

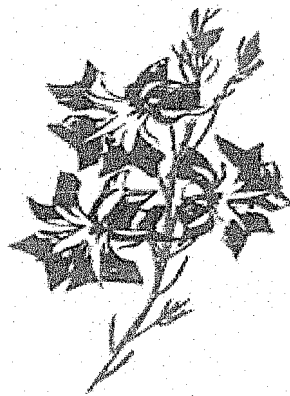
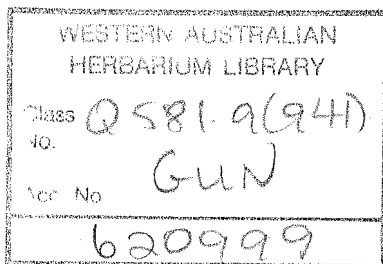
A SURVEY OF VEGETATION AND FLORA

OAK PARK SHIRE RESERVE

WALYORMOURING

(AND AN ADJOINING SMALL FRESH-WATER CLAYPAN)

Shire of Goomalling



Wildflower Society Logo:
Lechenaultia biloba

by

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and

Volunteers of the Bushland Plant Survey Project

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Information Systems
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TABLE OF CONTENTS

	Page
Summary	1
1. Introduction	2
2. The Study Area	3
Location	3
Climate	3
Landforms and soils	4
Vegetation	5
3. Survey Method	8
4. Vegetation	10
Plant Communities and the Vegetation Map	10
Vegetation condition	21
5. Flora	22
Species of Special Interest	23
Declared Rare and Priority flora	23
Geographically significant flora	24
Taxonomically significant flora	25
Weeds	26
The Field Herbarium	29
6. Discussion	30
Conservation Values	30
Management considerations	32
Weed prevention and control	32
Restoration and revegetation	33
Rising water table and salinity	34
Other disturbances	34
Management checklist	35
7. Conclusion	36
8. Acknowledgments	37
9. References	38
Appendices:	
Appendix I: Site vegetation descriptions and condition (by plant community)	42
Appendix II: Plant species list for Oak Park Reserve	45
Appendix III: Plant species on the Fresh-water Claypan	57
Appendix IV: Plant species occurrences on the quadrats grouped by plant community	59
Appendix V: Categories relating to threatened species	71

SUMMARY

- The survey has helped to achieve the purposes of educating the community about bushland, with 29 volunteers from the Wildflower Society of Western Australia and the local Goomalling community participating in field work and 9 Wildflower Society volunteers helping in post survey work.
- Eleven permanent 10x10 metre quadrats have been established in Oak Park Reserve and one in a Fresh-water Claypan on adjoining private property.
- Eight vegetation communities have been recognised in the 149 hectares of the Reserve.
- 235 native plant taxa (species, subspecies and varieties) from 56 families were recorded in the Reserve.
- Five priority species were recorded in this survey:
 - *Scaevola tortuosa* (Priority 1)
 - *Schoenus capillifolius* / sp. Beaufort (G.J. Keighery 6291) group (Priority 1)
 - *Blennospora phlegmatocarpa* (Priority 2)
 - *Persoonia chapmaniana* (Priority 3)
 - *Stemnanthemum tridentatum* (Priority 4)
- Fourteen species were found outside or at the limit of their currently known range.
- Forty-eight introduced species (weeds) were recorded. Fourteen of these were only recorded in the disturbed area around the gravel pit.
- A field herbarium containing most of the species recorded in the survey has been presented to the Oak Park Catchment Group.
- The Reserve has high conservation value in a shire that retains less than 6 percent of its native vegetation. It supports a range of vegetation communities including Fresh-water Claypans which are threatened and poorly represented in conservation reserves, and species rich York Gum Tree Mallee over Shrubland which is locally uncommon and possibly uncommon within the Wheatbelt.
- The most serious threats to the condition and conservation values of the Reserve, which lies low in the landscape, are weeds and a rising watertable causing waterlogging and salinisation.

1. INTRODUCTION

The Wildflower Society's Bushland Plants Survey Project is a community project that has been in existence since 1988. It has the combined objectives of learning through involvement and bushland conservation and is based on the belief that by developing an understanding of our surroundings we are better able to value them. It aims to help community groups and individual landholders know and conserve their bushland by providing training and help to survey, document and monitor vegetation and flora. In particular it encourages the recognition of native plants and plant communities. This knowledge can then be utilised in the management and conservation of the bushland.

The Oak Park Catchment group, represented by local farmer Geoff White and the community Landcare coordinator John Silver, applied for a survey to be carried out in the 149 hectares of Oak Park Shire Reserve (No. A1407), in the Shire of Goomalling. The group is part of the Goomalling LCDC. The reserve borders Lake Walyormouring, a large saline seasonal lake which is gazetted as an A Class Native Flora and Fauna Reserve (No. 17186) and lies in the lower reaches of the catchment. The south-western edge of the reserve has an abandoned gravel pit and once had a recreation area but the remainder of the reserve is bushland in very good to excellent condition. During the course of the survey botanists Greg Keighery and Neil Gibson who are familiar with the vegetation of the Wheatbelt discovered a small Fresh-water Claypan (wetland) on the adjoining private property. The rich plant species diversity of freshwater wetland communities, which are strongly under threat from salinity, had recently been recognised and the site was considered worthy of study. With permission from the landowner, this claypan was included in the survey.

Approximately 93 per cent of the wheatbelt area of Western Australia has been cleared for agriculture in the last 150 years (Beard, 1990). Broad-scale clearing for agriculture since the 1940's has meant that less than 6% of the area of the Shire of Goomalling still retains original native vegetation on public and private land (Beeston *et al.* 1994). Salinity is probably the greatest environmental threat facing Western Australia and Goomalling Shire is one of the six most salt affected shires in Western Australia (Weaving 1999, Figure 16 p.37b). All uncleared land is of significant value in the region, not only for habitat and biodiversity values but also for its role in the hydrological balance. It is now government policy that where possible, shires should retain a minimum 20% remnant vegetation with recommendations that the "threshold level" for a vegetation community is 30% of the pre-clearing level. In the many wheatbelt shires that have already had greater levels of clearing, **all** remaining remnants are valuable resources and command a high priority for conservation. "The retention and management of bushland is an investment in the sustainability of agricultural systems and landscapes in general" (Anon 2000).

The survey was conducted over a weekend in the spring of 1999. Wildflower Society volunteers and a coordinating botanist travelled to the Goomalling area to work alongside local community participants. As well as the benefit of on-ground survey experience for all involved, much value and enjoyment was gained in the social interactions. It was agreed with John and Geoff that survey outcomes would include a plant species list and vegetation map for the reserve; a brief report; a field herbarium for retention and use by the local Landcare group and local community; and presentation of the results to a meeting of the catchment group. This report describes the vegetation, flora and conservation values of the bushland site. It provides some baseline data for future management of the bushland and for revegetation in the area. Another survey was conducted by the Wildflower Society in 1996 on private property high in the landscape in the Gabby Quoi Quoi catchment, also in the Goomalling Shire and just sixteen kilometres (approx.) north of this study (Gunness *et al.* 1998).

The project has been supported since its inception by a series of federal government grants. This survey was supported by funds from the Bushcare Program of the Natural Heritage Trust (1998-99). The Department of Conservation and Land Management and the Wildflower Society also provided support.

2. THE STUDY AREA

Location

Oak Park Shire Reserve is located at the junction of Oak Park road and Botherling East road approximately 17 kilometres north north east of the town of Goomalling (20 kilometres by road) and 15.5 kilometres west north west of Dowerin (21 kilometres by road) (Figure 1). Goomalling is approximately 150 kilometres by road north-east of Perth. The study area is in the western part of the "central wheatbelt" and Goomalling is one of sixteen shires which lie within the Avon Catchment. Agricultural land use in the area is mainly cropping (wheat, barley, canola, lupins) and sheep.

Climate

The climate is dry warm Mediterranean, characterised by cool wet winters and warm to hot dry summers with 7–8 dry months per year. Average annual rainfall at Goomalling is 368mm with 63 per cent falling during the 4 months from May to August inclusive. The average maximum temperatures range from 34.3°C in January to 16.7°C in July and average minimum temperatures from 17°C in January and February to 6.5°C in August (Commonwealth of Australia 2001, Bureau of Meteorology).

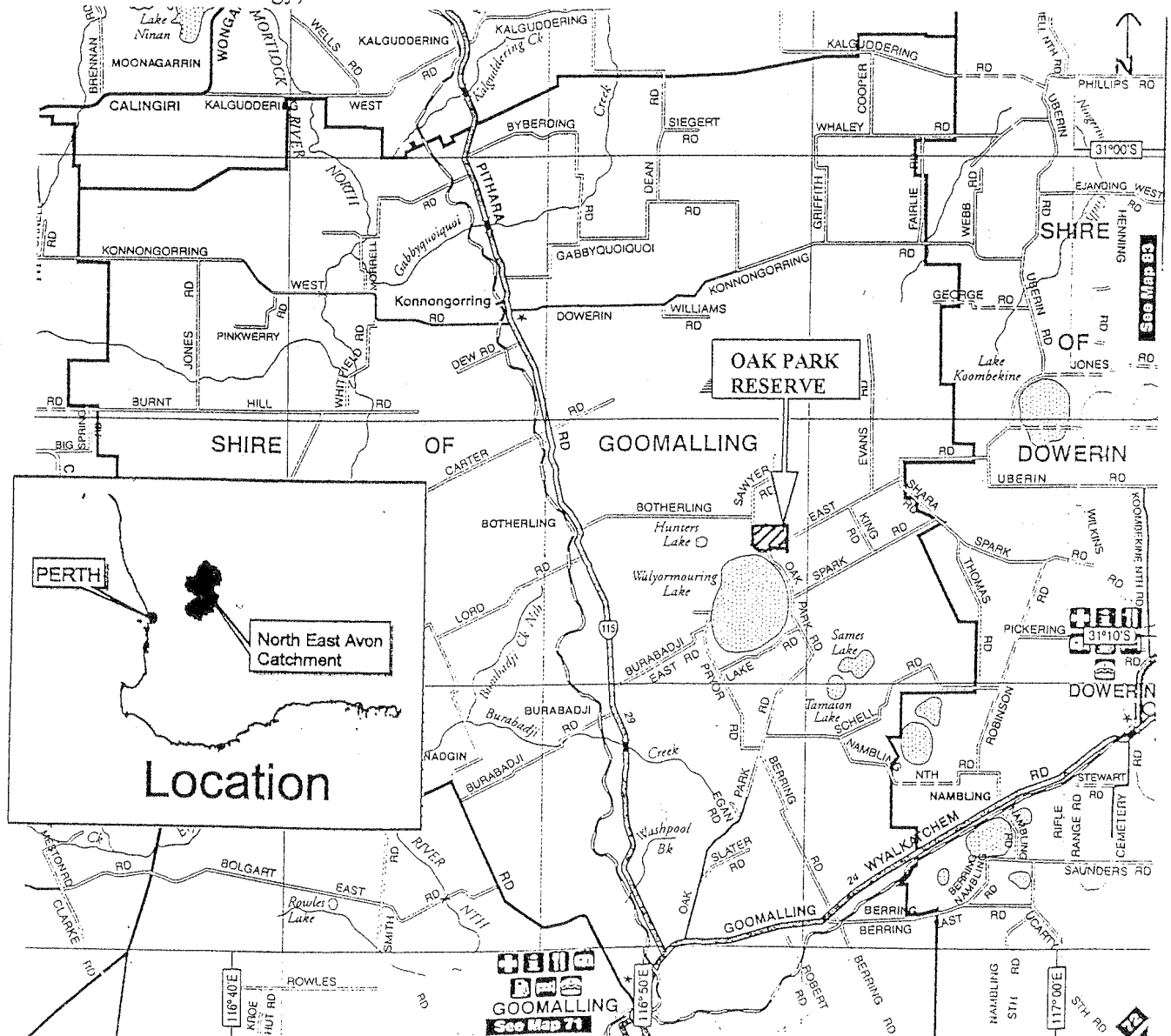


Figure 1: Locality Map for Oak Park Reserve, Goomalling. (Source: The West Australian Traveller's Atlas, Edition 3, 2000)

Landforms and Soils

Goomalling lies to the east of the Darling fault and Precambrian rocks that form part of the Yilgarn block underlie the area. These ancient granites and gneisses are approximately 2900-2500 million years old. The even grained granitic rocks are surrounded by alluvium of clay, sand and loam (Wilde and Low 1978).

The study area falls in the Zone of Ancient Drainage (Lantzke and Fulton 1994) which contains remnants of an ancient sluggish drainage system which now only flows in wet years. North-east of Goomalling drainage is disorganised and drainage is collected in small lakes such as those of the Walyormouring - Oak Park area. Broad shallow valleys rimmed by low hills typify the area (Photograph 1). These lakes were once mostly fresh, but now salt lakes and scalds are common, fringed by Swamp She-oak (*Casuarina obesa*), Paperbark (*Melaleuca* species) and Samphires. Skeletons of dead trees in these saline areas reflect the water logging and salinity problems of the Wheatbelt.



Photograph 1: View across the Oak Park catchment landscape from the granite hill on Pryor's Road, looking towards Lake Walyormouring and its associated drainage and lakes system with Oak Park Reserve behind. This illustrates the low rolling hills and broad valley systems of the area. (All photographs by Brian Moyle.)

The two soil groups of the Oak Park area are yellow sandy earths which are widespread on the sandy uplands in the central, eastern and northern Wheatbelt and alkaline grey shallow sandy duplex on the lower seasonally waterlogged areas (Weaving 1999, Schoknecht 2001). On a regional mapping basis, three soil-landscape types have been mapped for the study area (Frahmand in prep.):

- **Kwelkan 1 phase** (258KyKW1) on the higher ground of the reserve. Soils of this unit are brown sandy earths, shallow and deep loamy duplex, and deep and shallow sand on gently undulating to undulating rises typically supporting vegetation of York Gum, Jam, *Acacia* species and Tamar.
- **Trayning saline phase** (258KbTRs) on the middle reaches of the reserve. Soils are mainly saline, loamy duplex, and sandy earth, typically supporting vegetation of Salmon Gum, York Gum, *Acacia* species, Saltbush and Samphire.
- **Wallambin Baandee Subsystem** (258WaBA) of the salt lake chains and adjoining lunettes (wind blown dunes bordering the lakes). Soils are salt lake, red and grey calcareous loamy earths, and saline wet soils typically consisting of bare areas and Samphire-Saltbush-Bluebush flats.

Vegetation

Vegetation in Western Australia has been described on a broad scale in a series of publications by Beard (eg. Beard 1979, 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) in the northern reaches of the Goomalling Vegetation System (Beard 1979). 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, halophytes on saline soils (Beard 1981).

The Goomalling Vegetation System (Beard 1979) is typified by very extensive sandplains covering more than half the area. They are mostly on higher ground and apparently of aeolian (wind blown) origin as they overlie metamorphic rocks, not granite and consist of fairly deep yellow earthy sands. The original vegetation types included:

- Scrub-heath or locally *Banksia* Low Woodland on the sandplain
- Woodlands of York Gum (*Eucalyptus loxophleba*) and Salmon Gum (*E. salmonophloia*) in the valleys where soils are red hard setting loams
- Teatree and samphire vegetation in extensive salt flats along major drainage areas on yellow alkaline loams

All these types were represented in some form in Oak Park Reserve. Beard comments that "owing to total clearing of this country for farming without retention of reserves it is now very difficult to compile a list of component species". Most of the mapping of original vegetation for this area was deduced from vegetation on roadsides.

In more recent studies the state of 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 purpose for developing IBRA bioregions was 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). They found that, at the time of study, less than 1 % of the Avon Wheatbelt IBRA 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.

Vegetation studies in the Goomalling Shire appear to have been limited. A brief study was conducted by the Department of Fisheries and Wildlife (Muir 1979) of the only three nature reserves within the shire. These included the largest, Lake Walyormour Reserve A17186 (291 hectares), Catmulligan Well Nature Reserve 737 (19 hectares) and Reserve 24885 (6 hectares). All were fairly disturbed and surrounded by grazing land. Reserve 737 contained York Gum-Jam Woodland, York Gum-Swamp She-oak Woodland and creek margins with Swamp She-oak trees over an understorey of grasses and weeds. However it had been significantly disturbed by grazing, a gravel pit, dumped rubbish, a dam, timber removal and showed evidence of salting. Detailed vegetation monitoring has been undertaken along transects at Lake Walyormour including studies of death and recruitment of *Casuarina obesa* and *Melaleuca strobophylla* (Halse *et al.* 1993, Gurner *et al.* 1998/99). Obviously any bushland in good condition in the Shire is of high value.

The Wildflower Society conducted a survey on 80 hectares of bushland on private property in the Gabby Quoi Quoi catchment (Gunnness *et al.* 1998). This site was high in the catchment and included areas of granite outcrops so provides a comparison to this study in the lower catchment. Five vegetation types were described: Open Eucalypt Woodlands with Wandoo, Salmon Gum, Gimlet or York Gum; York Gum-Jam Open Woodland; Rock She-oak Low Open Woodland;

Granite complex supporting shrublands and *Borya* Herblands and Tamar Shrubland. Two hundred and twenty four native plant taxa were recorded and a field herbarium of specimens from the survey prepared for the Landcare group.

Beard's broadscale (1:250 000) mapping recognised several vegetation types within the Goomalling Shire. At that scale of mapping two vegetation types were mapped for Oak Park Reserve (Figure 2) (Hopkins *et al.* 2000, Beard 1979):

- Medium Woodland: York Gum and Salmon Gum
- Succulent steppe: *Melaleuca thyoides* thicket over samphire

Only 5.4 % of the original woody vegetation cover remains in the Goomalling Shire (Land Monitor Project, 1996 woody vegetation cover) and the existing remnants for the study region are shown in Figure 2. This shows Oak Park Reserve as having only scattered woody vegetation. The Land Monitor project mapping is considered accurate to within approximately 5% (Bailey and Carr, pers. comm. 2001). It appears that the Jam Low Open Woodland and Tamar Shrubland in the eastern sector of the Reserve have not been included as remnant vegetation. Despite such inaccuracies the figure illustrates the general scarcity of original woody vegetation remaining in the region and highlights the significance of any remnants.

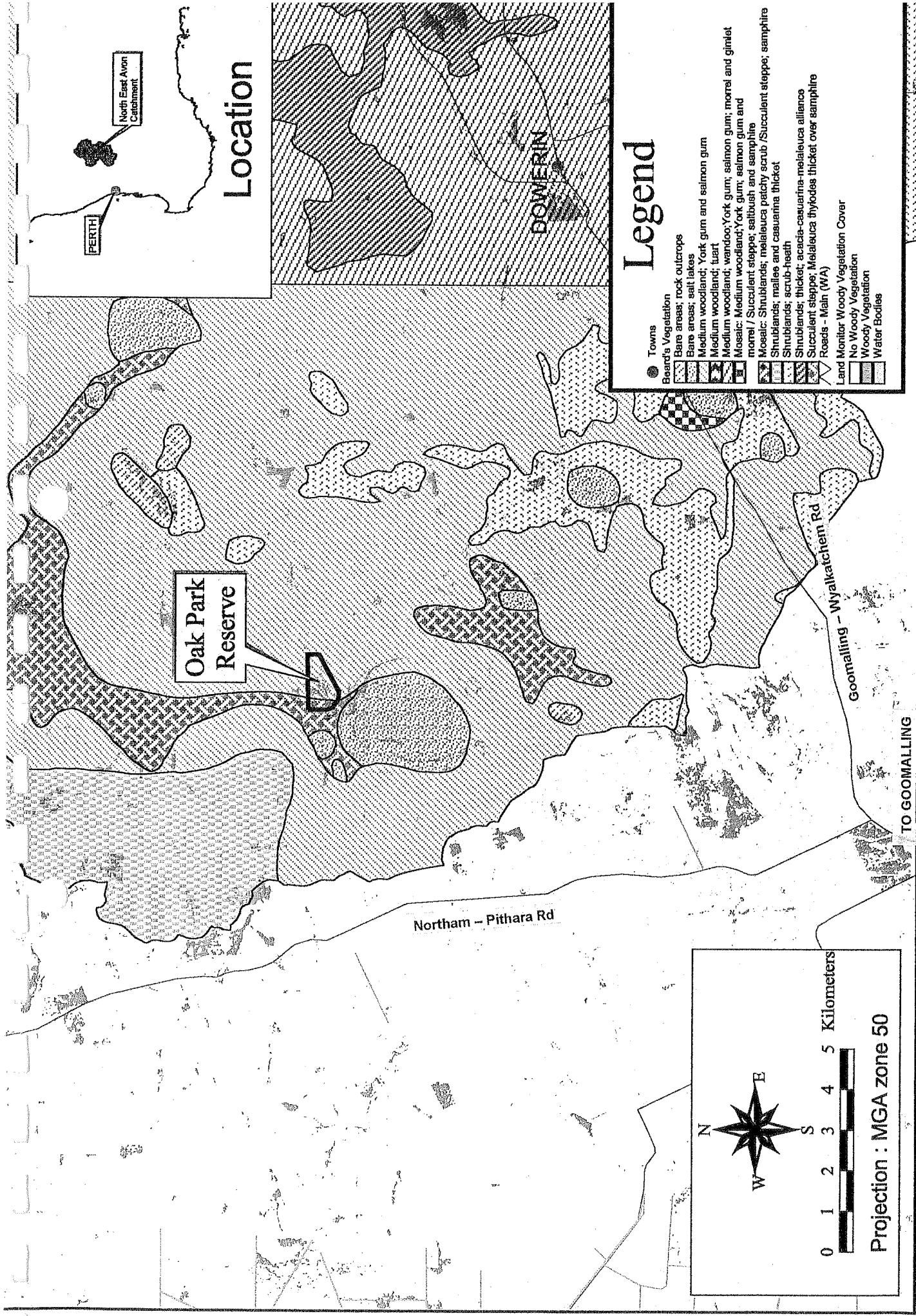


Figure 2: Remnant woody vegetation currently existing and Beard vegetation types mapped according to original natural vegetation (Land Monitor Project)

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3. SURVEY METHOD

Survey work on the reserve was conducted during the 1999 spring flowering season on a weekend in mid September and again in late October. Eleven 10m x 10m quadrats were located and described within the 149 hectares of Oak Park Reserve and one quadrat in the adjacent freshwater wetland. These were chosen to sample the full range of plant communities that were identified from aerial photographs and field reconnaissance. Quadrats were located in the areas of bushland that were in the best condition.

Groups comprised of the 23 volunteers and botanists from the Wildflower Society Bushland Plant Survey program and 6 interested people from the local community collected data. Each group was led by a botanist or experienced volunteer. Information collected included a physical description of the quadrat site, vegetation structure and canopy cover and a list of all the vascular plant species present at the time of survey. Additional species occurring within each community were also recorded (as adjacents). Opportunistic collections of species not recorded in or adjacent to quadrats were also made across the site. Vegetation descriptions were then made based on the structure, cover and dominant species. Table 1 details the structural classification used.

The survey techniques are well described in the Wildflower Society publication "Bushland Plant Survey for the Community" (Keighery 1994). The methods have proved successful for community participation. The quadrats and data sheets provide a systematic procedure for the collection of information and avoid concentrating just on the common and obvious species. They provide the baseline information for the plant species list and the plant community descriptions. The 10 x 10 metre quadrats were marked with galvanised steel fence droppers and the markers left in position enabling them to be relocated for future monitoring by the local community. Copies of the quadrat data sheets were given to the catchment group. Photographs of each quadrat were taken at the time of the survey and are another useful monitoring record. These have been given to the catchment group in the form of colour slides.

An initial plant identification session was carried out on fresh specimens on the Saturday evening of the survey weekend. Volunteers, botanists and the survey coordinator then carried out identification work in regular sessions at the Western Australian Herbarium. All plant specimens were verified against specimens from the WA Herbarium with several specimens verified with the help of specialist botanists. A field herbarium has been compiled for the study area and presented to the Oak Park Catchment group. Duplicates of some specimens have been lodged at the Western Australian Herbarium. It is considered that the survey will have recorded approximately 80-90 % of the plant species present in the remnant.

Some limitations of the study were as follows:

- The survey was conducted over one flowering season only. It included a preliminary visit in winter, the spring survey weekend and a revisit later in the spring to collect the later flowering annuals and grasses. Recording over several seasons and times of year would be necessary to document the full complement of species.
- The survey was restricted to flowering plants and other well-known groups such as ferns and cycads. Fungi, mosses, lichen, liverworts and algae were not recorded as the amount of information and available expertise to identify these groups is still limited.
- Consistency in estimates of crown cover and vegetation condition is difficult when several people are carrying out the survey work as individual interpretation varies. Vegetation condition is considered relative to what pristine bushland would be. The condition categories used are given in Table 2.
- Soil descriptions are based on basic field observations without any sampling or analysis. Colour and broad soil type classification of the upper horizon was recorded and if evidence from anthills or holes was present, the sub-surface soil was also described.

Table 1: Structural Classification (from Keighery 1994, adapted from Muir 1977 and Aplin 1979).

Life Form/ Height Class	Canopy Cover (percentage)			
	100 - 70	70 - 30	30 - 10	2 - 10
Trees over 30m	Tall Closed Forest	Tall Open Forest	Tall Woodland	Tall Open Woodland
Trees 10 - 30m	Closed Forest	Open Forest	Woodland	Open Woodland
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
Shrubs over 2m	Closed Scrub	Open Scrub	Tall Shrubland	Tall Open Shrubland
Shrubs 1 - 2m	Closed Heath	Open Heath	Shrubland	Open Shrubland
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 2: Vegetation Condition Scale (Keighery B.J. 1994)

1 Pristine	Pristine or nearly so, no obvious signs of disturbance
2 Excellent	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.
3 Very Good	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
4 Good	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.
5 Degraded	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.
6 Completely degraded	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.

- Although collections of every species recorded were made for identification purposes, the entire flora of the site does not have voucher (duplicate) specimens lodged at the Western Australian Herbarium. However collected specimens were matched against specimens from the Herbarium (verified). Where possible, plants of special interest have had specimens lodged at the Herbarium.
- Detailed floristic analysis of the data on a regional basis awaits sufficient collection of data across the wheatbelt. The data from this survey has been made available to the CALMScience Biological Survey Group. Scientists from the unit are undertaking a four-year biological survey of the Wheatbelt, based on compatible sampling procedures (Keighery *et al.* 2001a).
- 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

PLANT COMMUNITIES AND THE VEGETATION MAPS

Using aerial photo interpretation and on-ground observations, plant community groups were recognised based on vegetation structure, dominant plant species, position in the landscape and soil type and these have been mapped for the reserve (Figure 3). The aerial photograph illustrated in Figure 3 was flown in 1993 but mapping was done from more recent 1:25 000 aerial photographs flown in 1998. The broad mapping units listed in a general trend from higher to lower positions across the landscape are as follows:

- T Tamar (*Allocasuarina campestris*) Open Shrublands
- J Jam (*Acacia acuminata*) Low Open Woodlands
- Y York Gum (*Eucalyptus loxophleba*) Tree Mallee over Shrublands
- C Fresh-water Claypans supporting Sedgeland
- L Lake Dune: Mixed Open Shrubland, Herbland and Open Sedgeland with scattered *Banksia prionotes*
- M *Melaleuca* Tall Open Scrub
- S Swamp She-oak (*Casuarina obesa*) Low Woodlands
- H Samphire Flats (*Halosarcia* species Low Shrublands)
- D Disturbed areas

The vegetation units (mapping units; plant communities) vary in their species dominance and composition and the interpretation of the map (Figure 3) should be done in conjunction with the descriptions of the units that follows. The vegetation structure descriptions and condition ratings for the quadrats in each unit are provided in Appendix I.

1. Tamar Open Shrublands (T) (Quadrat 1) (Photographs 2 and 3)

These Open Shrublands, in the middle section of the reserve, were characterised by Tamar (*Allocasuarina campestris*) to 2 metres tall. Jam (*Acacia acuminata*) was scattered throughout but was not dominant and this unit is distinguished from the Jam Low Woodlands by the presence of Tamar to 2 metres with at least 5% canopy cover. Similarly to the Jam Woodlands the understorey was a Herbland of *Borya sphaerocephala* and numerous annuals. Grasses and sedges were also an important component. The boundaries between the Jam Woodlands and the Tamar Shrublands were not always well defined and the species of each unit mix in a mosaic.

2. Jam Low Open Woodlands (J) (Quadrats 2, 11) (Photographs 4 and 5)

These Low Woodlands occurred on brown sandy loams in the eastern and southern sector of the reserve, with Jam commonly the sole dominant in the tallest stratum. York Gums (*Eucalyptus loxophleba*) were scattered throughout but were not a significant component of the canopy layer. The understorey was a well-developed Herbland dominated by *Borya sphaerocephala*, *Opercularia vaginata*, *Dampiera lavandulacea* and rich assortment of annual species. Grasses and sedges were also common. The most common grasses were *Austrostipa elegantissima*, *Austrostipa tenuifolia*, *Neurachne alopecuroidea* and *Austroanthonia acerosa*, and sedges *Schoenus clandestinus* and *Schoenus nanus*. These Woodlands were relatively poor in shrubs although *Grevillea paniculata* sometimes formed a layer.

Several species were common to both the Tamar Shrublands and the Jam Woodlands but not to the other vegetation types. They included Sandalwood (*Santalum spicatum*), *Astroloma serratifolium*, the herbs *Borya sphaerocephala*, *Burchardia umbellata*, *Gonocarpus nodulosus*, *Hydrocotyle callicarpa*, the grass *Amphipogon strictus* and the sedge *Schoenus clandestinus*.

3. York Gum (Open) Tree Mallee over Shrublands (Y) (Quadrats 3, 9 and 10) (Photographs 6 and 7)

This plant community was situated behind the Lake Dune and between the lake and the Tamar Shrublands on sandy soils overlying clay. It was characterised by the dominance of the Mallee (multi-stemmed) form of York Gum to 12 metres tall and with a canopy cover of 30 percent or more, and by the presence of a well-developed mixed shrub layer of varying height, even forming an Open (Low) Heath (30-70% canopy cover). Common species in the shrub understorey included *Hakea preissii*, *Santalum acuminatum* (Quandong), *Olearia dampieri* subsp. *eremicola*, *Eremophila lehmannii*, *Daviesia benthamii* subsp. *benthamii*, *Acacia acuararia* and *Scaevola spinescens*. A herb layer was also present, well developed where the mallee and shrub canopy were sparser and consisting mostly of a rich assortment of annuals which included many daisies. Grasses were also part of the ground layer.

In addition to the more abundant characteristic species listed in the previous paragraph there were several species which were confined to this vegetation type. They included the shrubs *Acacia erinacea*, *Eremophila decipiens*, *Maireana marginata*, *Stylobasium australe*, *Templetonia sulcata* and the herbs *Hydrocotyle pilifera* var. *glabrata* and *Plantago debilis*.

Quadrat OAKP9 was included in this community. It was on the sands behind the lake and intermediate between the York Gum Tree Mallee community and the Jam Low Woodlands described above. Jam was dominant and herbs formed a distinctive understorey layer. It shared species common to both vegetation types.

York Gum Woodlands typically support a rich herb layer. This community appeared unusual in having a well developed and species diverse shrub layer. Whether it is significantly different from other communities in the Wheatbelt cannot be concluded until the analysis of data in the CALMScience biological survey is completed. Beard (1979) noted that in the Goomalling Vegetation System it was unusual to find a good stand of *Eucalyptus loxophleba* Woodlands and that the ground plants had mostly been replaced by introduced species.

N ↑

Key

- == Bushland survey boundary
- Plant community boundary
- x 3 Quadrat location
- - - Track
- === Creek-line

Mapped plant communities

- T Tamar Open Shrublands
- J Jam Low Open Woodlands
- Y York Gum Tree Mallee over Shrublands
- C Fresh-water Claypans (Sedgelands)
- L Lake Dune (Mixed Shrublands, Herblands, Sedgelands, *Banksia*)
- M Melaleuca Tall Open Scrub
- S Swamp She-oak Low Woodlands
- H Samphire Flats (*Halosarcia* Low Shrublands)
- D Disturbed - Cleared areas

Scale: 0 300 metres

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WA 3139c Goomalling Shire Run 5
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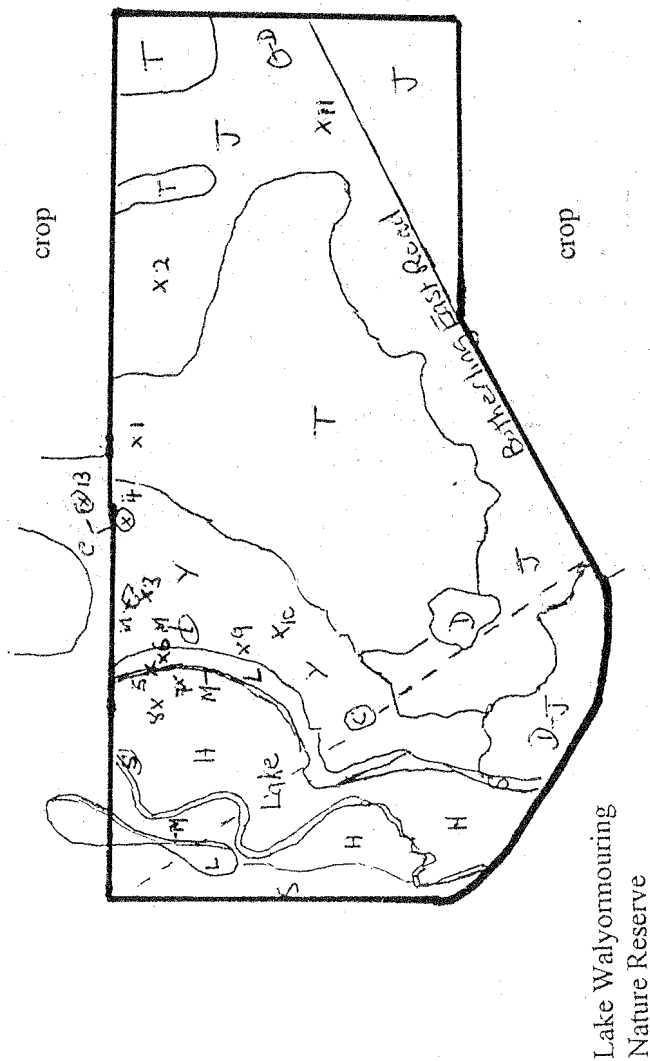
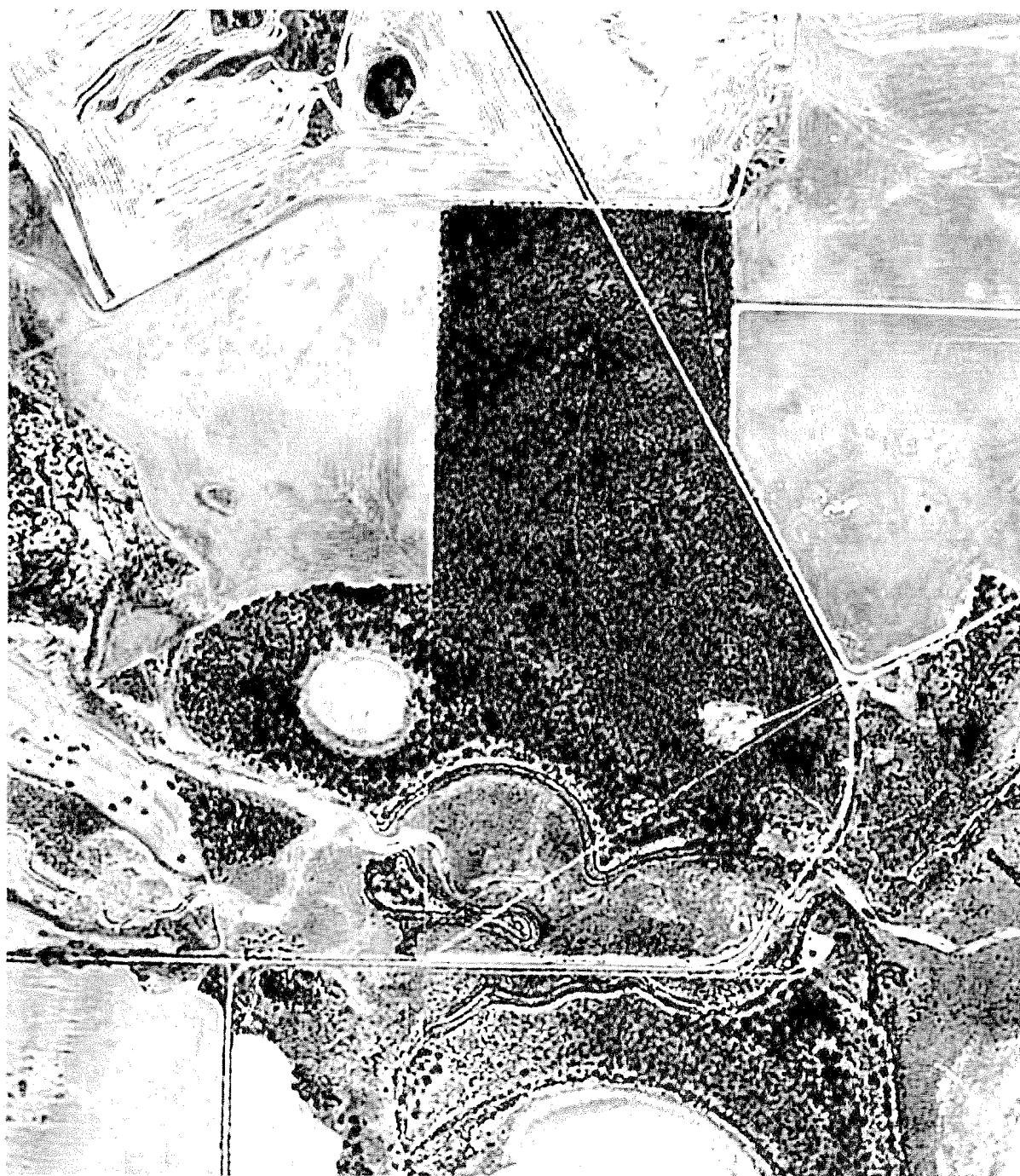


Figure 3: Aerial photograph and overlay of vegetation map of Oak Park Reserve



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Photograph 2: Pincushions (*Borya sphaerocephala*) were a dominant species in the herb layer of the Tamar Open Shrublands and desiccate to a dried brown plant over summer. This photograph was taken in April 1999 before the first rains.



Photograph 3: Tamar Open Shrubland with the resurrected Pincushions in flower. They re-hydrate almost immediately following rain. This community shared many species with the Jam Low Open Woodland and was distinguished by the presence of Tamar (*Allocasuarina campestris*).



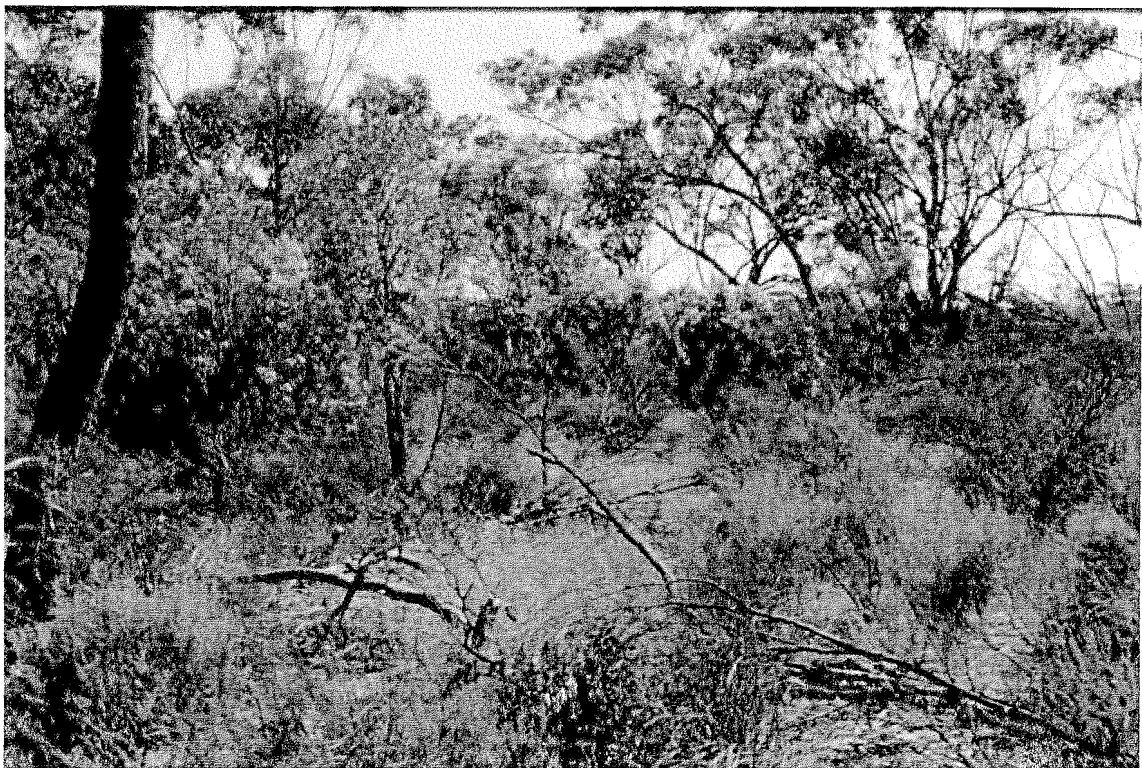
Photograph 4: Jam (*Acacia acuminata*) Low Open Woodland over a Shrubland of the cream flowered *Grevillea paniculata* and a ground layer of herbs, grasses and sedges dominated by *Borya sphaerocephala* and *Opercularia vaginata*. The old trunks amongst mature Jam trees indicate the area was long unburnt. (Quadrat OAKP 2, 18/9/99, with 51 native and 8 weed species)



Photograph 5: Our host Geoff White amidst a sea of the feathery flowering heads of Elegant Spear Grass (*Austrostipa elegantissima*) and Orange Immortelle (*Waitzia acuminata*). Both these species are widespread throughout the Wheatbelt Woodlands.



Photograph 6: Groups of up to 6 people including a botanist, Wildflower Society volunteers and local community participants work on 10x10m quadrats describing the vegetation and recording all species present. York Gum Open Tree Mallee over Jam Low Open Woodland with its annual understorey in flower. (Quadrat OAKP 9, 18/9/99 with 37 native and 11 weed species)



Photograph 7: The dark barked, multi-stemmed York Gum (*Eucalyptus loxophleba*) Tree Mallee grew in association with Tall Open Shrublands and Heath and pockets of species rich herblands. This community was the most species rich of the vegetation types in the reserve. (Quadrat OAKP 3, 18/9/99 with 59 native and 13 weed species)

4. Fresh-water Claypans supporting Sedgeland (C) (Quadrats 4 & 13) (Photographs 8 & 9)

Two small claypans (seasonal or ephemeral freshwater wetlands) were located within the York Gum Tree Mallee community. The smaller of these two winter wet, summer dry wetlands which was shallower and dried earlier was in Oak Park Reserve and the larger was on the adjoining private property. They are described as follows:

- ***Chorizandra enodis*, *Schoenus humilis* Sedgeland with emergent *Hakea preissii*** (Quadrat 4) (Photograph 8)

This was a small depression with a clay base that had some surface water at the time of survey in September and was dry in October. Scattered shrubs grew around the edge and the basin was a Sedgeland dominated by Black Bristlerush (*Chorizandra enodis*) and *Schoenus humilis* with a rich suite of herbs growing in conjunction with the sedges. Shrubs included *Hakea preissii*, *Grevillea hakeoides*, *Rhagodia drummondii* and *Scaevola spinescens*. Species that were exclusive to this quadrat included the herbs *Goodenia micrantha*, *Hydrocotyle rugulosa*, *Hypoxis glabella* var. *leptantha*, *Prasophyllum gracile*, *Stylidium ecorne*, and *Stylidium inundatum* the annual sedge *Schoenus tenellus* and the shrub *Eutaxia microphylla*.

- ***Eleocharis acuta* Open Sedgeland** within a York Gum, Swamp She-oak Low Woodland over *Hakea preissii* Open Shrubland. (Quadrat 13 on private property) (Photograph 9)

This was a larger claypan than the one described above which held water for longer periods and supported a greater diversity of ephemeral freshwater wetland (semi-aquatic) flora. It was also nestled amongst York Gum, Swamp She-oak (*Casuarina obesa*) and *Hakea preissii* were growing around its perimeters. Sedges were an important component of the flora with the perennial Common Spikerush (*Eleocharis acuta*) dominant along with three annual *Schoenus* species, *Isolepis congrua* and *Chorizandra enodis*. Fourteen taxa were exclusive to this quadrat and included the herbs: *Crassula natans* var. *minus*, *Elatine gratioloides*, *Myriocephalus occidentalis*, *Myriophyllum drummondii*, *Potamogeton ochreateus*, *Triglochin* sp. A. Flora of Australia (G.J. Keighery 2477), *Trithuria bibracteata*; sedges: *Eleocharis acuta*, *Isolepis congrua*, *Schoenus capillifolius* /sp. Beaufort (G.J. Keighery 6291) group; rushes: *Juncus radula*; grasses: *Agrostis avenacea*; and ferns: *Marsilea drummondii*, *Ptilularia novae-hollandiae*.

Because this claypan was outside the boundaries of Oak Park Reserve the species recorded were not included in the Reserve species list but have been included separately (Appendix III).

The species composition and high species richness were fairly typical of claypans of the inner Wheatbelt on the edge of the Darling Range (Mike Lyons pers. comm.). Taxa that were exclusive to the two claypans were as follows: *Amphibromus nervosus*, *Chorizandra enodis*, *Glossostigma drummondii* and *Goodenia pusilliflora*.

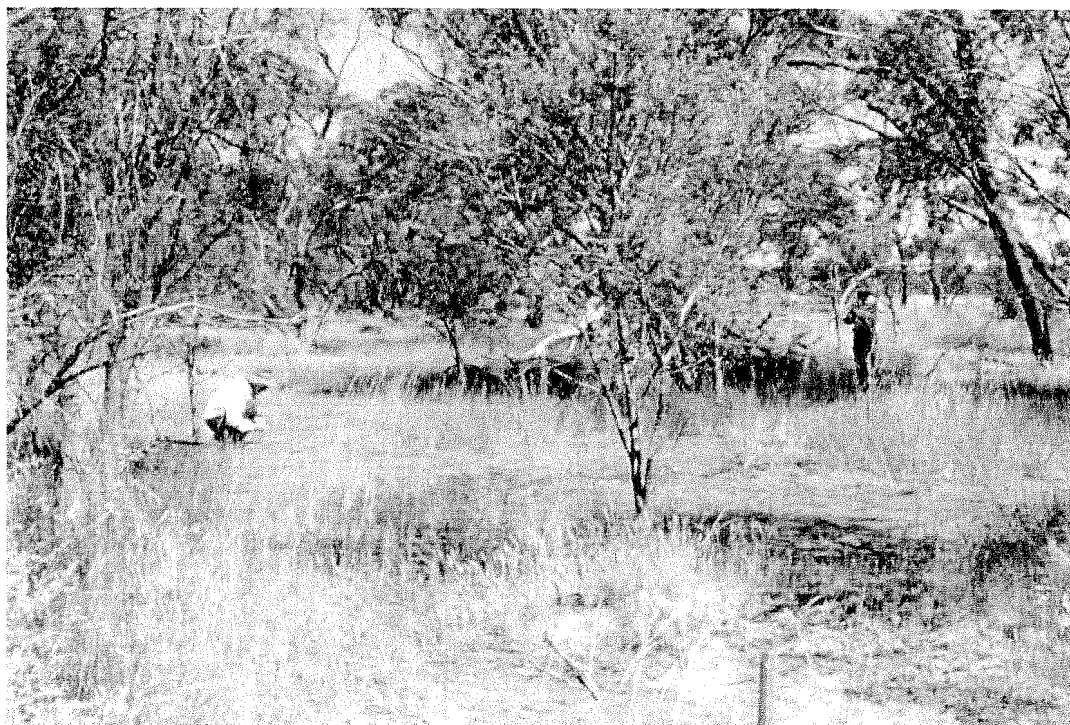
5. Lake dune: Mixed Open Shrubland, Herbland and Open Sedgeland with scattered *Banksia prionotes* (L) (Quadrat 6) (Photographs 10 and 11)

This community was situated on the lunette comprised of wind blown sands deposited from the bed of the salt lake which it bordered. The dune supported a mixed Herbland and a rich annual Herbland as well as perennial and annual sedges and grasses. Acorn Banksia (*Banksia prionotes*) was an occasional emergent and dead ones were evident. Dominant species included *Calytrix angulata*, *Podotheca gnaphalioides*, *Borya laciniata*, *Podolepis canescens*, **Ursinia anthemoides*, *Lepidobolus preissianus*, *Schoenus subfascicularis* and *Amphipogon turbinatus*. In later spring the area was a colourful herbland with species including *Brachyscome ciliaris*, *Brachyscome iberidifolia*, *Brunonia australis* and *Stylidium ecorne*. Species confined to this community included *Calytrix leschenaultii*, *Jacksonia fasciculata*, *Conostylis aculeata*, *Corynotheca micrantha*, *Quinettia urvillei* and *Amphipogon turbinatus*.

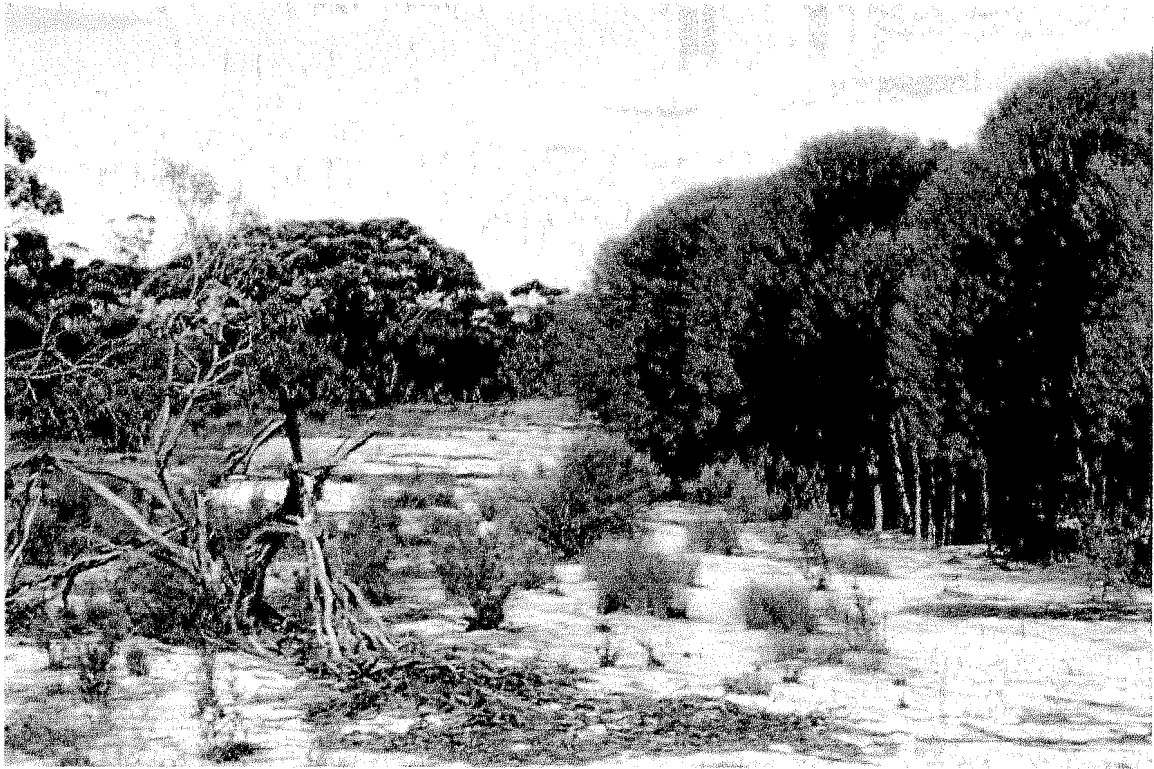
Beyond the western edge of Oak Park Reserve, on a sand ridge across the Sawyer road-Oak Park road causeway was an example of this community where *Banksia prionotes* was dominant.



Photograph 8: This was the smaller of the ephemeral Fresh-water Claypans located on the edge of the York Gum Tree Mallee and Tamar Open Shrubland communities. It was moist in September and Black Bristlerush (*Chorizandra enodis*) was dominant. It had dried out by October. The grey straggly shrub under the York Gum on the edge is *Rhagodia drummondii*. (Quadrat OAKP 4, 18/9/99 with 55 native and 16 weed species)



Photograph 9: The larger of the Fresh-water Claypans nestled amongst York Gum on the adjoining private property. In September there was a pool of water which had receded to this damp area in late October. The bright green sedge is Common Spikerush (*Eleocharis acuta*) and the grey green small tree is Needle Tree (*Hakea preissii*). Austral Pillwort (*Pilularia novae-hollandiae*) an aquatic fern was growing and setting its spores as the water receded. This occurrence is an eastern extension of the known range of this species. (Quadrat OAKP 13, 25/10/99 with 33 native and 13 weed species)



Photograph 10: The Lake Dune illustrating its position above the *Melaleuca* Tall Scrub which bordered the salt lake, and with the York Gum Tree Mallee behind. This photograph was taken in April 1999 when annuals were absent and shows the wind deposited sands with scattered shrubs and perennial sedges and a dead Acorn Banksia (*Banksia prionotes*).



Photograph 11: The Lake Dune unit, (south of photograph 10) at its transition with the York Gum Tree Mallee. This photograph was taken in October and illustrates the seasonal variations and the colourful array of annual herbs and perennial grasses. Little can surpass the beauty of the brilliant blue masses of Native Cornflower (*Brunonia australis*).

6. *Melaleuca* Tall Open Scrub (M) (Quadrat 5)

This vegetation type had two associations, one bordering the salt lake and one within the York Gum Tree Mallee. They were characterised by thickets of *Melaleuca*.

- *Melaleuca uncinata*, *Melaleuca hamulosa* Tall Open Scrub forming a fringing border on the edge of the lake (Quadrat 5) (Photograph 10)

Broom Bush (*Melaleuca uncinata*) and *Melaleuca hamulosa* formed a dense narrow 10 to 20 metre band on sand on the lake edge above the samphire. A few herbs and grasses grew beneath but did not form an understorey layer. Associated species (uncommon) included *Scholtzia* ? *parviflora*, *Rhagodia drummondii*, *Chamelaucium micranthum*, *Podolepis canescens* and **Vulpia myuros*.

- *Melaleuca uncinata* Tall Open Scrub within the York Gum Tree Mallee community (not sampled)

Small virtually monospecific thickets of Broombush were located amongst the York Gum. They were very dense and so lacked an understorey although the shade-loving *Parietaria cardiostegia* occurred in this unit.

7. Swamp She-oak Woodlands (S) Not sampled

Swamp She-oak (*Casuarina obesa*) formed a fringing Low Woodland on the western edge of the salt lake. There were also scattered skeletons of dead trees amongst samphire on the lake-bed indicating a rising water table and increased salinity levels which has meant increased dominance of samphires. These were outside the area of survey. The adjoining large saline Lake Walyormouring has been the site of Wetland Vegetation Monitoring and the mature and regenerating Swamp She-oak in that reserve have been monitored (Halse *et al.* 1993, Gurner *et al.* 1998/99)

8. Samphire Flats (*Halosarcia* species Low Shrublands) (H) (Quadrats 7 and 8) (Photograph 12)

This community covered the bed of the salt lake on winter wet, saline loams. *Halosarcia* species were the dominant feature forming a Low Shrubland. *Halosarcia lepidosperma* and *H. pergranulata* dominated the outer edge with *H. lepidosperma* and *H. indica* subsp. *bidens* dominant further inwards. In association was *Calandrinia granulifera*, *Hyalochlamys globifera*, *Crassula colorata* Very Open Herblands and an Open Grassland of the salt tolerant introduced grasses **Lolium multiflorum* x *L. perenne* hybrid, **Parapholis incurva*, **Ehrharta longiflora* and **Hordeum geniculatum*. Other species found only in this community included *Apium annuum*, *Calandrinia* sp. Needilup (K.R. Newbey 4892), *Centrolepis glabra*, *Cotula cotuloides*, *Crassula peduncularis*, *Didymanthus roei*, *Enchylaena lanata*, *Schoenus sculptus* and **Spergularia rubra*.

Several species were shared in common with the fresh claypans. These are species adapted to waterlogging but they are also salt tolerant. They included *Triglochin mucronata* and the weeds **Cotula bipinnata*, **Juncus bufonius*, **Lolium multiflorum* x *L. perenne* hybrid, **Hordeum geniculatum*, **Parapholis incurva* and **Trifolium tomentosum*.

9. Disturbed – Cleared areas (D) (Photograph 13)

The area of the old gravel pit is mapped as disturbed. Although it was within Jam Woodland there was a large bare area surrounded by weeds. Several weeds were recorded here but not elsewhere in the Reserve. The area on the south-western boundary was also heavily weed invaded and mapped as disturbed. It was once a recreation area with a cricket ground and has been left un-managed since its days of community activities.



Photograph 12: The salt lake bed was covered with Samphire (*Halosarcia* species) Low Shrublands along with salt tolerant herbs and grasses including several weedy species. Swamp She-oak and *Melaleucas* were also scattered across the bed. The dead trunks are a symbol of the vegetation changes associated with waterlogging and salinisation. The lake margin is marked by the dark band of *Melaleuca* Tall Scrub, and beyond are the emergent crowns of the York Gums. Photograph taken in April 1999.



Photograph 13: The south- western section of the reserve was somewhat degraded by weed invasion. Conspicuous by its shape and solitude was this Common Prickly Pear (**Opuntia stricta*) being examined by botanist Greg Keighery.

VEGETATION CONDITION

With the exception of the salt lake and the south-west corner west of the gravel pit, the vegetation of Oak Park Reserve was in excellent to very good condition. The quadrats were located in areas of best condition and all the Woodland and Shrubland areas were rated excellent. Although several weed species were recorded, weed invasion was not severe in these communities and there was no evidence of recent fire history or other signs of disturbance. The dune vegetation was rated very good instead of excellent because of the presence of dead Banksias. The samphire flats were recorded as degraded due to the rising water table and salinity causing deaths, and to the high incidence of weed invasion. Weeds and a rising water table with the associated waterlogging and salinity were the most serious threats to the condition of the bushland.

The bottom south-west corner detracted from the overall excellent condition of the reserve. The gravel pit is a weed sink and poses a threat to further weed invasion in the reserve. Several weeds that were not recorded elsewhere in the reserve were growing in and around the disturbed ground of the gravel pit. Measures should be taken to remove them and control any spread. The Jam Low Woodland west of the gravel pit was heavily weed invaded, particularly with Bearded Oats (*Avena barbata*) and Lupins. It had once been a recreational area with a cricket pitch and a hall so past activities had created disturbance in that area compared with the relatively undisturbed nature of the rest of the area. There was still fairly good native flora amongst the weeds including a large orchid population, particularly of *Caladenia* species. There was also a heavily weed invaded patch of ground north of Botherling East road on the eastern boundary where soil had been dumped in the Jam Low Woodland. On the edges adjoining the cropped paddocks the abundance of weeds was higher than within the reserve.

Road verges are often heavily weed infested as they suffer regular disturbance from grading and vehicles and slashers carry weed seed on them. Where Botherling East road bisects the reserve on the western edge the vegetation was still in very good condition, coming right to the edge of the road, with surprisingly low levels of weed invasion. Particular care should be taken when grading the road to avoid disturbing the vegetation and to prevent pushing weed infested dirt into the edges.

The dead skeletons of Swamp She-oak and Paperbarks on the salt lake indicate an altered moisture regime and increasing salt levels. This lake and Lake Walyormour were once fresh or near fresh (G. White pers. comm.), as were most of the wetlands in the Avon Catchment until the 1930's when salinity changes began to take effect (Sanders 1991). A rising water table would mean longer periods of inundation and waterlogging which even some salt tolerant species are not able to withstand. As well, salt tolerant weed species have invaded the samphire flats. Reduction in species diversity in these low lying saline areas has been observed widely across Wheatbelt valleys where complex communities are replaced by a few succulents and weeds (Keighery *et al.* 2001a).

Although there were no obvious signs of salinity affecting the Woodland and shrubland communities above the salt lake at Oak Park, salt tolerant weedy grass species were recorded at the Fresh-water Claypan indicating salt levels are likely to be increasing in those low lying sites also. The species concerned, which were also present on the samphire flats, were the grasses **Hordeum geniculatum*, **Lolium multiflorum* x *L. perenne*, **Parapholis incurva* and the annual herb **Cotula bipinnata*.

5. FLORA

Oak Park Reserve

Within the 149 hectares of Oak Park Reserve a total of 235 native vascular plant taxa (species, subspecies and varieties) and 48 non-native weed species were recorded from 61 plant families (Appendix II). These were comprised of 139 perennials and 144 annuals.

Ten plant families accounted for 59 per cent of the total taxa. The daisy family Asteraceae was the largest group with 36 native and 6 weed taxa. All but one were annuals, only appearing in the late winter and spring months. Grasses (Poaceae) were the second largest group with 37 taxa but 19 (51%) were weeds. The top ten species rich families were as follows:

Family	No. native species	No. weed species	Total no. species
Asteraceae (Daisies)	36	6	42
Poaceae (Grasses)	18	19	37
Orchidaceae (Orchids)	18	0	18
Papilionaceae (Peas)	8	6	14
Myrtaceae	12	0	12
Mimosaceae (Wattles)	10	0	10
Apiaceae	9	0	9
Cyperaceae (Sedges)	8	1	9
Chenopodiaceae	8	0	8
Goodeniaceae	8	0	8

A high number of species occurred only infrequently. One hundred and twenty-two (43%) of the total 283 taxa were recorded only once, 71 on or adjacent to the quadrats and 51 from collections made on transects through the bushland. This 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 CALMScience Biological survey in the Wheatbelt (Keighery 2000) and other surveys in this program have reflected this phenomenon.

Whenever people are first introduced to the survey technique, there is always an expression of surprise at the number of species that can be found in a small area. It is so easy for us to overlook the less obvious, but they are all an important part of the diverse natural system. The number of species found on each 10m x10m quadrat varied from 23 (15 natives, 8 weeds – quadrat OAKP 7) on the Samphire Flats to a maximum of 72 (59 natives, 13 weeds – quadrat OAKP 3) in the York Gum Tree Mallee over Shrublands. This provides an indication of the variation in species composition of different vegetation types.

The number of species recorded, although not as high as some of the most species rich sites recorded in surveys elsewhere in the south-west, compares favourably to other surveys in the region. A survey conducted by the Wildflower Society with the same search effort in the nearby Gabby Quoi Quoi catchment recorded 260 species (224 natives and 36 weeds) on an 80 hectare remnant around granite outcrops. In that study the York Gum-Jam Woodland was the most species rich community with up to 61 species per quadrat and herbaceous, grass and sedge species of the ground layer contributing to the richness. In this study The York Gum Tree Mallee was the most species rich community owing to the high diversity of shrubs and herbs. Examples of some of the richest sites in the south west are as follows: on the Pinjarra Plain up to 80 native species per quadrat can be found (Keighery *et al.* 1997); on lateritic kwongan at Eneabba an average 69.8 species were recorded in 100 m² (Griffin *et al.* 1983), and on the top of Mt Lesueur 81 species in 100 m² (Griffin and Hopkins 1985). Privately owned remnants at Tincurrin and East Yornaning supported up to 69 and 71 native species respectively per quadrat (Gunnness *et al.* 1999 and Gunnness *et al.* 2000). High species richness is commonly attributed to Kwongan/Heath

communities that are species rich in shrubs. Other communities are rich in perennial and annual herbs. Studies on the Swan Coastal Plain (Gibson *et al.* 1994) and in the Wheatbelt (Keighery *et al.* 2001a) have found that most ephemeral wetlands also have very high species richness

A list of the plant species found in the reserve is provided in Appendix II. Appendix IV provides a species list indicating the quadrats on which each species was recorded, ordered according to vegetation type. This list can be used to match the species that belong to a particular plant community and can be very useful for plant selection for any revegetation program.

Fresh-water Claypan on adjoining private property (OAKP 13)

This quadrat has been excluded from the above discussion which related to the Shire Reserve only. A total of 36 native taxa and 13 weeds from 25 plant families were recorded from this plant community (Appendix III). These were comprised of 32 annuals and 17 perennial species. Several were semi-aquatic or wetland species; that is they are adapted to survive in areas with alternate periods of inundation and partial dryness. Fourteen species were only recorded in this plant community and are listed in the vegetation description in the previous section (page 16). Some of these are discussed in the following section because their occurrence extends the known distribution range.

SPECIES OF SPECIAL INTEREST

1. Declared Rare and Priority Flora

No species of declared rare flora were recorded in the survey. Five threatened species (Priority taxa) (Atkins 2001) 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 V.

***Scaevola tortuosa* (Tortuous-stem Scaevola) (Goodeniaceae) Priority 1**

This is a perennial herb which is at first low and spreading and then ascending. It has blue flowers and striate, tortuous stems. It is known only from a few collections on clay soils from Cunderdin, Kellerberrin and south of Mount Holland. It was recorded in this survey in the York Gum Tree Mallee and this population is a range extension and the western limit of its known range.

***Schoenus capillifolius* / sp. Beaufort (G.J. Keighery 6291) group (Cyperaceae) Priority 1**

This annual sedge, collected on the Fresh-water Claypan on the adjoining private property, is a little known and rarely collected species. It had affinities with a semi-aquatic species described from only a single collection in a winter-wet claypan near the Beaufort River north of Kojonup (Rye 1997). This specimen did not key correctly and the species limits in this group need more taxonomic work (B.Rye pers. comm.).

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

This daisy is an annual cottony hairy herb with yellow florets (compared with the white florets of the common *Blennospora drummondii*). 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. In this survey it was collected in three vegetation types: the lake dune, the Melaleuca Tall Open Scrub on the salt lake edge and the York Gum Tree Mallee. This collection appears to be a northern extension of its previously known range and is also on the western limit of its range. Its known range extended from Meckering, Cunderdin to Nyabing, Lake Grace and Hyden.

***Persoonia chapmaniana* (Proteaceae) Priority 3**

This spreading shrub with yellow flowers was recorded on the edge of the York Gum Tree Mallee near the small Fresh Claypan. It is a distinctive species which does not closely resemble other *Persoonias* except *Persoonia pentaschista* which also has 5-ribbed subterete leaves and occurs further north (Mullewa, Paynes Find). It is the only *Persoonia* known to have verrucose drupes (warty fruits) (Weston 1995). It has a fairly limited distribution, previously known from an area bounded by Carnamah, Coomberdale, Lake Ninan (south west of Wongan Hills) and Kulja (near Kalannie) growing in dry sclerophyll Woodlands always in the vicinity of salt lakes. This occurrence extends its southern limit.

***Stenanthemum tridentatum* (Rhamnaceae) Priority 4**

This is a small shrub with heads of inconspicuous white or cream flowers in July-November. It was recorded in this survey in Jam Low Open Woodland. It appears to be more widespread than originally thought but never seems to occur in abundance. It has recently been changed from Priority 3 to Priority 4. The Wildflower Society survey at Konnongorring extended its known range north and this record is in a similar northern range. Other Wildflower Society surveys have recorded it from Tincurrin, Wickepin and Quairading, and Herbarium records show collections from south-western areas such as Kukerin, Kulin district, Wagin, Gunyidi, Duranillin, Boddington and Tutanning.

2. 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). 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 CALMScience Biological survey of the Wheatbelt, for example, will doubtless increase the number of recordings and locations of many taxa.

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

- **Taxa at the north-eastern limit of range**

Those near the north-eastern (northern and inland) limit of their range (species which are commonly to the south and west of the study area) included:

***Myriophyllum drummondii* (Milfoil):** a semi-aquatic annual herb that was collected in the Fresh-water Claypan on adjoining private property. Better fruiting material is needed to ensure this identification is correct and this group of aquatic plants are not well recorded or collected. This species has been recorded from clay wetlands in the Jarrah Forests and Coastal Plain in the south-west, so this record would be an inland and northern range extension.

***Pilularia novae hollandiae* (Austral Pillwort):** an aquatic perennial fern recorded from the Fresh-water Claypan. It was producing sporophores in November as the claypan dried out. It is known from areas of shallow waters on the Swan Coastal Plain as far north as the Upper Swan and extending through the south west to Northcliffe and the Stirling Ranges. This record extends its range north and into the edge of the Wheatbelt.

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

Those near the western limit of their range (species which commonly occur further inland) include:
The two priority species *Scaevola tortuosa* and *Blennospora phlegmatocarpa* discussed in the above section.

***Platysace maxwellii* (Karno, Native Potato):** This slender shrub with edible tubers was recorded from the Jam Low Open Woodlands. It was not abundant and pressed specimens dry black. It is within the known range of distribution, which extends from Ballidu to Tammin and south to Ravensthorpe and the south coast. It is on the western limit of its distribution at Oak Park.

Podolepis tepperi: this small annual daisy was found in the York Gum Tree Mallee and on the Lake Dune. It occurs in the Wongan Hills area and is widespread in areas south and eastwards. The Wongan Hills and Oak Park populations appear to represent the western limits of distribution.

Caladenia exilis subsp. *exilis* (Salt Lake Spider Orchid): this cream coloured Spider Orchid was recorded in the Jam Open Woodland on the lower slopes above the salt lake in the south west section of the reserve which was notable for the abundance of Spider Orchids. This species is sporadically distributed in the Wheatbelt from Mullewa south to the Woodanilling area. It normally grows in well-drained sands on the margins of salt lakes or rarely, (as in this instance) on seasonally damp flats in open scrub (Hopper and Brown 2001). So although it is within its known range of distribution it is on the western limit of its range.

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

Those at their northern limit (species which commonly occur further south) include:

Millotia major: a small annual herb which was recorded in the York Gum Tree Mallee at Oak Park. Herbarium collections are from Albany to Lake Grace, Southern Cross, Kalgoorlie and areas east. This record is a significant range extension to the north west.

Pelargonium havlasae: This tuberous perennial herb with attractive white flowers which are striped pink, was recorded several times in the York Gum Tree Mallee. Collections have been made from Tammin - Hyden - Stirling Ranges and east to Esperance. This appears to be a population at the north west limit of its range.

Potamogeton ochreatus (Blunt Pondweed): an aquatic perennial herb which normally grows submerged in lakes, dams, wetlands and rivers. It was growing in the larger of the Fresh-water Claypans when it was full of water. It has been recorded from Wooroloo on the Swan Coastal Plain south to the Frankland River. This record extends its known range north and inland into the Wheatbelt.

Schoenus tenellus (Tiny Flatsedge): an annual sedge found on claypans and swamps, it was recorded on the small Fresh-water Claypan. Previous records are mainly from the Swan Coastal Plain and south coast region to Albany and inland to Lake Muir. This is a northern extension of its range.

Sebaea ovata (Yellow Sebaea): an annual herb with yellow flowers, which was recorded from the small Fresh-water Claypan and the Samphire flats. It has been poorly collected and previous collections from granitic soils and winter-wet flats are from areas around Narrogin, Pingelly, Wickepin and south to Albany, Newdegate and Cape Arid. This record is a big range extension to the north as well as being a western limit.

3. Taxonomically significant flora

***Austrodanthonia* sp. Goomalling (A. Gunness et. al. OAKP10/63)**

This perennial Wallaby Grass differs from other Western Australian species of *Austrodanthonia* in having a germination flap like Bandicoot Grass (*Monachather paradoxus*) (T. McFarlane pers. comm.). The arrangement of hairs on the back of the lemma is also different from other species of *Austrodanthonia*. It was first recognised from a collection in York Gum-Jam Woodland during the Wildflower Society survey at Konnongorring and was again collected in the York Gum Tree Mallee in this survey suggesting it may have a limited distribution within the region. However matching specimens have also been fairly widely collected in the CALM Wheatbelt survey (N. Gibson, pers.comm.). Further taxonomic work should verify the status of this new species, which has been awarded a phrase name (see below) as a recognised but undescribed taxon.

Some collections have had "phrase names" applied. These may be for recognised but as yet undescribed taxa (see above). Another example is:

***Calandrinia* sp. Needilup (K.R. Newbey 4892)** (listed in the field herbarium as *Calandrinia* un-named sp. (OAKP 7/24)). This small button-like succulent herb with hedgehog-like capsules was recorded on the Samphire Flats. It tends to occur around salt lakes and has been

poorly collected from the Wheatbelt. A collection made by Ken Newbey from Needilup has been denoted as the typical form until the taxonomic description is completed and a name published.

The taxonomy of some groups is still poorly defined or under revision and so accurate determinations are not always possible. In this study examples included:

Scholtzia ? *parviflora* This group is under revision by M.E. Trudgen. He identified the specimens collected from the Melaleuca Tall Scrub on the edge of the salt lake as being similar to *Scholtzia parviflora* but considered they needed closer scrutiny within the context of his taxonomic revision.

Sedge (*Schoenus* and *Lepidosperma*) species: Because the sedges have been a poorly studied and collected group, it is likely that there are many species, particularly perennial species that are still not named or recognised. Identifications sometimes have to be based on a 'best match' of determined specimens in the WA Herbarium. Two annual species collected in this survey did not key out well or match named specimens (B. Rye pers.comm.) They were:

Schoenus humilis/plumosus: recorded from the waterlogged areas of the reserve on the Fresh-water Claypans and the Samphire flats. The material did not exactly match either species and further collections of fully fertile material and consideration of their taxonomy is required.

Schoenus capillifolius/ sp. **Beaufort (G.J. Keighery 6291) group:** (see discussion in first part of this section under Priority species).

WEEDS

Weeds are plants which are not native to bushland and commonly invade areas of native vegetation following disturbances such as flooding, grazing, fire, soil disturbance (for example: road-making, drain-building, firebreaks). Weed invasion has been recognised as the dominant indicator of degradation of native vegetation in the Wheatbelt (Safstrom 1995) and one of the greatest threats to remnant populations of threatened plants in south-western Australia (Brown *et al.* 1998). Weed seed can be carried by water, wind, birds, animal droppings, machinery or carried on peoples clothes and footwear. Dumping of garden rubbish is a common cause of spread in urban areas.

Seventeen per cent (48 species) of the total plants recorded in Oak Park Reserve were weeds (Table 3), all but four being annuals. One weed (**Crassula natans* var. *natans*) was recorded only on the adjoining Fresh-water Claypan. Annual grasses and daisies were the most common and abundant weeds throughout the reserve and most germinate each year from seed and vary in their impact on the native vegetation. The most frequently recorded species (occurred on 50% or more of the quadrats) were: Flatweed (**Hypochaeris glabra*), Capeweed (**Arctotheca calendula*), Blowfly Grass (**Briza maxima*), **Ursinia* (**Ursinia anthemoides*), Annual Veldt Grass (**Ehrharta longiflora*), Rat's Tail Fescue (**Vulpia myuros*), Bearded Oat (**Avena barbata*), Silvery Hairgrass (**Aira caryophylla*), Common Sow Thistle (**Sonchus oleraceus*) and Common Bartsia (**Parentucellia latifolia*). All the vegetation types had a significant proportion of weed species although the Tamar Open Shrubland and the Jam Low Open Woodland on the eastern half of the reserve had the lower proportions of weeds compared to native species recorded. It is the abundance and the incidence of aggressive weeds that is a threat to the condition and integrity of the bushland.

The old gravel pit and immediate surrounds was heavily weed invaded and several species were recorded only around that area. They were: **Emex australis*, **Erodium botrys*, **Ixia maculata*, **Lupinus cosentinii*, **Malva parviflora*, **Orobanche minor*, **Polypogon monspeliensis*, **Raphanus raphanistrum*, **Romulea rosea*, **Silene gallica*, **Trifolium arvense*, **Trifolium glomeratum*, **Trifolium hirtum*, and **Trifolium subterraneum*.

Table 3: Weed species recorded at Oak Park Reserve and the adjoining Fresh-water Claypan (listed alphabetically by genus and grouped by quadrats and plant community. See Appendix IV page 59 for key)

Quadrats

Botanical name	Family	Common name	Quadrats													
			T	1	2	11	9	3	10	4	13	6	5	7	8	Opp
* <i>Aira caryophylla</i>	Poaceae	Silvery Hairgrass	1				11	9	10	4	13					
* <i>Anagallis arvensis</i> var. <i>caerulea</i>	Primulaceae	Pimpernel						9a	3	4						
* <i>Arctotheca calendula</i>	Asteraceae	Capeweed	1	2		11	9	3	10	4	13				8	
* <i>Avena barbata</i>	Poaceae	Bearded Oat		2			9	3	10			6			8	
* <i>Avena fatua</i>	Poaceae	Wild Oat	1													
* <i>Briza maxima</i>	Poaceae	Blowfly Grass, Large Quaking Grass	1	2		11	9	3	10	4		6				
* <i>Bromus diandrus</i>	Poaceae	Great Brome								4						
* <i>Bromus hordeaceus</i>	Poaceae	Soft Brome														
* <i>Bromus rubens</i>	Poaceae	Red Brome					3	10	4						8	
* <i>Centaureum erythraea</i>	Gentianaceae	Common Centaury														
* <i>Cotula bipinnata</i>	Asteraceae	Ferny Cotula									13			7	8	
* <i>Crassula natans</i> var. <i>minus</i>	Crassulaceae	Australian Crassula									13					
* <i>Ehretia longiflora</i>	Poaceae	Annual Veldtgrass						10		4	13	6	5	7	8	
* <i>Emex australis</i>	Polygonaceae	Doublegee, Three-cornered Jack, Spiny Emex														+
* <i>Erodium botrys</i>	Geraniaceae	Long Storksbill														+
* <i>Hordeum geniculatum</i>	Poaceae	Mediterranean Barley Grass									13			7	8	
* <i>Hypochoeris glabra</i>	Asteraceae	Flat Weed, Smooth Cat's-ear	1	2		11	9	3	10	4	13	6	5		8	
* <i>Isolepis marginata</i>	Cyperaceae	Coarse Club-rush						3		4						
* <i>Ixia maculata</i>	Iridaceae	Yellow Ixia														+
* <i>Juncus bufonius</i>	Juncaceae	Toad Rush								4	13			7	8	
* <i>Lolium multiflorum</i> x <i>L. perenne</i>	Poaceae	Rye Grass Hybrid									13			7	8	
* <i>Lolium perenne</i> x <i>L. rigidum</i>	Poaceae	Rye Grass Hybrid									13			7	8	
* <i>Lolium rigidum</i>	Poaceae	Annual or Wimmera Rye Grass						3		4						
* <i>Lupinus cosentinii</i>	Papilionaceae	Australian Blue Lupin														+
* <i>Malva parviflora</i>	Malvaceae	Small-flowered Mallow, Marshmallow														+
* <i>Opuntia stricta</i>	Cactaceae	Common Prickly Pear														+
* <i>Orobancha minor</i>	Orobanchaceae	Lesser Broomrape														+

Quadrats

Botanical name	Family	Common name	Quadrats											
			1	2	11	9	3	10	4	13	6	5	7	8
			T	J		Y	C	L	M	H	OPP			
<i>*Osteospermum clandestinum</i>	Asteraceae	Stinking Roger				9					6	5	8	
<i>*Parapholis incurva</i>	Poaceae	Coast Barb Grass											7	8
<i>*Parenticellia latifolia</i>	Scrophulariaceae	Common Bartsia	1	2		9	3	10	4					
<i>*Pentstemonis airoides</i>	Poaceae	False Hairgrass				9					6	5		
<i>*Plantago coronopus</i> subsp. <i>commutata</i>	Plantaginaceae	Buckhorn Plantain												8
<i>*Polypogon monspeliensis</i>	Poaceae	Annual Barbrgrass												
<i>*Raphanus raphanistrum</i>	Brassicaceae	Wild Radish												+
<i>*Romulea rosea</i>	Iridaceae	Guildford Grass												+
<i>*Silene gallica</i> var. <i>gallica</i>	Caryophyllaceae	French Catchfly												+
<i>*Sonchus oleraceus</i>	Asteraceae	Common Sowthistle				9	3		4			5	7	8
<i>*Spergularia rubra</i>	Caryophyllaceae	Sand Spurry											7	8
<i>*Trifolium arvense</i>	Papilionaceae	Hare's Foot Clover												+
<i>*Trifolium glomeratum</i>	Papilionaceae	Cluster Clover, Ball Clover												+
<i>*Trifolium hirtum</i>	Papilionaceae	Rose Clover												+
<i>*Trifolium subterraneum</i>	Papilionaceae	Subterranean Clover	1											+
<i>*Trifolium tomentosum</i>	Papilionaceae	Woolly Clover												+
<i>*Triticum aestivum</i>	Poaceae	Wheat		2	11				4	13				8
<i>*Ursinia anthemoides</i>	Asteraceae	Ursinia		2	11	9	3		4		6	5		
<i>*Vulpia muralis</i>	Poaceae					9	3							
<i>*Vulpia myuros</i> var. <i>megalura</i>	Poaceae	Rat's Tail Fescue			11									
<i>*Vulpia myuros</i> var. <i>myuros</i>	Poaceae	Rat's Tail Fescue	1	2								5		
<i>*Wahlenbergia capensis</i>	Campanulaceae	Cape Bluebell				9a			4		6			

THE FIELD HERBARIUM

A field herbarium accompanies this report. It contains named specimens (pressed and dried) of the species recorded on or adjacent to the quadrats and on traverses through the reserve. The specimens have been mounted on A4 sheets in plastic sleeves, held in eight Lever Arch files. The herbarium provides not only a record of the plant species found, but is a local resource to help with plant identification and to encourage people to learn more about their bushland plants.

The specimens have been grouped by **growth form** and then arranged alphabetically in plant **families** and within families alphabetically by **genera**. So, as well as being grouped according to how we logically separate plants by their structure or growth form, they have also been separated according to typical botanical classification. The growth form groups (see Appendix II key for definitions) are as follows:

- Trees and Shrubs
- Creepers
- Ferns and Fern Allies
- Herbs
- Grasses
- Sedges and Rushes and Sedge-like plants
- Weeds (grouped together by Family regardless of growth form)

In addition the plants of the adjoining Fresh-water Claypan have been included, separated into native and weed species and grouped by family not growth form.

The weeds have been grouped alone as it is considered important to any bushland management to be able to distinguish between a native plant and an introduced plant. Although some weeds are important pasture or crop plants, they are a threat to bushland.

If you want to match a plant you have found you can narrow your selection to the likely group. For example, you have a specimen of a wattle: that will be found in a trees and shrubs file under family Mimosaceae in the genus *Acacia*.

This survey will not have recorded the full complement of plants to be found in the reserve. As additional species are found at different times of year and under different seasonal conditions, they can be pressed and dried and added to the herbarium.

A considerable amount of volunteers' time and effort has gone into compiling the field herbarium and landholders are encouraged to make the maximum use of it and to develop it further. The field herbarium has been photocopied. This makes a less bulky reference set, contained in one folder instead of several, and is more durable for use in the field. It is also an "insurance" copy.

Field Herbaria can be constructed in different manners, to suit the individual or group's needs. For example, some are done on index card. The booklet "How to Create a Local Herbarium" (Patrick 1997), outlines how to collect and prepare herbarium specimens and how to care for a herbarium and is available from CALM. Try and store the herbarium in a dry, insect free place. Insect damage will destroy the specimens. The best way to avoid this is to freeze the specimens for several days at least once per year or if any evidence of damage occurs.

6. DISCUSSION

CONSERVATION VALUES

There are several factors that contribute to the conservation value of bushland remnants. Vegetation is just one part of the whole ecosystem and reflects soils, climate, landforms and drainage. 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 Oak Park Reserve that makes it a valuable area of natural heritage of high nature conservation value. It also points to the threat that salinity poses to these values.

- **Plant communities typical and representative of the region**

A principal aim of conservation is to keep and protect adequate representation of plant communities and their associated plant species within any local area, regardless of their rarity at a regional level. This intrinsic value of bushland still being present contributes strongly to a 'sense of place'. Oak Park Reserve provides an example of the vegetation of broad valleys, low in the landscape, on the western edge of the Wheatbelt.

- **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. York Gum Woodlands have been widely cleared or modified by grazing [97% of York Gum/Jam woodland has been cleared in the South West Botanical Province (Safstrom *et al.* 1999) based on Beard's 1:250,000 vegetation maps and analysis by Hopkins *et al.* (1996)] and typically have a herbaceous understorey (Beard 1990). The York Gum Tree Mallee with the well defined and species diverse shrub layer as well as a species rich herbaceous layer may be uncommon and is poorly represented in the Wheatbelt.

One of the landscape features and an important part of the natural biodiversity of the Avon River basin are numerous lakes and wetlands of varying size and depth. Many of these have come under threat from clearing, grazing and salinisation. The seasonal Fresh-water Claypans were probably once more common, but are now a rare plant community which is poorly represented in the nature reserve system. Most freshwater wetlands in the Wheatbelt are on private property (Keighery *et al.* 2001a). Representation of the different Wheatbelt vegetation types in the reserve system is generally poor (Hopkins *et al.* 1996, Thackway and Cresswell 1995). The CALMScience biological survey in progress will provide a better understanding of floristic patterning and give some indication of the distribution and the conservation status of these floristic units.

In the past it was generally accepted that at least ten per cent of the original extent of any vegetation type or ecosystem should be protected (preferably in secure reserves). This is now considered an "endangered" level and recommendations are for a threshold of thirty per cent of the original extent of a vegetation community to be preserved for conservation of biodiversity (Anon 1999). With less than six percent of the native vegetation of the Goomalling Shire still existing, the study sites have highly significant value. Indeed all remnants are significant.

- **Diversity of vegetation types 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 8 vegetation types and 235 native vascular plant taxa, the site supported a diverse assemblage of plant communities and native plants. Quadrats contained 23 to 72 species with the York Gum Tree Mallee supporting the greatest number of species.

While Heaths are generally recognised as some of the most species rich communities, survey work on the Swan Coastal Plain (Gibson *et al.* 1994) and in the Wheatbelt (Keighery *et al.* 2001a), has shown that the ephemeral (winter wet, summer dry) wetlands are often equally species rich, with up to 90 species per quadrat. This richness is in perennial and annual herbs compared with the shrubs of heathlands, and is related to the groups of species with life cycles staggered throughout the year. One group flowers and seeds or becomes dormant in autumn as the wetlands fill, an aquatic winter group appears when the wetlands are full, another as the wetlands dry in spring and one in early summer when the wetland is dry. The Oak Park Fresh-water Claypans were only sampled twice, in early and late spring and it is likely that other species would be present at other times of year.

There is a tendency to attribute greater value to areas or vegetation types which are rich in species, than to areas with a low species diversity. Where species richness is low because of degrading processes then the value of that area is lessened, but areas that are frequently naturally species poor, have their own unique value and are of no less importance than naturally diverse areas. Such variation in the vegetation types adds another dimension to the diversity.

- **Size of remnant**

The larger the remnant the greater the conservation value and viability. Of the mere six percent of remnant vegetation remaining in the Goomalling Shire, 5.4% is located on private land in 222 patches and 57% of these patches are smaller than 20 hectares in size (Beeston *et al.* 1994). Oak Park is obviously an important public reserve and at 149 hectares is a large one for the region.

- **Perimeter to area ratio**

The lower the ratio the greater the conservation value because the influence of edge effects is minimised. Long narrow blocks, for example, are subject to greater edge disturbances such as wind, fertiliser drift, weed invasion and increased run-off, than a rectangular block. Oak Park Reserve fares well on this score although Botherling East road is an intrusion adding to the edge effect. However the vegetation along this road is still in excellent condition and the road offers an opportunity for travellers to experience the value of this reserve in an otherwise heavily cleared landscape. From a management viewpoint, the less the perimeter in relation to the core area, the lower the cost of fencing.

- **Proximity, connectivity and size of other remnants**

This is a two-sided coin in that areas with habitat not already conserved in the area have a high value, but replication of habitats is also important to ensure conservation of the dynamic and variable gene pools. Large reserves and ones adjacent to or connected to other remnant vegetation are less likely to suffer species extinction than an isolated reserve, and have greater value for flora and fauna. It should also be acknowledged that all naturally occurring bushland with its different vegetation types has conservation value in its own right. Lake Walyormour Nature Reserve on the south western side and adjoining uncleared private land on the north west end add to the value of Oak Park Reserve.

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

Five threatened species, at least thirteen species near the limit of their range, and five species of taxonomic significance increases the conservation value of the site. Work to define threatened ecological communities is currently in progress (English and Blyth 1997) but at this stage there is still insufficient regional information on the Wheatbelt to generally recognise threatened communities. It is likely that the Fresh-water Claypans will be found to be a threatened ecological community.

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

Being low in the landscape, the plant communities and several species in Oak Park Reserve are under threat from a rising water table and salinisation. The salt lake and adjoining Lake Walyormouring have already undergone changes from a once fresh or near fresh regime to a saline one (G. White pers.comm.). Current knowledge estimates that approximately 1 500 taxa, including 450 endemics occur low in the Western Australian Wheatbelt landscape in riverine valleys, freshwater wetlands or naturally saline areas (Keighery *et al.* 2001a). These are in danger of extinction over the next 100 years as a consequence of rising saline groundwater. Those species with restricted distributions (eg. *Calandrinia* sp. Needilup (K.R. Newbey 4892) and uncommon occurrence (eg. priority taxa listed on pages 23 and 24) are at greatest risk. Several hundred more taxa found only in the adjoining lowland Woodlands, Mallee and *Melaleuca* Shrublands, such as those at Oak Park, will be under threat in the longer term.

The values of bushland are increasingly being recognised and any bushland area has several significant features. Safstrom and Craig (1996) is a useful guide when evaluating bushland values.

MANAGEMENT CONSIDERATIONS

With conservation of the bushland of the reserves a major objective, the following section discusses some of the threats to biodiversity and conservation values that became apparent during the course of the survey. The processes considered most threatening to bushland include rising water table and salinity, weed invasion and grazing (eg., Safstrom 1995; Yates and Hobbs 1997; Weaving 1999). Oak Park Reserve is threatened by all but grazing. The discussion attempts to provide some background for implementing management decisions and suggests some management points for consideration. Wendy Bradshaw (2001) in her book 'Critters and Crops' offers a concise but comprehensive overview of many of the issues raised here. It is very worthwhile reading in any considerations of biodiversity and ecosystem management within the rural landscape.

Any management plans for this reserve should address (Keighery *et al.* 2001b)

- The conservation (natural heritage), recreation, cultural heritage and education values
- Threats to these values
- Management practices to control the threats and
- Promotion of these values

1. Weed Prevention and Control

Weeds are not only products of disturbance, they are agents in perpetuating disturbance by preventing the establishment of native vegetation. Germinating native plant seedlings cannot compete with the more vigorous and rapid-growing weeds for nutrients and light. The extra biomass and fuel load of weeds make areas more prone to fire and they regenerate more rapidly than native plants after a fire or other disturbance. As well they are less efficient water-users than native perennials and increase the risk of erosion particularly during summer storms when the weedy annuals have died off. Weed species may be of value as crop or pasture species (eg Lupins, Clover), and often the paddocks adjoining the remnant bushland are the major source of weed invasion. 'Western Weeds' (Hussey *et al.* 1997) discusses the threat of weeds and is a helpful and valuable guide to their identification.

Weed invasion on the reserve was greatest where there had been a history of disturbance such as around the gravel pit and old recreation area in the Jam Low Woodlands at the south-western end, around the edges adjoining paddocks, or where the bushland was under stress from waterlogging and salinisation. A weed control program needs to be undertaken to protect the conservation values of the reserve. Generally speaking, removing weeds from areas of bushland in very good to excellent condition is of higher priority than removing weeds from more degraded areas. High priority should also be given to targeting weeds that are uncommon or isolated such as those

around the gravel pit and at the site where soil was dumped on the eastern boundary north of Botherling road. Their early control would prevent further spread. The species concerned are listed on page 26 and appear as + in the "opps" (opportunistic collections) column of Table 3 on pages 27 and 28.

Many of the weed species were non-aggressive 'packer' species: they mix with rather than replace native species and their control is difficult. For example Silvery Hair Grass is very widespread and common but does not appear to aggressively dominate native species. Although Flatweed was common it was generally small in size, but in fertile situations its broad rosette can dominate and displace native species. Other weeds however can aggressively invade and replace the native species. Bearded Oats and Wild Oats (*Avena fatua*) and Annual Veldt Grass are a serious threat as they are invasive and compete for space and decrease the growth of other plants. Hussey and Wallace (1993) report that removal of Wild Oats caused a doubling in size and number of flower heads of the native daisy *Podolepis gracilis*.

Information about how to assess and map weeds and prepare a weed control program can be obtained through the Environmental Weeds Action Network (web site: <http://members.iinet.net.au/~ewan/>). They have been conducting trials at Quairading to investigate ways of controlling Wild Oats in bushland. Results so far are promising and results will be available at the completion of the three-year trial period. Dixon and Keighery (1995) in the book 'Managing Perth's Bushlands' list suitable methods to control specific weed species.

A 'Weed Break' - a living barrier of native species - can be an effective measure to prevent weed seed from surrounding areas blowing into bushland. It would also act as a filter to fertiliser and insecticide drift. In all the surveys we have conducted on farm remnants, there is an obvious decline in weed frequency as you move inwards from the outside perimeter of the bushland. Dense Shrubland such as some Tamar Shrublands act as effective natural barriers or filters against the intrusion of windblown weed seed, so no action is required where they form boundaries. Healthy mature Salmon Gums are very efficient water harvesters and have an extensive root system that takes up surface soil moisture, preventing the establishment of weeds. However Open Woodlands adjoining cleared paddocks such as the Jam Woodlands on the eastern edge of the reserve, are highly prone to invasion by wind blown seed particularly on the edges effected by prevailing winds. A weed break on these boundaries could be effective.

For a short-term cost of establishing a weed break there would be long term benefits. The weed break would ideally consist of readily established species that are native to the remnant and match the plant community it adjoins. Added benefits could include using the break as a source of seed for further regeneration, utilising honey producing species, increasing the area under perennial species to combat seepage, waterlogging and salinity lower in the landscape. Farmnote 38/2000 (Ochtman and Holt 2000) is dedicated to the topic of vegetation buffer zones.

2. Restoration and revegetation

The management requirements of bushland can range from "leave well alone" to intensive revegetation efforts. In non-degraded areas, no management except protection from unnatural disturbance is the best. In areas with low levels of disturbance or even long periods of multiple disturbance but where the plant community is still in 'very good' to 'good' condition (Table 2, page 9), restoration measures are appropriate. Restoration requires removal of disturbances and careful weed management to allow natural processes to take place and bring back more of the original diversity. Revegetation is the most intensive level of management and should be aimed at places that are devoid of natural vegetation or in areas of natural vegetation that are so degraded that replanting is necessary.

If a revegetation program is proposed the questions to be addressed are

- Why revegetate?
- What species should be planted and where?
- When and how should they be planted?

Whether the purpose is to plant a crop windbreak, a livestock shelterbelt, to form corridors linking bushland remnants or to revegetate and enhance the values of existing bushland, species selection is a critical part of any revegetation program. In addition it is important to match species to the soils, drainage, climate and natural plant communities of the area. This survey provides information to show what species prefer to grow together and on what soil types. Refer to Appendix IV where the species are listed by quadrat and vegetation type (plant community).

The gravel pit requires revegetation utilising seed sourced from the Reserve. A comprehensive weed control program needs to be undertaken initially. This will need to be on-going as weed seed will be persisting in the soil. A combination of direct seeding and planting into the ripped surface could be applied. Do not introduce topsoil from elsewhere as that would mean a high risk of weed invasion. Select species from those recorded for the Jam Low Woodland (see column J, Appendix IV), remembering it would also be worth trying to collect some seed of native herbs, grasses and sedges along with the Jam and shrubs. It is wise to at least start by selecting perennial species that will give the longest return on the planting investment, and the most easily propagated species.

In all projects collect seed from your own bushland and the local area so that you select individuals with genes adapted to the local conditions. Be careful not to create disturbances in the bushland and do not over-harvest but ensure sufficient seed bank is retained to allow natural regeneration. Explore the possibilities of direct seeding following suitable ground preparation versus planting of seedlings. Seedlings could be grown under contract.

Publications such as: 'Revegetation Guide to the Central Wheatbelt' (Lefroy *et al.* 1991), is a useful guide to assist with a revegetation plan; and 'Seed Collection of Australian Native Plants' (Ralph, 1994) for help with seed collecting.

3. Rising Water Table and Salinity

It is beyond scope of this project to offer solutions to this complex problem. Proceedings of the recent workshop on dealing with salinity in Wheatbelt valleys summarise the state of knowledge and thinking in this area (Anon 2001). Part of a strategy to protect biodiversity from the encroaching salinisation has been the identification of the most threatened plant communities and the regions with highest levels of biodiversity, leading to the selection of a series of Natural Diversity Recovery Catchments. Special efforts with intensive management and intervention will be centred on these catchments. To the author's knowledge, areas in the Goomalling Shire have not fallen into these categories. In addition the Water and Rivers Commission have been given the charter to develop and implement management plans for high priority wetlands at risk from salinity outside the conservation estate (wetlands on private land or vested with local government) (Government of Western Australia 2000).

Salinisation and hydrological changes (waterlogging) is already responsible for reducing the biodiversity of lowland communities such as the Woodlands, Mallee, Melaleuca Scrub and Fresh-water Claypans at Oak Park Reserve. Weeds and a few succulents will replace these species rich and complex plant communities. This process is an ongoing one and areas such as the study area are under severe threat, even if remedial action is taken. The presence of salt tolerant weeds in the Samphire flats and even on the Fresh-water Claypan and the dead trees on the salt lake indicate that salinisation and waterlogging are already taking place. Maintaining the bushland in good health by controlling weeds and fire is the minimum measure.

4. Other disturbances

Grazing by farm livestock, rabbits and kangaroos may prevent native seedling regeneration. Species such as She-oak (*Allocasuarina* species) are particularly susceptible to being grazed. As well, weed seed can be spread in the droppings of grazing animals and it is not uncommon to see clover or grass seedlings emerge from a scat. Rabbit warrens can also be a source of further erosion.

Access tracks are always a threat as a source of disturbance and entry for weed invasion and dieback. Tracks should always be kept to the minimum required and be maintained sensitively with the minimum of soil disturbance and no clearing of adjoining vegetation. Avoid using tracks in wet conditions and beware of transporting weed seed and infected soil at any time. Practice good soil hygiene by not allowing access to dirty vehicles, especially in wet weather.

5. Management Checklist

The following checklist summarises some management points for consideration.

- Build an awareness in the local community and the Shire Council of
 - the values of the Reserve
 - the threat of weeds to the Reserve
 - the threat of waterlogging and salinisation to the Reserve
 - an acceptance that there is a problem
 - a commitment to take management actions and to provide the necessary resources (financial, supply of labour and materials on an ongoing basis)
- Monitor current weed infestations and control any new outbreaks. Consider control of aggressive species or localised outbreaks such as at the gravel pit to prevent further spread.
- Avoid activities that cause disturbance in order to prevent weed spread and dieback. Minimise vehicle access and confine to already developed tracks. Avoid use in wet conditions.
- Consider a native vegetation buffer zone (weed break) around the exposed boundary sections to prevent weed intrusion and fertiliser and herbicide drift.
- Use locally sourced seed for any revegetation projects – at the gravel pit and for corridor linkages elsewhere in the catchments:
 - match species to soil types and landforms;
 - target perennial species which are readily established first;
 - combine plants from different strata-trees, shrubs **and** perennial ground layer species
- Maintain all boundary fences to prevent introduced livestock from grazing the bushland.
- Control feral animals, particularly rabbits.
- Encourage neighbouring farmers to spread fertiliser and pesticides well away from the boundaries adjoining bushland to avoid any drift into the bushland.
- Consider applying a covenant to the Reserve to ensure its protection in perpetuity.

7. CONCLUSION

This survey has shown that Oak Park Reserve is a bushland area with very high conservation value. Because of its position low in the landscape, the area is under threat from waterlogging and salinisation. This survey has provided a picture of the current status of the vegetation and flora.

Some attributes giving the site its special values are:

- It has a diverse and species rich flora of high conservation significance: 235 native plant taxa including 5 threatened species, numerous species near the limits of their range and taxonomically significant taxa.
- It has eight vegetation types representing those of the lower landscape or broad valleys of the Avon catchment on the western edge of the central Wheatbelt.
- The Fresh-water Claypans are likely to be determined to be a threatened ecological community poorly represented in reserves. The York Gum Mallee over Shrubland is uncommon.
- It is one of only a few large areas of bushland remaining in the Goomalling Shire. It plays a critical role in conserving species diversity and supporting vegetation and flora representative of the area.

Loss of habitat is one of the greatest threatening processes to flora and fauna. With 93% of the Wheatbelt cleared (Beard 1990); about 30 % of the agricultural area threatened by salt (Keighery 2000); less than 6 per cent of remnant vegetation remaining in the Goomalling Shire (Beeston *et al.* 1994); and predictions that at least half of Australia's terrestrial bird species face extinction by the end of the 21st century due to land clearing and habitat decline (Recher 1999); the value of bushland patches such as this cannot be overstated. Not only are they aesthetically valuable, they are important for their flora and vegetation values, as fauna refuges and they are of enormous value to the conservation estate. There is a growing awareness and recognised need to protect remaining native vegetation and restore and revegetate degraded and cleared areas. The information that is provided by this project is highly relevant to these issues. The project provides a hands-on insight to the complexity and richness of the bushland that is so often "taken for granted". It provides the information required to select species for revegetation purposes in the area. In addition, the undertaking provided enjoyable and rewarding times for the people involved both in field survey and herbarium work.

The Shire of Goomalling is to be commended for retaining the Oak Park Reserve as a natural bushland area. It has been encouraging to find catchment groups with the enthusiasm and insight to undertake and value the outcomes of surveys of the flora and vegetation of their bushland. The survey has helped to achieve the purposes of educating the community about bushland and fostering city-country links. Twenty-three Wildflower Society volunteers and botanists and seven members of the local community participated in the survey weekend and several more volunteers and botanists were involved with plant identifications and field herbarium preparations. The resulting information and field herbarium will be available as resources to the community and it is hoped that the interest and awareness in the vegetation and flora of the local area will continue to grow.

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APPENDICES

APPENDIX I: SITE VEGETATION DESCRIPTIONS AND CONDITION (by plant community)

1. Tamar Open Shrublands (T)

Quadrat OAKP 1

Tamar (*Allocasuarina campestris*) Open Shrubland over *Borya sphaerocephala* and mixed species Herbland, *Amphipogon strictus*, *Neurachne alopecuroidea*, *Austrostipa elegantissima* Very Open Grassland and *Schoenus clandestinus* Very Open Sedgeland.

Condition Rating: excellent

Soil: brown loam

Drainage: moderate to good

Aspect: gentle north slope

Number of species: 48 (40 natives, 8 weeds)

Latitude: 31° 07.807 Longitude: 116° 52.952

2. Jam Low Open Woodlands (J)

Quadrat OAKP 2

Jam (*Acacia acuminata*) Low Open Woodland over *Grevillea paniculata* Shrubland over *Opercularia vaginata*, *Borya sphaerocephala* Herbland.

Condition Rating: excellent

Soil: brown sandy loam

Drainage: good

Aspect: gentle north west slope

Number of species: 59 (51 natives, 8 weeds)

Latitude: 31° 07.853 Longitude: 116° 53.175

Quadrat OAKP 11

Jam Low Open Woodland over *Borya sphaerocephala*, *Opercularia vaginata*, *Gilberta tenuifolia*, *Dampiera lavandulacea* Herbland and *Neurachne alopecuroidea*, *Austrostipa eremophila*, *Austrostipa tenuifolia* Grassland.

Condition Rating: excellent

Soil: brown sandy loam

Drainage: good

Aspect: gentle west slope

Number of species: 56 (49 natives, 7 weeds)

Latitude: 31° 08.018 Longitude: 116° 53.328

3. York Gum (Open) Tree Mallee over Shrublands (Y)

Quadrat OAKP 3

York Gum (*Eucalyptus loxophleba*) Tree Mallee over *Hakea preissii*, Quandong (*Santalum acuminatum*) Tall Open Shrubland over *Olearia dampieri* subsp. *eremicola*, *Eremophila lehmanniana*, *Acacia acuaria*, *Daviesia benthamii* Open Low Heath over a mixed Herbland and *Austrostipa elegantissima* Very Open Grassland.

Condition Rating: excellent

Soil: light brown sandy loam

Drainage: moderate (winter wet)

Aspect: flat

Number of species: 72 (59 natives, 13 weeds)

Latitude: 31° 07.805 Longitude: 116° 52.806

Quadrat OAKP 9

York Gum Very Open Tree Mallee, Jam Low Open Woodland over *Rhagodia drummondii* Low Open Shrubland over *Podotheca gnaphalioides*, *Gilberta tenuifolia*, *Borya laciniata* Closed Herbland, *Austrostipa elegantissima*, *Austrostipa variabilis* Very Open Grassland and *Lepidobolus preissianus* Very Open Sedgeland

Condition Rating: excellent

Soil: light brown sand

Drainage: good

Aspect: gentle east slope

Number of species: 48 (37 natives, 11 weeds)

Latitude: 31° 07.912 Longitude: 116° 52.704

Quadrat OAKP 10

York Gum (*Eucalyptus loxophleba*) Open Tree Mallee / Woodland over *Scaevola spinescens*, *Eremophila lehmanniana*, *Daviesia benthamii* Open Heath over mixed Very Open Herbland, *Austrostipa elegantissima* Very Open Grassland.

Condition Rating: excellent

Soil: loamy sand

Drainage: good

Aspect: gentle south slope

Number of species: 58 (49 natives, 9 weeds)

Latitude: 31° 07.944 Longitude: 116° 52.736

4. Fresh-water Claypans supporting Sedgeland (C)

Quadrat OAKP 4

Chorizandra enodis, *Schoenus humilis* Sedgeland with emergent *Hakea preissii*. A seasonal freshwater wetland glade within a York Gum Woodland.

Condition Rating: excellent

Soil: grey brown sandy clay with scattered laterite on upper edges of depression

Drainage: poor (seasonal - winter - fresh wetland)

Aspect: depression in a gentle north slope

Number of species: 71 (55 natives, 16 weeds)

Latitude: 31° 07.802 Longitude: 116° 52.858

Quadrat OAKP 13

Eleocharis acuta Open Sedgeland within a York Gum, Swamp She-oak (*Casuarina obesa*) Low Woodland over *Hakea preissii* Open Shrubland.

Condition Rating: under water on 18/9/99, excellent on 25/10/99

Soil: brown clay

Drainage: poor (winter/spring fresh wetland)

Aspect: flat

Number of species: 46 (33 natives, 13 weeds)

Latitude: 31° 07.757 Longitude: 116° 52.948

5. Lake dune: Mixed Open Shrubland, Herbland and Open Sedgeland with scattered *Banksia prionotes* (L)

Quadrat OAKP 6

Banksia prionotes Low Open Woodland over *Calytrix angulata* Low Open Shrubland over *Podotrochea gnaphalioides*, **Ursinia anthemoides*, *Borya laciniata* Open Herbland, *Amphipogon turbinatus* Very Open Grassland and *Lepidobolus preissianus*, *Schoenus subfascicularis* Very Open Sedgeland

Condition Rating: very good - good

Soil: white sand

Drainage: very good

Aspect: flat dune crest

Number of species: 39 (30 natives, 9 weeds)

Latitude: 31° 07.812 Longitude: 116° 52.698

6. *Melaleuca* Tall Open Scrub (M) (Quadrat 5)

Quadrat OAKP 5

Melaleuca uncinata, *Melaleuca hamulosa* Tall Open Scrub

Condition Rating: very good

Soil: white sand

Drainage: good

Aspect: gentle west slope

Number of species: 26 (19 natives, 7 weeds)

Latitude: 31° 07.824 Longitude: 116° 52.697

7. Swamp She-oak Low Woodlands (S) Not sampled

8. Samphire Flats (*Halosarcia* species Low Shrublands) (H)

Quadrat OAKP 7

Halosarcia lepidosperma, *Halosarcia pergranulata*, Low Shrubland over *Calandrinia granulifera* Very Open Herbland and **Lolium multiflorum* x *Lolium perenne*, **Parapholis incurva*, **Hordeum geniculatum* Open Grassland.

Condition Rating: degraded (Rising water table has killed tree and shrub layer)

Soil: brown sandy loam

Drainage: poor (winter wet)

Aspect: flat

Number of species: 23 (15 natives, 8 weeds)

Latitude: 31° 07.823 Longitude: 116° 52.669

Quadrat OAKP 8

Halosarcia lepidosperma, *Halosarcia indica* subsp. *bidens* Low Shrubland over **Hordeum geniculatum*, **Lolium multiflorum* x *Lolium perenne*, **Ehrharta longiflora* Grassland and *Hyalochlamys globifera*, *Calandrinia granulifera*, *Crassula colorata* Open Herbland.

Condition Rating: degraded (Rising water table has killed tree and shrub layer)

Soil: grey brown loamy sand

Drainage: poor (winter wet)

Aspect: flat

Number of species: 37 (21 natives, 16 weeds)

Latitude: 31° 07.837 Longitude: 116° 52.647

APPENDIX II: PLANT SPECIES LIST

All taxa (species, subspecies and varieties) recorded on the quadrats as well as taxa observed elsewhere within the Reserve 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.
- 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*** members of the families Cyperaceae and Centrolepidaceae
- Rush*** herbs which are grass-like in appearance. Members of the families Juncaceae and Restionaceae
- Vine** a climbing, scrambling or trailing plant 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.

* 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 OAK PARK RESERVE, WALYORMOURING - Shire of Goomalling (alphabetically by Family)

Botanical name	Family	Common name	Life form	Growth form	Cons. code
<i>Ptilotus declinatus</i>	Amaranthaceae	Curved Mulla Mulla	P	herb	
<i>Ptilotus divaricatus</i> var. <i>divaricatus</i>	Amaranthaceae	Climbing Mulla Mulla	P	shrub	
<i>Ptilotus drummondii</i> var. <i>drummondii</i>	Amaranthaceae	Pussytail, Narrowleaf Mulla Mulla	P	herb	
<i>Ptilotus humilis</i> var. <i>humilis</i>	Amaranthaceae	Mulla Mulla	A	herb	
<i>Ptilotus polystachyus</i>	Amaranthaceae	Prince of Wales Feather, Bottlewasher	A or P	herb	
<i>Ptilotus spathulatus</i>	Amaranthaceae		P	herb	
<i>Caesia alfordii</i>	Anthericaceae		A	herb	
<i>Caesia occidentalis</i>	Anthericaceae		A	herb	
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	Anthericaceae		A	herb	G
<i>Corynolheca micrantha</i>	Anthericaceae	Blue Squill	A	herb	
<i>Dichopogon preissii</i>	Anthericaceae		P	semi-shrub	
<i>Thysanotus manglicianus</i>	Anthericaceae	Nodding Chocolate Lily	P/A	herb	
<i>Tricoryne tenella</i>	Anthericaceae	Fringed Lily	A	twining herb	
<i>Apium annuum</i>	Apiaceae		P	herb	
<i>Daucus glochidatus</i>	Apiaceae	Native Carrot	A	herb	
<i>Hydrocotyle callicarpa</i>	Apiaceae	Small Pennywort	A	herb	
<i>Hydrocotyle pilifera</i> var. <i>glabrata</i>	Apiaceae	Pennywort	A	herb	
<i>Hydrocotyle rugulosa</i>	Apiaceae	Pennywort	A	herb	
<i>Platysace maxwellii</i>	Apiaceae	Karno, Native Potato	A	herb	
<i>Trachymene cyanopetalata</i>	Apiaceae		P	herb	G
<i>Trachymene ornata</i>	Apiaceae	Spongefruit	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>Arctotheca calendula</i>	Asteraceae	Capeweed	A	herb	
<i>Blennospora drummondii</i>	Asteraceae		A	herb	
<i>Blennospora phlegmatocarpa</i>	Asteraceae		A	herb	P2

Botanical name	Family	Common name	Life form	Growth form	Cons. code
<i>Brachyscome bellidioides</i>	Asteraceae		A	herb	
<i>Brachyscome ciliaris</i>	Asteraceae	Variable Daisy	A	herb	
<i>Brachyscome iberidifolia</i>	Asteraceae	Swan River Daisy	A	herb	
<i>Brachyscome perpusilla</i>	Asteraceae	Tiny Daisy	A	herb	
<i>Calotis hispidula</i>	Asteraceae	Bindy Eye	A	herb	
<i>Ceratogyne obionoides</i>	Asteraceae	Wingwort	A	herb	
* <i>Cotula bipinnata</i>	Asteraceae	Ferny Cotula	A	herb	
<i>Cotula coronopifolia</i>	Asteraceae	Waterbuttons	A or P	herb	
<i>Cotula cotuloides</i>	Asteraceae	Smooth Cotula	A	herb	
<i>Erynophyllum tenellum</i>	Asteraceae		A	herb	
<i>Gilberta tenuifolia</i>	Asteraceae		A	herb	
<i>Gnephosis tenuissima</i>	Asteraceae		A	herb	
<i>Gnephosis tridens/uniflora</i>	Asteraceae		A	herb	
<i>Hyalochlamys globifera</i>	Asteraceae		A	herb	
<i>Hyalosperma demissum</i>	Asteraceae		A	herb	
<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>	Asteraceae		A	herb	
* <i>Hypochaeris glabra</i>	Asteraceae	Flat Weed, Smooth Cat's-ear	A	herb	
<i>Lawrencella rosea</i>	Asteraceae		A	herb	
<i>Millottia major</i>	Asteraceae		A	herb	G
<i>Olearia dampieri</i> subsp. <i>eremicola</i> ms	Asteraceae	Inland Daisy Bush	P	shrub	
* <i>Osteospermum claudesitum</i>	Asteraceae	Stinking Roger	A	herb	
<i>Podolepis canescens</i>	Asteraceae	Bright or Grey Podolepis	A	herb	
<i>Podolepis capillaris</i>	Asteraceae	Wiry Podolepis	A	herb	
<i>Podolepis lessonii</i>	Asteraceae		A	herb	
<i>Podolepis tepperi</i>	Asteraceae		A	herb	
<i>Podolheca angustifolia</i>	Asteraceae	Sticky Longheads	A	herb	G
<i>Podolheca gnaphalioides</i>	Asteraceae	Golden Longheads	A	herb	

Botanical name	Family	Common name	Life form	Growth form	Cons. code
<i>Pogonolepis stricta</i>	Asteraceae		A	herb	
<i>Quinetia urvillei</i>	Asteraceae		A	herb	
<i>Rhodanthe citrina</i>	Asteraceae		A	herb	
<i>Rhodanthe laevis</i>	Asteraceae	Smooth Sunray	A	herb	
<i>Rhodanthe manglesii</i>	Asteraceae	Pink Sunray	A	herb	
<i>Rhodanthe pygmaea</i>	Asteraceae		A	herb	
<i>Senecio glossanthus</i>	Asteraceae	Slender Groundsel	A	herb	
* <i>Sonchus oleraceus</i>	Asteraceae	Common Sowthistle	A	herb	
* <i>Ursinia anthemooides</i>	Asteraceae	Ursinia	A	herb	
<i>Waitzia acuminata</i> var. <i>acuminata</i>	Asteraceae	Orange Immortelle	A	herb	
<i>Waitzia acuminata</i> var. <i>albicans</i>	Asteraceae		A	herb	
<i>Borya lacininata</i>	Boryaceae	Pincushions	P	herb	
<i>Borya sphaerocephala</i>	Boryaceae	Pincushions	P	herb	
* <i>Raphanus raphanistrum</i>	Brassicaceae	Wild Radish	A	herb	
<i>Brunonia australis</i>	Brunoniaceae	Native Cornflower, Blue Pincushion	A	herb	
* <i>Opuntia stricta</i>	Cactaceae	Common Prickly Pear	P	shrub	
* <i>Wahlenbergia capensis</i>	Campanulaceae	Cape Bluebell	A	herb	
<i>Wahlenbergia preissii</i>	Campanulaceae	Annual Bluebell	A	herb	
* <i>Silene gallica</i> var. <i>gallica</i>	Caryophyllaceae	French Catchfly	A	herb	
* <i>Spargularia rubra</i>	Caryophyllaceae	Sand Spurry	A	herb	
<i>Allocasuarina campestris</i>	Casuarinaceae	Tamar	P	shrub	
<i>Casuarina obesa</i>	Casuarinaceae	Swamp She-oak	P	tree	
<i>Aphelia brizula</i>	Centrolepidaceae		A	sedge-like herb	
<i>Centrolepis alepyroides</i>	Centrolepidaceae		A	sedge-like herb	
<i>Centrolepis drummondiana</i>	Centrolepidaceae		A	sedge-like herb	
<i>Centrolepis glabra</i>	Centrolepidaceae	Smooth Centrolepis	A	sedge-like herb	
<i>Centrolepis humillima</i>	Centrolepidaceae	Dwarf Centrolepis	A	sedge-like herb	

Botanical name	Family	Common name	Life form	Growth form	Cons. code
<i>Centrolepis pilosa</i>	Centrolepidaceae		A	sedge-like herb	
<i>Centrolepis polygyna</i>	Centrolepidaceae	Wiry Centrolepis	A	sedge-like herb	
<i>Didymanthus roei</i>	Chenopodiaceae		P	shrub	
<i>Enchylaena lanata</i>	Chenopodiaceae		P	shrub	
<i>Halosarcia indica</i> subsp. <i>bidens</i>	Chenopodiaceae	Samphire	P	shrub	
<i>Halosarcia lepidosperma</i>	Chenopodiaceae	Samphire	P	shrub	
<i>Halosarcia pergranulata</i>	Chenopodiaceae	Samphire	P	shrub	
<i>Maireana marginata</i>	Chenopodiaceae		P	shrub	
<i>Rhagodia drummondii</i>	Chenopodiaceae		P	shrub	
<i>Rhagodia preissii</i> subsp. <i>preissii</i>	Chenopodiaceae		P	shrub	
<i>Burchardia umbellata</i>	Colchicaceae	Milkmaids	A	herb	
<i>Wimmeria</i> sp. probably <i>W. 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 colorata</i> var. <i>colorata</i>	Crassulaceae	Dense Crassula	A	herb	
<i>Crassula decumbens</i> var. <i>decumbens</i>	Crassulaceae	Rufous Stonecrop	A	herb	
<i>Crassula peduncularis</i>	Crassulaceae	Purple Stonecrop	A	herb	
<i>Chorizanthe enodis</i>	Cyperaceae	Black Bristlerush	P	sedge	
* <i>Isoplepis marginata</i>	Cyperaceae	Coarse Club-rush	A	sedge	
<i>Lepidosperma costale</i>	Cyperaceae		P	sedge	
<i>Schoenus clandestinus</i>	Cyperaceae		P	sedge	
<i>Schoenus humilis</i> / <i>plumosus</i>	Cyperaceae		A	sedge	
<i>Schoenus nanus</i>	Cyperaceae	Tiny Bog-rush	A	sedge	
<i>Schoenus sculpius</i>	Cyperaceae	Gimlet Bog-rush	A	sedge	
<i>Schoenus subfascicularis</i>	Cyperaceae		P	sedge	
<i>Schoenus tenellus</i>	Cyperaceae		A	sedge	G
<i>Acanthocarpus canaliculatus</i>	Dasyopogonaceae		P	herb	

Botanical name	Family	Common name	Life form	Growth form	Cons. code
<i>Lomandra effusa</i>	Dasygongonaceae	Scented Matrush	P	herb	
<i>Lomandra</i> sp.	Dasygongonaceae	Matrush	P	herb	
<i>Drosera glanduligera</i>	Droseraceae	Pimpinel Sundew	A	herb	
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	Droseraceae	Bridal Rainbow, Climbing Sundew	P/A	herb	
<i>Drosera macrophylla</i>	Droseraceae	Showy Sundew	P/A	herb	
<i>Drosera ranellosa</i>	Droseraceae	Branched Sundew	P/A	herb	
<i>Drosera subhirtella</i>	Droseraceae	Sunny Rainbow	P/A	herb	
<i>Astroloma serratifolium</i>	Epacridaceae	Kondrung	P	shrub	
* <i>Centaurium erythraea</i>	Gentianaceae	Common Centaury	A	herb	
<i>Sebaea ovata</i>	Gentianaceae	Yellow Sebaea	A	herb	G
* <i>Erodium botrys</i>	Gentianaceae	Long Storkbill	A	herb	
<i>Erodium cygnorum</i>	Gentianaceae	Blue Heronsbill	A	herb	
<i>Pelargonium havilae</i>	Gentianaceae		P	herb	G
<i>Dampiera lavandulacea</i>	Goodeniaceae	Lavender Dampiera	P	herb / low shrub	
<i>Goodenia berlandina</i>	Goodeniaceae		A	herb	
<i>Goodenia micrantha</i>	Goodeniaceae		A	herb	
<i>Goodenia pusilliflora</i>	Goodeniaceae		A	herb	
<i>Scaevola spinescens</i>	Goodeniaceae	Smallflower Goodenia	P	shrub	
<i>Scaevola tortuosa</i>	Goodeniaceae	Curran Bush	P	herb/semi shrub	
<i>Velleia cynopotamica</i>	Goodeniaceae	Tortuous-stem Scaevola	P	herb	PI
<i>Velleia</i> sp. aff. <i>cynopotamica</i>	Goodeniaceae		A	herb	
<i>Anigozanthos humilis</i>	Haemodorraceae	Catspaw	A	herb	
<i>Conostylis aculeata</i> subsp. <i>aculeata</i>	Haemodorraceae	Prickly Conostylis	P/A	herb	
<i>Conostylis prolifera</i>	Haemodorraceae	Mat Cottonheads	P	herb	
<i>Tribonanthes longipetala</i>	Haemodorraceae		P	herb	
<i>Gonocarpus nodulosus</i>	Haloragaceae		A	herb	
<i>Hypoxis glabella</i> var. <i>leptantha</i>	Hypoxidaceae	Tiny Star	P/A	herb	

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<i>*Ixia maculata</i>	Iridaceae	Yellow Ixia	P/A	herb	
<i>Orthrosanthus laxus</i> var. <i>laxus</i>	Iridaceae	Morning Iris	P/A	herb	
<i>*Romulea rosea</i>	Iridaceae	Guildford Grass	P/A	herb	
<i>*Juncus bufonius</i>	Juncaceae	Toad Rush	A	rush	
<i>Triglochin mucronata</i>	Juncaginaceae	Prickly Arrowgrass	A	herb	
<i>Triglochin nana</i>	Juncaginaceae	Arrowgrass	A	herb	
<i>Triglochin</i> sp. aff. <i>calciatapa</i>	Juncaginaceae	A Spurred Arrowgrass	A	herb	
<i>Cassytha glabella</i>	Lauraceae	Tangled Dodder Laurel	P	twining parasite	
<i>Isotoma hypocrateriformis</i>	Lobeliaceae	Woodbridge Poison	A	herb	
<i>Lobelia heterophylla</i>	Lobeliaceae	Wing-seeded Lobelia	A	herb	
<i>Lobelia tenuior</i>	Lobeliaceae	Slender Lobelia	A	herb	
<i>Phyllanthium sulcatum</i>	Loganiaceae		A	herb	
<i>Amnyema miraculosa</i> subsp. <i>miraculosa</i>	Loranthaceae	Mistletoe	P	parasitic shrub	
<i>*Malva parviflora</i>	Malvaceae	Small-flowered Mallow, Marshmallow	A	herb	
<i>Acacia acutaria</i>	Mimosaceae	Jam	P	shrub	
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	Mimosaceae		P	tree	
<i>Acacia brumalis</i>	Mimosaceae		P	shrub	
<i>Acacia erinacea</i>	Mimosaceae		P	shrub	
<i>Acacia latipes</i> subsp. <i>latipes</i>	Mimosaceae		P	shrub	
<i>Acacia ligustrina</i>	Mimosaceae		P	shrub	
<i>Acacia microbotrya</i>	Mimosaceae		P	shrub or tree	
<i>Acacia restiacea</i>	Mimosaceae	Manna Wattle	P	tree	
<i>Acacia saligna</i>	Mimosaceae	Kudjong, Orange Wattle	P	shrub	
<i>Acacia</i> sp.	Mimosaceae		P	shrub	
<i>Eremophila decipiens</i>	Myoporaceae	Slender Fuchsia	P	shrub	
<i>Eremophila lehmanniana</i>	Myoporaceae		P	shrub	
<i>Eremophila subfloccosa</i>	Myoporaceae	Dense-felted Eremophila	P	shrub	

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<i>Baeckea crispiflora</i>	Myrtaceae		P	shrub	
<i>Calytrix angulata</i>	Myrtaceae	Yellow Starflower	P	shrub	
<i>Calytrix leschenaultii</i>	Myrtaceae	Starflower	P	shrub	
<i>Chamelaucium micranthum</i>	Myrtaceae	Wax Flower	P	shrub	
<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	Myrtaceae	York Gum	P	tree	
<i>Leptospermum erubescens</i>	Myrtaceae	Roadside Tea-tree	P	shrub	
<i>Melaleuca adnata</i>	Myrtaceae		P	shrub	
<i>Melaleuca hamulosa</i>	Myrtaceae		P	shrub or tree	
<i>Melaleuca lateriflora</i> subsp. <i>lateriflora</i>	Myrtaceae		P	shrub or tree	
<i>Melaleuca uncinata</i>	Myrtaceae		P	shrub	
<i>Scholtzia ?parviflora</i>	Myrtaceae	Broom Bush, Kwidjard	P	shrub	
<i>Verticordia chrysanthella</i>	Myrtaceae		P	shrub	
<i>Ophioglossum lissitricum</i>	Ophioglossaceae	Feather Flower	P	fern	
<i>Caladenia denticulata</i>	Orchidaceae	Adder's Tongue	P	herb	
<i>Caladenia exilis</i> subsp. <i>exilis</i>	Orchidaceae	Yellow Spider Orchid	P/A	herb	
<i>Caladenia flava</i> subsp. <i>flava</i>	Orchidaceae	Salt Lake Spider Orchid	P/A	herb	
<i>Caladenia footeana</i>	Orchidaceae	Cowslip Orchid	P/A	herb	
<i>Caladenia hirta</i> subsp. <i>hirta</i>	Orchidaceae	Crimson Spider Orchid	P/A	herb	
<i>Caladenia hirta</i> subsp. <i>rosea</i>	Orchidaceae	Sugar Candy Orchid	P/A	herb	
<i>Caladenia hirta</i> subsp. <i>rosea</i> hybrid	Orchidaceae	Pink Candy Orchid	P/A	herb	
<i>Caladenia longicauda</i> subsp. <i>eminens</i>	Orchidaceae	Pink Candy Orchid	P/A	herb	
<i>Caladenia radialis</i>	Orchidaceae	Large White Spider Orchid	P/A	herb	
<i>Caladenia roei</i>	Orchidaceae	Drooping Spider Orchid	P/A	herb	
<i>Cyanicula gemmata</i>	Orchidaceae	Ant Orchid	P/A	herb	
<i>Diuris</i> sp. aff. <i>corymbosa</i>	Orchidaceae	Blue China Orchid	P/A	herb	
<i>Leporella fimbriata</i>	Orchidaceae	Donkey Orchid	P/A	herb	
<i>Prasophyllum cyphochilum</i>	Orchidaceae	Hare Orchid	P/A	herb	
	Orchidaceae	Pouched Leek Orchid	P/A	herb	

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Botanical name	Family	Common name	Life form	Growth form	Cons. code
<i>Prasophyllum gracile</i>	Orchidaceae	Leek Orchid	P/A	herb	
<i>Prasophyllum</i> sp.	Orchidaceae	Leek Orchid	P/A	herb	
<i>Thelymitra antemifera</i>	Orchidaceae	Vanilla Orchid, Lemon Orchid	P/A	herb	
<i>Thelymitra villosa</i>	Orchidaceae	Custard Orchid	P/A	herb	
* <i>Orobanche minor</i>	Orobanchaceae	Lesser Broomrape	P/A	parasitic herb	
<i>Oxalis peremans</i>	Oxalidaceae	Wood Sorrel	P/A	herb	
<i>Chorizema genistoides</i>	Papilionaceae	Flame Pea	P	shrub	
<i>Daviesia benthamii</i> subsp. <i>benthamii</i>	Papilionaceae		P	shrub	
<i>Eutaxia microphylla</i> var. <i>microphylla</i>	Papilionaceae		P	shrub	
<i>Gastrolobium spinosum</i> var. <i>spinosum</i>	Papilionaceae	Prickly Poison	P	shrub	
<i>Isotropis juncea</i>	Papilionaceae	Slender Lamb Poison	P	semi-shrub	
<i>Jacksonia fasciculata</i>	Papilionaceae		P	shrub	
* <i>Lupinus cosentinii</i>	Papilionaceae	Australian Blue Lupin	A	herb	
<i>Mirbelia ramulosa</i>	Papilionaceae		P	shrub	
<i>Templetonia sulcata</i>	Papilionaceae	Kerosene Bush	P	shrub	
* <i>Trifolium arvense</i>	Papilionaceae	Hare's Foot Clover	A	herb	
* <i>Trifolium glomeratum</i>	Papilionaceae	Cluster Clover, Ball Clover	A	herb	
* <i>Trifolium hirtum</i>	Papilionaceae	Rose Clover	A	herb	
* <i>Trifolium subterraneum</i>	Papilionaceae	Subterranean Clover	A	herb	
* <i>Trifolium tomentosum</i>	Papilionaceae	Woolly Clover	A	herb	
<i>Dianella revoluta</i>	Phormiaceae	Blue Flax Lily	P	herb	
* <i>Plantago coronopus</i> subsp. <i>commutata</i>	Plantaginaceae	Buckshorn Plantain	A or P	herb	
<i>Plantago debilis</i>	Plantaginaceae	Plantain	A	herb	
<i>Agrostis preissii</i>	Poaceae	Bent Grass	A	grass	
* <i>Aira caryophylla</i>	Poaceae	Silvery Hairgrass	A	grass	
<i>Amphibromus nervosus</i>	Poaceae	Swamp Wallaby Grass	P	grass	
<i>Amphipogon strictus</i>	Poaceae	Greybeard Grass	P	grass	

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<i>Amphipogon turbinatus</i>	Poaceae	Greybeard Grass	P	grass	
<i>Aristida contorta</i>	Poaceae	Bunched Kerosene Grass	A (or P)	grass	
<i>Austrodanthonia acerosa</i>	Poaceae	Wallaby Grass	P	grass	
<i>Austrodanthonia setacea</i>	Poaceae	Wallaby Grass	P	grass	
<i>Austrodanthonia</i> sp. Goomalling (Gunness <i>et. al.</i> 1973)	Poaceae	Wallaby Grass	P	grass	
<i>Austrostipa elegantissima</i>	Poaceae	Feather Spear Grass	P	grass	
<i>Austrostipa eremophila</i>	Poaceae	Desert Spear Grass	P	grass	
<i>Austrostipa hemipogon</i>	Poaceae	Spear Grass	P	grass	
<i>Austrostipa macalpinei</i>	Poaceae	Golden Spear Grass	A	grass	G
<i>Austrostipa tenuifolia</i>	Poaceae	Spear Grass	P	grass	
<i>Austrostipa tricophylla</i>	Poaceae	Spear Grass	P	grass	
<i>Austrostipa variabilis</i>	Poaceae	Variable Spear Grass	P	grass	
* <i>Avena barbata</i>	Poaceae	Bearded Oat	A	grass	
* <i>Avena fatua</i>	Poaceae	Wild Oat	A	grass	
* <i>Briza maxima</i>	Poaceae	Blowfly Grass, Large Quaking Grass	A	grass	
* <i>Bromus diandrus</i>	Poaceae	Great Brome	A	grass	
* <i>Bromus hordeaceus</i>	Poaceae	Soft 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 geniculatum</i>	Poaceae	Mediterranean Barley Grass	A	grass	
* <i>Lolium multiflorum</i> x <i>L. perenne</i>	Poaceae	Rye Grass Hybrid	A	grass	
* <i>Lolium perenne</i> x <i>L. rigidum</i>	Poaceae	Rye Grass Hybrid	A	grass	
* <i>Lolium rigidum</i>	Poaceae	Annual or Wimmera Rye Grass	A	grass	
<i>Monachather paradoxus</i>	Poaceae	Bandicoot Grass	P	grass	
<i>Neurachne alopecuroides</i>	Poaceae	Foxtail Mulga Grass	P	grass	
* <i>Parapholis incurva</i>	Poaceae	Coast Barb Grass	A	grass	

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<i>*Pentstemonis airoides</i>	Poaceae	False Hairgrass	A	grass	
<i>*Polypogon monspeliensis</i>	Poaceae	Annual Barbggrass	A	grass	
<i>*Triticum aestivum</i>	Poaceae	Wheat	A	grass	
<i>*Vulpia muralis</i>	Poaceae		A	grass	
<i>*Vulpia myuros</i> var. <i>megalaria</i>	Poaceae	Rat's Tail Fescue	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>Comesperma scoparium</i>	Polygalaceae	Broom Milkwort	P	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 eremaea</i>	Portulacaceae	Small Purslane, Twining Purslane	A	herb	
<i>Calandrinia granulifera</i>	Portulacaceae	Pygmy Purslane	A	herb	
<i>Calandrinia</i> sp. Needleup (K. R. Newbey 4892)	Portulacaceae	Purslane	A	herb	
<i>*Anagallis arvensis</i> var. <i>caerulea</i>	Primulaceae	Pimpernel	A	herb	
<i>Banksia prionotes</i>	Proteaceae	Acorn Banksia	P	tree or shrub	
<i>Grevillea hakeoides</i> subsp. <i>hakeoides</i>	Proteaceae		P	shrub	
<i>Grevillea paniculata</i>	Proteaceae		P	shrub	
<i>Hakea preissii</i>	Proteaceae	Needle Tree	P	shrub	
<i>Hakea prostrata</i>	Proteaceae	Harsh Hakea	P	shrub	
<i>Persoonia chapmaniana</i>	Proteaceae		P	shrub	P3
<i>Clematis delicata</i> ms	Ranunculaceae	Clematis	P	climber	
<i>Desmodium asper</i>	Restionaceae		P	sedge	
<i>Harperia lateriflora</i>	Restionaceae		P	sedge	
<i>Lepidobolus preissianus</i>	Restionaceae		P	sedge	
<i>Cryptandra myriantha</i>	Rhamnaceae	Chaff Rush	P	shrub	
<i>Stenanthemum tridentatum</i>	Rhamnaceae		P	shrub	P4
<i>Opercularia vaginata</i>	Rubiaceae	Dog Weed	P	herb or shrub	

Botanical name	Family	Common name	Life form	Growth form	Cons. code
<i>Santalum acuminatum</i>	Santalaceae	Quandong	P	tree or shrub	
<i>Santalum spicatum</i>	Santalaceae	Sandalwood	P	tree or shrub	
<i>Glossostigma drummondii</i>	Scrophulariaceae	Mudmat	A	herb	
* <i>Parentiucellia latifolia</i>	Scrophulariaceae	Common Bartsia	A	herb	
<i>Keraudrenia integrifolia</i>	Sterculiaceae	Common Fire-bush	P	shrub	
<i>Levenhookia dubia</i>	Stylidiaceae	Hairy Stylewort	A	herb	
<i>Stylidium calcaratum</i>	Stylidiaceae	Book Triggerplant	A	herb	
<i>Stylidium ecorne</i>	Stylidiaceae	Foot Triggerplant	A	herb	
<i>Stylidium inundatum</i>	Stylidiaceae	Hundreds and Thousands	A	herb	
<i>Stylidium leptophyllum</i>	Stylidiaceae	Needle-leaved Triggerplant	P	herb	
<i>Stylidium petiolare</i>	Stylidiaceae	Horn Triggerplant	A	herb	
<i>Stylobasium australe</i>	Surianaceae		P	shrub	
<i>Parietaria cardostegia</i>	Urticaceae	Pellitory	A	herb	

APPENDIX III: PLANT SPECIES LIST FOR THE FRESH-WATER CLAYPAN ADJOINING OAK PARK RESERVE, WALYORMOURING - Shire of Goomalling

Botanical name	Family	Common name	Life form	Growth form	Cons. code
<i>Trachymene ornata</i>	Apiaceae	Spongefruit	A	herb	
<i>Bulbine semibarbata</i>	Asphodelaceae	Leek Lily	A	herb	
* <i>Arctotheca calendula</i>	Asteraceae	Capweed	A	herb	
* <i>Cotula bipinnata</i>	Asteraceae	Ferny Cotula	A	herb	
<i>Cotula coronopifolia</i>	Asteraceae	Waterbuttons	A or P	herb	
* <i>Hypochaeris glabra</i>	Asteraceae	Flat Weed, Smooth Cat's-ear	A	herb	
<i>Myriocephalus occidentalis</i>	Asteraceae		A	herb	
<i>Pogonolepis stricta</i>	Asteraceae		A	herb	
<i>Casuarina obesa</i>	Casuarinaceae	Swamp She-oak	P	tree	
<i>Rhagodia drummondii</i>	Chenopodiaceae		P	shrub	
<i>Wilsonia humilis</i>	Convolvulaceae	Silky Wilsonia	P	semi-shrub	
<i>Crassula decumbens</i> var. <i>decumbens</i>	Crassulaceae	Rufous Stonecrop	A	herb	
* <i>Crassula natans</i> var. <i>minus</i>	Crassulaceae	Australian Crassula	A	aquatic herb	
<i>Chorizandra enodis</i>	Cyperaceae	Black Bristlerush	P	sedge	
<i>Eleocharis acuta</i>	Cyperaceae	Common Spikerush	P	sedge	
<i>Isolepis congrua</i>	Cyperaceae		A	sedge	
<i>Schoenus capillifolius</i> / sp. Beaufort (G.J. Keighery 6291)	Cyperaceae		A	sedge	P1
<i>Schoenus humilis</i> / <i>plumosus</i>	Cyperaceae		A	sedge	
<i>Elatine gratioloides</i>	Elatinaceae	Waterwort	A	herb	
<i>Goodenia pusilliflora</i>	Goodeniaceae	Smallflower Goodenia	A	herb	
<i>Tribonanthes longipetala</i>	Haemodorraceae		P	herb	
<i>Myriophyllum drummondii</i>	Haloragaceae	Milfoil	A	aquatic herb	G
<i>Trithuria bibracteata</i>	Hydatellaceae		A	aquatic herb	
* <i>Juncus bufonius</i>	Juncaceae	Toad Rush	A	rush	
<i>Juncus radula</i>	Juncaceae		P	rush	
<i>Triglochin mucronata</i>	Juncaginaceae	Prickly Arrowgrass	A	herb	
<i>Triglochin</i> sp. A. Flora of Australia (G.J. Keighery 2477)	Juncaginaceae		A	herb	

Botanical name	Family	Common name	Life form	Growth form	Cons. code
<i>Triglochin</i> sp. aff. <i>calceitrapa</i>	Juncaginaceae	A Spurred Arrowgrass	A	herb	
<i>Marsilea drummondii</i>	Marsileaceae	Common Nardoo	P	aquatic fern	
<i>Ptilularia novae-hollandiae</i>	Marsileaceae	Austral Pillwort	P	aquatic fern	G
<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	Myrtaceae	York Gum	P	tree	
<i>Melaleuca uncinata</i>	Myrtaceae	Broom Bush, Kwidjard	P	shrub	
* <i>Trifolium tomentosum</i>	Papilionaceae	Woolly Clover	A	herb	
* <i>Plantago coronopus</i> subsp. <i>commutata</i>	Plantaginaceae	Buckshorn Plantain	A or P	herb	
<i>Agrostis avenacea</i>	Poaceae	Blown Grass	A	grass	
* <i>Aira caryophyllea</i>	Poaceae	Silvery Hairgrass	A	grass	
<i>Amphibromus nervosus</i>	Poaceae	Swamp Wallaby Grass	P	grass	
<i>Austrodanthonia</i> sp. Goomalling (Gunness <i>et al.</i> OAKP10/63)	Poaceae	Wallaby Grass	P	grass	
<i>Austrostipa elegantissima</i>	Poaceae	Feather Spear Grass	P	grass	
* <i>Ehrharta longiflora</i>	Poaceae	Annual Veldtgrass	A	grass	
* <i>Hordeum geniculatum</i>	Poaceae	Mediterranean Barley Grass	A	grass	
* <i>Lolium multiflorum</i> x <i>L. perenne</i>	Poaceae	Rye Grass Hybrid	A	grass	
* <i>Parapholis incurva</i>	Poaceae	Coast Barb Grass	A	grass	
* <i>Vulpia muralis</i>	Poaceae		A	grass	
<i>Comesperma integerrimum</i>	Polygalaceae	Milkwort	P	twining shrub	
<i>Calandrinia eremaea</i>	Portulacaceae	Small Purslane, Twining Purslane	A	herb	
<i>Potamogeton ochreatus</i>	Potamogetonaceae	Blunt Pondweed	P	aquatic herb	
<i>Hakea preissii</i>	Proteaceae	Needle Tree	P	shrub	
<i>Glossostigma drummondii</i>	Scrophulariaceae	Mudmat	A	herb	

APPENDIX IV: PLANT SPECIES OCCURRENCES BY QUADRATS AND PLANT COMMUNITIES

This list shows all taxa listed according to the quadrats on which they were found in Oak Park Reserve and the adjoining Fresh-water Claypan. The taxa are listed alphabetically by genus and the quadrats are grouped according to vegetation type (plant community in which they occurred).

KEY

Column 1 Botanical Name

* 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 Species occurrences on each quadrat, grouped by vegetation type

The species located on or adjacent to each quadrat is indicated. There is a column for each of the quadrats.

1,2,... plant species occurs in quadrats 1 and 2 ...

1a, 2a, ... plant species was recorded outside the quadrat but nearby in the same community

+ plant species was recorded within the study area but not on or adjacent to a quadrat
(an opportunistic collection)

Vegetation types are denoted by the letter as per text in report and are as follows:

T	Tamar (<i>Allocasuarina campestris</i>) Open Shrublands
J	Jam (<i>Acacia acuminata</i>) Low Open Woodlands
Y	York Gum (<i>Eucalyptus loxophleba</i>) Tree Mallee over Shrublands
C	Fresh Claypans supporting Sedgelands
L	Lake Dune: Mixed Open Shrubland, Herbland and Open Sedgeland with scattered <i>Banksia prionotes</i>
M	<i>Melaleuca</i> Tall Open Scrub
S	Swamp She-oak (<i>Casuarina obesa</i>) Low Woodlands
H	Samphire Flats (<i>Halosarcia</i> species Low Shrublands)
D	Disturbed areas (D)

APPENDIX IV: PLANT SPECIES ACCORDING TO QUADRAT AND PLANT COMMUNITY, OAK PARK RESERVE AND ADJOINING CLAYPAN

Botanical name	Family	Common name	Quadrats												
			1	2	11	9	3	10	4	13	6	5	7	8	OPP
<i>Acacia acutaria</i>	Mimosaceae		T		J		Y		C		L	M	H		
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	Mimosaceae	Jam	1	2	11	9	3	10	4						
<i>Acacia brumalis</i>	Mimosaceae					9a									+
<i>Acacia erinacea</i>	Mimosaceae						3a	10							
<i>Acacia latipes</i> subsp. <i>latipes</i>	Mimosaceae			+											
<i>Acacia ligustrina</i>	Mimosaceae	Manna Wattle				9a	10								+
<i>Acacia microbotrya</i>	Mimosaceae				+										
<i>Acacia restiacea</i>	Mimosaceae				+										
<i>Acacia saligna</i>	Mimosaceae	Kudjong, Orange Wattle			+						+				
<i>Acacia</i> sp.	Mimosaceae				+										
<i>Acanthocarpus caudiculatus</i>	Dasyopogonaceae						+								
<i>Actinobole uliginosum</i>	Asteraceae	Flannel Cudweed				9a	10					5a			
<i>Agrostis avenacea</i>	Poaceae	Blown Grass								13					
<i>Agrostis preissii</i>	Poaceae	Bent Grass						4							
* <i>Aira caryophyllea</i>	Poaceae	Silvery Hairgrass	1		11	9	10	4	13						
<i>Allocasuarina campestris</i>	Casuarinaceae	Tamar	1												
<i>Amphibromus nervosus</i>	Poaceae	Swamp Wallaby Grass						4	13						
<i>Amphipogon strictus</i>	Poaceae	Greybeard Grass	1	2	11										
<i>Amphipogon turbinatus</i>	Poaceae	Greybeard Grass									6				
<i>Anyema miraculosa</i> subsp. <i>miraculosa</i>	Loranthaceae	Mistletoe	1a		11		3a	10a							
* <i>Anagallis arvensis</i> var. <i>caerulea</i>	Primulaceae	Pimpernel				9a	3	4							
<i>Anigozanthos humilis</i>	Haemodoraceae	Catspaw			+										
<i>Aphelia brizula</i>	Centrolepidaceae														
<i>Apium annuum</i>	Apiaceae														
* <i>Arctotheca calendula</i>	Asteraceae	Capeweed	1	2	11	9	3	10	4	13			7	8	
<i>Aristida contorta</i>	Poaceae	Bunched Kerosene Grass				9a					6			8	
<i>Astroloma serratifolium</i>	Epacridaceae	Kondrung	1		11										

Quadrats

Botanical name	Family	Common name													
			1	2	11	9	3	10	4	13	6	5	7	8	OPP
			T	J		Y	C	L	M	H					
<i>Austrodanthonia acerosa</i>	Poaceae	Wallaby Grass		2	11										
<i>Austrodanthonia setacea</i>	Poaceae	Wallaby Grass					4								
<i>Austrodanthonia</i> sp. Goomalling (Gunness	Poaceae	Wallaby Grass													
<i>Austrostipa elegantissima</i> et al. OAKP10/63)	Poaceae	Feather Spear Grass	1	2	11	9	3	10	13	6	5				
<i>Austrostipa eremophila</i>	Poaceae	Desert Spear Grass			11										
<i>Austrostipa hemipogon</i>	Poaceae	Spear Grass	1	+											
<i>Austrostipa macalpinei</i>	Poaceae	Golden Spear Grass				9									
<i>Austrostipa tenuifolia</i>	Poaceae	Spear Grass		2	11		4	6							
<i>Austrostipa trichophylla</i>	Poaceae	Spear Grass		2		9	3	6							
<i>Austrostipa variabilis</i>	Poaceae	Variable Spear Grass				9									
* <i>Avena barbata</i>	Poaceae	Bearded Oat		2		9	3	10	6					8	
* <i>Avena fatua</i>	Poaceae	Wild Oat	1												
<i>Baeckea crispiflora</i>	Myrtaceae			+	11a										
<i>Banksia prionotes</i>	Proteaceae	Acorn Banksia													
<i>Blennospora drummondii</i>	Asteraceae					3	10	4							
<i>Blennospora phlegmatocarpa</i>	Asteraceae					3					5				
<i>Borya laciniata</i>	Boryaceae	Pincushions				9					6				
<i>Borya sphaerocephala</i>	Boryaceae	Pincushions	1	2	11										
<i>Brachyscome bellidioides</i>	Asteraceae														
<i>Brachyscome ciliaris</i>	Asteraceae	Variable Daisy										5a			
<i>Brachyscome iberidifolia</i>	Asteraceae	Swan River Daisy				9									
<i>Brachyscome perpusilla</i>	Asteraceae	Tiny Daisy				9a	3	10	4						
* <i>Briza maxima</i>	Poaceae	Blowfly Grass, Large Quaking Grass	1	2	11	9	3	10	4	6					
* <i>Bromus diandrus</i>	Poaceae	Great Brome													
* <i>Bromus hordeaceus</i>	Poaceae	Soft Brome													
* <i>Bromus rubens</i>	Poaceae	Red Brome												8	
<i>Brunonia australis</i>	Brunoniaceae	Native Cornflower, Blue Pincushion				9	3	10	4						

Quadrats

Botanical name	Family	Common name	1	2	11	9	3	10	4	13	6	5	7	8	OPP
			T	J	Y	C	L	M	H						
<i>Bulbine semibarbata</i>	Asphodelaceae	Leek Lily					3			13					
<i>Burchardia umbellata</i>	Colchicaceae	Milkmaids	1	2	11										
<i>Caesia alfordii</i>	Anthericaceae		1					10							
<i>Caesia occidentalis</i>	Anthericaceae				+										
<i>Caladenia denticulata</i>	Orchidaceae	Yellow Spider Orchid		+											+
<i>Caladenia exilis</i> subsp. <i>exilis</i>	Orchidaceae	Salt Lake Spider Orchid													
<i>Caladenia flava</i> subsp. <i>flava</i>	Orchidaceae	Cowslip Orchid								6					
<i>Caladenia footeana</i>	Orchidaceae	Crimson Spider Orchid													+
<i>Caladenia hirta</i> subsp. <i>hirta</i>	Orchidaceae	Sugar Candy Orchid				9	3								+
<i>Caladenia hirta</i> subsp. <i>rosea</i>	Orchidaceae	Pink Candy Orchid													+
<i>Caladenia hirta</i> subsp. <i>rosea</i> hybrid	Orchidaceae	Pink Candy Orchid				9									+
<i>Caladenia longicauda</i> subsp. <i>eminens</i>	Orchidaceae	Large White Spider Orchid				9									+
<i>Caladenia radialis</i>	Orchidaceae	Drooping Spider Orchid													
<i>Caladenia roei</i>	Orchidaceae	Ant Orchid					+								
<i>Calandrinia eremaea</i>	Portulacaceae	Small Purslane, Twining Purslane				9	3		4	13		5			
<i>Calandrinia granulifera</i>	Portulacaceae	Pygmy Purslane					3	10	4		6	5a	7	8	
<i>Calandrinia</i> sp. Needilup (K.R. Newbey 4892)	Portulacaceae	Purslane													
<i>Calotis hispidula</i>	Asteraceae	Bindy Eye													+
<i>Calytrix angulata</i>	Myrtaceae	Yellow Starflower			+						6				1
<i>Calytrix leschenaultii</i>	Myrtaceae	Starflower									6a				
<i>Cassytha glabella</i>	Lauraceae	Tangled Dodder Laurel			11										
<i>Casuarina obesa</i>	Casuarinaceae	Swamp She-oak								13				8a	
<i>Centaurium erythraea</i>	Gentianaceae	Common Centaury												8	
<i>Centrolepis alepyroides</i>	Centrolepidaceae		2										7		
<i>Centrolepis drummondiana</i>	Centrolepidaceae		2												
<i>Centrolepis glabra</i>	Centrolepidaceae	Smooth Centrolepis												8	
<i>Centrolepis humillima</i>	Centrolepidaceae	Dwarf Centrolepis				3	10						7	8	

Quadrats

Botanical name	Family	Common name													
			1	2	11	9	3	10	4	13	6	5	7	8	OPP
			T	J	Y	C	L	M	H						
<i>Centrolepis pilosa</i>	Centrolepidaceae			11							6				
<i>Centrolepis polygyna</i>	Centrolepidaceae	Wiry Centrolepis			3	4							7	8	
<i>Ceratogyne obionoides</i>	Asteraceae	Wingwort	2	11	9										
<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	Anthericaceae	Blue Squill	1	2	11	3	4								
<i>Chamaelaucium micranthum</i>	Myrtaceae	Wax Flower										5			
<i>Chorizandra enodis</i>	Cyperaceae	Black Bristlerush					4	13							
<i>Chorizema genistoides</i>	Papilionaceae	Flame Pea	1a	+											
<i>Clematis delicata</i> ms	Ranunculaceae	Clematis			+										
<i>Comesperma integririmum</i>	Polygalaceae	Milkwort	1	2	3	10	4	13							
<i>Comesperma scoparium</i>	Polygalaceae	Broom Milkwort			10a										
<i>Conostylis aculeata</i> subsp. <i>aculeata</i>	Haemodoraceae	Prickly Conostylis									6a	5a			
<i>Conostylis prolifera</i>	Haemodoraceae	Mat Cottonheads	2			4a									
<i>Corynotheca micrantha</i>	Anthericaceae										6				
* <i>Cotula bipinnata</i>	Asteraceae	Ferny Cotula								13			7	8	
<i>Cotula coronopifolia</i>	Asteraceae	Waterbuttons					4	13					7a		
<i>Cotula cotuloides</i>	Asteraceae	Smooth Cotula											7	8	
<i>Crassula colorata</i> var. <i>acuminata</i>	Crassulaceae	Dense Crassula												8	
<i>Crassula colorata</i> var. <i>colorata</i>	Crassulaceae	Dense Crassula									6		7		
<i>Crassula decumbens</i> var. <i>decumbens</i>	Crassulaceae	Rufous Stonecrop			9	3	10								
* <i>Crassula natans</i> var. <i>minus</i>	Crassulaceae	Australian Crassula			9										
<i>Crassula pedunculata</i>	Crassulaceae	Purple Stonecrop								13					
<i>Cryptandra myriantha</i>	Rhamnaceae			+											
<i>Cyanicula gemmata</i>	Orchidaceae	Blue China Orchid	1												
<i>Dampiera lavandulacea</i>	Goodeniaceae	Lavender Dampiera	1	2	11	9	10				6a				
<i>Daucus glochidiatus</i>	Apiaceae	Native Carrot													
<i>Daviesia benthamii</i> subsp. <i>benthamii</i>	Papilionaceae				3										
<i>Desmodium asper</i>	Restionaceae		2	11a											

Quadrats

Botanical name		Family	Common name												
			T	J	Y	C	L	M	H	OPP					
			1	2	11	9	3	10	4	13	6	5	7	8	
			1	2	11	9	10		6						
			1	2		3	10	4							
			2a										7	8	
			1	2	11		4								
			1	2a		3	4								
			1												
			1	2a			4a							+	
							10		6	5	7	8			
									13						
									13						
														+	
														8	
														8	
						9a	3	10							
						3	10								
														+	
						9	3	10	4		6			+	
								10	4						
						9a	3	10		13		(5)			
								4							
								10a							
			1	2	11	9	3		4						

Quadrats

Botanical name	Family	Common name	Quadrats												
			1	2	11	9	3	10	4	13	6	5	7	8	OPP
			T		J		Y		C		L	M	H		
<i>Gnephosis tridens/uniflora</i>	Asteraceae		1	2	11	9							8		
<i>Gonocarpus nodulosus</i>	Haloragaceae		1a	2			3	10	4						
<i>Goodenia hercandiana</i>	Goodeniaceae														
<i>Goodenia micrantha</i>	Goodeniaceae														
<i>Goodenia pusilliflora</i>	Goodeniaceae	Smallflower Goodenia							4a	13					
<i>Grevillea hakeoides</i> subsp. <i>hakeoides</i>	Proteaceae						3		4		6a				
<i>Grevillea paniculata</i>	Proteaceae		2		11										
<i>Hakea preissii</i>	Proteaceae	Needle Tree				9	3a	10	4	13					
<i>Hakea prostrata</i>	Proteaceae	Harsh Hakea			+										
<i>Halosarcia indica</i> subsp. <i>bidens</i>	Chenopodiaceae	Samphire													
<i>Halosarcia lepidosperma</i>	Chenopodiaceae	Samphire											8		
<i>Halosarcia pergranulata</i>	Chenopodiaceae	Samphire											7	8	
<i>Harperia lateriflora</i>	Restionaceae				11								7		
<i>*Hordeum geniculatum</i>	Poaceae	Mediterranean Barley Grass								13			7	8	
<i>Hyalochlamys globifera</i>	Asteraceae										6		7	8	
<i>Hyalosperma demissum</i>	Asteraceae										6				
<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>	Asteraceae		1a			9	3	10							
<i>Hydrocotyle callicarpa</i>	Apiaceae	Small Pennywort	1	2	11										
<i>Hydrocotyle pilifera</i> var. <i>glabrata</i>	Apiaceae	Pennywort					3	10	4						
<i>Hydrocotyle rugulosa</i>	Apiaceae	Pennywort													
<i>*Hypochoeris glabra</i>	Asteraceae	Flat Weed, Smooth Cat's-ear	1	2	11	9	3	10	4	13	6	5		8	
<i>Hypoxis glabella</i> var. <i>leptantha</i>	Hypoxidaceae	Tiny Star													
<i>Isolepis congrua</i>	Cyperaceae									13					
<i>*Isolepis marginata</i>	Cyperaceae	Coarse Club-rush					3		4						
<i>Isotoma hypocrateriformis</i>	Lobeliaceae	Woodbridge Poison	1						4						
<i>Isotropis juncea</i>	Papilionaceae	Slender Lamb Poison							4a						
<i>*Ixia maculata</i>	Iridaceae	Yellow Ixia	2		11										+

Quadrats

Botanical name	Family	Common name	1	2	11	9	3	10	4	13	6	5	7	8	OPP
			T	J	Y	C	L	M	H						
<i>Jacksonia fasciculata</i>	Papilionaceae	Toad Rush									6a				
* <i>Juncus bufonius</i>	Juncaceae														
<i>Juncus radula</i>	Juncaceae														
<i>Keraudrenia integrifolia</i>	Sterculiaceae	Common Fire-bush			11a										
<i>Lawrencella rosea</i>	Asteraceae		1	2	11	9	3	10	4					7	8
<i>Lepidobolus preissianus</i>	Restionaceae	Chaff Rush			11	9					6				
<i>Lepidosperma costale</i>	Cyperaceae		2		11a										
<i>Leporella fimbriata</i>	Orchidaceae	Hare Orchid			11										
<i>Leptospermum erubescens</i>	Myrtaceae	Roadside Tea-tree			+										
<i>Levenhookia dubia</i>	Stylidiaceae	Hairy Stylewort			11a			10							
<i>Lobelia heterophylla</i>	Lobeliaceae	Wing-seeded Lobelia	1	2			3								
<i>Lobelia tenuior</i>	Lobeliaceae	Slender Lobelia	1	2			3								
* <i>Lolium multiflorum</i> x <i>L. perenne</i>	Poaceae	Rye Grass Hybrid													
* <i>Lolium perenne</i> x <i>L. rigidum</i>	Poaceae	Rye Grass Hybrid							4	13			7	8	
* <i>Lolium rigidum</i>	Poaceae	Annual or Wimmera Rye Grass					3								
<i>Lomandra effusa</i>	Dasyopogonaceae	Scented Matrush		2a	11		3	10							
<i>Lomandra</i> sp.	Dasyopogonaceae	Matrush			11				4						
* <i>Lupinus cosentinii</i>	Papilionaceae	Australian Blue Lupin	1												
<i>Maireana marginata</i>	Chenopodiaceae						3	10							+
* <i>Malva parviflora</i>	Malvaceae	Small-flowered Mallow, Marshmallow*													
<i>Marsilea drummondii</i>	Marsileaceae	Common Nardoo								13					+
<i>Melaleuca adnata</i>	Myrtaceae								+						
<i>Melaleuca hamulosa</i>	Myrtaceae														
<i>Melaleuca lateriflora</i> subsp. <i>lateriflora</i>	Myrtaceae											5			
<i>Melaleuca uncinata</i>	Myrtaceae											5		8a	
<i>Millotia major</i>	Myrtaceae	Broom Bush, Kwidjard					3a	10a		13a		5		8	
<i>Mirbelia ramulosa</i>	Asteraceae						3								
	Papilionaceae		1a	2											

Quadrats

Botanical name	Family	Common name														
			1	2	11	9	3	10	4	13	6	5	7	8	OPP	
T	J	Y	C	L	M	H										
<i>Monachather paradoxus</i>	Poaceae	Bandicoot Grass		11	9											
<i>Muehlenbeckia adpressa</i>	Polygonaceae	Climbing Lignum														
<i>Myriocephalus occidentalis</i>	Asteraceae												7			
<i>Myriophyllum drummondii</i>	Haloragaceae	Milfoil														
<i>Neurachne alopecuroides</i>	Poaceae	Foxtail Mulga Grass														
<i>Olearia dampieri</i> subsp. <i>eremicola</i> ms	Asteraceae	Inland Daisy Bush	1	2	11	9	3a	10	4		6	5				
<i>Opercularia vaginata</i>	Rubiaceae	Dog Weed	1	2	11	9a	3	10	4		6	5				
<i>Ophioglossum lusitanicum</i>	Ophioglossaceae	Adder's Tongue	1	2	11				4		6a					
<i>Opuntia stricta</i>	Cactaceae	Common Prickly Pear		2												
<i>Orobancha minor</i>	Orobanchaceae	Lesser Broomrape														
<i>Orthrosanthus laxus</i> var. <i>laxus</i>	Iridaceae	Morning Iris		+										+		
<i>Osteospermum clandestinum</i>	Asteraceae	Stinking Roger				9					6	5		8		
<i>Oxalis perennans</i>	Oxalidaceae	Wood Sorrel					3									
<i>Parapholis incurva</i>	Poaceae	Coast Barb Grass														
<i>Parentucellia latifolia</i>	Scrophulariaceae	Common Bartsia	1	2		9	3	10	4	13			7	8		
<i>Parietaria cardostegia</i>	Urticaceae	Pellitory														
<i>Pelargonium havilae</i>	Geraniaceae					9	3a	10								
<i>Pentaschistis airoides</i>	Poaceae	False Hairgrass				9					6	5		+		
<i>Persoonia chapmaniana</i>	Proteaceae															
<i>Phyllanthum sulcatum</i>	Loganiaceae								+							
<i>Ptilularia novae-hollandiae</i>	Marsileaceae	Austral Pillwort	1	11	9	3										
<i>Plantago coronopus</i> subsp. <i>commutata</i>	Plantaginaceae	Buckshorn Plantain														
<i>Plantago debilis</i>	Plantaginaceae	Plantain														
<i>Platysace maxwellii</i>	Apiaceae	Karno, Native Potato			11				4a							
<i>Podolepis canescens</i>	Asteraceae	Bright or Grey Podolepis														
<i>Podolepis capillaris</i>	Asteraceae	Wiry Podolepis	2	11	9	3a			4		6	5				
<i>Podolepis lesssonii</i>	Asteraceae				9	3	10	4								
			1			3		4								

Quadrats

Botanical name	Family	Common name													
			1	2	11	9	3	10	4	13	6	5	7	8	OPP
<i>Podolepis tepperi</i>	Asteraceae		T												
<i>Podolheca angustifolia</i>	Asteraceae	Sticky Longheads			11			10			6				
<i>Podolheca gnaphalioides</i>	Asteraceae	Golden Longheads			11	9	3	10			6	5			
<i>Pogonolepis stricta</i>	Asteraceae														
* <i>Polypogon monspeliensis</i>	Poaceae	Annual Barbrgrass							4	13				8	
<i>Potamogeton ochreatus</i>	Potamogetonaceae	Blunt Pondweed								13					+
<i>Prasophyllum cyphochilum</i>	Orchidaceae	Pouched Leek Orchid	1a		11										
<i>Prasophyllum gracile</i>	Orchidaceae	Leek Orchid							4						
<i>Prasophyllum sp.</i>	Orchidaceae	Leek Orchid		2											
<i>Ptilotus declinatus</i>	Amaranthaceae	Curved Mulla Mulla		2					4a						
<i>Ptilotus divaricatus</i> var. <i>divaricatus</i>	Amaranthaceae	Climbing Mulla Mulla					+								
<i>Ptilotus drummondii</i> var. <i>drummondii</i>	Amaranthaceae	Pussytail, Narrowleaf Mulla Mulla		2											
<i>Ptilotus humilis</i> var. <i>humilis</i>	Amaranthaceae	Mulla Mulla													
<i>Ptilotus polystachyus</i>	Amaranthaceae	Prince of Wales Feather, Bottlewasher			11a										
<i>Ptilotus spathulatus</i>	Amaranthaceae							10a							
<i>Quinetia urvillei</i>	Asteraceae										6				
* <i>Raphanus raphanistrum</i>	Brassicaceae	Wild Radish													+
<i>Rhagodia drummondii</i>	Chenopodiaceae		1a			9	3	10	4	13	6	5			
<i>Rhagodia preissii</i> subsp. <i>preissii</i>	Chenopodiaceae							10							
<i>Rhodanthe citrina</i>	Asteraceae														
<i>Rhodanthe laevis</i>	Asteraceae	Smooth Sunray	1												+
<i>Rhodanthe manglesii</i>	Asteraceae	Pink Sunray	1				3	10							
<i>Rhodanthe pygmaea</i>	Asteraceae		1	2	11		3								
* <i>Romulea rosea</i>	Iridaceae	Guildford Grass					3								+
<i>Santalum acuminatum</i>	Santalaceae	Quandong													+
<i>Santalum spicatum</i>	Santalaceae	Sandalwood													
<i>Scaevola spinescens</i>	Goodeniaceae	Currant Bush	1a	2a	11										
						9a	3	10	4						

Quadrats

Botanical name	Family	Common name	Quadrats												
			1	2	11	9	3	10	4	13	6	5	7	8	OPP
<i>Scaevola tortuosa</i>	Goodeniaceae	Tortuous-stem Scaevola	T												
<i>Schoenus capillifolius</i> sp. Beaufort (G.J.)	Cyperaceae					9									
<i>Schoenus clandestinus</i>	Cyperaceae		1	2	11					13					
<i>Schoenus humilis</i> plumosus	Cyperaceae														
<i>Schoenus nanus</i>	Cyperaceae	Tiny Bog-rush												8a	
<i>Schoenus sculpius</i>	Cyperaceae	Gimlet Bog-rush		2	11		3								
<i>Schoenus subfascicularis</i>	Cyperaceae														
<i>Schoenus tenellus</i>	Cyperaceae					9a					6	5		8	
<i>Scholtzia ?parviflora</i>	Myrtaceae								4						
<i>Sebaea ovata</i>	Gentianaceae	Yellow Sebaea							4			5		8	
<i>Senecio glossanhus</i>	Asteraceae	Slender Groundsel					3								
* <i>Silene gallica</i> var. <i>gallica</i>	Caryophyllaceae	French Catchfly													
* <i>Sonchus oleraceus</i>	Asteraceae	Common Sowthistle				9	3		4			5	7	8	+
* <i>Spergularia rubra</i>	Caryophyllaceae	Sand Spurry												7	8
<i>Stenanthemum tridentatum</i>	Rhamnaceae				+										
<i>Stylidium calcaratum</i>	Stylidiaceae	Book Triggerplant		2											
<i>Stylidium ecorne</i>	Stylidiaceae	Foot Triggerplant							4a						
<i>Stylidium inundatum</i>	Stylidiaceae	Hundreds and Thousands							4						
<i>Stylidium leptophyllum</i>	Stylidiaceae	Needle-leaved Triggerplant		+					4						
<i>Stylidium petiolare</i>	Stylidiaceae	Horn Triggerplant	1	2											
<i>Stylobasium australe</i>	Surianaceae														
<i>Templetonia sulcata</i>	Papilionaceae	Kerosene Bush				9	3	10	4						
<i>Thehymitra antemifera</i>	Orchidaceae	Vanilla Orchid, Lemon Orchid	1	2	11	9a	3a	10							
<i>Thehymitra villosa</i>	Orchidaceae	Custard Orchid	1a												
<i>Thysanotus manglesianus</i>	Anthericaceae	Fringed Lily				9	3								
<i>Trachymene cyanopetala</i>	Apiaceae		1	2	11	9a	3	10	4						
<i>Trachymene ornata</i>	Apiaceae	Spongefruit		2	11	9a	3	10	4	13		5			

Quadrats

Botanical name	Family	Common name	Quadrats												
			1	2	11	9	3	10	4	13	6	5	7	8	OPP
<i>Trachymene pilosa</i>	Apiaceae	Native Parsnip	T												
<i>Tribonanthes longipetala</i>	Haemodorraceae														
<i>Tricoryne tenella</i>	Anthericaceae			2			9	3	4	13a		5			
* <i>Trifolium arvense</i>	Papilionaceae	Hare's Foot Clover		2	11										+
* <i>Trifolium glomeratum</i>	Papilionaceae	Cluster Clover, Ball Clover													+
* <i>Trifolium hirtum</i>	Papilionaceae	Rose Clover													+
* <i>Trifolium subterraneum</i>	Papilionaceae	Subterranean Clover	1												+
* <i>Trifolium tomentosum</i>	Papilionaceae	Woolly Clover							4	13				8	
<i>Triglochin mucronata</i>	Juncaginaceae	Prickly Arrowgrass								13			7	8	
<i>Triglochin nana</i>	Juncaginaceae	Arrowgrass												8	
<i>Triglochin</i> sp. A. Flora of Australia (G.J. Keighley 2477)	Juncaginaceae									13					
<i>Triglochin</i> sp. aff. <i>calcutrapa</i>	Juncaginaceae	A Spurred Arrowgrass					3	10	4	13					
<i>Trithuria bibracteata</i>	Hydatellaceae									13					
* <i>Triticum aestivum</i>	Poaceae	Wheat		2	11										
* <i>Ursinia anthemoides</i>	Asteraceae	Ursinia		2	11		9	3	4		6	5			
<i>Velleia cynoplotamica</i>	Goodeniaceae		1		11				4						
<i>Velleia</i> sp. aff. <i>cynoplotamica</i>	Goodeniaceae			2											
<i>Verticorelia chrysanthella</i>	Myrtaceae	Feather Flower		+	+										
* <i>Vulpia muralis</i>	Poaceae						9	3		13					
* <i>Vulpia myuros</i> var. <i>megallura</i>	Poaceae	Rat's Tail Fescue			11										
* <i>Vulpia myuros</i> var. <i>myuros</i>	Poaceae	Rat's Tail Fescue	1	2											
* <i>Wahlenbergia capensis</i>	Campanulaceae	Cape Bluebell					9a		4		6	5			
<i>Wahlenbergia preissii</i>	Campanulaceae	Annual Bluebell		2			9	3	10		6				
<i>Waitzia acuminata</i> var. <i>acuminata</i>	Asteraceae	Orange Immortelle	1	2	11		9	3							
<i>Waitzia acuminata</i> var. <i>albicans</i>	Asteraceae			+											
<i>Wilsonia humilis</i>	Convolvulaceae	Silky Wilsonia												8	
<i>Wurmbea</i> sp. probably <i>W. tenella</i>	Colchicaceae	Eight Nancy		2					4	13a					

APPENDIX V: 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.