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**A VEGETATION SURVEY**  
**of**  
**YENYENING LAKES NATURE RESERVE**  
**AND ADJOINING VEGETATION**  
**Shires of Beverley, Brookton and Quairading**  
**for the**  
**Yenyening Lakes Management Committee**



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Cover Photograph: View across Morrel Pool with Samphires in the foreground, and dunes with Salt River Gum (*Eucalyptus sargentii* subspecies *sargentii*) and *Melaleuca atroviridis* ms in the background. (Photo A. Gunness 12/10/02)

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## 1. INTRODUCTION

The Yenyening Lakes Management Committee approached the Wildflower Society of Western Australia during 2001, to conduct a vegetation and flora survey of the Yenyening Lakes Nature Reserve and adjoining bushland. A two-part proposal was submitted to conduct a vegetation survey with the option to include a flora survey. Funding was only available to carry out the vegetation survey and the project was approved in 2002. The Bushcare program of the Natural Heritage Trust and the Department of Conservation and Land Management provided the funding.

The Wildflower Society has managed a Bushland Plant Survey Project, based on community involvement, since 1988. Unlike recent projects, the Wildflower Society was 'contracted' by a community group to conduct the survey work. Local community members and Wildflower Society volunteers were invited to participate.

The "Yenyening Lakes" are a system of interconnected lakes and adjoining channels located approximately 160 kilometres east-south-east of Perth. Above the Lakes lies the broad flat valley of the Salt River, an ancient drainage channel, and downstream the Lakes flow into the Avon River at Qualandary Crossing. The Lakes fall within the boundaries of three different Shires: Beverley, Brookton and Quairading. Yenyening Lakes are often spelt Yenyenning Lakes. The former is the originally named spelling and is used in this report.

The Yenyening Lakes Nature Reserve is actually two adjoining reserves vested in the Conservation Commission of Western Australia and managed by the Narrogin District of the Department of Conservation and Land Management (CALM). Reserve 31837 of 681 hectares in the western sector of the system includes the main lakes. Reserve 28088 is 2417 hectares in size and is the upstream, eastern sector of the system (Figure 1). This study included the two reserves and adjoining public and private bushland. A management strategy for Yenyening Lakes and adjoining areas was prepared in 1996 (Yenyening Lakes Management Group 1996) and a revised management strategy will soon be published. To be able to properly manage the Yenyening Lakes system an understanding of all its values is important. The purpose of this project was to record and describe the vegetation currently existing.

The Lakes have always received saline inflows from natural salt lake systems upstream in the catchment. Since the advent of clearing for agriculture more salt has entered the system from rising groundwater and increased run-off from surrounding cleared areas. Water levels and flow through the Lakes system can be highly seasonal depending on rainfall timing and intensity, not only within the local region but within the greater Avon catchment further inland. There have been years of winter drought when the Avon River downstream of Yenyening Lakes did not flow at all (1914 and 1940 and the recent one of 2002) and years of major historic floods (twelve in the period 1877-1985 and most recently in 2000).

Apart from broad-scale vegetation mapping by Beard (1981) and a bird survey (RAOU 1993) there appears to be no published biological data on Yenyening Lakes. Given the extent of the Lakes system, the land vesting, the time since development of the area (clearing of surrounding areas began in the 1890s), and the natural, cultural, historical and community values of the area it is surprising that no detailed biological studies have been conducted until now. Until recent times wetland and riparian systems have been undervalued and poorly studied and often considered too degraded to include in broad scale vegetation studies.



## 2. THE STUDY AREA

### LOCATION

The Yenyening Lakes are located approximately 160 kilometres east-south-east of Perth, 39 kilometres south-east of Beverley and 30 kilometres north-east of Brookton. They are situated on the western end of the Salt River near where it joins the Avon River. The lakes fall within the central western wheatbelt, within the Avon Catchment, and at the boundaries of three different Shires: Beverley, Brookton and Quairading (Figure 1). Agricultural land use in the area is mainly broadacre farming (cropping of wheat, oats, barley, canola and lupins, and grazing for wool and meat).

### CLIMATE

The climate is Mediterranean, characterised by cool, wet winters and hot dry summers. The wettest months are May to August when rain is associated with the passage of winter cold fronts. Thunderstorms may locally provide rain during summers. Average annual rainfall at Beverley is 423mm with 74 per cent falling during the five months from May to September inclusive (115 year average). The average maximum temperatures range from 33.4°C in February to 16.7°C in July and average minimum temperatures from 16.5°C in February to 5.1°C in August (Commonwealth of Australia 2002, Bureau of Meteorology).

### LANDFORMS AND SOILS

The study area falls on the huge geological formation known as the Yilgarn block which is bounded by the Darling Fault in the west and by the greenstone belts of the Southern Cross and Murchison districts in the east and north-east. Precambrian rocks of ancient granites and gneisses which are approximately 2900-2500 million years old are the underlying bedrock. A geological feature of the area is the Jimperding Gneiss complex, a 40 kilometre wide zone from north of Toodyay to east of Beverley that coincides with the Avon Valley (Safstrom 1997).

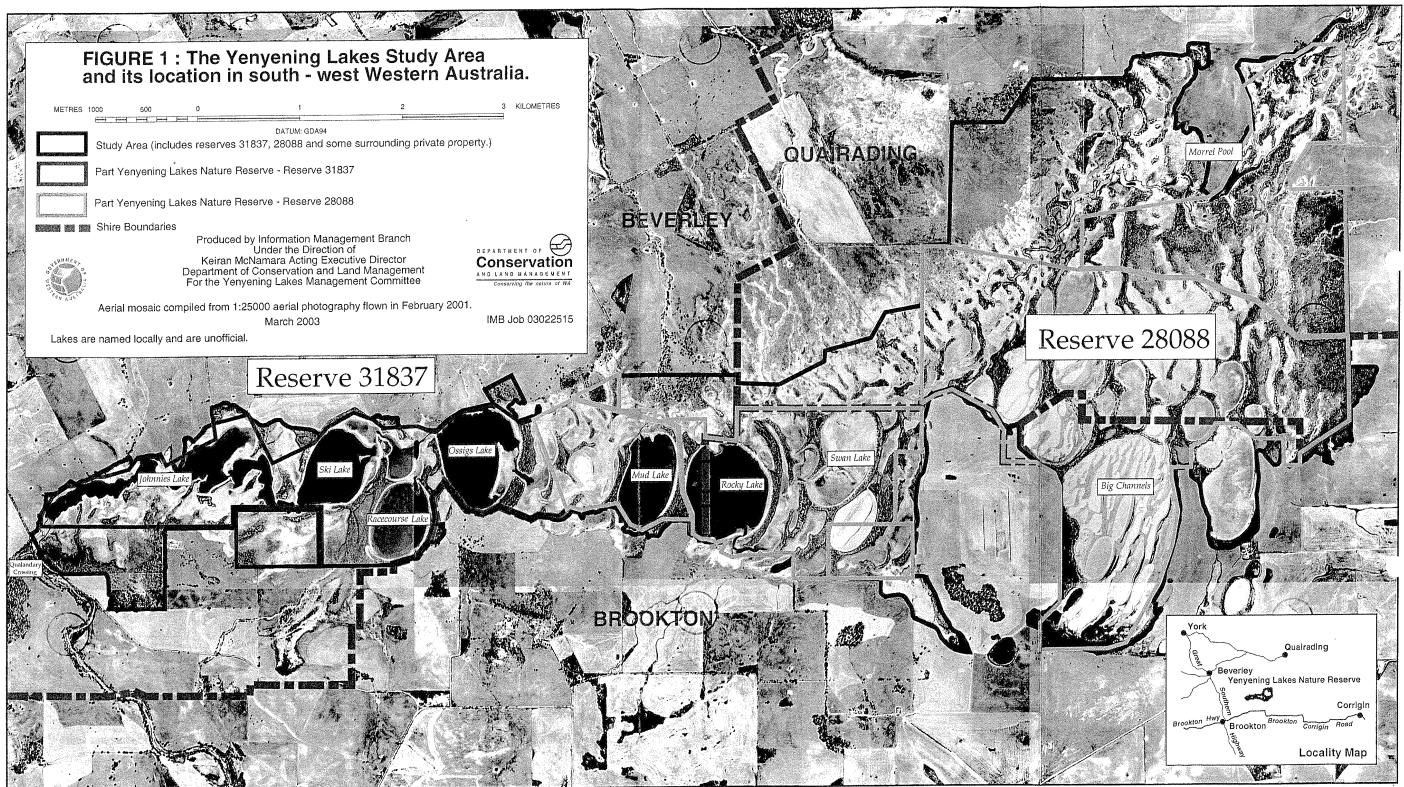
The Yenyening Lakes mark the boundary between the Zone of Rejuvenated Drainage to the west and the Zone of Ancient Drainage to the east (Lantzke and Fulton 1994). The landscape of the latter is a gently undulating plateau with wide convex divides, long gentle slopes and broad valleys with salt lakes at their lowest points. The salt lakes of the wheatbelt are part of large chains of lakes that represent remnants of a former ancient river system - part of the Yilgarn River paleo-drainage. The salt lakes are groundwater systems, covered by surface water intermittently, and so represent a dry basin or playa environment (Commander 1999). They fill periodically with rainfall and surface run-off and are brackish to saline, becoming more saline with evaporation and dissolution of surface salt. Salt lakes are distinguished from claypans, which are perched above the groundwater.

The soil-landscape system of the Lakes and adjoining land is described by Verboom and Galloway (unpublished, in Safstrom 1997) as follows:

**Wallambin System (WAL):** Salt lake chains in the central Zone of Ancient Drainage with salt lake soil and calcareous loamy earth. Mallee, Morrel Woodland and Saltbush-Bluebush-Samphire flats predominate. This is the system of the lakes.

**Mortlock System (MLK):** Poorly drained valley flats in the northern Zone of Rejuvenated Drainage. Major soil types are deep grey sandy duplex (sometimes alkaline) and saline wet soil. York Gum - Jam - Wandoo - Salmon Gum - She-oak Woodlands make up the principal vegetation

**Trayning System (TRY):** Valley floors in the Zone of Ancient Drainage with alkaline red shallow loamy duplex, alkaline grey sandy duplex (shallow and deep), calcareous loamy earth and hard cracking clay as the major soil types. Main vegetation types include Salmon Gum - Gimlet - Wandoo - York Gum Woodlands.



Salt lake soils vary in salinity depending on the substrate from which they were derived and the extent of subsequent leaching. A series of sand dunes and lunettes (crescent shaped sand rises) are associated with the lake system and are the result of reworking of sand deposits by wind (aeolian origin). Fresh water lenses may be found underneath these rises due to the fresh water re-charging through the sand layer and becoming trapped beneath the sand surface. It is thought that these fresh water lenses play an important role in the survival of vegetation on the sand rises.

## VEGETATION

Vegetation in Western Australia has been described on a broad scale in a series of publications by Beard (e.g. Beard 1980, 1981, 1990). He divided the state into botanical provinces, districts, subdistricts and systems. Within this framework the study site falls in the Avon Botanical District, in the western central (inner) Wheatbelt Region of the South-west Botanical Province (Beard 1981, 1990) and in the York Vegetation System (Beard 1980).

A vegetation system consists of a particular series of plant communities recurring in catenary sequence (a chain across the landscape) or mosaic pattern governed by soil types, topographical and geological features. The typical sequences of vegetation in its original state in the Avon Botanical District comprised Scrub Heath on sandplain, *Acacia-Casuarina* thickets on ironstone, Woodlands of York Gum (*Eucalyptus loxophleba*), Salmon Gum (*E. salmonophloia*) and Wandoo (*E. wandoo*) on loams and halophytes (salt tolerant plants) on saline soils (Beard 1981).

Beard (1981) mapped the vegetation of the study area as salt flats, Eucalypts, Teatree and Samphire. York Gum and Wandoo Woodland adjoin to the north with patches of kwongan (heath or shrublands) and sandplain to the north of Morrel Pool. On the south side he mapped sandplain and York Gum - Wandoo Woodlands with York Gum and Salmon Gum Woodlands further east. He also described "succulent steppe": samphire communities consisting of succulent low shrubs, which occur in saline areas. They may form only a ground layer or they may be associated with Teatree shrubs and/or eucalypt woodlands.

In more recent studies Western Australia has been divided into 26 biogeographic regions known as IBRA (Interim Biogeographic Regionalisation for Australia) regions (Thackway and Cresswell 1995). Beard's Avon Botanical District corresponds with Thackway and Cresswell's IBRA Avon Wheatbelt Region. The IBRA bioregions were developed to "provide a broad framework for identifying deficiencies in the existing system of protected areas, and for setting priorities for action in establishing the national reserves system in Australia" (Thackway and Cresswell 1995, piii). The study found that less than 1 per cent of the IBRA Avon Wheatbelt Region was in secure reserves and that the reserves did not evenly represent the variation that occurs within the native vegetation of the region. In other words, very little of indigenous ecosystems remain and protection of the biodiversity of the region is very poor.

## 3. SURVEY METHOD

Aerial photo stereo pairs at a scale of 1:25 000 were studied to identify the different vegetation patterns and access points for field survey. Thirteen landowners with property adjoining the Lakes system were contacted to gain permission to access the Reserve or adjoining bushland and their participation was invited.

Survey work was conducted over three field trips in July, September and October 2002. As much of the Reserve as possible was traversed by foot or by vehicle. Because of two successive dry seasons water levels in all lakes were low and the channel flats were dry, permitting access throughout the system. This is unusual for the winter and spring months. Repeating patterns on the aerial photographs were verified on the ground and notes made about variations as the area was traversed. It is estimated that approximately 60 percent of the vegetated section of the study

area was traversed. This provided the basis for mapping the remaining patterns on the aerial photographs using stereoscopic pairs. Having identified different patterns on the aerial photos representative areas were targeted for detailed vegetation descriptions. Within a particular vegetation type the following information was collected:

- Vegetation structure: dominant species in each structural layer, canopy cover for each layer and associated species. Vegetation descriptions could then be made. The structural classification scheme used was that described by Keighery (1994) (Appendix I, Table A).
- Soil type
- Landscape position
- Vegetation condition: condition was assessed in terms of whether the vegetation was the product of hydrological change (in other words original, or impacted by changes in water level and salinity), and also according to the scale in Keighery (1994) (Appendix I, Table B).
- Plant specimens were collected at each site for later identification.

The survey was conducted during a second successive drought year with very poor establishment of annuals and poor flowering of perennials throughout much of the wheatbelt. It is likely that less than 70 per cent of species within the study area would have been recorded. All plant specimens were verified against specimens from the WA Herbarium, with several specimens verified with the help of specialist botanists. Duplicates of some specimens will be lodged at the Western Australian Herbarium and at the Northam Office of Water and Rivers Commission.

The project botanist carried out fieldwork with assistance over the three trips from 10 Wildflower Society volunteers (including three CALM botanists), nine community members and a District Officer from CALM in Narrogin.

Some limitations of the study were as follows:

- Because the study did not include a detailed flora survey, a systematic technique of data collection using quadrats was not used. Although attempts were made to collect and identify as much of the flora as possible this study should not be considered detailed in its floristics.
- The mapping of Vegetation Units is somewhat subjective, based on structural dominance. Other workers may make different interpretations of vegetation types or boundaries but the broad interpretation should match.

#### 4. VEGETATION

The vegetation was a reflection of its position in the landscape, soils, salinity and the extent, frequency and duration of inundation. The soil – landscape mix consisted of:

- 'original' soils on the outer edges of the system and the higher parts of the sand dunes,
- deep yellow sand dunes, aeolian in origin
- alluvial sandy loams on the broad flats,
- white sands of wind blown (aeolian) rises which may be reworked by flooding,
- grey clay loams of the channel flats which are subject to the greatest degree of flooding, salinity and waterlogging.

#### VEGETATION UNITS

Using aerial photo interpretation and on-ground observations, vegetation types were recognised based on vegetation structure, dominant plant species, position in the landscape and soil type.

Twenty-two Vegetation Units were recognised and they are as follows:

##### Forests

1. Salmon Gum (*Eucalyptus salmonophloia*) Open Forest
2. Swamp She-oak (*Casuarina obesa*) Closed Forest over *Juncus kraussii* Sedgeland

##### Woodlands

3. Salt River Gum (*Eucalyptus sargentii* subspecies *sargentii*) (Low) Open Woodland
4. York Gum (*Eucalyptus loxophleba*) Low Open Woodland
5. Wandoo (*Eucalyptus wandoo*), York Gum and Swamp She-oak Low Open Woodland
6. Rock She-oak (*Allocasuarina huegeliana*) - Jam (*Acacia acuminata*) Low Open Woodland
7. Acorn Banksia (*Banksia prionotes*) Low Open Woodland

##### Mallees

8. *Eucalyptus orthostemon* ms Very Open Shrub Mallee over mixed *Melaleuca* Shrublands
9. *Eucalyptus hypochlamydea* Open Shrub Mallee

##### Shrublands

10. *Melaleuca atroviridis* ms Tall Shrubland over *Rhagodia drummondii* Low Open Shrubland
- 11a. Mixed *Melaleuca* Shrublands on slopes of sand rises
- 11b. Mixed *Melaleuca* Shrublands on flats
12. *Scholtzia* sp. Yenyening Lakes (A. Gunness 2824) Shrublands on slopes of sand rises
13. Needle Tree (*Hakea preissii*) Tall Shrubland
14. *Melaleuca acuminata* subspecies *websteri* Closed Heath
15. Tamar (*Allocasuarina campestris*) Tall Open Shrubland

##### Modified Shrublands

16. Samphire (*Halosarcia lepidosperma*, *H. leptoclada* subspecies *inclusa*, *H. halocnemoides*) Low Open Shrubland over Open Herbland with emergent *Melaleuca lateriflora* and *Melaleuca atroviridis* ms

## Samphire Shrublands

17. *Halosarcia indica* subspecies *bidens*, *Halosarcia lepidosperma*, *Frankenia pauciflora* Open Low Heath
18. *Halosarcia pergranulata*, *Halosarcia halocnemoides* Low Shrubland

## Sedgeland (Rushes)

19. *Hopkinsia anoectocolea* (Open) Sedgeland on white sand rises in drainage channels
20. Freshwater Perched Lake: *Baumea riparia*, *Juncus kraussii* Closed Sedgelands under *Melaleuca brevifolia* Open Scrub

## Lake edges

21. Closed (Tall) Shrublands (e.g. *Melaleuca thyoides* or *Callistemon phoeniceus*)
22. Herbland +/- *Halosarcia halocnemoides* Low Open Shrubland

## DESCRIPTIONS OF VEGETATION UNITS

The Vegetation Units varied in their structural composition, species dominance and composition. Photographs 1 to 14 (Pages 21 to 27) illustrate some of the different vegetation types and their associated species. They are described as follows:

### FORESTS

#### 1. Salmon Gum (*Eucalyptus salmonophloia*) Open Forest

This was not a Unit of the lake system, but a striking, healthy stand of Salmon Gums was situated on the slope above the beach at the southern end of Racecourse Lake (Photograph 1). There were also small remnants on red loam slopes above Johnnie's Lake and Ski Lake. The understorey was very open, a typical feature of Salmon Gum Forests and Woodlands, with *Rhagodia drummondii* the dominant species. Other understorey species were *Maireana enchylaenoides*, *Stylobasium australe*, *Oxalis peremans*, *Pelargonium havlasae*, *Austrodanthonia caespitosa* and *Austrostipa variabilis*.

#### 2. Swamp She-oak (*Casuarina obesa*) Closed Forest over *Juncus kraussii* Sedgeland

This Unit was situated at the southern end of the Big Channels adjacent to Hall's property and east of Swan Lake. Fresh water seepage comes from the upslope area. Swamp She-oak trees and saplings of varying ages and diameter formed a Closed Forest (80% canopy cover and approximately 20 stems/5m<sup>2</sup>) which was difficult to penetrate. The ground was wet underfoot and spongy from accumulated litter. The rush *Juncus kraussii* formed a layer beneath (40% cover) and there were scattered *Melaleuca halmaturorum* amongst the She-oak.

### WOODLANDS

#### 3. Salt River Gum (*Eucalyptus sargentii* subspecies *sargentii*) (Low) Open Woodland

These Woodlands to 10 metres in height were situated on the edge of sand rises on brown loamy sands and on the edges of the loam over clay flats in the eastern sector of the Lakes System (Photograph 2). Salt River Gum reached its western limit at Swan Lake. Sometimes it formed a narrow band a single tree width on the edge of sand dunes adjoining lakes or the sand rises of lunettes. On many of the sand rises *Halosarcia indica* subspecies *bidens* (Vegetation Unit 17) was encroaching up-slope. Like Salmon Gum Woodlands, the understorey of Salt River Gum was very open with no well-defined layers. Understorey species included *Rhagodia drummondii*, *Halosarcia indica* subspecies *bidens*, *Sarcozona praecox*, *Disphyma crassifolium* and annual herbs *Brachyscome iberidifolia*, *Gnephosis angianthoides*, *Crassula exserta*,

*Podolepis capillaris*, *Podotheca angustifolia*, \**Romulea rosea* and grasses *Eragrostis dielsii*, \**Pentaschistis airoides* and \**Vulpia myuros*. (\*denotes a weed species)

#### 4. York Gum (*Eucalyptus loxophleba*) Low Open Woodland

This Unit was scattered through the western sector, both on the outer edges of the lake system and within the larger sand dunes bordering the lakes where they occupied the highest ground on original (as opposed to wind blown) red sandy loams (e.g. Eastern side of Ossig's lake). The York Gum forms Low Open Woodlands (to 8 metres) and the trees were often spreading and low branching (mallee-like in appearance but with a single trunk at the base (Photograph 3). Many were old and senescing. The understorey typically consisted of a *Rhagodia drummondii* Open Shrubland and a Very Open Herbland. Ground layer species included *Lepidosperma* sp. A2 Island Flat (G.J. Keighery 7000), *Lomandra effusa*, *Lomandra micrantha* subspecies *teretifolia*, *Gahnia* sp. (matches K.L. Wilson 2754), \**Romulea rosea*, \**Hypochaeris glabra* and *Acanthocarpus canaliculatus*.

#### 5. Wandoo (*Eucalyptus wandoo*), York Gum and Swamp She-oak (*Casuarina obesa*) Low Open Woodland

This mixed Woodland Unit occupied a band on the southern outer edge of the lakes system, east of Qualandary Crossing, on sandy clay loam soils. Beneath an Open Woodland of Wandoo and York Gum was Low Open Woodland of Swamp She-oak and Jam over *Hakea preissii* (Needle Tree) Tall Shrubland over *Rhagodia drummondii* Open Shrubland. Ground layer species included *Gahnia* sp. (matches K.L. Wilson 2754), *Lomandra effusa*, *Acanthocarpus canaliculatus*, *Halosarcia indica* subspecies *bidens* and *Podolepis capillaris*.

#### 6. Rock She-oak (*Allocasuarina huegeliana*) – Jam (*Acacia acuminata*) Low Open Woodland

This Unit occupied the yellow sand dunes bordering the lakes. Vegetation Units 11a or 12 commonly bordered it (Photograph 4). The condition of the vegetation was varied. On the north-east side of Ossig's Lake for example, the condition was good to degraded (see Table B, Appendix I) with low cover and low species richness. The south-west side of Racecourse Lake was in very good condition with fewer weeds and greater structural and species diversity.

Rock She-oak and Jam were the typical overstorey species. Their relative dominance and cover varied but cover was mostly less than 5 per cent. York Gum was sometimes scattered through this unit. *Banksia prionotes* (Acorn Banksia) was occasionally present but always in poor health and dead specimens were also evident. Shrub layers also varied in cover and composition. Typical species included *Rhagodia drummondii*, *Eremaea pauciflora*, *Grevillea paniculata*, *Grevillea eriostachya*, *Santalum acuminatum*, *Calothamnus quadrifidus*, *Calytrix leschenaultii*, *Acacia leptopetala* and the twiner *Comesperma integerrimum*. Species of a Very Open Sedgeland included *Lepidobolus preissii*, *Lyginia imberbis*, *Mesomelaena pseudostygia* and *Lepidosperma* sp. A2 Island Flat (G.J. Keighery 7000). Common herbs were *Borya laciniata*, *Dianella revoluta*, *Podolepis canescens*, *Thysanotus patersonii*, *Lawrencella rosea*, *Goodenia berardiana*, *Actinobole uliginosum* and grasses *Neurachne alopecuroidea* and *Austrostipa elegantissima*. A weedy layer was sometimes prominent and included \**Arctotheca calendula*, \**Briza major*, \**Avena barbata*, \**Ursinia anthemoides*, \**Pentaschistis airoides* and \**Tripteris clandestina*.

#### 7. Acorn Banksia (*Banksia prionotes*) Low Open Woodland

This Unit is a relic of the original yellow sandplain that was cleared from the slopes on the southern side of the lakes system. One remnant in excellent condition adjoined Vegetation Units 2 and 20 on the south side of the Big Channels (Photograph 5). The other small remnants were on narrow edges (western side of Big Channels and bordering a wetland on Mills' property). Acorn Banksia (to 10 metres tall) dominated, along with *Xylomelum angustifolium* over an

Open Shrubland of *Rhagodia drummondii*, *Melaleuca subtrigona*, *Billardiera* sp., *Petrophile ericifolia*, *Leptospermum erubescens*, *Regelia ciliata* over *Mesomelaena pseudostygia* Very Open Sedgeland. A herb layer was more evident in the smaller more open patches. Species included *Borya laciniata*, *Podolepis canescens*, *Dianella revoluta*, *\*Hypochaeris glabra* and the grass *Austrostipa elegantissima*. Many species were in common with the sand dune Vegetation Unit 6.

## MALLEES

### 8. *Eucalyptus orthostemon* ms Very Open Shrub Mallee over mixed *Melaleuca* Shrublands

This Unit occurred on sandy loam flats throughout the lakes system and is differentiated from Unit 11b by the presence of *Eucalyptus orthostemon* ms. *E. orthostemon* ms is a lignotuberous mallee (Photograph 6) and formed a very open layer (2-5% cover) in association with a Tall Open Shrubland of *Melaleuca atroviridis* ms over a Mixed Shrubland. This was commonly a mix of any of the following species: *Melaleuca brophyi*, *Melaleuca lateriflora*, *Melaleuca acuminata* subspecies *websteri*, *Melaleuca adnata*, *Santalum acuminatum*, *Rhagodia drummondii* over *Gahnia* sp. (matches K.L. Wilson 2754) Very Open Sedgeland. On the eastern edge of the system this unit formed a complex with units 11b and sometimes unit 10 and on small sandy rises within the units *Chamelaucium micranthum* (salt lake form), *Darwinia halophila* and *Conostephium preissii* were also present. Drifts of annuals were evident during a spring visit to the eastern sector and the herb layer included *Podolepis lessonii*, *Podolepis canescens*, *Blennospora phlegmatocarpa*, *Pogonolepis stricta*, *Brachyscome iberidifolia*, *Borya laciniata*, *Crassula exserta*, *Calandrinia calypttrata* and *Calandrinia granulifera*.

### 9. *Eucalyptus hypochlamydea* Open Shrub Mallee

This Unit was uncommon, being located on the moderately steep slope above Morrel Pool and on a rise on yellow loamy sand approximately 1.6 kilometres west-south-west of Morrel Pool. A few specimens of *Eucalyptus hypochlamydea* were also located on the outer boundary of the reserve south of Johnnie's Lake. The multi-stemmed mallee to 8 metres tall (Photograph 7) formed a Very Open layer over a mixed Open Shrubland and Low Open Shrubland. Shrub species included *Melaleuca atroviridis* ms, *Melaleuca adnata*, *Melaleuca brophyi*, *Bossiaea* sp. indet., *Chamelaucium micranthum* (salt lake form), *Rhagodia drummondii* and *Enchylaena tomentosa*. Ground layer species included *Lomandra effusa*, *Clematis delicata* and annual herbs.

## SHRUBLANDS

### 10. *Melaleuca atroviridis* ms Tall Shrubland over *Rhagodia drummondii* Low Open Shrubland

*Melaleuca atroviridis* ms was one of the most commonly occurring species throughout the system. It was conspicuous as Tall Shrubland islands on sandy rises within the bed of the system. It also formed thickets on the loam flats within Vegetation Units 8 and 11b or in depressions in the sand dunes. A species poor unit, it was dominated by *Melaleuca atroviridis* ms to 5 metres tall and ranging in cover from less than 30% up to 70% (Tall Shrubland to Open Scrub) over a *Rhagodia drummondii* Low Open Shrubland. In openings within the thickets an annual herb layer established. Species included *Gnephosis angianthoides*, *Ptilotus humilis*, *Crassula exserta*, *Trachymene pilosa*, *\*Vulpia myuros* and *\*Hypochaeris glabra*.

This unit commonly adjoined Vegetation Unit 17, which was down-slope (Photograph 8). The samphires in some instances were moving up-slope and displacing the *Melaleucas*. Although many of the sand rise 'islands' have been mapped as a single Unit – Vegetation Unit 10 - they are in fact Unit 10 surrounded by a band of Unit 17, which is too narrow to map.



### 11a. Mixed *Melaleuca* Shrublands on slopes of sand rises

This Unit was situated on white windblown sands commonly on the edges of sand dunes bordering lakes. It was distinguished from Unit 10 by the lack of dominance of *Melaleuca atroviridis* ms, from Unit 22 because it was broader than a single tree fringe and not monospecific and from Unit 11b by soils and landscape position. It was commonly dominated by *Melaleuca brophyi* Open Heath or Shrubland (to 2 metres tall), or a mixture of species including *Melaleuca atroviridis* ms, *Melaleuca hamata* or *Melaleuca carrii*. The understorey was an Open Low Shrubland of *Rhagodia drummondii* and *Comesperma integerrimum* over a Very Open Herbland of *Blennospora phlegmatocarpa*, *Angianthus tomentosus* and *Crassula exserta*.

These Shrublands were usually situated either above a lake beach and below Vegetation Unit 6 (Photograph 4) or above Samphire Vegetation Unit 17. They sometimes merged with Vegetation Unit 12. The Unit varied in width from very narrow to a broad band and so was sometimes too narrow to map. This Unit is probably a mobile one. *Melaleucas* once covered much of the bed, which is now Samphire flats, and they have been forced up-slope. They are species that are sensitive to the period of inundation and have drowned as the watertable has risen. Seed would be washed and deposited in bands along the rises as floodwaters rise and recede.

### 11b. Mixed *Melaleuca* Shrublands on flats

This Unit occupied the broad sandy loam flats throughout the lakes system. It was separated from Unit 11a on the sandy slopes by its position in the landscape and greater species diversity. It was distinguished from Unit 8 by the absence of *Eucalyptus orthostemon* ms. Units 8 and 11b may be falsely separated as they share other common characteristics. The species mosaic was variable in composition and density across this unit. Near McLean Road in the western sector for example the vegetation was *Melaleuca adnata* Open Scrub (2 metres tall with 70% cover) over *Melaleuca hamata* Shrubland over *Rhagodia drummondii* Low Open Shrubland and *Gahnia* sp. (matches K.L. Wilson 2754) Very Open Sedgeland with emergent *Melaleuca atroviridis* ms.

On the eastern side of Swan Lake there was a mixed *Melaleuca* Open Heath (*Melaleuca atroviridis* ms, *M. brophyi*, *M. halmaturorum*, *M. lateriflora*) over *Rhagodia drummondii*, *Halosarcia indica* Low-Open Shrubland over *Gahnia* sp. (matches K.L. Wilson 2754), *Lepidosperma* sp. A2 Island Flat (G.J. Keighry 7000) Open Sedgeland.

In the eastern sector, open areas within the shrublands supported rich annual herblands: *Blennospora phlegmatocarpa*, *Podotheca gnaphalioides*, *Ptilotus humilis*, *Borya laciniata*, *Crassula* spp., *Calandrinia* spp., *\*Vulpia myuros*, *\*Ursinis anthemoides*, *\*Moraea setifolia*. Associated species included *Hakea preisii*, *Lycium australe*, *Exocarpus aphyllus* and on sandy rises within the Unit *Chamelaucium micranthum* (salt lake form), *Baeckea crispiflora*, *Darwinia halophila* and *Santalum acuminatum*.

### 12. *Scholtzia* sp. Yenying Lakes (A. Gunness 2824) Shrublands on slopes of sand rises

This Unit occurred on the shoulder of sand dunes down-slope of Unit 6. *Scholtzia* sp. Yenying Lakes (A. Gunness 2824) was always dominant. Sometimes it formed a band along the contour of 2-3 metre high, spreading, multi-stemmed shrubs. Otherwise it was in a broader band in mixture with *Leptospermum erubescens*, *Chamelaucium micranthum* (salt lake form), *Melaleuca brophyi* and *Melaleuca carrii*. An understorey was not usually present although sand dune species of Unit 6 sometimes co-mingled, e.g. *Lepidosperma* sp. A2 Island Flat (G.J. Keighry 7000), *Lepidobolus preissianus*, *Rhagodia drummondii*, *Blennospora phlegmatocarpa*, *Brachyscome iberidifolia*. On the western edge of Racecourse Lake it was growing with *Melaleuca adnata* and formed a band between Vegetation Unit 17 and Unit 6.

Vegetation Units 11a and 12 merged into each other where they adjoin Unit 6 and the two could not always be mapped separately as they were too narrow to define (e.g. Ski Lake, Ossigs Lake). Unit 12 was always up-slope of Unit 11a.

### 13. Needle Tree (*Hakea preissii*) Tall Shrubland

This Unit occurred on two small, grey brown loam flats south of Morrel Pool. It was a Needle Tree Tall Shrubland over *Rhagodia drummondii*, *Lycium australe* Shrubland over *Enchylaena tomentosa*, *Disphyma crassifolium* subspecies *clavellatum* Low Shrubland over a *Pogonolepis stricta* and mixed annuals Herbland, *\*Bromus rubens* Very Open Grassland and *Gahnia* sp. (matches K.L. Wilson 2754) Very Open Sedgeland. There were a few old emergent York Gums as well as dead trees suggesting it was a unit resulting from some kind of disturbance such as fire or grazing. Needle Tree was scattered on the loam flats throughout the system and it is a species known to increase under disturbed conditions. The flats were surrounded by Samphire with a sandy strip between the Samphires and the Shrubland supporting a Herbland of *Frankenia drummondii*, *Wilsonia humilis*, *Erymophyllum ramosum*, *Hyalosperma glutinosum* and others.

### 14. *Melaleuca acuminata* subspecies *websteri* Closed Heath

This Unit occurred only as a small band amidst Wandoo Woodland on private property adjoining the Reserve north of Ossig's lake. *Melaleuca acuminata* subspecies *websteri* (to 1.5 metres tall and 70% cover) formed a Closed Heath. There were occasional *Melaleuca lateriflora*, *Melaleuca adnata* and *Melaleuca atroviridis* ms emergents, with *Calandrinia* sp., *Dichopogon capillipes* and *Pelargonium havlasae* in the Very Open Herb layer.

### 15. Tamar (*Allocasuarina campestris*) Tall Shrubland

This Unit existed as small remnants on gravelly sandy loam on the southern edge of the lake system. This vegetation type was extensively cleared for farming. The best example was located between Mud Lake and Rocky Lake with another patch north of the elevated pool on the western edge of the Big Channels. Tamar (up to 4 metres tall) was dominant with a few emergent Jam. The understorey was a mixed Open Herbland rich in annuals and Open Grassland. Species included *Borya laciniata*, *Dianella revoluta*, *Podolepis canescens*, *Podolepis tepperi*, *Trachymene* spp., *Millotia tenuifolia*, *Drosera macrantha*, *Crassula colorata*, *Austrostipa elegantissima* and *\*Pentaschistis airoides*.

## MODIFIED SHRUBLANDS

### 16. Samphire (*Halosarcia lepidosperma*, *H. leptoclada* subspecies *inclusa*, *H. halocnemoides*) Low Open Shrubland over Open Herbland with emergent *Melaleuca lateriflora* and *Melaleuca atroviridis* ms

This Unit (Photograph 9) formed a fairly extensive area on pale grey hard setting clay loam flats south-west of Morrel Pool. It is mapped as modified as it appears to be in a transition state between *Melaleuca* flats (Vegetation Unit 11b) and Samphire flats (Vegetation Units 17 and 18). It adjoined and lay slightly lower in the landscape than Unit 11b and above the secondary Unit 18. The vegetation can be described as *Halosarcia lepidosperma* Low Shrubland over *Halosarcia leptoclada* subspecies *inclusa*, *Halosarcia halocnemoides*, *Disphyma crassifolium* and *Roycea spinescens* Low Open Shrubland over *Ptilotus fasciculatus*, *Wilsonia humilis* and *\*Moraea setifolia* Open Herbland with scattered *Melaleuca lateriflora* and *Melaleuca atroviridis* ms. Associated species included *Arthropodium* sp. Yenyening (G. Keighery and N. Gibson 2957), *Erymophyllum tenellum*, *Erymophyllum ramosum*, *Angianthus pygmaeus* and *\*Parapholis incurva*.

Although Samphires were a dominant component there was a mix of species which were "hanging on" in what is probably a drowning environment, more waterlogged and saline than

Unit 11b but not as saline as Units 17 and 18. Two threatened species were found growing only on these flats (*Ptilotus fasciculatus* and *Arthropodium* sp. Yenyening (G. Keighery and N. Gibson 2957) (Photographs 16a and 16d).

#### **SAMPHIRE SHRUBLANDS**

The boundaries between the following two Samphire Units and bare ground were difficult to map and can change according to environmental conditions (flooding, drought). Samphires are succulent species of the family Chenopodiaceae (*Halosarcia*, *Sarcocornia*, *Sclerostegia*, *Tecticornia*, *Tegicornia*) commonly associated with saline environments. They occupy the lowest part of the landscape in the Lakes system and have increased as the water table has risen and the system has become more saline, replacing *Melaleuca* Shrublands. Dead stems and tree trunks of the former Shrublands were commonly emergent through the Samphires (Photograph 10). These Vegetation Units were species poor.

##### **17. *Halosarcia indica* subspecies *bidens*, *Halosarcia lepidosperma*, *Frankenia pauciflora* Open Low Heath**

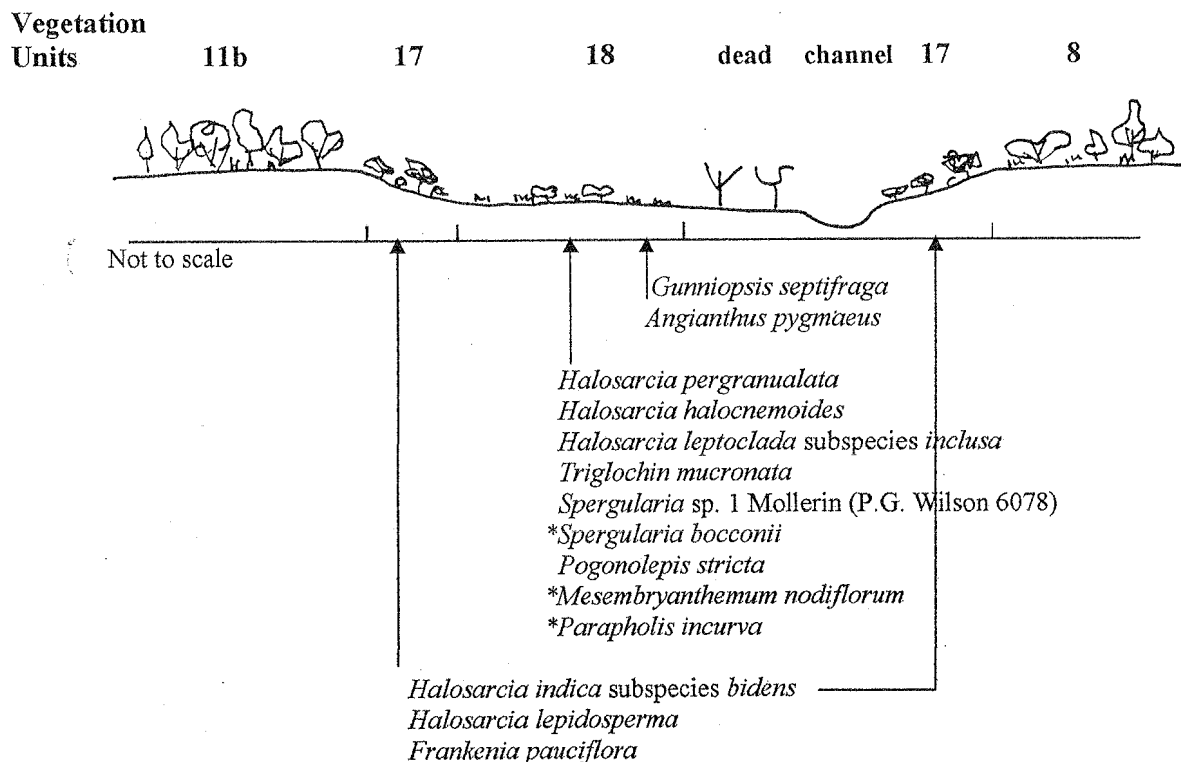
This Unit (Photographs 8 and 11) occurred on the lowest edges of sand rises and on wind-blown or water-deposited very low rises in the channel bed. It almost always fringed Vegetation Unit 10 and on some of the rises supporting Salt River Gum was moving up-slope. The characteristic species of this unit were *Halosarcia indica* subspecies *bidens*, *Halosarcia lepidosperma* and *Frankenia pauciflora*. Other species included *Atriplex lindleyi* subspecies *inflata*, *Didymanthus roei*, *\*Mesembryanthemum nodiflorum*, *Sarcocornia quinqueflora*, *\*Cotula bipinnata*, *Disphyma crassifolium*, *Angianthus tomentosus*, *Bulbine semibarbata* and *\*Moraea setifolia*.

The different Samphires occupy different niches within the saline environment. *Halosarcia indica* subspecies *bidens* is always found on well-drained saline soils (Datson 2000) and occupies higher ground than the species of Unit 18 (Photograph 11). The Samphire species of this unit are taller than Unit 18. *Halosarcia indica* subspecies *bidens* and *Halosarcia lepidosperma* have an upright habit and the former was often growing to 1 metre in height.

##### **18. *Halosarcia pergranulata*, *Halosarcia halocnemoides* Low Shrubland**

This Unit was a Low Shrubland with the Samphires growing to no more than 50 centimetres (Photographs 11 and 12). It was located on lower ground than Unit 17, in the channel bed and flats and around lake beaches. It often adjoined bare or salt scalded ground. *Halosarcia halocnemoides* and *Halosarcia pergranulata* were dominant, *Halosarcia leptoclada* subspecies *inclusa* was less common. An understorey of Very Open Herbland was not uncommon and species included *Angianthus pygmaeus*, *Spergularia* spp., *Triglochin mucronata*, *Pogonolepis stricta*, *\*Cotula bipinnata*, *Cotula cotuloides*, *\*Mesembryanthemum nodiflorum*, *Sclerolaena diacantha*, *Threlkeldia diffusa* and the grass *\*Parapholis incurva*.

The following profile illustrates a typical pattern of Vegetation Unit associations with Samphires across the flats and bordering the rises.



**Figure 2:** Profile of Samphires on channel bed and banks between mixed *Melaleuca* Shrublands at McLean's Road boundary of Yenyening Reserve.

#### Sub-units of Unit 18, too small to map.

In the eastern sector of the lakes system there were small populations of threatened species of Samphire.

***Roycea spinescens* and *Halosarcia* sp. Central Wheatbelt (M.N.Lyons & S.D.Lyons 2760).** These two species were growing together forming a mat on the sandy clay floor above Morrel Pool within Vegetation Unit 18 (Photograph 12).

***Roycea pycnophylloides* and *Halosarcia* sp. Central Wheatbelt (M.N.Lyons & S.D.Lyons 2760).** The Declared Rare species *Roycea pycnophylloides* (to 10 centimetres tall and 2-3% cover) (Photograph 16b) was growing on small mounds of accumulated sandy clay with coarse granitic pebbles within a bare Samphire flat (Unit 18) and on a nearby lower slope of a dune east of Vegetation Unit 16. It is known elsewhere to occur in the seepage zone below sand dunes of saline wetlands (M. Lyons pers. comm). Associated species included *Halosarcia* sp. Central Wheatbelt (M.N.Lyons & S.D.Lyons 2760), *Halosarcia leptoclada* subspecies *inclusa* and *Halosarcia halocnemoides*.

#### SEDGELANDS (RUSHES)

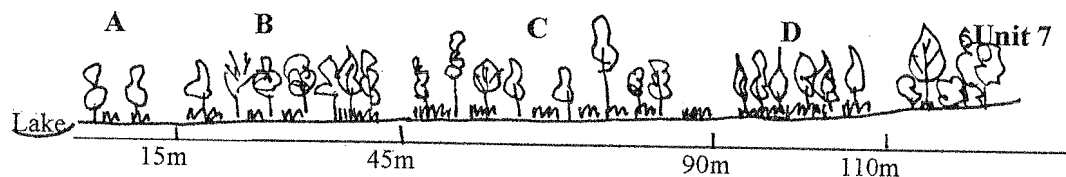
##### 19. *Hopkinsia anoetocolea* (Open) Sedgeland on white sand rises in drainage channels

This Unit (Photograph 13) was found on the top of sand rises within the channels in three locations in the eastern sector of the Reserve. *Hopkinsia anoetocolea* is a rush with sand binding rhizomatous roots (Photograph 14) and it grew in dense clumps to form a distinctive monospecific layer. In one situation it was growing amongst Vegetation Unit 12 and in the other it was adjacent to a degrading Salt River Gum / *Melaleuca atroviridis* ms / Samphire Unit 18 complex.

## 20. Freshwater Perched Lake: *Baumea riparia*, *Juncus kraussii* Closed Sedgeland under *Melaleuca brevifolia* Open Scrub

This band of vegetation was situated below the Low Open Acorn Banksia Woodland (Vegetation Unit 7) and above a perched lake at the south-west corner of the Big Channels. It was a seepage area receiving water from the adjacent sandplain and collecting in a perched freshwater lake. Local farmer Henry Hall related that the rushes have appeared in the last 50 years, as a result of increased run-off following clearing and the water seeping out in this zone. Shortage of time only allowed a rapid assessment of this site. Further investigations are needed to fully describe it.

The vegetation formed bands, of variable height and density, of *Melaleuca* thickets over rushes between the lake and the Banksia Woodland as follows.



- A: *Melaleuca thyoides* Open Scrub over *Juncus kraussii* (<50% cover) Rushes  
 B: *Melaleuca brevifolia* Closed Heath over *Baumea riparia* Closed Rushes with emergent Swamp She-oak.  
 C: *Melaleuca brevifolia* Open Heath over *Baumea riparia* Closed Rushes with emergent *Melaleuca viminea*.  
 D: *Melaleuca brevifolia* Closed Scrub over *Juncus kraussii* Closed Rushes. Associated species: *Schoenus* aff. *subfascicularis*.

**Figure 3:** Profile of vegetation adjoining the Perched Lake

### LAKE EDGES

Two units which formed bands along the lake shorelines were commonly too narrow to map. Unit 21 was often only one tree or shrub width. The vegetation of the shorelines of the lakes was sometimes confusing, e.g. southern end of Ossig's Lake where huge sand depositions after the 2000 floods had changed the shoreline position.

## 21. Closed (Tall) Shrublands (e.g. *Melaleuca thyoides* or *Callistemon phoeniceus*)

This band commonly comprised a single species e.g. *Melaleuca thyoides* on the lakes bordered by sand dunes, or *Callistemon phoeniceus* at the edge of Rocky Lake where water seeps out along a diorite band. *Melaleuca thyoides* specimens were commonly old or dying. The only sightings of *Eucalyptus rudis* were at the lake's edges at the southern ends of Racecourse Lake and Ossig's Lake.

## 22. Herbland +/- *Halosarcia halocnemoides* Low Open Shrubland

This Unit was a "colonising" unit located in washed white sands along shorelines and adjacent to bare lake-beds. Tiny salt tolerant annual herbs form an Open Herbland after water recedes. They adjoined or grew in association with a *Halosarcia halocnemoides*, *Halosarcia pergranulata* Low Open Shrubland. Species included *Gunniopsis septifraga*, *Angianthus strictus*, *Gnephosis angianthoides*, *Cotula coronopifolia*, \**Cotula bipinnata*, *Calandrinia* sp. Needilup (K.R. Newbey 4892) and \**Parapholis incurva*.

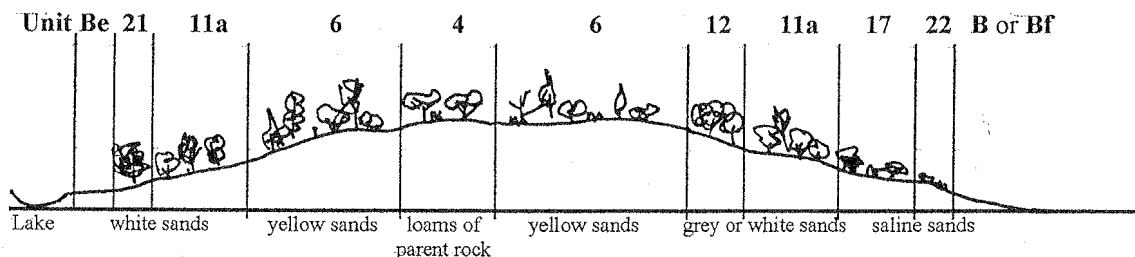
## THE VEGETATION MAP AND HOW TO INTERPRET IT

Mapping was done from 1:25 000 aerial photographs flown in February 2001 and transcribed onto a base mosaic. The maps were then digitised by the Information Management Branch, GIS Section, in the Department of Conservation and Land Management. The vegetation map is produced on a single folded sheet in the sleeve at the back of the report.

The map is a reflection of the vegetation and water levels in the lake at the time the aerial photography was flown. It should be interpreted using the descriptions of Vegetation Units above and the following notes.

- A. The Vegetation Units have been denoted on the map by their number. For clarity, instead of showing 22 different coloured units, the map was coloured according to the eight broader structural groups. The Shrublands were divided into two groups according to their position in the landscape: those on sand rises and those on flats.
- B. The main lakes are labelled with names and were holding water at the time of photography.
- C. The areas that did not support vegetation were designated as follows:
  - B** Bare lake bed
  - Bb** Braided lake bed. A lake bed banded with sand rises (with or without colonising samphires). These braided areas in the eastern sector are known locally as the Channels.
  - Bf** Bare flats. The low-lying flats bordering channels and outside lake boundaries. They are inundated in flood events, probably hypersaline, and do not support any vegetation
  - Be** Sandy beaches surrounding lakes
- D. At the scale mapped it was impossible to always distinguish the very narrow Vegetation Units. These included
  - Unit 12: *Scholtzia* sp. Yenyening Lakes (A. Gunness 2824) Shrublands on slopes of sand rises. This unit sometimes graded into Unit 11a, and so the map would show Unit 11a but not Unit 12. It was often just a very narrow band (<10 metres on the ground) too narrow to define on the map. It was commonly up-slope of Unit 11a or Unit 3 and down-slope of Unit 6, but would not be shown on the map. Sometimes it was a band above Samphire Unit 17 on the slope of a sand dune (Unit 6).
  - Unit 21: Closed (Tall) Shrublands (e.g. *Melaleuca thyoides* or *Callistemon phoeniceus*)
  - Unit 22: Herbland +/- *Halosarcia halocnemoides* Low Open Shrubland
- E. The following profile is an idealised illustration of the sequence of structural Vegetation Units of a sand dune bordering a lake (e.g. Ossigs Lake).

Not to scale



- F. Although islands of Vegetation Unit 10 (*Melaleuca atroviridis* ms Tall Shrubland over *Rhagodia drummondii* Low Open Shrubland) are mapped as a single unit they were commonly a rise of Unit 10 surrounded by a narrow band of Unit 17 (*Halosarcia indica* subspecies *bidens*, *Halosarcia lepidosperma*, *Frankenia pauciflora* Open Low Heath).

- G. The boundaries between the two Samphire Units 17 and 18 were very difficult to interpret, especially in the eastern sector of the Reserve. A combination of numbers on the map indicates the area was mapped as a complex of those units. So 18/17/Bf indicates an area where Unit 18 was dominant with Unit 17 and Bare flats interspersed, where the boundaries were impossible to distinguish on the aerial photographs, and ground interpretation was not practical.

Samphires move about according to seasons and are susceptible to changes in conditions. Hence mapping them is difficult. They generally seed prolifically but only reproduce when they have the right conditions of salinity, moisture and temperature. They germinate freely when the soil is wet with relatively fresh water, for example after a flood event or after very heavy rain and the principal factors affecting their zonation appear to be the period of wetness and salt concentration (Datson 2002).

#### VEGETATION CONDITION

The overall impression of the Yenyening Lakes was of a degraded system severely impacted by salinity. This was evident in the large expanses of bare flats or samphire flats with the emergent dead trunks of a previous vegetation (most frequently *Melaleuca* species) (Photograph 10). However, the vegetation in the upper landscape is still relatively intact.

Vegetation condition was assessed in response to two sets of disturbances or degrading processes. Firstly, those directly related to hydrological change, particularly increased salinity and waterlogging, and secondly the widespread disturbances such as weed invasion, fire and grazing. The lower landscape has been most affected by hydrological changes whereas the vegetation in the upper landscape has been subject to other degrading processes.

The Vegetation Units have been categorised according to the degree of modification from the original, caused by hydrological change, as follows (Table I). (Note: this classification was developed in discussion with Mike Lyons, Neil Gibson and Greg Keighery)

- **Intact or Primary:** vegetation highest in the landscape on sand rises and 'original' soil types.
- **Modified:** mid level in landscape, and edges of slopes. A mixture of original vegetation and salt tolerant species. Probably sensitive to altered water levels.
- **Secondary:** Colonising Samphires +/- emergent dead trunks on low-lying ground where salinity and waterlogging have caused plant community changes. Salt tolerant species have replaced original vegetation
- **Bare saline flats**

**Table 1:** A broad classification of the vegetation of Yenyening Lakes according to degree of modification by hydrological change

Category	Landscape position	Vegetation Unit
<b>Intact or Primary</b>	Upper slopes: <ul style="list-style-type: none"> <li>• Sand dunes</li> <li>• Sandy loam flats</li> <li>• Parent soils</li> </ul>	Rock She-oak – Jam Low Woodlands (Unit 6), <i>Scholtzia</i> sp. Shrublands (Unit 12)  Melaleuca Shrublands (Units 8 and 11b)  Salmon Gum, Salt River Gum, York Gum and Wandoo Woodlands (Units 1, 3, 4 and 5) <i>E. hypochlamydea</i> Mallee (Unit 9) Tamar Shrublands (Unit 15)
<b>Modified</b>	Low broad flats  Lower edges of sand rises	Modified shrublands (Unit 16) Needle tree Shrublands (Unit 13)  Lower edges, with invading <i>Halosarcia indica</i> , of : Salt River Gum Woodlands (Unit 3) <i>Melaleuca atroviridis</i> ms Shrublands (Unit 10) Mixed <i>Melaleuca</i> Shrublands (Unit 11a)
<b>Secondary</b>	Lower slopes and channel flats	Samphire communities +/- emergent dead trunks (Units 17, 18 and 22 )
<b>Bare</b>	Drainage lines, saline flats	

The main degrading processes identified in the **lower landscape** were:

- **Salinity:** caused by a rising watertable, inundation, evaporation of surface water and a build up of soluble salts within the soil profile, affecting the plant's ability to take up moisture. Species vary in their salinity tolerance.
- **Waterlogging:** also caused by a rising watertable. The poorly drained soils of the lower landscape can become saturated with water limiting oxygen supply to the roots. The depth and period of inundation of waterlogged areas influences species distribution.

It is difficult to know which factor is having the greater influence. It has been observed that the combined effect of salinity and waterlogging may have a much greater effect on the growth of woody species than either factor on its own.

- **Flooding and drought (climate extremes):** Flooding causes physical damage to vegetation and moves sand about causing changes in the vegetation patterns on the flats and edges of lakes. In addition sands are moved about by wind. Mass germination can occur as water recedes and the subsequent survival depends on the combination of environmental factors following. The mosaic pattern of species and variation in their densities throughout the system was probably a reflection of these factors. Samphires in particular move about according to flood and drought regimes.

Plants of the lower landscape must be able to respond to growing in wet conditions for some or all of their life cycle and need to be adapted to changing water levels and episodic flooding. In addition, the system is subject to periods of extreme climate fluctuations such as the 2000 floods followed by 2 years of drought, and so species have to be tolerant of varying periods of wet and dry and to different depths and duration of inundation. This was reflected



in the change of vegetation according to small changes in elevation, correlated to a difference in duration of inundation and salt content.

The main degrading processes identified in the **upper landscape** were:

- **Impacts from domestic, feral and native animals.** Grazing and nutrient enrichment are both factors which encourage weed competition. Domestic livestock have been fenced from most areas of the system for many years. Grazing by rabbits and kangaroos is ongoing and in drought years intensifies as the kangaroos seek shelter and feed. The lack of regeneration may be due in large part from intensive kangaroo grazing pressure.
- **Weed invasion:** weeds were present in all the vegetation types and probably most aggressive in the degraded areas of the sand dunes (particularly Unit 6). Thirty-seven species were recorded (13 per cent of the total taxa recorded). Many of these were widespread pasture species - 15 were grasses and others were specific to saline habitats (e.g. *\*Mesembryanthemum nodiflorum*, *\*Spergularia bocconii*). This study did not undertake a comprehensive account of weeds.
- **Inappropriate fire regimes:** There were no recent signs of fire. Fire can be a regeneration mechanism for senescent species by stimulating germination of dormant seeds. On the other hand fire at too frequent intervals can destroy seed stored in the canopy or the soil and eliminate species which take a long time to reach maturity and replenish their seed bank. Disturbance by fire also encourages the growth of many rapidly established weed species.

A few of the primary areas were still in excellent condition – with various structural layers still intact and few signs of disturbance (e.g. Acorn Banksia Low Open Woodland at the southern end of the Big Channels, Mallee Woodlands on the eastern side of the Reserve and the Tamar Tall Open Shrubland remnant between Mud Lake and Rocky Lake). Other primary units were in good to degraded condition - with structural layers missing or in decline, significant weed invasion obvious and species richness diminishing. Vegetation Unit 6 (Rock She-oak - Jam Low Open Woodland on sand dunes) was typically varied in condition. The rises on the north-east side of Ossig's lake and around the north-west side of Ski Lake were in the poorest condition. They were suffering from significant weed invasion, upper and mid storey species were missing or dying and there were no signs of regeneration. Factors contributing to the decline probably include heavy grazing by rabbits and kangaroos, increasing aridity and long term absence of regeneration mechanisms such as fire.

The lack of regeneration of woody species throughout the system was conspicuous. Two drought years and heavy grazing by kangaroos could have eliminated any new germination since the 2000 floods. Some species will not germinate, even in wet soils, if the soils are saline. This may explain the lack of regeneration of Swamp She-oak, Flooded Gum and Melaleucas, which normally appear in dense bands around lakes following flood events.

#### CHANGES OVER TIME

It is often difficult to imagine that bushland as you see it now has not always been the same. Not only is vegetation in a naturally dynamic state, but changes to the environment of the study area through human intervention (direct and indirect) have been occurring over more than a century. The main periods of clearing of vegetation for agriculture in the Western Australian wheatbelt were 1900-1930 and 1950-1980 and this resulted in the rise of saline groundwater. The wetlands of the wheatbelt suffered significant changes owing to salinisation, increased run-off, siltation and eutrophication. The salinity status of the Yenyening Lakes system has increased over time from being probably originally fresh in winter and brackish in summer, to being permanently saline.

As I traversed the lakes system I so often wished for a crystal ball to show me what the sites I was standing on would have looked like 50 or 100 years ago. This study will at least provide a

picture for comparison in future times, but how can we compare the past when few records exist and no detailed studies have been undertaken?

## 1. Human recollection

We were fortunate to have Henry Hall accompany us during two days of field-work. He has lived most of his life in the area and knows the Yenyening Lakes intimately through extensive wanderings, duck shooting and keen observation, and has memories dating to the late 1920s. His recollections help to provide some indications of the changes that have taken place and were as follows:

Up until 1931 the water in the lakes was fresh enough to water the dogs. Then the moderately salt tolerant aquatic herb *Ruppia maritima* started colonising. It was good duck feed. In 1975-76 the *Ruppia* was preventing movement of ski boats on the Ski Lakes but in subsequent years the water became too salty even for *Ruppia* to survive. Henry recalls that Samphires did not start to colonise in significant proportions until soon after the disappearance of *Ruppia*. His first recollections of Samphires were of a small fringe around a lake edge in 1962.

In the wet years of 1965-66 water in the lakes was fresher. In a survey with Vincent Serventy they estimated there were 3000 Swan eggs in the eastern sector from Swan Lake through the Channels as far as Morrel Pool. Swan nesting is now virtually non-existent, as the water is too saline.

He frequently drew attention to the changes in density of *Melaleucas*. Small sandbanks, which were once impenetrable *Melaleuca* thickets, are now Samphires. In 1945 they used to hide in these thickets when duck shooting and had considerable difficulty walking through the area. He asked us to imagine when the *Melaleuca* trunks, which now stand dead amongst the samphires on the flats, once had canopies that shaded the flats and they would be loud with the sound of beetles.

Traversing the sand dunes of Ossig's Lake we were discussing the condition of the vegetation of the species rich Vegetation Unit 6 (Rock She-oak – Jam Low Open Woodland). Henry said "Oh it is about 15 per cent as good as it used to be. You would be blinded by the mass of colour". The edge of Ossig's Lake was often a bank of orchids.

He also suggested that the decline of some Tamar in Unit 15 could be due to an increasingly arid climate. He has rainfall records as far back as 1898 and claims the current climate is 27% drier than average.

Many of these recollections match those recorded by Sanders (1991) in her oral histories documenting changes in wheatbelt wetlands. She recorded that most of the wetlands of the Avon River documented in the project were fresh or near fresh until the early 1930s. Trees and fresh water aquatic vegetation started dying in Yenyening Lakes in the period 1931-35. She also mentions one of Henry Hall's recollections about how in the early 1930s after rain in the wheatbelt the lakes used to "come down". Each lake, connected by channels, used to fill slowly one after the other. After the trees started to die in the late 1930s, the filling and overflow was accelerated due to the lack of vegetation. Since the Samphires have increased in the last 25 years, the flood regime has reverted back to how it was in the early 1930s.

## 2. Photographic records

An aerial photomosaic of the western sector of the lakes compiled from aerial photos flown in December 1972 was compared to the February 2001 aerial photographs used for this mapping project. The most obvious change was the replacement of Vegetation Unit 10 (*Melaleuca atroviridis* ms Tall Shrubland) by Samphire Unit 17 over some of the low sand rises in the

channel flats. There was also an obvious decline in cover of a patch of Wandoo Woodland (Unit 5) outside the reserve boundary north of Ossig's Lake.

More detailed comparative studies could be undertaken to show changes over time by obtaining early aerial stereo photographs. There are undoubtedly photographs held by locals that would illustrate earlier landscapes. A photographic history could be an interesting project for the local community.

### 3. Previous studies

As already mentioned, no detailed vegetation studies have been undertaken. Beard (1980) conducted broad scale (1: 250 000) vegetation mapping of the region and observations made during fieldwork in spring 1977 were as follows. "At Yenyening Lakes the lakes and interconnecting channels are lined with trees of *Casuarina obesa*. Adjoining flats are under open woodland of *Eucalyptus loxophleba* and *E. rudis*."

This is certainly not the picture of the Lakes today with both *Casuarina obesa* (Swamp She-oak) and *E. rudis* (Flooded Gum) being uncommon. Perhaps Vegetation Unit 2 (Swamp She-oak Closed Forest) is a reminder of these former Swamp She-oak fringes. The Avon River downstream of Qualandary Crossing fits Beard's description much more closely.

Beard also observed that the yellow sandplain along the valley (on the southern side of the Lakes) covered by *Banksia-Xylomelum* alliance (remnant Vegetation Unit 7, photograph 5) is the ultimate south-east extent of an alliance which occurs on yellow sandplain as far north as the Murchison River. In other words, the remnant is an important example of a widely cleared vegetation type at the limit of its distribution.

### 4. Current observations

In broad terms the Vegetation Units of the upper landscape are still relatively intact, although subject to degrading processes, whereas the vegetation of the lower landscape is in a continuing state of modification. As the water table has risen the species which originally occurred low in the landscape (e.g. *Melaleuca* spp., *Casuarina obesa* and *E. rudis*) have disappeared or retreated to narrow bands upslope and been replaced by Samphires and salt tolerant annual species. It is currently evident that the Samphire *Halosarcia indica* subspecies *bidens* which occupies well drained saline sites is moving upslope and replacing *Melaleuca atroviridis* ms and Salt River Gum on the lower edges of their stands as they retreat to smaller islands and areas upslope.

The low prickly shrub *Anthocercis anisantha*, which is at the southern limit of its range in the area, appeared to be in a vulnerable state. There were the dead remains of a population in Vegetation Unit 5 on the south-west side of the Reserve. A few living plants were seen on the sand rise above the beach at the southern end of Racecourse Lake. This seemed to indicate that species have probably disappeared from the area, but with no earlier studies it is impossible to know how many.



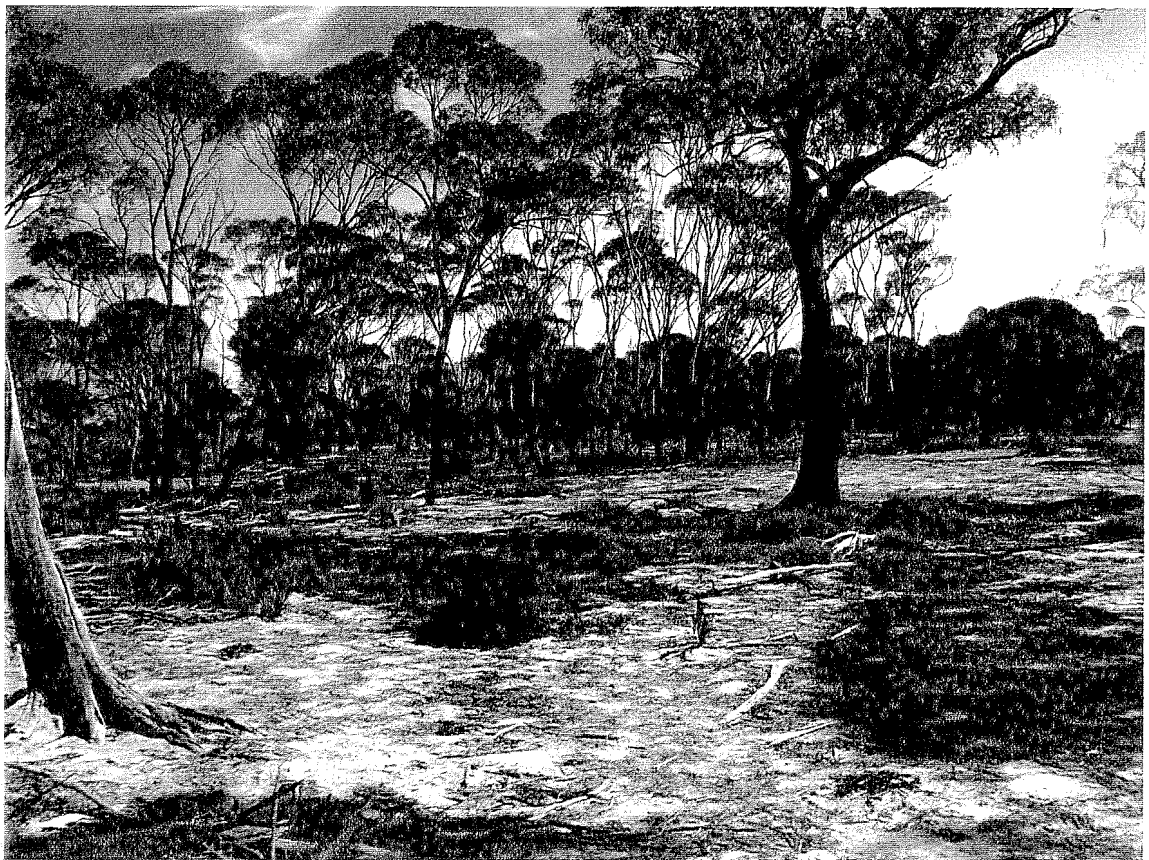


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**Photograph 1: Salmon Gum Open Forest (Vegetation Unit 1)**

These were only small remnants on the edge of the Lakes system. This stand with the typically sparse understorey was at the southern end of Racecourse Lake.

(Photo A. Gunness 19/7/02)



**Photograph 2: Salt River Gum Open Woodland (Vegetation Unit 3).** These trees with their distinctive dark barked trunks and shiny crown were a conspicuous element of the dunes in the eastern sector of Yenyening Lakes. (Photo N. Gibson 12/10/02)





**Photograph 3:** York Gum Low Open Woodland (Vegetation Unit 4) with *Rhagodia drummondii* forming a shrub layer. A characteristic unit of the western sector of the Lakes. (Photo A. Gunness 17/6/02)



**Photograph 4:** Looking from the sand dune at the southern edge of Ossig's lake through Jam over a Herbland of *Podrothea gnaphalioides* to a border of *Scholtzia* sp. Yenyening Lakes (A. Gunness 2824) and *Melaleuca brophyi* on the lake's edge. (Vegetation Units 6, 12, 11a) (Photo A. Gunness 19/7/02)







**Photograph 5: Acorn Banksia Low Open Woodland (Vegetation Unit 7).** A fringing relic of the original adjoining upslope vegetation on deep yellow sands cleared for agriculture.  
(Photo A. Gunness 19/7/02)



**Photograph 6: *Eucalyptus orthostemon* ms,** a lignotuberos mallee found on the flats of Vegetation Unit 8. The tussocks in the background are *Gahnia* sp. (matches K.L. Wilson 2754).  
(Photo A. Gunness 17/6/02)



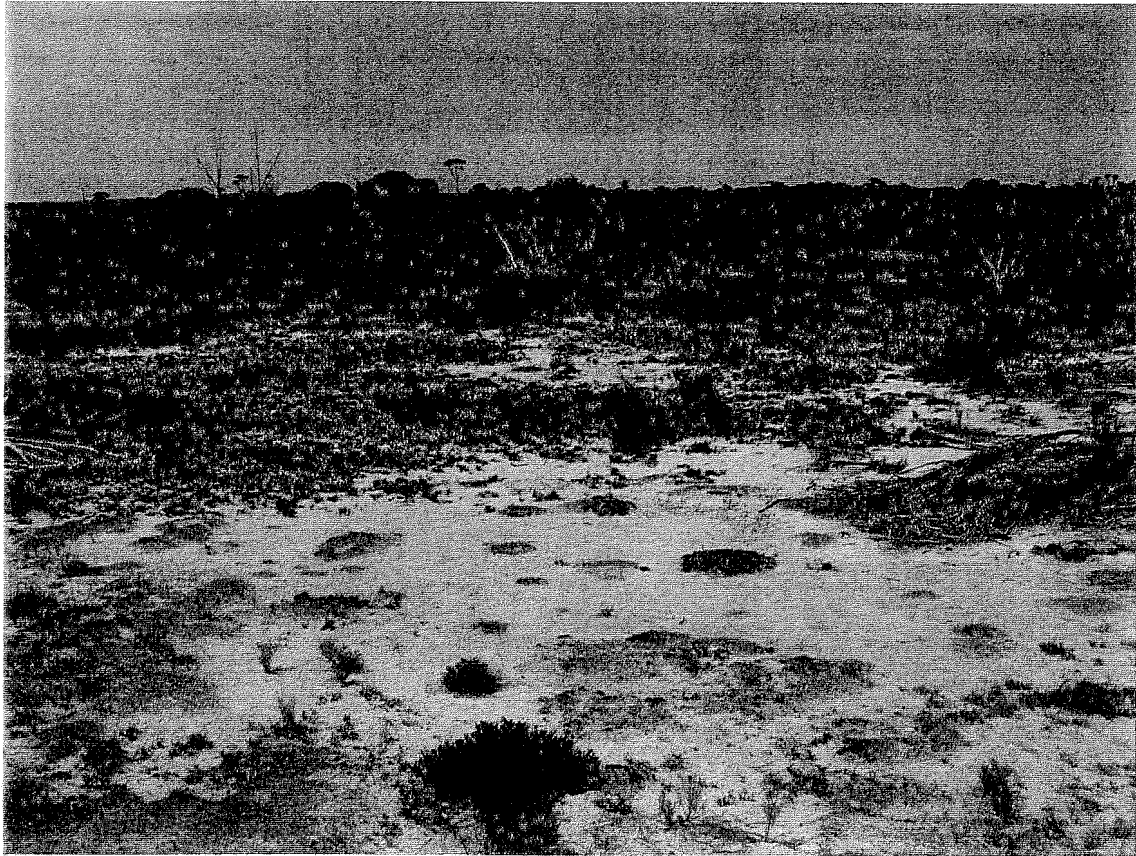


Photograph 7: *Eucalyptus hypochlamydea* Open Shrub Mallee (Vegetation Unit 9).  
(Photo A. Gunness 12/10/02)

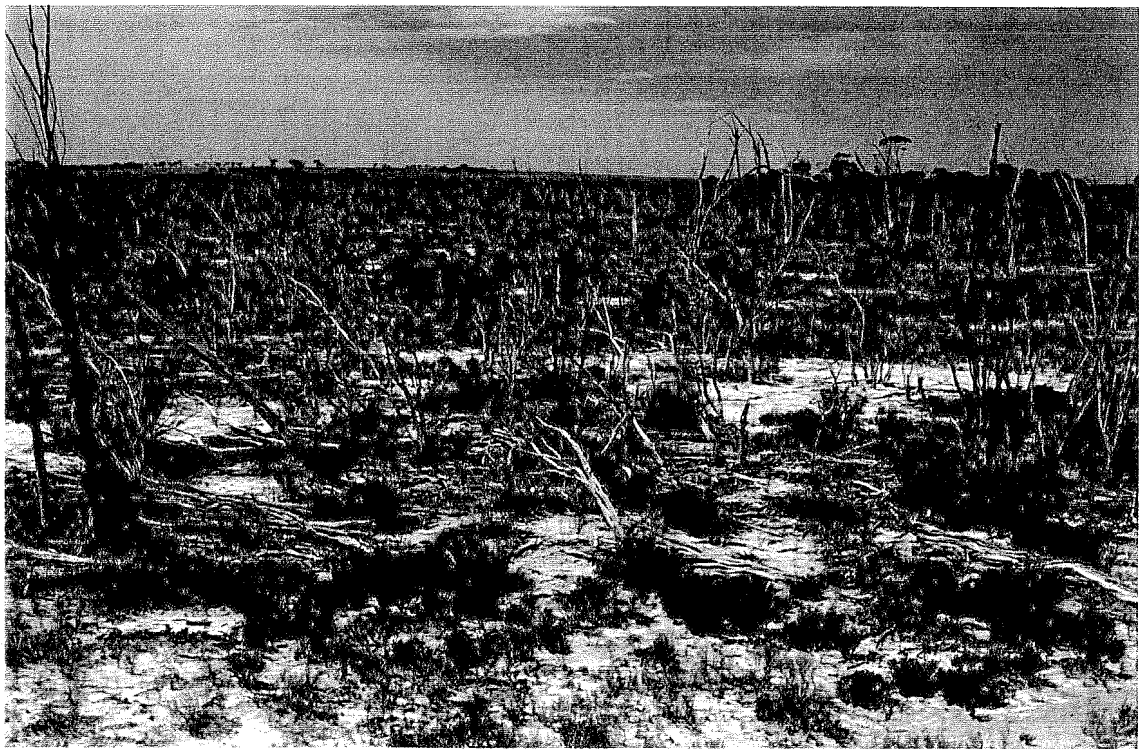


Photograph 8: *Melaleuca atroviridis* ms Tall Shrubland over *Rhagodia drummondii* Low Open Shrubland on a low rise (Vegetation Unit 10) surrounded by Samphire Vegetation Unit 17 with *Halosarcia indica* subspecies *bidens*. Wildflower Society volunteers and community members assisted in the survey. (Photo N. Gibson 12/10/02)





**Photograph 9:** The modified shrublands of Vegetation Unit 16 with a large population of the Declared Rare species *Ptilotus fasciculatus*. Samphires are displacing *Melaleuca* Shrublands. (Photo N. Gibson 13/10/02)



**Photograph 10:** Samphire flats west of Racecourse Lake. They have colonised the low parts of the landscape and the dead remnants of the former *Melaleuca* Shrublands add to the stark picture of salinisation. (Photo A. Gunness 18/6/02)







**Photograph 11:** View across the Samphire flats near Qualandary Crossing showing the zonation with Vegetation Unit 18 (*Halosarcia halocnemoides*, *H. pergranulata*) in the foreground, rising to the taller Unit 17 (*Halosarcia indica* subspecies *bidens*) below *Melaleuca atroviridis* ms and Swamp She-oak. (Photo A. Gunness 19/7/02)



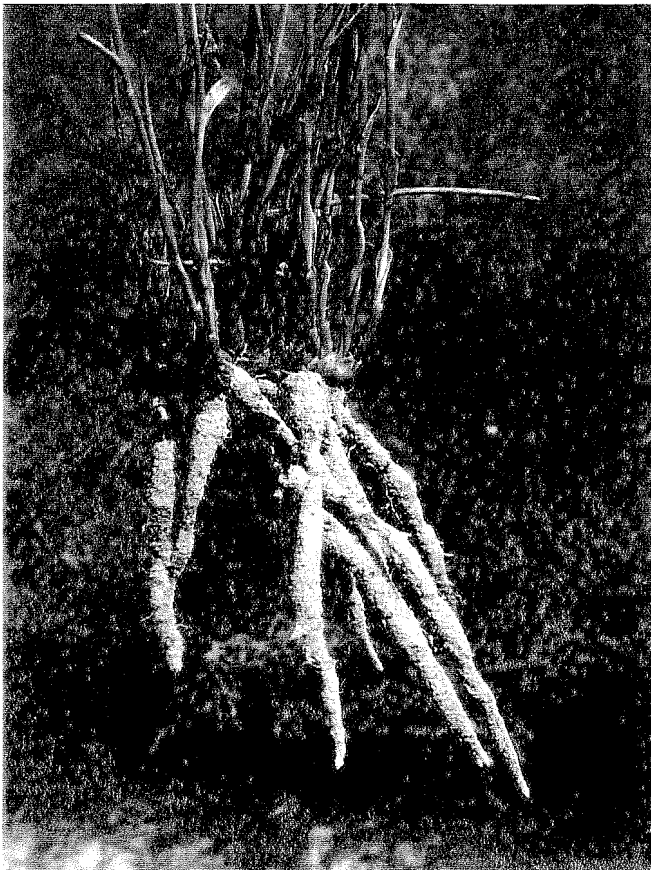
**Photograph 12:** A close up inspection of the ground hugging *Roycea spinescens* growing amidst Vegetation Unit 18 on the clay flats above Morrel Pool. Note the few remaining old Morrells (*Eucalyptus longicornis*) after which the pool was named. (Photo A. Gunness 12/10/02)







**Photograph 13:** *Hopkinsia anoectocolea* Sedgeland (Vegetation Unit 19). This unit was uncommon on sandy rises in the eastern sector of the Yenyening Lakes Nature Reserve. (Photo N. Gibson 13/10/02)



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**Photograph 14:**

Sand binding roots characteristic of *Hopkinsia anoectocolea*. (Photo N. Gibson 13/10/02)



## 5. FLORA

Within the 3105 hectares of Yenyening Lakes Reserve and the pockets of bushland on adjoining public and private property a total of 257 native vascular plant taxa (species, subspecies and varieties) and 37 non-native weed species were recorded from 67 plant families (Appendix II). These were comprised of 197 perennials and 97 annuals.

Because this project was aimed at describing the vegetation (based on dominant species), detailed floristic studies were not undertaken so these results will only reflect perhaps 70 per cent of the total flora of the Yenyening Lakes system. The survey was also conducted in a second consecutive year of drought, thus annual species in particular will be incompletely recorded. Many wetland species commonly flower over spring and summer and many *Chenopodiaceae* are summer-autumn flowering. Further fieldwork in the summer and autumn following more 'normal' seasons would be likely to add significantly to the species recorded so far.

Six plant families accounted for 55 per cent of the total taxa. The Daisy family (*Asteraceae*) and the Myrtle family (*Myrtaceae*) were the largest groups. The daisies were mostly annual species whereas the Myrtles were all perennials. The top six species rich families were as follows:

Family (No. genera)	No. native species	No. weed species	Total no. species
<b>Asteraceae (Daisies) (28)</b>	35	7	42
<b>Myrtaceae (12)</b>	41	0	41
<b>Chenopodiaceae (11) (Samphires + Saltbushes)</b>	25	0	25
<b>Poaceae (Grasses) (15)</b>	8	15	23
<b>Mimosaceae (Wattles) (1)</b>	19	0	19
<b>Proteaceae (7)</b>	13	0	13

The flora reflected the variety of habitats of the system – the saline specialists (e.g. *Chenopodiaceae*, *Aizoaceae* and *Frankeniaceae*) lowest in the landscape, species of varying salt and waterlogging tolerance on the lower slopes (e.g. *Melaleuca* species) and species of the wider south-west Western Australian flora on the sand dunes and adjoining up-slope areas. The species of the "lower landscape" are in an ongoing state of change in response to the changing hydrological regime.

There were several taxa which are typically found on saline flats and margins of salt lakes (Photographs 15a-f) (Lyons 1999, Paczkowska and Chapman 2000, Western Australian Herbarium Florabase 1988), some growing even on the more elevated ground (e.g. *Blennospora*, *Darwinia*). Their presence suggests there has always been a saline component to the system, although early recollections do not include any samphires and recall fresh lakes (see previous section). Examples include: *Argyrolottis turbinata*, *Angianthus pygmaeus*, *Blennospora phlegmatocarpa*, *Gnephosis angianthoides*, *Gnephosis tridens* (all *Asteraceae*), *Billardiera lehmannii*, *Chenopodiaceae* (*Atriplex*, *Halosarcia*, *Maireana*, *Sclerolaena*), *Darwinia halophila*, *Disphyma crassifolium*, *Eucalyptus sargentii*, *Frankenia* spp., *Gunniopsis septifraga*, *Lepilaena preissii* and *Stenopetalum salicola*.

Many species occurred only infrequently. This is a reflection of the high incidence of naturally rare plants in the flora of south-west Western Australian and highlights the importance of the entire area of the remnant in maintaining the species diversity and being representative of the flora of the area. It also suggests that every extra area of bushland protected is likely to better protect the infrequently occurring plant taxa. Species rarity at quadrat level, individual remnant level and a regional level has been recognised by the CALM Science Division Biological survey in the Wheatbelt (Keighery 2000) and other surveys in this program have reflected this phenomenon.

A list of the plant species found in the study area, arranged alphabetically by family, is provided in Appendix II. Appendix III provides a species list, arranged alphabetically by species, indicating species occurrence according to Vegetation Unit. This was compiled from field observations during the course of the vegetation mapping and is not fully comprehensive. More detailed floristic monitoring would be required for this table to truly reflect the species associations. However, this list can be very useful for plant selection for any revegetation program.

## **SPECIES OF SPECIAL INTEREST**

### **1. Declared Rare and Priority Flora**

Two species of declared rare flora, eight threatened species (Priority taxa) (Atkins 2001) and three taxa for consideration for listing as threatened flora were located within the study area, and they are described below. Voucher material has been submitted to the Western Australian Herbarium for most of these taxa (if sufficient material was collected during the survey). Rare and threatened species are protected under the *Wildlife Conservation Act 1950* and their management falls under the jurisdiction of the Department of Conservation and Land Management (CALM). Priority taxa are those which have uncertain conservation status. The various categories relating to threatened flora and their meanings are summarised in Appendix IV. Because this survey did not include a detailed flora survey, it will not necessarily have recorded all the threatened species within the study area. More populations than those found in this survey, of those taxa listed below, could occur within the Yenyening Lakes Reserve.

The response of the following species to altered hydrology and changes in salinity is poorly understood. Management will therefore be difficult without better information about their environmental tolerances.

#### ***Ptilotus fasciculatus* (Amaranthaceae) (Fitzgerald's Mulla Mulla) Declared Rare Flora**

This prostrate species of Mulla Mulla has pink flowers that emerge laterally and then sit upwards (Photograph 16a). It was presumed extinct until 2000 having previously only been known from the original collection made by W V Fitzgerald in 1907 from near Cunderdin. It had been confused with *Ptilotus caespitosus* (Salt Lake Mulla Mulla) which is now presumed extinct. In recent years it has been recorded from sandy rises above saline flats in the central and northern wheatbelt, in at least seven populations extending from near Hyden to the Chapman Valley near Yuna. This population of several hundred plants growing on the flats of Vegetation Unit 16 (Modified Shrublands) is a significant find. It adds to the protection of the species within a Conservation Reserve but it is in a vulnerable location threatened by altered hydrology and salinity.

#### ***Roycea pycnophylloides* (Chenopodiaceae) (Saltmat) Declared Rare Flora**

This tiny bluish grey ground hugging samphire (Photograph 16b) has male and female flowers on separate plants. A small population of 40-50 plants was recorded in this study below a sand ridge to the east of Vegetation Unit 16. Plants were growing on the lower slope as well as being washed down onto a bare samphire flat where they were growing on small mounds of accumulated sandy clay with some coarse granite pebbles. Ten other populations (ranging in size from a few plants to more than a million) have been recorded from saline flats and edges of salt lakes on the Mortlock River, at Pingaring, Cunderdin and Kondinin Salt Marsh Nature Reserve. The tolerance to changing salinity levels of this species is unknown.

#### ***Acacia sclerophylla* var. *teretiuscula* (Mimosaceae) Priority 1**

This spreading wattle was recorded only once on the south-west edge of the Reserve in Vegetation Unit 8 (*Eucalyptus orthostemon* ms Very Open Shrub Mallee). This would appear to be a western limit of its known range with other records from areas near Muntadgin, Coolgardie, Corrigin, Bruce Rock, Hyden, Lake Grace and Newdegate. It is poorly conserved as populations are on road and water reserves.

***Eucalyptus loxophleba* x *Eucalyptus wandoo* hybrid (Myrtaceae) Priority 1**

This hybrid has the dark peeling bark typical of York Gum clearing to smooth Wandoo bark in upper branches with fruits intermediate between the two species. It was growing on the end of a sand rise west of Ski Lake and a specimen was also growing in private property adjoining the reserve. It has been recorded in a number of locations in the western wheatbelt where the two parents co-occur (e.g. Mundaring, Clackline, Toodyay, Wandering, Quairading, Wickiepin and Tincurrin).

***Frankenia glomerata* (Frankeniaceae) (Cluster Head Frankenia) Priority 1**

This prostrate shrub with a head white or pale pink flowers was growing at the base of the slope adjacent to Morrel Pool with *Halosarcia indica* and other species of Vegetation Unit 17. This species is known only from a few populations - on the Mortlock River, Lake Hurlstone west of Hyden and east of Norseman. This occurrence is the western most record of its distribution.

***Acacia arcuatis* (Mimosaceae) Priority 2**

This wattle was recorded in Vegetation Unit 15 (Tamar Tall Open shrubland) adjacent to the south-west end of Rocky Lake. It is known to occur on undulating plains and rises on sands and sandy loams sometimes with lateritic gravel with records north to Piawaning and then from Corrigin to Ongerup.

***Blennospora phlegmatocarpa* (Asteraceae) Priority 2**

This daisy is an annual cottony hairy herb with yellow florets. It is generally restricted to saline, often sandy soils on the margins of salt lakes of the Avon River catchment, with a few collections from woodlands on non-saline soils. Its known range extends from Goomalling, Meckering, Cunderdin to Nyabing, Lake Grace and Hyden. It was a common component of the ground flora throughout the Yenyening Lakes Reserve particularly on the edges of sand rises.

***Frankenia drummondii* (Frankeniaceae) Priority 3**

This is also a prostrate Frankenia with white flowers (Photograph 16c), found growing on sandy loam soils on the edge of Vegetation Units 8 (*Eucalyptus orthostemon* ms Very open Shrub Mallee) and 13 (Needle Tree Tall Shrubland). It is known from other populations near Lake Chinocup, Arthur River, Kondinin salt marsh, the Hyden area (Lakes Cronin and Hurlstone, Middle Ironcap) and Lake King.

***Hopkinsia anoectocolea* (Restionaceae) Priority 3**

This perennial sedge-like plant is dioecious (separate male and female flowers) and has stout creeping rhizomes and sand binding roots (Photograph 14). The genus *Hopkinsia* is only distantly related to the true Restionaceae family and may be recognised in a separate family (Meney and Pate 1999). It was recorded forming a 'Sedgeland' (Vegetation Unit 19) on sand rises in three locations in the eastern part of the Reserve. It is otherwise known from a few restricted locations in sand on margins of salt lakes at Tammin, sand rises on the Mortlock River flats and on stream margins and seasonally wet Heath north of Enneabba.

***Triglochin stowardii* (Juncaginaceae) Priority 3**

A small tufted annual herb which was located growing on the edge of Vegetation Unit 11a (Mixed *Melaleuca* Shrublands) on the slopes of a sand rise. It is probably more widespread throughout the Reserve. It occurs elsewhere in swamps and salt lakes with records from Arthur River, Williams, Mortlock River salt flats near Meckering, Moora, Mollerin and Watheroo.

***Eucalyptus spathulata* subspecies *salina* ms (Myrtaceae) Proposed**

This new subspecies has recently been described (Nicolle and Brooker in press) from Mallets restricted to the Salt River drainage system. It has been nominated for inclusion on the Western Australian Schedule of Declared Endangered Flora. A small population was located on the flat (Vegetation Unit 8) at the end of McLean Road making it the western most record so far. The subspecies *salina* has been distinguished from *Eucalyptus spathulata* subspecies *spathulata*, which is restricted to the Murray River (WA) catchment and inland drainage basins, by its green generally broader leaves in contrast to the metallic bluish ones and the three (or seven) flowered

inflorescences and larger fruits. It has a more northern distribution than subspecies *spathulata* and is known from scattered populations from the north of Quairading, south-east through Pingaring to this population. It is distinguished from *Eucalyptus orthostemon* ms with which it was growing in association, also by leaf colour and growth form. *E. orthostemon* ms has metallic olive green leaves and is a mallee with multiple stems and a lignotuber (Photograph 6). *E. spathulata* subspecies *salina* is a mallet without a lignotuber (Photograph 17). It is known only from saline drainage lines and flats often in small stands and sometimes associated with *Eucalyptus sargentii* subspecies *sargentii* and *E. myriadena*.

## 2. Taxonomically significant flora

### *Eucalyptus orthostemon* ms (Myrtaceae) (Photograph 6)

This is named as a new species (Nicolle and Brooker in press) referring to populations of mallees previously incorrectly referred to as *E. vergrandis*. It is distinguished by its combination of a mallee habit with a lignotuber, linear or almost linear metallic olive green adult leaves, erect stamen filaments, cream flowers and small to medium sized +/- terete buds and fruits. It is widespread but scattered in the central wheatbelt from Miling and south of Pithara in the north, south to Gordon River north of Cranbrook. It is commonly associated with sub-saline and saline flats or drainage basins as well as poorly drained low rises of white to grey loams with ironstone gravel. It has been observed growing with *E. vergrandis*, which has a more southern distribution, in the northern part of the southern wheatbelt, south-east of Tambellup. *E. orthostemon* ms was growing on broad flats (elevated above the valley floor) throughout the Yenyening Lakes Reserve (Vegetation Unit 8).

Nicolle and French (2003) recommend *E. orthostemon* ms as a salt and waterlogging tolerant species well suited to revegetation of areas showing signs of secondary salinity. They also recommend *E. hypochlamydea* (Vegetation Unit 9) (Photograph 7) for the same purpose. Being lignotuberous they have the added advantage of regenerating following fire or other destructive events.

Some collections have had "phrase names" applied. These are for recognised but as yet undescribed taxa. The following three taxa have had phrase names applied during the period of this study.

### *Arthropodium* sp. Yenyening (G. Keighery and N. Gibson 2957) (Anthericaceae)

A population of this tiny lily with purple flowers (Photograph 16d) and a tuberous root was discovered on the flats of Vegetation Unit 16 growing amongst *Ptilotus fasciculatus*. It is a previously unknown species so this small population has very high conservation value. It needs to be further studied and should be considered for listing as Priority flora.

### *Halosarcia* sp. Central Wheatbelt (M.N.Lyons & S.D.Lyons 2760) (Chenopodiaceae)

This recently recognised samphire has a distinctive habit. It forms low mats with stems rising to about 10cm. Within the Lakes it was collected near Morrel Pool, and associated with the population of *Roycea pycnophylloides*. It has been collected at several locations within the Wheatbelt, including Kondinin Salt Marsh, on the western margins of Lake Altham and Lake Chinocup, near Pingaring, and from low sandy rises on the bed of the Mortlock River near Cunderdin. In all of the sites from which it is known, it occupies a similar habitat to *Roycea pycnophylloides*. It is likely to be recommended for listing as Priority flora.

### *Scholtzia* sp. Yenyening Lakes (A. Gunness 2824) (Myrtaceae)

The genus *Scholtzia* and related genera are currently under taxonomic revision. This taxon is a new species (M. Trudgen pers. comm.) yet to be named. It is a spreading shrub that occurred fairly frequently throughout the system (Photograph 18). It commonly grew in a band on the upper slope of sand rises or as a fringe with *Melaleuca* species. The only specimens in the Western Australian Herbarium are ones collected from Yenyening Lakes during this survey. It is possible that other material from sand rises on the east Mortlock River and from near Lake Walyormouring (Goomalling) will match.

***Gahnia* sp. (matches K.L. Wilson 2754) (Cyperaceae)**

This sedge has some similarities to *Gahnia trifida* but is smaller and does not appear to match any named specimens in the WA Herbarium. Many of the sedges are under revision and identification can be difficult. There is a specimen in the WA Herbarium collected and determined by the taxonomist Karen Wilson as *Gahnia* sp. with a collection number of K. L. Wilson 2754, and the Yenyening specimens match it closely. This species was fairly common on the clay loam flats of Vegetation Units 8 and 11b as well as some of the Woodland units (in background of Photograph 6).

***Melaleuca atroviridis* ms (Myrtaceae)**

This taxon is one of the complex of species formerly grouped under *Melaleuca uncinata* (Broom Bush). This complex has been under revision and several taxa have been recognised but their names are not yet published –hence ‘ms’ denoting a manuscript name. This taxon was previously recognised as *Melaleuca* sp. Wongan Hills (R. Davis 1959). It varied within the study area from a single stemmed to a multi-stemmed tall shrub with dark fibrous bark. It can be distinguished from its closest relative in the area, *Melaleuca hamata*, by its elongated fruits, distinct from the round fruits of *M. hamata*. The two species grew together in Vegetation Unit 8/11b near McLean Road. A dense stand of what appeared to be *M. atroviridis* ms grew on the eastern boundary of the system amongst the flats of Vegetation Unit 8/11b complex, but it was unusual to find no fertile specimens.

As already illustrated, the taxonomy of some groups is still poorly defined or under revision and so accurate determinations are not always possible. In this study another example included:

***Bossiaea* sp. indet. (Papilionaceae)**

This is another genus under revision and this taxon is a recognised but not yet named species (J. Ross pers. comm). It has some affinities with *Bossiaea peduncularis*. Other known specimens come from sites on decomposed granite or laterite. This collection from underneath *Eucalyptus hypochlamydea* (Vegetation Unit 9) on the slope above Morrell Pool is a range extension.

Some other taxa that have had name changes, are as follows:

*Moraea setifolia* was *Gynandriris setifolia*

*Pittosporum angustifolium* was *Pittosporum phylliraeoides* var. *microcarpa*

*Oligochaetochilus pictus* was *Pterostylis picta*

### **3. Geographically significant flora**

The distribution of species which have been collected throughout the state and incorporated into the collection of the Western Australian Herbarium is recorded on Florabase (WA Herbarium 1998). Survey records and field experience, combined with this information enables a picture of the distribution of species to be developed. As more survey work is carried on within Western Australia, the knowledge of species occurrences will continue to change and the information provided here is current at the time of writing. Results from the CALM Science Division Biological survey of the Wheatbelt, for example, will doubtless increase the number of recordings and locations and herbarium vouchers of many taxa.

Some species recorded in this survey are near the limits of their range:

- **Taxa at the western limit of range**

***Eucalyptus sargentii* subspecies *sargentii* (Myrtaceae) (Salt River Gum)**

A striking mallet with dark bark at the base and dense foliage restricted to the crown above a white trunk. It reached the western limit of its central wheatbelt range within the Yenyening Lakes system where it formed a narrow band along the edge of sand rises or grew in wider stands on broader rises (Photograph 2). On smaller rises where the ground-water levels are encroaching, Samphires were tending to spread upwards and Salt River Gum was tending to move downslope with the result that some were dying and others appeared threatened. It occurs

in saline depressions and around salt lakes from Cadoux south to Lake Grace and east to near Hyden.

Nicolle and French (2003) recommend it as a species suited to revegetation of areas showing signs of secondary salinity. It has been widely used and performed well in revegetation of saline soils. Being a mallet without a lignotuber, it is killed by fire or other destructive events.

- **Taxa at the northern and north-western limit of range**

*Dianella brevicaulis* (Phormiaceae)

This lily with shorter flower spikes than the more common *Dianella revoluta* was recorded on the flats of Vegetation Unit 11b. It occurs on sandy clay flats in the south-west and south coastal areas and has been recorded from Harrismith and Lake King. This would appear to be the north-west limit of its range.

*Lomandra rupestris* (Dasypogonaceae)

This rhizomatous grey herb has been recorded from Popanyinning, Wickiepin and through the southern wheatbelt to southern coastal areas. Along with a record from the Beverley airfield the Yenyening Lakes records appear to be a north-west limit of its range.

*Melaleuca brophyi* (Myrtaceae)

This was a common species on the flats and sand rises of the Yenyening Lakes system. It is a species found on saline, low lying areas from an area north-east of Hyden through the southern wheatbelt. It appears here to be at the north-western limit of its distribution.

- **Taxa at the southern limit of range**

*Roycea spinescens* (Chenopodiaceae)

This rigid shrub forms colonies on saline flats and salt lakes. Populations were growing on the samphire flats in the eastern sector of Yenyening Lakes (Photograph 14). It is known from the Mortlock River flats and saline areas in the north and central wheatbelt. This appears to be a southern limit of its known distribution.

**Some taxa recorded on the Walkers property (Salt River catchment adjoining northern boundary of the study area)**

A half-day traverse was made across the braided valley of channels and sand rises of the Salt River on the Walker's land adjoining Yenyening Lakes Reserve. Although there was similarity in vegetation and species composition with the Yenyening system, there were also variations and the following species were recorded from the Walker's but not in the study area. Three priority species were recorded in this brief inspection.

*Amphipogon caricinus* (Poaceae) Long Greybeard Grass

*Eremophila decipiens* subspecies *decipiens* (Myoporaceae)

*Frankenia punctata* (Frankeniaceae)

*Glischrocaryon aureum* (Haloragaceae) Common Popflower

*Grevillea hakeoides* subspecies *hakeoides* (Proteaceae)

*Levenhookia leptantha* (Stylidiaceae) Trumpet Stylewort

*Olearia incondita* (Asteraceae)

*Opercularia rubioides* (Rubiaceae) **Priority 2**

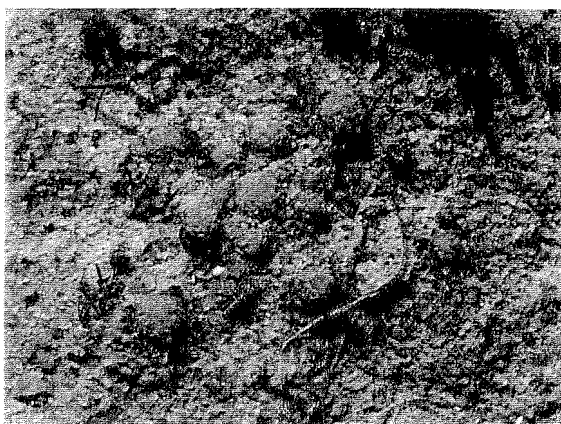
*Podothea pritzellii* (Asteraceae) **Priority 2** (Photograph 15c)

*Sarcozona praecox* (Aizoaceae) Sarcozona

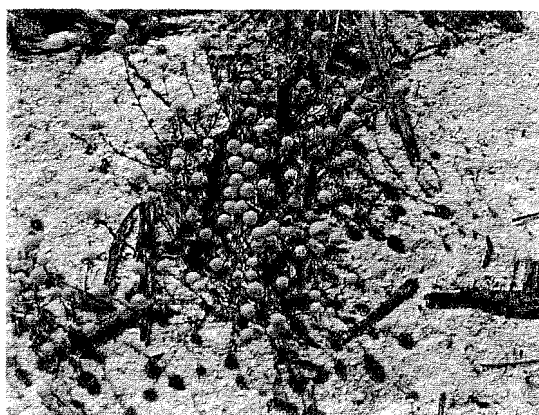
*Siloxerus humifusus* (Asteraceae)

*Scaevola tortuosa* (Goodeniaceae) Tortuous-stem Scaevola **Priority 1** (Photograph 15f)





15a *Angianthus pygmaeus* (Asteraceae)



15b *Gnephosis angianthoides* (Asteraceae)



15c *Podothea pritzellii* (Asteraceae)  
Priority 2



15d *Chamelaucium micranthum* (Myrtaceae)



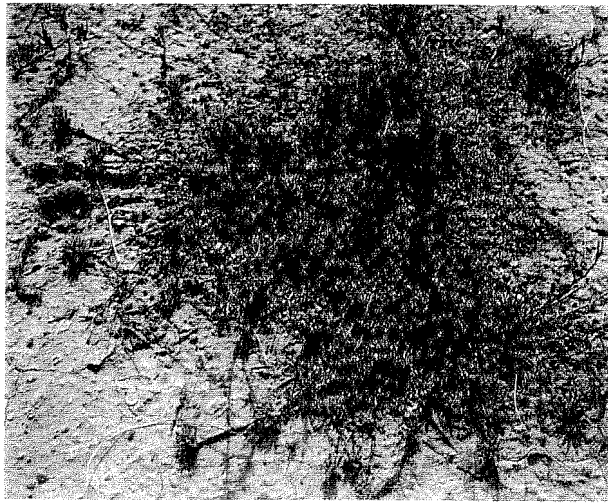
15e *Disphyma crassifolium* (Aizoacea)



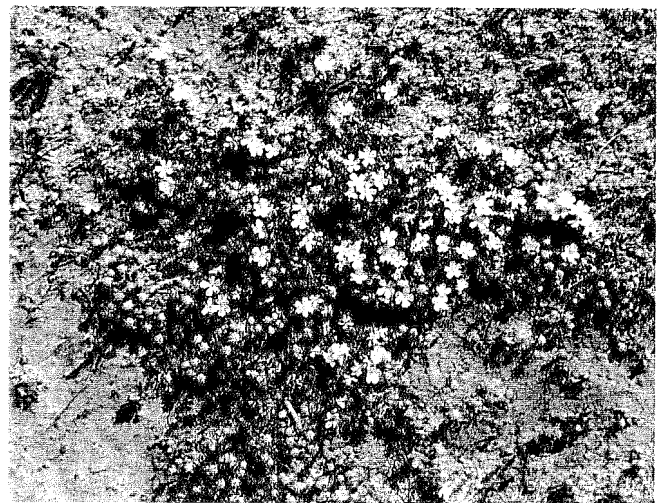
15f *Scaevola tortuosa* (Goodeniaceae)  
Priority 1

Photograph 15: Some species recorded during this survey, typical of naturally saline wetlands.  
(Photos N. Gibson 12/10/02)

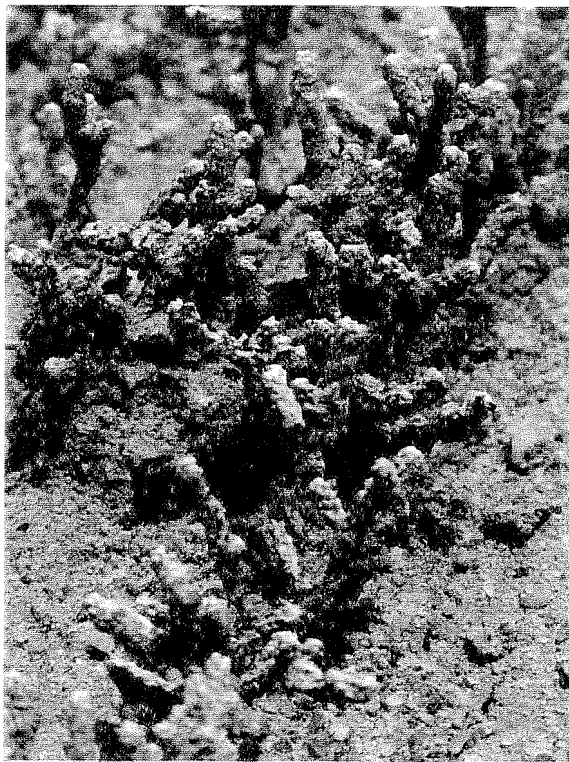




16a *Ptilotus fasciculatus* (Amaranthaceae)  
DRF



16c *Frankenia drummondii* (Frankeniaceae) (white  
flowers) Priority 3 with *Pogonolepis strictus*



16b *Roycea pycnophylloides* (Chenopodiaceae)  
DRF



16d *Arthropodium* sp. Yenying (G. Keighery and  
N. Gibson 2957) (Anthericaceae)  
new species

**Photograph 16:** Species of high conservation value. (Photos N. Gibson 12/10/02)





**Photograph 17:** *Eucalyptus spathulata* subspecies *salina* ms (Myrtaceae) A mallet without a lignotuber this newly recognised subspecies is restricted to the Salt River drainage system. (Photo N. Gibson 13/10/02)



**Photograph 18:** *Scholtzia* sp. Yenyening Lakes (A. Gunness 2824) (Myrtaceae) This newly recognised species is an attractive shrub of the Myrtle family and was common on the edges of sand rises. (Photos A. Gunness & N. Gibson 13/10/02)



## 6. CONSERVATION VALUES

Vegetation surveys are one ideal way of providing an understanding of the biodiversity of an area because plants are diverse, reflect high levels of endemism, respond to narrow environmental gradients, are easily sampled, taxonomically known and easy to monitor. Vegetation surveys are thus an effective means of assessing the conservation values of bushland. The following section is aimed at providing an understanding of the attributes of Yenyening Lakes Nature Reserve.

- **Vegetation typical and representative of the region**

A principal aim of conservation is to keep and protect adequate representation of vegetation and its associated plant species within any local area, regardless of its rarity at a regional level. This intrinsic value of bushland still being present contributes strongly to a 'sense of place'. Yenyening Lakes Nature Reserve provides an example, at the western edge, of the vegetation of the broad valleys of the ancient drainage systems of the Avon catchment.

Recent studies of wheatbelt wetlands have helped to highlight the botanical values of naturally saline wetland chains. Six hundred and ninety taxa have been recorded from naturally saline areas with a significant component unique to these systems as well as being centres of diversity for Asteraceae and Chenopodiaceae (Lyons *et al.* 2002).

Although much of the vegetation of the lower landscape of Yenyening Lakes is the product of secondary salinity, it still retains significant botanical values. These include similarities to those of primary saline systems indicated by the presence of salt tolerant species common to naturally saline wetlands.

- **Diversity of vegetation types and/or flora**

An area with a diverse flora and range of vegetation types is considered to have more value than an area with fewer taxa or vegetation types. With 22 Vegetation Units and 257 native vascular plant taxa, the Yenyening Lakes system supported a diverse assemblage of vegetation types and native plants.

- **Habitat or vegetation type not well conserved elsewhere**

In areas as heavily cleared as the Wheatbelt, every remnant adds to the conservation value of the vegetation types they support. Representation of the different Wheatbelt vegetation types in the reserve system is generally poor (Hopkins *et al.* 1996, Thackway and Cresswell 1995).

Some features of the system are confined to a distinct geographical zone. For example Vegetation Unit 12 (*Scholtzia* sp. Yenyening Lakes (A.Gunness 2824) Shrublands on the slopes of rises) does not occur further east. According to Mike Lyons it possibly occurs along the western boundary of the Zone of Ancient Drainage, through Meckering, Cunderdin and Piawaning.

*Banksia prionotes* (Acorn Banksia) communities of the wheatbelt have been identified as possible threatened ecological communities (Safstrom *et al.* 2000). This adds value to the small remnant left on the southern boundary of the Reserve. It is also a southern limit of the expression of this vegetation type. The Tamar Shrubland remnant is also of value because of its rarity within the Lakes system itself and is a vegetation type that has been widely cleared from the surrounding area. The Sedgeland of the Perched Lake are also unique wetlands within the local context.



- **Presence of rare, threatened or significant species**

Two species of Declared Rare Flora, eight threatened species, three new taxa, at least ten species near the limit of their range, and four species of taxonomic significance increases the conservation value of the site. This is a high incidence of threatened and significant species. It may be a reflection of the lack of detailed studies in these habitats. It also reflects the natural rarity of species in the south-west flora. The rare and threatened flora species are concentrated in the eastern sector of the Lakes system, 'upstream' of the main lakes.

- **Size and connectivity of remnant**

The larger the remnant the greater the conservation value and viability. Yenyening Lakes Nature Reserve with an area of 3098 hectares is a large Reserve when compared with others in the wheatbelt. It is an important link in a continuous corridor with the Salt River valley upstream and the Avon River downstream. Although its values as waterbird habitat have significantly declined it still provides important habitat and is a link in seed transportation throughout the river system. However, the narrow, broken pockets of upland vegetation bordering the system mean it is poorly buffered from external elements such as weed invasion, spray drift and run-off.

- **Position in the landscape relative to rising water tables**

Yenyening Lakes are the westernmost expression of an extensive salt lake chain within the ancient Yilgarn River catchment, which extends out through the eastern wheatbelt to the Goldfields. The lowest parts of the landscape which have been subjected to flooding and inundation (increasing salinity and waterlogging) have been converted to Samphires and are secondary salt flats. However, there are still some elements of the lower landscape that have high value. This includes the population of *Roycea pycnophylloides*. Otherwise the values are concentrated upslope. The dune elements are very similar to primary saline wetlands in the central and northern wheatbelt.

## **7. RECOMMENDATIONS**

The survey highlighted that despite vegetation changes, which have been brought about by an increasingly saline and waterlogged environment, the Yenyening Lakes system still holds significant natural values. There is still a critical lack of knowledge and information about the biology and ecology of many wetland and riparian species (e.g. Gunness 1996). Work is needed to understand the behaviour of species in response to changing environmental regimes, particularly salinity and waterlogging and nutrient levels. This is particularly relevant if these values are to be retained and the populations of Threatened Flora are to be protected.

The following comments summarise where I believe there are major shortfalls in information, as well as some management aspects to be considered.

### **Further Research Work**

1. Promote work that will improve the understanding of how different plants are adapted to different degrees of salinity and waterlogging. Work being conducted in focus catchments under the Salinity Action Plan is presumably undertaking some of this sort of work. Perhaps it could be tied in with the Yenyening Lakes System especially in the area of Vegetation Unit 16. This could involve
  - water table monitoring
  - changes in topographic height in relation to water table and species locations (eg to gain better understanding of high water levels before drowning of species occurs)
2. Aerial photo interpretation of changes over time.



3. Compilation of a photographic history, conducted as a community project.
4. Further vegetation studies of adjoining bushland areas. During this study brief inspections were made in bushland on two nearby private properties
  - Walker's land on the Salt River upstream and
  - Fleay's Woodlands and Shrublands on downstream flats.

Both areas had vegetation in excellent condition and vegetation types which shared characteristics with Yenyening Lakes as well as having significant differences. The latter is probably a good example of what the fringing vegetation on the clay loam soils of the downstream areas of the Yenyening Lakes was once like. More detailed survey of these areas would add immense value to the knowledge of this diverse and dynamic saline/fresh complex. A greater understanding of the whole system (Salt River plus Yenyening Lakes and adjoining lands) would be valuable in future management decisions.

### Management Considerations

1. Install permanent monitoring quadrats in the different vegetation types to:
  - track changes
  - to monitor the species of conservation value

This survey has been the first attempt to adequately record the vegetation of the Yenyening Lakes. No baseline existed from which to monitor changes. Better records and understanding of species behaviour would have enabled better decisions about making changes to water levels. Better information will help in future management.

2. Avoid extended inundation of flats by impounding water. The 'modified' plant communities are under greatest threat from altered hydrology and support species of high conservation value.
3. Develop in conjunction with CALM, a seed collection, storage and record keeping program. This is a key action listed by the WA Government to conserve biodiversity values at greatest threat from increasing salinity (State Salinity Council 2000). Such a program would need to be well controlled so that species of limited distribution and population numbers (eg *Eucalyptus spahulata* subspecies *salina*) are not over-collected. It would:
  - serve as an insurance against extinction of threatened species in the system,
  - develop a seed bank of species suitable for revegetation,
  - increase the understanding of species behaviour through data collection.
4. Expand native vegetation buffer zones, which also act as a weed breaks, around the perimeter of the Reserve.
5. Develop a weed management program, particularly to improve and maintain the condition of upslope areas. Helpful publications include 'Bushland Weeds' (Brown and Brooks 2002), 'Western Weeds' (Hussey *et al.* 1997) and 'Managing Perth's Bushland' (Scheltema and Harris 1995).
6. Maintain all boundary fences to prevent introduced livestock from grazing the bushland.
7. Control feral animals, particularly rabbits.

## 8. CONCLUSION

The Yenyening Lakes system has been significantly modified over the past century. In particular the floor of the lakes has undergone secondary salinisation due to rising groundwater and saline water flows from surrounding cleared areas. The existing vegetation reflects these changes with the loss of *Melaleuca* Shrublands and fringing Swamp She-oak and Flooded Gum Woodlands and an increase in Samphires. Effects of changes to the periods of inundation due to a rising water table and alterations of the flow regime by man made structures are harder to quantify.

Small changes in elevation of the landscape had a significant effect on species distribution and was a key factor separating the large number of Vegetation Units within the system. The species most at threat are those low in the landscape where the threat of a still rising water table, or water impounding, means only species which are salt and/or waterlogging tolerant will survive. These are the species that have already colonised the channel flats. We will never know how many species have already been lost from those areas. Species on the edges of sand rises and the lower flats of Vegetation Unit 16 are the most vulnerable. These include the threatened species *Ptilotus fasciculatus* and the newly discovered *Arthropodium* sp. Yenyening (G.Keighery and N. Gibson 1957). Any management actions that alter the hydrology of these areas, such as holding back water for extended periods, will place them under serious threat. In contrast the vegetation and flora of the sand dunes and elevated broad flats, still retain much of their structural integrity and diversity and have high conservation value.

Within the 22 Vegetation Units, 294 plant species (maybe 70 per cent of total) were recorded, including two Declared Rare species, three new taxa and eight priority species. The entire system is very diverse. Although conservation values are concentrated upslope there are also valuable elements of the lower landscape. These include a population of the threatened *Roycea pycnophylloides* and the recently recognised *Halosarcia* sp. Central Wheatbelt (M.N.Lyons & S.D.Lyons 1976) and several naturally occurring saline specialist species. It is also a salt lake system at the western edge of the chains of lakes throughout the wheatbelt.

This survey has provided a picture of the current status of the vegetation against which future changes can be compared. It has highlighted the need for better understanding of species responses to environmental change, and for actions to be considered in the management of Yenyening Lakes to maintain the conservation values.

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# APPENDIX I

**Table A:** Structural Classification (from Keighery B.J. 1994, adapted from Muir 1977 and Aplin 1979).

Life Form/ Height Class	Canopy Cover (per centage)			
	100 - 70	70 - 30	30 - 10	2 - 10
8 Trees over 30m	Tall Closed Forest	Tall Open Forest	Tall Woodland	Tall Open Woodland
7 Trees 10 - 30m	Closed Forest	Open Forest	Woodland	Open Woodland
6 Trees under 10m	Low Closed Forest	Low Open Forest	Low Woodland	Low Open Woodland
Tree Mallee	Closed Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Shrub Mallee	Closed Shrub Mallee	Shrub mallee	Open Shrub Mallee	Very Open Shrub Mallee
4 Shrubs over 2m	Closed Scrub	Open Scrub	Tall Shrubland	Tall Open Shrubland
3 Shrubs 1 - 2m	Closed Heath	Open Heath	Shrubland	Open Shrubland
1+2 Shrubs under 1m	Closed Low Heath	Open Low Heath	Low Shrubland	Low Open Shrubland
Grasses	Closed Grassland	Grassland	Open Grassland	Very Open Grassland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland

**Table B:** Vegetation Condition Scale (Keighery B.J. 1994)

<b>1 Pristine</b>	Pristine or nearly so, no obvious signs of disturbance.
<b>2 Excellent</b>	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. For example: damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
<b>3 Very Good</b>	Vegetation structure altered, obvious signs of disturbance. For example: disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
<b>4 Good</b>	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example: disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
<b>5 Degraded</b>	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example: disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback, salinity and grazing.
<b>6 Completely degraded</b>	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

## APPENDIX II: PLANT SPECIES LIST

All taxa (species, subspecies and varieties) recorded in Yenyening Lakes Nature Reserve and adjoining bushland are listed. The taxa are listed alphabetically by family, and within families, alphabetically by genera.

### KEY

#### Column 1 Botanical Name

subsp. = subspecies

var. = variety

\* indicates a weed species

ms after a name indicates that this is a manuscript name which is yet to be published.

#### Column 2 Plant Family

#### Column 3 Common Name

Common names follow Bennett (1993).

#### Column 4 Life form

- A Annual:** a plant which completes its life cycle in less than one year, i.e. germinates from seed, flowers, sets seed and dies in the same year.
- P Perennial:** a plant that lives three or more years (growing seasons).
- B Biennial:** a plant which completes its life cycle in more than one but not more than two years. Usually forms a basal rosette of leaves the first year and flowers, fruits and dies in the second year.
- P/A** plants with perennial rootstocks (e.g., bulbs, corms) but with above ground parts which die back each year (common in the families Orchidaceae and Iridaceae).

#### Column 5 Growth form or Habit

- Tree** a woody plant over 2 metres tall with a single stem or branches well above the base.
- Shrub** a woody plant, multi-stemmed at or close to the base, or if single stemmed under 2 metres tall.
- Mallee** shrubs or trees with many stems arising at or below ground level.
- Herb** a plant without a persistent above ground woody stem (excluding grasses, sedges and rushes).
- Grass** members of the family Poaceae.
- Sedge or sedge-like<sup>¶</sup>** members of the families Cyperaceae and Centrolepidaceae.
- Rush<sup>¶</sup>** herbs which are grass-like in appearance. Members of the families Juncaceae and Restionaceae.
- Creepers, Vines** climbing, scrambling or trailing plants often with special modifications for climbing (described in shrub layer).
- Fern** plants which reproduce by spores rather than seeds. Belong to the division in the plant kingdom called Pteridophyta. Also includes fern allies.

<sup>¶</sup> in structural descriptions these are grouped together

#### Column 6 Conservation Status (Rare/Priority)

Department of CALM Declared Rare Flora and Priority Taxa (Atkins 2001)

- DRF** Declared Rare Flora
- P1** Priority 1: Poorly known taxa
- P2** Priority 2: Poorly known taxa
- P3** Priority 3: Poorly known taxa
- P4** Priority 4: Rare taxa
- G** Geographically significant flora (range extensions)

APPENDIX II: Plant species list for the Yenyening Lakes study area (alphabetically by Family)

Botanical name	Family	Common name	Life form	Growth form	Cons. status
<i>Disphyma crassifolium</i>	Aizoaceae	Round-leaved Pigface	P	succulent shrub	
<i>Gummiopsis septifraga</i>	Aizoaceae		A	herb	
* <i>Mesembryanthemum nodiflorum</i>	Aizoaceae	Slender Iceplant	A	herb	
<i>Sarcosoma praecox</i>	Aizoaceae	Sarcosoma	A	succulent shrub	
<i>Ptilotus fasciculatus</i>	Amaranthaceae		P	herb	DRF
<i>Ptilotus humilis</i> var. <i>humilis</i>	Amaranthaceae	Mulla Mulla	A	herb	
<i>Ptilotus manglesii</i>	Amaranthaceae	Pom Poms	P	herb	
<i>Ptilotus polystachyus</i>	Amaranthaceae	Prince of Wales Feather, Bottlewasher	A or P	herb	
<i>Ptilotus spathulatus</i>	Amaranthaceae		P	herb	
<i>Arthropodium</i> sp. Yenyening (G.Keighery & N.Gibson 2957)	Anthericaceae	A Chocolate Lily	P/A	herb	Proposed
<i>Caesia</i> sp.	Anthericaceae		P/A	herb	
<i>Chamaecilla corymbosa</i> var. <i>corymbosa</i>	Anthericaceae	Blue Squill	A	herb	
<i>Dichopogon capillipes</i>	Anthericaceae	Chocolate Lily	P/A	herb	
<i>Dichopogon fimbriatus</i>	Anthericaceae	Chocolate Lily	P/A	herb	
<i>Thysanotus manglesianus</i>	Anthericaceae	Fringed Lily	A	twining herb	
<i>Thysanotus patersonii</i>	Anthericaceae	Fringed Lily	A	twining herb	
<i>Trachymene cyanopetala</i>	Apiaceae		A	herb	
<i>Trachymene pilosa</i>	Apiaceae	Native Parsnip	A	herb	
<i>Bulbine semibarbata</i>	Asphodelaceae	Leek Lily	A	herb	
<i>Actinobole uliginosum</i>	Asteraceae	Flannel Cudweed	A	herb	
<i>Angianthus pygmaeus</i>	Asteraceae	Pygmy Angianthus	A	herb	
<i>Angianthus tomentosus</i>	Asteraceae	Camel-grass	A	herb	
* <i>Arctotheca calendula</i>	Asteraceae	Capeweed	A	herb	
<i>Argyroglossis turbinata</i>	Asteraceae		P	twining shrub	
<i>Blennospora phlegmatocarpa</i>	Asteraceae		A	herb	P2
<i>Brachyscome iberidifolia</i>	Asteraceae	Swan River Daisy	A	herb	
<i>Brachyscome perpusilla</i>	Asteraceae	Tiny Daisy	A	herb	
<i>Chthonocephalus pseudevax</i>	Asteraceae	Woolly Groundheads	A	herb	
* <i>Cotula bipinnata</i>	Asteraceae	Ferny Cotula	A	herb	
<i>Cotula coronopifolia</i>	Asteraceae	Waterbuttons	A or P	herb	

Botanical name	Family	Common name	Life form	Growth form	Cons. status
<i>Cotula cotuloides</i>	Asteraceae	Smooth Cotula	A	herb	
<i>Erymophyllum ramosum</i> subsp. <i>ramosum</i>	Asteraceae		A	herb	
<i>Erymophyllum tenellum</i>	Asteraceae		A	herb	
<i>Gnephosis angianthoides</i>	Asteraceae		A	herb	
<i>Gnephosis drummondii</i>	Asteraceae		A	herb	
<i>Gnephosis tenuissima</i>	Asteraceae		A	herb	
<i>Gnephosis tridens</i>	Asteraceae		A	herb	
<i>Helichrysum leucopsidum</i>	Asteraceae		A	herb	
<i>Hyalochlamys globifera</i>	Asteraceae		P	herb	
<i>Hyalosperma demissum</i>	Asteraceae		A	herb	
<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>	Asteraceae		A	herb	
* <i>Hypochoeris glabra</i>	Asteraceae	Flat Weed, Smooth Cat's-ear	A	herb	
<i>Lawrencella rosea</i>	Asteraceae		A	herb	
<i>Millotia tenuifolia</i>	Asteraceae	Soft Millotia	A	herb	
<i>Olearia dampieri</i> subsp. <i>eremicola</i> ms	Asteraceae	Inland Daisy Bush	A	herb	
<i>Podolepis canescens</i>	Asteraceae	Bright or Grey Podolepis	P	shrub	
<i>Podolepis capillaris</i>	Asteraceae	Wiry Podolepis	A	herb	
<i>Podolepis lessonii</i>	Asteraceae		A	herb	
<i>Podolepis tepperi</i>	Asteraceae		A	herb	
<i>Podotheca angustifolia</i>	Asteraceae		A	herb	
<i>Podotheca gnaphalioides</i>	Asteraceae	Sticky Longheads	A	herb	
<i>Pogonolepis stricta</i>	Asteraceae	Golden Longheads	A	herb	
<i>Quinella urvillei</i>	Asteraceae		A	herb	
<i>Rhodanthe citrina</i>	Asteraceae		A	herb	
<i>Schoenia filifolia</i> subsp. <i>filifolia</i>	Asteraceae		A	herb	
<i>Senecio glossanthus</i>	Asteraceae	Slender Groundsel	A	herb	
* <i>Sonchus oleraceus</i>	Asteraceae	Common Sowthistle	A	herb	
* <i>Sonchus tenerrimus</i>	Asteraceae	Clammy Sowthistle	A	herb	
* <i>Tripteris clandestina</i>	Asteraceae	Stinking Roger	A	herb	
* <i>Ursinia anthemoides</i>	Asteraceae	Ursinia	A	herb	
<i>Waitzia acuminata</i> var. <i>acuminata</i>	Asteraceae	Orange Immortelle	A	herb	
<i>Heliotropium curassavicum</i>	Boraginaceae	Smooth Heliotrope	A	herb	
<i>Borya laciniata</i>	Boryaceae	Pincushions	P	herb	

Botanical name	Family	Common name	Life form	Growth form	Cons. status
<i>*Brassica tournefortii</i>	Brassicaceae	Wild Turnip, Mediterranean Turnip	A	herb	
<i>Stenopetalum salicola</i>	Brassicaceae		A	herb	
<i>Labichea lanceolata</i> subsp. <i>brevifolia</i>	Caesalpiniaceae	Tall Labichea	P	shrub	
<i>Senna artemisioides</i> subsp. <i>filifolia</i>	Caesalpiniaceae		P	shrub	
<i>*Spergularia bocconii</i>	Caryophyllaceae		A	herb	
<i>Spergularia</i> sp.1 Mollerin (P.G. Wilson 6078)	Caryophyllaceae		P	herb	
<i>Spergularia</i> sp.4 Laverton (A.C. Beauglehole 59928 & E.G. Errey)	Caryophyllaceae		P	herb	
<i>Allocasuarina campestris</i>	Casuarinaceae	Tamar	P	shrub	
<i>Allocasuarina huegeliana</i>	Casuarinaceae	Rock She-oak	P	tree	
<i>Casuarina obesa</i>	Casuarinaceae	Swamp She-oak	P	tree	
<i>Centrolepis humillima</i>	Centrolepidaceae	Dwarf Centrolepis	A	sedge-like herb	
<i>Centrolepis polygyna</i>	Centrolepidaceae	Wiry Centrolepis	A	sedge-like herb	
<i>Atriplex amnicola</i>	Chenopodiaceae	Swamp Saltbush	P	shrub	
<i>Atriplex hymenotheca</i>	Chenopodiaceae		P	shrub	
<i>Atriplex lindleyi</i> subsp. <i>inflata</i>	Chenopodiaceae		A (or P)	herb	
<i>Atriplex paludosa</i> subsp. <i>baudinii</i>	Chenopodiaceae	Marsh Saltbush	P	herb	
<i>Atriplex semibaccata</i>	Chenopodiaceae	Berry Saltbush	P	shrub	
<i>Atriplex semibaccata</i> hybrid x ?	Chenopodiaceae	Berry Saltbush hybrid	P	shrub	
<i>Atriplex vesicaria</i>	Chenopodiaceae	Bladder Saltbush	P	shrub	
<i>Didymianthus roei</i>	Chenopodiaceae		P	shrub	
<i>Enchylaena lanata</i>	Chenopodiaceae		P	shrub	
<i>Enchylaena tomentosa</i>	Chenopodiaceae	Barrier Saltbush	P	shrub	
<i>Halosarcia doleiformis</i>	Chenopodiaceae	Samphire	P	shrub	
<i>Halosarcia halocnemoides</i>	Chenopodiaceae	Shrubby Samphire	P	shrub	
<i>Halosarcia indica</i> subsp. <i>bidens</i>	Chenopodiaceae	Samphire	P	shrub	
<i>Halosarcia lepidosperma</i>	Chenopodiaceae	Samphire	P	shrub	
<i>Halosarcia leptoclada</i> subsp. <i>inclusa</i>	Chenopodiaceae	Samphire	P	shrub	
<i>Halosarcia pergranulata</i>	Chenopodiaceae	Black Seed Samphire	P	shrub	
<i>Halosarcia</i> sp. Central Wheatbelt (M.N. Lyons & S.D. Lyons 2760)	Chenopodiaceae		P	Shrub	Proposed
<i>Maireana brevifolia</i>	Chenopodiaceae	Small Leaf Bluebush	P	shrub	
<i>Maireana enchylaenoides</i>	Chenopodiaceae	Small Leaf Bluebush	P	herb	

Botanical name	Family	Common name	Life form	Growth form	Cons. status
<i>Rhagodia drummondii</i>	Chenopodiaceae		P	shrub	
<i>Roycea pycnophylloides</i>	Chenopodiaceae	Saltmat	P	herb/shrub	DRF
<i>Roycea spinescens</i>	Chenopodiaceae		P	shrub	G
<i>Sarcocornia quinqueflora</i>	Chenopodiaceae	Beaded Samphire	P	herb or shrub	
<i>Sclerolaena diacantha</i>	Chenopodiaceae	Grey Copperburr	P	herb	
<i>Threlkeldia diffusa</i>	Chenopodiaceae	Coast Bonefruit	P	herb	
<i>Wurmbea tenella</i>	Colchicaceae	Eight Nancy	A	herb	
<i>Wilsonia humilis</i>	Convolvulaceae	Silky Wilsonia	P	semi-shrub	
<i>Crassula colorata</i> var. <i>acuminata</i>	Crassulaceae	Dense Crassula	A	herb	
<i>Crassula exserta</i>	Crassulaceae		A	herb	
* <i>Crassula natans</i> var. <i>minus</i>	Crassulaceae	Australian Crassula	A	aquatic herb	
<i>Actinostrobilus pyramidalis</i>	Cupressaceae	Swamp Cypress	P	shrub	
<i>Baumea riparia</i>	Cyperaceae		P	sedge	
<i>Gahnia</i> sp. (matches K.L. Wilson 2754)	Cyperaceae	Saw Sedge	P	sedge	
<i>Gahnia trifida</i>	Cyperaceae	Coast Saw Sedge	P	sedge	
* <i>Isolepis marginata</i>	Cyperaceae	Coarse Club-rush	A	sedge	
<i>Lepidosperma</i> sp. A2 Island Flat (G.J. Keighery 7000)	Cyperaceae		P	sedge	
<i>Lepidosperma</i> sp. K. Boorabbin (K.L. Wilson 2579)	Cyperaceae		P	sedge	
<i>Mesomelaena pseudostygia</i>	Cyperaceae		P	sedge	
<i>Schoenus</i> aff. <i>subfascicularis</i>	Cyperaceae		P	sedge	
<i>Acanthocarpus canaliculatus</i>	Dasyopogonaceae		P	herb	
<i>Lomandra effusa</i>	Dasyopogonaceae	Scented Matrush	P	herb	
<i>Lomandra micrantha</i> subsp. <i>teretifolia</i>	Dasyopogonaceae	Matrush	P	herb	
<i>Lomandra rupestris</i>	Dasyopogonaceae	Matrush	P	herb	G
<i>Hibbertia rupicola</i>	Dilleniaceae		P	shrub	
<i>Hibbertia subvaginata</i>	Dilleniaceae		P	shrub	
<i>Drosera bulbosa</i>	Droseraceae	Red-leaved Sundew	P/A	herb	
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	Droseraceae	Bridal Rainbow, Climbing Sundew	P/A	herb	
<i>Drosera menziesii</i> subsp. <i>menziesii</i>	Droseraceae	Pink Rainbow	P/A	herb	
<i>Conostephium preissii</i>	Epacridaceae		P	shrub	
<i>Frankenia drummondii</i>	Frankeniaceae		P	prostrate shrub	P3
<i>Frankenia glomerata</i>	Frankeniaceae	Cluster Head Frankenia	P	shrub	P1
<i>Frankenia pauciflora</i>	Frankeniaceae	Sea Heath	P	shrub	

Botanical name	Family	Common name	Life form	Growth form	Cons. status
<i>*Erodium botrys</i>	Geraniaceae	Long Storksbill	A	herb	
<i>Erodium cygnorum</i> subsp. <i>cygnorum</i>	Geraniaceae	Blue Heronsbill	A	herb	
<i>Pelargonium havlasae</i>	Geraniaceae		P	herb	
<i>Dampiera lavandulacea</i>	Goodeniaceae	Lavender Dampiera	P	herb / low shrub	
<i>Goodenia berardiana</i>	Goodeniaceae		A	herb	
<i>Velleia cynopotamica</i>	Goodeniaceae		A	herb	
<i>Verreauxia reinwardtii</i>	Goodeniaceae	Common Verreauxia	P	shrub	
<i>Gyrostemon subnudus</i>	Gyrostemonaceae		P	shrub	
<i>*Moraea setifolia</i>	Iridaceae		P/A	herb	
<i>*Romulea rosea</i>	Iridaceae	Guildford Grass	P/A	herb	
<i>*Juncus acutus</i>	Juncaceae	Spiny Rush	P	rush	
<i>*Juncus bufonius</i>	Juncaceae	Toad Rush	A	rush	
<i>Juncus kraussii</i> subsp. <i>australiensis</i>	Juncaceae	Sea Rush	P	rush	
<i>Triglochin minutissima</i>	Juncaginaceae		A	herb	
<i>Triglochin mucronata</i>	Juncaginaceae	Prickly Arrowgrass	A	herb	
<i>Triglochin stowardii</i>	Juncaginaceae		A	herb	P3
<i>Dicrastylis corymbosa</i>	Lamiaceae		P	shrub	
<i>Mallophora globiflora</i>	Lamiaceae		P	shrub	
<i>Prostanthera candiculata</i>	Lamiaceae		P	shrub	
<i>Cassytha glabella</i> forma <i>casuarinae</i>	Lauraceae	Tangled Dodder Laurel	P	twining parasite	
<i>Lobelia alata</i>	Lobeliaceae	Angled Lobelia	P	herb	
<i>Anyema miraculosa</i> subsp. <i>miraculosa</i>	Loranthaceae	Mistletoe	P	parasitic shrub	
<i>Acacia acanthoclada</i> subsp. <i>acanthoclada</i>	Mimosaceae	Harrow Wattle	P	shrub	
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	Mimosaceae	Jam	P	tree	
<i>Acacia acutata</i>	Mimosaceae		P	shrub	
<i>Acacia arcuatifilis</i>	Mimosaceae		P	shrub	P2
<i>Acacia bidentata</i>	Mimosaceae		P	shrub	
<i>Acacia erinacea</i>	Mimosaceae		P	shrub	
<i>Acacia lasiocalyx</i>	Mimosaceae	Silver Wattle	P	tree or shrub	
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	Mimosaceae		P	shrub	
<i>Acacia latipes</i> subsp. <i>latipes</i>	Mimosaceae		P	shrub	
<i>Acacia leptopetala</i>	Mimosaceae		P	shrub	
<i>Acacia lineolata</i> subsp. <i>lineolata</i>	Mimosaceae		P	shrub	

Botanical name	Family	Common name	Life form	Growth form	Cons. status
<i>Acacia microbotrya</i>	Mimosaceae	Manna Wattle	P	tree	
<i>Acacia multispicata</i>	Mimosaceae		P	shrub	
<i>Acacia saligna</i>	Mimosaceae	Kudjiong, Orange Wattle	P	shrub	
<i>Acacia sclerophylla</i> var. <i>teretiuscula</i>	Mimosaceae		P	shrub	P1
<i>Acacia sericocarpa</i>	Mimosaceae		P	shrub	
<i>Acacia sessilis</i>	Mimosaceae		P	shrub	
<i>Acacia sessilispica</i>	Mimosaceae		P	shrub	
<i>Acacia tratmaniana</i>	Mimosaceae		P	shrub	
<i>Eremophila lehmanniana</i>	Mimosaceae		P	shrub	
<i>Baeckea crispiflora</i>	Myoporaceae		P	shrub	
<i>Callistemon phoeniceus</i>	Myrtaceae		P	shrub	
<i>Calothamnus quadrifidus</i>	Myrtaceae	Lesser Bottlebrush	P	shrub	
<i>Calothamnus sanguineus</i>	Myrtaceae	One-sided Bottlebrush	P	shrub	
<i>Calytrix leschenaultii</i>	Myrtaceae	Silky-leaved Bloodflower	P	shrub	
<i>Chamelaucium micranthum</i> (Salt Lake form)	Myrtaceae	Starflower	P	shrub	
<i>Darwinia halophila</i> ms	Myrtaceae	Wax Flower	P	shrub	
<i>Eremaea pauciflora</i>	Myrtaceae		P	shrub	
<i>Eucalyptus capillosa</i> subsp. <i>polyclada</i>	Myrtaceae		P	shrub	
<i>Eucalyptus</i> hybrid? ( <i>E. loxophleba</i> x <i>E. orthostemon</i> x <i>E. wandoo</i> )	Myrtaceae	Mallee Wandoo	P	mallee	
<i>Eucalyptus hypochlamydeia</i> subsp. <i>ecdysiastes</i>	Myrtaceae		P	mallee	
<i>Eucalyptus longicornis</i>	Myrtaceae	Red Morrel	P	tree	
<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	Myrtaceae	York Gum	P	mallee or tree	
<i>Eucalyptus loxophleba</i> x <i>E. wandoo</i>	Myrtaceae	York Gum - Wandoo hybrid	P	tree	P1
<i>Eucalyptus orthostemon</i> ms	Myrtaceae		P	mallee	
<i>Eucalyptus phenax</i>	Myrtaceae		P	mallee	
<i>Eucalyptus rudis</i>	Myrtaceae	Kangaroo Island Mallee	P	mallee	
<i>Eucalyptus salmonophloia</i>	Myrtaceae	Flooded Gum	P	tree	
<i>Eucalyptus sargentii</i> subsp. <i>sargentii</i>	Myrtaceae	Salmon Gum	P	tree	
<i>Eucalyptus spathulata</i> subsp. <i>salina</i> ms	Myrtaceae	Salt River Gum	P	tree	G
<i>Eucalyptus wandoo</i>	Myrtaceae	Mallet	P	mallet	Proposed
<i>Leptospermum erubescens</i>	Myrtaceae	White Gum, Wandoo	P	tree	
<i>Melaleuca acuminata</i> subsp. <i>websteri</i>	Myrtaceae	Roadside Tea-tree	P	shrub	
	Myrtaceae		P	shrub	



Botanical name	Family	Common name	Life form	Growth form	Cons. status
<i>Melaleuca adnata</i>	Myrtaceae		P	shrub	
<i>Melaleuca atroviridis</i> ms	Myrtaceae	A Broom Bush	P	shrub	
<i>Melaleuca brevifolia</i>	Myrtaceae		P	shrub	
<i>Melaleuca brophyi</i>	Myrtaceae		P	shrub	
<i>Melaleuca carrii</i>	Myrtaceae		P	shrub	G
<i>Melaleuca halmaturorum</i>	Myrtaceae		P	shrub	
<i>Melaleuca hamata</i>	Myrtaceae		P	shrub	
<i>Melaleuca hamulosa</i>	Myrtaceae	A Broom Bush	P	shrub	
<i>Melaleuca lateriflora</i> subsp. <i>lateriflora</i>	Myrtaceae		P	shrub or tree	
<i>Melaleuca leptospermoides</i>	Myrtaceae		P	shrub or tree	
<i>Melaleuca subtrigona</i>	Myrtaceae		P	shrub	
<i>Melaleuca thyoides</i>	Myrtaceae		P	shrub	
<i>Melaleuca vineana</i>	Myrtaceae		P	shrub or tree	
<i>Regelia ciliata</i>	Myrtaceae	Mohan	P	shrub or tree	
<i>Scholtzia</i> sp. Yenyening Lakes (A. Gunness 2824)	Myrtaceae		P	shrub	
<i>Verticordia acerosa</i> var. <i>preissii</i>	Myrtaceae		P	shrub	
<i>Verticordia densiflora</i> var. <i>caespitosa</i>	Myrtaceae	Feather Flower	P	shrub	
<i>Verticordia lindleyi</i> subsp. <i>purpurea</i>	Myrtaceae	Feather Flower	P	shrub	
<i>Caladenia flava</i> subsp. <i>flava</i>	Myrtaceae	Feather Flower	P	shrub	
<i>Cyanicula gemmata</i>	Orchidaceae	Cowslip Orchid	P/A	herb	
<i>Oligochaetochilus pictus</i>	Orchidaceae	Blue China Orchid	P/A	herb	
<i>Pterostylis</i> sp.	Orchidaceae		P/A	herb	
<i>Oxalis perennans</i>	Orchidaceae		P/A	herb	
<i>Boissiaea</i> sp. indet.	Oxalidaceae	Wood Sorrel	P/A	herb	
<i>Daviesia hakeoides</i> subsp. <i>subnuda</i>	Papilionaceae		P	shrub	
<i>Gastrolobium spinosum</i> var. <i>spinosum</i>	Papilionaceae		P	shrub	
<i>Jacksonia furcellata</i>	Papilionaceae	Prickly Poison	P	shrub	
<i>Dianella brevicaulis</i>	Papilionaceae	Grey Stinkwood	P	shrub	
<i>Dianella revoluta</i>	Phormiaceae	Blue Flax Lily	P	herb	G
<i>Stypantra glauca</i>	Phormiaceae	Blue Flax Lily	P	herb	
<i>Billardiera lehmanniana</i>	Phormiaceae	Blindgrass	P	herb	
<i>Pittosporum angustifolium</i>	Pittosporaceae	Kurup	P	herb	
<i>*Plantago coronopus</i> subsp. <i>commutata</i>	Pittosporaceae	Weeping Pittosporum	P	tree or shrub	
	Plantaginaceae	Buckshorn Plantain	A or P	herb	

Botanical name	Family	Common name	Life form	Growth form	Cons. status
<i>Amphipogon turbinatus</i>	Poaceae	Greybeard Grass	P	grass	
<i>Austrodanthonia caespitosa</i>	Poaceae	Wallaby Grass	P	grass	
<i>Austrostipa elegantissima</i>	Poaceae	Feather Spear Grass	P	grass	
<i>Austrostipa macalpinei</i>	Poaceae	Golden Spear Grass	A	grass	
<i>Austrostipa</i> sp.	Poaceae	Variable Spear Grass	P	grass	
<i>Austrostipa variabilis</i>	Poaceae	Variable Spear Grass	P	grass	
<i>*Avena barbata</i>	Poaceae	Bearded Oat	A	grass	
<i>*Briza maxima</i>	Poaceae	Blowfly Grass, Large Quaking Grass	A	grass	
<i>*Briza minor</i>	Poaceae	Shivery Grass	A	grass	
<i>*Bromus diandrus</i>	Poaceae	Great Brome	A	grass	
<i>*Bromus hordeaceus</i>	Poaceae	Soft Brome	A	grass	
<i>*Bromus madritensis</i>	Poaceae	Madrid Brome	A	grass	
<i>*Bromus rubens</i>	Poaceae	Red Brome	A	grass	
<i>*Ehrharta longiflora</i>	Poaceae	Annual Veldtgrass	A	grass	
<i>Eragrostis dielsii</i>	Poaceae	Mallee Love Grass	A(or P)	grass	
<i>*Hordeum marinum</i>	Poaceae		A	grass	
<i>*Lolium perenne</i>	Poaceae	Perennial Rye Grass	A	grass	
<i>*Lolium rigidum</i>	Poaceae	Annual or Wimmera Rye Grass	A	grass	
<i>Neurachne alopecuroides</i>	Poaceae	Foxtail Mulga Grass	P	grass	
<i>*Parapholis incurva</i>	Poaceae	Coast Barb Grass	A	grass	
<i>*Pentstemonis airoides</i>	Poaceae	False Hairgrass	A	grass	
<i>*Polypogon monspeliensis</i>	Poaceae	Annual Beardgrass	A	grass	
<i>*Vulpia myuros</i> var. <i>myuros</i>	Poaceae	Rat's Tail Fescue	A	grass	
<i>Comesperma integerrimum</i>	Polygalaceae	Milkwort	P	twining shrub	
<i>*Emex australis</i>	Polygonaceae	Doublegee, Three-cornered Jack, Spiny Emex	A	herb	
<i>Muehlenbeckia adpressa</i>	Polygonaceae	Climbing Lignum	P	twining shrub	
<i>Calandrinia calyptrata</i>	Portulacaceae	Pink Purslane	A	herb	
<i>Calandrinia eremaea</i>	Portulacaceae	Small Purslane, Twining Purslane	A	herb	
<i>Calandrinia granulifera</i>	Portulacaceae	Pygmy Purslane	A	herb	
<i>Calandrinia</i> sp. Needilup (K.R. Newbey 4892)	Portulacaceae	Purslane	A	herb	
<i>Ruppia</i> sp.	Potamogetonaceae		P	aquatic herb	
<i>*Anagallis arvensis</i> var. <i>caerulea</i>	Primulaceae	Pimpinel	A	herb	

Botanical name	Family	Common name	Life form	Growth form	Cons. status
<i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i>	Proteaceae	Common Woollybush	P	shrub	
<i>Banksia attenuata</i>	Proteaceae	Slender Banksia	P	tree or shrub	
<i>Banksia prionotes</i>	Proteaceae	Acorn Banksia	P	tree or shrub	
<i>Grevillea eristachya</i>	Proteaceae	Flame Grevillea	P	shrub	
<i>Grevillea hookeriana</i> subsp. <i>hookeriana</i>	Proteaceae	Red Toothbrushes	P	shrub	
<i>Grevillea paniculata</i>	Proteaceae		P	shrub	
<i>Hakea lissocarpa</i>	Proteaceae	Honey Bush	P	shrub	
<i>Hakea preissii</i>	Proteaceae	Needle Tree	P	shrub	
<i>Hakea prostrata</i>	Proteaceae	Harsh Hakea	P	shrub	
<i>Hakea scoparia</i>	Proteaceae		P	shrub	
<i>Petrophile ericifolia</i> subsp. <i>ericifolia</i>	Proteaceae		P	shrub	
<i>Synaphea spinulosa</i> subsp. <i>spinulosa</i>	Proteaceae		P	shrub	
<i>Xylomelum angustifolium</i>	Proteaceae		P	shrub or tree	
<i>Clematis delicata</i> ms	Ranunculaceae	Sanboplain Woody Pear	P	shrub or tree	
<i>Desmodadus asper</i>	Restionaceae	Clematis	P	climber	
<i>Desmodadus flaxuosus</i>	Restionaceae		P	rush	
<i>Harperia lateriflora</i>	Restionaceae		P	rush	
<i>Hopkinsia anoetocolea</i>	Restionaceae		P	rush	
<i>Lepidobolus preissianus</i>	Restionaceae		P	rush	P3
<i>Lyginia imberbis</i>	Restionaceae	Chaff Rush	P	rush	
<i>Cryptandra nutans</i>	Restionaceae		P	rush	
<i>Trymalium daphnifolium</i>	Rhamnaceae		P	shrub	
<i>Exocarpos apyllus</i>	Rhamnaceae		P	shrub	
<i>Santalum acuminatum</i>	Santalaceae	Leafless Ballart	P	(tree) or shrub	
<i>Santalum murrayanum</i>	Santalaceae	Quandong	P	tree or shrub	
<i>Santalum spicatum</i>	Santalaceae	Bitter Quandong	P	tree or shrub	
<i>Dodonaea pinifolia</i>	Santalaceae	Sandalwood	P	tree or shrub	
<i>Dodonaea viscosa</i> subsp. <i>angustissima</i>	Sapindaceae	Sticky Hop Bush	P	shrub	
* <i>Zaluzianskya divaricata</i>	Sapindaceae	Sticky Hop Bush	P	shrub	
<i>Anthocercis anisantha</i> subsp. <i>anisantha</i>	Scrophulariaceae	Spreading Night Phlox	A	herb	
<i>Anthotroche pamosa</i>	Solanaceae		P	shrub	
<i>Lycium australe</i>	Solanaceae	Felted Anthotroche	P	Shrub, erect or prostrate	
	Solanaceae	Australian Boxthorn	P	shrub	

Botanical name	Family	Common name	Life form	Growth form	Cons. status
<i>Stackhousia monogyna</i>	Stackhousiaceae	Candles	P	herb	
<i>Stackhousia muricata</i>	Stackhousiaceae		A or P	herb	
<i>Stylobasium australe</i>	Surianaceae		P	shrub	
<i>Xanthorrhoea preissii</i>	Xanthorrhoeaceae	Grass tree, Balga	P	shrub-like herb	
<i>Lepilaena preissii</i>	Zanichelliaceae	Slender Watermat	A	aquatic herb	

### APPENDIX III: PLANT SPECIES ACCORDING TO VEGETATION UNIT

This list shows all taxa listed according to the Vegetation Unit in which they were found in the Yenyenning Lakes study area during the survey. It is a guide only, not a detailed inventory. The taxa are listed alphabetically by genus.

#### KEY TO VEGETATION UNITS

##### Forests

1. Salmon Gum (*Eucalyptus salmonophloia*) Open Forest
2. Swamp She-oak (*Casuarina obesa*) Closed Forest over *Juncus kraussii* Sedgeland

##### Woodlands

3. Salt River Gum (*Eucalyptus sargentii* subspecies *sargentii*) (Low) Open Woodland
4. York Gum (*Eucalyptus loxophleba*) Low Open Woodland
5. Wandoo (*Eucalyptus wandoo*), York Gum, and Swamp She-oak Low Open Woodland
6. Rock She-oak (*Allocasuarina huegeliana*) - Jam (*Acacia acuminata*) Low Open Woodland
7. Acorn Banksia (*Banksia prionotes*) Low Open Woodland

##### Mallees

8. *Eucalyptus orthostemon* ms Very Open Shrub Mallee over mixed *Melaleuca* Shrublands
9. *Eucalyptus hypochlamydea* Open Shrub Mallee

##### Shrublands

10. *Melaleuca atroviridis* ms Tall Shrubland over *Rhagodia drummondii* Low Open Shrubland
- 11a. Mixed *Melaleuca* Shrublands on slopes of sand rises
- 11b. Mixed *Melaleuca* Shrublands on flats
12. *Scholtzia* sp. Yenyenning Lakes (A. Gunness 2824) Shrublands on slopes of sand rises
13. Needle Tree (*Hakea preissii*) Tall Shrubland
14. *Melaleuca acuminata* subspecies *websteri* Closed Heath
15. Tamar (*Allocasuarina campestris*) Tall Open Shrubland

##### Modified Shrublands

16. Samphire (*Halosarcia lepidosperma*, *H. leptoclada* subspecies *inclusa*, *H. halocnemoides*) Low Open Shrubland over Open Herbland with emergent *Melaleuca lateriflora* and *Melaleuca atroviridis* ms

##### Samphire Shrublands

17. *Halosarcia indica* subspecies *bidens*, *Halosarcia lepidosperma*, *Frankenia pauciflora* Open Low Heath
18. *Halosarcia pergranulata*, *Halosarcia halocnemoides* Low Shrubland

##### Sedgelands (Rushes)

19. *Hopkinsia anoetocolea* (Open) Sedgeland on white sand rises in drainage channels
20. Freshwater Perched Lake: *Baumea riparia*, *Juncus kraussii* Closed Sedgelands under *Melaleuca brevifolia* Open Scrub

##### Lake edges

21. Closed (Tall) Shrublands (eg. *Melaleuca thyoides* or *Callistemon phoeniceus*)
22. Herbland +/- *Halosarcia halocnemoides* Low Open Shrubland

APPENDIX III: Plant species of the Yenyening Lakes study area, listed alphabetically according to the Vegetation Unit in which they were found

Botanical name	Family	Vegetation Unit																							
		Forests		Woodlands			Mallees		Shrublands					Samphire					Sedge			Edges			
		1	2	3	4	5	6	7	8	9	10	11 a	11 b	12	13	14	15	16	17	18	19	20	21	22	
<i>Acacia acanthoclada</i> subsp. <i>acanthoclada</i>	Mimosaceae																								
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	Mimosaceae					+			+				+												
<i>Acacia acutata</i>	Mimosaceae																+								
<i>Acacia arcuatifolia</i>	Mimosaceae																								
<i>Acacia bidentata</i>	Mimosaceae																								
<i>Acacia erinacea</i>	Mimosaceae									+															
<i>Acacia lasiocalyx</i>	Mimosaceae						+																		
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	Mimosaceae												+												
<i>Acacia latipes</i> subsp. <i>latipes</i>	Mimosaceae												+												
<i>Acacia leptopetala</i>	Mimosaceae						+		+																
<i>Acacia lineolata</i> subsp. <i>lineolata</i>	Mimosaceae																								
<i>Acacia microbotrya</i>	Mimosaceae						+			+															
<i>Acacia multispicata</i>	Mimosaceae						+																		
<i>Acacia saligna</i>	Mimosaceae						+						+												
<i>Acacia sclerophylla</i> var. <i>teretiuscula</i>	Mimosaceae								+																
<i>Acacia sericocarpa</i>	Mimosaceae																								
<i>Acacia sessilis</i>	Mimosaceae						+																		
<i>Acacia sessilispica</i>	Mimosaceae																								
<i>Acacia tritmaniana</i>	Mimosaceae						+						+												
<i>Acanthocarpus canaliculatus</i>	Mimosaceae						+																		
<i>Actinobole uliginosum</i>	Dasyopogonaceae					+			+																
<i>Actinostrobilus pyramidalis</i>	Asteraceae						+			+															
<i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i>	Cupressaceae						+																		
<i>Allocasuarina campestris</i>	Proteaceae							+																	
<i>Allocasuarina huegeliana</i>	Casuarinaceae						+						+				+								
<i>Allocasuarina huegeliana</i>	Casuarinaceae						+																		
<i>Amphipogon turbinatus</i>	Poaceae			+																					
<i>Anyema miraculosa</i> subsp. <i>miraculosa</i>	Loranthaceae						+																		
* <i>Anagallis arvensis</i> var. <i>caerulea</i>	Primulaceae												+												
<i>Angianthus pygmaeus</i>	Asteraceae																	+		+					+
<i>Angianthus tomentosus</i>	Asteraceae								+										+		+				+

Botanical name		Vegetation Unit																						
		Forests			Woodlands			Mallees			Shrublands						Sampshire Sedge Edges							
Family		1	2	3	4	5	6	7	8	9	10	11 a	11 b	12	13	14	15	16	17	18	19	20	21	22
<i>Anthocercis anisantha</i> subsp. <i>anisantha</i>	Solanaceae																							
<i>Anthotroche pamosa</i>	Solanaceae						+					+	+											
* <i>Arctotheca calendula</i>	Asteraceae						+					+	+											
<i>Argyrolottis turbinata</i>	Asteraceae											+	+						+					
<i>Arthropodium</i> sp. Yenyening (G.Keighery & N.Gibson 2957)	Anthericaceae													+				+						
<i>Atriplex amnicola</i>	Chenopodiaceae																							
<i>Atriplex hymenolotheca</i>	Chenopodiaceae																	+						
<i>Atriplex lindleyi</i> subsp. <i>inflata</i>	Chenopodiaceae																		+					
<i>Atriplex paludosa</i> subsp. <i>baudinii</i>	Chenopodiaceae							+												+				
<i>Atriplex semibaccata</i>	Chenopodiaceae																							
<i>Atriplex semibaccata</i> hybrid x ?	Chenopodiaceae																			+				
<i>Atriplex vesicaria</i>	Chenopodiaceae																							
<i>Austrodanthonia caespitosa</i>	Poaceae	+					+										+							
<i>Austrostipa elegantissima</i>	Poaceae								+				+											
<i>Austrostipa macalpinei</i>	Poaceae																				+			
<i>Austrostipa</i> sp.	Poaceae	+							+			+					+							
<i>Austrostipa variabilis</i>	Poaceae								+															
* <i>Avena barbata</i>	Poaceae									+														
<i>Baeckea crispiflora</i>	Myrtaceae							+																
<i>Banksia attenuata</i>	Proteaceae							+																
<i>Banksia prionotes</i>	Proteaceae							+																
<i>Baumea riparia</i>	Cyperaceae						+																	
<i>Billardiera lehmanniana</i>	Pittosporaceae																					+		
<i>Blennospora phlegmatocarpa</i>	Asteraceae								+		+	+	+									+		
<i>Borya laciniata</i>	Boryaceae						+		+			+	+	+			+							
<i>Bossiaea</i> sp. indet.	Papilionaceae							+		+		+	+					+						
<i>Brachyscome iberidifolia</i>	Asteraceae						+			+														
<i>Brachyscome perpusilla</i>	Asteraceae																							
* <i>Brassica tournefortii</i>	Brassicaceae						+			+							+							
* <i>Briza maxima</i>	Poaceae								+															
* <i>Briza minor</i>	Poaceae								+				+				+							

Vegetation Unit																										
Botanical name	Family	Forests			Woodlands			Mallees			Shrublands						Samphire			Sedge			Edges			
		1	2	3	4	5	6	7	8	9	10	11 a	11 b	12	13	14	15	16	17	18	19	20	21	22		
* <i>Bromus diandrus</i>	Poaceae																									
* <i>Bromus hordeaceus</i>	Poaceae																									
* <i>Bromus madritensis</i>	Poaceae							+				+														
* <i>Bromus rubens</i>	Poaceae			+					+			+														
<i>Bulbine semibarbata</i>	Asphodelaceae																									
<i>Caesia</i> sp.	Anthericaceae															+									+	
<i>Caladenia flava</i> subsp. <i>flava</i>	Orchidaceae						+																			
<i>Calandrinia calyptrata</i>	Portulacaceae						+			+					+											
<i>Calandrinia eremaea</i>	Portulacaceae				+		+		+									+								
<i>Calandrinia granulifera</i>	Portulacaceae							+				+							+							
<i>Calandrinia</i> sp. Needilup (K.R. Newbey 4892)	Portulacaceae																+		+						+	
<i>Callistemon phoeniceus</i>	Myrtaceae																									
<i>Calothamnus quadrifidus</i>	Myrtaceae						+																		+	
<i>Calothamnus sanguineus</i>	Myrtaceae						+	+																		
<i>Calytrix leschenaultii</i>	Myrtaceae						+																			
<i>Cassytha glabella</i> forma <i>casuarinae</i>	Lauraceae						+						+													
<i>Casuarina obesa</i>	Casuarinaceae		+				+																		+	
<i>Centrolepis humillima</i>	Centrolepidaceae																									
<i>Centrolepis polygyna</i>	Centrolepidaceae							+																		
<i>Chamaecilla corymbosa</i> var. <i>corymbosa</i>	Anthericaceae						+																			
<i>Chamelaucium micranthum</i> (Salt Lake form)	Myrtaceae						+		+				+													
<i>Chthonocephalus pseudevax</i>	Asteraceae													+												
<i>Clematis delicata</i> ms	Ranunculaceae								+				+													
<i>Conosperma integririmum</i>	Polygalaceae						+				+	+														
<i>Conostephium preissii</i>	Epacridaceae						+																			
* <i>Cotula bipinnata</i>	Asteraceae							+					+						+						+	
<i>Cotula coronopifolia</i>	Asteraceae																								+	
<i>Cotula cotuloides</i>	Asteraceae																								+	
<i>Crassula colorata</i> var. <i>acuminata</i>	Crassulaceae																+									
<i>Crassula exserta</i>	Crassulaceae			+				+	+										+							
* <i>Crassula natans</i> var. <i>minus</i>	Crassulaceae													+												
<i>Cryptandra nutans</i>	Rhamnaceae						+																			



Botanical name		Vegetation Unit																							
		Forests		Woodlands					Mallees			Shrublands					Samphire					Sedge	Edges		
		1	2	3	4	5	6	7	8	9	10	11 a	11 b	12	13	14	15	16	17	18	19	20	21	22	
<i>Cyanicula gemmata</i>	Orchidaceae																								
<i>Dampiera lavandulacea</i>	Goodeniaceae						+																		
<i>Darwinia halophila</i> ms	Myrtaceae												+												
<i>Daviesia hakeoides</i> subsp. <i>subnuda</i>	Papilionaceae						+																		
<i>Desmodcladus asper</i>	Restionaceae						+																		
<i>Desmodcladus flaxuosus</i>	Restionaceae																								
<i>Dianella brevicaulis</i>	Phormiaceae												+												
<i>Dianella revoluta</i>	Phormiaceae						+						+												
<i>Dichopogon capillipes</i>	Anthericaceae																								
<i>Dichopogon fimbriatus</i>	Anthericaceae														+										
<i>Dicrasylis corymbosa</i>	Lamiaceae					+																			
<i>Didymanthus roei</i>	Chenopodiaceae								+																
<i>Disphyma crassifolium</i>	Aizoaceae						+		+			+							+						
<i>Dodonaea pinifolia</i>	Sapindaceae																								
<i>Dodonaea viscosa</i> subsp. <i>angustissima</i>	Sapindaceae								+								+								
<i>Drosera bulbosa</i>	Droseraceae																								
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	Droseraceae						+		+																
<i>Drosera menziesii</i> subsp. <i>menziesii</i>	Droseraceae							+									+								
<i>*Ehrharta longiflora</i>	Poaceae											+													
<i>*Emex australis</i>	Polygonaceae																								
<i>Enchylaena lanata</i>	Chenopodiaceae							+																	
<i>Enchylaena tomentosa</i>	Chenopodiaceae							+																	
<i>Eragrostis dielsii</i>	Poaceae																								
<i>Eremaea pauciflora</i>	Myrtaceae																								
<i>Eremophila lehmanniana</i>	Myoporaceae						+																		
<i>*Erodium botrys</i>	Geraniaceae						+		+			+													
<i>Erodium cygnorum</i> subsp. <i>cygnorum</i>	Geraniaceae						+																		
<i>Erymophyllum ramosum</i> subsp. <i>ramosum</i>	Asteraceae						+																		
<i>Erymophyllum tenellum</i>	Asteraceae														+								+		
<i>Eucalyptus capillosa</i> subsp. <i>polyclada</i>	Myrtaceae																							+	
<i>Eucalyptus</i> hybrid? ( <i>E. loxophleba</i> x <i>E. orthostemon</i> x <i>E. wandoo</i> )	Myrtaceae				+			+																	

Botanical name		Vegetation Unit																							
		Forests			Woodlands			Mallees			Shrublands					Samphire					Sedge	Edges			
		1	2	3	4	5	6	7	8	9	10	11 a	11 b	12	13	14	15	16	17	18	19	20	21	22	
<i>Eucalyptus hypochlamydeia</i> subsp. <i>ecdysiastes</i>	Myrtaceae									+															
<i>Eucalyptus longicornis</i>	Myrtaceae																								
<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	Myrtaceae				+	+	+							+											
<i>Eucalyptus loxophleba</i> x <i>E. wandoo</i>	Myrtaceae					+	+																		
<i>Eucalyptus orthostemon</i> ms	Myrtaceae								+																
<i>Eucalyptus phenax</i>	Myrtaceae									+															
<i>Eucalyptus rudis</i>	Myrtaceae																								
<i>Eucalyptus salmonophloia</i>	Myrtaceae	+																							
<i>Eucalyptus sargentii</i> subsp. <i>sargentii</i>	Myrtaceae			+																					
<i>Eucalyptus spathulata</i> subsp. <i>salina</i> ms	Myrtaceae											+													
<i>Eucalyptus wandoo</i>	Myrtaceae					+		+																	
<i>Exocarpos aphyllus</i>	Santalaceae							+																	
<i>Frankenia drummondii</i>	Frankeniaceae								+					+											
<i>Frankenia glomerata</i>	Frankeniaceae													+					+						
<i>Frankenia pauciflora</i>	Frankeniaceae																								
<i>Gahnia</i> sp. (matches K.L. Wilson 2754)	Cyperaceae				+	+			+			+													
<i>Gahnia trifida</i>	Cyperaceae													+											
<i>Gastrolobium spinosum</i> var. <i>spinosum</i>	Papilionaceae					+			+			+													
<i>Gnephosis angianthoides</i>	Asteraceae			+															+						+
<i>Gnephosis drummondii</i>	Asteraceae																								
<i>Gnephosis tenuissima</i>	Asteraceae																								
<i>Gnephosis tridens</i>	Asteraceae					+		+																	
<i>Goodenia berardiana</i>	Goodeniaceae					+			+																
<i>Grevillea eriostachya</i>	Proteaceae					+	+										+								
<i>Grevillea hookeriana</i> subsp. <i>hookeriana</i>	Proteaceae																								
<i>Grevillea paniculata</i>	Proteaceae					+																			
<i>Gummiopsis septifraga</i>	Aizoaceae																								
<i>Gyrostemon subnudus</i>	Gyrostemonaceae						+																		+
<i>Hakea lissocarpa</i>	Proteaceae					+																			
<i>Hakea preissii</i>	Proteaceae								+					+											
<i>Hakea prostrata</i>	Proteaceae				+																				
<i>Hakea scoparia</i>	Proteaceae					+		+																	

Botanical name		Family	Vegetation Unit																							
			Forests			Woodlands			Mallees			Shrublands						Sampshire			Edges					
			1	2	3	4	5	6	7	8	9	10	11 a	11 b	12	13	14	15	16	17	18	19	20	21	22	
<i>Halosarcia doleiformis</i>		Chenopodiaceae												+												
<i>Halosarcia halocnemoides</i>		Chenopodiaceae																								
<i>Halosarcia indica</i> subsp. <i>bidens</i>		Chenopodiaceae																								
<i>Halosarcia leptosperma</i>		Chenopodiaceae												+												+
<i>Halosarcia leptoclada</i> subsp. <i>inclusa</i>		Chenopodiaceae																								
<i>Halosarcia pergranulata</i>		Chenopodiaceae																								
<i>Halosarcia</i> sp. Central Wheatbelt (M.N. Lyons & S.D. Lyons 2760)		Chenopodiaceae																								
<i>Harperia lateriflora</i>		Restionaceae																								+
<i>Helichrysum leucopsidum</i>		Asteraceae																								
<i>Heliotropium curassavicum</i>		Boraginaceae																								
<i>Hibbertia rupicola</i>		Dilleniaceae																								
<i>Hibbertia subvaginata</i>		Dilleniaceae																								
<i>Hopkinsia anoetocolea</i>		Restionaceae																								
* <i>Hordeum marinum</i>		Poaceae																								
<i>Hyalochlamys globifera</i>		Asteraceae																								
<i>Hyalosperma demissum</i>		Asteraceae																								
<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>		Asteraceae																								
* <i>Hypochoeris glabra</i>		Asteraceae																								
* <i>Isolepis marginata</i>		Cyperaceae																								
<i>Jacksonia furcellata</i>		Papilionaceae																								
* <i>Juncus acutus</i>		Juncaceae																								
* <i>Juncus bufonius</i>		Juncaceae																								
<i>Juncus kraussii</i> subsp. <i>australiensis</i>		Juncaceae																								+
<i>Labichea lanceolata</i> subsp. <i>brevifolia</i>		Caesalpiniaceae																								
<i>Lawrencella rosea</i>		Asteraceae																								
<i>Lepidobolus preissianus</i>		Restionaceae																								
<i>Lepidosperma</i> sp. A2 Island Flat (G.J. Keighery 7000)		Cyperaceae																								
<i>Lepidosperma</i> sp. K. Boorabbin (K.L. Wilson 2579)		Cyperaceae																								
<i>Lepilaena preissii</i>		Zanichelliaceae																								

Botanical name		Vegetation Unit																													
		Forests			Woodlands			Mallees			Shrublands					Samphire															
		1	2	3	4	5	6	7	8	9	10	11 a	11 b	12	13	14	15	16	17	18	19	20	21	22							
Family	Myrtaceae	Lobeliaceae	Poaceae	Poaceae	Dasypogonaceae	Dasypogonaceae	Dasypogonaceae	Solanaceae	Restionaceae	Chenopodiaceae	Chenopodiaceae	Lamiaceae	Myrtaceae	Myrtaceae	Myrtaceae	Myrtaceae	Myrtaceae	Myrtaceae	Myrtaceae	Myrtaceae	Myrtaceae	Myrtaceae	Myrtaceae	Myrtaceae	Myrtaceae	Aizoaceae	Cyperaceae	Asteraceae	Iridaceae	Polygonaceae	Poaceae
<i>Leptospermum erubescens</i>						+																									
<i>Lobelia alata</i>							+																								
<i>*Lolium perenne</i>																															
<i>*Lolium rigidum</i>																															
<i>Lomandra effusa</i>				+	+			+																							
<i>Lomandra micrantha</i> subsp. <i>teretifolia</i>				+		+		+																							
<i>Lomandra rupestris</i>						+																									
<i>Lycium australe</i>			+					+																							
<i>Lyginia imberbis</i>						+																									
<i>Maireana brevifolia</i>																															
<i>Maireana enchylaenoides</i>	+																														
<i>Mallophora globiflora</i>			+			+																									
<i>Melaleuca acuminata</i> subsp. <i>websteri</i>								+										+													
<i>Melaleuca adnata</i>								+										+													
<i>Melaleuca atroviridis</i> ms								+										+													
<i>Melaleuca brevifolia</i>								+										+													
<i>Melaleuca brophyi</i>								+										+													
<i>Melaleuca carpii</i>								+										+													
<i>Melaleuca halimiflorum</i>		+																+													
<i>Melaleuca hamata</i>								+										+													
<i>Melaleuca hamulosa</i>																		+													
<i>Melaleuca lateriflora</i> subsp. <i>lateriflora</i>								+										+													
<i>Melaleuca leptospermoides</i>						+																									
<i>Melaleuca subtrigona</i>																															
<i>Melaleuca thyoides</i>							+																								
<i>Melaleuca viminea</i>																		+													
<i>*Mesembryanthemum nodiflorum</i>																															
<i>Mesomelaena pseudostygia</i>						+																									
<i>Millotia tenuifolia</i>																															
<i>*Moraea setifolia</i>																															
<i>Muehlenbeckia adpressa</i>							+		+																						
<i>Neurachne alopecuroides</i>				+	+	+	+																								

Vegetation Unit																										
Botanical name		Family	Forests			Woodlands			Mallees			Shrublands						Samphire			Sedge			Edges		
			1	2	3	4	5	6	7	8	9	10	11 a	11 b	12	13	14	15	16	17	18	19	20		21	22
<i>Olearia dampieri</i> subsp. <i>eremicola</i> ms		Asteraceae																								
<i>Oligochaetochilus pictus</i>		Orchidaceae											+													
<i>Oxalis perennans</i>		Oxalidaceae	+																							
<i>*Parapholis incurva</i>		Poaceae							+				+								+					
<i>Pelargonium havlasae</i>		Geraniaceae	+																							
<i>*Pentastichis airoides</i>		Poaceae	+							+			+					+								+
<i>Petrophile ericifolia</i> subsp. <i>ericifolia</i>		Proteaceae																								
<i>Pittosporum angustifolium</i>		Pittosporaceae																								
<i>*Plantago coronopus</i> subsp. <i>commutata</i>		Plantaginaceae																								
<i>Podolepis canescens</i>		Asteraceae			+			+																		
<i>Podolepis capillaris</i>		Asteraceae				+			+													+				
<i>Podolepis lessonii</i>		Asteraceae								+			+										+			
<i>Podolepis tepperi</i>		Asteraceae																								
<i>Podotricha angustifolia</i>		Asteraceae																								
<i>Podotricha gnaphalioides</i>		Asteraceae			+								+										+			
<i>Pogonolepis stricta</i>		Asteraceae																								
<i>*Polypogon monspeliensis</i>		Poaceae							+				+								+				+	+
<i>Prostanthera canaliculata</i>		Lamiaceae																								
<i>Pterostylis</i> sp.		Orchidaceae								+																
<i>Ptilotus fasciculatus</i>		Amaranthaceae																								
<i>Ptilotus humilis</i> var. <i>humilis</i>		Amaranthaceae																								
<i>Ptilotus manglesii</i>		Amaranthaceae							+				+													
<i>Ptilotus polystachyus</i>		Amaranthaceae											+													
<i>Ptilotus spatulatus</i>		Amaranthaceae											+													
<i>Quinella urvillei</i>		Asteraceae																								
<i>Regelia ciliata</i>		Myrtaceae																								
<i>Rhagodia drummondii</i>		Chenopodiaceae	+																							
<i>Rhodanthe citrina</i>		Asteraceae				+		+		+		+			+											
<i>*Romulea rosea</i>		Iridaceae																								
<i>Royceea pycnophylloides</i>		Chenopodiaceae							+				+													
<i>Royceea spinescens</i>		Chenopodiaceae																								
<i>Ruppia</i> sp.		Potamogetonaceae																								

Vegetation Unit																								
Botanical name	Family	Forests			Woodlands			Mallees			Shrublands					Samphire			Sedge			Edges		
		1	2	3	4	5	6	7	8	9	10	11 a	11 b	12	13	14	15	16	17	18	19	20	21	22
<i>Santalum acuminatum</i>	Santalaceae																							
<i>Santalum murrayanum</i>	Santalaceae						+			+														
<i>Santalum spicatum</i>	Santalaceae						+					+												
<i>Sarcocornia quinqueflora</i>	Chenopodiaceae																	+						
<i>Sarcocornia praecox</i>	Aizoaceae																							
<i>Schoenia filifolia</i> subsp. <i>filifolia</i>	Asteraceae			+									?											
<i>Schoenus</i> aff. <i>subfascicularis</i>	Cyperaceae																							
<i>Scholtzia</i> sp. Yenyening Lakes (A.G. 2824)	Myrtaceae						+							+								+		
<i>Sclerolaena diacantha</i>	Chenopodiaceae									+									+					
<i>Senecio glossanthus</i>	Asteraceae			+																				
<i>Senna artemisioides</i> subsp. <i>filifolia</i>	Caesalpiniaceae																	+						
* <i>Sonchus oleraceus</i>	Asteraceae										+	+												
* <i>Sonchus tenerrimus</i>	Asteraceae							+																
* <i>Spergularia bocconii</i>	Caryophyllaceae																							
<i>Spergularia</i> sp.1 Mollerin (P.G. Wilson 6078)	Caryophyllaceae																		+	+				+
<i>Spergularia</i> sp.4 Laverton (A.C. Beaglehole 59928 & E.G. Errey)	Caryophyllaceae																+							
<i>Stackhousia monogyna</i>	Stackhousiaceae						+																	
<i>Stackhousia muricata</i>	Stackhousiaceae																							
<i>Stenopetalum salicola</i>	Brassicaceae																			+				
<i>Stylobasium australe</i>	Surianaceae										+													
<i>Styandra glauca</i>	Phormiaceae	+					+																	
<i>Synaphea spinulosa</i> subsp. <i>spinulosa</i>	Proteaceae						+																	
<i>Threlkeldia diffusa</i>	Chenopodiaceae																							
<i>Thysanotus manglesianus</i>	Anthericaceae																		+					
<i>Thysanotus patersonii</i>	Anthericaceae						+				+	+								+				
<i>Trachymene cyanopetala</i>	Apiaceae																							
<i>Trachymene pilosa</i>	Apiaceae			+			+																	
<i>Triglochin minutissima</i>	Juncaginaceae						+										+							
<i>Triglochin mucronata</i>	Juncaginaceae										+													+
<i>Triglochin stowardii</i>	Juncaginaceae											+							+					+

Botanical name		Vegetation Unit																								
		Forests			Woodlands			Mallees			Shrublands							Samphire			Sedge			Edges		
		1	2	3	4	5	6	7	8	9	10	11 a	11 b	12	13	14	15	16	17	18	19	20	21	22		
	Family																									
<i>*Tripteris clandestina</i>	Asteraceae																									
<i>Trymalium daphnifolium</i>	Rhamnaceae																									
<i>*Ursinia anthemoides</i>	Asteraceae						+		+				+									+				
<i>Velleia cynopotamica</i>	Goodeniaceae																+									
<i>Verreauxia reinwardtii</i>	Goodeniaceae						+										+									
<i>Verticordia acerosa</i> var. <i>preissii</i>	Myrtaceae						+																			
<i>Verticordia densiflora</i> var. <i>caespitosa</i>	Myrtaceae						+																			
<i>Verticordia lindleyi</i> subsp. <i>purpurea</i>	Myrtaceae						+																			
<i>*Vulpia myuros</i> var. <i>myuros</i>	Poaceae			+	+				+				+				+				+					
<i>Waitzia acuminata</i> var. <i>acuminata</i>	Asteraceae			+									+													
<i>Wilsonia humilis</i>	Convolvulaceae			+									+				+									
<i>Wurmbea tenella</i>	Colchicaceae						+																			
<i>Xanthorrhoea preissii</i>	Xanthorrhoeaceae						+	+																		
<i>Xylomelum angustifolium</i>	Proteaceae							+																		
<i>*Zaluzianskya divaricata</i>	Scrophulariaceae			+			+																			

#### APPENDIX IV: CATEGORIES RELATING TO THREATENED SPECIES (Atkins 2001, Brown *et al.* 1998)

**Declared Rare Flora (DRF)** are provided special protection under the *Wildlife Conservation Act 1950* and are declared rare by notice published in the Government Gazette. The following categories are included in DRF:

**Rare** - less than a few thousand adult plants of the taxon existing in the wild.

**Endangered** (in danger of extinction) - the taxon is in serious risk of disappearing from the wild state within one or two decades if present land use and other causal factors continue to operate.

**Deemed to be threatened and in need of special protection** - the taxon is not presently in danger of extinction but is at risk over a long period through continued depletion, or largely occurs on sites likely to experience changes in land use which could threaten its survival in the wild.

**Presumed extinct** - the taxon has not been collected, or otherwise verified, over the past 50 years despite thorough searching, or all known populations have been destroyed more recently.

**Priority flora** (plants of uncertain conservation status) are divided into categories according to the degree of threat.

**Priority One - poorly known taxa** - taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as rare but are in urgent need of further survey.

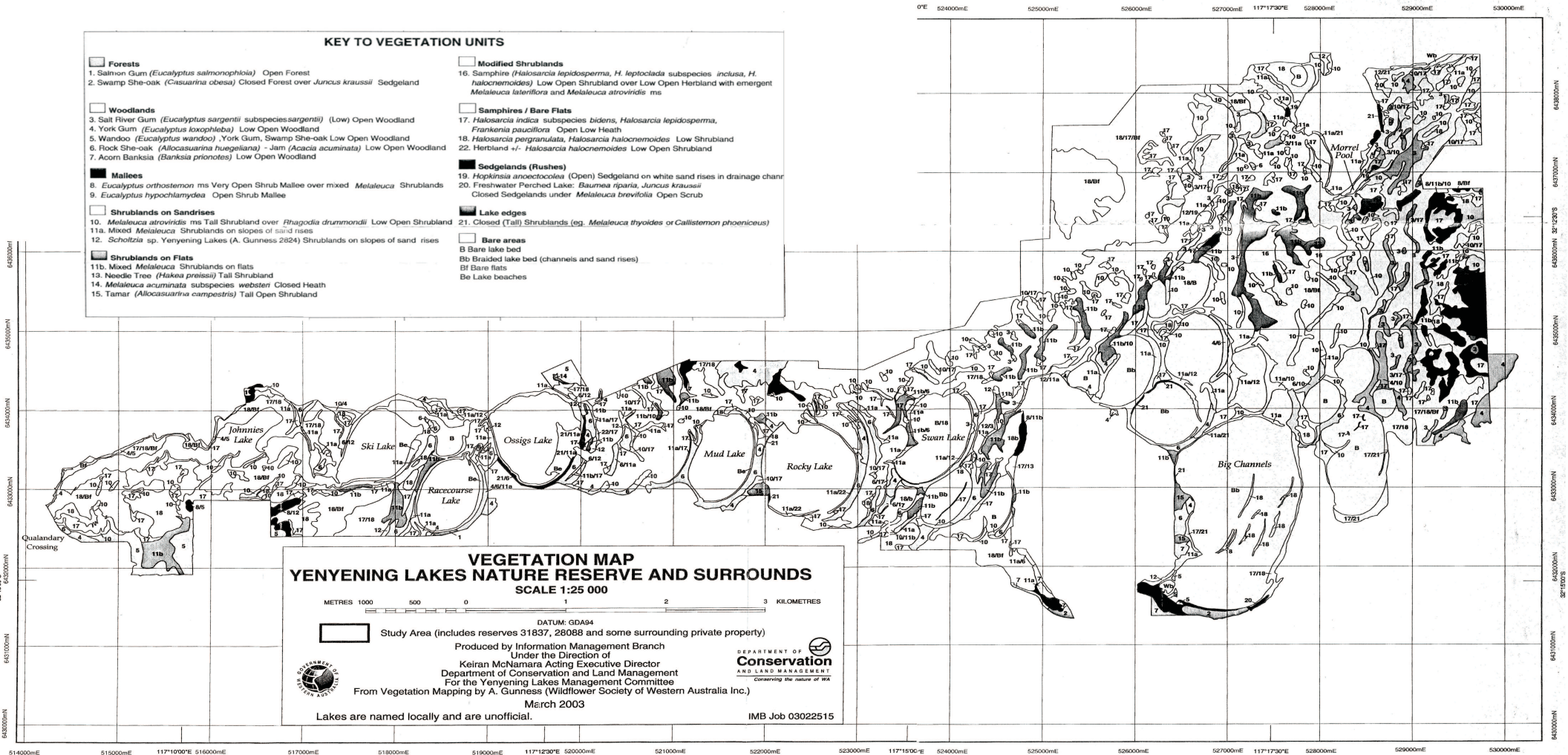
**Priority Two - poorly known taxa** - taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (ie. not currently endangered). Such taxa are under consideration for declaration as rare but are in urgent need of further survey.

**Priority Three - poorly known taxa** - taxa which are known from several populations, at least some of which are not believed to be under immediate threat (ie. not currently endangered). Such taxa are under consideration for declaration as rare but are in urgent need of further survey.

**Priority Four - rare taxa** - taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

A "Declared Rare Flora and Priority Flora List" is published each year by CALM.





Ref ID 341  
 QV. 322. (Ecoscapes consulting Report.  
 - Digitized this map + additional polys.)