Tuart Forest National Park

management plan 79

2014

Department of Parks and Wildlife

Conservation Commission WESTERN AUSTRALIA

Department of Parks and Wildlife
Locked Bag 104
Bentley Delivery Centre WA 6983
Phone: (08) 9219 9000
Fax: (08) 9334 0498

www.dpaw.wa.gov.au

August 2014

ISBN 978-1-921703-45-4 (print)
ISBN 978-1-921703-46-1 (online)

This management plan was prepared by the Conservation Commission of Western Australia (Conservation Commission) through the agency of the Department of Parks and Wildlife (the department).

Questions regarding the use of this material should be directed to:

Planning Unit
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

The recommended reference for this publication is:

Department of Parks and Wildlife (2014) Tuart Forest National Park Management Plan 2014. Management plan number 79. Department of Parks and Wildlife, Perth.

This document is available in alternative formats on request.

Please note: URLs (or web addresses) in this document that conclude a sentence are followed by a full point. If copying the URL please do not include the full point.

Cover image reference/acknowledgment:

Main: Aerial view of Tuart Forest National Park.
Photo – Martin Pritchard

Top left: Tuart trees (*Eucalyptus gomphocephala*).
Photo – Parks and Wildlife

Top right: Western ringtail possum (*Pseudocheirus occidentalis*).
Photo – Adrian Wayne

Header photo: A view of the Vasse-Wonnerup wetlands with tuart woodlands in the background.
Photo – Parks and Wildlife

All photos in this plan are credited to the department, unless otherwise indicated.

Tuart Forest National Park

management plan 79

2014

Conservation Commission of Western Australia

Department of Parks and Wildlife

Acknowledgments

Planning team

This management plan was prepared by a Department of Parks and Wildlife (the department) planning team consisting of Sophie Bishop, Tina Bowers, Paul Roberts, Robert Chandler, Greg Mair, Kim Williams, Peter Hanly, John Carter, Peter Henderson and Brad Commins.

The planning team would like to thank the many other department staff, past and present, who contributed to the preparation of, and commented on, the management plan, particularly Ken Ninyette, John Tillman, Roger Armstrong, Jason Foster, Chris Bishop, Dave Hampton, Bronwen Keighery, Greg Keighery, Andrew Webb, Gil Field, Sam Hamill and Blackwood District staff. Comment and advice during the development of this plan was also provided by the Tuart Health Research Group (in particular Katinka Ruthrof) and Department of Water (DoW).

Community involvement

Many groups, individuals and agency representatives made valuable contributions to the development of this document. The assistance of the Tuart Forest National Park Community Advisory Committee is especially acknowledged: Bernie Masters (Chairman), Martin Pritchard, Bethwyn Hastie, Michael Cassanet, Hal Scott, Des Donnelly, Robert Breeden, Jack Bradshaw, Barbara Councillor-Corbett Stammner, Ken Carratti, Will Oldfield and Graeme Rundle (deceased) (Conservation Commission observer).

Noongar people

The term ‘Noongar’ refers to Aboriginal people who live in the south-west corner of Western Australia (WA), 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 contributions and aspirations of Noongar people in caring for country are acknowledged. The department recognises the important and valuable knowledge that Noongar people hold within the plan area. It is important that Noongar people’s intellectual property rights are recognised and protected. Any information presented that has been handed down should not be used outside the context of this management plan.

Contents

Acknowledgments ..... **ii**
Introduction and management context **1**
1. Overview 1
2. Management plan area 1
3. Key values and threats 2
4. Management directions 3
5. Land tenure and boundaries 3
6. Legislative and policy framework 6
7. Management arrangements with Noongar people 8
8. Community involvement and off-reserve management 9
9. Performance assessment 10
10. Administration 11
11. Term of the plan 11
Managing the natural environment **12**
12. Physical environment 12
13. Biological environment 15
14. Protecting the natural environment 24
Managing cultural heritage **35**
15. Aboriginal and other Australian heritage 35
Managing visitor use **39**
16. Visitor opportunities and planning 39
17. Access 41
18. Visitor activities and use 42
19. Tourism and commercial operations 48
Managing resource use **50**
20. Mineral and petroleum exploration and development 50
21. Other resource use 51
Research and monitoring **54**
References **55**
Personal communications 60
Maps **61**
Map 1. Tenure 61
Map 2. Ecosystem management zones 62
Map 3. Visitor use and access 63
Map 4. Mining tenements and utilities 64
Appendices **65**
Appendix 1. Rare, priority and other significant flora 65
Appendix 2. Rare, priority and other significant fauna 66
Appendix 3. Assessment of beekeeping sites within the planning area 67
Glossary **68**

Introduction and management context

1. Overview

The majestic tuart (*Eucalyptus gomphocephala*) tree is one of the most cherished and well-known trees in WA. Tuart trees are highly valued by the community for their many social, scenic and ecological benefits (Powell and Keighery 2003). Tuart trees are restricted to the Swan Coastal Plain in the south-west of WA. The best known home to the tallest and largest tuart trees and the largest remaining/southern-most tall woodland tuarts is Tuart Forest National Park. However, most of the original extent of tuart in WA has been largely cleared for agriculture or housing, and tuart trees are under threat even in their natural habitats by pressures including weed invasion, inappropriate fire regimes, pest animals, altered hydrological regimes and diseases, which highlights the importance of Tuart Forest National Park for long-term tuart conservation.

2. Management plan area

This management plan covers three reserves that make up Tuart Forest National Park, Ludlow State Forest[1] , Reserve 868 and several other proposed additions (a total area of more than 3,030ha) collectively referred to as the 'planning area' (see Tables 1 and 2).

The planning area is less than 200km south of Perth and 15km north-east of Busselton within the City of Busselton and the Shire of Capel. It is elongated and fragmented in shape, running parallel to the coast and extending 25km from Minninup in the north-east to its south-western boundary near the Sabina River (see Map 1).

Looking up into the canopy of a large tuart tree.

1 Ludlow State Forest is the unofficial name of State Forest No. 2.

3. Key values and threats

Key values

The most significant values of the planning area are:

- vegetation types and landscapes characterised by the presence of tuart, a tree species that is endemic to the Swan Coastal Plain
- the internationally significant Ramsar-listed Vasse-Wonnerup wetlands and nationally significant 'eastern wetlands'
- a mosaic of upland and wetland plant communities that provide important habitat for threatened species such as the western ringtail possum (*Pseudocheirus occidentalis*)
- Noongar cultural heritage sites of mythological, archaeological and spiritual significance
- buildings and structures of other Australian cultural heritage significance including former forestry worker houses, lime kilns, timber mills and railways
- opportunities for a range of recreational activities including scenic driving, bushwalking, birdwatching and horseriding.

Key threats

Major threats affecting the planning area's key values include:

- weeds such as bridal creeper (*Asparagus asparagoides*), arum lily (*Zantedeschia aethiopica*) and pasture grasses
- excessive grazing of native vegetation by rabbits (*Oryctolagus cuniculus*) and western grey kangaroos (*Macropus fuliginosus*)
- the impacts of habitat fragmentation because of vegetation clearing in the surrounding landscape
- limited variation in the age-class structure of tuart, with a large proportion of aging trees and a lack of natural regeneration of seedlings
- inappropriate fire regimes (particularly infrequent, large and intense bushfires and frequent fires that are intense enough to kill fire regime specific species), which will be exacerbated by a drying and warming climatic trend
- threats to tuart health from insect attack and pathogens such as *Armillaria luteobubalina* and *Phytophthora cinnamomi*
- altered hydrology associated with declining rainfall and the impacts of adjacent land use
- pollution and eutrophication of water bodies
- unauthorised and inappropriate recreational access and activities (for example, off-road vehicles and trail bikes)
- predation and competition from non-native animal (fauna) species such as foxes (*Vulpes vulpes*), cats (*Felis catus*) and feral honeybees (*Apis* species).

4. Management directions

Vision

Tuart Forest National Park, the largest example of Western Australia's tall tuart communities, will continue to provide valuable habitat for the western ringtail possum and other native fauna. Bordering the Ramsar-listed Vasse-Wonnerup wetlands, the national park is valued by the community for its aesthetic beauty, natural values, significance to Noongar people and its historical significance as a centre of the early timber industry in Western Australia. In partnership with key stakeholders and the wider community, rehabilitation will continue to ensure that the Tuart Forest National Park is a functioning tuart ecosystem. Natural, cultural and recreational values will be maintained and will continue to be further enhanced for future generations.

This vision, which is derived from community input and reflects the key values of the planning area, will be supported by the implementation of the department's corporate plan (see www.dpaw.wa.gov.au).

In complementing the vision, key management directions in the plan include:

- protecting and re-establishing the high conservation value ecosystems within the planning area, particularly the tall tuart woodlands and eastern wetlands
- managing species of conservation significance to maintain long-term viability of populations, particularly the western ringtail possum
- engaging with the community to encourage a sense of attachment to the planning area and ensure support for the management of the area.

5. Land tenure and boundaries

The reserves that make up the planning area are outlined in Tables 1 and 2 and shown on Map 1.

5.1 Existing reserves

Tuart Forest National Park comprises three Class 'A' reserves vested in the Conservation Commission, with the purpose of national park (see Table 1). It is proposed to consolidate reserves 40250 and 43059 into reserve 40251.

Table 1. Existing reserves comprising Tuart Forest National Park

Reserve name/type	Reserve number	Existing purpose	Class	Area (ha)	Created[2] (year)
Tuart Forest National Park[1]	40251	National park	A	1,101	1987
Tuart Forest National Park[1]	40250	National park	A	683	1987
Tuart Forest National Park[1]	43059	National park	A	265	1994
			Total area	2,049	

1 The name 'Tuart Forest National Park' is formally state approved.
2 Gazettal date for the current purpose.

5.2 Proposed additions and tenure changes

Creation of a conservation reserve system that is comprehensive, adequate and representative (CAR) helps meet obligations under the international Convention on Biological Diversity (see www.cbd.int, Section 6 – *Legislative and policy framework*). The existing and proposed conservation reserves will be managed

to achieve biodiversity objectives that are consistent with the *National Strategy for the Conservation of Australia's Biological Diversity* (Commonwealth of Australia 1996). This strategy has since been reviewed to produce *Australia's Biodiversity Conservation Strategy 2010-2030* (Commonwealth of Australia 2010a), which with *Australia's Strategy for the National Reserve System 2009-2030* (Commonwealth of Australia 2010b) has been endorsed by the Natural Resource Management Ministerial Council. The 2010 strategy recognises that much of the 1996 strategy remains relevant. The Conservation Commission's Position Statement No. 2 *Implementation of Conservation Reserve Proposals* (see www.conservation.wa.gov.au) also provides guidance on achieving a CAR conservation reserve system. CAR targets for the national reserve system are outlined in Commonwealth of Australia (2010b) (see Glossary).

The planning area lies within the Swan Coastal Plain Interim Biogeographic Regionalisation for Australia (IBRA) region, and more specifically the Perth IBRA subregion. About 10.5 per cent of the pre-European (pre-1750) extent of vegetation in the Swan Coastal Plain IBRA region is protected within conservation reserves, of which 1.9 per cent is within the planning area. Similarly, 11.6 per cent of the Perth IBRA subregion is protected within conservation reserves, of which 2.6 per cent is within the planning area. Of the 30,316ha of tuart remaining on the Swan Coastal Plain, 21 per cent (or 6,400ha) is currently within conservation reserves and eight per cent (2,460ha) is contained within the planning area.

Proposed additions to the Tuart Forest National Park are listed in Table 2 and shown on Map 1. The proposed additions will increase the proportion of (i) vegetation in the Swan Coastal Plain IBRA region protected within conservation reserves, and (ii) tuart within conservation reserves to 31 per cent (or 9,400ha). These additions are proposed to become vested in the Conservation Commission as Class 'A' reserves. As the proposed additions become vested with the Conservation Commission, they will be managed in accordance with this management plan. Any proposed reserve addition or tenure change will be subject to consultation within government before any addition or change occurs.

Table 2. Proposed additions and tenure changes

Proposed addition	Vesting	Class	Area[2] (ha)	Proposed change
Lot 17 on Plan 40604 (part of FMP ID[1] 119)	Freehold	N/A	35	Incorporate into Reserve 40251
Lot 2 on Plan 3280 (part of FMP ID 124)	Freehold	N/A	40	Incorporate into Reserve 40251
Lot 100 on Plan 301596 (part of FMP ID 124)	Freehold	N/A	9	Incorporate into Reserve 40251
Lot 101 on Plan 301596 (part of FMP ID 124)	Freehold	N/A	7	Incorporate into Reserve 40251
Lot 94 on Plan 39525 (part of FMP ID 119)	Freehold	N/A	0.1	Incorporate into Reserve 40251
Undeveloped road reserves	Local government	Other	10	Incorporate into Reserve 40251
Unallocated Crown Land: • Lot 302 on Plan 45948 (part of FMP ID 124) • Lots 307 and 308 on Plan 45949 (part of FMP ID 123) • UCL drain (part of FMP ID 123)	Unvested	Other	 0.2 1 2.1	Incorporate into Reserve 40251

Proposed addition	Vesting	Class	Area[2] (ha)	Proposed change
Ludlow State Forest No. 2 (part of FMP ID 123 and FMP ID 124)	Conservation Commission	A	877.6	Incorporate into Reserve 40251
Unvested reserve 868	Unvested	N/A	2	Unmanaged Reserve
		Total Area	984	

[1] The FMP ID number refers to specific reserve proposals in the Forest Management Plan 2014 – 2023 (FMP) (Conservation Commission 2013).
[2] Area figures in this table may not necessarily match those in the FMP, as FMP figures have been rounded to the nearest 10ha.

Ludlow State Forest

Ludlow State Forest No. 2 is a proposed addition to Tuart Forest National Park. In 1976, the Environmental Protection Authority (EPA) recommended that State Forest No. 2 be managed *"for multiple use with priority given to recreation and conservation of the tuart forest"*, and that *"existing pine plantations within the defined tuart forest be progressively phased out and replaced by tuart"*. In 1987, part of State Forest No. 2 was excised to form Tuart Forest National Park, as suggested in the Central Forest Region Management Plan 1987 (see www.dpaw.wa.gov.au). In 1993 the EPA stated that following harvest, pine plantations in State forest would be rehabilitated to tuart and added to the national park (EPA 1993a). On 14 August 2001 the then Minister for the Environment and Heritage Judy Edwards announced that pine harvesting by the Forest Products Commission (FPC) at Ludlow was *"part of the Government's long-term goal of converting the area from State forest to a national park"* (see www.mediastatements.wa.gov.au).

The addition of Ludlow State Forest (FMP ID 123 and 124) reflects tenure recommendations in the Forest Management Plan 2014–2023 (FMP) (Conservation Commission 2013) and the long-term intention, consistent with statements above, to transfer all of Ludlow State Forest No. 2 to Tuart Forest National Park and rehabilitate with tuart following harvesting of plantation timber. Given the large areas involved, costs associated with rehabilitation and other constraints, this will be an ongoing program during the life of this management plan and beyond.

The Bemax mining lease covers 216ha of Ludlow State Forest. Mining has now finished and following completion of rehabilitation, the lease area will be incorporated into Tuart Forest National Park (EPA 2003).

Ludlow settlement is partly within Ludlow State Forest and Reserve 868. It is likely that a separate reserve will be created over the settlement, however the boundary, vesting and purpose of the reserve will be dependent on future management arrangements and subject to consultation within government.

Freehold land

One of the ministerial requirements (Minister for Environment 2003) for approval for Bemax to mine part of Ludlow State Forest (see also Section 20 – *Mineral and petroleum exploration and development*) was the provision of funding for the long-term benefit to conservation of tuart forest in the Ludlow area. One of the strategies for achieving this is the acquisition of additional land, which is why lots 2, 17, 100 and 101 are proposed as additions to Tuart Forest National Park. Lot 94 was land ceded to the state following a rural subdivision. These proposed additions to Tuart Forest National Park also reflect tenure recommendations in the FMP (ID 119 and 124).

Road and rail reserves

Several undeveloped road reserves traverse or lie next to the planning area. The department will liaise with the City of Busselton, the Shire of Capel and Main Roads WA to investigate the possibility of

adding these road reserves to Tuart Forest National Park. If added, any tracks located within these reserves will be closed and rehabilitated unless they are required for management access.

Nomenclature (naming)

Although the name 'Tuart Forest National Park' is formally State-approved, there is community sentiment about this and other names in the area. The department's nomenclature guidelines provide guidance on the process of approval of names for reserves, features or assets, which includes community consultation and referral to the department's Nomenclature Committee, the Conservation Commission and the State Geographic Names Committee (where names are formally approved).

Throughout this management plan, specific locations within the planning area are often referred to using paddock (Keighery and Keighery 2002) or forest block names (Sclater 2001), which reflect the historical land use of the planning area. A diagram showing the location of the paddock and forest block names is at Figure 1.

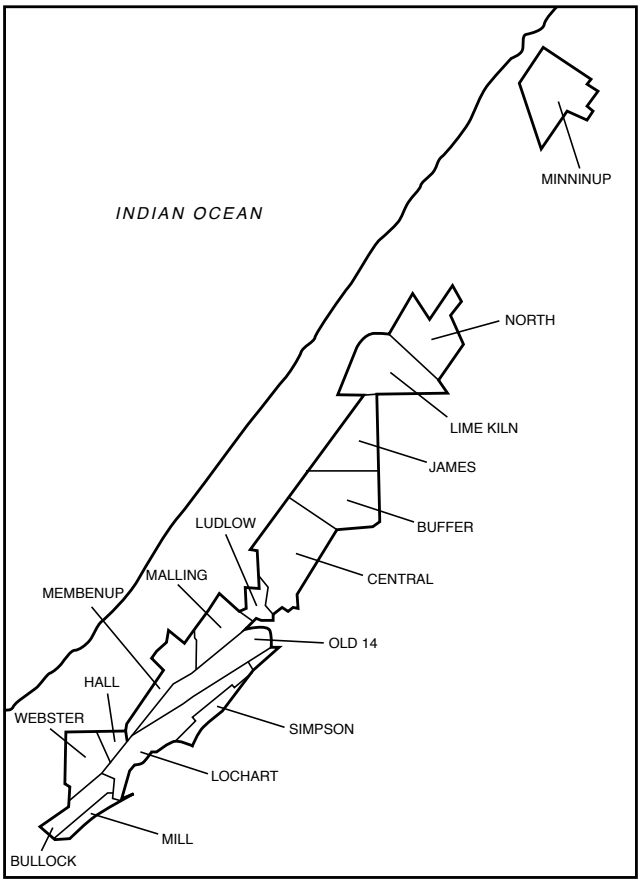


Figure 1. Paddock and forest block names

Desired outcome

Increased protection of vegetation in the Swan Coastal Plain IBRA region within conservation reserves.

Management actions

1. Implement the tenure recommendations as outlined in Tables 1 and 2, subject to government consideration and determination.
2. Consolidate reserves 40250 and 43059 into reserve 40251.
3. Where appropriate, seek to incorporate adjoining or nearby land, if identified as having high conservation value or management benefits, and subject to government consideration and determination.
4. Manage any proposed reserve additions that become vested with the Conservation Commission in accordance with this management plan.
5. Consider proposals to change the name of the national park and/or park features in consultation with traditional owners and the wider community and in accordance with the department's nomenclature guidelines.

6. Legislative and policy framework

The department administers 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* (WC Act), which provides for the protection of native plants (flora) and

fauna within the State. The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), administered by the Australian Government, relates to the protection of nationally listed threatened species and ecological communities, heritage (including Ramsar sites) and key threatening processes.

This management plan also conforms to policies (see www.dpaw.wa.gov.au) of the department and key policies are referred to throughout the document. Relevant policies may be developed, revised or superseded during the life of the plan. The preparation and/or revision of subsidiary management documents will be guided by the department's Policy 1 – *Department of Parks and Wildlife – Key documents*.

The FMP (Conservation Commission 2013) provides the over-arching planning and management framework for lands in the south-west vested in the Conservation Commission, including State forests and conservation reserves, and complements this management plan, which ensures a more comprehensive approach to managing the area.

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 departmental business plans and the preparation of subsidiary management documents (operational plans), which provide more detail for specific areas.

International conservation agreements

Australia is a signatory to several important international conservation agreements that have implications for management of the planning area:

- Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention[2])
- China-Australia Migratory Bird Agreement
- Japan-Australia Migratory Bird Agreement
- Republic of Korea-Australia Migratory Bird Agreement
- Convention of Migratory Species of Wild Animals (known as the Bonn Convention)
- Convention on Biological Diversity.

The Vasse-Wonnerup wetlands (Ramsar site number 484) were listed under the Ramsar Convention in 1990, with an additional area (incorporating parts of the planning area) included in 2000. About 309ha of the 1,115ha Vasse-Wonnerup system falls within the planning area (see Map 2 and Section 12 – *Physical environment, Hydrology*).

Tuart Forest National Park provides valuable habitat for the threatened western ringtail possum.
Photo – Adrian Wayne

2 'The Convention on Wetlands', or the 'Ramsar Convention' after the Iranian town in which the treaty was developed in 1971, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

7. Management arrangements with Noongar people

This management plan aims to provide a framework to engage and collaborate with Noongar people in managing the planning area.

Noongar people have a strong desire to care for country and practise customary activities according to their traditional laws and customs, to be involved in cooperative management of conservation reserves and to strengthen cultural ties to the land. Working with Noongar people to care for the land is essential for the preservation of natural and cultural heritage, as well as enriching cross-cultural awareness. The involvement of traditional custodians in cooperative management of department-managed lands and waters also provides cultural, spiritual and economic benefits to Noongar people.

The Conservation Commission and the department acknowledge the aspirations of Noongar people to:

- have their traditional rights to country recognised
- conduct customary activities on department-managed lands and waters
- participate in the ongoing planning, decision-making and management of department-managed lands and waters.

The *Native Title Act 1993* (Native Title Act) sets out processes for consultation with native title claimants and native title representative bodies when major public works are undertaken, management plans are being prepared, or other work undertaken. The South West Aboriginal Land and Sea Council is the native title representative body for the Noongar people within the planning area. There are three registered native title claims that cover parts of the planning area: Harris Family (WC1996/041), Gnaala Karla Booja (WC1998/058) and South West Boojarah 2 (WC2006/004), although no native title determinations have been made at this time. Notwithstanding formal recognition of native title, the department will continue to recognise that Noongar people have strong and enduring interests over department-managed lands and waters and desire to continue cultural activities in these areas.

Changes to the CALM Act will now enable joint management of department-managed lands. The department's Policy 87 – *Aboriginal joint management* (see www.dpaw.wa.gov.au) provides guidance on involving Aboriginal and other parties in the management of the State's lands and waters. At the time of writing the plan, negotiations are taking place for the comprehensive settlement of native title over the South West – the South West Native Title Settlement (SWNTS). The SWNTS negotiations include a component relating to joint management.

Desired outcome

Engagement with Noongar people on all aspects of land management.

Management actions

1. Work with Noongar people so that their knowledge and cultural values inform and guide management actions.
2. Where consent is given by Noongar people to use traditional knowledge, ensure it is appropriately acknowledged.
3. Foster connection to country by allowing customary activities, consistent with legislation and regulations.
4. Encourage training, employment and economic development opportunities through cooperative management arrangements.

5. Ensure that management adapts to and conforms with any legislative or policy changes and native title resolutions during the life of this plan.

8. Community involvement and off-reserve management

Community involvement and support is an integral part of the department's operations, including during the development and implementation of this management plan. A key objective for the department is to develop community awareness and appreciation of the State's natural environment and promote community involvement in its protection and conservation.

Community involvement and support

The community has been involved in the preparation of this management plan. In particular, members of the Tuart Forest National Park Community Advisory Committee provided advice on many issues throughout the planning process.

Ongoing community support is essential for the successful implementation of this management plan. Tuart Forest National Park provides opportunities for community members to take part in volunteer activities such as trail maintenance, vegetation rehabilitation, fauna surveys and weed removal. Volunteer activities not only increase the department's work capabilities and skills base but also foster communication links and understanding with the community.

Off-reserve management and partnerships

Principles for effective neighbour relations are outlined in the department's Policy 65–*Good neighbour policy* (see www.dpaw.wa.gov.au) and are important for fostering partnerships with the community. Implementation of this plan cannot be achieved in isolation as various other land tenures adjoin the planning area. In particular, catchment protection, feral animal control, threatened species protection and fire management need to be approached from the broader integrated land management perspective to achieve desired outcomes for the planning area. The department works with other land managing agencies, neighbours and the local community to achieve effective and coordinated management of cross-boundary issues.

The department liaises with the relevant Australian government department responsible for the management of Ramsar wetlands (such as the Vasse-Wonnerup wetland system), migratory bird species and threatened plants and animals listed under the EPBC Act. Several State Government agencies have responsibilities for, or provide advice on, land-use practices near the planning area, including drainage, fire, declared pest animals and plants, and water resource use.

Liaison with the City of Busselton and the Shire of Capel is especially important, given local government:

- broadly represents the views of the communities within their constituency
- is able to encourage planning and land management practices that complement management of the planning area
- work with the department to provide cooperative and coordinated fire fighting on or near department-managed land along with the Department of Fire and Emergency Services (DFES), local bush fire brigades and volunteers
- shares responsibilities in the provision and maintenance of the public road network.

The planning area is within the South West natural resource management region, which, in partnership with governments, Noongar groups, land managers and community groups, help deliver Australian government conservation funding programs. Annual funding programs across catchments, such as the

Geographe Bay Catchment, contribute toward effective management of the planning area, and interaction with natural resource management groups is important to provide for integrated natural resource management.

Many threatened species, including cockatoos, are highly mobile and travel across tenures. For those species that have recovery plans (see Section 13 – *Biological environment*), liaising with landholders will be important in implementing recovery actions, especially in increasing awareness of the species' conservation status and providing information on how landholders can help in recovery efforts.

Desired outcome

Effective involvement, liaison and partnership with organisations, statutory bodies and the local community in planning and management, including sharing local knowledge of the area.

Management actions

1. Liaise with neighbours, local authorities, relevant agencies and other stakeholders to encourage off-reserve conservation and the effective, coordinated management of cross-boundary issues.
2. Continue to support, promote and provide opportunities for volunteer and community involvement in management of the planning area.
3. Continue to contribute towards the department's volunteer database.
4. The department will:
    - develop and implement programs that seek to provide the community with educational opportunities and information on management of the planning area
    - maintain public consultation processes
    - provide opportunities for community participation in voluntary activities and educational and social development programs relating to management of the planning area.

9. Performance assessment

Performance assessment is an essential part of environmental management systems, and the results of performance assessments serve many uses including (i) the promotion of adaptive management, which leads to continuous improvement, (ii) improving management planning practice and management outcomes, and (iii) promoting accountability and public support for management actions (see performance assessment policy at www.conservation.wa.gov.au). The Conservation Commission will measure the success of this plan in accordance with section 19(1)(g) of the CALM Act by using selected key performance indicators (KPI) (that largely correspond with key values and threats) and other mechanisms as appropriate.

Desired outcome

The department has developed systems and processes to provide evidence of plan implementation.

Management actions

1. Establish and maintain a portfolio of evidence throughout the life of the plan to prove that this management plan has been successfully implemented.
2. Report to the Conservation Commission within the timeframes stipulated for each KPI.

10. Administration

The planning area lies within the department's Blackwood District of the South West Region. The day-to-day implementation of this management plan is the responsibility of the district manager. The district manager will coordinate the implementation of this management plan for the parks and reserves in the planning area within allocated budgets and other resources. Operational management is also supported by staff from the South West Region and the department's specialist branches.

11. 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, 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.

Managing the natural environment

This chapter describes the natural values of Tuart Forest National Park and its proposed additions, the threats to those values, and the management actions that the department is proposing to mitigate threats.

12. Physical environment

Climate

The planning area experiences a mediterranean climate with mild, warm summers and cool, wet winters. The mean maximum temperature is 29.2˚C in summer and 17.1˚C in winter (BoM 2010). Long-term average annual rainfall (recorded for more than 128 years) is 811mm, however over the past 30 years this has declined to 749mm (BoM 2010).

The south-west of WA is experiencing a trend of increasing temperatures and declining rainfall, which is predicted to continue (CSIRO, BoM 2007). Major impacts of a warming and drying climate relevant to the planning area include:

- a possible increase in the incidence and intensity of bushfires
- altered hydrological regimes, particularly a reduced amount of time that wetlands hold water, which in turn impacts waterbird habitat
- reduced soil moisture, which has been identified as a potential threat to tuart health as trees subject to water stress are also more susceptible to insect attack (TRG 2002).

The common donkey orchid (*Diuris longifolia*) is one of a number of orchid species found in the planning area.

Being able to accurately determine that a key value has been adversely and directly affected by climate change is difficult, and may be unlikely during the life of this plan. Climate change will be taken into consideration when assessing KPIs, and if monitoring indicates that climate change could be influencing key values, the department will consider further management options. The department's recently published Climate Change Strategy entitled *Adapting to our changing climate* (DEC 2012) will guide the department's adaptation to climate change.

Geology, landform and soils

The planning area is characterised by gently undulating relief, ranging from 5-10m above sea level. It is located at the southern end of the Swan Coastal Plain, where it overlies the southern Perth Basin, and is predominantly within the Spearwood Dune landform system, which is one of three coastal aeolian (wind-

deposited material) dune belts of the Swan Coastal Plain. The wetlands of the planning area fall within the Abba soil system to the east and Vasse soil system along parts of the western boundary.

For those parts situated in the Spearwood Dune system, the geology consists of Tamala limestone, overlain by brown and yellow sands of varying depths (McArthur 1991, Forests Department of WA 1979). Toward the west, the soils are predominantly brown soils overlying beach-deposited limestone at shallow depth (Forests Department of WA 1979), transitioning to dark calcareous sands and estuarine deposits of the Vasse-Wonnerup wetlands (Tille and Lantzke 1990). The soils towards the east are podsolic and more leached, varying from greyish brown at the surface to bright yellow at 1.5m depth (Forests Department of WA 1979).

The eastern parts of the planning area situated in the Abba soil system contain wetland clay soils, which are poorly drained, wet and semi-wet sandy grey-brown gradational and duplex soils (Tille and Lantzke 1990) that are susceptible to mixing following disturbance (for example, pine harvesting and off-road vehicle use).

Operational and recreational activities have the potential to adversely affect the geology, landforms and soils of the planning area. Particularly in the eastern wetlands, surface soils and vegetation are easily disturbed by activities that deplete vegetation cover, damage soil structure, erode soils and cause the loss of soil microbes. Wetland soils are particularly susceptible to erosion when disturbed. Such threats need to be ameliorated through appropriate visitor management and operation management procedures. For acid sulfate soils, see Section 14 – *Protecting the natural environment, Altered hydrological regimes*.

Hydrology

The planning area falls across the Vasse-Wonnerup Estuary and Capel river sub-catchments, which together make up part of the larger Geographe Bay catchment area. The Geographe Bay catchment is in turn within the greater Busselton Coast surface water drainage basin (see www.water.gov.au). The heavily modified Abba and Ludlow rivers pass through Tuart Forest National Park and State Forest No. 2 (Map 1).

Three 'conservation category wetlands'[3], covering a total area of 142ha, occur in the planning area (Map 2): the Vasse-Wonnerup wetland system, 'Simpson Block' wetlands and 'Buffer Block' wetlands. The 'Simpson' and 'Buffer' block wetlands, located on the eastern side of the planning area, are also referred to as the 'eastern wetlands', and are managed for their floristic and nationally-significant ecosystem values (see Section 13 – *Biological environment: Native plants and plant communities* and *Ecological communities*).

A view of the Vasse-Wonnerup wetlands with tuart woodlands in the background.

The eastern wetlands. Photo – Bronwen Keighery

3 Wetlands of the Swan Coastal Plain have been classified into 'Conservation', 'Resource enhancement' and 'Multiple use' management categories (EPA 1993b). These wetland management categories are used to guide decisions made by agencies involved in land use planning and development. 'Conservation category wetlands' are those of highest ecological values, and which should be managed to preserve and protect these values.

While only a very small part of the Vasse-Wonnerup conservation category wetland occurs in the planning area (Map 2), a much bigger area of Tuart National Park (15 per cent) occurs within the internationally significant Vasse-Wonnerup Ramsar site. While most of the Vasse-Wonnerup Ramsar site is Unallocated Crown Land, FMP ID 122 proposes most of the site as nature reserve. A number of agencies and organisations work collaboratively through the Vasse Estuary Technical Working Group (DEC 2009b) in monitoring and management programs, including the Geographe Catchment Council, land conservation district committees, Department of Agriculture and Food Western Australia (DAFWA), DoW, Department of Fisheries, City of Busselton, Shire of Capel, and Water Corporation (WRM 2007). The majority of these programs are related, either directly or indirectly, to problems of water quality (see Section 14 – *Protecting the natural environment, Altered hydrological regimes*).

An Ecological Character Description (ECD) for the Vasse-Wonnerup Ramsar Site has been prepared that documents baseline condition of all aspects of the wetland; its biota, hydrology, geomorphology, physico-chemistry and social, cultural and economic significance, to guide management actions (WRM 2007), although there is currently no management plan for the site itself. The ECD, together with the Vasse-Wonnerup Wetlands and Geographe Bay Water Quality Improvement Plan (DoW 2010), outlines key management recommendations, for relevant agencies and organisations to implement. Under the Ramsar Convention there is an expectation that signatories will at least maintain, and where appropriate enhance, the values for which wetlands have been listed. In order to determine whether or not this is being achieved, it is necessary for values to be monitored. However, the scope and frequency of monitoring are determined by a number of factors including perceived levels of threat to values and availability of resources for monitoring (DEC 2009a). This management plan is consistent with the recommendations from the ECD and DoW (2010). While other agencies have primary responsibility for water monitoring in the area, the department's main focus lies in the fringing vegetation that extends into the park (see Section 13 – *Biological environment: Native plants and plant communities* and *Ecological communities*), although the influence of water quality is a function of how the waterways in the area are managed.

Floodgates on the exit channels of the Vasse and Wonnerup estuaries (outside the planning area) are managed by the Water Corporation (under guidelines developed by the Vasse Estuary Technical Working Group), which has delegated responsibility for their operation during summer and autumn to maintain minimum water levels and water quality (WRM 2007). The floodgates have a major influence on the hydrology and ecology of the wetlands within and next to the planning area, which contain a significant food and nesting resource for big numbers of waterbirds, including internationally significant migratory species (WAPC 2005).

Groundwater in the planning area is part of the Busselton-Capel groundwater area (WAPC 2005), which incorporates an unconfined superficial aquifer as well as the underlying Leederville and Yarragadee aquifers (DoW 2008). There has been a general trend of declining summer minimum groundwater levels over the past 20 years, although maximum levels in winter remain steady (DoW 2008).

Nutrient levels are high in the Vasse-Wonnerup wetland system because of agricultural fertiliser run-off, stock wastes and unsewered areas in Busselton (WRM 2007). Although a substantial portion of these nutrients is either taken up by fringing vegetation or retained in the bed of the estuaries bound to sediments, the Vasse-Wonnerup system is still one of the most nutrient-enriched wetland systems in the south-west of WA (Weaving 1998, WAPC 2005). Nutrient loads are expected to decrease under climate change scenarios, however flows will also decrease, resulting in lower groundwater levels that would not replenish wetlands and a string of detrimental ecological effects. The negative effects associated with a reduced rainfall regime would far outweigh the positive effects of the reduced load delivery to the bay and wetlands from the catchment (Hall 2009). Salinity levels in the Vasse-Wonnerup wetlands range from fresh to brackish in winter but approach seawater levels in summer and can become hypersaline in places (WRM 2007, Bernie Masters *pers. comm.* 2008). This large seasonal range in salinity is harsh for many biota, particularly salt-sensitive fauna species, but also creates a variety of sub-habitats allowing a wide range of freshwater, estuarine and marine communities to co-exist (WRM 2007).

Desired outcome

The geological features, soils and hydrological values of the planning area are protected and conserved.

Management actions

1. Identify and protect valuable or important geomorphic features and soils that are vulnerable to environmental disturbance, such as soils around wetlands.
2. Protect wetlands and hydrological processes from damage or disturbance that may affect water quality or quantity.
3. Assess all development proposals for potential adverse impacts on geological or hydrological features such as soils, surface water movement and groundwater quality and quantity, and refer proposals that may impact on these values to the EPA for further assessment and evaluation.
4. Control access to and restrict all activities in areas identified as vulnerable to disturbance.
5. Assess soil quality in areas to be rehabilitated and restore soil conditions to help with ecosystem rehabilitation.
6. Liaise with DoW about information maintained on surface and groundwater hydrological regimes in the planning area, and use this as a base for future investigations and monitoring of water quality and quantity.
7. Remain abreast of current knowledge and contemporary management approaches in relation to climate change and its possible impacts on native ecosystems.

13. Biological environment

Native plants and plant communities

The planning area has a high level of flora diversity, with 96 families that are made up of 596 native species[4] including 34 subspecies (Western Australian Herbarium 2007 and the department's Species and Communities Branch 2008). The planning area lies within the internationally-recognised biodiversity hot spot known as the South West Botanical Province and is also within the Busselton-Augusta national biodiversity hot spot[5]. Several studies (Government of WA 2003, 2004a, 2004b) have led to recommendations for the protection of specific areas. More than 90 per cent of the flora (of the planning area plus nearby State Forest No. 12) has been documented (Keighery and Keighery 2002).

Plant species and communities of conservation significance are listed at Appendix 1, and include:

- Vasse featherflower[6] (*Verticordia plumosa* var. *vassensis*), which is a threatened species or 'rare flora' declared and listed under the WC Act as 'endangered', and under the EPBC Act as 'endangered'
- 24 priority species (three priority 2, 13 priority 3 and eight priority 4 species)
- five endemic species, including *Verticordia plumosa* var. *vassensis* (see also Keighery and Keighery 2002)
- four relictual species
- one species with a disjunct distribution, *Isolepis oldfieldiana* (a member of the Cyperaceae family)
- tuart and yate (*E. cornuta*) occurring at the southern and northern extent of their ranges, respectively.

4 Plant species naming in this plan follows the Western Australian Herbarium's FloraBase, unless otherwise indicated.

5 See www.environment.gov.au.

6 See EPBC Act listing at www.environment.gov.au.

The department's *Declared Rare and Poorly Known Flora in the Central Forest Region* (Williams *et al.* 2001) provides guidance for the management, protection and recovery of threatened and priority flora in the region to ensure their continued survival.

The priority 3 species *Verticordia attenuata* is found in the Ludlow State Forest.

Tuart regeneration within James Paddock.

Five principal plant communities have been identified and described by Keighery and Keighery (2002):

- tuart tall woodland over pasture grasses
- tuart tall woodland over slender banksia (*Banksia attenuata*) woodland
- tuart tall woodland over peppermint open forest
- flat and basin wetlands
- pine plantations with relict tuart.

The majority of plant communities consist of tall tuart woodland with an overstorey dominated by tuart, with some marri (*Corymbia calophylla*) and jarrah (*E. marginata*) found in the northern parts. Peppermint (*Agonis flexuosa*) is dominant as a secondary overstorey species in some parts of the planning area. Based on canopy density, some parts of the planning area classify as tuart open forest (areas with greater than 50 per cent canopy cover) (Government of WA 2003). Two other plant communities have also been identified (yate woodland and riverine communities associated with drainage channel edges), although they are relatively small in area and highly disturbed (Keighery and Keighery 2002). Many of the plant communities lack structural diversity because of a lack of natural regeneration of tuart and understorey species.

Tuart occurrence within the planning area is of particular conservation significance, as not only is the species restricted to the Swan Coastal Plain, but only 31 per cent of its original extent remains (TRG 2004). The presence of mature tuart is necessary to maintain biodiversity values, especially in sustaining viable populations of fauna that rely on big tree hollows. There has been a reduction in the availability of suitable tree hollows through the loss of older trees with no younger tuarts to replace them, and competition for hollows from fauna species not local to the area. Sudden death of individual tuart trees has been observed in the planning area and the cause is yet to be determined. An additional threat to mature tuart is the risk of being lost in a single event such as bushfire and wind throw during storms. Where possible, mature tuart trees will be protected by limiting threats that reduce the resilience of tuart ecosystems. The monitoring of tuart health will also be ongoing, and management will be adapted during the life of the plan in light of new research.

There are several tuart plots throughout the planning area (see Map 2), which were planted in the 1960s and 1970s in areas once cleared for forest management purposes (Des Donnelly *pers. comm.* 2010). The plots represent a valuable resource as they contain trees of known age and thus are a useful reference in planning for future restoration. A small number of tuart plots will be used as age-class reference sites to determine the most suitable age variation and density of tuart in an effort toward restoring ecosystem function in the tuart communities of the planning area.

A decline in flooded gum (*E. rudis*) has been observed within and next to the planning area, particularly along the Abba River. Although the causes are unclear, it is thought that several factors are leading to the weakening of the trees and weakened trees suffer physiological changes that make them more susceptible to insect attack.

There is limited knowledge about peppermint biology and its role in the tall tuart woodland ecosystem, however it has become dominant in some parts of the planning area and competes with tuart and prevents the establishment of tuart seedlings. In other parts of the planning area, peppermint decline has been observed since 2005 (Bernie Masters *pers. comm.* 2010) for reasons that are unknown. As peppermint is the primary food source for the threatened western ringtail possum, peppermint density and age-class representation should not fall to a level where food resources are unable to sustain the current possum population, at least until knowledge of peppermint physiology and its role in the tall tuart woodland ecosystem can be further understood.

Keighery and Keighery (2002) rated the condition of vegetation in the planning area, with results ranging from 'very good' to 'completely degraded' in the upland plant communities. At the time of survey, the mixed eucalypt woodland at Minninup Block was considered to be 'very good' to 'good' in the most undisturbed areas. In general, condition declines from north to south. The wetlands are generally in better condition than the uplands, and riverine habitats are considered to be in the worst condition, being rated as 'degraded' to 'very degraded'.

Clearing in the surrounding landscape and past land management practices such as grazing, altered fire regimes and the introduction of softwood plantations have resulted in adverse changes to ecosystems within the planning area (Keighery and Keighery 2002). In particular, the absence of natural recruitment of tuart, which is the dominant species and considered to be of key ecological importance, indicates that the tuart ecosystems are functionally degraded and are not self-sustaining (Jack Bradshaw *pers. comm.* 2010).

In the Ramsar wetland, while other vegetation monitoring has been undertaken elsewhere in the estuary (DEC 2009c), some vegetation health monitoring has been undertaken in the park by Froend *et al.* (2000), although these plots have been made redundant by recent fringing vegetation rehabilitation works in the same area. Monitoring in these areas is concerned with planting survival and growth, rather than vegetation composition parameters.

If left unaddressed, parts of the planning area are likely to experience further deterioration in vegetation condition and ecosystem function. In response, an ecosystem management program has been developed that identifies seven ecosystem management zones (see Map 2). The objectives and management actions applicable within each zone are outlined in Table 3.

Table 3. Ecosystem management zones

Management zone	Objectives	Management actions
Zone 1: Vasse-Wonnerup riparian habitat Consists of the western-most sections of the planning area that are part of the Vasse-Wonnerup wetland system. Predominantly riparian vegetation or cleared land with good conditions for rehabilitation. Includes occurrences of the proposed Busselton yate threatened ecological community (TEC).	Protect and enhance the Vasse-Wonnerup wetland/tall tuart community transition zone. Protect and enhance the proposed Busselton yate TEC. Protect and increase the area of native vegetation that links the tall tuart communities with the Vasse-Wonnerup wetlands.	Continue to re-establish native vegetation in lots 2, 100 and 101. Increase species diversity in existing rehabilitation areas within this zone.
Zone 2a: Cleared plantations and former freehold land This zone is largely cleared, providing a valuable opportunity to do experimental trials in rehabilitation. Includes species from the tall tuart communities and the eastern wetlands, as well as occurrences of the proposed Busselton yate TEC.	Protect and enhance the eastern wetland/tall tuart community transition zone. Protect and enhance the proposed Busselton yate TEC. Protect and increase habitat for fauna that are highly represented in zones 5 and 6 (for example, western ringtail possum and brushtail possum). Enhance resilience of this zone to disturbance and threatening processes.	Undertake experimental trials in rehabilitation of the tall tuart communities to address knowledge deficits. Re-establish native vegetation in cleared areas, adapting management according to results of experimental trials.
Zone 2b: Plantations to be cleared Contains some relict tuarts, as well as pine and karri plantations proposed for harvesting. The southern block also contains some wetland areas.	Following tree harvesting, objectives will be the same as Zone 2a.	Retain and avoid damaging individual tuart trees that occur in these areas during pine harvesting. Following tree harvesting, management actions will be the same as Zone 2a.
Zone 3: Eastern wetlands Made up of freshwater wetlands with plant communities unusual for this part of the Swan Coastal Plain. Also contains a transition zone between the wetlands and upland tuart woodland community.	Protect and enhance the eastern wetland/tall tuart community transition zone. Maintain the condition of ecological communities and conserve significant flora.	Develop and implement a weed control program. Investigate ecological fire requirements and if necessary apply fire to enhance regeneration.

Management zone	Objectives	Management actions
Zone 4: Old ash-bed tall tuart regeneration Contains tuart that was regenerated 10 to 30 years ago using ash-bed stands. There is little diversity in secondary and understorey species.	Protect and enhance the condition of regenerated tuart, including a variation in the age-class structure. Improve the representation of secondary and understorey species.	At selected sites, evaluate the need to introduce variation in the age-class structure of tuart and implement a regeneration program where required. Where necessary, modify the density of regenerated tuart stands to maintain health of remaining trees. Re-establish secondary and understorey vegetation.
Zone 5: Mature tall tuart woodland This zone is rich in fauna diversity and abundance, supporting species and communities from the Vasse-Wonnerup wetlands and tall tuart woodland. Supports a large proportion of the possum populations in the planning area and contains mature tuart with hollows that provide fauna habitat.	Protect and enhance the condition of the mature tuart woodland. Protect fauna habitat and fauna populations that are highly represented in this zone (for example, western ringtail possum and brushtail possum).	At selected sites, evaluate the need to introduce variation in the age-class structure of tuart and implement a regeneration program where required. Protect mature tuarts and tree hollows from threats such as inappropriate fire regimes. Re-establish native vegetation, including tuart, where gaps occur in the canopy because of a loss of senescent trees. Monitor tuart health for signs of decline.
Zone 6: Mixed eucalypt woodland This zone is made up of a variety of eucalypts with some natural understorey. This zone contains higher understorey species diversity than the other tuart dominated zones.	Maintain and protect diversity of vegetation occurrences within this zone.	Identify knowledge deficits about ecological structure and function of the mixed eucalypt woodland ecosystem. Monitor for plant diseases such as *Phytophthora cinnamomi.* Evaluate the impacts of grazing by native and introduced species. Develop and implement a weed control program.

Management zone	Objectives	Management actions
Zone 7: Degraded woodland with infrastructure The Ludlow settlement and Bemax mining lease are included in this zone. Rehabilitation is occurring within the Bemax mining lease.	Maintain and enhance condition and species diversity of unmined sections of the Bemax mining lease.	Monitor Bemax rehabilitation as set out in associated Ministerial conditions (Minister for Environment 2003). Continue with rehabilitation of the unmined component of Bemax mining lease. Undertake further experimental trials on rehabilitation of tall tuart ecosystems. Re-establish native vegetation in cleared areas, adapting management according to results of experimental trials.

Desired outcomes

Native plants and plant communities are identified, protected and conserved.

Ecosystems are rehabilitated to maintain or improve ecological integrity in the long term.

Management actions

1. Identify native plants and plant communities that may need special protection, and implement management actions to minimise the impacts from threatening processes, for example:
    - assess and where necessary propose statutory protection
    - where practicable, develop, review and implement recovery plans for threatened species and ecological communities
    - assess all proposed operations and developments for potential impacts.
2. Rehabilitate disturbed areas, and periodically monitor and evaluate vegetation condition to assess rehabilitation efforts.
3. Collect seed from tuart and other plant species preferably within the planning area in seed years, and use for rehabilitation purposes.
4. Conduct age-class structural mapping of tuart in the planning area to determine the current and desirable long-term age-class structure.
5. Based on the results from the structural mapping, select several age-class reference sites within the planning area, and undertake the following:
    - introduce variation into the age-class structure of tuart by planting seedlings
    - monitor and, where necessary, modify the distribution and density of flora species (including tuart and peppermint) with a long-term aim of restoring ecological function.
6. Implement the ecosystem management actions outlined in Table 3, according to the zoning scheme as indicated on Map 2.

7. Minimise grazing impacts by kangaroos on rehabilitated areas by implementing protective measures such as temporary fencing or plant guards.

8. Restrict unauthorised vehicle access to high conservation value areas.

Key performance indicators

Performance measure	Target	Reporting requirement
Complete structural mapping of tuart in the planning area.	Map the current age-class structure of tuart in the planning area.	Every five years.
Area of tuart woodland communities meeting specified conditions of structural diversity.	Overall extent and condition of the tuart woodlands is maintained, and changes are made to the age-class structure of tuart at selected sites to improve diversity and ecosystem function.	Every five years.
Population size and number of populations of threatened flora species.	Maintain or improve the population size and number of populations of threatened flora species during the life of the plan.	Every five years, or as per recovery plans if applicable.
The existing and desirable floristic composition and age-class structure of the tuart communities.	Determine the existing and desirable floristic composition and age-class structure of the tuart communities.	Every five years.

Native animals and habitats

The planning area is isolated from similar habitats and has low fauna diversity when compared to nearby conservation reserves. However, it does contain a mix of species at the wetland and terrestrial interface. A total of 113 native animal species[7] have been recorded in the planning area including 14 mammals, 67 birds, 19 reptiles, seven amphibians and six fish (Western Australian Museum 2007, Dell *et al.* 2002, Napier 1982, Cable Sands 2002 and Morgan *et al.* 1998). Surveys undertaken on the Bemax mining lease recorded 61 species, including seven previously unrecorded bird species.

Fauna species of conservation significance that are found in the planning area are listed at Appendix 2, and include:

- four species listed as 'rare or likely to become extinct' under the WC Act – the endangered Carnaby's cockatoo (*Calyptorhynchus latirostris*) and Baudin's cockatoo (*Calyptorhynchus baudinii*), and the vulnerable southern brush-tailed phascogale or wambenger (*Phascogale tapoatafa* ssp. [WAM M434]) and western ringtail possum or ngwayir
- three species listed under the EPBC Act – the endangered Carnaby's cockatoo, and the vulnerable Baudin's cockatoo and western ringtail possum
- 19 species of trans-equatorial migratory shorebird (WAPC 2005) and 15 migratory bird species listed under the EPBC Act, including eastern great egret (*Ardea modesta*) and fork-tailed swift (*Apus pacificus*), which are also protected under international migratory bird treaties
- three priority species – western false pipistrelle (*Falsistrellus mackenziei*) (priority 4), quenda or southern brown bandicoot (*Isoodon obesulus fusciventer*) (priority 5) and water rat or rakali (*Hydromys chrysogaster*) (priority 4)

7 Native animal naming in this plan follows the Western Australian Museum, unless otherwise indicated.

- more than half of the reptile species of the South West (Chapman and Dell 1985) and one of the most diverse reptile assemblages of tuart woodlands (Dell *et al.* 2002)
- seven frog species, all endemic to WA (Tyler *et al.* 2000) and representing about half the species that occur across the Swan Coastal Plain (Dell *et al.* 2002, How and Dell 1993)
- 20 fauna species endemic to the South West, including three birds (Baudin's cockatoo, Carnaby's cockatoo and the red-capped parrot (*Purpureicephalus spurius*)), a bat (western false pipistrelle), seven amphibians, four fish, four reptiles and one mammal species, the western ringtail possum
- five taxonomic groups of subterranean fauna, none of which have been previously identified and all may be new, undescribed species (Biota Environmental Sciences 2003).

Recovery plans exist for Baudin's cockatoo (Department of Environment and Conservation 2008a), Carnaby's cockatoo (Department of Parks and Wildlife 2013), and western ringtail possum (Department of Parks and Wildlife 2014).

The wetlands of the Vasse-Wonnerup system are of international importance, supporting peak numbers of 25,000 to 35,000 waterbirds consisting of 83 different species (WRM 2007) including several migratory species protected under the international migratory bird agreements. The wetlands also support the largest breeding colony of black swan (*Cygnus atratus*) in southern WA (WAPC 2005).

The eastern wetlands contain species compositions typical of wetlands on the eastern side of the Swan Coastal Plain, which has been predominantly cleared (Keighery and Keighery 2002). The eastern wetlands are close to the nationally significant McCarley's Swamp (May and McKenzie 2003) and are therefore likely to support similar ecological values, making them potentially of national significance (Bronwen Keighery *pers. comm.* 2007).

There are three important ecological transition zones in the planning area that provide habitat for a mix of wetland and terrestrial fauna species and require careful management to mitigate threatening processes. They are the transition zone between the Vasse-Wonnerup wetlands and mature tall tuart woodland, between the eastern wetlands and mature tall tuart woodland, and between the eastern wetlands and cleared pine plantation.

Mature tuart trees are necessary to sustain viable populations of fauna that rely on big tree hollows for habitat (for example, common brushtail possum (*Trichosurus vulpecula* ssp. *vulpecula*), western ringtail possum and a range of birds). There has been a reduction of suitable tree hollows because of the loss of older trees with limited recruitment of younger tuarts, the loss of trees in the surrounding areas and competition for hollows from introduced and other problem species such as the honeybee, galah (*Cacatua roseicapilla*), eastern long-billed corella (*Cacatua tenuirostris*) and little corella (*Cacatua sanguinea*). The protection of mature tuart and recruitment for replacement as old trees die is critical for the preservation of fauna habitat. Mature tuarts within the vicinity of the Ramsar wetland provide important habitat for various waterbirds (WRM 2007), including hollows for both roosting and nesting, and while quantifying the usage of tuart trees by nesting waterbirds is a recommendation in the ECD, little information is known and this may not be practical or useful. There has also been some monitoring of waterbirds in the Ramsar wetlands (WRM 2007), although there has been no formal waterbird breeding monitoring undertaken for more than a decade.

The distribution of the western ringtail possum has declined markedly since European settlement (Jones 2004), and given the Ludlow-Busselton area has long been known as the last substantial stronghold for western ringtail possums left on the Swan Coastal Plain, this species will be a priority for monitoring during the life of the plan.

Desired outcome

Native animals and their habitats are identified, protected and conserved.

Management actions

1. Identify native fauna that may need special protection, and implement management actions to minimise impacts from threatening processes, for example:
    - assess and where necessary propose statutory protection
    - where practicable, develop, review and implement recovery plans for threatened species
    - assess all proposed operations and developments for potential impacts.
2. Maintain or enhance wildlife movement corridors and habitats such as tree canopies to provide for the ecological requirements of native fauna.
3. Consider the habitat requirements of fauna species and, where necessary, use fire to promote biodiversity.
4. Ensure on-ground works such as pine harvesting consider impacts on native fauna species and habitats.
5. Monitor populations of western ringtail possum, and/or other specially protected fauna declared in accordance with the WC Act and identified in relevant nature conservation plans.

Key performance indicator

Performance measure	Target	Reporting requirement
Population size of western ringtail possum, and/or other specially protected fauna declared in accordance with the WC Act and identified in relevant nature conservation plans.	No sustained decrease in the population size of western ringtail possum, and/or other specially protected fauna declared in accordance with the WC Act and identified in relevant nature conservation plans.	Every five years, or as per recovery plans if applicable.

Ecological communities

May and McKenzie (2003) identified three priority ecological communities in the planning area. A summary of the priority ecological communities is at Table 4. There is one TEC listed under the EPBC Act within the planning area – the 'Clay Pans of the Swan Coastal Plain' ecological community, which is listed as critically endangered. The eastern wetlands are an example of the 'Herb rich shrublands in clay pans' community (SCP08), which is one of the component communities making up the claypans TEC. The eastern wetlands were floristically sampled in 2012. The department has also recommended one priority ecological community for listing as a TEC as it is considered to be critically endangered, but this has not yet been endorsed by the Minister for Environment.

Table 4. Conservation significant ecological communities[1]

Community	Status
E. cornuta, A. flexuosa and *E. decipiens* forest on deep yellow-brown siliceous sands over limestone (Busselton yate community).	Currently priority 1, but recommended to be upgraded to critically endangered (Val English *pers. comm.* 2008).
Quindalup *E. gomphocephala* and/or *A. flexuosa* woodlands (community type 30b).	Priority 3
Wooded wetlands that support colonial waterbird nesting areas	Priority 2

[1] See www.dpaw.wa.gov.au, accessed August 2013.

Desired outcome

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

Management actions

1. Identify ecological communities that may need special protection, and implement management actions to minimise the impacts from threatening processes, for example:
    - assess and where necessary propose statutory protection
    - where practicable, develop, review and implement recovery plans for ecological communities
    - assess all proposed operations and developments for potential impacts.
2. Monitor the extent and floristic composition of ecological communities of conservation significance, particularly the eastern wetlands and proposed Busselton yate ecological communities.

Key performance indicators

Performance measure	Target	Reporting requirements
Baseline extent and composition of vegetation communities in the eastern wetlands 'herb rich shrublands in clay pans' community	No decrease in the extent or significant change to the species composition of vegetation communities in the eastern wetlands 'herb rich shrublands in clay pans' community.	Every five years.
The floristic composition and size of the proposed Busselton yate TECs.	No decline in the floristic composition or size of the proposed Busselton yate TECs.	Every five years, or as per recovery plan if applicable.

14. Protecting the natural environment

Altered hydrological regimes

Changing seasonal patterns and the quantity and quality of water draining into the Geographe Bay catchment impacts directly and indirectly on wetland values and ecosystem health (see Section 12 – *Physical environment, Hydrology*). They are often inter-related with other threats such as invasive plants, disease, inappropriate fire regimes and acid sulfate soils. Physical and chemical processes such as salinity, acidification, eutrophication and turbidity, can and have caused adverse impacts in aquatic ecosystems. Ongoing water quality monitoring of the Vasse-Wonnerup wetlands is of particular importance and is a requirement of its listing under the Ramsar Convention, although other agencies and organisations play a bigger role in this than the department (see Section 12 – *Physical environment, Hydrology*).

Most of the planning area is at low risk of forming acid sulfate soils, however alluvial sediments that make up the Vasse-Wonnerup floodplain and wetland areas are at high risk if disturbed (WAPC 2003). Any disturbance to these soils (including rehabilitation) requires careful assessment and monitoring to ensure potential impacts are identified. Guidance on the identification, investigation, treatment and management of soils and water in acid sulfate soil landscapes can be found on the Department of Environment Regulation website (see www.der.wa.gov.au).

Water stress associated with groundwater abstraction and reduced rainfall is considered a likely contributing factor to tuart decline within the planning area (TRG 2004). The South West groundwater areas allocation plan (DoW 2009) provides direction on the taking and use of groundwater resources in the area.

Desired outcome

There is no detrimental impact on the planning area arising from changes to groundwater and surface water hydrological processes.

Management actions

1. Protect water sources, wetlands and hydrological processes within the planning area from damage or disturbance that may affect water quality or quantity.
2. Ensure all proposed activities and developments that may modify the current hydrological regime are assessed and any adverse impacts are prevented or mitigated.
3. Undertake rehabilitation actions where the health of fringing riparian vegetation has been adversely affected by build-up of excessive nutrient-rich sediments.

Lasiopetalum membranaceum is a priority 3 species only found in the south-west of WA. Photo – Bronwen Keighery

4. Work cooperatively with DoW to maintain monitoring of surface and groundwater quality and quantity programs in the planning area.
5. Engage with relevant authorities (for example, DoW), adjacent landholders and community groups about water quality and quantity, and provide advice and direction as necessary to ensure key values are protected.

Introduced plants

The department has developed an Invasive Plant Prioritisation Process (see www.dpaw.wa.gov.au), which is an integrated approach to weed management in WA and replaces the statewide environmental weed species rankings of the *Environmental Weed Strategy for Western Australia* (CALM 1999). This process provides an updated ranking of the threat of each weed species on a department regional basis against specific criteria, and aims to consider: (1) a 'species-led', and (2) an 'asset-based' approach to control the threat of environmental weeds within WA.

Further requirements (statutory or otherwise) of land managers to manage weeds include Declared Plants requirements as set out in the *Biosecurity and Agriculture Management Act 2007* (BAM Act), or Ministerial requirements under Part IV of the *Environmental Protection Act 1986* (EP Act).

The planning area has an extensive weed problem, with 193 weed species recorded and very few areas unaffected. Six weed species are 'declared' under sections 39-41 of the BAM Act. Many weed species are widely distributed and are often associated with riparian and moisture-gaining sites.

Two species of significant concern are arum lily and bridal creeper. Bridal creeper is a Weed of National Significance and a strategic plan has been prepared for its management (DEH and AWMCRC 2003). Arum lily and bridal creeper occur extensively throughout the planning area, often in dense thickets and have the ability to change the structure and function of ecosystems (CALM 1999).

Bullrush (*Typha orientalis*) and the divided sedge (*Carex divisa*) provide important habitat and act as wildlife corridors for some native fauna species. Their removal should be undertaken in conjunction with a replacement program of native flora species that can provide the same habitat functions.

Introduced pasture grasses are common and effective management can only be achieved when followed by immediate rehabilitation with native species. This will occur as part of the implementation of rehabilitation programs.

Pine plantations and plots in the planning area are intended for rehabilitation with native species following harvesting. The department will liaise with the FPC to ensure the removal of pine minimises impacts on biodiversity. A trial plot of karri (*E. diversicolor*) exists along the northern edge of Ecosystem Management Zone 2b (see Map 2). The trial plot of karri has no significant fauna habitat value because of its relatively young age (that is, no hollows have developed) and its occurrence is outside its natural range, and therefore the trial plot of karri is proposed to be removed during the life of this plan. Any tree removals will require appropriate hygiene practices to prevent the spread of the soil-borne fungus *Armillaria luteobubalina.*

Next to the south-west corner of the Ludlow settlement, some pine is interspersed with tuart. These pines provide habitat for fauna including the western ringtail possum, Carnaby's cockatoo and nankeen night heron (*Nycticorax caledonicus*). Therefore they will be retained until they senesce, in which case they will be removed and replaced with native species.

Weed control will focus on high conservation value areas, being the eastern wetlands (Ecosystem Management Zone 3) and mixed eucalypt woodlands (Ecosystem Management Zone 6) (see Map 2). Subject to available resources, weed control will also be carried out in areas of high community interest such as road verges, along boundaries with private property and around recreation sites. Any weed control undertaken in the planning area will be managed to minimise impacts on non-target flora species, particularly understorey species such as native herbs and grasses.

Desired outcome

The impacts of introduced plants on biodiversity values are minimised.

Management actions

1. Maintain information on declared plants including presence, abundance and distribution, relevant biological information and history of control, and finalise the Invasive Plant Prioritisation Process to combine a species-led approach with an asset-based approach to prioritise biodiversity benefit of weed control.
2. Liaise with the FPC to ensure pine removal operations do not impact on biodiversity values.
3. The FPC will conduct its operations in accordance with the FMP, particularly in relation to the guidelines for soil protection in the *Code of Practice for Timber Plantations* (FIFWA 2006).
4. Rehabilitate cleared plantation and other disturbed areas with relevant native vegetation to minimise the likelihood of further weed invasion.
5. Liaise with relevant agencies and neighbouring landholders to:
    - facilitate effective, coordinated environmental weed management
    - identify priority weeds using risk based procedures for determining their relative importance
    - facilitate knowledge transfer, awareness raising and capacity building and
    - use volunteers to help in weed management control programs.
6. Use planning procedures, and operational controls, to identify the relative importance of areas for protection, and to minimise the risk of spread and impacts from priority weeds already present.
7. Develop and implement a weed control plan for high conservation value areas, being the eastern wetlands and mixed eucalypt woodlands, and areas of high community interest.
8. Remove the karri trial plot and rehabilitate with native species.

Key performance indicators

Performance measure	Target	Reporting requirement
Weed control program for selected parts of the planning area.	Develop and implement a weed control program for the eastern wetlands, mixed eucalypt woodlands and areas of high community interest.	Every five years.
Removal of the karri trial plot.	Remove the trial plot of karri from the planning area.	Within five years.

Introduced and other problem animals

The red fox, feral cat and rabbit are the most common and widespread introduced animals within the planning area and continue to pose a threat to the survival of the western ringtail possum, brushtail possum, quenda, southern brush-tailed phascogale and water rat. Ducklings and other birds that migrate from their nest in mature tuart hollows to the Vasse-Wonnerup wetlands are also affected by introduced predators.

As part of the department's *Western Shield* program, fox baiting occurs in the planning area four times a year, with additional baiting to protect specific habitats, known populations of threatened animals, or new fauna release sites. While the large boundary to area ratio is not conducive to long-term control of foxes, baiting will continue until alternative management options are available. The department is also seeking to maximise this control effort by working strategically and collaboratively with neighbouring land managers.

The presence of feral cats in the planning area is acknowledged. Control of feral cats is difficult because of the recurrence of domestic cats originating from adjacent rural and urban areas. At the time of writing, cat baits are being trialled elsewhere in the State as part of the *Western Shield* program and it is possible that during the life of this plan, cat baits will be used in the planning area.

There is concern about the number of western grey kangaroos in the planning area and on surrounding private properties, as elevated populations of kangaroos have the potential to overgraze native plants, particularly tuart, seedlings and hinder ecosystem rehabilitation. Despite the seemingly high number of kangaroos in the area, the role of the kangaroo in tuart ecosystems is poorly understood and further research is required. The department will continue to monitor the population levels and grazing pressures from kangaroos, and will consider a kangaroo reduction program in conjunction with neighbouring landholders, within and next to the planning area if required.

Rabbits are widespread and highly abundant in the planning area and potential environmental impacts are likely to be similar to those imposed by kangaroos. Rabbit control measures will be implemented when environmental impacts become unacceptable.

The galah has expanded its natural range to include the planning area and has increased in number. It can be aggressive in competing for tuart hollows (John Carter *pers. comm.* 2007) and as such is considered a problem animal. The eastern long-billed corella and little corella also occur and like the galah, their population sizes are increasing, which creates competition for food and habitat. The department will continue to monitor the population size and impacts of these bird species.

Feral honeybees can impact on the values of the planning area by competing with native fauna for tree hollows and floral resources such as pollen and nectar, increasing seed-set in some weeds and potentially threatening the amenity and safety of visitors. The feasibility of completely removing them is low, as localised eradication would be followed by re-colonisation from new swarms invading the area. Management will focus on controlling colonies around recreation sites and where practicable, managing the distribution and density of managed hives in areas of high conservation value.

Insect damage alone generally does not affect the health of tuart trees. However, when insect attack occurs in conjunction with other threatening processes such as water stress or inappropriate fire, the impacts on tuart trees can be more severe. The following insects are of most concern in the planning area (TRG 2004):

- tuart bud weevil (*Haplonyx tibialis*), which impacts on viable tuart seed
- pasture-derived leaf feeders, which impact on young or regenerating tuart
- tuart longicorn beetle (*Phoracantha impavida*), which attacks the trunks of younger trees, sometimes killing them.

In comparison to other areas, neither tuart nor flooded gum decline is occurring to a significant degree in the planning area, though they are known to occur in isolated cases. Stressed trees are more vulnerable to insect attack and hence the severity of insect attack will be considered when monitoring tuart and flooded gum health.

Desired outcome

The impacts of introduced and other problem animals on biodiversity values are minimised.

Management actions

1. Continue to provide advice and support for kangaroo control on adjacent private properties.
2. Where necessary, erect fencing to protect rehabilitated areas, high conservation value areas and other areas from grazing by rabbits and kangaroos.
3. Investigate other control methods for kangaroos and other problem animals.
4. Monitor the population levels and grazing pressure of kangaroos on the values of the planning area, and consider implementing a kangaroo reduction program if required.
5. Work collaboratively with other agencies and land managers, as appropriate, to identify priority pests and problem animals using risk-based procedures for determining their relative importance.
6. Where reasonable and practicable, implement control programs for priority pests and problem animals and encourage the coordinated involvement of government, industry, the community and other land managers in addressing these pest species and problem animals, including through facilitating knowledge transfer, awareness raising and capacity building.
7. Continue to undertake fox control as part of the *Western Shield* program.
8. Monitor the occurrence of other introduced animals and implement control actions as required.

Key performance indicator

Performance measure	Target	Reporting requirement
Fox baiting as part of the *Western Shield* program.	Carry out fox baiting a minimum of four times a year in the planning area.	Annually.

Diseases

Tuart is considered relatively resistant to *Phytophthora cinnamomi* (TRG 2004), but other plant species within the planning area are highly susceptible to this disease. Scott *et al.* (2012) suggest that it is unlikely that *P. cinnamomi* poses a threat to tuart, which grows predominantly on the calcaric Spearwood and Quindalup soils (Ruthrof *et al.* 2002), which are not conducive to *P. cinnamomi* infestation (Shearer and Dillon 1996). *P. cinnamomi* is not known to occur in the planning area, however recent research has

detected the presence of the endemic *P. multivora* (Paul Barber *pers. comm.* 2008). Scott *et al.* (2012) also suggest that *P. multivora* causes significant fine root loss of tuart under controlled conditions. The department's Policy 3 – *Management of Phytophthora and diseases caused by it* (see www.dpaw.wa.gov.au) and the Conservation Commission's Position Statement No. 7 (see www.conservation.wa.gov.au) provide guidance for managing *P. cinnamomi*. The department will monitor the planning area for signs of these diseases and will support continued research into the significance of *P. multivora.* Disease hygiene practices will be taken into account as part of on-ground works and in visitor planning to prevent the introduction and/or spread of diseases in the planning area.

At least 50 plant families and more than 200 native plant species are susceptible to the endemic soil-borne fungus *Armillaria luteobubalina* including tuart, peppermint, jarrah, prickly moses (*Acacia pulchella*) and bull banksia (*Banksia grandis*), all of which are found within the planning area (Robinson and Rayner 1998). *A. luteobubalina* is common in all forest, woodland and coastal heath communities in the south-west (Robinson 2004). Logging stumps are an important refuge for survival of *A. luteobubalina* for up to 30 years and a source of infection of nearby hosts (Kile 1981). When rehabilitation occurs in areas where pine and karri are removed, appropriate hygiene practices will be employed. The intensity of tree felling may also influence the artificial spread of *Armillaria* (Richard Robinson *pers. comm.* 2007) and therefore pine and karri may need to be removed in patches. Prevention is the best treatment and disease hygiene practices are essential to ensure the disease is not spread. However, full elimination of this endemic pathogen is not considered desirable or possible as it is naturally occurring in undisturbed areas of the South-West (Richard Robinson *pers. comm.* 2007).

Some frog species within the planning area appear to have been impacted by *chytridiomycosis*, including slender tree frog (*Litoria adelaidensis*), motorbike frog (*L. moorei*), western banjo frog (*Limnodynastes dorsalis*) and moaning frog (*Heleioporus eyrei*) (Aplin and Kirkpatrick 2001). Because of limited knowledge of this pathogen, management will focus on implementing hygiene practices during all on-ground operations and monitoring current populations to detect any significant decline in frog numbers.

Desired outcome

The impact and spread of existing plant and animal diseases is minimal and no new diseases are introduced into the planning area.

Management actions

1. Monitor the impact of *chytridiomycosis*, *Armillaria* and *P. multivora* by progressively identifying and assessing significant disease-free areas, and mapping the extent of *chytridiomycosis*.
2. Implement appropriate hygiene practices when undertaking works within the planning area (for example, harvesting pines) to reduce the risk of introducing and/or spreading pathogens.
3. Document and respond as necessary to outbreaks of problem plant and animal diseases that become apparent during the life of the plan.
4. Liaise with relevant agencies and neighbouring land managers to facilitate effective, coordinated disease management in the planning area and surrounding areas.

Key performance indicator

Performance measure	Target	Reporting requirement
The proportion of operations undertaken with an approved hygiene management plan.	No planned operations undertaken without an approved hygiene management plan.	Every five years.

Fire

Fire is an important disturbance factor that has influenced, and continues to influence, the biodiversity of all ecosystems in the planning area. The drying climate and flammable vegetation of the planning area make it prone to bushfire, and when lightning strikes coincide with severe fire weather conditions and areas with high fuel accumulation, damaging bushfire can occur. Hence, fire management planning is important to protect biodiversity as well as the community.

Management of fire on department-managed land is underpinned by legislation (for example, *Bush Fires Act 1954*, CALM Act and precedents established under common law), and guided by the department's Policy 19 – *Fire management policy* (see www.dpaw.wa.gov.au), Policy 88 – *Prescribed burning* (see www.dpaw.wa.gov.au) and the associated *Code of practice for fire management* (DEC 2008b). Additionally, the *Emergency Management Act 2005* sets out the emergency management arrangements for the State, requiring that several emergency response plans be maintained. The response plan for bushfire is *Westplan Fire* (see www.semc.wa.gov.au), which sets out the department's role and obligations, along with that of other relevant agencies, in contributing to bushfire prevention and mitigation, preparedness, response and recovery. The Conservation Commission's Position Statement No. 1 – *Fire Management* (see www.conservation.wa.gov.au) also provides guidance on fire management on land vested in the Commission.

The department has a well-established framework and process for planning, implementing and reviewing its prescribed burning program. This fire management plan approach considers biogeography, land use, community protection and other factors, such as the available workforce, plant and equipment, and establishes management objectives, burn strategies, risk management and success criteria. When fully implemented, it is intended to operate at five levels, which includes regional fire management plans, the master burn planning process, three year (six season) indicative burn plans, annual burn programs and prescribed fire plans (Conservation Commission 2013).

This management plan provides the strategic framework that will be used to develop fire regimes that are ecologically appropriate and protect life and community assets. Engaging with the public is vital if the role and effects of fire, the application of planned fire and fire suppression operations are to be understood. There is community interest in the planning process and outcomes associated with prescribed fire management. To this end, the department has made and will continue to make, its planned burn programs publicly available (see www.dpaw.wa.gov.au).

Fire and biodiversity

Many species possess a variety of adaptive traits or 'vital attributes' that enable persistence in this generally fire-prone environment (Burrows and Wardell-Johnson 2003). While many species and communities are resilient to a range of fire regimes, some have specific fire regime requirements. As there are gaps in knowledge of the fire requirements for some flora and fauna species, fire management will initially focus on the protection of threatened species, the proposed Busselton yate TEC and significant fire-sensitive species and habitats that require specific fire regimes such as tuart woodlands, organic-rich soils (peatlands), habitat protection within reeds and rushes, western ringtail possum and black cockatoos. As information on the ecological parameters of species becomes available, this will be incorporated into the prescribed burning program. Fire regimes that have been developed to protect life and community assets will complement ecological fire regimes where possible.

Threatened species within the planning area that are vulnerable to fire include the western ringtail possum, southern brush-tailed phascogale, Baudin's cockatoo and Carnaby's cockatoo. The fire-sensitive threatened flora species *Verticordia plumosa* var. *vassensis* also occurs in the planning area. Where no fire ecology information exists for a particular species, carefully monitored experimental burning might be considered. Protection of threatened species will take priority when devising fire regimes important to ecosystem function.

Tuart is well adapted to fire. It has the capacity to recover rapidly from low and moderate intensity fires and regeneration via seedlings occurs almost exclusively following high intensity fire. High intensity fire in tuart woodlands can result in prolific post-fire seedling regeneration, however intense fires can also cause tree deaths (Ruthrof *et al.* 2002). Tuart also takes some time to produce new seed and repeated intense fires can be destructive to tuart woodlands (Ruthrof *et al.* 2002, Archibald *et al.* 2006). The size-class structure of tuart populations is often determined by fire history, however in the case of the planning area it is more attributable to previous land-use history. Cohorts of young trees, such as those resulting from seedling regeneration following fires, are critical as they replace trees in decline or that have died (Archibald *et al.* 2006). Tuart (and tuart understorey) regeneration requires small-scale burning of patches of forest to create ashbeds suitable for seed or seedlings, although without some form of protection (for example, fencing) regeneration does not survive to become viable recruitment due to extensive grazing by kangaroos.

Changes in the understorey of tuart communities in the planning area have been linked to the decline in regular burning and the commencement of grazing by cattle soon after European settlement (TRG 2004). In some parts, the lack of fire over recent decades, history of livestock grazing and extensive weed invasion and peppermint understorey have resulted in tuart stands dominated by veteran trees with limited regeneration.

Although tuart is well adapted to fire, many of the veteran trees may be unable to survive intense fires or produce enough quality seed to enable regeneration. In addition, many mature trees are in a state of structural decline, which may render them vulnerable to low intensity fires including prescribed burns. Therefore, to ensure these individual trees are protected, raking or removing fuel from the base of trees, protecting with water when lighting, or physically excluding groups of trees from planned burns will be considered where practicable.

Fire management of the planning area

Forestry in Tuart Forest National Park. Photo – Battye Library

Patch burning of small areas has and will continue to be applied to regenerate tuart communities. Trials involving fire have been applied within the planning area and in other tuart ecosystems in the past, although the findings are not well documented. There is a need to draw together all existing research and operational results as an initial step in designing future trials into tuart re-establishment (see *Research and Monitoring*). Outcomes from trials will be used to update fire management within the planning area. Monitoring of post-fire survival and recruitment success will be conducted to determine if tuart communities are benefiting from prescribed burns.

The risk of bushfires impacting life and community assets in the planning area is considered low to moderate. In making this determination, the location and extent of fire-vulnerable community assets and the likelihood and consequences posed by fire to those assets are considered. A summary of assets identified within and surrounding the planning area is listed in Table 5.

Table 5. Asset protection areas

Asset protection area	Management actions and considerations
Neighbouring farms and residential properties	Response to bushfire requires joint operations with DFES, the City of Busselton, the Shire of Capel, volunteer fire brigades, local landowners and residents. Strategic buffers are required to act as low fuel zones and will be achieved through prescribed fire, mechanical fuel modification (slashed breaks and buffers) or weed control. Maintenance of strategic access and firebreaks.
Ludlow settlement	The settlement is heritage listed and some buildings are currently tenanted. Future use of the settlement may see an increase in visitor numbers. Strategic access and firebreak network to be maintained. Prescribed burning, mechanical fuel modification or weed control will be required to establish asset protection buffers. New water sources for fire management activities may need to be established. Powerlines at the settlement have potential to ignite fires and present a hazard in the event of fire. Asbestos is present in some buildings and presents a hazard in the event of a fire. The settlement is divided between the Shire of Capel and the City of Busselton. Fire suppression activities will require involvement of both local governments. Consideration will be given to developing a site-specific fire protection plan for the Ludlow settlement.
Tuart Drive	The high scenic quality of mature tuarts along Tuart Drive is valued by the community. Prescribed burns and fire suppression activities must be planned to minimise impact on mature trees without compromising safety to the public and firefighters.
Tree plantations	Prescribed burning of understorey may occur. Plantation timber is of significant economic value. Strategic access within plantation areas will be maintained where practicable.
Recreation sites	Existing recreation sites include the Possum Paths walktrail, Layman day-use site, Malbup bird hide and walk trail, Higgins Road day-use site, Membenup day-use site and the Ludlow River day-use site. Additional recreation sites may be established.
Infrastructure	There is a need for new water sources to facilitate prescribed burning and bushfire suppression activities. An electrical transmission line and below ground gas pipeline traverse the southern part of the planning area. A water pipeline and bore provide water for the Ludlow settlement. Power transmission lines and telephone lines associated with the Ludlow settlement.
Rehabilitation areas and fire regime-specific species	Newly planted or regenerated seedlings, including tuart, are susceptible to fire. Rehabilitation plots are located within the Bemax mining lease and other parts of the planning area. Mature tuart trees may be killed or severely weakened by moderate to intense fires. Structurally weakened trees can pose a risk to the public and firefighters and will need to be assessed and managed in accordance with the department's Fire Operations and Visitor Risk guidelines.

The planning area adjoins agricultural land, tree plantations, residential settlements and a mining lease. In many cases, the adjacent private property contains small areas of remnant trees with some understorey. This is a particular concern for managers as these areas are generally burnt infrequently and may be close to key community assets. It is therefore important to foster good neighbour relations with adjoining landowners, particularly to ensure complementary fire management on adjoining lands (see Section 8 – *Community involvement and off-reserve management*). In this respect, local government authorities have a dual responsibility with the department to mitigate the impacts of bushfire. Engaging with local government, volunteer bush fire brigades, DFES, other relevant State Government agencies and Bemax Cable Sands will be necessary to ensure effective fire management across jurisdictions. Fire management in the planning area will, as far as practicable, be integrated with fire management on adjoining lands.

There is a strategic access network for the planning area, which comprises public and strategic access roads and tracks. This network will be maintained to ensure safe access for fire fighting vehicles and to permit effective fire management. A road and trail maintenance program is in place that considers potential impacts on natural, cultural and recreation values. Where possible, bushfires will be contained within management units defined by existing roads, rather than by constructing new firelines around the perimeter of the fire. If temporary firebreaks are constructed during fire suppression activities, they will be rehabilitated to minimise soil erosion, spread of disease or weeds and unauthorised access.

Desired outcomes

Natural values, including tuart woodlands, are maintained by and protected from fire.

Life and community assets are protected from bushfire.

Management actions

1. Use fire management guidelines to protect and conserve fire regime specific ecosystems, species and significant habitats.
2. Undertake bushfire suppression and recovery operations in a manner that aligns with the department's fire operations guidelines.
3. Undertake research on the regeneration success of tuart after fire, including a review of previous investigations and the effects of carrying out patch burning of small-scale areas, and adapt management accordingly.
4. Maintain roads and tracks used for fire management.
5. Implement weed and pest animal control programs in association with prescribed burns and bushfires to minimise post-fire impacts on tuart woodlands, native animals and other natural values.
6. Adapt fire management to new knowledge gained through research, monitoring and experience, including unplanned events such as bushfires.
7. Liaise with relevant agencies, local bush fire brigades and neighbouring landowners and managers to facilitate effective, coordinated management of fire in the planning area and surrounding areas by encouraging cooperative arrangements and ensuring community protection from fire is at an appropriate level.
8. Consult with stakeholders and interested community members on the planning and implementation of prescribed burning and other fire management programs to:
    a. develop community understanding of, support for and collaboration in, fire management
    b. enable constructive discussion and deliberations on fire management approaches.
9. Maintain a competent capability in fire management, including prescribed burning and bushfire prevention and mitigation, preparedness, response and recovery.

10. Undertake an annual prescribed burning program in a manner that:

    a. seeks to address the risk presented by bushfire to the ecological, social, cultural and economic values occurring on lands managed by the department, and the risk presented by bushfire emanating from land it manages into surrounding land

    b. considers any specific ecological, silvicultural, social, cultural and other identified management objectives in areas subject to prescribed burning (such as patch burning of small areas for tuart and tuart woodland understorey regeneration)

    c. seeks to minimise emissions of greenhouse gases while achieving fuel reduction objectives so as to avoid major emissions arising from periodic catastrophic bushfires

    d. maintains or enhances the conservation of biodiversity by maintaining or enhancing the diversity of understorey vegetation structure and composition that facilitates a diversity of habitat opportunities

    e. creates and uses new knowledge in an adaptive management framework

    f. is assessed against stated objectives for the program and stated objective(s) and success criteria for individual burns.

11. Where required, undertake prescribed burning giving consideration to the fauna distribution information system.

12. When undertaking prescribed burns, implement measures to protect veteran tuart trees where possible.

13. Unless deemed necessary for ongoing management requirements, rehabilitate firebreaks constructed during bushfire suppression activities.

Key performance indicator

Performance measure	Target	Reporting requirement
Small-scale patch burns in the planning area to establish tuart and tuart woodland understorey regeneration.	A minimum of two small-scale patch burns every five years that result in the establishment of tuart and tuart woodland understorey regeneration.	Every five years.

Managing cultural heritage

15. Aboriginal and other Australian heritage

Management of Noongar and other Australian cultural heritage in the planning area is guided by WA's *Aboriginal Heritage Act 1972*, the *Heritage of Western Australia Act 1990* and the department's Policy 18 – *Recreation, tourism and visitor services* (see www.dpaw.wa.gov.au).

Noongar culture and heritage

There are six Noongar heritage sites registered with the Department of Aboriginal Affairs (DAA) in the planning area, which include mythological and historical sites and sites containing physical evidence of Noongar presence in the area such as artefacts, scatter and a modified tree. The planning area is part of land (*boodja*) traditionally occupied by the Wardandi people, who occupied the coast from Bunbury to Cape Leeuwin and inland as far as Nannup (Berndt and Berndt 1979, Tindale 1974, cited in WAPC 2005). Tilbrook (1983) suggested that at least 13 different socio-linguistic Noongar groups existed in the South West. These groups, including the Wardandi people, shared traditions and a common language, albeit with local variations and are collectively known as Noongars.

As the register maintained by DAA is not a comprehensive listing of all Noongar sites, assessments may be necessary before any operations that may inadvertently cause damage to sites of significance for Noongar people. This may include examinations of the ethnographic and archaeological heritage values. Appropriate approvals under the *Aboriginal Heritage Act 1972* are required before proceeding with any public works that may affect Noongar heritage values.

Under section 56(2)(a) of the CALM Act, the department is responsible for protecting and conserving the value of the land to the culture and heritage of Aboriginal persons. The department will follow any policy, protocol or agreement entered into, including any arising from the SWNTS agreement, to protect and conserve Noongar heritage sites and to ascertain the value of the land to the culture and heritage of Noongar people (Conservation Commission 2013). DAA and the Department of the Premier and Cabinet have released *Cultural Heritage Due Diligence Guidelines* (see www.daa.wa.gov.au). Good working relationships with Noongar people will help in ensuring these guidelines are effectively applied and that relevant Acts are complied with.

Activities for Aboriginal customary purpose

Amendments to the CALM Act (and associated regulations), together with the WC Act, allow Noongar people to access lands and/or waters managed by the department to conduct traditional activities, subject to regulations. The department's Policy 86 – *Aboriginal customary activities* (see www.dpaw.wa.gov.au) provides guidance on establishing a framework for decision making in relation to recognising activities undertaken by Aboriginal people for customary purposes, and in the application of relevant regulations. Such traditional customary purposes may be for medicinal, artistic, ceremonial or other cultural purposes. The hunting and gathering of food by Noongar people is an important part of their culture, enabling them to maintain traditional relationships with the land and water, share knowledge and partake in traditional practices. Noongar people in the region continue to access the lands and waters of the planning area to undertake cultural activities and gather a range of traditional foods including various plants, mammals, fish, birds, reptiles, frogs and invertebrates. The department will work with registered native title claimant groups, joint management parties and local Noongar communities to develop local area arrangements to support and manage customary activities on department-managed lands and waters, including the taking

of traditional food by Noongar people. The development of relationships at a local level is vital to the ongoing management of customary activities on department-managed lands and waters.

Traditional custodians have a strong desire to care for country and practise customary activities according to their traditional laws and customs, to be involved in the cooperative management of conservation reserves in WA and to strengthen cultural ties to the land. Working with Noongar people to care for the land will be beneficial to the preservation of natural and cultural heritage, as well as enriching cross-cultural awareness. The involvement of traditional custodians in the cooperative management of department-managed lands and waters provides a suite of cultural, spiritual and economic benefits to Noongar people. While it is possible that management arrangements with Noongar people may change during the life of the management plan, the department will continue to recognise the interests of Noongar people on reserves where native title has been extinguished and their desire to continue cultural activities and customs in these areas.

Other Australian heritage

The planning area has a long history associated with early European settlement and the agricultural and forestry industries (Kay 1985, Storrie and Thomson-Dans 2011). Two sites are listed on the *State Register of Heritage Places* (the lime kilns [Heritage Place No. 4622] and the Ludlow settlement [Heritage Place No. 15834]) and 10 sites are listed on the *Municipal Heritage Inventory* of the City of Busselton and the Shire of Capel (see www.heritage.wa.gov.au, accessed August 2013):

- Ludlow Tuart Forest Heritage Precinct (City of Busselton), Heritage Place No. 4416
- Ballarat Tramline Plaque and Wheel (City of Busselton), Heritage Place No. 5333
- Route of the Ballarat Railway Line (City of Busselton), Heritage Place No. 5358
- Wonnerup wetlands (City of Busselton), Heritage Place No. 5376
- Vasse River and Estuary (City of Busselton), Heritage Place No. 5371
- Dinny Connell's House, National Park (Shire of Capel), Heritage Place No. 15144
- Single Men's Quarters, Ludlow State Forest (Shire of Capel), Heritage Place No. 14874
- Formation Road existing alignment (Shire of Capel), Heritage Place No. 15147
- Lime Kilns (Shire of Capel), Heritage Place No. 4622
- Forestry Houses, Ludlow State Forest No. 2 (Shire of Capel), Heritage Place No. 14872

Forest Department sawmill at Wonnerup. Photo – Battye Library

Tuart fire tower tree at Ludlow. Note the pegs on the left side of the tree. Photo – Paul Roberts

The Ludlow settlement is a permanent entry on the *State Register of Heritage Places* and is also listed on the *Municipal Heritage Inventory* of the City of Busselton and the Shire of Capel. The settlement includes Ludlow Road and the bridge over the Ludlow River, three groups of forestry cottages, the former sawmill, forestry workshops and compound, a school and the former Forests Department district office, among other buildings. This historic precinct was the location of the first Forestry School in the State, established in 1921 (and remaining in operation until 1927) as a result of the work of internationally renowned forest conservator, Charles Edward Lane-Poole (see Kay 1985, www.heritage.wa.gov.au). Ludlow State Forest No. 2, gazetted in June 1919, was one of the first areas in WA to be protected as State forest (Keighery and Keighery 2002).

To the north of the Ludlow settlement are remains of a wooden tramway that was used between 1921 and 1928 to transport tuart logs to the Wonnerup mill. The tramway is listed on the Shire of Capel's *Municipal Heritage Inventory* and several original sleepers remain along the side of the road. Part of this site was disturbed during mining by Bemax. However any infrastructure that was unearthed was removed and replaced on the cessation of mining.

The remains of the old Ballarat tramline and bridges can also be found in the planning area. The railway passed through the southern portion of Tuart Forest National Park and is listed on the City of Busselton's *Municipal Heritage Inventory*. The railway, the first in the State, was officially opened by Governor Weld on 23 December 1871 and was important in the early development of the timber industry in the State's south-west. The first railway bridge in WA, the Ballarat Bridge, was named after the Ballarat engine, which was the first locomotive to be used in WA.

The remains of the lime kilns, an industrial complex of circular kilns with unique spiral loading ramps, are located in Tuart Forest National Park. The kilns are listed on the *State Register of Heritage Places* and the Shire of Capel's *Municipal Heritage Inventory*.

Desired outcomes

Conserve and protect the value of the land to the culture and heritage of Noongar people.

Conserve and protect other Australian heritage.

Management actions

1. Create opportunities for local Noongar people to be involved in protecting and maintaining cultural heritage values.
2. Comply with Commonwealth and State legislation and departmental policies before commencing operations that have the potential to impact on cultural heritage.

3. Consult local Noongar people, South West Aboriginal Land and Sea Council and DAA, and refer to the State Aboriginal Site Register and other relevant registers to ensure the protection and conservation of Noongar cultural heritage.
4. Manage and regularly monitor threatening processes (such as fire, introduced plants and animals) and visitor activities to ensure Noongar and other Australian cultural heritage is not adversely impacted.
5. Consult and involve the local community and relevant organisations (such as local government agencies), and refer to heritage registers to ensure the protection and conservation of other Australian heritage.
6. Use agency procedures that ensure that the presence and type of heritage places are appropriately recorded, accessible to staff and considered before operations take place.
7. Cooperate with Commonwealth and State agencies, local governments and non-statutory organisations in relation to other Australian cultural heritage identification and conservation.

Key performance indicator

Performance measure	Target	Reporting requirement
Protection of registered or identifiable heritage sites.	No disturbance of registered or identifiable heritage sites without formal consultation and approval with local Noongar people and/or relevant stakeholders.	Annually.

Managing visitor use

In the planning area, the major areas of focus for managing visitor use are to:

- improve facilities at existing recreation sites
- provide interpretation at recreation sites to enhance visitor understanding and enjoyment
- consider the development of new walk and dual-use trails.

The provision of visitor services, facilities and experiences in the planning area is guided by the department's Policy 18 – *Recreation, tourism and visitor services* (see www.dpaw.wa.gov.au).

16. Visitor opportunities and planning

Regional recreational context

Birdwatching is a popular activity in the planning area.

Tuart Forest National Park is located within the Great South West National Landscape (see www.australia.com), which "hides one of the world's last remaining stands of Tuart trees". Bussell Highway runs parallel and next to the planning area and is intersected at two points by Tuart Drive, a dedicated scenic route that runs through the middle of the planning area. Both roads provide opportunities to view tall tuarts, which is the main natural attraction for visitors. As well as scenic driving, the planning area provides a desirable setting for other recreational activities such as bushwalking, birdwatching, photography and horseriding.

While it is recognised that recreational opportunities in the planning area are comparatively limited, it is important that visitor planning takes into account activities provided for elsewhere in the region, rather than endeavouring to provide a wide range of visitor opportunities in the planning area that could reduce the quality of experience or compromise natural and cultural values. There are many opportunities for recreational activities close to the planning area including four-wheel driving, scenic driving, cycling on public roads through the planning area, boating, walking, caving, climbing, sightseeing, camping, fishing, swimming, surfing and picnicking.

Vehicle counts undertaken in 2006–07 along Tuart Drive indicate an average of 1,580 vehicles (traffic count by Shire of Capel 2 February 2006) passing daily during summer and 1,349 vehicles (traffic count by City of Busselton 27 August to 10 September 2007) in winter. However, most of these vehicles continue without stopping, as Tuart Drive is a major thoroughfare for local residents and tourists destined for the nearby towns. There are no records of vehicle or visitor numbers for any of the recreation sites within the planning area.

Visitors that stop in the planning area do so at established recreation sites located at the southern end including the Layman, Membenup, Malbup and Higgins Road day-use sites (see Map 3). While there are no established recreation sites in Minninup block of the planning area, recreational activity does occur, particularly horseriding and bushwalking.

The number of visitors to the planning area is thought to be relatively low, however if visitor numbers increase or there is a clear need for additional visitor information during the life of the plan, the department may undertake visitor surveys to gain an understanding of trends and levels of satisfaction with the available recreational facilities.

Visitor planning

Planning for visitor use is necessary to manage issues of visitor risk, environmental impacts, social benefit, equity, public demand and potential economic benefit. More detailed site planning will be required before the development of additional recreation sites and to manage more specific visitor use issues.

The planning area has significant visual landscape values in the distinctive tall tuart woodlands and open views over the wetlands. The department's Visual Landscape Management system will be adhered to in all aspects of land management operations, including in the planning and development of new facilities, signs and infrastructure.

Visitor safety

The department routinely conducts risk assessments of all designated recreation areas, with mitigation works undertaken on a priority basis according to the degree of risk posed to visitors. Personal injury and damage to property because of falling trees and limbs, particularly from tuart trees, can pose a serious risk to visitor safety. Removal of hazardous trees and limbs in and around all designated recreation areas has been undertaken and will be an ongoing requirement. Tree pruning may be required along existing and potential new walk trails, particularly at points where people are likely to congregate, such as interpretation sites.

Mosquito breeding sites occur within and adjacent to the planning area and present an increased risk of exposure to mosquitoes and possible infection by diseases they transmit. The City of Busselton and the Shire of Capel have mosquito control strategies that detail the intention to apply a larvicide (*altosid*) at breeding sites within the Vasse-Wonnerup Estuary, outside the planning area (see www.busselton.wa.gov.au and www.capel.wa.gov.au). Mosquito risk warning signs will be maintained at all designated recreation sites. The Conservation Commission also has a position statement about mosquito control (see www.conservation.wa.gov.au).

Desired outcome

Visitors are able to enjoy a range of nature-based recreation and tourism opportunities.

Management actions

1. Provide and maintain a range of safe nature-based visitor services and facilities consistent with the department's Policy 18 – *Recreation, tourism and visitor services.*
2. Ensure existing and future recreation and tourism developments and visitor activities have a minimal impact on key values and ensure they are designed, developed and maintained to department standards.
3. Monitor visitor numbers and impacts on recreation sites, and undertake informal surveys of visitor activities such as bushwalking and horseriding.
4. Use the data collected from visitor satisfaction surveys and social research to improve management and minimise environmental, social and economic impacts in the planning area.
5. Undertake visitor risk assessments of all recreation sites and facilities as part of a visitor risk management program in addition to that which occurs on a day-to-day basis and implement appropriate action as necessary.

Key performance indicator

Performance measure	Target	Reporting requirement
Visitor satisfaction with nature-based facilities.	Maintain or increase visitor satisfaction with nature-based facilities.	Every five years.

17. Access

The planning area is easily accessible, with public access available to vehicles through sealed and unsealed roads and tracks. Access needs to be carefully managed to balance the demand for access with protection of key values, including the natural landscape, that are highly valued by many visitors and the community.

Tuart Drive is the main access road through the planning area. Photo – Paul Roberts

Access to the planning area occurs predominantly via Tuart Drive and Layman Road. Other roads that provide access to the planning area include Ludlow North Road, Stirling Road and Mallokup Road (see Map 3). Formation Road is a historic unsealed road managed by the department that runs through the middle of the planning area north of the Ludlow settlement. Public access to the southern section of Formation Road is restricted because of the need to protect rehabilitated areas within the Bemax mining lease, but will eventually be re-opened once rehabilitation requirements have been met. Liaison with Main Roads WA and the Shire of Capel will be important to manage impacts that may arise from road upgrades proposed in 'Roads 2030' (MRWA 2013).

The planning area contains numerous tracks that were formed before the national park was gazetted. Tracks through the planning area (except those indicated on Map 3 or tracks required for management access) will be progressively closed to vehicles during the life of this plan. This will aid in rehabilitation, help with the maintenance of environmental values and improve visitor safety. Tracks that are designated as management access only will be signposted accordingly.

Fences occur throughout much of the planning area, although limited maintenance is carried out and some gates are not locked. The majority of fences were constructed to control livestock when the planning area was used for grazing and will be retained and maintained as required for management purposes. Problems associated with unauthorised access into the planning area include rubbish dumping, abandoned vehicles, vandalism, theft of infrastructure such as fences, gates and signs and illegal access by off-road vehicles. Public access to the planning area will be managed through the provision of clearly identified access points and signage.

Unauthorised off-road driving has led to the degradation of vegetation and soils, the spread of weeds and diseases and is a risk to public safety through conflicts between vehicles and other park users. In particular, off-road vehicle activity in the cleared corridors beneath the powerlines that traverse the eastern

wetlands is causing significant environmental damage. The railway reserves managed by the Public Transport Authority (outside the planning area) act as a conduit for unauthorised vehicle access into the planning area. The department will liaise with the relevant agencies to restrict unauthorised vehicle access into the planning area.

Driving along roads and tracks closed to the public, or where there are no tracks, is not permitted. 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 permitted.

Access to the Bemax mining lease (M 70/86) is restricted and is specifically fenced to prevent unauthorised entry to the lease site.

Desired outcome

Provide and maintain safe and effective access that facilitates visitor enjoyment of the planning area while minimising impacts on natural, cultural and recreation values.

Management actions

1. Provide and maintain access (as shown in Map 3) for management and public use, consistent with department standards and in consultation with visitors and relevant stakeholders. Retain and signpost management access tracks as appropriate.
2. Prohibit vehicles driving off dedicated roads, department-managed roads and tracks, except with the approval of the district manager.
3. Provide information to visitors on the different types and locations of safe and appropriate access.
4. Negotiate with the appropriate authorities to close unnecessary or unused road reserves, adding them to Tuart Forest National Park (see Section 5 – *Land tenure and boundaries*).
5. Retain and maintain existing fences that are required for management purposes.
6. Where appropriate, improve access for disabled visitors.
7. Seek complementary management of the adjacent unvested railway reserves to minimise impacts on adjacent parts of the planning area through unauthorised access.

18. Visitor activities and use

Day-use

Established day-use sites include the Layman and adjacent Malbup day-use sites, Membenup and Ludlow River. The lime kilns heritage site and Ludlow settlement are occasionally used by visitors as informal day-use areas, although there are no facilities at these sites. Day-use sites are shown at Map 3 and their management settings are listed in Table 6.

Malbup day-use site. Photo – Paul Roberts

Management of day-use sites will focus on improving the quality of established sites, in combination with a better standard of access and interpretation to direct visitors to sites that best meet their requirements.

There are no authorised camp sites in the planning area, although unauthorised camping does occur at the Ludlow River day-use site.

Table 6. Existing and proposed day-use sites

Day-use site	Activity	Comments or proposals
Layman	Picnicking	Picnic tables, toilets and rubbish bins are provided.
Malbup	Bushwalking, interpretation and wildlife viewing	This site is the access point for the Possum Paths and Malbup bird hide (see Table 7). Facilities include interpretation panels and a car parking area. The *Busselton Wetlands Trails Master Plan* (Shire of Busselton 2007) outlines a concept for a proposed bird hide (overlooking the Vasse Estuary) and access path leading off the existing Possum Paths.
Membenup	Nature appreciation, bushwalking, picnicking and interpretation	This site is a popular area to view tall tuart trees. The *Busselton Wetlands Trails Master Plan* (Shire of Busselton 2007) outlines a concept for a new walk trail leading to a proposed bird hide overlooking the Wonnerup Estuary.
Ludlow settlement	Picnicking, overnight stays and interpretation	There are no day-use facilities at the settlement but it is used as an informal picnic area. A new day-use area may be established but is dependent on future management of the settlement.
Ludlow River	Roadside rest area	Picnic tables and rubbish bins are provided at this site.
Higgins Road	Interpretation	This site has a car park, interpretive trail and information shelter.
Lime kilns (proposed)	Interpretation	Proposals include formalising a car park and walk paths and establishing interpretation about the heritage values of the site, once the kilns have been made structurally secure and consistent with the *Lime Kilns Heritage Assessment and Conservation Plan* (Ecoscape 1996).

Bushwalking

The three established walk trails in the planning area are the Possum Paths (2km in length), the Malbup bird hide access trail (a 400m gravel path and boardwalk off the Possum Paths trail) and the 800m Tuart Discovery Trail at Higgins Road. Several short informal walk trails exist at the lime kilns heritage site and Ludlow settlement, and bushwalking also occurs on vehicle tracks and firebreaks.

Two walk trails leading to new bird hides overlooking the Vasse-Wonnerup wetlands are proposed in the *Busselton Wetlands Trails Master Plan* (Shire of Busselton 2007). The department has indicated in-principle support for these trail concepts, as well as others proposed in the *Shire of Capel Trails Master Plan* (Shire of Capel 2009), but their development will be subject to assessment of social and environmental considerations and availability of resources for the design, construction and maintenance of the trails.

Although several walk trails are proposed, which trails are developed will depend on the availability of funding, outcomes of further trail planning and consultation with the local Noongar community and other interest groups. A summary of the existing and proposed trails within the planning area and their class is provided in Table 7 and shown at Map 3. Other bushwalks may be developed as demand increases after detailed planning and public consultation.

Birdwatching on the trail to the Malbup bird hide. Photo – Roger Paine

Table 7. Existing and proposed walk trails

Walk trail	Proposed class (1-6)[1]	Comments or proposals
Possum Paths	3	A 2km walk trail popular for spotlighting of western ringtail and brushtail possums.
Malbup bird hide	1	A 400m walk trail leading from the Possum Paths to the Malbup bird hide.
Malbup-Abba bird hide (proposed)	3	A 930m walk trail extending from the existing Possum Paths leading to a new bird hide on the Vasse Estuary. This trail concept is outlined in the *Busselton Wetlands Trails Master Plan*.
Membenup bird hide (proposed)	2	A 1.4km walk trail and new bird hide on the Wonnerup Estuary. This trail concept is outlined in the *Busselton Wetlands Trails Master Plan*.
Ludlow-Layman (proposed)	3	A proposed 6km walk trail leading from the Ludlow settlement to the Layman day-use site, connecting with the Membenup day-use site. Consideration will be given to a dual-use path, and linking with the existing Busselton path network.
Tuart Discovery Trail	3	From the Higgins Rd day-use site, a short (<800m) walk trail interpreting the effects of fire on tuart regeneration.
Lime kilns (proposed)	2	Development of a short walk trail around the lime kilns may be required to protect the structures.
Tuart Forest Heritage Trail (proposed)	3	Proposed heritage walk trail that will start from Ludlow settlement and finish at the historic Lime kilns site.
Ludlow Tramway and Stagecoach Heritage Walk trail (proposed)	3	A circuit walk trail will be established to include the tramway and stagecoach pass, which will start and end in the Ludlow settlement. Plaques will be placed at appropriate places along the walk trail.

1 Walk trails are classified according to Australian Standard 2156.1 Walking Tracks – Classification and Signage. Variables taken into consideration include trail condition, gradient, signage, infrastructure and terrain. Classification ranges from 1 (least degree of difficulty) to 6 (most difficult).

Horseriding

Horseriding is a popular activity in the planning area, particularly in the northern parts, including Minninup Block. Commercial horse training has also occurred for several years, with trainers known to exercise racehorses within the planning area. There are no formal bridle trails and unrestricted access has led to recreational horseriders and commercial horse trainers using informal tracks, particularly next to rural residential properties in the Minninup area. These include tracks created for management, as well as tracks created without authorisation.

Recently, horseriding has become a more contentious management issue as natural areas may be unable to sustain the pressures that result from the activity. There is particular management concern that horseriding may affect environmentally sensitive areas and the rehabilitation of tuart ecosystems through the creation of unauthorised tracks.

Given its previous history and demand as a recreational activity, recreational riding will be permitted in the planning area on selected tracks and on undeveloped public road reserves. Tracks designated for horseriding will be selected in consultation with horseriders, with proposed tracks identified by the department shown on Map 3. Signs will be provided to guide horseriders, and the department will consider developing a voluntary recreational horseriding permit system to monitor the level of use. If demand for recreational riding increases during the life of the plan, the department will liaise with relevant local governments and stakeholders to investigate the feasibility of providing formal facilities such as horse trailer parking (to discourage unauthorised access points such as cutting fences, and *ad hoc* tracks) and tethering yards. Any tracks that are designated for horseriding will remain available to other park users.

To minimise the potential for conflict with other visitors, horseriding will not be permitted south of the Ludlow settlement, as other recreational activities are concentrated in this area. Horseriding will also not be permitted in environmentally sensitive areas such as wetlands and rehabilitated areas. The department will continue to monitor horseriding activity and, if the activity is shown to have an unacceptable impact on natural, cultural, or other recreational values, access will be modified or the activity excluded from the planning area.

The training and exercising of racehorses is not considered recreational, but a commercial activity undertaken for private financial benefit, which provides limited or no benefit to the park or park users. As such, use of the planning area by commercial horse trainers will be phased out over five years from when this management plan is gazetted. In the meantime, commercial horse trainers will be required to apply for a commercial operations licence to allow the department to regulate the activity and minimise environmental impacts and conflicts with other visitors (see also Section 19 – *Tourism and commercial operations*).

Until the activity is phased out, the training and exercising of commercial racehorses will be permitted on the same tracks available to recreational horseriders.

Dogs

There are no designated areas for visitors with dogs (or dog exercise areas) in the planning area because of the limited availability of space at recreation sites, potential for conflict with other visitors, and impacts from dogs on breeding populations of threatened fauna species and migratory birds. Additionally, fox baiting programs occur throughout the planning area and these baits are fatal to dogs.

If Ludlow settlement is developed for accommodation, it may be possible to allow domestic dogs within the boundary of the settlement. This needs further consideration as it is important that the ability to undertake fox control with 1080 baits in the planning area is not affected.

Public dog exercise areas managed by the City of Busselton and the Shire of Capel exist close to Forrest Beach, Peppermint Grove Beach and at Busselton.

Desired outcome

Provide a range of opportunities for visitor activities that facilitate enjoyment, appreciation and understanding of the key values of the planning area.

Management actions

1. Provide and maintain a range of recreation opportunities as shown at Map 3, consistent with the adequate protection of key values, recreational development criteria, site capability, safety standards and the rights and enjoyment of other visitors.
2. Monitor the impacts of, and demand for, recreational activities and manage activities in liaison with users where impacts become significant or unacceptable.
3. Allow recreational horseriding and horse training on designated tracks to the north of the Ludlow settlement and on undeveloped public roads (subject to action 9 below), and consider the development and implementation of a recreational horseriding permit system.
4. Install signage for horseriders that outlines the location of tracks and access points, safety guidelines and guidelines for minimising the impacts of horseriding on natural values.
5. Continue to restrict camping in the planning area (with the possible exception of Ludlow settlement).
6. Prohibit dogs within the planning area, except registered guide dogs and dogs required for emergency search and rescue purposes.
7. Provide information to visitors about recreational opportunities.
8. Liaise with the Shire of Capel, the City of Busselton and other relevant stakeholders to develop recreational facilities within and next to the planning area.
9. Phase out the training and exercising of commercial racehorses within five years from when this management plan is gazetted.
10. Where appropriate, designate horse areas under the Conservation and Land Management Regulations 2002 (CALM Regulations) during the life of the plan, subject to management action 1 above.

Key performance indicator

Performance measure	Target	Reporting requirement
Horseriding is provided for on designated tracks.	Identify suitable tracks to designate for use by recreational horseriders in consultation with the community.	Every five years.

Visitor interpretation and education

Information on facilities, attractions, activities, access and regulations is available through signage, printed materials (for example, books and brochures), the department's website and staff. Information is also available from external sources, including conservation groups, volunteers, tour operators and the tourism industry.

The key values of the planning area have been used to develop two primary themes for interpretation within Tuart Forest National Park, which are outlined in Table 8.

Table 8. Primary interpretive themes

Primary theme	Interpretive stories	Major sites for interpretation
Woodlands and Wetlands – a rich mosaic of wetland and upland ecosystems	Tuart the species – *E. gomphocephala* • tuart on the Swan Coastal Plain • unique eucalypt biology • Tuart Forest National Park – the tallest tuarts and the largest tuart woodlands • problems with tuart (woodland structure and regeneration, tuart decline)	Membenup, Higgins Road, Malbup, Ludlow settlement, proposed Ludlow –Layman walk trail
	Wildlife of the tuart woodlands • western ringtail possum, Carnaby's and Baudin's cockatoos, wambenger, kangaroos, bats, reptiles, invertebrates	Malbup, proposed Ludlow –Layman walk trail
	River and wetland ecosystems • Vasse-Wonnerup wetlands – Ramsar and waterbirds • the Abba and Ludlow rivers • the eastern wetlands	Malbup (bird hides, proposed Malbup-Abba trail), Ludlow settlement (Ludlow River)
The Tuart Forest and People – people affect the forest, the forest affects people	Noongar people and the tuart forest • significant sites for Wardandi people • stories about the tuart forest area, people, plants and animals	Proposed walk trails (Membenup, Ludlow-Layman, Malbup-Abba)
	Explorers and settlers • exploration and encounters with Noongar people • colonial settlement	Lime kilns, Layman
	Resource use • livestock grazing • lime production • forestry in the tuart forest – the early days of forestry management in WA • plantation timber • mineral sands mining	Lime kilns, Ludlow settlement, Layman, Ludlow River (plantations)
	The tuart forest now and in the future • conservation – State forest No. 1 and 2, protests against the mine, the values of the tuart forest today • research – woodland rehabilitation, fire management, tuart decline • rehabilitation – (tuart re-establishment, understorey diversity, woodland structure), including the success or otherwise of minesite rehabilitation	

These primary themes will be used to guide the type of interpretation likely to be provided at each recreation site in the planning area.

Use of the planning area for educational activities is currently low, with the Possum Paths and Malbup bird hide the most popular sites visited by school groups. Development of new recreation sites and walk trails, with improvements to existing sites, will increase opportunities for providing education programs. The possible development of the Ludlow settlement for overnight accommodation could provide more opportunities for educational programs.

Desired outcome

Provide visitors with a range of natural and cultural interpretive experiences, while ensuring adverse impacts on key values are minimised.

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 (i) key values and management issues, such as appropriate visitor activities, behaviour, access and visitor safety (ii) the tall tuart woodlands, and (iii) the Noongar cultural values and other Australian history of the planning area.

2. Work with Noongar and other stakeholders as appropriate in the development of visitor information and education opportunities.

Key performance indicator

Performance measure	Target	Reporting requirement
Provision of interpretive sites.	A range of interpretive sites consistent with the themes outlined in Table 8 are provided.	Every five years.

19. Tourism and commercial operations

At present, there are no leases within the planning area for recreation or tourism purposes.

The Ludlow settlement includes several former forestry cottages that are let by the department to private tenants, however the maintenance of buildings and provision of services is placing a significant impost on the department's resources. Because of insufficient income being generated under the current management arrangement, the condition of the buildings and other facilities is deteriorating and significant restoration and ongoing maintenance work is required to maintain the heritage values of the site. From a financial perspective, the department does not consider the current arrangement a viable option. The future management of Ludlow settlement is unclear and a change in management may occur during the life of this management plan. It is likely a new reserve will be created over the settlement, with the reserve vesting and purpose dependent on future management arrangements.

At the time of writing, 58 'T class' commercial tour operations possess licences to conduct activities in Tuart Forest National Park, although the number of operators that actually run tours or activities in the area may be much less. Although use of the planning area by commercial tour operators is low, opportunities may increase during the life of this plan, particularly if the Ludlow settlement is developed for short-stay accommodation.

Horseriding is permitted as a recreational activity in parts of the planning area (see Map 3), however the use of the planning area by horse trainers is considered a commercial activity under the CALM Regulations. The department will phase out the training and exercising of commercial racehorses within five years from when this management plan is gazetted. Until this time, commercial horse trainers will be required to obtain a Commercial Operations Licence, pursuant to Part 7 of the CALM Regulations, to train horses in the planning area. Licence applications will be assessed in accordance with department Policy 18 – *Recreation, tourism and visitor services* (see www.dpaw.wa.gov.au).

Desired outcome

Allow for a range of services and experiences in the planning area through the involvement of private enterprise, consistent with the objectives of this management plan.

Management actions

1. Ensure commercial horse trainers apply for a Commercial Operations Licence to undertake commercial horse training in the planning area.
2. Ensure all commercial operations operate under a lease, licence or permit agreement with appropriate conditions, in accordance with departmental policies and the department's *Commercial operator handbook – terrestrial*.
3. Monitor commercial operator compliance with licence conditions and the level and impact of operator use to ensure commercial operations are sustainable.

Managing resource use

20. Mineral and petroleum exploration and development

For three years until 2009, Bemax Cable Sands Pty Ltd mined titanium minerals from mining lease M70/86 within Ludlow State Forest (Minister for Environment 2003) (Map 4). Mining of the deposit disturbed 110ha of the 216ha lease (CALM 2006). Rehabilitation of 106ha of unmined land is being undertaken by the department over a 10 year period, and monitoring and maintenance of rehabilitation on the mined area is likely to be ongoing during the life of this plan. Public access to the lease area is restricted to prevent disturbance to rehabilitated areas. This will continue until rehabilitation has reached a stage where it is considered robust enough to withstand visitor pressures.

In total, there are five tenements issued under the *Mining Act 1978* across the planning area (Map 4), although the number and the status of tenements will change over time (see the Department of Mines and Petroleum's [DMP] *Tengraph* online database and the Data and Software Centre at www.dmp.wa.gov.au). Bemax Cable Sands has a pending tenement (E70/3525) over part of Minninup Block and North Block, however a condition for approval to mine the M70/86 lease was for the company to never pursue further mining within Tuart Forest National Park (Minister for Environment 2003). There are also pending tenements held by Balde Exploration Consultants (E70/1512) and Iluka Midwest (M70/739) in the area. Iluka Midwest has a small live tenement (L70/22) over the rail reserve that crosses the southern part of the national park.

Extraction of basic raw materials

This section is focused on activities associated with extraction of basic raw materials (BRM) that is not covered and approved under the *Mining Act 1978*. While the extraction of BRM such as gravel, shale, clay, sand, limestone and rock generally continues to be in-demand by local governments and Main Roads WA for the maintenance of roads (and is also used by the department for recreation and management activities), extraction of BRM does not occur in the planning area and there is no foreseeable need to extract BRM in the future. In the unlikely event that there is demand for access to BRM, alternative sources outside the planning area will be encouraged. Extraction within the planning area may be permitted, but only in accordance with relevant strategies, policies and guidelines. The determination of raw material needs from within the planning area should be assessed within the framework of relevant government strategies such as the State Gravel Supply Strategy (see www.mainroads.wa.gov.au). The extraction of BRM can result in the loss of vegetation and the introduction and spread of disease and weeds, as well as having visual impacts. There is a presumption against accessing BRM on conservation reserves, and any application will be assessed on a case-by-case basis.

Desired outcome

Minimise impacts from mineral and petroleum exploration and development on key values.

Management actions

1. Provide advice, and where appropriate assistance, to industry and government agencies in relation to the effects of mining and petroleum exploration and development on native ecosystems, the means by which those effects may be reduced (including through retention of ecological linkages between unmined areas throughout mine envelopes, to link with adjacent native vegetation areas outside mine envelopes) and the appropriate rehabilitation of native vegetation as those operations are completed.
2. Encourage an active adaptive management approach to the management of mine site rehabilitation.

3. In conjunction with DMP, evaluate the likely impact of proposed mineral, petroleum or geothermal exploration and development activities, and monitor existing activity.
4. Complete an audit of the Bemax Cable Sands statement number 639 schedule 2 *Proponents Environmental Management Commitments.*
5. In accordance with department and Conservation Commission policies, permit access to BRM from the planning area where:
    - the use of the material helps in the protection and management of the area
    - a more environmentally acceptable alternative is not available
    - the material is used within the boundaries or enclaves of the planning area
    - extraction is consistent with this management plan and purpose and tenure of the area.

21. Other resource use

Water resources

The main State legislation that governs water resource management is the *Rights in Water and Irrigation Act 1914* (RIWI Act), which is administered by DoW. A licence issued by DoW is the key regulatory instrument governing the extraction of surface water and groundwater. Each licence defines an annual right to take water (an individual annual entitlement or allocation) and sets conditions that apply to the allocation. This Act also requires that water be set aside to sustain the environment.

DoW prepares water allocation plans to decide what 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 and 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 (see www.water.wa.gov.au).

The department's primary role 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 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 the department is required to consult the Conservation Commission in relation to land vested in the Commission.

There are two groundwater bores in the planning area. One is licensed to the department and provides drinking water to Ludlow settlement, and the other is allocated to Bemax Cable Sands to help with its rehabilitation obligations (Bemax Cable Sands 2008). However, Bemax Cable Sands no longer require the bore, and it will subsequently be transferred to the department. There are also unlicensed bores within the planning area that will be closed to prevent leakage and unlicensed abstraction.

In addition to bores within the planning area, there are many bores in close proximity to, but outside the planning area that are licensed with DoW. Unsustainable groundwater use has the potential to impact on the values of the planning area by lowering the watertable, which could impact on wetlands and plant communities. The department will continue to liaise with DoW to ensure environmental impacts from groundwater abstraction are avoided.

Forest produce and forest products

Tuart Forest National Park contains some exotic plantation species, which will be removed during the life of this management plan and cleared areas will be rehabilitated with tuart and other local native species.

Parts of Ludlow State Forest also contain exotic tree species, primarily pine, which are managed by the FPC for the commercial harvest of timber. It is the department's intention for all of Ludlow State Forest to be incorporated into Tuart Forest National Park (see Section 5 – *Land tenure and boundaries*), although the exotic timber within Ludlow State Forest will be progressively harvested and rehabilitated with tuart.

Forest produce may be generated in accordance with licences issued under section 99A(1) of the CALM Act for (i) use for therapeutic, scientific or horticultural purposes, (ii) essential works, and (iii) the taking or removal of exotic trees (for example, *Pinus*), honey, beeswax or pollen (by apiary site permit). The extraction and sale of craftwood from national parks and nature reserves is not permitted. Under section 33(1)(cb) of the CALM Act, forest produce obtained through the carrying out of necessary operations (on nature reserves) or compatible operations (on national parks or conservation parks) can be used for the purpose of 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.

Removal of firewood has detrimental impacts including reduced habitat integrity and the spread of disease, such as *Phytophthora,* through illegal access. Furthermore, there is a shortage of dead wood in the planning area that can be used for rehabilitation purposes (for example, for the creation of ashbeds) and this is likely to be the case for the duration of this plan. As such, firewood collection will not be permitted in the planning area. For further information about access to public firewood, see www.dpaw.wa.gov.au.

Beekeeping

There are six apiary sites within the planning area. As part of developing the management plan, the sites have been assessed in accordance with the department's revised draft Policy 41 – *Beekeeping on public land* (see www.dpaw.wa.gov.au). None of the apiary sites are rated as 'suitable', three sites are classified as 'highly constrained' and the other three sites are 'suitable but conditional', with conditions that include seasonal restrictions. Appendix 3 shows the conditions already placed on each permit. These conditions may render the existing sites unviable for use by commercial beekeepers and there are few suitable locations within the planning area to relocate sites. Therefore, continued use of the planning area for commercial beekeeping may be unviable. To address this, the department will negotiate with beekeepers to identify replacement sites outside the planning area.

Needle-leaved chorizema (*Chorizema aciculare*) is a common species found throughout the South West, which is visited by honeybees.

Public utilities and services

This management plan provides for the continuation of existing utility and service arrangements. Utilities that traverse the planning area are shown at Map 4.

Two railway reserves cross the southern portion of the planning area to the east of Tuart Drive and are managed by the Public Transport Authority. Cross-boundary management issues such as weed establishment and four-wheel-drive vehicle and trail bike activity are impacting on parts of the planning area.

An underground gas pipeline is within one of the unvested railway reserves. The department will liaise with the Public Transport Authority and Alinta Energy to ensure these easements are managed to minimise impacts on the planning area.

A high-voltage powerline traverses the eastern boundary of the planning area crossing both occurrences of the eastern wetlands. Uncontrolled access along the powerline corridors is degrading the wetlands and there is potential for powerline maintenance to also cause adverse impacts. Powerlines are also situated to the south of Layman Road, near Lot 100, near the Ludlow settlement and to the south of Stirling Road.

The department will continue to assess and monitor any future developments or proposals that may impact on the values of the planning area. Where proposals are likely to have a significant adverse impact, they will be referred to the EPA for formal environmental impact assessment under the EP Act and may also require approval under the EPBC Act.

Desired outcome

Impacts on the values of the planning area from resource use are minimal and any disturbance from resource use is appropriately rehabilitated and/or restored.

Management actions

1. Regulate the supply of other forest produce through the administration of relevant licensing legislation.
2. Refer any proposals for resource use to the EPA for formal assessment where such proposals are likely to adversely affect the key values of the planning area.
3. Liaise with DoW to ensure groundwater abstraction does not impact on the natural values of the planning area.
4. In accordance with the CALM Act, use forest produce that becomes available from essential works for the purposes of making improvements to conservation reserves.
5. Designate apiary access routes, supervise apiary field activities (including application of dieback hygiene principles), install signage at apiary sites and review apiary site management.
6. In accordance with the apiary analysis (see Appendix 3), renew apiary permits and consider the cancellation or relocation of sites, possibly outside the planning area, consistent with assessment criteria. No new apiary sites will be permitted in conservation reserves that have no historical use.
7. Liaise with beekeepers, the Beekeeping Industry Consultative Committee and DAFWA to ensure the most efficient and sustainable use of sites.
8. Permit new utilities and services only where they are consistent with the CALM Act and government policy, where there are no viable alternatives, and where they minimise adverse impacts on the planning area's key values.
9. Liaise and consider the development of a cooperative management arrangement with the Public Transport Authority, Alinta Energy and Western Power for management of the unvested railway reserves and associated utilities to minimise impacts on adjacent parts of the planning area.
10. Continue to prohibit the collection of firewood within the planning area.

Research and monitoring

Research and monitoring are important components of management and are necessary for the successful implementation of this management plan. The plan allows for the adaptation of management in light of new knowledge arising from research and monitoring through the continual review of management activities to ensure best practice management.

Broad direction for research and monitoring in the planning area is provided by the department's *A Strategic Plan for Biodiversity Conservation Research 2008-2017* (DEC 2008c), as well as species recovery plans, the nature conservation plan for the South West Region and research priorities set by the Centre of Excellence for Climate Change, Woodland and Forest Health (see www.foresthealth.com.au), based at Murdoch University (which replaced the Tuart Response Group).

Desired outcome

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

Management actions

1. Develop and implement an integrated program of survey, research and monitoring aimed at collecting evidence to allow reporting on KPIs and facilitating management of the planning area, with a focus on key values and issues identified in this management plan, the establishment of baseline information and other department research priorities.
2. Incorporate research and monitoring findings into interpretive and educational material where appropriate.
3. Encourage and support volunteers, educational institutions and other organisations where their research contributes directly to department management actions or the implementation and assessment of this management plan.
4. Monitor for signs of tree decline, particularly tuart, flooded gum and peppermint.
5. Adapt management according to research outcomes, including the assessment of ecosystem rehabilitation and experimental trials.
6. Collate and review previous research findings from experimental trials involving fire and tuart regeneration, both from within the planning area and in other tuart ecosystems. Incorporate any findings when planning for fire in the future.

References[8]

Aplin, K. and Kirkpatrick, P. (2001) In the pursuit of the frog fungus. *Landscope*, 16(3): 10-16.

Archibald, R., Bowen, B., Hardy, G., McCaw, L. and Close, D. (2006) *Tuart Bulletin No.6 The role of fire in tuart decline at Yalgorup*. Tuart Decline Research Findings.

Bemax Incorporating Cable Sands (2008) *Ludlow titanium minerals mine M70/86 decommissioning and closure plan*. Bemax Incorporating Cable Sands (unpublished), Bunbury. Available from www.bemax.com.au/HappyValley.asp, accessed September 2013.

Berndt, R.M. and Berndt, C.H. (1979) *Aborigines of the west: their past and their present*. University of Western Australia Press, Nedlands.

Biota Environmental Sciences (2003) *Ludlow stygofauna survey*. Cable Sands (WA) Pty Ltd (unpublished), Bunbury.

Burbidge, A.A. and de Tores, P. (1998) *Western Ringtail Possum (Pseudocheirus occidentalis) Interim Recovery Plan 1997 –1999*. Interim Recovery Plan No. 17. Department of Conservation and Land Management, Wanneroo. Available from www.dpaw.wa.gov.au, accessed October 2013.

BoM (2010) *Summary statistics – Busselton*. Retrieved February 15, 2010, from Climate Statistics for Australian Locations, Bureau of Meteorology. Available from www.bom.gov.au/climate/averages/tables/cw_009569.shtml.

Burrows, N. and Wardell-Johnson, G. (2003) Fire and plant interactions in forested ecosystems of south-western Western Australia. In I. Abbott, and N. Burrows, *Fire in Ecosystems of the South-west of Western Australia: impacts and management* (pp. 225 – 268). Backhuys Publishers, Leiden.

Cable Sands (2002) *Ludlow titanium minerals/mine: environment review and management program*. Cable Sands (WA) Pty Ltd. Unpublished, Bunbury.

CALM (1999) *Environmental weed strategy for Western Australia.* Department of Conservation and Land Management, Perth. Available from www.dpaw.wa.gov.au, accessed August 2013.

CALM (2006) *Ludlow tuart forest rehabilitation plan for Bemax Resources (Cable Sand Ltd) mining lease 70/86 - draft version 4*. Unpublished, Busselton.

Chapman, A. and Dell, J. (1985) Biology and zoogeography of the amphibians and reptiles of the Western Australian Wheatbelt. *Records of the Western Australian Museum*, 12(1): 1-46.

Commonwealth of Australia (1996) *The National Strategy for the Conservation of Australia's Biological Diversity*. Commonwealth Department of the Environment, Sport and Territories. Available from www.environment.gov.au, accessed August 2013.

Commonwealth of Australia (2010a) *Australia's Biodiversity Conservation Strategy 2010-2030*. Natural Resource Management Ministerial Council, Department of Sustainability, Environment, Water, Population and Communities, Canberra. Available from www.environment.gov.au, accessed August 2013.

Commonwealth of Australia (2010b) *Australia's Strategy for the National Reserve System 2009-2030*.

8 References that do not have a referenced website address are publicly available, or can be requested, through the department's Conservation Library in the Keiran McNamara Conservation Science Centre at Kensington. For more information on how to search the department's catalogue, the location of the library and how to make loan requests see www.dpaw.wa.gov.au.

Environment Australia, Canberra. Available from www.environment.gov.au, accessed August 2013.

CSIRO, BoM (2007) *Climate Change in Australia: Technical Report 2007*. Commonwealth Scientific and Industrial Research Organisation and Bureau of Meteorology. 148 pp. Available from www.csiro.au, accessed August 2013.

Conservation Commission (2013) *Forest Management Plan 2014-2023*. Conservation Commission of Western Australia. Available from www.conservation.wa.gov.au, accessed December 2013.

DEC (2008a) *Forest Black Cockatoo (Baudin's Cockatoo, Calyptorhynchus baudinii and Forest Red-tailed Black Cockatoo Calyptorhynchus banksia naso* recovery plan. Department of Environment and Conservation, Perth. Available from www.dpaw.wa.gov.au, accessed October 2013.

DEC (2008b) *Code of Practice for Fire Management*. Department of Environment and Conservation, Western Australia. Available from www.dpaw.wa.gov.au, accessed September 2013.

DEC (2008c) *A Strategic Plan for Biodiversity Conservation Research 2008 – 2017.* Department of Environment and Conservation. Available from www.dpaw.wa.gov.au, accessed August 2013.

DEC (2009a) *Monitoring conservation values of a Ramsar wetland: Vasse-Wonnerup wetlands system, Busselton*. Information Sheet 2, Science Division. Department of Environment and Conservation. Available from www.dpaw.wa.gov.au, accessed October 2013.

DEC (2009b) *Management of the Ramsar-listed Vasse-Wonnerup wetlands*. Information Sheet 28, Science Division. Department of Environment and Conservation. Available from www.dpaw.wa.gov.au, accessed September 2013.

DEC (2009c) *Resource Condition Report for Significant Western Australian Wetland: Vasse Estuary.* Department of Environment and Conservation. Perth, Western Australia.

DEC (2012) *Adapting to our changing climate*. Department of Environment and Conservation. Available from www.dpaw.wa.gov.au, accessed August 2013.

DEH and AWMCRC (2003) *Bridal creeper (Asparagus asparagoides) weed management guide.* Department of the Environment and Heritage and the Cooperative Research Centre for Australian Weed Management. Available from www.environment.gov.au, accessed August 2013.

Dell, J., How, R.A. and Burbidge, A.H. (2002) Vertebrate fauna of tuart woodlands. In B.J. Keighery and V.M. Longman, *Tuart (Eucalyptus gomphocephala) and Tuart Communities* (pp. 254-276). Wildflower Society of Western Australia (Inc.), Perth.

Department of Parks and Wildlife (2013) *Carnaby's cockatoo (*Calyptorhynchus latirostris*) recovery plan*. Department of Parks and Wildlife, Perth, Western Australia. Available from www. environment.gov.au, accessed March 2014.

Department of Parks and Wildlife (2014) *Western ringtail possum (Pseudocheirus occidentalis) recovery plan. Wildlife Management Program No.58*. Department of Parks and Wildlife, Perth, WA. Available from www.dpaw.wa.gov.au.

DoW (2008) *South west groundwater areas water management plan – allocation. Draft for public comment*. Department of Water, Perth.

DoW (2009) *South West groundwater areas allocation plan*. Water resource allocation and planning series. Report No. 21. Department of Water, Perth. Available from www.water.wa.gov.au.

DoW (2010) Vasse Wonnerup Wetlands and Geographe Bay water quality improvement plan. Department of Water, Perth. Available from www.water.wa.gov.au, accessed October 2013.

Ecoscape (1996) *Heritage assessment and conservation plan for lime kilns. Tuart Forest National Park.* Ecoscape Australia Pty Ltd and Hammond and Green Pty Ltd, Perth.

EPA (1993a) *Red Book Status Report on the Implementation of Conservation Reserves for Western Australia (1976-1984).* Report 15. Environmental Protection Authority, WA.

EPA (1993b) *A Guide to Wetland Management in the Perth and Near Perth Swan Coastal Plain Area. Bulletin 686,* Environmental Protection Authority, Perth. Available from www.epa.wa.gov.au, accessed October 2013.

EPA (2003) *Ludlow titanium minerals mine, 34km south of Bunbury - report and recommendations of the Environmental Protection Authority. Bulletin 1098.* Environmental Protection Authority, Perth. Available from www.epa.wa.gov.au, accessed August 2013.

FIFWA (2006) *Code of Practice for Timber Plantations in Western Australia*. Forest Industries Federation (WA) Inc., Bentley. 59p. Available from www.forestindustries.com.au, accessed September 2013.

Forests Department of WA (1979) *Ludlow tuart forest working plan 1979 – 1985.* Forests Department of Western Australia, Perth.

Froend, R.H., Pettit, N. and Franke, B. (2000) *Vegetation Monitoring and Mapping of the Vasse estuary*. Unpublished technical report for the Geographe Catchment Council, Ministry for Planning and Department of Conservation and Land Management, Busselton.

Government of WA (2003) *An atlas of tuart woodlands on the Swan Coastal Plain in Western Australia*. Department of Conservation and Land Management, Tuart Response Group, Ecoscape. Department of Conservation and Land Management, Perth. Available from www.dpaw.wa.gov.au, accessed February 2014.

Government of WA (2004a) *Tuart conservation and management strategy, December 2004*. Prepared by the Tuart Response Group on behalf of the Government of Western Australia. Department of Conservation and Land Management, Kensington, W.A. 75p.

Government of WA (2004b) *Tools for identifying indicative high conservation tuart woodlands*. Prepared by Ecoscape (Australia) Pty Ltd for the Department of Conservation and Land Management. Department of Conservation and Land Management, North Fremantle. 29p.

Hall, J. (2009) *Nutrient modelling in the Vasse Geographe catchment*. Water Science Technical Series No. 2. Department of Water, Western Australia. Available from www.water.wa.gov.au, accessed October 2013.

How, R.A. and Dell, J. (1993) *Vertebrate Fauna of the Perth Metropolitan Region: Consequences of a Modified Environment*. In: Hipkins, M. (Ed) Urban Bush Management (pp28 - 47), Australian Institute of Urban Studies, Perth, WA.

Jones, B.A. (2004) *The possum fauna of Western Australia: decline, persistence and status.* In: Goldingay, R.L. and Jackson, S.M. (Eds) The Biology of Australian Possums and Gliders. Surrey Beatty & Sons, Chipping Norton, p 149-160.

Kay, I. (1985) The tenuous tuart. *Landscope*, 1(3): 10-14.

Keighery, G.J. and Keighery, B.J. (2002) Floristics of the Tuart Forest reserve. In B.J. Keighery, and V.M. Longman, *Tuart (Eucalyptus gomphocephala) and tuart communities* (pp.180-252). Wildflower Society of

Western Australia (Inc.), Perth.

Kile, G.A. (1981) *Armillaria luteobubalina*: a primary cause of decline and death of trees in mixed species eucalypt forests in central Victoria. *Australian Forest Research*, 11: 63–77.

May, J.E. and McKenzie, N.L. (2003) *A biodiversity audit of Western Australia's biogeographical subregions in 2002*. Department of Conservation and Land Management, Kensington, WA. 724p.

McArthur, W.M. (1991) *Reference soils of south-western Australia*. Department of Agriculture, Perth.

Minister for Environment (2003) *Statement No. 639: Statement that a proposal may be implemented (Pursuant to the provisions of the Environmental Protection Act 1986) – Ludlow titanium minerals mine, 34km south of Bunbury, Shire of Capel*. Government of Western Australia, Perth. Available from www.epa.wa.gov.au, accessed August 2013.

Morgan, D.L., Gill, H.S. and Potter, I.C. (1998) Distribution, identification and biology of freshwater fishes in south-western Australia. *Records of the Western Australian Museum*, Supplement No. 56.

MRWA (2013) *Roads 2030: Regional Strategies for Significant Local Government Roads – South West Region*. Main Roads Western Australia and Western Australia Local Government Association. Available from walga.asn.au, accessed February 2014.

Napier, G.J. (1982) *A biological survey of the Ludlow tuart forest*. Forests Department of Western Australia (unpublished), Busselton.

Powell, R. and Keighery, B. (2003) Cherish the tuart. *Landscope*, 18(3): 16-22.

Robinson, R. (2004) *Armillaria root disease: fact sheet, management of Armillaria root disease.* Department of Conservation and Land Management, Kensington. 2p.

Robinson, R. and Rayner, M. (1998) *Armillaria luteobubalina in regrowth karri stands: a report on the state of knowledge of Armillaria root disease in karri regrowth forests in the southwest of Western Australia and recommendations for future research.* Department of Conservation and Land Management, Perth.

Ruthrof, K.X., Yates, C.J. and Loneragan, W.A. (2002) The biology of tuart. In B.J. Keighery, and V.M. Longman, *Tuart (Eucalyptus gomphocephala) and tuart communities* (pp. 254-276). Wildflower Society of Western Australia (Inc.), Perth.

Sclater, J.B. (2001) *Lost your block? The origins of WA's forest block names.* Safety Bay, Western Australia.

Scott, P.M., Jung, T., Shearer, B.L., Barber, P.A., Calver, M. and Hardy, G.E.St.J. (2012) Pathogenicity of *Phytophthora multivora* to *Eucalyptus gomphocephala* and *Eucalyptus marginata. Forest Pathology,* 42: 289-298.

Shearer, B.L. and Dillon, M. (1996) Impact and disease centre characteristics of *Phytophthora cinnamomi* infestations of Banksia woodlands on the Swan Coastal Plain, Western Australia. *Aust. J. Bot.,* 44: 79–90.

Shire of Busselton (2007) *Busselton wetlands trails master plan.* Draft Report. Transplan Pty Ltd and Mike Haliburton Associates, Perth. Available from www.busselton.wa.gov.au, accessed August 2013.

Shire of Capel (2009) *Shire of Capel Trails Master Plan*. Shire of Capel. Available from www.capel.wa.gov.au, accessed August 2013.

Storrie, A. and Thomson-Dans, C. (2011) Tuart Forest National Park. *Landscope*, 27(1): 40-47.

Tilbrook, L. (1983) *Nyungar tradition: glimpses of Aborigines of south-western Australia, 1829-1914.* University of Western Australia Press, Perth.

Tille, P.J. and Lantzke, N.C. (1990) *Busselton, Margaret River, Augusta: land capability study.* Department of Agriculture, Perth.

Tindale, N.B. (1974) *Tribal Boundaries in Aboriginal Australia*. Department of National Development, Canberra.

TRG (2002) *Status report: tuart conservation and protection*. Tuart Response Group, Government of Western Australia, Perth.

TRG (2004) *Draft tuart conservation and management strategy*. Tuart Response Group, Government of Western Australia, Perth.

Tyler, M.J., Smith, L.A. and Johnstone, R.E. (2000) *Frogs of Western Australia*. Western Australian Museum, Perth.

WAPC (2003) *Acid sulfate soils planning bulletin No. 64*. Western Australian Planning Commission, Perth. Available from www.planning.wa.gov.au, accessed August 2013.

WAPC (2005) *Busselton wetlands conservation strategy*. Western Australian Planning Commission, Perth. Available from www.planning.wa.gov.au, accessed August 2013.

Weaving, S. (1998) *Geographe Bay catchment natural resource atlas.* Geographe Catchment Council, Busselton.

Williams, K., Horan, A., Wood, S. and Webb, A. (2001) *Declared rare and poorly known flora in the Central Forest Region.* Western Australian Wildlife Management Program No. 33. Department of Conservation and Land Management, Western Australia. Available from www.dpaw.wa.gov.au, accessed August 2013.

WRM (2007) *Ecological character description Vasse-Wonnerup wetlands, Ramsar site, south-west Western Australia*. Perth: Unpublished report to the Department of Environment and Conservation and Geographe Catchment Council Inc. by Wetland Research and Management. Available from www.water.wa.gov.au, accessed August 2013.

Personal communications

Department of Parks and Wildlife

Val English, Principal Ecologist, Kensington

Bronwen Keighery, Senior Environmental Officer, Kensington

John Carter, Nature Conservation Program Leader, Blackwood District, Busselton

Richard Robinson, Senior Research Scientist, Manjimup

Murdoch University

Paul Barber, Project Coordinator, Tuart Health Research Group

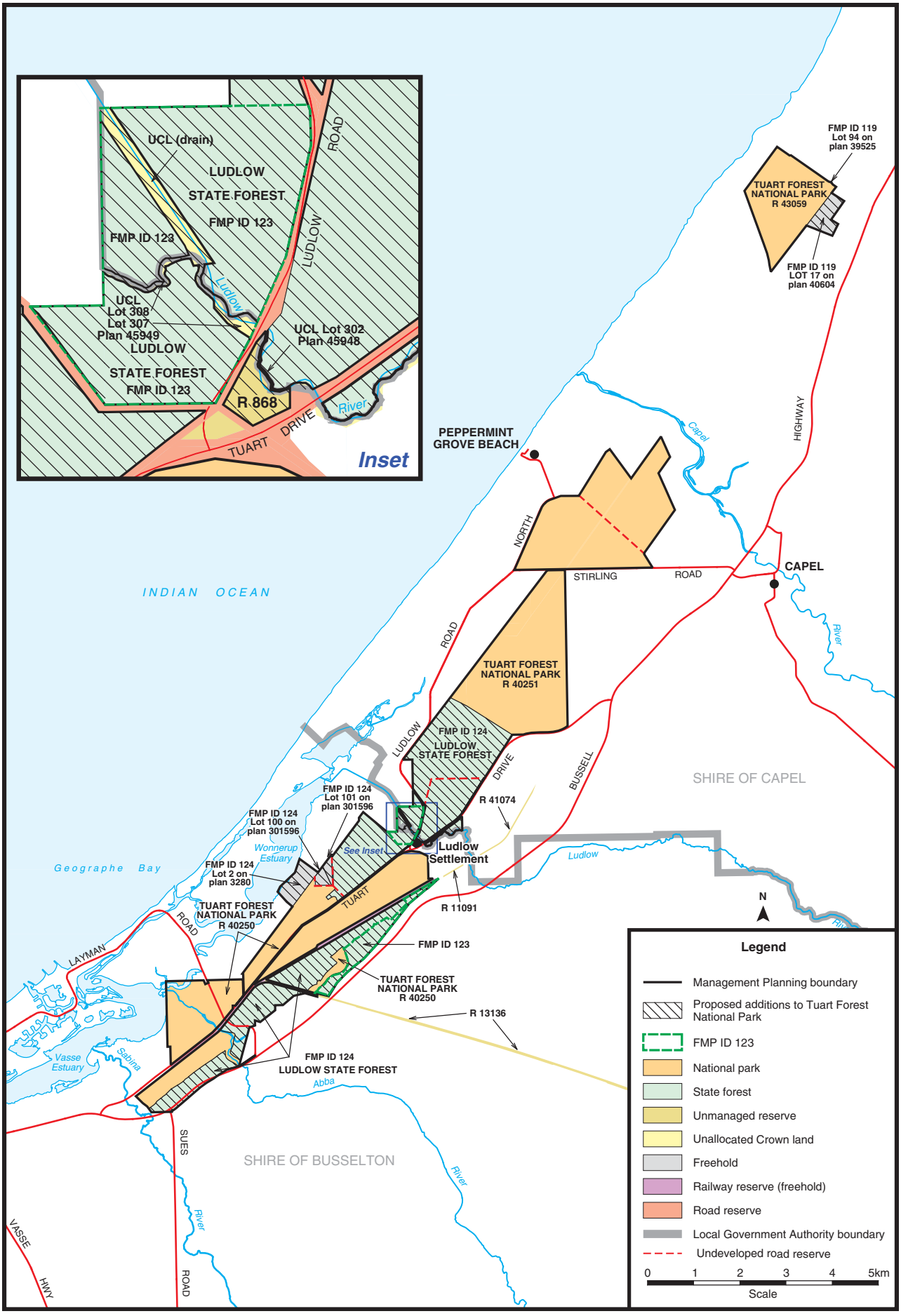
Others

Bernie Masters, Chairman, Tuart Forest National Park Community Advisory Committee

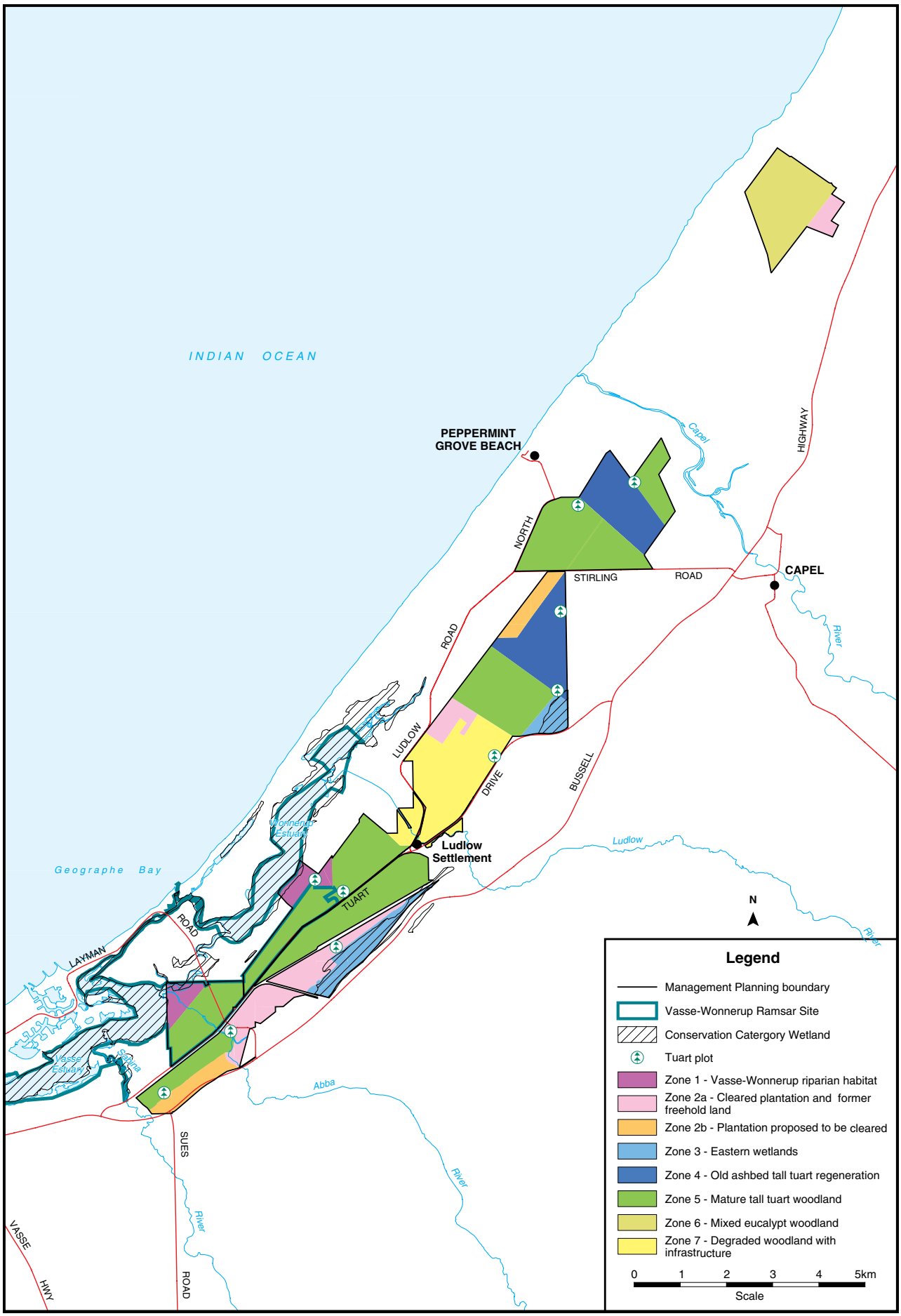
Des Donnelly, Tuart Forest National Park Community Advisory Committee

Jack Bradshaw, Tuart Forest National Park Community Advisory Committee

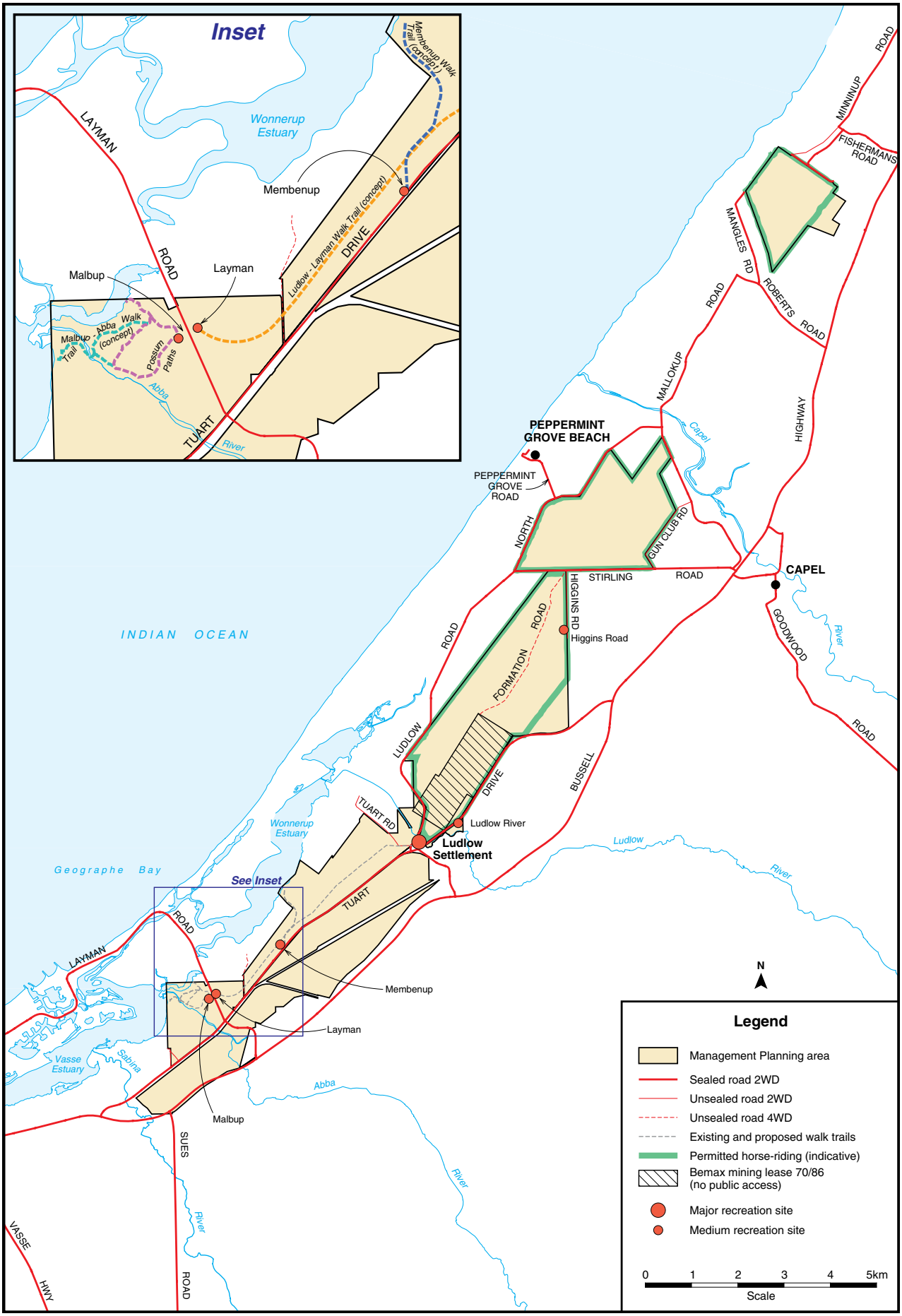
Map 1. Tenure


UCL (drain)
LUDLOW
STATE FOREST
FMP ID 123
ROAD
LUDLOW
FMP ID 123
Ludlow
UCL
Lot 308
Lot 307
Plan 45949
LUDLOW
STATE FOREST
FMP ID 123
UCL Lot 302
Plan 45948
R 868
River
TUART
DRIVE
Inset
FMP ID 119
Lot 94 on
plan 39525
TUART FOREST
NATIONAL PARK
R 43059
FMP ID 119
LOT 17 on
plan 40604
PEPPERMINT
GROVE BEACH
Capel
HIGHWAY
NORTH
STIRLING
ROAD
CAPEL
INDIAN OCEAN
ROAD
TUART FOREST
NATIONAL PARK
R 40251
River
LUDLOW
FMP ID 124
LUDLOW
STATE FOREST
DRIVE
BUSSELL
SHIRE OF CAPEL
FMP ID 124
Lot 101 on
plan 301596
R 41074
FMP ID 124
Lot 100 on
plan 301596
Wonnerup
Estuary
See Inset
Ludlow
Settlement
Ludlow
Geographe Bay
FMP ID 124
Lot 2 on
plan 3280
TUART
TUART FOREST
NATIONAL PARK
R 40250
R 11091
N
ROAD
LAYMAN
FMP ID 123
TUART FOREST
NATIONAL PARK
R 40250
R 13136
Vasse
Estuary
Sabina
FMP ID 124
LUDLOW STATE FOREST
Abba
SUES
River
SHIRE OF BUSSELTON
River
VASSE
HWY
ROAD
Legend
Management Planning boundary
Proposed additions to Tuart Forest National Park
FMP ID 123
National park
State forest
Unmanaged reserve
Unallocated Crown land
Freehold
Railway reserve (freehold)
Road reserve
Local Government Authority boundary
Undeveloped road reserve
0 1 2 3 4 5km
Scale

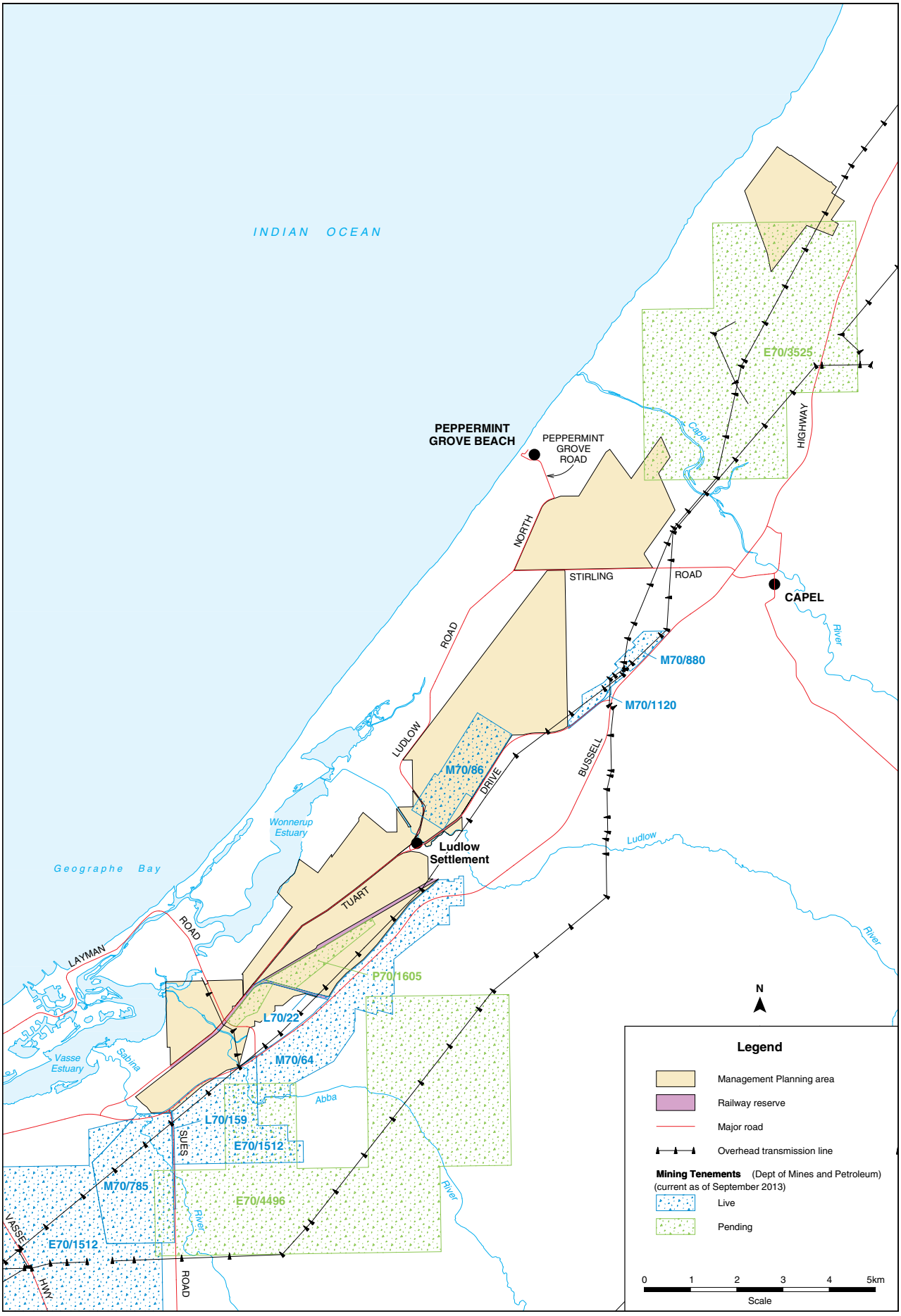
Map 2. Ecosystem management zones



Map 3. Visitor use and access



Map 4. Mining tenements and utilities



Appendices

Appendix 1.
Rare, priority and other significant flora

Species	Common name	Conservation code*
Schoenus benthamii		P3
Cardamine paucijuga		P2
*Trichocline sp. Treeton (*B.J. Keighery & N. Gibson 564)		P2
Blennospora doliiformis		P3
Chamaescilla gibsonii		P3
Eryngium sp. Ferox (G.J. Keighery 16034)		P3
Schoenus natans	Floating bog-rush	P4
Montia australasica		P2
Isopogon formosus ssp. *dasylepis*		P3, LE
Verticordia attenuata		P3, LE
Angianthus drummondii		P3
Eryngium pinnatifidum subsp. *palustrems*		P3
Meionectes tenuifolia		P3
Lasiopetalum membranaceum		P3
Myriophyllum echinatum		P3
Synaphea hians		P3
Stylidium longitubum	Jumping jacks	P3
Aponogeton hexatepalus	Stalked water ribbons	P4
Chamelaucium sp. Yoongarillup (G.J. Keighery 3635)		P4, LE
Caladenia speciosa		P4
Eucalyptus rudis ssp. *cratyantha*		P4
Stylidium striatum	Fan-leaved triggerplant	P4
Thysanotus glaucus		P4
Ornduffia submersa		P4
Verticordia plumosa var. *vassensis*		R, LE
Isolepis oldfieldiana		D
Astartea zephyra		LE
Eucalyptus cornuta	Yate	RE
Eucalyptus gomphocephala	Tuart	RE
Cheilanthes austrotenuifolia		RT
Homalosciadium homalocarpum		RM
Leptoceras menziesii		RM
Pilularia novae-hollandiae	Austral pillwort	RT

* R = rare, P = priority, LE = locally endemic, D = disjunct, RT = relictual taxonomic, RM = relictual monotypic, RE = range-end.

Records obtained from the Western Australian Herbarium 2007, the department's Species and Communities Branch 2008, and NatureMap 2013. Some species names have been recently revised.

Appendix 2.
Rare, priority and other significant fauna

Common name	Scientific name	Conservation code*			Ref
		WA	EBPC	Other	
Amphibians					
Crawling frog or Gunther's toadlet	*Pseudophryne guentheri*	En			1, 2
Moaning frog	*Heleioporus eyrei*	En			1, 2, 3, 4
Motorbike frog	*Litoria moorei*	En			2, 3
Sandplain or squelching froglet	*Crinia insignifera*	En			1, 2, 3, 4
Slender tree frog	*Litoria adelaidensis*	En			2, 3
Whooping frog	*Heleioporus inornatus*	En			3
Birds					
Baudin's cockatoo	*Calyptorhynchus baudinii*	T(S1), En	VU	T(EN), CITES	2, 3
Carnaby's cockatoo	*Calyptorhynchus latirostris*	T(S1)	EN	T(EN)	4
Fish					
Hardyhead species	*Atherinosoma* sp.	En			5
Nightfish	*Bostockia porosa*	En			3, 5
Western minnow	*Galaxias occidentalis*	En			3, 5
Western pygmy perch	*Nannoperca vittata*	En			
Mammals					
Quenda or Southern brown bandicoot	*Isoodon obesulus fusciventer*	P5		LR(nt)	1, 4
Southern brush-tailed phascogale	*Phascogale tapoatafa* ssp. (WAM M434)	T(S1)		LR(nt)	1, 2, 3, 4
Rakali or water rat	*Hydromys chrysogaster*	P4			
Western false pipistrelle	*Falsistrellus mackenziei*	En, P4		LR(nt)	1, 2, 3
Western ringtail possum	*Pseudocheirus occidentalis*	En, T(S1)	VU	T(VU)	1, 2, 3, 4
Reptiles					
South western cool skink	*Acritoscincus trilineatum*	En			2
South western Crevice skink	*Egernia napoleonis*	En			2
Two-toed earless skink	*Hemiergis quadrilineata*	En			2
West coast morethia (skink)	*Morethia lineoocellata*	En			1, 2, 4

* As of March 2008

References
1 = Western Australian Museum (2007); 2 = Dell et al. (2002); 3 = Napier (1982); 4 = Cable Sands (2002); 5 = Morgan et al. (1998)

EXPLANATION OF CODES

WA
En Endemic to the South West
T Threatened or SP Specially Protected fauna declared under the WC Act, and in particular:

- T(S1) Rare or likely to become extinct

Priority Fauna:

- P4 Taxa in need of monitoring (not considered threatened or in need of special protection but could be if present circumstances change)
- P5 Taxa in need of monitoring (subject to a conservation program, the cessation of which would result in the species becoming threatened within five years)

EPBC
Under the EPBC Act: EN Endangered; VU Vulnerable

Other
(T) Threatened according to the International Union for Conservation of Nature (IUCN) categories:
(EN) Endangered – facing a very high risk of extinction in the wild in the near future
(VU) Vulnerable – facing a high risk of extinction in the wild in the medium-term future
(LR) Lower Risk when evaluated against the IUCN categories the criteria for threatened status not met:
(nt) Near Threatened – not Conservation Dependent but is close for qualifying for Vulnerable

Appendix 3. Assessment of beekeeping sites within the planning area

Beekeeping sites within the planning area were assessed against environmental and management criteria and subsequently categorised as either suitable, suitable but conditional or highly constrained. The table below shows the result of the assessment and indicates criteria that require additional conditions. Some of these additional conditions have been included as guidance and should be seen as a minimum set.

	Environmental criteria							Management criteria					Additional Conditions
Beekeeping site no.	Are rare, priority 1 or priority 2 flora visited by bees?			Are other conservation significant flora visited by bees?	Presence of TECs and likely impacts			Fauna habitat (for example, nesting hollows)	Recreation sites within 500m	Class 1 or 2 walk trail within 200m	Disease risk areas	Weed management		
	Yes Impact year round	Yes Impact seasonal	No Predicted impact		Impact year-round	Impact seasonal	No Predicted impact					Impact seasonal	Impact year-round	
Suitable (none of the sites in the planning area are considered suitable)														
Suitable but conditional														
3162				X			X					X		B, C, F (Jun- Dec)
3530		X		X								X		A (Sep-Oct), C, F (Jul-Feb)
2847		X		X						X		X		A (Aug-Apr), B, C, F(Jul-Feb)
Highly constrained														
3163	X			X					X			X		N/A
2765		X		X			X		X	X		X		N/A
2764		X		X					X	X		X		N/A

Guidance for additional conditions

A	Seasonal restriction based on flowering period of flora. Site must be available for a minimum of one month. Placement and number of hives may be restricted.
B	Placement (at least 100m from TEC/PEC populations) and number of hives may be restricted. Monitoring of representative samples for health of adult populations and seedling recruitment or TEC/PEC to ensure there is no decline because of apiary management, taking into account other factors such as drought, disease, fire, environmental weeds or other disturbances. If unacceptable impacts are shown or observed later, treatment will become the same as A.
C	There may be a need to review populations within the planning area to determine whether these populations are significant to the conservation of the species. If deemed significant then treatment will become the same as A.
D	When a feral honeybee program is in place, then use of the site will be restricted during periods when the queen may swarm, such as spring, or a suitable method to restrict the queen should be implemented.
E	For new sites in old-growth forest where there are no feral honeybees present, a condition may be that if during the period of the permit, feral honeybees are located within 2km of the site, the site will be temporarily restricted until the feral honeybees are controlled.
F	Seasonal restriction based on flowering period of environmental weeds however, only until the environmental weed has been successfully eradicated.

Glossary

Acid sulfate soils	Soils that contain iron sulphides within waterlogged sediments are known as 'potential acid sulfate soils'. When these iron sulphides are exposed to air (for example, through decreases in the watertable, inappropriate soil disturbance and dewatering) the minerals oxidise, producing big quantities of iron compounds and sulphuric acid. Initially a chemical reaction, the process is accelerated by soil bacteria. The resulting acid can release other substances, including heavy metals from the soils into the surrounding environment.
Community assets	Bushfire threat analysis is a tool used to identify community assets and defines what is an acceptable outcome in the event of a bushfire. Community assets may include firefighter and public safety, townsites, semi-rural urban developments, critical infrastructure and lifelines (such as key access roads and bridges, pipelines, transmission lines), built infrastructure, recreation sites and trails, adjacent plantations, private property, research sites, natural assets (such as TECs, specially protected fauna, threatened flora, significant habitats and landscape values), Noongar and other Australian heritage sites, water supply areas, apiary sites, community routine and business continuity.
Compatible operations	Activities conducted by the department that are approved by the Minister for Environment as being compatible with the purposes for which the park or management area is managed under the CALM Act.
Comprehensive, adequate and representative	The terms together describe the attributes of an ideal conservation reserve system. The terms are defined by Commonwealth of Australia (2010b) and are summarised below (including targets): • *comprehensiveness* – inclusion within protected areas samples of the full range of ecosystems recognised at an appropriate scale within and across each bioregion (target – by 2015, achieve a national target of examples of at least 80 per cent of the number of regional ecosystems in each IBRA bioregion) • *adequacy* – the maintenance of the ecological viability and integrity of populations, species and communities at a bioregional scale (target – by 2030, include critical areas to ensure the viability, resilience and integrity of ecosystem function in response to a changing climate, to act as core lands of a broader whole of landscape approach to biodiversity conservation) • *representativeness* – the principle that those areas that are selected for inclusion in reserves reasonably reflect the biotic diversity of the ecosystems from which they derive. That is, comprehensiveness considered at a finer scale (IBRA subregion) (target – by 2025, achieve a national target of examples of at least 80 per cent of the number of regional ecosystems in each IBRA subregion).
Convention on Biological Diversity	Australia signed the 'Convention on Biological Diversity' (Rio Convention) at the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil in 1992.
Craftwood	Traditionally, craftwood has been restricted to *Banksia* nuts, *Xanthorrhoea* bases, sheoak and jarrah timber offcuts, although burls are not craftwood.
Department-managed lands and waters	The term refers to nature reserves, national parks, conservation parks and CALM Act section 5(1)(g) and (h) reserves vested in the Conservation Commission.
Directory of Important Wetlands	The directory was a collaborative effort between Commonwealth and State nature conservation agencies to identify important wetlands, provide a substantial knowledge base of what defines wetlands, their variety and the dependence on them of many flora and fauna species (see www.environment.gov.au, accessed August 2013).
Ecological character	Defined in the Ramsar Convention (Resolution IX.1 of the 9th meeting of the Conference of Parties to the Convention on Wetlands, Uganda, November 2005) as "…the combination of the ecosystem components, processes and benefits/services that characterise the wetland at a given point in time".

Endemic	Endemic or endemism refers to native plants or animals that are confined in their natural occurrence to a particular region, with a distribution that ranges less than 150km.
Environmental weed	An introduced plant that establishes in natural ecosystems and adversely modifies natural processes, resulting in decline of invaded communities (CALM 1999).
Essential works	As defined in section 99a(2) of the CALM Act includes works that are required to establish or re-establish access to land or to provide fire containment lines.
Forest produce	For the purposes of the CALM Act, 'forest produce' includes trees, parts of trees, timber, sawdust, chips, firewood, charcoal, gum, kino, resin, sap, honey, seed, beeswax, rocks, stone and soil but, subject to the foregoing, does not in Division 1 of Part VIII include minerals within the meaning of the Mining Act.
Introduced	Plants and animals that, because of human activity, occur beyond their accepted normal distribution and that threaten valued environmental, agricultural or other social resources by the damage they cause. For example, feral animals that have become established as wild or naturalised populations.
Mining tenement	Under the *Mining Act 1978*, means a prospecting licence, exploration licence, retention licence, mining lease, general purpose lease or a miscellaneous licence granted or acquired under this Act or by virtue of the repealed Act.
Necessary operations	Activities conducted by the department that are necessary for the preservation or protection of persons, property, land, waters, flora or fauna, or for the preparation of a management plan.
Pre-European	The term 'pre-European' (or pre-1750), while not corresponding exactly with the year of European settlement in Australia, is used for the National Vegetation Information System because of its international usage in greenhouse science and vegetation monitoring to describe the time just prior to industrialisation in relation to estimates of changes in vegetation types and cover since European settlement.
Problem animals	In the context of this plan, the term 'problem species' refers to a native species that has become unnaturally high in number and/or is causing severe adverse impacts on the surrounding natural environment.
Podsolic	Soil profile associated with cool humid temperate areas; a strongly leached pale horizon underlies darker horizons where humus has accumulated.
Priority plant and animal species	Species that have not yet been adequately surveyed to be listed under Schedule 1 or 2 of the WC Act are added to the priority flora and priority fauna lists under priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. Taxa that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in priority 4, and are species that require regular monitoring. Conservation Dependent species are placed in priority 5 (see www.dpaw.wa.gov.au, accessed August 2013).
Public works	Public works include buildings or fixed structures, roads, railways, bridges, bores or any major earthworks.
Relictual	Pertaining to an archaic form in an otherwise extinct taxon.
State Gravel Supply Strategy	A strategic and coordinated approach to assessing future gravel supply and demand for the wider region.
Threatened species	The WC Act provides for taxa (species, subspecies and varieties) of native plants and animals to be specially protected as they are under identifiable threat of extinction, are rare, or otherwise in need of special protection.
Unallocated Crown land	Unallocated Crown land (UCL), formerly known as vacant Crown land, is Crown land that is not subject to any interest (other than Native title interests under the Native Title Act) and which is not reserved or declared or otherwise dedicated under the *Land Administration Act 1997* or any other Act (see www.lands.wa.gov.au).
Vital attributes	Vital attributes and life history traits are critical physical characteristics of plants and animals that determine their ability to survive different fire intervals. For plants, it mainly relates to (i) methods of persistence (seeder or sprouters), (ii) conditions to establish and grow to maturity, and (iii) timing of life stages (for example, juvenile period and viable seed set). For animals, it relates to (i) the ability to survive fire and early post-fire period (type of refuge, mobility, scale and intensity of fire), (ii) habitat requirements (seral stage of the vegetation) and (iii) fecundity and dispersal characteristics.

20130363-0814-200