Kalbarri National Park

'nature's window'

management plan 83

2015

Department of Parks and Wildlife

Conservation Commission WESTERN AUSTRALIA

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Main Nature's Window at The Loop. Photo – Melissa Loomes/Parks and Wildlife
Top right Coastal cliffs. Photo – Rory Chapple/Parks and Wildlife
Top left Branching fringe lily (*Thysanotus dichotomus*). Photo – Rory Chapple/Parks and Wildlife

Header photo View of The Loop from Nature's Window. Photo – Clare Atkins/Parks and Wildlife

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Contents

Summary

Kalbarri National Park, created in 1963, is situated on the lower reaches of the Murchison River, about a six and a half hour drive north of Perth, and surrounds the coastal tourist town of Kalbarri on Western Australia's Coral Coast. The park's spectacular wildflowers, majestic Murchison Gorge, coastal landscapes and vast rolling sandplains provide a stunning setting for visitors to enjoy and engage in a wide range of recreational activities. The park's Aboriginal cultural heritage, fascinating history of 17th century European exploration and more recent use as a pastoral station provide a wealth of stories that enhance visitor appreciation and experience.

The Kalbarri National Park management plan aims to protect the values of the park in the long term. The plan provides a summary of policies, guidelines and operations proposed to be undertaken in the park over the next 10 years.

Desired outcomes, management actions and key performance indicators are used to highlight management priorities, with a focus on:

- managing cultural heritage
- managing visitor use
- involving the community
- managing the natural environment
- managing resource use, and
- research and monitoring.

These priorities are used by the Conservation Commission of Western Australia (Conservation Commission) to assess implementation of the plan by the Department of Parks and Wildlife (the department; Parks and Wildlife).

Lands with significant conservation values adjacent to Kalbarri National Park are included within the scope of this plan.

Managing cultural heritage

The park is located within Nanda country and has many Aboriginal heritage sites including artefacts, mythological places, paintings, a quarry and midden sites. Ethnographic and archaeological surveys have been conducted over a relatively small portion of the park and it is highly unlikely that all sites have been officially recorded. Parks and Wildlife will continue to work with Nanda to protect Aboriginal heritage sites and values within the park.

Management arrangements with Aboriginal people may change over the life of this plan. Joint management has been identified by Nanda as a priority, and, if resources and capacity allow, a joint management agreement under the *Conservation and Land Management Act 1984* (CALM Act) will be considered. Joint management arrangements will require the amendment or review of this management plan. While formal joint management is explored, Parks and Wildlife will continue to foster cooperative and consultative management arrangements with Nanda.

The park also contains a range of sites associated with historic development between Perth and Carnarvon, including stock routes, telegraph lines, the State Barrier Fence and sites associated with early European exploration.

The focus of managing cultural heritage in this management plan is to protect and conserve the value of the land to the culture and heritage of Aboriginal people.

Murchison Gorge near Ross Graham Lookout. Photo – Clare Atkins/ Parks and Wildlife

Managing visitor use

With around 300,000 visits per year, the park is one of WA's major tourist destinations. Key visitor attractions are the spectacular wildflowers from late winter to early spring and geological features such as the soaring coastal cliffs and dramatic natural rock formations along the Murchison Gorge including Nature's Window.

Visitors use recreation sites in the park to enjoy spectacular vistas from lookouts or as a starting point for activities such as bushwalking, overnight hiking and abseiling. However, much of the park is not accessible by vehicle and is seldom visited.

The focus for managing visitor use in this management plan is to improve access to the Murchison Gorge recreation sites by sealing The Loop/Z Bend road and continue to maintain and improve existing recreation sites and opportunities as indicated in Tables 1 and 2.

Involving the community

The local community has a long-standing involvement with management of the park. In the 1960s, Kalbarri's first school headmaster, Ross Graham, was instrumental in the push to establish the national park to ensure the conservation and future enjoyment of the area. Current community involvement includes working with Nanda to foster cooperative and consultative management arrangements, the school-based *Bush Rangers* program, the State Emergency Service, the Kalbarri Volunteer Bush Fire Service, the local tourism industry and neighbouring land managers.

This management plan seeks to build on existing relationships and engender ongoing support and community involvement in park planning and management.

Managing the natural environment

Kalbarri National Park has an array of natural values including unique geological features, sites of geoheritage significance and important botanical diversity, because it is in a transition zone for south-west and arid zone flora and fauna. It features a variety of landscapes including coastal areas, cliffs, gorges, sandplains and rangelands, and is a translocation site for locally-extinct fauna species.

Pressures on these values include introduced animals, in particular feral goats (*Capra hircus*) and pigs (*Sus scrofa*); environmental weeds and inappropriate fire regimes.

The focus for managing the natural environment in this management plan is to:

- conserve the park's flora and fauna and areas of geological significance
- reduce the impacts of introduced animals, weeds and inappropriate fire regimes on the park's key values.

Managing resource use

Mining, beekeeping and water extraction and other utilities occur within the park. The focus for managing resource use is to minimise any impacts of these activities on the park's key values.

Research and monitoring

A commitment to research and monitoring will provide knowledge to assist in the conservation of the park's key values. It will also aid in evaluating the effectiveness of management actions in protecting these values. Priorities for research and monitoring include areas where:

- the quality of base data is the poorest
- understanding of the effect of management actions is poorest
- there have been unanticipated changes in factors that affect the park, such as access or adjacent land uses.

The focus for research and monitoring in this management plan is to increase knowledge and understanding of the impact of management activities and visitor use on the park's key values, providing information to support actions that enhance their protection.

Adjacent lands of conservation significance

Lands adjacent to Kalbarri National Park (see Map 1) have been identified as having conservation significance and this plan proposes their consideration for inclusion in the conservation reserve system and management under the CALM Act. Their reservation will be considered after discussion with relevant stakeholders and will involve the negotiation of an Indigenous Land-Use Agreement (ILUA)[1].

1 An ILUA is a voluntary agreement about the use and management of lands and/or waters between a native title group and any other people, organisations or government agencies. It can be negotiated at any time and it is not necessary to have a determination by the Federal Court about the existence of native title. Once finalised, an ILUA can be registered with the National Native Title Tribunal, binding all parties.

Introduction

Overview

This management plan has been prepared by the Conservation Commission through the department. The planning area covers Kalbarri National Park[2] (183,004ha) and considers adjacent lands for addition to the conservation reserve system, comprising about 239,778ha (see Maps 1 and 2 and *Consideration of adjacent lands*). If the adjacent lands are added to the conservation reserve system, the planning area will cover 422,782 ha.

The planning area is located about 160km north of Geraldton on Western Australia's Coral Coast, within the shires of Northampton and Shark Bay. It lies at the northern limit of the internationally recognised south-west biodiversity hotspot, within the Geraldton to Shark Bay Sand Plains national biodiversity hotspot. The planning area is within the traditional lands of the Nanda (see *Managing cultural heritage*).

The park straddles the lower reaches of the Murchison River, which has cut an 80km-long red-and-white-banded gorge through the underlying rocks, en route to the Indian Ocean (see Map 1). The park's varied features provide an array of things to see and do, including the magnificent Murchison River Gorge renowned for attractions like Nature's Window, a spectacular cliff-dominated coastline, a vast rolling sandplain seasonally covered in wildflowers and European and Aboriginal cultural history.

The town of Kalbarri, at the mouth of the Murchison River, is surrounded by the park to the south and east (see Map 1). The town services a growing tourist trade (the town's main economic contributor), the local fishing industry and surrounding agricultural and pastoral activities. With new residential subdivisions, and promotion of Kalbarri as a holiday destination, it is expected that residential and tourist numbers will grow in the long term (see *Managing visitor use*).

Eagle Gorge. Photo – Parks and Wildlife

2 Reserve 27004, Class 'A', vested in the Conservation Commission with the purpose of national park.

Key values and pressures

Key values

Cultural

- A long history of Nanda use of the area and many Aboriginal heritage sites including artefacts, mythological places, paintings, a quarry, and midden sites.
- Permanent pools of the Murchison River are significant to Nanda culture and history, highlighted by the concentration of cultural sites along the river.
- Historic sites associated with development between Perth and Carnarvon (e.g. stock routes, telegraph lines, the State Barrier Fence and sites associated with 17th century European exploration).

Recreation and tourism

- Spectacular and varied landscapes provide opportunities for a diverse range of nature-based experiences such as hiking, nature appreciation (e.g. wildflowers, coastal and gorge scenery), fishing, canoeing, adventure tourism (e.g. abseiling and rock climbing) and commercial tourism operations.
- One of the State's popular holiday destinations (around 300,000 visits per year), underpinning the local area's tourism-driven economy.

Community

- The strong relationship between the Kalbarri community and the park, with its history of extensive community involvement in nature conservation and visitor service activities, dating back to the park's vesting in 1963.
- Opportunities for the provision of adventure activities, with the area being used by schools and special-interest recreational groups.
- A successful partnership with Kalbarri District High School, through Parks and Wildlife's *Bush Rangers* program.
- Cooperative arrangements with emergency groups such as the Western Australian Police, Kalbarri Volunteer Bushfire Service, the State Emergency Service, Department of Fire and Emergency Services (DFES) and St John Ambulance.
- Protection of part of the Kalbarri Water Reserve Public Drinking Water Source Area.
- Opportunities for education and interpretation of natural and cultural values.
- A study site for tertiary and other educational institutions.

Natural

- Unique geological features and sites, including the Tumblagooda Sandstone, the Murchison Gorge and fossils.
- Has the third highest number of plant species recorded in any Western Australian park, after Fitzgerald River and Lesueur national parks, and many species at the northern limit of their distribution.
- Populations of threatened plant species, especially along the Murchison Gorge.
- Variety of landscapes including coastal areas, cliffs, gorges, sandplains and rangelands.
- Transition zone for south-west and arid zone plants and animals.
- Large diversity of reptiles, with 75 species in total. The sandplain is particularly important as reptile habitat.
- Translocation site for the locally extinct chuditch (*Dasyurus geoffroii*), woylie (*Bettongia penicillata*) and tammar wallaby (*Macropus eugenii* subsp. *derbianus*), and the potential to reintroduce other

species of plants and animals back into the park.

- Free of *Phytophthora cinnamomi*, hence provides a refuge for plant species affected by *Phytophthora* in the north of the South West Botanical Province.
- Permanent river pools and the Murchison is the only river in the south-west land division with no introduced fish species.
- Located on the boundary of two significant biogeographic regions, which contributes to a comprehensive, adequate and representative system of protected areas.

The threatened northern dwarf spider orchid, (*Caladenia bryceana* subsp. *cracens*). Photo – Gemma Phelan/Parks and Wildlife

Release of tammar wallaby to establish new populations in the park. Photo – Parks and Wildlife

Economic

- Major attraction for visitors to Kalbarri. Kalbarri is one of the highest earners of tourism revenue of towns on the Coral Coast (Cervantes to Exmouth). Many local businesses have a tourism focus, with some operating in the park.
- The potential to develop new opportunities in the park (e.g. developing Aboriginal cultural tourism experiences), which could see greater economic benefits for Kalbarri as a result of visitors staying longer.

Pressures

The main pressures on the key values of Kalbarri National Park are:

- introduced species, in particular goats, as well as pigs, foxes (*Vulpes vulpes*), feral cats (*Felis catus*), rabbits (*Oryctolagus cuniculus*) and weeds
- impacts from human activities, unplanned fire and inappropriate land uses
- impacts from upstream activities in the Murchison River Catchment (e.g. potential introduction of fish and weeds, salinity, siltation and water extraction) and
- large, damaging bushfires and/or inappropriate fire regimes, changing climate, resulting in declining rainfall and higher temperatures, which may impact on species composition and increase the frequency, scale and intensity of bushfires.

Management context

Vision

The outstanding natural values and rich cultural heritage of Kalbarri National Park will be conserved for the appreciation and enjoyment of the community, in cooperation with Nanda.

Legislation and policy

Parks and Wildlife administers the park in accordance with the provisions of the:

- CALM Act, which provides for the protection of native flora and fauna and Aboriginal culture and heritage on lands and waters to which the act applies
- *Wildlife Conservation Act 1950* (Wildlife Conservation Act), which provides specific protection for native flora and fauna within Western Australia.

These acts and other relevant legislation can be found at the State Law Publisher's website (www.slp.wa.gov.au).

Management arrangements with Aboriginal people

Traditional owners have a strong desire to care for, to strengthen cultural ties to and be involved in the management of their country on land and at sea. Working with traditional owners to manage their land will bring cultural, spiritual and economic benefits to Aboriginal people, and enhance management.

The planning area lies within Nanda country. The Nanda native title claim (WC00/13/WAD6136/1998) is still to be determined, although native title has been extinguished over the park.

The Nanda traditional owners have expressed their strong desire to pursue joint management of the park with Parks and Wildlife over the life of the plan. As a result, Parks and Wildlife will seek resources and support for the development of a formal joint management agreement under the CALM Act with Nanda. Formal joint management arrangements under the CALM Act will require the amendment or review of this management plan. In the meantime, the department will continue to work to foster cooperative and consultative management arrangements with Nanda until a formal joint management agreement is finalised.

Consultation with Nanda prior to park development. Photo – Rory Chapple/Parks and Wildlife

The lands adjacent to the park that are to be considered for addition to the conservation reserve system

(see *Consideration of adjacent lands*) are either UCL or other crown reserves. As a result the CALM Act applies to these areas and native title has not been extinguished. For these areas, an ILUA between Nanda and the department may be considered to enable the reservation and management of these lands in the planning area. An ILUA may include provisions for a joint management agreement; the conduct of customary activities; improved access for management and recreation; protection of Nanda culture and heritage; development of interpretive material; and tourism and other commercial or employment opportunities.

Desired outcome

- Nanda are involved in the planning and management of land in the planning area.

Management actions

1. Seek resources and support for pursuing an ILUA and joint management arrangements with Nanda for the planning area.
2. Work with Nanda to promote their participation in commercial activities, employment and training opportunities.
3. Ensure consultation with Nanda for activities that may impact on cultural and heritage values.

Administration

Parks and Wildlife's Geraldton District office, in the Midwest Region, will be responsible for day-to-day implementation of the management plan. Geraldton District coordinates the operational management of the park and, where applicable, the adjacent lands considered for reservation. Operational management is also supported by staff from the Midwest Region and Parks and Wildlife specialist branches.

Term of the plan

This management plan will guide management of the planning area for a period of 10 years. During this time, amendments to the plan may be made under section 61 of the CALM Act, with any proposed changes first released for public comment. At the end of the 10-year period, the management plan may be reviewed and a new management plan prepared. If the plan is not reviewed and replaced by the end of the 10-year period, it will remain in force until a new plan is approved.

Assessing performance

The Conservation Commission will measure the success of the implementation of this plan by using key performance indicators and other mechanisms as appropriate. Key performance indicators have been chosen to highlight performance targets for key components of the plan. These indicators are identified throughout the plan and are presented with a performance measure, target and reporting requirements. Key performance indicators measure the protection of the key values of the planning area and are linked to the objectives, desired outcomes and management actions.

Parks and Wildlife is required to implement this plan and provide information to the Conservation Commission to enable assessment of its implementation.

Consideration of adjacent lands

Floodwaters at Hardabut Pool (2006), an area adjacent to Kalbarri National Park that will be considered for reservation. Photo – Anthony Raudino/Parks and Wildlife

Lands adjacent to Kalbarri National Park have been identified as having conservation significance and this plan proposes that they are considered for inclusion in the conservation reserve system and managed under the CALM Act. These areas comprise unallocated Crown land (UCL) including former pastoral leases acquired for conservation, unmanaged reserves and a reserve vested in the Shire of Northampton. Most of these areas straddle the North West Coastal Highway and adjoin Toolonga Nature Reserve and Eurardy Station to the east and Zuytdorp Nature Reserve and Murchison House Station to the west (see Map 2). Knowledge and understanding of the values, pressures and management issues associated with these areas, particularly those to the north and east of the park, is more limited than in the national park. These adjacent lands will be considered for addition to the conservation reserve system within the life of this plan.

Reservation of these lands will make a contribution towards a conservation reserve system that is comprehensive, adequate and representative (CAR) and the protection of significant natural, cultural, and heritage values. Their reservation will be considered after discussion with relevant stakeholders and the likely negotiation of an ILUA (see *Reservation process* and *Management arrangements with Aboriginal people*).

Reservation process

Adding land to the conservation reserve system, or changing the classification of existing reserves, is subject to various government processes. For example, native title is still to be determined over the adjacent lands considered for reservation. In order to have an 'affect' on native title, the reservation process needs to comply with the 'future act' provisions of the *Native Title Act 1993* (Cth) (Native Title Act) and is likely to involve the negotiation of an ILUA (see *Management arrangements with Aboriginal people*).

Once the areas identified for inclusion in the conservation reserve system have been considered and agreed to by key stakeholders, reservation of those areas may proceed. There is a range of vesting options for the potential additions to the conservation estate, and the land will be managed in accordance with the desired outcomes and management actions identified in this plan. If necessary, the plan will be amended to ensure relevance to these areas is maintained.

Lands of conservation significance, areas that link to other conservation areas such as the Shark Bay World Heritage Property or will improve the management of the planning area (such as introduced species control), will be considered for addition to the conservation reserve system, subject to usual government consideration and determination.

Further detail on the adjacent lands and descriptions of their current land tenure, conservation significance and rationale for their inclusion in the conservation reserve system are provided in Appendix 1.

Desired outcome

- The adjacent lands of conservation significance are considered for reservation.

Management actions

1. Consider and progress the proposed tenure changes outlined in Tables 3 to 5 in Appendix 1.
2. Liaise with relevant stakeholders in planning and managing activities on adjacent lands considered for reservation.
3. Manage land identified in Tables 3 to 5 in Appendix 1 in accordance with this management plan if they become vested in a responsible body, or amend the plan if necessary.

Neighbouring land use

The planning area is influenced by activities and events beyond its boundary. Therefore, effective management of the planning area cannot be achieved in isolation, but must be integrated in the broader landscape. The planning area is bordered by the ocean to the west and by Kalbarri, pastoral leases and nature reserves to the north, south and east. It is also cut by road reserves (see Map 2). Activities on these lands and upstream along the Murchison River can influence the success of implementation of this management plan and conservation of values.

Parks and Wildlife works with neighbours on issues such as dividing fences, fire management, control of weeds and introduced animals, straying stock and access to lands managed by the department. Complementary recreation planning and management and visual landscape management are also important issues affecting neighbours. The department's *Good neighbour policy* guides the management of cross-boundary issues, outlining the roles and responsibilities of Parks and Wildlife and its neighbours and aims to build good relations in applying its legislation, policies and actions.

Neighbouring lands of particular relevance include:

- a number of residential subdivisions
- the Shire-vested reserve (No. 12996) known locally as the river reserve
- an area of UCL between Kalbarri and the park along a 15km section of the river corridor known locally as Paradise Flat[3]
- unvested Crown reserve 656.

Impacts on the environment are particularly significant along the interface between the park and Kalbarri townsite (see inset on Map 2) and reserve 656 (see Map 2). Off-road vehicles enter the park from adjacent lands such as the river reserve, Paradise Flat and rubbish tip and often drive off designated roads. The increased risk of fire due to the proximity of the town also requires careful planning and management (see *Fire*). Cooperative working relationships between Parks and Wildlife and neighbouring land managers are most important at this interface.

Introduced animals such as goats, pigs and foxes have an impact on the natural values of the planning area and neighbouring lands. Effective control requires a cooperative approach with neighbouring land managers.

Eurardy Station borders the park to the north-east (see Map 1) and has been managed for conservation since 2005 when it was purchased by Bush Heritage Australia. It provides an important link between the

3 Paradise Flat is popular for bush camping and other various recreational use and is of particular interest for the Nanda community.

park and adjacent lands considered for reservation to the north and east of the park. Parks and Wildlife and Bush Heritage Australia work collaboratively to ensure management is complementary.

In some places, boundary fences do not coincide with officially registered boundaries. Fences may need to be realigned or boundaries altered. This will require consultation with neighbouring land managers and the Department of Lands.

Desired outcome

- Effective cooperative working arrangements between Parks and Wildlife and neighbouring landowners.

Management actions

1. Continue to work cooperatively with neighbouring land managers to ensure complementary management of lands adjoining the planning area, with a particular focus on the interface between the park and Kalbarri.
2. Undertake surveys and consultation in cases where boundary fences do not align with cadastral boundaries, and seek to make required changes through the Department of Lands.

Managing cultural heritage

Aboriginal culture and heritage

Kalbarri National Park lies within Nanda country. For thousands of years, Nanda have lived in the area around Kalbarri, from Woomerangee Hill in the north to Northampton in the south (Jackson & de Grand 1996). Their way of life is dependent upon an intimate knowledge of the land.

Nanda believe the landscape and its features were formed by the activities of their ancestors during the Dreamtime, and that spiritual power resides in the landscape. Nanda hold knowledge associated with many prominent features of the park. As part of Nanda culture, the landscape is a living being, and must be treated with respect. Nanda's use of inland and coastal natural resources is an important aspect of contemporary Nanda associations with their country.

Nanda traditional owners carry out a heritage survey prior to park development. Photo – Rory Chapple/Parks and Wildlife

The park is of considerable significance to Nanda and the Murchison River is of particular importance. Sixty-seven Aboriginal sites within the park are recorded on the Department of Aboriginal Affairs' *Register of Aboriginal Sites*, most of which are adjacent to the Murchison River. Nanda Dreaming describes the Murchison River's place as central to Nanda culture and stories describe the connection between the sky, ocean, land and Nanda.

Ethnographic and archaeological surveys have been conducted over a relatively small portion of the park and it is therefore highly unlikely that all Aboriginal sites have been officially recorded.

Under the *Aboriginal Heritage Act 1972*, Aboriginal sites are protected whether registered or not and it is an offence to alter an Aboriginal site unless permission is granted in accordance with the Aboriginal Heritage Act. If proposed management actions may disturb an Aboriginal site, an assessment is required before the operation proceeds. Parks and Wildlife will work with the Department of Aboriginal Affairs, Nanda and the Yamatji Marlpa Aboriginal Corporation to ensure Aboriginal sites are not damaged. Parks and Wildlife will comply with the State Government's *Cultural Heritage Due Diligence Guidelines* when actions are proposed.

Parks and Wildlife will also work with Nanda to protect Aboriginal sites and values in the park. This may involve managing access to sites identified by Nanda. Many Nanda sites and cultural information associated with these are sensitive and Nanda have stressed the importance of keeping the location of these places private and avoiding the dissemination of this information to the broader public. Parks and Wildlife will work with Nanda to maintain this confidentiality to assist with their protection.

Management arrangements may change over the life of the plan. This may involve the development of an ILUA and a formal joint management agreement. See *Management arrangements with Aboriginal people* for more information.

Aboriginal stone tools and artefacts. Photo – Sue Hancock/Parks and Wildlife

Activities for Aboriginal customary purposes

Customary activities by Aboriginal people can include hunting for food, preparing medicine and engaging in artistic and ceremonial events[4]. These activities are an important part of Aboriginal culture, enabling maintenance of relationships with the land, water and fire; sharing of knowledge; engagement in traditional practices; and accessing and looking after places of significance.

Special guidelines exist for the taking of certain plants and animals by Aboriginal people in conservation reserves (e.g. threatened or specially protected flora and fauna species). A list of flora and fauna that should not be gathered or hunted is available from the Parks and Wildlife's office in Geraldton or www.dpaw.wa.gov.au/parks/aboriginal-involvement/92-customary-activities.

Wildlife cannot be taken for a commercial purpose. The activity must also be carried out safely and be consistent with this management plan and relevant legislation (e.g. regarding the use of fire, firearms and fishing).

Aboriginal people can access most Parks and Wildlife-managed lands and waters for customary activities, except areas that pose a safety risk or are environmentally sensitive and where permission is required.

More information on Aboriginal customary activities can be found in the *Guide to Aboriginal customary activities on Parks and Wildlife-managed lands and waters* (DEC 2012b), at http://www.dpaw.wa.gov.au/images/documents/parks/aboriginal-involvement/20130242_Guide_to_Aboriginal_Customary_Activities_Booklet_v15.pdf.

Parks and Wildlife acknowledges Nanda aspirations to obtain native title over their traditional lands and waters. The Yamatji Marlpa Aboriginal Corporation is the native title representative body appointed under the Native Title Act for Nanda's native title claim that extends over the planning area. Parks and Wildlife will continue to recognise the interests of Nanda and their desire to continue cultural activities in the planning area, irrespective of whether native title has been determined.

Other cultural heritage

The Kalbarri area has a rich European history of nearly 400 years. In 1629 two survivors of the Batavia shipwreck are thought to have been marooned in the area as punishment for their role in a mutiny and massacre at the nearby Houtman Abrolhos Islands, prompting speculation that these men were the first Europeans to live in Western Australia (Playford 1998). Dutch exploration of the coastline occurred in 1697 when Willem de Vlamingh charted the Western Australian coast, naming numerous features including Red Bluff, a prominent coastal feature in the park.

Almost two centuries later pioneering explorers travelled north from the fledgling Swan River Colony to report on the area's mineral and pastoral potential. In 1839, George Grey undertook an epic sea voyage with a party of 11 to explore the coastline around Carnarvon. On the return journey the party was wrecked at Gantheaume Bay near the mouth of the Murchison River. During this unscheduled visit to the area now in Kalbarri, Grey made very significant recordings of Nanda life that greatly expanded the European understanding of Aboriginal people.

4 Aboriginal customary purpose is defined by section 103A of the CALM Act.

Augustus Gregory explored the area in 1848 and discovered lead, promoting the subsequent development of mines at Geraldine, Galena and Mary Springs, which lie east of the park. Also in 1848, Murchison House Station was established north of the park.

In 1894, a telegraph line was constructed between Geraldton and Hamelin Pool and passed through the planning area. While this was maintained, its easement was also used as a bridle path and provided a stock route used by drovers to transport sheep and cattle between Tamala and Murchison House stations and Northampton. On the way, drovers camped at a number of locations, including Junga Dam and Emu Springs in the Murchison Gorge (Mitchell 2009; Patrick 2001).

Despite increasing pastoral and mining interest in the area, there was little settlement around Kalbarri until the end of the 19th century. In the 1900s, small numbers of fishermen visited the mouth of the Murchison River and, by 1944, some had set up permanent camps. Through the 1940s, the number of fishing camps grew and by 1951 the town of Kalbarri was officially gazetted. The fishing industry continued to develop and over ensuing decades became one of the largest economic contributors to the town.

While fishing was a major drawcard, the area's natural beauty was also noted, and local school teacher Ross Graham passionately lobbied for the area to be declared a national park. The park was gazetted in 1963, and a lookout in the park has since been named in his honour.

Today, tourism is the largest economic contributor to Kalbarri, which has a population of about 1,500 people.

Desired outcomes

- Working with Nanda, the cultural and heritage values of the land for Aboriginal people are protected and conserved.
- Aboriginal people are involved in conducting customary activities.
- Other cultural heritage values are protected.
- Improved cross-cultural awareness for Parks and Wildlife staff and other groups using the park.

Management actions

1. Continue to work with Nanda to facilitate the practice of customary activities.
2. Support the improvement of cross-cultural awareness through Parks and Wildlife staff training and visitor information.
3. Carry out management actions in a manner sensitive to Nanda cultural and heritage values.
4. Minimise adverse effects of management activities on Aboriginal and other cultural and heritage values.
5. Work with Nanda to maintain confidentiality of sensitive sites, places and cultural information.

Key performance indicator

Performance measure	Target	Reporting
Protection of Aboriginal and other cultural heritage sites.	No adverse impacts on Aboriginal and other cultural heritage sites because of management activities.	Every five years.

Managing visitor use

Kalbarri National Park is in Tourism WA's Coral Coast region. Tourism in Kalbarri is the largest economic contributor to any town (based on domestic and international visitor nights and day trips) in the Coral Coast region (Tourism WA 2010).

Kalbarri is enclosed by the park, one of WA's major tourist destinations. The park offers visitors spectacular wildflower displays and dramatic river gorge and coastal landscapes. Nature's Window at The Loop recreation site on the Murchison Gorge is one of the State's best known natural tourism icons.

The park has about 300,000 visits per year. Most visitors arrive between April and October, when weather is mild and wildflower displays are at their peak. Peak numbers are also experienced during school holidays.

Visitors enjoying the view of the Murchison Gorge from the lookout at Nature's Window. Photo – Clare Atkins/Parks and Wildlife

There are 14 formal recreation sites in the park (see Map 3) and two entry stations. Visitors use these sites to enjoy the spectacular vistas from lookouts or as a starting point for activities such as bushwalking, overnight hiking and abseiling. However, much of the park is not accessible by vehicle and is seldom visited.

Parks and Wildlife's Policy Statement No. 18 *Recreation, tourism and visitor services* (DEC 2006) outlines the principles, operational guidelines, procedures and administrative arrangements in relation to recreation and tourism within the park.

Planning for visitor use

Planning for future visitor use needs to protect key values and maintain and enhance experiences that attract people to the area. Planning can help to highlight areas under pressure from overuse, and identify opportunities to enhance visitor experiences. It also considers future needs and ways to alleviate pressure on, or protect values of, the area.

A number of factors need to be considered before visitor sites or access roads are developed or upgraded. These include (but are not limited to):

- physical environment (e.g. weather, geology, landforms, visual landscape, soils, hydrology and catchments)
- biological environment (e.g. threatened native plants, animals and communities)
- pressures (e.g. weeds, introduced animals, altered hydrology, disease and fire)
- other management programs (e.g. areas baited under the *Western Shield* program)
- culture and heritage (including Nanda's aspirations)
- existing and future visitor use, including opportunities outside the park (e.g. site carrying capacity and demand)

- visitor safety
- resource use (e.g. mineral exploration, utilities)
- policy, tenure and legislation
- research and scientific reference areas.

Consideration of these factors will form an important part of detailed visitor planning, comprehensive site assessment and consultation with stakeholders for the construction of recreation sites, facilities, trails and roads.

A proposed recreation site hierarchy (major, medium and minor[5]) shown on Map 3 and Table 1 indicates the range of developments proposed across the park. This tool is used to ensure a range of recreation opportunities is provided across the landscape.

Potential recreation opportunities in the adjacent lands considered for reservation are described in *Appendix 1*.

Visitor safety

Parks and Wildlife's visitor risk management program is implemented in Kalbarri National Park to identify and manage risks that may cause injury or misadventure. This is done in a way that does not unnecessarily diminish visitor enjoyment in the process.

One of the many visitor safety signs informing visitors of the risks within the park. Photo – Melissa Loomes/Parks and Wildlife

Specific risks to visitors include:

- extreme temperatures (which increase the risk of dehydration and heat exhaustion), particularly within Murchison Gorge
- falls and slips from cliff edges and overhangs if visitors stray from formal lookouts and walk trails
- visitors becoming injured or lost in remote areas in challenging terrain and having limited communication for emergency assistance
- delays in emergency response due to road conditions and communication limitations
- risks associated with water activities (e.g. swimming and rock fishing).

In recent years, several accidents resulting in serious injury and death have occurred in the park. Most have involved heat exhaustion and dehydration in the Murchison Gorge, but fishers have also been washed off rocks by large waves. Consequently, Parks and Wildlife has put considerable effort into ensuring adequate information about the conditions and risks in the park is available before people visit, as well as providing signage within the park to highlight risks. The seriousness of many visitor risks can be reduced through attention to personal safety, maintenance of facilities and provision of information about risks and how to avoid them.

The park is also nationally significant for rock climbing and other adventure sports. These activities are inherently risky and serious accidents may result from falls from cliff edges and faces, rocks and other objects falling onto climbers and entanglement in equipment.

5 A major site has a greater range of services, facilities and experiences than a medium or minor site.

Parks and Wildlife works closely with Western Australian Police, State Emergency Service, St John

Ambulance and volunteer bushfire brigades to manage visitor safety within the park. Parks and Wildlife is also a member of the Local Emergency Management Committee, which has developed local emergency management arrangements for Kalbarri and outlines policies, procedures, strategies and priorities for emergency management in Kalbarri and roles and responsibilities of those involved.

Long distance hikers must register with the park ranger and are provided with safety information. Parks and Wildlife also works with local tour operators and tourism businesses to distribute information to visitors about risks in the park and appropriate safety precautions.

Improved mobile phone communications may help to decrease emergency response times and improve emergency incident outcomes. Parks and Wildlife will investigate and implement the provision of improved communications within Murchison Gorge.

Information, interpretation and education

Raising community awareness, appreciation and understanding of park values via information, interpretation and education fosters a sense of community ownership, engenders support for management and encourages appropriate behaviour.

Information, interpretation and education currently available includes pre-visit information on the Explore Parks website and from Parks and Wildlife offices, as well as brochures, signage, smartphone applications (e.g. EveryTrail guides), information provided by commercial tourism operators and opportunities for community involvement.

An interpretation plan, prepared for the park in 2001, guides the ongoing development of information, education and interpretation for visitors. The interpretation plan identifies three main themes about the park:

- history has shaped the way we live
- it is a special place worth caring for, and
- it is a dynamic environment from coastal cliffs to the Murchison Gorge.

Further to this, current and future interpretation will include information about:

- hiking in the Murchison Gorge and along the coast
- Aboriginal cultural heritage (names, stories and language)
- flora, fauna and other natural values
- geological values
- other cultural heritage, and
- visitor safety.

Nanda traditional owners have a strong desire to develop a cultural and interpretive centre within the park, as a place to interpret Nanda culture and provide an opportunity to repatriate Nanda artefacts and historical records back to Nanda country. Considerable planning and feasibility assessment for such a centre will be required. Parks and Wildlife will consider any proposals from Nanda for an interpretive centre.

Signs, such as these at a trail head at Ross Graham Lookout, provide information and interpretation for visitors. Photo – Melissa Loomes/Parks and Wildlife

Desired outcomes

- The range of suitable nature-based recreation opportunities is maintained and enhanced.
- The visitor risk management program is implemented and appropriate visitor behaviour is encouraged.
- Community awareness, understanding and appreciation of values is improved through the provision of interpretation and education.

Management actions

1. Provide for recreation and tourism opportunities consistent with this management plan.
2. Undertake annual visitor risk assessments to identify and manage risks associated with all recreational use, using specialist advice if necessary (e.g. geotechnical specialists).
3. Provide visitor information about appropriate behaviour and personal risk minimisation.
4. Fulfil Parks and Wildlife's obligations under the Local Emergency Management Committee's local emergency management arrangements.
5. Investigate options to improve communication and emergency response equipment in the park and implement appropriate solutions.
6. Liaise with the community and stakeholders about rock fishing safety.
7. Update and implement the information and interpretation plan for the park to improve visitor experiences and safety.
8. Involve Nanda in the communication of cultural and heritage values, including using Nanda language in interpretation materials and the names of places and trails, where appropriate.

Key performance indicator

Performance measure	Target	Reporting
Visitor safety within the park.	The number of serious incidents[6] reported, per 100,000 visits remains stable or decreases from the commencement of the plan.	Annual.

Visitor access

Vehicle access

Access to Kalbarri National Park is via two sealed roads:

- George Grey Drive (managed by Main Roads Western Australia), provides access to all eight coastal recreation sites
- Ajana–Kalbarri Road (managed by the Shire of Northampton) provides access to inland gorge sites.

All other roads in the park are managed by Parks and Wildlife and comprise spur roads to the coastal and gorge sites, many of which are sealed. Map 1 shows public road access in and around the park.

In 2014, 12km of the unsealed road to The Loop, Inyaka Wookai Watju (West Loop), and Z Bend was sealed. The remaining unsealed section of road continues to cause visitor dissatisfaction. In dry weather, road surfaces become powdery and corrugated, making access for two-wheel-drive vehicles difficult. The unsealed roads often need to be closed during wet weather, preventing visitors from accessing the Murchison Gorge recreation sites.

6 Serious incidents are those requiring medical treatment.

As well as being a significant ongoing cost to Parks and Wildlife, maintenance of the unsealed section of The Loop/Z Bend access roads has an environmental impact as basic raw materials for road maintenance are sourced from within the park. Sealing of the remaining 20km of this road is proposed.

The feasibility of a coastal road between Kalbarri and Shark Bay/Steep Point was considered in the late 1990s by Main Roads Western Australia as a long-term goal (Main Roads Western Australia 1997). With regard to the northern section of any coast road proposal, the *Shark Bay terrestrial reserves and proposed reserve additions management plan* (DEC 2012c) notes that 'the department believes the two-wheel drive proposal has significant environmental, cultural and social implications and is not consistent with the management settings or wilderness quality of the area. Therefore the proposal is not supported by the department.' This position is maintained in this management plan. The Mid West Development Commission released the Mid West Tourism Development Strategy in 2014, which proposes a four-wheel drive road along the Zuytdorp Coast between Kalbarri and Shark Bay. No alignment has been proposed, so it is uncertain whether such a road will pass through the planning area. Parks and Wildlife will consider any such proposals once more detailed planning and feasibility assessment is completed.

Sealed roads to many of the recreation sites within the park provide easy access for all vehicles, including cars with caravans. Photo – Melissa Loomes/Parks and Wildlife

There are many four-wheel-drive tracks available only for fire and other management purposes within the park. Opening some of these to visitors may be considered, but not before thorough assessments of environmental impact and visitor risk are completed.

The need for new vehicle access options will be assessed during visitor planning. Vehicles are restricted to roads and tracks open to the public.

Boat access

Boat access within the park is limited to non-motorised recreational watercraft such as canoes and kayaks (see *Visitor activities*).

Access for people with disabilities

Since 2001, many recreation sites in the park have been upgraded to provide improved access. Parks and Wildlife seeks to facilitate the broadest possible community use of the park, including, where possible, access to facilities by people with disabilities [7].

Existing and future facilities within the park may be reviewed over the life of the plan to determine the possibility of providing universal access. Sites with potential for enhanced access include The Loop, Inyaka Wookai Watju (West Loop), Meanarra Hill and the Z Bend lookout.

7 Depending on people's disability, they might need the aid of a carer or helper to get to and from the facilities.

Desired outcome

- Safe access that facilitates visitor appreciation of natural, cultural and recreation values without having significant adverse impacts on those values is provided, where possible.

Management actions

1. Complete the sealing of access roads (including car parks) to The Loop, Inyaka Wookai Watju (West Loop) and Z Bend.
2. Work cooperatively with Main Roads Western Australia and the Shire of Northampton regarding roads managed by these agencies that provide access to the park.
3. Continue to provide access that considers the needs of people with disabilities.
4. Close and rehabilitate tracks that are not required, or that have an unacceptable impact on key values.
5. Open, where appropriate, four-wheel-drive tracks for public access.

Visitor activities

Day-use sites

Recreation sites in Kalbarri National Park are shown on Map 3. Table 1 identifies the proposed changes to existing sites, including upgrade of facilities and access.

Table 1. Existing day-use sites in Kalbarri National Park

Site	Site hierarchy	Proposed changes
The Loop	major	• continue to maintain existing facilities
Z Bend	major	• seal and expand parking area • provide new facilities including toilets, shelters and picnic furniture • update signage and interpretation for, and upgrade access to the Z Bend Gorge Trail, Z Bend Lookout Trail and Idinggada Yina (Four Ways Trail)
Meanarra Hill	medium	• seal parking area • upgrade lookout and develop a short walk trail from parking area to the lookout • update signage and interpretation • consider development of a walk trail and mountain bike trail connecting to Kalbarri
Hawks Head	medium	• continue to maintain existing facilities • consider development of gorge access to facilitate emergency evacuation for hikers and a day-hike option from Ross Graham Lookout
Ross Graham Lookout	medium	• continue to maintain existing facilities
Inyaka Wookai Watju (West Loop Lookout)	major	• develop a new cantilevered lookout allowing expansive views of the Murchison Gorge • expand parking area • provide new facilities including shelters, sealed walk trail, picnic facilities, toilets and interpretation

Entry station (The Loop/Z Bend)	minor	• continue to maintain existing facilities
Entry station (Ross Graham Lookout/Hawks Head)	minor	• continue to maintain existing facilities
Red Bluff	major	• continue to maintain existing facilities • complete the sealing of spur roads and parking areas
Mushroom Rock	minor	
Rainbow Valley	minor	
Pot Alley	medium	
Eagle Gorge	medium	
Shell House and Grandstand Rock Gorge	medium	
Island Rock	medium	
Natural Bridge/Castle Cove	major	

Day-use shelter at Ross Graham Lookout provides shade and seats for visitors. Photo – Clare Atkins/Parks and Wildlife

The park is listed as a high priority for amenity enhancement (that is, sealing roads to major attractions and providing parking spaces, areas of shade and signage) in the *Draft Mid West regional planning and infrastructure framework* (DoP & WAPC 2011). Existing sites within the park have limited capacity to expand and cater for an increase in the number of peak-time visitors. New recreation sites may be required to reduce pressure on existing sites and add to the range of experiences on offer to visitors. The potential development of new sites and opportunities throughout the life of the plan will be considered where appropriate (see *Planning for visitor use*).

Bushwalking

Trails within Kalbarri National Park have varying degrees of difficulty and provide visitors with a range of walking and hiking opportunities. The Bigurda Coastal Trail (a three-hour, one-way, 8km walk with views of seascapes) is one of the most popular in the park. Increased use of this trail is anticipated as adjacent residential areas continue to develop. Other trails include Mushroom Rock Nature Trail (a 2km loop) and The Loop Trail (a 3-4-hour, 8km loop walk starting at Nature's Window). Hikes along the Murchison Gorge may also involve overnight stays (see *Overnight hiking and canoeing*). More specific detail on trails and trail conditions can be found on Parks and Wildlife's Explore Parks WA website and through smartphone applications (such as EveryTrail guides).

Opportunities for new trails and experiences will be considered, subject to demand and the protection of natural and cultural values. There is scope for new medium to long distance walk trails in the park as alternatives to the challenging Loop Trail. Table 2 shows existing and potential walk trails in the park.

Visitors enjoy views of the ocean and coastal cliffs on the Bigurda Trail at Natural Bridge and Castle Cove. Photo – Nathan Greenhill/Parks and Wildlife

Table 2. Walk trails within Kalbarri National Park

Trail*	Length (km)	Class+	Action
Coastal trails			
Mushroom Rock Nature Trail	2	3	• maintain and consider hardening surface
Bigurda Coastal Trail	8	3	• maintain
Gaba gaba Yina (Red Bluff Trail)	various	1, 2 & 3	• maintain
Potential: Natural Bridge to Red Bluff	TBD	TBD	• investigate demand and feasibility for a trail, possibly for cycling
Inland trails			
Nature's Window Trail	0.5	2/3	• maintain as a class 2 trail with a transition to class 3 through to Nature's Window • seal remainder of the trail from The Loop to the transition point • develop a node at the trail transition point, installing a new shelter, lookout point and seating
The Loop Trail	8	4	• maintain as a class 4 trail with trail markers
Inyaka Wookai Watju (West Loop) Lookout Trail	0.5	1	• develop, in partnership with the Nanda community, a universally accessible loop trail at the redeveloped Inyaka Wookai Watju (West Loop) site to a lookout over the Murchison Gorge
Z Bend Lookout Trail	1.2	3	• maintain as a class 3 trail • investigate if assisted access can be provided down to the Z Bend Lookout via a raised boardwalk

Z Bend Gorge Trail	2.6	4	• maintain as a class 4 trail • continue to monitor the rocky outcrops for visitor safety issues • investigate extending the trail to Placid Pool (~4.5km) downstream, including developing facilities such as ladders to aid access
Idinggada Yina (Four Ways Trail)	4	4	• maintain as a class 4 trail
Ross Graham River Trail	0.7	3	• maintain as a class 3 trail
River Gorge Hike (Ross Graham Lookout to The Loop via the Z Bend)	38	5	• maintain as a class 5 trail (natural, low-key walk trail for overnight hiking) • manage user numbers by requiring registration at Park Headquarters[8] before undertaking the hike • investigate the development of facilities at Z Bend to aid access to Placid Pool • develop a new trail guide
Potential: walk trail from Meanarra Hill to Kalbarri	TBD	3#	• investigate demand and feasibility
Potential: mountain bike trail at Meanarra Hill	TBD		• investigate demand and feasibility

* This table does not include several shorter walks which provide access to lookouts and around the vicinity of recreation sites.
+ Parks and Wildlife uses Standards Australia (AS2156.1 2001) classification of walk trails (see www.standards.org.au).
# Walk trail class is indicative.
TBD – to be determined.

Overnight stays

Vehicle-based camping

Currently, there are no formally designated vehicle-based camping[9] sites in the park. There is, however, high demand for camping throughout the Midwest region and a strong desire from the community for vehicle-based camping in the park. Parks and Wildlife will investigate the feasibility of providing for this type of activity. Further planning and development of a camping area will occur over the life of the plan once a suitable location has been identified (including on part of the former Murchison House Station[10]) and as resources allow. In the meantime, areas designated for camping for groups in the park will be gazetted under regulation 6 of the CALM Regulations.

Nature-based accommodation

A number of sites within the park have potential for development including through Naturebank[11] (see *Commercial operations and tourism*).

8 The Park Headquarters is located on the park boundary, approximately 4km from Kalbarri.

9 Informal vehicle-based camping is in areas that are not signposted for camping or designated as a camping area.

10 Areas formerly part of the Murchison House Station refers to the part of Murchison House Station that has been acquired by Parks and Wildlife for conservation. This term also applies to areas formerly part of Nerren Nerren Station.

11 Naturebank is a government initiative that aims to assess and release sites within protected areas for the development of low-impact visitor accommodation and experiences.

Overnight hiking and canoeing

Overnight hiking and canoeing[12] occurs in association with long-distance hiking, canoeing and rock climbing through the Murchison Gorge, predominantly by organised groups. A hike between Ross Graham Lookout and The Loop takes four days, with shorter hikes possible between Ross Graham Lookout and Z Bend or between Z Bend and The Loop. Locations for overnight camping on these routes are not defined and visitors must be fully self-sufficient. Facilities are not provided and visitors are encouraged to apply 'Leave No Trace' practices. Overnight hikers, canoeists and rock climbers are required to register with and obtain advice (including the code of conduct and safety information) from the park ranger well before commencing their trip. Registration and authorisation are ways of managing hiker numbers, the experience and the impacts.

Visitors who are 'wild' camping overnight while hiking, canoeing or rock climbing in the Murchison Gorge are currently required to obtain lawful authority from the District Manager in Geraldton and register with rangers in the park. This inefficient process will be addressed by defining and declaring all of the Murchison Gorge as a 'designated camping area' specifically for people hiking, canoeing or rock climbing in the gorge, subject to a range of conditions. As a result, visitors wanting to 'wild camp' in the Murchison Gorge while undertaking these activities will only have to register with park rangers and comply with the code of conduct.

Key attractions for long distance hikers are the solitude and remote qualities of the Murchison Gorge away from the main visitor sites. Access needs to be carefully controlled to maintain this experience and minimise any associated environmental impacts. Overnight hiking and canoeing are currently not having a marked impact on values or visitor experiences. The burying of toilet waste is not known to have caused environmental or health issues, as the Murchison Gorge is periodically flushed during flood events. Visitor impacts will, however, be monitored over the life of the plan and action taken if required.

Campfires

Campfires and firewood collection can impact on the natural environment. Campfire escapes can start bushfires, and firewood collecting can lead to loss of vegetation cover. Campfires are therefore discouraged in the park. Overnight hikers and canoeists must obtain lawful authority from Parks and Wildlife to light campfires at the time of registration.

Cycling

Sealing the roads to coastal recreation sites has significantly improved cycle access to and within the park. With increasing residential development adjacent to the park, cycle trails with linkages to Kalbarri are likely to be well used. There is potential to develop a mountain bike trail near Meanarra Hill, with a link to Kalbarri. Meanarra Hill is a highly disturbed environment with significant management issues (e.g. erosion). Development of a trail at this site may help to manage these problems.

There is also potential to develop a cycle path from Red Bluff to Natural Bridge.

12 Overnight hiking or canoeing is sometimes referred to as remote, 'wild' or backpack camping.

There are spectacular wildflower displays in spring, including this pink woolly featherflower (*Verticordia monadelpha*). Photo – Aberline Attwood

Wildflower and wildlife viewing

The most spectacular wildflower display in the park is usually from late winter, through spring and into early summer. Where possible, stopping bays will be incorporated in road design so visitors can safely stop to photograph wildflowers and wildlife. Signage in the park provides visitors with some information about wildflowers in the area. Additional brochures, publications and online resources assist visitors seeking more detailed information.

The park provides opportunities for visitors to see a range of native fauna. Bird watching and viewing whales and dolphins from coastal sites are particularly popular.

Further reintroductions of locally extinct fauna species will provide greater opportunities for wildlife viewing in the park.

Australian sea lions (*Neophoca cinerea*) are occasionally seen off the coast (see *Native animals and habitats*).

Water-based activities

There are relatively low levels of canoe and kayak use in the park. Access to the Murchison Gorge is difficult, river flows are highly seasonal and better opportunities are available near the Murchison River mouth, closer to Kalbarri. However, commercial operators run canoeing tours in the Murchison Gorge when water levels are high enough.

A number of river pools in the park are suitable for swimming at various times, when water levels are high enough. Visitors also use access within the park to get to areas outside the park for swimming (e.g. access through the park at Red Bluff to the ocean).

Rock fishing is a popular but risky activity along the coast. Fishers are made aware of the risks through pre-visit information and signs. Photo – Rory Chapple/Parks and Wildlife

There is a long history of rock fishing along the coast for a range of species. Large, unpredictable swells make both rock fishing and swimming along this stretch of the coastline hazardous, and the activity entails significant risk. A number of fatalities have occurred.

Pre-visit information and signage highlights the risks associated with water-based activities in the park (see *Visitor safety*).

Abseiling and rock climbing

Abseiling is a popular adventure activity in the park, carried out by commercial tour operators, school and climbing groups and the State Emergency Service. Photo – Sue Hancock/Parks and Wildlife

Abseiling and rock climbing are gaining popularity, with existing use mainly in the Murchison Gorge near Z Bend. The Z Bend area is one of the best sport climbing areas in Australia and rock climbers are a significant user group of the park. Both rock climbing and abseiling are carried out at designated sites by a commercial tour operator and by school groups, independent climbers and the State Emergency Service (for training purposes). Regular liaison with user groups will assist information exchange and management of potential impacts of these activities on natural and cultural values.

Desired outcomes

- A range of activities and facilities that allow visitors to enjoy key features and attractions with minimal adverse impacts on natural and cultural values.
- Opportunities to experience remoteness and solitude are maintained.

Management actions

1. Maintain and progressively upgrade day-use sites as indicated in Table 1, as resources allow.
2. Designate all of the Murchison Gorge in the park for the purposes of camping under the CALM regulations, for long distance hiking, canoeing and rock climbing in the gorge, subject to conditions laid out in the Murchison Gorge code of conduct.
3. Maintain a registration system for visitors camping remotely, in association with long distance hiking, canoeing and rock climbing in the Murchison Gorge, and consider limiting numbers as required, to maintain the quality of this experience and manage environmental and other impacts.
4. Develop and provide information for overnight hikers, canoeists and rock climbers to help minimise safety risks and environmental impacts and liaise with user groups in relation to these.
5. Designate areas for the purposes of camping under regulation 6 of the CALM Regulations within the park, initially for group camping and later for all visitors.
6. Investigate the feasibility of providing vehicle based camping in the park and, on the basis of this, developing a camping area, as resources permit.
7. Progressively upgrade existing walk trails and consider developing new trails (for walking/hiking, cycling and mountain biking) as indicated in Table 2.
8. Manage water-based activities in a manner that minimises environmental impacts, safety risks, and conflict with other visitors.
9. Monitor impacts associated with visitor activities and manage these to minimise unacceptable impacts.
10. Repair and manage areas of degraded land, including disturbance around Meanarra Hill.
11. Continue to record visitor numbers, conduct visitor surveys, encourage other social research and use the information collected to improve management.

Key performance indicator

Performance measure	Target	Reporting
Community satisfaction with park facilities and services.	Greater than 85% visitor satisfaction levels with park facilities and services.	Year one, then every five years.

Commercial operations and tourism

Commercial concessions, such as leases and licences for commercial tourism operations, allow private businesses to offer tourism and recreation opportunities, facilities and services to the public. This can assist in providing quality visitor experiences in Kalbarri National Park. Commercial concessions are granted in consultation with the Conservation Commission, and must be consistent with the purpose of the park, the protection of its values, the conditions of the Parks and Wildlife's *Commercial operator handbook – terrestrial* and with the objectives of this management plan.

Local, intrastate and interstate commercial tour operators provide for a range of activities including bushwalking, canoeing, abseiling, scenic flights, wildflower tours and general sightseeing tours. All commercial visitor services operating on lands and waters managed by Parks and Wildlife require a licence or lease issued by the department. The number of concessions issued may be restricted if necessary to protect natural or cultural values or maintain the quality of visitor experiences.

Leases can be granted for commercial services that occupy land, require exclusive rights of access and require substantial infrastructure. No leases currently exist within the park

A number of areas in the park have the capacity to support low-impact, nature-based accommodation. Naturebank is a State Government initiative that aims to assess and release sites within protected areas for the development of low-impact visitor accommodation and experiences. Any site chosen as a Naturebank project will need to undergo a detailed assessment and consultation process.

Desired outcome

- Commercial activities complement Parks and Wildlife facilities and services, and are provided in a way that enriches visitor experiences.

Management actions

1. Evaluate proposals for licences and commercial tourism leases and allow their establishment, if appropriate, according to Parks and Wildlife policy.
2. Monitor commercial tour operations and ensure compliance with licence and lease conditions.
3. Consider development of nature-based accommodation opportunities.

Involving the community

Effective community involvement and support is a cornerstone of Parks and Wildlife's management of Kalbarri National Park.

It is a priority for Parks and Wildlife to encourage and facilitate community involvement in order to:

- raise awareness of, encourage input to and generate greater public acceptance of decisions about the area's management
- garner additional resources for park management and enhance the department's ability to respond to emergencies
- provide information, education and interpretation about the area's values to the wider community.

The community of Kalbarri is mostly surrounded by the park and has a long-standing involvement in management of the area. Examples of current community involvement in the area's management include:

- Nanda involvement in issues pertaining to their culture (e.g. protecting heritage sites, undertaking heritage surveys, interpreting Aboriginal culture and naming recreation sites – see *Managing cultural heritage*)
- the State Emergency Service and Kalbarri Volunteer Bush Fire Service aid in suppression of bushfires and in search and rescue operations
- the creation and maintenance of a herbarium, located at Park Headquarters, by a small but active group of volunteers
- school and university education programs in the park, such as the Kalbarri District High School *Bush Rangers* program, which has assisted with revegetation works, wildlife research and weed removal programs
- engagement with the Kalbarri tourism industry, which is a key income earner for the community – park managers engage with local tour operators, accommodation providers and visitor centre staff to exchange information about park management issues
- consultation with neighbouring land managers, which is crucial to effective management of the park and the wider planning area (see *Neighbouring land use*).

Bush Rangers from Kalbarri District High School work on walk trail construction between Natural Bridge and Island Rock. Photo – Sue Hancock/Parks and Wildlife

Community engagement was a critical component in preparing this management plan and the community was given a number of opportunities to provide input. A 'have your say' brochure was distributed to encourage individuals and organisations to register their interest in the planning process and identify issues to be considered during the development of the plan. Visitor satisfaction surveys and general discussions with Parks and Wildlife staff also provided valuable input. The submissions in response to the 'have your say' brochure and discussions with Nanda people and park visitors were taken into consideration. The submissions on the draft management plan were included in developing the final plan.

Desired outcome

- Community involvement and support benefits park planning and management.

Management actions

1. Continue to provide and promote opportunities for the community to be involved in the planning and management of the park.
2. Continue to support volunteer involvement in Parks and Wildlife programs.
3. Work with other agencies and stakeholders to exchange information and provide opportunities for improved management of the planning area.

Managing the natural environment

Climate

The planning area has a warm, semi-arid to arid Mediterranean climate with a winter-dominant rainfall pattern. Kalbarri receives mean annual rainfall of 347mm. Evaporation is highest during January and February and lowest during the winter months. The average annual evaporation of 2500mm exceeds average rainfall (DoW 2006). Average daily maximum and minimum temperatures at Kalbarri are 31˚C and 20˚C in January, and 20˚C and 10˚C in July.

Climate change is already evident in the planning area and throughout south-western Australia. Total annual rainfall in the park has declined by 15-20mm per decade since records began in 1970 (an overall decline of up to 80mm in annual rainfall) and mean temperatures have increased by 0.2-0.3ºC per decade (an overall increase of up to 1.2ºC) (Bureau of Meteorology 2014). This trend is expected to continue, and is likely to lead to increased bushfire frequency and intensity (IPCC 2014). Recent droughts have resulted in decreased surface and groundwater available for plants. Mass plant deaths across Kalbarri National Park have been observed in recent years, especially in banksia species (see *Native plants and plant communities*), which may be an early effect of climate change in the Kalbarri area. Vulnerable plants and animals include species that are geographically restricted, at the extent of their ranges or sensitive to fire, for example, malleefowl (*Leipoa ocellata*) and orchids.

Accurately determining that a species, community or habitat has been directly and adversely affected by varying climatic conditions is difficult. Further research will be important in better understanding the impacts of climate change at a species and community level and management will be adapted on the basis of these findings. Uncertainty about appropriate responses to the effects of a changing climate mean that increasing areas held in conservation reserves and managing other pressures (such as weeds, introduced animals, fire and disturbance) may be the best options to protect biodiversity in the immediate future. Management must aim to improve the resilience of species and decrease their vulnerability to a changing climate.

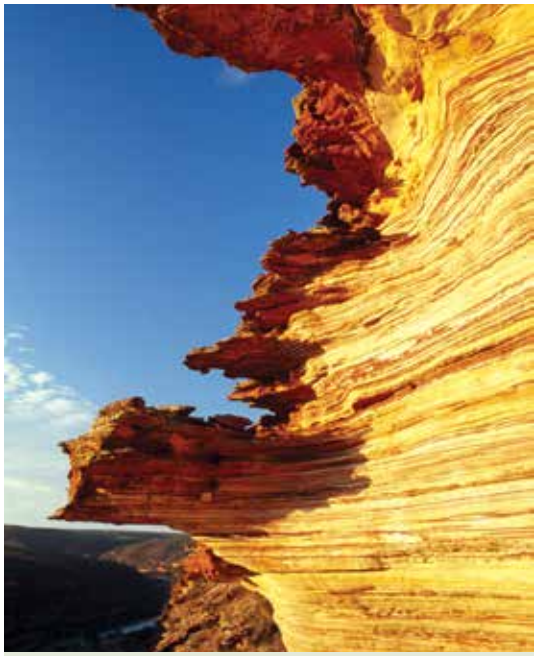
A landscape-scale approach that links large, connected habitats and maintains ecological processes across a range of environmental gradients is important in responding to varying climatic conditions.

Desired outcome

- Management actions at regional, community and species level consider and adapt to a changing climate.

Management actions

1. Support research into identifying and monitoring the impacts of climate change.
2. Implement adaptive management techniques (particularly in relation to fire management) to respond to impacts of climate change on vulnerable species, communities and ecosystems.
3. Improve the resilience of species and communities vulnerable to a changing climate by limiting non-climate stresses (e.g. disturbance, introduced animals, weeds and inappropriate fire regimes).



Tumblagooda sandstone at The Loop. Photo – Rory Chapple/Parks and Wildlife

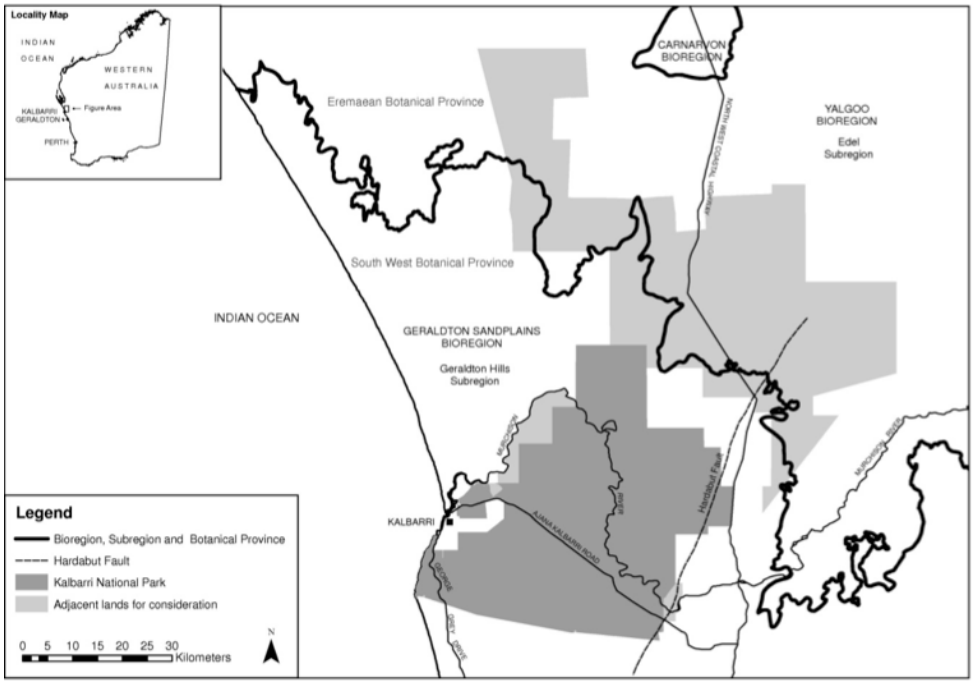
Geology, landforms and soils

The geology of the park is one of its key values and standout features. The forces of weathering and erosion have shaped the area, creating features such as the Murchison Gorge, Nature's Window and the Natural Bridge. Landforms and geological features are key attractions, for their scenic value and for the setting they provide for visitors to undertake a wide range of recreational activities. These features are also significant to Nanda.

Geoheritage sites contain unique geological features with outstanding value within Western Australia and have significant scientific and educational values for the community (Department of Mines and Petroleum 2010). The park has two geoheritage sites: site 97, Murchison Gorge; and site 119, Shell House Coastal Cliffs.

The park's most dramatic geological feature, the Murchison Gorge, is composed of exposed red and white Tumblagooda Sandstone[13]. The gorge is 85km long with a maximum depth of 150m. The Tumblagooda Sandstone dominates the gorge as far inland as Hardabut Pool. Much of the park's appeal lies in the near horizontal banding of the Tumblagooda Sandstone in the Murchison Gorge and along the coastal cliffs. The sand was deposited in the river and on tidal flats and rippled surfaces can be seen at Nature's Window (Hocking, 1991). Hardabut Pool is the location of the Hardabut Fault, which defines the boundary between the Perth and Carnarvon basins (see Figure 1). Here there is an abrupt transition from sandstone to granite, with an abundance of granite outcrops south of the fault. Granite does not occur within the current park boundary.

Figure 1. Biophysical features of the planning area



13 Deposited during the Silurian period (about 430 million years ago).

The rocky coastal cliffs of the park are mostly sediments of the Tumblagooda Sandstone, as well as deposits of Wittecarra Sandstone, Kockatea Shale[14] and Tamala Limestone[15]. These cliffs are vulnerable to erosion from storms and undercutting by wave action, with both processes making them unstable.

Mobile dunes, composed of loose siliceous sands[16] with occasional outcrops of laterite[17], are found along the coast south of Kalbarri (Hocking *et al*. 1982). They can become unstable if the vegetation is damaged. Revegetation is often required to prevent erosion in degraded areas or those impacted by fire and following site works or track closures. Fencing to prevent grazing by rabbits and western grey kangaroos (*Macropus fuliginosus*) and placing brush on coastal dunes are important strategies to rehabilitate these areas.

The rest of the park is located on an undulating sandplain plateau[18] of white and yellow quartz sands, with patchy outcrops of laterite. The plateau was uplifted during the Tertiary period[19], with the Murchison River carving the spectacular Murchison Gorge to expose the Tumblagooda Sandstone (Hocking *et al*. 1987, Peers, 1977). The sandplain is steeply divided by the Murchison River and moderately divided at Wittecarra Gully. It is also vulnerable to erosion, especially in disturbed areas, where soil loss can be rapid once the vegetation is removed. Priorities for rehabilitating disturbed areas on the plateau are:

- access tracks around Meanarra Hill
- gravel pits along The Loop/Z Bend Road that will not be required once the road is sealed (see *Basic raw materials*)
- existing recreation sites where there is soil loss in cleared areas
- protection of scenic landscapes.

Fossil impressions made by ancient sea scorpions (*eurypterids*). Photo – Melissa Peake/Parks and Wildlife

The geology and landforms of the park provide a dramatic and scenic landscape. Any proposed recreation site, infrastructure or access developments in the park will require careful planning to minimise visual impacts (see *Managing visitor use*) since any visual impacts to the landscape become obvious in the predominantly low vegetation.

Geological features of the park provide valuable insights into evolution and the earliest life forms on land. Impressions (trace fossils) of long-extinct large arthropods have been found in the Tumblagooda Sandstone. Scientifically, these trace fossils form the most important fossil trackway site in Australia and are of international significance. They provide unique clues to the evolution of the land's first inhabitants. It is believed the trace fossils near the Z Bend and The Loop recreation sites and in other locations in the park were made by sea scorpions (*eurypterids*) and other ancient arthropods. These track-makers are possibly one of the Earth's earliest land dwellers. Fossil evidence of peculiar worm burrows called Skolithos are also found in the park. Trace fossils are a major visitor attraction and provide an easily accessible display of geological and faunal history of the park for

14 Formed during the early Triassic period (about 200 million years ago).

15 Cretaceous and Pleistocene deposits (55–141 million years ago).

16 Siliceous sands are whitish in colour and composed of silica.

17 Laterite soil types are reddish in colour and rich in iron and aluminium.

18 Late Pliocene and Pleistocene deposits (about 2 million years ago)

19 About 50 million years ago

interpretation. Fossil sites are, however, vulnerable to disturbance and activities that may result in damage are to be discouraged and directed to more appropriate areas to help protect geological values.

Marine invertebrate fossils (mainly sponges, but also molluscs, coral, sea urchins and bryozoans) are found in sedimentary layers on a sandstone breakaway near Junga Dam. These middle to late Eocene (41-34 million years ago) fossil deposits are mainly deep-water species thought to have been washed into shallower water. They provide insights into environmental and climatic conditions of the time and have great scientific value (Darragh & Kendrick 2008).

Desired outcome

- The significant features of the geology, landforms and soils are conserved.

Management actions

1. Ensure geological features (including fossils), visual landscape qualities and soil types vulnerable to environmental damage are protected during management activities and proposed developments.
2. Rehabilitate disturbed areas with local species where required.
3. Provide opportunities for visitors to increase their awareness and appreciation of geological values.
4. Manage access to significant geological features which are vulnerable to damage.

Key performance indicator

Performance measure	Target	Reporting
Protection of geological features.	No adverse impacts on geological features as a result of management activities.	Every five years.

Hydrology

Surface water

The Murchison River is the second longest river in WA (after the Gascoyne River), extending nearly 800km inland from the coast. The 82,000km^2 Murchison River Catchment forms part of the Murchison River Basin. Within the park, this basin also includes portions of the Wittecarra Gully, Hutt River and coastal catchments.

Flow rates in the Murchison River are highly variable from year to year, depending on rainfall over the catchment. The peak annual flow occurred in 2006, when a flow of 1.8 million megalitres was recorded by the Department of Water, making the Murchison the largest river by flow volume in the area (DoW 2010).

Water in the Murchison River is usually brackish with a mean salinity of 2,000mg per litre (total dissolved solids) and the river exports 149,000 tonnes of salt each year. Even though it is one of the five biggest rivers in the south west, salt export is low compared with other rivers in the area (DoE 2005). While relatively little of the Murchison Basin has been cleared, the recorded salinity and sediment load has been attributed to clearing and/or grazing in the catchment (DoE 2005).

The lower reaches of the Murchison River[20] are located in the Geraldton Sandplain Bioregion and listed in the federal government's *Directory of Important Wetlands*. This part of the river is outside the planning area, but is impacted by management actions in the park and throughout the wider catchment.

Permanent river pools are set in the long, narrow, steep-sided gorge of the Murchison River. Many of these pools have heritage value as camps used by Nanda, 17th century European explorers, and drovers (see *Managing cultural heritage*).

20 Reference number WA037.

The Murchison River in flood, from Ross Graham Lookout, 2006. Photo – Tony Raudino/Parks and Wildlife

Surface and groundwater are affected by variations in climate. A change in hydrological regimes will influence species abundance (particularly for species at the end of their range), vegetation structure and, in turn, wildlife habitats in the park.

Groundwater

Groundwater aquifers occur in the porous and fractured Tumblagooda Sandstone and Wittecarra Sandstone, which underlie the park. Recharge of the aquifer is through infiltration of rainfall, run-off from outcrops and river flows (when these intersect a sandstone outcrop) during flood events. Groundwater is fresh to brackish where there are sandstone outcrops, with salinity increasing with depth and distance from these outcrops (Johnson & Commander 2006). Water flows westward towards the ocean south of Kalbarri and towards the river valley near the Murchison River. The Tumblagooda Sandstone aquifer provides public drinking water for Kalbarri (see *Water resource use*).

Groundwater seeps and soaks occur in the Tumblagooda Sandstone, particularly near the Ross Graham Lookout. These provide valuable habitat for frogs, waterbirds, fish and small mammals, especially during dry periods. These springs and seeps are of ongoing cultural importance to the Nanda, being central to the life of Nanda ancestors. For Nanda, it is important these seeps and soaks are kept free of weeds and introduced animals.

Catchment management

Water quality is a catchment-wide issue, and therefore requires an integrated whole-of-catchment approach.

Potential pressures impacting water quality include:

- introduced animals (e.g. goats and pigs trampling/browsing vegetation and fouling water)
- soil erosion and excessive sediment loads during flood events due to grazing in the catchment
- nutrients and non-nutrient contaminants from land use within the catchment
- increases in salinity caused by upstream management practices
- groundwater abstraction for developments outside the park.

The Department of Water monitors both surface and groundwater quality and quantity. A water monitoring station in the park at Emu Springs measures a number of variables such as discharge, conductivity, temperature, flow rates, rainfall and mean salinity. The groundwater bores, which extract water to supply Kalbarri (see *Water resource use*) are used to monitor physical water quality indicators, inorganic metals and non-metals, organics, nutrients and water levels. Parks and Wildlife will continue to support the Department of Water's water quality monitoring program.

Desired outcome

- The natural and cultural values of ground and surface water are maintained.

Management actions

1. Ensure that proposed developments or operations and activities (e.g. recreational use) are managed to minimise impacts on hydrological values.
2. Support the Department of Water in continuing water quality monitoring of the Murchison River Basin.
3. Support relevant authorities and land managers within the Murchison River Catchment in considering the impacts of activities on hydrological values.

Native plants and communities

Kalbarri National Park is botanically significant and lies within several broader areas recognised nationally and internationally for their diversity of flora. The park is part of:

- the South West Australia international biodiversity hotspot[21], one of 34 in the world and the only one in Australia
- the Geraldton Hills to Shark Bay Sand Plains national biodiversity hotspot[22], one of 15 in Australia
- a transition zone between the South West (temperate and eucalypt dominated) and Eremaean (arid and acacia dominated) botanical provinces (see Figure 1).

One thousand and twenty-nine native plant species have been recorded within the park. This is comparable to the botanical significance of the Stirling Range (1,543 species) and the Fitzgerald Biosphere Reserve (1,557 species) (Keighery & Gibson 1999)[23].

The species in the park come from 180 families; with the best represented being Myrtaceae (eucalypts and paperbarks – 188 species), Fabaceae (legumes, peas and wattles – 115 species), Proteaceae (banksias and grevilleas – 78 species) and Asteraceae (daisies – 65 species).

Nineteen species are endemic to the park, including Kalbarri catspaw (*Anigozanthos kalbarriensis*), Kalbarri lepidosperma (*Lepidosperma rupestre*) and *Xanthoparmelia kalbarriensis*. The total number of endemic plant species is likely to be higher.

Twenty-three per cent (241 species) of species in the park are at the northern limit of their natural ranges, making the health of the Kalbarri environment vital to their genetic diversity. Therefore, these plants are particularly vulnerable to the impacts of climate change (see *Climate*) and changes to hydrological regimes (see *Hydrology*). Keighery *et al*. (2000) reported that plant species at the northern limit of their ranges in the park were predominantly from the Myrtaceae, Proteaceae and Orchidaceae families. These families make up a large proportion of the overall flora in the park and are showing signs of decline.

The widespread death of several proteaceous sandplain species has been reported anecdotally in recent years. The cause is unknown, although it has coincided with recent years of drought. The continuation of drought and other climate change impacts will exacerbate this situation, possibly causing a large proportion of the area's flora to disappear. More research and monitoring and implementation of strategies to protect the area's flora are important (see *Climate change*).

21 International biodiversity hotspots are areas with exceptional concentrations of endemic species (at least 1,500 plant species) and experiencing exceptional loss of habitat (more than 70 per cent), as identified by Conservation International. (Myers et al. 2000; Conservation International 2012).

22 National biodiversity hotspots are locations in Australia with particularly high levels of biodiversity under threat.

23 Data obtained from NatureMap (http://naturemap.dpaw.wa.gov.au/default.aspx) in April 2012 and Keighery et al. 2000. NatureMap is a spatial database that can be used to find up-to-date records.

The park is renowned for its colourful wildflowers, which attract a large number of visitors every year. Wildflower appreciation is further discussed in *Visitor activities*.

Flora of conservation significance

The park contains a number of flora species of conservation significance including:

- nine species listed as 'threatened flora' under the Wildlife Conservation Act (*Wildlife Conservation (Rare Flora) Notice 2014*)— *Androcalva bivillosa*, small dragon orchid (*Caladenia barbarella*), Hoffman's spider orchid (*Caladenia hoffmanii*), Beard's mallee (*Eucalyptus beardiana*), northern dwarf spider orchid (*Caladenia bryceana* subsp. *cracens*), Kalbarri spider orchid (*Caladenia wanosa*), kneeling hammer orchid (*Drakaea concolor*), Kalbarri leschenaultia (*Lechenaultia chlorantha*) and short-petalled beyeria (*Beyeria lepidopetala*). All of these species, with the exception of *A. bivillosa* and short-petalled beyeria, are also listed as threatened or vulnerable[24] under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

The threatened kneeling hammer orchid. Photo – Kiera Foster/Parks and Wildlife

Three-flowered stachystemon is a priority flora species (*Stachystemon nematophorus*). Photo – Kiera Foster/Parks and Wildlife

- 85 priority[25] species including six Priority 1 species, 37 Priority 2 species, 32 Priority 3 species and 10 Priority 4 species
- 246 species (nearly 24 per cent of all recorded species in the park) recorded at the end of their range. Of these, 98 per cent are at their northern limit (Keighery *et al*. 2000)
- one relic species of fern, *Psilotum nudum*[26], for which the Murchison River is the only known location in southern Western Australia (Jaensch & Lane 1993).

Pressures on flora of conservation significance include grazing by goats and rabbits; digging and trampling by pigs; competition from weeds; inappropriate fire regimes; disturbance from management activities; and changes in river flow affecting riparian vegetation (Patrick 2001; May & McKenzie 2002). Patrick (2001) identifies a range of strategies for protecting threatened flora in the Geraldton District, many of which apply to the protection of species in the park. These include:

24 A native species is eligible to be included in the endangered category at a particular time if, at that time, (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria. A native species is eligible to be included in the vulnerable category at a particular time if, at that time, (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria (Department of Sustainability, Environment, Water, Population and Communities 2012).

25 Priority 1 and 2 flora, in particular, are still considered to be under threat even though they are not declared as 'rare' under the Wildlife Conservation Act.

26 Ancient and primitive taxa, of which other members are now extinct, that was abundant over a large area, but now only occurs over a very restricted area.

- undertaking more survey and mapping work
- adding lands on which rare species are represented to the conservation reserve system
- managing the impacts of pigs, rabbits and weeds
- managing recreation and other activities where threatened flora is found
- undertaking more research into threatened species (e.g. population biology, breeding systems and fire responses)
- managing fire regimes
- seed collection and long-term storage (as a source of seeds for future re-establishment)
- translocating threatened and priority flora

An interim recovery plan has been prepared for the threatened short-petalled beyeria and northern dwarf spider orchid. Guidance for the management and protection of threatened and priority flora is also provided by Parks and Wildlife's *Declared rare and poorly known flora of the Geraldton District* (Patrick 2001).

Vegetation associations

The park is dominated by scrub heath on sandplain, with compositional variation. To the south of the Murchison River, the vegetation overlies an undissected plateau, with wide expanses of gently undulating yellow sandplain. Undulating sandplain also lies to the north of the Murchison River, with both areas supporting rich flora. The Murchison Gorge is dominated by low woodland with jam (*Acacia acuminata*) and *Jacksonia cupulifera* scrub with small rock sheoak (*Allocasuarina huegeliana*) trees in rocky areas, jam and scattered river gum (*Eucalyptus camaldulensis*) in the lower flats of the gorge and river swamp sheoak (*Casuarina obesa*) lining the river (Beard 1976).

Other shrubland associations in the park include: summer-scented wattle (*Acacia rostellifera*) scrub/heath; York gum (*Eucalyptus loxophleba*) mallee scrub; umbrella bush (*A. ligulata*) mallee open scrub; and heath on coastal limestone. Associations found both within the park and the adjacent lands considered for reservation include: acacia thickets, bowgada and jam scrub with scattered York gum and red mallee; tree heath between the sandhills with banksia, grevillea, acacia and melaleuca species and thickets of umbrella bush and broom bush (*Melaleuca uncinata*) on dark brown loamy soil.

The addition of the adjacent lands considered for reservation will result in the protection of eight under-represented vegetation associations (see *Consideration of adjacent lands*).

Ecological communities

The Kalbarri ironstone community is a Priority 1 Ecological Community, consisting of winter-wet melaleuca/mallee shrublands over herbs, surrounded by sandplains (in the vicinity of Z Bend and Junga Dam). This community also occurs at Yerina Springs to the south of the park and on Eurardy Station to the north. Generally, ironstone communities occur on shallow red soils (less than 10cm deep). Many plants that occur in these communities are endemic or near endemic to them. In the south-west, ironstone soils with unusual plant communities occur in only a small number of places (English & Blyth 2000).

The vegetation of the Directory of Important Wetlands site – Murchison Gorge (lower reaches) has also been identified as an ecosystem at risk, as it contains the threatened kneeling hammer orchid, Kalbarri spider orchid, Kalbarri leschenaultia and long-leaved myrtle (*Hypocalymma longifolium*), and priority flora such as *Calytrix harvestiana*, *Malleostemon* sp. Hardabutt Rapids, *Murchisonia fragrans* and three-flowered stachystemon.

Drought and drying conditions may be a threat to a number of communities within the park, including river gum communities along the Murchison River and the vegetation of the sandplain. Changes to

groundwater are also thought to be impacting sandplain communities (see *Hydrology*). Plant communities in the vicinity of Wittecarra Gully are likely to be groundwater dependent and impacted by drier conditions.

Plant disease

One positive sample of *Phytophthora arenaria* was confirmed on the southern boundary of the park from a single plant more than 20 years ago (C Dunn pers. comm. 2012). The disease has not been subsequently identified and does not appear to be a significant threat to the park. Unlike the more destructive *P. cinnamomi*, *P. arenaria* is thought to be endemic to the northern sandplains of WA and episodic following extreme rainfall events (Rhea *et al*. 2011). However, using appropriate hygiene practices during soil disturbance activities is still important in keeping the area free of *Phytophthora*, other plant diseases and weeds. In addition, sealing The Loop/Z Bend access road will reduce road maintenance requirements; therefore reducing the risk of introduction and spread of *Phytophthora* and other plant diseases. No other plant diseases have been detected in the park.

Desired outcomes

- Native plants and ecological communities are conserved.
- The range of existing native plant species and vegetation associations is maintained.
- No outbreaks of plant disease resulting from management actions.

Management actions

1. Maintain records of plant species and communities of conservation interest.
2. Develop, update and implement interim recovery plans for threatened flora and ecological communities.
3. Assess the conservation status of, and pressures on, the Kalbarri Ironstone ecological community and the vegetation of the Murchison Gorge (lower reaches).
4. Monitor the condition and conduct evaluation programs for the Kalbarri Ironstone ecological community and vegetation of the Murchison Gorge (lower reaches), where required.
5. Continue to apply hygiene practices to minimise the spread of weeds and plant disease resulting from management activities.
6. Continue regular observation for outbreaks of plant disease and, in particular, any occurrences of *Phytophthora* species. If required, prepare and implement a disease control plan consistent with Parks and Wildlife management approaches.
7. Provide visitor information about the values of native plants and plant communities in the park and strategies to reduce the risk of introducing plant diseases.

Key performance indicators

Performance measure	Target	Reporting
Viable populations of priority and threatened flora.	Maintain viable populations of priority and threatened flora, from the commencement of the plan.	Every five years, or as per recovery plan.
Maintenance of disease free plant populations.	No plant diseases are introduced and/or spread as a result of management activities.	Annually.

Native animals and habitats

While fauna research has been carried out in Kalbarri National Park, no comprehensive survey has been conducted. To date, 268 native fauna species[27] have been recorded in the park; 18 mammal, 144 bird, 70 reptile, eight amphibian, 18 invertebrate and 10 fish[28] species. It is anticipated that additional survey work across the park will identify more species.

Fauna of conservation significance

The park contains many fauna species of conservation significance, including:

- four threatened species listed under the Wildlife Conservation Act (*Wildlife Conservation (Specially Protected Fauna) Notice 2014*) – the chuditch, Carnaby's cockatoo (*Calyptorhynchus latirostris*), malleefowl, and shield-backed trapdoor spider (*Idiosoma nigrum*), and two species listed under the Wildlife Conservation Act as specially protected –peregrine falcon (*Falco peregrinus*) and Australian sea lion[29]
- three threatened species listed under EPBC Act – the endangered Carnaby's cockatoo and vulnerable chuditch and malleefowl
- fifteen migratory bird species, which are listed under international agreements
- six priority species – the golden gudgeon (*Hypseleotris aurea*), stripe-sided robust slider (*Lerista axillaris*), *Pletholax gracilis* subsp. *edelensis*, Australian bustard (*Ardeotis australis*), bush stone-curlew (*Burhinus grallarius*) and tammar wallaby
- three species endemic to the park (the stripe-sided robust slider and invertebrates *Austrogomphus gordoni* and *Harrisius* sp.)
- seventeen species at the northern limit of their range (five amphibians, two birds, two fish, three mammals and five reptiles) and a reptile species at the southern limit of its range.

A chuditch trapped during an annual program to monitor the population health and density of this threatened mammal living in the Murchison Gorge. Photo – Melissa Peake/Parks and Wildlife

Fauna reconstruction

Kalbarri National Park is part of Parks and Wildlife's *Western Shield* program, which proposes to reconstruct native wildlife as far as possible through predator control, habitat management and translocation of species no longer found in the park. Three species have been reintroduced to the park to date. The chuditch was introduced in 2000, the woylie between 2000 and 2005 and the tammar wallaby in 2010. These reintroductions have had varied success, with only the chuditch now flourishing in the park.

At a species level, the woylie has declined by around 90 per cent between 1999 and 2010 and some populations in the south-west have declined up to 95 per cent (Wayne 2011). In the park, woylies have not been recorded since 2006 (the year after translocations ceased), suggesting the population is now extinct. Tammar wallabies are known to persist but population numbers are low (J Renwick pers. comm. 2012). Fox baiting in the park has also led to an increase in other species such as malleefowl.

27 Data obtained from district records and NatureMap (http://naturemap.dpaw.wa.gov.au/default.aspx) in January 2012. This spatial database can be used to find up-to-date records.

28 These fish species occur throughout the Murchison River and, are likely to occur within the planning area.

29 Australian sea lions have been recorded on beaches within Kalbarri National Park. It is likely this part of the coast is used by individuals passing through rather than as a more permanent 'haul-out' site or breeding colony.

The black-footed rock wallaby (*Petrogale lateralis*) and quenda (*Isoodon obesulus*) may also be considered for reintroduction. These species are thought to have disappeared from the park because of competition or predation from introduced animals such as goats, pigs, foxes and feral cats. Although the park was also once home to the western barred bandicoot (*Perameles bougainville*), burrowing bettong or boodie (*Bettongia lesueur*), rufous hare-wallaby or mala (*Lagorchestes hirsutus*), and banded hare-wallaby or mernine (*Lagostrophus fasciatus*), past reintroductions to unfenced areas have had limited success, so their reintroduction to the park is not a priority. However, if reintroduction technologies and predator control (especially feral cat control) improves significantly over the life of the plan, the reintroduction of these species may be considered.

Recovery plans exist for a number of threatened species found in the park or proposed to be reintroduced to the park: the chuditch (Orell & Morris 1994), woylie (Yeatman & Groom 2012), Carnaby's cockatoo (DEC 2012a), malleefowl (Benshemesh 2007) and five species of rock wallaby, including the black-footed rock wallaby (Pearson 2009).

Habitats

The Murchison River is an important fauna habitat. It supports tropical and temperate fish species and is the southern limit of many northern fish species (Allen 1982; Allen *et al*. 2005). It is the only other habitat for the golden gudgeon apart from the Gascoyne River; and is the northern limit for the black bream (*Mylio butcheri*) (Mitchell 2009). Although all other major river systems from the Gascoyne (near Carnarvon) to the Pallinup River (east of Albany) contain introduced fish species (Mitchell 2009), no introduced fish have been recorded in the Murchison River. The absence of introduced fish from the Murchison River needs to be maintained (see *Introduced and other problem animals*). This requires a whole-of-catchment approach, as any species introduced upstream will impact on the whole river system.

The Department of Fisheries has responsibilities under the *Fish Resources Management Act 1994* to manage fish and fish habitat and is the lead agency for managing aquatic biosecurity. Parks and Wildlife will liaise with the Department of Fisheries regarding these responsibilities.

The permanent waterholes of the Murchison River are home to a variety of frog species and numerous freshwater invertebrates, mainly small crustaceans. Seagulls, terns and a variety of migratory waders feed in the mudflats along the river and the permanent pools support a large diversity of waterbirds and terrestrial birds that depend on fresh water.

The ecology of the Murchison Gorge and associated riparian zones is not well understood, but these areas are likely to support a range of species not found in the sandplain. The gorge contains many micro-habitats important to water-dependent and fire-sensitive fauna. Birds, particularly Carnaby's cockatoos, use nesting hollows in river gums and other trees growing in the gorge. A number of surveys have recorded locally endemic invertebrate species, so it is likely the gorge supports relict invertebrates, with restricted geographical ranges. Annual monitoring of chuditch suggests they are predominantly found in this area. The gorge is also a hunting and nesting ground for the peregrine falcon.

The sandplain plateau provides important wildlife habitat and is home to several genera of burrowing and opportunistic breeding frogs including *Neobatrachus* and *Heleioporus* species, the southern sandhill frog (*Arenophryne xyphorhyncha*) and the turtle frog (*Myobatrachus gouldii*). It is a hotspot for a wide variety of reptile species. Many bird species are found on the sandplain plateau, in particular, a large number of honeyeater species that are attracted to the flowering plants, which provide an abundance of nectar. Malleefowl also inhabit the sandplain and tammar wallabies have been translocated here, where they inhabit patches of dense thicket.

Animal diseases

Exotic diseases may have been responsible for the early declines of mammals and other vertebrate fauna in Western Australia following settlement (Abbott 2006, 2008) and no doubt disease has played a role in the decline of some species in the park.

The current extent of animal diseases within Kalbarri National Park is unknown. However, a range of animal diseases could potentially be introduced to the park:

- mammal diseases – pathogenic organisms have been linked to recent woylie declines (Thompson *et al*. 2008)
- *Chytridiomycosis*, an infectious disease caused by the amphibian chytrid fungus, with two species of frog found in the park—the western banjo frog (*Lymnodynastes dorsalis*) and false western froglet (*Crinia pseudinsignifera*)—reported with this disease in other parts of Australia (Australian Wildlife Health Network 2009)
- diseases present in fauna populations that are expressed when individuals or populations become stressed, for example, a wart-like growth disease in western barred bandicoots and the parasites *Toxoplasma, Trypanosoma* and *Theileria* identified in woylies.

Diseases can be exposed to, and spread within, animal populations through the transportation, trapping and handling of animals, and can be transferred to and from people and stock. Parks and Wildlife's *Minimising disease risk in wildlife management: standard operating procedures for fauna translocation, monitoring, and euthanasia in the field* (Chapman *et al*. 2011) provides guidance for appropriate hygiene and quarantine protocols.

Desired outcomes

- Native animals and habitats are conserved.
- The range of native fauna species is maintained.
- Locally extinct mammal species are re-established.
- No outbreaks of animal disease result from management actions.

Management actions

1. Maintain records of fauna species and habitats of conservation significance (in particular chuditch, woylie, tammar wallaby, Carnaby's cockatoo and malleefowl).
2. Develop, update and implement recovery plans for threatened fauna as required.
3. Assess proposed development operations and activities for potential impacts on fauna.
4. Continue to implement the *Western Shield* program including:
    - continuing the control of introduced predator species
    - assessing appropriate fauna reintroductions
    - carrying out relevant fauna reconstruction activities for identified species
    - monitoring target threatened fauna.
5. Continue to apply hygiene protocols to management actions to minimise the spread of animal disease.
6. Report identified animal diseases and implement appropriate management if required.
7. Provide visitor information about native animals and habitats in the park and strategies to reduce the risk of introducing animal diseases.

Key performance indicators

Performance measure	Target	Reporting
Viable populations of threatened and priority fauna species are maintained or increased.	Maintain populations of threatened and priority fauna species from the commencement of the plan.	Every five years.
Maintenance of disease free animal populations.	No animal diseases are introduced and/or spread as a result of management activities.	Annually.

Weeds

The weed verbesina (*Verbesina enceloides*) is often found growing along road verges in the park. Photo – Tony Raudino/ Parks and Wildlife

Weeds displace native plants, particularly on disturbed sites, by competing with them for light, nutrients and water, preventing native seedling recruitment, altering soil nutrients and altering the abundance of native animals. Weeds can also impact on animal habitats, harbour pests and diseases, and alter fire regimes.

Most of the park is weed free and infestations tend to be along the river and access roads and tracks and around recreation sites. However, weeds are a recognised threatening process within the park, with 84 weed species identified. Parks and Wildlife has undertaken an invasive plant prioritisation process that ranks the threat posed by weed species on a statewide basis against specific criteria. Information on the assessment for the Midwest Region can be found on the Parks and Wildlife website at www.dpaw.wa.gov.au/plants-and-animals/plants/weeds/156-how-does-dpaw-manage-weeds.

Of the weeds recorded:

- eleven rated as high priority in the Parks and Wildlife invasive plant prioritisation process will be the focus for weed control in the park; castor oil plant (*Ricinus communis*), ice plant (*Mesembryanthemum crystallinum*), Mediterranean turnip (*Brassica tournefortii*), Paterson's curse (*Echium plantagineum*), ruby dock (*Acetosa vesicaria*), verbesina (*Verbesina encelioides*), African love grass (*Eragrostis curvula*), *Lapeirousia anceps*, buffel grass (*Cenchrus ciliaris*), capeweed (*Arctotheca calendula*) and Brazilian pepper (*Schinus terebinthifolius*)
- six are rated as having a high impact on biodiversity in the Environmental Weed Strategy for Western Australia (CALM 1999); Mediterranean turnip, buffel grass, African love grass, sandplain lupin (*Lupinus cosentinii*), ruby dock and great brome (*Bromus diandrus*)
- three are declared under the Biosecurity and Agriculture Management Act 2007 (BAM Act); saffron thistle (*Carthamus lanatus*), Paterson's curse and doublegee (*Emex australis*)
- there are no Weeds of National Significance[30] (although three have been nominated: Paterson's curse, African love grass and Brazilian pepper).

30 The Weeds of National Significance (WoNS) program coordinates the national effort against 20 of Australia's worst invasive plants (Commonwealth of Australia 2010).

Weeds have entered the park and spread via the Murchison River, pedestrian and vehicle access, introduced animals (especially goats and pigs), past grazing and escaped stock from adjoining properties. The banks of the Murchison River are particularly vulnerable to invasion by capeweed.

The development of a weed control plan for the park will be important in prioritising weed species for control effort. The plan will aim to:

- identify weed control priorities and map those identified as high priority for control
- limit the introduction and establishment of new weeds with potential to significantly impact on key values
- monitor, evaluate and document weed control effectiveness
- be consistent with and complement regional weed management approaches
- provide a coordinated approach with neighbours and other stakeholders across the broader landscape
- include hygiene protocols for management activities to limit the spread of weeds
- allow for adaptive management.

Desired outcomes

- Impacts of weeds upon key values are minimised.
- No introductions of new weed species or new infestations of existing weed species that impact on key values.

Management actions

1. Prepare, maintain and implement a weed control plan as outlined above.
2. Regularly monitor new recreation sites, road developments and other disturbed areas to ensure any new weed infestations are quickly detected and controlled.
3. Develop opportunities to educate the community and visitors about identifying priority weeds species and appropriate hygiene practices.
4. Liaise with neighbouring land managers and implement measures to prevent weeds from adjacent areas becoming established.

Key performance indicators

Performance measure	Target	Reporting
Weed control within the park.	Infestations of high priority weed species are contained or reduced.	Every two years.
	Implementation of the weed control plan.	Annually.

Introduced and other problem animals

Introduced and other problem animals can seriously impact on native species and natural systems through predation, habitat destruction, competition for food and territory, introduction of disease and environmental degradation caused by grazing, accelerated erosion and pollution of waterways. The presence of introduced predators in Kalbarri National Park also limits the potential for fauna reconstruction (see *Native animals and habitats*).

The control of introduced animals requires a planned and prioritised approach. It is not feasible to eradicate or even control all introduced species. Priorities for action include species declared under the BAM Act and introduced animals significantly impacting important habitats or threatened species and communities. Feral goats, pigs, rabbits, foxes and cats present the most significant pressures on the values of the park.

Feral goats are the most significant introduced herbivore in the park and across the region. They have a marked impact on the environment, especially within Murchison Gorge, where control options are limited. Goats graze and trample native vegetation, increase soil erosion, cause sedimentation and fouling of waterways, and continually reinvade the park from surrounding lands. The impact of goats is exacerbated by other animals including pigs, rabbits and native herbivores such as kangaroos.

Goats are the most significant introduced herbivore in the park. They graze and trample vegetation, increase soil erosion and sedimentation and foul the Murchison River. Photo – David Pearson/Parks and Wildlife

Before 2006, goat control in the park was sporadic. From 2006, aerial culling has been carried out annually in the warmer months, when goats tend to congregate along the Murchison River (trapping and mustering are ineffective due to the area's rugged, inaccessible terrain). Where possible, culling is coordinated to coincide with goat mustering on Murchison House Station to maximise its effectiveness. This has proven to be very effective. Vegetation recovery following the removal of goats is monitored by comparing vegetation cover in a number of goat exclusion plots to control plots where goats are not excluded, to provide information on the effectiveness of control operations. Where goat numbers are low, ground culling may also be an effective tool.

Feral pigs have been present in the park since the 1960s and, like goats, trample vegetation (particularly orchids because pigs seek out their tubers), disturb soil, spread disease, increase sedimentation and fouling of waterways, and compete with native animals for food. Numbers are difficult to estimate, but impacts are concentrated in the Murchison Gorge. Pigs are culled opportunistically during the annual aerial goat control program in the park and poison baits have also been used. Damage by pigs is recorded during monitoring of threatened plant populations.

Rabbits are widespread, but their impacts are greatest on the coast. The success of rehabilitation at coastal sites in the park has been limited because of grazing pressure from rabbits. Rehabilitation sites must be fenced to prevent rabbits from gazing on seedlings.

Foxes and feral cats are found throughout the park and the wider region, and have severely reduced the distribution and abundance of native animal species through predation. Foxes are controlled as part of Parks and Wildlife's *Western Shield* program. Fox baiting using 1080 is implemented at a density of one bait per 20ha. The success of the baiting program is measured by a fauna monitoring program. Fox and feral cat numbers have been monitored before and after baiting in recent years (2011–12) and this demonstrated much lower

An area of vegetation from which goats have been excluded (on the left) is flourishing. Heavy grazing by goats is evident on the unfenced side (on the right). Photo – Mike Paxman/Parks and Wildlife

fox numbers in the park than in surrounding (non-baited) areas. Monitoring will also consider whether an increase in one or more subordinate predators (e.g. feral cats) occurs after a dominant predator (e.g. foxes) is removed or reduced in number.

Parks and Wildlife has developed an effective broadscale feral cat bait, Eradicat®, recently approved for predator control across the State. It is likely it will be applied in the park over the life of the plan as part of the *Western Shield* program.

Feral bees (*Apis mellifera*) are present near permanent water, particularly around the Murchison River. Here they inhabit rocky caves, overhangs and tree hollows used for nesting, possibly displacing native fauna and competing for nectar. Management will focus on controlling colonies and swarms around recreation sites.

House mice (*Mus musculus*) are common close to Kalbarri. Currently, no control measures are used.

Goats, pigs, foxes and other feral animals move across tenures in and out of the park and neighbouring land. Coordinated control of introduced animals must be undertaken cooperatively with neighbouring land managers to maximise success.

The Murchison River is free of introduced fish species and needs to remain this way to protect the park's natural values. Introduced fish species can breed rapidly, be aggressive, displace native species and disrupt aquatic ecosystems. Once established, introduced fish can be virtually impossible to eradicate. Public education is important to prevent the introduction of fish species and to encourage recreational fishers and visitors to report any introduced fish seen in the Murchison River (DoF 2010). Given the length of the Murchison River and its tributaries, any action will require a coordinated effort.

The development of an introduced animal control plan for the park will be important in prioritising introduced animal species for control effort. The plan will aim to:

- identify control priorities (e.g. introduced animals declared under the BAM Act and those impacting on threatened species and communities or areas of high natural value)
- limit the introduction and establishment of new introduced animals with potential to significantly impact key values
- monitor, evaluate and document control effectiveness
- be consistent with and complement regional management approaches (that is, consider the adjacent lands considered for reservation)
- provide a coordinated approach with neighbours and other stakeholders across the broader landscape
- include capacity for adaptive management.

No domestic animals including dogs (other than guide dogs), cats and horses are permitted in the park.

Desired outcomes

- Impacts of introduced and other problem animals upon key values are minimised.
- No new introduced animal species.

Management actions

1. Prepare and implement an introduced animal control plan as outlined above.
2. Continue to control goats and pigs, seeking support and assistance from Murchison House Station.
3. Continue to control foxes and other introduced animals in collaboration with neighbouring land managers.
4. Work with community groups and other relevant stakeholders (e.g. the Western Australian Field and Game Association) to encourage their involvement in introduced and problem animal control.
5. Continue to undertake research and monitoring of introduced animals and their effects on and

interactions with native species, and adapt management accordingly.

6. Consider fencing and rehabilitating high-value areas to protect them from the impacts of grazing and trampling, particularly from introduced animals.
7. Monitor the severity of impacts caused by other introduced and problem animals such as feral bees and house mice and investigate methods of control if required.
8. Maintain and expand the use of goat exclusion plots and conduct an associated monitoring program to measure vegetation recovery, as an indicator of control effectiveness.
9. Work with neighbouring land managers, catchment groups, local government, other relevant agencies and the wider community to increase awareness of the ecological impacts should introduced fish species be released into natural waterways in the park.

Key performance indicators

Performance measure	Target	Reporting
Introduced/feral animal control within the park.	The number of goats and pigs shot in the Murchison Gorge per cull, over consecutive years, decreases in relation to effort.	Annually.
	Implementation of the introduced animal control plan.	
	Decrease in pig damage recorded in populations of threatened and priority flora.	Every two years.
	Demonstrated vegetation recovery in areas from which feral goats and pigs have been removed.	Every two years.

Fire

Fire management activities on lands managed by Parks and Wildlife are subject to the provisions of the CALM Act and Wildlife Conservation Act, which provides for the protection of fauna and flora in this state. The *Bush Fires Act 1954* also applies to Parks and Wildlife-managed lands and enables authorised officers to suppress bushfires and undertake other activities. Under common law, Parks and Wildlife also has a duty as an occupier of land in relation to management of risk. Further guidance on fire management and prescribed burning is provided by departmental policies 19 and 88 and the Conservation Commission's Position statement No. 1 *Fire management* (Conservation Commission 2011). Whole-of-government responsibilities and arrangements for the management of bushfires are provided in WESTPLAN Fire (State Emergency Management Committee 2013).

Parks and Wildlife will incorporate guidance from legislation and policy, this management plan, the Midwest Regional Fire Management Plan, ecological, biogeographic and land use information, and interested stakeholders, in its 'prescribed fire planning process'. This process identifies areas where prescribed fire is to be applied over the seasons (see www.dpaw.wa.gov.au/management/fire/prescribed-burning/54-planning-for-prescribed-burning). Prescribed burns may be undertaken for a number of purposes, including protection of park visitors and surrounding residents, management of the natural environment and for scientific research. Burn programs are regularly reviewed and the public is given an opportunity to view the proposed prescribed burn areas and provide feedback.

During a bushfire emergency, priority is given to protecting human life, critical infrastructure and community assets. Protection of natural values is also factored into incident action plans. Where possible, mitigation measures will be applied in a way that does not compromise the integrity of the natural environment.

For thousands of years, fire has been present in the Australian landscape through lightning strikes and applied practice. Aboriginal people used fire regularly (Nicholson 1981, Burrows and Christensen 1991,

Haynes 1991, Pyne 1991, Latz 1994, Burrows *et al*. 2000) to improve hunting and foraging opportunities, to encourage certain species to recolonise, to 'clean up the country' by removing dead or aging vegetation, to communicate and for ceremonial purposes.

The ecological effects and patterns resulting from traditional Aboriginal burning in the park are not documented or well understood. Fire is culturally significant to Nanda people and there is still some burning knowledge amongst Nanda elders who worked in the pastoral industry. Nanda have indicated their preference for small areas of land to be burned more frequently with less intensity.

Bushfires in the park are commonly started by lightning strikes. Photo – Sue Hancock/Parks and Wildlife

Fire behaviour

Fuel, weather and topography are the main factors influencing fire behaviour; together they determine the rate of spread and intensity of a fire. In Kalbarri National Park, the main fuel types are coastal heath and scrub-heath vegetation. Research on fire behaviour specific to the park is limited but some information is available from anecdotal observations and from experiments conducted in similar fuels near Eneabba (Westcott 2010) and on the south coast (McCaw 1997).

The park's shrublands have a discontinuous ground fuel layer, meaning fires predominantly spread by direct flame contact between canopies. This mode of fire spread makes it unusual for fires to burn in vegetation less than eight years old, except during severe fire weather conditions. In particular, fire behaviour is heavily influenced by wind speed and direction, with relatively strong winds required to spread fire. Fires in the park usually begin as long, narrow tongues running in the direction of prevailing winds.

Most fires within the park are started by lightning. In the summer months, hot, dry northerly winds can result in very high temperatures, low humidity and strong winds. These conditions are associated with the formation of low pressure troughs along the west coast, and may be accompanied by dry lightning storms, which can ignite bushfires (McCaw 1998).

Managing fire to protect life, property and biodiversity

Prescribed fire planning aims to reduce the impacts of unplanned fire on life, property and biodiversity. This occurs by maintaining an effective system of landscape-scale mosaics and fuel-reduced buffers. Together, these decrease the extent and frequency of bushfires and provide a mosaic of habitats of different ages across the landscape. For fire management to be effective, it must be carried out across boundaries, regardless of land tenures.

The high degree of predictability in the wind speed and direction experienced in the park assists with achieving safe and effective prescribed burning. The steady southerly winds experienced through much of the year make it possible to undertake north-south aligned open-edged burns relatively safely. East-west open-edged burns[31] are more difficult to implement due to the instability of easterly wind patterns. Open-edged burning requires specific weather conditions following ignition. It is only undertaken when the overnight conditions are mild enough to allow fires to self-extinguish. There is usually only a short period of time during the year when suitable overnight conditions coincide with daytime conditions in which fire

31 Open-edged burns are those that are only contained by a break on one side. Vegetation will continue to burn until conditions become mild enough to extinguish it.

will spread through the park's discontinuous fuels. The size of this 'burning window' constrains the park's prescribed burning program.

Another method used to protect assets from bushfire involves pushing over vegetation in areas of heavy fuels, allowing it to dry on the ground and then burning it. Mulching vegetation, without burning, also occurs. These two methods are used in areas where there are high-value assets (e.g. on the town site boundary), where the consequences of a prescribed burn escaping would be dire.

Life and community assets

Community assets in and around the park that require protection from bushfire include Kalbarri, properties surrounding the park, the airport and the two access roads to the town. Assets within the park include recreation sites and facilities, the radio communication repeater station and tower on Meanarra Hill, infrastructure associated with utilities, and cultural and heritage sites.

A vehicle access network of public roads and strategic management tracks within the park will be maintained. Temporary fire access tracks constructed during suppression activities will be rehabilitated.

A rapid response by Parks and Wildlife and the Kalbarri Volunteer Bushfire Brigade ensured this bushfire burning on the park boundary was contained quickly. Photo – David Pratt

Through the Kalbarri Local Area Management Committee (of which Parks and Wildlife is a member – see *Visitor safety*), an evacuation plan has been developed to ensure the safe evacuation of park visitors during a bushfire. Parks and Wildlife may also close recreation sites on days of very high to catastrophic fire danger.

Fire and biodiversity

The park is a very fire-prone environment. Although many species have adapted to fire, inappropriate fire regimes[32] affect biodiversity, population viability and long-term conservation of many of the species, communities and habitats found within the park. Therefore, burn prescriptions will reflect ecological, species or habitat requirements. No single fire regime is optimal for all species and an adaptive approach for prescribed fire planning that considers new research is required.

Species have varied responses to fire. In the park, vegetation in sandplain areas typically responds well to fire but areas that burn less frequently and have sparser vegetation—such as sandstone breakaways, wet refuge areas and particularly the Murchison Gorge—are likely to have fire-sensitive species. Resprouters are plants that recover from fire by resprouting unaffected buds. Reseeders are plants killed by fire that regenerate from soil-stored seed. The survival strategies of these species contribute to identifying appropriate fire regimes.

32 A 'fire regime' is a description of fire in terms of (a) fire frequency (how often it occurs on a site), (b) fire intensity (how much heat energy is released), (c) season (what time of year it occurs), (d) scale (how big it is), and (e) spatial diversity (how patchy it is at both a landscape and local scale). For more information on fire regimes and the environment, refer to the Parks and Wildlife website www.dpaw.wa.gov.au/management/fire.

Some wildlife species require special consideration when planning prescribed fires, for example, habitats for tammar wallabies are identified and burning is carried out to protect these where possible. In addition, tammar wallabies prefer a diversity of habitats, so prescribed burning aims for a diversity of fuel ages (and hence greater biodiversity). Consideration will be given to carrying out or increasing fox baiting following large bushfires because expanses of burnt vegetation provide limited cover, leaving native fauna more prone to predation.

Community awareness

Engaging with the public is vital to ensure a high level of community awareness of fire, fire-mitigation strategies and fire-suppression operations. Parks and Wildlife will assist DFES and the Shire of Northampton to communicate important messages about fire management to park visitors and the local community. Parks and Wildlife will also make information about its fire-management practices readily available to the public. Park visitors will be made aware of the importance of personal bushfire safety by on-ground staff and signage.

Community involvement in fire suppression is particularly strong in Kalbarri, due to a positive spirit of cooperation between Parks and Wildlife, the Kalbarri Volunteer Bushfire Service, DFES, the State Emergency Service, and the WA Police. Collaborative fire management is facilitated by the Local Emergency Management Committee. Members of these groups also participate in search and rescue operations in the park.

Desired outcomes

- Threat of bushfire to life and community assets is reduced.
- Stakeholders are engaged in the prescribed fire planning process.
- Biodiversity and cultural and heritage sites are considered in developing prescribed fire plans.

Management actions

1. Maintain an appropriate level of bushfire suppression preparedness by ensuring adequate equipment, access to water, strategic access and communications.
2. Continue to implement a prescribed fire and fuel modification program that incorporates relevant fire management policies, guidelines and available knowledge (including fire history) to:
    - protect Kalbarri, neighbouring properties and other assets (both within and outside the park) from bushfire
    - adapt management and implement appropriate fire management for flora, fauna and habitats that require specific fire regimes
    - establish and maintain a diverse vegetation structure across the landscape.
3. Work closely with DFES, the Shire of Northampton, Kalbarri Volunteer Bushfire Service and local government volunteer bushfire brigades, neighbouring land managers, the community and other authorities to encourage cooperative arrangements and ensure appropriate community protection from fire.
4. Promote public education and awareness of Parks and Wildlife's fire planning and management, the effects of fire on the natural environment, the need to prevent bushfires, the safety and survival of people, and protection of property.
5. Work with Nanda in managing fire, including prescribed burning and protection of cultural and heritage sites.
6. Establish and maintain post-fire monitoring sites to measure the impact of bushfire and prescribed fire, and to develop an understanding of the ecological fire requirements of the park's flora, fauna and ecological communities.
7. Develop and implement recovery plans after bushfires in the park.

Key performance indicators

Performance measure	Target	Reporting
The impact of bushfire and prescribed fire on human life or community assets.	No serious injury to people or damage to community assets attributed to Parks and Wildlife's fire management.	Annually.
	Prescribed burns are completed according to the annual program which is regularly reviewed, implemented, evaluated and adapted where necessary.	
The impact of fire management activities on known threatened flora and priority ecological communities.	No adverse unplanned impacts on threatened flora and priority ecological communities as a result of fire management activities.	Annually.

Managing resource use

Mineral and petroleum operations

Mining in Western Australia is primarily administered by the Department of Mines and Petroleum through the granting of various tenements under the *Mining Act 1978* and the *Petroleum and Geothermal Energy Resources Act 1967* and their regulations. The Mining Act regulates mineral exploration and mining and the Petroleum and Geothermal Energy Resources Act regulates petroleum, geothermal energy and greenhouse gas storage. The holders of tenements are required to meet certain conditions in order to retain exploration and development rights. For example, all development projects must undergo environmental, heritage and native title assessments. Exploration and development proposals that may cause significant impact on key values must be referred to the Environmental Protection Authority for environmental impact assessment. Actions that may have a considerable impact on matters of national significance[33] may also require approval under the EPBC Act.

While legislation provides a process for industry to apply for access to undertake mining and petroleum exploration and development in Kalbarri National Park, Parks and Wildlife, the Conservation Commission and the Minister for Environment will consider any proposals on a case-by-case basis. Cases where access and/or development are incompatible with protection of the park's key values will be identified as early as possible in government assessment processes and the granting of a mining lease within the park will require the consent (with conditions where appropriate) of both houses of the Western Australian Parliament. In the event that mining is approved, Parks and Wildlife will work with relevant authorities to avoid or minimise any impacts to acceptable levels.

There are no mineral exploration licences over the park; however there is a petroleum application covering the eastern part of the park and the adjacent lands considered for reservation. There are also a number of mineral exploration licence applications over the adjacent lands considered for reservation (see *Consideration of adjacent lands*). The latest information on tenements can be found on the Department of Mines and Petroleum's Tengraph database[34].

Basic raw materials

Extraction of basic raw materials (BRM) is required for the construction of new infrastructure and the maintenance of existing infrastructure. It is Parks and Wildlife's preference that basic raw materials are sourced from outside the park. When this is not feasible, Parks and Wildlife will consider access to basic raw materials on the basis it is for use within the boundary of the park. This may occur for operations such as road building.

Desired outcome

- Impacts of mineral and petroleum operations and extraction of basic raw materials on key values are minimised.

Management actions

1. Work with the Department of Mines and Petroleum, the Environmental Protection Authority and on behalf of the Minister for Environment to provide advice on proposed mineral and petroleum operations that may impact on the park and seek to avoid or minimise these impacts.

33 Under the EPBC Act, matters of national significance include nationally listed threatened species and ecological communities.

34 See www.dmp.wa.gov.au.

Nanda Traditional Owners provide advice about Aboriginal cultural heritage during investigations into sources of basic raw material (gravel) in the park, prior to the commencement of road developments. Photo – Rory Chapple/Parks and Wildlife

2. Ensure that any areas disturbed by mineral and petroleum operations are rehabilitated in accordance with the conditions of the mining or exploration tenure or approval documentation as well as appropriate best practice rehabilitation standards and guidelines.
3. Rehabilitate areas disturbed by basic raw material extraction in accordance with departmental policies and undertake post-rehabilitation monitoring and evaluation to assist compliance and support future decisions.
4. Ensure that all mineral and petroleum operations and basic raw material extraction adhere to departmental disease hygiene practices.

Beekeeping

There are no apiary sites within Kalbarri National Park. Future use of the park for beekeeping will be assessed in line with the assessment criteria within Parks and Wildlife's draft Policy Statement No. 41 *Beekeeping on public land* (Parks and Wildlife 2015) and associated guidelines. Criteria such as proximity to threatened flora and ecological communities, weeds, disease risk areas and recreation sites, will be considered during the assessment.

Desired outcome

- Impacts of beekeeping and introduced honeybees on key values are minimised.

Management actions

1. Assess applications for apiary site permits within the park against the criteria in Parks and Wildlife's draft Policy Statement No. 41 *Beekeeping on public land* (Parks and Wildlife 2015) and associated guidelines.

Water resource use

Water resource use is regulated under the *Rights in Water and Irrigation Act 1914* (RIWI Act) administered by the Department of Water. Under the RIWI Act, proponents are required to obtain a licence from the Department of Water to extract water within the Gascoyne Groundwater Proclamation Area. Parks and Wildlife may, under the CALM Act, issue a water removal permit to proponents seeking to extract water from land vested in the Conservation Commission. Where infrastructure for water abstraction is necessary, a lease may also be required. Guidance is also provided by the Conservation

Commission's Position Statement No. 11- *The protection of surface and groundwater biodiversity values of lands vested in the Conservation Commission of Western Australia* (Conservation Commission 2014).

Groundwater from the Tumblagooda Sandstone aquifer provides drinking water for Kalbarri, drawn from six Water Corporation production bores outside the planning area. The bores lie within the gazetted Kalbarri Water Reserve Public Drinking Water Source Area, which covers the town and parts of Kalbarri National Park to the south and east of the town. There is one monitoring bore in the park, which also provides water to the park headquarters. The Water Corporation production bores are surrounded by wellhead protection zones (one of which extends into the park), which are designated to protect a drinking water source from contamination in the immediate vicinity of bores (a 500m radius from production bores).

The area within the Kalbarri Water Reserve is a Priority 1 Protection Area (gazetted under the *Country Areas Water Supply Act 1947*). The *Kalbarri water reserve drinking water source protection plan: Kalbarri and Port Kalbarri town water supply* (DoW 2006) provides guidance for protecting water quality. Management activities must be planned to minimise impacts on the values of this drinking water source.

Desired outcome

- Impacts of water resource use on key values are minimised.

Management actions

1. Ensure management activities and land uses in the park comply with the *Kalbarri water reserve drinking water source protection plan: Kalbarri and Port Kalbarri town water supply* (DoW 2006).
2. Follow legislative requirements and Parks and Wildlife policy in assessing and approving water removal permits under the CALM Act.
3. Liaise with the Department of Water and Water Corporation about water extraction from the park and its long-term impacts.

Utilities and services

Utilities and services within Kalbarri National Park include:

- high-voltage powerlines
- co-located Parks and Wildlife and Western Australian Police radio communication repeater station and tower on Meanarra Hill
- telephone line
- Telstra fibre optic cable.

There is a need to expand mobile phone coverage within the park (see *Visitor safety*).

Proposed utilities or services need to be located to minimise impacts on the area's key values, including visual amenity. To limit these impacts, Parks and Wildlife prefers that utility infrastructure that is not servicing the park itself is located outside the park. When this is unavoidable, the use of already degraded areas, pre-existing corridors or co-location with existing infrastructure is preferred.

Police and Parks and Wildlife radio communication repeater station and tower on Meanarra Hill. Photo – Mike Paxman/Parks and Wildlife

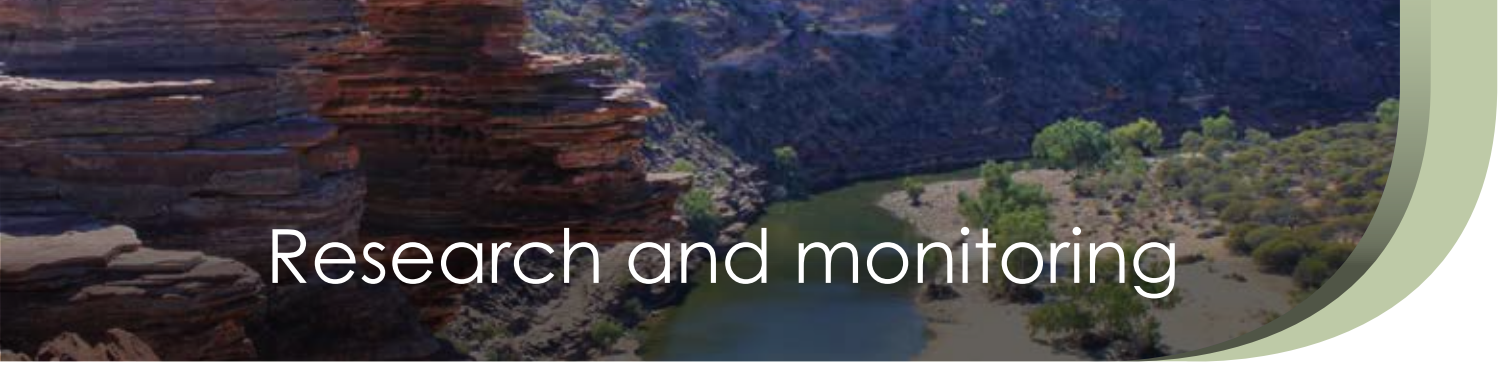
If at any stage utilities and services are no longer required, the infrastructure will be removed and the land rehabilitated.

Desired outcomes

- Impacts of utilities and services on key values are minimised.
- Infrastructure and services in and around Kalbarri National Park facilitate park management.

Management actions

1. Locate new utilities or services within existing corridors and/or outside the park, where possible.
2. Liaise with utility providers to ensure that utilities and services are operated and maintained in accordance with Parks and Wildlife conditions.
3. Ensure the responsible management of environmental issues associated with providing and maintaining utilities and services, particularly issues of disease hygiene and weed control.
4. Ensure the removal of infrastructure and rehabilitation of land when utilities and services are no longer required.
5. Work with utility and service providers to minimise environmental and visual impacts.
6. Seek to maximise mobile phone coverage.



Research and monitoring

Management of Kalbarri National Park and the wider planning area should be based on up-to-date and sound knowledge. Ongoing monitoring and evaluation of management practices is important to assess their effectiveness and allow for adaptive management.

Research and monitoring will help achieve the key performance indicators listed in this plan. This will include gaining a better understanding of those values identified as being most at risk and the pressures most likely to have adverse impacts on key values.

Research and monitoring projects aim to evaluate the effectiveness of management in protecting key values and priority is given to areas where:

- the quality of base data is the poorest
- understanding of the effect of management actions is poorest
- there have been unanticipated changes affecting the park, such as access or adjacent land uses.

Major research and monitoring projects in the park that will be developed through the life of this plan include:

- research and monitoring to better understand the impacts of climate change on park values
- research and monitoring associated with the *Western Shield* program and the translocation of priority fauna (see *Fauna reconstruction* and *Introduced and other problem animals*)
- flora monitoring (e.g. rare and priority species, weed mapping and goat exclusion plots showing the impact of grazing by goats)
- social research (e.g. visitor surveys and Nanda cultural research).

Desired outcome

- Knowledge and understanding of key values and management issues is increased and aids in the implementation of this management plan.

Radio tracking tammar wallabies following their translocation into the park. Photo – Mike Paxman/Parks and Wildlife

Management actions

1. Conduct integrated research and monitoring programs that facilitate management, with a focus on key values and pressures identified in this management plan; the establishment of baseline information; meeting key performance indicators; and other departmental research priorities.
2. Encourage and support, wherever possible, external agencies and individuals where their research contributes directly to departmental objectives or the implementation and auditing of this management plan.
3. Ensure information gained through research, monitoring and experience is placed in regional and district office libraries/databases, and kept up to date.
4. Incorporate research and monitoring findings into performance assessment against the objectives of this management plan and adapt future management, if required.

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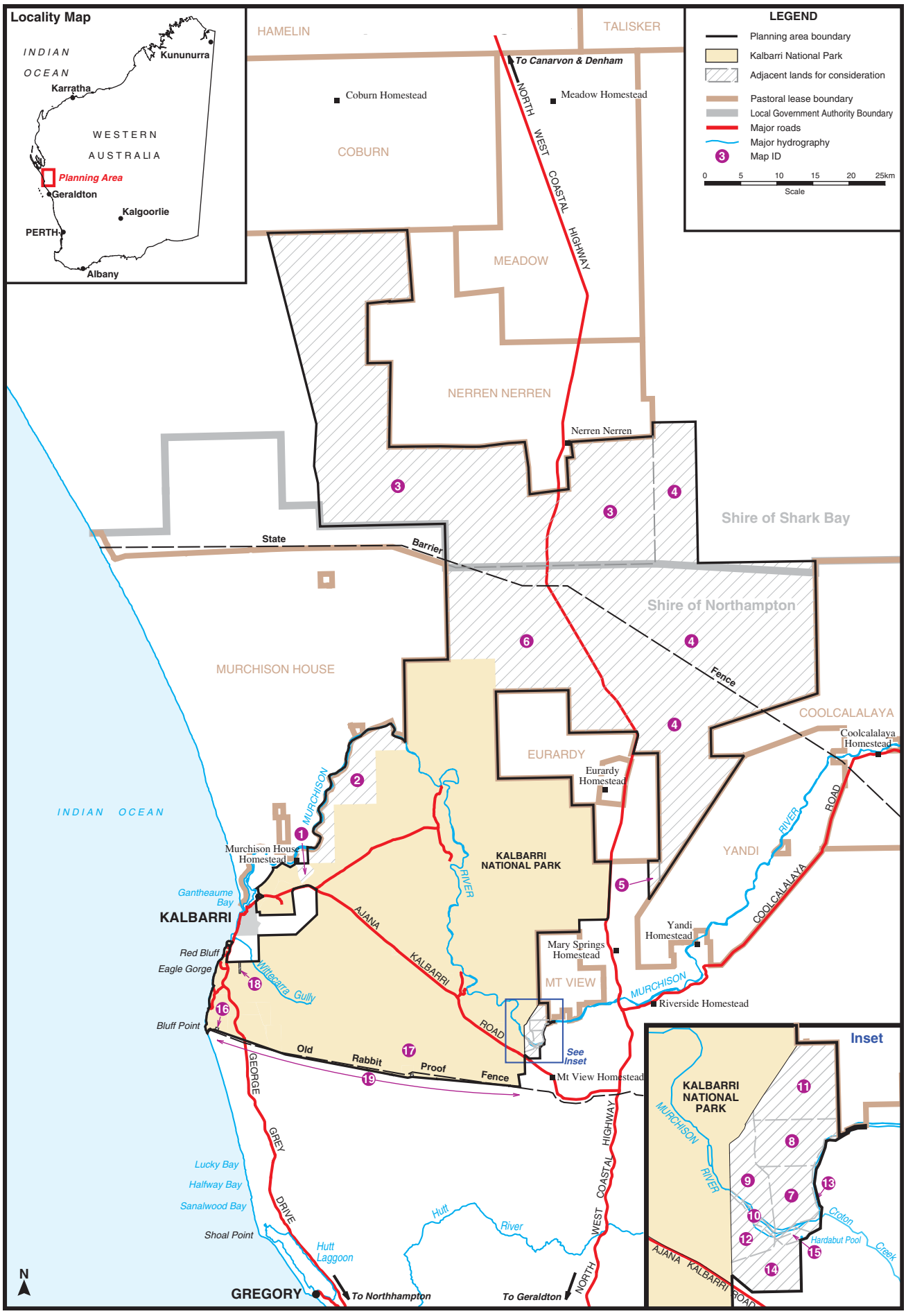
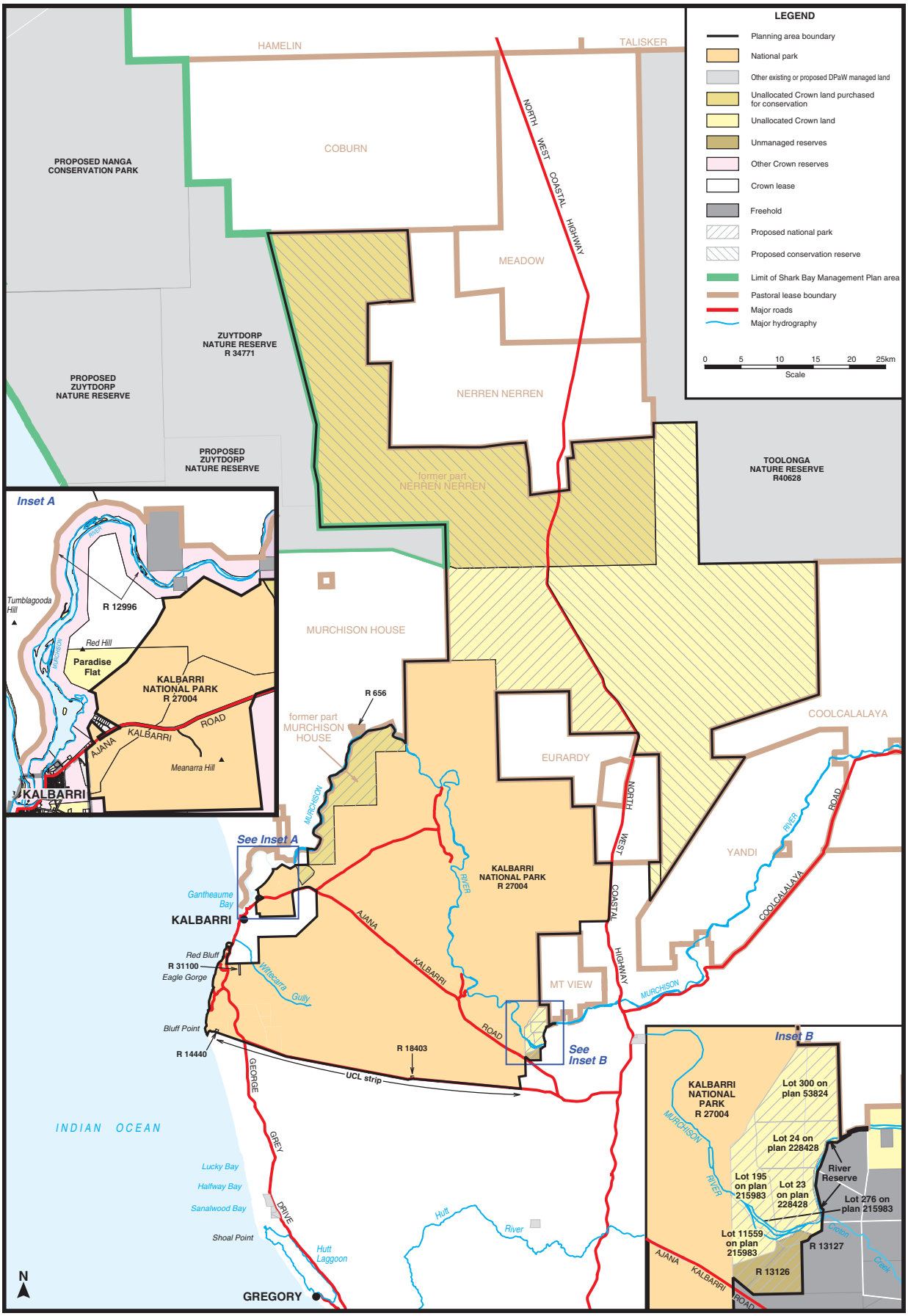
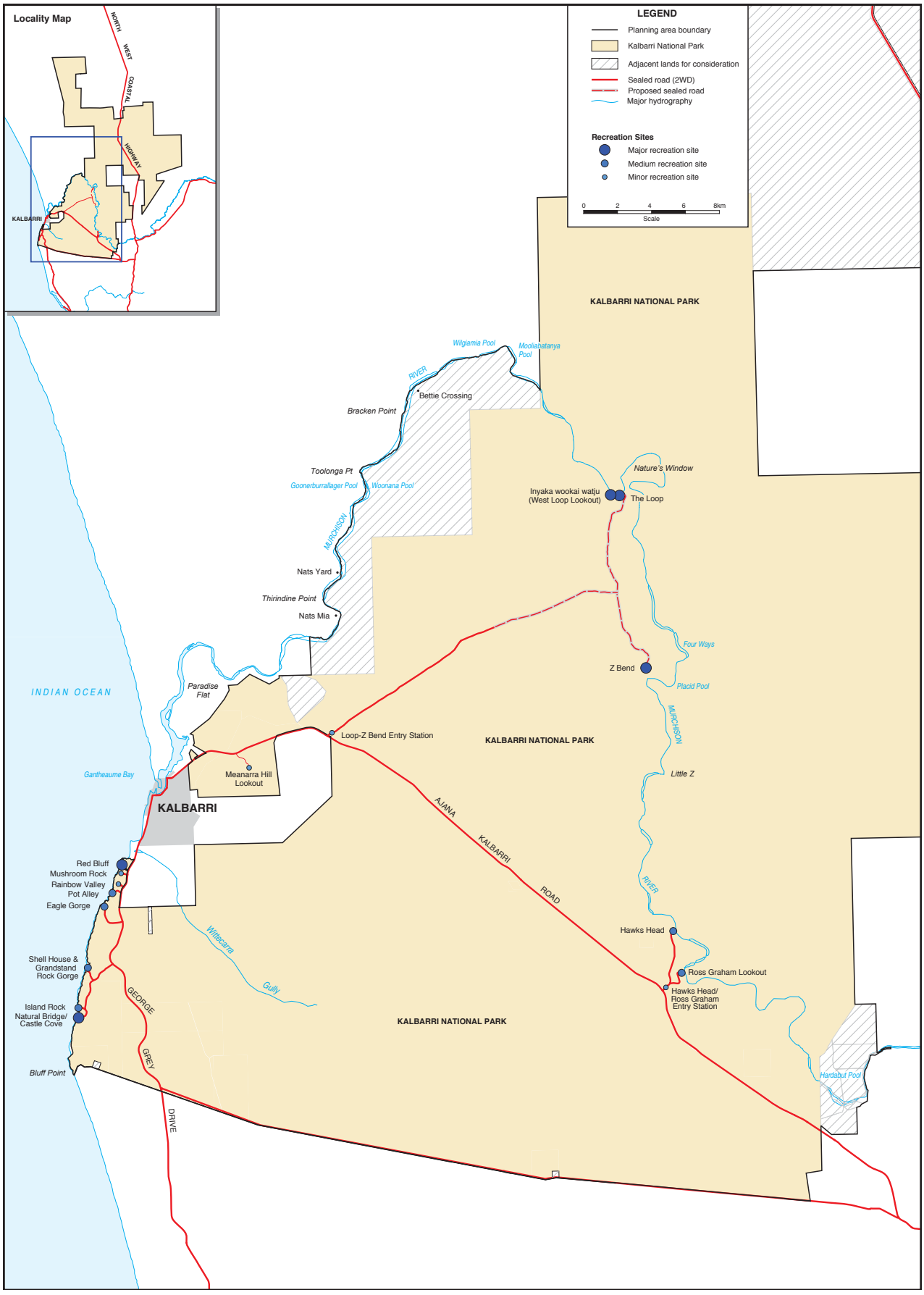
Map 1 Planning area



Map 2 Existing and proposed tenure



Map 3 Recreation sites



Appendix

Consideration of adjacent lands – further detail

The Interim Biogeographic Regionalisation for Australia (IBRA) system provides a planning framework for selecting and measuring a CAR system of protected areas. The benchmark reservation level for CAR reserve systems is that at least 15 per cent of each bioregion and any subregions within it should be managed as part of the conservation reserve system.

The adjacent lands considered for inclusion in the conservation reserve system identified in this plan will increase the area of the under-represented Geraldton Hills subregion in the conservation reserve system by about 2.6 per cent and the Edel subregion by about 12.2 per cent (see Figure 1).

Land within the planning area but outside Kalbarri National Park falls into three categories:

- lands purchased for conservation
- UCL and unmanaged reserves
- Reserve 31100.

The rationale for considering the inclusion of these conservation and culturally significant lands in the conservation reserve system is given below.

Land purchased for conservation

There are three areas of former pastoral lease in the planning area purchased for inclusion in the conservation reserve system: the central portion of Nerren Nerren pastoral lease and two portions of Murchison House on the eastern side of the Murchison River. These areas, shown on Map 1 (Map ID 1–3) are UCL and are described in Table 3. They were identified for reservation:

- to better protect the natural, cultural and recreational values of the Murchison Gorge
- to allow the development of new and/or complementary recreation sites and experiences (including access to these sites) to those already on offer within the park
- to provide a more practical reserve management boundary.

Reservation of portions of former Murchison House Station (Map ID 1) was recommended in *Conservation reserves for Western Australia: As recommended by the Environmental Protection Authority 1976: systems 1, 2, 3, 5* (EPA 1976).

UCL purchased for conservation is currently managed under an MoU between Parks and Wildlife and the Department of Lands. The MoU provides interim guidance for aquiring and managing pastoral leases prior to their inclusion in the conservation reserve system. Management goals include:

- conservation of native plants, animals and habitats
- conservation of physical, cultural and scenic resources
- conservation of groundwater resources
- management of weeds and introduced animals
- rehabilitation of areas degraded by past activities
- provision of sustainable, high-quality nature-based recreation and tourism opportunities, where appropriate
- facilitation of public enjoyment by providing access and visitor facilities, where appropriate
- consideration of joint management arrangements with the traditional owners.

Where possible, integrated management in accordance with the CALM Act is proposed for the land identified in Table 3, as well as the park and other surrounding lands. If reservation is achieved, management guided by the MoU will cease and management under this management plan will commence.

Table 3. Land purchased for conservation

Map ID	Proposed addition	Area (ha)	Current tenure	Proposed change
1	Lot 3035 on plan 45068 (former part Murchison House Station)	428.69	UCL (former pastoral lease acquired for conservation)	Add to KNP
2	Lot 3037 on plan 45068 (former part Murchison House Station)	8,100.3	UCL (former pastoral lease acquired for conservation)	Add to KNP
3	Lot 368 on plan 52033 (former part Nerren Nerren Station)	104,211.2	UCL (former pastoral lease acquired for conservation)	Conservation reserve

UCL – unallocated Crown land
KNP – Kalbarri National Park
Conservation reserve – land to which the CALM Act applies

UCL and unmanaged reserves

The plan proposes areas of UCL and unmanaged reserves for inclusion in the conservation reserve system. These areas are shown on Map 1 and described in Table 4. These areas have been identified for reservation because:

Map ID 4

- it supports vegetation associations, floristic communities or landscape types that are either not represented or not well represented in the conservation reserve system and have been identified as being of high priority for addition
- it will provide for a more practical reserve management boundary and improve ecological linkages to conservation reserves outside the planning area, providing larger areas with improved potential for conservation
- part of the area is recommended in *Conservation reserves for Western Australia: As recommended by the Environmental Protection Authority 1976: systems 1, 2, 3, 5* (EPA 1976)

Map ID 5

- it will provide a more practical reserve management boundary and improve ecological linkages to conservation reserves outside the planning area, providing larger areas with improved potential for conservation

Map ID 6

- it is identified in a Cabinet decision in 1992 for addition to the conservation reserve system to compensate or offset previous excisions from the park
- it will provide a more practical reserve management boundary and improve ecological linkages to conservation reserves outside the planning area, providing larger areas with improved potential for conservation

Map ID 7–15

- these areas will provide better protection for the natural, cultural and recreational values of the Murchison Gorge
- these will provide refuges for species impacted by climate change, which will, in turn, improve the resilience of affected species
- these will increase the representation and protection of the important geodiversity in the area
- these will provide potential for the development of new and/or complementary recreation sites and experiences to those already on offer within the park
- are recommended for amalgamation with the park in the Kalbarri plan (Department of Planning and Urban Development 1992)

Map ID 16, 17, 19

- these will provide a more practical reserve management boundary.

These lands are currently managed under an MoU between Parks and Wildlife and the Department of Lands. The MoU provides guidance for the administration and/or management of UCL and unmanaged Crown reserves outside the Perth metropolitan area, regional centres and town sites. It identifies a range of management responsibilities for Parks and Wildlife, some of which include:

- fire prevention
- control of environmental weeds and introduced animals
- managing the harvesting of flora and forest produce
- liaison with relevant stakeholders, including local government, neighbours and Aboriginal people
- recreation management
- management of special values such as Aboriginal cultural heritage.

Where possible, integrated management in accordance with the CALM Act is proposed for the land identified in Table 4, as well as the park and other surrounding lands. If reservation is achieved, management guided by the MoU will cease and management under this management plan will commence.

Table 4. UCL and unmanaged reserves

Map ID	Proposed addition	Area (ha)	Current tenure	Proposed change
4	UCL PIN 1012123, 11488528, 11488529, (west of Coolcalalaya and Yandi pastoral leases)	95, 851.2	UCL	Conservation reserve
5	Murchison loc 171 (Lot 171 on plan 210528)	657.7	UCL	Conservation reserve
6	UCL PIN 1012103, 1012105 (north of Eurardy pastoral lease)	28,626.1	UCL	Add to KNP
7	Murchison loc 23 (Lot 23 on plan 228428)	244.5	UCL	Add to KNP
8	Murchison loc 24 (Lot 24 on plan 228428)	318.4	UCL	Add to KNP
9	Murchison loc 195 (Lot 195 on plan 215983)	250.7	UCL	Add to KNP
10	Murchison loc 276 (Lot 276 on plan 215983)	30.3	UCL	Add to KNP
11	Lot 300 on plan 53824	463.9	UCL	Add to KNP
12	Victoria loc 11559 (Lot 11559 on plan 215983)	155.8	UCL	Add to KNP
13	River reserve (part PIN 10005474)	68.0	UCL	Add to KNP

14	R 13126 (Purpose: camping. Class C)	251.7	Crown reserve	Add to KNP
15	R 13127 (Purpose: waterway. Class C)	27.5	Crown reserve	Add to KNP
16	R 14440 (Purpose: Paddock, Rabbit Department. Class C)	15.8	Crown reserve	Add to KNP
17	R 18403 (Purpose: Water and camping, Rabbit Department. Class C)	15.8	Crown reserve	Add to KNP
19	UCL PIN 1005456, 1005466, 1323870, 1185611, 1323869, 1185610, part of 1113766 (adjoining southern boundary of Kalbarri National Park)	27.7	UCL	Add to KNP

UCL – unallocated Crown land
KNP – Kalbarri National Park
Conservation reserve – land to which the CALM Act applies

Reserve 31100

This management plan furthers the 1992 government decision that Reserve 31100 be considered for inclusion in the conservation reserve system. The area is shown on Map 1 (Map ID 18) and described in Table 5. This reserve originally contained Kalbarri airstrip, which has since been relocated. Reserve 31100 was identified for addition to the park as compensation for the area excised from the park for the relocation of the airport. The addition of this reserve will also provide a more practical reserve management boundary.

Reserve 31100 is vested in the Shire of Northampton, with the shire responsible for its rehabilitation and management. As the reserve was used as an airstrip, the land currently has degraded natural values and is in need of rehabilitation. Addition of the area to rationalise the park boundary will occur once the area has been successfully rehabilitated.

Table 5. Reserve 31100

Map ID	Proposed addition	Area (ha)	Current tenure	Proposed change
18	R 31100 Vested in the Shire of Northampton Purpose: Aerial landing ground Class C	32.4	Crown reserve WPL (21 years) approval of Minister required	Add to KNP

KNP – Kalbarri National Park

Conservation significance of adjacent lands considered for reservation

The conservation significance, pressures and management issues on lands to be considered for reservation are outlined below.

Geology, landforms and soils

Geology of the adjacent lands considered for reservation to the north-east of the park are part of the Victoria Plateau and comprise a gently undulating sandplain with minor fields of sand dunes.

The Hardabut Fault lies to the south-east of the park, within the area considered for reservation in the Hardabut Pool area. South of the Hardabut Fault is the Northampton Complex, which contains the oldest rocks in the region and is poorly represented in the conservation reserve system. Addition of UCL and

reserves 13126 and 13127 (Map ID 7–15) in the Hardabut Pool area will increase the representation and protection of the important geodiversity in the area (granulite and gneiss). The geodiversity may also support flora species and vegetation types not currently well represented in the conservation reserve system.

Former part Murchison House Station includes about 30km of the Murchison River and features of geological significance such as sandstone gorge.

There is potential for damage to geological features, landforms and soils on these lands from introduced animals and associated erosion, particularly on areas of former pastoral lease.

Native plants and plant communities

Although flora surveys have been conducted on the adjacent lands, further work is required. Four hundred and thirty plant species have been recorded, with five species endemic to these areas. Many were documented as part of the southern Carnarvon Basin survey, conducted in 1994 and 1995, when flora was surveyed on Nerren Nerren Station (Keighery *et al*. 2000).

The adjacent lands considered for reservation contain a number of species of conservation significance including:

- five species listed as 'threatened flora' under the *Wildlife Conservation Act (Wildlife Conservation (Rare Flora) Notice 2014*)— small dragon orchid, northern dwarf spider orchid, Beard's mallee, long-leaved myrtle (*Hypocalymma longifolium*) and Kalbarri leschenaultia. All these species are also listed as threatened or vulnerable under the EPBC Act
- 43 priority species comprising 9 Priority 1 species, 11 Priority 2 species, 16 Priority 3 species and seven Priority 4 species
- 35 recorded range-end species (eight per cent of all recorded species in the adjacent lands). Of these, 94 per cent are at their northern limit (Keighery *et al*. 2000).

An interim recovery plan has been prepared for one threatened species in the adjacent lands, *H. longifolium*.

The vegetation of the adjacent lands is predominantly shrubland comprising acacia or proteaceous species. These lands contain 13 vegetation associations, six of which are not found in Kalbarri National Park. In addition, eight of these vegetation associations are currently underrepresented in the conservation reserve system (less than 15 per cent).

Reservation of these areas will protect four of these underrepresented vegetation associations to greater than 15 per cent in conservation reserves (the IBRA benchmark). Representation of the mallee and acacia thicket on coastal dunes (currently not protected in any conservation reserves) will increase by 97.5 per cent. Similarly, the adjacent lands considered for reservation will increase the protection of shrublands of acacia, casuarina, *Eucalyptus eudesmioides*, *Banksia ashbyi* and thickets of other mixed species by 66.6 per cent and bowgada scrub and scattered eucalypt and cypress pine by 23.1 per cent. Representation of other vegetation associations will also improve.

Native animals and habitats

As with flora, native animal surveys of the adjacent lands considered for reservation have been limited. Three hundred and seventy species have been recorded from these lands, comprising 16 mammals, 97 birds, 50 reptiles and 207 invertebrates. Most of these were documented as part of the southern Carnarvon Basin survey, conducted in 1994 and 1995, when sites on Nerren Nerren and at Hardabut Pool were surveyed for fauna (Burbidge *et al.* 2000).

The adjacent lands considered for reservation contain the following fauna species of conservation significance:

- three threatened species listed under the *Wildlife Conservation Act (Wildlife Conservation (Specially Protected Fauna) Notice 2014*): malleefowl, eastern curlew (*Numenius madagascariensis*) and shield-backed trapdoor spider and the specially protected peregrine falcon
- one threatened species listed under EPBC Act: the malleefowl
- four migratory bird species listed under international agreements, the eastern curlew, ruddy turnstone (*Arenaria interpres*), fork-tailed swift (*Apus pacificus*) and rainbow bee-eater (*Merops ornatus*)
- three priority species: the taper-tailed west coast slider (*Lerista humphriesi*), Australian bustard and bush stone-curlew
- eight invertebrate species endemic to the adjacent lands considered for reservation
- the red wattlebird (*Anthochaera carunculata*), which is at the northern limit of its range
- the micro slider (*Lerista micra*), which is at the southern limit of its range.

Surveys by Halse *et al*. (2000) at Hardabut Pool suggest very high invertebrate species richness, which is probably typical of much of the Murchison River within the planning area.

The adjacent lands have not been well surveyed for fauna habitat. The woodlands in the north-eastern part of the park and on UCL east of the North West Coastal Highway (Map ID 4) are likely to support red-tailed black cockatoos (*Calyptorhynchus banksii*) and malleefowl. Areas of tree heath in the adjacent lands considered for reservation may also be important bird habitat.

Weeds

Few weeds have been recorded in the adjacent lands considered for reservation, though the area has not been well surveyed. As the majority of these areas are former pastoral lease or UCL that adjoins existing pastoral leases, weeds are likely to exist.

Introduced and other problem animals

Further surveys for introduced animals are required in the adjacent lands considered for reservation and are likely to indicate significant impacts. Goats, pigs, rabbits, foxes and feral cats are believed to impact the adjacent lands. More detail on these species is provided in *Introduced and other problem animals*.

The following introduced species are also known from the adjacent lands:

- Camels (*Camelus dromedarius*) are known from wetland soaks in Zuytdorp Nature Reserve to the north of the planning area and are possibly present in northern parts of the adjacent lands considered for reservation, such as part of the former Nerren Nerren Station (DEC 2012c). Currently, no control measures are used.
- Deer (*Cervus timorensis*) may be present in the northern parts of the adjacent lands considered for reservation (DEC 2012c), such as the UCL east of the North West Coastal Highway (Map ID 4). Currently, no control measures are used.
- Wild dogs have recently moved from further inland into northern and north-eastern parts of the adjacent lands considered for reservation and are likely to be present on part of the former Nerren Nerren Station. Currently, no direct control measures are used.

Fire

Under MOUs with the Department of Lands (which has legislative responsibility for the management of UCL), Parks and Wildlife is responsible for managing fire preparedness on UCL and unmanaged reserves outside the metropolitan area, regional centres and town sites, while local government is responsible for bushfire suppression. This applies to the areas of UCL and unmanaged reserves within the adjacent lands.

Aboriginal culture and heritage

The adjacent lands considered for reservation contain 19 Aboriginal sites recorded on the Department of Aboriginal Affairs *Register of Aboriginal Sites*. The section of the Murchison River adjacent to part of the former Murchison House Station is of particular importance to Nanda and 16 Aboriginal sites are recorded on this land, close to the water. The lower reaches of the river and their deep river pools are particularly significant to Nanda. The Hardabut area is also significant, with a number of sites recorded. Ethnographic and archaeological surveys have been conducted over a relatively small portion of the adjacent lands considered for reservation and it is highly unlikely that all Aboriginal sites have been officially recorded.

Other cultural heritage

Part of the State Barrier Fence (known as Fence No. 3), passes through the adjacent lands considered for reservation to the north-east of the park (Department of Agriculture 2001). The State Barrier Fence was originally constructed between 1901 and 1907 and comprises a number of separate fences. Constructed in an arc from north of Kalbarri to east of Ravensthorpe, the State Barrier Fence was designed to keep rabbits, wild dogs, emus (*Dromaius novae-hollandiae*), kangaroos and other pest and problem animals out of agricultural and pastoral areas. Parts of the fence are still maintained for this reason today.

Visitor use

Due to their remoteness and lack of access, few visitors use the adjacent lands considered for reservation, especially in areas north of the park. Where visitor use does occur, such as in the Hardabut Pool area (Map ID 7–15), no recreation sites or facilities are provided and use is unmanaged.

There is great potential to develop recreation opportunities in the adjacent lands considered for reservation and this will be considered in consultation with Nanda.

Sites including part of the former Murchison House Station downstream of The Loop and the Hardabut Pool area (see Map 1 IDs 1, 2 and 7–15 respectively) are likely to provide new opportunities for camping, bushwalking, hiking, sightseeing, abseiling and rock climbing, and for canoeing and kayaking on the Murchison River. Should part of the former Murchison House Station be gazetted as conservation reserve, a range of sites that complement experiences already available in the park and in the surrounding landscape may be considered.

Mineral and petroleum operations

There is a petroleum application and a number of mineral exploration licence applications for the adjacent lands, including applications to explore for heavy mineral sands deposits to the north of the park and to explore for lead deposits the east of the park. Further detail is available on the Department of Mines and Petroleum website.

Beekeeping

There are several apiary sites on the adjacent lands considered for reservation. These sites are used about every four years to make use of the pollen from York gum. To determine the compatibility of beekeeping with key values of the areas being utilised, an assessment will be conducted at the time of renewal of the apiary site permit. The assessment will be consistent with the draft revised Policy Statement No. 41 *Beekeeping on public land* and the *General conditions for using apiary authorities on Crown land in Western Australia* (Parks and Wildlife 2013) and will consider criteria such as proximity to threatened flora and ecological communities, weeds, disease risk areas and recreation sites.