

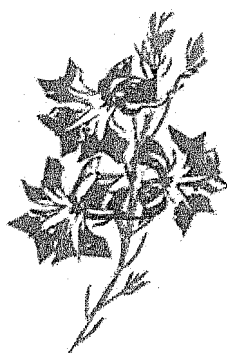
A SURVEY OF VEGETATION AND FLORA

WOGARL RESERVE

in the

GRABALL CATCHMENT

Shire of Narembeen



Wildflower Society Logo:
Lechenaultia biloba

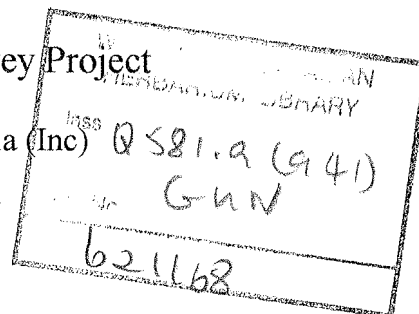
by

Ann G. Gunness
and

Volunteers of the Bushland Plant Survey Project

Wildflower Society of Western Australia (Inc)
PO Box 64 Nedlands WA 6909

April 2002



This project was supported by funds from the Bushcare Program of the Natural Heritage Trust (1999-2000). Support was also provided by the Western Australian Department of Conservation and Land Management.

TABLE OF CONTENTS

	Page
Summary	1
1. Introduction	2
2. The Study Area	3
Location	3
Climate	4
Landforms and soils	4
Vegetation	4
3. Survey Method	9
4. Vegetation	11
Plant Communities and the Vegetation Map	11
Discussion	21
Vegetation condition	21
5. Flora	22
Species of Special Interest	23
Declared Rare and Priority flora	23
Geographically significant flora	24
Taxonomically significant flora	26
Weeds	29
The Field Herbarium	29
6. Discussion	32
Conservation Values	32
Management considerations	34
Weed prevention and control	34
Restoration and revegetation	35
Other disturbances	36
Management checklist	36
7. Conclusion	37
8. Acknowledgments	38
9. References	39
 Appendices:	
Appendix I: Site vegetation descriptions and condition (by plant community)	42
Appendix II: Plant species list for Wogarl Reserve	48
Appendix III: Plant species occurrences on the quadrats grouped by plant community	61
Appendix IV: Categories relating to threatened species	76

SUMMARY

- The survey has helped to achieve the purposes of involving the community in a project aimed at hands on learning about plants in bushland and bushland conservation. Thirty volunteers and botanists from the Wildflower Society of Western Australia and 8 members of the local Narembeen community participated in fieldwork and 11 Wildflower Society volunteers helped in post survey work.
- Twenty-one permanent 10x10 metre quadrats have been established in Wogarl Reserve.
- Eight plant communities have been recognised in the 280 hectares (approximately) of the Reserve.
- 333 native plant taxa (species, subspecies and varieties) from 56 families were recorded in the Reserve.
- Ten priority species and one unrecognised taxon (sp. nov.) were recorded in this survey:
 - *Melaleuca grieviana* (Priority 1)
 - *Acacia lirellata* subsp. *compressa* (Priority 2)
 - *Conostylis albescens* (Priority 2)
 - *Cryptandra dielsii* (Priority 2)
 - *Verticordia multiflora* subsp. *solox* (Priority 2)
 - *Euryomyrtus leptospermoides* (Priority 3)
 - *Leucopogon sulcatus* (Priority 3)
 - *Micromyrtus racemosa* variety *carinata* ms (Priority 3)
 - *Verticordia mitodes* (Priority 3)
 - *Grevillea asteriscosa* (Priority 4)
 - *Eutaxia* sp. nov. Wogarl (A. Gunness *et al.* sn.) (undescribed taxon)
- At least fourteen species were found outside or at the limit of their currently known range or have a limited distribution.
- Eighteen introduced species (weeds) were recorded (only 5% of the total taxa).
- A field herbarium containing most of the species recorded in the survey has been presented to the Narembeen LCDC.
- The Reserve has high conservation value in a shire that retains only 8 percent of its native vegetation. It supports a range of vegetation types, in excellent condition, which are a reflection of the soil, landscape position and climate along with the clearing and fire history of the Reserve.
- The most serious threats to the condition and conservation values of the Reserve are the man made disturbances of drains, tracks and gravel pits and the associated nodes of weed invasion.

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 Narembeen LCDC, represented by the community Landcare coordinator Shane Lyons, applied for a survey to be carried out in the 280 hectares of Wogarl Reserve in the Graball Catchment in the Shire of Narembeen. The "reserve" on the old Wogarl Townsite is currently unallocated Crown land. The bushland is bisected by the railway line on which is located a CBH grain terminal. The intention of the Narembeen LCDC is to gain management of the area with the aim of covenanting the bushland areas outside the CBH terminal. It is locally perceived as having high conservation value. This survey was seen as part of the process of education of the community, providing benchmark data for management and covenanting processes and for providing data for rehabilitation projects in the area. The reserve forms part of a project that aims to link and protect bushland remnants in the Graball Catchment. That project's primary aim is to ensure long term survival of Malleefowl in the region.

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 only 8% of the area of the Shire of Narembeen still retains original native vegetation on public and private land (Beeston *et al.* 1994). Salinity is probably the greatest environmental threat facing Western Australia. 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 2000. Wildflower Society volunteers and a coordinating botanist travelled to the 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 Shane 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 Landcare 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.

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 (1999-2000). The Department of Conservation and Land Management and the Wildflower Society also provided support.

2. THE STUDY AREA

LOCATION

Wogarl Reserve is located 22.5 kilometres NNE of Narembeen at the junction of Wogarl-Graball road, West Wogarl road, Coverley road and Wogarl-Muntadgin road (Figure 1). Narembeen is approximately 300 kilometres by road east of Perth. The study area is in the eastern wheatbelt in Narembeen Shire, within the Lockhart Catchment (Figure 3). Agricultural land use in the area is mainly broadacre farming (cropping of wheat, barley, canola and lupins and sheep grazing).

The reserve falls near the boundary of the Yilgarn and Lockhart catchments that are part of the vast Avon River Drainage Basin. The Yilgarn and Lockhart Catchments have a low relief with large open valleys, poorly defined drainage lines and chains of salt lakes (Avon River Management Authority (ARMA) 1993).

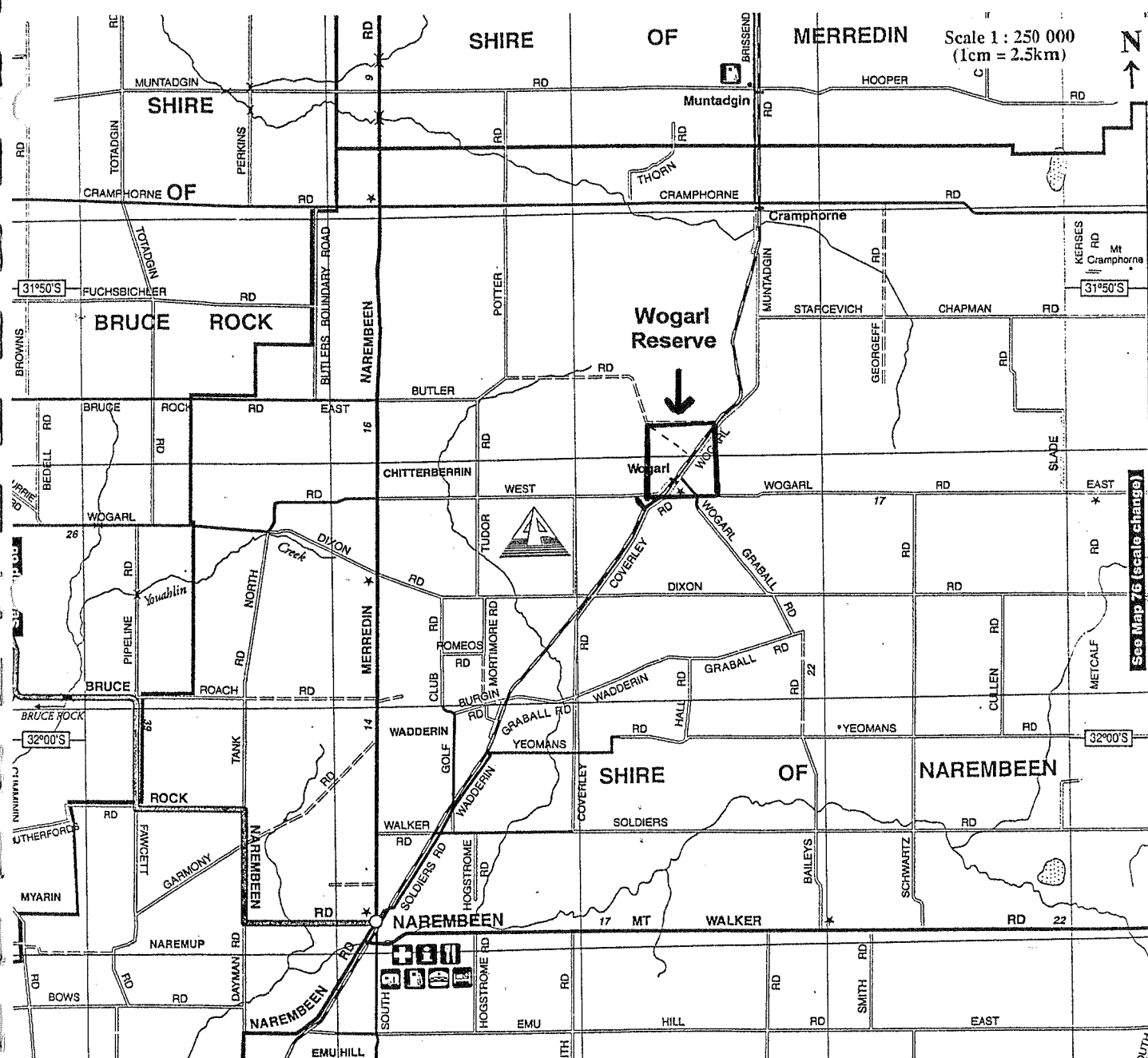


Figure 1: Locality Map for Wogarl Reserve, Narembeen. (Source: The West Australian Traveller's Atlas, Edition 3, 2000)

CLIMATE

The climate is dry warm Mediterranean, characterised by cool, wet winters and hot dry summers with 7–8 dry months per year. The growing season rainfall for the region can be highly variable. Two climatic systems give rise to rainfall in the eastern wheatbelt: southern frontal systems which pass from west to east; and rain from tropical air. The wettest months are May to August when rain is associated with the passage of winter cold fronts. Thunderstorms may locally provide rain during summers. Average annual rainfall at Narembeen is 335mm with 56 per cent falling during the 4 months from May to August inclusive (73 year average). The average maximum temperatures range from 33.7°C in January to 16.4°C in July and average minimum temperatures from 16.6°C in January to 5.3°C in August (Commonwealth of Australia 2001, Bureau of Meteorology).

LANDFORMS AND SOILS

The study area falls on the huge geological formation known as the Yilgarn block which is bounded by the Darling Fault in the west and by the greenstone belts of the Southern Cross and Murchison districts in the east. Precambrian rocks of ancient granites and gneisses which are approximately 2900–2500 million years old are the underlying bedrock. A lateritic duricrust (a hardened ironstone surface layer formed of quartz, iron oxide, alumina and clay pellets strongly cemented together) which developed during the Cretaceous and early Tertiary eras, covered the area. This surface has decayed and been extensively eroded and in the study area the remnants of this laterite blanket are expressed as 'gently rolling sandplains, small plateaux of laterite above breakaways and gently inclined laterite slopes passing down into valleys' (Gee 1982). There are occasional tors of outcropping granite (the underlying bedrock) such as Muntadgin rock. Valleys are broad and lack clearly defined watercourses. Long shallow straight valleys alternate with broad interfluves.

The soils of the study area tend to consist of areas of colluvium and sheetwash. The valleys contain red loam soils and the interfluves are mantled with sand of varying thickness often overlying or exposing the laterite duricrust. The sands are derived from the decomposition and erosion of the Tertiary laterite. The geological units as per Gee (1982) for the Wogarl Reserve are:

- Qc clay, silt, sand: buff or red with quartz fragments and calcareous nodules, mainly colluvial deposits.
- Ts clean sand, yellow to white, containing scattered limonite nodules, remnant of extensive tertiary sandplain.
- Tl laterite, limonite nodules in cemented matrix, grades upwards into Ts and downwards into weathered bedrock.

VEGETATION

Vegetation in Western Australia has been described on a broad scale in a series of publications by Beard (eg. Beard 1972, 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 eastern central (outer) Wheatbelt Region of the South-west Botanical Province (Beard 1981, 1990) in the Muntadgin Vegetation System (Beard 1972). 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).

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.

The Muntadgin Vegetation System (Beard 1972) occupies relatively high lying country with large areas of residual sandplain forming part of an old plateau surface, dissected by shallow valleys draining to the west and north west. The vegetation of the sandplains consists of dense thickets of shrubs rarely exceeding 2.5 metres in height. There are many granite outcrops (though not within this study). The valleys contain red brown sandy loams overlying clay which carry a Mallee vegetation. If the clay is close to the surface the Mallee changes to Woodland. Most of Beard's mapping of original vegetation was deduced from vegetation on roadsides. The original vegetation types included:

- Mallee and Woodland

Beard (1972) noted that the principal Mallee species were York Gum and Ribbon-barked Gum (*E. sheathiana*). He described *E. loxophleba* as a 'small contorted specimen with a copper-coloured smooth bark quite unlike its arborescent ecotype, the typical York Gum.' This has since been recognised as a subspecies of York Gum now known as *E. loxophleba* subsp. *lissophloia* (Smooth Barked York Gum).

On the bottomland soils he described a patchy mixture of small to medium sized trees of Salmon Gum and Gimlet, more rarely Red Morrel (*E. longicornis*) forming various sized groups within the Mallee. Throughout the Woodland and Mallee was a sparse understorey of shrubs from 0.6 to 2.5 metres in height with a mostly bare ground cover.

- Thickets

Beard described thickets as two layered with a dense upper layer 2 to 2.5 metres in height and a sparser lower layer of smaller ericoid shrubs 60-90 centimetres high. In areas that are very long unburnt the sandplain Mallees outgrow other species and become very spreading. On deep sands the upper layer thins out and the lower layers become denser but there does not appear to be any difference in species composition in the Muntadgin system.

Most of these types were represented in some form in Wogarl Reserve.

Beard's broadscale (1:250 000) mapping recognised several vegetation types within the Narembreen Shire. At that scale of mapping just one vegetation type was mapped for Wogarl Reserve (Figure 2) (Hopkins *et al.* 2000, Beard 1972):

- C3Sc – Shrubland: Broombush (*Melaleuca uncinata*) Thicket on sandplain, *Casuarina* – *Acacia* – *Melaleuca* alliance

Only 8.1 % of the original woody vegetation cover remains in the Narembreen Shire (Beeston *et al.* 1994) and the existing remnants for the study region are shown in Figure 3 (Land Monitor Project, 1996 woody vegetation cover). The Land Monitor project mapping is considered accurate to within approximately 5% (Bailey and Carr, pers. comm. 2001). The figure illustrates the general scarcity of original woody vegetation remaining in the region, particularly in the northern Shires of the Lockhart catchment, and highlights the significance of any remnants.

Vegetation studies in the Narembreen Shire appear to have been limited, as has been the situation for most of the wheatbelt. A brief study was conducted by the Department of Fisheries and Wildlife (Muir 1978) of five of the eight nature reserves then listed within the shire, which totalled 0.9% of the area of the shire. The report listed the different vegetation formations and associated species for the reserves. They included:

Reserve 9754 of 686 hectares, 50 kilometres north of Narembreen and dominated by a granite outcrop. Vegetation included Salmon Gum Woodland; Jam Low Woodland; York Gum Tree Mallee; *Casuarina corniculata* Heath and *Ecdeiocolea* Sedgeland.

Reserve 13565 of 366 hectares, 56 kilometres ENE of Narembeen: lies within the Coolgardie Botanical district and appeared to show transition characteristics between south-west and Eremaean species. Vegetation included *Eucalyptus gracilis* (Yorrell) and Salmon Gum Open Low Woodland; Mallee over Shrublands and Mallee with no understorey; Wattle-*Casuarina* Shrubland and *Thryptomene* Heath.

Emu Hill A Class Nature Reserve A25039 of 89 hectares, 5.5 kilometres SW of Narembeen which was an area of granite with York Gum and Jam.

Mt Cramphorne Reserve 27521 of 334 hectares, 41 kilometres NE of Narembeen which supported Wandoo Woodland, Tamma (*Casuarina campestris*) Heath and lithic (rock) complex.

Reserve 31091 of 40.5 hectares 23 kilometres due east of Narembeen. Vegetation included Jam Woodlands, *Melaleuca hamulosa* Thicket and Samphire Flats.

In other words they represented a range of vegetation types across different positions in the landscape. There appear to be some similarities in vegetation and species to Wogarl but with the possible exception of Reserve 13565, none with the broad representation of the sandplain Shrublands. These reserves are of a relatively large size in comparison to many of the central and western wheatbelt reserves.

The Wildflower Society conducted a survey on 55 hectares of bushland on private property in the South Bodallin catchment in the Yilgarn Shire (Keating *et al.* 2001). Eight vegetation types were described within the three broader map units of Forest/Woodland, Mallee and Shrubland/Heathland/Scrub, with some strong similarities to this survey. One hundred and ninety one native plant taxa were recorded and a field herbarium of specimens from the survey prepared for the landholder and the Catchment group.

Another survey was carried out by the Wildflower Society on two small reserves in the Merredin township (Pioneer Cemetery and Snell Street Reserve) (Gunness and Campbell 1998). Eight different vegetation types were recognised and 220 native taxa recorded with some species and vegetation types in common with this survey.

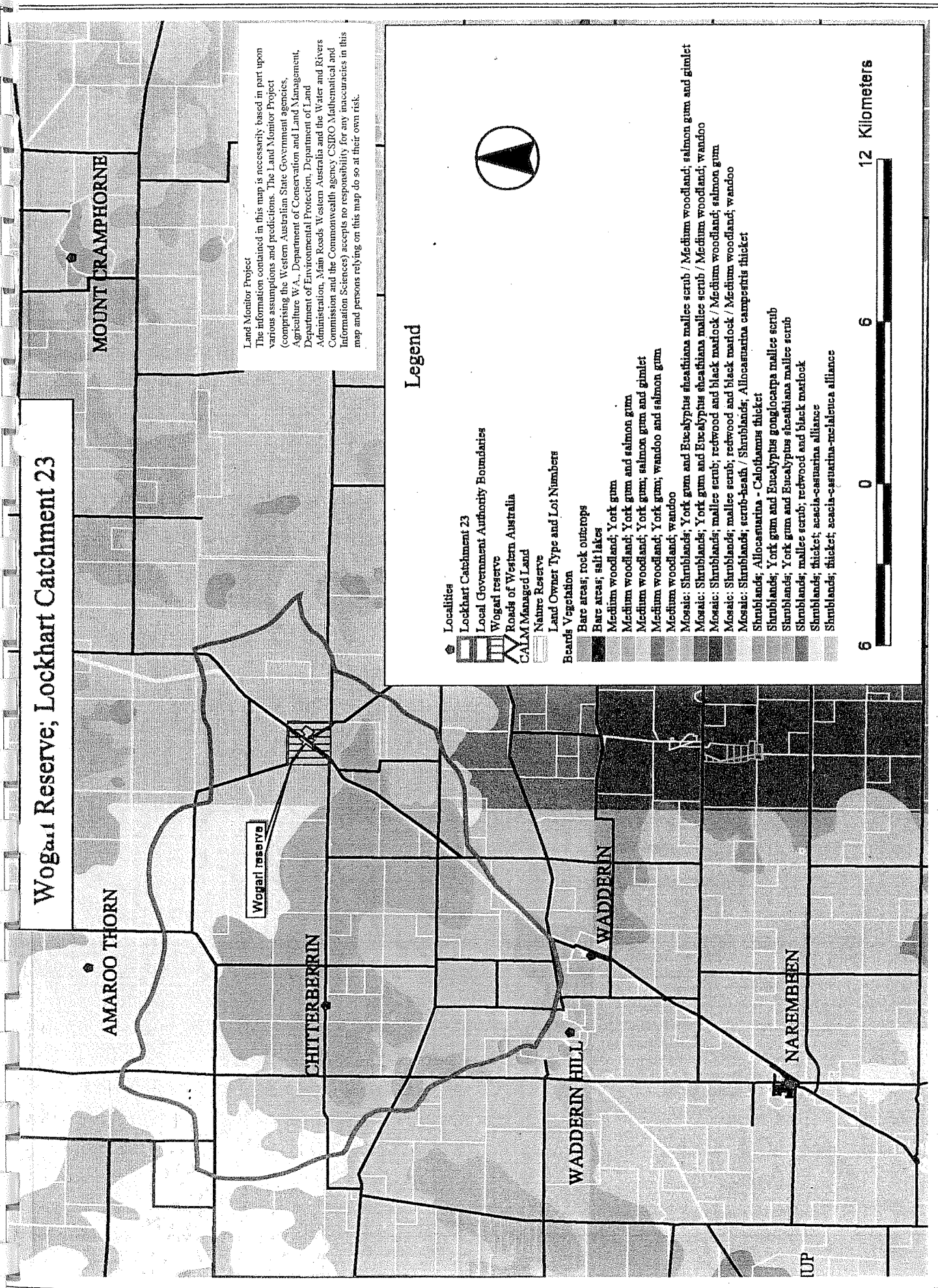


Figure 2: Beard vegetation types mapped according to original natural vegetation. (Land Monitor Project)

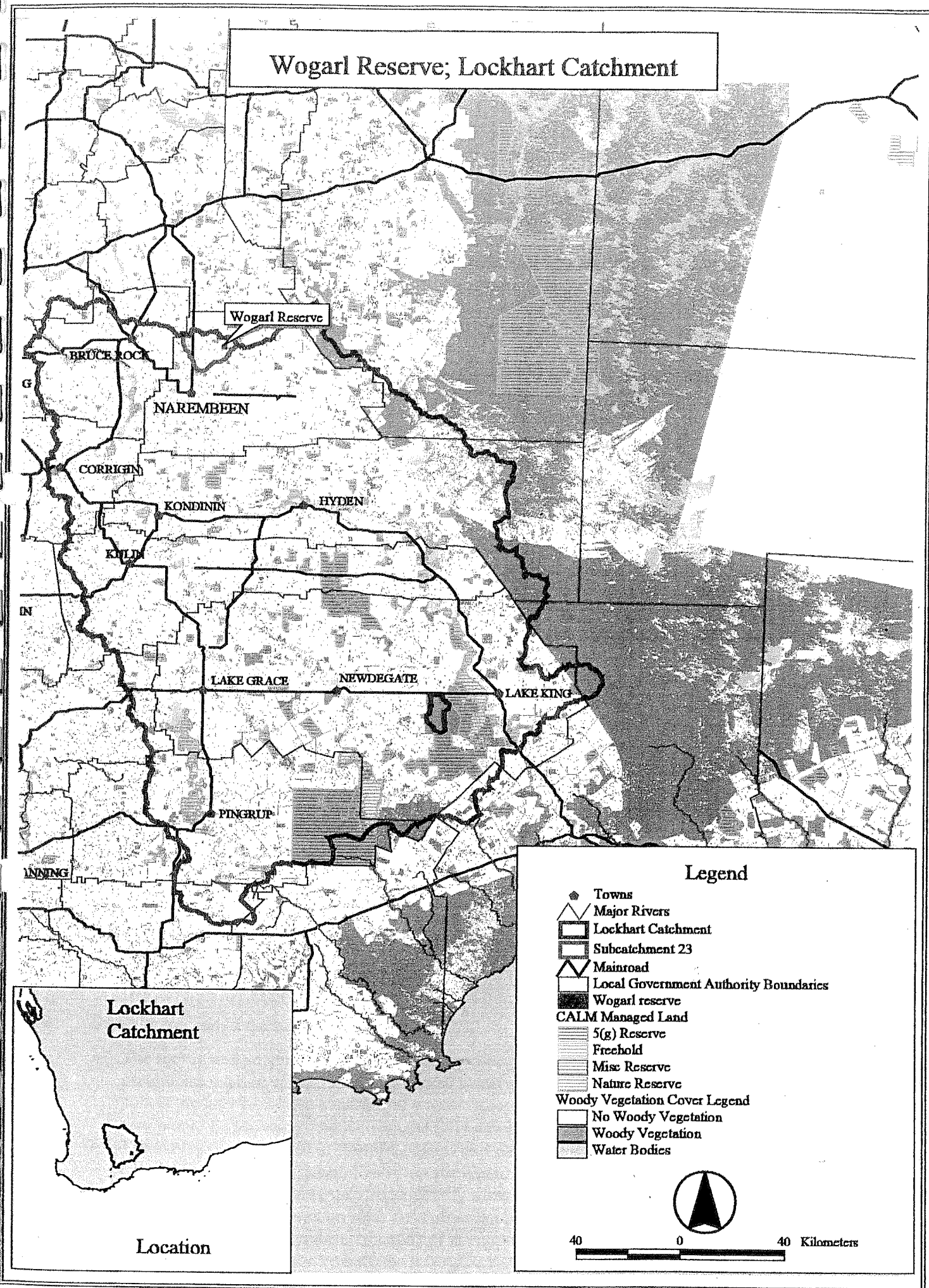


Figure 3: Woody Vegetation Cover, Local Government Authority boundaries and CALM managed lands within the Lockhart catchment. (Land Monitor Project, 1996)

3. SURVEY METHOD

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 use of 10 x 10 metre quadrats and standardised data sheets provides a systematic procedure for the collection of information and ensures that all species are recorded, not just the common and obvious ones. They provide the baseline information for the plant species list and the plant community descriptions. The 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. Photographs of each quadrat were taken at the time of the survey and are another useful monitoring record. At the end of the project copies of the quadrat data sheets and photographs are given to the Landcare group.

Survey work on the reserve was conducted during the 2000 spring flowering season on a weekend in late August and again in late October. Twenty-one 10m x 10m quadrats were located and described within the 280 hectares of Wogarl Reserve. 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.

Twenty-six volunteers and 4 botanists from the Wildflower Society Bushland Plant Survey program and 8 interested people from the local community collected data. The participants were divided into groups of 4 to 6 people and 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 and near the quadrat were also recorded (as adjacents). Collections of species not recorded in or adjacent to quadrats were also made across the site (opportunistics). Vegetation descriptions were then made based on the structure, cover and dominant species. Table 1 details the structural classification used. A vegetation condition rating was assigned according to the scale in Table 2. The project leader checked the data for consistency on the site re-visit.

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 Narembeen LCDC. Duplicates of some specimens have been lodged at the Western Australian Herbarium. Normally in a survey of this intensity approximately 80-90 % of the plant species present in the remnant would be recorded. This survey season was during a particularly dry year with a very poor establishment of annuals throughout much of the wheatbelt, and certainly within the study area. It is likely that less than 80% of species would have been recorded.

Some limitations of the study were as follows:

- The survey was conducted over one flowering season only, in a dry year. 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.
- 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 CALMSscience 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 5). Mapping was done from 1:25 000 aerial photographs flown in 1996.

Broadly speaking there were Eucalypt communities (Woodlands and Mallee) and Shrubland communities of various height, density and species composition. These have been distinguished in eight mapping units. The soils and relative positions in the landscape of these units are illustrated in the catenary sequence diagram (Figure 4). 'Catena' is Latin for chain and across the landscape is a sequence of soil types linked to their position on the slope. For each soil type there is a corresponding vegetation type. The sequence shown is typical for the wheatbelt though individual segments vary in their proportion and the vegetation is really a mosaic. The plant communities appear to merge into one another, Mallee is mingled with Shrublands and Woodlands. The differentiation between slopes and valleys is not always easily evident within a bushland area like Wogarl. The Shrublands are on the laterite and sandplain on the higher ground and the Woodlands occupy the valleys.

The mapping units are as follows:

1. EUCALYPT COMMUNITIES

- W Salmon Gum (*Eucalyptus salmonophloia*) - Gimlet (*Eucalyptus salubris*) Woodland
- M Mallee over *Melaleuca-Acacia* Shrublands
- C Open Shrub Mallee over *Callitris-Allocasuarina* Tall Shrublands

2. SCRUB / SHRUBLANDS / HEATH

- S Scrub (+/- Mallees) (Shrubs > 2metres tall, >30% canopy cover)
- O Tall Open Shrublands (+/- Mallees) (Shrubs >2 metres tall, <30% canopy cover)
- T Tamar (*Allocasuarina campestris*) Mixed Shrubland
- P *Melaleuca* Closed Heath
- H Open Heath over Sedgeland

3. D Disturbed areas

Wogarl Reserve

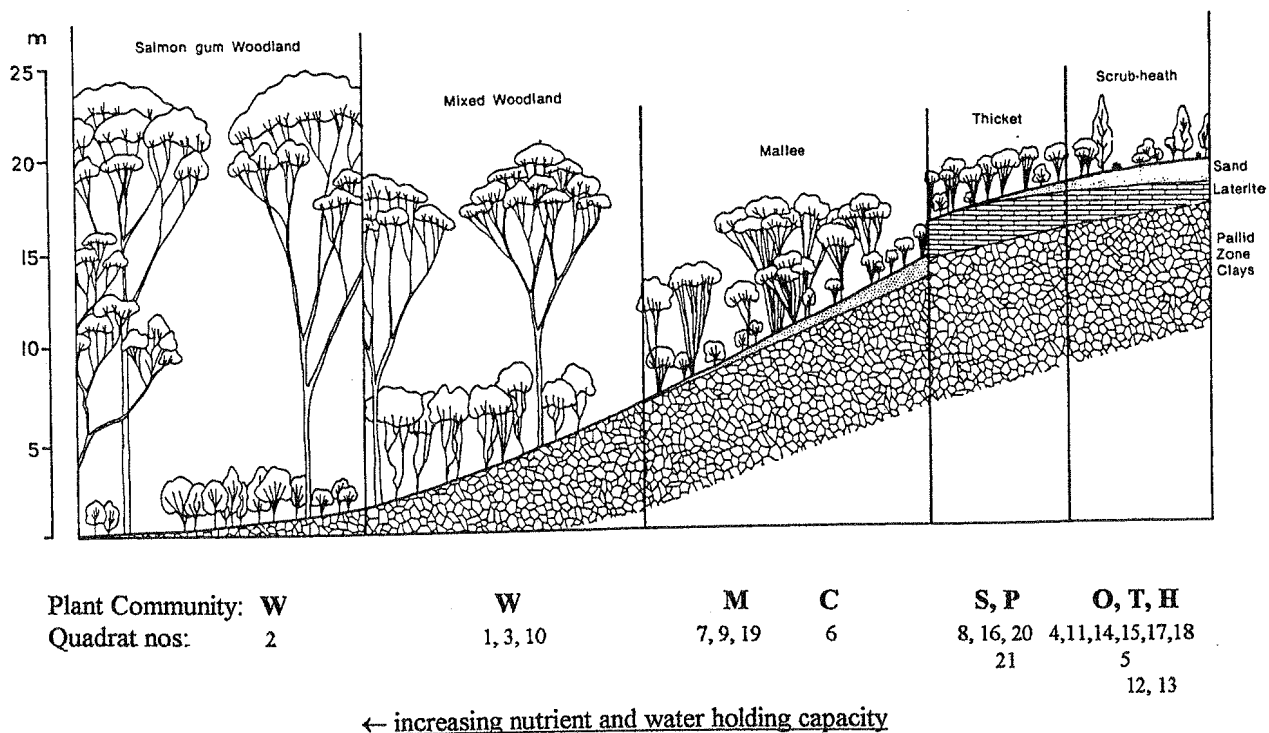


Figure 4: Typical catenary sequences of soil and vegetation structural units for the wheatbelt, modified to illustrate the situation at Wogarl Reserve (from Beard 1990, p49).

The vegetation units (mapping units; plant communities) vary in their structural composition, species dominance and composition and the interpretation of the map (Figure 5) 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. Photographs 1 to 10 (Pages 16 to 20), taken by Brian Moyle, illustrate the different vegetation types.

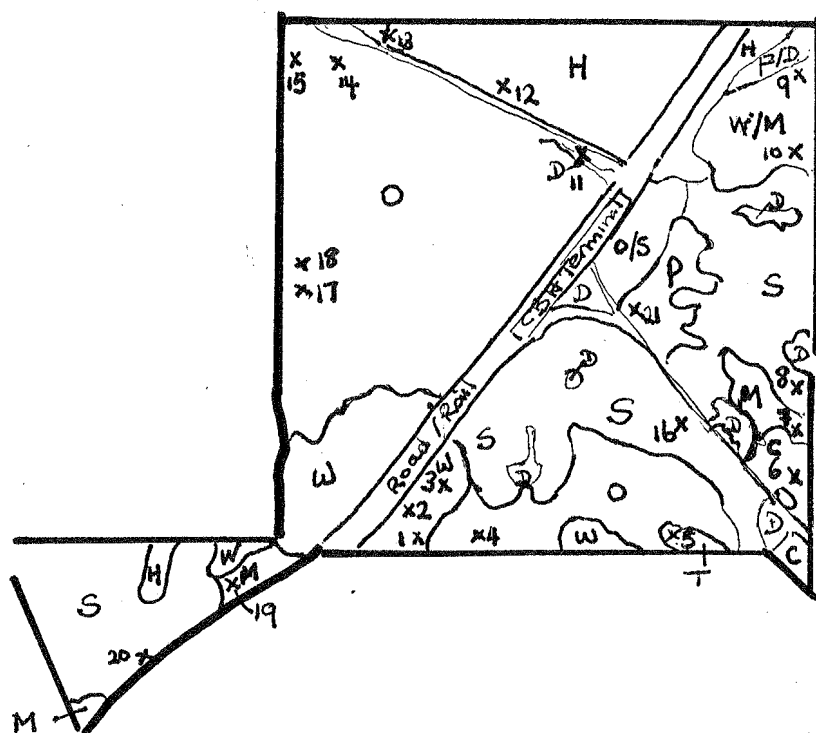
1. EUCALYPT COMMUNITIES

These were situated on the 'valley soils': red-brown sandy loams on the lower slopes of the broad valley. The taller Woodlands occur where the clay content is higher and nearer the surface, the Mallee associations further up slope with duplex soils (contrasting horizons) with varying amounts of sand or gravel which have washed down slope above the loam. Beard (1990) noted these Mallee communities within the wheatbelt typically form small patches within, or as transitions between, Woodlands and Shrublands.

In addition to soil and landscape position differences, the Eucalypt communities are distinguished from the Scrub/Shrubland/Heath communities by the structural and species dominance of *Eucalyptus* species, the relative lack of shrub species, absence of species from the family Proteaceae and presence of a greater variety of grasses. This lack of understorey is reflected in the reduced species diversity (number of species per quadrat ranged from 10 to 24). The high water usage by the Eucalypts reduces competition from understorey species.

W Salmon Gum - Gimlet Woodland (Quadrats 1, 2, 3, 10) (Photograph 1)

The tallest of the plant communities in Wogarl Reserve these Woodlands were located in the south-west and north-east corners of the bushland on the heaviest of the red-brown sandy loam soils. Species dominance varied, Salmon Gum and Gimlet grew together over a Tall Shrubland layer (Quadrats 1, 10) or grew independently of each other over a Low Open Shrubland



KEY

- Bushland survey boundary
- Plant community boundary
- x 3 Quadrat location

MAPPED PLANT COMMUNITIES

Eucalypt communities

- W** Salmon Gum (*Eucalyptus salmonophloia*) - Gimlet (*Eucalyptus salubris*) Woodland
- M** Mallee over *Melaleuca*-*Acacia* Shrublands
- C** Open Shrub Mallee over *Callitris*-*Allocasuarina* Tall Shrublands

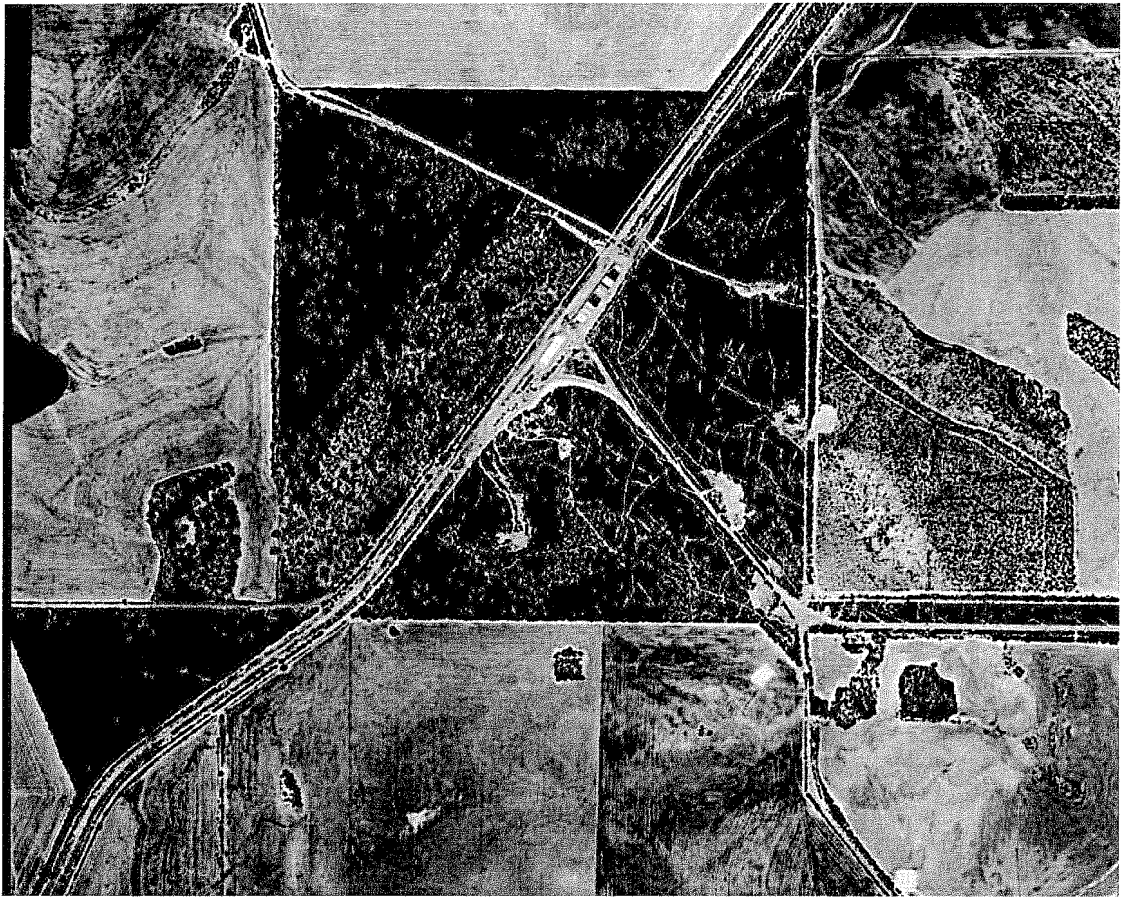
Scrub / Shrublands / Heath

- S** Scrub (+/- Mallees)
- O** Tall Open Shrublands (+/- Mallees)
- T** Tamar (*Allocasuarina campestris*) Mixed Shrubland
- P** *Melaleuca* Closed Heath
- H** Open Heath over Sedgeland

- D** Disturbed areas

Scale: 0 ————— 500
metres

Figure 5: Aerial photograph and overlay of vegetation map of Wogarl Reserve



(Quadrats 2, 3). Mallee species also grew in association with these Woodland species: Smooth Barked York Gum (*Eucalyptus loxophleba* subspecies *lissophloia*), Gooseberry Mallee (*Eucalyptus calycogona*), Ribbon-barked Gum (*Eucalyptus sheathiana*) and Yorrell (*Eucalyptus yilgarnensis*). The shrub layer was generally very open with the daisy bush *Olearia muelleri* a characteristic species. Other shrub species included *Acacia acuminata*, *Acacia hemiteles*, *Acacia merallii*, *Melaleuca acuminata* and *Daviesia benthamii*. The ground layer was very sparse, perennial grasses *Austrodanthonia* species and *Austrostipa elegantissima* sometimes forming a Very Open Grassland.

M Mallee over Melaleuca-Acacia Shrublands (Quadrats 7, 9, 19) (Photographs 2 and 3)

The defining character of this unit was the dominance of Mallee eucalypts on loams. The species composition and density varied through all layers. Quadrat 7 (photograph 2) was a "patch" of Mallee within Scrub, distinctive for the characteristic multi-stemmed attractive trunks of Gooseberry Mallee (*Eucalyptus calycogona*) and Ribbon-barked Gum (*Eucalyptus sheathiana*) with fairly sparse layers of shrubs beneath, including *Melaleuca eleuterostachya*, *Daviesia benthamii*, *Olearia muelleri* and *Acacia intricata*. Quadrats 9 and 19 had transition characteristics, 9 a Woodland transition and it is mapped as a Woodland complex (photograph 3), and 19 a Shrubland transition. Refer to Appendix I for structure and different species composition of the quadrats.

C Open Shrub Mallee over Callitris-Allocasuarina Tall Shrublands (Quadrat 6) (Photograph 4)

This is another Mallee "patch" in the south east corner of the reserve with a greater content of ironstone gravel in the loamy sand than the previous unit M. It was characterised by the presence of the Cypress Pine (*Callitris glaucophylla*). Mallee Wandoo (*Eucalyptus capillosa* subspecies *capillosa*) and scattered Burracoppin Mallee (*Eucalyptus burracoppinensis*) grew over a Tall Shrubland layer of Cypress Pine and Black Tamar (*Allocasuarina acutivalvis*) and a Low Shrubland of *Melaleuca condylosa* and *Phebalium ambiguum*.

2. SCRUB / SHRUBLANDS / HEATH

These covered the greater area of Wogarl Reserve and were situated on the upland or sandplain soils that are sandy and contain varying proportions of ironstone gravel. The five communities were differentiated firstly by pattern on the aerial photograph and height and density (canopy cover) of the shrub layers. Communities S, O and H were difficult to differentiate on species composition – a suite of species appears to spread itself across the landscape in a variety of mixtures. Some trends were evident but should be treated cautiously. As well, some species were uncommon and appeared only once or twice. Communities T and P were characterised by species composition as well as pattern and structure.

S Scrub (+/- Mallees) (Quadrats 8, 16, 20) (Photograph 5)
(Beard denotes scrub as 'thicket' – very dense one or two layered shrub communities.)

This unit was on soils with more gravel than the Tall Open Shrublands, situated on the eastern side of the reserve and in the western half of the lower offset triangle. It was a relatively tall dense Shrubland with the dominant shrub layer taller than 2 metres and a canopy cover more than 30%. Black Tamar (*Allocasuarina acutivalvis*) was typically dominant, *Melaleuca eleuterostachya*, *Melaleuca condylosa* and *Acacia beauverdiana* were also in the tallest layer. Mallees were scattered throughout with their crowns sometimes emergent. Shrubs from the family Myrtaceae were the most frequently occurring, also species from Proteaceae, Rutaceae, Casuarinaceae and Epacridaceae were common. Lower shrub layer species included *Thryptomene cuspidata*, *Micromyrs obovata*, *Baeckea tenuiramea*, *Melaleuca cordata*, *Phebalium ambiguum*, *Phebalium megaphyllum*, *Drummondia hasselli* and *Astroloma serratifolium*. Ground layer herbs and grasses were sparse except on Quadrat 20 which was on a

drainage line within the Scrubland, with higher moisture content and some disturbance (from rabbit warrens and being situated near the road edge).

O Tall Open Shrublands (+/- Mallees) (Quadrats 4, 11, 14, 15, 17, 18) (Photographs 6, 7 and 8) (Denoted by Beard as 'Scrub' – open shrub communities)

This unit with several open shrub layers as well as grasses and sedges, was one of the most species rich of the vegetation types in the reserve and differed from the Scrub in having a lower density and canopy cover (less than 30%) of the dominant layer. Soils tended to be duplex with a lower ironstone gravel content. This unit was situated on the eastern side of the reserve and in a band along the southern boundary falling between the Eucalypt Woodlands and the Scrub communities.

The species composition of this unit was variable with no particular species exhibiting dominance or being characteristic. Those that occurred on 3 or more of the quadrats in this unit included the shrubs *Acacia acuminata*, *Acacia hemiteles*, *Acacia merallii*, *Psammomoya choretroides*, *Beaufortia interstans*, *Melaleuca calyptroides*, *Melaleuca cordata*, *Melaleuca uncinata*, *Micromyrtus obovata*, *Verticordia chrysantha*, *Grevillea acacioides*, *Hakea erecta*, *Hakea scoparia*, *Isopogon scabriusculus*, *Phebalium filifolium*, *Phebalium tuberculatum*, *Drummondita hasselli*, and the perennial sedges *Lepidosperma* sp. A2 Island Flat (Keighery 7000), *Schoenus calcatus*, and *Schoenus hexandrus* and Foxtail Mulga Grass (*Neurachne alopecuroidea*). Many of these species were also present in the other Shrubland units.

T Tamar Mixed Shrubland (Quadrat 5) (Photograph 9)

This unit was characterised by the dominance of Tamar (*Allocasuarina campestris*) less than 2 metres tall. It was situated near the south-eastern boundary within the Tall Open Shrubland. Associated species included the shrubs *Acacia assimilis*, *Calothamnus gilesii*, *Hibbertia eatoniae* and *Baeckea crispiflora*. The grass *Amphipogon caricinus* formed an open layer and there were scattered herbs in the ground layers.

P Melaleuca Closed Heath (Quadrat 21)

This unit was situated on the northern side of Wogarl-Graball road between the Scrub and the Tall Shrubland on shallow sandy duplex soils with ironstone gravel at 35 cm. It was characterised by a dense layer of shrubs less than 2 metres tall with a canopy cover exceeding 70% and the absence of a ground layer. Species of the Family Myrtaceae were dominant. Broom Bush (*Melaleuca uncinata*) and *Hakea erecta* were the tallest shrubs and with *Melaleuca carrii*, *Melaleuca spicigera* and *Phebalium tuberosum* formed a Closed Heath over a Low Open Shrubland of *Micromyrtus obovata* and *Thryptomene cuspidata*. The dense shrubs meant the unit was not species rich, with 18 species.

H Open Heath over Sedgeland (Quadrats 12, 13) (Photograph 10)

Situated on the northern side of Butler road, this was a species rich unit dominated by shrubs less than 2 metres tall with a well-developed ground layer dominated by sedges. Many of the species in this unit were also present in the Tall Open Shrublands and the *Melaleuca* Closed Heath (eg. *Hakea erecta*, *Melaleuca uncinata*, *Micromyrtus obovata*, *Isopogon scabriusculus*), but in contrast there were at least 17 species which were recorded only in this unit. The ground layer was in places dominated by the sedge *Ecdeiocolea monostachya*. Other species included the herb *Borya sphaerocephala*, the grass *Amphipogon caricinus* and sedges *Lepidosperma brunonianum*, *Schoenus calcatus* and *Schoenus hexandrus*. The emergent wattles *Acacia lirellata* subspecies *compressa* and *Acacia ephedroides* with the distinctive 'minni-ritchi' peeling bark gave the unit a characteristic appearance.

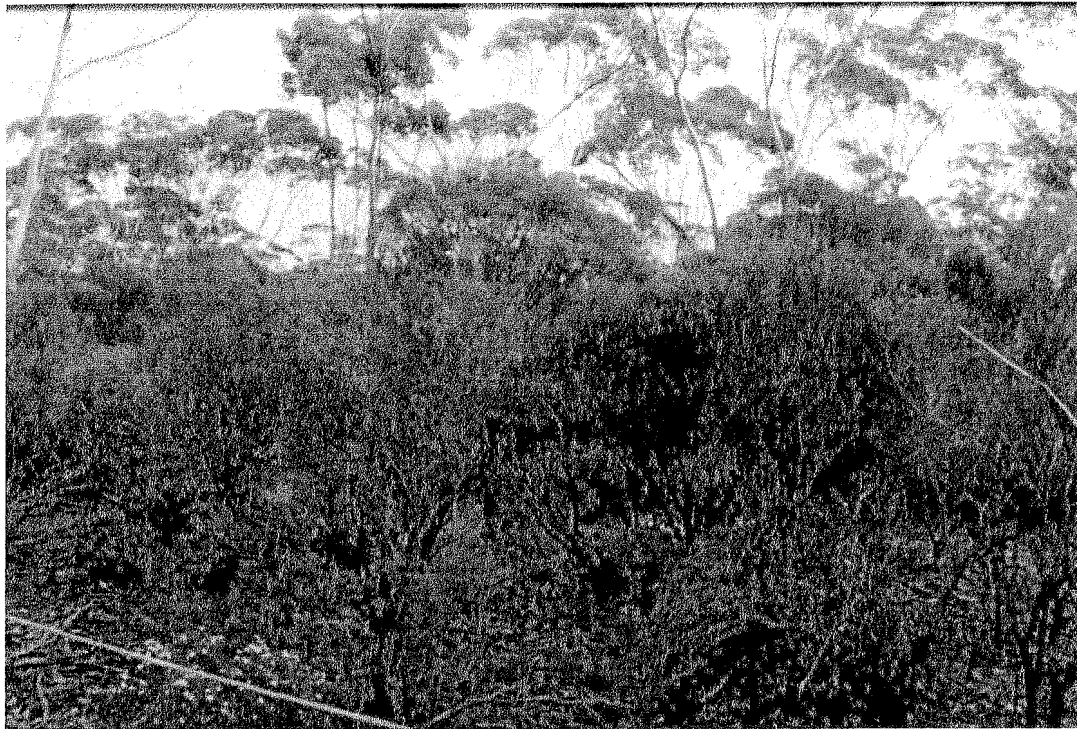


←

Photograph 1: Eucalypt Woodlands were situated on the red loam soils in the south-west and north-east corners of the Reserve. Here Salmon Gum towers over the Smooth Barked York Gum. Shrub and ground layers were typically sparse. Species included the tall shrubs *Melaleuca acuminata* and Jam, the low shrub *Olearia muelleri* and the perennial grasses *Austrodanthonia* spp. (Quadrat WOGL1, 26/8/00 with 23 native and 1 weed species)



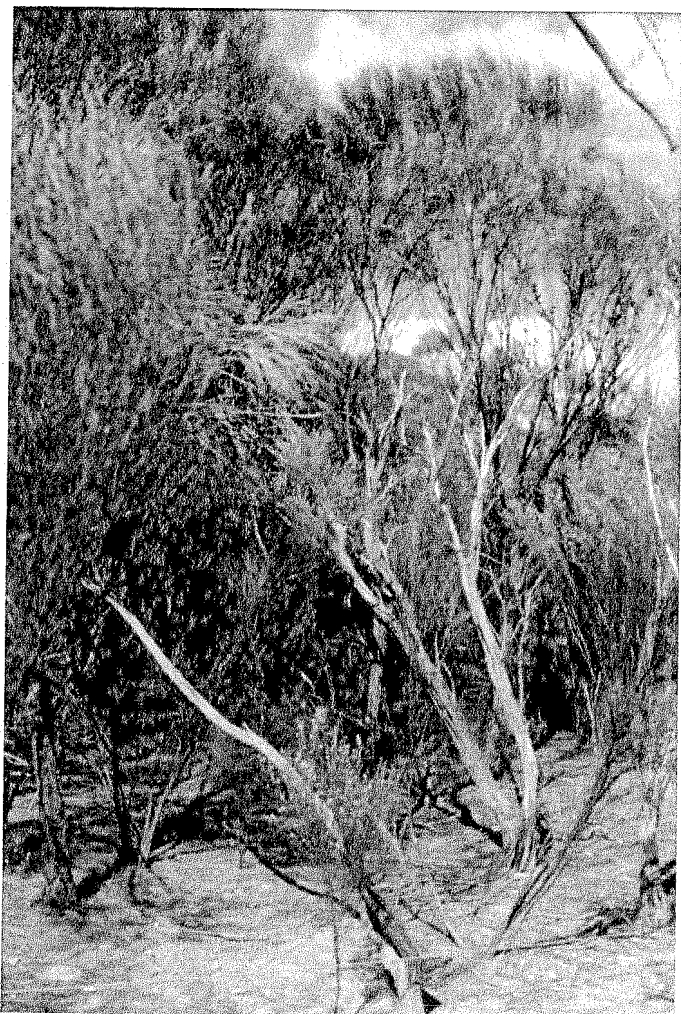
Photograph 2: Mallee communities can be very attractive with the many fine multi-stemmed variously coloured trunks. This Mallee patch was Gooseberry Mallee (*Eucalyptus calycogona*), Ribbon-barked Gum (*Eucalyptus sheathiana*) Shrub Mallee over *Melaleuca eleuterostachya* Tall Open Shrubland over *Daviesia benthamii* Open Shrubland over *Olearia muelleri*, *Acacia intricata* Low Open Shrubland. (Quadrat WOGL 7, 26/8/00 with 10 native species)



Photograph 3: Another Mallee community at a transition with the Eucalypt Woodlands and with a well-developed shrub layer dominated by *Melaleucas*. Redwood (*Eucalyptus transcontinentalis*), Gooseberry Mallee (*Eucalyptus calycogona*), *Eucalyptus myriadena* Very Open Mallee over *Melaleuca eleuterostachya* Tall Open Shrubland over *Melaleuca lateriflora*, *Daviesia benthamii*, *Acacia hemiteles* Open Heath over *Melaleuca grieviana* Low Shrubland. (Quadrat WOGL 9, 26/8/00 with 19 native and 4 weed species.)

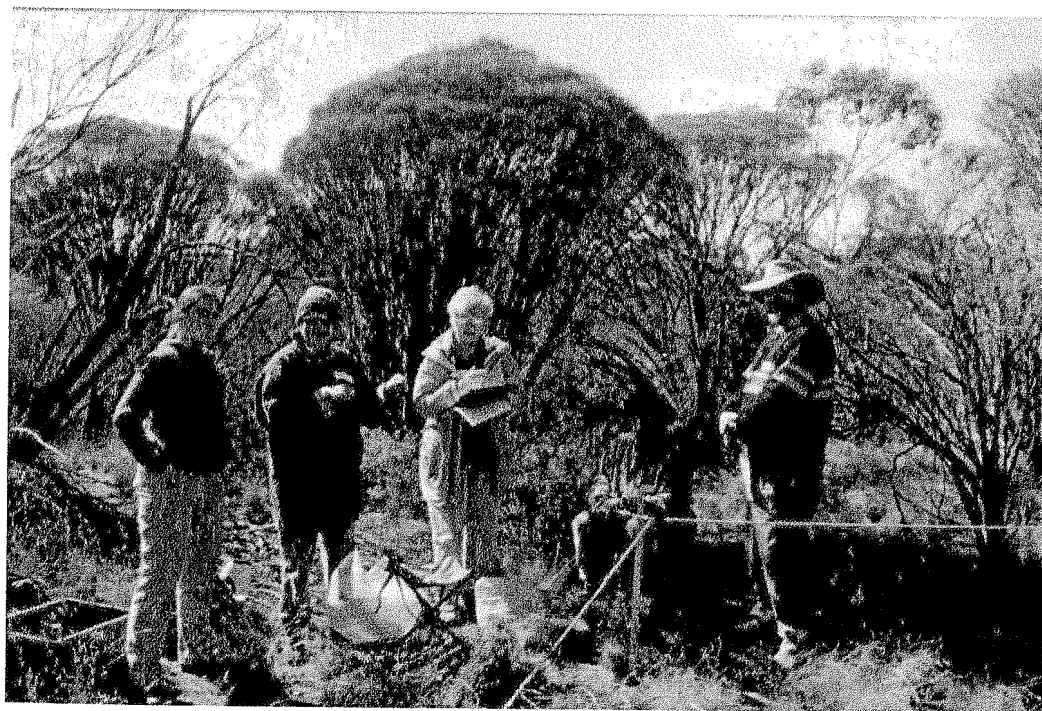


Photograph 4: Mallee Wandoo (*Eucalyptus capillosa* subspecies *polyclada*) Open Shrub Mallee over Cypress Pine (*Callitris glaucophylla*), Black Tamar (*Allocasuarina acutivalvis*) Tall Shrubland over *Melaleuca condylosa*, *Phebalium ambiguum* Low Shrubland on gravelly loamy sand in the south-east corner of the reserve. The yellow rope defines the boundary of the 10x10metre quadrat and volunteers record the data for each site. (Quadrat WOGL 6, 26/8/00 with 12 native and 1 weed species)

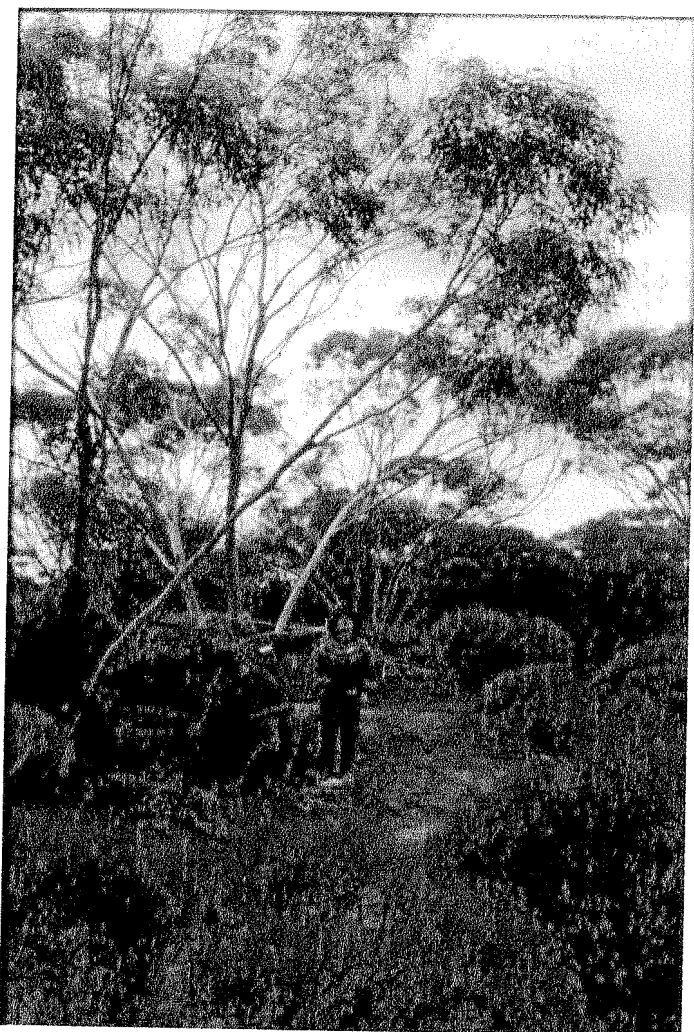


←

Photograph 5: The **Open Scrub** community of tall dense shrubs was typically dominated by Black Tamar (*Allocasuarina acutivalvis*) and lacked a ground layer. This quadrat also had Grey Tamar (*Allocasuarina corniculata*) and a lower shrub layer dominated by species from the Family Myrtaceae, including *Micromyrtus obovata*, *Melaleuca cordata*, *Baeckea tenuiramea*, *Chamelaucium pauciflorum* and *Thryptomene cuspidata*. (Quadrat WOGL 16, 26/8/00, with 27 native species)



Photograph 6: A probably long unburnt **Tall Shrubland** in the southern sector of the Reserve consisting of Jam (*Acacia acuminata*), *Melaleuca eleuterostachya* Tall Shrubland over *Baeckea crispiflora*, *Phebalium tuberosum* Shrubland over *Amphipogon caricinus* grassland. Working in groups of 4 to 6 people allows all participants to be involved in the tasks of recording, collecting and tagging specimens. (Quadrat WOGL 4, 26/8/00, with 15 native species)



←

Photograph 7: Fruit and buds are required for *Eucalyptus* identification. When they are not fallen on the ground they need to be collected from the canopy. Here a sling-shot is being thrown to pull some down from Ribbon-barked Gum (*Eucalyptus sheathiana*). This was a patch of Mallee over *Melaleuca uncinata* Tall Open Shrubland over *Acacia eremophila*, *Olearia dampieri* subspecies *eremicola* Open Shrubland and was mapped with **Tall Open Shrublands**. (Near Quadrat WOGL 11, 26/8/00 with 16 native and 2 weed species)



Photograph 8: The **Tall Open Shrubland** community with the multiple layers of shrubs was one of the most species rich of the vegetation types in the reserve. This is Grey Tamar (*Allocasuarina corniculata*), *Acacia yorkrakinensis*, *Melaleuca uncinata* Tall Open Shrubland over *Phebalium tuberculatum*, *Beaufortia interstans*, *Melaleuca cordata* Shrubland in the north-west corner. (Quadrat WOGL 15, 26/8/00 with 37 native species)



Photograph 9: Tamar Mixed Shrubland characterised by the dominance of Tamar (*Allocasuarina campestris*) less than 2 metres tall growing with *Acacia assimilis* and *Calothamnus gilesii* over low shrubs *Hibbertia eatoniae*, *Baeckea crispiflora* and the grass *Amphipogon caricinus*. Bill and Joan Flint standing in the right of the photo are farmers from west of Hyden – Joan is a botanical collector with a keen eye. (Quadrat WOGL 5, 26/8/00 with 21 native species)



Photograph 10: Open Heath over Sedgeland on the northern side of Butler road was a species rich community dominated by shrubs less than 2 metres tall and a well developed ground layer dominated by sedges. This quadrat was Black Tamar (*Allocasuarina acutivalvis*) Shrubland over *Isopogon scabriusculus*, *Melaleuca platycalyx*, *Verticordia chrysantha* Open Low Heath over *Ecdeiocolea monostachya* Open Sedgeland over *Borya sphaerocephala* Very Open Herbland with emergent Tammin Mallee (*Eucalyptus leptopoda*), *Acacia ephedroides* and *Acacia lirellata* subspecies *compressa*. (Quadrat WOGL 13, 26/8/00 with 50 native species)

3. D Disturbed areas

Several gravel pits were situated within the reserve and were areas of bare sand or ironstone gravel with a few colonising species scattered across them. The broad rail and road reserve and the CBH terminal were also mapped in this category.

DISCUSSION

Climate and soil types are the two major factors influencing vegetation type within a region. However many other factors, such as disturbances can also influence the vegetation. The vegetation patterns at Wogarl Reserve strongly suggest other influences and the mapping in this report is merely a reflection of the vegetation as it existed at the time of survey. For instance the Tall Open Shrublands (O) and the Open Heath over Sedgeland (H) share many species in common but were structurally different. It is probably no coincidence that the boundary between these two units is along West Wogarl road and it may in fact be an old fire boundary with the associated patterns being age related. Beard (1990) observed that the height and structure of the *Acacia-Casuarina-Melaleuca* alliance on sandplain soils of moderate depth varied with time since the last fire.

Another boundary, which did not appear to be differentiated by vegetation type, ran parallel to the railway line bisecting the Tall Open Shrubland of the western sector. It is possible that this is an old clearing boundary with the eastern sector being regrowth. This "reserve" was known as the Old Wogarl Townsite. Although we were unable to find any recorded history of the site, anecdotal evidence suggests that part of the area was once cleared (Shane Lyons pers. comm.).

VEGETATION CONDITION

The quadrats were located in areas of best condition and were all rated excellent to pristine with the exception of Quadrats 11 and 20 which had some disturbance close by and the highest incidence of weeds. In other words at the quadrat locations there was little or no evidence of (recent) disturbance and the vegetation structure was intact. However, the reserve as a whole entity was heavily fragmented by roads, tracks and gravel pits, which reduced the overall excellent condition. Despite this network of disturbed surfaces and the potential entry fronts for weed invasion the incidence of weeds was low. Eleven of the twenty-one quadrats had no weeds recorded and there was little evidence of weeds along the roadsides except on the boundary in the south-west corner. This may be partly attributed to the particularly dry season and lack of annual species at the time of survey but the soil and vegetation types appear to be resilient to weed intrusion. Weed diversity and density are useful guides in assessing vegetation condition as weed numbers commonly increase as a result of disturbance. Undisturbed vegetation resists weed establishment.

Although there was no evidence of recent fire damage in the bushland, as discussed in the previous section, the vegetation patterns suggest past disturbances such as fire and clearing have probably taken place.

There was evidence of rabbit and kangaroo activity through the bushland. The major threat from both these animals is grazing and the spread of weed seeds in droppings. Heavy grazing would prevent native seedling regeneration. Species such as She-oak (*Allocasuarina* species) are particularly susceptible to being grazed when young. Rabbit warrens can be a significant source of disturbance and erosion.

5. FLORA

Within the 280 hectares of Wogarl Reserve a total of 333 native vascular plant taxa (species, subspecies and varieties) and 18 non-native weed species were recorded from 56 plant families (Appendix II). These were comprised of 304 perennials and 47 annuals.

Ten plant families accounted for 65 % of the total taxa, five families for 48 %. The Myrtle family Myrtaceae was the largest group with 68 native taxa, all perennials. The top ten species rich families were as follows:

Family	No. native species	No. weed species	Total no. species
Myrtaceae	68	0	68
Proteaceae	35	0	35
Mimosaceae (Wattles)	23	0	23
Asteraceae (Daisies)	16	5	21
Poaceae (Grasses)	14	7	21
Orchidaceae (Orchids)	13	0	13
Goodeniaceae	12	0	12
Cyperaceae (Sedges)	11	0	11
Papilionaceae (Peas)	10	1	11
Rutaceae	11	0	11

A high number of species occurred only infrequently. One hundred and fifty-seven (44%) of the total 351 taxa were recorded only once, 83 on or adjacent to the quadrats and 73 from collections made on transects through the bushland and collections on the road verges. This is a reflection of the high incidence of naturally rare plants in the flora of south-west Western Australian and highlights the importance of the entire area of the remnant in maintaining the species diversity and being representative of the flora of the area. It also suggests that every extra area of bushland protected is likely to better protect the infrequently occurring plant taxa. Species rarity at quadrat level, individual remnant level and a regional level has been recognised by the CALMS Science Biological survey in the Wheatbelt (Keighery 2000) and other surveys in this program have reflected this phenomenon.

A notable feature of the opportunistic species collected was the number of plants observed **only** on the road verges or in the gravel pits. Forty-seven species were collected from road verges with thirty-one of those being once only collections during the survey. Many of them were pioneer plants – plants which are the first to establish after a disturbance and which disappear as Shrublands become established. They are often soft-leaved in comparison to the hard sclerophyll leaved climax species. Examples were: *Cyanostegia angustifolia*, *Cyanostegia microphylla*, *Dicrastylis corymbosa*, *Goodenia pinifolia*, *Lechenaultia biloba*, *Leptospermum nitens*, *Leptospermum roei*, *Microcorys ericifolia*, *Pimelea aeruginosa*, *Pimelea angustifolia*, *Pityrodia lepidota*, *Senna pleurocarpa* variety *angustifolia*, *Solanum hoplopetalum*, *Stackhousia scoparia*, *Velleia discophora*, *Verticordia endlicheriana* and *Verticordia picta*.

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 a diverse natural system. The number of species found on each 10m x10m quadrat varied from 10 (all natives, quadrat WOGL 7) in the Mallee over *Melaleuca-Acacia* Shrublands to a maximum of 50 (all natives, quadrat WOGL 13) in the Open Heath over Sedgeland. This provides an indication of the variation in species composition of different vegetation types.

The number of species recorded was not as high as some of the most species rich sites recorded in surveys elsewhere in the south-west, but compares favourably to other surveys in the region. The results reflect the species richness you would expect from such communities, eg. The dense cover of Scrub means the species rich annual herb layers are missing. A survey conducted by the

Wildflower Society with the same search effort at Bodallin in the Yilgarn catchment recorded 191 species (184 natives and 7 weeds) on a 55 hectare bushland block (Keating *et al.* 2001). In that study the Woodlands were the most species rich community with up to 38 native species per quadrat. Another Wildflower Society survey (Gunness and Campbell 1998) on two small reserves in the Merredin township recorded 240 species (220 natives and 20 weeds). 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 70 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 (Gunness *et al.* 1999 and Gunness *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. It must be remembered that some plant communities are not species rich but they are equally important in the ecosystem.

A list of the plant species found in the reserve is provided in Appendix II. Appendix III 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.

SPECIES OF SPECIAL INTEREST

1. Declared Rare and Priority Flora

No species of declared rare flora were recorded in the survey. Ten 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 IV.

Melaleuca grieviana (Myrtaceae) Priority 1

This is a blue-grey shrub with cream-yellow flowers in semi-globular heads. It has been very poorly collected and previously recognised only from the Narembeen, Cowcowing (near Wyalkatchem) and Parker Range areas – it is within its known distribution. It was located in the Mallee over *Melaleuca-Acacia* Shrublands.

Acacia lirellata subspecies *compressa* (Mimosaceae) Priority 2 (Figure 6b)

This bushy procumbent spreading shrub with deep yellow globular flowers is confined to the Avon Wheatbelt region on sandplains and clayey loam. It was growing in the Tall Open Shrubland and in the Open Heath over Sedgeland. This population is at the centre of its known distribution with other collections from the Narembeen-Muntadgin area as well as Ballidu, Holleton, Bruce Rock and one record further north west between Wubin and Wongan Hills.

Conostylis albescens (Haemodoraceae) Priority 2

This is a rhizomatous perennial herb with cream-yellow flowers suffused with purple on the lobes. It has a very restricted distribution being found only on sandplains near Koonadgin, north of Merredin and near Booraan along the Great Eastern highway. In this survey it was collected on 3 quadrats in the north-western sector of the site in Tall Open Shrubland and Open Heath. It is in similar habitat to other collections and this population is a small southern extension of the range.

Cryptandra dielsii (Rhamnaceae) Priority 2 (Figure 6f)

This small intricately branched shrub with white flowers was also collected on 3 quadrats in Tall Open Shrubland and Open Heath. It has a fairly limited distribution, previously known from

sandplain areas, often over laterite from Manmanning, near Tammin, Durokoppin Nature Reserve, north of Yorkrakine Rock and south-east to Holt Rock. This occurrence is therefore within its known distribution.

This group is still under taxonomic review and the species with pedicellate flowers, as this has, will be taken out of the genus *Cryptandra* (Mike Hislop, pers. comm.)

***Verticordia multiflora* subspecies *solox* (Featherflower) (Myrtaceae) Priority 2**

This small shrub with yellow flowers was recorded just once in the Tamar Mixed Shrubland. This record is within its known range of occurrence that extends from south-east of Merredin to south of Marvel Loch and to Hyden, Mt Coudax, Lake Cronin.

***Euryomyrtus leptospermoides* (Myrtaceae) Priority 3**

This open or straggly shrub which can grow to 1 metre and has white flowers was recorded just once in this survey in the Open Heath over Sedgeland. It grows in Heaths, Shrublands and Scrub in a belt paralleling the Great Eastern Highway between Merredin and Koorarawalyee (east of Southern Cross). It is not widely distributed and is apparently uncommon (Trudgen 2001) and this record is within but probably near the southern limit of its range.

***Leucopogon sulcatus* (Beard Heath) (Epacridaceae) Priority 3**

This low shrub with small white tubular flowers was recorded once in the Tall Open Shrubland in the north-west corner of the site. It has been recorded from Mallee, Heath and Scrub in areas between Kellerberrin and Tammin, Marvel Loch, Holleton (east of Wogarl) and Hatter's Hill. So it is also restricted in its distribution and this record is within the known range.

***Micromyrtus racemosa* variety *carinata* ms (Myrtaceae) Priority 3**

This is a slender shrub, with small white flowers, which grows to approximately 1.5 metres tall. It was recorded in this survey in the Open Shrub Mallee over *Callitris-Allocasuarina* Tall Shrublands. It has been recorded in southern regions on sandy soils in the Ravensthorpe Ranges and at Canal Rocks. This population is a disjunct occurrence a long way north from other records.

***Verticordia mitodes* (Featherflower) (Myrtaceae) Priority 3**

Another of the striking Featherflowers, this is a spreading low shrub to 0.7 metres with pink to purple flowers. It was recorded in the Tall Open Shrubland on the western boundary of the site. It is known from sandplains within a fairly restricted distribution: Nungarin, Carrabin, Merredin, Moorine Rock, Southern Cross, Booraan, Chiddarcooping Hill. So this population is within its known range.

***Grevillea asteriscosa* (Star-leaf Grevillea) (Proteaceae) Priority 4**

This is a prickly shrub which can grow more than 2 metres tall and has scarlet red flowers. It is called Star-leaf Grevillea because of the distinctive shape of the sharply pointed whorled leaves. It was recorded on the outer edges of the Scrub unit. It is also associated with granite outcrops and gravelly soils. It has been collected from the Muntadgin and Narembreen area but is another species that is not widely distributed, known also from Bruce Rock and south through Bullaring, Bendering, Kulin, Kondinin and Lake Grace. It has been grown successfully in cultivation.

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). Survey records and field experience combined with this information enables a picture of the distribution of species to be developed. As more survey work is carried on within Western Australia, the knowledge of species occurrences will continue to change and the information provided here is current at the time of writing. Results from the 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 eastern limit of range**

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

***Acacia rigida* (Mimosaceae):** A low sprawling shrub with pungent phyllodes and yellow globular flowers, this wattle was collected on the road verges at the edge of the Tall Open Shrubland, in the northern part of the reserve. It is also known from Corrigin, Kellerberrin, areas between Kondinin and Narembene and west at Talbot Road on the Darling scarp. This record is at its eastern limit.

***Brachyloma mogin* ms (Epacridaceae):** This shrub with pale red flowers is known from near Pingelly, west of Katanning and the Corrigin area. It was collected in the Tall Open Shrubland in the north-west corner of the Reserve. This record is a north-east extension and limit of its known range. "ms" refers to its manuscript name – it has been recognised as a new species and is currently being described by Ray Cranfield. Until the name and description is published it remains as a manuscript name.

***Schoenus armeria* (Cyperaceae):** This tufted perennial sedge was recorded on one quadrat in the Tall Open Shrubland. It occurs inland of a line from north of Geraldton, through Tammin to Albany. This record appears to be on the eastern edge of its range.

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

Those near the western limit of their range (species which commonly occur further inland) include:

***Allocasuarina spinosissima* (Casuarinaceae):** discussed in the section below on taxonomically significant taxa.

***Verreauxia villosa* (Hairy Verreauxia) (Goodeniaceae):** This grey velvety shrub with yellow flowers was recorded as an opportunistic collection in the Open Heath. There are other records from the region – Muntadgin, Merredin, Hyden and west to Southern Cross and Coolgardie. It appears to be on the western limit of its range.

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

Taxa that normally occur north of the area include the two priority species *Conostylis albens* and *Euryomyrtus leptospermoides* as well as:

***Acacia inceana* subspecies *conformis* (Mimosaceae):** This wattle was recorded in the Tall Open Shrubland understorey of the Salmon Gum-Gimlet Woodland in the south-western corner of the reserve. It occurs from Mt Gibson and Moora through to Nungarin and east to Southern Cross. This appears to be at its southern limit.

***Hakea minyma* (Proteaceae):** This shrub which can grow to 3 metres and has cream to pink flowers was recorded in the Scrub in the south-west triangle of the reserve. It is fairly widespread and occurs north to Mullewa, south to Cowcowing (north of Wyalkatchem) and east to Coolgardie with scattered records in the desert further east. This record appears to be at the southern limit of its distribution.

***Verticordia auriculata* (Myrtaceae):** This pink flowering shrub was recorded in the Tall Open Shrublands and from a gravel pit. It is well collected in an area extending from Yalgoo to Bruce Rock. This appears to be the southern most record of this species.

Verticordia endlicheriana var. *compacta* (Myrtaceae): This is a compact shrub with yellow flowers that turn red-brown as they age. It was recorded from the Open Heath. Two Herbarium collections have been made from this area (Bruce Rock and south of Narembeen) but most populations are in areas north from Mt Gibson, Moora, Dalwallinu, Wubin, Wongan Hills, Dowerin. So this record and the one from south of Narembeen appear to be its southern and eastern range limit.

- **Taxa with a limited distribution, disjunct distribution or poorly collected**

Other taxa are endemics (not found outside the state) with a relatively limited range and the study site fell within that range, or they have a limited or disjointed distribution.

Acacia anfractuosa (Mimosaceae): This spindly, weeping small tree or shrub was a characteristic emergent along with *Acacia ephedroides* in the Open Heath over Sedgeland. It has a fairly limited distribution ranging from Mukinbudin, to Kellerberrin to Bruce Rock and along the Great Eastern Highway through Southern Cross and towards Coolgardie. Several collections have been made in the Muntadgin area.

Beyeria brevifolia variety *robustior* (Euphorbiaceae): This shrub with inconspicuous flowers and a height to 1.5 metres was recorded in the Tall Open Shrublands and the *Melaleuca* Closed Heath. It has been recorded from a few scattered localities on sandplains including Merredin, Kambalda and Ravensthorpe. It is possible that it is just poorly collected and is more widespread than records indicate.

Eucalyptus subangusta subspecies *cerina* (Myrtaceae): This mallee was recorded in the Mallee on the eastern side of the site and in the Tamar Shrubland. It is endemic to a fairly restricted area with Herbarium records from Trayning, Chiddarcooping Nature Reserve (Mukinbudin), Merredin, Bullfinch, Westonia and the Hyden-Norseman road.

Leucopogon sp. **Corrigin** (K. Kershaw KK2091) (Epacridaceae): This low shrub with tiny leaves and white Beard Heath flowers was collected from the roadside and Open Heath over Sedgeland. It is known only from an area within the eastern wheatbelt, centred around the study site. Other records have been made from Dragon Rocks Nature Reserve, the Narembeen to Hyden road, north of Bruce Rock, Beendering Reserve and Corrigin.

Verticordia endlicheriana var. *endlicheriana* (Myrtaceae): A shrub with yellow flowers, it is common in the south coast region. There are disjunct records further north in the wheatbelt at Corrigin and Wagin and this record adds to that eastern wheatbelt distribution range. It was recorded in the Open Heath.

3. Taxonomically significant flora

Eutaxia sp. nov. **Wogarl** (A. Gunness et al. sn.) aff. *Pultenaea neurocalyx*: An unrecognised taxon

This grey-green pea shrub was an opportunistic collection from the Open Heath over Sedgeland. It does not match any taxa recognised in the WA Herbarium collection but is closest to the *Pultenaea neurocalyx* group having similar venation beneath the calyx hairs, bracteoles in the same position and a similar style and ovary. The identity of this collection remains to be clarified. Further material needs to be collected and searches made for other populations. It is possible it should be listed as a threatened taxon.

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 a Wildflower Society survey at Konnongorring and was again collected in the

York Gum Tree Mallee in a nearby survey at Goomalling 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:

***Baeckea* sp. Burngup (A.M. Coates 4423)** This erect shrub with pink flowers was collected in the Mallee over *Melaleuca-Acacia* Shrublands in the south-west triangle. It is known across an area from Mukinbudin to Southern Cross and south through Bruce Rock, Narembeen to Hyden. A collection made by Anne Coates from Burngup in Lake Grace Shire has been denoted as the typical form until the taxonomic description is completed and a name published.

Some taxa appeared to be inter-grades or hybrids.

Allocasuarina corniculata* and *Allocasuarina spinosissima

These two species are within a range of overlap of distribution (*Allocasuarina spinosissima* is at its western limit) and they intergrade, with characters common to both taxa so they are difficult to distinguish apart. They may possibly both occur, or there may be just one or other of the species. They were common in the Open Shrublands and Heath in Wogarl.

***Phebalium megaphyllum* - *tuberculosum* - *filifolium* group**

All three species were present in Wogarl Reserve and some specimens shared characteristics of more than one taxon suggesting they were probably hybrids. Paul Wilson, the taxonomist who works on this genus, has observed intergrades within this group (pers. comm.). He has noticed that this hybridisation has occurred since white settlement and is often associated with cleared areas.

The following page of photographs by Mark Brundrett illustrates some of the species that occurred in Wogarl Reserve (Figure 6). They illustrate not only the wealth of colour and form of our flora but some of the interesting adaptive traits. Figures 6b and 6f are described in the Priority Flora section.

Acacia ephedroides (Mimosaceae) (6a): The minni-ritchi bark is a very distinctive feature of this wattle. The trunk and branches are a striking reddish-brown colour covered in peeling flakes/strips of bark. It was striking as an emergent in the Open Heath over Sedgeland.

Leptosema daviesioides (Papilionaceae) (6c): A shrub which is unusual for the large red pea flowers which emerge at ground level around the base of the very prickly plant. Perhaps a ground dwelling animal pollinates it. Like many peas this is leafless and the spiky branchlets are in fact modified stems.

Thryptomene cuspidata (Myrtaceae) (6d) and *Baeckea tenuiramea* (Myrtaceae) (6e): These wonderfully floriferous Myrtles are some of the showiest shrubs in these Shrubland communities. They would make excellent garden subjects if they could be introduced into the nursery trade.

Hakea francisiana (Proteaceae) (6g): This shrub is very attractive with its long silvery grey leaves and showy flower spikes which are an important nectar source. Flower colour can vary from pale pink to red.

Isopogon scabriusculus subspecies *stenophyllus* (Proteaceae) (6h): The genus known as Coneflowers. Unlike many members of the Proteaceae family they do not retain woody fruits and this character helps to distinguish them from their nearest relatives the genus *Petrophile*. Flowers are characteristically pink or purple.

Xanthorrhoea nana (Xanthorrhoeaceae) The Dwarf Blackboy does not have a trunk and the manner in which the flower spikes come out sideways in a semi-prostrate manner is typical of this long-lived species.



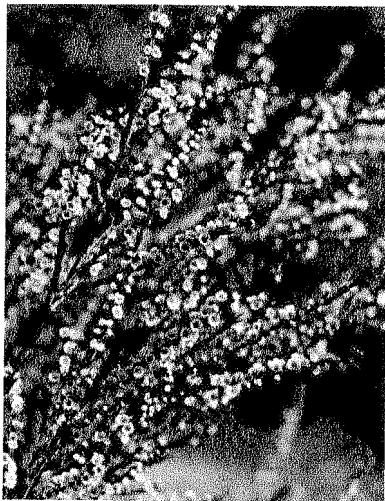
a. *Acacia ephedroides*



b. *Acacia lirellata* subsp.
compressa



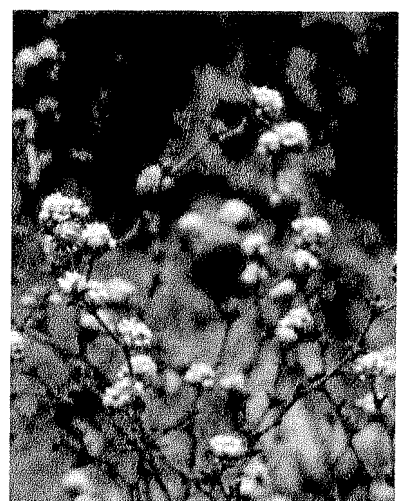
c. *Leptosema daviesioides*



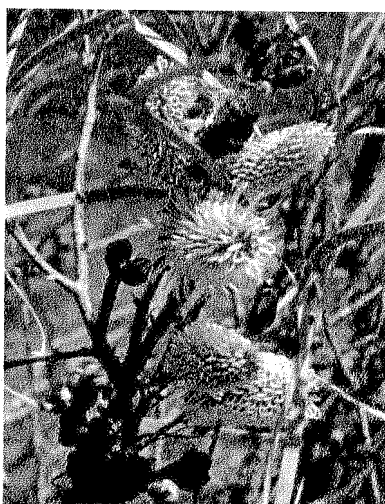
d. *Thryptomene cuspidata*



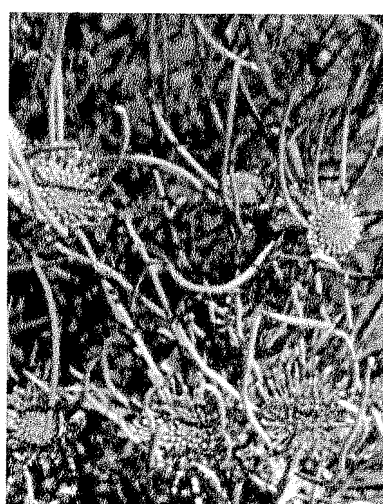
e. *Baeckea tenuiramea*



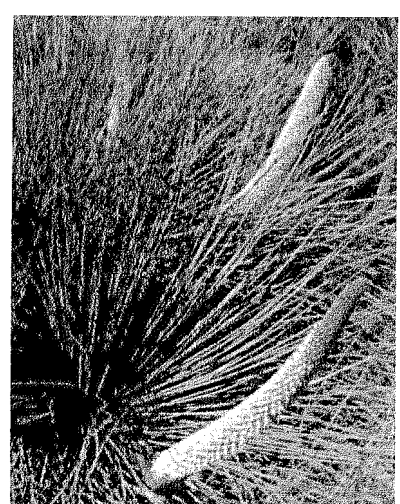
f. *Cryptandra dielsii*



g. *Hakea francisiana*
Pink Spike Hakea



h. *Isopogon scabriusculus*
subsp. *stenophyllus*



i. *Xanthorrhoea nana*
Dwarf Grass Tree

Figure 6: A selection of the flora of Wogarl Reserve

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. In rural areas the dumping of animal carcasses is a source of invasion. The rotting carcass is a nutrient source, sheep wool is a harbour for weed seed.

Five per cent (18 species) of the total plants recorded in Wogarl Reserve were weeds (Table 3). All except the bulbous Guildford Grass (*Romulea rosea*) were annuals. Ten of the twenty-one quadrats were free of weeds. The highest incidence was on Quadrat 20 (11 weeds) which was on a natural flow line, adjacent to a track and had a rabbit warren on its edge. Quadrat 9 in the north-east corner also had a higher than average incidence (7 weeds including adjacents). It was near the boundary adjoining farmland and near a flow line that carried run-off from the adjacent farm.

The weed status of the reserve was low in comparison to many other bushland sites surveyed within the wheatbelt. Weed levels ranging from 6 to 17% have been recorded in other surveys within this program. The very dry season and poor germination of annuals may have meant that the incidence of weeds was lower than in an average season. However the generally excellent condition of the vegetation except in the areas already mentioned would suggest that the weed incidence is commonly low. This is in keeping with the findings in the survey at Bodallin where only 4% of the total flora recorded were weeds (Keating *et al.* 2000).

These Scrub and Shrubland communities in the lower rainfall areas of the wheatbelt appear naturally resilient to weed invasion. In fact native vegetation is resistant until disturbance or nutrient enrichment take place. In Wogarl Reserve, both factors are acting where drains have been pushed, and it is these areas that are the main nodes of weed presence. Not only is there extra water flowing through the reserve but it would be carrying with it nutrients and soil from the adjacent farmed ground. In addition the risk of erosion along the drainage line is increased. The gravel pits and road and track verges carry relatively low weed burdens, no doubt due to the low nutrient status and moisture content of the lateritic soils. If soil was blown or carted in to these areas it is likely that weed invasion would follow. Weeds were evident along the edges near the Eucalypt Woodlands in the south-west corner. Seed would have blown in from the adjoining farmland and established on the disturbed track edges on soils of higher nutrient and water holding capacity. The Woodland areas also have a more open understorey than the Scrub/Shrubland/Heath where the plants act as a natural barrier.

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 (refer to the Key in Appendix II for definitions) are as follows:

Trees, Mallees and Shrubs

Herbs

Grasses

Sedges and Rushes

Weeds (grouped together by Family regardless of 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. Notes such as flower colour, seed collecting times or any other points of interest can be added to the copy. 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.

Table 3: Weed species recorded at Wogar reserve (listed alphabetically by genus and grouped by quadrats & plant community) (see Appendix III p. 61 for key)

Botanical name	Family	Common name	Quadrats																			opp			
			1	2	3	10	7	9	19	6	8	16	20	4	11	14	15	17	18	5	12		11	12	13
			W																						

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 Wogarl Reserve that makes it a valuable area of natural heritage of high nature conservation value.

- **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'. Wogarl Reserve provides an example of the vegetation typical of this eastern side of the central Wheatbelt, consisting of Scrub, Shrublands and Heath on the residual sandplains and laterite slopes above Woodlands and Mallee on the lower slopes.

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

The highly variable species composition of the Scrub/Shrubland/Heath communities means that effective conservation will depend on there being numerous viable remnants. In areas as heavily cleared as the Wheatbelt, every remnant adds to the conservation value of the vegetation types they support. Representation of the different Wheatbelt vegetation types in the reserve system is generally poor (Hopkins *et al.* 1996, Thackway and Cresswell 1995). Figure 3 illustrates the scattered and fairly small reserves in the Shire of Narembeen and highlights the value of this bushland. The CALMSscience biological survey in progress will provide a better understanding of floristic patterning and give some indication of the distribution and the conservation status of different floristic units.

Until recently it was generally held 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 only eight percent of the native vegetation of the Narembeen Shire still existing, the study site has 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 333 native vascular plant taxa, the site supported a diverse assemblage of plant communities and native plants. Quadrats contained 10 to 50 native species with the Open Heath over Sedgeland supporting the greatest number of species. Quadrats in the agricultural zone of the south-west of the state commonly contain at least 20 and sometimes 90 species, equal to 'Kwongan', always considered the most species rich sites (Keighery 2000).

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 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.

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

Ten threatened species, one new taxon, at least fourteen species near the limit of their range or with limited ranges, and three species of taxonomic significance increases the conservation value of the site. This is a high incidence of threatened and significant species for one location. It may be a reflection of the lack of detailed studies in these more distant regions of the state. It also reflects the natural rarity of species in the south-west flora, as already discussed in relation to the number of singleton records.

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.

- **Condition of vegetation**

The condition of all the vegetation types was excellent to pristine, with the various layers intact and a very low level of weed invasion except where drainage was directed into the bushland. The network of tracks, gravel pits and the afore-mentioned drains unfortunately reduce the overall condition of the bushland with the greatest threat from the effect of drains.

- **Size of remnant**

The larger the remnant the greater the conservation value and viability. Wogarl Reserve with an area of 280 hectares is a large remnant when compared with others in the wheatbelt. Of the 8.1 percent of remnant vegetation remaining in the Narembeen Shire, 6.5% is located on private land and 79% of these patches are smaller than 20 hectares in size (Beeston *et al.* 1994).

- **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. From a management viewpoint, the less the perimeter in relation to the core area, the lower the cost of fencing. The square shape of Wogarl Reserve is in its favour but the road and railway bisecting the block, Butler road and Wogarl-Graball road disrupt the entirety and create extra edges.

- **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. Wogarl is a relatively large bushland block but within heavily cleared surroundings. Roadside corridors extending in three directions and linking with other remnants are important buffers to this valuable island block. The LCDC have a project under-way to establish 110 hectares of linkages and corridors within the Graball catchment and Wogarl Reserve is included in this scheme.

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

In a landscape with relatively minor relief, Wogarl Reserve is actually well situated on the upper part of the landscape. There were no signs of waterlogging or salinity in the bushland. In a shire where salinity is a major problem, the position in the landscape and excellent condition mean the Reserve is of outstanding importance now and in the long term.

The values of these healthy bushland areas in the overall picture of biodiversity and sustainability is being increasingly recognised. 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). 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. In the words of Denis Saunders (2002) from CSIRO Sustainable Ecosystems: "The first rule of management of fragmented landscapes is that all native systems left should be preserved, because they are going to be the skeletons on which we rebuild the landscapes."

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.

As already discussed weeds were localised and not a major problem over most of the site. Maintaining the site in excellent condition should be the goal. Preventing further disturbance is the best form of weed control and taking measures to reduce the disturbance and weed load where they are a problem. A review of the drainage into the site would be appropriate, with the goal of keeping drainage from agricultural lands away from bushland. Targeting of aggressive weed species such as Wild Oats and Wild Turnip could be worthwhile.

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 act as effective natural barriers or filters against the intrusion of windblown weed seed, so no action is required where they form boundaries. However Open Woodlands adjoining cleared paddocks, such as the Woodlands on the southern 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 10), 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. It is not necessary in Wogarl Reserve.

The network of tracks and gravel pits within Wogarl Reserve beg the question of how to manage. Many of the tracks which were obvious on the 1996 aerial photograph were not as evident on the ground in 2000 suggesting that natural restoration was taking place and should be allowed to continue. Further soil disturbance should be avoided and no soil should be introduced to any of the gravel pits when they become disused. Their closure should be encouraged. Repair might just need to include battering of the sides and some direct seeding or brushing (laying branches containing ripe seeds onto the surface) with species from within the reserve.

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 III where the species are listed by quadrat and vegetation type (plant community). Remember to select native herbs, grasses and sedges as well as trees, mallees 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. Other disturbances

Draining water from adjoining land into the bushland is a very serious threat to the conservation values of the bushland and should be prohibited. The extra water and nutrients are agents of disturbance and as discussed weed invasion was worst in areas where drains had been built. If ponding occurred within the bushland, then waterlogging would become a serious threat to the vegetation.

Access roads and 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.

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.

4. Management Checklist

The following checklist summarises some management points for consideration.

- Build an awareness in the local community and the management body of
 - the values of the Reserve
 - the threat of drains and weeds to the Reserve
 - a commitment to take appropriate management actions and to provide the necessary resources (financial, supply of labour and materials on an ongoing basis)
- Prohibit drains which bring water from adjoining farms into the reserve.
- Review the requirement for gravel pits and close and restore those no longer required. Place the focus on positioning gravel pits in already cleared areas.
- Monitor current weed infestations and control any new outbreaks. Consider control of aggressive species or localised outbreaks 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 southern boundary sections to prevent weed intrusion and fertiliser and herbicide drift.
- Use locally sourced seed for any revegetation projects –gravel pits and 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.
- Pursue the proposal to apply a covenant to the Reserve to ensure its protection in perpetuity.

7. CONCLUSION

This survey has shown that Wogarl Reserve is a bushland area with very high conservation value. 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: 333 native plant taxa including 10 threatened species, one unrecognised taxon and one recently recognised species and at least fourteen species at or near the limits of their range or with a limited range.
- It has eight vegetation types, in excellent condition, representative of the sandplains and lower slopes of the Avon catchment in the eastern central Wheatbelt.
- It is one of only a few large areas of bushland remaining in the Narembene 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); only 8.1 per cent of remnant vegetation remaining in the Narembene 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 Narembene LCDC is to be commended for recognising the conservation value of Wogarl Reserve and taking measures to ensure that the present tenure as unallocated crown land is converted to permanent status as bushland. The survey has helped to achieve the purposes of helping the community learn, through involvement, about plants in bushland and bushland conservation as well as fostering city-country links. Thirty Wildflower Society volunteers and botanists and eight 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.

8. ACKNOWLEDGMENTS

Shane Lyons from the Narembeen LCDC was responsible for the survey application and for helping with the organisation of the survey weekend. Frank and Betty Gould generously made their farm house available as home for the survey volunteers for the weekend. Participants in the survey weekend from the local community were Bill and Joan Flint, Kennedy and Nigel Miller, Shane and Lara Lyons, Dan Cheetham and Chris Padfield. Bill and Joan Flint also participated in the return visit later in the season. Joan has a great knowledge of the flora of her region, is a keen collector and keeper of the Regional Herbarium.

The help and enthusiasm of the Wildflower Society volunteers and botanists who are so generous with their time and knowledge is a highlight of the program. Logan Anderson, Anne and Alan Bellman, Mary Bremner, Chris and Daniel Brooks, Kate Brown, Mark Brundrett, Karen Clarke, Margaret Collins, Jeff Faulkner, Carolyn Garavanta, David and Sylvia Garlick, Neil Gibson, Rosemary Graham, Olga Green, Giles Harford, Val House, Greg Keighery, Suzie Lintern, Felicity Littleton, Amanda Malone, Brian Moyle, Dorothy Perret, Cynthia Playford, Howard and James Shotter and Sylvia Tetlow took part in the survey weekend. In addition to helping with the field survey Anne Bellman, Sylvia Garlick, Elizabeth George, Gerald Kryssman, Brian Moyle, Dorothy Perret, Alice Stubber, Andrew Thomson and Pat Wenham assisted with the follow-on work at the Herbarium which included plant sorting and identification, and compiling of the Reference Herbarium. Thanks to Mark Brundrett for the selection of slides of the Wogarl Reserve flora. Special thanks to Brian Moyle for regular support, for taking the photographs of vegetation and scanning them and Mark's photos for this report and the donation of slides to the Landcare group.

Plant identifications were verified at the WA Herbarium by Ann Gunness with assistance from the following specialists: Andrew Brown (Orchids), Elizabeth George (*Verticordia*), Neil Gibson (*Eucalyptus*), Mike Hislop (general, especially *Melaleuca* and *Epacridaceae*), Greg Keighery (general, especially monocotyledons and *Eucalyptus*), Brendan Lepschi (*Melaleuca*), Barbara Rye (*Rhamnaceae*), Leigh Sage (*Goodeniaceae*), Malcolm Trudgen (*Baeckea*, *Euryomyrtus*, *Micromyrtus*, *Rinzia* and *Thryptomene*), Stan Webster (*Acacia*) and Paul Wilson (*Chenopodiaceae*).

The regular weekly use of the Reference Herbarium facilities at the Western Australian Herbarium is an integral part of the project and the Herbarium support is gratefully acknowledged. Photocopying facilities provided by the Swan Catchment Centre are also a benefit to the project. Thanks to the project's Steering Committee: Brian Moyle, Bronwen Keighery, Mary Gray and Karen Clarke for their support throughout the project and for their comments on the report. Also to Greg Keighery and Neil Gibson, thanks for general support, discussion and advice.

Acknowledgment is also due to the Department of Environmental Protection, especially Brendon Ward, Lindsay Bourke and Anthony Langdon for producing the maps of remnant vegetation and Beard vegetation types (Figures 2 and 3). This information was reproduced with permission from the Land Monitor Project (perennial vegetation from 1966 Landsat TM imagery) and the Spatial Resource Information Group, Agriculture WA.

The Bushland Plant Survey Project is a community volunteer program. This project has been supported by funds from the Bushcare Program of the Natural Heritage Trust (1999-2000) and by the Department of Conservation and Land Management and the Department of Environmental Protection.

9. REFERENCES

- Anon (1999). Environmental Protection of Native Vegetation in Western Australia Preliminary Position Statement No. 2. Environmental Protection Authority. (Perth, Western Australia.)
- Anon (2000). Final Report of the Native Vegetation Working Group (The Government of Western Australia.)
- Aplin, T.E.H. (1979). The Flora. In 'Environment and Science'. (Ed. B.J. O'Brien) (University of Western Australia Press, Perth).
- Atkins, K.J. (2001). Declared Rare and Priority Flora list for Western Australia. (Department of Conservation and Land Management, Como, WA.)
- Avon River Management Authority (ARMA) (1993). Avon River System management Strategy. (Waterways Commission, Perth)
- Beard, J.S. (1972). Vegetation Survey of Western Australia. The Vegetation of the Southern Cross Area, Western Australia: Map and Explanatory Memoir (1: 250 000 series). (Vegmap Publications, Perth.)
- Beard, J.S. (1981). Vegetation Survey of Western Australia: Swan. 1:1 000 000 Vegetation Series. Explanatory Notes to Sheet 7. (University of Western Australia Press, Perth).
- Beard, J.S. (1990). 'Plant Life of Western Australia'. (Kangaroo Press: Kenthurst, NSW.)
- Beeston, G.R., Mlodawski, G., Sanders, A. and True, D. (1994). Remnant Vegetation Inventory in the Southern Agricultural Areas of Western Australia. (Agriculture Western Australia, Perth.)
- Bennett, E.M. (1993). 'Common and Aboriginal Names of Western Australian Plant Species.' (Wildflower Society of Western Australia, Eastern Hills Branch, Glen Forrest.)
- Bradshaw, W. (2001). 'Critters and Crops: the critical connection'. (Greening Australia, Western Australia. Fremantle.)
- Brown, A., Thomson-Dans, C. and Marchant, N. (Eds.) (1998). 'Western Australia's Threatened Flora'. (Department of Conservation and Land Management)
- Commonwealth of Australia, Bureau of Meteorology. (2001). Climate information website. [<http://www.bom.gov.au/climate/averages/>]
- Dixon, B. and Keighery, G. (1995). Suggested methods to control weeds. In 'Managing Perth's Bushlands'. (Eds. M. Scheltema and J. Harris.) pp. 26-143. (Greening Western Australia, Perth.)
- English, V.J. and Blyth, J. (1997). Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province. Project No. N701. Final report to Environment Australia. (Department of Conservation and Land Management, Como, WA.)
- Gee, R.D. (1982). Geological Survey of Western Australia 1: 250 000. Geological Series - Explanatory Notes, Southern Cross Sheet 50-16.

- Griffin, E.A., Hopkins, A.J.M. and Hnatuik, R.J. (1983). Regional variation in Mediterranean-type shrublands near Eneabba, south-western Australia. *Vegetatio* **52**, 103-127.
- Griffin, E.A. and Hopkins, A.J.M. (1985). The flora of Mt Lesueur, Western Australia. *Journal of the Royal Society of Western Australia*, **67**, 45-57.
- Gunness, A. and Campbell, R. (1998). Plants of the Pioneer Cemetery and Snell Street Reserve at Merredin. (Wildflower Society of Western Australia, Nedlands.)
- Gunness, A.G. and volunteers of the Wildflower Society Bushland Plant Survey Project, (1999). A Survey of Vegetation and Flora of Heritage Bushland on the McBurney's 'Nyamutin Farm', East Yornaning LCDC, Shire of Cuballing. (Wildflower Society of Western Australia, Nedlands.)
- Gunness, A.G. and volunteers of the Wildflower Society Bushland Plant Survey Project, (2000). A Survey of Vegetation and Flora of Heritage Bushland on the Taylor's Property 'Woodford' at Tincurrin in the Fence Road Catchment, Shire of Wickepin. (Wildflower Society of Western Australia, Nedlands.)
- Hopkins, A.J.M., Coker, J., Beeston, G.R., Bowen, P. and Harvey, J.M. (1996). Conservation status of vegetation types throughout Western Australia. Final Report: Australian Nature Conservation Agency National Reserves Systems Co-operative Program, Project No N703. (Department of Conservation and Land Management and Department of Agriculture, Western Australia.)
- Hopkins, A.J.M., Beeston, G.R. and Harvey, J.M. (2000). A database on the vegetation of Western Australia, Stage 1. *CALMScience* (In press).
- Hussey, B.M.J., Keighery, G.J., Cousens, R.D., Dodd, J. and Lloyd, S.G. (1997). 'Western Weeds: A guide to the weeds of Western Australia'. (The Plant Protection Society of Western Australia Inc.: Victoria Park, WA.)
- Keating, C.D.M. and volunteers of the Bushland Plants Survey Project, (2001). The Vegetation and Flora of Heritage Bushland on Buddy Kent's property "Tippaburra" in the South Bodallin Catchment in the Shire of Yilgarn. (Wildflower Society of Western Australia, Nedlands.)
- Keighery, B.J. (1994). Bushland Plant Survey: A guide to plant community survey for the community. (Wildflower Society of Western Australia: Perth.)
- Keighery, B.J., Keighery, G.J. and Gibson, N. (1997). Floristics of Reserves and Bushland Areas of the Perth region (System 6). Parts XI-XV. PartXI: Floristics of the Mundijong road bushland. (Wildflower Society of WA Inc., Nedlands.)
- Keighery, G.J. (2000). Wheatbelt wonders under threat. *Landscape* **16** No. 2. (Department of Conservation and Land Management, Western Australia.)
- Keighery, G.J., Halse, S. and McKenzie, N. (2001a). Why wheatbelt valleys are valuable and vulnerable: the ecology of wheatbelt valleys and threats to their survival. In: Conference Papers 'Dealing with Salinity in Wheatbelt Valleys: Processes, Prospects and Practical Options' (State Salinity Council and Avon Working Group, Western Australia.)
- Keighery, G.J., Keighery, B.J. Gibson, N. and Gunness A.G. (2001b). The vegetation and Flora of Quairading Nature Reserve, Shire of Quairading, Western Australia. (Wildflower Society of Western Australia (Inc.) Nedlands.)

- Lefroy, E.C., Hobbs, R.J. and Atkins, L.J. (1991). 'Revegetation Guide to the Central Wheatbelt'. Department of Agriculture Western Australia, Bulletin 4231.
- Muir, B.G. (1977). Biological survey of the Western Australian wheatbelt, Part II. Records of the Western Australian Museum, Supplement No. 3.
- Muir, B.G. (1978). Some Nature Reserves of the Western Australian Wheatbelt, Part 4: Narembeen Shire. (Perth: Department of Fisheries and Wildlife, Unpublished Report.)
- Ochtman, M. and Holt, C. (2000). Vegetation Buffer Zones. Farmnote No. 38/2000. (Agriculture Western Australia.)
- Patrick, S. (1997). 'How to Create a Local Herbarium'. (Land for Wildlife and Department of Conservation and Land Management, Western Australia.)
- Ralph, M. (1994). 'Seed Collection of Australian Native Plants for Revegetation, Tree Planting and Direct Seeding'. (Murray Ralph, Fitzroy)
- Recher, H.F. (1999). The state of Australia's avifauna; a personal opinion and prediction for the new millennium. *Australian Zoologist* **31**, 11-27.
- Safstrom, R. (1995). Conservation values of small reserves in the Central Wheatbelt of Western Australia: A framework for evaluating the conservation values of small reserves. Unpublished report for the Department of Conservation and Land Management, Western Australia.
- Safstrom, R. and Craig, G.F. (1996). Environmental Evaluation of Native Vegetation in the Wheatbelt of Western Australia. Principles and Criteria Used to Appraise Land Clearing Proposals. Report prepared for the Western Australian Department of Environmental Protection.
- Saunders, D. (2002). The ecological imperatives for conservation and management of native vegetation. In *Western Wildlife* **6** (1): 1, 4-6. Newsletter of the Land for Wildlife Scheme. (Department of Conservation and Land Management, Western Australia.)
- Thackway, R. and Cresswell, I.D. (Eds) (1995). 'An interim Biogeographic Regionalisation for Australia: a framework for setting priorities in the National Reserves System'. Version 4.0. (Australian Nature Conservation Agency, Canberra.)
- Trudgen, M.E. (2001). Reinstatement and revision of *Euryomyrtus* (Myrtaceae). *Nuytsia* **13**(3): 543-566.
- Weaving, S. (1999). 'Avon and Upper Hotham Region Natural Resource Atlas'. (Spatial Resources Information Group, Agriculture Western Australia.)
- Yates, C.J. and Hobbs, R.J. (1997). Temperate Eucalypt Woodlands: a review of their status, processes threatening their persistence and techniques for restoration. *Australian Journal of Botany* **45**: 949-973.
- Western Australian Herbarium (1998). Florabase – Information on the Western Australian Flora. [<http://www.calm.wa.gov.au/science/florabase.html>] (Department of Conservation and Land Management, Western Australia.)

APPENDICES

APPENDIX I: SITE VEGETATION DESCRIPTIONS AND CONDITION (BY PLANT COMMUNITY)

EUCALYPT COMMUNITIES

W. Salmon Gum – Gimlet Woodlands

Quadrat WOGL 01

Salmon Gum (*Eucalyptus salmonophloia*), Gimlet (*Eucalyptus salubris*) Open Woodland over Smooth Barked York Gum (*Eucalyptus loxophleba* subspecies *lissophloia*) Very Open Shrub Mallee over *Melaleuca acuminata*, Jam (*Acacia acuminata*), *Acacia inceana* Tall Open shrubland over *Olearia muelleri* Low Open Shrubland over *Austrodanthonia caespitosa* Open Grassland.

Condition Rating: excellent

Soil: red brown sandy loam

Drainage: moderate

Aspect: flat

Number of species: (23 natives, 1 weed)

Lat/long: 31° 54.583' S, 118° 31.277' E

Quadrat WOGL 02

Salmon Gum (*Eucalyptus salmonophloia*) Open Woodland over Smooth Barked York Gum (*Eucalyptus loxophleba* subspecies *lissophloia*) Open Shrub Mallee over *Olearia muelleri* Low Open Shrubland over *Austrostipa elegantissima*, *Austrodanthonia* sp. Goomalling (A. Gunness *et. al.* OAKP10/63) Very Open Grassland.

Condition Rating: excellent

Soil: brown sandy loam

Drainage: moderate - good

Aspect: gentle south-west slope

Number of species: (21 natives, 0 weeds)

Lat/long: 31° 54.547' S, 118° 31.284' E

Quadrat WOGL 03

Gimlet (*Eucalyptus salubris*) Low Open Forest over Gooseberry Mallee (*Eucalyptus calycogona*) Open Shrub Mallee over *Olearia muelleri* Low Open Shrubland.

Condition Rating: excellent - pristine

Soil: pink brown sandy loam

Drainage: moderate

Aspect: flat

Number of species: (17 natives, 2 weeds)

Lat/long: 31° 54.497' S, 118° 31.331' E

Quadrat WOGL 10

Salmon Gum (*Eucalyptus salmonophloia*) Tall Open Woodland over Ribbon-barked Gum (*Eucalyptus sheathiana*), Smooth Barked York Gum (*Eucalyptus loxophleba* subspecies *lissophloia*) Open Shrub Mallee over *Daviesia benthamii*, *Eremophila drummondii* Shrubland over *Olearia muelleri* Low Open Shrubland.

Condition Rating: pristine

Soil: light brown sandy loam

Drainage: moderate

Aspect: flat to very gentle north west slope

Number of species: (19 natives, 3 weeds)

Lat/long: 31° 53.967' S, 118° 32.035' E

M. Mallee over *Melaleuca*-*Acacia* Shrublands

Quadrat WOGL 07

Gooseberry Mallee (*Eucalyptus calycogona*), Ribbon-barked Gum (*Eucalyptus sheathiana*)
Shrub Mallee over *Melaleuca eleuterostachya* Tall Open Shrubland over *Daviesia benthamii*
Open Shrubland over *Olearia muelleri*, *Acacia intricata* Low Open Shrubland.

Condition Rating: excellent - pristine

Soil: brown clay loam

Drainage: good

Aspect: very gentle west slope

Number of species: (10 natives, 0 weeds)

Lat/long: 31° 54.395' S, 118° 32.060' E

Quadrat WOGL 09

Redwood (*Eucalyptus transcontinentalis*), Gooseberry Mallee (*Eucalyptus calycogona*),
Eucalyptus myriadena Very Open Mallee over *Melaleuca eleuterostachya* Tall Open Shrubland
over *Melaleuca lateriflora*, *Daviesia benthamii*, *Acacia hemiteles* Open Heath over *Melaleuca*
grieveana Low Shrubland.

Condition Rating: excellent

Soil: orange-brown sandy loam

Drainage: good

Aspect: gentle north slope

Number of species: (19 natives, 4 weeds)

Lat/long: 31° 53.811' S, 118° 32.039' E

Quadrat WOGL 19

Ribbon-barked Gum (*Eucalyptus sheathiana*), Smooth Barked York Gum (*Eucalyptus*
loxophleba subspecies *lissophloia*) Shrub Mallee over *Acacia eremophila* variety *eremophila*,
Melaleuca eleuterostachya Tall Open Shrubland over *Acacia hemiteles* Shrubland over
Austrostipa elegantissima, *Austrostipa variabilis* Open Grassland and *Podolepis lessonii*,
Podolepis capillaris, *Lomandra effusa* Very Open Herbland.

Condition Rating: excellent

Soil: brown loamy sand

Drainage: good

Aspect: flat to very gentle north slope

Number of species: (20 natives, 1 weed)

Lat/long: 31° 54.650' S, 118° 30.985' E

C. Open Shrub Mallee over *Callitris*-*Allocasuarina* Tall Shrublands

Quadrat WOGL 06

Mallee Wandoo (*Eucalyptus capillosa* subspecies *polyclada*) Open Shrub Mallee over Cypress
Pine (*Callitris glaucophylla*), Black Tamar (*Allocasuarina acutivalvis*) Tall Shrubland over
Melaleuca condylosa, *Phebalium ambiguum* Low Shrubland.

Condition Rating: pristine

Soil: orange loamy sand

Drainage: good

Aspect: gentle north-west slope

Number of species: (12 natives, 1 weed)

Lat/long: 31° 54.516' S, 118° 32.046' E

SCRUB / SHRUBLANDS / HEATH

S. Scrub (+/- Mallees)

Quadrat WOGL 08

Black Tamar (*Allocasuarina acutivalvis*), *Melaleuca condylosa* Open Scrub over *Thryptomene cuspidata*, *Phebalium ambiguum* Shrubland over *Phebalium megaphyllum* Low Open Shrubland with emergent Tall Sand Mallee (*Eucalyptus eremophila*), *Eucalyptus subangusta* subspecies *cerina* and Redwood (*Eucalyptus transcontinentalis*).

Condition Rating: excellent

Soil: orange-brown clay

Drainage: moderate

Aspect: gentle south-west slope

Number of species: (17 natives, 0 weeds)

Lat/long: 31° 54.349' S, 118° 32.055' E

Quadrat WOGL 16

Black Tamar (*Allocasuarina acutivalvis*), Grey Tamar (*Allocasuarina corniculata*) Open Scrub over *Micromyrtus obovata* Open Heath over a *Melaleuca cordata*, *Baeckea tenuiramea*, *Chamelaucium pauciflorum*, *Thryptomene cuspidata* Low Shrubland.

Condition Rating: excellent

Soil: yellow-grey sand

Drainage: good

Aspect: gentle west slope

Number of species: (27 natives, 0 weeds)

Lat/long: 31° 54.450' S, 118° 31.881' E

Quadrat WOGL 20

Acacia beauverdiana, *Melaleuca eleuterostachya*, Black Tamar (*Allocasuarina acutivalvis*) Tall Open Shrubland over *Hibbertia glomerosa*, *Santalum acuminatum*, *Grevillea asteriscosa* Low Open Shrubland over *Amphipogon caricinus*, *Austrostipa elegantissima* Open Grassland.

Condition Rating: very good (rabbit warren in midst, very small area)

Soil: orange brown loamy sand with lateritic gravel

Drainage: good

Aspect: very gentle east slope

Number of species: (25 natives, 11 weeds)

Lat/long: 31° 54.791' S, 118° 30.811' E

O. Tall Open Shrublands (+/- Mallee)

Quadrat WOGL 04

Jam (*Acacia acuminata*), *Melaleuca eleuterostachya* Tall Shrubland over *Baeckea crispiflora*, *Phebalium tuberosum* Shrubland over *Amphipogon caricinus* grassland with scattered emergent Smooth Barked York Gum (*Eucalyptus loxophleba* subspecies *lissophloia*).

Condition Rating: excellent - pristine

Soil: orange brown sandy loam

Drainage: good

Aspect: very gentle south-west slope

Number of species: (15 natives, 0 weeds)

Lat/long: 31° 54.588' S, 118° 31.407' E

Quadrat WOGL 11

Ribbon-barked Gum (*Eucalyptus sheathiana*) Very Open Shrub Mallee over *Melaleuca uncinata* Tall Open Shrubland over *Acacia eremophila*, *Olearia dampieri* subspecies *eremicola* Open Shrubland over *Aristida contorta*, *Austrostipa elegantissima* Open Grassland.

Condition Rating: very good

Soil: cream sandy loam

Drainage: good

Aspect: gentle north-west slope

Number of species: (16 natives, 2 weeds)

Lat/long: 31° 53.927' S, 118° 31.543' E

Quadrat WOGL 14

Tammin Mallee (*Eucalyptus leptopoda* subspecies *leptopoda*) Very Open Shrub Mallee over Tamar (*Allocasuarina campestris*), *Allocasuarina spinosissima* Tall Open Shrubland over *Hakea erecta* Open Shrubland over *Melaleuca cordata*, *Melaleuca calyptroides* Low Open Shrubland over *Borya constricta* Very Open Herbland and *Ecdeiocolea monostachya*, *Lepidobolus preissianua* subspecies *volubilis* Open Sedgeland.

Condition Rating: excellent

Soil: yellow brown loamy sand

Drainage: good

Aspect: flat

Number of species: (42 natives, 0 weeds)

Lat/long: 31° 53.782' S, 118° 31.158' E

Quadrat WOGL 15

Grey Tamar (*Allocasuarina corniculata*), *Acacia yorkkrakinensis*, *Melaleuca uncinata* Tall Open Shrubland over *Phebalium tuberosum*, *Beaufortia interstans*, *Melaleuca cordata* Shrubland with scattered Burracoppin Mallee (*Eucalyptus burracoppinensis*).

Condition Rating: pristine

Soil: grey sand over gravel

Drainage: good

Aspect: gentle east slope

Number of species: (37 natives, 0 weeds)

Lat/long: 31° 53.757' S, 118° 31.062' E

Quadrat WOGL 17

Melaleuca uncinata, *Hakea erecta*, *Acacia beauverdiana*, *Santalum acuminatum* Tall Shrubland over *Micromyrtus obovata* Open Shrubland over *Phebalium tuberosum*, *Beaufortia interstans*, *Hibbertia eatoniae* Low Shrubland over *Amphipogon caricinus* Very Open Grassland with the parasitic scrambler *Cassytha nodiflora* common.

Condition Rating: very good

Soil: yellowish sandy loam

Drainage: good

Aspect: gentle south-west slope

Number of species: (44 natives, 0 weeds)

Lat/long: 31° 54.218' S, 118° 31.055' E

Quadrat WOGL 18

Stiff-leaved Mallee (*Eucalyptus rigidula* subspecies *rigidula*) Very Open Shrub Mallee over *Melaleuca uncinata*, *Hakea erecta*, *Isopogon scabriusculus* Open Shrubland over *Phebalium tuberosum*, *Hibbertia eatoniae*, *Beaufortia interstans* Open Low Heath over *Schoenus hexandrus*, *Lepidosperma* sp. A2 Island Flat (Keighery 7000) Very Open Sedgeland.

Condition Rating: pristine

Soil: yellow-orange sandy loam

Drainage: good

Aspect: gentle south-east slope

Number of species: (39 natives, 1 weed)

Lat/long: 31° 54.122' S, 118° 31.064' E

T. Tamar Mixed Shrubland**Quadrat WOGL 05**

Tamar (*Allocasuarina campestris*), *Acacia assimilis*, *Calothamnus gilesii* Shrubland over *Hibbertia eatoniae*, *Baeckea crispiflora* Low Shrubland over *Amphipogon caricinus* Very Open Grassland with emergent *Eucalyptus subangusta* subspecies *cerina*.

Condition Rating: excellent

Soil: yellow brown sandy loam

Drainage: good

Aspect: very gentle westerly slope

Number of species: (21 natives, 0 weeds)

Lat/long: 31° 54.608' S, 118° 31.834' E

P. Melaleuca Closed Heath (Thicket)**Quadrat WOGL 21**

Melaleuca uncinata, *Hakea erecta* over *Melaleuca carriei*, *Phebalium tuberosum*, *Melaleuca spicigera* Closed Heath over *Micromyrtus obovata*, *Thryptomene cuspidata* Low Open Shrubland.

Condition Rating: excellent

Soil: pale yellow sand to 35cm and then lateritic gravel

Drainage: good

Aspect: gentle west slope

Number of species: (17 natives, 1 weed)

Lat/long: 31° 54.237' S, 118° 31.753' E

H. Open Heath over Sedgeland

Quadrat WOGL 12

Melaleuca uncinata, *Hakea erecta* Open Heath over *Baeckea rosea*, *Micromyrtus obovata* Low Open Shrubland over *Amphipogon caricinus* Open Grassland over *Ecdeiocolea monostachya* Open Sedgeland.

Condition Rating: pristine

Soil: light brown - yellow sand

Drainage: good

Aspect: flat to very gentle north slope

Number of species: (23 natives, 0 weeds)

Lat/long: 31° 53.870' S, 118° 31.465' E

Quadrat WOGL 13

Tammin Mallee (*Eucalyptus leptopoda* subspecies *leptopoda*) Open Shrub Mallee and Black Tamar (*Allocasuarina acutivalvis*) Shrubland over *Isopogon scabriusculus*, *Melaleuca platycalyx*, *Verticordia chrysantha* Open Low Heath over *Ecdeiocolea monostachya* Open Sedgeland over *Borya sphaerocephala* Very Open Herbland with emergent *Acacia ephedroides* and *Acacia lirellata* subspecies *compressa*.

Condition Rating: pristine

Soil: sandy loam over lateritic gravel

Drainage: good

Aspect: very gentle east slope

Number of species: (50 natives, 0 weeds)

Lat/long: 31° 53.766' S, 118° 31.229' E

APPENDIX II: PLANT SPECIES LIST

All taxa (species, subspecies and varieties) recorded on quadrats as well as taxa observed elsewhere within Wogarl 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.
- Mallee** shrubs or trees with many stems arising at or below ground level
- Herb** a plant without a persistent above ground woody stem (excluding grasses, sedges and rushes)
- Grass** members of the family Poaceae
- Sedge or sedge-like*** members of the families Cyperaceae and Centrolepidaceae
- Rush*** herbs which are grass-like in appearance. Members of the families Juncaceae and Restionaceae
- Creepers, Vines** climbing, scrambling or trailing plants often with special modifications for climbing (described in shrub layer)
- Fern** plants which reproduce by spores rather than seeds. Belong to the division in the plant kingdom called Pteridophyta. Also includes fern allies.

* 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 SPECIESLIST FOR WOGARL RESERVE IN THE GRABALL CATCHMENT, SHIRE OF NAREMBEEN (Alphabetically by Family)

Botanical name	Common name	Family	Life form	Growth form	Cons code
<i>Ptilotus gaudichaudii</i>	Mulla Mulla	Amaranthaceae	A	herb	
<i>Ptilotus holosericeus</i>	Mulla Mulla	Amaranthaceae	P	herb	
<i>Ptilotus polystachyus</i> var. <i>polystachyus</i>	Prince of Wales Feather	Amaranthaceae	A or P	herb	
<i>Ptilotus spathulatus</i>	Mulla Mulla	Amaranthaceae	P	herb	
<i>Agrostocrinum scabrum</i>	Blue Grass Lily	Anthericaceae	P	herb	
<i>Laxmannia grandiflora</i> subsp. <i>grandiflora</i>		Anthericaceae	P	herb	
<i>Thysanotus patersonii</i>	Twining Fringe Lily	Anthericaceae	P/A	twining herb	
<i>Thysanotus sparteus</i>	Fringed Lily	Anthericaceae	P/A	herb	
<i>Thysanotus triandrus</i>	Fringed Lily	Anthericaceae	P/A	herb	
<i>Tricoryne tenella</i>		Anthericaceae	P	herb	
<i>Daucus glochidatus</i>	Australian Carrot	Apiaceae	A	herb	
<i>Hydrocotyle rugulosa</i>	Pennywort	Apiaceae	A	herb	
<i>Platysace trachymenioides</i>	Pennywort	Apiaceae	P	shrub	
<i>Trachymene cyanopetala</i>		Apiaceae	A	herb	
<i>Trachymene</i> sp.		Apiaceae	A	herb	
<i>*Arctotheca calendula</i>	Capeweed	Asteraceae	A	herb	
<i>*Hypochoeris glabra</i>	Flat Weed, Smooth Cat's-ear	Asteraceae	A	herb	
<i>*Osteospermum clandestinum</i>	Sinking Roger	Asteraceae	A	herb	
<i>*Sonchus oleraceus</i>	Common Sowthistle	Asteraceae	A	herb	
<i>*Ursinia anthemoides</i>	Ursinia	Asteraceae	A	herb	
<i>Angianthus tomentosus</i>	Camel-grass	Asteraceae	A	herb	
<i>Chionocephalus pseudevax</i>	Woolly Groundheads	Asteraceae	A	herb	
<i>Erymophyllum tenellum</i>		Asteraceae	A	herb	
<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>		Asteraceae	A	herb	
<i>Lawrencella rosea</i>	Pink Everlasting	Asteraceae	A	herb	
<i>Olearia dampierii</i> subsp. <i>eremicola</i> ms		Asteraceae	P	shrub	
<i>Olearia muelleri</i>	Goldfield's Daisy	Asteraceae	P	shrub	
<i>Podolepis capillaris</i>	Wiry Podolepis	Asteraceae	A	herb	
<i>Podolepis lessonii</i>		Asteraceae	A	herb	
<i>Podolepis tepperi</i>		Asteraceae	A	herb	

Botanical name	Common name	Family	Life form	Growth form	Cons code
<i>Podotheca angustifolia</i>	Sticky Longheads	Asteraceae	A	herb	
<i>Podotheca gnaphalioides</i>	Golden Longheads	Asteraceae	A	herb	
<i>Pterochaeta paniculata</i>	Woolly 'Waitzia'	Asteraceae	A	herb	
<i>Rhodanthe laevis</i>	Smooth Sunray	Asteraceae	A	herb	
<i>Rhodanthe manglesii</i>	Pink Sunray	Asteraceae	A	herb	
<i>Waitzia acuminata</i> var. <i>acuminata</i>	Orange Immortelle	Asteraceae	A	herb	
<i>Borya constricta</i>	Pincushions	Boryaceae	P	herb	
<i>Borya laciniata</i>	Pincushions	Boryaceae	P	herb	
<i>*Brassica tournefortii</i>	Mediterranean or Wild Turnip	Brassicaceae	A	herb	
<i>*Raphanus raphanistrum</i>	Wild Radish	Brassicaceae	A	herb	
<i>Senna pleurocarpa</i> var. <i>angustifolia</i>	Native Senna	Caesalpinaceae	P	shrub	
<i>Wahlenbergia gracileta</i> / <i>preissii</i>	Annual Bluebell	Campanulaceae	A	herb	
<i>Allocasuarina acutivalvis</i> subsp. <i>acutivalvis</i>	Black Tamar	Casuarinaceae	P	shrub /small tree	
<i>Allocasuarina campestris</i>	Tamar	Casuarinaceae	P	shrub	
<i>Allocasuarina corniculata</i>	Grey Tamar	Casuarinaceae	P	shrub	
<i>Allocasuarina helmsii</i>		Casuarinaceae	P	shrub	G
<i>Allocasuarina microstachya</i>		Casuarinaceae	P	shrub	
<i>Allocasuarina spinosissima</i>		Casuarinaceae	P	shrub	
<i>Allocasuarina choretroides</i>		Casuarinaceae	P	shrub	G
<i>Psammomoya choretroides</i>		Celastraceae	P	shrub	
<i>Atriplex semibaccata</i>	Berry Saltbush	Chenopodiaceae	P	herb	
<i>Enchylaena lanata</i>		Chenopodiaceae	P	shrub	
<i>Maireana brevifolia</i>	Small Leaf Bluebush	Chenopodiaceae	P	shrub	
<i>Maireana georgii</i>	Satiny Bluebush	Chenopodiaceae	P	shrub	
<i>Rhagodia preissii</i> subsp. <i>preissii</i>		Chenopodiaceae	P	shrub	
<i>Wilsonia humilis</i>	Silky Wilsonia	Convolvulaceae	P	shrub	
<i>Crassula colorata</i> var. <i>acuminata</i>	Dense Stonecrop	Crassulaceae	A	herb	
<i>Callitris glaucophylla</i>	Cypress Pine	Cupressaceae	P	tree or shrub	
<i>Callitris tuberculata</i>	Mallee Cypress Pine	Cupressaceae	P	tree or shrub	
<i>?Gahnia drummondii</i>		Cyperaceae	P	sedge	
<i>Lepidosperma brunonianum</i> (broad leaf form)	Sword-sedge	Cyperaceae	P	sedge	
<i>Lepidosperma brunonianum</i> (narrow leaf form)	Sword-sedge	Cyperaceae	P	sedge	
<i>Lepidosperma</i> sp. (Wogar 16/26)		Cyperaceae	P	sedge	

Botanical name	Common name	Family	Life form	Growth form	Cons code
<i>Lepidosperma</i> sp. A2 Island Flat (Keighery 7000)	Sword-sedge	Cyperaceae	P	sedge	
<i>Lepidosperma</i> sp. K Boorabbin (K.L. Wilson 2579)		Cyperaceae	P	sedge	
<i>Mesomelaena preissii</i>		Cyperaceae	P	sedge	
<i>Schoenus armeria</i>		Cyperaceae	P	sedge	G
<i>Schoenus calcatus</i>		Cyperaceae	P	sedge	P3
<i>Schoenus hexandrus</i>		Cyperaceae	P	sedge	
<i>Schoenus</i> sp. A1 Boorabbin (K.L. Wilson 2581)		Cyperaceae	P	sedge	
<i>Chamaeeros fimbriata</i>	Fringe-leaf	Dasypogonaceae	P	herb	
<i>Lomandra effusa</i>	Scented Matrush	Dasypogonaceae	P	herb	
<i>Lomandra</i> sp.	Matrush	Dasypogonaceae	P	herb	
<i>Lomandra</i> sp. Wheatbelt	Matrush	Dasypogonaceae	P	herb	
<i>Hibbertia eatoniae</i>	Guinea Flower	Dilleniaceae	P	shrub	
<i>Hibbertia glomerosa</i>	Guinea Flower	Dilleniaceae	P	shrub	
<i>Hibbertia rupicola</i>	Guinea Flower	Dilleniaceae	P	shrub	
<i>Hibbertia stowardii</i>	Guinea Flower	Dilleniaceae	P	shrub	
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	Bridal Rainbow, Climbing Sundew	Droseraceae	P/A	herb	
<i>Drosera macrophylla</i>	Showy Sundew	Droseraceae	P	herb	
<i>Drosera</i> sp.	Sundew	Droseraceae	P/A	herb	
<i>Drosera</i> sp. (pygmy)	Pygmy Sundew	Droseraceae	P/A	herb	
<i>Ecdeiocolea monostachya</i>		Ecdeiocoleaceae	P	sedge	
<i>Andersonia lehmanniana</i>		Epacridaceae	P	shrub	
<i>Astroloma serratifolium</i>	Kondrung	Epacridaceae	P	shrub	
<i>Brachyloma mogin</i>		Epacridaceae	P	shrub	
<i>Leucopogon hamulosus</i>	Beard Heath	Epacridaceae	P	shrub	
<i>Leucopogon</i> sp. Corrigin (K. Kershaw KK 2091)	Beard Heath	Epacridaceae	P	shrub	G
<i>Leucopogon sulcatus</i>	Beard Heath	Epacridaceae	P	shrub	P3
<i>Lysinema ciliatum</i>	Curry Flower	Epacridaceae	P	shrub	
<i>Beyeria brevifolia</i> var. <i>robustior</i>		Euphorbiaceae	P	shrub	G
* <i>Erodium botrys</i>	Long Storkbill	Geraniaceae	A	herb	
<i>Erodium cygnorum</i>	Blue Heronsbill	Geraniaceae	A	herb	
<i>Dampiera eriocephala</i>	Woolly-headed Dampiera	Goodeniaceae	P	herb	
<i>Dampiera lavandulacea</i>	Lavender Dampiera	Goodeniaceae	P	herb/semi-shrub	

Botanical name	Common name	Family	Life form	Growth form	Cons code
<i>Dampiera</i> sp. aff. <i>linearis</i>	Wedge-leaved Dampiera	Goodeniaceae	P	herb	
<i>Goodenia convexa</i>		Goodeniaceae	P	herb	
<i>Goodenia glareicola</i>		Goodeniaceae	P	herb	
<i>Goodenia helmsii</i>	Long-spiked Goodenia	Goodeniaceae	P	shrub	
<i>Goodenia incana</i>	Hoary Goodenia	Goodeniaceae	P	herb	
<i>Goodenia pinifolia</i>	Pine-leaved Goodenia	Goodeniaceae	P	shrub	
<i>Lechenaultia biloba</i>	Blue Leschenaultia	Goodeniaceae	P	shrub	
<i>Velleia cynopotamica</i>		Goodeniaceae	A	herb	
<i>Velleia discophora</i>	Cabbage Poison	Goodeniaceae	A	herb	
<i>Verreauxia villosa</i>	Hairy Verreauxia	Goodeniaceae	P	shrub	G
<i>Conostylis albens</i>		Haemodorum	P	herb	P2
<i>Haemodorum</i> sp.	Blood root	Haemodorum	P	herb	
<i>Glischrocaryon aureum</i> var. <i>angustifolium</i>	Common Popflower	Haloragaceae	P	herb	
<i>Gonocarpus</i> ? <i>nodulosus</i>		Haloragaceae	A	herb	
<i>Gonocarpus confertifolius</i>		Haloragaceae	A or P	herb	
<i>Hypoxis glabella</i> var. <i>glabella</i>	Tiny Star	Hypoxidaceae	P/A	herb	
* <i>Romulea rosea</i>	Guildford Grass	Iridaceae	P/A	herb	
<i>Juncus radula</i>		Juncaceae	P	rush	
<i>Triglochin</i> sp.	Arrowgrass	Juncaginaceae	A	herb	
<i>Cyanostegia angustifolia</i>	Tinsel Flower	Lamiaceae	P	shrub	
<i>Cyanostegia microphylla</i>	Tinsel Flower	Lamiaceae	P	shrub	
<i>Dicrasylis corymbosa</i>		Lamiaceae	P	shrub	
<i>Dicrasylis parvifolia</i>		Lamiaceae	P	shrub	
<i>Hemigenia dielsii</i>		Lamiaceae	P	shrub	
<i>Microcorys ericifolia</i>		Lamiaceae	P	shrub	
<i>Microcorys</i> sp. stellate (A. Strid 21885)		Lamiaceae	P	shrub	
<i>Pityrodia lepidota</i>		Lamiaceae	P	shrub	
<i>Pityrodia terminalis</i>	Native Foxglove	Lamiaceae	P	shrub	
<i>Westringia rigida</i>	Stiff Westringia	Lamiaceae	P	shrub	
<i>Cassipourea aurea</i> var. <i>hirta</i>	Dodder Laurel	Lauraceae	P	parasitic twiner	
<i>Cassipourea glabella</i>	Tangled Dodder Laurel	Lauraceae	P	parasitic twiner	
<i>Cassipourea glabella</i> forma <i>dispar</i>	Tangled Dodder Laurel	Lauraceae	P	parasitic twiner	

Botanical name	Common name	Family	Life form	Growth form	Cons code
<i>Cassytha melantha</i>	Large Dodder Laurel	Lauraceae	P	parasitic twiner	
<i>Cassytha nodiflora</i>	Dodder Laurel	Lauraceae	P	parasitic twiner	
<i>Cassytha pomiformis</i>	Dodder Laurel	Lauraceae	P	parasitic twiner	
<i>Lobelia</i> sp. probably <i>L. gibbosa</i>	Tall Lobelia	Lobeliaceae	A	herb	
<i>Logania flaviflora</i>	Yellow Logania	Loganiaceae	P	shrub or herb	
<i>Acacia acanthoclada</i> subsp. <i>acanthoclada</i>	Harrow Wattle	Mimosaceae	P	shrub	
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	Jam	Mimosaceae	P	shrub or tree	
<i>Acacia anfractuosa</i>		Mimosaceae	P	shrub or tree	G
<i>Acacia assimilis</i> subsp. <i>assimilis</i>		Mimosaceae	P	shrub or tree	
<i>Acacia becuverdiana</i>	Pukkat	Mimosaceae	P	shrub or tree	
<i>Acacia consanguinea</i>		Mimosaceae	P	shrub	
<i>Acacia densiflora</i>		Mimosaceae	P	shrub	
<i>Acacia dielsii</i>		Mimosaceae	P	shrub	
<i>Acacia ephedroides</i>		Mimosaceae	P	shrub or tree	
<i>Acacia eremophila</i> var. <i>eremophila</i>		Mimosaceae	P	shrub	
<i>Acacia hemiteles</i>		Mimosaceae	P	shrub	
<i>Acacia inceana</i> subsp. <i>conformis</i>		Mimosaceae	P	shrub or tree	G
<i>Acacia intricata</i>		Mimosaceae	P	shrub	
<i>Acacia lirellata</i> subsp. <i>compressa</i>		Mimosaceae	P	shrub	P2
<i>Acacia merrallii</i>		Mimosaceae	P	shrub	
<i>Acacia multispicata</i>		Mimosaceae	P	shrub	
<i>Acacia neurophylla</i> subsp. <i>erugata</i>		Mimosaceae	P	shrub or tree	
<i>Acacia neurophylla</i> subsp. <i>neurophylla</i>		Mimosaceae	P	shrub	
<i>Acacia rigens</i>	Nealie	Mimosaceae	P	shrub or tree	G
<i>Acacia rigida</i>		Mimosaceae	P	shrub	
<i>Acacia spinosissima</i>		Mimosaceae	P	shrub	
<i>Acacia trauianiana</i>		Mimosaceae	P	shrub	
<i>Acacia yorkakinensis</i> subsp. <i>acrita</i>		Mimosaceae	P	shrub or tree	
<i>Eremophila decipiens</i>	Slender Fuchsia	Myoporaceae	P	shrub	
<i>Eremophila drummondii</i>		Myoporaceae	P	shrub	
<i>Baeckea crispiflora</i> (type 1)		Myrtaceae	P	shrub	
<i>Baeckea crispiflora</i> (type 2)		Myrtaceae	P	shrub	

Botanical name	Common name	Family	Life form	Growth form	Cons code
<i>Baeckea grandibractea</i>		Myrtaceae	P	shrub	
<i>Baeckea muricata</i>		Myrtaceae	P	shrub	
<i>Baeckea rosea</i> ms		Myrtaceae	P	shrub	
<i>Baeckea</i> sp. Burngup (A.M. Coates 4423)		Myrtaceae	P	shrub	
<i>Baeckea tenuiramea</i>		Myrtaceae	P	shrub	
<i>Beaufortia bracteosa</i>		Myrtaceae	P	shrub	
<i>Beaufortia interstans</i>		Myrtaceae	P	shrub	
<i>Calothamnus gilestii</i>		Myrtaceae	P	shrub	
<i>Calothamnus quadrifidus</i>		Myrtaceae	P	shrub	
<i>Calytrix breviseta</i> subsp. <i>stipulosa</i>	One-sided Bottlebrush	Myrtaceae	P	shrub	
<i>Calytrix leschenaultii</i>		Myrtaceae	P	shrub	
<i>Calytrix sapphirina</i>		Myrtaceae	P	shrub	
<i>Calytrix violacea</i>		Myrtaceae	P	shrub	
<i>Chamelaucium ciliatum</i>		Myrtaceae	P	shrub	
<i>Chamelaucium pauciflorum</i> subsp. <i>pauciflorum</i>		Myrtaceae	P	shrub	
<i>Eucalyptus burracoppinensis</i>	Burracoppin Mallee	Myrtaceae	P	mallee	
<i>Eucalyptus calycogona</i> subsp. <i>calycogona</i>	Gooseberry Mallee	Myrtaceae	P	mallee	
<i>Eucalyptus capillosa</i> subsp. <i>capillosa</i>	Wheatbelt Wandoo	Myrtaceae	P	tree	
<i>Eucalyptus capillosa</i> subsp. <i>polyclada</i>	Mallee Wandoo	Myrtaceae	P	mallee	
<i>Eucalyptus eremophila</i>	Tall Sand Mallee	Myrtaceae	P	mallee	
<i>Eucalyptus leptopoda</i> subsp. <i>leptopoda</i>	Tammin Mallee	Myrtaceae	P	mallee	
<i>Eucalyptus leptopoda</i> x ? <i>Eucalyptus sheathiana</i> hybrid		Myrtaceae	P	mallee	
<i>Eucalyptus loxophleba</i> subsp. <i>lissophloia</i>	Smooth Barked York Gum	Myrtaceae	P	mallee	
<i>Eucalyptus myriadena</i>		Myrtaceae	P	tree (mallee)	
<i>Eucalyptus rigidula</i> subsp. <i>rigidula</i>	Stiff-leaved Mallee	Myrtaceae	P	mallee	
<i>Eucalyptus salmonophloia</i>	Salmon Gum, Wurak	Myrtaceae	P	tree	
<i>Eucalyptus salubris</i>	Gimlet	Myrtaceae	P	tree (mallee)	
<i>Eucalyptus sheathiana</i>	Ribbon-barked Gum	Myrtaceae	P	tree (mallee)	
<i>Eucalyptus subangusta</i> subsp. <i>cerina</i>		Myrtaceae	P	mallee	G
<i>Eucalyptus transcontinentalis</i>	Redwood	Myrtaceae	P	tree (mallee)	
<i>Eucalyptus yilgarnensis</i>	Yorrell	Myrtaceae	P	mallee (tree)	
<i>Euryomyrtus leptospermoides</i>		Myrtaceae	P	shrub	P3

Botanical name	Common name	Family	Life form	Growth form	Cons code
<i>Leptospermum erubescens</i>	Roadside Tea-tree	Myrtaceae	P	shrub	
<i>Leptospermum nitens</i>	Tea-tree	Myrtaceae	P	shrub	
<i>Leptospermum roei</i>	Tea-tree	Myrtaceae	P	shrub	
<i>Leptospermum</i> sp. ? <i>roei</i> or <i>nitens</i> (infertile)	Tea-tree	Myrtaceae	P	shrub	
<i>Melaleuca acuminata</i> subsp. <i>acuminata</i>		Myrtaceae	P	shrub	
<i>Melaleuca calyptroides</i>		Myrtaceae	P	shrub	
<i>Melaleuca carpii</i>		Myrtaceae	P	shrub	
<i>Melaleuca condylosa</i>		Myrtaceae	P	shrub	
<i>Melaleuca cordata</i>		Myrtaceae	P	shrub	
<i>Melaleuca eleuterostachya</i>		Myrtaceae	P	shrub	
<i>Melaleuca grieviana</i>		Myrtaceae	P	shrub or tree	
<i>Melaleuca lateriflora</i> subsp. <i>lateriflora</i>	Gorada	Myrtaceae	P	shrub	P1
<i>Melaleuca laxiflora</i>		Myrtaceae	P	shrub or tree	
<i>Melaleuca pauperiflora</i> subsp. <i>fastigiata</i>		Myrtaceae	P	shrub	
<i>Melaleuca platycalex</i>		Myrtaceae	P	small tree /shrub	
<i>Melaleuca pungens</i>		Myrtaceae	P	shrub	
<i>Melaleuca spicigera</i>		Myrtaceae	P	shrub	
<i>Melaleuca uncinata</i>	Broom Bush	Myrtaceae	P	shrub or tree	
<i>Melaleuca villosispala</i> ms		Myrtaceae	P	shrub	
<i>Micromyrtus obovata</i>		Myrtaceae	P	shrub	
<i>Micromyrtus racemosa</i> var. <i>carinata</i> ms		Myrtaceae	P	shrub	P3
<i>Rinzia carnosia</i>		Myrtaceae	P	shrub	
<i>Thryptomene cuspidata</i>		Myrtaceae	P	shrub	
<i>Verticordia acerosa</i> var. <i>preissii</i>	Featherflower	Myrtaceae	P	shrub	
<i>Verticordia auriculata</i>	Featherflower	Myrtaceae	P	shrub	G
<i>Verticordia chrysantha</i>	Featherflower	Myrtaceae	P	shrub	
<i>Verticordia chrysanthella</i>	Featherflower	Myrtaceae	P	shrub	
<i>Verticordia endlicheriana</i> var. <i>compacta</i>	Featherflower	Myrtaceae	P	shrub	G
<i>Verticordia endlicheriana</i> var. <i>endlicheriana</i>	Featherflower	Myrtaceae	P	shrub	G
<i>Verticordia eriocephala</i>	Common Cauliflower	Myrtaceae	P	shrub	
<i>Verticordia mitodes</i>	Featherflower	Myrtaceae	P	shrub	P3
<i>Verticordia multiflora</i> subsp. <i>solox</i>	Featherflower	Myrtaceae	P	shrub	P2

Botanical name	Common name	Family	Life form	Growth form	Cons code
<i>Verticordia picta</i>	Painted Featherflower	Myrtaceae	P	shrub	
<i>Verticordia plumosa</i> var. <i>incrassata</i>	Featherflower	Myrtaceae	P	shrub	
<i>Verticordia roei</i> subsp. <i>roei</i>	Featherflower	Myrtaceae	P	shrub	
<i>Caladenia dimidia</i>		Orchidaceae	P/A	herb	
<i>Caladenia paradoxa</i>	Spider Orchid	Orchidaceae	P/A	herb	
<i>Caladenia pendens</i> subsp. <i>pendens</i>	Spider Orchid	Orchidaceae	P/A	herb	
<i>Caladenia saccharata</i>	Sugar Orchid	Orchidaceae	P/A	herb	
<i>Cyanicula amplexans</i>		Orchidaceae	P/A	herb	
<i>Cyanicula deformis</i>	Blue Fairy Orchid	Orchidaceae	P/A	herb	
<i>Pterostylis recurva</i>	Jug Orchid	Orchidaceae	P/A	herb	
<i>Pterostylis sanguinea</i>	Dark Banded Greenhood	Orchidaceae	P/A	herb	
<i>Pterostylis scabra</i>	Bronze Sheil Orchid	Orchidaceae	P/A	herb	
<i>Pterostylis</i> sp.		Orchidaceae	P/A	herb	
<i>Pterostylis</i> sp. aff. <i>nana</i>	Fawn Snail Orchid	Orchidaceae	P/A	herb	
<i>Pterostylis</i> sp. aff. <i>nana</i>	Hairy Stemmed Snail Orchid	Orchidaceae	P/A	herb	
<i>Thelymitra sargentii</i>	Freckled Sun Orchid	Orchidaceae	P/A	herb	
<i>Oxalis perennans</i>	Wood Sorrel	Oxalidaceae	P/A	herb	
* <i>Medicago</i> sp.		Papilionaceae	A	herb	
<i>Daviesia benthamii</i> subsp. <i>acanthoclona</i>		Papilionaceae	P	shrub	
<i>Daviesia hakeoides</i> subsp. <i>subnuda</i>		Papilionaceae	P	shrub	
<i>Daviesia nudiflora</i> subsp. <i>nudiflora</i>		Papilionaceae	P	shrub	
<i>Eutaxia</i> sp. nov. Wogar! (A. Gunness et al. sn.) aff. <i>Pultenaea neurocalyx</i>		Papilionaceae	P	shrub	Sp. nov.
<i>Gastrolobium parviflorum</i>	Box Poison	Papilionaceae	P	shrub	
<i>Gastrolobium spinosum</i> var. <i>spinosum</i>	Prickly Poison	Papilionaceae	P	shrub	
<i>Jacksonia nematoclada</i>	Merredin Jacksonia	Papilionaceae	P	shrub	
<i>Jacksonia racemosa</i>		Papilionaceae	P	shrub	
<i>Leptosema daviesioides</i>		Papilionaceae	P	shrub	
<i>Mirbelia trichocalyx</i>		Papilionaceae	P	shrub	
<i>Dianella revoluta</i>	Blue Flax Lily	Phormiaceae	P	herb	
<i>Cheiranthra filifolia</i> var. <i>filifolia</i>		Pittosporaceae	P	shrub	
<i>Plantago debilis</i>	Plantain	Plantaginaceae	A	herb	

Botanical name	Common name	Family	Life form	Growth form	Cons code
<i>*Avena barbata</i>	Bearded Oats	Poaceae	A	grass	
<i>*Briza maxima</i>	Blowfly Grass, Large Quaking Grass	Poaceae	A	grass	
<i>*Briza minor</i>	Shivery Grass, Small Quaking Grass	Poaceae	A	grass	
<i>*Bromus rubens</i>	Red Brome	Poaceae	A	grass	
<i>*Ehrharta longiflora</i>	Annual Veldtgrass	Poaceae	A	grass	
<i>*Pentstemonis airoides</i>	False Hairgrass	Poaceae	A	grass	
<i>*Vulpia myuros</i>	Rat's Tail Fescue	Poaceae	A	grass	
<i>Agrostis avenacea</i>	Blown Grass	Poaceae	A	grass	
<i>Amphipogon caricinus</i>	Long Greybeard Grass	Poaceae	P	grass	
<i>Aristida contorta</i>	Bunched Kerosene Grass	Poaceae	P	grass	
<i>Austrodanthonia caespitosa</i>	Common Wallaby Grass	Poaceae	P	grass	
<i>Austrodanthonia setacea</i>	Small-flower Wallaby Grass	Poaceae	P	grass	
<i>Austrodanthonia</i> sp. Goomalling (A. Guinness <i>et al.</i> OAKP 10/63)	Wallaby Grass	Poaceae	P	grass	
<i>Austrostipa elegantissima</i>	Feather Spear Grass	Poaceae	P	grass	
<i>Austrostipa hemipogon</i>	Spear Grass	Poaceae	P	grass	
<i>Austrostipa tricophylla</i>	Spear Grass	Poaceae	P	grass	
<i>Austrostipa variabilis</i>	Variable Spear Grass	Poaceae	P	grass	
<i>Chloris truncata</i>	Windmill Grass	Poaceae	P	grass	
<i>Eragrostis dielsii</i>	Mallee Lovegrass	Poaceae	P or A	grass	
<i>Neurachne alopecuroides</i>	Foxtail Mulga Grass	Poaceae	P	grass	
<i>Spartochloa scirpoides</i>		Poaceae	P	grass	
<i>Comesperma scoparium</i>	Broom Milkwort	Polygalacaceae	P	shrub	
<i>Comesperma spinosum</i>	Spiny Milkwort	Polygalacaceae	P	shrub	
<i>Comesperma volubile</i>	Lovecreeper	Polygalacaceae	P	twining climber	
<i>Calandrinia granulifera</i>	Pygmy Purslane	Portulacaceae	A	herb	
<i>*Anagallis arvensis</i> var. <i>caerulea</i>	Pimpernel	Primulaceae	A	herb	
<i>Banksia eldersoniana</i>	Swordfish Banksia	Proteaceae	P	shrub	
<i>Conospermum brownii</i>	Blue-eyed Smokebush	Proteaceae	P	shrub	
<i>Dryandra conferta</i> var. <i>conferta</i>		Proteaceae	P	shrub	
<i>Grevillea acacioides</i>		Proteaceae	P	shrub	
<i>Grevillea acutaria</i>		Proteaceae	P	shrub	

Botanical name	Common name	Family	Life form	Growth form	Cons code
<i>Grevillea asterisosa</i>	Star-leaf Grevillea	Proteaceae	P	shrub	P4
<i>Grevillea cagiana</i>	Red Toothbrushes	Proteaceae	P	shrub	
<i>Grevillea didymobotrya</i> subsp. <i>didymobotrya</i>		Proteaceae	P	shrub	
<i>Grevillea excelsior</i>	Flame Grevillea	Proteaceae	P	tree or shrub	
<i>Grevillea hookeriana</i> subsp. <i>apiculoba</i>	Black Toothbrushes	Proteaceae	P	shrub	
<i>Grevillea huegellii</i>		Proteaceae	P	shrub	
<i>Grevillea paniculata</i>		Proteaceae	P	shrub	
<i>Grevillea paradoxa</i>	Bottlebrush Grevillea	Proteaceae	P	shrub	
<i>Grevillea pterosperma</i>		Proteaceae	P	shrub	
<i>Grevillea teretifolia</i>	Round-leaf Grevillea	Proteaceae	P	shrub	
<i>Hakea cygna</i> subsp. <i>cygna</i>	Swan Fruit Hakea	Proteaceae	P	shrub	
<i>Hakea erecta</i>		Proteaceae	P	shrub	
<i>Hakea francisiana</i>	Pink Spike Hakea, Emu Tree	Proteaceae	P	shrub or tree	
<i>Hakea incrassata</i>	Marble Hakea	Proteaceae	P	shrub	
<i>Hakea meisneriana</i>		Proteaceae	P	shrub	
<i>Hakea minyma</i>		Proteaceae	P	shrub	G
<i>Hakea multilineata</i>	Grass Leaf Hakea	Proteaceae	P	shrub	
<i>Hakea platysperma</i>	Crickit Ball Hakea	Proteaceae	P	shrub	
<i>Hakea preissii</i>	Needle Tree	Proteaceae	P	shrub	
<i>Hakea recurva</i>	Djanokmurd	Proteaceae	P	shrub or tree	
<i>Hakea scoparia</i> subsp. <i>scoparia</i>		Proteaceae	P	shrub	
<i>Isopogon scabriusculus</i> subsp. <i>stenophyllus</i>		Proteaceae	P	shrub	
<i>Persoonia coriacea</i>	Leathery-leaf Persoonia	Proteaceae	P	shrub	
<i>Persoonia inconspicua</i>		Proteaceae	P	shrub	
<i>Persoonia quinquenervis</i>		Proteaceae	P	shrub	
<i>Persoonia saundersiana</i>		Proteaceae	P	shrub	
<i>Petrophile ericifolia</i>	Cone Bush	Proteaceae	P	shrub	
<i>Petrophile seminuda</i>	Cone Bush	Proteaceae	P	shrub	
<i>Synaphea interioris</i>		Proteaceae	P	shrub	
<i>Synaphea spinulosa</i>		Proteaceae	P	shrub	
<i>Desmodcladus asper</i>		Proteaceae	P	shrub	
<i>Lepidobolus preissianus</i> subsp. <i>vohibilis</i>	Chaff-rush	Restionaceae	P	sedge	

Botanical name	Common name	Family	Life form	Growth form	Cons code
<i>Cryptandra apetala</i> var. <i>anomala</i>		Rhamnaceae	P	shrub	
<i>Cryptandra dielsii</i>		Rhamnaceae	P	shrub	P2
<i>Cryptandra myriantha</i>		Rhamnaceae	P	shrub	
<i>Cryptandra wilsonii</i>		Rhamnaceae	P	shrub	
<i>Stenanthemum stipulosum</i>		Rhamnaceae	P	shrub	
<i>Trymalium daphnifolium</i>		Rhamnaceae	P	shrub	
<i>Boronia coerulescens</i> subsp. <i>spinescens</i>		Rutaceae	P	shrub	
<i>Boronia ternata</i> var. <i>foliosa</i>		Rutaceae	P	shrub	
<i>Drummondia hassellii</i>	Peak Charles Drummondia	Rutaceae	P	shrub	
<i>Microcybe multiflora</i> subsp. <i>multiflora</i>		Rutaceae	P	shrub	
<i>Phebalium ambiguum</i>		Rutaceae	P	shrub	
<i>Phebalium filifolium</i>	Slender Phebalium	Rutaceae	P	shrub	
<i>Phebalium megaphyllum</i>		Rutaceae	P	shrub	
<i>Phebalium megaphyllum</i> x <i>P. tuberosum</i> intergrade		Rutaceae	P	shrub	
<i>Phebalium</i> sp. aff. <i>tuberosum</i> (?hybrid with <i>P. filifolium</i>)		Rutaceae	P	shrub	
<i>Phebalium tuberosum</i>		Rutaceae	P	shrub	
<i>Philotheca tomentella</i>		Rutaceae	P	shrub	
<i>Exocarpos apyllus</i>	Leafless Ballart	Santalaceae	P	shrub	
<i>Leptomertia preissiana</i>		Santalaceae	P	shrub	
<i>Santalum acuminatum</i>	Quandong	Santalaceae	P	tree/shrub	
<i>Dodonaea viscosa</i> subsp. <i>angustissima</i>	Hopbush	Sapindaceae	P	shrub	
<i>Cyphanthera microphylla</i>		Solanaceae	P	shrub	
<i>Solanum hoplopetalum</i>	Thorny Solanum, Afghan Thistle	Solanaceae	P	herb	
<i>Stackhousia scoparia</i>		Stackhousiaceae	P	herb	
<i>Stylidium ? leptophyllum</i>	Needle-leaved Triggerplant	Stylidiaceae	P	herb	
<i>Stylidium dielsianum</i>	Tangle Triggerplant	Stylidiaceae	P	creeping herb	
<i>Stylidium repens</i>	Matted Triggerplant	Stylidiaceae	P	creeping herb	
<i>Stylidium stowardii</i>		Stylidiaceae	P	creeping herb	
<i>Stylidium yilgarnense</i>	Yilgarn Triggerplant	Stylidiaceae	P	herb	

Botanical name	Common name	Family	Life form	Growth form	Cons code
<i>Pimelea aeruginosa</i>		Thymelaeaceae	P	shrub	
<i>Pimelea angustifolia</i>	Narrow-leaved Pimelea	Thymelaeaceae	P	shrub	
<i>Pimelea brevistyla</i> subsp. <i>minor</i>		Thymelaeaceae	P	shrub	
<i>Pimelea imbricata</i> var. <i>piligera</i>		Thymelaeaceae	P	shrub	
<i>Pimelea suaveolens</i> subsp. <i>flava</i>	Yellow Scented Banjine	Thymelaeaceae	P	shrub	
<i>Hybanthus epacroides</i>	Spiny Hybanthus	Violaceae	P	shrub	
<i>Hybanthus floribundus</i> subsp. <i>floribundus</i>		Violaceae	P	shrub	
<i>Xanthorrhoea nana</i>	Dwarf Grass Tree	Xanthorrhoeaceae	P	grass tree	

APPENDIX III: PLANT SPECIES OCCURRENCES BY QUADRATS AND PLANT COMMUNITIES

This list shows all taxa listed according to the quadrats on which they were found in Wogarl Reserve. 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

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

v = road verge g = gravel pit

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

- W** Salmon Gum (*Eucalyptus salmonophloia*) - Gimlet (*Eucalyptus salubris*) Woodland
- M** Mallee over *Melaleuca-Acacia* Shrublands
- C** Open Shrub Mallee over *Callitris-Allocasuarina* Tall Shrublands
- S** Scrub (+/- Mallees) (Shrubs > 2metres tall, >30% canopy cover)
- O** Tall Open Shrublands (+/- Mallees) (Shrubs >2 metres tall, <30% canopy cover)
- T** Tamar (*Allocasuarina campestris*) Mixed Shrubland
- P** *Melaleuca* Closed Heath
- H** Open Heath over Sedgeland
- D** Disturbed areas

APPENDIX III: PLANT SPECIES LISTED BY QUADRAT & PLANT COMMUNITY, WOGARL RESERVE IN THE GRABALL CATCHMENT, SHIRE OF NAREMBEEN

Quadrats

Botanical name	Family	Common name	1	2	3	10	7	9	19	6	8	16	20	4	11	14	15	17	18	5	T	G	H	opp
<i>Acacia acanthoclada</i> subsp. <i>acanthoclada</i>	Mimosaceae	Harrow Wattle																						
<i>Acacia acuminata</i> subsp. <i>acuminata</i>	Mimosaceae	Jam	1	2	3a		9a	a						4					5a					+
<i>Acacia anfractuosa</i>	Mimosaceae																							
<i>Acacia assimilis</i> subsp. <i>assimilis</i>	Mimosaceae																	18	5				13	+/opp
<i>Acacia beaueverdiana</i>	Mimosaceae	Pukkati								6	8	16	20					17						+/opp
<i>Acacia consanguinea</i>	Mimosaceae																							+
<i>Acacia densiflora</i>	Mimosaceae						7a																	+
<i>Acacia dielsii</i>	Mimosaceae																							+/opp
<i>Acacia ephedroides</i>	Mimosaceae																							+/opp
<i>Acacia eremophila</i> var. <i>eremophila</i>	Mimosaceae								19					11										
<i>Acacia hemiteles</i>	Mimosaceae		1	2	10	7a	9	19		a			4a	a									a	
<i>Acacia inaeana</i> subsp. <i>conformis</i>	Mimosaceae		1																					
<i>Acacia intricata</i>	Mimosaceae						7		6a															
<i>Acacia lirellata</i> subsp. <i>compressa</i>	Mimosaceae																							
<i>Acacia merrallii</i>	Mimosaceae																							
<i>Acacia multispicata</i>	Mimosaceae																							
<i>Acacia neurophylla</i> subsp. <i>erugata</i>	Mimosaceae																							
<i>Acacia neurophylla</i> subsp. <i>neurophylla</i>	Mimosaceae		1a	2a	3	a	9	a		a														+/opp
<i>Acacia rigens</i>	Mimosaceae	Nealie							6															+/s
<i>Acacia rigida</i>	Mimosaceae													11										
<i>Acacia spinosissima</i>	Mimosaceae																							
<i>Acacia tratmaniana</i>	Mimosaceae																							
<i>Acacia yorkianensis</i> subsp. <i>acrita</i>	Mimosaceae																							
<i>Agrostis avenacea</i>	Poaceae	Blown Grass																						
<i>Agrostocrinum scabrum</i>	Anthericaceae	Blue Grass Lily																						
<i>Allocasuarina acutivalvis</i> subsp. <i>acutivalvis</i>	Casuarinaceae	Black Tamar																						

Botanical name	Family	Common name	1	2	3	10	7	9	19	6	8	16	20	4	11	14	15	17	18	5	21	12	13	opp
			W				M	C	S	O										T	G	H		
<i>Allocasuarina campestris</i>	Casuarinaceae	Tamar													14					5				
<i>Allocasuarina corniculata</i>	Casuarinaceae	Grey Tamar							16						15							a		+20
<i>Allocasuarina helmsii</i>	Casuarinaceae																							+opp2,
<i>Allocasuarina microstachya</i>	Casuarinaceae																							13
<i>Allocasuarina spinosissima</i>	Casuarinaceae																							13
<i>Amphipogon caricinus</i>	Poaceae	Long Greybeard Grass	2					19	6a	a	20	4	11		14	17	a		17	18	5	21	12	13
<i>*Anagallis arvensis</i> var. <i>caerulea</i>	Primulaceae	Pimpernel							20															13
<i>Andersonia lehmanniana</i>	Epacridaceae																							+opp2
<i>Angianthus tomentosus</i>	Asteraceae	Camel-grass																						+
<i>*Arctotheca calendula</i>	Asteraceae	Capeweed	1						20	4a														+v
<i>Aristida contorta</i>	Poaceae	Bunched Kerosene Grass													11									+v
<i>Astroloma serratifolium</i>	Epacridaceae	Kondrung							6a	8a	16	20							17					+v
<i>Atriplex semibaccata</i>	Chenopodiaceae	Berry Saltbush	1	2a																				
<i>Austrodanthonia caespitosa</i>	Poaceae	Common Wallaby Grass	1																					
<i>Austrodanthonia setacea</i>	Poaceae	Small-flower Wallaby Grass						19																
<i>Austrodanthonia</i> sp. <i>Goomalling</i> (A. Guinness et al. 1973)	Poaceae	Wallaby Grass	2					9																
<i>Austrostipa elegantissima</i>	Poaceae	Feather Spear Grass	1	2	3	10	7	9	19	8	20	4	11	14				17		5				13
<i>Austrostipa hemipogon</i>	Poaceae	Spear Grass													11									
<i>Austrostipa tricophylla</i>	Poaceae	Spear Grass	2																					
<i>Austrostipa variabilis</i>	Poaceae	Variable Spear Grass						19							4									
<i>*Avena barbata</i>	Poaceae	Bearded Oats													20									+18
<i>Baeckea crispiflora</i> (type 1)	Myrtaceae																							+5
<i>Baeckea crispiflora</i> (type 2)	Myrtaceae														20	4				5				
<i>Baeckea grandibractea</i>	Myrtaceae														16									+v
<i>Baeckea muricata</i>	Myrtaceae														16									
<i>Baeckea rosea</i> ms	Myrtaceae																	17				a		

Botanical name	Family	Common name	1	2	3	10	7	9	19	6	8	16	20	4	11	14	15	17	18	5	21	12	13	opp
			W				M	C	S	O										TG	H			
<i>Baeckea</i> sp. Burngup (A.M. Coates 4423)	Myrtaceae																							+v
<i>Baeckea tenuiramea</i>	Myrtaceae																							
<i>Banksia elderiana</i>	Proteaceae	Swordfish Banksia					a		16									15 17				a	13	+v
<i>Beaufortia bracteosa</i>	Myrtaceae																							+v
<i>Beaufortia interstans</i>	Myrtaceae																							
<i>Beyeria brevifolia</i> var. <i>robustior</i>	Euphorbiaceae																							
<i>Boronia coerulescens</i> subsp. <i>spinescens</i>	Rutaceae																							
<i>Boronia ternata</i> var. <i>foliosa</i>	Rutaceae																							+v
<i>Borya constricta</i>	Boryaceae	Pincushions																						
<i>Borya laciniata</i>	Boryaceae	Pincushions																						+
<i>Brachyloma mogin</i>	Epacridaceae																							
<i>*Brassica tournefortii</i>	Brassicaceae	Mediterranean or Wild Turnip																						
<i>*Briza maxima</i>	Poaceae	Blowfly Grass, Large Quaking Grass					19																	
<i>*Briza minor</i>	Poaceae	Shivery Grass, Small Quaking Grass																						
<i>*Bromus rubens</i>	Poaceae	Red Brome				10	9																	+v
<i>Caladenia dimidia</i>	Orchidaceae																							
<i>Caladenia paradoxa</i>	Orchidaceae	Spider Orchid																						
<i>Caladenia pendens</i> subsp. <i>pendens</i>	Orchidaceae	Spider Orchid																						
<i>Caladenia saccharata</i>	Orchidaceae	Sugar Orchid																						
<i>Calandrinia granulifera</i>	Portulacaceae	Pygmy Purslane																						
<i>Callitris glaucophylla</i>	Cupressaceae	Cypress Pine					a		6															
<i>Callitris tuberculata</i>	Cupressaceae	Mallee Cypress Pine																						+v
<i>Calothamnus gilesii</i>	Myrtaceae								6a															
<i>Calothamnus quadrifidus</i>	Myrtaceae	One-sided Bottlebrush																						
<i>Calytrix breviseta</i> subsp. <i>stipulosa</i>	Myrtaceae																							
<i>Calytrix leschenaultii</i>	Myrtaceae																							

Botanical name	Family	Common name	1	2	3	10	7	9	19	6	8	16	20	4	11	14	15	17	18	5	21	12	13	opp
			W			M			C	S	O	TG			H									
<i>Calytrix sapphirina</i>	Myrtaceae										a			14	18								13	+/23
<i>Calytrix violacea</i>	Myrtaceae									a				18										
<i>Cassytha aurea</i> var. <i>hirta</i>	Lauraceae	Dodder Laurel								20														+
<i>Cassytha glabella</i>	Lauraceae	Tangled Dodder Laurel									14												12	
<i>Cassytha glabella</i> forma <i>dispar</i>	Lauraceae	Tangled Dodder Laurel									a													
<i>Cassytha melantha</i>	Lauraceae	Large Dodder Laurel								16				17	a									
<i>Cassytha nodiflora</i>	Lauraceae	Dodder Laurel									14													
<i>Cassytha pomiformis</i>	Lauraceae	Dodder Laurel												15	18								12	
<i>Chamaexeros fimbriata</i>	Dasyopogonaceae	Fringe-leaf								a	11													+/g
<i>Chamelaucium ciliatum</i>	Myrtaceae									16														+/v/20
<i>Chamelaucium pauciflorum</i> subsp. <i>pauciflorum</i>	Myrtaceae										a													
<i>Cheiranthiera filifolia</i> var. <i>filifolia</i>	Pittosporaceae																							
<i>Chloris truncata</i>	Poaceae	Windmill Grass	1								11												a	
<i>Chthonocephalus pseudevax</i>	Asteraceae	Woolly Groundheads																						
<i>Comesperma scoparium</i>	Polygalaceae	Broom Milkwort									a	15	a											
<i>Comesperma spinosum</i>	Polygalaceae	Spiny Milkwort								6														
<i>Comesperma volubile</i>	Polygalaceae	Lovecreeper																						
<i>Conospermum brownii</i>	Proteaceae	Blue-eyed Smokebush									14	a											13	+/oppH
<i>Conostylis albescens</i>	Haemodorumaceae																							
<i>Crassula colorata</i> var. <i>acuminata</i>	Crassulaceae	Dense Stonecrop	1					10	9		a			a	18								13	+/12
<i>Cryptandra apetala</i> var. <i>anomala</i>	Rhamnaceae													14	15									+/opp2
<i>Cryptandra dielsii</i>	Rhamnaceae													14										+/v
<i>Cryptandra myriantha</i>	Rhamnaceae																							+/v
<i>Cryptandra wilsonii</i>	Rhamnaceae																							
<i>Cyanicula amplexans</i>	Orchidaceae		1a																					
<i>Cyanicula deformis</i>	Orchidaceae	Blue Fairy Orchid									a													

Botanical name	Family	Common name	1	2	3	10	7	9	19	6	8	16	20	4	11	14	15	17	18	5	21	12	13	opp
			W	M	C	S	O	TG	H															
<i>Cyanostegia angustifolia</i>	Lamiaceae	Tinsel Flower				a																		+/g
<i>Cyanostegia microphylla</i>	Lamiaceae	Tinsel Flower																						+/v
<i>Cyphanthera microphylla</i>	Solanaceae																							
<i>Dampiera eriocephala</i>	Goodeniaceae	Woolly-headed Dampiera																						+/g
<i>Dampiera lavandulacea</i>	Goodeniaceae	Lavender Dampiera																						
<i>Dampiera</i> sp. aff. <i>linearis</i>	Goodeniaceae	Wedge-leaved Dampiera																						+/v, 14
<i>Daucus glochidiatus</i>	Apiaceae	Australian Carrot	3																					
<i>Daviesia benthamii</i> subsp. <i>acanthoclona</i>	Papilionaceae		3a	10	7	9																		
<i>Daviesia hakeoides</i> subsp. <i>subnuda</i>	Papilionaceae																							
<i>Daviesia nudiflora</i> subsp. <i>nudiflora</i>	Papilionaceae																							+/opp2
<i>Desmodium asper</i>	Restionaceae																							+/opp3
<i>Dianella revoluta</i>	Phormiaceae	Blue Flax Lily	1a																					
<i>Dicrastylis corymbosa</i>	Lamiaceae																							+/v
<i>Dicrastylis parvifolia</i>	Lamiaceae																							+/23, v
<i>Dodonaea viscosa</i> subsp. <i>angustissima</i>	Sapindaceae	Hopbush																						+/9&10
<i>Drosera macrantha</i> subsp. <i>macrantha</i>	Droseraceae	Bridal Rainbow, Climbing Sundew	1a	2a																				
<i>Drosera macrophylla</i>	Droseraceae	Showy Sundew																						
<i>Drosera</i> sp.	Droseraceae	Sundew																						
<i>Drosera</i> sp. (pygmy)	Droseraceae	Pygmy Sundew																						
<i>Drummondia hassellii</i>	Rutaceae	Peak Charles Drummondia																						
<i>Dryandra conferta</i> var. <i>conferta</i>	Proteaceae																							
<i>Ecdeiocolea monostachya</i>	Ecdeiocoleaceae																							
* <i>Ehrharta longiflora</i>	Poaceae	Annual Veldtgrass																						
<i>Enchylaena lanata</i>	Chenopodiaceae																							
<i>Eragrostis dielsii</i>	Poaceae	Mallee Lovegrass	2	3	10	9																		
<i>Eremophila decipiens</i>	Myoporaceae	Slender Fuchsia	2a																					+

Botanical name	Family	Common name	1	2	3	10	7	9	19	6	8	16	20	4	11	14	15	17	18	5	21	12	13	opp
			W				M			C	S				O					TG		H		
<i>Eremophila drummondii</i>	Myoporaceae					10	7	9	?													2		
* <i>Erodium botrys</i>	Geraniaceae	Long Storksbill						9a																
<i>Erodium cygnorum</i>	Geraniaceae	Blue Heronsbill	1	2																				+
<i>Erymophyllum tenellum</i>	Asteraceae		1	2																				
<i>Eucalyptus burracoppinensis</i>	Myrtaceae	Burracoppin Mallee								6	16					14	15	a						
<i>Eucalyptus calycogona</i> subsp. <i>calycogona</i>	Myrtaceae	Gooseberry Mallee	3				7	9a																+
<i>Eucalyptus capillosa</i> subsp. <i>capillosa</i>	Myrtaceae	Wheatbelt Wandoo					7			6														
<i>Eucalyptus capillosa</i> subsp. <i>polyclada</i>	Myrtaceae	Mallee Wandoo					7a				8													
<i>Eucalyptus eremophila</i>	Myrtaceae	Tall Sand Mallee									16					14						13		+16
<i>Eucalyptus leptopoda</i> subsp. <i>leptopoda</i>	Myrtaceae	Tammin Mallee																						
<i>Eucalyptus leptopoda</i> x ? <i>Eucalyptus sheathiana</i>	Myrtaceae								19		a			4										
<i>Eucalyptus loxophleba</i> subsp. <i>lissophloia</i>	Myrtaceae	Smooth Barked York Gum	1	2		10			9a															
<i>Eucalyptus myriadena</i>	Myrtaceae																							
<i>Eucalyptus rigidula</i> subsp. <i>rigidula</i>	Myrtaceae	Stiff-leaved Mallee																						
<i>Eucalyptus salmonophloia</i>	Myrtaceae	Salmon Gum, Wurak	1	2		a													a	18				
<i>Eucalyptus salubris</i>	Myrtaceae	Gimlet	1a	3		a																		
<i>Eucalyptus sheathiana</i>	Myrtaceae	Ribbon-barked Gum				10	7	19							11		a							
<i>Eucalyptus subangusta</i> subsp. <i>cerina</i>	Myrtaceae						7a				8?													
<i>Eucalyptus transcontinentalis</i>	Myrtaceae						9				8													
<i>Eucalyptus yilgarnensis</i>	Myrtaceae	Redwood																						
<i>Euryomyrtus leptospermoides</i>	Myrtaceae	Yorrell	1a	2a	3a														a			13		+23
<i>Eutaxia</i> sp. nov. Wogarl (A. Gunness et al. sn.) aff. <i>Papilionaceae</i>	Papilionaceae																							
<i>Exocarpos aphyllus</i>	Santalaceae	Leafless Ballart																						
? <i>Gahnia drummondii</i>	Cyperaceae																							
<i>Gastrolobium parviflorum</i>	Papilionaceae	Box Poison	2a						9a		8a							15						
<i>Gastrolobium spinosum</i> var. <i>spinosum</i>	Papilionaceae	Prickly Poison																						

Botanical name	Family	Common name	1	2	3	10	7	9	19	6	8	16	20	4	11	14	15	17	18	5	21	12	13	opp
			W				M		C	S		O								T	G	H		
<i>Glischrocaryon aureum</i> var. <i>angustifolium</i>	Haloragaceae	Common Popflower								20														+v
<i>Gonocarpus confertifolius</i>	Haloragaceae									20														+v
<i>Gonocarpus ? nodulosus</i>	Haloragaceae									20														
<i>Goodenia convexa</i>	Goodeniaceae																					12		+v, 12
<i>Goodenia glareicola</i>	Goodeniaceae																							+v, 12
<i>Goodenia helmsii</i>	Goodeniaceae	Long-spiked Goodenia																						+
<i>Goodenia incana</i>	Goodeniaceae	Hoary Goodenia																						+v, 14
<i>Goodenia pinifolia</i>	Goodeniaceae	Pine-leaved Goodenia																						+v
<i>Grevillea acacioides</i>	Proteaceae											14 a	17 a											
<i>Grevillea acutaria</i>	Proteaceae																							
<i>Grevillea asteriscosa</i>	Proteaceae	Star-leaf Grevillea								20														+
<i>Grevillea cagiana</i>	Proteaceae	Red Toothbrushes																						+14
<i>Grevillea didymobotrya</i> subsp. <i>didymobotrya</i>	Proteaceae									6a	8 a													
<i>Grevillea excelsior</i>	Proteaceae	Flame Grevillea																						+v
<i>Grevillea hookeriana</i> subsp. <i>apiculoba</i>	Proteaceae	Black Toothbrushes																						+v, +10
<i>Grevillea huegellii</i>	Proteaceae																							
<i>Grevillea paniculata</i>	Proteaceae																							
<i>Grevillea paradoxa</i>	Proteaceae	Bottlebrush Grevillea								6a	8	16												
<i>Grevillea pterosperma</i>	Proteaceae																							+v
<i>Grevillea teretifolia</i>	Proteaceae	Round-leaf Grevillea																						+23
<i>Haemodorum</i> sp.	Haemodoraceae	Blood root																						
<i>Hakea cygna</i> subsp. <i>cygna</i>	Proteaceae	Swan Fruit Hakea																						
<i>Hakea erecta</i>	Proteaceae																							
<i>Hakea francisiana</i>	Proteaceae	Pink Spike Hakea, Emu Tree																						
<i>Hakea incrassata</i>	Proteaceae	Marble Hakea								16														+opp2, +14
<i>Hakea meisneriana</i>	Proteaceae																							

Botanical name	Family	Common name	1	2	3	10	7	9	19	6	8	16	20	4	11	14	15	17	18	5	21	12	13	opp
			W				M		C	S	O									TG	H			
<i>Hakea minyma</i>	Proteaceae																							
<i>Hakea multineata</i>	Proteaceae	Grass Leaf Hakea								a														+
<i>Hakea platysperma</i>	Proteaceae	Cricket Ball Hakea									a	15												+
<i>Hakea preissii</i>	Proteaceae	Needle Tree																						+
<i>Hakea recurva</i>	Proteaceae	Djanokmurd																						+
<i>Hakea scoparia</i> subsp. <i>scoparia</i>	Proteaceae								8a			14	15	17	18							13		
<i>Hemigenia dielsii</i>	Lamiaceae																							
<i>Hibbertia eatoniae</i>	Dilleniaceae	Guinea Flower								a		14	15	17	18	5					a	13		
<i>Hibbertia glomerosa</i>	Dilleniaceae	Guinea Flower								20														+14
<i>Hibbertia rupicola</i>	Dilleniaceae	Guinea Flower																						+v,17
<i>Hibbertia stowardii</i>	Dilleniaceae	Guinea Flower										14	17	18										
<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>	Asteraceae		1	+																				
<i>Hybanthus epacroides</i>	Violaceae	Spiny Hybanthus																						+v,14
<i>Hybanthus floribundus</i> subsp. <i>floribundus</i>	Violaceae																							+12
<i>Hydrocotyle rugulosa</i>	Apiaceae	Pennywort	2	3			9																	
* <i>Hypochoeris glabra</i>	Asteraceae	Flat Weed, Smooth Cat's-ear	3	10			9	a		20	11													
<i>Hypoxis glabella</i> var. <i>glabella</i>	Hypoxidaceae	Tiny Star	3																			13		+19
<i>Isopogon scabriusculus</i> subsp. <i>stenophyllus</i>	Proteaceae																					13		
<i>Jacksonia nematoclada</i>	Papilionaceae	Merredin Jacksonia																						+v
<i>Jacksonia racemosa</i>	Papilionaceae																							+opp2
<i>Juncus radula</i>	Juncaceae																							+
<i>Lawrencella rosea</i>	Asteraceae	Pink Everlasting	1a	2			9	19			4a	a												
<i>Laxmannia grandiflora</i> subsp. <i>grandiflora</i>	Anthericaceae																							
<i>Lechenaultia biloba</i>	Goodeniaceae	Blue Leschenaultia																						+v
<i>Lepidobolus preissianus</i> subsp. <i>volubilis</i>	Restionaceae	Chaff-rush																				a	13	
<i>Lepidosperma brunonianum</i> (broad leaf form)	Cyperaceae	Sword-sedge																				12	13	

Botanical name	Family	Common name	1	2	3	10	7	9	19	6	8	16	20	4	11	14	15	17	18	5	21	12	13	opp
			W				M	C	S	O	T	G	H											
<i>Lepidosperma brunonianum</i> (narrow leaf form)	Cyperaceae	Sword-sedge																						
<i>Lepidosperma</i> sp. A2 Island Flat (Keighery 7000)	Cyperaceae	Sword-sedge																						
<i>Lepidosperma</i> sp. K Boorabbin (K.L. Wilson 2579)	Cyperaceae																							
<i>Lepidosperma</i> sp. (Wogarl 16/26)	Cyperaceae																							
<i>Leptomeria preissiana</i>	Santalaceae																							
<i>Leptosema daviesioides</i>	Papilionaceae																							
<i>Leptospermum erubescens</i>	Myrtaceae	Roadside Tea-tree																						
<i>Leptospermum nitens</i>	Myrtaceae	Tea-tree																						
<i>Leptospermum roei</i>	Myrtaceae	Tea-tree																						
<i>Leptospermum</i> sp. ? <i>roei</i> or <i>nitens</i> (infertile)	Myrtaceae	Tea-tree																						
<i>Leucopogon hamulosus</i>	Epacridaceae	Beard Heath																						
<i>Leucopogon</i> sp. Corrigin (K. Kershaw KK 2091)	Epacridaceae	Beard Heath																						
<i>Leucopogon sulcatus</i>	Epacridaceae	Beard Heath																						
<i>Lobelia</i> sp. probably <i>L. gibbosa</i>	Lobeliaceae	Tall Lobelia																						
<i>Logania flaviflora</i>	Loganiaceae	Yellow Logania																						
<i>Lomandra effusa</i>	Dasyopogonaceae	Scented Matrush																						
<i>Lomandra</i> sp.	Dasyopogonaceae	Matrush																						
<i>Lomandra</i> sp. "Wheatbelt"	Dasyopogonaceae	Matrush																						
<i>Lysinema ciliatum</i>	Epacridaceae	Curry Flower																						
<i>Maireana brevifolia</i>	Chenopodiaceae	Small Leaf Bluebush																						
<i>Maireana georgii</i>	Chenopodiaceae	Satiny Bluebush																						
* <i>Medicago</i> sp.	Papilionaceae																							
<i>Melaleuca acuminata</i> subsp. <i>acuminata</i>	Myrtaceae																							
<i>Melaleuca calyptroides</i>	Myrtaceae																							
<i>Melaleuca carrii</i>	Myrtaceae																							
<i>Melaleuca condylosa</i>	Myrtaceae																							

Botanical name	Family	Common name	1	2	3	10	7	9	19	6	8	16	20	4	11	14	15	17	18	5	21	12	13	opp
			W				M		C		S			O						TG		H		
<i>Melaleuca cordata</i>	Myrtaceae								6		16			14 15 17										
<i>Melaleuca eleuterostachya</i>	Myrtaceae						7	9	a				20	4										+22
<i>Melaleuca grieviana</i>	Myrtaceae						9																	+4,5
<i>Melaleuca lateriflora</i> subsp. <i>lateriflora</i>	Myrtaceae	Gorada	3				7a	9	a															
<i>Melaleuca laxiflora</i>	Myrtaceae								a															
<i>Melaleuca pauperiflora</i> subsp. <i>fastigiata</i>	Myrtaceae						7a																	
<i>Melaleuca platycalyx</i>	Myrtaceae																							
<i>Melaleuca pungens</i>	Myrtaceae																							
<i>Melaleuca spicigera</i>	Myrtaceae																							
<i>Melaleuca uncinata</i>	Myrtaceae	Broom Bush																						
<i>Melaleuca villosipala</i> ms	Myrtaceae																							
<i>Mesomelaena preissii</i>	Cyperaceae																							
<i>Microcorys ericifolia</i>	Lamiaceae																							
<i>Microcorys</i> sp. stellate (A. Strid 21885)	Lamiaceae																							
<i>Microcybe multiflora</i> subsp. <i>multiflora</i>	Rutaceae																							
<i>Micromyrtus obovata</i>	Myrtaceae																							
<i>Micromyrtus racemosa</i> var. <i>carinata</i> ms	Myrtaceae																							
<i>Mirbelia trichocalyx</i>	Papilionaceae																							
<i>Neurachme alopecuroidea</i>	Poaceae	Foxtail Mulga Grass																						
<i>Olearia dampierii</i> subsp. <i>eremicola</i> ms	Asteraceae																							
<i>Olearia muelleri</i>	Asteraceae	Goldfield's Daisy																						
<i>*Osteospermum clandestinum</i>	Asteraceae	Stinking Roger																						
<i>Oxalis perennans</i>	Oxalidaceae	Wood Sorrel																						
<i>*Pentstemonis airoides</i>	Poaceae	False Hairgrass																						
<i>Persoonia coriacea</i>	Proteaceae	Leathery-leaf Persoonia																						
<i>Persoonia inconspicua</i>	Proteaceae																							

Botanical name	Family	Common name	1	2	3	10	7	9	19	6	8	16	20	4	11	14	15	17	18	5	21	12	13	opp
			W				M		C		S				O					TG		H		
<i>Persoonia quinquenervis</i>	Proteaceae										a			4a	a		17							
<i>Persoonia saundersiana</i>	Proteaceae										a													
<i>Petrophile ericifolia</i>	Proteaceae	Cone Bush																						
<i>Petrophile seminuda</i>	Proteaceae	Cone Bush																						
<i>Phebalium ambiguum</i>	Rutaceae										6	8	a											+/opp2
<i>Phebalium filifolium</i>	Rutaceae	Slender Phebalium									a									21				
<i>Phebalium megaphyllum</i>	Rutaceae																							
<i>Phebalium megaphyllum</i> x <i>P. tuberculosum</i>	Rutaceae																							
<i>Phebalium</i> sp. aff. <i>tuberculosum</i> (hybrid with <i>P. filifolium</i>)	Rutaceae																							
<i>Phebalium tuberculosum</i>	Rutaceae													4	a		15	17	18	5a	21	12		
<i>Philotheca tomentella</i>	Rutaceae													4a										+/v
<i>Pimelea aeruginosa</i>	Thymelaeaceae																							+/v
<i>Pimelea angustifolia</i>	Thymelaeaceae	Narrow-leaved Pimelea																						+12
<i>Pimelea brevistyla</i> subsp. <i>minor</i>	Thymelaeaceae																							+18
<i>Pimelea imbricata</i> var. <i>piligera</i>	Thymelaeaceae																							+/opp3,
<i>Pimelea suaveolens</i> subsp. <i>flava</i>	Thymelaeaceae	Yellow Scented Banjine									a													+/v
<i>Pityrodia lepidota</i>	Lamiaceae																							+/g
<i>Pityrodia terminalis</i>	Lamiaceae	Native Foxglove																						
<i>Plantago debilis</i>	Plantaginaceae	Plantain																						
<i>Platysace trachymenioides</i>	Apiaceae	Pennywort																						
<i>Podolepis capillaris</i>	Asteraceae	Wiry Podolepis	1																					
<i>Podolepis lessonii</i>	Asteraceae																							
<i>Podolepis tepperi</i>	Asteraceae																							
<i>Podotroche angustifolia</i>	Asteraceae	Sticky Longheads																						+7
<i>Podotroche gnaphalioides</i>	Asteraceae	Golden Longheads																						+23
<i>Psammomoya choretroides</i>	Celastraceae																							+15

Botanical name	Family	Common name	1	2	3	10	7	9	19	6	8	16	20	4	11	14	15	17	18	5	21	12	13	opp
			W				M	C	S	O	T	G	H											
<i>Stackhousia scoparia</i>	Stackhousiaceae																							+v
<i>Stenanthemum stipulosum</i>	Rhamnaceae																							
<i>Stylichium dielstanum</i>	Styidiaceae	Tangle Triggerplant																						
<i>Stylichium ? leptophyllum</i>	Styidiaceae	Needle-leaved Triggerplant																						
<i>Stylichium repens</i>	Styidiaceae	Matted Triggerplant																						
<i>Stylichium stowardii</i>	Styidiaceae																							
<i>Stylichium yilgarnense</i>	Styidiaceae	Yilgarn Triggerplant																						
<i>Synaphea interioris</i>	Proteaceae																							+v,g
<i>Synaphea spinulosa</i>	Proteaceae																							+v,opp2
<i>Thelymitra sargentii</i>	Orchidaceae	Freckled Sun Orchid																						
<i>Thryptomene cuspidata</i>	Myrtaceae																							
<i>Thysanotus patersonii</i>	Anthericaceae	Twining Fringe Lily																						+v
<i>Thysanotus sparteus</i>	Anthericaceae	Fringed Lily																						
<i>Thysanotus triandrus</i>	Anthericaceae	Fringed Lily																						+v,14
<i>Trachymene cyanopetala</i>	Apiaceae																							
<i>Trachymene</i> sp.	Apiaceae																							
<i>Tricoryne tenella</i>	Anthericaceae																							
<i>Triglochin</i> sp.	Juncaginaceae	Arrowgrass																						
<i>Trymalium daphnifolium</i>	Rhamnaceae																							
* <i>Ursinia anthemoides</i>	Asteraceae	Ursinia																						+9&10
<i>Velleia cycnopotamica</i>	Goodeniaceae																							
<i>Velleia discophora</i>	Goodeniaceae	Cabbage Poison																						+v
<i>Verreauxia villosa</i>	Goodeniaceae	Hairy Verreauxia																						+v,opp2
<i>Verticordia acerosa</i> var. <i>preissii</i>	Myrtaceae	Featherflower																						+g
<i>Verticordia auriculata</i>	Myrtaceae	Featherflower																						
<i>Verticordia chrysantha</i>	Myrtaceae	Featherflower																						

Botanical name	Family	Common name	1	2	3	10	7	9	19	6	8	16	20	4	11	14	15	17	18	5	21	12	13	opp
			W				M		C	S	O									T	G	H		
<i>Verticordia chrysanthella</i>	Myrtaceae	Featherflower																		5			13	
<i>Verticordia endlicheriana</i> var. <i>compacta</i>	Myrtaceae	Featherflower																						
<i>Verticordia endlicheriana</i> var. <i>endlicheriana</i>	Myrtaceae	Featherflower																						+v, 14
<i>Verticordia eriocephala</i>	Myrtaceae	Common Cauliflower								a	20												13	
<i>Verticordia mitodes</i>	Myrtaceae	Featherflower																						
<i>Verticordia multiflora</i> subsp. <i>solox</i>	Myrtaceae	Featherflower																						
<i>Verticordia picta</i>	Myrtaceae	Painted Featherflower																						
<i>Verticordia plumosa</i> var. <i>incrassata</i>	Myrtaceae	Featherflower																						+v, 14
<i>Verticordia roei</i> subsp. <i>roei</i>	Myrtaceae	Featherflower																						+14
* <i>Vulpia myuros</i>	Poaceae	Rat's Tail Fescue							6															
<i>Wahlenbergia gracilentia</i> / <i>preissii</i>	Campanulaceae	Annual Bluebell	2	10						20										5				
<i>Waitzia acuminata</i> var. <i>acuminata</i>	Asteraceae	Orange Immortelle	2							20	4	11								5		12		+
<i>Westringia rigida</i>	Lamiaceae	Stiff Westringia																						
<i>Wilsonia humilis</i>	Convolvulaceae	Silky Wilsonia	3																					
<i>Xanthorrhoea nana</i>	Xanthorrhoeaceae	Dwarf Grass Tree																					13	

APPENDIX IV: CATEGORIES RELATING TO THREATENED SPECIES (Atkins 2000, 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.

