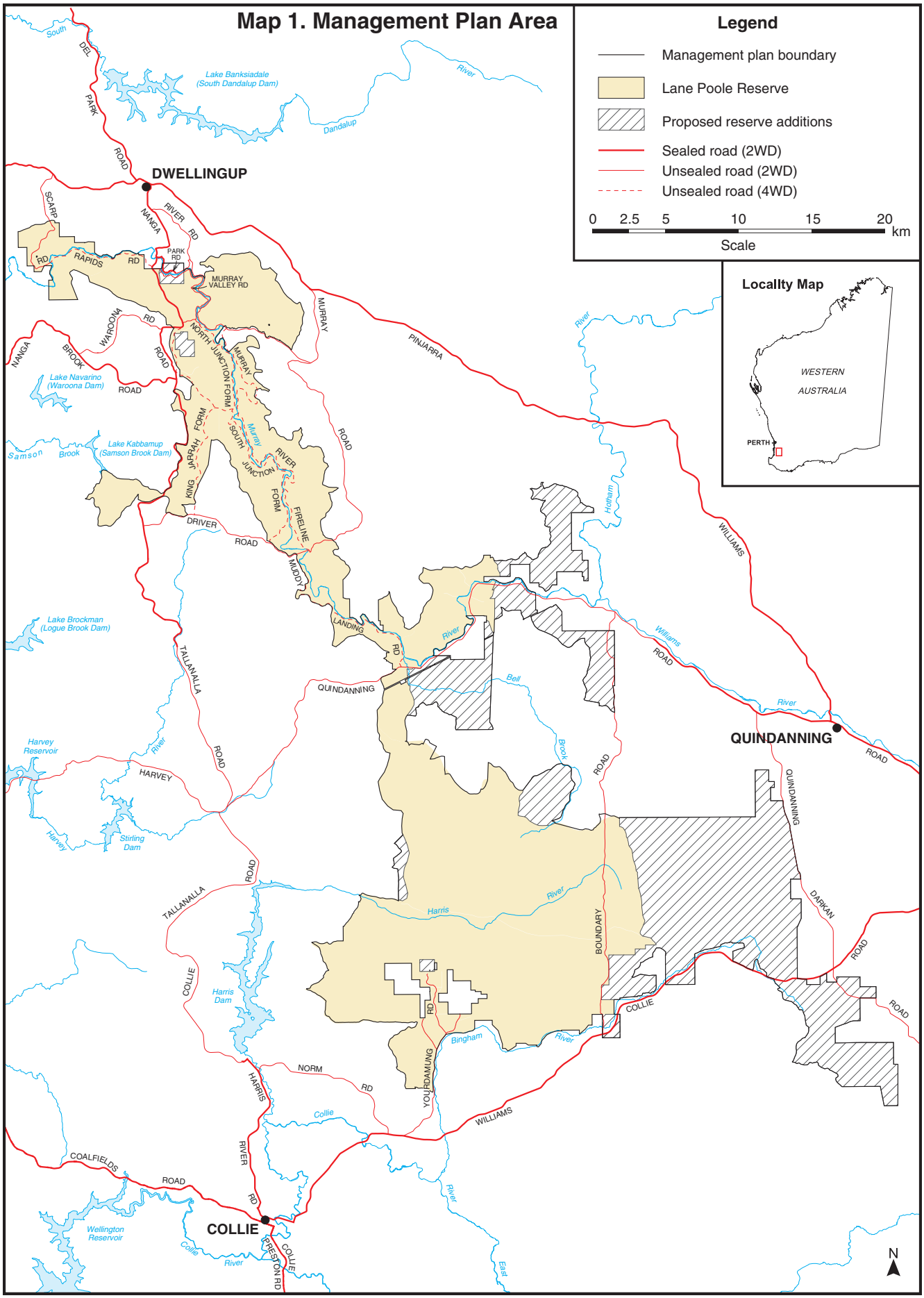
Chris Bird, Research Science Division, WA Fisheries and Marine Research Laboratory
Clinton Syers, Fisheries Management Officer - South West Bioregion

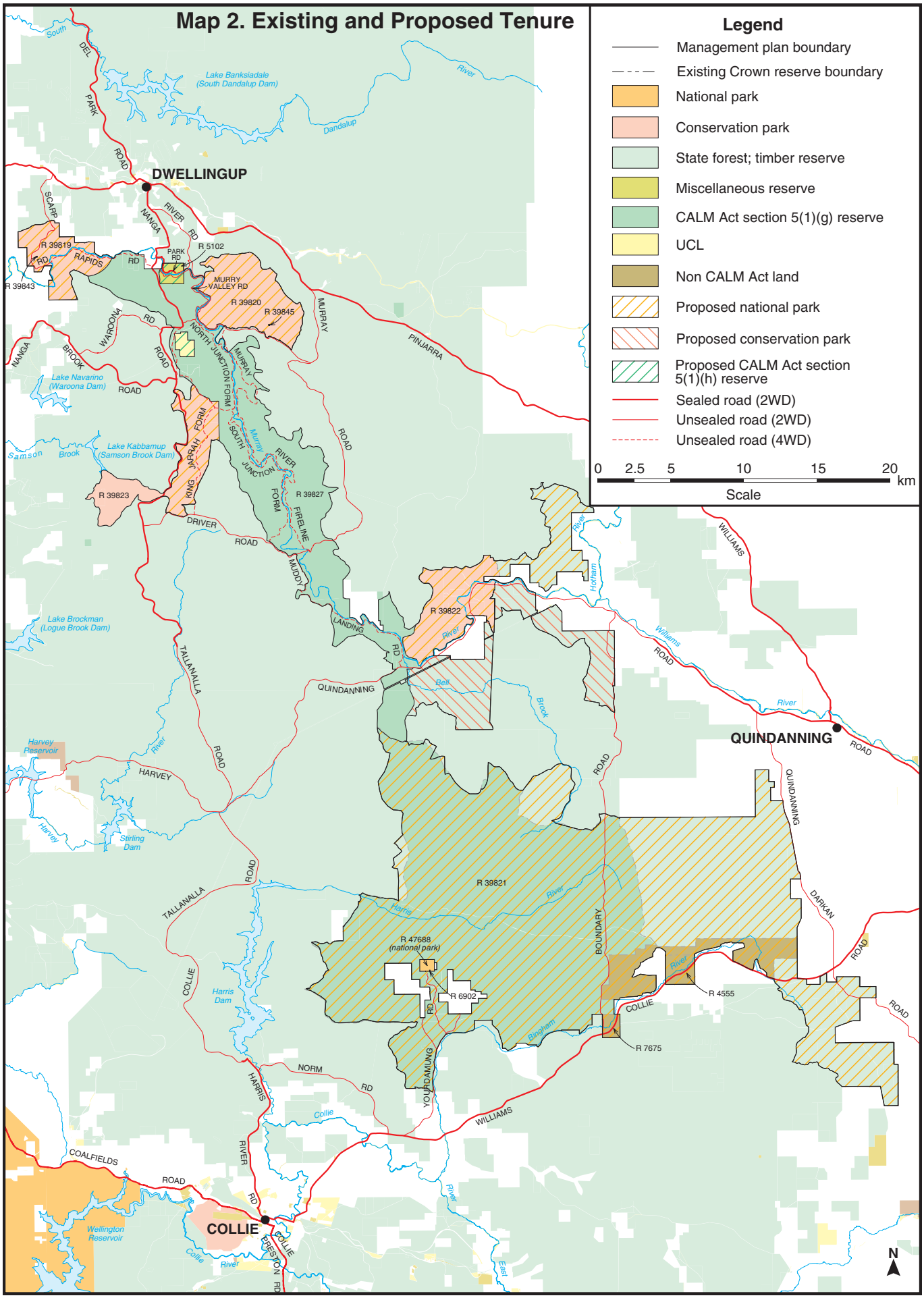
Tourism Western Australia

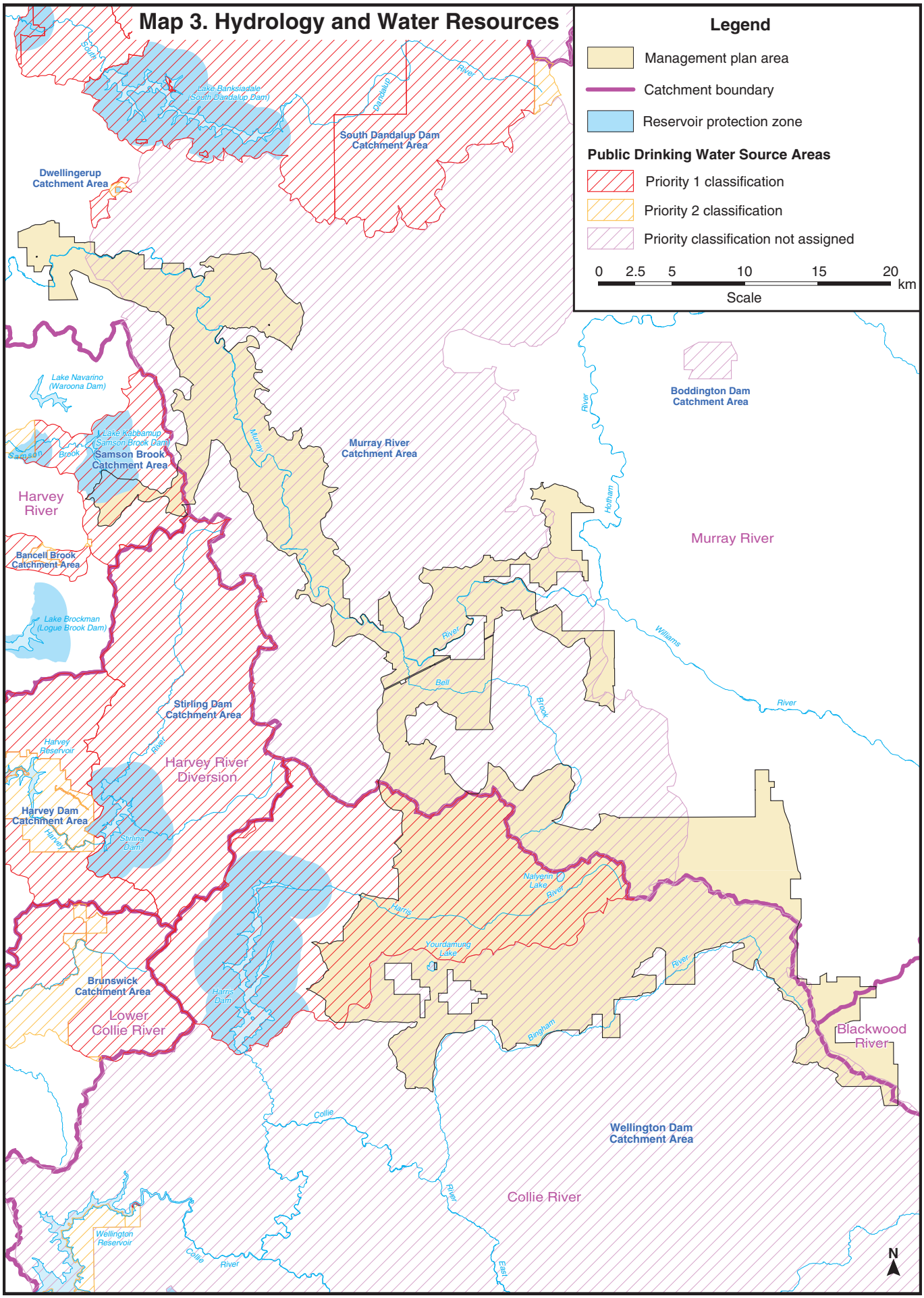
Eugene Stankevicius, Planning Manager, Tourism Industry Development.

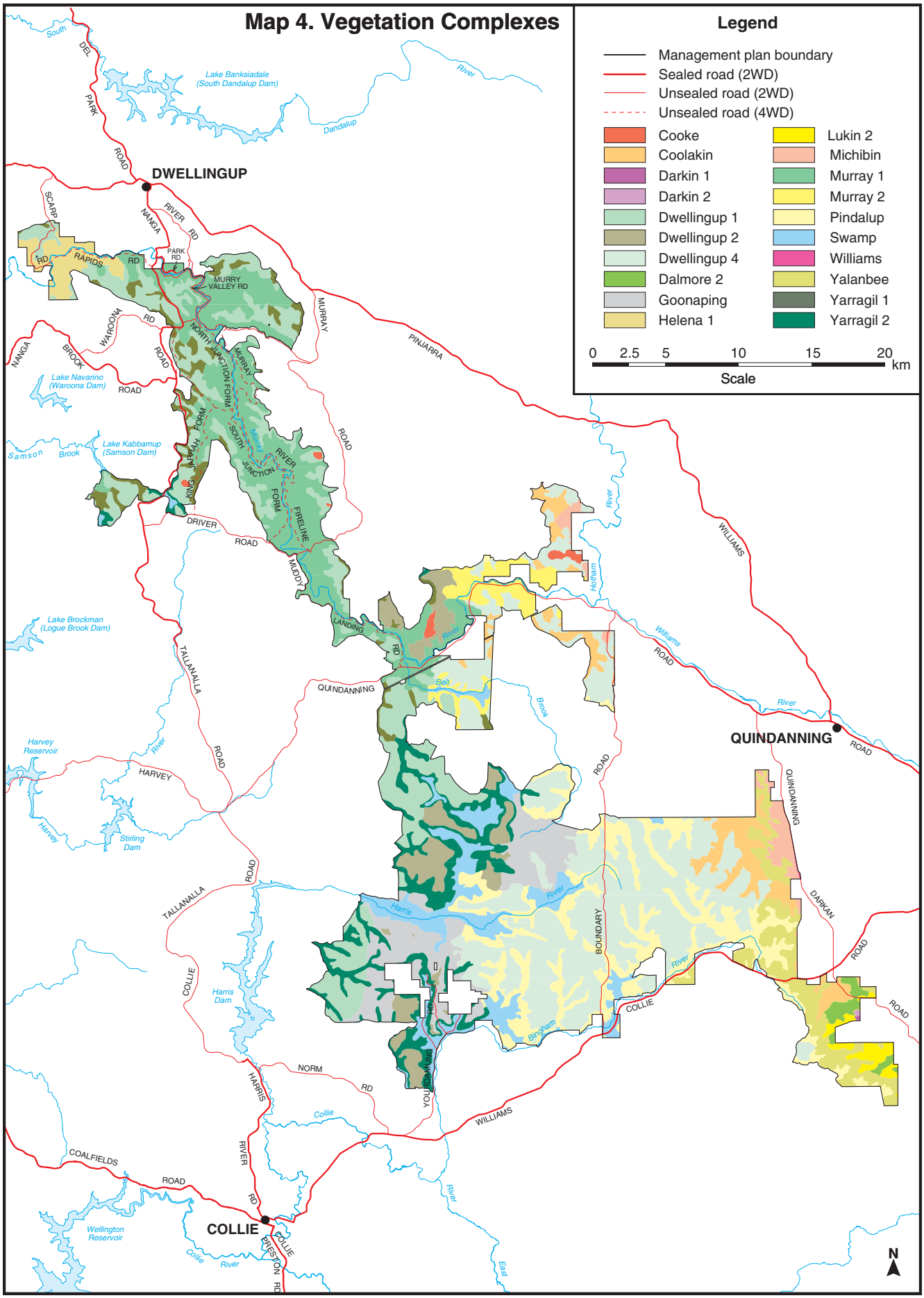
Shire of Collie

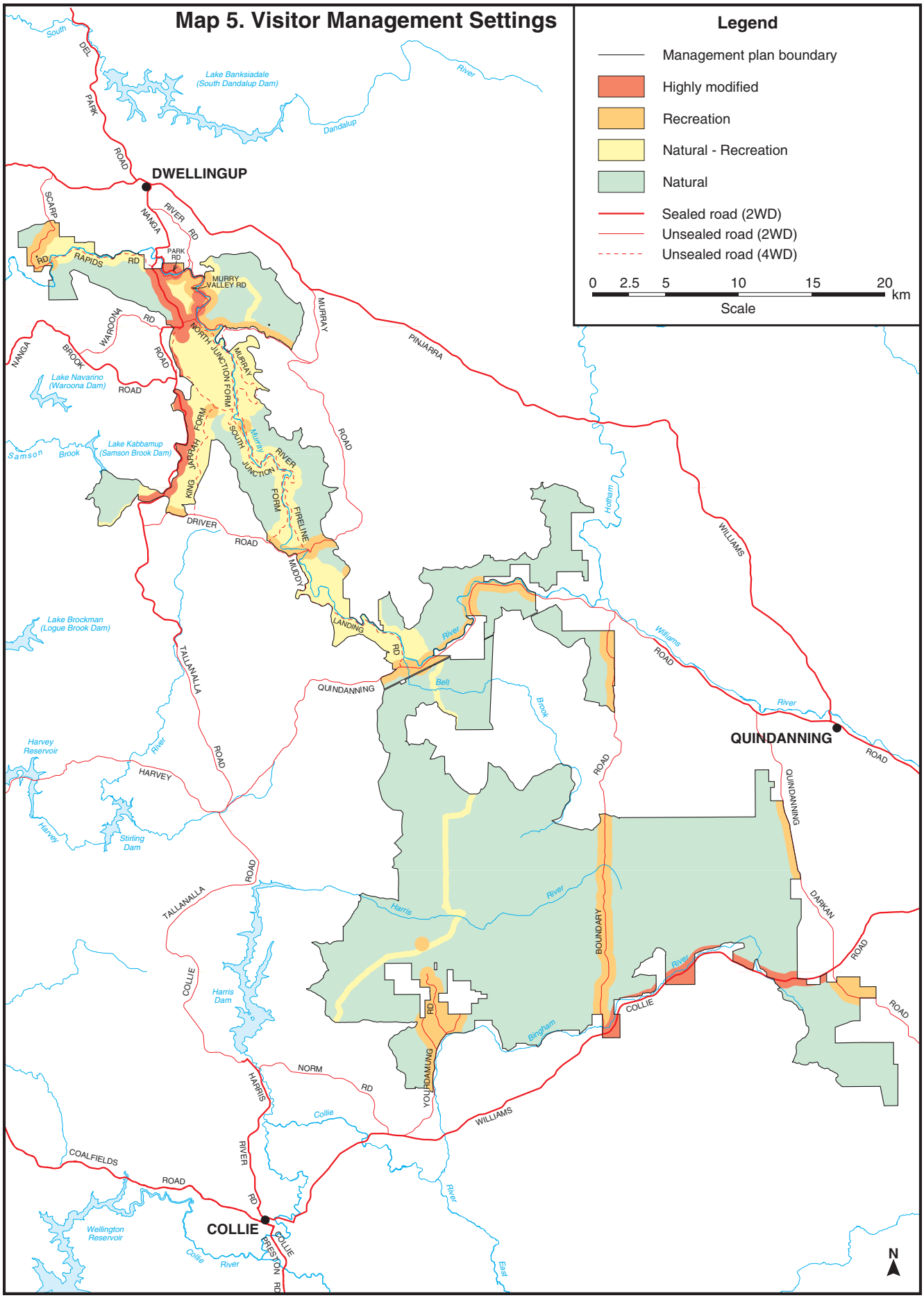
Andrew Watts, Planning Officer

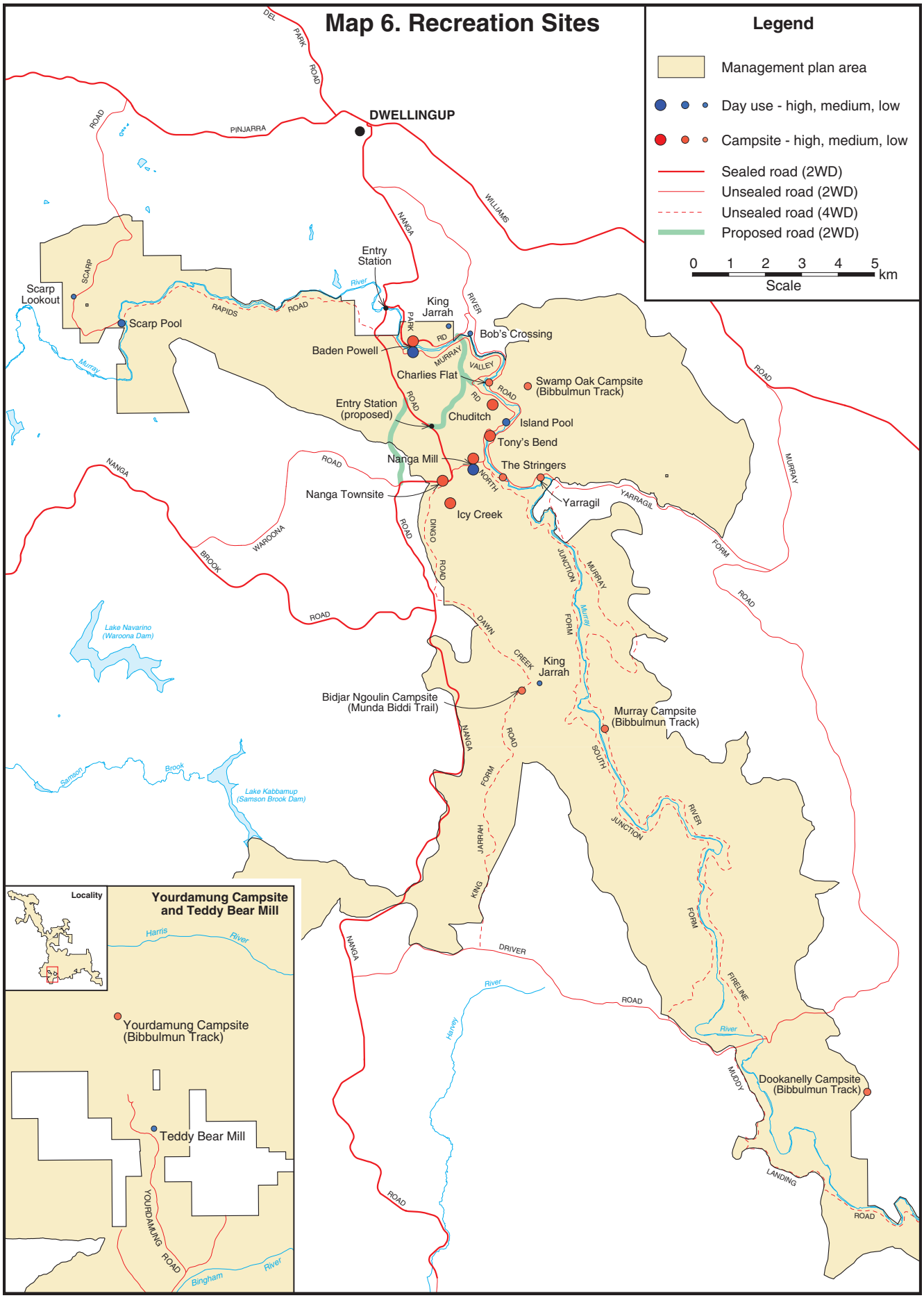

Map 1. Management Plan Area
Legend
Management plan boundary
Lane Poole Reserve
Proposed reserve additions
Sealed road (2WD)
Unsealed road (2WD)
Unsealed road (4WD)
0 2.5 5 10 15 20
km
Scale
Locallty Map
WESTERN AUSTRALIA
PERTH
DWELLINGUP
QUINDANNING
COLLIE
Lake Banksiadale (South Dandalup Dam)
Dandalup River
South Dandalup River
DEL PARK ROAD
SCARP RD
NANGA RIVER RD
RAPIDS RD
PARK RD
MURRAY VALLEY RD
WAROONA ROAD
NANGA BROOK ROAD
Lake Navarino (Waroona Dam)
NORTH JUNCTION FORM
SOUTH JUNCTION FORM
Murray River
MURRAY ROAD
PINJARRA ROAD
Lake Kabbamup (Samson Brook Dam)
Samson Brook
YARRAH KING FORM
FIRELINE
DRIVER ROAD
MUDDY
LANDING RD
Lake Brockman (Logue Brook Dam)
TALLANALLA ROAD
QUINDANNING
Bell Brook
Williams River
WILLIAMS ROAD
Hotham River
Harvey Reservoir
Harvey River
HARVEY ROAD
Stirling Dam
TALLANALLA ROAD
Harris River
BOUNDARY ROAD
QUINDANNING ROAD
DARKAN ROAD
COLLIE ROAD
Harris Dam
COLLIE RD
Bingham River
YOURDAMUNG RD
NORM RD
HARRIS RIVER RD
Collie River
WILLIAMS ROAD
COALFIELDS ROAD
Wellington Reservoir
Collie River
PRESTON RD
COLLIE
Collie River East
N

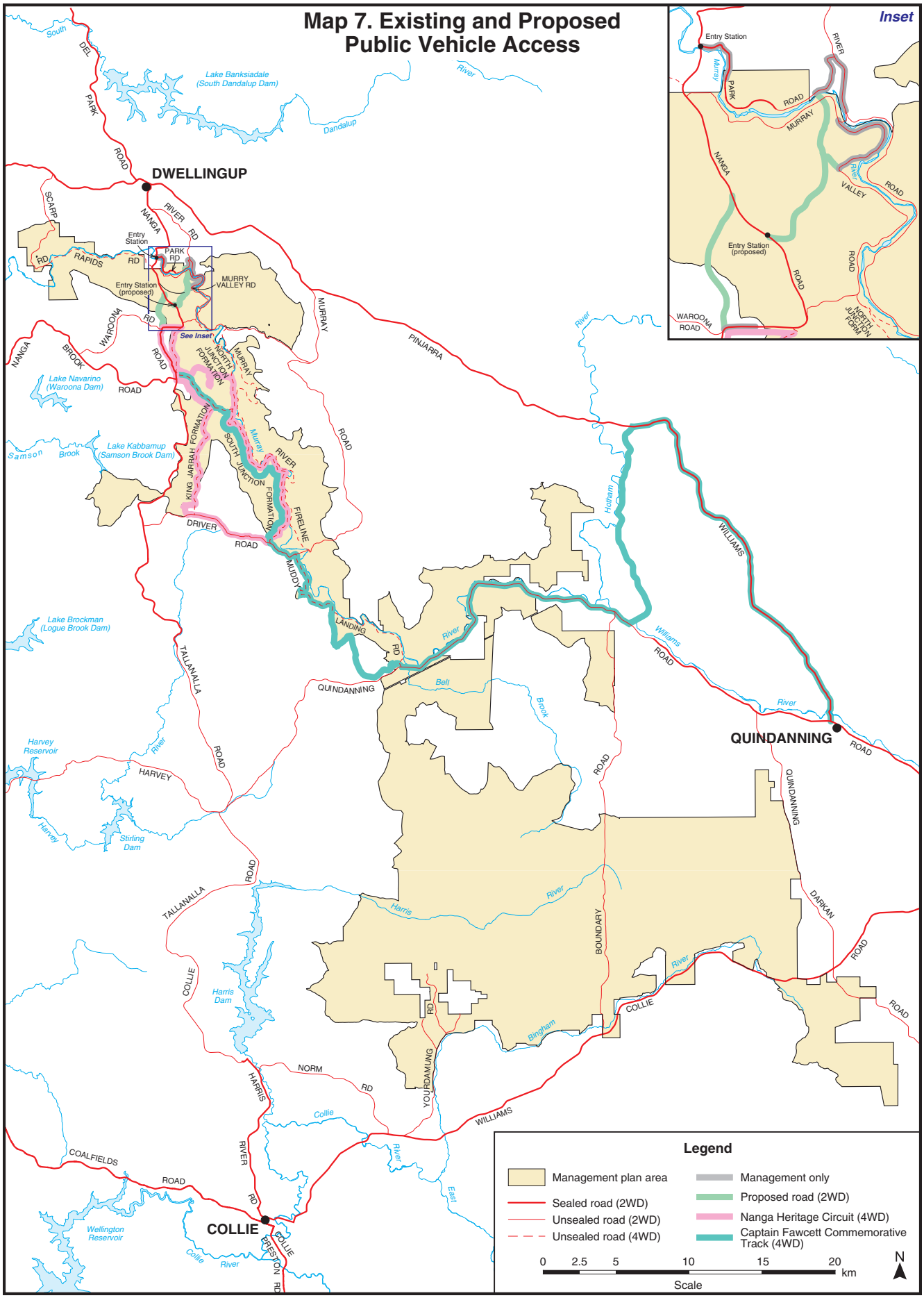

Map 2. Existing and Proposed Tenure
Legend
Management plan boundary
Existing Crown reserve boundary
National park
Conservation park
State forest; timber reserve
Miscellaneous reserve
CALM Act section 5(1)(g) reserve
UCL
Non CALM Act land
Proposed national park
Proposed conservation park
Proposed CALM Act section 5(1)(h) reserve
Sealed road (2WD)
Unsealed road (2WD)
Unsealed road (4WD)
0 2.5 5 10 15 20 km
Scale
DWELLINGUP
QUINDANNING
COLLIE
Lake Banksiadale (South Dandalup Dam)
Lake Navarino (Waroona Dam)
Lake Kabbamup (Samson Brook Dam)
Lake Brockman (Logue Brook Dam)
Harvey Reservoir
Stirling Dam
Harris Dam
Wellington Reservoir
R 39819
R 5102
R 39843
R 39820
R 39845
R 39823
R 39827
R 39822
R 39821
R 47688 (national park)
R 6902
R 4555
R 7675
SOUTH DANDALUP RIVER ROAD
PARK ROAD
SCARP ROAD
NANGA RIVER ROAD
RAPIDS ROAD
MURRY VALLEY RD
WAROONA ROAD
NANGA BROOK ROAD
NORTH JUNCTION FORM
MURRAY ROAD
PINJARRA ROAD
SOUTH JUNCTION FORM
MURRAY RIVER
JARRAH KING FORM
DRIVER ROAD
FIRELINE
MUDDY LANDING ROAD
TALLANALLA ROAD
HARVEY ROAD
QUINDANNING ROAD
BOUNDARY ROAD
WILLIAMS ROAD
DARKAN ROAD
COLLIE ROAD
YOURDAMUNG ROAD
NORM ROAD
HARRIS RIVER ROAD
COALFIELDS ROAD
BRESTON ROAD
WILLIAMS ROAD
Dandalup River
Samson Brook
Harvey River
Collie River
Bell Brook
Bingham River
Harris River
Collie East River
Hotham River
Williams River
N

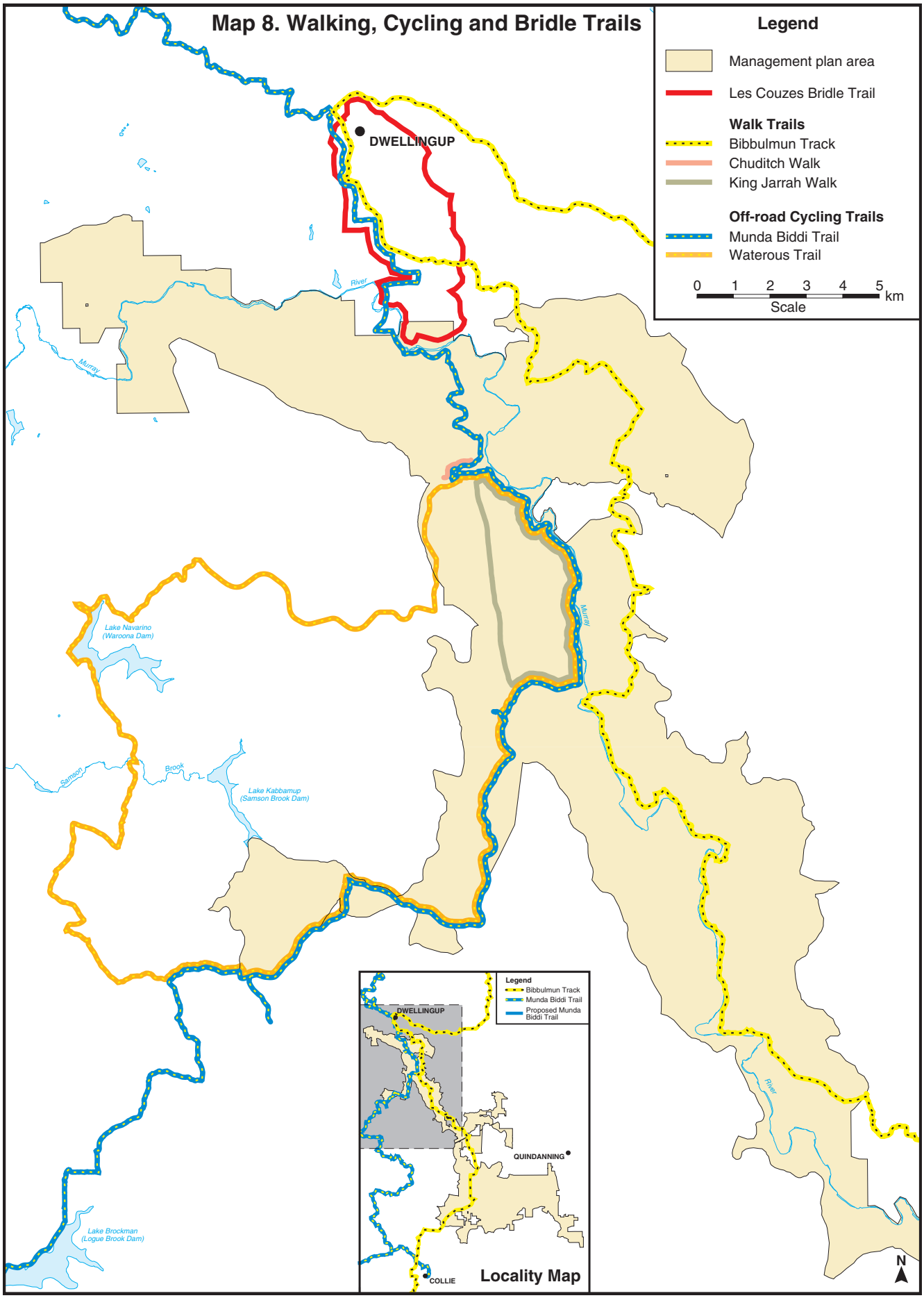

Map 3. Hydrology and Water Resources
Legend
Management plan area
Catchment boundary
Reservoir protection zone
Public Drinking Water Source Areas
Priority 1 classification
Priority 2 classification
Priority classification not assigned
0 2.5 5 10 15 20
km
Scale
Dwellingerup Catchment Area
Lake Banksiadale (South Dandalup Dam)
South Dandalup Dam Catchment Area
Boddington Dam Catchment Area
Lake Navarino (Waroona Dam)
Lake Kabbarup (Samson Brook Dam)
Samson Brook Catchment Area
Murray River Catchment Area
Harvey River
Bancell Brook Catchment Area
Lake Brockman (Logue Brook Dam)
Murray River
Stirling Dam Catchment Area
Harvey Reservoir
Harvey River Diversion
Harvey Dam Catchment Area
Stirling Dam
Nalyerin Lake
Yourdamung Lake
Brunswick Catchment Area
Harris Dam
Lower Collie River
Blackwood River
Wellington Dam Catchment Area
Collie River
Wellington Reservoir
N

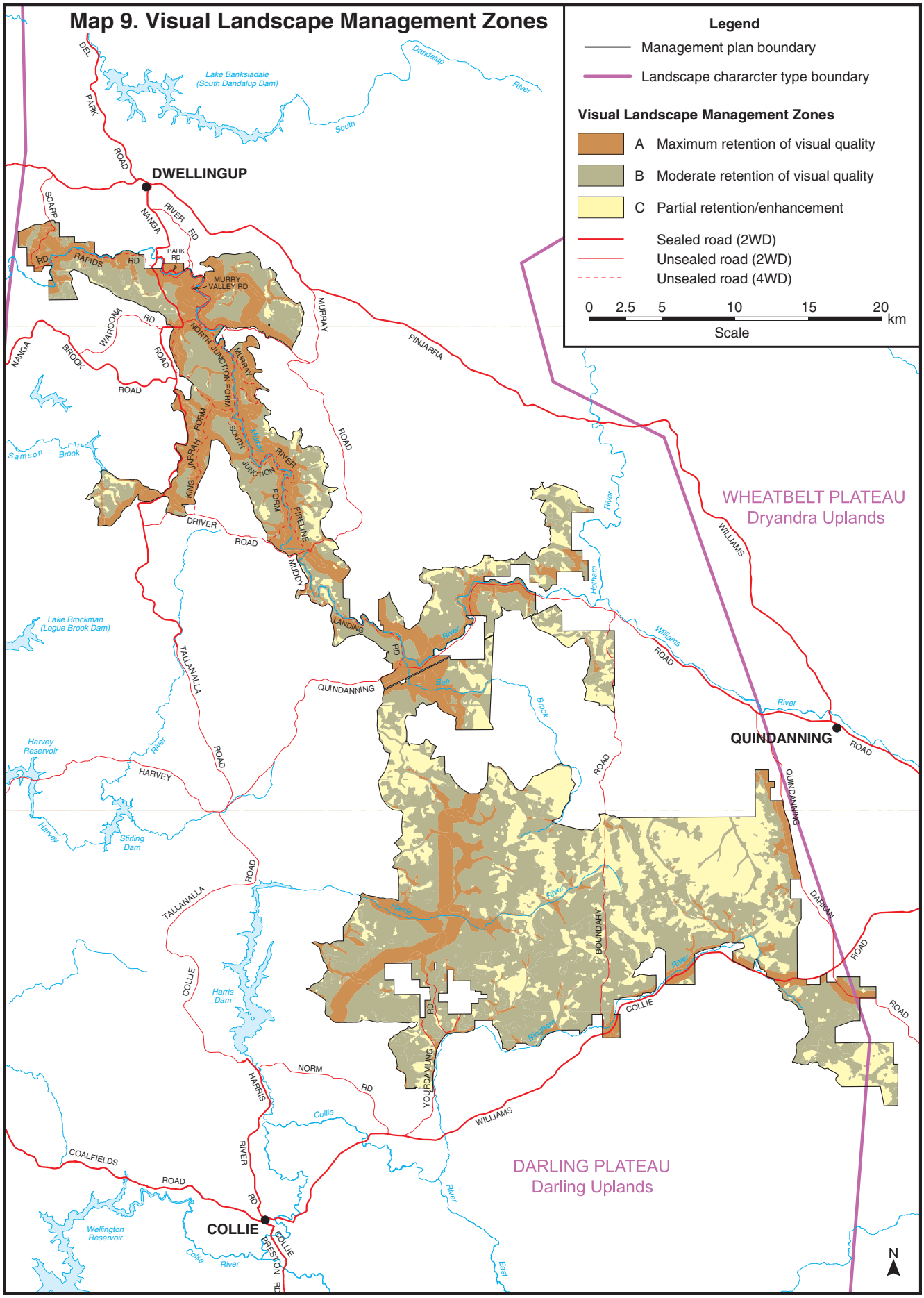

Map 4. Vegetation Complexes
Legend
Management plan boundary
Sealed road (2WD)
Unsealed road (2WD)
Unsealed road (4WD)
Cooke
Coolakin
Darkin 1
Darkin 2
Dwellingup 1
Dwellingup 2
Dwellingup 4
Dalmore 2
Goonaping
Helena 1
Lukin 2
Michibin
Murray 1
Murray 2
Pindalup
Swamp
Williams
Yalanbee
Yarragil 1
Yarragil 2
0 2.5 5 10 15 20 km
Scale
DWELLINGUP
QUINDANNING
COLLIE
Lake Banksiadale (South Dandalup Dam)
Dandalup River
South Dandalup River
Lake Navarino (Waroona Dam)
Lake Kabbamup (Samson Dam)
Samson Brook
Lake Brockman (Logue Brook Dam)
Harvey Reservoir
Harvey River
Stirling Dam
Harris Dam
Wellington Reservoir
Collie River
Collie East River
Hotham River
Williams River
Bell Brook
Bingham River
Harris River
Murray River
Murray River North Junction Form
Murray River South Junction Form
King Jarrah Form
Firelines
Scarp
Nanga Brook
Waroona Road
Park Road
Rapids Road
Murray Valley Rd
Nanga River Rd
Pinjarra Road
Driver Road
Muddy Landing Rd
Tallanalla Road
Quindanning Road
Williams Road
Harvey Road
Norm Harris Rd
Coalfields Road
Collie River Rd
Collie Preston Rd
Quindanning Darkan Road
Quindanning Collie Boundary Rd
Bingham Rd
N

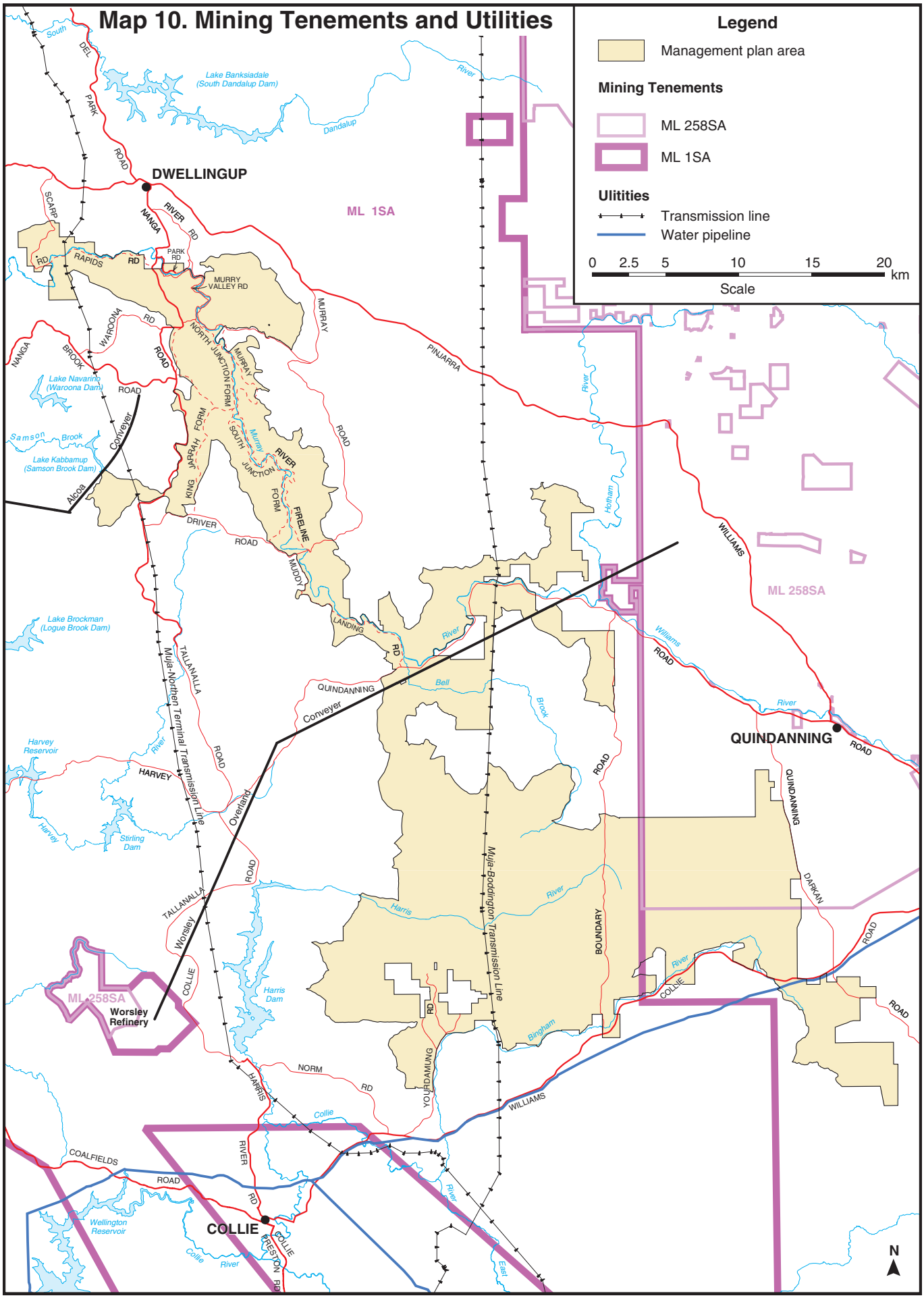

Map 5. Visitor Management Settings
Legend
Management plan boundary
Highly modified
Recreation
Natural - Recreation
Natural
Sealed road (2WD)
Unsealed road (2WD)
Unsealed road (4WD)
0 2.5 5 10 15 20 km
Scale
DWELLINGUP
COLLIE
QUINDANNING
Lake Banksiadale (South Dandalup Dam)
Dandalup River
South Dandalup River
Lake Navarino (Waroona Dam)
Lake Kabbamup (Samson Brook Dam)
Samson Brook
Lake Brockman (Logue Brook Dam)
Harvey Reservoir
Harvey River
Stirling Dam
Harris Dam
Wellington Reservoir
Collie River
Collie River East
Murray River
Hotham River
Williams River
Bell Brook
Bingham River
Harris River
Youndamung Brook
Scarp Rapids Rd
Park Rd
Nanga River Rd
Murry Valley Rd
Waroona Rd
Nanga Brook Road
North Junction Form
South Junction Form
Jarrah Form
King Form
Firelne
Driver Road
Muddy Landing Rd
Tallanalla Road
Quindanning Road
Pinjarra Road
Murray Road
Williams Road
Quindanning Darkan Road
Boundary Road
Coalfields Road
Norm Harris Rd
Collie River Rd
Collie Preston Rd
Williams Collie Road
N


Map 6. Recreation Sites
Legend
Management plan area
Day use - high, medium, low
Campsite - high, medium, low
Sealed road (2WD)
Unsealed road (2WD)
Unsealed road (4WD)
Proposed road (2WD)
0 1 2 3 4 5 km
Scale
DWELLINGUP
DEL PARK ROAD
PINJARRA ROAD
WILLIAMS ROAD
NANGA ROAD
SCARP ROAD
Scarp Lookout
Scarp Pool
RAPIDS ROAD
Murray River
Entry Station
Entry Station (proposed)
King Jarrah PARK RD
Bob's Crossing
RIVER ROAD
Baden Powell
MURRAY VALLEY ROAD
Charlies Flat
Swamp Oak Campsite (Bibbulmun Track)
Chuditch
Island Pool
Tony's Bend
Nanga Mill
The Stringers
NORTH ROAD
Nanga Townsite
Icy Creek
Yarragil
YARRAGIL FORM ROAD
MURRAY ROAD
DINGO ROAD
JUNCTION
MURRAY FORM
DAWN CREEK
King Jarrah
Bidjar Ngoulin Campsite (Munda Biddi Trail)
Murray Campsite (Bibbulmun Track)
SOUTH JUNCTION RIVER FORM
NANGA ROAD
WAROONA BROOK ROAD
Lake Navarino (Waroona Dam)
Samson Brook
Lake Kabbamup (Samson Brook Dam)
JARRAH KING FORM
NANGA ROAD
DRIVER ROAD
Harvey River
FIRELINE
MUDDY
Dookanelly Campsite (Bibbulmun Track)
LANDING ROAD
Locality
Yourdamung Campsite and Teddy Bear Mill
Harris River
Yourdamung Campsite (Bibbulmun Track)
Teddy Bear Mill
YOURDAMUNG ROAD
Bingham River


Map 7. Existing and Proposed Public Vehicle Access
Inset
DWELLINGUP
COLLIE
QUINDANNING
Lake Banksiadale (South Dandalup Dam)
Dandalup River
South DEL PARK ROAD
SCARP RD
NANGA RIVER RD
RAPIDS RD
Entry Station
PARK RD
Entry Station (proposed)
MURRY VALLEY RD
See Inset
WAROONA ROAD
NANGA BROOK ROAD
Lake Navarino (Waroona Dam)
Lake Kabbamup (Samson Brook Dam)
Samson Brook
KING JARRAH FORMATION
NORTH JUNCTION FORMATION
SOUTH JUNCTION FORMATION
Murray RIVER
MURRAY ROAD
PINJARRA ROAD
DRIVER ROAD
FIRELINE
MUDDY
LANDING RD
QUINDANNING
Lake Brockman (Logue Brook Dam)
TALLANALLA ROAD
Harvey Reservoir
Harvey River
HARVEY ROAD
Harvey
Stirling Dam
Bell Brook
Hotham River
WILLIAMS ROAD
Williams River
QUINDANNING ROAD
DARKAN ROAD
BOUNDARY RD
Harris River
COLLIE ROAD
Harris Dam
YOURDAMUNG RD
Bingham River
NORM RD
HARRIS RIVER RD
Collie River
East
COALFIELDS ROAD
Wellington Reservoir
COLLIE ERSTON RD
Entry Station
Murray River PARK ROAD
MURRAY VALLEY ROAD
NANGA ROAD
Entry Station (proposed)
WAROONA ROAD
NORTH JUNCTION FORM
Legend
Management plan area
Sealed road (2WD)
Unsealed road (2WD)
Unsealed road (4WD)
Management only
Proposed road (2WD)
Nanga Heritage Circuit (4WD)
Captain Fawcett Commemorative Track (4WD)
0 2.5 5 10 15 20 km
Scale
N


Map 8. Walking, Cycling and Bridle Trails
Legend
Management plan area
Les Couzes Bridle Trail
Walk Trails
Bibbulmun Track
Chuditch Walk
King Jarrah Walk
Off-road Cycling Trails
Munda Biddi Trail
Waterous Trail
0 1 2 3 4 5 km
Scale
DWELLINGUP
Murray River
Lake Navarino (Waroona Dam)
Samson Brook
Lake Kabbamup (Samson Brook Dam)
Lake Brockman (Logue Brook Dam)
Legend
Bibbulmun Track
Munda Biddi Trail
Proposed Munda Biddi Trail
DWELLINGUP
QUINDANNING
COLLIE
Locality Map
N


Map 9. Visual Landscape Management Zones
Legend
Management plan boundary
Landscape chararcter type boundary
Visual Landscape Management Zones
A Maximum retention of visual quality
B Moderate retention of visual quality
C Partial retention/enhancement
Sealed road (2WD)
Unsealed road (2WD)
Unsealed road (4WD)
0 2.5 5 10 15 20 km
Scale
DWELLINGUP
QUINDANNING
COLLIE
WHEATBELT PLATEAU
Dryandra Uplands
DARLING PLATEAU
Darling Uplands
Lake Banksiadale
(South Dandalup Dam)
Lake Brockman
(Logue Brook Dam)
Harvey Reservoir
Stirling Dam
Harris Dam
Wellington Reservoir
PARK ROAD
SCARP RD
NANGA RIVER RD
RAPIDS RD
MURRY VALLEY RD
WAROONA RD
NANGA BROOK ROAD
NORTH JUNCTION FORM
SOUTH JUNCTION FORM
YARRAH FORM
KING ROAD
DRIVER ROAD
FIRELINE
MIDDY LANDING RD
TALLANALLA ROAD
HARVEY ROAD
QUINDANNING ROAD
MURRAY ROAD
PINJARRA ROAD
WILLIAMS ROAD
BOUNDARY ROAD
DARKAN ROAD
COLLIE ROAD
NORM RD
HARRIS RIVER RD
COALFIELDS ROAD
COLLIE ERSTON RD
YOURDAMUNG RD
Dandalup River
South
Murray
Samson Brook
Harvey River
Bell Brook
Horham River
Williams River
Harris River
Ringlah
Collie River
East
N


Map 10. Mining Tenements and Utilities
Legend
Management plan area
Mining Tenements
ML 258SA
ML 1SA
Ulitities
Transmission line
Water pipeline
0 2.5 5 10 15 20 km
Scale
DWELLINGUP
QUINDANNING
COLLIE
ML 1SA
ML 258SA
Worsley Refinery
Lake Banksiadale (South Dandalup Dam)
Lake Navarino (Waroona Dam)
Lake Kabbamup (Samson Brook Dam)
Lake Brockman (Logue Brook Dam)
Harvey Reservoir
Stirling Dam
Harris Dam
Wellington Reservoir
Dandalup River
Samson Brook
Harvey River
Collie River
Hotham River
Williams River
Bell Brook
Bingham River
Collie East River
South Dandalup Dam Road
Park Road
Scarp Road
Nanga River Road
Nanga Brook Road
Waroona Road
Murry Valley Road
North Junction Form
South Junction Form
Murray River Road
Pinjarra Road
Alcoa Conveyer
Driver Road
Firebreak King Road
Muddy Landing Road
Tallanalla Road
Harvey Road
Overland Conveyer
Quindanning Conveyer
Muja-Northern Terminal Transmission Line
Muja-Boddington Transmission Line
Williams Road
Quindanning Road
Darkan Road
Boundary Road
Yourdamung Road
Norm Harris Road
Worsley Collie Road
Coalfields Road
Preston Road
N

Appendix 1. Performance Assessment

Key Performance Indicators for the planning area

Key Values	Key Objectives	Key Performance Indictors		
		Performance Measure	Target	Reporting Requirements
Part B. Management Directions and Purpose				
Section 14 – Existing and Proposed Tenure				
	To protect conservation reserves of the planning area by providing maximum security of tenure, class and purpose	14.1 Tenure actions for which the Department and Conservation Commission are responsible	14.1 Complete all tenure actions for which the Department and Conservation Commission are responsible within the life of the management plan	Every 5 years
Part C. Managing the Natural Environment				
Section 19 – Native Plants and Plant Communities				
A rich mosaic of significant habitats including un-dammed riparian areas and wetland, granite outcrops, old-growth forests and wandoo woodlands Populations of rare and priority flora and fauna	To protect and conserve native plants and plant communities	19.1 The persistence and condition of populations of threatened species	19.1 Subject to natural variation, recovery and maintenance of viable populations of threatened flora	Every 5 years or as per recovery plans, if applicable
Section 20 – Native Animals and Habitats				
A rich mosaic of significant habitats including un-dammed riparian areas and wetland, granite outcrops, old-growth forests and wandoo woodlands Populations of rare and priority flora and fauna	To protect and conserve native animals and their habitats	20.1 Range and population size of threatened and other specially protected fauna	20.1 Subject to natural variation, recovery and maintenance of viable populations of threatened and other specially protected fauna	Every 5 years or as per recovery plans, if applicable
Section 22 – Environmental Weeds				
A rich mosaic of significant habitats including un-dammed riparian areas and wetland, granite outcrops, old-growth forests and wandoo woodlands	To minimise the impacts of environmental weeds on key values	22.1 The extent of blackberry at priority locations such as recreation sites and riparian areas	22.1 Decrease in the extent of blackberry	Every 5 years

Key Values	Key Objectives	Key Performance Indictors		
		Performance Measure	Target	Reporting Requirements
Section 23 – Introduced and Other Problem Animals				
A diverse array of natural environments providing numerous research opportunities to increase knowledge associated with ecological, biological and physical processes, native flora and fauna and their habitats, the effects of threatening processes and for visitor research	To minimise the impacts of introduced and other problem animals on key values	23.1 Populations and area impacted by feral pigs in priority areas	23.1 No increase in the number of populations or area impacted by feral pigs in priority areas	Every 5 years
Section 25 - Fire				
A rich mosaic of significant habitats including un-dammed riparian areas and wetland, granite outcrops, old-growth forests and wandoo woodlands	To conserve biodiversity across the landscape and to protect life and community assets in and near the planning area	25.1 The impact of bushfire on life and community assets	25.1 No loss of life or serious injury, or significant community assets attributable to the Department's fire management	Annually
		25.2 The extent of fire diversity measured by the diversity and scale of post-fire (seral) stages for theoretical negative exponential curve for the south-west	25.2 The distribution of post-fire fuel ages (time since fire) for theoretical negative curve for the south-west approximates a negative-exponential distribution (see Figure 8)	Annually
		25.3 The persistence of threatened species within each LCU	25.3 No loss of populations or significant decline of threatened species at the LCU scale	Every 5 years
Part D. Managing Our Cultural Heritage				
Section 26 – Indigenous Heritage				
Indigenous sites, artefacts and landscapes of mythological, cultural and spiritual significance of cultural significance to Aboriginal people	To protect and conserve the Indigenous cultural heritage in consultation with Aboriginal people	26.1 Protection of known or identifiable Indigenous heritage sites	26.1 No disturbance without formal approval and consultation	Every 5 years
Section 26 – Non-indigenous Heritage				
Non-indigenous cultural heritage associated with early settlements and the timber industry	To protect and conserve the non-indigenous cultural heritage	27.1 Protection of known or identifiable non-indigenous heritage sites	27.1 No disturbance without formal approval and consultation	Every 5 years

Key Values	Key Objectives	Key Performance Indictors		
		Performance Measure	Target	Reporting Requirements
Part E. Managing Visitor Use				
Section 28 – Visitor Opportunities				
A terrestrial environment that provides opportunities for a diverse range of nature-based recreational tourism opportunities including Un-dammed riverine environment of the Murray River providing opportunities for canoeing, kayaking, rafting, swimming, fishing and marroning	To provide a range of nature-based recreation and tourism opportunities based on visitor demand and trends while ensuring the impacts on key values are minimised	28.1 Visitor satisfaction levels of nature-based experiences	28.1 Visitor satisfaction levels of nature-based experiences are maintained or increased from 2011 levels	Every 5 years
Section 29 – Visitor Use Planning				
A terrestrial environment that provides opportunities for a diverse range of nature-based recreational tourism opportunities	To provide visitors with a range of nature-based experiences while ensuring the impacts on key values are minimised	29.1 The range of visitor management settings (i.e. from natural to highly modified)	29.1 Maintain visitor management settings over the life of the plan	Every 5 years
Section 33 – Visitor Safety				
A terrestrial environment that provides opportunities for a diverse range of nature-based recreational tourism opportunities	To minimise risks to visitor safety and encourage appropriate visitor behaviour while maintaining a range of visitor experiences wherever possible	33.1 The proportion of accidents/incidents per visit reported annually to the Department	33.1 The proportion of accidents/incidents per visit reported annually to the Department remains stable or decreases from 2011 levels	Every 5 years
		33.2 Reducing the proportion of reports of antisocial behaviour in the planning area	33.2 The number of reports of antisocial behaviour remains stable or decreases from 2011 levels	Every 5 years
Section 34 – Domestic Animals				
	To protect natural values and visitors from the impacts of domestic animals	34.1 The number of dogs recorded outside of designated areas	34.1 A decreasing trend in the number of dogs recorded outside of designated areas from when sites are initially designated	Every 3 years
Part F. Managing Resource Use				
Section 39 - Rehabilitation				
	To rehabilitate disturbed ecosystems to a stable condition resembling as close as possible the natural ecosystem structure, function and/or process	39.1 The area of disturbed ecosystems (e.g. from fireline construction, mining, pine harvesting) that have undergone rehabilitation	39.1 Increase in the area of disturbed ecosystems that have undergone rehabilitation	Every 5 years

Appendix 2. Proposed Additions to Lane Poole Reserve

Proposed Additions[1]	Area (ha)	Current			Proposed class A reserves vested in the Conservation Commission	
		Purpose	Vesting	Class	Tenure	Purpose
Un-named reserve 47688[2]	79	National park	Conservation Commission	A	National park	National park
State forest (FMP IDs 63-65[3], 74-76, 78 and part of 79)	12,161	State forest	Conservation Commission	A	National park	National park
Timber reserve (part of FMP IDs 77 & 79)	4686	Timber reserve	Conservation Commission	C	National park	National park
Crown reserve 4555 (part of FMP ID 77)	395	Resting place for travellers and stock	Unvested	A	National park	National park
Crown reserve 7675 (part of FMP ID 77)	189	Resting place for travellers and stock	Unvested	A	National park	National park
Water Resources Ministerial body freehold (part of FMP ID 77)	1918	N/A	Not vested	N/A	National park	National park
Crown reserve 6902[1] (part of FMP ID 77)	0.3	Water	Unvested	C	National park	National park
State forest (part of FMP ID 73)	4276	State forest	Conservation Commission	A	Conservation park	Conservation park
Unallocated Crown Land (part of FMP ID 73)	49	N/A	Not vested	N/A	Conservation park	Conservation park
Miscellaneous reserve 5102 (FMP ID 61)	230	Recreation and parklands	CALM Executive Body	A	CALM Act section 5(1)(h)	Recreation and enjoyment of natural environment and the agreement defined in s 2 of the Alumina Refinery Agreement Act 1961
Unallocated Crown Land (FMP ID 62[4])	180	N/A	Not vested	A	CALM Act section 5(1)(h)	Recreation and enjoyment of natural environment and the agreement defined in s 2 of the Alumina Refinery Agreement Act 1961

[1] = ID 77 as identified in the FMP also included reserve 39821 (see Table 1) which, for the purposes of this table, has been removed to indicate the proposed additions to the reserve only. Reserve 39821 is proposed to be converted to national park. Crown reserve 6902 is also included as part ID 77.

[2] = The proposal was identified in the Lane Poole Reserve Management Plan 1990-2000.

[3] = The proposal for FMP additions ID 63-65 and reserve to national park differs from that detailed in the *Forest Management Plan 2004-2013* (proposed addition as conservation park) as an outcome of stakeholder consultation and subsequent Government consideration and endorsement.

[4] = Formerly freehold land held in the name of the CEO of the Department.

Appendix 3. Rare, Priority and Other Significant Flora

Species	Common Name	Conservation code
Actinostrobus pyramidalis	Swamp cypress	RT
Boronia tenuis	Blue Boronia	P4
Byblis gigantea	Rainbow plant	P2
Caladenia bryceana subsp. *bryceana*	Dwarf spider orchid	R
Callistachys lanceolata	Wonnich	RM
Calothamnus graniticus subsp. *Leptophyllus*		P4, D
Darwinia pimelioides		P4, LE
Drosera occidentalis subsp. occidentalis		P4
Epiblema grandiflorum var. grandiflorum		RM
Goodenia filiformis	Thread-leaved goodenia	P3
Grevillea manglesii subsp. *ornithopoda*		P2
Hibbertia ovata		LE
Homalosciadium homalocarpum		RM
Hydrocotyle lemnoides	Aquatic pennywort	P4
Lasiopetalum cardiophyllum		P4
Macrozamia riedlei	Zamia	RT
Parmeliopsis macrospora		P3
Parsonsia diaphanophleba		P4, LE
Pertusaria trachyspora		P2
Pteridium esculentum	Bracken	RT
Pultenaea skinneri	Skinner's pea	P4
Schoenus natans	Floating bog-rush	P4
Schoenus subaphyllus		D
Senecio leucoglossus		P4
Stylidium ireneae		P4
Villarsia submersa		P4

R = rare, P = priority, LE = locally endemic, RT = relictual, RM = relictual monotypic, D = disjunct.

Appendix 4. Specially Protected and Priority Fauna

Species	Common Name	Conservation code[43]		
		WA	EPBC	IUCN
Ardeotis australis	Australian bustard	P4		
Atrichornis clamosus	Noisy scrub bird	S1	VU	EN
Bettongia penicillata ogilbyi	Woylie	S1		EN
Burhinus grallarius	Bush stone curlew	P4		
Calamanthus campestris montanellus	Rufous fieldwren	P4		
Calyptorhynchus banksii naso	Forest red-tailed black cockatoo	S1		VU
Calyptorhynchus baudinii	Baudin's cockatoo	S1	VU	EN
Calyptorhynchus latirostris	Carnaby's cockatoo	S1	EN	EN
Ctenotus delli	Dell's skink	P4		
Dasyurus geoffroii	Chuditch	S1		VU
Falco peregrinus	Peregrine falcon	S4		
Falcunculus frontatus	Crested shrike-tit	P4		
Falsistrellus mackenziei	Western false pipistrelle	P4		
Hydromys chrysogaster	Water rat	P4		
Isoodon obesulus fusciventer	Quenda (southern brown bandicoot)	P5		
Macropus eugenii derbianus	Tammar wallaby	P5		
Macropus irma	Western brush wallaby	P4		
Morelia spilota imbricata	Carpet python	S4		
Myrmecobius fasciatus	Numbat	S1	VU	VU
Ninox connivens connivens	Barking owl	P2		
Phascogale tapoatafa ssp.	Brush-tailed phascogale	S1		VU
Pomatostomus superciliosus	White-browed babbler	P4		
Pseudocheirus occidentalis	Western ringtail possum	S1	VU	VU
Rostratula benghalensis australis	Australian painted snipe	S1		VU
Setonix brachyurus	Quokka	S1	VU	VU
Tyto novaehollandiae novaehollandiae	Masked owl	P3		

Source: Wildlife Conservation (Specially Protected Fauna) Notice 2010, EPBC Act list of threatened fauna (accessed January 2008) and the 2007 IUCN Red List categories used to rank threatened species in WA. Fauna species list obtained from the WA Museum May 2006.

[43] Conservation codes are described in the glossary under 'threatened fauna' and 'priority flora and fauna listings'.

Appendix 5. Environmental Weeds

Species	Common Name	Distribution	Invasive	Environmental Impacts
High (4)				
Asparagus asparagoides+*	Bridal creeper	x	x	x
Typha orientalis	Bullrush	x	x	x
Watsonia meriana var. *bulbillifera*	Bugle Lily Watsonia	x	x	x
*Zantedeschia aethiopica**	Arum lily	x	x	x
Moderate (21)				
Aira cupaniana	Silvery hairgrass	x	x	
Arctotheca calendula	Cape weed	x	x	
Briza maxima	Blowfly grass	x	x	
Briza minor	Shivery grass	x	x	
Crassula natans	Crassula	x	x	
*Gomphocarpus fruticosus**	Cotton bush	x	x	
Holcus lanatus	Yorkshire fog	x	x	
Hordeum leporinum	Barley grass	x	x	
Hypochaeris glabra	Smooth cat's ear flat weed	x	x	
Hypochaeris radicata	Flatweed	x	x	
Isolepis marginata	Coarse club rush	x	x	
Lolium rigidum	Annual rye grass	x	x	
Orobanche minor	Lesser broomrape	x	x	
Pinus pinaster	Pinaster Pine	x	x	
Pinus radiata	Radiata Pine	x	x	
Polypogon monspeliensis	Annual beardgrass	x	x	
Pseudognaphalium luteoalbum	Jersey cudweed	x	x	
Rostraria cristata	Mediterranean hairgrass	x	x	
*Solanum linnaeanum**	Apple of Sodom	x	x	
Sonchus oleraceus	Common sowthistle	x	x	
Trifolium dubium	Suckling clover	x	x	
Vulpia bromoides	Squirrels tail fescue	x	x	
Mild (2)				
*Argemone ochroleuca**	Mexican poppy	x		
Juncus microcephalus	Tiny-headed rush	x		
Low (9)				
Bromus hordeaceus	Soft brome			
Cotula coronopifolia	Waterbuttons			
Dipogon lignosus	Dolichos pea			
Hypericum perforatum	St John's wort			
Mentha pulegium	Pennyroyal			
Monopsis debilis	Regal purple			
Plantago lanceolata	Ribwort plantain			
Rubus fruticosus+*	Blackberry			
Sisymbrium officinale	Hedge mustard			
Unrated as of 1999 (4)				
Bartsia trixago	White bartsia			
*Echium plantagineum**	Paterson's curse	x		x
Lythrum hyssopifolia	Lesser loosestrife			
Rumex brownii	Swamp dock			

Species	Common Name	Distribution	Invasive	Environmental Impacts
Not Listed (4)				
Disa bracteata	African weed orchid			
Lactuca serriola forma serriola	-			
Lotus subbiflorus	Hairy bird's-foot trefoil			
Sonchus asper subsp. *Asper*	Prickly sowthistle			

* Declared species under the Agriculture and Related Resources Protection Act (as at 17 Jan 2007)
\+ Weeds of National Significance

Environmental Weeds Strategy for Western Australia (EWS) Rating

High: Priority for control and/or research
Moderate: Control or research efforts should be directed to it if funds are available in addition to reasonably high level of monitoring
Mild: Monitoring and control where appropriate
Low: Low level of monitoring
Distribution: wide current or potential distribution including consideration of known history of wide spread distribution elsewhere in the world. (Score as yes or no).
Invasiveness: Ability to invade bushland in good to excellent condition or ability to invade waterways. (scored as yes or no)
Environmental Impacts: Ability to change the structure, composition and function of ecosystems. In particular, an ability to form a monoculture in a plant community (scored as yes or no).
Based on the *Environmental Weed Strategy for Western Australia (1999)*

Appendix 6. Introduced and Other Problem Animals

Species	Common Name
Mammals	
Felis catus	Feral cat
*Oryctolagus cuniculus**	Rabbit
Rattus rattus	Black rat
*Sus scrofa**	Feral pig
*Vulpes vulpes**	Red fox
Birds[44]	
Dacelo novaeguineae[∇]	Laughing kookaburra
Fish	
Gambusi holbrooki	Mosquito fish
Oncorhynchus mykiss	Rainbow trout
Perca fluviatilis	Redfin perch
Salmo trutta	Brown trout
Invertebrates	
Apis mellifera	(European) honeybee
Cherax cainii[o]	Marron
Cherax destructor	Yabbie
Perthida glyphopa[+]	Jarrah leafminer
Perthida ssp.[+]	Flooded gum leafminer

* Declared species under the Agriculture and Related Resources Protection Act (as of 13 March 2006).
[∇] Considered 'acclimatised' and protected under the Wildlife Conservation Act.
[o] Marron endemic to WA but are not indigenous to the Murray River.
[+] Native insects considered as problem animals.

[44] *Streptopelia chinensis* (Spotted turtle-dove) and *Streptopelia senegalensis* (Laughing turtle-dove) are species that have the potential to invade areas of the planning area.

Appendix 7. Life and Community Assets Vulnerable to Bushfire

Life and Community Assets*	Acceptable Outcome
Fire fighter and public safety	No loss of life due to bushfire
Nearby townsite (e.g. Dwellingup) and semi rural urban developments in close proximity to forested areas that lack adequate refuge areas	Minimal loss of community assets with little financial loss and disruption to local communities. No loss of life due to bushfire
Essential utilities and infrastructure (e.g. water pipeline, transmission lines, powerlines, solar power structures at Icy Creek, bridges, roads, culverts, conveyer belts, communication towers (e.g. Mt Saddleback, Mt Williams and Lemon Rd)	Minimal and short-term financial impacts on infrastructure and minimal disruption to local communities
Built structures including the Rangers house, accommodation and facilities (e.g. huts, toilets) at Icy Creek, along the Bibbulmun Track, Munda Biddi Trail and other recreation sites	Minimal financial loss and disruption to regular activities and impact on historical values/infrastructure
Recreation day use sites, camping areas and tracks/trails (e.g. Bibbulmun Track, Munda Biddi Trail and Nanga Heritage Circuit), in particular high use sites in the northern recreation area and the infrastructure associated with them	Physical infrastructure may be lost, but is readily replaced at an acceptable cost. No loss of life due to bushfire
Pine and blue gum plantations within and adjoining the planning area	Minimal financial loss and minor affects on productive potential in the medium term
Private property (e.g. freehold enclaves, private accommodation, school camps)	Minimal financial loss and disruption to regular activities
Indigenous and non indigenous heritage sites (e.g. Indigenous artefacts, mills)	No loss of known Indigenous and non-indigenous heritage
Public drinking water source areas such as the Samson and Harris catchment areas	Short-term affects on potable water quality and quantity as a result of bushfire and minimal disruption to public water supply
Infrastructure associated with mining (e.g. conveyer belts)	Minimal and short-term financial impacts on infrastructure and minimal disruption to mining operations
Apiary sites	Short term impacts on production capacity and hives

* Not all community assets listed are confined within the planning area.

Appendix 8. Conditional Burning Areas Classification

Conditional Burning Area Classifications include:

(a) Fire Exclusion Reference Areas[45] are areas (generally less than 500ha) where fire has been deliberately excluded to provide opportunities for a reference site for scientific studies of the effects of different fire regimes on the environment. These areas are broadly representative of the landscape within which they are located. The fire management objective is to protect these areas from bushfire and exclude fire in perpetuity.

(b) Scientific Study Area is an area in which scientific study is being undertaken and for the period of that study is not to be burnt or burnt as per the study requirements.

(c) No Planned Burn - Management Plan is an area identified in a gazetted management plan or draft management plan that has been specifically identified as an area not to be burnt by prescribed fire.

(d) Fire Exclusion - Harvesting is an area where timber harvesting has been planned and fire should be excluded to allow pre-harvesting operations such as dieback interpretation and flora surveys to be undertaken.

(e) Fire Exclusion - Habitat is an area identified as having special value as fauna or flora habitat due to its vegetation structure, species composition, seral stages, niche values or location.

(f) Fire Exclusion - Silviculture is an area that contains regrowth that is sensitive to fire.

(g) Fire Exclusion - Cultural is an area identified as having Indigenous or non-indigenous cultural values that are sensitive to fire.

(h) Specified Management Regimes is an area identified in a gazetted management plan or draft management plan that has been assigned a specific fire regime for a specified purpose. Examples may be to achieve ecological diversity using variable rotations (5-20 years) or longer burns of about 10-20 years, or a carefully considered and managed prescribed burning program initiated to promote the maintenance of rare fauna habitat in areas of particular importance for wildlife conservation. It may also included selected areas of major vegetation types that should not receive prescribed burning until a biological survey has been conducted on them.

[45] The selection criteria for Fire Exclusion Reference Areas is currently under review following a public comment period.

Appendix 9. Visitor Management Settings Criteria*

	Natural	Natural -Recreation	Recreation	Highly modified
Principle purposes	Conservation of significant natural and cultural values, with low level recreation.	Conservation of significant natural and cultural values, with low to medium level recreation.	Moderate intensity recreation.	Moderate to high level recreation, education and interpretation. Group activities specifically catered for at many sites.
Description	Remote areas with conservation significance. Some evidence of previous development in process of rehabilitation, or existing human activity related to management tracks/trails, designated 4WD tracks and walking tracks.	Modified environment but dominated by natural vegetation and landscapes of conservation significance. Signs of past use evident.	Modified environment but includes areas with 'natural' landscape values. Exotic plants may be present but rarely dominant, recreation facilities present.	Highly modified environments with a moderate to high level of nature-based developments set in a mostly natural landscape. Signs of human activity are a regular feature.
Access (access standards and type of transport used by visitors, resource users and protected area managers)	Vehicles: 4WD only. Walk: AS Walking Track class 4 to 6; tracks generally formed (class 6 tracks not formed). Boats: non-motorised boats only. Cycle: types 4 cycle trail. Horses: no horses permitted. Airstrip: no airstrips permitted.	Vehicles: 4WD, sometimes 2WD seasonal. Walk: AS Walking Track class 3 to 5; tracks formed. Boats: boats, motorised and non-motorised, on designated routes/areas Cycle: types 4 cycle trail. Horses: designated bridle trails possible. Airstrip: natural earth.	Vehicles: 2WD unsealed. Walk: AS Walking Track class 2 to 4; tracks generally formed. Boats: boats, motorised and non-motorised, on designated routes/areas Cycle: types 2 & 3 cycle trails. Horses: designated bridle trails possible. Airstrip: unsealed.	Vehicles: 2WD sealed. Walk: AS Walking Track class 1 & 2; tracks well constructed; universal access provided where appropriate and practical Boats: Areas may be open to all types of boats. Cycle: type 1 cycle trails. Horses: designated bridle trails possible. Airstrip: sealed.

	Natural	Natural -Recreation	Recreation	Highly modified
Site modification (Extent, type and design of infrastructure, facilities, amenities and the style of accommodation provided)	Minimal modification at sites. 'No Facilities' level of development. Overnight stays: campsites not defined. Day use: Car parking not defined. Facilities: No facilities provided.	Minor modifications at specific sites. 'Medium' and 'Low' level of development. Overnight stays: campsites generally defined. Day use: Car parking generally defined. Facilities: Basic facilities may be provided such as shade shelters, BBQs, toilets.	Modification of sites evident. 'Medium' level of development. Overnight stays: campsites generally defined; nature-based built accommodation either single structure (e.g. shack/hut) or semi-permanent multiple structures (e.g. safari camp). Day use: Car parking area defined. Facilities: Facilities generally provided such as shade and interpretive shelters, gas BBQs, tables, toilets.	Modification of site clearly evident. 'Medium' to 'high' level of development. Overnight stays: nature-based built accommodation with multiple structures and a moderate level of facilities and services (safari camp, ecolodge). Day use: Defined car parking areas and bays. Facilities: High level of facilities including shade shelters, gas BBQs, tables, toilets, rubbish collection, visitor information in shelter / building.
Social interaction (Density of users and degree of social interaction and opportunities for solitude)	Little interaction between users, with small numbers of brief encounters with individuals or small groups only except at campsites.	High likelihood of contact with individuals and small groups along access routes and at campsites.	High level of contact with others at campsites and along access routes. Campsite design allows for group camping.	Constant interaction expected. Group and family activities important part of visitor experience. Interaction with others unavoidable. Natural setting important but in the security of a safe and managed environment.
Degree of self reliance (level of support services)	Visitors must be totally self-reliant. Support services infrequent or unreliable.	Visitors must still be largely self-reliant. Basic support services provided in specific locations.	Self-reliance requirements are generally low where facilities are provided, but outdoor skills will be important in areas away from roads and tracks.	Minimal self-reliance. High level of support facilities usually present or in close proximity.
Style of visitor management (level of on-site management, site constraints and regulations)	Infrequent DEC presence. Information principally off-site (e.g. brochures, guides, maps); minimal signs. Low maintenance.	Some management presence including visits by DEC staff and signs. Information may be provided on-site. Permit system may be used to control access; emphasis on establishing appropriate visitor expectations and behaviour.	May be frequent ranger presence. Interpretive material, brochures and track guides available. Moderate on-site management requirements, including signs and barriers; facilities may be common but clustered.	Frequent staff presence, on-site manager. Could be interpretative and education focus. High degree of on-site management including use of physical barriers and on-site staff; vehicle and pedestrian movement heavily controlled.

	Natural	Natural -Recreation	Recreation	Highly modified
Interpretation facilities and services	Signposting may be provided at trailheads; track markers and signs may occur for public health or safety reasons (e.g. at track junctions). Some guided tours may be permitted (see below).	Signposting may be provided where necessary. Interpretive material off-site or at trailheads; guided tours permitted.	Well signposted at trailheads and along track. Interpretive shelters, displays and leaflets, guided tours may be provided. Primary themes may be expressed at recreation sites. Extensive range of opportunities.	Well signposted at trailheads and along track. Interpretive shelters, displays and leaflets, guided tours may be provided; visitor centre may be present. Primary themes may be expressed at recreation sites. Extensive range of opportunities.
Commercial uses	CTO licences permitted, but may consider regulating numbers to maintain visitor experiences consistent with setting (E class). Focus on nature-based/cultural activities. Leases generally not permitted, or if allowed then setting revised.	CTO licences permitted with focus on nature-based/cultural activities. Leases permitted in appropriate tenure and subject to strict sustainable conditions.	CTO licences permitted, nature-based/cultural and adventure activities. Leases permitted	CTO licences permitted, nature-based/ cultural and adventure activities. Leases permitted.
Probable recreation experiences	Opportunities for solitude, independence, closeness to nature, tranquillity and self-reliance in an environment that offers a high degree of challenge. Although the activity may not be based on the use of a motorised vehicle, the influence of vehicles and the safety afforded by them may be significant.	Opportunities for challenging interaction with nature using outdoor skills. Opportunities may have human elements but still high probability that visitors can experience isolation from human influences.	Opportunities to interact with nature while still having access to facilities. Interaction with others expected.	Opportunities for nature appreciation and social interaction in a safe environment. Facilities support group activities. Interaction with others unavoidable.

*The criteria for Wilderness Area (as recognised in *Policy 62 – Identification And Management of Wilderness and Surrounding Areas*) 1A – Wilderness and 1B – Surrounding Areas and Highly Modified B have been removed from this table as they are not applicable to the planning area.

Appendix 10. Guidelines for Visual Landscape Assessment

Visual landscape management involves maintaining, restoring or enhancing natural and cultural landscape values, as well as planning and designing land use activities and developments to provide diverse views and minimise negative impacts. Human imposed changes to the landscape should be subordinate to the established natural visual character. Guidelines for landscape management are as follows:

Zone A

These areas are a high priority for visual landscape management. The objective in these areas is to retain the maximum amount of visual quality. Guidance for management is as follows:

- Focus on the maximum protection of all existing visual landscape features. These features should be identified and evaluated before any management activities.
- Landscape alteration should be low as this zone is the least accommodating to visual change.
- Alterations to landscape character should be subtle, remaining subordinate to natural elements by borrowing extensively from form, line, colour, texture and scale found commonly in the surrounding landscape. Alterations should be visually in evident within one year of project completion.
- Avoid operations that lead to a major change in scenic quality in the short-term.
- Prescribed burning should minimise impact on landscape values (i.e. maintaining substantial sections of unburnt areas around sensitive areas).
- Slash breaks required for fire management should use techniques to minimise visual landscape impacts wherever possible.
- Facilities and activities which utilise and yet disturb very little of the natural environment should be encouraged such as walking tracks and small day use areas.
- Where structures are required they should be small scale, carefully sited away from major natural focal points, out of viewer sight-lines (preferably at a background distance and where the time viewed is shortest) and where vegetation or landform screening can be used.
- Road design and construction should remain subordinate to landscape elements by utilising minimum design standards, limited cuts and fill, minimum clearing widths, undulating edges, sensitive alignment. Roads and tracks should also focus views onto distinctive features where possible.
- Previously disturbed areas should be given the highest priority for rehabilitation until the desired standard of scenic quality is attained.
- Interpretive and explanatory signing should be utilised before and during operations that alter landscape character (i.e. recreation site development, prescribed burning adjoining sensitive areas).
- Land uses and developments that do not require scenic environments should be excluded (e.g. mining, quarries, large recreation sites, large car parks, roads, telecommunication towers and powerlines).

Zone B

These areas are a moderate priority for visual landscape management. The objective in these areas is to retain a moderate amount of visual quality. Landscape alterations may be visually apparent but the focus should remain on the protection of the dominant existing visual landscape features. In this instance, alterations to the naturally established landscape character should still borrow form, line, colour, texture and scale from natural elements.

Zone C

These areas are a low priority for visual landscape management. The objective in these areas is for partial retention/enhancement of visual quality. Guidelines for management are as follows:

- Landscape alterations may be visually dominant (i.e. accommodating to visual change) but should reflect the existing lines, forms, colours and textures of the surrounding landscape.
- Where possible, the Department should seek to optimise and enhance (e.g. through rehabilitation) visual quality over the medium to longer term.
- Essential but visually depreciative facilities not requiring areas of scenic amenity should be accommodated in these areas first (e.g. gravel pits, transmission towers and powerlines).
- Views to disturbed landscapes may require landform and vegetation screening.

Appendix 11. Commercial Apiary Site Assessment

Criteria and Approach for Assessing Commercial Apiary Sites within the Planning Area

	Suitable	Suitable but Conditional	Highly Constrained
Approach	Maintain or increase numbers of apiary sites in these areas. Standard permit conditions would apply	Maintain or increase numbers of apiary sites in these areas. Additional permit conditions would apply such as increased hygiene control and seasonal, site location and access restrictions. Research and monitoring at these sites may be required	Close, and relocate where possible, any current apiary sites in these areas. Prevent any new apiary sites in these areas
Environmental Criteria			
1. Threatened and other conservation significant flora within a 2km radius[1]	No rare, priority 1 or 2 flora present that are visited by honeybees	Rare, priority 1 or 2 flora present that are visited by honeybees and impacts are seasonal or undetermined[2]	Rare, priority 1 or 2 flora present that are visited by honeybees and impact is predicted to be year-round[2]
	No priority 3 or 4, endemic, disjunct or relictual flora present that are visited by honeybees	Rare, priority 1 or 2 flora present that are visited by honeybees but no predicted impact[3] Priority 3 or 4, endemic, disjunct or relictual flora that are visited by honeybees present[4]	-
2. Significant communities within a 2km radius	No threatened ecological communities (TECs) or priority ecological communities (PECs)	TEC or priority 1 or 2 PEC present and impacts are seasonal[2] TEC or priority 1 or 2 PEC present but no predicted impact[3] Priority 3 or 4 PEC present and flora is visited by honeybees[4]	A TEC or priority 1 or 2 PEC present and impact is predicted to be year-round[2]
3. Threatened fauna and other significant habitats (i.e. habitats for fauna adversely impacted by honeybees) within a 2km radius	No old-growth forest or other known habitat of hollow nesting threatened fauna present	Old-growth forest or other known habitat of hollow nesting threatened fauna is present[5]	
	No threatened, priority 1 or 2 pollen or nectar feeding birds or mammals present	Threatened, priority 1 or 2 pollen or nectar feeding birds or mammals present that are seasonally impacted[2]	Threatened, priority 1 or 2 pollen or nectar feeding birds or mammals present and impact is predicted to be year-round[2]
	No fauna watering points at fauna breeding centres and re-introduction sites present	-	Fauna watering point at fauna breeding centres and re-introduction sites present[6]
	No other significant habitats or communities present	Other significant habitats or communities are present that are seasonally impacted[7]	Other significant habitats or communities are present that are impacted year-round

	Suitable	Suitable but Conditional	Highly Constrained
Management Criteria			
1. Previous use	A conservation reserve that has authorised historic use of commercial beekeeping	-	A conservation reserve that has no authorised historic use of commercial beekeeping
2. Access	Public or suitable management vehicle only access is available	-	There is no public or suitable management vehicle only access or current access is being closed
	No gazetted wilderness present	'Candidate' wilderness only	Gazetted wilderness or wilderness proposed to be gazetted present
3. Recreation sites or dwellings within a 500m radius	No built accommodation/ camping/day use site present	-	Built accommodation/ camping/day use site present
4. Tracks and trails within a 200m radius	No walk trail present (Class 1 or 2)	Walk trail (Class 1 or 2) present but only used infrequently, or proposed walk trail (Class 1 or 2)	Walk trail (Class 1 or 2) present and used frequently
5. Disease control[8]	Low risk of *P. cinnamomi* spread	*P. cinnamomi* present or area identified as protectable from *P. cinnamomi* spread but there is an existing site Disease present or vegetation identified as being susceptible to disease and there is a risk of spread from existing apiary activities	Area identified as protectable from *P. cinnamomi* spread and there are no existing sites Disease present, or vegetation identified as susceptible to disease and there are no existing sites
6. Apiary sites within 3km radius	No other apiary sites present		Apiary site present
7. Feral honeybee management within 2km	-	Feral honeybee control program in place[9]	-
8. Weed management within a 2km radius	No high or moderate environmental weeds present that are considered to have an increased seedset due to honeybees	High or moderate rated environmental weeds that are considered to have an increased seed set due to honeybees but flower seasonally[10]	High or moderate rated environmental weeds that are considered to have an increased seed set due to honeybees and flower year-round
9. Other management concerns	No impact on Departmental operations or the requirements of other authorities controlling Crown land or Government reserves	An impact on Departmental operations or the requirements of other authorities controlling Crown land or Government reserves that can be managed	An impact on Departmental operations or the requirements of other authorities controlling Crown land or Government reserves that can not be managed

Notes

[1] This process has been based on where there is spatial data for threatened and other conservation significant flora. A list is available for the threatened and other conservation significant flora within the planning area (and buffer), which has been assessed as being impacted by honeybees. This apiary assessment should be adaptive through the life of the plan and the best data incorporated, for example if during an application for a new site or during a review of an existing site, any new locations of these identified species are found, then this data should be incorporated and the assessment should be rerun for the site.

[2] Impacts are seasonal or undetermined (see Guidance for Additional Conditions – A). Where impacts are predicted to be year-round, the area will be considered to be highly constrained.

[3] Visited by honeybees, but no predicted impact. These flora and communities are still of high conservation significance and a precautionary approach is warranted (see Guidance for Additional Conditions – B).

[4] As with note 3 above, priority 3 or 4, endemic, disjunct and relictual flora are of conservation significance and a precautionary approach is warranted. In addition, although populations of these species may be widespread and impacts on these populations may not threaten the existence of the species, there still may be some populations that should be afforded higher protection (e.g. the population may be (1) at the species' range end, (2) the largest viable population or (3) genetically significant) (see Guidance for Additional Conditions – C).

[5] If there is a current apiary site and there are feral honeybees present, then use can continue year-round. However, old-growth forest and other significant habitats for hollow nesting fauna will be targeted for feral honeybee control (see Guidance for Additional Conditions – D). For new sites within old-growth forest see Guidance for Additional Conditions – E.

[6] Native fauna breeding centres and fauna re-introduction sites often have watering points. Commercial beekeeping in the vicinity may disturb the animals from drinking.

[7] No other significant habitat or community likely to be impacted by honeybees has been identified during the planning process however, they may be identified during the life of this management plan

Other significant habitats may be identified due to:

- new research/information;
- changes in threat status of fauna; and/or
- changes in resource availability – for example, directly after a fire, when competition between species such as honey possums and honeybees would be at its highest.

[8] Standard disease control conditions will apply. The soil dryness index may be used to restrict vehicle access to the sites. There should be no new sites established in areas that are:

- protectable from *P. cinnamomi*;
- designated Disease Risk Areas; or
- in vegetation associations identified as susceptible to disease.

[9] There may need to be seasonal restrictions (see Guidance for Additional Conditions – D) when a feral honeybee control program is in place.

[10] High or moderate environmental weeds are a high priority for the Department to control (see Guidance for Additional Conditions – F).

Guidance for Additional Conditions

A. Seasonal restriction based on flowering period of flora or target flora with respect to pollen or nectar feeding birds/mammals. Site must be available for a minimum of 1 month otherwise the impact is year-round. Placement and number of hives also may be restricted if threatened flora/fauna occurs at apiary site.
B. Placement (at least 100 metres from populations) and number of hives may be restricted. Monitoring of representative samples for health of adult populations and seedling recruitment or TEC/PEC to ensure there is no decline due to apiary management, taking into account other factors such as drought, disease, fire, environmental weeds and other disturbances. If unacceptable impacts are shown or observed later, then treatment will be the same as A.
C. There may be a need to review populations within the planning area to determine whether these populations are significant to the conservation of the species. If deemed significant then treatment will be the same as A.
D. When a feral honeybee program is in place, then use of the site will be restricted during periods when the queen may swarm, such as Spring or a suitable method to restrict the queen should be implemented.
E. For new sites in old-growth forest where there are no feral honeybees present, a condition may be that if during the period of the permit, feral honeybee hives are located within 2 kilometres of the site, the site will be temporarily restricted until the feral honeybees are controlled.
F. Seasonal restriction based on flowering period of environmental weed however, only until the environmental weed has been successfully eradicated.

Assessment of Current Apiary Sites within the Planning Area

Apiary sites within the planning area were assessed against the environmental and management criteria and categorised as suitable, suitable but conditional or highly constrained. The table below shows the result of the assessment and indicates what criteria require additional conditions. Some of these additional conditions have been included as guidance but should be seen as a minimum set.

Apiary Site No.	Environmental Criteria Assessment								Management Criteria Assessment					Conditions
	Rare & Priority 1, 2 Flora Visited			Other	TEC			Fauna	Rec. Sites	Class 1 or 2 Walk Trail	Disease Risk	Weed Management		
	Impact Year Round	Impact Seasonal	No Predicted Impact	Cons. Flora Visited	Impact Year Round	Impact Seasonal	No Predicted Impact	Habitat (e.g. Old Growth)				Impact Seasonal	Impact Year-round	
Suitable (6)														
2569														
2570														
3356														
3357														
3712														
4183														
Suitable but Conditional (38)														
32								x						D
140								x			x			D
142								x			x			D
1056								x			x			D
2323								x			x			D
2337								x						D
2338								x						D
2497								x			x			D
2498								x			x			D
2534								x			x			D
2537				x				x			x			C, D
2767											x			
2920								x			x			D
2921											x			
2932								x			x			D
2934				x				x			x			C, D
2980								x			x			D
3355								x						D
3413								x			x	x		D, F (Oct-Apr, Jun, Jul)
3422				x				x						C, D
3679								x						D

Apiary Site No.	Environmental Criteria Assessment								Management Criteria Assessment					Conditions
	Rare & Priority 1, 2 Flora Visited			Other	TEC			Fauna				Weed Management		
	Impact Year Round	Impact Seasonal	No Predicted Impact	Cons. Flora Visited	Impact Year Round	Impact Seasonal	No Predicted Impact	Habitat (e.g. Old Growth)	Rec. Sites	Class 1 or 2 Walk Trail	Disease Risk	Impact Seasonal	Impact Year-round	
3916				x				x						C, D
3940								x			x			D
4101								x						D
4181								x						D
4182								x						D
4400								x			x			D
4558								x			x			D
4904				x				x						C, D
5048								x						D
5205								x						D
5216								x						D
5225								x						D
5242											x			
5415								x			x			D
5497				x				x			x			C, D
5503											x			
5561				x								x		C, F (Oct-Feb)
Highly Constrained (7)														
2281								x	x		x			NA
2291				x				x			x		x	NA
2546				x				x			x		x	NA
2560				x				x	x		x			NA
2933				x				x			x	x	x	NA
2998				x				x	x		x			NA
5416								x			x		x	NA
Sites within 2km of Planning Area* (42)														
14								x			x			D
24								x						D
281											x			
282											x			
1346								x			x			D
1791				x				x						C, D
2058				x										C
2059				x							x			C
2068											x			
2071				x				x				x		C, D, F (Oct-Dec)
2072				x					x			x		C, F (Oct-Feb)

Apiary Site No.	Environmental Criteria Assessment								Management Criteria Assessment					Conditions
	Rare & Priority 1, 2 Flora Visited			Other	TEC			Fauna				Weed Management		
	Impact Year Round	Impact Seasonal	No Predicted Impact	Cons. Flora Visited	Impact Year Round	Impact Seasonal	No Predicted Impact	Habitat (e.g. Old Growth)	Rec. Sites	Class 1 or 2 Walk Trail	Disease Risk	Impact Seasonal	Impact Year-round	
2078														
2288														
2347											x			
2351														
2352								x			x			D
2496								x						D
2507								x			x			D
2511								x			x			D
2516								x			x			D
2517								x			x			D
2536				x				x			x			C, D
2561								x	x		x	x		D, F (Oct-Apr, Jun, Jul)
2562											x			
2571											x			
2881								x			x			D
2960								x			x			D
2974								x						D
2978											x			
2985								x			x			D
3661														
3706				x										C
3707				x								x	x	C, F (Oct-Apr, Jun, Jul)
3708														
3833								x						D
3835								x						D
3856								x						D
3892								x						D
3939														
4180								x			x			D
4916				x								x	x	C, F (Oct-Apr, Jun, Jul)
6120								x			x			D
Pool Sites (4)														
2319														
2320								x						D
4693								x						D
5047								x						D

* Sites located within a 2km radius of the planning area may be subject to an additional assessment. This assessment reflects data obtained specifically for the planning area.

2010013-0911-X