

064938

~~00199~~

# Issues Paper

## Tuart Forest National Park Management Plan

2006

Tuart Forest National Park<sup>1</sup> and its proposed additions (the planning area) have been identified as a State priority for the preparation of a management plan. This paper identifies key values and issues within the planning area for consideration by the Department of Environment and Conservation (the Department) and the Conservation Commission of Western Australia (Conservation Commission) during the management planning process. Combined with community consultation, this paper will guide the development of management objectives, strategies and Key Performance Indicators for the management plan.

## INTRODUCTION

### **Management Plan Area**

The planning area covered by this management plan (Map 1) will include:

- ❖ Tuart Forest National Park (Reserves 43059, 40250 and 40251);
- ❖ Proposed addition of 56 ha of land: Lots 2, 100 and 101\*, to the western side of the Tuart Forest National Park;
- ❖ Proposed addition of 35 ha of land: Lot 17\*, on the eastern side of Minninup block (the most northern portion of the Tuart Forest National Park);
- ❖ Proposed additions of 50 ha and 60 ha of State forest and other reserves under the *Forest Management Plan 2004-2013* (including Reserve 868 – Ludlow settlement); and
- ❖ State Forest 2.

\* Land to be added to the planning area as a result of offsets from Cable Sands (WA) Pty Ltd mining operations (see *Mining Activities*).

The planning area currently has two major tenure issues including the transfer of State forest to the national park and the proposed addition of Reserve 868.

In 1993, the State forest in the planning area (State Forest 2) was recommended in the Environmental Protection Authority's (EPA) *Red Book Status Report (1993) on the implementation of conservation reserves for Western Australia* to be added to the national park following the removal of pine plantations (managed by the Forest Products Commission (FPC)) and subsequent replacement with tuart (see *Environmental Weeds – Pine*). This is also consistent with earlier recommendations made by the Conservation through Reserves Committee (CTRC) in 1974 and 1976 and the intention of the former Forests Department (Forests Department of Western Australia, 1979).

The State is obliged under the *Wood Processing (WESFI) Agreement Act 2000* to replant areas of pine necessary to give effect to its long-term timber supply commitments. The FPC has requested that the Department find alternate land for it to replant pine in return for loss of the plantation land in State Forest 2. The Department is not obligated to provide alternative areas for FPC plantation establishment but in this case has explored the availability of land for this purpose.

Reserve 868 is currently unvested with a purpose of 'Forests Department Quarters and Public Recreation'. It has an area of approximately 2 ha and contains the former Forests Department workshop, pine sawmill, a residential settlement and former forestry huts, teacher's house, school and Departmental District Office (Heritage and Conservation Professionals 2004). There are also some houses north of Reserve 868 that are within the boundary of State Forest 2. These houses, along with the residential settlement in Reserve 868, are being let through a commercial rental agency.

Despite being unvested, the Department has management responsibility for Reserve 868 and in particular, the infrastructure and associated services from the main supply lines create a significant cost. In 1999, the Department requested vesting of Reserve 868 with a change in purpose to suit its intended future use. This tenure proposal did not progress and has since been replaced by the tenure proposal under the recent *Forest Management Plan 2004 – 2013* to add it to the national park.

---

<sup>1</sup> A national park is an area that has national significance for scenic, cultural or biological values, and can accommodate recreation that is consistent with maintaining these values.

The south-western part of the planning area adjoins the Vasse-Wonnerup Estuary, which fulfils the criteria for listing and international protection under the Ramsar Convention (see *Ecological Communities – Vasse-Wonnerup Estuary*). This wetland system was first registered in 1990 and then amended in 2000 to include part of Tuart Forest National Park (Reserve 40250). The Western Australian Planning Commission, in collaboration with the Department and other key stakeholders, prepared the *Busselton Wetlands Conservation Strategy* to protect these wetland values. Management objectives of this plan, particularly in the area of Reserve 40250, will need to take this strategy into consideration.

### **Brief Overview**

The planning area is located within the Shires of Busselton and Capel and extends approximately 25 km from Minninup in the north-east to its south-western boundary near the Sabina River (See Map 1). It mainly consists of the Tuart Forest National Park and State Forest 2, both of which are class 'A' reserves. The planning area, which covers 3030 ha, contains the largest and most southern representation of tuart woodlands – tall tuart woodland structural vegetation type (Hopkins et al. 1996). Past land management practices such as grazing by stock, altered fire regimes and silvicultural practices based on wood production, have resulted in significant changes in understorey structure and tuart woodland ecosystem processes. Land clearing for agriculture has also led to a now highly fragmented tuart landscape with a large boundary-to-area ratio, and is consequently subject to various external influences such as limited gene flow and invasion of pest animals and weeds. Implementing weed control programs with the subsequent restoration of the tall tuart woodland ecosystem will be the major focus of this plan.

The planning area is a part of, and adjoins, the Vasse-Wonnerup Estuary (a listed wetland under the Ramsar Convention) and is also important for the conservation of some threatened faunal species, including the western ringtail possum and Carnaby's cockatoo. It is particularly valued for its 'sense of place' by the community and maintains a considerable natural and cultural heritage value recognised on local, state and national levels. Furthermore, the majority of visitors to the planning area are those people who choose to travel along Tuart Drive, a dedicated tourist scenic route managed by local government authorities (See Map 1). As a result, maintaining the aesthetic appeal of the planning area is of high importance.

An application submitted by Cable Sands (WA) Pty Ltd (Cable Sands) to mine part of State Forest 2 (147ha) for titanium minerals was approved in November 2003 by the Minister for the Environment (the Minister) subject to the conditions set by the Minister in the statement of approval (Statement no. 639) (see *Mining Activities*). The mining lease (M 70/86) is located between the northern and southern parts of the Tuart Forest National Park and comprises 217 ha (See Map 1). Mining commenced in 2004 and is estimated to take 3-4 years to mine the deposit and a further 9 years to complete rehabilitation (until approximately 2017).

The planning area is also located amongst one of Australia's fastest growing populations, which is likely to result in a substantial amount of subdivision of surrounding rural properties with an increased demand for coastal residential development. As a result, associated landuse pressures will present a major challenge to the integrity of the planning area in maintaining its values.

## **MANAGEMENT DIRECTIONS AND PURPOSE**

### ***Management Arrangements with Aboriginal People***

The Department recognises the importance of including Aboriginal people and their views on land management throughout the planning process. By working together with Aboriginal people to care for country, there will be great benefits for the preservation of heritage and conservation of the environment, as well as for cross cultural awareness.

The Government has indicated a commitment to explore joint management arrangements with traditional owners by developing a consultation paper outlining options for ownership, administration and joint management of conservation lands in Western Australia (Government of Western Australia 2003). This paper discusses how these joint management arrangements may work.

The input of the Traditional Owners into this management plan will be achieved in a number of ways including:

- through invitation for membership on the Tuart Forest National Park Community Advisory Committee by a representative for each of the Claimants who cover the planning area;
- through the South West Aboriginal Land and Sea Council, with which the Department has a Memorandum of Understanding; and
- through direct consultation with the relevant claimants.

## **MANAGING THE NATURAL ENVIRONMENT**

Managing the natural environment involves identification and careful consideration of the natural values within the planning area and the threats that impact upon their existence. This will ultimately lead to improved decision-making and hence successful management strategies to ensure their protection.

### ***Biogeography***

The planning area contains the largest and most southern remnant of tall tuart woodland, which is the only remaining contiguous example of the uplands, wetlands and rivers of the Ludlow Plain Land System of the Spearwood Dune System (Keighery and Keighery 2002). With 46% of its natural distribution already contained within conservation estate (Government of Western Australia 2002), the proposed additions to the planning area will further contribute to the establishment and management of a comprehensive, adequate and representative tall tuart woodland ecosystem.

### ***Catchment Protection***

The Busselton Basin covers 2560 km<sup>2</sup> (Pen 1997) and is predominantly comprised of the Geographe Bay Catchment, which extends from Bunbury to Cape Naturaliste covering 78% of the Basin's area (Weaving 1998). The planning area lies entirely within this catchment, which contains nine short riverine systems. The Abba and the Ludlow Rivers, which have their headwaters in the Whicher Scarp, are the only rivers that traverse the planning area and discharge into Geographe Bay via the Vasse-Wonnerup Estuary (Pen 1997 and WAPC 2005).

The hydrology of the Geographe Bay Catchment has been altered by modification of the natural drainage network. Diversion drains have been constructed to allow flow from some rivers to be diverted directly out into the Bay to avoid flooding of the estuary in winter. Similarly, floodgates located on the exit channels of the estuary, were built to allow excess outflow of freshwater in winter when water levels are higher on the upstream side of the gates, and conversely, to prevent tidal saltwater intrusion by closing when water levels downstream are higher. After winter, the floodgates maintain a predetermined water level in the estuary to allow for summer evaporation (WAPC 2005).

The fringing (salt intolerant) vegetation of the wetland has been adversely affected as a result of deliberate inflow of excess seawater into the Vasse-Wonnerup Estuary in the late 1980s. This inflow of seawater occurred over the summer period to prevent fish deaths and maintain the water level beyond the requirement of the natural component of the wetland (J. Lane *pers. comm.*). As the eastern boundary of the Ramsar wetland site lies within the planning area, rehabilitation of the riparian zone along the Abba River and around the mouth of the Abba River will need to be addressed.

The planning area falls within the Busselton-Capel Groundwater Area, which contains significant groundwater resources. Preliminary estimates are that sustainable yields are approximately 130 million KL per year (WAPC 2005), although these are in the process of being revised. The three aquifers in this area are, from top to bottom, the unconfined Superficial aquifer, the underlying Leederville aquifer and finally the lower Yarragadee aquifer. The Superficial aquifer is recharged predominantly via rainfall (but also from minor amounts of discharge from the underlying aquifers). Discharge of this aquifer occurs directly into the ocean, via streams, drains, and wetlands and as leakage into the unconfined aquifers. Both the latter two processes eventually lead to groundwater discharge into the ocean.

The Leederville and Yarragadee aquifers, both primarily recharge via direct infiltration of rainfall in their outcrop areas, but also via downward leakage from the overlying superficial formations. Whilst both the Leederville and Yarragadee aquifers can discharge upward into their respective overlying aquifers, the quantities are small compared to the main discharge, which occurs offshore. Generally groundwater flow in all three aquifers is towards the coast (WAPC 2005, Water Authority of Western Australia 1995) although heavy groundwater abstraction can locally change this, which is a potential issue for the planning area if the Yarragadee abstraction proposal is approved (See *Proposed Water Extraction*).

### **Native Plants and Plant Communities**

The planning area is known for its tall mature tuarts (*Eucalyptus gomphocephala*), its suite of orchid species and a secondary storey dominated in parts by native peppermint (*Agonis flexuosa*). Keighery and Keighery described the area in 2002 as containing a high level of species diversity resulting from its extensive upland areas and complex wetland plant communities. Five principal plant communities were surveyed, four of which are associated with the upland areas and the other with seasonally inundated or waterlogged areas. With a total vascular flora of 705 species (543 of them being native, including nine priority species), the planning area is the largest and most southern representation of tall tuart woodland throughout its distribution (Keighery and Keighery 2002).

### **Restoration of the Tall Tuart Woodland Ecosystem**

In the past, heavy grazing by stock and altered fire regimes have disturbed and modified the planning area resulting in extensive weed invasion, which has contributed to the lack of tuart regeneration. Despite this, there are residual values in the planning area that have the potential to be adversely affected by restoration of the tall tuart woodland ecosystem and therefore protection of these values is an important facet in the restoration process. These values include:

- significant habitat (eg. pine and other weed species used as groundcover refuge) for various faunal species including the largest population of western ringtail possum secured in a conservation reserve on the Swan Coastal Plain (see *Native Animals and Habitats – Important Habitats and Environmental Weeds*);
- the riparian zone on the eastern boundary of the Ramsar wetland (Vasse-Wonnerup Estuary) site; and
- a large diversity of orchid species.

Consequently, the main focus of the management plan will be determining the aim of restoration as well as achieving a balance in preserving present-day values.

Some factors that need to be considered are:

- the large amount of restoration required to achieve conservation/social benefits;
- the urgency of actions;
- the availability of scientific knowledge relating to understorey composition and restoration ecology (ie. achieving a functioning ecosystem through the restoration and conservation of unique values in the planning area);
- replacement/recruitment mechanisms;
- the availability of a suitable seed source/local provenance for rehabilitation; and
- the feasibility of controlling threatening processes, particularly invasive weeds and grazing by kangaroos and rabbits.

Initial restoration of the tall tuart woodland ecosystem has already commenced in the Cable Sands mining lease. The unmined component is being rehabilitated by the Department as part of the Minister for Environment's condition to mine the site (see *Mining Activities*). The entire mining lease will be added to the national park following rehabilitation.

### Rare and Priority Flora

The planning area contains nine species of Priority taxa<sup>2</sup>. Of these, there are two Priority 2<sup>3</sup> taxa (*Calytrix* sp. and *Trichocline* sp.), two Priority 3<sup>4</sup> taxa (*Verticordia attenuata* and *Lasiopetalum membranaceum*) and five Priority 4<sup>5</sup> taxa (*Eucalyptus rudis* subsp. *cratyantha*, *Villarsia submersa*, *Schoenus natans*, *Aponogeton hexatepalus* and *Acacia flagelliformis*). There are three other species that are considered significant because their only occurrence on the Swan Coastal Plain is within the planning area. There are also rare hybrids between yate and tuart present within the south-western boundary of the planning area (Keighery and Keighery 2002).

### Tuart Decline

To the north of the planning area, tuart decline is significantly affecting much of the Yalgorup National Park. Collaborative research by Murdoch and Edith Cowan Universities, and the Department suggest that the predisposing cause might be due to below ground factors (eg. absence of mycorrhizal root associations). However, other factors such as insect attack (Tuart borers: *Phorocantha* spp and Tuart bud weevils: *Haplonyx tibialis*), altered fire regimes, increased understorey competition and climate change have a contributory and cumulative impact on weakened woodland ecosystems (D. Haswell *pers. comm.*).

Whilst gradual tuart decline has not been observed in the planning area, the tuart health research focus at Yalgorup now includes work at Ludlow that will lead to the development of early detection and subsequent management systems (D. Haswell *pers. comm.*).

### Flooded Gum Decline

A decline in the native eucalypt, flooded gum (*Eucalyptus rudis*), has been observed in areas adjacent to the planning area. The cause of this decline is unclear, although a substantial increase (in comparison to the planning area) in the lerp forming psyllid (*Creiis periculosa*) has been noted (K. Williams *pers. comm.* and J. Carter, *pers. comm.*).

Whilst these native insects cause extensive defoliation in flooded gum, eventually leading to the death of some trees (Clay and Majer 2001), they are not considered to be the primary cause of the decline. Rather, it is thought that a number of factors are leading to the weakening of the trees, and weakened trees suffer physiological changes that affect insect populations (A. Wills *pers. comm.*).

There are also other native species that are known to cause defoliation in flooded gum: leafminer (*Perthida* sp.) and leafblister sawfly (*Phylacteophaga froggattii*), both of which are also native species, the former being endemic to the southwest of Western Australia (A. Wills *pers. comm.*). Flooded gum also carries high loads of other insects such as gall formers of various types and therefore it could be considered a keystone species for supporting an insect fauna (A. Wills *pers. comm.*).

---

<sup>2</sup> In addition to rare flora and specially protected fauna, which are gazetted under the Wildlife Conservation Act 1950, the Department maintains a list of priority species (flora and fauna) as a mechanism to highlight species of special conservation interest. These are species that:

- a may be threatened but there is insufficient survey data available to accurately determine their true status (Priority 1 to 3).
- b are adequately known, are rare but not currently threatened, or meet criteria for 'Near Threatened', or that have been recently removed from the threatened list for reasons other than taxonomy (Priority 4).
- c are conservation dependant (Priority 5).

<sup>3</sup> Priority 2 – Species that are known from one or a few collections or sight records (generally less than five), some of which are on lands not under imminent threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.

<sup>4</sup> Priority 3 – Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.

<sup>5</sup> Priority 4 – Species that are categorised as either Rare, Near Threatened and other species in need of monitoring:

- a Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.
- b Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent (Priority 5), but that are close to qualifying for Vulnerable.
- c Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Consequently, its protection is of high importance. Due to the decline being within close proximity to the planning area, this remains a potential issue for consideration in this management plan.

### **Native Animals and Habitats**

#### **Threatened Fauna**

The planning area contains two species of specially protected fauna: western ringtail possum (*Pseudocheirus occidentalis*) and Carnaby's cockatoo (*Calyptorhynchus latirostris*). Four other species that have also been recorded within the planning area, are currently included on the Department's priority species list: southern brush-tailed phascogale (*Phascogale tapoatafa tapoatafa*), western false pipistrelle (*Falsistrellus mackenziei*), water-rat (Rakali) (*Hydromys chrysogaster*) and the quenda (*Isoodon obesulus fusciventer*).

Of some concern is the fluctuation in numbers of brush tail and ringtail possums in particular parts of the planning area. At this stage the reason/s for this are not clear.

#### **Important Habitats**

Some trees within the planning area are extremely important for many faunal species including a large diversity of birds (e.g. wetland birds, raptors and birds generally inhabiting the woodland) and arboreal mammals (e.g. possums and bats). Tuart hollows are predominantly used as nesting sites, peppermint trees are the primary source of food for the western ringtail possum, and existing pine trees provide some food for the abovementioned specially protected cockatoo species. All of these tree species have been known to be used as habitat for the western ringtail and brush tail possums. With the removal of the pine from State Forest 2 (see *Management Plan Area* and *Environmental Weeds – Pine*), the demand for tuart hollows is expected to rapidly increase as affected animals, particularly possums, begin to seek alternate refuge in the northern part of the planning area.

#### **Galahs**

In recent years, the pink and grey galah (*Cacatua roseicapilla*) has extended its range to the south west of Western Australia and has increased in numbers in the planning area as a result. Although it is a native species, it can be aggressive in competing with other native bird species and arboreal mammals that have a more restricted range, particularly for food and shelter (J. Carter *pers. comm.*). As such, it is considered a pest species in the planning area.

#### **Kangaroos**

Urbanisation along the Busselton coast (particularly around Port Geographe and Peppermint Grove Beach) has resulted in a loss of natural habitat, placing increasing importance on the planning area to provide a refuge for native fauna. Western grey kangaroos (*Macropus fuliginosis*) seeking refuge within the planning area are known to graze on crops in adjacent private property and fear of escalating kangaroo numbers has created concerns for many surrounding landholders.

However, recent monitoring has found the population to be stable with the current level of approved culling on private property (K. Williams *pers. comm.*). Grazing by kangaroos also impacts on environmental values of the planning area and is an issue when managing tuart rehabilitation sites.

### **Ecological Communities**

#### **Threatened Ecological Communities**

There are currently no known threatened ecological communities within the planning area though there is potential for stygofauna (subterranean fauna) to exist given the amount of limestone present in the area.

#### **Priority Ecological Communities**

There are two Priority 3<sup>6</sup> ecological communities that currently exist within the planning area. These include floristic community type 25: southern *Eucalyptus gomphocephala* – *Agonis flexuosa* woodlands and floristic community type 30b: Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands.

---

<sup>6</sup> Priority 3 – Poorly known ecological communities: Ecological communities that are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

There are also two other Priority 3 (wetland) groups that are considered to be present within the planning area as indicated by the floristics of the area, but further research is required to confirm this information (Keighery and Keighery 2002).

#### **Vasse-Wonnerup Estuary**

The Vasse-Wonnerup Estuary, which covers an area of 1115 ha, borders the planning area, is a listed wetland under the Ramsar Convention and has also been included on the Register of National Estate for its natural heritage value. Part of the area comprising the Ramsar wetland site (the eastern riparian zone) is contained within the southwest corner of the planning area (Reserve 40250). Mature tuarts within this area are an important habitat for various waterbirds, providing hollows for both roosting and nesting.

Fulfilling two of the eight criteria developed to identify wetlands of international importance, the Vasse-Wonnerup Estuary supports at least 1% of the populations of Black-winged Stilt (*Himantopus himantopus*) and Red-necked Avocet (*Recurvirostra novaehollandiae*) in Australia and contains approximately 30 000 birds and almost 90 species, including a number of migratory species (WAPC 2005). The largest regular breeding population of Black Swan (*Cygnus atratus*) in Western Australia also occurs here (WAPC 2005). Protection of their habitats is an important factor for the management of all these waterbird species.

In relation to the planning area, there is a requirement for rehabilitation of the riparian zone as fringing vegetation such as melaleucas are in decline and weeds such as the introduced typha species are beginning to dominate (see *Catchment Protection* and *Environmental Weeds*).

#### **Environmental Weeds**

The planning area has an extensive weed problem with few 'weed free' areas present. The magnitude of the weed problem is a result of past land management practices and the size and shape of the planning area. Over 160 species of weeds occur in the area and are dominated by pasture grasses. Thirteen species are listed in the *Environmental Weed Strategy for Western Australia* (CALM 1999) as 'high' in terms of their environmental impact. Many of these are widely distributed across the planning area and are often associated with riparian and moisture-gaining sites.

Aside from a variety of pasture grasses requiring weed control as a result of their ability to restrict regeneration of tuart and other native understorey species (Keighery and Keighery 2002), the weeds of most concern include arum lily (*Zantedeschia aethiopica*) and bridal creeper (*Asparagus asparagoides*). Both of these species are currently listed by the Agricultural Protection Board as 'declared plants' under the *Agriculture and Related Resources Protection Act 1976*. Both species have a wide distribution, occur in dense thickets and have the ability to change the structure, composition and function of the tall tuart woodland ecosystem (CALM 1999).

Trials in the Cable Sands mining lease have been effective in controlling arum lily with herbicide. However, as a result of its limited distribution, the rust fungus has only been successful to some extent in controlling bridal creeper. With bridal creeper being such a high priority for control, a more effective weed control technique will need to be devised for this species.

Consideration would also need to be given in relation to control of the introduced typha species and the risk of its spread through wildfire. This species is a disturbance opportunist and may encroach on the tall tuart woodland ecosystem if not carefully managed and monitored. In addition, kikuyu and couch are also weeds of great concern in the riparian zone and the interface with the Vasse-Wonnerup Estuary.

Control of weeds in the planning area can be achieved progressively when carried out in conjunction with a restoration program. However, it will need to consider the protection of any native animals that may depend on the pines and existing ground cover for refuge and the effect that weed control methods may have on the important populations of orchids present and trees of high conservation value (See *Restoration of the Tall Tuart Woodland Ecosystem*).



Therefore it is important that prior to removal, all weed species are accurately and extensively mapped and that an appropriate restoration program is implemented, to prevent or minimise any adverse impacts (for example weed re-invasion and/or substitution following removal by fire).

#### Pine

Following tuart harvesting, rotations of pine were introduced to the planning area to buy time while tuart regeneration techniques were being devised, to suppress peppermint growth and to make economic gains from harvesting softwood (Forests Department of Western Australia 1979).

The establishment of pine plantations for commercial harvesting ceased in 1971 (Forests Department of Western Australia 1979) and existing pine plantations were earmarked for rehabilitation with native species (see *Management Plan Area*). Residual pines still exist and will need to be removed. Pines located at the Ludlow townsite have state heritage value for their representativeness of a number of pine plantations established in the early 1900's to supplement imports and local hardwoods (Heritage and Conservation Professionals 2004). Therefore retention of these particular pines will be required.

In all cases of pine removal within the planning area, consideration will need to be given with regard to:

- ❖ value of the pine as fauna habitat (e.g. for birds, possums and other arboreal mammals) ;
- ❖ spread of the plant pathogen (*Armillaria luteobubalina*) that causes the disease known as Armillaria;
- ❖ potential for weed establishment following harvesting/removal;
- ❖ wildlings and seed stored within the soil;
- ❖ visual amenity, particularly from Tuart Drive; and
- ❖ visitor safety.

Some exotic species, as well as some native tree species that have been introduced to the planning area such as karri, also exist within species trial plots (see *Species Trial Plots and Tuart Plantations*) and may need to be removed.

#### **Pest Animals**

The red fox (*Vulpes vulpes*), feral cat (*Felis catus*) and rabbit (*Oryctolagus cuniculus*) are the most common and widespread pest animals within the planning area. Other pest species include the long-billed corella (*C. tenuirostris*), little corella (*C. sanguinea*), feral bees (*Apis mellifera*), mosquitofish (*Gambusia holbrooki*), carp (*Carassius* sp.) and redfin perch (*Perca fluviatilis*). Rainbow lorikeets (*Trichoglossus haematodus moluccanus*) have also been identified as a potential pest and close monitoring of their distribution and impact on other natural values of the planning area may be necessary.

#### **Foxes and Cats**

Foxes and cats in particular pose the greatest threat to birds and small mammals (35gm – 5kg) within the planning area. The Western Shield program, which was implemented in 1996, has reduced fox populations in the past with the distribution of 1080 poison baits. Whilst the large boundary to area ratio is not conducive to long-term pest animal control due to the high probability of reinvasion, its short-term success warrants continued baiting until better management options are available. In addition, a suitable control program will also need to be developed for cats. Integrated management of both baiting programs with surrounding private property owners is important.

#### **Rabbits**

Grazing pressure by rabbits creates substantial competition for food with small native animals. They are also likely to cause extensive damage to areas of high conservation value such as future rehabilitation trial plots through grazing and movement.

### Corellas, Rainbow Lorikeets and Feral Bees

The long-billed and little corella species occurring within the planning area were both introduced from the eastern states (J. Carter *pers. comm.*) and are increasing in numbers which, along with feral bees, can create substantial competition for food and shelter, particularly in taking over tuart nesting hollows used by native and/or significant bird species (e.g. wetland birds, raptors and birds generally inhabiting the woodland) and arboreal mammals (e.g. bats and possums). Rainbow lorikeets were introduced in the 1960s and are a potential threat within the planning area for similar reasons.

### Fish

Three introduced fish species have been previously recorded within the planning area, including mosquitofish, carp and redfin perch. These species compete with, and predate on, decapods and native freshwater fish and frogs. Aside from the direct loss of these native freshwater species, the disturbance will ultimately impact on the water birds that depend on this faunal component as a food source.

## **DISEASE**

### Plant Diseases

*Armillaria luteobubalina* is a native pathogen that causes the plant disease known as Armillaria. It appears to be the most significant plant disease within the planning area and it mainly occurs in coastal dune vegetation and forested areas (Shearer 1994) where it proliferates in areas of freshly cut tree stumps. The disease can be fatal for a variety of native plant species such as eucalypts, melaleucas and other woody shrubs. The spread of the pathogen is a particular issue for the removal of the pine and other introduced species within the planning area (see *Species Trial Plots and Tuart Plantations*). In particular, consideration will need to be given to the removal of the stumps. However, full elimination of this endemic pathogen is not desirable as it is naturally occurring in undisturbed areas of the southwest (R. Robinson *pers. comm.*).

### Animal Diseases

Some frog species within the planning area appear to have been impacted by the highly infectious disease known as Chytridiomycosis. The disease is caused by the chytrid fungus (*Batrachochytrium dendrobatidis*), which invades the frog's skin surface, causing damage to the keratin layer, and is fatal in most frog species (Department of Environment and Heritage 2004). As a result, it has been listed as a key threatening process under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999).

### Fire

Setting clear fire management objectives for the conservation of biodiversity, and for the protection of other values such as life and property, remains fundamental to the development of fire management plans.

The planning area essentially exists as a remnant, so following disturbances such as fire, normal ecosystem processes including post-fire recolonisation, will be effected. Invasion by weeds and pest animals following fire is also likely to be prevalent in the absence of a weed control program (See *Environmental Weeds*).

At present, regular prescribed burning is not undertaken in the planning area as it is generally considered to be at a low to moderate risk of large-scale wildfire, primarily due to its low fuel structure (a result of past grazing and dominance by pasture grasses) and relatively rapid fire suppression response time. The main requirement for fire management over much of the planning area is to promote the regeneration of tuart, a keystone species, by creating ashbeds timed with adequate availability of canopy-stored seed. Following regeneration, there may be a continued requirement to exclude fire in some areas for an extended period to allow the development of tuart regeneration to a fire resilient stage. There may also be a requirement to use fire as part of a program to improve the health of the tuart forest, as part of the understorey restoration program or to ameliorate the impacts of intense wildfires, should the risk of wildfire increase.

Issues requiring particular consideration for the planning area include:

- fire history;
- identification of a) fire sensitive and b) fire maintained species or communities, and their ecological requirements with respect to fire;

- the effect of fire on the mature tuart trees where no saplings or young tuart trees exist;
- the role of fire in regenerating tuart and other important ecosystem components;
- high canopy scorch and leaf drop, which can reduce the amount of food and shelter available in the short term for faunal species;
- the effect of fire regimes on the proliferation of weeds in the absence of a suitable rehabilitation program (see *Environmental Weeds*);
- the effect of fire in fragmented landscapes, especially where entire habitats are at risk;
- the provision of strategic fire protection from potentially large intense fires that will adversely affect conservation values and community assets, for example, the Ludlow townsite, visitors to the planning area, developed recreation sites and adjoining private property; and
- areas of high landscape value.

Further information is required on the fire ecology/requirements (e.g. frequency, season and fire intensity) and fire tolerance of the native plants and animals of the planning area, as well as accurately locating species, communities and habitats of conservation significance.

## **MANAGING OUR CULTURAL HERITAGE**

### ***Indigenous Heritage***

Custodianship of Indigenous heritage within the planning area resides with those Aboriginal people who have authority to speak for the lands. There are some native title claims that exist over the planning area.

There are four registered Indigenous heritage sites within the planning area. They include site types of modified trees, skeletal and burial, artefacts and scatter, mythological and historical. The primary responsibility for Indigenous heritage management lies with the Department of Indigenous Affairs under the *Aboriginal Heritage Act 1972* in consultation with Aboriginal communities and individuals. Under this Act, it is an offence to damage these sites, whether they are registered or not.

Currently little is known about the issues in relation to the protection and interpretation of the Indigenous heritage within the planning area.

### ***Non-Indigenous Heritage***

The planning area has important non-Indigenous heritage value as it contains the State's first forestry school, the tuart mill, the lime kilns and remnants of the old Ballarat railway and bridges. In particular, the settlement at Ludlow and the old lime kilns are important sites, both of which are listed on the State's Heritage List. Any maintenance of the facilities in, and future use of, the settlement at Ludlow will need to consider any potential impacts on the heritage value of the reserve (see *Management Plan Area*). There are also opportunities for the development of interpretation for other visitor and tourism facilities to promote the value of heritage sites within the planning area.

## **MANAGING VISITOR USE**

The planning area is valued by the community as a scenic area to partake in a range of activities such as bushwalking, horseriding and scenic driving, for which it is most known. It contains the Membenu and Layman picnic sites, with the latter offering facilities such as barbecues, picnic tables, interpretation and the possum walk trail.

Projects that enhance tourism and visitor use will be considered during the planning process using the offset funding from the Cable Sands mining operations (see *Visitor Information and Interpretation*).

There is currently a lack of information available in relation to visitor statistics in the planning area.

### ***Visitor Access***

The planning area is situated close to the major population centres of Busselton and Capel and is mostly accessed by vehicle, although some areas are accessible via walk tracks and informal horse trails.

Public access is predominantly via Tuart Drive (a gazetted and sealed road managed by local government authorities), which borders the eastern side of the planning area in the north and dissects the planning area in the south. This is the primary scenic route through the area (See *Visual Landscape*).

The Cable Sands mining lease has been specifically fenced off to restrict access. However, unrestricted (off-road) access in particular, has led to a significant level of disturbance to the surrounding environment. The rail reserve passing through the southern portion of the planning area is one example of this. Unlicensed drivers and the use of unlicensed/unregistered motorbikes is an ongoing problem for management as well as the illegal dumping of stolen or unwanted vehicles.

Many of the tracks within the planning area are remnants of former forestry operations. Providing safe access, avoiding duplication, minimising environmental degradation and the spread of weeds, protecting key conservation values, directing visitors away from inappropriate areas (e.g. culturally sensitive areas, areas of high visitor risk or areas under rehabilitation) and assisting with management operations are all issues for consideration during the planning process.

### **Recreational Use**

#### **Bushwalking**

Bushwalking is a popular recreational activity within the planning area although, only one formal walk trail (possum walk trail) exists. Several informal walk trails exist in areas of interest such as the old lime kilns near North Block (See Map 2). Issues of waste disposal, domestic animals and the introduction and/or spread of weeds and pathogens will need to be addressed, although the impacts of illegal off-road driving and horse riding are of greater concern.

#### **Horse riding**

Horse riding is a popular recreational activity within the planning area. Both recreational horse riders and commercial horse trainers use most firebreaks or internal tracks, particularly around smaller rural residential properties in the Minnipup area (see Map 2). The intensity of horse riding within the planning area decreases progressively in the southerly direction (D. Lathwell *pers. comm.*). Adverse impacts on the environment (e.g. erosion, spread of weeds, trampling of native flora and disturbance to native fauna) are occurring as a result. Horse riding may also impact on other visitors by modifying track conditions (so they are unusable for alternate recreational activities such as bushwalking) or through accidental collision, particularly if riding at speed. The lack of suitable float parking is an issue for horse riders in general. There are also issues with rubbish disposal, horse defecation and the unauthorised development of access points (eg. cutting fences), circuits/tracks and stockyards.

The management plan needs to consider whether horse riding, on both a commercial and/or recreational basis will be sustainable and whether visitor risks can be sufficiently minimised. If horse riding is permitted within the planning area, it should be managed through the designation of bridal trails.

#### **Domestic Animals**

Dogs, cats and other domestic animals (excluding horses) are generally not permitted in conservation reserves and this status quo is likely to remain. Their presence can disturb native fauna, introduce pathogens that cause disease, spread weeds or cause a nuisance to other visitors, and may themselves be at risk from fox baits. In accordance with the *Conservation and Land Management Regulations 2002*, dogs may be permitted in 'designated areas', although there are no designated areas for dog exercise within the planning area.

People are known to take their dogs into the planning area, although at present this is not a major issue. However, as urban development increases, pressure from the public to walk/exercise their dogs in the planning area may increase.

Currently public dog exercise areas exist in close proximity to the planning area at Forest Beach in Peppermint Grove Beach and along the coastline running parallel to Geographe Bay Road in Busselton between Princep Street and Freycinet Drive.

### **Scenic Driving**

Scenic driving occurs mostly along Tuart Drive and is a highly valued experience by the community.

### **Day use facilities**

There is a lack of day use facilities within the planning area. Currently the area contains two picnic sites: Layman and Membenup. Facilities have deteriorated in recent years and upgrading and/or the establishment of new day use facilities may be required during the life of this management plan.

### **Built Accommodation**

Built accommodation exists within the Ludlow settlement and is currently let out through a commercial rental agency. In the past, attempts to lease this accommodation to commercial operators for activities/uses compatible with the purpose of national park (e.g. ecotourism) have been unsuccessful (see *Management Plan Area*).

Accommodation and other facilities within the townsite require significant upgrading and ongoing maintenance and some of the facilities are also constructed using asbestos, which creates potential health issues that will need to be considered. Therefore in its current capacity, it is not a suitable option for the Department to continue with its management from a financial perspective. However, the area has since been included as a tenure proposal under the *Forest Management Plan 2004 – 2013* and it is envisaged that once the change in vesting and purpose has been implemented, more appropriate arrangements for this accommodation can be made.

### **Visitor Safety**

Visiting and enjoying the planning area can involve risks to visitors. The Department manages the risks presented to visitors by their activities in the natural, cultural and developed environments through an ongoing visitor risk program and regular risk audits of all designated recreation areas and access tracks.

Falling trees and limbs are the most significant risk to visitors in the planning area. These risks are managed by monitoring the health of trees, removing unstable or damaged limbs and providing signage about the risk in all designated recreation areas. The Plan will also need to consider the safest location for trail alignments and other visitor facilities.

Ross River Virus and Barmah Forest Virus are a health risk within the planning area. They occur in nature in transmission cycles between mosquitoes and native wildlife such as kangaroos (Shire of Busselton 2005). Mosquitoes, which transmit the viruses, breed in the adjacent Vasse-Wonnerup Estuary and take shelter in the tuart woodland where the peppermint trees dramatically reduce the wind speed, allowing them to survive for longer periods (K. Williams *pers. comm.*).

Although there is concern over the use of insecticides and its potential impact on wetland sites of high conservation value, the need to control mosquitoes to reduce the risk of viruses and extreme nuisance in nearby residential areas is also acknowledged as a high priority.

The old rifle range, located in the southern part of the planning area and the old rubbish tip and former Departmental chemical store, located within the Ludlow settlement in Reserve 868, are potential contaminated sites. Any development for visitor use and/or facilities will be diverted away from these areas to avoid any health risks.

### **Visual Landscape**

Maintaining the aesthetic appeal of the planning area is a significant issue for the management plan as the majority of visitors to the planning area are those people who choose to travel along Tuart Drive, to view the tall tuart trees of the south west.

Under the *Forest Management Plan 2004-2013*, the FPC is required to consider the impact of plantation operations on the visual quality of the landscape (particularly from Tuart Drive) and where reasonable and practicable, conduct operations in a manner that seeks to reduce its impact on visual landscape values.

Similarly, as part of the Minister for Environment's condition to mine the area in State Forest 2, Cable Sands is required to ensure the mining operations do not unduly affect visual amenity of the area (Minister for the Environment 2003). The Department will need to consider visual amenity if removal of karri and other exotic species is required within the planning area as well as plantations of tuart which currently exist in rows along Tuart Drive and may require thinning to achieve a more natural appearance (see *Species Trial Plots and Tuart Plantations*).

Any upgrading and/or widening of Tuart Drive as well as any construction of new facilities/infrastructure or upgrading of various internal roads that the Department may undertake, will need to consider potential impacts on the visual landscape values for visitors to the planning area. The rail reserve in the southern part of the planning area (see *Public Utilities and Services*) and the management of weeds are also visual landscape issues for consideration during the planning process.

## MANAGING RESOURCE USE

### ***Mining Activities***

In November 2003, the Minister for the Environment approved Cable Sands' application to mine part of State Forest 2 (147 ha) for titanium minerals (Minister for the Environment 2003). The mining lease, M 70/86, comprises 217 ha and is located within the State Forest 2 boundary between the northern and southern parts of the Tuart Forest National Park (see Map 1). Mining commenced in 2004 and is estimated to take 3-4 years to mine the deposit and a further 9 years to complete rehabilitation (until approximately 2017).

The unmined component (107 ha) will be rehabilitated by the Department using Cable Sands offset funds, which resulted from the Minister for the Environment's approval for the project. Once rehabilitation has been completed, the entire mining lease area will be added to the national park.

Other conservation offsets include:

- acquisition of 35 ha and 56 ha of land adjacent to the planning area (see *Management Plan Area*);
- rehabilitation of acquired lands, national park and State forest;
- the Australian Research Council Linkage Project investigating tuart health;
- projects that enhance tourism and visitor use; and
- community education and awareness.

(Minister for the Environment 2003)

In relation to the mining operations, Cable Sands has also committed to further conditions set by the Minister for the Environment including:

- the protection and conservation of native flora and fauna where reasonable and practicable;
- protection of the quality of groundwater and surface water for surrounding users;
- protection of Indigenous and European cultural heritage values;
- ensuring visual amenity is not adversely affected;
- future protection of conservation reserves; and
- ensuring ongoing community consultation and involvement.

(Minister for the Environment 2003)

Diversion of recreational activities away from the mine site will be necessary to ensure the safety of visitors to the planning area as well as Cable Sands and Departmental personnel (see *Visitor Access*).

There are two other mining tenements within the planning area that have not been approved and are currently pending – Balde Exploration Consultants exploration application (E 70/1512) and Iluka Midwest's mining application (M 70/739). Both areas of interest are located in the southern section of the planning area and occur over both national park and State forest tenure.

### **Public Utilities and Services**

The provision of public utilities and services, and their associated infrastructure and corridors, can result in environmental impacts to conservation areas.

The rail reserve that passes through the southern portion of the planning area, comprises three unvested reserves (41074, 11091 and 13136). As a result of its location, it creates issues relating to weed establishment, fragmentation and disturbance to the visual landscape. The underground gas pipeline that extends along the rail reserve creates issues in relation to access and maintenance. Old bridge crossings along the rail reserve are an issue for public safety.

The Department is responsible for the infrastructure and associated services (e.g. power, telephone, water and gas) to the Ludlow settlement and its tenants, which creates a significant cost. Overhead power lines to the Ludlow settlement can create hazards for arboreal mammals (particularly possum species) inhabiting the planning area. In addition, possums and falling tree limbs may occasionally cause power shortages and structural damage to the power lines. Other issues associated with overhead power lines include fragmentation, weed establishment and illegal access.

Access is also an ongoing issue for drain maintenance and can often be destructive to vegetation values within the planning area.

### **Forest Produce**

#### **Pine**

Under the *Forest Management Plan 2004 – 2013*, it is proposed that 108 ha of State forest will be reserved under the *Land Administration Act 1997* as national park, vested with the Conservation Commission and managed by the Department. Similarly, the remaining areas of State Forest 2 (which contain pine) were also recommended to become national park (see *Management Plan Area*). Consequently, the management plan will need to consider issues relating to pine removal, such as visual landscape, spread of *Armillaria luteobubalina*, restoration with native species, commercial use of any removed forest products and the protection of native fauna, as well as management of the State forest prior to gazettal as national park.

### **Species Trial Plots and Tuart Plantations**

There are several species trial plots located within the planning area that consist of both exotic and native species (karri and an eastern states eucalypt) that have previously been introduced.

The removal of some species, such as karri, may have a significant impact on some faunal values (e.g. nesting sites for the cockatoo species and arboreal mammals) and needs to be rationalised against the desire to restore the tuart forest ecosystem. A eucalypt species native to the eastern states is endangered and plots within the planning area may have some value in maintaining genetic diversity. Consequently, any removal of species in these plots will require careful consideration.

Tuart plantations exist along Tuart Drive. Their uniform planting in rows gives an unnatural appearance that may impact on visual landscape values and hence requires consideration in terms of visual amenity (see *Visual Landscape*).

### **Water Extraction**

Generally, groundwater and surface water are used to meet the requirements of town supplies and commercial use (e.g. grazing and mining). The Busselton Water Board delivers public water supplies to the town of Busselton, whilst the Water Corporation manages all other reticulated water supplies (Water Authority of Western Australia 1995). With regard to groundwater extraction, the amount allocated for licenced use and public water supply currently has little impact on water availability within the planning area.

The Capel River is the only proclaimed surface watercourse within close proximity to the planning area. The Abba and Ludlow river systems, which dissect the planning area, are not proclaimed and therefore water use cannot be accurately determined (J. Woodward *pers. comm.*).

The entire planning area falls within a proclaimed groundwater catchment (See *Catchment Protection*). Currently 7 000 KL/yr is being extracted from the superficial aquifer for domestic irrigation. Extraction from some adjoining lands has been known to affect the quality of water supplied to the Ludlow tenants (K. Williams, pers. comm.). The Yarragadee South confined aquifer has approximately 2 GL extracted, almost all of which, is allocated to Cable Sands for the mining lease. This licence expires in December 2008.

#### **Proposed water abstraction**

The Water Corporation is currently proposing to abstract a further 45 GL/yr from the Southwest Yarragadee aquifer and pipe it to Harvey where it will be integrated into the *Integrated Water Supply Scheme (IWSS)*. Although none of the proposed water abstraction bores or associated infrastructure are located nearby, implications may arise in relation to water availability within the planning area. More specifically, increased drawdown, creating a general lowering of the watertable and changes in discharge/recharge dynamics, are potential impacts for other users as well as groundwater dependant ecosystems (GDEs). GDEs in particular are most likely to be potentially impacted by alterations in the quality, quantity, seasonal patterns and trends of the Yarragadee aquifer due to water abstraction.

A proposal has been referred to the Environmental Protection Authority for assessment under the *Environmental Protection Act, 1986*, the Water and Rivers Commission as part of the water licensing process and the Sustainability Panel for consideration as part of the sustainability assessment.

## **INVOLVING THE COMMUNITY**

### ***Visitor Information and Interpretation***

There is little visitor information and interpretation available within the planning area. The State Government has committed to the allocation of funding for visitor and tourism facilities as part of the offsets from Cable Sands mining operations within the planning area (see *Mining Activities*). Community consultation (including consultation with Traditional Owners in relation to Indigenous heritage) will be integral in interpreting heritage values.

### ***Working with the Community***

Public interest in the area is extremely high indicating the need for a range of opportunities for public participation.

As part of its ongoing commitment to engage the community in land management and conservation, the Department will establish the Tuart Forest National Park Community Advisory Committee, with involvement from the Conservation Commission, to assist it with the development of this management plan. Comments will also be sought from the community on the release of the draft management plan for public comment. It is anticipated that further opportunities for public involvement will arise throughout the planning process.

Other related community involvement processes are:

- the Minister for the Environment's Tuart Response Group that provides Government and community based oversight of the conservation and management of all tuart woodlands of the Swan Coastal Plain;
- a Ludlow subcommittee of the Tuart Response Group that functions to provide expert consultative advice on the tuart conservation initiatives funded through the Cable Sands offsets following approval to proceed with mining; and
- the Ludlow Working Party that reports to the Minister for the Environment and functions to provide advice on sand mining compliance in the planning area.



## References

CALM (1999) *Environmental Weed Strategy for Western Australia*, Department of Conservation and Land Management, Perth, Western Australia.

Clay, R. and Majer, J. (2001) *Flooded Gum (Eucalyptus rudis) Decline in the Perth Metropolitan Area: A Preliminary Assessment*, Curtin University of Technology, School of Environmental Biology, Perth, Western Australia.

Department of Environment and Heritage (2003) *National Wetlands Database*, <http://www.deh.gov.au/cgi-bin/wetlands/report.pl> Accessed April 2006.

Department of Environment and Heritage (2004) *Chytridiomycosis (amphibian chytrid fungus disease)*. Department of Environment and Heritage, Canberra, ACT.

EPA (1993) *Red Book Status Report (1993) on the implementation of conservation reserves for Western Australia* Environmental Protection Authority, Perth, Western Australia.

Forests Department of Western Australia (1979) *Ludlow Tuart Forest Working Plan 1979 – 1985*. Forests Department of Western Australia, Perth, Western Australia.

Government of Western Australia (2002) *Status Report: Tuart Conservation and Protection*. Prepared by the Department of Conservation and Land Management for the Tuart Response Group.

Government of Western Australia (2003) *Indigenous Ownership and Joint Management of Conservation Lands in Western Australia*. Consultation paper.

Heritage and Conservation Professionals (2004) *Ludlow Forestry Settlement, Ludlow Road, Ludlow, Heritage Assessment*. Prepared for the Department of Housing and Works on behalf of Department of Conservation and Land Management, Perth, Western Australia

Hopkins, A. J. M., Coker, J., Beeston, G. R., Bowan, P., and Harvey, J. M. (1996) *Conservation status of vegetation types throughout Western Australia: Final Report*. Australian Nature Conservation Agency National Reserves System Co-operative Research Program.

Keighery, G.J. and Keighery, B.J. (2002) *Floristics of the Tuart Forest Reserve*. In: *Tuart (Eucalyptus gomphocephala) and tuart communities*. Wildflower Society of Western Australia (Inc.).

Minister for the Environment (2003) *Statement that a proposal may be implemented (Pursuant to the provisions of the Environmental Protection Act 1986) – Ludlow Titanium Minerals Mine, 34 kilometres south of Bunbury, Shire of Capel* Statement No. 000639.

Pen, L. (1997) *A systematic overview of environmental values of the wetlands, rivers and estuaries of the Busselton-Walpole region*. Water and Rivers Commission, Perth, Western Australia.

Shearer, B.L. (1994) *The major plant pathogens occurring in native ecosystems of south-west Australia*. In: Withers, P.C., Cowling, W.A. and Wills, R.T. (eds). *Plant Diseases in Ecosystems: Threats and impacts in south-western Australia*. J. Roy. Soc. of WA 77: 113-122

Shire of Busselton (2005) *Mosquito Control Minimisation Strategy*, Shire of Busselton, Busselton, Western Australia.

WAPC (2005) *Busselton Wetlands Conservation Strategy*, Western Australian Planning Commission, Western Australia.

Water Authority of Western Australia (1995) *Busselton-Capel Groundwater Area Management Plan* Water Authority of Western Australia, Perth, Western Australia.

Weaving, Sarah (1998) *Geographe Bay Catchment Natural Resource Atlas*, Geographe Catchment Council, Western Australia.

### Map 1

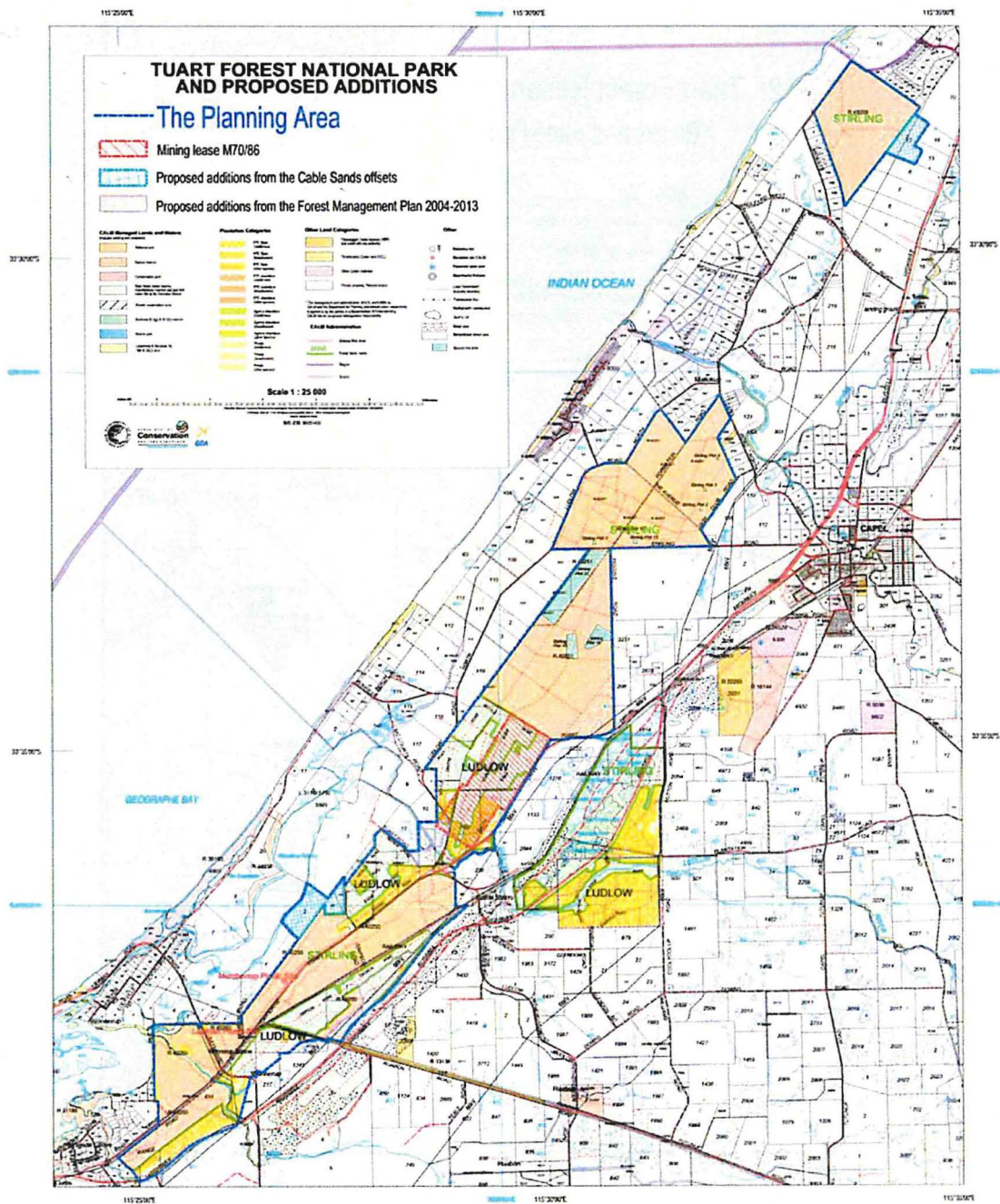


Figure 1: The planning area for Tuart Forest National Park Management Plan.

## Map 2

Tuart (*Eucalyptus gomphocephala*) and Tuart Communities: Floristics of the Tuart Forest Reserve  
GJ Keighery & BJ Keighery

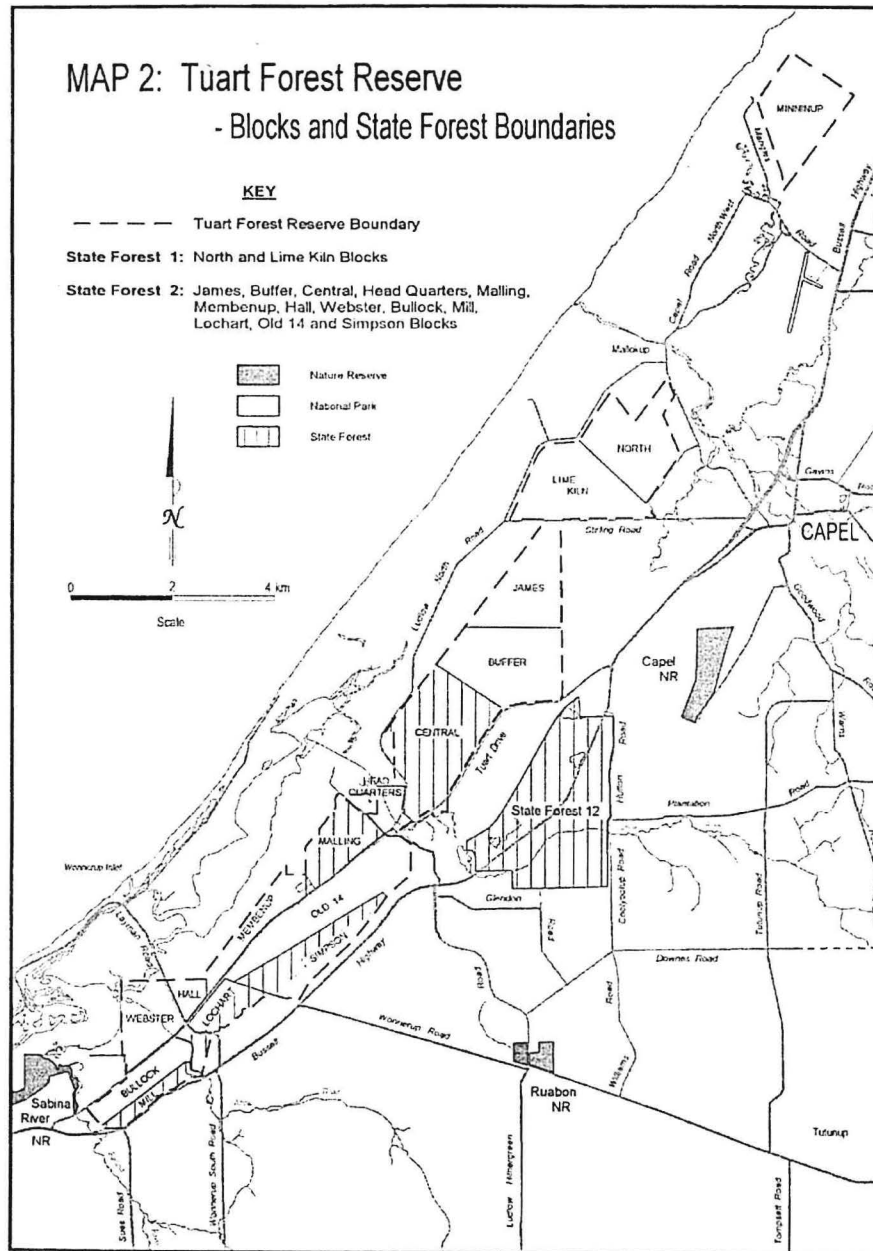


Figure 2: The planning area for Tuart Forest National Park Management Plan displaying the names of the blocks (Keighery and Keighery 2002).