Corymbia calophylla - Xanthorrhoea preissii **woodlands and shrublands** (Swan Coastal Plain Community type 3c - Gibson *et al.* 1994)

INTERIM RECOVERY PLAN 2000-2003

by
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Photo: Val English

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DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

Natural Heritage Trust
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FOREWORD

Interim Recovery Plans (IRPs) are developed within the framework laid down in Department of Conservation and Land Management (CALM) Policy Statements Nos 44 and 50

IRPs outline the recovery actions that are required to urgently address those threatening processes most affecting the ongoing survival of threatened taxa or ecological communities, and begin the recovery process.

CALM is committed to ensuring that Critically Endangered ecological communities are conserved through the preparation and implementation of Recovery Plans or Interim Recovery Plans and by ensuring that conservation action commences as soon as possible and always within one year of endorsement of that rank by CALM's Director of Nature Conservation.

This Interim Recovery Plan will operate from 31January 2000 but will remain in force until withdrawn or replaced. It is intended that, if the ecological community is still ranked Critically Endangered, this IRP will be replaced by a full Recovery Plan after three years.

The provision of funds identified in this Interim Recovery Plan is dependent on budgetary and other constraints affecting CALM, as well as the need to address other priorities.

Information in this IRP was accurate at January 2000.

SUMMARY

Name: *Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands

Description: Plant community located on heavy soils of the eastern side of the Swan Coastal Plain between Bullsbrook, and Waterloo near Bunbury. Dominant species in the community are the trees *Corymbia calophylla* and occasionally *Eucalyptus wandoo*; the shrubs *Xanthorrhoea preissii*, *Acacia pulchella*, *Dryandra nivea*, *Gompholobium marginatum*, and *Hypocalymma angustifolia* and the herbs *Burchardia umbellata*, *Cyathochaeta avenacea* and *Neurachne allopecuroidea* (Gibson *et al.* 1994). The introduced species *Briza maxima* and *Romulea rosea* are also common.

CALM Region(s): Swan, Central Forest

CALM District(s): Perth, Mundaring, Mornington

Shire(s): Swan, Serpentine-Jarrahdale, Waroona, Dardanup

Recovery Team: To be established. The team will be chaired by a CALM Swan Region representative. The Recovery Team will report annually to CALM's Corporate Executive.

Current status: Assessed 21 November 1995 as Critically Endangered

Habitat requirements: Marri (*Corymbia calophylla*) dominated plant communities were probably some of the most common on heavy soils on the eastern side of the Swan Coastal Plain (Keighery and Trudgen 1992; Gibson *et al.* 1994). Gibson *et al.* (1994) recognised three distinct communities in this group. The floristic composition of these communities varies with rainfall, with the *Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands occurring on the driest of the sites.

IRP Objective(s): To maintain or improve the overall condition of the plant community in the known locations and reduce the severity of threat, with the aim of reclassifying it from Critically Endangered to Endangered.

Criteria for success:

- An increase in the area of this community under conservation management.
- Maintenance in terms of diversity and basic composition of native species (as described by Gibson *et al.* 1994) as well as hydrological and biological processes, taking account of natural change of the community over time.
- Improvement in terms of reduction of numbers of exotic species and of other threatening processes as defined in this document.

Criterion for failure: Significant loss of area or further modification of occurrences of the threatened ecological community.

Summary of Recovery Actions:

1. Establish Recovery Team	14. Alter purpose of reserve 23953
2. Liaison with landholders, management bodies and managers	15. Implement drainage strategy
3. Clarify and monitor boundaries	16. Control rabbits
4. Disseminate information	17. Place care, control and management of Occurrence 5 in Shire
5. Install markers	18. Place care, control and management of UCL in NPNCA
6. Develop fire management strategy	19. Monitor flora
7. Implement fire management strategy, implement dieback hygiene	20. Monitor weed populations
8. Implement weed control	21. Monitor for dieback

9. Fence occurrences	22. Replant / rehabilitate
10. Transfer management of occurrences if necessary	23. Assess hydrological information
11. Develop Management Plans	24. Conduct research (cost to be determined)
12. Amalgamate unallocated Crown land (Swan Locations 11314 and 11764), and reserve 6955 if necessary, with reserve 23953	25. Report on management strategies
13. Negotiate land swaps for reserve 6955	

1. BACKGROUND

1.1 History, defining characteristics of ecological community, conservation significance and status

A series of Marri (*Corymbia calophylla*) dominated plant communities occur on heavy soils between Waterloo (near Bunbury) and Bullsbrook. These vegetation associations are considered to have been some of the most extensive types on the eastern side of the Swan Coastal Plain, but have suffered extensive clearing and are now regionally rare (Keighery and Trudgen 1992; Department of Environmental Protection 1996; Gibson *et al.* 1994). The dominant species in the overstorey vary between the three community types recognised by Gibson *et al.* (1994). The wettest sites are dominated by *Corymbia calophylla* and *Kingia australis*; the intermediate type by *Corymbia calophylla* and *Eucalyptus marginata*; and the driest type (this one) is dominated by *Corymbia calophylla* and *Xanthorrhoea preissii*. The driest community is associated with the lowest species richness. The wettest type is also critically endangered, and the intermediate group is vulnerable.

Seven occurrences of the *Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands have been located through extensive survey of the southern Swan Coastal Plain that involved compilation and analysis of data from over 1,100 plots (Keighery and Trudgen 1992; Gibson *et al.* 1994; Department of Environmental Protection 1996). All of the occurrences within the area considered under Perth's Bushplan that contain the community are included in the Perth's Bushplan document (State of Western Australia 1998). This document provides that any proposals likely to affect occurrences of threatened ecological communities will be dealt with through the Bushplan process, coordinated between the Department of Environmental Protection, Ministry for Planning, CALM and the Water and Rivers Commision. The aim of Bushplan is to protect sites listed within the Bushplan document (State of Western Australia 1998).

There are only approximately 43 ha of the community remaining. Of this, about four hectares occur on land managed by the Commonwealth, 27 hectares are on lands managed by Shire Councils, ten hectares are in reserves not placed in any management body or on unallocated Crown land, and about 0.3 hectares occur in a nature reserve. Some recently recognised additional occurrences of the community are included in Perth's Bushplan (State of Western Australia 1998) but are not considered in this IRP. These will be assessed as part of the implementation of this plan.

Dominant species (as per Gibson *et al.* 1994) are the trees *Corymbia calophylla*, and occasionally *Eucalyptus wandoo*; the shrubs *Xanthorrhoea preissii*, *Acacia pulchella*, *Dryandra nivea*, *Gompholobium marginatum*, and *Hypocalymma angustifolia;* and the herbs *Burchardia umbellata*, *Cyathochaeta avenacea* and *Neurachne allopecuroidea.* The introduced species *Briza maxima* and *Romulea rosea* are also common, but weed levels in most occurrences are currently quite low. A full list of taxa that occur in at least 50% of the plots in the community is at Appendix 1.

The most significant threat to the community is clearing, as only 0.3 hectares of the type occurs in a secure conservation reserve and a third of the total area of the community remaining is unvested or on unallocated Crown land. Recreation reserve 23953, vested in the Shire of Swan that contains Occurrence 3 (refer Section 1.2 for descriptions of locations) is, however, managed mainly for conservation and recreation.

Dieback caused by *Phytophthora* species is not recorded from occurrences of the community, but may be present.

Too frequent fire is another major threat to the community. Fires have occurred recently in the occurrences at the reserve on Talbot Road, Stratton and at Waterloo (Occurrences 3 and 7 respectively, see Table 1).

The only occurrence located in the publicly-owned conservation estate is at Ellen Brook Nature Reserve. This area is currently managed primarily for the Western Swamp Tortoise (Burbidge and Kuchling 1994). A number of management actions undertaken for the tortoise will also aid the conservation of plant communities (refer Section 1.2).

Several occurrences (Occurrences 1, 3 and 4; refer Table 1 below) are surrounded by highly urbanised areas. The frequency of fires, impact of recreational activities and incidence of illegal rubbish dumping and wood cutting are generally increased in urban zones. These factors can all lead to degradation of plant communities through increasing weed invasion and alteration of structure, species composition or loss of component taxa.

Although the occurrences are on the driest sites occupied by Marri communities on the Swan Coastal Plain, Occurrences 1, 2, 5, 6 and 7 occur on very low lying land. This may predispose the sites to the impacts of hydrological changes such as increasing inundation and salinisation as a consequence of clearing or urbanisation of the catchment.

Table 1: Extent and location of occurrences (from north to south)

Occurrence Number	Location	Land Tenure	Estimated area
Occurrence 1	Bullsbrook; Pearce Airforce Base	Commonwealth of Australia - Department of Defence	4 ha
Occurrence 2	Ellen Brook Nature Reserve 27620; Great Northern Hwy, Upper Swan	National Parks and Nature Conservation Authority (NPNCA)	0.3 ha
Occurrence 3	Reserve 23953 - Talbot Road, Stratton	Shire of Swan	27 ha (area estimated from Keighery and Keighery 1993)
Occurrence 4	Swan Location 11764; Middle Swan Cemetery reserve 6955; Middle Swan	Unallocated Crown land Metropolitan Cemeteries Board	3.5 ha (areas estimated from Keighery and Keighery 1993) 0.5 ha
Occurrence 5	Reserve 23793 and Part Lot 101/3 (Plan 3950); Duck Pond Road Peel Estate	Not placed in any management body	3.6 ha
Occurrence 6	Reserve 22215; Yarloop	Shire of Waroona	0.5 ha
Occurrence 7	Reserve 23376; Waterloo	Not placed in any management body	4 ha

1.2 Description of Occurrences

Wandoo dominates in the overstorey in Occurrence 1. This occurrence is located on land managed by the Commonwealth Department of Defence. Buildings owned by the Department of Defence occur to the west of the site on the opposite side of Great Northern Highway, and suburban housing occurs to the north and south of the remnant adjacent to the roads that surround the remnant. The approximately triangular remnant containing the community covers about 21 hectares. Great Northern Highway is immediately adjacent to the west, Chittering Road to the east, and local roads occur to the north and south of the remnant. Litter, including garden waste that increases weed invasion, is deposited into the remnant from surrounding urban areas.

Occurrence 2 is located within a Nature Reserve that is managed primarily for the conservation of the threatened fauna species, the Western Swamp Tortoise *Pseudemydura umbrina* (Burbidge and Kuchling 1994). This reserve also contains the community 'herb rich shrublands in clay pans' (community type 8 as described by Gibson *et al.* 1994) that has been assessed as vulnerable (English and Blyth 1997). Specific land management practices described in the Recovery Plan for the tortoise are likely to also aid the conservation of the threatened plant communities in the reserve. Actions such as fencing to prevent fox reinvasion, removal of the drain that channels storm water into the reserve, and prevention of wildfires

wherever possible are likely to aid the recovery of plant communities in the reserve. Fencing is likely to prevent degradation from overuse by recreational users. Minimising the frequency of fires and the flow of nutrients from drains would help prevent weed invasion and probably help maintain species composition.

Highly invasive weeds occur very close to or within the critically endangered plant community in the reserve. The use of herbicides to eradicate these weeds, taking care not to impact the tortoise or its food animals, is likely to be a necessary part of the management of the critically endangered and the vulnerable plant communities in this reserve.

Occurrence 3 is located in Talbot Road Recreation reserve 23953. This reserve, covering about 67 hectares, is between Talbot Road to the east and Stratton Boulevard to the west. The remainder of the reserve contains another ecological community type also assessed as critically endangered (English and Blyth 1997). This community type was described as 'eastern shrublands and woodlands' (type 20c) by Gibson *et al.* (1994).

Unallocated Crown land (Swan Location 11314) occurs along the south-west boundary of reserve 23953, with O'Connor Road and housing occurring adjacent to the remainder of the southern boundary. Cemetery reserve 6955 occurs to the south of the unallocated Crown land. Another section of unallocated Crown land (Swan Location 11764) lies adjacent to the south eastern boundary of the cemetery reserve. All of these areas are contiguous, and contain areas of the other critically endangered community, type 20c (Gibson *et al.* 1994). The entire remnant consisting of four separate areas of land tenure is referred to as 'Talbot Road bushland'. Other minor reserves including a compensation basin, and other drainage areas managed by the Water Corporation, and an unused road reserve managed by the Shire of Swan, also occur within the Talbot Road bushland. Another contiguous area of remnant vegetation occurs on Homeswest land to the north of reserve 23953 in an area that is planned for development.

The Talbot Road recreation reserve, and the remainder of this remnant is heavily utilised by walkers for recreation. Not all of the boundaries of reserve 23953 are fenced. The reserve has been frequently burnt by illegally lit fires in the last five years. Occurrence 3 also contains the Priority 3 taxa (see Glossary for definitions of terms) *Synaphea acutiloba* and *Synaphea pinnata.* (Gibson *et al.* 1994). The Priority flora *Isopogon drummondii* (Priority three), *Lambertia multiflora* var *darlingensis* ms (Priority three), and *Thysanotus glaucus* (Priority 4) occur within community type 20c in the Talbot Road bushland (Gibson *et al.* 1994). Keighery and Keighery (1993) have recorded a total of 366 native plant taxa in Talbot Road bushland.

Occurrence 4 is located in the southern most parcel of unallocated Crown land and in the adjacent Cemetery reserve within Talbot Road bushland (Gibson *et al*. 1994; Keighery and Keighery 1993). Blanchard Road occurs to the south with houses on the opposite side of the road. Houses also occur to the east and north, and an old disused gravel pit that is rehabilitating naturally is to the west side of this remnant. The Priority 3 taxa (see Glossary) - *Hakea myrtoides* and *Synaphea acutiloba* occur within this occurrence.

Occurrence 5, the Duck Pond Road site in Peel Estate, is surrounded by roads. Mundijong Road is to the south and Duck Pond Road and the old Mundijong Road alignment to the north, with cleared agricultural lands on the opposite side of each road. This community occupies most of the remnant between the two roads. Another community identified by Gibson *et al.* (1994) 'dense shrublands on clay flats' (type 9) that has been assessed as vulnerable (English and Blyth 1997) occupies the remainder. Part of community 3c occurs in an unvested reserve, with the remainder on unallocated Crown land. The Shire of Serpentine - Jarrahdale manages the whole remnant, as well as the adjacent roadside remnant on Mundijong Road. One species of Declared Rare Flora (see Glossary for definitions) and *Acacia lasiocarpha* var. *bracteata* (Priority 1) also occur within the Duck Pond Road remnant (Keighery 1996; Keighery *et al*. 1997).

The areas of remnant vegetation on the road verges along Mundijong Road between the Duck Pond Road occurrence and Webb Road to the east are extremely important as they represent one of only two remaining linear remnants that span the alluvial soils of the southern Swan Coastal Plain. The other remnant of this type occurs on the Wonnerup-Tutunup Road in Busselton. The catena of plant communities that spanned the southern Swan Coastal Plain is only represented in these two areas (Gibson *et al.* 1994).

Keighery (1996) provides a detailed treatment of the conservation values and management guidelines for roadside remnants on Mundijong Road.

Occurrence 6 at Yarloop is within a four hectare remnant in a Drainage and Camping reserve. However, the community only covers a small proportion of the reserve, with the remainder being a vulnerable community type (English and Blyth 1997). This other type is termed 'dense shrublands on clay flats' - type 9 as defined by Gibson *et al.* (1994). South Western Highway is to the west of the remnant, with cleared farmlands to the north and east, and an area of pines on private land to the south.

Occurrence 7 occupies most of the northern portion of an unmanaged Government Requirements reserve that covers a total of almost eight hectares. The remainder of the reserve contains another two community types identified by Gibson *et al.* (1994). 'Herb rich shrublands in clay pans' (type 8) has been assessed as vulnerable (English and Blyth 1997), and 'deeper wetlands on heavy soils' (type 13) is likely to be lower risk as defined by English and Blyth (1997). This reserve was burnt in early 1997 in a series of fires caused by a train passing on the adjacent rail line. The reserve is a long narrow remnant, sandwiched between South Western Highway to the north and the rail line to the south. A Declared Rare Flora taxon occurs in the reserve adjacent to the rail line. A weed-infested drain divides the reserve east-west. Much of the area of the deeper wetlands in the reserve is infested with the invasive weed *Watsonia*.

Data on all of the above occurrences of threatened ecological communities are held in the threatened ecological community (TEC)database at CALM, at the Wildlife Research Centre, Woodvale.

Some additional occurrences of several threatened ecological communities, including type 3c, have been identified recently. This has occurred during the integrated process of updating the 'System 6' Conservation Through Reserves System Recommendations and the Ministry for Planning Urban Bushland Strategic Plan, resulting in Perth's Bushplan (State of Western Australia 1998). Most of these newly found occurrences are small and/or degraded (B. Keighery[1] personal communication) and additional information is required to enter them on the TEC database. All occurrences of threatened ecological communities are a focus for protection in Perth's Bushplan document (State of Western Australia 1998).

1.3 Biological and ecological characteristics

This community occurs on the driest of the soils, and the lowest rainfall sites of the group of Marri dominated communities that occur on the heavy soils on the eastern side of the Swan Coastal Plain (Gibson *et al.* 1994). Soils on which the community occurs are still relatively wet, however.

Plant taxa that commonly occur in the community are listed at Appendix 1. The mean species richness for the ten plots in the community is 48 species in 100 square metres (Gibson *et al.* 1994). An average of six weed species were recorded per plot, which is higher than in the two other Marri dominated communities in the group, but is still relatively low.

Occurrences 1, 2, 5, 6, and 7 all occur on the Guildford Unit of the Fluviatile Deposit group as mapped by Churchward and McArthur (1980). The soils are otherwise known as the Guildford clays. This Unit is described as "Flat Plain with medium textured deposits; yellow older duplex soils" (Churchward and McArthur 1980).

Occurrences 3 and 4 occur on or near the junction of the Guildford Unit and the Forrestfield Unit (Churchward and McArthur 1980). The Forrestfield Unit of the Ridge Hill Shelf group is described by them as "laterised foothills of the Darling Scarp characterised by gravelly and sandy spurs".

1.4 Hydrology

Hydrological data on this community are limited. Available data are derived from the personal observations of those who have surveyed the plant community (Gibson *et al.* 1994; Department of Environmental Protection 1996), and from information in reports such as Davidson (1995).

The hydrology of specific areas of the eastern side of the Swan Coastal Plain has been altered through the construction of drains to lower the watertable (Keighery and Trudgen 1992). Despite a likely increase in

[1] Bronwen Keighery, Department of Environmental Protection, 141 St Georges Terrace, Perth, 6000

recharge due to clearing and urbanisation, drainage has probably resulted in an overall lowering of the watertable in localised areas (B. Keighery Personal communication.). Altered periods or depths of ponding may affect the timing of growth of herbs in the understorey, and may also affect the composition of the community by favouring different plant species.

Occurrences frequently become inundated in the wetter months due to rainfall and surface flows as the community occurs mainly on soils that contain a clay layer that is quite impervious. In some areas groundwater is very close to the surface. On Duck Pond Road (Occurrence 5) for example, groundwater is 0-3 metres below the surface at the end of spring (Davidson 1995). Surface waters may link to groundwater in the wetter months at such sites and may influence the quantity and quality of water on the surface of the sites at this time of the year.

Levels of between 1,500 and 2,000 milligrams per litre total dissolved salts (mg/L TDS) have been recorded for the shallow Leederville aquifer in the area of Occurrence 5 (Davidson 1995). In such areas, Guildford Clay soils inhibit the infiltration of rainfall and cause concentration of salts by evaporation (Davidson 1995). Apart from Occurrence 5, none of the occurrences of this community is included in areas studied in Davidson (1995). Some sites are very close to that study area, however, and water quality and groundwater levels can be extrapolated. The salinity level in Occurrences 1, 2, 3, 4 and 5 is likely to be between 500 and 1,000 mg/L TDS. The depth to groundwater in Occurrences 1, 3 and 4 is likely to be greater than 12 metres, whereas it is likely to be 0 to 3 metres in Occurrence 2 (Ellen Brook Nature Reserve). The water level and quality in Occurrences 6 and 7 are not known.

Where the shallow aquifers are saline and groundwater is in contact with the surface in winter, clearing, and particularly urbanisation, have the potential to increase the depth or period of ponding. Evaporation of a greater volume of water may then increase surface salinisation. Occurrence 5 in particular may be under threat from such processes. Water quality and levels in Ellen Brook Nature Reserve (occurrence 3) are currently monitored as part of the Recovery Plan for the Western Swamp Tortoise (Burbidge and Kuchling 1994), and any required remedial actions would be identified through this program. Development around the Nature Reserve is proposed to be controlled through the development of an Environment Protection Policy by the Environmental Protection Authority.

1.5 Threatening processes

Clearing

Clearing for agriculture has been extensive on the heavy soils on the eastern side of the Swan Coastal Plain - with some 97% of all vegetation in the area cleared historically (Keighery and Trudgen 1992; CALM 1990). The Marri dominated communities on these heavy soils were probably some of the most common on this portion of the plain but are now very rare and are likely to be at least 90% cleared (Gibson *et al.* 1994). Future proposals to clear are more likely to be associated with developments for housing, roads, or industry. If proposed developments are likely to affect occurrences of threatened ecological communities they will require assessment under the Bushplan process (State of Western Australia 1998).

One of the occurrences in Middle Swan (Occurrence 4) appears to have been partially cleared and gravel extracted from the site. Other areas of the community were probably cleared historically for gravel extraction or other uses, and have been grazed or otherwise disturbed since and have not regenerated. Most occurrences are surrounded by cleared land.

Altered fire regimes

Fires are likely to have a significant effect on the vegetation composition in Mediterranean ecosystems (Gill *et al.* 1981). It is also likely that the fire regime in the remnants containing the occurrences has been modified since European settlement to more frequent fires, especially hot burns. Talbot Road bushland, which contains Occurrences 3 and 4, is frequently burnt by vandals, and Occurrence 7 was burnt by wildfire in November 1997.

These Mediterranean ecosystems would be adapted to fire and indeed may require a particular fire regime to assist regeneration. If an appropriate frequency of fires is exceeded however, species that are obligate seeders may not have sufficient time to flower and produce seed. If the time between fires is too long, obligate seeders may become senescent and unable to regenerate. Therefore, fires must occur at appropriate intervals and possibly at the appropriate season and intensity to maintain the integrity of plant communities.

Disturbance events such as fire increase weed invasion, especially in small remnants, as discussed below. The risk of fire is also generally increased by the presence of grassy weeds in the understorey, as they are likely to be more flammable than many of the original native species in the herb layer.

Weed invasion

Weed invasion is usually enhanced by disturbances such as fires and grazing if weed propagules are present. All of the occurrences of this community are close to weed sources such as urban or agricultural areas and would be vulnerable to weed invasion following any disturbance. Small remnants often exhibit surprising resistance to weed invasion particularly if left undisturbed, however (Keighery 1996). In this community, this relates to the density of cover, seasonal inundation and the hardness of the soils in summer, and alteration of any of these factors reduces the ability to resist weed invasion (Keighery 1996).

There are tracks through most occurrences of the community. Weeds have invaded to varying extents along these tracks and such areas should be considered priority areas for weed control. In particular, piles of soil scraped from tracks generally contain high concentrations of weeds and act as a source of weed invasion. Such piles should be avoided when tracks are cleared, or be removed where they already exist.

A weed control program would be necessary to maintain or improve the condition of occurrences of the community in the long term. Panetta and Hopkins (1991) state that the aims of weed control are to maintain the pre-invasion condition of the habitat (prevention); control or arrest ongoing weed invasion (intervention); and reverse the degraded condition of the habitat where applicable (rehabilitation). A weed control program would involve the following steps (adapted from Panetta and Hopkins 1991):

1. Accurately mapping the boundaries of weed populations
2. Selecting an appropriate herbicide or other method of weed control after determining which weeds are present
3. Controlling weeds that pose the greatest threat to the community in the early stages of invasion where possible, eg invasive perennial grasses
4. Rehabilitation through reintroduction of local native species where areas are no longer capable of regenerating following weed control.

Introduction of Disease

Dieback caused by *Phytophthora* species has the potential to impact the community, although it is not known if this vegetation type is susceptible to the disease. Plant communities on heavy soils such as those associated with this community, especially in relatively flat areas, are generally not highly susceptible to dieback disease (Helyar 1994). Occurrences have not been tested for the presence of dieback and risk of introduction of disease should therefore be minimised by ensuring good hygiene procedures. This would involve washdown of any equipment used adjacent to the community, and restricting access by vehicles and machinery to dry soil conditions.

Hydrological changes

Increased clearing would be expected to result in increased runoff and an increase in recharge to the groundwater table, while on the other hand uncontrolled extraction from irrigation bores may lower groundwater levels, especially in summer. Altered periods or depths of ponding may affect the timing of growth of herbs in the understorey, and may also effect the species composition of the community by favouring different plant species.

Salinisation and Inundation

Salinisation may increase as a result of evaporation of increased volumes of surface water, especially where saline superficial aquifers are in contact with the surface. This is especially true for clay soils, which inhibit rainfall infiltration and result in high evaporation rates and concentration of salts (Davidson 1995).

The groundwater and salinity levels in occurrences of the community that are at risk (Occurrence 5 in particular) should be monitored to determine if salinisation or increased inundation pose a major threat to the community. Remedial actions such as replanting with deep rooted vegetation in strategic parts of the catchment may be necessary if monitoring indicates increased salinisation or inundation are a problem.

Grazing

Grazing of plant communities causes alteration to the species composition, both in the selective grazing of edible species, and in the introduction of weeds as a result of trampling and general disturbance. It is not known if occurrences of the community have been grazed historically, however, weed invasion in some of the remnants containing the type indicates they may have been grazed (Occurrences 1, 2, 5 and 6).

Erosion by wind and water

Erosion by wind and water may also occur following removal of vegetation by clearing, grazing or fire, but may not be significant for this community, which is located on heavy soils. Some erosion of soil occurs as a consequence of the drain through Talbot Road bushland (Occurrence 3).

1.6 Conservation status

The community meets criterion B (ii) as follows, for Critically Endangered (CR) (English and Blyth 1997):

Current distribution is limited and there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes

1.7 Strategy for recovery

To identify, and influence the management of, the areas in which the community occurs, so maintaining natural biological and non biological attributes of the sites and the current area covered by the community.

To conduct appropriate research into the ecological characteristics of the community to develop further understanding about the management actions required to maintain or improve its condition.

2. RECOVERY AIM AND CRITERIA

2.1 To maintain or improve the overall condition of the *Corymbia calophylla* - *Xanthorrhoea preissii* woodland and shrublands and reduce the level of threat with the aim of reclassifying it from Critically Endangered to Endangered.

2.2.1 Criteria for success

- An increase in the area, and number of occurrences of this community under conservation management.
- Maintenance in terms of diversity and basic composition of native species (as described in Gibson *et al.* 1994) as well as hydrological and biological processes, taking account of natural change of the community over time.
- Improvement in terms of reduction of numbers of exotic species and of other threatening processes as defined above.

2.2.2 Criterion for failure

Significant loss of area or further modification of occurrences of the threatened ecological community.

3 RECOVERY ACTIONS

The responsible authority is frequently listed as the relevant CALM District. This refers largely to initiating and guiding actions. However, in general the relevant CALM District, in cooperation with the Western Australian Threatened Species and Communities Unit (WATSCU) and the Recovery Team has the primary responsibility for securing funds for recovery actions.

Note 1. The conservation actions conducted under the Western Swamp Tortoise Recovery Plan (Burbidge and Kuchling 1994) will be significant in implementation of management actions for Occurrence 2 (Ellen Brook Nature Reserve).

Note 2. Wherever applicable, the detailed conservation actions listed in the Management Plan for Talbot Road bushland (Safstrom and Taman 1999) will be adopted for Occurrences 3 and 4.

3.1 Establish a Recovery Team

Responsibility: WATSCU
Cost: $0 (the small cost of attendance at meetings is expected to be covered by Recovery Team members)
Completion date: Year 1

3.2 Liaise with current management bodies, owners, land managers and other interested groups to implement recommendations held in this IRP

All but one of the occurrences of the community are managed by authorities other than CALM, or are not placed with a management body. The involvement of management bodies, land managers, local community groups and industry in the recovery of the community wherever possible and practical is therefore essential to the recovery process.

The involvement of the Biodiversity Group of Environment Australia and the Northern Swan Landcare Group as well as the Commonwealth Department of Defence should be sought on management of Occurrence 1. The Friends of Talbot Road, Blackadder-Woodbridge Creek Catchment Group and the local Nyoongar people should be consulted on management of Occurrences 3 and 4. The unvested remnant on Mundijong Road is managed by the Shire of Serpentine-Jarrahdale in association with the Roadside Care Volunteers and Serpentine-Jarrahdale Landcare Group. The groups received a Bushcare grant to implement management. Other stakeholders should be consulted on management of the community as they are identified.

Responsibility: CALM (Perth, Mundaring and Mornington Districts; WATSCU)
Cost: $1,500 p.a. for all liaison (not including vehicle costs)
Completion date: Ongoing

3.3 Clarify and continue to monitor the extent and boundaries of all known occurrences of the community

Other occurrences of this community are identified in Perth's Bushplan (State of Western Australia 1998). The boundaries of these occurrences, and any others identified in future, will be determined.

Occurrences should be monitored every two years. Boundaries can be determined from current aerial photographs and minimal onsite checking. This information should be added to the threatened ecological community database as recommended in English and Blyth (1997). English and Blyth (1997) also recommend the establishment of a Geographic Information System database for information on threatened ecological communities. When this is available, boundary information should be included.

The boundaries of Occurrences 1, 2 and 5 need to be accurately mapped, (Occurrences 6 and 7 were mapped in February/March 1999), but the community is considered to have been well searched for (Keighery and Trudgen 1992; Gibson *et al.* 1994; DEP 1996).

Responsibility: CALM, (Perth, Mundaring and Mornington Districts; WATSCU)
Cost: $1,000 p.a.
Completion date: Occurrences 6 and 7 were accurately mapped in Feb/March 1999. Ongoing

3.4 Determine management requirements of any other identified occurrences

The management requirements of the additional occurrence of the community as listed in Perth's Bushplan (State of Western Australia 1998) and any others identified in future will be determined.

Responsibility: CALM (Regions; WATSCU)
Cost: Costs of all liaison included in 3.2
Completion date: Ongoing.

3.5 Disseminate information about the community

To prevent accidental destruction of the community, and gain public support for its conservation it is recommended that information about the community be provided by local CALM staff to all stakeholders including management bodies, landholders, and managers of land containing the community. This would include information from the threatened ecological community database, and maps indicating the location of the community. This action is recommended in English and Blyth (1997).

Local CALM staff should ensure regular liaison with landowners and managers of land containing the community to ensure threatened ecological community information is up to date.

A publicity campaign utilising signs, local media and poster displays in prominent areas should be undertaken to encourage awareness about this threatened ecological community.

Responsibility: CALM (Corporate Relations Division; Perth, Mundaring, and Mornington Districts; WATSCU)
Cost: $1,500 in Year 1, $500 in Year 2
Completion date: Ongoing

3.5 Install markers to indicate the locations of occurrences of the community alongside tracks, fire-breaks or roads

CALM will mark, or encourage the appropriate authorities to mark roadside occurrences, and occurrences of threatened ecological communities located on tracks or fire-breaks with the same pegs as used to mark threatened flora, to reduce the likelihood of accidental destruction. This action is recommended in English and Blyth 1997.

This action cannot be undertaken for several occurrences (Occurrences 1, 2, 5, 6 and 7 in particular) until action 3.3 is completed.

Responsibility: CALM (Perth, Mundaring and Mornington Districts; WATSCU)
Cost: $1,000 for 1999
Completion date: Year 2

3.6 Monitor flora

Data collected should include weed levels, plant species diversity, and species composition of flora.

Occurrences should be monitored two-yearly to provide information on condition. This information should be added to the threatened ecological community database as recommended in English and Blyth (1997).

Material from unfamiliar plant species should be collected (except identified Declared Rare Flora). Following the second monitoring period, data should be analysed and compared.

Floristic plots have been placed in all occurrences (total of 10 plots - Gibson *et al.* 1994; Department of Environmental Protection 1996). All native and weed species were recorded, but density or cover values for each species were not included in these data and would be essential for determining changes over time (eg as a result of too frequent fire). Line intercept and photographic methods as described in Hopkins *et al.* (1987) could be utilised to monitor these parameters, using permanent plots already in place from other surveys (Gibson *et al.* 1994).

Responsibility: CALM (Perth, Mundaring and Mornington Districts)
Cost: $5,000 every second year (total of 10 plots in the community) for field survey, specimen identification, and databasing for 1 monitoring period
Completion date: Ongoing

3.7 Develop a Fire Management Strategy

3.7.1 Develop and implement a fire management strategy that encompasses the following (3.7.1-3.7.4) and includes an annual fire monitoring and reporting schedule

There is a need for research into recovery of the community from fire (to be conducted under Action 3.6 - flora monitoring), and to determine the implications of findings for management. This should also include developing a fire history map of the occurrences, which is updated annually. No planned burns should be implemented for the life of this IRP for areas burnt since 1993, unless results of future studies suggest it is necessary and urgent.

The WA Fire and Rescue Service in liaison with other stakeholders has developed a Fire Management Plan for Talbot Road bushland that contains Occurrences 3 and 4. It specifies no planned burns without consultation with CALM, no construction of new fire-breaks, a fire-fighting strategy, implementation of dieback hygiene for all vehicles, routine fuel and weed monitoring, and maintenance of fire-breaks.

A similar strategy should be developed for all occurrences of this community, using the plan for Talbot Road bushland as a guide. CALM's Perth and Mundaring Districts are developing Fire Management Plans for all remnants in their districts that contain occurrences of threatened ecological communities. Close liaison with all stakeholders is needed to develop such Fire Management Plans.

There is a no-burn policy at Ellen Brook Nature Reserve (Burbidge and Kuchling 1994), and the reserve would only be burnt as a result of wild fires.

Responsibility: CALM (Perth; Mundaring and Mornington Districts; WATSCU); liaison with all stakeholders including Fire and Rescue and Bush Fire Brigades
Cost: $1,700 in 1999 and 2000 (for Occurrences 1, 5, 6, and 7)
Completion date: Year 2

3.7.2 Ensure maintenance of strategic fire-breaks to help prevent fire spreading to the community

Maintenance of existing fire-breaks is appropriate where fire-breaks are already constructed, unless maintenance is likely to cause spread or intensification of dieback or otherwise degrade the community. Fire-break maintenance should be carried out with a minimum of soil disturbance, using herbicides or mowing wherever possible. No new fire-breaks should be constructed or existing breaks upgraded around occurrences of this community on CALM managed lands without the approval of the Director of Nature Conservation. Local CALM staff should be involved in planning of fire-break construction and maintenance for all occurrences of the community.

No new fire-breaks should be constructed within the community.

Responsibility: CALM (Perth, Mundaring, and Mornington Districts); liaison with surrounding landholders
Cost: $1,800 p.a.**;** costs of liaison included in 3.2
Completion date: Ongoing

3.7.3 Liaise with surrounding landholders to ensure strategies for fuel reduction on their lands do not impact the community

For example, burning at inappropriate times when fires are likely to spread to adjacent lands should be avoided.

Responsibility: CALM (Perth, Mundaring and Mornington Districts); liaison with surrounding landholders
Cost: Costs of liaison included in 3.2
Completion date: Ongoing

3.7.4 Ensure fire suppression strategy does not impact the community

Ensure fire fighting authorities recognise the importance of not constructing new tracks during their operations, including during wildfires. The use of heavy machinery to create new fire-breaks within the community should be avoided as additional disturbance would encourage further weed invasion, and chemicals that may be toxic to the community should not be used. Guidelines for appropriate fire suppression actions should be developed.

A local CALM staff member should be present during wildfires and controlled burns in remnants that contain occurrences of the community, to advise on protecting the conservation values of the community.

Responsibility: CALM (Perth, Mundaring and Mornington Districts); liaison with local Bush Fire Brigades and Fire and Rescue Service
Cost: Costs of preparation of guidelines and liaison included in 3.7.1; additional funds for CALM district staff to attend fires in the community ($500 p.a.)
Completion date: Ongoing

3.8 Ensure hygiene conditions

Occurrences have generally not been tested for presence of dieback, and the susceptibility of the community to the disease is not known. Risk of introduction of disease should therefore be minimised by ensuring good hygiene procedures. This would involve washdown of any equipment used adjacent to the community, and restricting access by vehicles and machinery to dry soil conditions. As standard practice, all vehicles entering remnants that contain the community should be free of soil, and plant propagules.

No vehicle access should be allowed onto undisturbed areas of the community. Hygiene procedures should be applied when using tracks on bushland adjacent to the community.

Responsibility: CALM (Perth, Mundaring and Mornington Districts), all personnel using machinery in the occurrences
Cost: Costs of all liaison is included in 3.2; other costs to be underwritten by user of machinery
Completion date: Ongoing

3.9 Assess and monitor weed populations

Floristic data from Keighery and Trudgen (1992), Gibson *et al.* (1994) and other reports on individual areas may help identify those weeds that pose the greatest threat to each occurrence, as all weed species that occur in plots have been recorded. Some significant weeds in occurrences may not occur in plots, however. Weed populations should be accurately mapped and appropriate herbicides or other method of weed control determined.

Responsibility: CALM (Perth, Mundaring, and Mornington Districts)
Cost: Mapping of the boundaries of weeds $2,000 in 1999 and 2001; monitoring of weed levels to be incorporated into Action 3.6
Completion date: Ongoing

3.10 Implement weed control, and replanting where necessary

Initial stages of rehabilitation should involve control of perennial weeds and their replacement with local species, where appropriate. High priority actions may also include the removal of piles of soil scraped from tracks that contain high concentrations of weeds and act as a source of weed invasion. Local species suitable for replanting should be identified from plot data for each occurrence in Gibson *et al.* (1994) and from the results of Action 3.6.

The highest priority should be controlling weeds that pose the greatest threat to the community in the early stages of invasion where possible, eg invasive perennial grasses and *Watsonia*. Rehabilitation through reintroduction of local native species may be necessary if areas are no longer capable of regenerating following weed control.

Where possible only seed from the same occurrence should be used for rehabilitation. No species not occurring, or not thought to have occurred, in a particular occurrence should be introduced into that occurrence.

External funds would need to be obtained to undertake this action.

Responsibility: CALM (Perth, Mundaring and Mornington Districts), vestees
Cost: $3,000 p.a. for weed control in Occurrences 1, 2, 5, 6, 7; costs of replanting and rehabilitation to be determined. Weed control costs for Occurrences 3 and 4 - $21,600 in 1999, $20,000 in 2000, and $19,800 for weed control (whole remnant); costs of rehabilitation in Occurrences 3 and 4 $2,600 in 2000; $7,500 in 2001
Completion date: Ongoing

3.11 Fence remnants that contain the community, where necessary

Fencing may be necessary to prevent degradation where occurrences are in high usage areas, or to prevent grazing. Occurrences 1, 3 and 4 are suffering some degradation from the impact of recreational use such as trail bikes and four wheel drive vehicles and from rubbish dumping. Fencing requirements of Occurrence 1 need to be determined. Occurrence 2 is already fenced, and the remnant that contains Occurrences 3 and 4 is partly fenced to prevent inappropriate vehicle access, however, trail bikes and other unauthorised vehicles still enter the latter areas (G. MacKinnon[2] personal communication.). The fencing requirements of Talbot Road bushland are described in Safstrom and Taman (1999). Occurrences 5, 6, and 7 probably do not require fencing at this time, as they are more remote from urban areas.

Responsibility: Managers of remnants that contain the community in consultation with CALM (Mundaring District)
Cost: Costs of fencing remainder of Talbot Road bushland $5,800 in Year 1, $5,100 for each of Year2 and Year 3. Costs for Occurrence 1 to be determined
Completion date: Year 3

3.12 Monitor for dieback

Survey for dieback in the community. Priority areas for dieback treatment in the community should be determined from the Dieback Protocol that is currently being prepared by CALM. Data on dieback presence and impact, and future biodiversity implications eg loss or decline of Declared Rare Flora or Priority taxa,

[2] Grant MacKinnon, Shire of Swan, Morrison Road, Midland 6056

structurally or functionally important taxa are likely to be important determinants of the priority of treatment of individual occurrences.

Dieback survey of Talbot Road Bushland (Occurrences 3 and 4) indicates that much of the remnant is infested (Safstrom and Taman 1999).

Dieback has so far been recorded in this community only in the Talbot Road occurrences. Wherever it is detected, any dieback front should be monitored at least every five years in summer and flagging marking the front replaced regularly. Additional plot information (refer 3.6) would provide useful monitoring data.

Responsibility: CALM (Perth, Mundaring and Mornington Districts)
Cost: $8,000
Completion date: Year 1

3.13 Assess hydrological information

Occurrences of the community may be at risk from increased inundation or salinisation due to rising groundwater and increased ponding as a result of clearing of the catchments.

Groundwater levels and quality are routinely monitored by the Water and Rivers Commission (and in specific areas by Agriculture Western Australia and local Land Conservation District Committees (LCDCs)). Data in Davidson (1995) suggests Occurrence 5, in particular, may be at risk from hydrological changes and information for areas close to this community should be assessed.

Responsibility: CALM (Perth District); liaison with Agriculture Western Australia, LCDCs and the WRC
Cost: $500 pa for Occurrence 5
Completion date: Ongoing

3.14 Design and conduct research

Research should be designed to increase the understanding of the characteristics of the community to assist future management decisions. Such research could include:

1. The hydrogeology of occurrences of the community.

2. The impact of weeds on the community.

3. The role of disturbance in regeneration of the community.

4. The development of a monitoring system. Protocols will be developed based on recommendations held in English and Blyth (1997).

5. Significant biological processes in the community eg pollination biology, germination requirements, longevity and time taken to reach maturity of important plant taxa in the community.

Responsibility: CALM (CALMScience Division; Perth, Mundaring, and Mornington Districts; WATSCU)
Cost: Recovery Team to determine costs and likely funds available through other sources and to recommend a research program and sources of funds to CALM
Completion date: To be determined

3.15 Report on success of management strategies for the occurrences

Reporting should be part of annual reports prepared by the Recovery Team for CALM's Corporate Executive. A final report would be presented as part of or complementary to the full recovery plan for the community, if a full recovery plan is necessary.

Responsibility: Recovery Team in consultation with CALM (Perth, Mundaring and Mornington Districts; WATSCU)
Cost: $2,000
Completion date: Year 3

3.16 Investigate transferring the care, control and management of areas that contain the community to the NPNCA if conservation management seems unlikely, or if the areas become available

If effective management for conservation seems unlikely to result from recommendations held in this IRP or if areas that contain the community become available, CALM will negotiate to have the reserves, and other remnants that contain the community, and adequate buffer areas where required, declared Class A reserves for the purpose of 'Conservation of Flora and Fauna' vested in the National Parks and Nature Conservation Authority.

Areas to which this recommendation applies comprise those covered by the community, and include buffer areas in some cases. Suggested management boundaries as listed below follow logical borders such as those of existing reserves or remnants and may be selected to include other known threatened ecological communities.

This recommendation applies to the following areas:

i) Triangular remnant on Department of Defence land Bullsbrook (Occurrence 1), between Great Northern Highway and Chittering Road
ii) Reserve 23953, reserve 6955 and Swan Locations 11314 and 11764 (Occurrences 3 and 4)
iii) Part Peel Estate Lot 101/3, and the remnant portion of Reserve 23793 (Occurrence 5) and the Mundijong Road reserve between Webb Road and the western edge of the remnant at Duck Pond Road.
iv) Reserve 22215 (Occurrence 6).

Responsibility: CALM (Perth, Mundaring and Mornington Districts, Land Adminstration Section), DOLA
Cost: To be determined
Completion date: Ongoing

SPECIFIC MANAGEMENT ACTIONS; OCCURRENCES 1, 5 AND 6

3.17 Develop Management Plans

If Management Plans that would conserve the threatened ecological community are not being prepared or implemented, CALM (and the Biodiversity Group, Environment Australia for Occurrence 1) will seek involvement in the cooperative preparation of plans for occurrences that include management considerations as listed in this IRP.

Members of the Northern Swan Landcare Group are involved in the management of Occurrence 1.

The Roadside Care Volunteers and the Serpentine-Jarrahdale Landcare Group are involved in the management of the roadside remnants that contain Occurrence 5. Keighery (1996) provides a detailed account of the conservation values and management recommendations for this area.

Responsibility: CALM (Perth, Mundaring and Mornington Districts; WATSCU), vestees and land managers
Cost: Costs of liaison included as part of 3.2; cost of plan development $20,000
Completion date: 2000

SPECIFIC MANAGEMENT ACTIONS; RESERVE 23953 (OCCURRENCE 3); SWAN LOCATIONS 11764 AND 11314, AND RESERVE 6955 (OCCURRENCE 4).

3.18 Develop management plan for Talbot Road bushland

A Management Plan is being developed for Talbot Road bushland (Safstrom and Taman (1999).

Responsibility: CALM (Mundaring District); Shire of Swan in liaison with all stakeholders
Cost: $20,000 to develop plan; costs of liaison included as part of 3.2
Completion date: Year 2

3.19 Amalgamate unallocated Crown land (UCL) with reserve 23953

Negotiate to have Swan Locations 11314 and 11764 (northern and southern UCL areas within the remnant that also contains reserve 23953) amalgamated with reserve 23953.

The entire remnant held within Talbot Road bushland provides a significant buffer for the two threatened ecological communities that occur within the remnant and should be managed for conservation.

Responsibility: CALM (Mundaring District, Land Acquisitions Section); Shire of Swan; Department of Land Administration (DOLA)
Cost: Costs of liaison included in 3.2
Completion date: Year 2

3.20 Negotiate land swaps for the remnant portion of reserve 6955 if necessary

In the event of an unsatisfactory outcome for reserve 6955 from recommendations 3.16 and 3.17 in this IRP, and in Perth's Bushplan (State of Western Australia 1998), CALM will liaise with relevant agencies to seek to locate land suitable for the use and requirements of the Metropolitan Cemeteries Board. If such a site is found, CALM will pursue amalgamation of 'Cemeteries' reserve 6955 with reserve 23953.

The linear remnant within reserve 6955 that links Swan Locations 11314 and 11764 would provide a good buffer for the critically endangered communities in Talbot Road bushland.

Responsibility: CALM (Mundaring District, Land Acquisitions Section); DOLA
Cost: Costs of liaison included in 3.2
Completion date: If and when required

3.21 Negotiate to have the purpose of reserve 23953 altered to 'Conservation and Recreation'

Following implementation of Recommendations 3.19 (and 3.20 if achieved), negotiate to have the purpose of amalgamated reserve 23953 altered to 'Conservation and Recreation'.

Responsibility: CALM (Mundaring District; Land Administration Section); Shire of Swan and DOLA
Cost: Costs of liaison included in 3.2
Completion date: Year 2

3.22 Implement drainage strategy

The unconfined drain through Talbot Road bushland may be spreading and causing intensification of dieback in this and other adjacent plant communities (J. Carter, V. English personal observation.). A strategy to confine or divert the drainage waters into the Blackadder Creek so that the hydrology of adjacent areas returns to a more natural state, will be implemented as part of the management plan being developed by Safstrom and Taman (1999)

The Nyoongar aboriginal people have cultural links to Blackadder Creek that runs through the remnant and should be consulted with regard any changes to drainage in the Talbot Road bushland.

Responsibility: CALM (Mundaring District); Shire of Swan; Water and Rivers Commission (WRC) in consultation with relevant Aboriginal groups
Cost: Costs of liaison included in 3.2; diversion of drainage $600 in 2000; $24,700 in 2001 (from Safstrom and Taman 1999)
Completion date: Year 2

3.23 Design and implement a rabbit control program for Talbot Road bushland

A rabbit control program should be implemented in the eastern portion of Talbot Road bushland where recent fires have disturbed the understorey vegetation. Care should be taken not to impact local fauna.

Levels of rabbit control with baiting will depend on the combined effects of the two viruses, Myxomatosis and Calicivirus, the last of which occurs in a patchy manner in the metropolitan area. Although these two viruses provide excellent results in some areas they must still be supported by other control methods. Baiting for rabbits using Pindone is likely to be the most viable option, as use of 1080 may result in poisoning of dogs and cats. Pindone can only be used where macropods are not present, however. Baiting is generally conducted in summer and repeated each year if rabbits reappear in future years (T. Black[3] personal communication).

Responsibility: CALM (Mundaring District); Shire of Swan; Agriculture Western Australia
Cost: $1,300 pa for baiting of Talbot Road bushland (using Pindone)
Completion date: Ongoing

SPECIFIC MANAGEMENT ACTIONS - OCCURRENCE 5

3.24 Negotiate to have unvested remnant on Mundijong Road vested in the Shire of Serpentine-Jarrahdale as Class A reserve for Conservation and Passive Recreation

The linear remnant on Mundijong Road is very significant as it represents one of only two remaining cross sections of native vegetation that span the alluvial soils of southern Swan Coastal Plain. The eastern end of this remnant contains another critically endangered community (type 3a) and the central portion contains a vulnerable community (type 8) as described by Gibson *et al.* (1994).

Negotiate to have care, control and management of unmanaged lands (as follows) placed with the Shire of Serpentine-Jarrahdale as Class A reserve for 'Conservation and Passive Recreation';

i) Part Peel Estate Lot 101/3, and the remnant portion of Reserve 23793 (Occurrence 5) and the Mundijong Road reserve between Webb Road and the western edge of the remnant at Duck Pond Road
(Note 1: reserve 23793 is managed by the Shire and local community groups although it is unvested)
(Note 2: Occurrence 5 of this community occupies only a portion of the described area, but this recommendation is worded to be consistent with recommendations held in Interim Recovery Plans for other

[3] Terry Black, Agriculture Western Australia, Baron-Hay Court, South Perth, 6151

threatened ecological communities that occur along Mundijong Road and Duck Pond Road, Mundijong (*Corymbia calophylla - Kingia australis* woodlands on heavy soils - Gibson *et al*. (1994) type 3a).

Responsibility: CALM, (Land Administration Section; Perth District), DOLA
Cost: Costs of liaison included as part of 3.2
Completion date: Year 1

SPECIFIC MANAGEMENT ACTIONS - OCCURRENCE 7 - UNALLOCATED LAND

3.25 Acquire unallocated land that contains the community and vest the area in the NPNCA

CALM negotiate with land managers and the Department of Land Administration to seek vesting of unallocated Crown land - Reserve 23376 (Occurrence 7) with the NPNCA as Class A reserve for Conservation of Flora and Fauna.

Responsibility: Responsibility: CALM, (Land Administration Section; Mornington District), DOLA
Cost: Costs of liaison included as part of 3.2
Completion date: Year 2

Table 2: Summary of recovery actions

Recovery Action	Occurrences	Responsibility	Completion date
Establish Recovery Team	All	CALM (WATSCU)	Year 1
Liaison with landholders, management bodies and managers	All	CALM (Perth, Mundaring and Mornington Districts, WATSCU)	Ongoing
Clarify and monitor boundaries	All	CALM (Perth, Mundaring and Mornington Districts, WATSCU)	Ongoing
Disseminate information	All	CALM (Corporate Relations Division, Perth, Mundaring and Mornington Districts, WATSCU)	Ongoing
Install markers	All	CALM (Perth, Mundaring and Mornington Districts, WATSCU)	Year 2
Develop fire management strategy	1, 5, 6 and 7	CALM (Perth, Mundaring and Mornington Districts, WATSCU) in consultation with all stakeholders	Development of Fire Management Plans begun. Remaining plans to be completed Year 2.
Implement fire management strategy, implement dieback hygiene	All	CALM (Perth, Mundaring and Mornington Districts), Bush Fire Brigades, Fire and Rescue Service	Ongoing
Implement weed control	All	CALM (Perth, Mundaring, and Mornington Districts), management bodies	Ongoing
Fence occurrences	1, 3, 4	Management bodies in consultation with CALM (Mundaring District)	Year 1
Transfer care, control and management of occurrences if necessary	Areas yet to be determined	CALM (Mundaring, Perth and Mornington Districts, Land Acquisitions Section), current management bodies, DOLA	As necessary
Develop Management Plans	1, 3, 4, 5, 6, 7	CALM (Mundaring, Perth and Mornington Districts), management bodies, land managers	Year 2
Amalgamate VCL (Swan Locations 11314 and 11764), and reserve 6955 if necessary, with reserve 23953	3, 4	CALM (Mundaring District, Land Acquisitions Section), DOLA	Year 2
Negotiate land swaps for reserve 6955	3, 4	CALM (Mundaring District, Land Acquisitions Section), DOLA	As necessary

Table 2: cont.

Recovery Action	Occurrences	Responsibility	Completion date
Alter purpose of reserve 23953	3	CALM (Mundaring District, Land Acquisition Section), Shire of Swan, DOLA	Year 2
Implement drainage strategy	3	CALM (Mundaring District), Shire of Swan, WRC	Year 1
Control rabbits	3 and 4	CALM (Mundaring District); Shire of Swan, Agriculture Western Australia	Ongoing
Transfer management of Occurrence 5 to Shire of Serpentine-Jarrahdale	5	CALM (Perth District, Land Acquisitions Section), Shire of Serpentine-Jarrahdale, DOLA	Year 1
Vest UCL in NPNCA	7	CALM (Perth and Mornington Districts, Land Acquisitions Section), DOLA	Year 2
Monitor flora	All	CALM (Perth, Mundaring, and Mornington District)	Ongoing
Monitor weed populations	All	CALM (Perth, Mundaring, and Mornington Districts)	Ongoing
Monitor for dieback	All	CALM (Perth, Mundaring, and Mornington Districts)	Year 1
Replant / rehabilitate	Costs to be determined	CALM (Perth, Mundaring, and Mornington Districts)	Ongoing
Assess hydrological information	5	CALM (Perth District); liaison with WRC, LCDCs and Agriculture Western Australia	Ongoing
Conduct research (cost to be determined)	All	CALM (CALMScience, Perth, Mundaring, and Mornington Districts, WATSCU)	No date set
Report on management strategies	All	CALM (Perth, Mundaring, and Mornington Districts; WATSCU), Recovery Team	Year 3

Table 3: Summary of costs for each recovery action

Recovery Action	Year 1	Year 2	Year 3
Establish Recovery Team			
Liaison with landholders, management bodies and land managers (Costs equally attributed to each responsible group)	$1,500	$1,500	$1,500
Clarify and monitor boundaries (Costs equally attributed to each responsible group)	1,000	1,000	1,000
Disseminate information (Costs equally attributed to each responsible group)	1,500	500	
Install markers (Costs equally attributed to each responsible group)	1,000		
Develop fire management strategy	1,700 (Mund = 850; P = 850)	1,700 (Morn)	
Implement fire management strategy, implement dieback hygiene (Costs equally attributed to each responsible group)	2,300	2,300	2,300
Implement weed control	25,100 (Mund = 23,100 (cost whole remnant); P= 1,000; Morn = 1,000)	22,500 (Mund = 20,500; P= 1,000; Morn = 1,000)	23,300 (Mund=21,300, P=1,000, Morn = 1,000)
Fence Occurrence 1 (Costs attributed to Mundaring District)	To be determined		
Fence Occurrence 3 and 4 (Costs attributed to Mundaring District)	5,800	5,100	5,100
Transfer care, control and management of selected occurrences (areas yet to be determined)	To be determined		

Table 3: Cont

Recovery Action	Year 1	Year 2	Year 3
Develop Management Plans	25,000 (Mund = 20,000; P= 5,000)	15,000 (Mund = 5,000; Morn = 10,000)	
Amalgamate VCL (Swan Locations 11764, 11314), and reserve 6955 if necessary, with reserve 23953 (Costs attributed to Mundaring District)			
Negotiate land swaps for reserve 6955			
Alter purpose of reserve 23953 (Costs attributed to Mundaring District)			
Implement drainage strategy for Talbot Rd Bushland (Costs attributed to Mundaring District)		600	24,700
Control rabbits (Costs attributed to Mundaring District)	1,300	1,300	1,300
Transfer management of Occurrence 5 to Shire			
Vest VCL in NPNCA (Costs attributed to Mornington District)			
Monitor Flora	5,000 (Mund = 2,500; P = 1,500; Morn = 1,000)		5,000
Monitor weed populations (One third of costs attributed to each District)	2,000		2,000
Replant / rehabilitate		2,600 (Occurrences 3, 4)	7,500 (Occurrences 3, 4)
Monitor for dieback	8,000 (Mund = 4,000; P = 2,000; Morn = 2,000)		
Assess hydrological information (Costs attributed to Perth District)	500	500	500
Conduct research	To be determined		
Report on management strategies			2,000
Develop Management Plan for Occurrence 1 (Costs attributed to Mundaring District)			5,000
Total	**$81,700**	**$54,600**	**$81,200**

Unless specified in column one; codes for costs attributed to CALM Districts in columns two, three and four are as follows:
P = Perth District; Mund = Mundaring District; Morn = Mornington District

Summary of costs over three years

Total $217,500

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Grant MacKinnon	Swan Shire Council
David Mitchell	CALM's Swan Region
Lyndon Mutter	CALM's Perth District
Scott Wood	Formerly of CALM's Mornington District
Kim Williams	CALM's Central Forest Region

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APPENDIX 1

Vascular Plants recorded from at least 50% of plots in occurrences (From Gibson *et al.* 1994)

	Taxon
	Acacia pulchella
*	*Briza maxima*
	Burchardia umbellata
	Caesia micrantha
	Cyathochaeta avenacea
	Cyathochaeta clandestina
	Daviesia preissii
	Drosera menziesii subsp. *penicillaris*
	Dryandra nivea
	Corymbia calophylla
	Gompholobium marginatum
	Hypocalymma angustifolium
*	*Hypochaeris glabra*
	Lepidosperma sp. (BJK & NG 232)
	Loxocarya flexuosa
	Mesomelaena tetragona
	Neurachne alopecuroidea
	Opercularia vaginata
*	*Romulea rosea*
	Sowerbaea laxiflora
	Stipa pycnostachya
	Tetraria octandra
	Thysanotus manglesianus/patersonii complex
	Xanthorrhoea preissii

* Introduced

GLOSSARY

Fluviatile - found in or near rivers

STATUS OF FLORA TAXA (FROM CALM, 1997)

Declared Rare Flora	'taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection and have been gazetted as such.'
Priority 1	'taxa which are known from one or a few populations which are under threat.'
Priority 2	'taxa which are known from one or a few populations, at least some of which are not believed to be under immediate threat.'
Priority 3	'taxa which are known from several populations, at least some of which are not believed to be under immediate threat.'