



# Swan Coastal Plain South

management plan 85

2016



Department of  
Parks and Wildlife



Conservation  
Commission  
WESTERN AUSTRALIA

Department of Parks and Wildlife  
17 Dick Perry Avenue  
Kensington WA 6151

Phone: (08) 9219 9000  
Fax: (08) 9334 0498

dpaw.wa.gov.au

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Questions regarding this plan should be directed to:

Planning Branch  
Department of Parks and Wildlife  
17 Dick Perry Avenue, Kensington WA 6151  
Locked Bag 104 Bentley Delivery Centre WA 6983

Phone: (08) 9219 9000  
Email: [planning@dpaw.wa.gov.au](mailto:planning@dpaw.wa.gov.au)

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### **Front cover photos**

**Main** Aerial view of Leschenault Peninsula Conservation Park.  
Photo – Owen Donovan/Parks and Wildlife

**Top left** Carnaby's cockatoo (*Calyptorhynchus latirostris*).  
Photo – Leonie Valentine

**Top right** Banksia tree on the Lake Pollard walk trail, Yalgorup National Park.  
Photo – Melissa Loomes/Parks and Wildlife

**Header photo** Vegetation of the Canning River Regional Park.  
Photo – Kym Pearce/Parks and Wildlife

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# Acknowledgments

## Planning team

This management plan was prepared by a Department of Parks and Wildlife planning team consisting of Grace Patorniti, Karl Brennan, Peter Hanly, Catherine Prideaux, Craig Olejnik, Shawn Debono, Brett Fitzgerald and Ewen MacGregor. Previous planning team members included Brendan Dooley, Kathleen Lowry, Melissa Loomes, Kathryn McGuane and Kym Pearce.

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## Community involvement

Many individuals, community groups, organisations and government agencies made valuable contributions to the development of the draft and final versions of this management plan. The planning team would especially like to acknowledge the contribution from the City of Canning (a key stakeholder in the management of the Canning River Regional Park) and the Canning River Regional Park Community Advisory Committee.

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Thank you to all those who took the time to make a submission on the draft management plan after it was released for public comment.

## Noongar people

The term 'Noongar' refers to Aboriginal people who live in the south-west corner of Western Australia, between Jurien Bay and Esperance. The word 'Noongar' can be spelt in different ways and spelling in this form should also be seen to encompass the Nyoongar, Nyungar, Noongah and Nyungah spellings.

The traditional owners of the planning area are acknowledged. The contributions and aspirations of Noongar people in caring for country are acknowledged. The department recognises the importance of the cultural and heritage values of the area and the important and valuable knowledge that Noongar people hold.

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# Introduction and management context

This management plan was prepared by the Conservation Commission of Western Australia (Conservation Commission), through the Department of Parks and Wildlife (the department, or Parks and Wildlife). The management plan provides broad direction for parks and reserves on the southern part of the Swan Coastal Plain that are vested in the Conservation Commission and managed, on behalf of the Conservation Commission, by Parks and Wildlife. It also identifies the key values, management issues and opportunities to ensure that management priorities to minimise impacts are determined at a strategic level. Detailed planning (referred to as subsidiary documents and/or operational management plans) may be undertaken to guide works on the ground within individual reserves.

Key directions of this management plan include: protecting the Peel-Yalgorup and Vasse-Wonnerup Ramsar wetland systems; promoting and enhancing the long-term stability of tuart stands; gaining local knowledge about, and controlling, introduced species; understanding hydrology and maintaining or improving water balances in consultation with other government departments; managing species and ecological communities of conservation significance to maintain long-term viability of populations; fostering and improving community understanding of, and involvement in, the management of the key values; and providing a range of compatible nature-based recreation opportunities and public education.

## 1. Overview of the Swan Coastal Plain

The Swan Coastal Plain comprises a mixture of fragmented and elongated parks and reserves that protect highly valued habitats and remnant vegetation including tuart woodlands, heath, wetlands, estuaries, river systems and coastal plain with high levels of diversity and endemism of flora and fauna. Many of the parks and reserves are known for their high quality landscapes and cultural values, while at the same time providing facilities in a natural environment within an urban and rural setting, for public use, enjoyment and education.

The Swan Coastal Plain has the highest population density in Western Australia (WA). It is predicted that by 2050, 3.5 million people will live in the Perth and Peel regions, representing more than 75 per cent of WA's total population (WAPC 2015). The Peel region's population is expected to more than double in population from 2011 to 2050 (WAPC 2015).

The environmental pressures imposed on, and predicted for, natural areas that are fragmented and surrounded by rural and urban development mean that such areas need active management if they are to play a role in conservation of regional biodiversity. Hence, the principal management objective for the conservation reserves on the Swan Coastal Plain is to conserve flora, fauna and landscape condition. The consolidation, expansion and ongoing management of the formal conservation reserve system are key strategies for biodiversity conservation on the Swan Coastal Plain. Further, cross-boundary management with adjoining landholders, the wider community and other stakeholders is integral to the successful implementation of this management plan.

Natural areas in urban and rural surroundings, such as those on the Swan Coastal Plain, bring the experience of natural places within people's reach to create a strong sense of community and to improve the quality of life and local amenity (Government of Western Australia 2000a). *The Peel 2020 Sustainability Strategy* (Peel Development Commission 2008) identifies values including the 'health of the waterways and environment' and the 'regional and rural identity' as being the most important to the community. Reserves on the Swan Coastal Plain provide different levels of nature-based recreational opportunities that are compatible with the protection of the conservation values of the reserves.

## 2. Management plan area

The management plan covers 82 existing parks and reserves on the southern Swan Coastal Plain, totaling about 22,000ha (Map 1 and Appendix 1) and about 4,600ha of proposed additions (Maps 3-5 and Appendix 3). These parks and reserves are collectively referred to as ‘the planning area’. The management plan also provides integrated management direction for the Canning River Regional Park (Appendix 2).

The planning area extends from the Darling Range in the east, to the coastline in the west and from Dunsborough in the south to the Swan River in the north (Map 1). The planning area is within the local government areas of the cities of Perth, Subiaco, Armadale, Canning, Gosnells, Kwinana, Mandurah, Bunbury and Busselton, and the shires of Capel, Dardanup, Harvey, Kalamunda, Murray, Peppermint Grove, Serpentine-Jarrahdale and Waroona.

Some of the parks and reserves are covered by outdated terrestrial management plans. This management plan will replace the following management plans:

- *Canning River Regional Park Management Plan 1997–2007* (CALM 1997)
- *Matilda Bay Reserve Management Plan 1992–2002* (CALM 1992a)
- *Yalgorup National Park Management Plan 1995–2005* (CALM 1995)
- *Leschenault Peninsula Management Plan 1998–2008* (CALM 1998)
- *Benger Swamp Nature Reserve Management Plan 1987–1992* (CALM 1987).

The management plan is consistent with all remaining management plans on the Swan Coastal Plain (see [www.dpaw.wa.gov.au/parks/management-plans](http://www.dpaw.wa.gov.au/parks/management-plans)) and is complementary to the *Forest Management Plan 2014-2023* (Conservation Commission 2013).

## 3. Key values and management issues

### Key values

The key values for the planning area are:

#### Natural values

- The planning area is part of an internationally recognised ‘biodiversity hotspot’ (one of 35 of the world’s richest and most threatened reservoirs of plant and animal life) and is the only one in Australia recognised by the International Union for Conservation of Nature (IUCN).
- Internationally and nationally significant wetlands, including portions of the ‘Peel–Yalgorup system’ and ‘Vasse–Wonnerup system’ Ramsar sites, which provide habitat, migration stopovers, moulting grounds, and breeding and drought refuge for thousands of waterbirds.
- Conservation category wetlands, which exist in about 80 per cent of the planning area.
- A rich mosaic of river, wetland and upland ecosystems, which include plant species of conservation significance, threatened ecological communities (TECs), threatened fauna and species either endemic to the Swan Coastal Plain or poorly represented in the conservation reserve system.
- Remnant stands of tuart (*Eucalyptus gomphocephala*) woodland, which are highly valued for sustaining ecosystem functions, and enhancing landscape, cultural and social values.



Peel-Yalgorup Ramsar site – Creery Wetlands Nature Reserve.  
Photo – Kym Pearce/Parks and Wildlife





Vasse-Wonnerup Ramsar site. Photo – Kym Pearce/Parks and Wildlife

### Cultural values

- Aboriginal sites including ethnographic, anthropological and archaeological sites, and landscapes of mythological, ceremonial and spiritual significance.
- Opportunities for joint management arrangements with Noongar people.
- Links to early exploration and colonial settlement, establishment of agriculture and industry, and wartime activities.

### Recreation and social values

- Opportunities for education, recreation and interpretation relating to the natural and cultural values of the planning area.
- Opportunities for nature-based tourism and commercial operations.
- Opportunities for scientific research on aspects of the planning area's natural values including biodiversity and Ramsar wetlands.



Boating activities adjacent to Matilda Bay Reserve.  
Photo – Kym Pearce/ Parks and Wildlife

### Key management issues

The major management issues for the planning area include:

- altered hydrological regimes such as inundation and changes to flow regimes of rivers, resulting from vegetation clearing, acidic groundwater, surface water storage and groundwater extraction
- nutrient run-off into wetlands and waterways from surrounding land uses including rural and residential areas
- weed invasion
- predation and competition from introduced and other problem animals
- the continuing spread of *Phytophthora* spp
- habitat fragmentation and isolation from other areas of remnant vegetation
- inappropriate fire regimes, particularly unplanned fire in small fragmented reserves, with a frequency and intensity that may result in local extinction of plant populations and/or which does not allow sufficient recovery of plant regeneration and specialised fauna habitat
- unauthorised and inappropriate recreational access and activities (for example by off-road vehicles and trail bikes), illegal cutting of vegetation, firewood collection and rubbish dumping
- impacts on the reserves' natural values and infrastructure from increasing visitor numbers.

## 4. Vision

*In 2025, the landscape condition and biodiversity values of the parks and reserves of the planning area will be conserved and enhanced. Key sites will provide valuable places for people to enjoy recreation activities in a predominantly natural setting. The cultural, social and natural values of the landscape as a whole will be understood and respected.*

## 5. Legislation and policy

Management plans are guided by legislation and policy, and in turn provide guidance for departmental subsidiary management documents such as fire response plans, weed control plans, introduced and problem animal control plans and recreation site development plans. Conservation reserve planning occurs at several levels, with management plans being one of a suite of documents and systems that assist management decision making.

The department manages the parks and reserves of the planning area in accordance with the provisions of the *Conservation and Land Management Act 1984* (CALM Act), which provides for the management of lands and waters vested in the Conservation Commission, and the *Wildlife Conservation Act 1950*, which provides for specific protection of native flora and fauna within WA.

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), administered by the Australian Government, relates to the protection and management of nationally and internationally important threatened flora and fauna species, ecological communities and heritage places. Actions that have, or are likely to have, a significant impact on a matter of national environmental significance require approval from the Australian Government environment minister in addition to any approval that may be needed in WA. Matters of national environmental significance in the planning area are: (i) wetlands of international importance (listed under the Ramsar Convention), (ii) threatened species and ecological communities and (iii) migratory species protected under international agreements,

There are other environmental legislation and Parks and Wildlife policies (see [www.dpaw.wa.gov.au/about-us/36-policies-and-legislation](http://www.dpaw.wa.gov.au/about-us/36-policies-and-legislation)), which are relevant to this management plan and are referred to throughout the document.

This management plan provides a summary of operations proposed to be undertaken in the planning area as required under the CALM Act and addresses Commonwealth and international obligations. It also provides guidance for department business plans and the preparation of subsidiary management documents (operational management plans), which provide more detail for specific sites or management issues.

### International conservation agreements

Australia is a signatory to the following international conservation agreements, which affect management of the planning area:

- Convention on Wetlands of International Importance especially as Waterfowl Habitat 1971 (Ramsar Convention)
- China-Australia Migratory Bird Agreement (CAMBA)
- Japan-Australia Migratory Bird Agreement (JAMBA)
- Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)
- Convention on the Conservation of Migratory Species of Wild Animals (known as the Bonn Convention).

## Obligations under the Ramsar Convention

To be identified as a wetland of international importance and accepted on the Ramsar list, a wetland ecosystem must satisfy at least one of the Ramsar Convention's nine Criteria for Listing Internationally Important Wetlands (Ramsar Convention 2005).

The Peel–Yalgorup system (Ramsar site number 482) was listed in June 1990 and the site was significantly extended in 2001. It meets seven of the nine Ramsar criteria (Appendix 4).

The Vasse–Wonnerup system (Ramsar site number 484) was also listed in June 1990 and the site was extended in 2000. It meets two of the nine Ramsar criteria (Appendix 5).

In addition to promoting the conservation and wise use of wetlands, contracting parties to the Ramsar Convention accept several other responsibilities, including managing a Ramsar site to maintain its 'ecological character'. The ecological characters of the Peel–Yalgorup system and the Vasse–Wonnerup system Ramsar sites have been described in Hale & Butcher (2007) and WRM (2007) respectively. The ecological character description (ECD) includes a summary of the critical ecosystem components and processes, limits of acceptable change to the values of the wetlands and management recommendations, all of which provide guidance to this management plan. A summary of the critical ecosystem components and processes are shown in appendices 4 and 5.

The specific limits of acceptable change identified in Hale & Butcher (2007) and WRM (2007) will be used where possible as indicators of change for the key performance indicators for hydrology (see Section 12. *Physical environment*) and fauna (see Section 13. *Biological environment*) as they relate to the Ramsar sites in the planning area. The limits of acceptable change depict the variation that is considered acceptable in a particular measure or feature of the ecological character of the wetland.

This management plan covers the portions of the Ramsar wetland systems that are vested in the Conservation Commission. About 62 per cent (16,553ha) of the Peel–Yalgorup Ramsar site falls within lands managed by the department (Figure 1).

The department manages 35 per cent (about 390ha) of the Vasse–Wonnerup Ramsar site, which includes the Tuart Forest National Park (DPaW 2014a). With the proposed additions to the planning area, the total area managed by the department will be about 98 per cent (Figure 2).

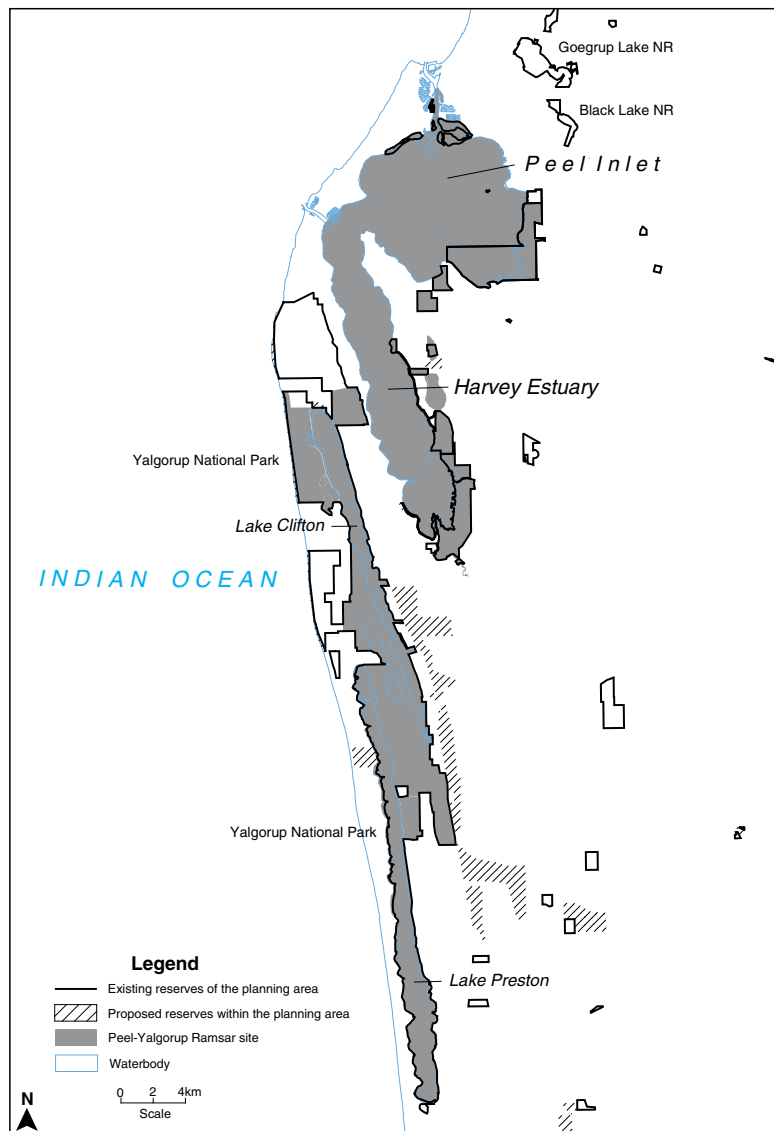


Figure 1: Reserves of the planning area in the Peel-Yalgorup Ramsar site

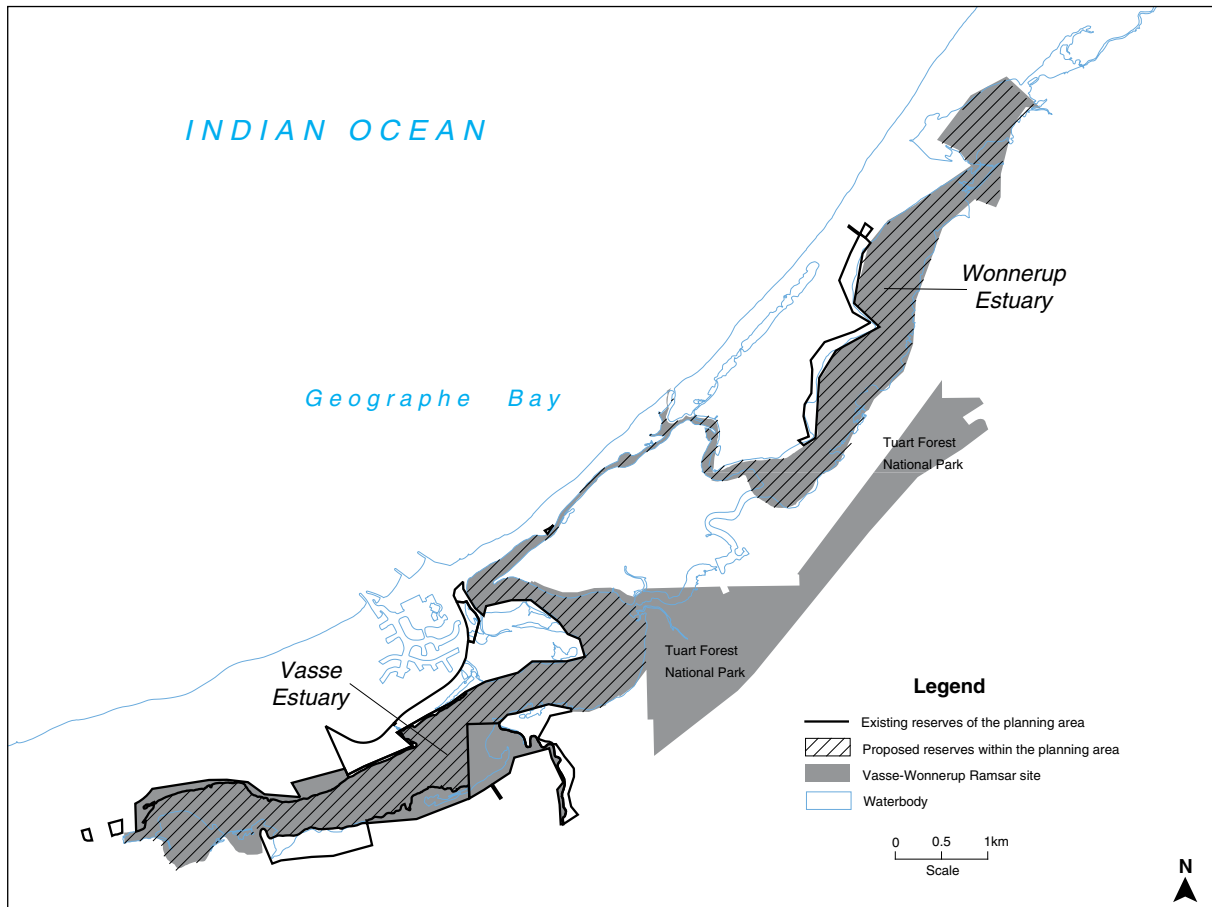


Figure 2: Reserves of the planning area in the Vasse-Wonnerup Ramsar site

The *Peel–Yalgorup System Ramsar Site Management Plan* (Peel-Harvey Catchment Council 2009) was officially launched in 2011. The *Busselton Wetlands Conservation Strategy* (WAPC 2005) provides a guide for sustainable land use and wise management of the Busselton Wetlands area, including the Vasse–Wonnerup Ramsar site. The department supports the strategies that are outlined in these documents where they relate to lands and waters vested in the Conservation Commission and will work with key stakeholders where possible to help in the implementation of the strategies.

### Desired outcome

The key values of the planning area are protected and conserved through the support of relevant legislation and policies.

### Management actions

1. Implement this management plan in accordance with relevant legislation and policy, including Commonwealth and international obligations.
2. Support complementary strategies in the *Peel–Yalgorup System Ramsar Site Management Plan* (Peel-Harvey Catchment Council 2009) and the *Busselton Wetlands Conservation Strategy* (WAPC 2005).

## 6. Management arrangements with Noongar people

The Conservation Commission and the department support joint management arrangements with traditional custodians. On 14 March 2012, the CALM Act was amended by the *Conservation Legislation Amendment Act 2011* to enable joint management of department-managed lands and other types of lands with Aboriginal people. The CALM Act, along with the department's *Policy Statement 87 - Aboriginal joint management* (DPaW 2015a) and *Guideline No. 11 – Development and management of Aboriginal joint management arrangements* (DPaW 2015b) provides the framework for how the department engages in joint management.

In June 2015, Indigenous Land Use Agreements (ILUAs) for the resolution of native title across the South West of Western Australia (the SWNT Settlement) were executed by the Minister for Environment, Director General of Parks and Wildlife, Chairs of the Conservation Commission and Marine Parks and Reserves Authority and other parties. The SWNT Settlement includes four of the native title claims over the management plan area: Gnaala Karla Booja (WC98/58), Southwest Boojarah #2 (WC06/4-1), Whadjuk (WC11/9) and Harris Family (WC96/41). Once the SWNT Settlement commences, native title rights and interests will be surrendered in exchange for a package of benefits contained within the ILUAs, including co-operative and joint management over parts of the conservation estate.

As part of the SWNT Settlement, the native title claim groups will be replaced by Regional Corporations and the South West Aboriginal Land and Sea Council will be replaced by a Central Services Corporation. The department will establish Cooperative Management Committees with the Regional Corporations, which will provide advice on the management of conservation estate within each Regional Corporation area. The Cooperative Management Committees will also identify and make recommendations for areas to be formally jointly managed under the CALM Act. The SWNT Settlement commits the department to entering into two formal joint management agreements under the CALM Act within each Regional Corporation area within ten years of the SWNT Settlement commencing. The Joint Management Bodies will have a more detailed and geographically focused management role than the Cooperative Management Committees, and will make management decisions that are consistent with the management plan for specific parks or reserves.

Should the department and the relevant Regional Corporation agree to enter into a joint management agreement for a park or reserve within this management plan area, then the joint management agreement relating to those parks or reserves will be attached to the management plan.

### Desired outcome

Involvement of Noongar people in the management of the planning area.

### Management actions

1. Work with Regional Corporations through the Cooperative Management Committees to gain Noongar input into the management of the conservation estate within the management plan area, including on priorities for joint management, the value of the land to the culture and heritage of Aboriginal people, relevant policies and procedures and the conduct of Aboriginal customary activities.
2. Identify and facilitate training, employment and economic development opportunities through cooperative management and joint management arrangements.
3. Implement the obligations in the SWNT Settlement regarding joint management of conservation estate.

## 7. Community involvement and off-reserve management

Community involvement and partnerships are an integral part of the department's operations, including the development and implementation of this management plan. A key objective for the department is to encourage and enhance community support for native flora and fauna in WA, by ensuring volunteer programs provide a significant contribution to protecting and conserving the State's parks, forests, wildlife and other natural assets. Community involvement is particularly important in the planning area, which is surrounded by heavily populated urban areas, and can contribute greatly to effective management of the reserves.

### Community involvement and support

The community was involved in the preparation of the draft management plan, with many community groups and members having provided advice on issues throughout the planning process and during the development of this final plan.

The Conservation Commission and Parks and Wildlife recognise the ongoing connection of Noongar people to the land of the planning area and encourages Noongar people to continue to use the land for cultural and recreational purposes (see Section 15. *Noongar culture and heritage*).

Ongoing community support is essential for the successful implementation of this management plan. Reserves within the Swan Coastal Plain provide many opportunities for community members to take part in volunteer activities such as:

- track maintenance, including 'adopt-a-track' programs (for example the track adoption program with four-wheel drive clubs)
- input into visitor planning
- campground hosting (for example at Yalgorup National Park)
- citizen science projects
- vegetation rehabilitation and weed removal
- fauna monitoring.

Volunteer activities increase the department's work capabilities and skills base, and are a valuable asset to the management of reserves. They also foster communication links, community ownership, sense of place and understanding with the community.



Members of Birdlife Australia mist netting for migratory birds. Photo – Paul Tholen/ Parks and Wildlife

## Off-reserve management and partnerships

Principles for effective neighbour relations are described in the department's *Good neighbour policy* (DEC 2007). It is important for fostering partnerships with the community that these principles be followed when managing the planning area. Management objectives for this plan cannot be achieved in isolation, as lands of varying tenure adjoin the planning area. In particular, the following activities need to be approached from the broader integrated land management perspective to achieve the management objectives for the planning area:

- catchment protection and water quality
- introduced species control
- threatened species protection
- visitor and fire management.

The department works with other land management agencies, neighbouring landholders and the local community to achieve effective and coordinated management of cross-boundary issues. Parks and Wildlife also liaises with the Australian Department of the Environment, which is responsible for the management of Ramsar wetlands, migratory bird species and threatened flora and fauna listed under the EPBC Act.

Several State Government agencies have responsibilities for, or provide advice on, land use practices near the planning area, including:

- declared problem animals and plants (Department of Agriculture and Food)
- drainage and water resource use (Department of Water).

Liaison with the local government authorities is especially important, given that local government:

- broadly represents the views of the communities within their jurisdiction
- is able to encourage planning and land management practices that complement management of the planning area
- along with local bushfire brigades and volunteers, works with the department to provide cooperative and coordinated firefighting on or near Parks and Wildlife-managed land
- shares responsibilities in the provision and maintenance of the public road network.

The planning area lies within the management regions of the Swan and South West natural resource management (NRM) groups (that is Perth NRM, Peel Harvey Catchment Council and South West Catchments Council) which, in partnership with government agencies, Aboriginal groups, land managers and community groups, help deliver federal and state government conservation funding programs. Financial grants from this initiative and effective partnerships such as GeoCatch (covering the Geographe Bay Catchment, see [geocatch.asn.au](http://geocatch.asn.au)), contribute significantly towards the management of the planning area.



Rehabilitation in the Peel area. Photo – Melissa Loomes/ Parks and Wildlife

Many threatened fauna species such as Carnaby's cockatoo (*Calyptorhynchus latirostris*) and the forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*) are highly mobile and travel across different land tenures in search of food, shelter or social interaction. Liaison with landholders will be important in implementing recovery actions for these species, particularly in increasing awareness about threatened species and providing information on actions that landholders can undertake to help in the recovery effort.

A range of covenant and voluntary management schemes (for example the department's Nature Conservation Covenant and Land for Wildlife schemes) help properties that are next to the planning area. These, along with the National Trust of Australia (WA)'s conservation covenant program, offer protection and linkage benefits for natural values as well as provide support and advice for landholders.

### Desired outcome

Community involvement and support benefits planning and management of the planning area.

### Management actions

1. Liaise with neighbours, local authorities, relevant agencies and other stakeholders to facilitate off-reserve conservation and the effective, coordinated management of cross-boundary issues.
2. Continue to provide and promote opportunities for volunteer and community involvement in management of the planning area.
3. Continue to administer the Canning River Regional Park Community Advisory Committee.
4. Continue to contribute towards Parks and Wildlife's volunteer database.
5. Consider seeking corporate sponsorship and other innovative funding arrangements for the planning area.

## 8. Performance assessment

The Conservation Commission will assess the implementation of this management plan in accordance with section 19(1)(g)(iii) of the CALM Act. The EPBC Act, through the Environment Protection and Biodiversity Conservation Regulations 2000, regulates the reporting of sites in Australia that are listed under the Ramsar Convention.

### Key performance indicators

A set of key performance indicators (KPIs) has been included to target the key components of this management plan. The KPIs reflect desired outcomes and objectives, while the management actions guide the department's contribution in achieving these. The KPIs are identified throughout the management plan and presented with performance measures, targets and reporting requirements. Any sustained change (that is, a continuous decrease or increase, for example to populations) will trigger the need for further investigation to determine the cause of that change. See the Conservation Commission's *Position Statement No. 9* for criteria on developing KPIs for management plans prepared under the CALM Act (Conservation Commission 2014) available at [www.conservation.wa.gov.au](http://www.conservation.wa.gov.au).

### Portfolio of data and information

The department is required to establish and maintain a portfolio of evidence relating to the KPIs, to measure the effectiveness of the implementation and management of actions. The first step is establishing adequate baseline data.

## 9. Administration

The day-to-day implementation of the management plan is the responsibility of the department's district managers and Regional Parks Unit's manager (for Matilda Bay Reserve and department-managed lands of Canning River Regional Park), who coordinate the operational management of parks and reserves of the planning area. The planning area is within the department's Swan Coastal, Perth Hills, Wellington and Blackwood districts.



## 10. Term of the plan

This management plan will guide management of the planning area for a period of 10 years from the date that a notice is published in the Government Gazette. During this time, amendments to the management plan may be made in accordance with section 61 of the CALM Act. If an amendment is necessary, the proposed changes will be released for public comment. At the end of the 10-year period, the management plan may be reviewed and a new plan prepared. In the event that the plan is not reviewed and replaced at the end of the 10-year period, this plan will remain in force until a new management plan is approved.

## 11. Tenure and proposed land arrangements

### Existing reserves

A summary of the parks and reserves for which this plan provides statutory management, is given below. A detailed list of the tenure for existing reserves of the planning area is provided in Appendix 1. All existing parks and reserves are vested in the Conservation Commission, with the exception of Boodalan Nature Reserve and areas of Canning River Regional Park. For the purpose of this management plan, the planning area is divided into the following three areas:

#### 1. Northern parks and reserves of the planning area (Map 2)

This area includes department-managed lands within the boundary of the Metropolitan Region Scheme. The administration of these parks and reserves is by the department's Swan Region and Regional Parks Unit (for Matilda Bay Reserve and department-managed lands of Canning River Regional Park). The total area of the existing reserves is about 2,077ha. The 19 parks and reserves, including 16 Bush Forever sites, are:

- 11 nature reserves, all <150ha, with the purpose of 'conservation of flora and fauna'
- one nature reserve >1,000ha with the purpose of 'conservation of flora and fauna'
- Leda Nature Reserve (438ha) with the purpose of 'conservation of flora and fauna'
- one nature reserve and three conservation parks in the Canning River Regional Park, totalling 111ha. The regional park has a total area of 242ha (excluding the 43ha waterbody that is the Canning River), which also includes other private and Crown land
- Matilda Bay and Keanes Point, two CALM Act section 5(1)g reserves nestled along the Swan River.

Matilda Bay and Keanes Point reserves and Canning River Regional Park form part of the Swan Canning Riverpark. The Swan Canning Riverpark includes the waterways, adjoining river reserve and public land of the Swan, Canning, Helena and Southern rivers.

#### Canning River Regional Park

Canning River Regional Park is south-east of Perth in the City of Canning. It extends for about 6km along both sides of the Canning River, from Nicholson Road in Cannington to Shelley Bridge (Leach Highway) in Riverton. The boundary of the Canning River Regional Park reflects the Parks and Recreation reservations of the Metropolitan Region Scheme. The Western Australian Planning Commission (WAPC) has responsibility for defining the boundary of the park through the Metropolitan Region Scheme, as well as for the acquisition of private land within the park. As the park is within the Development Control Area established by the *Swan and Canning Rivers Management Act 2006*, development within the park is subject to approval by either Parks and Wildlife or the Minister for Environment rather than the WAPC or the local government.

Lands within the park boundary are vested in government agencies or owned by private landholders. The regional park's current management areas and the management responsibilities for them are outlined in Appendix 2, with the intent being that the conservation areas are primarily managed by Parks and Wildlife. The department has liaised with the City of Canning in the development of this management plan, and the City will be further consulted about the implementation of management actions that specifically relate to Canning River Regional Park.



Canning River Regional Park in the northern parks and reserves section of the planning area.  
Photo – Grace Patornifi/ Parks and Wildlife

## 2. Central parks and reserves of the planning area (Map 3)

This area includes department-managed lands within the boundary of the Peel Region Scheme and Yalgorup National Park. Management of these parks and reserves is by the department's Swan Region. The total area of the existing reserves is about 17,827ha. The 27 parks and reserves are:

- 15 nature reserves of <150ha, including islands and wetlands, with the purpose of 'conservation of flora and fauna'. Boodalan Nature Reserve is jointly vested in the Conservation Commission and the Shire of Murray, with the purpose of 'recreation and conservation of fauna'.
- five nature reserves >150ha, with the purpose of 'conservation of flora and fauna', including two reserves >1,000ha along the banks of the Peel–Harvey Estuary
- Yalgorup National Park, extending in a north-south direction between 13km and 60km south of Mandurah, comprising three reserves totalling about 13,140ha
- two conservation parks, including Len Howard Conservation Park (67ha)
- two CALM Act section 5(1)g reserves, including one with the purpose of 'conservation and the protection of Aboriginal heritage and culture'.



Len Howard Conservation Park in the central parks and reserves section of the planning area.  
Photo – Melissa Loomes/ Parks and Wildlife

### 3. Southern parks and reserves of the planning area (Maps 4 and 5)

This area includes department-managed lands within the boundary of the Greater Bunbury Region Scheme and other reserves. The administration of these parks and reserves is by the department's South West Region. The total area of the existing reserves is about 2,405ha. The 36 parks and reserves are:

- 30 nature reserves of <150ha, including adjoining reserves along waterways and wetlands, and reserves that protect remnant vegetation, TECs and conservation significant species
- two nature reserves >150ha: Bengier Swamp Nature Reserve (536ha), and Locke Nature Reserve (200ha), both with the purpose of 'conservation of flora and fauna'
- Leschenault Peninsula Conservation Park, north of Bunbury, comprising two parcels of land totalling 580ha
- one unnamed CALM Act section 5(1)g reserve
- two CALM Act section 5(1)h reserves, including one for the purpose of 'Tuart conservation and restoration'.



Broadwater Nature Reserve in the southern parks and reserves section of the planning area.  
Photo – Melissa Loomes/Parks and Wildlife

### Proposed changes and additions

The existing and proposed parks and reserves will be managed to achieve biodiversity objectives that are consistent with the *Australia's Biodiversity Conservation Strategy 2010–2030* (Natural Resource Management Ministerial Council 2010) and the *Australia's Strategy for the National Reserve System 2009-2030* (Natural Resource Policies and Program Committee 2009), which was endorsed by the Natural Resource Management Ministerial Council.

Creation of a conservation reserve system that is comprehensive, adequate and representative (CAR) helps meet obligations under the United Nations Convention on Biological Diversity (the Rio Convention), to which Australia is a signatory.

The planning area lies within the Swan Coastal Plain Interim Biogeographic Regionalisation for Australia (IBRA) region. As at 2014, 10.8 per cent of the Swan Coastal Plain IBRA region was protected for conservation (that is categorised as IUCN I-IV and within department-managed lands) (Government of Western Australia 2014). All proposed additions will help in increasing the proportion of parks and reserves in the formal CAR reserve system for Western Australia, which is guided by *Policy Statement 31 – Terrestrial conservation reserve system* (DPaW 2015c). Many of the parks and reserves are small and/or narrow and their consolidation through additions would allow more effective management. Of the 30,312ha of tuart woodland remaining on the Swan Coastal Plain, 8,852ha (or 29 per cent) will be part of the planning area.

Proposed changes to existing reserves and additions within the planning area are summarised below. More details are listed in Appendix 3 and shown on maps 3, 4 and 5. Reserve changes proposed in this management plan are consistent with the *Forest Management Plan 2014–2023* (Conservation Commission 2013). In addition, lands such as unused road reserves, unallocated Crown land (UCL) and other Crown land may be considered for addition to the planning area if it supports the desired outcomes of this management plan. As proposed additions listed in Appendix 3 become vested in the Conservation Commission, they will be managed in accordance with this management plan.

### Northern parks and reserves of the planning area

The expansion of small fragmented reserves, through the consolidation of vegetated land parcels, will help support the desired outcomes of this management plan. Many areas of land have been identified as Bush Forever sites and bought by WAPC (Government of Western Australia 2000a). The planning area may be expanded through the acquisition and incorporation of unmade road reserves, UCL and other Crown land, if such additions will help in protecting regionally significant environmental values, or include poorly represented areas of the region.

Any regional park changes or proposed additions, such as Bush Forever sites, will be investigated and vested in the appropriate vesting authority. An area of regional open space (ROS), also part of Bush Forever site No. 224, between Nicholson Road in Cannington to Roe Highway in Beckenham is being reviewed for potential addition to Canning River Regional Park. This ROS of about 90ha, situated along the banks of the Canning River, includes Hester Park and Beckenham Open Space. The subject land is mostly owned by WAPC with some areas of public recreation managed by the City of Gosnells (for example Hester Park). The future management arrangements of the subject land have not been determined though the intention is for the ROS to be vested and/or managed by the City of Gosnells and/or the Department of Parks and Wildlife.

### Central parks and reserves of the planning area

Proposals to incorporate portions of Myalup State Forest (No. 16) into Yalgorup National Park originated from previous planning documents (DCE 1983, CALM 1994, Conservation Commission 2004). Areas of native vegetation in Myalup State Forest, outside those identified in the above documents, should also be considered as future additions to Yalgorup National Park.

The EPA (2010) commented that the Yalgorup lakes system should be protected by increasing and consolidating the area of Yalgorup National Park through the acquisition and incorporation of lands adjacent to the lakes and/or lands that contain internationally, nationally or regionally significant environmental values. This would help support the desired outcomes of this management plan and rationalise park boundaries.

Boodalan Nature Reserve (Reserve 33749), an island reserve in the Peel Inlet, is jointly vested in the Conservation Commission and the Shire of Murray, and has a purpose of ‘recreation and conservation of fauna’. The current state of the reserve is that it appears to be predominantly submerged at low tide and fully submerged at high tide. This management plan proposes that this be investigated and if appropriate, the purpose is amended accordingly or the nature reserve is delisted/abolished.

Since the 1980s, the State Government and community have recognised the need to protect and manage areas surrounding the Peel Inlet and Harvey Estuary as a proposed regional park. Planning for the proposed Peel Regional Park progressed through the *Peel Regional Park – Proposal for Establishment, Administration and Use* (DPUD 1993) report, and was further detailed in the Inner Peel Region Structure Plan in 1997. The proposed Peel Regional Park comprises terrestrial areas reserved as ‘Regional Open Space’ as well as marine areas reserved as ‘Waterways’ under the Peel Region Scheme. The park will comprise about 6,000ha of land surrounding the Peel Inlet and Harvey Estuary, as well as about 14,000ha of the estuary and waterways themselves. The park will be managed for conservation and recreation purposes across a range of different tenures. It is proposed that Parks and Wildlife will coordinate management of the Peel Regional Park according to a management plan prepared under the CALM Act and in consultation with stakeholders. The management plan will provide the statutory framework for management of those lands within the regional park vested in the Conservation Commission and also provide direction for other agencies in managing their lands in the park. Consultation on park management issues including final park boundaries and a new park name will also occur during this process.

### Southern parks and reserves of the planning area

Many of the proposed additions arise from long-standing recommendations from previous management plans or planning documents (CTRC 1974, EPA 1993, CALM 1998a, Conservation Commission 2004, DoP 2005). Proposed additions have also been identified, based on more recent assessments of known natural, cultural and social values, and the threats to these values.

WAPC (2005) supports action to improve linkages and/or wildlife corridors between Tuart Forest National Park and Wonnerup Estuary. In addition, expanding the planning area around the Vasse-Wonnerup wetlands system would improve, and help in the protection of, the environmental and landscape values. Freehold land (where available), unused road reserves, Crown land and unvested reserves close to wetlands, and/or that contain internationally, nationally and regionally significant environmental values, should be considered for acquisition.

Planning for a proposed Leschenault Regional Park is progressing through the preparation of an Establishment Plan by the Department of Planning, in consultation with the Department of Parks and Wildlife, local governments and other stakeholders. The park will comprise about 2,146ha of land reserved as 'Regional Open Space' in the Greater Bunbury area that surrounds the Leschenault Estuary, including Leschenault Peninsula Conservation Park (Reserve 42470) and inland along the foreshores of the Collie and Brunswick rivers. The aims of the Establishment Plan are to identify the need for and the values of the park, define the lands proposed for inclusion in the park and propose a model for the vesting and management of the park.

### Desired outcome

The key values of the planning area are protected by applying to the reserves the most appropriate tenure, class and purpose, and progressing the proposed additions as appropriate to increase the resilience of the reserves.

### Management actions

1. Cooperate with relevant agencies towards achieving a comprehensive, adequate and representative reserve system, through Bush Forever and other land planning processes.
2. Continue to promote and encourage integrated management of parks and reserves with adjoining landowners and other key stakeholders.
3. Continue to promote and encourage integrated management of the Canning River Regional Park with relevant government agencies, local government and private landowners, and develop subsidiary management documents, in accordance with this plan.
4. Subject to the public consultation phase and appropriate government processes, consider ratifying reserve names for provisionally named reserves and give consideration to the naming process for other un-named reserves.
5. In consultation with the Shire of Murray, monitor Boodalan Nature Reserve and if required, amend its tenure as outlined above.
6. Progress and implement the proposed additions to the conservation estate as listed in Appendix 3.
7. Manage the proposed additions that become vested in the Conservation Commission in accordance with this management plan and applicable legislation. Other proposed additions not listed in Appendix 3 will also be managed in accordance with this management plan.
8. Identify adjacent areas of regionally significant bushland, which also strengthen ecological linkages, for potential acquisition and reservation under the CALM Act.



# Managing the natural environment

This chapter describes the natural values of the planning area, the management issues related to these values and the management actions proposed by the department to address these issues.

For many parks and reserves on the Swan Coastal Plain, there is a need for a biodiversity inventory, consolidation of information, and analysis and monitoring of conservation status and ecosystem condition. This is particularly important for obtaining quantitative benchmark information on hydrological regimes and plant requirements (particularly in estuarine systems), introduced and other problem animals, and interactions between fire and weeds to determine appropriate post-fire weed control in small remnant reserves.

The EPA has previously estimated that some 80 per cent of the wetlands on the Swan Coastal Plain have been lost or irreversibly degraded (EPA 2004). More than 97 per cent of the heavier, more fertile soils on the eastern side of the Swan Coastal Plain have been cleared (CALM 1990, cited in Keighery and Trudgen 1992). Information on flora and fauna can be found on the NatureMap database (see [naturemap.dpaw.wa.gov.au/](http://naturemap.dpaw.wa.gov.au/)), which is a joint project of Parks and Wildlife and the Western Australian Museum.

## 12. Physical environment

### Climate change

Long-term climate variability is affecting the south-west of WA, which is experiencing a trend of increasing temperatures and declining rainfall. The number of days hotter than 40°C has been increasing since the 1990s and late autumn and winter rainfall has been decreasing (CSIRO 2012). The EPA (2007) stated that by 2030 there will be an up to 2°C rise in temperature in all seasons and that there will be a 20 per cent reduction in winter rainfall from 1960 to 1990 levels.

Climate change may have significant effects on the key values of the planning area. The major effects of a warming and drying climate that are relevant to the planning area are:

- an increase in incidence and intensity of bushfires
- altered hydrological regimes, particularly decreasing watertables and streamflow, which in turn affects maintenance of critical habitat (such as wetlands) for many flora and fauna species of conservation value
- the risk of inundation of low-lying areas from sea level rises.

The coastline of Geographe Bay (Kay *et al.* 1992) and the coastline within the local government authorities of Mandurah, Rockingham, Bunbury and Busselton, is particularly vulnerable to erosion (Climate Commission 2011).

While there is limited knowledge about the resilience of natural systems to anticipated climate changes, protecting natural areas and maintaining their ecosystem functions can help to decrease its vulnerability to climate change. This management plan proposes the following strategies to help improve the resilience of species and ecosystems in general and subsequently help ecosystems cope with the effects of climate change:

- expansion of reserves of the planning area
- controlling introduced and problem plants and animals
- maintaining critical habitat (for example wetlands)
- planning appropriate fire management
- continuing re-introduction programs.

## Geomorphology

The planning area is within the physiographic unit of the Swan Coastal Plain. This unit, characterised by a generally subdued topography, is formed almost entirely of river (fluvial) and windblown (aeolian) depositional material. Within the extent of the planning area there are four distinct landforms that are roughly parallel to the coast. They are described in work by McArthur & Bettenay (1974) and summarised below.

The four landforms, from east to west, are:

- the Pinjarra Plain - formed by river transported unconsolidated clayey alluvium and three generations of dunes;
- the Bassendean Dune System - the oldest dune system, a gently undulating aeolian sand plain that has been leached of carbonate leaving mostly quartz sand;
- the Spearwood Dune System - consists of slightly calcareous (contains carbonate) aeolian sand; and
- the Quindalup Dune System - the youngest dune system, consists of sand dunes or ridges formed by windblown unconsolidated calcareous and quartz beach sand.

The Pinjarra Plain is the most common landform on the Swan Coastal Plain, yet the least represented in the formal conservation reserve system (EPA 2006, Webb *et al.* 2009). Any additions to the planning area on the Pinjarra Plain will help in the management of small and fragmented parks and reserves, as well as protecting regionally significant environmental values.

## Hydrology

The planning area covers several catchments within the Swan Coastal Plain and contains a complex mosaic of estuaries, rivers, tributaries and wetlands. The rivers and wetlands have economic, recreational and environmental values.

The major rivers that cross the planning area originate east of the Darling Scarp and flow to the ocean. On the Swan Coastal Plain, surface run-off and groundwater discharge contribute to the flows within these rivers and their tributaries. The major rivers and some tributaries are perennial, having greater flows in winter than in summer, but some rivers and tributaries are also fed by drainage corridors all year round. A major component of the summer flows is from groundwater discharge (Davidson 1995). The wetlands, such as lakes and swamps, have formed along the boundaries of the dune systems, though some wetlands occur within the dune systems (McArthur & Bettenay 1974, Davidson 1995). Many of these wetlands are dependent on groundwater.

Wetlands with key values in the planning area are:

- Ramsar-listed Peel–Yalgorup and Vasse–Wonnerup wetland systems
- six wetlands listed in the *Directory of Important Wetlands in Australia* (Environment Australia 2001):
  - Swan Canning Estuary (CALM 1999a)
  - Brixton Street Swamps (form part of Kenwick Wetlands Nature Reserve)
  - Peel–Harvey Estuary
  - Yalgorup Lakes System
  - Benger Swamp
  - Vasse–Wonnerup Wetland System.

About 80 per cent of the existing planning area contains conservation category wetlands identified in the department's *Geomorphic Wetlands Swan Coastal Plain* dataset (see [www.dpaw.wa.gov.au/management/wetlands/](http://www.dpaw.wa.gov.au/management/wetlands/)).

The specific limits of acceptable change identified in Hale and Butcher (2007) for Peel–Yalgorup system Ramsar site and in WRM (2007) for Vasse–Wonnerup system Ramsar site will be used where possible as indicators of change for the key performance indicator for hydrology.

An understanding of surface water and groundwater flows is essential for conservation management of these wetlands, some of which also contain declared rare flora, threatened fauna and TECs. About two-thirds of EPBC Act listed TECs are associated with groundwater or surface water dependent ecosystems (V. English [Parks and Wildlife] 2012, pers. comm.) - for the list of TECs endorsed by the Minister for Environment (May 2014) see [www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities](http://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities). Groundwater dependent ecosystems may be affected by local and regional changes in groundwater flow (DoW 2009), while others, such as, Benger Swamp, can be impacted by irrigation (see Section 14. *Protecting the natural environment - Altered hydrological regimes*).

The Department of Water (DoW) is responsible for the management and protection of WA's water resources (see Section 26. *Water resources*). Close liaison with DoW with regard to allocation and catchment protection planning is needed to ensure that conservation values and their hydrological requirements are understood and met.

Parks and Wildlife protects and manages the Swan Canning Riverpark, which includes the Canning River, in partnership with other government agencies, community groups, private landowners and other stakeholders. The Swan River Trust is an advisory body, providing planning and strategic advice to the Minister for Environment and to the Director General of Parks and Wildlife. For more information on the Swan River Trust, see [www.swanrivertrust.wa.gov.au/](http://www.swanrivertrust.wa.gov.au/).



Floodgates in the Vasse-Wonnerup Ramsar site. Photo – Kym Pearce/ Parks and Wildlife

### Desired outcome

Geomorphological and hydrological values of the planning area are protected and conserved.

### Management actions

1. Keep informed of current knowledge and contemporary management approaches in relation to climate change and its tangible effects on the natural ecosystems in the planning area.
2. Identify and protect geological features and soil types vulnerable to environmental damage (such as coastal dunes and/or riparian areas) and assess and mitigate the potential effects on these from land uses, proposed developments and other activities.
3. Work with key stakeholders to maintain or improve the ecological character of Ramsar sites, and the condition and key values of conservation category wetlands (and/or wetlands in the *Directory of Important Wetlands*) on department-managed lands.
4. Work closely with the DoW and other key stakeholders to monitor hydrological regimes of surface water and groundwater through the measurement of water parameters taken at bores, gauging stations, weirs and other water sampling points; use this information to increase understanding of potential hydrological impacts and requirements to protect key conservation values.



5. Engage with stakeholders in relation to water quality and quantity to promote good relations, and to provide advice and direction for policy and development as necessary to protect conservation values. The stakeholders include:
  - a) Department of Water
  - b) Water Corporation
  - c) Harvey Water
  - d) NRM groups
  - e) Local governments.
6. Develop and implement programs to monitor the condition of conservation category wetlands.
7. Develop a priority list of wetlands needing management actions or interim management guidelines, with priorities based on wetlands at highest risk (probability and consequence) from threatening processes including water quality, weeds, inappropriate fire regimes and groundwater decline.
8. Prioritise sites for management where improved knowledge is needed to understand the hydrology of critical habitat and develop appropriate hydrological regimes to protect key values, especially habitat for migratory birds.

#### Key performance indicator

Performance measure	Target	Reporting requirement
Hydrology and/or water quality limits of acceptable change for Ramsar wetlands	Limits of acceptable change are not exceeded	Every five years

## 13. Biological environment

Management actions are guided by the department's *Policy Statement 35 – Conserving threatened species and ecological communities* (DPaW 2015d) and *Guideline No. 35 – Listing and recovery of threatened species and ecological communities* (DPaW 2015e). Information on species, including species of conservation significance, is provided on the NatureMap database (see [naturemap.dpaw.wa.gov.au/](http://naturemap.dpaw.wa.gov.au/)).

### Native plants and plant communities

The planning area is within the South-West Botanical Province, which supports an estimated 5,700 taxa of vascular plants, representing two-thirds of the estimated plant taxa in WA (Hopper *et al.* 1996, Beard *et al.* 2000). About 79 per cent of the plant taxa in the South-West Botanical Province are endemic to the province (Beard *et al.* 2000).

The southern portion of the planning area (also referred to as the Busselton Plain, which is the southern-most portion of the Swan Coastal Plain IBRA region (Webb *et al.* 2009)) is part of the Busselton-Augusta hotspot, one of 15 of Australia's national biodiversity hotspots (DotE 2015). The entire planning area is part of the South-West Australia biogeographic region, Australia's only internationally recognised biodiversity hotspot and one of 35 in the world.

The planning area is species rich and has north–south and east–west variation in species and vegetation complexes distribution. There are high levels of diversity and endemism with all threatened species being endemic or restricted to the Swan Coastal Plain, individual geomorphic units or the south-west region. The Pinjarra Plain is floristically the most diverse landform (Keighery & Keighery 1991, Webb *et al.* 2009). Significant principal distributions are centred on claypans and vernal pools, relictual wetlands, and deep sands. Although some plants are rare because of their requirement for a specific restricted habitat, the majority have become rare or threatened because of the activities of humans. Continued land clearing, plant diseases (particularly *Phytophthora* spp.), weeds and introduced and other problem animals, road works, utility servicing and upgrades, urbanisation, grazing by domestic stock and changes to hydrological regimes continue to impact flora and ecological communities.

As part of some floristic studies on the Swan Coastal Plain over the past 20 years (for example Gibson *et al.* 1994) to provide more detailed knowledge of the conservation status of species and communities, permanent plots have been set up to delimit floristic community types across the study areas. Many of these studies have been used for a ‘whole-of-government’ approach for the protection of flora (for example Bush Forever and Swan Bioplan). The Conservation Commission’s *Forest Management Plan 2014–2023* (Conservation Commission 2013) provides a detailed background on several studies that have led to recommendations for the protection of specific areas. Floristic reports from the Government of Western Australia (2000b), Keighery *et al.* (2006) and Webb *et al.* (2009) help to consolidate flora knowledge, identify information gaps, and summarise knowledge on naturally significant areas around the Perth metropolitan area, the Peel–Harvey eastern estuary area and the Busselton Plain.

### Flora of conservation significance

The planning area contains the following conservation significant species:

- 45 species of ‘rare flora’ declared and listed under the Wildlife Conservation Act (that is *Wildlife Conservation (Rare Flora) Notice 2015*) – including 25 critically endangered species (for example *Darwinia whicherensis* and *Verticordia plumosa* var. *ananeotes*), eight endangered species (for example *Diuris purdiei* and *Macarthuria keigheryi*) and 12 vulnerable species (for example *Grevillea elongata* and *Tetraria australiensis*); 41 of these species are also listed under the EPBC Act.
- 152 priority species.

Current conservation efforts are primarily targeting threatened species, most of which have national or interim recovery plans or conservation advices which identify threats and recommend actions to protect the species. A list of recovery plans can be found on the department’s website, [www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/198-approved-interim-recovery-plans](http://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/198-approved-interim-recovery-plans). Recovery actions include field surveys, mapping and monitoring of populations, translocations, identifying appropriate fire management regimes, weed management, minimising the effects of development, and controlling access for recreation and utilities.



*Calytrix breviseta* subsp. *brevisetata* (critically endangered under the Wildlife Conservation Act). Photo – Parks and Wildlife

## Plant communities

Vegetation complex mapping of the Swan Coastal Plain was completed by Heddle *et al.* (1980) and takes into account soils, landforms and floristics. More detailed studies of floristic communities present on the southern Swan Coastal Plain were prepared for the Bush Forever and Swan Bioplan projects and some studies were completed by Gibson *et al.* (1994).

Tuart conservation within the planning area is of particular significance. Although tuart stands and tuart woodlands in general are not formally listed, the species is restricted to the Swan Coastal Plain and only 35 per cent of the pre-European extent of tuart woodlands and forests remain (CALM 2003a). Large tracts of tuart-dominated forest and woodlands exist in Yalgorup National Park and the surrounding reserves. The southern limit of the tall tuart forest on the Swan Coastal Plain is the Tuart Forest National Park (DPaW 2014). Mature tuarts are highly valued for conserving biodiversity, especially in sustaining viable populations of fauna that rely on large tree hollows, as well as for maintaining ecosystem function and providing connectivity between remnant vegetation.

In recent years, tuarts in Yalgorup have suffered a significant decline in health including poor crown condition, death and reduced sapling regrowth. This may be a result from a combination of biotic and abiotic factors such as habitat loss and fragmentation, changes in land management (for example fire management and forestry practices), changes in hydrology, problem animals, pathogens and climate change (Barber & Hardy 2006).



Tuart tree (*Eucalyptus gomphocephala*). Photo – Parks and Wildlife

Fringing vegetation, which acts as buffers around lakes, rivers and ephemeral wetlands, is considered to be of high conservation value. In the planning area, the vegetation in buffers range from degraded to very good condition. Fringing vegetation is not only an important part of wetland ecosystem function, but is also a transition zone between wetland and upland communities and provides valuable ecological linkages. Some wetland plant communities are under threat because of grazing (current and previous regimes), changing hydrology, salinity, weeds and inappropriate recreation activities.

Additional ecosystem monitoring is needed to establish baseline data for many of the parks and reserves of the planning area, particularly on small fragmented reserves. Some opportunities exist to monitor and/or identify possible locations of ecological communities through remote sensing, spatial modelling and predictive mapping.

The Swan Coastal Plain is altered to such an extent that much of the remnant vegetation is regionally significant and needs some level of protection (EPA 2006). Recommended additions to the conservation reserve system include areas that support vegetation types that are significant and not well represented in the planning area or in the conservation reserve system.

**Desired outcome**

Native plants and plant communities in the planning area are identified, protected and conserved.

**Objective**

Maintain or improve the population size of threatened flora species.

**Management actions**

1. Establish vegetation monitoring programs (or systematic flora surveys) with a focus on threatened species and communities, that are linked where possible to fauna monitoring, and that inform adaptive management.
2. Consolidate existing information and maintain a spatial inventory of plant species and communities that may need special protection (for example NatureMap).
3. Undertake a strategic threat analysis on threatened flora as a basis to prioritise and implement management actions to mitigate threatening processes, namely weeds, disease, native and introduced species, grazing and inappropriate fire regimes.
4. Develop, implement and review recovery plans for species of conservation significance, where practical.
5. Provide advice on land use planning processes including statutory planning, environmental impact assessments and applications for clearing permits to ensure that biodiversity values are maintained, and monitor relevant conditions placed on approvals.
6. Encourage rehabilitation of:
  - a) areas that contribute to the viability of threatened species and communities;
  - b) disturbed areas, particularly those associated with wetland and riparian areas, using local provenance material where possible
  - c) degraded tuart stands
  - d) banksia woodlands
  - e) small remnants.
7. Periodically monitor and evaluate vegetation condition to assess and inform rehabilitation efforts.
8. Protect mature tuart trees by limiting threats that reduce resilience of tuart ecosystems, and monitor tuart health and adapt management practices to new knowledge gained through research.

**Key performance indicator**

Performance measure	Target	Reporting requirement
The persistence and conservation status of populations of threatened (i.e. rare) flora in the planning area	Subject to natural variation and/or taxonomic changes, there is a recovery and/or maintenance of viable populations of threatened flora	Every five years, or as per recovery plan(s)

**Native animals and habitats**

Research on the Swan Coastal Plain (for example How & Dell 1993) indicates that fauna have particular habitat and spatial requirements and respond poorly to the effects of fragmentation and its associated impacts, such as fire, weeds, competitors and predators. Therefore a primary aim for fauna management within the planning area is the expansion and protection of existing habitats and rehabilitation of degraded areas.

Birds are the most studied fauna group in the planning area. Baseline fauna data, with a focus on mammals in large reserves and on reptiles, is needed for a better understanding of the status of fauna populations in the planning area.

## Fauna of conservation significance

The planning area contains the following fauna species of conservation significance:

- 23 threatened and other specially protected fauna taxa listed under the Wildlife Conservation Act (that is *Wildlife Conservation (Specially Protected Fauna) Notice 2015*) (\*also listed under the EPBC Act):
  - Four mammals – chuditch\* (*Dasyurus geoffroii*), western ringtail possum\* (*Pseudocheirus occidentalis*), south-western brush-tailed phascogale (*Phascogale tapoatafa* subsp.) and Australian sea-lion (*Neophoca cinerea*)
  - 13 birds – Australasian bittern\* (*Botaurus poiciloptilus*), curlew sandpiper (*Calidris ferruginea*), great knot (*Calidris tenuirostris*), lesser sand plover (*Charadrius mongolus*), fairy tern\* (*Sterna nereis nereis*), Baudin’s cockatoo\* (*Calyptorhynchus baudinii*), Carnaby’s cockatoo\*, forest red-tailed black cockatoo\*, red-tailed tropicbird (*Phaethon rubricauda*), grey-tailed tattler (*Tringa brevipes*), southern giant petrel\* (*Macronectes giganteus*), eastern curlew (*Numenius madagascariensis*) and peregrine falcon (*Falco peregrinus*)
  - Two reptiles – loggerhead turtle\* (*Caretta caretta*) and leatherback turtle\* (*Dermochelys coriacea*)
  - Two insects – both bee species (*Leioproctus douglasiellus* and *Neopasiphae simplicior*)
  - One crustacean – Dunsborough burrowing crayfish\* (*Engaewa reducta*)
  - One mollusc – Carter’s freshwater mussel (*Westralunio carteri*)
- 15 priority species:
  - Two Priority 1 – a cricket (*Pachysaga strobila*) and fish, pouched lamprey (*Geotria australis*)
  - Four Priority 3 – two reptiles, a fish and a bird: lined skink (*Lerista lineata*), black-striped snake (*Neelaps calonotos*), black-stripe minnow (*Galaxiella nigrostriata*) and masked owl (SW ssp) (*Tyto novaehollandiae novaehollandiae*)
  - Seven Priority 4 – three mammals, three birds and one insect: western false pipistrelle (*Falsistrellus mackenziei*), water-rat (*Hydromys chrysogaster*), western brush wallaby (*Macropus irma*), blue-billed duck (*Oxyura australis*), hooded plover (*Charadrius rubricollis*), little bittern (*Ixobrychus minutus*) and graceful sun-moth (*Synemon gratiosa*)
  - Two Priority 5 – two mammals: southern brown bandicoot (quenda) (*Isodon obesulus fusciventer*) and tammar wallaby (*Macropus eugenii derbianus*)

Wetlands on the Swan Coastal Plain are important habitats for birds. The Peel–Harvey Estuary, the Yalgorup lakes, Benger Swamp and the Busselton wetlands have been identified as ‘important bird areas’ (IBAs), which are sites of international importance for bird conservation for resident waterbirds and migratory shorebirds. IBAs are small enough to be practical targets for conservation management but large enough to meet the global IBA criteria (criteria are defined in Dutson *et al.* 2009; see [www.birddata.com.au/iba.vm](http://www.birddata.com.au/iba.vm) for more details of each IBA).



White-faced heron (*Egretta novaehollandiae*). Photo – Babs and Bert Wells

The Peel–Yalgorup system regularly supports in excess of 20,000 birds annually. Within this site, the Peel–Harvey Estuary support 86 species, with 29 migratory species listed under international agreements and an additional 32 species included on the national list of migratory species under the EPBC Act (Hale & Butcher 2007). The Vasse–Wonnerup system regularly supports between 25,000 and 35,000 waterbirds annually, including 40 species that have priority conservation status at a state, national or international level (WRM 2007). Benger Swamp is the only location on the Swan Coastal Plain known to support the critically endangered Australasian bittern. It is also one of seven known breeding sites in the south-west for the freckled duck (*Stictonetta naevosa*). Bird monitoring has been occurring for many years at wetlands on the Swan Coastal Plain (refer to Jaensch 1986, Scopewest – Storey *et al.* 1993, Lane *et al.* 2007).

The specific limits of acceptable change identified in Hale & Butcher (2007) for Peel–Yalgorup system Ramsar site and in WRM (2007) for Vasse–Wonnerup system Ramsar site will be used where possible as indicators of change for the key performance indicator for fauna.

The department has recovery plans for five species of conservation significance in the planning area – the chuditch, Carnaby’s cockatoo, the forest red-tailed black cockatoo, Baudin’s cockatoo and the western ringtail possum (see [www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/197-approved-recovery-plans](http://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/197-approved-recovery-plans)). National recovery plans have been released for the southern giant petrel (SEWPac 2011), the Australian sea lion (SEWPac 2013) and the loggerhead turtle (Environment Australia 2003).



Western ringtail possum (*Pseudocheirus occidentalis*). Photo – Paul Tholen/ Parks and Wildlife

The Department of the Environment (then Department of the Environment, Water, Heritage and the Arts) released an EPBC Act policy statement in 2009 about the western ringtail possum, to help in determining whether proposed actions are likely to have significant impacts on the species (DEWHA 2009).

The policy statement identifies the four main threats to the western ringtail possum: habitat loss and fragmentation, predation by foxes (*Vulpes vulpes*) and cats (*Felis catus*), altered fire regimes and competition with the common brushtail possum (*Trichosurus vulpecular*). Other major threats include urbanisation and associated threats such as removal of *Agonis flexuosa*, reduced canopy connection, roadkill and domestic animal attack. The southern part of the Swan Coastal Plain is considered to be important for the western ringtail possum because of a number of unique characteristics, including the highest known population densities, high quality peppermint (*Agonis flexuosa*) habitat, and areas of habitat where the brushtail possum does not co-occur and therefore does not compete for resources; the area also supports the biggest known population of western ringtail possums, which may form a critical resource for survival of the species (DEWHA 2009). Leschenault Peninsula Conservation Park and Yalgorup National Park are translocation sites for the western ringtail possum, where individuals are being monitored and studied for research purposes.

## Ecological linkages

Ecological linkages (described in Molloy *et al.* 2009) aim to link significant bushland patches to contribute to the retention and viability of native vegetation and fauna habitat. Such linkages will help in reducing habitat fragmentation and the loss of biodiversity and key ecological function (EPA 2009). The ecological linkages in the planning area will be protected and improved through the expansion of the existing reserves with the proposed additions. The proposed additions will help consolidate fragmented vegetated land parcels and improve the resilience of such areas.

Ecological linkages within the planning area provide a stepping stone of habitats to help in maintaining ecological processes by providing migratory routes for fauna, green belts to limit effects of urbanisation on species and ecological communities, access to areas containing seasonally variable food and other resources, and a refuge from major disturbances. The refuge function is especially relevant with regard to large bushfires and potential long-term effects of global warming.

The South West Regional Ecological Linkages Project recognises a series of regionally significant ecological linkages across the south-west landscape (Molloy *et al.* 2009). Ecological linkages within the planning area function in a north–south and/or east–west direction. Rivers and associated riparian vegetation are often the most contiguous ecological linkages and wetlands within the planning area can provide linkages in a regional and international context.

Vegetation of the Quindalup Dunes and, to a lesser extent, the Spearwood Dunes, retains some relatively contiguous ecological linkages, particularly through Yalgorup National Park and Canning River Regional Park. Elsewhere the landscape is highly fragmented and therefore maintenance and expansion of conservation reserves, and strategic restoration of existing bushland for ecological function, is considered a priority.

## Desired outcome

Native animals and habitats in the planning area are protected.

## Objective

Maintain or improve the conservation status of threatened and priority listed fauna species.

## Management actions

1. Consolidate existing information and maintain a spatial inventory of fauna species that may need special protection (for example NatureMap).
2. Develop, implement and review recovery plans for specially protected species, where practical.
3. Identify gaps in knowledge of fauna composition, abundance and distribution, and undertake, support or encourage systematic fauna surveys that are linked to a monitoring program.
4. Expand and protect existing habitats and rehabilitate degraded areas to a standard suitable for fauna habitat, on a priority basis.
5. Undertake a strategic threat analysis of threatened fauna as a basis for prioritising and implementing management actions to mitigate threatening processes, namely weeds, disease, native and introduced species, grazing and inappropriate fire regimes.
6. Undertake or support further systematic biological surveys, or monitoring of the internationally important wetlands.

### Key performance indicators

Performance measure	Target	Reporting requirement
The persistence and conservation status of populations of threatened (i.e. rare, Priority one and Priority two) fauna species in the planning area	No local extinction of threatened fauna populations	Every five years, or as per recovery plans
Changes in species diversity of migratory waterbirds in the planning area	Subject to local natural variation, no sustained decrease from known levels in the diversity of migratory waterbirds	Every five years
Biological limits of acceptable change for Ramsar wetlands	Limits of acceptable change are not exceeded	Every 5 years

### Ecological communities

The planning area contains the following threatened and priority ecological communities:

- 19 threatened ecological communities listed in WA (that is List of Threatened Ecological Communities endorsed by the Western Australian Minister for Environment, correct to June 2015) – comprising five critically endangered communities (for example *Corymbia calophylla* – *Kingia australis* woodlands on heavy soils, Swan Coastal Plain community type 3a - Gibson *et al.* 1994), six endangered communities (for example *Banksia attenuata* woodland over species rich dense shrublands, Swan Coastal Plain community type 20a - Gibson *et al.* 1994) and eight vulnerable communities (for example *Corymbia calophylla* woodlands on heavy soils of the southern Swan Coastal Plain); eight of these communities and the priority ecological community ‘Subtropical and Temperate Coastal Saltmarsh’ are also listed under the EPBC Act.
- 12 priority ecological communities.



Southern wet shrublands, an endangered ecological community. Photo – Parks and Wildlife



Thrombolite (Stromatolite-like microbialite) community of a coastal brackish lake (Lake Clifton), a critically endangered ecological community. Photo – Kym Pearce/ Parks and Wildlife



More data are needed on priority (potentially threatened) ecological communities to determine their conservation status and a risk assessment is needed to determine where to focus efforts. Recovery plans have been prepared by Parks and Wildlife for all ecological communities that are ranked critically endangered in WA. Recovery plans have also been developed for most of the TECs ranked as endangered and some that have been ranked as vulnerable, on an ‘as needs’ basis and as resources permit (see [www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/198-approved-interim-recovery-plans](http://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/198-approved-interim-recovery-plans)).

**Desired outcome**

Ecological communities of conservation significance are identified, protected and conserved.

**Objective**

Maintain or improve the integrity (condition class and extent) and threat rank of TECs in the planning area.

**Management actions**

1. Develop, implement and review recovery plans for TECs.
2. Identify and protect threatened and priority ecological communities, and monitor their extent and condition (for example vegetation condition scale as per Bush Forever).
3. Undertake a strategic threat analysis of TECs as a basis for prioritising and implementing management actions to mitigate threatening processes, namely weeds, disease, native and introduced species, grazing and inappropriate fire regimes.

**Key performance indicator**

Performance measure	Target	Reporting requirement
Extent and condition of threatened ecological communities	No decline in extent or overall condition of threatened ecological communities	Every five years

## 14. Protecting the natural environment

### Altered hydrological regimes

Threats to the hydrological integrity of wetlands in the planning area include changes to groundwater and surface water flows, changes to water quality, artificial drainage corridors, encroachment of urban and rural development, fire, removal of fringing vegetation and weed invasion.

An essential component in protecting and maintaining the values of a wetland is to provide a buffer zone of terrestrial vegetation that is upslope of the outer edge of wetland dependent vegetation (Davies & Lane 1995). Buffer zones around wetlands can:

- improve water quality in surface water and groundwater
- protect environmental assets such as avifauna nesting and roosting sites
- help prevent weed infestation
- minimise the effects of nuisance insects on local residential areas.

Buffer zones along riverine systems can provide ecological linkages and corridors for flora and fauna.

There is an ongoing program of monitoring of water levels and water quality in bores and wetlands in the Canning River, the Yalgorup lakes, and within the Vasse–Wonnerup and Peel–Yalgorup systems where monitoring is a requirement under the Ramsar Convention to maintain their ‘ecological character’.

Water supplementation is occurring in some wetlands surrounding the planning area, such as Lake McLarty in the Peel–Yalgorup system (DEC 2008a), to maintain water levels and ensure the protection of key values.

Benger Swamp is affected by irrigation drain flows. Hence it is essential that any changes to irrigation, drainage systems and water allocations ensure that sufficient water is supplied to maintain the ecosystem that supports threatened fauna and migratory birds subject to international treaties with Australia.

Other sites that should be considered for supplementation need to be identified as part of a strategic overview for the Swan Coastal Plain, with a focus on TECs and water dependent areas, threatened flora and Ramsar-nominated sites.

### Acid sulfate soils

Acid sulfate soils in WA commonly occur in low lying wetlands, back-swamps, estuaries, salt marshes and tidal flats, though they are not confined to coastal regions. The majority of the planning area that has wetland or riverine systems within or near them are at high to moderate risk of effects from acid sulfate soils. Where acid sulfate soils are identified, management measures including no soil movement, dewatering or development need be adopted to reduce disturbance to these areas. For information about assessing and managing risks because of the presence of acid sulfate soil see [www.der.wa.gov.au/your-environment/acid-sulfate-soils](http://www.der.wa.gov.au/your-environment/acid-sulfate-soils).

### Desired outcome

The impacts of altered hydrological regimes on key values of the planning area are minimised.

### Management actions

1. Identify wetlands that may need water supplementation to maintain conservation values, considering issues such as the impacts to water source, delivery of water to the appropriate zone and possible effects of salinity. Undertake supplementation as deemed necessary.
2. When planning and carrying out operations (for example, during fire operations or assessing on- and off-site development proposals), identify the risk of acid sulfate soils and avoid disturbing, compacting, dewatering or displacing saturated soils at risk.

### Introduced plants and animals

#### Weeds

Gibson *et al.* (1994) found that the most abundant weeds on the Swan Coastal Plain were from the *Poaceae* family, and the highest occurrence of weeds was in seasonal wetlands in the Quindalup and Spearwood dune systems. The 'Swan Weeds' database on the department's *FloraBase* website (see [florabase.dpaw.wa.gov.au/](http://florabase.dpaw.wa.gov.au/)) provides information on the biology and management of environmental weeds in WA, with particular emphasis on those species occurring within the Swan NRM Region (partly within the Swan Coastal Plain, and the Darling Scarp and Plateau).

The department has developed a weed prioritisation process, *An integrated approach to Weed Management on DPaW-managed lands in WA* (DPaW 2013a), which replaces the statewide environmental weed species rankings of the *Environmental weed strategy for Western Australia* (CALM 1999b). This new process provides an updated ranking of the threat of each weed species on a department regional basis against specific criteria, and aims to consider a 'species-led' and an 'asset-protection-based' approach to control the threat of weeds in WA.

The department manages weeds in accordance with *Policy Statement 14 – Weed management* (DPaW 2015f) and has responsibility to manage species declared under the *Biosecurity and Agriculture Management Act 2007* (BAM Act).

Priority weed species for the Swan and South West regions and the Regional Parks Unit were identified based on their impacts, invasiveness, current and potential distribution, and feasibility of control. For information on the weed prioritisation process, see [www.dpaw.wa.gov.au/plants-and-animals/plants/weeds/156-how-does-dpaw-manage-weeds](http://www.dpaw.wa.gov.au/plants-and-animals/plants/weeds/156-how-does-dpaw-manage-weeds).



Parks and Wildlife staff removing cotton bush from private property. Photo – Brian Inglis/ Parks and Wildlife

The threat from weeds posed to biodiversity differs depending on the characteristics of each park and reserve and its associated land uses. Consequently, management priorities will need to be adjusted accordingly. Each Parks and Wildlife district has a weeds database from which they develop an annual works program and there is a weed management plan for Canning River Regional Park (Ecoscape (Australia) Pty Ltd 2000).

### Introduced and other problem animals

Management of introduced and other problem animals follows a planned and prioritised approach informed by whether or not the species is declared under the BAM Act and the level of threat to conservation significant species, communities or important habitats. The department's operations are guided by *Policy Statement 12 – Management of pest animals* (DPaW 2015g).

The small to medium sized ground mammals that now dominate fauna species on the Swan Coastal Plain include the cat, fox, house mouse (*Mus musculus*) and black rat (*Rattus rattus*) (Keighery *et al.* 2006). Significant introduced and problem animals include rabbits (*Oryctolagus cuniculus*) and kangaroos (*Macropus fuliginosus*) in small fragmented reserves, and wild pigs (*Sus scrofa*) in wetland areas.

Several reserves of the planning area are included in the department's long established 1080 baiting program ('Western Shield') for the control of foxes. These include parts of Yalgorup National Park and Leschenault Peninsula Conservation Park, and Benger Swamp, Creery Wetlands, Creery Islands and Locke nature reserves. These sites were chosen primarily because of the significant fauna that existed within the reserves, including the western ringtail possum, chuditch, bandicoot (quenda) and waterbirds. The response of predators to baiting, and other introduced species that pose a direct threat to native fauna, needs to be monitored. The priority for monitoring should be based on threat priority. At Canning River Regional Park, Parks and Wildlife works collaboratively with the City of Canning to control foxes with soft jaw traps.

Feral cat baiting is implemented as part of the Western Shield program in conservation reserves across the State with *Eradicat*®, recently approved broadscale feral cat bait. The expansion of the cat baiting program into larger reserves such as Yalgorup National Park and Leschenault Peninsula Conservation Park may be considered. In particular, cats are a significant threat to the western ringtail possum.

Feral pigs can cause substantial damage to wetlands, where their diggings disturb populations of rare flora and affect water quality. Illegal release of feral pigs for hunting occurs in parts of the planning area. This sustains local populations and causes damage to assets and conservation values.

Research, using 'exclusion areas' where kangaroos are kept out, has found that grazing pressure from western grey kangaroos can impact significantly on conservation values, particularly in small fragmented areas. Kangaroos will frequently occupy reserves after fires to graze on shoots and may cause major damage to sensitive areas such as wetlands or TECs. Management strategies to control kangaroos include fencing and shooting (licensed and regulated under the Wildlife Conservation Act). Research into biological population control by implants is ongoing (Herbert 2004, Herbert *et al.* 2010).

Feral populations of introduced fish can result from intentional translocations and are hard to control. The Department of Fisheries is the lead agency responsible for the management of introduced fish, with actions often needing a cooperative approach between the Department of Fisheries and major stakeholders.

Mosquitoes and midges, while a natural component of wetland ecosystems, can swarm in spring and summer and affect residents living near wetlands. The establishment of adequate buffers between lakes and surrounding development will reduce the effect of these pest insects on residents (Bowen *et al.* 2002) and can also improve water quality. The Conservation Commission, in principle, opposes mosquito control in nature reserves, Ramsar wetlands and other wetlands of high conservation value; however it also recognises that mosquito management within conservation reserves may be necessary to address public health concerns in relation to mosquito borne diseases (Conservation Commission 2011a). Some local government authorities, in liaison with the Department of Health, operate mosquito control under their own environmental management plans and with relevant statutory approval if mosquito control occurs near Ramsar sites (for example the Shire of Capel's *Mosquito Management Strategy* 2006).

### Desired outcome

The impacts of introduced plants and animals on key values of the planning area are minimised to maintain ecosystem health and vitality.

### Objective

Protect threatened or significant species and communities, and habitat of high conservation value, from negative impacts as a result of:

- new infestations of introduced plants and animals
- expansion of current populations of introduced plants and animals.

### Management actions

1. Limit the opportunity for weeds to be introduced and established through management activities by:
  - a) applying appropriate hygiene practices to machinery
  - b) minimising disturbance of soil during management activities
  - c) only importing soil from sources with strict soil quarantine.
2. Maintain surveillance for new weeds species and/or new infestations of weed species that are known to have a significant impact on ecosystem health and vitality.
3. Maintain recording systems (i.e. weeds database) for all weeds within Parks and Wildlife-managed lands.
4. Liaise with neighbouring landholders, and implement measures to prevent priority weeds from adjacent areas either establishing within or escaping from the planning area.
5. Continue development of the weed prioritisation process to combine a species-led approach with an asset-protection-based approach to prioritise the biodiversity benefit of weed control.
6. Work collaboratively with other agencies, land managers and the community, as appropriate, to identify introduced and other problem animals using risk-based procedures for determining their relative importance.
7. Where reasonable and practicable, implement control programs for priority weeds and introduced and other problem animals, and encourage the coordinated involvement of government, industry, the community and other land managers in managing these species across the landscape.

8. Continue weed control, and monitor and review its effectiveness through:
  - a) cooperation and coordination between Parks and Wildlife, and other stakeholders undertaking weed control in and around the planning area
  - b) monitoring weed species to verify that the objective is being successfully achieved.
9. Continue introduced predator control, and investigate, monitor and review its effectiveness through:
  - a) adequate documentation and timely delivery of the fox control program
  - b) cooperation and coordination between Parks and Wildlife, and other landholders and parties undertaking predator control in and around the planning area
  - c) monitoring introduced predator activity and abundance in association with the control program
  - d) monitoring native fauna species to verify that the conservation goals of fauna recovery plans are being successfully achieved and sustained.

### Key performance indicators

Performance measure	Target	Reporting requirement
The extent of weed species rated as 'very high – high' or impacting high priority locations	Decrease in the extent of weed species rated as 'very high – high' or impacting on high priority locations	After five years
New infestations of weeds in the planning area	New infestations of weed species rated as 'very high – high' are contained or reduced	After five years

### Disease

Dieback disease caused by *Phytophthora cinnamomi* continues to spread and affect the distribution and abundance of many native south-west plant species and their associated fauna. This plant pathogen and other related *Phytophthora* species present a significant threat to the health and vitality of many ecosystems in and outside the planning area. Hence, their management remains a high priority to minimise the risk of new infections in areas that are not yet infected. *P. cinnamomi* can alter species composition and ecosystem functioning by impacting susceptible species and vegetation types (some of which may be rare or threatened) and by increasing the vulnerability of impacted areas to invasion by weeds. It can negatively affect a range of other forest values, including productive capacity and the value of areas for recreation.

Soil movement activities, such as road construction or maintenance, vehicle use and bushwalking, are known to spread pathogens, particularly in moist, relatively low-lying sites, unless carried out under strictly controlled hygiene conditions. There are few means of controlling the pathogen's spread via autonomous root-to-root contact among plants, zoospores through soil and via surface water flows. Similarly, it is difficult to reduce the spread of the *Phytophthora* pathogen by fauna.

Management of *Phytophthora* is guided by *Policy Statement 3 - Management of Phytophthora disease* (DPaW 2015h). The Conservation Commission's *Position Statement No. 7 – The threat of Phytophthora dieback to biodiversity values on lands vested in the Conservation Commission of Western Australia* (Conservation Commission 2012) outlines the Conservation Commission's expectations in relation to the management of *Phytophthora* in Conservation Commission vested land. Subsidiary documents, which are periodically reviewed, detail the planning and approval process used by Parks and Wildlife and other proponents to minimise the risk of introduction and spread of *P. cinnamomi* (and other damaging agents, including weeds and problem animals). Useful tools in this approach include field demarcation of known infected areas and the preparation of hygiene management plans. Dieback mapping has been undertaken in parts of the planning area, to help with identifying protectable areas. The department will continue to monitor for signs of these diseases, support continued research and adapt management accordingly.

*Phytophthora* sp., particularly *P. multivora* has been implicated in ‘tuart decline’ in Yalgorup National Park (Scott *et al.* 2009). *P. multivora* is not inhibited by calcareous soils. Other biotic and abiotic processes, such as chronic insect infection, and changes in rainfall, salinity and/or soil nutrients, may also be implicated in the severe crown deterioration and plant mortality (Barber & Hardy 2006.) The Tuart Health Research Group, which collaborates with the Western Australian Centre of Excellence for Climate Change, Woodland and Forest Health, has adopted a collaborative and integrated approach to research into the possible causes of this decline and its impact on the biodiversity, the management of the decline and the restoration of these ecosystems.

Various forms of stem canker and *Armillaria* sp. are known to impact on threatened flora in the planning area. At least 50 families, and more than 200 species, of native plants are susceptible to the endemic soil-borne fungus *Armillaria luteobubalina*, including tuart, peppermint, jarrah (*Eucalyptus marginata*), *Acacia pulchella* and *Banksia grandis* (Robinson & Rayner 1998), all of which are found within the planning area. Other *Phytophthora* sp., gall rust (*Uromycladium tepperianum*) and the common, aerially dispersed, canker causing fungi may have a significant localised impact. Anecdotal reports are that many stands and individual marri (*Corymbia calophylla*) on the Swan Coastal Plain are being harmed by canker, particularly in colder and drought affected areas (Centre of Excellence for Climate Change, Woodland and Forest Health 2011).

Myrtle rust, a fungus, is a potential problem for the planning area. To date the fungus has not been detected in WA but the fungus is established in New South Wales, Victoria and Queensland. Myrtle rust is a serious fungal disease that attacks and kills plants in the Myrtaceae family such as eucalypts and peppermint trees (*Agonis flexuosa*).

### Desired outcome

The effects of diseases on key values of the planning area are minimised.

### Management actions

1. Work collaboratively with other agencies and land managers, as appropriate, to identify priority forest diseases and syndromes [or ‘tree decline’ when the cause is less clear or because of a combination of factors], using risk-based procedures for determining their relative importance.
2. Use planning procedures and operational controls to identify the important areas for protection, and to minimise the spread of, and impacts from, priority diseases already present.
3. Implement appropriate hygiene measures, including hygiene management plans, to minimise the spread of diseases during management operations and proposed development works.
4. Where reasonable and practicable, implement control programs for priority diseases, and encourage the coordinated involvement of government, industry, the community and other land managers in managing these diseases across the landscape.
5. Document and respond to outbreaks of diseases that become apparent.

### Fire

Organisational responsibility for fire management is shared between Parks and Wildlife, the Department of Fire and Emergency Services (DFES) and local government authorities. The arrangements are stipulated in the *Emergency Management Act 2005*, the accompanying regulations and the *State emergency management plan for fire (Westplan - fire)* (DFES 2013). These documents define four aspects of emergency management: prevention, preparedness, response and recovery. The department’s fire management activities, including prescribed fire, bushfire prevention and fire suppression are regulated by legislation (for example the *Bush Fires Act 1954* and the CALM Act). More guidance is provided by *Policy Statement 19 - Fire management* (DPaW 2015i), *Policy Statement 88 - Prescribed burning* (DPaW 2015j) and *Position Statement No. 1 Fire management* (Conservation Commission 2011b).

The Emergency Management Regulations 2006 prescribe DFES as the ‘hazard management agency’ responsible for emergency management of several hazards including fire, for the whole of the State. Parks and Wildlife and local government authorities are designated as ‘combat agencies’ responsible for the emergency management activity of fire suppression on lands that they manage, or on other lands at the request of DFES.

Further to this, Parks and Wildlife is responsible for the prevention and preparedness aspects of fire management on lands managed under the CALM Act and on UCL and unmanaged reserves that are not within town sites.

The *Guidelines for planning in bushfire prone areas* (WAPC 2015) provides guidance for minimising the impact of fire on new development proposals. Under these guidelines, local government is responsible for reviewing and ensuring compliance with bushfire management plans on private property. The department will promote these guidelines as a minimum requirement when providing comment on applications for subdivisions next to the planning area and encourage a high level of fire protection and preparedness on adjoining properties.

### Fire and biodiversity

Inappropriate fire regimes are a major threat to the diversity, viability and long-term conservation of communities, habitats and populations of many species within the planning area. While many flora taxa and ecosystems are resilient to a range of fire regimes, some have specific fire regime requirements. No single fire regime is optimal for all species (Burrows 2008, Burrows *et al.* 2008). Fire-sensitive species and ecosystems are most typically associated with the less flammable parts of the landscape that are not regularly exposed to fire (for example wetlands and riparian vegetation) and areas with discontinuous vegetation (for example rock outcrops or other areas of sparse vegetation).

The richness and diversity of fauna taxa is generally maximised by avoiding widespread intense bushfires and by maintaining a diversity of post-fire vegetation successional stages to provide habitat diversity (Bamford & Roberts 2003). The fire responses of native fauna will also vary depending on the extent of, and interaction of fire with, habitat fragmentation and other ecological disturbances (for example the effects of weeds, disease and introduced animals). The response of reptiles to fire has been found to be dependent on vegetation type and fire ages (Valentine *et al.* 2012).

Inappropriate fire regimes are particularly damaging to threatened species and ecological communities that have specific fire regime requirements or that are found in geographically or temporally restricted habitats. For example, overly frequent fires may reduce the availability of nesting material or sites for the Australasian bittern and riparian vegetation often needs near total exclusion of fire to persist.

Peat soils are common in the planning area and give rise to particular fire management considerations. Fires in peat soils are extremely difficult to extinguish and can burn for long periods of time. Considerable ecological damage can result from fire control activities as well as from the fire itself (Loomes *et al.* 2003). Increasing aridity from climate change may make peat soils more prone to fire.



Bushfire burning through Lake Clifton and surrounding wetlands. Photo – Owen Donovan/ Parks and Wildlife

Areas of remnant vegetation that are small in area and isolated from other remnants are also particularly sensitive to fire. A high intensity fire that affects the entirety of such a remnant may result in the loss of entire populations of rare and endemic flora. Such remnants also tend to experience significant impediments to post-fire recovery, such as kangaroo grazing and invasion of weeds. Post-fire weed control is a significant problem in small reserves and further information is required to understand weed invasiveness after fire and how to manage this effectively.

### Fire management in the planning area

Fire poses a significant risk to firefighters, visitors, adjoining landholders and local communities, as well as to conservation, cultural and community assets. It must be managed in a planned way to reduce the severity of bushfire and its associated impacts. Identifying fire-vulnerable conservation and community assets and places of cultural significance within the planning area and determining the likelihood and consequences of bushfires on them, will help to determine and prioritise the risk mitigation strategies for bushfires.

The department implements a range of bushfire mitigation strategies including:

- prescribed burning. This is a strategy used by Parks and Wildlife to:
  - conserve biodiversity by providing a spatial and temporal diversity in vegetation structure and therefore habitat opportunities
  - promote ecosystem resilience to disturbance from influences such as climate change and bushfire by providing a spatial and temporal diversity of vegetation structure, and therefore fauna habitat opportunities
  - mitigate the risk of damage to life and property from bushfires by managing the quantity and spatial distribution of fuel loads across the land it manages
- maintaining a fire detection system (for example fire towers and spotter aircraft)
- maintaining a strategic protection system (for example strategic firebreaks) to minimise the extent of bushfire runs and to maintain access for fire management purposes
- maintaining access for fire management purposes and fire response capabilities as needed
- community education and liaison
- liaison with other fire management authorities as needed (for example DFES, local government authorities and local fire brigades).

The department has a well-established process for planning, implementing and reviewing its prescribed burning program (see [www.dpaw.wa.gov.au/management/fire/prescribed-burning/54-planning-for-prescribed-burning](http://www.dpaw.wa.gov.au/management/fire/prescribed-burning/54-planning-for-prescribed-burning)). This ‘fire management plan’ approach considers factors such as biogeography, land use, community protection and the available workforce and equipment. It also establishes management objectives, burn strategies and success criteria. When fully implemented, it is intended to operate a hierarchy of five levels: ‘Regional Fire Management Plans’, the ‘Master Burn Planning process’, the ‘Three-year (six season) indicative burn plan’, the ‘Annual burn programs’ and ‘Prescribed Fire Plans’. The *Forest Management Plan 2014–2023* (Conservation Commission 2013) provides a detailed description of the five levels of the ‘fire management plan’ approach.

In determining its approach to suppressing bushfires, the department takes into consideration environmentally sensitive areas and may modify its approach accordingly, where practicable. The incident management structure may include a group that provides specialist environmental advice about the conduct of suppression and post-fire rehabilitation operations. All fire management activities, particularly construction of roads or fire lines, should be planned and undertaken with strict hygiene measures in place to avoid harmful effects on TECs and rare flora, with consideration given to containing fires within existing roads and tracks to minimise the necessity for disturbance associated with new fire lines. In small fragmented reserves or fire exclusion areas, existing roads or alternative firebreaks (for example herbicide breaks) for fire control could be considered.

Parks and Wildlife undertakes trials using fire within the planning area, such as in tuart ecosystems, and for control of various weed species. Outcomes from such trials will be used to update fire management procedures for the planning area. Monitoring of post-fire survival and recruitment success will be conducted to determine if communities are benefiting from prescribed burns.



## Desired outcome

Protection of life and community assets, and the protection and conservation of biodiversity.

## Objective

Fire management that results in:

- protection of human life, high value community assets and places of cultural significance
- protection of known populations of threatened species or TECs and no loss or significant damage attributable to the application of fire management strategies.

## Management actions

1. Continue to implement an annual prescribed burning program that:
  - a) seeks to address the risk of bushfire on the natural, cultural, recreation and economic values of lands managed by the department and the risk presented by bushfire that emanates from Parks and Wildlife-managed land
  - b) protects and conserves fire-sensitive, geographically and temporally restricted and conservation significant species, habitats and communities, and sites of rehabilitation, translocations and cultural significance
  - c) facilitates a diversity of habitats by maintaining or enhancing the diversity of vegetation structure and composition
  - d) creates and uses new knowledge in an adaptive management framework
  - e) is assessed against stated objectives for the program and stated objectives and success criteria for individual burns.
2. Undertake bushfire suppression and recovery operations in a manner that gives regard to fire operations guidelines that are periodically revised.
3. Continue to research the spatial and temporal arrangement of habitat needed to facilitate the persistence of flora, fauna and ecological communities, as resources permit.
4. Identify the highest conservation value reserves and establish and maintain post-fire monitoring sites to measure impact of bushfires and prescribed fires, and develop an understanding of fire ecology requirements, post-fire weed control, and introduced and other problem animal control.
5. Build and maintain management access for fire suppression where appropriate.
6. Appropriately rehabilitate disturbances resulting from fire line establishment during bushfire suppression.
7. Identify fire regimes in small, fragmented reserves, if appropriate.
8. Identify and protect community assets including recreation assets, neighbouring properties, utilities and valued resources through appropriate bushfire fuel management techniques.
9. Work closely with local government, Department of Fire and Emergency Services, Western Australian Planning Commission, local bushfire brigades, neighbouring landowners, communities and other authorities to encourage cooperative fire management arrangements, ensure appropriate community protection from fire and encourage new subdivisions adjoining the planning area to include fire protection measures commensurate with the level of bush fire hazard.
10. Promote public education and awareness of the department's fire planning and management, the effects of fire on the natural environment, the need to prevent bushfires and the safety and survival of people and property.

## Key performance indicators

Performance measure	Target	Reporting requirement
The impact of fire on human life or community assets	No loss of human life or serious injury and minimal loss of community assets attributable to the department's fire management	Annually
The persistence of threatened species and threatened ecological communities	No loss of known populations of threatened species or threatened ecological communities attributable to the application fire management strategies	Every five years

# Managing cultural heritage

Management of Noongar and other Australian cultural heritage in the planning area is guided by WA's *Aboriginal Heritage Act 1972* and *Heritage of Western Australia Act 1990*, the department's *Policy Statement 18 – Recreation, tourism and visitor services* (DEC 2006a), as well as any protocols or agreements entered into by the department under the SWNT Settlement.

## 15. Noongar culture and heritage

Noongar (meaning 'the people') are the traditional custodians of the south-west of Western Australia and the planning area. Noongar are one of the largest Aboriginal cultural blocks in Australia and a society that has a complex and harmonious relationship with their *boodja* (land). There is also significant diversity among Noongar people; they are made up of 14 different dialect/language groups, with the planning area covering three of these groups - *Whadjuk/Wajuk*, *Binjareb/Pinjarup* and *Wardandi*. Each of the language groups correlates with different geographic areas with ecological distinctions. Noongar people have ownership of their own *kaartdijin* (knowledge and culture).

Noongar heritage and *boodja* are interconnected. It encompasses laws and practices, connection to lands and waterways, and traditional ecological knowledge of the land. The Swan Coastal Plain was traditionally abundant in water supplies and a variety of environmental zones provided rich resources to Noongar people. Land use patterns of the Noongar people were based on seasonal and environmental factors (O'Connor *et al.* 1989). The rivers and the associated creek systems, the flow of lakes, wetlands and surrounding landscape were not only an important economic resource but were also intricately linked to the Dreaming stories of ancestral beings (O'Connor *et al.* 1995).

Within the planning area, there are about 40 Aboriginal heritage sites that are registered on the Department of Aboriginal Affairs' *Register of Aboriginal sites* (DAA 2015). This includes artefacts/scatter, water sources, camps, fish traps, hunting, skeletal material/burial, mythological, dreaming areas, men's and women's sites, ceremonial, engravings, historical, repository/cache, man-made structures and modified trees. There may be other sites to which the Aboriginal Heritage Act applies that are not listed on the Register of Aboriginal sites, as all sites are protected under the Aboriginal Heritage Act, whether they are registered or not.



Leschenault Peninsula and adjacent Leschenault Estuary - an Aboriginal heritage place.  
Photo – Grace Patorniti/ Parks and Wildlife

It is recognised that heritage places are still used today and provide a means of maintaining Noongar culture and heritage. The protection of Noongar heritage is therefore a matter of protecting Noongar cultural identity and facilitating access to the land to look after these heritage places and values.

Section 56 (2) of the CALM Act requires that in preparing a management plan that the Conservation Commission as the responsible body of the land shall have the objectives of protecting and conserving the value of the land to the culture and heritage of Aboriginal people, in a manner that does not have an adverse effect on the protection and conservation of the land's fauna and flora. The department will work with Noongar people through the Cooperative Management Committees and Joint Management Bodies, and will apply the Noongar Standard Heritage Agreement, established under the SWNT Settlement to identify, manage and protect Aboriginal heritage values within the planning area.

The Department of Aboriginal Affairs and the Department of the Premier and Cabinet have released *Aboriginal Heritage Due Diligence Guidelines* (DAA & DPC 2013). Good working relationships with Noongar people will help in ensuring that these guidelines are effectively applied and that relevant Acts are complied with (see [www.daa.wa.gov.au/Documents/HeritageCulture/Heritage%20management/AHA\\_Due\\_Diligence\\_Guidelines.pdf](http://www.daa.wa.gov.au/Documents/HeritageCulture/Heritage%20management/AHA_Due_Diligence_Guidelines.pdf)).

Opportunities to collaborate with the Regional Corporations and, where appropriate, other Noongar people to jointly manage the land, could also include working together to develop Aboriginal interpretive trails, education programs and conservation management arrangements. Some good models for this have already been developed, which may provide a useful guide (for example the *Noongar Consultation Protocol Guidelines: Swan and Canning Rivers Iconic Trails Project*, SWLSC 2011).

Consistent with the Due Diligence Guidelines and the Consultation Protocol Guidelines referred to above, the Swan River Trust has worked with the City of Canning and the department to receive approval under the Aboriginal Heritage Act for shoreline restoration projects and other on-ground works to maintain and improve the health of the Canning River, for foreshore areas within the City, including the Canning River Regional Park.

### Activities for Aboriginal customary purpose

The CALM Act, together with the Wildlife Conservation Act, allow Aboriginal people to access CALM Act land to conduct traditional activities, subject to some regulations. The CALM Act, along with department's *Policy Statement 86 - Aboriginal customary activities* (DPaW 2015j) provide the framework for how the department will liaise with Noongar people in relation to access to undertake customary activities. Such traditional customary purposes may be for medicinal, artistic, ceremonial or other cultural purposes.

The department will work with Regional Corporations, joint management parties and local Aboriginal communities to develop local area arrangements to support and manage customary activities on department-managed land and/or water, including the taking of traditional food by Noongar people. The development of relationships at a local level is seen as vital to the ongoing management of customary activities in these areas.

The hunting and gathering of food is an important part of Noongar culture, enabling traditional relationships with the land and water to be maintained, knowledge sharing and participation in traditional practices. Noongar people in the region continue to use the lands and waters of the planning area to undertake cultural activities and gather a variety of traditional foods including various plants, mammals, fish, birds, reptiles, frogs and invertebrates.

### Desired outcome

Noongar culture and heritage values are protected and conserved.

### Management actions

1. Work with the Regional Corporations through the Cooperative Management Committees to further identify and protect the value of the planning area to Noongar people, including participating in the development of policies and processes to describe how the department and Regional Corporations will work together to determine, conserve, protect and rehabilitate these values.
2. Comply with legislation and departmental policy to ensure operations do not negatively impact on culturally significant sites and objects.
3. Work with Cooperative Management Committees to maintain Noongar culture and heritage and manage threats to these values.
4. Develop local area arrangements as appropriate with the relevant Noongar groups to manage and facilitate customary activities.

### Key performance indicators

Performance measure	Target	Reporting requirement
Protection of Noongar heritage sites	No disturbance to Noongar heritage sites because of management activities, without formal approval	Every five years
Successful operation of cooperative and joint (if any) management bodies	Effective operation of cooperative and joint (if any) management bodies, demonstrated through all scheduled meetings taking place and participants' satisfaction with the meetings and outcomes	Every five years

## 16. Other Australian cultural heritage

The planning area has a rich historic heritage associated with early exploration and settlement, the agricultural and forestry industries and wartime activities. Evidence of colonial history is still seen today in the names of locations, buildings and old ruins.

The Heritage Council of Western Australia maintains a state register to recognise and protect places of cultural heritage significance. It includes buildings, structures, gardens and conservation sites, cemeteries, landscapes and archaeological sites. In the northern parks and reserves of the planning area, listed sites include the Royal Freshwater Bay Yacht Club on Keanes Point Reserve, parklands such as Matilda Bay Reserve and historic sites such as Woodloes Homestead in Canning River Regional Park.

Listed sites in the central parks and reserves of the planning area include geological features such as the thrombolites, historic sites such as the lime works and Lake Clifton tunnels and sites valued for conservation, landscape or open space including Yalgorup National Park, Creery wetlands, Goegrup lake system and the Peel–Harvey estuarine system. In the southern reserves, listed sites include the Vasse Estuary, Wonnerup Jetty (now just a site name) and part of the Broadwater wetlands.

Some places of heritage significance are listed in local government municipal inventories. Other places of heritage significance include evidence of early exploration and colonial settlement, such as the drover's camp at Martins Tank, Belvidere (former Princep estate and alternative lifestyle commune), Lake Clifton town site, Whittakers Mill and horse yard remnants at Duck Pond (a training and patrol ground for the 10th Light Horse Brigade during World War II).



Brick drying kiln at the former Lake Clifton lime works site in Yalgorup National Park. Photo – Grace Patorniti/ Parks and Wildlife

It is important that information continues to be collected and collated about historic sites within reserves and that this information is made available for interpretation and protection of the site where appropriate. The government heritage property disposal process for disposal or demolition of heritage places that meet the relevant criteria needs to be observed, where appropriate.

**Desired outcome**

Cultural heritage values are protected and conserved.

**Management actions**

1. Protect and conserve cultural heritage to ensure threatening processes do not have a negative impact.
2. Continue to collect and collate information on historic sites and provide interpretive material if appropriate.
3. Liaise with the Heritage Council of Western Australia, local government, other relevant organisations and the local community about the identification and appropriate protection and management of cultural heritage.
4. Liaise with the City of Canning and the Woodloes Homestead managers, to encourage the Woodloes Homestead managers to develop a site plan which includes links with the Canning River Regional Park.

**Key Performance indicator**

Performance measure	Target	Reporting requirement
Protection of other Australian cultural heritage sites	No disturbance to other Australian cultural heritage sites because of management activities, without formal approval	Every five years

# Managing visitor use

The provision of visitor services, facilities and experiences in the planning area is guided by the department's *Policy Statement 18 – Recreation, tourism and visitor services* (DEC 2006a).

## 17. Visitor opportunities and planning

Visitation has increased over the past 10 years in popular recreation areas such as Yalgorup National Park and Leschenault Peninsula Conservation Park. Visitor numbers are also high at Matilda Bay Reserve, estimated to have received the highest number of visits in the planning area of about 900,000 in the financial year 2014-2015. It is further estimated that 265,000 visits (extrapolated from the results of a 2005 study by consultants, Colmar Brunton) were made to Canning River Regional Park. Monitoring at Yalgorup National Park recorded 295,023 visits in 2014-2015, while Leschenault Peninsula Conservation Park, just north of Bunbury, received 261,433 visits (estimated from vehicle classifiers, traffic counters or pedestrian counters) during the same period. A visit is defined as a *'measurement unit involving a person going onto lands and waters of a park or protected area for the purposes mandated for the area. Each visitor who enters a park for a purpose mandated for the area creates a visit statistic; typically, the visit statistic has no length of stay data associated with it. This definition of a visit means that if a person leaves the park and re-enters at a later time, then a second visit data unit is recorded'* (Hornback & Eagles 1999).

Domestic tourism dominates over the international market. Also visitor numbers and patterns may be influenced by external infrastructure such as the opening of the Forrest Highway which adjoins Yalgorup National Park, existing and proposed subdivisions surrounding some reserves and externally organised statewide events. With a trend of increasing visitor use there is expected to be increasing pressure on the planning area.

### Visitor planning

It is necessary to plan for visitor use to manage issues relating to visitor risk, environmental impacts, social benefit, equity, public demand and potential economic benefit. On a larger scale, it is important that visitor planning takes into consideration activities provided elsewhere in and surrounding the planning area, rather than providing too wide a range of visitor opportunities that could reduce the quality of experience or compromise natural and cultural values. On a smaller scale, it is important to provide cost-efficient, effective and safe, services and utilities in the reserves that are compatible with the site specific natural and cultural values, as well as having the resources available to maintain these facilities.

Features such as footbridges, buildings and open grassed areas play an important role in the landscape of some reserves such as Matilda Bay Reserve and areas within Canning River Regional Park. Retaining visual quality should be a high priority in the planning area. The department's *Policy Statement 34 – Visual resource management* (CALM 1989) and guidelines should be adhered to in all aspects of land management, particularly the planning and implementation of new facilities, buildings, recreation sites and signs.



Bird hide at Lake Pollard in Yalgorup National Park.  
Photo – Melissa Loomes/ Parks and Wildlife

## Visitor safety

The department routinely conducts risk audits of all designated recreation areas and trails, with mitigation works undertaken on a priority basis according to the degree of risk posed to visitors. Visitor risks in the planning area include slipping and tripping on uneven ground, getting lost or injured when hazard and direction signs are stolen, damage to structures, falling tree limbs, bushfires and other emergencies. To help minimise the risk of injury to visitors the department has developed *Policy Statement 53 – Visitor risk management* (DPaW 2015l) and *Guideline No. 28 – Visitor risk management* (DPaW 2015m), which outline a visitor risk management program for the planning area.

## Visitor behaviour

Areas such as Canning River Regional Park, Yalgorup National Park, Leschenault Peninsula Conservation Park and some smaller nature reserves, are close to urban development but are still relatively secluded, which makes them a target for anti-social behaviour and illegal activity. Problems such as rubbish dumping, illegal access including by trail bikes and off-road vehicles, theft and vandalism of infrastructure (such as fences and signs) and illegal removal of vegetation, are some of the issues that need to be managed.

## Desired outcome

Community enjoyment and appreciation of the facilities and services, and the natural environment of the planning area.

## Objective

Maintain or increase visitor satisfaction in reserves that have dedicated facilities and services.

## Management actions

1. Provide and maintain a range of safe nature-based visitor facilities and services consistent with the department's *Policy Statement 18 – Recreation, tourism and visitor services* in appropriate reserves to:
  - a) maintain or enhance visitor satisfaction; and
  - b) protect and maintain the key values of the planning area.
2. Monitor visitor numbers and undertake visitor satisfaction surveys at selected areas and use the data to determine requirements for better meeting visitor needs and managing visitors.
3. Undertake visitor risk assessments of all recreation sites and facilities as part of a visitor risk management program, in addition to those which occur on a day-to-day basis and implement appropriate action as necessary.
4. Work with neighbouring land managers and owners to achieve complementary, consistent and strategic visitor planning for the greater area.
5. Ensure that any recreation site planning, including master plans and site development plans, takes into account all key values of the reserve.
6. Continue to implement measures (for example, interagency cooperative management programs, fencing and gate installation, issuing of infringement notices and education) as necessary to deter unauthorised access and illegal activities (for example rubbish dumping).

## Key performance indicator

Performance measure	Target	Reporting requirement
Visitor satisfaction at selected indicator sites with the planning area	Maintain or increase visitor satisfaction	Every five years

## 18. Visitor access

All formal recreation sites in the planning area are accessible by two-wheel-drive vehicles. Most road and track access on Parks and Wildlife-managed lands is managed by the department, except for dedicated public roads, which remain a separate road reserve managed by either Main Roads Western Australia or relevant local government authorities. A small number of unused road reserves are scattered across the planning area. Any unnecessary road reserves within the planning area will be considered for inclusion into the planning area, subject to the usual approval processes to change their tenure.

Off-road driving on roads and tracks closed to the public, or where there are no tracks, is not allowed unless signposted. Off-road vehicles can cause damage to sensitive areas such as coastal dune vegetation (causing loss of vegetation and soil erosion) and have the potential to spread diseases and weeds, pose risks to other users and reduce aesthetic values. Unauthorised access roads and tracks will be closed for site rehabilitation with appropriate signage and in consultation with local user groups, local government authorities, subdivision developers and interest groups.

All vehicles within the planning area must be registered under the *Road Traffic Act 1974* and drivers must possess a current driver's licence. Vehicles registered under the *Control of Vehicles (Off-road Areas) Act 1978* and unregistered off-road vehicles (for example ATVs, off-road motorbikes and dune buggies) are not allowed.



Access road to Martins Tank campground in Yalgorup National Park. Photo – Grace Patorniti/ Parks and Wildlife

Four-wheel-drive vehicles can access sections of beach through Yalgorup National Park, (2014–15 records estimate 131,602 total visits on Tims Thicket road, the northern access to the beach) and through Leschenault Peninsula Conservation Park (2014–15 records estimate 205,518 total visits to Buffalo Beach car park, the main access point to the beach). Four-wheel-drive access through Yalgorup National Park and along the beach at Leschenault Peninsula Conservation Park can be maintained provided that the activity does not damage the fragile dune system, harm other areas with conservation values or cause conflict with other users of the beach. The coastline between Yalgorup National Park and the low water mark is UCL and four-wheel-drive activity is actively managed by the shires of Waroona and Harvey, and the City of Mandurah. Leschenault Peninsula Conservation Park extends to the low water mark and there is a 'Code of the Coast' program in place, under which vehicles are allowed on the beach between the high and low water marks.

The Department of Fisheries controls all fishing operations; however the department controls access through the parks. The department's *Policy Statement 51- Access for commercial fishing through CALM lands* (CALM 1993) recognises that in general, existing rights of access will be maintained unless problems related to environmental degradation or conflict with visitor access and use occurs.



The completion of the Forrest Highway south of Perth has resulted in an increase in uncontrolled four-wheel-drive access to nature reserves on the eastern bank of the Harvey Estuary (C. Olejnik [Parks and Wildlife] 2011, pers. comm.). This will place increased pressure on the estuary and has the potential to introduce or increase the spread of dieback. Controlled access to the estuary will need to be considered to minimise impacts on key values. Much of the Vasse–Wonnerup Inlet does not provide for vehicle access and this will remain the case to protect conservation values.

Permanent access for reserve management will be sought where an adjacent subdivision offers an opportunity and where there is an advantage for reserve management purposes.

Access to parks and reserves often needs to be temporarily, seasonally or permanently closed to the public for management operations, such as:

- feral animal baiting
- fire management and emergency response
- flora and fauna monitoring
- weed control
- maintenance works.

The planning area may be accessed by vehicle, pedestrians, bicycle, boat, canoe and wheelchairs. Access needs to be carefully managed to balance the demand for visitor use (for example bushwalking, horseriding and mountain biking) with the protection of the key values of the planning area.

### Desired outcome

Provide and maintain visitor access, while protecting the key values of the planning area.

### Management actions

1. Require all motor vehicles accessing the planning area to stay on roads and tracks open to the public, with access on other roads and tracks requiring formal approval from the District Manager/Regional Parks Manager.
2. Temporarily, seasonally or permanently close management roads or tracks to the public, subject to prior-authorization by the District Manager/Regional Parks Manager. Signpost closed areas as ‘management access only’.
3. Ensure that road reserves are located to best protect the natural, cultural and landscape values and meet public access needs. Negotiate with appropriate authorities to cancel unnecessary or unused road reserves and add them to the planning area where appropriate.
4. Undertake design, construction and maintenance operations for unsealed roads, and progressively rehabilitate unnecessary or unauthorised roads and tracks.
5. Where appropriate, improve access to services, information and facilities for emergency services and people with disabilities.

## 19. Visitor activities

Matilda Bay Reserve, Canning River Regional Park, Len Howard Conservation Park, Yalgorup National Park and Leschenault Peninsula Conservation Park provide for a variety of compatible day use activities. Yalgorup National Park and Leschenault Peninsula Conservation Park are the only parks of the planning area with designated camping facilities. However, there is increased community concern about declining camping opportunities on private and Crown land, as well as increasing demand from Perth residents and tourists to experience camping in a non-urban setting. The department is responding to this by identifying appropriate sites for more camping and caravan experiences on Parks and Wildlife-managed land (see Section 19. *Visitor activities: Overnight stays*).

All but one of the nature reserves of the planning area are gazetted for the purpose of ‘conservation of flora and fauna’ (that is Boodalan Nature Reserve purpose is ‘recreation and conservation of fauna’). Hence, only compatible, ‘low impact’ recreation is allowed, and then only when it does not negatively affect the natural values and ecosystems of the reserve. Several nature reserves, including Kenwick Wetlands (that is Greater Brixton Wetlands and Brixton Wetlands), Creery Wetlands and Samphire Cove have walking trails, boardwalks, interpretation signs and bird hides for the bird and nature enthusiasts.

### Day use

A range of day-use sites are available in the planning area, and include picnic and barbecue areas, lookouts, interpretive stops, links to recreation trails and nature viewing sites. Future management of such facilities will depend on the types of users, the purpose of the reserve and the sensitivity of the conservation and landscape values.

Surrounding visitor facilities also need to be considered. These facilities include: roadhouses, caravan parks and other camp sites; walking, cycling and horseriding trails; four-wheel-drive roads and access; and day-use areas managed by local government.



Day-use site at Lake Clifton. Photo – Grace Patorniti/Parks and Wildlife



Boardwalk at Lake Clifton. Photo – Grace Patorniti/ Parks and Wildlife

## Trails

There are a variety of recreational trails in the planning area, including dual use paths in Matilda Bay Reserve and Canning River Regional Park that provide valuable access around the river system (Swan Canning Riverpark), low-key trails that lead to bird viewing areas and horseriding trails.

Over time, several trails have developed in areas where they either inadvertently cause harm to the natural environment or are just not appropriate for the purpose of the reserve. Some trails that traverse through Parks and Wildlife-managed land are also inappropriately located, poorly signed or in poor condition. Information is available about existing and proposed trails in the planning area and surrounding lands (such as Cuthbert *et al.* 2007, Transplan Pty Ltd *et al.* 2007, Tredwell Management 2008) and about a coordinated approach to developing trails for users (such as the *WA State Trail Bike Strategy*, Trail Bike Management Australia & Motorcycling WA 2008).

Existing and proposed trail opportunities will be assessed according to operational priorities and guided by strategic plans, such as those outlined under the headings below, and the WA Trail Development Process, which covers eight stages (that is 1. Proposal, 2. Framework, 3. Site Assessment, 4. Concept Planning, 5. Corridor Evaluation, 6. Detailed Design, 7. Construction and 8. Management). If new trails are needed, then site specific planning and public consultation will be undertaken as part of the development process. New trails should be assessed for appropriateness based on demand, environmental impacts (for example, spread of weeds and dieback), condition of the trails, possible conflict with other recreation users, and compatibility with the reserve purpose and the key values of the planning area.



Trailhead sign for the Heathlands trail in Yalgorup National Park. Photo – Grace Patorniti/Parks and Wildlife

## Horseriding

Horseriding may be allowed in national parks or conservation parks, but is not allowed in nature reserves except in some circumstances. Areas may be declared designated horseriding areas on some department-managed land where impacts are considered manageable and/or the activity has been previously allowed. Under the CALM Regulations, designated areas will be signposted where practical, with the conditions specified on the signs. Riding horses or other animals in the Canning River Regional Park is considered to be in conflict with other park values and users and is not allowed.

The effects of horseriding in protected areas such as national parks are well documented (Wells & Lauenroth 2007, Newsome *et al.* 2008). Studies have indicated the importance of providing appropriately designed and maintained horse trails, and educating riders to stay on trails because even relatively low levels of inappropriate activity can result in significant impacts (Newsome *et al.* 2002, Fairfax *et al.* 2012).

The first statewide horse trail strategy (PX2 Pty Ltd 2015) has been developed to provide guidance and structure for a coordinated approach to horse trail access, development and management. The Strategy identified key challenges such as:

- inadequate float parking at trailheads
- a lack of information on existing trails (for example trail location, access and details about the trails such as suitability and distance)
- a lack of maintenance of existing trails
- competing demands from other user groups for trails, land and funding
- conflicts and safety concerns with other trail users.

Parks and Wildlife supports in principle the recommendations outlined in *Taking the Reins: The Western Australian Recreational Horse Trail Strategy* (PX2 Pty Ltd 2015), where they relate to lands vested in the Conservation Commission. The department will work with key stakeholders, where possible, to help in the implementation of the recommendations. One of the Strategy's key focus areas, with related priority actions, is to compile a comprehensive State Equestrian Trails Register of existing horse trails and then conduct an initial review of the register to prioritise improvement works to trails (PX2 Pty Ltd 2015).

### Cycling

Cycling is an increasingly popular activity and mountain biking is one of the world's fastest growing recreational, sport and tourism activities in WA. *Our Bike Path 2014-2020* (WestCycle Incorporated 2014) is a strategic framework to guide the coordinated development and growth of all forms of cycling in WA.

The *Western Australian Mountain Bike Strategy 2015-2020* (WestCycle Incorporated 2015) sets out a series of strategies and recommendations for sustainable mountain biking. The draft *South West Mountain Bike Master Plan* (Common Ground Trails Pty Ltd 2014) provides a framework to create a high quality mountain bike trail network in the South West (that is the south-west of WA from Bunbury down to Pemberton), and identifies and prioritises areas for trail development. The master plan has not identified any sites within the southern parks and reserves of the planning area for potential future trail development.

A mountain bike master plan is now in preparation for the Perth and Peel region, which may identify sites within the northern and central parks and reserves of the planning area where designated trails may be developed.

### Overnight stays

Yalgorup National Park and Leschenault Peninsula Conservation Park are the only reserves of the planning area with designated camping areas. Martins Tank campground in Yalgorup National Park is on the banks of Martins Tank Lake among the tuart and peppermint woodland and provides for small and large group camping. In 2014–15 it was estimated there were 20,445 visits to Martins Tank campground, primarily in summer, Easter and school holidays and over long weekends. Belvidere campground and The Cut in Leschenault Peninsula Conservation Park are on the Leschenault estuary. Belvidere is the bigger camping area of the two and provides for small and big groups, pedestrian and cycle access, and caravans. It is estimated that in 2014–15 there were 54,003 visits to Belvidere campground. The Cut can be reached by boat, or by walking or cycling on the management access track from Belvidere. Camping fees apply to all sites.

Informal camping (that is no designated sites or facilities) while not allowed, does occur in several reserves. This can result in the degradation of the natural environment from littering, trampling of understorey plants, soil compaction and erosion.

Martins Tank campground has been expanded to cater for an increased number of visitors and to provide additional low cost camping and caravanning facilities. Additional camp sites are being installed in 2015 in Belvidere campground as part of the Parks for People Caravan and Camping initiative. The provision of additional camp grounds, with the potential to offer visitors alternative and varied styles of nature-based camping options may be considered.



Camp site at Martins Tank Campground. Photo – Grace Patorniti/Parks and Wildlife



Facilities at Martins Tank Campground. Photo – Grace Patorniti/ Parks and Wildlife

### Campfires

Campfires and firewood collection can have detrimental effects on the natural environment, including loss of vegetation cover, soil compaction and the accumulation of ash. Hot ash and coals from beach campfires can be a visitor risk, and campfire escapes are a cause of bushfires. Within the planning area, campfires are currently only allowed in fire rings at day-use areas and campgrounds in Yalgorup National Park and Leschenault Peninsula Conservation Park, except when fire bans apply. Consideration may be given to the provision of facilities for campfires within the planning area.

This management plan proposes some improvements to existing recreation facilities and sites including day-use sites, camping areas, trails and car parks (see Table 1).

Table 1 Objectives and proposals for recreation reserves of the planning area

Reserve name; objective/s for visitor activities and use	Proposals
All reserves	<p>Progressively upgrade, replace or remove facilities as determined by demand, visitor risk assessment and/or funding availability.</p> <p>Provide or modify facilities and services as necessary to facilitate comprehensive and integrated interpretation of natural, cultural and historic features.</p> <p>Provide universal visitor access to recreation facilities where possible.</p>
<b>Northern parks and reserves of planning area</b>	
Matilda Bay Reserve	
<p>Objective: To continue to ensure a high quality parkland setting that provides for a variety of compatible recreation activities and reflects the mix of Aboriginal and other cultural values, as well as conservation and landscape values that it has known for more than 100 years.</p>	<p>Ensure that ongoing maintenance and development at Matilda Bay Reserve is consistent with <i>Architectural design guidelines for developments at Matilda Bay Reserve, Crawley, Western Australia</i> (DEC &amp; Lawrence Associates Architects 2006).</p> <p>Maintain and upgrade dual use paths and feature points, and provide clear access and signage.</p> <p>Improve car park arrangements for the reserve with a priority on visitor safety.</p> <p>Continue to provide picnic facilities and designated function areas in a well maintained parkland setting.</p> <p>Continue to allow non-commercial events such as weddings with appropriate licences and permits.</p>
Canning River Regional Park	
<p>Objective: To encourage visitor day use while ensuring that the level and type of use is sustainable and that conflict with key values and other park users is minimised.</p>	<p>Review and update the existing <i>Recreation master plan</i> (CALM 1997), giving consideration to park access and with the aim of providing for parking and passive recreation activities including high quality walking and cycle paths, canoe launching facilities and lookouts.</p> <p>Continue to work with the City of Canning for a cooperative approach to maintenance and development of facilities, dual use paths, sites and information.</p> <p>Continue the use of a sign system based on the regional parks sign manual (<i>Sign System and Brand Images</i>, DEC 2006b) with a brand image that is effective in communicating park features, hazards, visitor orientation and information.</p>
<b>Central parks and reserves of the planning area</b>	
Len Howard Conservation Park	
<p>Objective: Encourage appropriate day use that is consistent with the conservation values of the reserve and develop interpretation at key sites.</p>	<p>Maintain and upgrade several access points with interpretation, signage and facilities at key sites in the park. Develop new interpretive facilities.</p> <p>Upgrade trails that will retain a natural recreation experience particularly near the wetland areas.</p> <p>Have a high ranger presence.</p>

Reserve name; objective/s for visitor activities and use	Proposals
Yalgorup National Park	
<p>Objective: To provide recreational opportunities in an equitable manner that do not negatively affect the park's values and that promote the understanding, appreciation and awareness of those values.</p>	<p>Maintain the recreation sites at Martins Tank, Tims Thicket, White Hill, Lake Clifton thrombolites, Preston Beach information bay and Lake Hayward. Investigate future development at sites including Whittakers Mill, Lime Kiln and Pink Lake.</p> <p>Investigate and upgrade a network of short and long recreation trails (including horseriding trails) and observation points that do not compromise conservation values and that take into consideration recreational use in surrounding reserves.</p> <p>Have a high ranger presence, and use campground hosts and other volunteers to provide interpretive and/or education activities at busy sites during peak season.</p> <p>Monitor recreation activities to identify impacts to conservation values (including dunes, tuarts, plants of conservation significance, wetlands, fringing vegetation and fauna relocation sites) and work with the local community and stakeholders to mitigate negative impacts or, restrict or eliminate the activity where practical.</p>
<b>Southern parks and reserves of the planning area</b>	
Leschenault Peninsula Conservation Park	
<p>Objective: To provide a wide range of nature-based recreational opportunities that will be consistent with protecting the parks natural and cultural values.</p>	<p>Maintain recreation sites at Belvidere campground and day use area, JB O'Reilly, Buffalo Beach, Tuart Grove and The Cut, and investigate future camping needs and opportunities.</p> <p>Have a high ranger presence with possible provision of interpretive and/or education activities at busy sites during peak season.</p> <p>Monitor recreation activities to identify impacts to conservation values (including dunes, plants of conservation significance, wetlands, fringing vegetation and fauna relocation sites) and work with the local community and stakeholders to mitigate negative impacts or, restrict or eliminate the activity where practical.</p>

### Water-based activities

Recreational fishing (freshwater and coastal) is managed by the Department of Fisheries under the *Fish Resources Act 1994* and is allowed in nature reserves, national parks and conservation parks unless specified. With respect to the planning area, the key recreational fishing areas include the Swan Canning Estuary and the Peel-Harvey Estuary. Inappropriate access to fishing sites through reserves managed by the department has occurred. This causes environmental degradation to riverbanks, foreshores and dune systems.

Several canoe trails, which pass by reserves of the planning area, exist in the Canning River, Peel Inlet, and Leschenault Estuary; and kayaking is known to occur on Goegrup Lake and surrounding lakes. Several canoe launch sites exist within Canning River Regional Park.

Changes in water levels and water quality must be taken into account when considering the suitability of water-based activities. Any such activities (for example canoeing or swimming), will need to be monitored for impacts to birds and other fauna, and to the riverbanks.

The Department of Transport is responsible for safety and navigation in and on waters in and surrounding the planning area. There are boat ramps at Matilda Bay Reserve and Koolijerrunp Nature Reserve (managed by the Shire of Murray) with several other boat ramps next to reserves such as Goegrup Lake Nature Reserve.

Any motorised water-based activities, such as water-skiing and personal water craft (for example jet-skis), will be allowed in designated areas only. In October 2014, the Department of Transport gazetted the closure of all waters of the Canning River upstream of the Kent Street weir to all motorised vessels, with the exception of Swan River Trust and Department of Water vessels, as the area contains oxygenation plant submerged infrastructure. The (Draft) *Sharing the Rivers, Swan Canning Riverpark-Aquatic Use Review and Management Framework* (Swan River Trust & Department of Transport 2011) proposes the introduction of closed waters for motorised vessels upstream of Riverton Bridge and the retention of existing closed waters for motorised vessels at Matilda Bay.

### Domestic animals (dogs and cats)

Dogs are allowed in national parks or conservation parks only in designated areas, but are not allowed in nature reserves. The exception is approved assistance dogs (for example guide dogs) and specially trained dogs for search and rescue operations, security or educational purposes or feral animal control, which may be allowed in all areas. Areas may be declared designated dog areas on some department-managed land where impacts are considered manageable and/or there has been a history of dog access in the area. Under the CALM Regulations, designated areas will be signposted where practical, with the conditions specified on the signs.

Dogs are allowed at Buffalo Beach and on the beach below the high water mark in Leschenault Peninsula Conservation Park. Dogs on leads are also allowed along designated walk trails in Matilda Bay Reserve, Len Howard Conservation Park and Canning River Regional Park. There are designated dog exercise areas on some City of Canning-managed lands of the Canning River Regional Park. Further information is provided on the City of Canning website (see [www.canning.wa.gov.au/D/dogs.html](http://www.canning.wa.gov.au/D/dogs.html)).

Domestic cats are excluded from all department-managed lands; there are no exceptions to this 'exclusion of cats' policy. The City of Canning manages a local cat law (that is *City of Canning Control and Keeping of Cats Local Law 2007*) with an objective to protect native fauna within Cat Prohibited Areas, such as parks and reserves of the Canning River Regional Park (see [www.canning.wa.gov.au/component/option,com\\_jdownloads/Itemid,0/catid,17/task,viewcategory/](http://www.canning.wa.gov.au/component/option,com_jdownloads/Itemid,0/catid,17/task,viewcategory/)).

Some reserves of the planning area are baited for foxes with 1080 several times a year, which may pose a risk to domestic animals. Where baiting occurs, signage will be installed to notify and warn visitors of the risk.

### Desired outcome

A variety of high quality sites, facilities and trails that meet visitor needs and are compatible with key values.

### Management actions

1. Maintain, upgrade or develop recreational facilities including day use, camping, trails and car parks in accordance with this management plan (Table 1) and departmental policy. Rehabilitation and any necessary erosion control works should be considered an integral part of any such developments.
2. Investigate the current use, safety and conservation implications of the gazetted water ski area in Lake Preston and through the Department of Transport, consider revoking the gazettal.
3. Develop and/or implement existing recreation master plans for Yalgorup National Park and Leschenault Peninsula Conservation Park, in consultation with local users and other key stakeholders, highlighting sensitive areas and appropriate recreation use and considering the surrounding area.
4. Review and update the existing recreation master plan for Canning River Regional Park, in consultation with the City of Canning and other key stakeholders, highlighting sensitive areas and appropriate recreation use and considering the surrounding area.
5. Continue to liaise with the Department of Sport and Recreation, WestCycle, WA Mountain Bike Association and local government develop a mountain bike master plan for the Perth and Peel region. The master plan will identify suitable sites in the planning area where designated trails may be considered for development in the future.



6. Should sites in the planning area be identified for designated trails then the process will be guided by the WA Trail Development Process.
7. Review or develop other site plans before any on-ground implementation to manage specific visitor use issues.
8. Work with key stakeholders to provide other compatible recreation opportunities on areas adjoining or near to the reserves.
9. Support and promote Leave No Trace as a minimal impact program, where appropriate.

## 20. Visitor interpretation and education

The provision of consistent and accurate information to visitors allows managers to communicate the value of these areas and explain how to protect them. The department provides information about the planning area through a range of media, including park signs, information bays, printed materials, electronic media (for example the department’s Explore Parks WA website and ParkFinder WA mobile app.) and social networking. Information is also available from department staff, and from external sources such as conservation groups, volunteers, local governments, tour operators and tourism industry.



Interpretation sign at Belvidere day-use site. Photo – Grace Patorniti/Parks and Wildlife



Interpretation sign at Brixton Street Wetlands. Photo – Parks and Wildlife

The main interpretation sites in the planning area are within:

- Matilda Bay Reserve
- Canning River Regional Park
- Len Howard Conservation Park
- Yalgorup National Park
- Leschenault Peninsula Conservation Park.

Interpretive themes in some reserves include the conservation values for the area and how to protect these values. It is important that with increased pressure on reserves from rising visitor numbers and urban development, the department works with local government, developers and local community to develop information and interpretive facilities conveying the appropriate use of reserves, code of conduct on department-managed land and the conservation values.

Primary interpretive themes expressed within the planning area are:

- landscapes (wetlands, remnant bushland, catchments)
- ecology (relating to wetlands and waterways, flora and fauna of an area)
- biodiversity (bioregions, threatened or restricted habitats, introduced species and impacts)
- people (Noongar heritage, early explorers and settlers)
- recreation (activities and sites available, code of conduct appropriate for activities and reserves).

Education programs, including presentations and organised field activities, are targeted at specific user groups to foster greater awareness, appreciation and understanding of the area's key values. The planning area provides a base for a range of opportunities for education programs for schools, and the department often liaises with local schools.

There are education centres in several locations surrounding the reserves in the planning area. The Canning River Eco Education Centre, which is managed by the City of Canning, was opened in June 2008. Its aim is to increase awareness and understanding of the Canning River and surroundings by running environmental education programs in schools.

Canning River Regional Park has an interpretation plan (DEC 2010) that guides development and implementation of interpretive facilities and services in the regional park. There is a communication plan (CALM 2003b) for Perth's regional parks, which includes Canning River Regional Park. The *Canning River Regional Park Historical Survey* (Richards 1991) provides a guide to reference material that informs how the area, now occupied by the regional park, was used and settled in former times (that is early exploration, Aboriginal association, early settlement and places of historic interest). Also the interpretation plan, *Marli Riverpark: an Interpretation Plan for the Swan and Canning Riverpark* (National Trust of Australia (WA) 2014) includes information on Canning River Regional Park and Matilda Bay Reserve.

### Desired outcome

Increase visitor appreciation and awareness of the natural and cultural values of the planning area.

### Management actions

1. Provide, through partnerships and sponsorships where appropriate, quality information, interpretation and educational opportunities for visitors to increase their understanding and appreciation of:
  - a) key values of the planning area
  - b) management issues, such as appropriate visitor activities, behaviour, access and visitor safety
  - c) tuart woodlands
  - d) internationally important wetland systems
  - e) Noongar cultural values
  - f) other heritage of the planning area.

2. Involve Noongar people in the development of visitor information and education opportunities.
3. Develop and implement interpretation and communication plans for key sites.
4. Continue to maintain and upgrade interpretive facilities and directional signage, ensuring an accurate reflection of information and in conjunction with key stakeholders.

## 21. Tourism and commercial operations

Commercial concessions, such as leases and licences for commercial tourism operations, allow private businesses to offer high quality tourism and recreation opportunities, facilities and services to the public. This can help the department in providing quality visitor experiences within the planning area. Commercial concessions are granted in consultation with the Conservation Commission and must be consistent with the purpose of the reserve, the protection of key values and with the objectives of this management plan. Commercial concessions on land managed by Parks and Wildlife will be established and managed in accordance with *Policy Statement 18 – Recreation, tourism and visitor services* (DEC 2006a).

Licences allow commercial operators to enter and use Parks and Wildlife-managed lands and waters. Three reserves of the planning area have licenced commercial operations. Currently, there are four ‘T class’ commercial operators that possess licences to conduct activities at Matilda Bay Reserve, such as catering, wedding functions and small craft hire. In Yalgorup National Park, 61 ‘T class’ commercial operations licences are current for operators to conduct activities such as guided walks, wildlife watching and vehicle-based tours. In Leschenault Peninsula Conservation Park, 59 ‘T class’ commercial operations licences are current.

Leases are formal agreements that allow exclusive use of land. They are issued when the activity or land use involves significant infrastructure and/or retailing. There are two reserves of the planning area that have formal lease agreements. Keanes Point Reserve is leased to the Royal Freshwater Bay Yacht Club and Matilda Bay Reserve has nine leases which include a restaurant, kiosk, water sports complex, clubhouses and a power cabling easement. It is likely that the majority of these leases will continue throughout the life of the plan. Any future proposals should have a strong relevance to the historical or cultural aspects of the reserve.

### Desired outcome

Commercial and tourism activities are compatible with management objectives. The range of services and opportunities within the planning area is extended by the involvement of private enterprise, where appropriate.

### Management actions

1. Evaluate proposals for licences and commercial tourism leases according to departmental policy.
2. Ensure that all commercial operations operate under a lease, licence or permit agreement with appropriate conditions.
3. Investigate opportunities for partnerships with commercial operators to provide built accommodation and camping within the planning area, as deemed necessary and appropriate.



# Managing resource use

## 22. Resource exploration and development

Exploration, extraction and rehabilitation activities are approved and largely governed by other government agencies under legislation such as the *Environmental Protection Act 1986*, *Mining Act 1978* and state agreements. Petroleum (which includes oil, gas and geothermal energy) exploration and production within state land and onshore waters is authorised under the *Petroleum and Geothermal Energy Resources Act 1967* (Petroleum Act). The Department of Mines and Petroleum (DMP) is the State's lead agency for related assessment and approvals under the Mining Act and the Petroleum Act and is a decision making authority for non-state agreement projects under these Acts. Projects of state significance may be administered by the Department of State Development under project specific agreement acts.

A broad range of mineral commodities occur in the southern part of the Swan Coastal Plain and the whole of the underlying Perth Basin is a potential source of petroleum resources and geothermal energy. The area is also prospective for geological storage of greenhouse gases.

Applications to explore or mine within reserves vested in the Conservation Commission may be referred to the Minister for Environment as required under environmental, mining and petroleum legislation. Exploration and development proposals that may cause significant impact on key values may be referred to the EPA for environment impact assessment. Actions that can potentially have a significant impact on matters of national environmental significance may also require approval under the EPBC Act.

### Basic raw materials

The Mining Act applies to the exploration and extraction of basic raw materials within Crown land. However, basic raw materials extracted from within conservation reserves on Crown land for park management purposes do not require approval under this Act. The extraction of basic raw materials on private land for public purposes is mostly regulated by local government authorities.

Basic raw materials such as gravel, shale, clay, sand, limestone and rock continue to be in demand by local governments and Main Roads Western Australia for the construction and maintenance of roads. The department also uses basic raw materials for its own purposes in recreation and management activities.

The extraction of raw materials can result in the loss of vegetation and the introduction and spread of dieback and weeds, as well as having visual impacts. In considering applications by government agencies and local government authorities to access basic raw materials within lands vested in Conservation Commission, the Conservation Commission will be guided by the principles outlined in its *Position Statement No. 12 Basic Raw Materials: state government and local government access to lands vested in the Conservation Commission under the Conservation and Land Management Act 1984* (2015), see [www.conservation.wa.gov.au/position-statements.aspx](http://www.conservation.wa.gov.au/position-statements.aspx).

## 23. Public utilities and services

Infrastructure such as electricity, water, gas and telecommunication lines are placed on road reserves, easements or underground in the planning area.

This management plan provides for continuation of existing utility and service arrangements. Any proposed utilities or services need to be located to minimise impacts on the area's key values, including visual amenity. To limit these impacts, the department prefers that utility infrastructure that is not servicing the planning area itself be located outside the area. When this is unavoidable, the use of already degraded areas, pre-existing corridors or co-location with existing infrastructure is preferred.

The maintenance of existing infrastructure must consider sensitive sites such as TECs, rare flora, fauna breeding areas and cultural significance. Access, particularly in low lying wetlands, can lead to the spread of weeds and disease; therefore appropriate hygiene practices must be employed.

Utility providers need permission from the relevant District Manager/Regional Parks Manager for access to Parks and Wildlife-managed land. This permission will include conditions of entry and operation for the maintenance of infrastructure, including during emergencies.

Storm outlets and drains are present in Canning River Regional Park. These need to be managed for their aesthetics and their potential impacts on water quality. The City of Canning, Water Corporation and former Swan River Trust operational staff have upgraded some outfalls in the park in accordance with water sensitive urban design principles and best practice.

There are rubbish bins on some reserves. The collection of waste is the responsibility of either the department or local government authority.

The visual impact of any infrastructure or facilities should be carefully considered, along with issues such as erosion.

## 24. Forest produce

Licences may be granted under section 99A(1) of the CALM Act for (i) removal of exotic trees, honey, bees-wax or pollen, (ii) forest produce to be taken for use for therapeutic, scientific or horticultural purposes, or (iii) essential works (as defined in the Act).

Under section 33(1)(cb) of the CALM Act, forest produce obtained as a by-product of necessary operations (on nature reserves) or compatible operations (on national parks or conservation parks) can be used for making improvements to the land, where it is consistent with the reserve purpose. Forest produce obtained in this manner may be used by the department for management purposes.

Firewood collection, and the extraction and sale of craftwood from national parks and nature reserves, is not allowed.

## 25. Beekeeping

There are 17 current apiary sites on existing or proposed reserves of the planning area (within conservation reserves or within a 2km radius). Existing and proposed sites will be reviewed and managed in accordance with the department's *Policy Statement 41- Beekeeping on public land* and associated guidelines.

## 26. Water resources

The main state legislation that governs water resource management is the *Rights in Water and Irrigation Act 1914* (RIWI Act) with DoW responsible for issuing licences and permits under the RIWI Act. A licence issued by DoW is the main regulatory instrument governing the abstraction of surface and ground water. Each licence defines an annual right to take water (an individual annual entitlement or allocation) and sets conditions that apply to the allocation. The RIWI Act also requires that water be set aside to sustain the environment.

DoW prepares water allocation plans which state how much water can be taken for consumptive use, while leaving sufficient in the environment to meet in situ ecological and recreational or cultural needs. These plans, along with source protection plans, prepared by DoW and the Water Corporation, include objectives and policies that the department takes into account when planning at strategic and operational levels. Permits (related to the disturbance of beds and banks) and licences (for the taking and use of water) are required within proclaimed areas. The protection of water resources in the planning area is covered under the *Country Areas Water Supply Act 1947* and the *Metropolitan Water Supply Sewerage and Drainage Act 1909*. For information on water allocation plans see [www.water.wa.gov.au/Managing+water/Allocation+planning/default.aspx](http://www.water.wa.gov.au/Managing+water/Allocation+planning/default.aspx).

The primary role of the department in this aspect of water resource management is to provide input and advice into the licensing process about potential environmental risks associated with the taking of water from land vested in the Conservation Commission. This occurs through the environmental impact assessment process via advice to the Conservation Commission and the EPA. On lands vested in the Conservation Commission, the department-issued CALM Act section 101 permit is considered a precursor to a RIWI Act process and requires consultation with the Conservation Commission. See the Conservation Commission's *Position Statement No. 11* for additional guidance on the protection of surface and groundwater biodiversity values of lands vested in the Conservation Commission of Western Australia (December 2014) available at [www.conservation.wa.gov.au](http://www.conservation.wa.gov.au).

Under the *Waterways Conservation Act 1976*, management areas may be set aside for the conservation of watercourses and associated lands. Five management areas have been established in WA, including the Peel/Harvey Estuaries, and the Leschenault Estuary and associated rivers. Under this Act, the responsible minister can also use a licensing system to control the disposal of material into waterways.

The Preston Beach Water Reserve, located in part of the Yalgorup National Park, is the only public drinking water supply in the planning area (DoW 2006). DoW's Operational Policy 13 (DoW 2012) provides key guidance about the level and type of recreational activity allowed within a PDWSA. DoW requires access to public drinking water source areas to conduct investigations into alternative water supplies; and to access surface water, groundwater, and meteorological monitoring sites in the planning area for data collection and asset maintenance.

There are several bores and stream gauging stations maintained by the department and DoW either in, or next to, the planning area, which are used for research and monitoring purposes. Also, the department uses water points throughout the planning area for fire control, which will continue to be maintained.

Ground and surface water levels may be lowered by the use of licensed and unlicensed bores in urban areas, which in turn influences the volume of water in wetlands in the area. Water abstraction may need to be restricted in areas near the planning area to maintain the integrity of the lakes and wetlands (for example, Lake Clifton) and to maintain the 'filter strips' of fringing vegetation around the lakes.

The Kent Street Weir at Canning River Regional Park will be transferred from the Department of Water to Parks and Wildlife once the scheduled upgrade or replacement occurs in 2016. It is anticipated that access across the river at the weir will be maintained before, during and after these works. Parks and Wildlife will continue to manage the weir gates and water flows in consultation with other stakeholders.

### Desired outcome

Impacts of resource use on key values are minimised.

### Management actions

1. Provide advice in relation to development proposals (including proposals for infrastructure development, extraction of minerals and petroleum resources, development of geothermal energy and the geological storage of greenhouse gases), with a view to:
  - a) minimising the permanent loss of native vegetation and/or damage to its integrity because of development
  - b) seeking the replacement of native ecosystems permanently lost to development, in line with the *WA Environmental Offsets Policy* (Government of Western Australia 2011)
  - c) promoting the construction of infrastructure such as roads, pipelines and other utilities at common locations, such as infrastructure corridors, while minimising construction in sensitive areas.
2. Liaise with the Department of Mines and Petroleum and the Department of State Development to assess the effects of proposed resource use on important areas such as habitats for threatened species, cultural sites and key recreation sites.
3. Assist with monitoring compliance with conditions and management plans to ensure that any impacts from resource use are within predicted and approved limits, and seek appropriate offsets to fully address any loss of biodiversity values.
4. The Department of Parks and Wildlife will seek to ensure that all basic raw material removal from lands vested in the Conservation Commission will comply with relevant legislation, policies and guidelines.
5. Ensure resource users are responsible for managing environmental problems, particularly the introduction and spread of weeds and disease (for example *Phytophthora dieback*).
6. Provide for continued access by agencies and utility managers to department-managed lands for the maintenance of existing assets, while encouraging future placement of utilities to be outside of department-managed land.
7. Ensure that land disturbed for any utility infrastructure development or maintenance is adequately rehabilitated at the expense of the parties responsible.
8. Allow the removal of forest produce only where it is consistent with the CALM Act and where a licence is granted by the Director General (i) for therapeutic, scientific or horticultural purposes, (ii) because of essential works, or (iii) because of the removal of exotic trees and apiary activities.
9. Manage beekeeping in accordance with *Policy Statement 41- Beekeeping on public land* (under review) and the *General conditions for using apiary authorities on Crown land in Western Australia* (DPaW 2013b).
10. Liaise with the Department of Water and adjacent land managers about the management of water resources to ensure that sufficient environmental flows are maintained for rivers and wetlands in the planning area, and to ensure that negative environmental effects are minimised.

# Research and monitoring

Research and monitoring will help in achieving the key performance indicators listed in this plan. This includes gaining a better understanding of those values identified as being most at risk and the management issues most likely to have negative impacts on key values. The plan allows for the adaptation of management in light of new knowledge arising from research and monitoring, by regularly reviewing management activities.

Broad direction for research and monitoring in the planning area is provided by the department's Science and Conservation Division in *A strategic plan for biodiversity conservation research 2008–2017* (DEC 2008b) as well as species recovery plans, floristic reports and research priorities set by the Centre of Excellence for Climate Change, Woodland and Forest Health, based at Murdoch University. The *Ecological character description for the Peel–Yalgorup Ramsar site* (Hale & Butcher 2007) and the *Ecological character description for the Vasse–Wonnerup Ramsar site* (WRM 2007) provide direction for reducing knowledge gaps and highlight the monitoring priorities for the respective wetlands.

Research also includes social research, which contributes to an understanding of people's attitudes and behaviour towards the environment and how they interact with it. It can also help in better understanding issues related to the department's programs, improve decision making and the effective and timely delivery of services. It is important that surveys are periodically conducted throughout the planning area, targeting high use areas and areas of interest.

## Desired outcome

Increase knowledge and understanding of the key values and management issues to the planning area to inform management and allow assessment of the key performance indicators in this management plan.


## Management actions

1. Develop and implement an integrated program of survey, research and monitoring aimed at:
  - a) collecting evidence to allow reporting on key performance indicators
  - b) establishing baseline information
  - c) addressing key management issues
  - d) other department research priorities.
2. Incorporate research and monitoring findings into interpretive and educational material where appropriate.
3. Encourage and support, wherever possible, individuals, educational institutions and other organisations where their research contributes directly to departmental strategies or the implementation and assessment of this management plan.
4. Adapt management according to research outcomes, including the assessment of ecosystem rehabilitation and experimental trials.



Parks and Wildlife staff monitoring for birds in Kooljerrenup Nature Reserve. Photo – Melissa Loomes/Parks and Wildlife





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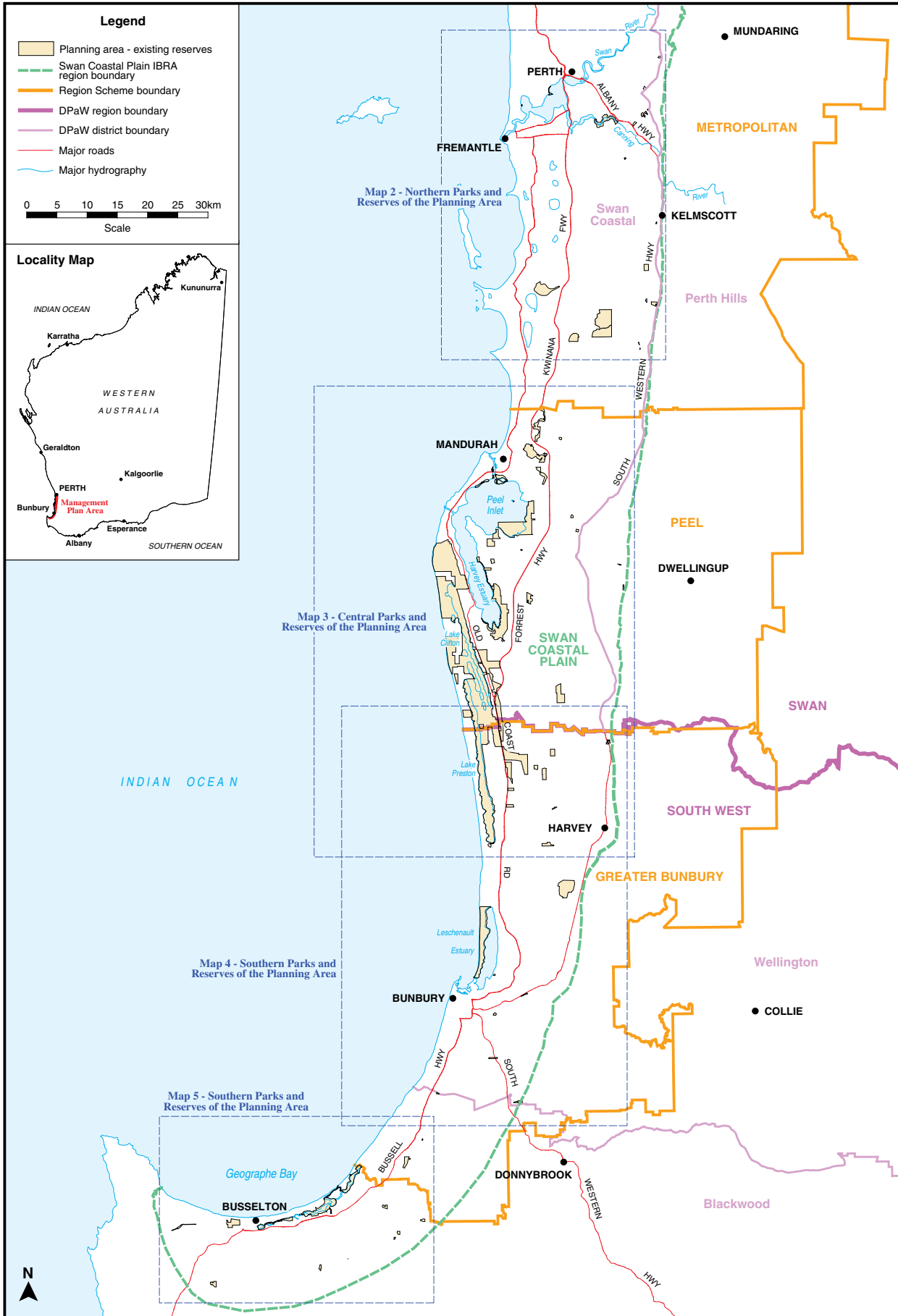
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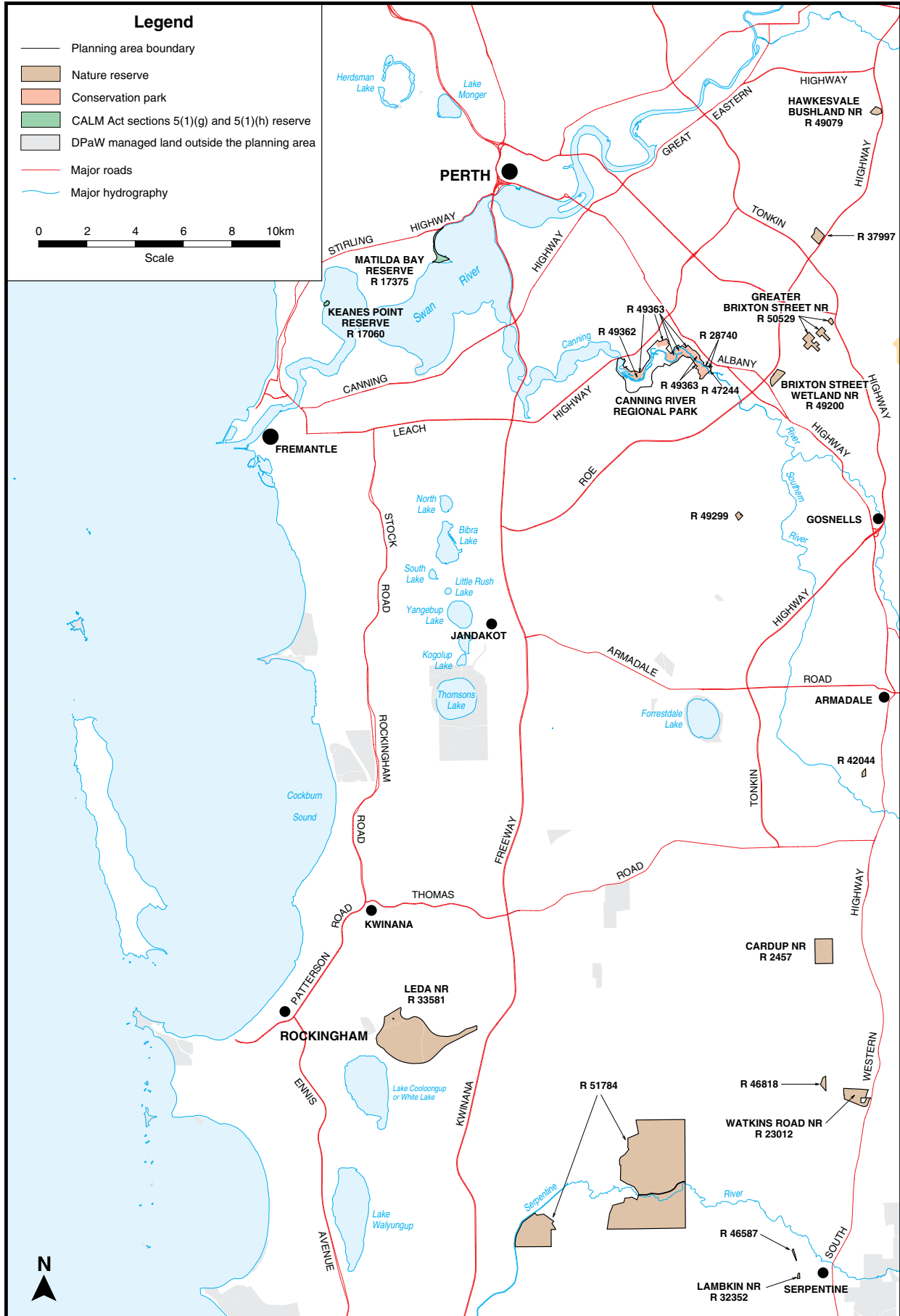
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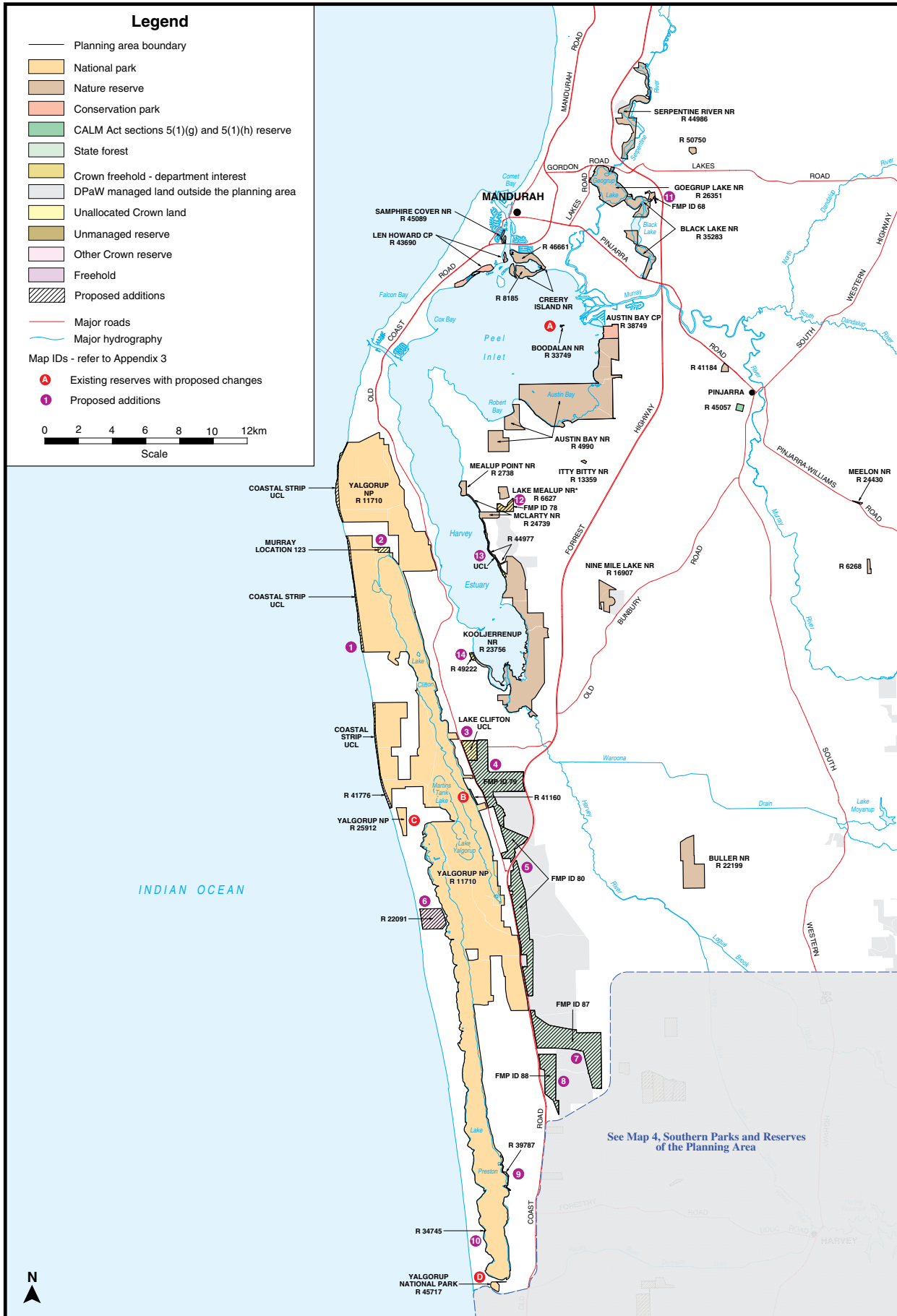
Map 1: Management plan area



Map 2: Northern parks and reserves of the planning area – tenure

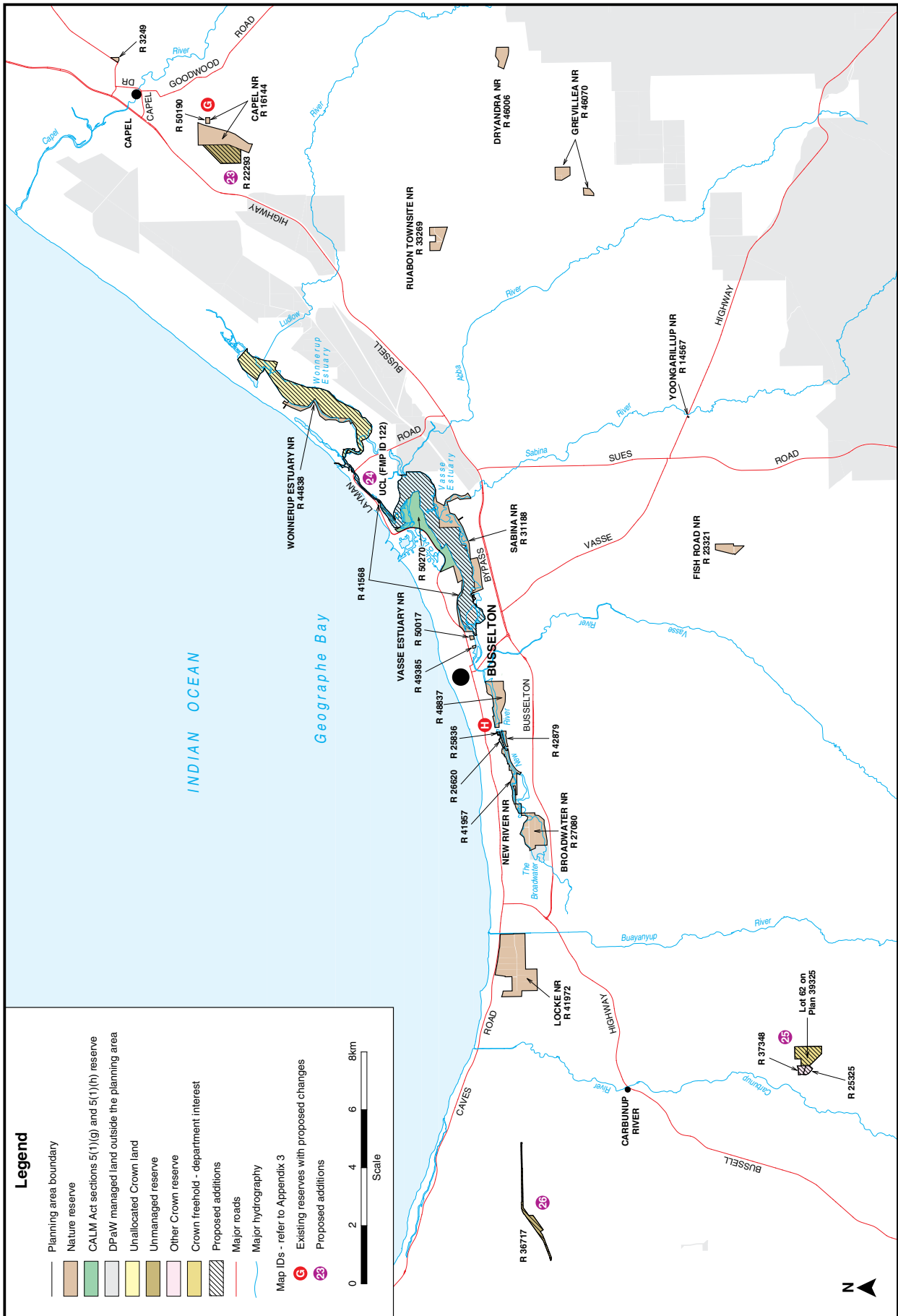


Map 3: Central parks and reserves of the planning area – tenure





Map 5: Southern parks and reserves of the planning area – tenure (continued)



# Appendices

## Appendix 1: Existing reserves of the planning area

Reserve name / tenure	Reserve number	Purpose	Class <sup>^</sup>	Area (ha) <sup>#</sup>	Comments
<b>Northern parks and reserves of planning area</b>					
Cardup Nature Reserve*	R 2457	Conservation of flora and fauna	A	75	
Dundas Road Nature Reserve*	R 37997	Conservation of flora and fauna	A	20	
Hawkevale Bushland Nature Reserve*	R 49079	Conservation of flora and fauna	A	10	
Keanes Point Reserve (5(1)(g) reserve)*	R 17060	Recreation and purposes incidental thereto	A	2	
Kenwick Wetlands Nature Reserve*	R 49200	Conservation of flora and fauna	A	20	Also known as Brixton St Wetlands
Kenwick Wetlands Nature Reserve*	R 50529	Conservation of flora and fauna	A	40	Also known as Greater Brixton St Wetlands
Lambkin Nature Reserve*	R 32352	Conservation of flora and fauna	U	2	
Leda Nature Reserve*	R 33581	Conservation of flora and fauna	A	440	
Matilda Bay Reserve (5(1)(g) reserve)*	R 17375	Recreation	A	20	
Un-named conservation park	R 28740	Conservation park	U	2	Forms part of Canning River Regional Park
Un-named conservation park	R 47244	Conservation park	U	1	Forms part of Canning River Regional Park
Un-named conservation park	R 49363	Conservation park	U	93	Forms part of Canning River Regional Park
Un-named nature reserve	R 49362	Conservation of flora and fauna	U	15	Forms part of Canning River Regional Park
Un-named nature reserve	R 42044	Conservation of flora and fauna	U	4	Also known as Lambert Lane Nature Reserve
Un-named nature reserve	R 46818	Conservation of flora and fauna	A	8	Also known as Roman Road Nature Reserve
Un-named nature reserve	R 46587	Conservation of flora and fauna	U	2	Also known as Bradby Nature Reserve
Un-named nature reserve	R 49299	Conservation of flora and fauna	A	5	



Reserve name / tenure	Reserve number	Purpose	Class <sup>a</sup>	Area (ha) <sup>#</sup>	Comments
Un-named nature reserve	R 51784	Conservation of flora and fauna	A	1312	
Watkins Road Nature Reserve*	R 23012	Conservation of flora and fauna	U	55	
<b>Central parks and reserves of planning area</b>					
Austin Bay Nature Reserve	R 4990	Conservation of flora and fauna	A	1660	Change name to Austin Bay/ Carrabungup Nature Reserve
Austin Bay Conservation Park*	R 38749	Conservation park	U	70	
Black Lake Nature Reserve*	R 35283	Conservation of flora and fauna	U	270	
Boodalan Nature Reserve	R 33749	Recreation and conservation of fauna	U	1	See Appendix 3 for proposed changes
Buller Nature Reserve	R 22199	Conservation of flora and fauna	A	300	
Creery Island Nature Reserve*	R 8185	Conservation of flora and fauna	A	75	
Creery Wetlands Nature Reserve*	R 46661	Conservation of flora and fauna	A	95	
Goegrup Lake Nature Reserve*	R 26351	Conservation of flora and fauna	U	320	
Itty Bitty Nature Reserve*	R 13359	Conservation of flora and fauna	A	3	
Kooljerrenup Nature Reserve	R 23756	Conservation of flora and fauna	A	1240	
Lake Mealup Nature Reserve*	R 6627	Conservation of flora and fauna	A	35	
Len Howard Conservation Park	R 43690	Conservation park	A	65	
McLarty Nature Reserve	R 24739	Conservation of flora and fauna	A	50	
Mealup Point Nature Reserve	R 2738	Conservation of flora and fauna	A	30	
Meelon Nature Reserve*	R 24430	Conservation of flora and fauna	A	3	
Nine Mile Lake Nature Reserve	R 16907	Conservation of flora and fauna	A	115	
Samphire Cover Nature Reserve*	R 45089	Conservation of flora and fauna	A	10	
Serpentine River Nature Reserve*	R 44986	Conservation of flora and fauna	A	260	
Un-named 5(1)(g) reserve	R 41160	Foreshore management	U	7	See Appendix 3 for proposed changes
Un-named 5(1)(g) reserve	R 45057	Conservation and the protection of Aboriginal heritage and culture	U	15	Known as Mooyootj Nature Reserve
Un-named nature reserve	R 6268	Conservation of flora and fauna	U	15	Also known as Burnside Native Reserve Proposed to reclassify as class A

Reserve name / tenure	Reserve number	Purpose	Class <sup>a</sup>	Area (ha) <sup>#</sup>	Comments
Un-named nature reserve	R 41184	Conservation of flora and fauna	A	15	Also known as Pinjarra Nature Reserve
Un-named nature reserve	R 44977	Conservation of flora and fauna	A	25	
Un-named nature reserve	R 50750	Conservation of flora and fauna	A	15	Also known as Murray Field Nature Reserve
Yalgorup National Park	R 11710	National park	A	13,050	
Yalgorup National Park*	R 25912	National park and propagation and harvesting of marram grass	U	65	See Appendix 3 for proposed changes
Yalgorup National Park*	R 45717	National park	A	20	See Appendix 3 for proposed changes
<b>Southern parks and reserves of planning area</b>					
Benger Swamp Nature Reserve	R 34811	Conservation of flora and fauna	U	580	
Broadwater Nature Reserve	R 27080	Conservation of flora and fauna	U	80	
Byrd Swamp Nature Reserve*	R 2517	Conservation of flora and fauna	A	40	
Capel Nature Reserve	R 16144	Conservation of flora and fauna	A	95	
Capel Nature Reserve*	R 50190	Conservation of flora and fauna	U	3	See Appendix 3 for proposed changes
Crampton Nature Reserve	R 24472	Conservation of flora and fauna	A	35	
Dryandra Nature Reserve*	R 46006	Conservation of flora and fauna	A	25	
Fish Road Nature Reserve	R 23321	Conservation of flora and fauna	U	25	
Harvey Flats Nature Reserve	R 12049	Conservation of flora and fauna and water	A	80	
Joshua Creek Nature Reserve*	R 49857	Conservation of flora and fauna	U	35	
Leschenault Peninsula Conservation Park*	R 42470	Conservation park	A	580	
Locke Nature Reserve	R 41972	Conservation of flora and fauna	U	200	
Morangarel Nature Reserve	R 38393	Conservation of flora and fauna	A	5	
New River Nature Reserve*	R 25836	Conservation of flora and fauna	U	1	See Appendix 3 for proposed changes
New River Nature Reserve*	R 26620	Conservation of flora and fauna	U	5	See Appendix 3 for proposed changes
New River Nature Reserve*	R 41597	Conservation of flora and fauna	U	30	
New River Nature Reserve*	R 42879	Conservation of flora and fauna	U	5	See Appendix 3 for proposed changes

Reserve name / tenure	Reserve number	Purpose	Class <sup>^</sup>	Area (ha) <sup>#</sup>	Comments
New River Nature Reserve*	R 48837	Conservation of flora and fauna	U	65	See Appendix 3 for proposed changes
Oats Road Nature Reserve*	R 46070	Conservation of flora and fauna	A	30	
Riverdale Nature Reserve	R 12632	Conservation of flora and fauna and water	A	40	
Ruabon Townsite Nature Reserve*	R 33269	Conservation of flora and fauna	U	35	
Sabina Nature Reserve	R 31188	Conservation of flora and fauna	A	103	
Un-named 5(1)(h) reserve	R 1086	Tuart conservation and restoration	U	50	
Un-named 5(1) (h) reserve	R 50270	Conservation	U	120	
Un-named 5(1)(g) reserve	R 3672	Timber	U	3	See Appendix 3 for proposed changes
Un-named Nature Reserve	R 3249	Conservation of flora and fauna	A	3	
Un-named nature reserve	R 49730	Conservation of flora and fauna	A	50	
Un-named nature reserve	R 40564	Conservation of flora and fauna	U	5	See Appendix 3 for proposed changes
Wellard Nature Reserve*	R 2547	Conservation of flora and fauna	A	10	
Wonnerup Nature Reserve*	R 41568	Conservation of flora and fauna	U	25	
Wonnerup Estuary Nature Reserve*	R 44838	Conservation of flora and fauna	U	30	
Vasse Estuary Nature Reserve*	R 49385	Conservation of flora and fauna	U	1	
Vasse Estuary Nature Reserve*	R 50017	Conservation of flora and fauna	A	2	
Waterloo Nature Reserve*	R 46108	Conservation of flora and fauna	U	12	
Yarloop Nature Reserve*	R 47123	Conservation of flora and fauna	A	9	
Yoongarillup Nature Reserve*	R 14567	Conservation of flora and fauna	U	0.1	Also known as Spanish Settlers

\*Provisional name.

<sup>^</sup>Class: U= Unclassified, A= class 'A' as defined in the *Land Administration Act 1997*.

<sup>#</sup>Approximate area.

## Appendix 2: Canning River Regional Park

### Canning River Regional Park current management areas

Planning area	Proposed reserve purpose	Proposed management agency
Area 1	Recreation and natural environment uses	City of Canning
Area 2	Recreation and natural environment uses	City of Canning
Area 3	Conservation park	Parks and Wildlife
Area 4	Recreation and natural environment uses	City of Canning / Private property*
Area 5	Recreation and natural environment uses	City of Canning / Private property*
Area 6	Conservation park	Parks and Wildlife / Private property*
Area 7	Recreation	City of Canning
Area 8	Recreation and natural environment uses	City of Canning
Area 9	Conservation park	Parks and Wildlife
Area 10	Conservation park	Parks and Wildlife
Area 11	Recreation	City of Canning
Area 11a	Conservation park	City of Canning
Area 12	Conservation park	Parks and Wildlife
Area 13	Recreation and natural environment uses	City of Canning
Area 14	Conservation park	Parks and Wildlife
Area 15	Heritage uses	City of Canning
Area 16	Conservation park	Parks and Wildlife
Area 17	Conservation park	Parks and Wildlife
Area 18	Recreation	City of Canning
Area 19	Conservation park	Parks and Wildlife
Area 20	Recreation and natural environment uses	City of Canning
Area 21	Conservation park	City of Canning
Area 22	Conservation park	Parks and Wildlife
Area 23	Recreation and natural environment uses	City of Canning
Area 24	Recreation and natural environment uses	City of Canning
Area 25	Conservation of flora and fauna <sup>1</sup>	Parks and Wildlife

**Conservation park** - reserves established to meet as much of the demand for recreation by members of the public as is consistent with the proper maintenance and restoration of the natural environment, the protection of indigenous flora and fauna and the preservation of any feature of archaeological, historic or scientific interest.

**Natural environment uses** - the management emphasis is to provide for appropriate uses of the natural environment. Areas will be managed for conservation and enhancement of flora and fauna, improvement of landscape qualities, and public use by walking trails and cycle paths.

**Recreation** - the management emphasis will be to provide a variety of recreation opportunities, being primarily passive recreation pursuits such as picnic facilities, and limited development of active recreation pursuits such as car parking, buildings, and reticulated and landscape areas. The type and scale of facilities provided will depend on the values of any given area, community demand for recreation, and appropriate park management.

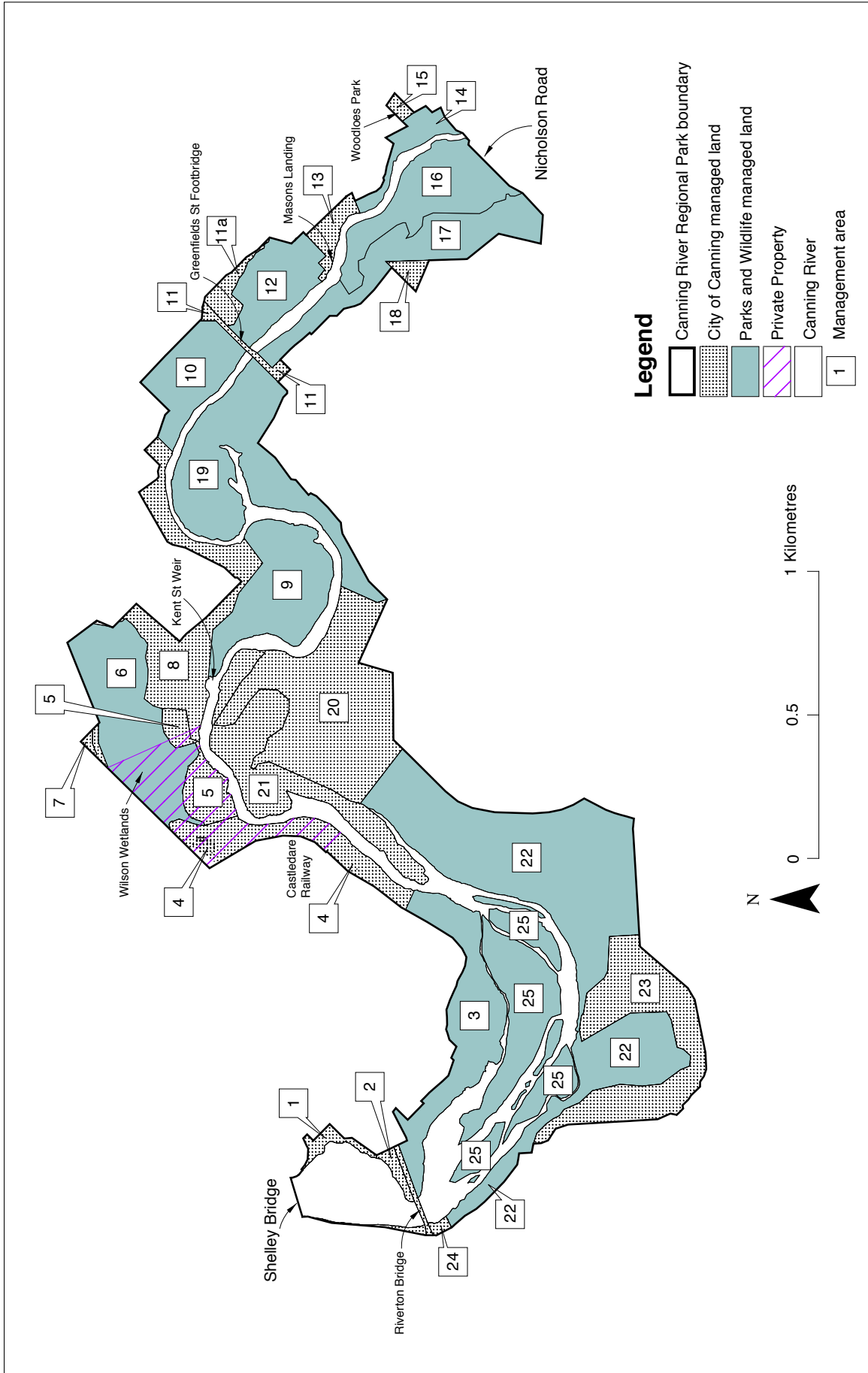
**Heritage uses** - Preservation of heritage site and the development of facilities for visitor interpretation.

<sup>1</sup>**Nature Reserve** - reserves established to maintain and restore the natural environment, and to protect, care for, and promote the study of, indigenous flora and fauna, and to preserve any feature of archaeological, historic or scientific interest.

\***Areas 4 & 5** - These areas also comprise private property. WAPC is investigating acquisition of the private freehold lots, with the intention of transferring them to the City of Canning.

\***Area 6** - This area also comprises private property. WAPC is investigating acquisition of the private freehold lots, with the intention of transferring them to Parks and Wildlife.

Canning River Regional Park current management areas



## Appendix 3: Proposed changes to existing reserves and additions within the planning area

Map ID	Reserve/Lot number	Current vesting	Current purpose	Area (ha) #	Proposed purpose	Class <sup>A</sup>	Proposed changes
<b>EXISTING RESERVES</b>							
A	R 33749 Boodalai Nature Reserve	Conservation Commission and Shire of Murray	Recreation and conservation of fauna	1	Conservation of fauna	U	Delist/abolish this nature reserve if the proposed investigation finds that it no longer serves its current purpose.
B	R 41160 Un-named 5(1)(g) reserve	Conservation Commission	Foreshore management	8	National park	A	Incorporate into Yalgorup National Park (R 11710).
C	R 25912 Yalgorup National Park*	Conservation Commission	National park and propagation and harvesting of marram grass	65	National park	U	Investigate inclusion into Yalgorup National Park (R 11710).
D	R 45717 Yalgorup National Park*	Conservation Commission	National park	20	National park	A	Incorporate into Yalgorup National Park (R 11710).
E	R 3672 Un-named 5(1)(g) reserve	Conservation Commission	Timber	3	Conservation of flora and fauna	U	Incorporate into Yarloop Nature Reserve* (R 47123).
F	R 40564 Un-named nature reserve	Conservation Commission	Conservation of flora and fauna	6	Conservation park	A	Incorporate into Leschenault Peninsula Conservation Park* (R 42470).
G	R 50190 Un-named nature reserve	Conservation Commission	Conservation of flora and fauna	3	Conservation of flora and fauna	A	Incorporate into Capel Nature Reserve (R 16144).
H	R 25836 R 26620 R 42879 R 48837 Un-named nature reserves	Conservation Commission	Conservation of flora and fauna	1 3 6 65	Conservation of flora and fauna	U	Incorporate into New River Nature Reserve* (R 41597).

Map ID	Reserve/Lot number	Current vesting	Current purpose	Area (ha)#	Proposed purpose	Class <sup>A</sup>	Proposed changes
<b>PROPOSED ADDITIONS</b>							
1	Coastal strip to low water mark	Unallocated Crown land	N/A	157	National park	A	Addition to Yalgorup National Park (R 11710) as recommended in the Yalgorup National Park Management Plan 1995–2005 (CALM 1995) to rationalise boundaries.
	Parts of R 41776	Shire of Waroona	Recreation and the protection of the environment	20			
2	Lot 123 on Plan 249814	Unallocated Crown land	N/A	20	National park		Addition to Yalgorup National Park (R 11710) as part of a land exchanged in 1992.
3	Lake Clifton townsite	Unallocated Crown land	N/A	85	National park	A	Addition to Yalgorup National Park (R 11710) as recommended in the Yalgorup National Park Management Plan 1995–2005 (CALM 1995).
4	Part of Myalup State Forest No. 16	Conservation Commission	State forest	560	National park	A	Addition as recommended by the FMP <sup>1</sup> - FMP ID 79. Incorporate into Yalgorup National Park (R 11710).
5	Part of Myalup State Forest No. 16	Conservation Commission	State forest	660	National park	A	Addition as recommended by the FMP <sup>1</sup> - FMP ID 80. Incorporate into Yalgorup National Park (R 11710).
6	R 22091	Shire of Waroona	Recreation and camping	160	National park	A	Addition to Yalgorup National Park (R 11710) for the protection of high conservation value.
7	Part of Myalup State Forest No. 16	Conservation Commission	State forest	690	National park	A	Addition as recommended by the FMP <sup>1</sup> - FMP ID 87. Incorporate into Yalgorup National Park (R 11710).
8	Part of Myalup State Forest No. 16	Conservation Commission	State forest	220	National park	A	Addition as recommended by the FMP <sup>1</sup> - FMP ID 88. Incorporate into Yalgorup National Park (R 11710).
9	R 39787	Shire of Harvey	Public recreation	15	National park	A	Addition to Yalgorup National Park (R 11710) as recommended in the Yalgorup National Park Management Plan 1995-2005 (CALM 1995) to protect fringing vegetation of Lake Preston.
10	R 34745	Shire of Harvey	Recreation	1	National park	A	Addition to Yalgorup National Park (R 11710) as recommended in the Yalgorup National Park Management Plan 1995-2005 (CALM 1995) to protect fringing vegetation of Lake Preston.

Map ID	Reserve/Lot number	Current vesting	Current purpose	Area (ha)#	Proposed purpose	Class <sup>A</sup>	Proposed changes
11	Lot 2 on Plan 68739	Conservation Commission	Conservation	2	Conservation of flora and fauna	A	Addition as recommended by the FMP <sup>i</sup> - FMP ID 68. Proposed creation of 'Barragup Nature Reserve'.
12	Lot 306 on Plan 255862	Freehold (State owned, DPaW-managed)	N/A	50	Conservation of flora and fauna	A	Addition as recommended by the FMP <sup>i</sup> - FMP ID 78. Proposed addition to McLarty Nature Reserve (R 24739).
13	Unallocated Crown land (PIN 447006)	Unallocated Crown land	N/A	15	Conservation of flora and fauna	A	Proposed addition to un-named nature reserve (R 44977).
14	R 49222	Unvested	Conservation; Foreshore management	8	Conservation of flora and fauna	A	Proposed addition to Kooljerrenup Nature Reserve (R 23756).
15	R 23307	Unvested	National park	10	Conservation of flora and fauna	A	Addition as recommended by the FMP <sup>i</sup> - FMP ID 90. Incorporate into Yarloop Nature Reserve* (R 47123).
16	Lot 1 on Diagram 72384	Freehold (State owned, DPaW-managed)	N/A	70	Conservation of flora and fauna	A	Addition as recommended by the FMP <sup>i</sup> - FMP ID 89 (Lot 1). Proposed addition to un-named nature reserve (R 49730).
	Lot 14 on Plan 42592	Freehold (State owned, DPaW-managed)	N/A	98			
	Lot 15 on Plan 52463	Freehold	N/A	74			
	Lot 16 on Plan 52463	Freehold	N/A	80			
17	Lot 3945 on Plan 144686	Freehold (State owned, DPaW-managed)	N/A	40	Conservation of flora and fauna	A	Addition as recommended by the FMP <sup>i</sup> - FMP ID 96. Proposed addition to Byrd Swamp Nature Reserve* (R 2517).
18	Lot 201 on Plan 63845	Freehold (State owned, DPaW-managed)	N/A	190	Conservation of flora and fauna	A	Proposed addition.
19	Lot 3 and 4 on Plan 3957	Freehold (State owned, DPaW-managed)	N/A	500	Conservation park	A	Addition as recommended by the FMP <sup>i</sup> - FMP ID 108. Addition as recommended in the Leschenault Peninsula management plan 1998-2008 (CALM 1998a). Incorporate into Leschenault Peninsula Conservation Park (R 42470).



Map ID	Reserve/Lot number	Current vesting	Current purpose	Area (ha)#	Proposed purpose	Class <sup>^</sup>	Proposed changes
20	R 40552	Executive Director Department of CALM	Timber Depot	15	Conservation of flora and fauna	A	For the protection of Priority Ecological Community. Recommended in the EPA review of Greater Bunbury Regional Scheme. Proposed creation of 'Picton Nature Reserve'.
21	R 1167 R 7684	Unvested Shire of Chapel	Parkland Recreation and landscape protection	20 4	Conservation of flora and fauna	A	Addition as recommended by the FMP <sup>1</sup> - FMP ID 114 (R 7684). Amalgamate R 1167 and R 7684 to create 'Franklandia Nature Reserve'.
22	Lot 201 on Plan 58483	Freehold (State owned, DPaW-managed)	N/A	8	Conservation of flora and fauna	A	Addition as recommended by the FMP <sup>1</sup> - FMP ID 120. Protection of Threatened Ecological Community. Proposed creation of 'Stratham Nature Reserve'.
23	R 22293	Unvested	Settlers requirements	60	Conservation of flora and fauna	A	Proposed addition to Capel Nature Reserve* (R 16144).
24	Vasse-Wonnerup Estuaries	Unallocated Crown land	N/A	700	Conservation of flora and fauna	A	Addition as recommended by the FMP <sup>1</sup> - FMP ID 122. Protection of Ramsar values.
25	Part of R 25325 <sup>2</sup> Part of R 37348 <sup>2</sup> Lot 62 on plan 39325	City of Busselton City of Busselton Freehold (State owned, DPaW-managed)	Gravel and recreation, motorcycle racing Rubbish disposal	6 6 45	Conservation of flora and fauna	A	Protection of high conservation values. <sup>2</sup> Council approved. Subject to finalisation of the subdivision process to excise the vegetated eastern portion. Amalgamate parts of R 25325, R 37348 and Lot 62 on Plan 39325 to create 'Kaloorup Nature Reserve'.
26	Part of R 36717 <sup>3</sup>	Unvested	Parkland	30	Conservation of flora and fauna	A	Protection of high conservation values. <sup>3</sup> Subject to consultation with the City of Busselton.

\*Provisional name.

#Approximate area – subject to negotiations with relevant land management authorities.

<sup>^</sup>Class: U= Unclassified, A= class 'A' as defined in the Land Administration Act 1997.

<sup>1</sup>FMP – Appendix 1 of the *Forest Management Plan 2014–2023* (Conservation Commission 2013).

## Appendix 4: Peel–Yalgorup Ramsar site

The Peel–Yalgorup Ramsar site is about 80km south of Perth. It lies within the City of Mandurah and the shires of Murray, Waroona and Harvey. It comprises the Peel Inlet and Harvey Estuary, the freshwater wetlands of lakes Mealup and McLarty (see also DEC 2008a), the Yalgorup National Park environment (including the saline lakes system) and sections of fringing upland. There are current proposals to include Geogrup and Black lakes on the Serpentine River (Peel–Harvey Catchment Council 2009).

The site is a 26,530ha wetland system of shallow estuary and saline, brackish and freshwater lakes that are considered to be representative examples of wetlands on the Swan Coastal Plain. The wetlands form a chain of diverse habitat types, which in turn support an array of ecologically important species and communities.

The full description of the Peel–Yalgorup Ramsar site can be found in the Ramsar Information Sheet at [www.environment.gov.au/water/topics/wetlands/database/pubs/36-ris.pdf](http://www.environment.gov.au/water/topics/wetlands/database/pubs/36-ris.pdf)

### Ramsar criteria for listing

The Peel–Yalgorup wetlands meet seven out of the nine qualifying Ramsar criteria.

#### Criterion 1

A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near natural wetland type found within the appropriate biogeographic region.

The site includes the biggest and most diverse estuarine complex in south-western Australia and also particularly good examples of coastal saline lakes and freshwater marshes.

#### Criterion 2

A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.

The fairy tern (*Sterna nereis*) is recognised on the IUCN Red List as vulnerable. The Lake Clifton thrombolite community (*Thrombolite microbialite*) community of a coastal brackish lake (Lake Clifton) is listed in the critically endangered category of threatened ecological communities under the EPBC Act.

#### Criterion 3

A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.

Lake Clifton, part of the Yalgorup National Park and Peel–Yalgorup system, supports the Lake Clifton thrombolite community.

#### Criterion 4

A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

The critical life stage of migration: annual use by big numbers of many species of migratory animals.

The critical life stage of breeding: regionally significant breeding cormorants, fish, crabs and prawns.  
The critical life stage of moulting: possible moulting phase in shelducks and musk ducks.

The critical life stage of drought refuge: seasonal influx of big numbers of waterbirds from dried out wetlands in surrounding areas, and periodic massive influx from wider regions during drought.

### Criterion 5

A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.

The site comprises the most important area for waterbirds in south-western Australia, supporting in excess of 20,000 waterbirds annually, with greater than 150,000 individuals recorded at one time.

Numbers exceeding 20,000 birds have been recorded in all comprehensive surveys conducted in the 1990s in the Peel–Harvey Estuary.

### Criterion 6

A wetland should be considered internationally important if it regularly supports one per cent of the individuals in a population of one species or subspecies of waterbird.

14 species have been identified as meeting this criterion:

- Red-necked avocet (*Recurvirostra novaehollandiae*)
- Red-necked stint (*Calidris ruficollis*)
- Red-capped plover (*Charadrius ruficapillus*)
- Hooded plover (*Thinornis rubricollis*)
- Black-winged stilt (*Himantopus himantopus*)
- Banded stilt (*Cladorhynchus leucocephalus*)
- Curlew sandpiper (*Calidris ferruginea*)
- Sharp-tailed sandpiper (*Calidris acuminata*)
- Fairy tern (*Sterna nereis*)
- Musk duck (*Biziura lobata*)
- Grey teal (*Anas gracilis*)
- Australasian shoveler (*Anas rhynchotis*)
- Australian shelduck (*Tadorna tadornoides*)
- Eurasian coot (*Fulica atra*).

### Criterion 8

A wetland should be considered internationally important if it is an important source of food for fish, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

The Peel–Yalgorup Ramsar site is important as a nursery and/or breeding and/or feeding ground for at least 50 species of fish as well as the commercially significant blue swimmer crab (*Portunus pelagicus*) and western king prawn (*Penaeus latisulcatus*).

The Peel–Harvey Estuary is a migratory route for the pouched lamprey (*Geotria australis*).

## Ecological character description

An ecological character description (ECD) for the Peel–Yalgorup Ramsar site was first produced at the time of listing in 1990. Since then there have been several changes in the surrounding catchment and to the wetlands, including the construction of the Dawesville Channel, as well as a substantial increase in the Mandurah population. In 2007, a new ECD was developed to take into account fundamental and permanent changes in the ecological components of the estuary. The summary table below is the benchmark against which future changes should be measured (after Hale & Butcher 2007).

Component	Description
<b>Peel–Harvey Estuary</b>	
Geomorphology	Shallow ‘bar-built’ estuary Narrow connections to the Indian Ocean (Mandurah Channel and Dawesville Channel) Organic sediments (black ooze)
Hydrology	Tidal exchange with Indian Ocean (now considered a ‘marine embayment’) Highly seasonal freshwater inflows from direct precipitation and rivers Limited groundwater inflow
Water quality	High concentrations of nutrients from catchment Seasonal variation in salinity (although salinity is now more marine) Water column stratification
Acid sulfate soils	Monosulfidic black ooze exposed via dredging
Phytoplankton	Decreased phytoplankton biomass
Benthic plants	Decreased macroalgae biomass Increased extent of seagrass
Littoral vegetation	Samphire community extent believed to have decreased Paperbark condition declining (Harvey Estuary)
Invertebrates	Commercially significant taxa include blue manna crabs and western king prawns. Diverse communities in the estuary and intertidal zones
Fauna	Estuarine and marine fish species, estuarine species possibly decreasing, marine species increasing Migratory route for some fish species High diversity and abundance of waterbirds Regularly supports > 20 000 waterbirds (150 000 recorded in 1977) Breeding recorded for 12 species Regularly supports > 1 per cent of population of 11 species (including IUCN Red List species fairy tern, <i>Sterna nereis</i> ) No evidence of change in waterbird abundance
<b>Yalgorup Lakes</b>	
Geomorphology	Shallow depressional wetlands No defined surface water inflows or outflow channels
Hydrology	Highly seasonal freshwater (predominantly groundwater) inflows No surface water outflows Suspected decrease in groundwater inflows Changes to lake levels – data deficient
Water quality	Brackish to hypersaline with seasonal salinity cycles, salinity suspected to be increasing Low nutrient concentrations, suspected to be increasing Some lakes exhibit stratification Highly alkaline (calcium and bicarbonate)
Benthic microbial community	Lake Clifton thrombolite (microbialite) population, suspected declining condition Cyanobacterial algal mats across the sediment surface in some lakes

Component	Description
Flora	Small buffer zones, particularly to east of Lake Clifton Some areas of paperbark communities
Fauna	Significant site for waterbirds, no evidence of change in abundance High numbers of shelduck and black swans (annually) One per cent of the population of five species Eight breeding species Fish kills at Lake Clifton
<b>Lakes McLarty and Mealup</b>	
Geomorphology	Shallow depressional wetlands No defined surface water inflows or outflow channels
Hydrology	Highly seasonal freshwater (predominantly groundwater) inflows No natural surface water outflows, both Lakes connected to artificial drainage network. Suspected decrease in groundwater inflows Changes to lake levels at Lake Mealup, increasing duration of dry period
Water quality	Naturally fresh to brackish conditions Severe acidification at Lake Mealup (pH 2.7) and nutrient enrichment Salinity and nutrients increasing at Lake McLarty
Flora	<i>Typha</i> in localised sections of Lake McLarty, extensive at Lake Mealup Sedges on lake margins Paperbark community at higher elevations and at Little Lake Mealup.
Fauna	Important habitat for freshwater invertebrates Provides habitat for high diversity and number of waterbirds Suspected increasing shorebirds at Lake McLarty and significant declines at Lake Mealup Twelve species recorded breeding
<b>Goegrup and Black lakes</b>	
Geomorphology	Riverine wetlands on the Serpentine River (Goegrup 'in-stream') Black Lake connects to Goegrup Lake via narrow channel
Hydrology	Highly seasonal freshwater (predominantly surface water) inflows Tidal influence from Peel Inlet
Water quality	Seasonal salinity cycle High nutrient concentrations (catchment nutrient loads) Low dissolved oxygen concentration
Flora	High phytoplankton biomass Samphire at low elevations in the littoral zone Paperbark communities at higher elevations
Fauna	Supports waterbirds, data deficient

## Appendix 5: Vasse–Wonnerup Ramsar site

The 1,115ha Vasse–Wonnerup Ramsar site is in the City of Busselton. It comprises the Vasse and Wonnerup estuaries (lagoons) and Wonnerup Inlet, as well as seasonally inundated floodplains, marshes in the lower reaches of tributary rivers, much of the northern shore of the Vasse Estuary, the lower reaches of the Sabina River (Reserve 31188) and part of the Tuart Forest National Park (Reserve 40250), including the lower reaches of the Abba River. The Ramsar site is less than half of the overall Busselton wetlands system, which covers some 2,500ha.

The site is of extensive, shallow, nutrient-enriched permanent wetlands with widely varying salinities. The site regularly supports peak numbers of 25 000 to 30 000 waterbirds, as well as the biggest regular breeding colony of black swan (*Cygnus atratus*) in Western Australia. The only estuary to support bigger numbers of waterbirds in the State is the Peel–Harvey estuary, which is 13 times the size of Vasse–Wonnerup.

A natural sand bar across the mouth of Wonnerup Inlet closes the system to the sea for much of the year and there are floodgates on the exit channels that connect the Vasse and Wonnerup estuaries to the narrow Wonnerup Inlet. The floodgates were installed in the early 1900s to mitigate flooding of adjoining agricultural land (Lane *et al.* 1997) during high river flows in winter and to prevent sea water inundation caused by storm surges. The gates effectively transformed the estuaries into shallow, winter-fresh/summer-saline lagoons, unique in Western Australia. Floodgates on the exit channels of the Vasse and Wonnerup estuaries are managed by the Water Corporation.

The full description of the Vasse–Wonnerup Ramsar site can be found in the Ramsar information sheet at [www.environment.gov.au/water/topics/wetlands/database/pubs/38-ris.pdf](http://www.environment.gov.au/water/topics/wetlands/database/pubs/38-ris.pdf).

### Ramsar criteria for listing

The Vasse–Wonnerup wetlands meet two out of the nine Ramsar criteria.

#### Criterion 5

A wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds.

More than 33,000 waterbirds were counted in January 1986 and waterbird data indicate that more than 20,000 waterbirds use the wetlands each year.

In the 1998 to 2000 survey more than 37,000 waterbirds from 68 species were found to use the wetlands (Lane 2009).

#### Criterion 6

A wetland should be considered internationally important if it regularly supports one per cent of the individuals in a population of one species or subspecies of waterbird.

At least one per cent of the Australian population of black-winged stilt (*Himantopus himantopus*) and at least one per cent of the world population of red-necked avocet (*Recurvirostra novaehollandiae*) use Vasse–Wonnerup system in most years.

The 1998 to 2000 surveys also found that the shelduck (*Tadorna tadornoides*) and Australasian shoveler (*Anas rhynchos*) were also in numbers greater than one per cent of the population (Lane 2009).

## Ecological character description

The summary table has been taken out of WRM 2007.

Component	Description
Geomorphology/Estuary morphology	Broad, shallow basin, large seasonal variation in area of inundation
Seasonally closed estuary	
Soil type	Sandy, poor nutrient retention, acid sulfate soils
Sedimentation and erosion	
Hydrology and hydrogeology	Seasonal freshwater inflows
Nutrients	Eutrophication
Salinity	Seasonal salinity regime
Dissolved oxygen	Summer anoxia/hypoxia
Phytoplankton and aquatic macrophytes	Microalgae, macroalgae, seagrasses
Fringing vegetation	Samphires, sedges and reeds, remnant eucalypts, paperbarks
Habitat connectivity	Tuart Forest National Park and Geographe Bay
Aquatic invertebrates	Zooplankton, benthic macroinvertebrates
Fish community	Freshwater, estuarine and marine fish
Waterbirds	International migratory species
Australian resident species	





