Rich 339

A SURVEY OF VEGETATION AND FLORA

RICH ROAD RESERVE

and

MALYALLING RESERVE

Shire of Wickepin

by

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and
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1. INTRODUCTION

The Wildflower Society's Bushland Plants Survey Project is a community project that has been in existence since 1989. 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 subjects of this report are two Wickepin shire reserves: 34 hectares on the corner of Rich Road and 86 Gate Road (called Rich Road Reserve for this report) in the South East Yealering Catchment and 83 hectares of Malyalling Reserve in the Boyning Catchment. Rich Road Reserve is gazetted as a Local Government Gravel Reserve and has a gravel pit on its eastern side. Gravel extraction had ceased as a result of community lobbying to protect the conservation value of the site, and the local council has agreed to rehabilitate the pit. The eastern block of Malyalling Reserve is gazetted as a Local Government Reserve for the protection of fauna and flora and the western block as a Class A Nature Reserve with part of it gazetted as a public utility reserve. It has conservation, recreational and historical significance to the local community. Within its boundaries are an old school site (1910-1925) and the locally renowned "MCG" oval – Malyalling Cricket Ground, the site of local cricket matches between 1920 and 1960. Malyalling rock is a large granite outcrop high in the landscape and a popularly visited site.

The survey was conducted over a weekend in the spring of 1999. Wildflower Society volunteers and a coordinating botanist travelled to Wickepin 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. This report describes the flora, vegetation and conservation values of the bushland sites. 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 (1998-99). The Department of Conservation and Land Management and the Wildflower Society also provided support.

Background to the survey sites

The Wickepin LCDC is made up of 9 catchment groups and in 1999 all groups came together to apply for funding from the Natural Heritage Trust for fencing of remnant bush and revegetation with local species. One of their main objectives was to slow the rate of biodiversity decline in the catchments. However they were not aware of any detailed vegetation surveys in their area and knew they needed some baseline data.

The Wickepin Landcare Development Officer (Robyn Cail) applied to the Wildflower Society to have surveys conducted on the 2 reserves which had been selected by the local community as priority areas of bushland for survey work. The local community had undertaken intense lobbying to get the local council to cease taking gravel from the Rich Road Reserve, so interest and enthusiasm for vegetation conservation were high. This was reflected in the very high participation rate of locals on the survey weekend. It was agreed with Robyn that survey outcomes would include a plant species list and vegetation map for each reserve, a brief report, a field herbarium for retention and use by the local Landcare group and local community, and presentation of the results to a meeting of the catchment groups.

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 7.5% of the area of the Shire of Wickepin still retains original native vegetation on public and private land (Beeston *et al.* 1994). It is now government policy that 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 for the maintenance of biodiversity 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).

2. THE STUDY AREA

Location

Rich Road Reserve is on the corner of 86 Gate road and Rich road, 30 kilometres east-north-east of the town of Wickepin. Malyalling Reserve is located 2 kilometres east of the Wickepin-Corrigin road on Kirk Rock road approximately 19 kilometres north-east of the town of Wickepin. Wickepin is approximately 240 kilometres by road south-east of Perth. Both are situated within the southernmost region of the Avon Basin in the shire of Wickepin (Figure1). Agricultural land use in the area is mainly cropping (wheat, barley, canola, lupins) and sheep.

Climate

The climate is Mediterranean, characterised by cool wet winters and warm to hot dry summers. Wickepin lies on the boundary of the 400mm annual rainfall isohyet, with rainfall decreasing eastwards. Average annual rainfall is 414mm at Wickepin with 80 per cent falling during the growing season from late April to October (Whitfield 1999).

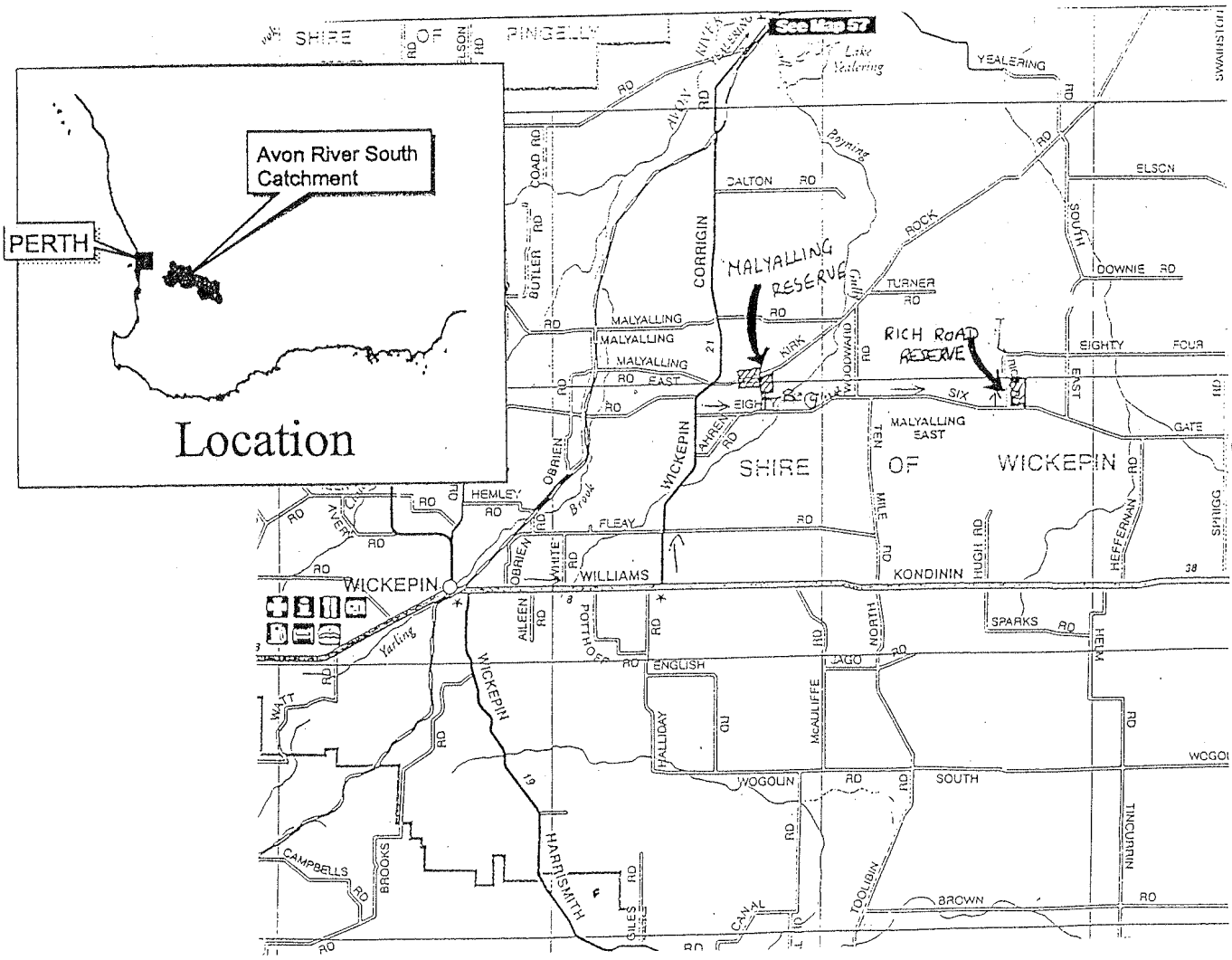


Figure 1: Locality Map for Rich Road Reserve and Malyalling Reserve, Wickepin. (Source: The West Australian Traveller's Atlas, Edition 3, 2000)

Landforms and Soils

The study area lies on the ancient shield known as the Yilgarn block, underlain by ancient granites about 2500 million years old. It falls just east of the Meckering line which corresponds with the division between the Zone of Rejuvenated Drainage to the west and the Zone of Ancient Drainage to the east (Lantzke and Fulton 1994). To the west in the Rejuvenated Drainage Zone, drainage lines are clearly defined and flow annually through rolling terrain. The Ancient Drainage Zone contains remnants of an ancient sluggish drainage system which now only flows in wet years. The laterite profile that once covered vast areas of the Yilgarn block, has been eroded over most of this area and the adjoining upper Blackwood catchment in the south. This has left a gently undulating landscape with little height difference between the hill-crests and broad valley floors (Tille and Percy 1995, Verboom and Galloway in prep.).

In the western part of the Ancient Drainage Zone, which includes the study area, "the uplands are dominated by sandy gravels, valleys are dominated by shallow and deep sandy duplex soils that are sometimes alkaline and sodic". Soil mapping has defined three sub-systems of the Yealering soil map unit for the two reserves (Verboom and Galloway in prep.):

- Sands, gravels and duricrust are found on the crests of rises supporting Heath. The larger areas of laterite have substantial backslopes with deeper sandy gravels, yellow sandy earths and deep pale sand.
- Undulating terrain with granite rock outcrops, coarse granitic sands becoming gradational brown loams and sandy duplexes further downslope, supporting York Gum – Jam – Rock She-oak and Wandoo Woodlands.
- Gently undulating slopes with sandy duplex soils vegetated by Wandoo and some Salmon Gum on the lower slopes.

Vegetation

The study sites fall in the Avon Botanical District in the Wheatbelt Region of the South-West Botanical Province (Beard 1981, 1990) and is on the western margin of the Corrigin Vegetation System which has a typical "outer wheatbelt" landscape (Beard 1980, 1981). Malyalling Reserve shares some characteristics of the "inner wheatbelt" Pingelly System (Beard 1981) which lies immediately west. Each vegetation system consists of a particular series of plant communities occurring in a mosaic pattern governed by soil types, topographical and geological features.

The Corrigin System is drained by the upper reaches of the Avon River but drainage dissection is shallow and slopes are gentle. There are few granite outcrops in this system whereas the hilly, deeply dissected Pingelly System is dominated by large granite domes and the associated Woodlands of York Gum (*Eucalyptus loxophleba*) and Rock She-oak (*Allocasuarina huegeliana*). The upper landscape of the Corrigin System is large patches of sand and laterite with the laterite coming to the surface at the edge of the sandplain. These areas support Kwongan (Shrublands, Thicket, Heath). Upper slopes below the sandplain tend to support Wandoo (*Eucalyptus wandoo*) with York Gum commonly occurring on middle slopes. Patches of Mallee can be found in the mid regions and Brown Mallet (*Eucalyptus astringens*) on breakaways. Salmon Gum (*Eucalyptus salmonophloia*) and Red Morrel (*Eucalyptus longicornis*) grow on flats with heavy soils. Flooded Gum (*Eucalyptus rudis*) lines the major creeks along with Lesser Bottlebrush (*Callistemon phoeniceus*). On the valley floors and along salty creeks Tea-tree (*Melaleuca* spp.) thickets, Swamp She-oak (*Cauarina obesa*) and samphire may be found. Malyalling Reserve on granite, high in the landscape was typical of the Pingelly system. Rich Road reserve on laterite fell within the upper to mid landscape position of the Corrigin system. It did not have Mallet breakaways.

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 the indigenous ecosystems remain and protection of the biodiversity of the region is very poor.

From a search of the literature it was evident that limited vegetation or flora survey work had been conducted in the Wickepin Shire. Yornaning Nature Reserve, a 248 hectare reserve 12 kilometres west north west of Wickepin was the site of one of the biological surveys conducted by the Western Australian Museum (Dell *et al.* 1979). The vegetation was described as basically *Eucalyptus wandoo – Allocasuarina huegeliana* Woodland with areas of Heath. Coates (1985, 1987) conducted a survey in Birdwhistle Nature Reserve and limited surveys, conducted in May and June, in 4 smaller reserves (20 to 54 hectares in size) in the Wickepin shire. These surveys recorded the vegetation associations with their common plant species. Birdwhistle Nature Reserve is a larger, upland reserve of 396 hectares 8 kilometres south of Wickepin and falls across the boundary of the Narrogin and Wickepin shires. Fourteen vegetation associations on granite and laterite were described along with the species recorded for each. Mattiske Consulting Pty Ltd. (1999) has conducted further work in Birdwhistle Nature Reserve for the Department of Conservation and Land Management – only species lists with no interpretation are available from CALM.

In 1991 Frans Mollemans undertook a vegetation survey of 11 southern wheatbelt shires, including the Wickepin shire. The purpose was to verify, from aerial photo interpretation and rapid ground survey techniques, areas of remnant, modified or scattered native vegetation (see Griffin 1995) for inclusion in the Spatial Resources Information Group's database of Agriculture WA. His report discusses the importance of retaining native vegetation and provides an overview of the status of remnants 10 years ago. He attributed high ecological significance (on a scale from extremely low to very high) to Malyalling Reserve, based on an assessment key he developed (Mollemans 1992). The key included factors such as presence of rare or priority flora, vegetation condition including structural complexity, degree of disturbance, and ability to recover from disturbance.

Beard's broadscale (1:250 000) mapping recognised several vegetation units within the Wickepin shire and catchments of the study areas. At that scale of mapping only one vegetation unit was mapped for Malyalling Reserve and a complex of two for Rich Road reserve (Beard 1980, Hopkins *et al.* 2000) and they are as follows:

- Rich Road Reserve was mapped by Beard (1980) as Scrub Heath – undifferentiated Kwongan communities (code xSZc) and *Allocasuarina campestris* thicket. The revised map (Figure 2) (Hopkins *et al.*2000) showing the area as Low Woodland: Jarrah-Banksia is in error.
- Malyalling Reserve was mapped by Beard as York Gum Medium Woodland (code E6mi).

Analysis and GIS mapping by the Land Monitor project has meant that the current extent of Beard vegetation units within Western Australia can be determined. In the following table Column 2 shows the total amount of each unit currently in existence as a percentage of the original extent (Ben Carr, pers. comm.). Column 3 shows the percentage of original extent which is in **secure** (IUCN class 1-4) CALM Reserves and Column 4 the percentage of original extent which is in **all** CALM Conservation Reserves (Hopkins *et al.* 2000). These figures illustrate the severe decline in area compared to the original extent, and poor conservation status for each unit.

Beard unit	% of original extent	% in secure CALM Reserves	% in all CALM Reserves
Shrublands, thickets xSc	10.1	0.1	0.1
York Gum Woodland E6mi	6.3	0.4	0.5

Only 7.5% of the original woody vegetation cover remains in the Wickepin Shire (Land Monitor Project, 1996 woody vegetation cover) and the existing remnants for the study region are shown in Figure 2. The figure illustrates the general scarcity of original woody vegetation remaining in the region and highlights the significance of the study area remnants.

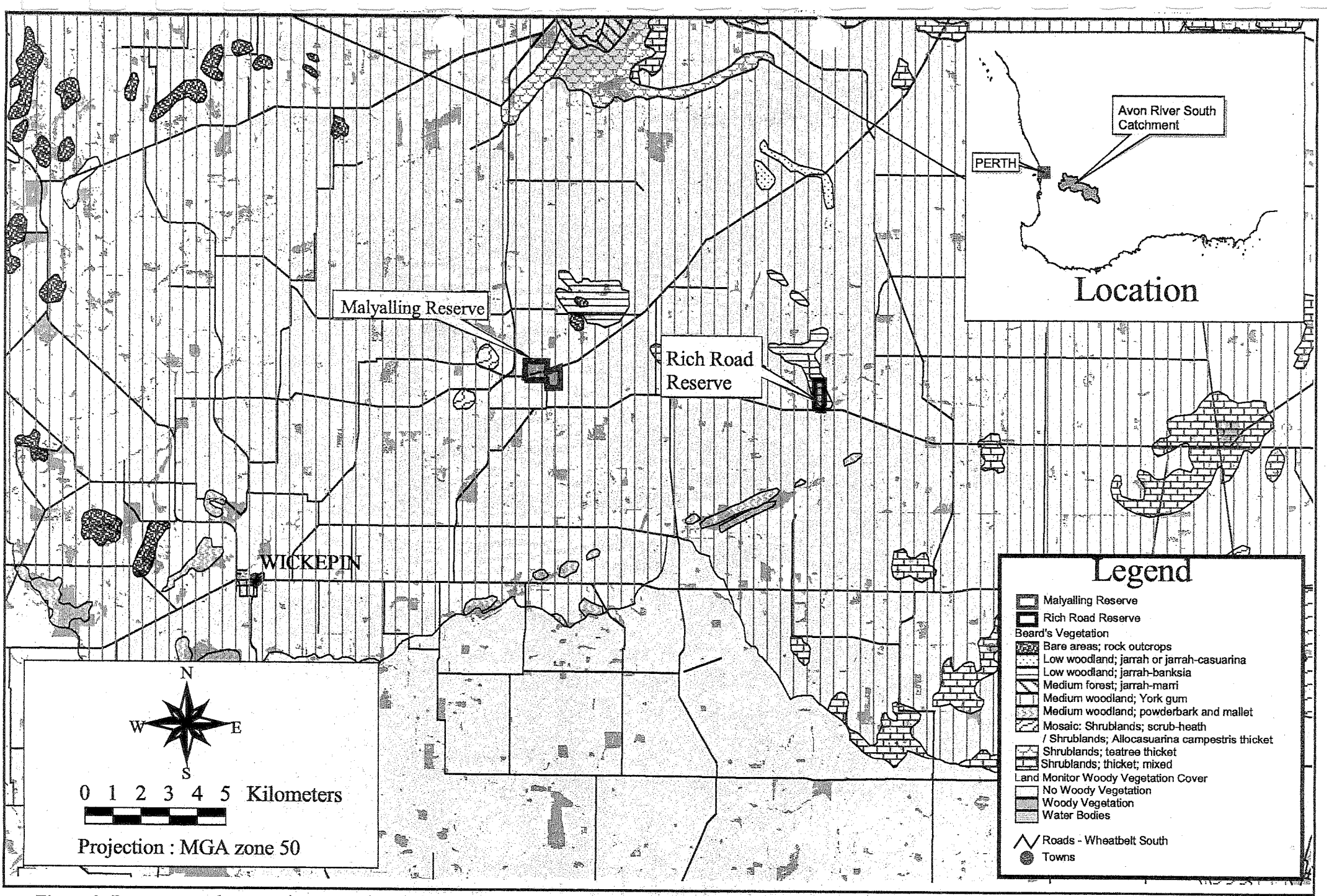


Figure 2: Remnant woody vegetation currently existing and Beard vegetation types mapped according to original natural vegetation. (Land Monitor Project)

3. SURVEY METHOD

Survey work on the two reserves was conducted during the 1999 spring flowering season on the first weekend in October. Twelve 10m x 10m quadrats were located and described within the diverse 34 hectares of Rich Road Reserve and seven quadrats in the 83 hectares of Malyalling Reserve. These were chosen to sample the full range of plant communities that were identified using aerial photographs and field reconnaissance. Quadrats were located in the areas of bushland that were in the best condition. Greater effort was expended at Rich Road Reserve, as this was the area of highest priority for the LCDC.

Groups comprised of the 13 volunteers from the Wildflower Society Bushland Plant Survey program and 21 interested people from the local community collected data. Each group was led by a botanist or experienced volunteer. Information collected included a physical description of the quadrat site, vegetation structure and canopy cover and a list of all the species present at the time of survey. Additional species occurring within each community were also recorded (as adjacents). Opportunistic collections of species not recorded on or adjacent to quadrats were also made across the site.

Vegetation descriptions were then made based on the structure, cover and dominant species. Table 1 details the structural classification used.

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

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

An initial plant identification session was carried out on fresh specimens on the Saturday evening of the survey weekend. Volunteers, botanists and the survey coordinator then carried out identification work in regular sessions at the Western Australian Herbarium. Assistance from specialist botanists was

provided for the identification of some specimens. A field herbarium has been compiled for the study area and presented to the Wickepin LCDC. Duplicates of some specimens have been lodged at the Western Australian Herbarium. It is considered that the survey will have recorded approximately 75-85 % of the plant species present in the remnants – a lower coverage for Malyalling Reserve than Rich Road Reserve because of limited time and fewer quadrats and search effort.

The limitations of the study were as follows:

- The survey was conducted over one flowering season only. It included a preliminary visit in winter plus the survey weekend. The cost and time of a collecting revisit later in the season was not considered justified because annuals and grasses were flowering on the October survey. A second visit is usually timed to collect these. Some of the earlier flowering annuals may have been missed. Recording over several seasons and times of year would be necessary to document the full complement of species.

- The survey was restricted to flowering plants and other well-known groups such as ferns and cycads. Fungi, mosses, lichen, liverworts and algae were not recorded as the amount of information and available expertise to identify these groups is still limited.

- Consistency in estimates of crown cover and vegetation condition is difficult when several people are carrying out the survey work as individual interpretation varies. Vegetation condition is considered relative to what pristine bushland would be. The condition categories used are given in Table 2.

- Soil descriptions are based on basic field observations without any sampling or analysis. Colour and broad soil type classification of the upper horizon was recorded and if evidence from anthills or holes was present, the sub-surface soil was also described.

- 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 will be made available to the CALMScience Biological Survey Group. Scientists from the unit are undertaking a four-year biological survey of the wheatbelt, based on compatible sampling procedures.

- 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.

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.

4. VEGETATION

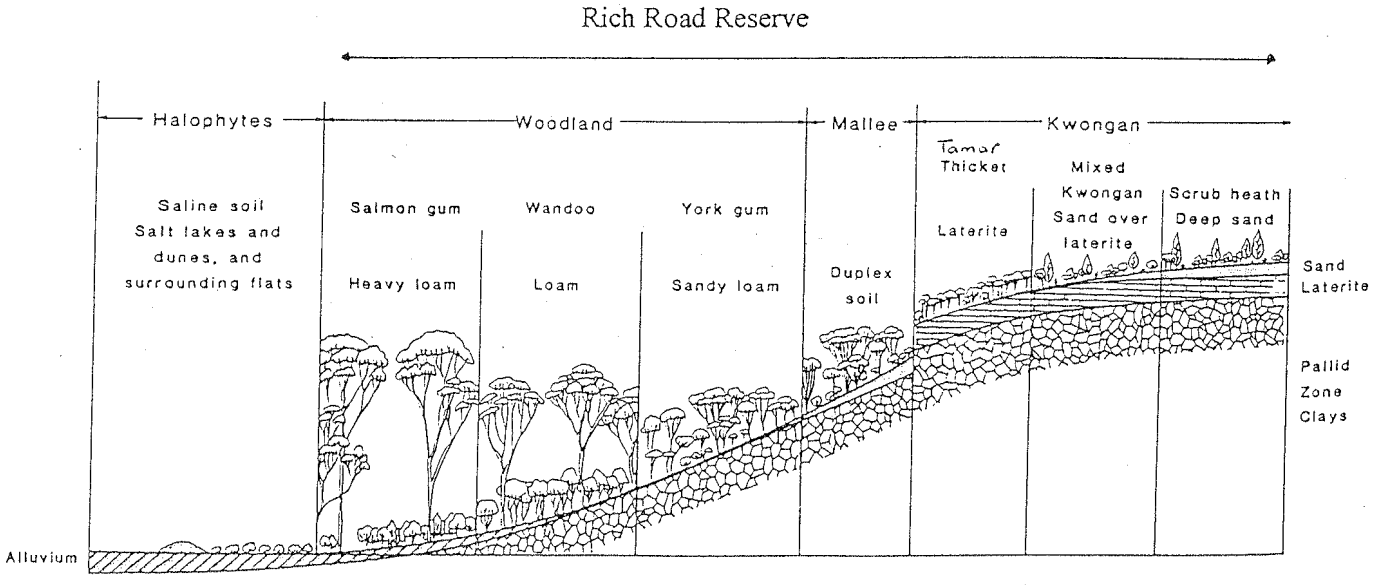
PLANT COMMUNITIES AND THE VEGETATION MAPS

Using aerial photo interpretation and on-ground observations, plant community groups were recognised based on position in the landscape, soil type, vegetation structure and dominant plant species, and these have been mapped for each reserve (Figures 4 and 15). Mapping was done from 1:25 000 aerial photographs flown in 1996.

RICH ROAD RESERVE

Within this relatively small reserve a complex mosaic of structural vegetation units, correlated to soil type and landscape position, existed. Broadly speaking there were Heath (or Shrubland), Mallee and Woodland communities. These have been distinguished in seven mapping units. The soils and relative positions in the landscape of these units are illustrated in the catenary sequence diagram (Figure 3), which is typical for the wheatbelt though individual segments vary in their proportion. '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 mapping units are:

1. Heath – Shrubland complex (H)
2. Tamar (*Allocasuarina campestris*) Shrubland (T)
3. Mallee (M)
4. Rock She-oak (*Allocasuarina huegeliana*) Woodlands (R)
5. Wandoo (*Eucalyptus wandoo*) – Rock She-oak Woodlands (W)
6. York Gum (*Eucalyptus loxophleba*) – Jam (*Acacia acuminata*) Low Woodlands (Y)
7. Salmon Gum (*Eucalyptus salmonophloia*) Woodlands (S)



Plant Community:	S	W, R	Y	M	T	T, H	H
Quadrat nos:	5	1,4,8,12	6	7	9	11	2,3

Figure 3: Typical catenary sequences of soil and vegetation structural units for the wheatbelt, modified to illustrate the situation at Rich Road Reserve (from Beard 1990, p116).

The vegetation units (mapping units; plant communities) vary in their species dominance and composition and the interpretation of the map (Figure 4) 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.

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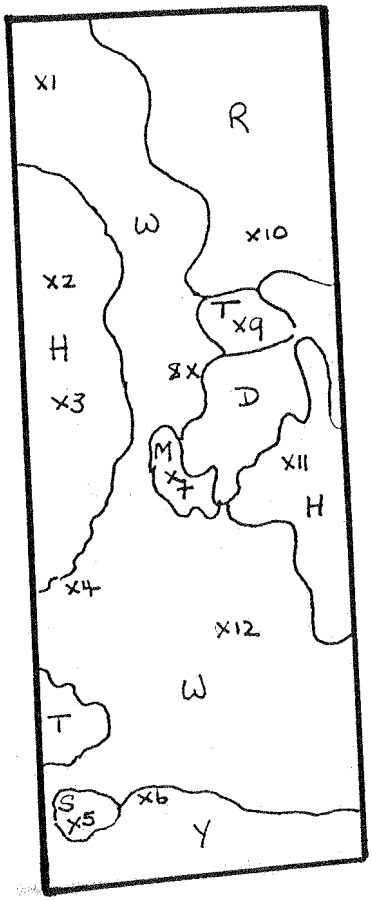

Key

▬	Bushland survey boundary
——	Plant community boundary
x 3	Quadrat location
- - -	Track

Mapped plant communities

H	Heath – Shrubland Complex
T	Tamar Shrublands
M	Mallee
R	Rock She-oak Woodlands
W	Wandoo – Rock She-oak Woodlands
Y	York Gum – Jam Low Woodlands
S	Salmon Gum Woodlands
D	Disturbed – Cleared areas

DOLA Aerial photograph 5061
WA 3798 (c) Yealering Run 6
1:25 000 13/10/96

Scale: 0——————300
metres

Figure 4: Aerial photograph and overlay of vegetation map of Rich Road Reserve

1. **Heath – Shrubland Complex (H)** (Quadrats 2, 3, 11) (Figures 5 and 6)

Two well-defined areas of Heath/Shrubland were present, on sands on the western side and on laterite adjacent to the gravel pit on the eastern side. They were characterised by an abundant and diverse array of shrubs, herbs and sedges, with Proteaceous shrubs (*Banksia, Dryandra, Hakea, Petrophile*) and Myrtaceous shrubs (*Baeckea, Beaufortia, Calothamnus, Melaleuca*) prominent. White-leaved Mallee (*Eucalyptus albida*) was emergent in the south-western patch of Heath and Rock She-oak also occurred as an emergent, infrequently on the south-west side but as a Low Open Woodland on the laterite adjoining the gravel pit. Species composition varied across the quadrats – some species were common to all the Heath quadrats (eg. *Hibbertia pungens, Chamaexeros serra, Schoenus* sp. A2 Kulin (B. Briggs 7939) and many were specific to each quadrat. *Acacia stenoptera, Baeckea preissii/floribunda* and *Banksia sphaerocarpa* var. *caesia* were recorded only on the three Heath quadrats. The number of species on each quadrat was high, particularly on the western side (59 and 53 native species per 100 m^2).

The high species richness and variable species composition ("low floristic uniformity") of these Shrublands conforms to other studies of kwongan on laterite soils in the wheatbelt (eg. Brown and Hopkins 1983, Brown 1989, Gunness 2000). Brown (1989) found a change continuum relating to a rainfall gradient, for example an increase in the number of species in Myrtaceae as the rainfall decreased below 430mm.

2. **Tamar (Tall) Shrubland (T)** (Quadrat 9)

Dense thickets of Tamar (*Allocasuarina campestris*) were scattered through the reserve on patches of gravelly loam, on the edges of Wandoo Woodland. They were characterised by thickets of Tamar 2-3 metres tall with very few associated species, grading into Tamar over Broom Bush (*Melaleuca uncinata*) and *Dryandra* sp. aff. *cirsioides*. On the north-eastern edge above the gravel pit Mallee Wandoo (*Eucalyptus capillosa* subsp. *polyclada*) grew in association with the above mentioned species.

Note: the boundaries between Heath and Tamar-Broom Bush Shrubland are not always well defined and the species of each unit mix in the transition zones. Beard (1990) refers to areas of Scrub Heath on sands above Thickets on laterite and here there appears to be a mosaic of that sequence, with some merging also at the Wandoo Woodland interface. Tamar characteristically appears to occur in the transitional zone between Heath and Woodlands (Gunness 2000).

3. **Mallee (M)** (Quadrat 7) (Figure 7)

This unit formed a narrow band on orange-brown loamy sand over clay below the gravel pit, between the Heath on laterite and Wandoo Woodland. 'Mallee' refers to eucalypts in a short many-stemmed form. Stiff-leaved Mallee (*Eucalyptus rigidula*) and *Eucalyptus hypochlamydea* subsp. *ecdysiastes* were dominant with Mallee Wandoo also present. Beneath the Mallees was a *Melaleuca uncinata, Leptospermum erubescens* Tall Shrubland over a *Lepidosperma* sp. A2 Island Flat (Keighery 7000) Very Open Sedgeland. Mallee formations in the wheatbelt typically occupy narrow bands between the woodlands of the valley soils and the kwongan of the sandplains on higher ground (Beard 1990).

4. **Rock She-oak Woodlands (R)** (Quadrat 10) (Figure 8)

These were located on the upper slope in the north-east sector of the reserve on loamy sand over laterite. They were distinguished from unit 5 by the dominance of Rock She-oak which formed a carpet of needles as a ground layer in places, and possibly deeper sandy soils. Wandoo were only scattered in occurrence. Annual herbs, particularly daisies (Asteraceae) and native grasses were conspicuous in the spring.

5. **Wandoo – Rock She-oak Woodlands (W)** (Quadrats 1, 4, 8,12)

These Woodlands formed a band through the middle of the reserve on laterite and on duplex soils of sandy loam over clays. They consisted of Wandoo over She-oak with a variable understorey : a shrub layer prominent on the laterite and herbland on the lower slope. Occasional Salmon Gums were scattered through the Wandoo Woodlands, their shiny crowns looming above the general Woodland level.

- **Wandoo Woodlands on laterite (upper slope)** (Quadrats 1, 8)
These occurred in the north-western corner of the reserve as a Wandoo Open Woodland over a Tamar - Broom Bush Tall Open Shrubland over *Dryandra* sp. aff. *cirsioides* Low Open Shrubland. They also occupied a small breakaway on the edge of the laterite below the gravel pit. There the Wandoo was over a Rock She-oak Low Open Woodland over a *Gastrolobium parviflorum, Hakea lissocarpha* Open Shrubland over a mixed Very Open Herbland.

- **Wandoo – Rock She-oak Woodlands (mid slope)** (Quadrats 4, 12) (Figure 9)
These were characterised by an understorey dominated by herbs with few shrubs, compared to the Wandoo on the laterite. In the mid reaches of the reserve the understorey was a low shrubland of *Gastrolobium parviflorum* and *Calytrix leschenaultii* over a well defined herb layer of *Dampiera lavandulacea, Borya sphaerocephala, Lawrencella rosea* and *Desmocladus asper, Lepidosperma* sp. A2 Island Flat (Keighery 7000) Open Sedgeland. The shrub layer disappeared on the south-eastern side but a rich herbland formed an understorey with species such as *Dampiera lavandulacea, Opercularia vaginata, Lomandra micrantha, Lagenophora huegelii, Helichrysum leucopsideum, Waitzia acuminata, Lawrencella rosea* and other assorted annuals.

6. **York Gum – Jam Low Woodlands (Y)** (Quadrat 6) (Figure 10)

These occupied the middle slope between the Wandoo and Salmon Gum Woodlands on loam. The spreading York Gum formed a Low Woodland canopy over Jam and scattered Rock She-oak. A middle shrub layer was absent, the understorey being a herb and grass layer with species including *Dampiera lavandulacea, Opercularia vaginata, Stypandra glauca* and numerous small annuals along with the grasses *Neurachne alopecuroidea, Austrostipa tricophylla, Amphipogon caricinus, Austrodanthonia setacea* and the sedge *Lepidosperma costale.*

7. **Salmon Gum Woodlands (W)** (Quadrat 5)

This was a small area on a flat at the southern end of the reserve, down-slope from the Wandoo Woodlands in a patch of heavier red brown loam over clay amidst the York Gum – Jam Woodland. A shrub layer was again absent and weedy grasses were prominent (**Briza maxima, *Bromus rubens, *Avena barbata, *Ehrharta longiflora, *Lolium rigidum*) amongst some native grasses (*Neurachne alopecuroidea, Austrostipa tricophylla, Austrodanthonia setacea*) and a very open mixed herb layer.

8. **Disturbed – Cleared areas (D)** (Figure 11)

The gravel pit on the eastern side of the reserve is mapped as disturbed. It is a bare area of ironstone gravel with some weed intrusions on the edges. It is to be revegetated by the shire.

Figure 5: Several participants can be involved in collecting quadrat data. The people sitting are filling out the recording sheets and tagging specimens, others collect specimens of all the different species in each 10x10m quadrat and the adjoining area. The dense low shrubland in this picture is part of the Rich Road Reserve Heath on sand. (Quadrat RICH 2, 2/10/99, with 59 native and 3 weed species) (All photographs by Brian Moyle.)

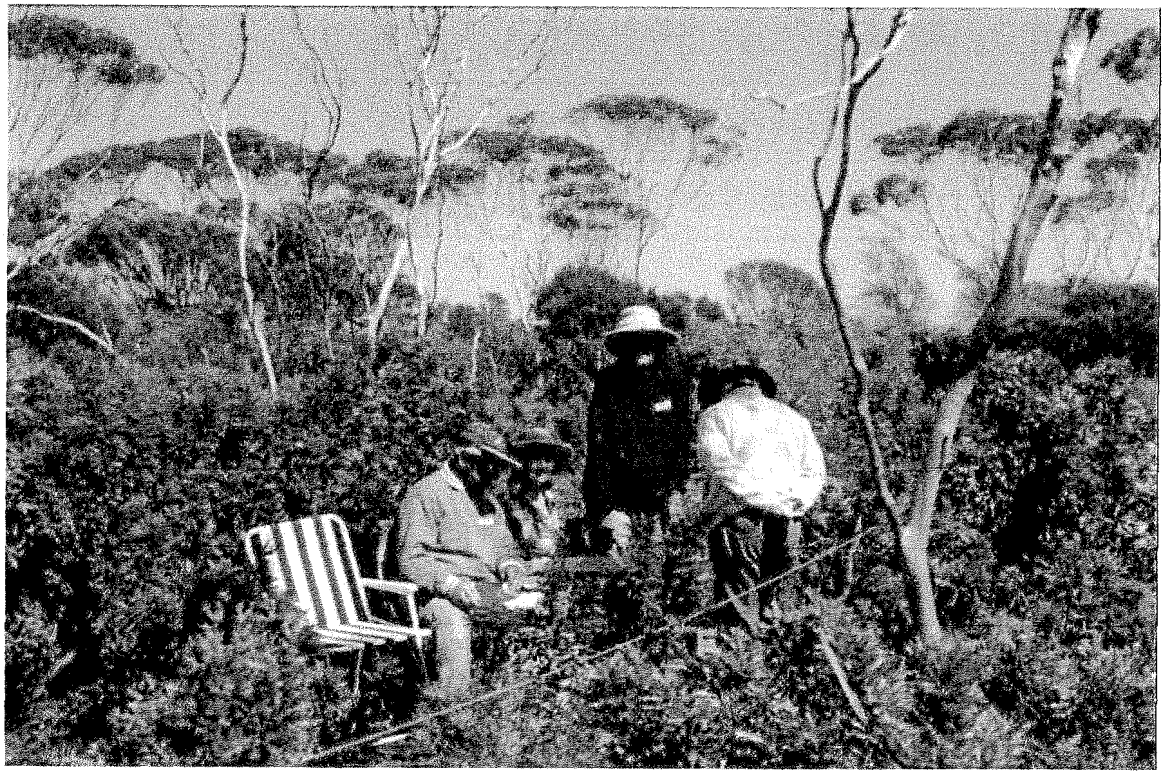

Figure 6: *Dryandra* sp. aff. *cirsioides* Open Heath with scattered White-leaved Mallee (*Eucalyptus albida*). The Heath quadrats were rich in species and virtually free of weeds. (Quadrat RICH 3, 2/10/99 with 53 native and 1 weed species)

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Figure 7: A band of Shrub Mallee was situated below the laterite of the gravel pit. Note the characteristic multi-stemmed trunks of Stiff-leaved Mallee (*Eucalyptus rigidula*) and *Eucalyptus hypochlamydea* subsp. *ecdysiastes*. The understorey was a *Lepidosperma* sp. A2 Island Flat (Keighery 2000) Very Open Sedgeland. (Quadrat RICH 7, 2/10/ 99 with 28 native and 6 weed species)

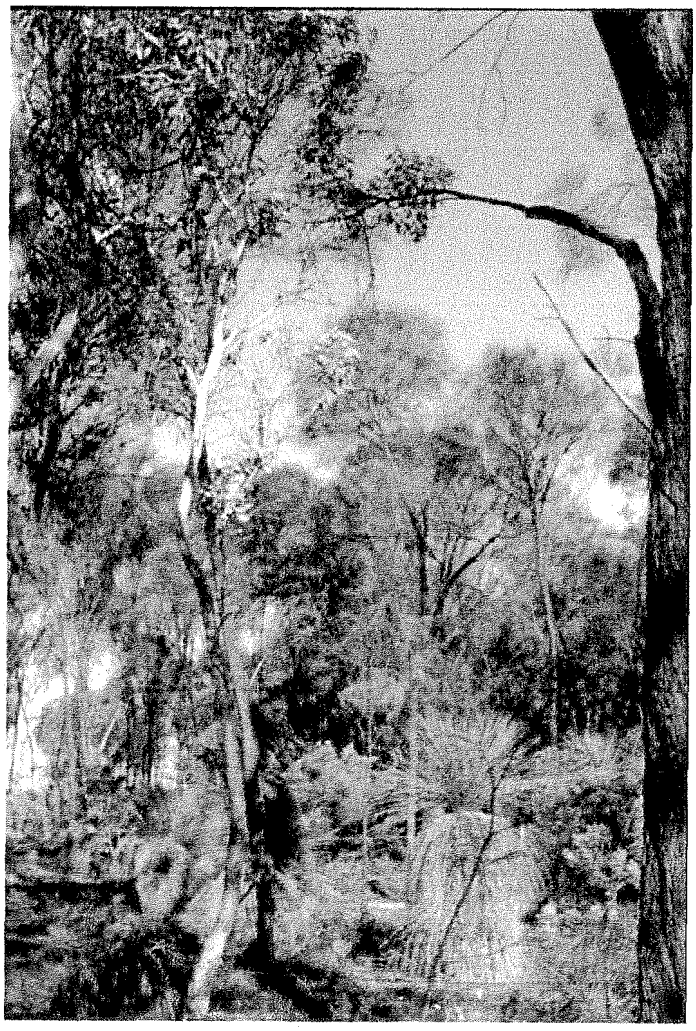

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Figure 8: Rock She-oak Woodlands in the north-east section of Rich Road Reserve were mostly She-oak dominant with scattered herbs amidst a carpet of needles. A patch of Grass Trees (*Xanthorrhoea drummondii*) were a feature of the understorey in the southern section of this community. (Quadrat RICH 10. 2/10/99 with 39 native and 3 weed species)

Figure 9: Wandoo Woodland over Rock She-oak Low Open Woodland was a much more open landscape than the Heath and occupied the mid reaches of Rich Road Reserve. Shrubs on the lower slopes of these Woodlands were sparse but a rich herbland and sedges formed a species rich ground layer. The orange rope marks the perimeter of the quadrat. (Quadrat RICH 4, 2/10/99, with 51 native and 7 weed species)

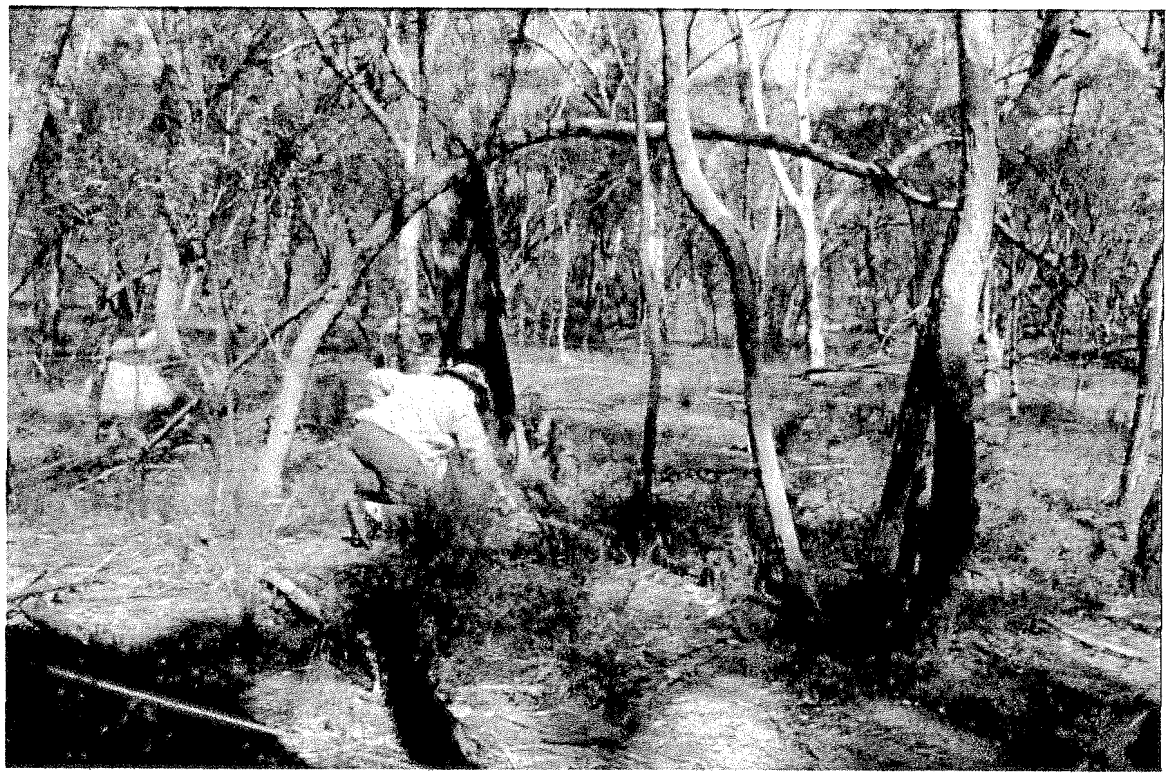
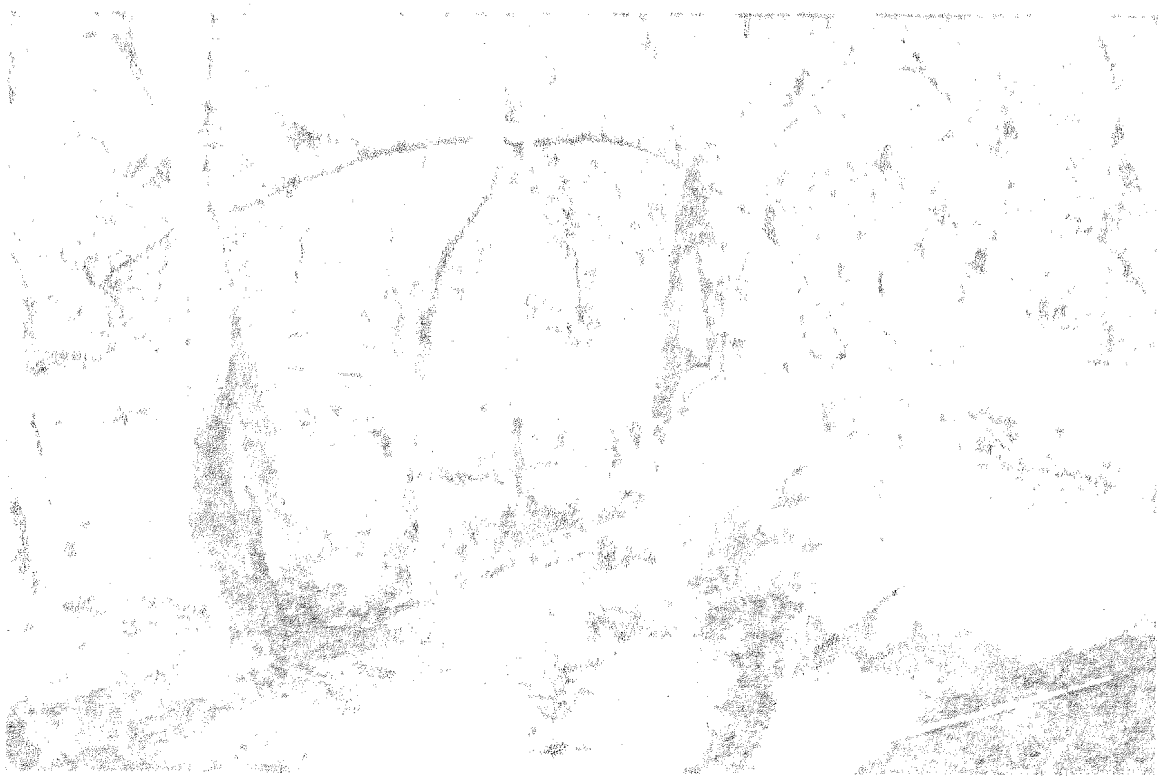


Figure 10: The dark fibrous bark of York Gum (*Eucalyptus loxophleba*) contrasted with the white bark of the Wandoo up-slope in Rich Road Reserve. A York Gum Low Woodland over Jam Low Open Woodland and a fairly open ground layer of herbs, grasses and sedges occupied the southern section of the reserve. (Quadrat RICH 6, 2/10/99 with 32 native and 5 weed species)



VEGETATION CONDITION (Rich Road Reserve)

Broadly speaking the vegetation on Rich Road Reserve was in very good condition. All the quadrats, which were located in areas of best condition, were rated very good or excellent. Some Grass Trees (*Xanthorrhoea drummondii*) had been killed by parrots destroying their crowns. Weed invasion was insignificant in the upper reaches of the reserve but more conspicuous in the Eucalypt Woodlands in the lower reaches. However three other significant disturbance factors were present. The first two could be sensitively managed to minimise threat to the bushland, the third is complex and the solution is at a landscape scale rather than a local or reserve scale.

1. Gravel Pit

Gravel extraction had left a large bare area of ironstone that will be revegetated (Figure 11). Within the gravel pit was a pile of soil and garden refuse harbouring a source of several weeds which were not present elsewhere in the reserve but are a potential source of invasion. They included Agapanthus (**Agapanthus praecox*), Great Brome (**Bromus rubens*), Whiteflower Fumitory (**Fumaria capreolata*), Barley Grass (**Hordeum leporinum*), Poppy (**Papaver* sp.), Subterranean Clover (**Trifolium subterraneum*) and Woolly Clover (**Trifolium tomentosum*). (an asterisk in front of a name indicates a weed species)

2. Rubbish dumping

There was considerable evidence of this, particularly old fencing wire, on the eastern side of the reserve and below the gravel pit (Figure 12). Not only is this an unsightly practice, it reflects a lack of appreciation of the values of the bushland. Rubbish piles provide harbour for rabbits and can also be deposition points for weed seed.

3. Rising water table and associated waterlogging and salinity

At the lowest lying south-west corner of the reserve there was evidence of tree decline from the effects of salinity (Figure 13). Salmon Gum and Wandoo were dying, and in a pondage area in the 86-Gate road table drain salt tolerant species were colonising (Figure 14). These included **Atriplex undulata*, an American plant introduced as a fodder plant, *Enchylaena lanata, Halosarcia pergranulata* and *Maireana brevifolia* (Small Leaf Bluebush). The cause of this is no doubt complex: past over clearing in the catchment, increased run-off from the bare ground of the gravel pit and pondage against 86-Gate road all playing some influence.

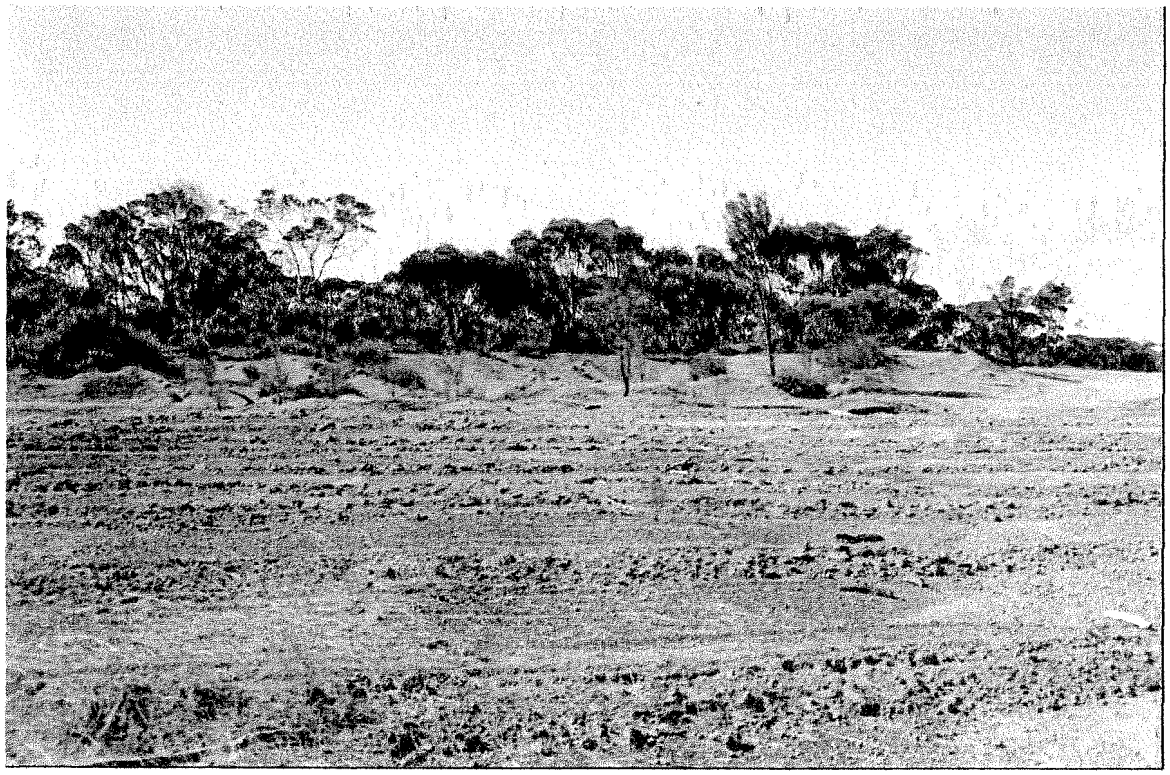
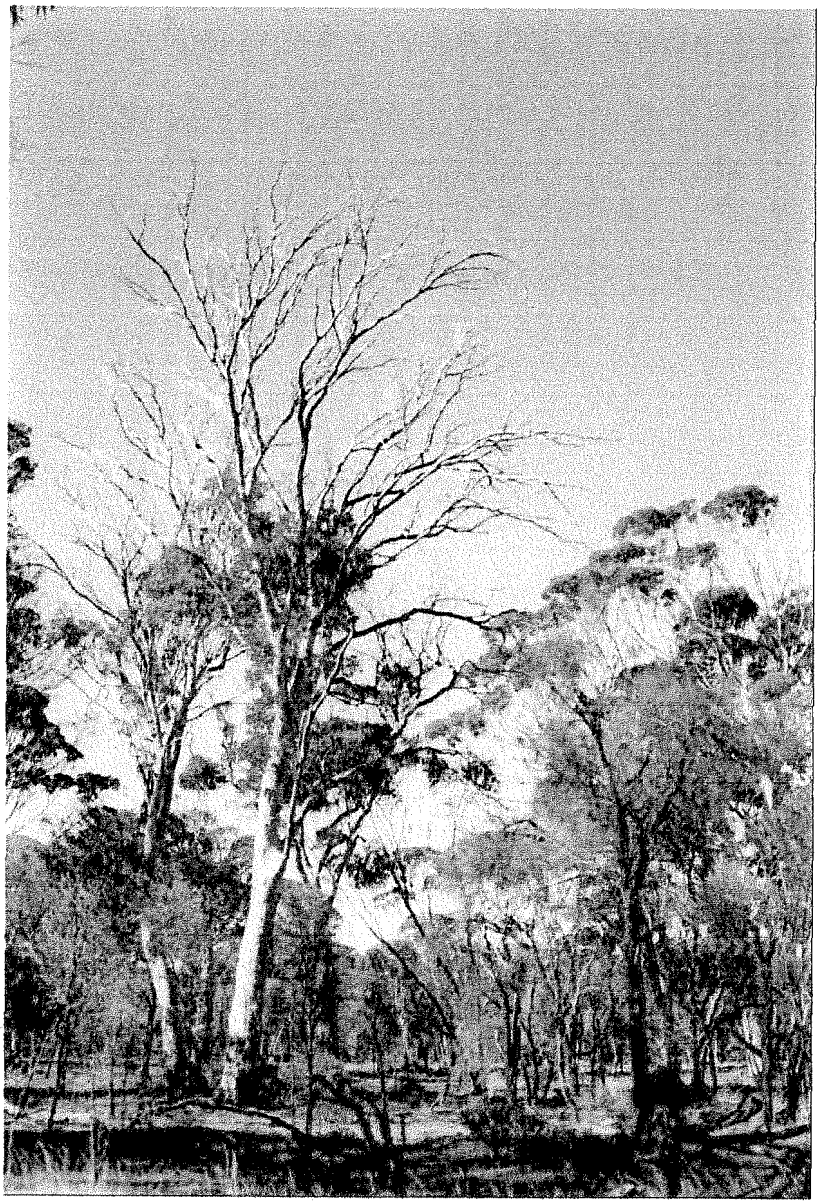


Figure 11: The gravel pit at Rich Road Reserve with the ironstone base ripped for planting. Mallee and Heath border the edge of the pit. April 2001.

Figure 12: Old fencing wire and other rubbish had been dumped in the Wandoo Woodland below the gravel pit at Rich Road Reserve. Rubbish dumping should be discouraged – it is unsightly and diminishes the bushland values, is a trap for weed seed and a source of weed introduction.



←**Figure 13**: The fatal signs of a rising saline water table. Salmon Gum and Wandoo in the lower south-west corner of Rich Road Reserve are dying (April 2001).

↓**Figure 14:** The lower south-west corner of Rich Road Reserve on the 86-Gate road boundary. In and adjoining the table drain where water has ponded, combined with a rising water table, the normal Woodland herb layer has been replaced by salt tolerant succulents: *Enchylaena lanata, Halosarcia pergranulata* and *Maireana brevifolia* (April 2001).

MALYALLING RESERVE

Malyalling rock, a large granite outcrop for which the reserve is named, dominated part of the reserve and associated with it were the Rock She-Oak – Jam – York Gum Woodlands on the granite derived soils. Eucalypt Woodlands on the slopes and Shrublands dominated by Tamar on laterite characterised the remainder of the reserve. Six vegetation units were distinguished:

1. Granite complex: granite outcrop and associated Herblands
2. Rock She-oak (*Allocasuarina huegeliana*) Woodlands
3. York Gum (*Eucalyptus loxophleba*) – Jam (*Acacia acuminata*) – Rock She-oak Woodlands
4. Wandoo (*Eucalyptus wandoo*) – Rock She-oak Woodlands
5. Salmon Gum (*Eucalyptus salmonophloia*) Woodlands
6. Tamar (*Allocasuarina campestris*) Thickets

These units are described in more detail as follows and mapped in Figure 15:

1. Granite complex (G) (Quadrat 3) (Figure 16)

A large granite outcrop dominates the high point of the eastern block of the reserve. In cracks and hollows where shallow granite soils collect, shrubs were able to establish and, with the seasonal rains, rich herblands appear in patches over the outcrop and in the shallow soils around the rim where water seeps. Lichens were also a characteristic feature on the granite surface. On the deeper soils below the outcrop were Low Woodlands of Rock She-oak, Jam and York Gum (mallee form).

On the outcrop the shrubs which had established in crevices were the brilliant red flowering Granite Kunzea (*Kunzea pulchella*) and *Dodonaea viscosa* subsp. *angustissima.* The seasonal herbland was dominated by Pincushions (*Borya sphaerocephala*) in association with a rich herb layer including *Crassula exserta, Drosera glanduligera, Arthropodium curvipes, Calandrinia calyptrata, Siloxerus multiflorus, Aphelia brizula, Levenhookia dubia, Glossostigma drummondii* and several Orchid species: *Prasophyllum gracile, Thelymitra antennifera, Thelymitra* sp. aff. *macrophylla, Diuris* sp. aff. *corymbosa* and *Spiculaea ciliata.* The native Bullrush (*Typha domingensis*) was growing in a gnamma hole (rock pool).

Pincushions, also known as Resurrection Plants are remarkable in their ability to transform, within just a day of rain, from an orange desiccated plant to one with normal green leaves. The Rock Fern, *Cheilanthes austrotenuifolia* is also a Resurrection Plant and was recorded on the granite. The fascinating Elbow Orchid (*Spiculaea ciliata*) is endemic to the south-west of Western Australia and is able to flourish in harsh summer conditions by producing a succulent flowering stem in the wetter months, which stores the necessary food and water. Equally remarkable is the way the flowers have evolved to resemble a female wasp, as well as giving off a chemical lure, both features designed to attract the male wasps and so bring about cross pollination.

Granite outcrops have been the subject of considerable ecological studies. They are often places with a special interest or association (picnic sites, lookout spots) and there are several informative sources describing the natural history of this special type of landscape: Hopper *et al.* 1997 and other articles in Proceedings from the Granite Outcrops Symposium; Hussey 1998; Nikulinsky and Hopper 1999; McMillan n.d. and a Revegetation on Farms Information Kit from Agriculture WA which includes some of the aforementioned articles).

2. Rock She-oak Woodlands (R) (Quadrat 2)

In some areas Rock She-oak completely dominated the overstorey rather than being in association with York Gum, Jam or Wandoo. The soils were sandy loam with a surface layer of laterite pebbles. *Acacia multispicata* was scattered in the understorey and an open herbland included *Borya sphaerocephala, Dampiera lavandulacea, Opercularia vaginata, Glischrocaryon aureum, Sowerbaea laxiflora, Stypandra glauca* and assorted annuals.

3. York Gum – Jam – Rock She-oak Open Woodlands (Y) (Quadrat 4) (Figure 17)

This unit was located on the slopes below Malyalling rock. On the shallowest soils below the outcrop Jam was sometimes dominant and in pure stands, sometimes mixed with Rock She-oak, and York Gum appeared as soils increased in depth. In the areas in best condition, such as in the York Gum Open Woodland over a Jam – Rock She-oak Low Woodland, on the south-west corner of Kirk Rock Road and Berrigan Road, the sedge *Lepidosperma costale* was a conspicuous understorey species along with the herbs *Borya sphaerocephala, Opercularia vaginata, Stypandra glauca* and many small annuals.

Much of this community was heavily weed invaded especially by the annual grasses **Briza maxima, *Avena barbata, *Vulpia myuros* and **Aira caryophyllea.* This is typical of York Gum Woodlands throughout the wheatbelt – they have either been cleared or grazed and few remain intact. The weed invasion on this area would likely have resulted from the long history of public recreation, vehicle and trampling disturbances and drift from the adjoining cleared land.

4. Wandoo – Rock She-oak Woodlands (W) (Quadrats 1, 5, 6) (Figure 18)

This unit was situated down-slope of the York Gum and She-oak dominant Woodlands in the north western and south eastern sectors of the reserve on loamy sands. It was typically a Very Open (Low) Wandoo woodland over a Rock She-oak Low Woodland although the relative proportion of the Wandoo and She-oak varied. It was distinguished from unit 2, however, by the presence of Wandoo and the lower density of She-oak. *Gastrolobium parviflorum* was scattered throughout in the shrub layer. Where the tree canopy cover was very open there was a typically herbaceous understorey which can be very colourful with swards of annuals in Spring (Figure 20). At the time of survey the tiny Trigger Plant *Stylidium emarginatum* formed a carpet of pink in patches in the south east sector. Other species of the Open Herbland understorey included *Borya sphaerocephala, Dampiera lavandulacea, Sowerbaea laxiflora, Drosera macrantha* and *Drosera subhirtella,* and several annual daisies: *Blennospora drummondii, Waitzia acuminata, Rhodanthe citrina, Rhodanthe laevis, Hyalosperma demissum, Millotia tenuifolia, Podotheca angustifolia.* Typical grasses included *Neurachne alopecuroidea, Austrostipa elegantissima, Amphipogon caricinus* and *Austrostipa tricophylla* and sedges *Lepidobolus preissianus, Desmocaladus asper* and *Schoenus nanus.*

Similarly to Rich Road Reserve there was also Wandoo Open Woodland on laterite (Figure 19). It formed a transitional band between Tamar thicket and Salmon Gum – Wandoo woodlands on duplex soils (area of Quadrat 5 on eastern side and on the north western boundary). Beneath the Wandoo was a Tamar Tall Open Shrubland over *Dryandra* sp. aff. *cirsioides* Open Shrubland over *Hibbertia pungens* Low Open Shrubland.

5. Salmon Gum Woodlands (S) (Quadrat 7) (Figure 21)

These tall attractive trees with their shiny crown atop the smooth trunks are always conspicuous and there were very fine stands on the western and eastern boundaries adjacent to Kirk Rock Road. Smaller stands were situated between Tamar and Wandoo and on the edge of the gravel pit, in the northern sector of the reserve. They were also typified by their very open "forest floor": large patches of open ground and leaf litter, with scattered shrubs. Shrubs included the low prickly wattles *Acacia lasiocarpa* and *Acacia erinacea* as well as *Olearia rudis, Westringia cephalantha* and *Westringia rigida.* Ground layer species were also sparse and included the herbs *Lomandra effusa, Lomandra micrantha, Caladenia calyptrata* and grasses *Austrostipa variabilis, Austrostipa elegantissima* and *Austrodanthonia setacea.*

6. Tamar Thickets (T) (Figure 19 in background)

These were situated on lateritic gravels in the northern sector of the reserve. Tamar formed a Tall Open Scrub growing as a multi-stemmed shrub at high density (2 metres apart). A sparse ground layer included *Borya sphaerocephala* and the grasses *Neurachne alopecuroidea, Austrodanthonia* sp. and *Austrostipa* sp.

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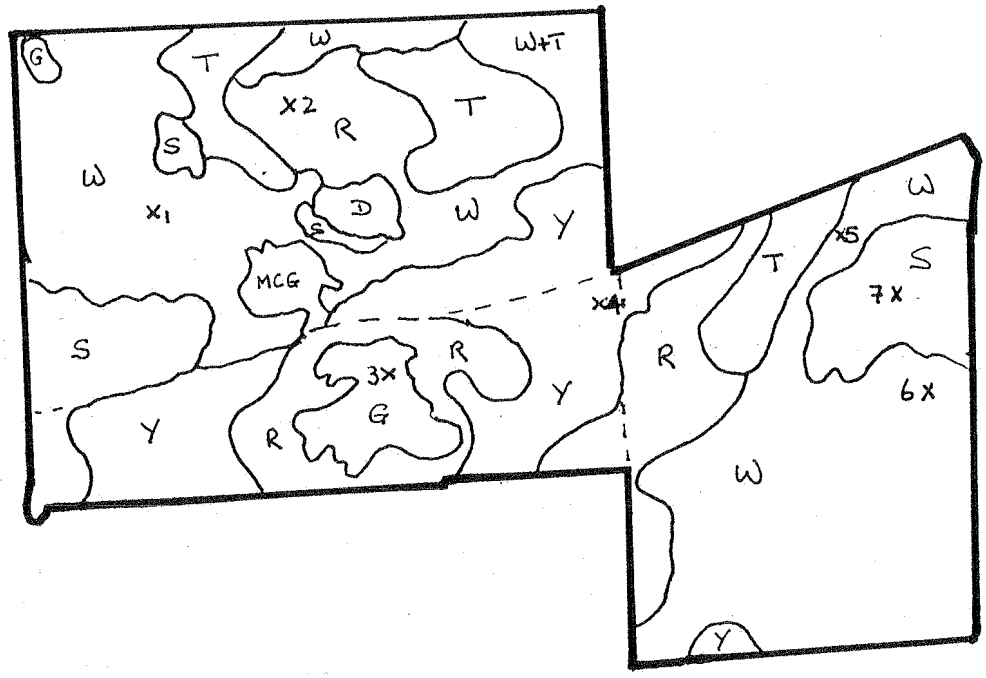

Key

▬▬	Bushland survey boundary
——	Plant community boundary
x 3	Quadrat location
- - -	Track

Mapped plant communities

G	Granite complex: granite outcrop and associated Herblands
R	Rock She-oak Woodlands
Y	York Gum – Jam – Rock She-oak Open Woodlands
W	Wandoo – Rock She-oak Woodlands
S	Salmon Gum Woodlands
T	Tamar Thickets
D	Disturbed - Cleared areas

DOLA Aerial photograph 5065
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Figure 15: Aerial photograph and overlay of vegetation map of Malyalling Reserve

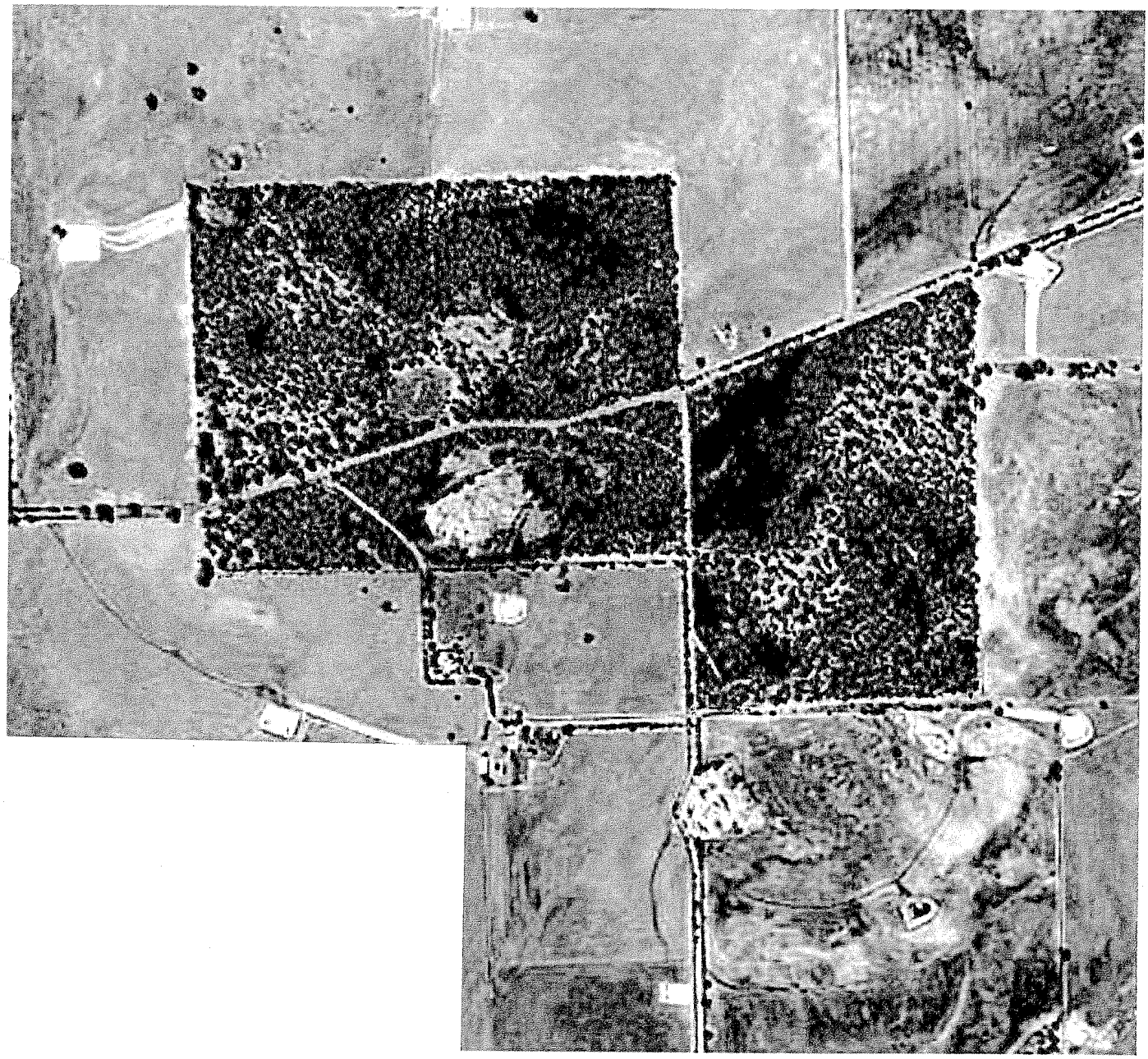

Figure 16: Malyalling Rock, which lends its name to the reserve, was well covered in mosses and lichens. Hardy shrubs including Granite Kunzea and Hopbush (*Dodonaea viscosa*) grew in rock crevices. Herbland patches establish in hollows where shallow granite soils collect and ephemeral herblands also grew around the seepage areas at the edges of the rock outcrop. The dark band in the background is York Gum –Jam -Rock She-oak Woodlands in the soils below the rock. (Quadrat MALY 3 on the rock had 21 native and 9 weed species, 3/10/99)

Figure 17: York Gum – Jam – Rock She-oak Woodlands are commonly associated with granites. Although in some parts of Malyalling Reserve they were heavily invaded with grassy weeds, this site had an understorey in relatively good condition and the sedge *Lepidosperma costale* was prominent. (Quadrat MALY 4, 3/10/99 with 39 native and 9 weed species)

Figure 18: Wandoo - Rock She-oak Low Woodland in the north-western sector of Malyalling Reserve. In some areas, such as here, She-oak was dominant and the shrub *Gastrolobium parviflorum* was conspicuous. More typically the understorey was more open with scattered herbs, sedges and grasses. (Quadrat MALY 1, 3/10/99, with 39 native and 7 weed species)

Figure 19: Contrasting with Figure 18 this Wandoo Low Open Woodland below Tamar thicket occupied laterite in the north eastern sector of the reserve near Quadrat MALY 5. This narrow band of laterite also supported a few typical Heath species. Malyalling reserve typically supported communities of granite derived soils in comparison to Rich Road Reserve with communities typical of a laterite profile. (April 2001)

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Figure 20: Very Open Wandoo-Rock She-oak Woodland can be carpeted in Spring with a layer of annual herbs. This photo was taken on the eastern side of Malyalling Reserve. The white Triggerplant (*Stylidium emarginatum*) was in full bloom and mixed with Sundews (*Drosera* spp.), purple *Sowerbaea laxiflora* and numerous daisies and other tiny herbs. (Quadrat MALY 6, 3/10/ 99 with 44 native and 5 weed species)

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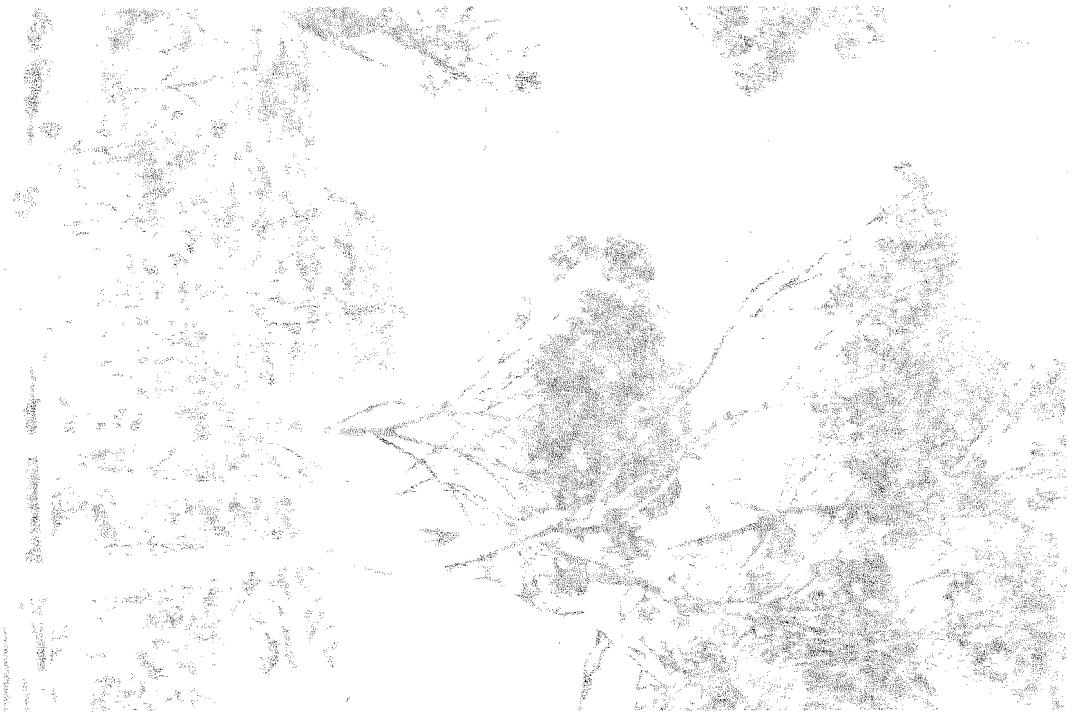
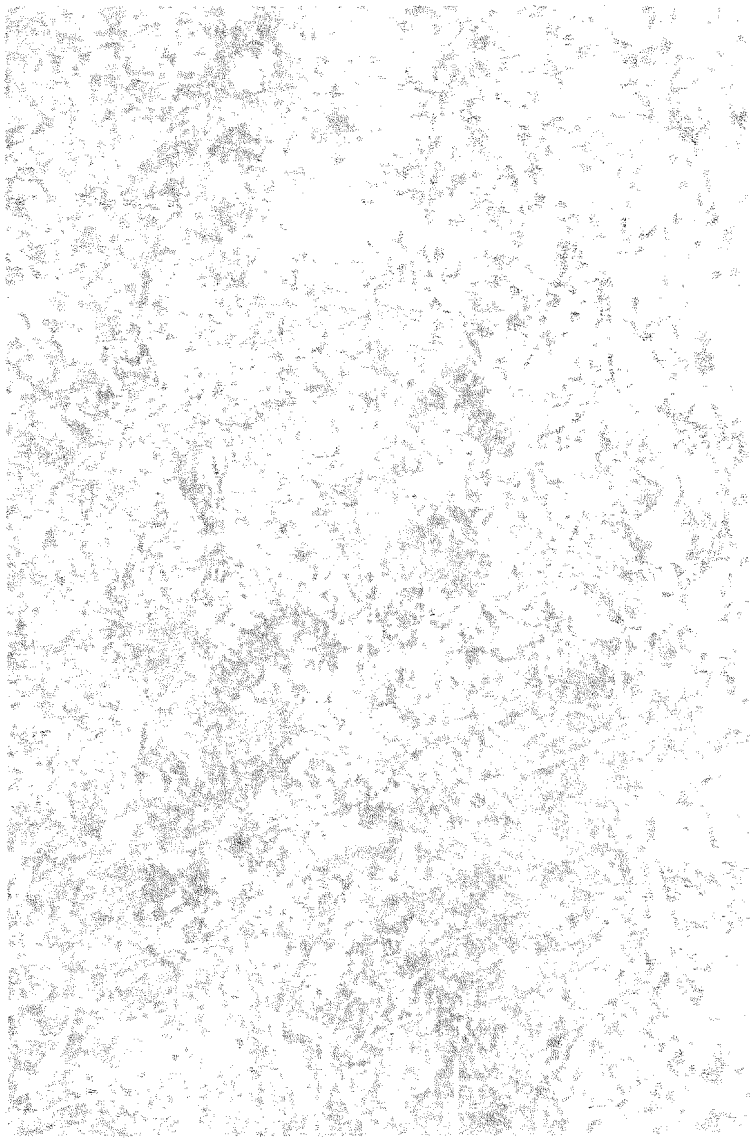
Figure 21: Majestic Salmon Gum with their smooth bark and shiny crown typically tower over a very open understorey. This photo shows the autumn bark coloration. (Western sector of Malyalling Reserve, April 2001)





7. **Disturbed – Cleared areas (D)** (Figures 22 and 23)

The Malyalling Cricket Ground (MCG), the old school site and the old gravel pit are areas that had been cleared and are now all unused. Jam is regenerating successfully on the MCG (Figure 22) and old school site but has a weedy grass understorey. A colourful patch of Harlequin Flower (*Sparaxis pillansii*) featured at the old school site in spring – no doubt naturalised from the school gardens during its operation from 1910-1925 (Figure 23). The ironstone gravel pit has been ripped and left to regenerate from the surrounding natural seed source.

VEGETATION CONDITION (Malyalling Reserve)

The condition on the quadrats was rated very good and this reflected the general condition of Malyalling Reserve. Historic usage of the cricket ground and the old school site obviously meant those areas were not intact bushland and weedy grasses and herbs dominated the ground layers. There was successful regeneration of Jam however and several native understorey species. The York Gum – Jam Woodlands on the slopes below the granite were quite heavily weed invaded. This is not unusual in York Gum Woodlands throughout the wheatbelt.

The main disturbance factors in the reserve were:

- Weed invasion – particularly in the York Gum –Jam Woodland where grassy weeds (particularly Wild Oats and Blowfly Grass) reduced the abundance and diversity of native ground flora.
- Access roads
- Vehicle and trampling damage to the lichen and moss crusts on the granite outcrop
- Rubbish dumping – a load of oats had been dumped under the Salmon Gum in the eastern corner of the reserve at the time of the survey. In March 2001 during a site revisit, a pile of household rubbish was observed in a nearby spot. This is an easily accessible area with an open understorey.
- Past activities including clearing for the MCG, the old school site, an old gravel pit and various tracks.

Figure 22: The MCG (Malyalling Cricket Ground) and surrounding oval, once the site of local cricket matches. Notice the Jam which has self-regenerated on the site since it was abandoned as a playing ground around 1960.

Figure 23: These Harlequin Flower (*Sparaxis pillansii*) were growing at the old school site – no doubt naturalised from the old school gardens. The school was operational from 1910-1925. Bulbous weeds are often very invasive in the Western Australian environment and this species has been recorded around settlements in the south west. It would be wise to control and monitor it to ensure it does not invade further.

5. FLORA

Within Rich Road Reserve and Malyalling Reserve combined, a total of 266 native vascular plant taxa (species, subspecies and varieties) and 31 non-native weed species were recorded from 57 plant families (Appendix II, Table 1). These were comprised of 201 perennials and 97 annuals. The proportions in each reserve were:

	Rich Road Reserve	Malyalling Reserve	Both Reserves
Native species	217	153	266
Weeds	23	24	31
Plant Families	49	48	57
Perennials	173	98	201
Annuals	67	79	97

Rich Road Reserve, although the smaller of the two reserves, had the greater species diversity. This was not unexpected because of the diversity of vegetation types and the percentage area of the very species rich Heath.

Ten plant families accounted for 65 per cent of the taxa. The daisy family Asteraceae was the largest group on both reserves with 34 taxa: 28 at Rich Road Reserve and 27 at Malyalling Reserve. The top ten species rich families were as follows:

Family	Rich Road Reserve		Malyalling Reserve		Both Reserves		
	Natives	Weeds	Natives	Weeds	Natives	Weeds	Total
Asteraceae (Daisies)	25	3	23	4	30	4	34
Poaceae (Grasses)	9	10	14	10	14	12	26
Myrtaceae	24	0	6	0	24	0	24
Orchidaceae (Orchids)	16	0	15	0	22	0	22
Proteaceae	22	0	4	0	22	0	22
Papilionaceae (Peas)	14	2	4	2	16	4	20
Cyperaceae (Sedges)	12	0	5	1	12	1	13
Mimosaceae (Wattles)	8	0	6	0	10	0	10
Anthericaceae (Lilies)	7	0	7	0	10	0	10
Stylidiaceae	7	0	7	0	8	0	8

A high number of species occurred only infrequently. One hundred and sixteen (39%) of the total 297 taxa were recorded only once, 84 on or adjacent to the quadrats and 32 from collections made on transects through the bushland. On Rich Road Reserve 93 of the total 240 taxa and on Malyalling Reserve 79 of the total 177 taxa, were once only records. This highlights the importance of the entire area of any remnant in maintaining the species diversity and being representative of the flora of an area. It also suggests that every extra area of bushland protected is likely to better protect the infrequently occurring plant taxa. Species rarity at quadrat level, individual remnant level and a regional level has been recognised by the CALMScience Biological survey in the Wheatbelt (Keighery 2000) and other surveys in this program have reflected this phenomenon.

Whenever people are first introduced to the survey technique, there is always an expression of surprise at the number of species that can be found in a small area. It is so easy for us to overlook the less obvious, but they are all an important part of the diverse natural system. The number of species found on each 10m x10m quadrat varied from 18 (14 natives, 4 weeds – quadrat MALY 7) to a maximum of 62 (59 natives, 3 weeds – quadrat RICH 2). This provides an indication of the variation in species composition of different vegetation types.

The Heath –Shrubland Complex was the most species rich community with a high diversity of shrubs and herbs. The number of species recorded, although not as high as some of the most species rich sites recorded in surveys elsewhere in the south-west, was favourably comparable to other surveys in the

southern wheatbelt. Examples of the richest sites are as follows: on the Pinjarra Plain up to 80 native species per quadrat can be found (Keighery *et al.*1997); on lateritic kwongan at Eneabba an average 69.8 species were recorded in 100 m^2 (Griffin *et al.*1983), and on the top of Mt Lesueur 81 species in 100 m^2 (Griffin and Hopkins 1985). Comparable wheatbelt areas: At Tutanning Reserve near Pingelly, the number of species on 100m^2 plots in kwongan ranged from 32 to 70 with a lot of variation in species composition between sites (Brown and Hopkins, 1983). Privately owned remnants at Tincurrin and East Yornaning supported up to 69 and 71 native species respectively per quadrat (Gunness 1999 and Gunness 2000).

The mixed Wandoo - She-oak and York Gum - She-oak Woodlands also had a high diversity of plants although they supported fewer shrubs than the Heath and the diversity is attributable chiefly to the herb species and also grasses. The Tamar Thickets and Salmon Gum Woodlands were the poorest in species. In the thickets the dense Tamar was the dominant shrub and permitted little light penetration so there were very few ground layer species and shrubs. Salmon Gum Woodlands often lack a developed shrub layer and ground layer species are generally sparse. This is possibly because Salmon Gums have such large water requirements and their extensive root systems prohibit the establishment of a dense understorey.

A list of the plant species found in each of the reserves 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 for each reserve. 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

- **Priority Flora**

Three threatened species (Priority taxa) (Atkins 2000) were located within the study areas, and they are described below. Voucher material has been submitted to the Western Australian Herbarium. 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.

Leucopogon pogonocalyx **(A Beard Heath) (Epacridaceae) Priority 1**
This slender shrub with small white flowers was recorded in Heath on Rich Road Reserve and was uncommon. It has some similarities to *Leucopogon* sp. Wandering (F.Hort 419) from the Wandering, York and Beverley region. However its sepals are obtuse and ciliate compared to the acute sepals of *Leucopogon* sp. Wandering. There are only a few collections of *Leucopogon pogonocalyx* from the Stirling Range area so this record is a significant northern extension of its range. It was uncommon in the area.

Stenanthemum tridentatum **(Rhamnaceae) Priority 3**
This is a small shrub with heads of inconspicuous white or cream flowers in July-November. It was recorded in this survey in Tamar Shrubland and York Gum Woodland on Rich Road Reserve and in Wandoo and Salmon Gum Woodlands on Malyalling Reserve. It appears to be more widespread than originally thought but never seems to occur in abundance. It is known, but not widely collected, from similar regions (Kukerin, Kulin district, Wagin, Gunyidi, Duranillin, and Tutanning). Other Wildflower Society surveys have recorded it from Tincurrin and Quairading, as well as a collection that extended its range north to Konnongorring near Wongan Hills.

Thysanotus tenuis **(Fringed Lily) (Anthericaceae) Priority 3**
This is a tuberous Fringed Lily which has purple flowers in spring and dies back in the dry season. Two recordings were made in granite communities in Malyalling Reserve. It occurs uncommonly in an area from Quairading to Brookton to Dumbleyung so this record is within its known range of occurrence.

- **Geographically significant flora**

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

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

1. 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:

Epilobium hirtigerum **(Hairy Willow Herb):** a perennial herb with pale pink to white flowers, recorded in the moist edge of the granite rock at Malyalling Reserve. It has been well collected over an area ranging from Shark Bay to the Stirling Ranges but this appears to be the only collection in the southern wheatbelt and is on the eastern edge of its distribution.

2. Taxa at the western limit of range

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

Goodenia krauseana: an annual herb with yellow flowers streaked purple. Other records are from the Coolgardie and Murchison districts, commonly around granite and greenstone (Norseman, Boingaring Rock, Balladonia, Hyden, Zanthus, Jaurdi Station). So this record from Malyalling Reserve is a large western extension of its previously known range.

Hakea subsulcata: an uncommon shrub in the Heath at Rich Road Reserve, it is located from Corrigin to Dumbleyung and areas east to Lake Grace, Newdegate, Ravensthorpe, Southern Cross and the Goldfields, putting the Wickepin area on the western edge of its distribution.

Hibbertia pungens **(Guinea Flower):** an erect or sprawling prickly shrub with yellow flowers found at Rich Road Reserve and on laterite at Malyalling Reserve. This species commonly occurs on the south coast and extends north to Ironcap and Norseman with a record at Kukerin. The populations located in this survey appear to be a north-western limit of the range.

Westringia rigida **(Stiff Westringia):** a low straggly shrub with striking white flowers spotted purple located under Salmon Gum and Wandoo at Malyalling Reserve. It is well collected in areas to the east of this study, but the most western record is between Narrogin and Wickepin so it is near its western limit.

3. Taxa at the southern limit of range

Those at their southern limit (species which commonly occur further north) include:

Acacia ericksoniae: this small leafed spinescent low wattle was uncommon at Rich Road Reserve and the record is a southern extension of its range. It is otherwise known from sandy soils in an area from north of York to Geraldton.

Hakea gilbertii: an uncommon shrub at Rich Road Reserve. It has been recorded from Eneabba south to Pingelly and Dryandra so this represents the southern edge of its range.

4. Taxa with a limited range or disjunct ranges

Other taxa are endemics with a relatively limited range and the study sites fell within that range.

Hakea brownii: recorded in Heath at Rich Road Reserve where it was uncommon. This is its centre of distribution (an area roughly bounded by Pingelly, Arthur River, Pingrup, Newdegate). It also occurs disjunctly on the Geraldton sandplains (between Three Springs and Eneabba and Coorow).

Petrophile glauca **(Cone Bush):** located in Heath at Rich Road Reserve this is a shrub with its centre of distribution in the southern wheatbelt (Corrigin, Kulin, Lake Grace, Harrismith, Pingrup) and south to Hopetoun. This population would be close to the western limit of its range.
Schoenus **sp. A2 Kulin (B. Briggs 7939):** this sedge was not uncommon at Rich Road Reserve but it has a fairly restricted distribution known so far from Dwellingup, Northam, Pingelly, Kulin, Bendering. As mentioned below, some of the sedges are in a poor taxonomic state and their status and distribution is likely to improve as further studies are undertaken.
Rhodanthe polycephala: this annual herb is widespread from Exmouth to the Stirling Ranges but with gaps in its distribution. There are no collections in the WA Herbarium from an area south of the Great Eastern highway to Gnowangerup so these populations from Rich Road and Malyalling Reserves suggest that the distribution may not be as disjunct as indicated, rather that it has not been well collected in the southern wheatbelt.

- **Taxonomically significant flora**

Dryandra **sp. aff.** *cirsioides* **(Proteaceae)**
This prickly shrub was relatively common in the Heath at Rich Road Reserve. It keyed to *Dryandra cirsioides* but was not typical and had features which are intermediate with *Dryandra purdieana* (M. Pieroni, pers. comm.).

Vittadinia cervicularis **(Asteraceae)**
This is an annual daisy that has not been commonly collected. Three varieties are recognised and this collection appears to resemble *Vittadinia cervicularis* var. *oldfieldii,* a Priority 1 taxon represented by only 2 collections in the WA herbarium: one collected in 1923 from Merredin and one collected in 1931 from Laverton. Further investigation and collections are needed to shed greater light on the status of this plant.

Some collections have had "phrase names" applied. These may be for recognised but as yet undescribed taxa. For example:

Goodenia pulchella **subsp. Wheatbelt (L.W. Sage & F. Hort 795)**
There are other collections in the Western Australian Herbarium of this subspecies. It is a common variant found throughout the wheatbelt. A collection made by Leigh Sage and F. Hort has been denoted as the typical form until the taxonomic revision or description is completed and a name published.

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

***Nemcia* spp.** There were collections of these pea shrubs from both reserves that had resemblances to *Nemcia obovata* and *Nemcia capitata* but were not a good match for either. Until the taxonomy of *Nemcia* and *Gastrolobium* is revised the status of some of the collections is likely to remain uncertain.
Sedge (*Schoenus* and *Lepidosperma*) species: Because the sedges have been a poorly studied and collected group, it is likely that there are many species of *Schoenus* that are still not named or recognised. Identifications sometimes have to be based on a 'best match' of determined specimens in the WA Herbarium. For example: *Schoenus* sp. aff. *pleiostemoneus:* the specimen most closely matched (had affinities with) *S. pleiostemoneus* but the nodes of the basal sheathing bracts were hairy instead of glabrous.

In addition some collections which do not match any named taxa have been given a "Rich Road" or "Malyalling" phrase name for the purpose of this report. For example:

Melaleuca **sp. (RICH11/26).** This is in order to be able to trace the specimens recorded on the quadrat sheets back to a vouchered specimen (specimen no. 26 collected on quadrat 11). This particular specimen was infertile but did not match any of the other specimens of *Melaleuca* collected on the site.

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.

Ten per cent (31 species) of the total plants recorded in the two reserves were weeds (Table 3), all but three being annuals. The most frequently recorded species were Flatweed (**Hypochaeris glabra*), Ursinia (**Ursinia anthemoides*), Silvery Hairgrass (**Aira caryophllea*), Blowfly Grass (**Briza maxima*), Rat's Tail Fescue (**Vulpia myuros*) and Common Bartsia (**Parentucellia latifolia*). The Heath-Shrubland Complex had the lowest incidence of weeds. The dense barrier formed by the low, thick and sometimes prickly shrubs of the Heath acts as a deterrent to weed invasion. The greatest incidence of weeds was in the Eucalypt Woodlands, particularly the Salmon Gum Woodland in Rich Road Reserve and the York Gum – Jam – Rock She-oak Woodlands in Malyalling Reserve. Salmon Gum Woodlands in good condition tend to have a natural barrier to weed invasion because of their extensive root system and high water demand. The high incidence at Rich Road Reserve is probably a sign of the declining health as discussed on page 16.

Most of the weed species were non-aggressive 'packer' species: they mix with rather than replace native species and their control is difficult. Although Flatweed was common over both sites it was generally small in size, but in fertile situations its broad rosette can dominate and displace native species. Annual grasses were the largest group and most germinate each year from seed and vary in their impact on the native vegetation. For example **Aira* is very widespread and common but does not appear to aggressively dominate native species. Although only recorded on one quadrat in each of the reserves, Wild Oats (**Avena barbata*) were common in the York Gum Woodlands at Malyalling Reserve, particularly in the south western section. They are a serious threat as they are invasive and compete for space and decrease the growth of other plants. Hussey and Wallace (1993) report that removal of Wild Oats caused a doubling in size and number of flower heads of the native daisy *Podolepis gracilis*. Harlequin Flower (*Sparaxis bulbifera*) at the old Malyalling school site has been known to spread rapidly (G. Keighery pers. comm.) and should be removed. Its close relative *Sparaxis bulbifera* is a very serious weed on clays and sands of the eastern coastal plain around Perth.

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 of the two reserves. 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 life form and then arranged alphabetically in plant families. So, as well as being grouped according to how we logically separate plants by their structure, they have also been separated according to typical botanical classification. The groups are as follows:

Trees, Shrubs and Creepers
Herbs: Dicotyledons
Monocotyledons (Ferns, Lilies and Lily-like plants, Orchids)
Grasses, Rushes, Sedges and Sedge-like plants
Weeds

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*. Herbs are plants that do not have a persistent woody stem and

exclude the grasses, sedges and rushes. Herbs are further divided into dicotyledons and monocotyledons. The distinguishing features are as follows:

Dicotyledons (Dicots)	Monocotyledons (Monocots)
2 seed leaves (cotyledons)	1 seed leaf (cotyledon)
Principal veins of leaf branching out from midrib or base of it, forming a distinct network	Principal veins of leaf parallel to one another
Flower parts in 4's or 5's or multiples of 4 or 5	Flower parts in 3's or multiples of 3
Root system a taproot	Root system fibrous, no taproot
Woody or herbaceous	Usually herbaceous
e.g. Daisies, Sundews, Eucalypts, Banksias, Peas	e.g. Orchids, Kangaroo Paws, Lilies, Grasses, Sedges, Rushes

Grasses, Rushes and Sedges are also monocotyledons but have been separated from the herbs because of their distinctive nature and different flower structure.

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.

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

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

Field Herbaria can be constructed in different manners, to suit the individual or group's needs. For example, some are done on index card. The booklet "How to Create a Local Herbarium" (Patrick 1997), outlines how to collect and prepare herbarium specimens and how to care for a herbarium and is available from CALM. Please ensure the herbarium is stored 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 every few months or particularly if any evidence of damage occurs.

Table 3: Weed species recorded at Rich Road Reserve and Malyalling Reserve (listed alphabetically by genus)

Botanical name	**Family**	**Common name**	**Life form**	**Growth form**	**RICH**	**MALY**
**Agapanthus praecox*	Amaryllidaceae	Agapanthus	P	herb	+	
**Aira caryophyllea/cupaniana*	Poaceae	Silvery Hairgrass	A	grass	+	+
**Anagallis arvensis*	Primulaceae	Pimpernel	A	herb	+	+
**Arctotheca calendula*	Asteraceae	Capeweed	A	herb	+	+
**Atriplex undulata*	Chenopodiaceae	A Saltbush	A/P	semi-shrub	+	
**Avellinia michelii*	Poaceae	Avellinia	A	grass		+
**Avena barbata*	Poaceae	Wild Oats	A	grass	+	+
**Brassica tournefortii*	Brassicaceae	Mediterranean Turnip	A	herb		+
**Briza maxima*	Poaceae	Blowfly Grass, Large Quaking Grass	A	grass	+	+
**Briza minor*	Poaceae	Shivery Grass, Small Quaking Grass	A	grass		+
**Bromus diandrus*	Poaceae	Great Brome	A	grass	+	+
**Bromus rubens*	Poaceae	Red Brome	A	grass	+	+
**Ehrharta longiflora*	Poaceae	Annual Veldtgrass	A	grass	+	+
**Fumaria capreolata*	Fumariaceae	Whiteflower Fumitory	A	herb	+	
**Hordeum leporinum*	Poaceae	Barley Grass	A	grass	+	
**Hypochaeris glabra*	Asteraceae	Flat Weed, Smooth Cat's-ear	A	herb		+
**Isolepis marginata*	Cyperaceae	Coarse Club-rush	A	sedge		+
**Lolium rigidum*	Poaceae	Wimmera or Annual Ryegrass	A	grass	+	
**Papaver sp.*	Papaveraceae	Poppy	A	herb	+	
**Parentucellia latifolia*	Scrophulariaceae	Common Bartsia	A	herb	+	+
**Pentaschistis airoides*	Poaceae	False Hairgrass	A	grass	+	+
**Petrorhagia velutina*	Caryophyllaceae	Velvet Pink	A	herb		+
**Polygonum aviculare*	Polygonaceae	Wireweed	A	herb	+	+
**Romulea rosea*	Iridaceae	Guildford Grass	P/A	herb	+	+
**Sonchus oleraceus*	Asteraceae	Common Sowthistle	A	herb		+
**Trifolium arvense*	Papilionaceae	Hare's Foot Clover	A	herb		+
**Trifolium campestre*	Papilionaceae	Hop Clover	A	herb		+
**Trifolium subterraneum*	Papilionaceae	Subterranean Clover	A	herb	+	
**Trifolium tomentosum*	Papilionaceae	Woolly Clover	A	herb	+	
**Ursinia anthemoides*	Asteraceae	Ursinia	A	herb	+	+
**Vulpia myuros*	Poaceae	Rat's Tail Fescue	A	grass	+	+

6. DISCUSSION

CONSERVATION VALUES

There are several factors that contribute to the conservation value of bushland remnants. Looking briefly at these in relation to the two reserves helps to provide an understanding of the attributes of the sites that make them valuable areas 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'. The two reserves provide examples of landscapes in a transitional zone of the wheatbelt. The granite outcrops and associated Eucalyptus and She-oak Woodlands of Malyalling Reserve are typical of landscapes to the west and the laterite supporting Heath-Shrubland complexes at Rich Road Reserve representative of areas east.

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

  In areas as heavily cleared as the wheatbelt, every remnant adds to the conservation value of the vegetation types they support. On a regional basis, good examples of Heath-Shrubland are conserved in Tutanning Reserve in the shire of Pingelly and in Harrismith reserve in the Wickepin shire. This vegetation complex is variable in composition and every representative is valuable. Granite outcrops in the wheatbelt are commonly in cleared surroundings. Good representation of the surrounding Woodlands at Malyalling Reserve is valuable. Representation of the different wheatbelt vegetation types in the reserve system is generally poor (Hopkins *et al.* 1996, Thackway and Cresswell 1995). The CALMScience biological survey in progress should provide a better indication of the conservation status of the different vegetation types.

  It has generally been accepted that at least ten per cent of the original extent of any vegetation type or ecosystem should be protected (preferably in secure reserves). This is now considered an "endangered" level and recommendations are for a threshold of thirty per cent of the original extent of a vegetation community to be preserved for conservation of biodiversity (Anon 1999). With only 7.7 percent of the native vegetation of the Wickepin Shire still existing, the study sites have highly significant value. Indeed all remnants are significant.

- **Diversity of vegetation types or flora**

  An area with a diverse flora and range of vegetation types is considered to have more value than an area with fewer taxa or vegetation types. With 8 vegetation types and 267 native vascular plant taxa, the sites supported a diverse assemblage of plant communities and native plants. Quadrats contained 18 to 62 species with the Heath areas supporting the greatest number of species. The most species rich sites in the state have up to 90 species in the same area (Keighery 2000).

  There is a tendency to attribute greater value to areas or vegetation types such as Shrublands (kwongan or heath) 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 such as the Salmon Gum Woodland and Tamar Thicket that are frequently naturally species poor, have their own unique value and are of no less importance than naturally diverse areas. Such variation in the vegetation types adds another dimension to the diversity.

  A survey over a greater period of time and at greater intensity for Malyalling Reserve would likely increase the number of species recorded.

- **Size of remnant**

  The larger the remnant the greater the conservation value. In the Wickepin shire more than 75% of all bushland remnants are less than 20 hectares in size (Beeston *et al.* 1994). Although not as large as desirable for maximum biodiversity, these 2 remnants of 34 and 83 hectares are larger than the average for the shire thus adding to their value.

- **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. Unfortunately the off-set nature of Malyalling Reserve increases its edge boundaries and the risk of degrading edge effects. The central road also divides the northern block.

- **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. Malyalling Reserve is one of the largest remnants in the local vicinity and both reserves are important linkages. Although the reserves are surrounded by cleared land there are other remnant patches in the catchments with potential for linking. Revegetation work such as corridor planting to improve bushland linkages within catchments is strongly recommended.

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

  Three confirmed and one possible threatened species, numerous species near the limit of their range, and several species of taxonomic significance increases the conservation value of the site. Work to define threatened ecological communities is currently in progress (English and Blyth 1997) but at this stage there is still insufficient regional information on the wheatbelt to generally recognise threatened communities and it is unlikely that any exist in these reserves.

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

  Being located high in the landscape in the upper catchment there is no sign of a rising water table at Malyalling Reserve. However this was not the case at Rich Road Reserve where evidence of a rising water table poses a serious threat.

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

MANAGEMENT CONSIDERATIONS

With conservation of the bushland of the reserves a major objective, the following section discusses some of the threats to biodiversity that became apparent during the course of the survey. The processes considered most threatening to bushland include weed invasion, grazing, rising water table and salinity (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.

Any management plans for these reserves should address (Keighery *et al.* 2001)

- 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 increase the risk of erosion particularly during summer storms when the weedy annuals have died off. Weed species may be of value as crop or pasture species (eg Lupins, Clover), and often the paddocks adjoining the remnant bushland are the major source of weed invasion. 'Western Weeds' (Hussey *et al.* 1997) discusses the threat of weeds and is a helpful and valuable guide to their identification.

Weed invasion on the reserves was greatest where there had been a history of disturbance such as in the York Gum Woodlands and at the MCG and old school site at Malyalling Reserve, or where the bushland was under stress. That was evident in the lowest corner of Salmon Gum and Wandoo at Rich Road Reserve. Increased light from a reduced canopy and decreased competition for water and nutrients probably contributed to the successful weed invasion.

Information about how to assess and map weeds at a site and prepare a weed control program can be obtained through the Environmental Weed Action Network. 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.

Preventing the introduction and spread of weeds is far easier and cheaper than removing them. This means avoiding disturbances. The dumping of garden refuse, grain and rubbish, all sighted in the reserves, needs to be discouraged and any spreading of weeds from these sources controlled.

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 Heath such as that at Rich Road or the Tamar Thickets at Malyalling Reserve act as effective natural barriers or filters against the intrusion of windblown weed seed so no action is required where they form boundaries. Healthy mature Salmon Gums are very efficient water harvesters and have an extensive root system that takes up surface soil moisture, preventing the establishment of weeds. However the open York Gum, Wandoo and She-oak Woodlands adjoining cleared paddocks such as exist on large sections of Malyalling Reserve boundaries, 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 8), restoration measures are appropriate. Restoration means removal of disturbances and careful weed management to allow natural regeneration to take place. 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. Selecting areas to be revegetated should be done in conjunction with a catchment salinity map and aimed at areas at lowest risk of salinity.

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 vegetation type.

The gravel pit at Rich Road Reserve requires revegetation utilising seed sourced from the reserve. A combination of direct seeding and planting into the ripped surface could be applied. Do not introduce topsoil from elsewhere as that would mean a high risk of weed invasion. Select species from those recorded for the Heath complex (see column H, Rich Road Reserve, Appendix III), remembering it would also be worth trying to collect some seed of native herbs, grasses and sedges along with the shrubs and mallees. 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

Water run-off from adjoining farmland can cause erosion and open up opportunities for weed invasion. Increased water flow, from adjoining land and from the bare ground of disturbances such as gravel pits can lead to waterlogging at sites lower in the landscape. Remedial action against this threat should be considered.

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. A rabbit warren at Rich Road Reserve near quadrat RICH 7 indicated rabbit control is necessary.

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

4. Checklist

The following checklist summarises some management points for consideration.

- Monitor current weed infestations and control any new outbreaks. Consider control of aggressive species such as Harlequin Flower at the old school site at Malyalling, or of localised outbreaks to prevent further spread such as at the Rich Road gravel pit.

- 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. Prohibit vehicle access onto Malyalling Rock to protect the fragile moss and lichen layers.

- Consider a native vegetation buffer zone (weed break) around the exposed boundary sections to prevent weed intrusion and fertiliser and herbicide drift.

- Plan revegetation and bushland linkage projects on a whole catchment basis. Focus these efforts on areas at lowest risk from salinity.

- Use locally sourced seed for any revegetation projects – at the gravel pit and 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 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.

- Encourage recognition of the values of the bushland in the local community and discourage degrading activities such as rubbish dumping.

- Consider applying covenants to the reserves to ensure their protection in perpetuity

7. CONCLUSION

This survey has shown that Rich Road and Malyalling Reserves are bushland areas with high conservation value. The following attributes give these sites their unique character and significant conservation value:

- They have a diverse and species rich flora of high conservation significance: 267 native plant taxa including 3, possibly 4 threatened species, numerous species near the limits of their range and taxonomically significant taxa.

- They have a variety of vegetation types at upper catchment and mid catchment positions in the landscape and the vegetation was typical of this 'transition' zone of the wheatbelt. The two reserves provide good examples of the different vegetation and flora on granite and laterite profiles

- The variability in species composition recorded in the survey highlighted the uniqueness of each piece of bushland even when in relatively close proximity to each other.

- They are relatively large areas of bushland in generally very good condition in a heavily cleared landscape.

Loss of habitat is one of the greatest threatening processes to flora and fauna. With 93% of the wheat belt cleared (Beard 1990); about 30 % of the agricultural area threatened by salt (Keighery 2000); less than 8 per cent of remnant vegetation remaining in the Wickepin 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 these 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.

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

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

RICH ROAD RESERVE

1. Heath – Shrubland complex

Quadrat RICH 2 (86GT 2)
Dryandra conferta var. *conferta, Banksia sphaerocarpa* Open Shrubland over *Petrophile squamata, Hibbertia pungens* Low Shrubland over *Opercularia vaginata* and mixed annual Open Herbland over *Neurachne alopecuroidea* Very Open Grassland and *Schoenus sesquiscipulus, Schoenus* sp. A2 Kulin (B. Briggs 7939) Open Sedgeland

Condition Rating: excellent
Soil: light brown loamy sand
Drainage: good
Aspect: gentle east slope
Number of species: 62 (59 natives, 3 weeds)

Latitude: 32° 43.052 Longitude: 117° 42.952

Quadrat RICH 3 (86GT 3)
Dryandra sp. aff. *cirsioides* Open Heath over a mixed Low shrubland over a mixed Very Open Herbland and *Lepidosperma* sp. P1 small head (M.D. Tindale 166A) Very Open Sedgeland with emergent White-leaved Mallee (*Eucalyptus albida*).

Condition Rating: excellent (pristine)
Soil: light brown sandy loam
Drainage: good
Aspect: gentle east slope
Number of species: 54 (53 natives, 1 weed)

Latitude: 32° 43.131 Longitude: 117° 42.989

Quadrat RICH 11
Rock She-oak Low Open Woodland over Tamar, *Melaleuca uncinata, Calothamnus sanguineus* Open Heath over *Banksia sphaerocarpa, Petrophile glauca* Low shrubland.

Condition Rating: excellent
Soil: red-brown lateritic gravel
Drainage: good
Aspect: gentle south-south-east slope
Number of species: 39 (37 natives, 2 weeds)

Latitude: 32° 43.167 Longitude: 117° 43.129

2. Tamar (*Allocasuarina campestris*) Shrubland

Quadrat RICH 9
MalleeWandoo (*Eucalyptus capillosa* subsp. *polyclada*) Open Tree Mallee over Tamar (*Allocasuarina campestris*), *Melaleuca uncinata* Tall Shrubland over *Dryandra* sp. aff. *cirsioides* Low Open Shrubland

Condition Rating: very good
Soil: red-brown gravelly loam
Drainage: good
Aspect: gentle north slope
Number of species: 22 (22 natives, 0 weeds)

Latitude: 32° 43.122 Longitude: 117° 43.108

3. Mallee

Quadrat RICH 7
Stiff-leaved Mallee (*Eucalyptus rigidula*), *Eucalyptus hypochlamydea* subsp. *ecdysiastes* Shrub Mallee over *Melaleuca uncinata, Leptospermum erubescens* Tall Shrubland over *Lepidosperma* sp. A2 Island Flat (Keighery 7000) Very Open Sedgeland

Condition Rating: excellent
Soil: orange-brown loamy sand
Drainage: good
Aspect: gentle south-west slope
Number of species: 34 (28 natives, 6 weeds)

Latitude: 32° 43.210 Longitude: 117° 43.015

4. Rock She-oak (*Allocasuarina huegeliana*) Woodlands

Quadrat RICH 10
Rock She-oak Woodland over *Xanthorrhoea drummondii* Open Shrubland over *Opercularia vaginata* Herbland.

Condition Rating: very good
Soil: light brown loamy sand over laterite
Drainage: good
Aspect: gentle north-west slope
Number of species: 42 (39 natives, 3 weeds)

Latitude: 32° 43.072 Longitude: 117° 43.115

5. Wandoo (*Eucalyptus wandoo*) – Rock She-oak Woodlands

Quadrat RICH 1 (86GT 1)
Wandoo Low Open Woodland over *Allocasuarina campestris, Melaleuca uncinata* Tall Open Shrubland over *Dryandra* sp. aff. *cirsioides* Low Open Shrubland

Condition Rating: excellent
Soil: loamy sand over laterite
Drainage: good
Aspect: gentle south-east slope
Number of species: 40 (37 natives, 3 weeds)

Latitude: 32° 42.971 Longitude: 117° 42.960

Quadrat RICH 4
Wandoo Woodland over Rock She-oak (*Allocasuarina huegeliana*) Low Open Woodland over *Gastrolobium parviflorum, Calytrix leschenaultii* Low Shrubland over *Borya sphaerocephala, Lawrencella rosea, Dampiera lavandulacea* Herbland and *Desmocladus asper, Lepidosperma* sp. A2 Island Flat (Keighery 7000) Open Sedgeland.

Condition Rating: excellent
Soil: brown sandy loam
Drainage: good
Aspect: gentle south-east slope
Number of species: 58 (51 natives, 7 weeds)

Latitude: 32° 43.234 Longitude: 117° 42.970

Quadrat RICH 8
Wandoo (Low) Woodland over Rock She-oak Low Open Woodland over *Gastrolobium parviflorum, Hakea lissocarpha* Open Shrubland over a mixed Very Open Herbland on a laterite breakaway slope.
Condition Rating: excellent
Soil: brown loamy sand amidst laterite
Drainage: good
Aspect: gentle south-west slope
Number of species: 40 (38 natives, 2 weeds)
Latitude: 32° 43.143 Longitude: 117° 43.040

Quadrat RICH 12
Wandoo Low Woodland over Rock She-oak Low Open Woodland over a mixed Herbland and mixed Very Open Grassland.
Condition Rating: very good
Soil: grey- brown sandy loam with scattering of laterite pebbles
Drainage: moderate
Aspect: gentle south slope
Number of species: 44 (39 natives, 5 weeds)
Latitude: 32° 43.306 Longitude: 117° 43.064

6. York Gum (*Eucalyptus loxophleba*) – Jam (*Acacia acuminata*) Woodlands

Quadrat RICH 6
York Gum (*Eucalyptus loxophleba*) Low Woodland over Jam Low Open Woodland over *Dampiera lavandualcea, Opercularia vaginata* Herbland, *Neurachne alopecuroidea, Amphipogon caricinus* Open Grassland and *Lepidosperma costale* Very Open Sedgeland
Condition Rating: very good
Soil: brown sandy loam
Drainage: moderate
Aspect: very gentle north slope
Number of species: 37 (32 natives, 5 weeds)
Latitude: 32° 43.412 Longitude: 117° 42.998

7. Salmon Gum (*Eucalyptus salmonophloia*) Woodlands

Quadrat RICH 5
Salmon Gum (*Eucalyptus salmonophloia*) Woodland over Jam (*Acacia acuminata*) Low Woodland over a mixed Very Open Herbland and Open Grassland.
Condition Rating: very good
Soil: red brown loam
Drainage: good
Aspect: gentle south slope
Number of species: 30 (22 natives, 8 weeds)
Latitude: 32° 43.412 Longitude: 117° 42.969

MALYALLING RESERVE

1. Granite complex: granite outcrop and associated Herblands

Quadrat MALY 3
Borya sphaerocephala, Crassula exserta and mixed species Herbland on granite outcrop
Condition Rating: very good
Soil: granite outcrop
Drainage: water collected in rock pools and at edge of rock
Aspect: gentle south-east sloping depression on top of granite outcrop
Number of species: 30 (21 natives, 9 weeds)
Latitude: 32° 42.912 Longitude: 117° 36.627

2. Rock She-oak (*Allocasuarina huegeliana*) Woodlands

Quadrat MALY 2
Rock She-oak Low Woodland over *Opercularia vaginata, Stypandra glauca, Glischrocaryon aureum, Borya sphaerocephala* Very Open Herbland.
Condition Rating: excellent
Soil: red brown sandy loam
Drainage: good
Aspect: gentle north slope
Number of species: 37 (31 natives, 6 weeds)
Latitude: 32° 42.700 Longitude: 117° 36.533

3. York Gum (*Eucalyptus loxophleba*) – Jam (*Acacia acuminata*) – Rock She-oak Woodlands

Quadrat MALY 4
York Gum (*Eucalyptus loxophleba*) Open Woodland over Jam, Rock She-oak Low Woodland over *Borya sphaerocephala, Opercularia vaginata* Herbland, *Austrostipa elegantissima, Neurachne alopecuroidea* Very Open Grassland and *Lepidosperma costale* Open Sedgeland
Condition Rating: very good (some dieback in York Gum crowns, no sign of regeneration in She-oaks)
Soil: red brown sandy loam
Drainage: good
Aspect: flat to very gentle north slope
Number of species: 48 (39 natives, 9 weeds)
Latitude: 32° 42.856 Longitude: 117° 36.814

4. Wandoo (*Eucalyptus wandoo*) – Rock She-oak Woodlands

Quadrat MALY 1
Wandoo Low Open Woodland over Rock She-oak Low Woodland over *Gastrolobium parviflorum* Shrubland over *Borya sphaerocephala, Dampiera lavandulacea* Closed Herbland and *Neurachne alopecuroidea* Very Open Grassland.
Condition Rating: excellent
Soil: light brown sand
Drainage: good
Aspect: gentle south-west slope
Number of species: 46 (39 natives, 7 weeds)
Latitude: 32° 42.743 Longitude: 117° 36.462

Quadrat MALY 5
Wandoo Low Open Woodland over Tamar Tall Open Shrubland over *Dryandra* sp. aff. *cirsioides* Open Shrubland over *Hibbertia pungens* Low Open Shrubland.

Condition Rating: very good
Soil: red brown laterite gravel on breakaway slope
Drainage: good
Aspect: gentle east-south-east slope
Number of species: 45 (41 natives, 4 weeds)

Latitude: 32° 42.770 Longitude: 117° 37.024

Quadrat MALY 6
Wandoo (Low) Open Woodland over Rock She-oak Low Open Woodland over *Borya sphaerocephala, Stylidium emarginatum* Open Herbland, **Vulpia myuros, Neurachne alopecuroidea* Very Open Grassland and *Lepidobolus preissianus* Very Open Sedgeland

Condition Rating: very good
Soil: grey brown loamy sand
Drainage: good
Aspect: gentle north-east slope
Number of species: 49 (44 natives, 5 weeds)

Latitude: 32° 42.871 Longitude: 117° 37.085

5. Salmon Gum (*Eucalyptus salmonophloia*) Woodlands

Quadrat MALY 7
Salmon Gum, Wandoo Open Woodland.
Associated species: *Acacia lasiocarpa* var. *sedifolia, Acacia erinacea, Olearia rudis, Lomandra effusa, Lomandra micrantha, Austrostipa variabilis*

Condition Rating: very good
Soil: light brown sandy loam
Drainage: good
Aspect: gentle south slope
Number of species: 18 (14 natives, 4 weeds)

Latitude: 32° 42.830 Longitude: 117° 37.039

6. Tamar (*Allocasuarina campestris*) Thickets

No quadrats

APPENDIX II: PLANT SPECIES LISTS

All taxa (species, subspecies and varieties) recorded on the quadrats as well as taxa observed elsewhere within the remnants are listed. The taxa are listed alphabetically by family, and within families, alphabetically by genera.

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 Life form

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

Column 5 Growth form or Habit

Tree	a woody plant over 2 metres tall with a single stem or branches well above the base.
Shrub	a woody plant multi-stemmed at or close to the base, or if single stemmed under 2 metres tall.
Herb	a plant without a persistent above ground woody stem (excluding grasses, sedges and rushes)
Grass	members of the family Poaceae
Sedge or sedge-like*	members of the families Cyperaceae and Centrolepidaceae
Rush*	herbs which are grass-like in appearance. Members of the families Juncaceae and Restionaceae
Vine	a climbing, scrambling or trailing plant often with special modifications for climbing (described in shrub layer)

* in structural descriptions these are grouped together

Column 6 Conservation Status (Rare/Priority)

Department of CALM Declared Rare Flora and Priority Taxa (Atkins 1998)

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

Column 7 Site Location

RICH	Rich Road Reserve
MALY	Malyalling Reserve

APPENDIX II: PLANT SPECIES LIST FOR RICH ROAD RESERVE AND MALYALLING RESERVE, SHIRE OF WICKEPIN (alphabetically by family)

Botanical name	**Family**	**Common name**	**Life form**	**Growth form**	**Cons code**	**RICH**	**MALY**
Cheilanthes sieberi subsp. sieberi	Adiantaceae	Rock Fern	P/A	fern			+
Ptilotus declinatus	Amaranthaceae	Curved Mulla Mulla	P	herb		+	
Ptilotus polystachyus	Amaranthaceae	Prince of Wales Feather	A	herb			+
Ptilotus spathulatus	Amaranthaceae	Mulla Mulla	A	herb		+	
**Agapanthus praecox*	Amaryllidaceae	Agapanthus	P	herb		+	
Arthropodium curvipes	Anthericaceae		P/A	herb		+	+
Caesia alfordii	Anthericaceae		A	herb			+
Chamaescilla corymbosa var. corymbosa	Anthericaceae	Blue Squill	A	herb		+	+
Chamaescilla spiralis	Anthericaceae		A	herb		+	
Dichopogon capillipes	Anthericaceae	Chocolate Lily	P/A	herb		+	+
Laxmannia grandiflora subsp. grandiflora	Anthericaceae		P	herb		+	
Laxmannia squarrosa	Anthericaceae		P	herb		+	
Sowerbaea laxiflora	Anthericaceae	Purple Tassels	A	herb			+
Thysanotus patersonii	Anthericaceae	Twining Fringe Lily	A	twining herb		+	+
Thysanotus tenuis	Anthericaceae	Fringed Lily	A	herb	P3		+
Hydrocotyle callicarpa	Apiaceae	Small Pennywort	A	herb		+	+
Hydrocotyle diantha	Apiaceae	Pennywort	A	herb			+
Hydrocotyle pilifera var. glabrata	Apiaceae	Pennywort	A	herb		+	+
Hydrocotyle rugulosa	Apiaceae	Pennywort	A	herb		+	
Trachymene cyanopetala	Apiaceae		A	herb		+	+
Trachymene ornata	Apiaceae	Spongefruit	A	herb		+	+
Trachymene pilosa	Apiaceae	Native Parsnip	A	herb		+	+
**Arctotheca calendula*	Asteraceae	Capeweed	A	herb		+	+
Blennospora drummondii	Asteraceae	Dwarf Beauty-heads	A	herb		+	+
Brachyscome bellidioides	Asteraceae		A	herb		+	
Brachyscome ciliaris	Asteraceae	Variable Daisy	A	herb			+
Brachyscome perpusilla var. tenella	Asteraceae	Tiny Daisy	A	herb		+	
Ceratogyne obionoides	Asteraceae	Wingwort	A	herb		+	+
Gnephosis drummondii	Asteraceae	Delicate Gnephosis	A	herb		+	+
Helichrysum leucopsideum	Asteraceae	Satin Everlasting	A	herb		+	+
Hyalosperma demissum	Asteraceae	Tiny Sunray	A	herb		+	+
Hyalosperma glutinosum subsp. glutinosum	Asteraceae		A	herb		+	+
**Hypochaeris glabra*	Asteraceae	Flat Weed, Smooth Cat's-ear	A	herb		+	+
Lagenophora huegelii	Asteraceae	Coarse Lagenophora	P	herb		+	+
Lawrencella rosea	Asteraceae	Pink Everlasting	A	herb		+	+
Millotia tenuifolia	Asteraceae	Soft Millotia	A	herb		+	+

Botanical name	Family	Common name	Life form	Growth form	Cons code	RICH	MALY
Olearia muelleri	Asteraceae	Goldfield's Daisy	P	shrub		+	
Olearia rudis	Asteraceae	Rough Daisybush	P	shrub		+	+
Podolepis canescens	Asteraceae	Bright or Grey Podolepis	A	herb		+	+
Podolepis capillaris	Asteraceae	Wiry Podolepis	A	herb		+	
Podolepis lessonii	Asteraceae		A	herb		+	+
Podotheca angustifolia	Asteraceae	Sticky Longheads	A	herb		+	+
Podotheca gnaphalioides	Asteraceae	Golden Longheads	A	herb		+	
Pterochaeta paniculata	Asteraceae	Woolly 'Waitzia'	A	herb		+	
Quinetia urvillei	Asteraceae		A	herb			+
Rhodanthe citrina	Asteraceae	Golden Sunray	A	herb		+	+
Rhodanthe laevis	Asteraceae	Smooth Sunray	A	herb		+	+
Rhodanthe manglesii	Asteraceae	Pink Sunray	A	herb		+	+
Rhodanthe polycephala	Asteraceae		A	herb		+	+
Siloxerus multiflorus	Asteraceae	Small Wrinklewort	A	herb			+
**Sonchus oleraceus*	Asteraceae	Common Sowthistle	A	herb			+
Trichocline spathulata	Asteraceae	Native Gerbera	P	herb			+
**Ursinia anthemoides*	Asteraceae	Ursinia	A	herb		+	+
Vittadinia cervicularis	Asteraceae		A	herb		+	
Waitzia acuminata var. acuminata	Asteraceae	Orange Immortelle	A	herb		+	+
Waitzia acuminata var. albicans	Asteraceae	'Pink' Immortelle	A	herb			+
Borya sphaerocephala	Boryaceae	Pincushions	P	herb		+	+
**Brassica tournefortii*	Brassicaceae	Mediterranean Turnip	A	herb			+
Wahlenbergia gracilenta	Campanulaceae	Annual Bluebell	A	herb			+
**Petrorhagia velutina*	Caryophyllaceae	Velvet Pink	A	herb			+
Allocasuarina campestris	Casuarinaceae	Tamar	P	shrub		+	+
Allocasuarina huegeliana	Casuarinaceae	Rock Sheoak	P	tree		+	+
Allocasuarina humilis	Casuarinaceae	Dwarf Sheoak	P	shrub		+	
Allocasuarina microstachya	Casuarinaceae		P	shrub		+	
Aphelia brizula	Centrolepidaceae		A	sedge-like herb			+
Centrolepis aristata	Centrolepidaceae	Pointed Centrolepis	A	sedge-like herb		+	+
**Atriplex undulata*	Chenopodiaceae	A Saltbush	A/P	semi-shrub		+	
Enchylaena lanata	Chenopodiaceae		P	shrub		+	
Halosarcia pergranulata	Chenopodiaceae		P	herb		+	
Maireana brevifolia	Chenopodiaceae	Small Leaf Bluebush	P	shrub		+	
Rhagodia preissii subsp. preissii	Chenopodiaceae		P	shrub			+
Chloanthes coccinea	Chloanthaceae		P	shrub		+	
Pityrodia terminalis	Chloanthaceae	Native Foxglove	P	shrub		+	
Crassula colorata var. colorata	Crassulaceae	Dense Stonecrop	A	herb		+	

Botanical name	Family	Common name	Life form	Growth form	Cons code	RICH	MALY
Crassula decumbens subsp. decumbens	Crassulaceae	Rufous Stonecrop	A	herb			+
Crassula exserta	Crassulaceae		A	herb			+
Crassula peduncularis	Crassulaceae	Purple Stonecrop	A	herb			+
**Isolepis marginata*	Cyperaceae	Coarse Club-rush	A	sedge			+
Lepidosperma brunonianum	Cyperaceae	Sword-sedge	P	sedge		+	+
Lepidosperma costale	Cyperaceae		P	sedge		+	+
Lepidosperma sp. A2 Island Flat (Keighery 7000)	Cyperaceae	Sword-sedge	P	sedge		+	+
Lepidosperma sp. aff. tenue	Cyperaceae		P	sedge		+	
Lepidosperma sp. P1 small heads (M.D. Tindale 166A)	Cyperaceae		P	sedge		+	
Lepidosperma tenue	Cyperaceae		P	sedge		+	+
Mesomelaena preissii	Cyperaceae		P	sedge		+	
Schoenus nanus	Cyperaceae	Tiny Bog-rush	A	sedge		+	+
Schoenus sesquispiculus	Cyperaceae	Bog-rush	P	sedge		+	
Schoenus sp. A2 Kulin (B Briggs 7939)	Cyperaceae		P	sedge		+	
Schoenus sp. aff. clandestinus	Cyperaceae		P	sedge		+	
Schoenus sp. aff. pleistomoneus	Cyperaceae		P	sedge		+	
Chamaexeros serra	Dasypogonaceae	Little Fringe-leaf	P	herb		+	
Lomandra effusa	Dasypogonaceae	Scented Matrush	P	herb		+	+
Lomandra micrantha subsp. teretifolia	Dasypogonaceae	Small-flower Matrush	P	herb		+	+
Lomandra sp. (MALR 6/30)	Dasypogonaceae		P	herb			+
Hibbertia acerosa	Dilleniaceae	Needle-leaved Guinea Flower	P	shrub		+	
Hibbertia pungens	Dilleniaceae	Guinea Flower	P	shrub		+	+
Drosera androsacea	Droseraceae	Cone Sundew	P	herb		+	
Drosera glanduligera	Droseraceae	Pimpernel Sundew	A	herb		+	+
Drosera macrantha subsp. macrantha	Droseraceae	Bridal Rainbow, Climbing Sundew	P/A	herb		+	+
Drosera menziesii subsp. menziesii	Droseraceae	Pink Rainbow	P/A	herb		+	
Drosera pycnoblasta	Droseraceae	Pearly Sundew	P	herb		+	
Drosera sp.	Droseraceae	Sundew	P/A	herb		+	+
Drosera subhirtella subsp. subhirtella	Droseraceae	Sunny Rainbow	P/A	herb		+	+
Andersonia caerulea	Epacridaceae	Foxtails	P	shrub		+	
Astroloma serratifolium var. placidum	Epacridaceae	Kondrung	P	shrub		+	+
Leucopogon cymbiformis	Epacridaceae	Beard Heath	P	shrub		+	
Leucopogon dielsianus	Epacridaceae	Beard Heath	P	shrub		+	
Leucopogon pogonocalyx	Epacridaceae	Beard Heath	P	shrub	P1	+	
Lysinema ciliatum	Epacridaceae	Curry Flower	P	shrub		+	
Monotaxis grandiflora	Euphorbiaceae	Diamond of the Desert	P	small shrub		+	

Botanical name	Family	Common name	Life form	Growth form	Cons code	RICH	MALY
Poranthera microphylla	Euphorbiaceae	Small Poranthera	A	herb		+	+
**Fumaria capreolata*	Fumariaceae	Whiteflower Fumitory	A	herb		+	
Erodium cygnorum	Geraniaceae	Blue Heronsbill	A	herb			+
Dampiera juncea	Goodeniaceae	Rush-like Dampiera	P	herb / semi-shrub		+	
Dampiera lavandulacea	Goodeniaceae	Lavender Dampiera	P	herb / semi-shrub		+	+
Dampiera lindleyi	Goodeniaceae		P	herb / semi-shrub		+	+
Goodenia berardiana	Goodeniaceae		A	herb			+
Goodenia krauseana	Goodeniaceae		A	herb			+
Goodenia pulchella subsp. Wheatbelt (L.W.Sage & F.Hoi 795)	Goodeniaceae		A	herb			+
Velleia cycnopotamica	Goodeniaceae		A	herb		+	+
Anigozanthos humilis	Haemodoraceae	Catspaw	P	herb		+	+
Conostylis prolifera	Haemodoraceae	Mat Cottonheads	P	herb		+	
Conostylis pusilla	Haemodoraceae	Cottonhead	P	herb			+
Conostylis villosa	Haemodoraceae	Cottonhead	P	herb		+	
Haemodorum sp.	Haemodoraceae	Blood Root	P	herb		+	
Glischrocaryon aureum	Haloragaceae	Common Popflower	P	herb		+	+
Gonocarpus nodulosus	Haloragaceae		A	herb			+
Patersonia drummondii subsp. drummondii	Iridaceae	Drummond's Patersonia	P	herb		+	
Patersonia juncea	Iridaceae	Rush-leaved Patersonia	P	herb		+	
**Romulea rosea*	Iridaceae	Guildford Grass	P/A	herb		+	+
Westringia cephalantha	Lamiaceae		P	shrub		+	+
Westringia rigida	Lamiaceae	Stiff Westringia	P	shrub			+
Cassytha aurea var. hirta	Lauraceae	Dodder Laurel	P	parasitic twiner		+	
Lobelia sp. probably L. tenue	Lobeliaceae		A	herb		+	+
Phyllangium paradoxum	Loganiaceae	Wiry Mitrewort	A	herb			+
Phyllangium sulcatum	Loganiaceae	Mitrewort	A	herb		+	+
Acacia acuminata subsp. acuminata	Mimosaceae	Jam	P	tree		+	+
Acacia ericksoniae	Mimosaceae		P	shrub		+	
Acacia erinacea	Mimosaceae		P	shrub			+
Acacia heteroclita subsp. heteroclita	Mimosaceae		P	shrub		+	+
Acacia lasiocarpa var. sedifolia	Mimosaceae		P	shrub		+	+
Acacia microbotrya var. microbotrya	Mimosaceae	Manna Wattle	P	tree		+	+
Acacia multispicata	Mimosaceae		P	shrub			+
Acacia pycnocephala	Mimosaceae		P	shrub		+	
Acacia squamata	Mimosaceae		P	shrub		+	
Acacia stenoptera	Mimosaceae	Narrow Winged Wattle	P	shrub		+	
Baeckea crispiflora	Myrtaceae		P	shrub		+	+

Botanical name	Family	Common name	Life form	Growth form	Cons code	RICH	MALY
Baeckea preissiana / floribunda complex	Myrtaceae		P	shrub		+	
Beaufortia bracteosa	Myrtaceae		P	shrub		+	
Beaufortia micrantha var. puberula	Myrtaceae	Little Bottlebrush	P	shrub		+	
Calothamnus quadrifidus	Myrtaceae	One-sided Bottlebrush	P	shrub		+	
Calothamnus sanguineus	Myrtaceae	Pindak, Silky-leaved Bloodflower	P	shrub		+	
Calytrix leschenaultii	Myrtaceae		P	shrub		+	+
Eucalyptus albida	Myrtaceae	White-leaved Mallee	P	mallee		+	
Eucalyptus capillosa subsp. polyclada	Myrtaceae	Mallee Wandoo	P	mallee		+	
Eucalyptus hypochlamydea subsp. ecdysiastes	Myrtaceae		P	mallee		+	
Eucalyptus loxophleba subsp. loxophleba	Myrtaceae	York Gum	P	tree		+	+
Eucalyptus rigidula	Myrtaceae	Stiff-leaved Mallee	P	mallee		+	
Eucalyptus salmonophloia	Myrtaceae	Salmon Gum, Wurak	P	tree		+	+
Eucalyptus wandoo	Myrtaceae	Wandoo	P	tree		+	+
Kunzea micromera	Myrtaceae	Kunzea	P	shrub		+	
Kunzea pulchella	Myrtaceae	Granite Kunzea	P	shrub			+
Leptospermum erubescens	Myrtaceae	Roadside Tea-tree	P	shrub		+	+
Melaleuca lecanantha	Myrtaceae	Honey-myrtle	P	shrub		+	
Melaleuca ? micrantha	Myrtaceae		P	shrub		+	
Melaleuca sp.	Myrtaceae		P	shrub		+	
Melaleuca sp. 86GT3/15	Myrtaceae		P	shrub		+	
Melaleuca sp. RICH 11/26	Myrtaceae		P	shrub		+	
Melaleuca uncinata	Myrtaceae	Broom Bush	P	shrub		+	
Verticordia chrysantha	Myrtaceae	Featherflower	P	shrub		+	
Verticordia grandiflora	Myrtaceae	Claw Featherflower	P	shrub		+	
Epilobium hirtigerum	Onagraceae	Hairy Willow Herb	P	herb			+
Caladenia falcata	Orchidaceae	Green Spider Orchid	P/A	herb		+	+
Caladenia flava subsp. flava	Orchidaceae	Cowslip Orchid	P/A	herb		+	+
Caladenia hirta subsp. rosea	Orchidaceae	Pink Candy Orchid	P/A	herb		+	
Caladenia pulchra	Orchidaceae	Slender Spider Orchid	P/A	herb		+	
Caladenia reptans subsp. reptans	Orchidaceae	Little Pink Fairy Orchid	P/A	herb		+	
Caladenia roei	Orchidaceae	Ant Orchid	P/A	herb		+	+
Caladenia saccharata	Orchidaceae	Sugar Orchid	P/A	herb			+
Caladenia splendens	Orchidaceae	Large White Spider Orchid	P/A	herb			+
Cyanicula gemmata	Orchidaceae	Blue China Orchid	P/A	herb		+	+
Diuris sp. aff. corymbosa	Orchidaceae	Wallflower Orchid, Donkey Orchid	P/A	herb		+	+
Elythranthera brunonis	Orchidaceae	Purple Enamel Orchid	P/A	herb		+	
Eriochilus dilatatus subsp. undulatus	Orchidaceae	Crinkle-leafed Bunny Orchid	P/A	herb		+	+
Leporella fimbriata	Orchidaceae	Hare Orchid	P/A	herb		+	+

Botanical name	Family	Common name	Life form	Growth form	Cons code	RICH	MALY
Prasophyllum gracile	Orchidaceae	Leek Orchid	P/A	herb		+	+
Pterostylis sanguinea	Orchidaceae	Dark Banded Greenhood	P/A	herb		+	+
Pterostylis sargentii	Orchidaceae	Frog Orchid	P/A	herb		+	
Pterostylis sp.	Orchidaceae	Greenhood	P/A	herb		+	
Pyrorchis nigricans	Orchidaceae	Red Beaks, Elephants' Ears	P/A	herb		+	
Spiculea ciliata	Orchidaceae	Elbow Orchid	P/A	herb			+
Thelymitra antennifera	Orchidaceae	Vanilla Orchid, Lemon Orchid	P/A	herb			+
Thelymitra sp. aff. macrophylla	Orchidaceae	Scented Sun Orchid	P/A	herb			+
Oxalis perennans	Oxalidaceae	Wood Sorrel	P/A	herb		+	
**Papaver sp.*	Papaveraceae	Poppy	A	herb		+	
Daviesia hakeoides subsp. subnuda	Papilionaceae		P	shrub		+	
Daviesia incrassata subsp. incrassata	Papilionaceae		P	shrub		+	
Gastrolobium parviflorum	Papilionaceae	Berry Poison	P	shrub		+	+
Gastrolobium spinosum var. spinosum	Papilionaceae	Prickly Poison	P	shrub		+	
Gastrolobium trilobum	Papilionaceae	Bullock Poison	P	shrub			+
Gompholobium marginatum	Papilionaceae		P	shrub		+	
Gompholobium scabrum	Papilionaceae		P	shrub		+	
Jacksonia condensata	Papilionaceae		P	shrub		+	
Mirbelia spinosa (intermediate with M. trichocalyx)	Papilionaceae		P	shrub		+	
Nemcia hookeri	Papilionaceae		P	shrub		+	
Nemcia obovata	Papilionaceae	Boat-leaved Poison	P	shrub			+
Nemcia sp. A. Avon (M.Crisp 6183)	Papilionaceae		P	shrub		+	
Nemcia sp. aff. hookeri	Papilionaceae		P	shrub		+	
Nemcia sp. aff. obovata/capitata	Papilionaceae		P	shrub		+	
Nemcia spathulata	Papilionaceae		P	shrub		+	+
Pultenaea ericifolia	Papilionaceae		P	shrub		+	
**Trifolium arvense*	Papilionaceae	Hare's Foot Clover	A	herb			+
**Trifolium campestre*	Papilionaceae	Hop Clover	A	herb			+
**Trifolium subterraneum*	Papilionaceae	Subterranean Clover	A	herb		+	
**Trifolium tomentosum*	Papilionaceae	Woolly Clover	A	herb		+	
Dianella revoluta	Phormiaceae	Blue Flax Lily	P	herb		+	+
Stypandra glauca	Phormiaceae	Blindgrass	P	herb		+	+
Marianthus erubescens	Pittosporaceae		P	twining shrub		+	
Agrostis avenacea	Poaceae	Blown Grass	A	grass			+
**Aira caryophyllea/cupaniana*	Poaceae	Silvery Hairgrass	A	grass		+	+
Amphipogon caricinus	Poaceae	Long Greybeard Grass	P	grass		+	+
Amphipogon sp.	Poaceae		P	grass		+	+

Botanical name	Family	Common name	Life form	Growth form	Cons code	RICH	MALY
Amphipogon turbinatus	Poaceae		P	grass			+
Aristida contorta	Poaceae	Bunched Kerosene Grass	P	grass			+
Austrodanthonia acerosa	Poaceae	Wallaby Grass	P	grass		+	+
Austrodanthonia setacea	Poaceae	Small-flower Wallaby Grass	P	grass		+	+
Austrostipa elegantissima	Poaceae	Feather Spear Grass	P	grass		+	+
Austrostipa hemipogon	Poaceae	Spear Grass	P	grass		+	+
Austrostipa temuifolia	Poaceae	Spear Grass	P	grass			+
Austrostipa tricophylla	Poaceae	Spear Grass	P	grass		+	+
Austrostipa variabilis	Poaceae	Variable Spear Grass	P	grass		+	+
**Avellinia michelii*	Poaceae	Avellinia	A	grass			+
**Avena barbata*	Poaceae	Wild Oats	A	grass		+	+
**Briza maxima*	Poaceae	Blowfly Grass, Large Quaking Grass	A	grass		+	+
**Briza minor*	Poaceae	Shivery Grass, Small Quaking Grass	A	grass			+
**Bromus diandrus*	Poaceae	Great Brome	A	grass		+	+
**Bromus rubens*	Poaceae	Red Brome	A	grass		+	+
**Ehrharta longiflora*	Poaceae	Annual Veldtgrass	A	grass		+	+
Eriachne ovata	Poaceae	Wanderrie	P	grass			+
**Hordeum leporinum*	Poaceae	Barley Grass	A	grass		+	
**Lolium rigidum*	Poaceae	Wimmera or Annual Ryegrass	A	grass		+	
Neurachne alopecuroidea	Poaceae	Foxtail Mulga Grass	P	grass		+	+
**Pentaschistis airoides*	Poaceae	False Hairgrass	A	grass		+	+
**Vulpia myuros*	Poaceae	Rat's Tail Fescue	A	grass		+	+
Comesperma integerrimum	Polygalacaeae		P	twining shrub			+
Comesperma scoparium	Polygalacaeae		P	twining shrub			+
Comesperma volubile	Polygalacaeae	Lovecreeper	P	twining shrub		+	+
**Polygonum aviculare*	Polygonaceae	Wireweed	A	herb		+	+
Calandrinia calyptrata	Portulacaceae	Pink Purslane	A	herb		+	+
**Anagallis arvensis*	Primulaceae	Pimpernel	A	herb		+	+
Banksia sphaerocarpa var. caesia	Proteaceae	Round-fruit Banksia	P	shrub		+	
Dryandra conferta var. conferta	Proteaceae		P	shrub		+	
Dryandra lindleyana subsp. agricola	Proteaceae		P	shrub		+	
Dryandra sp. aff. cirsoides	Proteaceae		P	shrub		+	+
Dryandra vestita	Proteaceae	Summer Dryandra	P	shrub		+	
Grevillea integrifolia	Proteaceae		P	shrub		+	
Hakea brownii	Proteaceae		P	shrub		+	
Hakea gilbertii	Proteaceae		P	shrub		+	
Hakea incrassata	Proteaceae	Marble Hakea	P	shrub		+	
Hakea lehmanniana	Proteaceae	Blue-flowered Hakea	P	shrub		+	

Botanical name	Family	Common name	Life form	Growth form	Cons code	RICH	MALY
Hakea lissocarpha	Proteaceae	Honeybush	P	shrub		+	+
Hakea prostrata	Proteaceae	Harsh Hakea	P	shrub		+	
Hakea scoparia subsp. scoparia	Proteaceae		P	shrub		+	+
Hakea subsulcata	Proteaceae		P	shrub		+	
Hakea trifurcata	Proteaceae	Two-leaf Hakea	P	shrub		+	
Isopogon divergens	Proteaceae		P	shrub		+	+
Isopogon teretifolius var. teretifolius	Proteaceae		P	shrub		+	
Persoonia quinquenervis	Proteaceae		P	shrub		+	
Petrophile brevifolia	Proteaceae	Cone Bush	P	shrub		+	
Petrophile glauca	Proteaceae	Cone Bush	P	shrub		+	
Petrophile squamata subsp. squamata	Proteaceae	Cone Bush	P	shrub		+	
Synaphea interioris	Proteaceae		P	shrub		+	
Desmocladus asper	Restionaceae		P	sedge		+	+
Lepidobolus preissianus	Restionaceae	Chaff-rush	P	sedge		+	+
Cryptandra leucopogon	Rhamnaceae		P	shrub		+	
Cryptandra nutans	Rhamnaceae		P	shrub		+	+
Cryptandra pungens	Rhamnaceae		P	shrub		+	
Stenanthemum tridentatum	Rhamnaceae		P	shrub	P3	+	+
Opercularia vaginata	Rubiaceae	Dog Weed	P	herb / semi-shrub		+	+
Santalum acuminatum	Santalaceae	Quandong	P	tree/shrub			+
Santalum spicatum	Santalaceae	Sandalwood	P	tree		+	
Dodonaea pinifolia	Sapindaceae	Hopbush	P	shrub			+
Dodonaea viscosa subsp. angustissima	Sapindaceae	Hopbush	P	shrub		+	+
Glossostigma drummondii	Scrophulariaceae		A	herb			+
**Parentucellia latifolia*	Scrophulariaceae	Common Bartsia	A	herb		+	+
Stackhousia monogyna	Stackhousiaceae	Candles	P	herb		+	+
Levenhookia dubia	Stylidiaceae	Hairy Stylewort	A	herb			+
Levenhookia pusilla	Stylidiaceae	Stylewort	A	herb		+	+
Stylidium calcaratum	Stylidiaceae	Book Triggerplant	A	herb		+	+
Stylidium emarginatum subsp. emarginatum	Stylidiaceae	Biddy-four-legs	P	herb		+	+
Stylidium leptophyllum	Stylidiaceae	Needle-leaved Triggerplant	A	herb		+	+
Stylidium petiolare	Stylidiaceae	Horn Triggerplant	A	herb		+	
Stylidium piliferum subsp. piliferum	Stylidiaceae	Common Butterfly Triggerplant	P	herb		+	+
Stylidium squamellosum	Stylidiaceae	Maize Triggerplant	P	herb		+	+
Pimelea brevifolia subsp. modesta	Thymeleaceae		P	shrub		+	
Typha domingensis	Typhaceae	Djandjid, Bulrush, Cumbungi	P	herb			+
Xanthorrhoea drummondii	Xanthorrhoeaceae	Grass Tree	P	herb/shrub		+	+

APPENDIX III: PLANT SPECIES OCCURRENCES BY QUADRATS AND VEGETATION TYPE

This list shows all taxa listed according to the quadrats on which they were found in Rich Road Reserve and then Malyalling Reserve. The taxa are listed alphabetically by genus and the quadrats are grouped according to vegetation type.

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 1and 2 ...
1a, 2a, ...	plant species was recorded outside the quadrat but nearby in the same community
+	plant species was recorded within the study area but not on or adjacent to a quadrat (an opportunistic collection)

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

Rich Road Reserve

H	Heath – Shrubland Complex
T	Tamar Shrublands
M	Mallee
R	Rock She-oak Woodlands
W	Wandoo – Rock She-oak Woodlands
Y	York Gum – Jam Low Woodlands
S	Salmon Gum Woodlands

Malyalling Reserve

G	Granite complex: granite outcrop and associated Herblands
R	Rock She-oak Woodlands
Y	York Gum – Jam – Rock She-oak Open Woodlands
W	Wandoo – Rock She-oak Woodlands
S	Salmon Gum Woodlands
T	Tamar Thickets

APPENDIX III: PLANT SPECIES LISTED BY QUADRAT & VEGETATION TYPE, RICH ROAD RESERVE AND MALYALLING RESERVE ,WICKEPIN

Botanical name	Family	Common name	Quadrats: Rich Road Reserve R2	R3	R11	R9	R7	R10	R1	R8	R4	R12	R6	R5	R+	M2	M3	M4	M1	M5	M6	M7	M+
			H			T	M	R			W			Y	S		G	R	Y		W		S	
Acacia acuminata subsp. *acuminata*	Mimosaceae	Jam									4			6	5			2a	4		5a	6	7a	
Acacia ericksoniae	Mimosaceae					9a																		
Acacia erinacea	Mimosaceae																			5a		7		
Acacia heteroclita subsp. *heteroclita*	Mimosaceae														+/7								+
Acacia lasiocarpa var. *sedifolia*	Mimosaceae		2			9a			1	8	4	12a								5	6a	7	
Acacia microbotrya var. *microbotrya*	Mimosaceae	Manna Wattle					7								+								+
Acacia multispicata	Mimosaceae																2						+
Acacia pycnocephala	Mimosaceae		2a	3																			
Acacia squamata	Mimosaceae		2	3																			
Acacia stenoptera	Mimosaceae	Narrow Winged Wattle	2	3	11a																		
**Agapanthus praecox*	Amaryllidaceae	Agapanthus													+								
Agrostis avenacea	Poaceae	Blown Grass																		5			
**Aira caryophyllea/cupaniana*	Poaceae	Silvery Hairgrass	2				7	10	1	8	4	12		6			3	2	4	1	5	6	7	
Allocasuarina campestris	Casuarinaceae	Tamar		3a	11	9					4a									1	5			
Allocasuarina huegeliana	Casuarinaceae	Rock Sheoak		3	11			10	1	8	4	12		6			3	2	4			6	7a	
Allocasuarina humilis	Casuarinaceae	Dwarf Sheoak	2a		11a																			
Allocasuarina microstachya	Casuarinaceae														+									
Amphipogon caricinus	Poaceae	Long Greybeard Grass										12		6						1		6		
Amphipogon sp.	Poaceae		2	3		9								6					4					
Amphipogon turbinatus	Poaceae																			1a				
**Anagallis arvensis*	Primulaceae	Pimpernel					7				4a				5				4					
Andersonia caerulea	Epacridaceae	Foxtails		3																				
Anigozanthos humilis	Haemodoraceae	Catspaw	2																	1a				
Aphelia brizula	Centrolepidaceae															3								
**Arctotheca calendula*	Asteraceae	Capeweed		3							4							2a	4	1			7	
Aristida contorta	Poaceae	Bunched Kerosene Grass																						+
Arthropodium curvipes	Anthericaceae													6		3								

Botanical name	Family	Common name	Quadrats: Rich Road Reserve R2	R3	R11	R9	R7	R10	R1	R8	R4	R12	R6	R5	R+	Malyalling Reserve M3	M2	M4	M1	M5	M6	M7	M+
			H			T	M	R			W		Y	S		G	R	Y		W		S	
Astroloma serratifolium var. *placidum*	Epacridaceae	Kondrung													+/7						6a		
**Atriplex undulata*	Chenopodiaceae	A Saltbush													+								
Austrodanthonia acerosa	Poaceae	Wallaby Grass	2																1				
Austrodanthonia setacea	Poaceae	Small-flower Wallaby Grass					7	10		8		12	6	5						5		7	
Austrostipa elegantissima	Poaceae	Feather Spear Grass	2	3	11		7	10	1	8	4						2	4	1	5	6	7	
Austrostipa hemipogon	Poaceae	Spear Grass									4		6							5			
Austrostipa tenuifolia	Poaceae	Spear Grass																4					
Austrostipa tricophylla	Poaceae	Spear Grass					7			8			6	5							6		
Austrostipa variabilis	Poaceae	Variable Spear Grass										12a							1			7	
**Avellinia michelii*	Poaceae	Avellinia																				7a	
**Avena barbata*	Poaceae	Wild Oats												5	+			4					
Baeckea crispiflora	Myrtaceae		2	3		9	7a	10	1		4a									5			
Baeckea preissiana / floribunda complex	Myrtaceae		2	3	11																		
Banksia sphaerocarpa var. *caesia*	Proteaceae	Round-fruit Banksia	2	3	11																		
Beaufortia bracteosa	Myrtaceae			3	11																		
Beaufortia micrantha var. *puberula*	Myrtaceae	Little Bottlebrush			11a																		
Blennospora drummondii	Asteraceae	Dwarf Beauty-heads	2	3		9	7	10	1	8	4	12	6				2		1	5	6		
Borya sphaerocephala	Boryaceae	Pincushions			11			10			4	12	6a	5		3	2	4	1	5	6		
Brachyscome bellidioides	Asteraceae														+/7								
Brachyscome ciliaris	Asteraceae	Variable Daisy																					+/7
Brachyscome perpusilla var. *tenella*	Asteraceae	Tiny Daisy										12											
**Brassica tournefortii*	Brassicaceae	Mediterranean Turnip																4a					
**Briza maxima*	Poaceae	Blowfly Grass Large Quaking Grass						10				12	6	5		3	2	4		5	6		
**Briza minor*	Poaceae	Shivery Grass Small Quaking Grass																	1a				
**Bromus diandrus*	Poaceae	Great Brome													+							7a	
**Bromus rubens*	Poaceae	Red Brome												5	+							7a	
Caesia alfordii	Anthericaceae																	4	1				

Botanical name	Family	Common name	Quadrats: Rich Road Reserve R2	R3	R11	R9	R7	R10	R1	R8	R4	R12	R6	R5	Malyalling Reserve R+	M3	M2	M4	M1	M5	M6	M7	M+
			H			T	M	R		W			Y	S		G	R	Y		W			S	
Caladenia falcata	Orchidaceae	Green Spider Orchid	3					10	1	8					+/7		2a		1	5			
Caladenia flava subsp. *flava*	Orchidaceae	Cowslip Orchid							1		4a		6a				2		1		6		
Caladenia hirta subsp. *rosea*	Orchidaceae	Pink Candy Orchid													+/6								
Caladenia pulchra	Orchidaceae	Slender Spider Orchid													+/4								
Caladenia reptans subsp. *reptans*	Orchidaceae	Little Pink Fairy Orchid													+/3								
Caladenia roei	Orchidaceae	Ant Orchid							1a	8a			6					4					
Caladenia saccharata	Orchidaceae	Sugar Orchid															2						+
Caladenia splendens	Orchidaceae	Large White Spider Orchid																					+
Calandrinia calyptrata	Portulacaceae	Pink Purslane					7			8		12		5		3						7	
Calothamnus quadrifidus	Myrtaceae	One-sided Bottlebrush	2a		11																		
Calothamnus sanguineus	Myrtaceae	Pindak Silky-leaved Bloodflower			11																		
Calytrix leschenaultii	Myrtaceae		2	3				10			4		6a							5a	6a		
Cassytha aurea var. *hirta*	Lauraceae	Dodder Laurel	2	3																			
Centrolepis aristata	Centrolepidaceae	Pointed Centrolepis	2		11						4	12							1		6		
Ceratogyne obionoides	Asteraceae	Wingwort							1		4	12						4	1	5	6		
Chamaescilla corymbosa var. *corymbosa*	Anthericaceae	Blue Squill			11			10								3	2			5	6		
Chamaescilla spiralis	Anthericaceae		2												+/7								
Chamaexeros serra	Dasypogonaceae	Little Fringe-leaf	2	3	11																		
Cheilanthes sieberi subsp. *sieberi*	Adiantaceae	Rock Fern														3		4					
Chloanthes coccinea	Chloanthaceae		2a	3																			
Comesperma integerrimum	Polygalacaeae																	4a					
Comesperma scoparium	Polygalacaeae																				6a		
Comesperma volubile	Polygalacaeae	Lovecreeper		3a	11	9		10a	1	8										5			
Conostylis prolifera	Haemodoraceae	Mat Cottonheads													+								
Conostylis pusilla	Haemodoraceae	Cottonhead																			6a		
Conostylis villosa	Haemodoraceae	Cottonhead	2	3	11a						4												
Crassula colorata var. *colorata*	Crassulaceae	Dense Stonecrop										12		5									

Botanical name	Family	Common name	Quadrats: Rich Road Reserve R2	R3	R11	R9	R7	R10	R1	R8	R4	R12	R6	R5	R+	Malyalling Reserve M3	M2	M4	M1	M5	M6	M7	M+
			H			T	M	R		W			Y	S		G	R	Y		W			S	
Crassula decumbens subsp. *decumbens*	Crassulaceae	Rufous Stonecrop																					+
Crassula exserta	Crassulaceae															3							
Crassula peduncularis	Crassulaceae	Purple Stonecrop																		5a			
Cryptandra leucopogon	Rhamnaceae		2	3																			
Cryptandra nutans	Rhamnaceae		2	3a																5			
Cryptandra pungens	Rhamnaceae		2a																				
Cyanicula gemmata	Orchidaceae	Blue China Orchid						10										4					
Dampiera juncea	Goodeniaceae	Rush-like Dampiera	2																				
Dampiera lavandulacea	Goodeniaceae	Lavender Dampiera								8	4	12	6	5				4	1	5	6	7a	
Dampiera lindleyi	Goodeniaceae		2	3						8a	4a										6		
Daviesia hakeoides subsp. *submuda*	Papilionaceae												6a		+/7								
Daviesia incrassata subsp. *incrassata*	Papilionaceae		2a																				
Desmocladus asper	Restionaceae										4	12		5	+/7						6a	7a	
Dianella revoluta	Phormiaceae	Blue Flax Lily					7a		1a	8			6	5		3a	2	4	1		6a	7	
Dichopogon capillipes	Anthericaceae	Chocolate Lily						10	1	8	4	12	6	5				4		5			
Diuris sp. aff. *corymbosa*	Orchidaceae	Wallflower Orchid Donkey Orchid													+/7	3	2	4			6a		
Dodonaea pinifolia	Sapindaceae	Hopbush																		5			
Dodonaea viscosa subsp. *angustissima*	Sapindaceae	Hopbush	2a													3							
Drosera androsacea	Droseraceae	Cone Sundew		3				10															
Drosera glanduligera	Droseraceae	Pimpernel Sundew	2								4					3		4	1		6		
Drosera macrantha subsp. *macrantha*	Droseraceae	Bridal Rainbow Climbing Sundew	2		11	9			1	8	4	12					2				6		
Drosera menziesii subsp. *menziesii*	Droseraceae	Pink Rainbow													+/7								
Drosera pycnoblasta	Droseraceae	Pearly Sundew	2a																				
Drosera sp.	Droseraceae	Sundew								8			6				2			5			
Drosera subhirtella subsp. *subhirtella*	Droseraceae	Sunny Rainbow						10			4					3a		4	1		6		
Dryandra conferta var. *conferta*	Proteaceae		2	3																			
Dryandra lindleyana subsp. *agricola*	Proteaceae														+								

Botanical name	Family	Common name	Quadrats: Rich Road Reserve R2	R3	R11	R9	R7	R10	R1	R8	R4	R12	R6	R5	R+	Malyalling Reserve M3	M2	M4	M1	M5	M6	M7	M+
			H			T	M	R			W		Y	S		G	R	Y		W		S	
Dryandra sp. aff. *cirsoides*	Proteaceae		3	11		9			1	8										5			
Dryandra vestita	Proteaceae	Summer Dryandra	2a	3																			
**Ehrharta longiflora*	Poaceae	Annual Veldtgrass					7							5			2						
Elythranthera brunonis	Orchidaceae	Purple Enamel Orchid			11																		
Enchylaena lanata	Chenopodiaceae														+								
Epilobium hirtigerum	Onagraceae	Hairy Willow Herb														3a							
Eriachne ovata	Poaceae	Wanderrie														3							
Eriochilus dilatatus subsp. *undulatus*	Orchidaceae	Crinkle-leafed Bunny Orchid							1a		4							4a					+
Erodium cygnorum	Geraniaceae	Blue Heronsbill														3a		4					
Eucalyptus albida	Myrtaceae	White-leaved Mallee	3																				
Eucalyptus capillosa subsp. *polyclada*	Myrtaceae	Mallee Wandoo				9	7																
Eucalyptus hypochlamydea subsp. *ecdysiastes*	Myrtaceae						7																
Eucalyptus loxophleba subsp. *loxophleba*	Myrtaceae	York Gum											6			3a		4a					
Eucalyptus rigidula	Myrtaceae	Stiff-leaved Mallee					7																
Eucalyptus salmonophloia	Myrtaceae	Salmon Gum Wurak												5								7	
Eucalyptus wandoo	Myrtaceae	Wandoo						10	1	8	4	12		5				4a		5	6	7	
**Fumaria capreolata*	Fumariaceae	Whiteflower Fumitory													+								
Gastrolobium parviflorum	Papilionaceae	Berry Poison								8	4	12		5a					1		6		
Gastrolobium spinosum var. *spinosum*	Papilionaceae	Prickly Poison						10a	1				6a										
Gastrolobium trilobum	Papilionaceae	Bullock Poison																			6a		
Glischrocaryon aureum	Haloragaceae	Common Popflower	2	3a	11a		7	10	1	8	4	12					2	4		5			
Glossostigma drummondii	Scrophulariaceae															3							
Gnephosis drummondii	Asteraceae	Delicate Gnephosis									4	12									6		
Gompholobium marginatum	Papilionaceae		2	3					1a														
Gompholobium scabrum	Papilionaceae														+								
Gonocarpus nodulosus	Haloragaceae										4a						2	4	1				
Goodenia berardiana	Goodeniaceae																				6a		+

Botanical name	Family	Common name	Quadrats: Rich Road Reserve R2	R3	R11	R9	R7	R10	R1	R8	R4	R12	R6	R5	R+	Malyalling Reserve M3	M2	M4	M1	M5	M6	M7	M+
			H		T	M	R		W			Y	S			G	R	Y		W		S	
Goodenia krauseana	Goodeniaceae																			5a			
Goodenia pulchella subsp. Wheatbelt (L.W.Sage &	Goodeniaceae																				6a		
Grevillea integrifolia	Proteaceae														+								
Haemodorum sp.	Haemodoraceae	Blood Root		11						4													
Hakea brownii	Proteaceae														+								
Hakea gilbertii	Proteaceae						10																
Hakea incrassata	Proteaceae	Marble Hakea	2																				
Hakea lehmanniana	Proteaceae	Blue-flowered Hakea		3																			
Hakea lissocarpha	Proteaceae	Honeybush	2						8	4	12a									5a			
Hakea prostrata	Proteaceae	Harsh Hakea	2a																				
Hakea scoparia subsp. *scoparia*	Proteaceae						10													5			
Hakea subsulcata	Proteaceae			11																			
Hakea trifurcata	Proteaceae	Two-leaf Hakea													+								
Halosarcia pergranulata	Chenopodiaceae														+								
Helichrysum leucopsideum	Asteraceae	Satin Everlasting				7			8		12		5						1a				
Hibbertia acerosa	Dilleniaceae	Needle-leaved Guinea Flower		3																			
Hibbertia pungens	Dilleniaceae	Guinea Flower	2	3	11			10	1											5			
**Hordeum leporinum*	Poaceae	Barley Grass													+								
Hyalosperma demissum	Asteraceae	Tiny Sunray	2					10		4		6						4		5a	6		
Hyalosperma glutinosum subsp. *glutinosum*	Asteraceae					7										3a							
Hydrocotyle callicarpa	Apiaceae	Small Pennywort	2		11a			10	1	4								4	1	5	6		
Hydrocotyle diantha	Apiaceae	Pennywort														3							
Hydrocotyle pilifera var. *glabrata*	Apiaceae	Pennywort									12	6					2	4				7a	
Hydrocotyle rugulosa	Apiaceae	Pennywort				9			8														
**Hypochaeris glabra*	Asteraceae	Flat Weed Smooth Cat's-ear	2		11		7			4	12	6	5		3	2	4	1	5	6	7		
**Isolepis marginata*	Cyperaceae	Coarse Club-rush													3								
Isopogon divergens	Proteaceae				11a															5a			

Botanical name	Family	Common name	Quadrats: Rich Road Reserve R2	R3	R11	R9	R7	R10	R1	R8	R4	R12	R6	R5	R+	Malyalling Reserve M3	M2	M4	M1	M5	M6	M7	M+
			H			T	M	R		W			Y	S		G	R	Y		W			S
Isopogon teretifolius var. *teretifolius*	Proteaceae														+/3								
Jacksonia condensata	Papilionaceae									4													
Kunzea micromera	Myrtaceae	Kunzea	2																				
Kunzea pulchella	Myrtaceae	Granite Kunzea														3a							
Lagenophora huegelii	Asteraceae	Coarse Lagenophora					7		1	8		12	6	5						5a	6a	7	
Lawrencella rosea	Asteraceae	Pink Everlasting	2a							8	4	12	6a				2	4	1		6		
Laxmannia grandiflora subsp. *grandiflora*	Anthericaceae		2	3																			
Laxmannia squarrosa	Anthericaceae							10	1a												6		
Lepidobolus preissianus	Restionaceae	Chaff-rush	2		11			10	1		4	12							1		6		
Lepidosperma brunoniamum	Cyperaceae	Sword-sedge		3a		9	7a			8										5a			
Lepidosperma costale	Cyperaceae												6			3a		4					
Lepidosperma sp. A2 Island Flat (Keighery 7000)	Cyperaceae	Sword-sedge					7				4										6		
Lepidosperma sp. aff. *tenue*	Cyperaceae				11																		
Lepidosperma sp. P1 small heads (M.D. Tindale	Cyperaceae			3																			
Lepidosperma tenue	Cyperaceae								1								2			5		7a	
Leporella fimbriata	Orchidaceae	Hare Orchid										12							1		6		
Leptospermum erubescens	Myrtaceae	Roadside Tea-tree					7													5a			
Leucopogon cymbiformis	Epacridaceae	Beard Heath			11a																		
Leucopogon dielsianus	Epacridaceae	Beard Heath	2a		11																		
Leucopogon pogonocalyx	Epacridaceae	Beard Heath	2																				
Levenhookia dubia	Stylidiaceae	Hairy Stylewort														3							
Levenhookia pusilla	Stylidiaceae	Stylewort	2	3	11a	9			1		4						2				6		
Lobelia sp. probably *L. tenue*	Lobeliaceae					9	7			8	4	12					2		1	5	6		
**Lolium rigidum*	Poaceae	Wimmera or Annual Ryegrass								8				5									
Lomandra effusa	Dasypogonaceae	Scented Matrush				9	7		1	8	4a	12		5					1		6a	7	
Lomandra micrantha subsp. *teretifolia*	Dasypogonaceae	Small-flower Matrush	2				7		1	8	4	12							1	5a	6a	7	
Lomandra sp. (MALR 6/30)	Dasypogonaceae																				6		

Botanical name	Family	Common name	Quadrats: Rich Road Reserve R2	R3	R11	R9	R7	R10	R1	R8	R4	R12	R6	R5	R+	Malyalling Reserve M3	M2	M4	M1	M5	M6	M7	M+
			H			T	M	R		W			Y	S		G	R	Y		W			S	
Lysinema ciliatum	Epacridaceae	Curry Flower		3																			
Maireana brevifolia	Chenopodiaceae	Small Leaf Bluebush													+								
Marianthus erubescens	Pittosporaceae					9	7a		1a	8													
Melaleuca lecanantha	Myrtaceae	Honey-myrtle	2a																				
Melaleuca ? micrantha	Myrtaceae		2																				
Melaleuca sp.	Myrtaceae		2	3				10															
Melaleuca sp. 86GT3/15	Myrtaceae			3																			
Melaleuca sp. RICH 11/26	Myrtaceae				11																		
Melaleuca uncinata	Myrtaceae	Broom Bush			11	9	7		1	8													
Mesomelaena preissii	Cyperaceae			3a							4												
Millotia tenuifolia	Asteraceae	Soft Millotia			11		7a			8		12						4	1	5	6		
Mirbelia spinosa (intermediate with *M.*	Papilionaceae			3																			
Monotaxis grandiflora	Euphorbiaceae	Diamond of the Desert		3																			
Nemcia hookeri	Papilionaceae														+								
Nemcia obovata	Papilionaceae	Boat-leaved Poison																		5			
Nemcia sp. A. Avon (M.Crisp 6183)	Papilionaceae		2																				
Nemcia sp. aff. *hookeri*	Papilionaceae														+								
Nemcia sp. aff. *obovata/capitata*	Papilionaceae				11	9a																	
Nemcia spathulata	Papilionaceae																			5			+/7
Neurachne alopecuroidea	Poaceae	Foxtail Mulga Grass	2	3	11	9	7	10	1	8	4	12	6	5			2a	4	1		6	7	
Olearia muelleri	Asteraceae	Goldfield's Daisy													+								
Olearia rudis	Asteraceae	Rough Daisybush								8		12								5a		7	
Opercularia vaginata	Rubiaceae	Dog Weed	2	3	11			10			4	12	6				2	4		5			
Oxalis perennans	Oxalidaceae	Wood Sorrel												5	+								
Papaver sp.	Papaveraceae	Poppy													+								
Parentucellia latifolia	Scrophulariaceae	Common Bartsia						10			4	12	6				2	4	1		6a		
Patersonia drummondii subsp. *drummondii*	Iridaceae	Drummond's Patersonia					7		1														

Botanical name	Family	Common name	Quadrats: Rich Road Reserve R2	R3	R11	R9	R7	R10	R1	R8	R4	R12	R6	R5	R+	Malyalling Reserve M3	M2	M4	M1	M5	M6	M7	M+
			H			T	M	R	W				Y	S		G	R	Y	W			S	
Patersonia juncea	Iridaceae	Rush-leaved Patersonia			11																		
**Pentaschistis airoides*	Poaceae	False Hairgrass								4									1				
Persoonia quinquenervis	Proteaceae		2a																				
Petrophile brevifolia	Proteaceae	Cone Bush	2	3																			
Petrophile glauca	Proteaceae	Cone Bush		3a	11																		
Petrophile squamata subsp. *squamata*	Proteaceae	Cone Bush	2	3																			
**Petrorhagia velutina*	Caryophyllaceae	Velvet Pink																					+
Phyllangium paradoxum	Loganiaceae	Wiry Mitrewort								4								4					
Phyllangium sulcatum	Loganiaceae	Mitrewort					7		1	8	4		6				2		1	5	6		
Pimelea brevifolia subsp. *modesta*	Thymeleaceae		2a																				
Pityrodia terminalis	Chloanthaceae	Native Foxglove													+								
Podolepis canescens	Asteraceae	Bright or Grey Podolepis										12a				3a							+/7
Podolepis capillaris	Asteraceae	Wiry Podolepis																				7a	
Podolepis lessonii	Asteraceae							10	1a	8	4	12	6			3a	2	4			6a		
Podotheca angustifolia	Asteraceae	Sticky Longheads	2				7	10	1	8	4	12				3a			1		6		
Podotheca gnaphalioides	Asteraceae	Golden Longheads				9a																	
**Polygonum aviculare*	Polygonaceae	Wireweed																				7a	
Poranthera microphylla	Euphorbiaceae	Small Poranthera			11				1				6				2			5	6		
Prasophyllum gracile	Orchidaceae	Leek Orchid						10								3							
Pterochaeta paniculata	Asteraceae	Woolly 'Waitzia'	2	3	11			10															
Pterostylis sanguinea	Orchidaceae	Dark Banded Greenhood		3		9			1								2				6a		
Pterostylis sargentii	Orchidaceae	Frog Orchid			11				1														
Pterostylis sp.	Orchidaceae	Greenhood		3																			
Ptilotus declinatus	Amaranthaceae	Curved Mulla Mulla											6a										
Ptilotus polystachyus	Amaranthaceae	Prince of Wales Feather														3a							
Ptilotus spathulatus	Amaranthaceae	Mulla Mulla												5									
Pultenaea ericifolia	Papilionaceae			3																			

Botanical name	Family	Common name	Quadrats: Rich Road Reserve R2	R3	R11	R9	R7	R10	R1	R8	R4	R12	R6	R5	R+	Malyalling Reserve M3	M2	M4	M1	M5	M6	M7	M+
			H			T	M	R		W			Y	S		G	R	Y	W			S	
Pyrorchis nigricans	Orchidaceae	Red Beaks Elephants' Ears		3						4													
Quinetia urvillei	Asteraceae									4							2a						
Rhagodia preissii subsp. *preissii*	Chenopodiaceae																					7a	
Rhodanthe citrina	Asteraceae	Golden Sunray							1a												6	7a	
Rhodanthe laevis	Asteraceae	Smooth Sunray	2		11	9	7	10		4a			6			3a	2		1	5	6		
Rhodanthe manglesii	Asteraceae	Pink Sunray												5a	+/4	3a		4	1				
Rhodanthe polycephala	Asteraceae												6	5				4					
**Romulea rosea*	Iridaceae	Guildford Grass													+	3							
Santalum acuminatum	Santalaceae	Quandong																					+
Santalum spicatum	Santalaceae	Sandalwood								4a					+								
Schoenus nanus	Cyperaceae	Tiny Bog-rush	2				7	10	1	4							2	4	1	5	6		
Schoenus sesquispiculus	Cyperaceae	Bog-rush	2							4													
Schoenus sp. A2 Kulin (B Briggs 7939)	Cyperaceae		2	3	11a			10															
Schoenus sp. aff. *clandestinus*	Cyperaceae		2	3																			
Schoenus sp. aff. *pleistomoneus*	Cyperaceae				11a											3a							
Siloxerus multiflorus	Asteraceae	Small Wrinklewort																4a					
**Sonchus oleraceus*	Asteraceae	Common Sowthistle															2		1		6		
Sowerbaea laxiflora	Anthericaceae	Purple Tassels														3							
Spiculea ciliata	Orchidaceae	Elbow Orchid						10						5	+/7	3a		4		5			
Stackhousia monogyna	Stackhousiaceae	Candles											6								6a	7a	
Stenanthemum tridentatum	Rhamnaceae					9										3a		4	1				
Stylidium calcaratum	Stylidiaceae	Book Triggerplant						10		4					+	3a					6		
Stylidium emarginatum subsp. *emarginatum*	Stylidiaceae	Biddy-four-legs															2						
Stylidium leptophyllum	Stylidiaceae	Needle-leaved Triggerplant			11a	9a		10															
Stylidium petiolare	Stylidiaceae	Horn Triggerplant	2												+								
Stylidium piliferum subsp. *piliferum*	Stylidiaceae	Common Butterfly Triggerplant	2	3	11				1	8a	4	12							1a				
Stylidium squamellosum	Stylidiaceae	Maize Triggerplant	2	3a	11				1a											5			

Botanical name	Family	Common name	Quadrats: Rich Road Reserve R2	R3	R11	R9	R7	R10	R1	R8	R4	R12	R6	R5	R+	Malyalling Reserve M3	M2	M4	M1	M5	M6	M7	M+
			H			T	M	R			W		Y	S		G	R	Y		W		S	
Stypandra glauca	Phormiaceae	Blindgrass									4	12	6			3a	2	4		5	6		
Synaphea interioris	Proteaceae		2a												+/7								
Thelymitra antennifera	Orchidaceae	Vanilla Orchid Lemon Orchid														3							
Thelymitra sp. aff. *macrophylla*	Orchidaceae	Scented Sun Orchid														3					6a		
Thysanotus patersonii	Anthericaceae	Twining Fringe Lily	2	3		9			1		4	12	6			3	2a	4a	1	5	6		
Thysanotus tenuis	Anthericaceae	Fringed Lily														3a		4a					
Trachymene cyanopetala	Apiaceae									8		12		5			2	4		5			
Trachymene ornata	Apiaceae	Spongefruit				9a			1	8	4					3			1		6		
Trachymene pilosa	Apiaceae	Native Parsnip	2			9	7	10			4	12	6						1		6		
Trichocline spathulata	Asteraceae	Native Gerbera																			6a		
**Trifolium arvense*	Papilionaceae	Hare's Foot Clover														3							
**Trifolium campestre*	Papilionaceae	Hop Clover														3							
**Trifolium subterraneum*	Papilionaceae	Subterranean Clover													+								
**Trifolium tomentosum*	Papilionaceae	Woolly Clover													+								
Typha domingensis	Typhaceae	Djandjid Bulrush Cumbungi														3a							
**Ursinia anthemoides*	Asteraceae	Ursinia			11		7		1		4	12	6	5		3	2	4	1		6	7	
Velleia cycnopotamica	Goodeniaceae							10					6					4	1	5			
Verticordia chrysantha	Myrtaceae	Featherflower	2a	3																			
Verticordia grandiflora	Myrtaceae	Claw Featherflower	2																				
Vittadinia cervicularis	Asteraceae													5a									
**Vulpia myuros*	Poaceae	Rat's Tail Fescue	2		11a		7		1		4					3		4	1	5	6		
Wahlenbergia gracilenta	Campanulaceae	Annual Bluebell					7													5			
Waitzia acuminata var. *acuminata*	Asteraceae	Orange Immortelle	2	3		9	7	10	1	8	4	12	6	5		3a	2	4	1		6		
Waitzia acuminata var. *albicans*	Asteraceae	'Pink' Immortelle																					+/7
Westringia cephalantha	Lamiaceae								1						+							7a	
Westringia rigida	Lamiaceae	Stiff Westringia																		5a		7a	
Xanthorrhoea drummondii	Xanthorrhoeaceae	Grass Tree	2	3	11			10		8a	4a						2a			5a			

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.