VEGETATION SURVEY

OF TWO NATURE RESERVES

NEAR KOJONUP

(Jingalup 17759 and South Jingalup 17760)

Prepared for
Katanning Reserve Management Officer
PO Box 811
KATANNING 6317 WA

By E.A. Griffin and Associates
Consulting Botanist
47 McMillan St
VICTORIA PARK 6100 WA

July 1985

E.A.GRIFFIN AND ASSOCIATES

TABLE OF CONTENTS

SUMMARY

The vegetation of Jingalup and South Jingalup Nature Reserve is described. Eight vegetation units are defined and mapped. Both reserves are mainly Low Forest A dominated by varying proportions of Jarrah and Wandoo. Jarrah almost exclusively dominates the lateritic uplands while Wandoo likewise the dissected valleys and loamy alluvium. Moderately dissected and gravelly loamy soils have a mixture of these two tree species. Marri is only locally important in some sandy soils. Shrubs are rarely the dominant strata. Dryandra sessilis is a significant species usually forming a scrub on the lateritic gravelly and duricrust soils beneath the Jarrah. In most other areas there are low shrubs which have a relatively low proportion of the biomass. A general relationship between the vegetation units and landscape is presented. No Gazetted Rare species was found. Only one species which has been considered geographically restricted has been reported. Several species found are at their south western limit of their distributions. Both reserves have significant conservation value because of their regional significance in an area which is largely cleared. Comments are made on management options.

INTRODUCTION

The following extract from the Consultancy Offer and Agreement outlines the scope of the current survey.

1. DESCRIPTION OF PROJECT

Reserve Nos 17759 and 17760 are the largest nature reserves in the Shire of Kojonup. A prescribed burning programme is required for these reserves, and it is also proposed that a detailed management plan be written over the next two years.

The objective of this consultancy is to prepare a detailed vegetation map of both reserves for use in planning.

2. PROJECT REQUIREMENTS

The consultant will survey the two reserves, and for each reserve:

a) Produce a vegetation map at the formation level with each formation to be further sub-divided into associations described by dominant species in the highest strata.

b) Provide a series of association descriptions, based on the classification system devised by B. Muir, which describe the range of associations found on the reserve. The site of each description should be recorded on the appropriate vegetation map.

c) Identify vegetation associations and habitat types which, as a matter of priority, should remain undisturbed. Particular attention should be given to identifying those areas from which fire should be excluded.

d) Collect and identify a representative sample of the flora of the reserves and lodge specimens with the field herbarium at the

Department's Katanning Office. Sample of less common, flowering specimens should also be lodged with the Western Australian Herbarium.

e) Record the identity, location and estimated population size of any gazetted rare plants which may occur on the reserves.

STUDY AREA AND LAND USE HISTORY

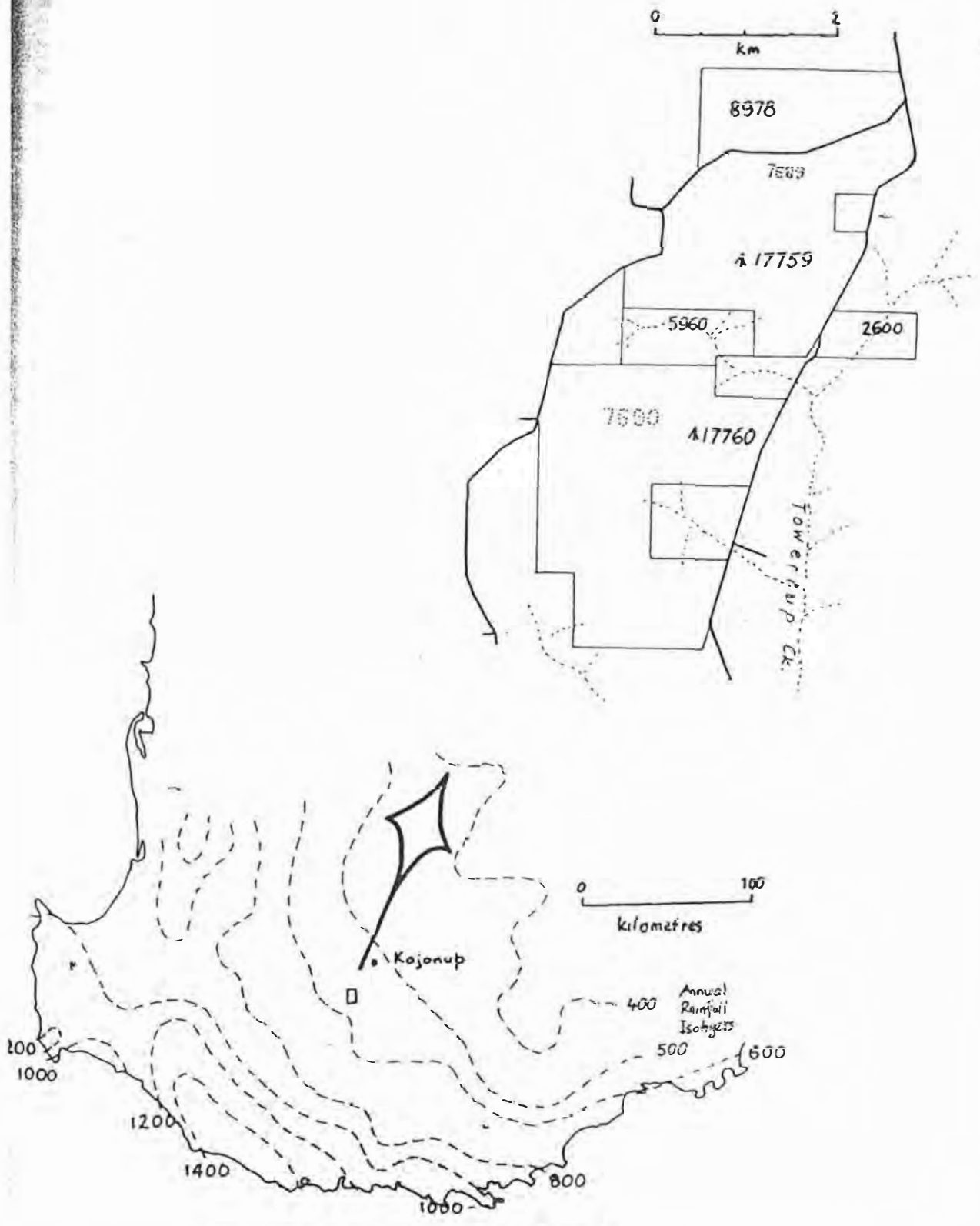
Parts of the two reserves were set aside for "Timber for Settlers" in 1921 (17759 - 350 acres, 17760 - 1000 acres) and both increased in 1922 (17759 - 1500 acres, 17760 - 1300 acres). Prior to this the better country for agriculture (valleys) had been taken up as early as 1904 (location 2600) and 1909 (location 5960). Both reserves were covered by grazing leases for most of the time of their existence till the leases were cancelled in July 1967. In 1955 the northern part of 17759 was excised to create location 8978. The current areas of these reserves are 427 hectares (17759) and 551 ha (1776) (see location map -Figure 1).

These reserves have been degraded by past grazing, timber cutting and presumably burning which has had an inderminable effect on the vegetation and flora. Extraction of gravel from several points has left unrepaired scars. Some gravel has been removed in the last few months from the south-east corner of 17760. Sand has also been removed from several areas. Rubbish has been dumped over many years as have the carcases of some sheep (some quite recently).

GEOLOGY

Because these two reserves have been considered in three different 1:250,000 geological maps (Wilde and Walker 1984, Muhling and Brakel, 1985 and an unpublished map) there is some confusion as to how best to describe the area. No map of the geology of the area will be presented because of difficulties in matching adjacent sheets.

FIGURE 1 Location Map



E.A.GRIFFIN AND ASSOCIATES

The reserves are on the Yilgarn block, in an area where the underlying rocks are principally Archaean granites, but only a small area of this material is outcropping in the region. A small area of Archaean Psammo-peletic schist was mapped on the east side of 17759. There are also quartz dykes and veins mapped in the same area. A dolerite dyke was found in the south-west corner of 17760 but had not been mapped.

Most of the area is covered by Cainozoic materials, however there has been some difference in interpretation of these. Much of the west of the reserves have been mapped as Tg (Tertiary alluvial and lacustrine deposits). These are relatively flat areas being once old drainage lines. In the eastern portions of the reserves the corresponding unit appears to be Cza (a Tertiary to Quaternary alluvium and colluvium) but little of this unit is present on this side because of the greater dissection of the landscape. Most of the reserves are covered by laterites or materials derived form its erosion. Both the Archaean granite and the Tertiary deposits have been laterized but the lateritic unit (Czl) is only mapped over areas of granite. The unit principally occurs on the hills and upland areas. A small area of Czs (residual sand overlying laterite) is mapped at the foot of the main hill on 17760. The valleys are mainly mapped as being colluvium (Qrc or Qc) which is sand, silt and clay and variably lateritized. It is in these areas that the crystalline rocks are exposed.

SOILS

No detailed soil map covering the area has been prepared. A rudimentary soil classification was prepared in about 1910 but gives very little more than an indication of the relative worth of areas for agriculture. Northcote et al (1967), in mapping at 1:2,500,000, drew a boundary between two units (Tf6 and Ub90) through the reserves. The principal soils in these areas appear to be (from the interpretation of descriptions "... hard acidic and neutral yellow mottled soils containing small to large amounts of ironstone gravels..." on the uplands and "... hard neutral and acidic yellow mottled soils ..." with much less gravel on the slopes. There may be small areas of leached sands and

red soils.

With the assistance of Mr H.M. Churchward, an attempt was made to map the soils of the area. This was mainly an aerial photographic interpretation with minimal field observations (Figure 2). There were no descriptions prepared. Essentially it shows a landscape subdivision of the reserves into essentially hills and valleys the soils of which are generally predictable.

VEGETATION AND FLORA

The vegetation of the reserves is covered by three 1:250,000 maps produced by two authors (Smith, 1972; Beard, 1979, 1980). These give only a very sketchy account of what might be present. Beard (1979) places the area clearly n Smith's Jingalup System of the Darling Botanical District - Menzies Subdistrict. Beard describes the area as having Jarrah-Marri forest on the summit, ironstone gravels and woodland of Marri and Wandoo on the slopes and flooded gum along the minor drainage lines. Smith mapped the area as Jarrah Open Forest or Woodland. This occurred mainly on lateritic ridges while he suggests Marri may be co-dominant where the soils are sandier.

Christensen's 1980 study was 40 to 100 km to the south-west of Jingalup. His ordination study of species composition of the vegetation was of value in the current study. The site-vegetation mapping of Havel 1975 was considered beyond its range of useful application and there was insufficient time to extend his system.

There is one published source of information on the flora of either reserve. Majer (1980) provides a brief list of species for 17760 but also indicates that in 17759, Gibbons (1977) recorded 104 plant species and in 17760 128 species. Although Majer uses Gibbons' species richness data, he has reservations about the reliability of the names provided (Majer pers. comm.). Hence the species list of Gibbons (1977) is not incorporated in this Gibbons' study of five nature reserves in the Kojonup area provides some understanding of the relativity of the reserves but was not particularly

useful for the current study.

CLIMATE

In Beard (1981, Figure 8) the Kojonup area is classified as Dry Mediterranean (5-6 dry months). Table 1 gives the mean monthly minimum and maximum temperatures and mean rainfall for the nearest comprehensive recording station to the Jingalup reserves (Kojonup). As rainfall gradients decline along a NE gradient, the reserves probably receive about 600 mm per annum.

Long term rainfall trends were not examined in detail but are probably declining as reported for the Lake Unicup area (Griffin, 1984) and the Albany area (Griffin, 1985).

METHODS

The two Jingalup Nature Reserves were visited for 5 days in two trips during April 1985. While the timing of the survey was totally inappropriate for the recognition and collection of most herbs and geophytes, most perennial shrubs were readily recognisable. Most of the tracks and firebreaks were traversed and detailed observations were made at 42 sites in these reserves. The location of these are represented on the contour map (Figure 3). The study relied on field recognition of vegetation units and qualitative correlation with aerial photo signals. Stereo examination of black and white aerial photographs taken on 20/11/1972. Mapping was done at a scale of about 1:10,000 on the Mt Barker run 1, number 5143 photograph.

RESULTS AND DISCUSSION

LIMITATIONS

The illucidation and description of the vegetation types in the Jingalup reserves has proven to be a difficult task which this study has only started on. Much of the reason for the difficulty is the relative homogeneity of the vegetation which means that field observations and interpretations need more careful consideration than would be necessary for a more diverse area. There are a few obviously different vegetation types but much of the vegetation appears to be in a continuum between these nodes. The dominance of the vegetation by two tree species has meant that discrimination between some vegetation types has to be essentially from landform, soil and subordinate (sometimes not very abundant) shrub species. It is probable that the relative importance of shrub species has been altered by the grazing of the area and this has contributed to the difficulties. The need for a dual focus for recognition has meant there has at times been a conflict. The vegetation map and descriptions can, at best, be considered to be only indicative ones. They rely heavily on a conceptual relationship developed here and a very generalized soil/landscape interpretation.

GENERAL DESCRIPTION OF VEGETATION

The vegetation of the Jingalup reserves is essentially a Low Forest A (sometimes Low Woodland A) of Jarrah and Wandoo in varying proportions. Jarrah dominates the lateritic uplands and sandy gravelly slopes while Wandoo is important on the steeper erosional slopes and alluvial areas where clays and loams (probably more poorly drained) are more important. Marri is only of minor importance in the reserve. It reaches its local peak in sandy alluvial areas, but can occur in most parts of the landscape, particularly the sandier area in 17759. The only other tree species to reach any importance is Mallett which is confined to two small mono-specific areas in 17760 where certain lateritic uplands have been eroded. Banksia grandis and Nuytsia floribunda can be very locally the main tree species where there are certain sandy soils. A

small area of Eucalyptus decipiens occurs as a subordinate low tree in an upper part of an old drainage line in reserve 17759 (site T24). There are only a couple of small areas where trees are absent. There are a couple of different types but the main one is clayey drainage depressions where Melaleuca ? hamulosa forms a Low Scrub. Leptospermum erubescens and Hakea undulata can form small patches of Heath where the tree cover is more open.

CONCEPTUAL EXPLANATION OF VEGETATION RELATIONSHIPS

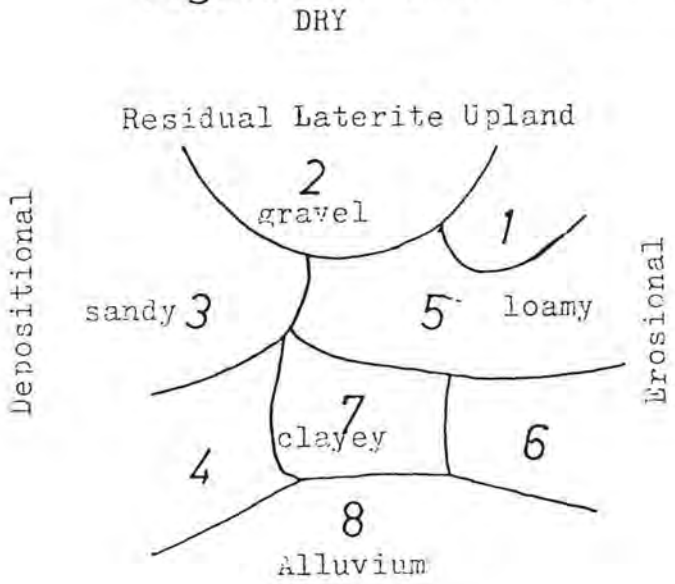
Figure 4 provides a hypothetical relationship between the eight major vegetation types which have been recognised in this study. In preparing this figure it was contended that the vegetation patterns showed a recognisable relationship with landscape and soil types. It also relied on the generalization that the geological substrate was essentially the same, however, the mainly granitic rocks of the area have dolerite and quartzite intrusions. No differences in vegetation related to these intrusions were recognised but this is not a conclusive statement.

In most areas of WA, the local distribution of soil types can best described in terms of landscape development and the distribution of erosion products. In the Jingalup area the soils are best related to the differential stripping of a lateritized granitic subsrate. The vegetation appears to conform with this concept. Jarrah dominates the intact lateritic uplands and the stable sandy gravelly colluvial slopes. Wandoo and Jarrah are both significant on the moderately eroded colluvial slopes while Wandoo alone is dominant where the erosion has been more complete exposing the lower portions of the lateritic profile, including country rock in some places. The several alluvial areas are mainly clayey or loamy soil and generally are dominated by Wandoo. The sandier patches have Marri.

GENERALISED VEGETATION DESCRIPTION

Figure 5 shows the distribution in both reserves of the 8 vegetation units recognised (Table 2). This map shows that the reserves are essentially

FIGURE 4 Conceptual Relationship between Vegetation and Landscape



VEGETATION UNITS

1 Mallet Low Forest A

2 Jarrah Low Forest A (lateritic upland type)

3 Jarrah Low Forest A (sandy slope type)

4 Jarrah - Leptospermum erubescens Low Woodland A/Low Heath C

5 Jarrah - Wandoo Low Forest A

6 Wandoo Low Forest A

7 Wandoo - Hakea prostrata Low Forest A/Scrub B

8 Melaleuca ? hamulosa Low Scrub A

dominated by three types (E. marginata Low Forest A - Units 2 and 3 and E. marginata - E. wandoo Low Forest A - Unit 5). The old plateau surface (lateritised upland) has E. marginata Low Forest A (unit 2). In this area there is mainly a laterite duricrust pavement with a sandy and gravelly matrix (although this unit does grow on the gravelly soils of some slopes). Dryandra sessilis thickets are prominent here, more so than in any of the other units in which this species occurs. The only other tall species in this unit is Banksia grandis which has only a scattered occurrence on the upland. The lower strata is relatively open and is a mixture of low shrubs and sedges. The main shrub species is Bossiaea ornata which grows mainly in the gravelly soils of this unit and units 4 and 5. Other important shrubs are Stypellia tenuifolia, Xanthorrhoea preissii and Hakea lissocarpha. Petropphile serruriae may be locally important on some gravelly slopes. Lepidospermum leptostachyum is the most common sedge although others are also present.

The relatively stable colluvial slopes are also dominated by Jarrah. The lateritic gravelly areas were considered to have the same vegetation type as the upland pavements. The more sandy areas were slightly different in the understorey species composition (E. marginata Low Forest A - Unit 3). Banksia grandis is usually most important and may form an Open Low Woodland B with an occasional Nuytsia floribunda. Dryandra sessilis can also be important in these circumstances but when the sand is deeper B. grandis and D. sessilis are usually less important. The major low shrub species in this unit is Bossiaea eriocarpa which essentially replaces B. ornata. In the sandier areas Calytrix flavescens and Franklandia fucifolia are important. These two essentially only occur in this unit. Styphellia tenuifolia is also important. Sedges can be quite abundant. Loxocarya fasciculata in sandy areas can form a Low Sedge stratum. Other species include Lyginia barbata and Lepidosperma angustatum.

Another unit of essentially sandy soils is E. marginata- Leptospermum erubescens Low Woodland A/Low Heath C (Unit 4). This unit occurs on sandy, gravelly soils in the lower parts of the landscape on gentle slopes. Although it is depositional, it is not clear why it is different from Unit 3. A higher proportion of clay or better moisture status is suspected. The tree stratum is

generally composed of all of the three main species although Jarrah seem to be the most important. This may be because of the small size of the patches with Jarrah intruding from the commonly adjacent Units 2 or 3. Similarly Dryandra sessilis was more common on the fringes and in smaller patches of Unit 4. The centre of the larger patches usually have only a few Marri and Wandoo over a Heath A of Leptospermum erubescens. The low shrub species is also variable dependent on patch size with the important species being Bossiaea ornata, Styphellia tenuifolia, Bossiaea eriocarpa, Hakea lissocarpha and Dryandra fraseri but rarely do they occur together. A small area of Heath (W of T30) is dominated by Leptospermum erubescens and Dryandra armata. The sedges are variable in abundance with Loxocarya fasciculata being the most important. These generally form an Open Low Sedge stratum.

The erosion of the lateritic profile provides three of the units recognised. Unit 1 (E. astringens Low Forest A) appears to occur in very specific areas of eroding breakaway slopes. Only two areas of this unit were found but their presence is not obvious. As in most of the occurrences of this species in the wheatbelt, there are usually very few tree cohorts or understorey species. Those shrub species found were very sparse and included Acacia pulchella, Bossiaea eriocarpa and Hibbertia commutata. Lepidosperma leptostachyum was the most important sedge found. The other two units recognised were dominated by either a mixture of Wandoo and Jarrah or Wandoo alone. Unit 5 (E. marginata-E. Wandoo Low Forest A) occupies the moderately eroded gravelly loamy slopes. It is probably best described as a gradient between Units 2 and 6 in which Jarrah and Wandoo dominate respectively. As far as it has been possible to define the vegetation units it was also necessary to include an area of Jarrah and Wandoo Low Forest A on a broad plain in this unit. The common factor appears to be that both landscape units have moderate levels of loam and perhaps similar drainage/moisture properties. One seemingly unusual occurrence on lateritic upland (in the NW corner of 17759) of a mixture of Wandoo and Jarrah (dominated by the former) was also include in this unit. The reasons for this occurrence is not clear but it seems to be related to the upland being in the process of eroding away. Dryandra sessilis is relatively common in this unit but far less important than its occurrences in Units 2 or 3. Mostly there are

just a few scattered plants or a scrub stratum. There is usually a reasonably well developed low shrub and sedge layer present. This appears to decline in importance as the Wandoo increases. Bossiaea eriocarpa is the most important low shrub together with Hakea lissocarpha, Hibbertia commutata and Acacia pulchella. The sedges include Lepidospermum leptostachyum, Loxocarya fasciculta and (mainly under the Wandoo) Loxocarya cinerea.

The more effectively stripped areas (usually moderately steep sided small gullies with distinct small breakaways) are dominated by Wandoo (E. wandoo Low Forest A - Unit 6). In this area the soils are mainly loamy or clayey with very little lateritic gravel. In places the country rock is exposed. Doleritic rocks are present at Site T17, while quartzitic rocks and gravel are at T38 and T42. The centre of the larger gullies have some alluvium and in these cases there may be some E. rudis (these areas are not actually in the reserve). Marri occurs in some of the gullies while Jarrah rarely. The shrubs are very sparse though clearly there are two strata. Gastrolobium bilobum and Acacia saligna are significant near the centre of these gullies. The lower stratum which can include Bossiaea eriocarpa, Hakea lissocarpha, Acacia pulchella and Hibbertia commutata. Sedges and annual exotic grasses and herbs are very important. Loxocarya cinerea can form a Dense Low Sedge stratum. The annuals were not identified.

The alluvial deposits have several units though only two have been recognised mainly because of the limited extent of the alluvium. The majority of the alluvium in the reserve is in old Quaternary (or Tertiary) drainage lines. These areas are relatively broad, flat and U-shaped rather than the V-shaped recent vallies (Unit 6). The majority of the alluvium is dominated by E. wandoo - Hakea prostrata Low Forest A/Scrub B. Wandoo appears to have invaded the loamy/clayey alluvium as the area has dried out. The Hakea appears to be a relict of wetter times. This species occurs only in small bands within this unit (and in Unit 8). Low shrubs are not common in Unit 7 and Hakea lissocarpha seems to be the most important of them. Sedges are more important with Loxocarya cinerea the main one. Others include L. fasciculata and the

sedgelike Chamaexeros serra and Patersonia occidentalis. Geophytes and annual herbs are probably also significant. The other unit defined is Unit 8 (Melaleuca ? hamulosa Low Scrub A). This unit is only a small area and represents the once wettest and heaviest soil in the reserve. It is noticeably declining in importance but it is not possible to say whether this will continue. Other tall shrubs include Hakea prostrata, H. varia and Acacia saligna. Hypocalymma angustifolia and Acacia pulchella are amongst the few low shrubs present. The sedge stratum can be very significant and is mainly dominated by Isolepis nodosus, particularly in the heavier soils while Conostylis serrulata and Patersonia occidentalis are present on the sandier fringes. Geophytes are represented at least by Tribonanthes ? longipetala. There is an area of an old drainage line which has a loamy soil mixed with lateritic gravel (T24). At this site, the vegetation appears to be a mixture of species from Units 5 and 7, with Eucalyptus decipiens unique to this site. This site was mapped as Unit 5. If there was a larger area of this unit, there may be a case for a separate unit. Another case where a unique vegetation type over a small area was found is at T16. This is a small area of loam which has a dense low herb layer of Loxocarya cinerea. Dryandra sessilis appears to have invaded this small depression which has obviously dried up.

Appendix 3 is a phytosociological table showing the occurrence of the major species in the 8 vegetation units recognised and this will be discussed later.

COMPARISON BETWEEN RESERVES EXAMINED

The major vegetation units (2 to 6) are present in both reserves, however, the lesser units are not. Unit 1 (Mallett) only occurs in 17760, while the old drainage line units (7 and 8) are only in 17759. There may be slight differences between the reserves in the Wandoo Low Forest A (Unit 6) because of the different country rocks present. Reserve 17759, which appears to have more quartzite intrusives, also has more Marri which apparently prefers sandier, better drained areas.

FLORA

A total of 148 native plant species are reported from these two reserves (Appendix 2). Proteaceae was the family with the largest number of species (24) with Leguminosae (20) and Myrtyaceae (18) the next most important. Genera with the largest number of species were Eucalyptus (8), Dryandra (7 -1 doubtful), Hakea (6), Leucopogon (6) and Stylidium (5). Only four species of alien species are recorded but this is a gross underestimate. Jingalup (17759) has 130 and Jingalup South (17760) has 100 of the species recorded. This difference is at least contributed to by the greater collecting activity of other workers in 17759 but it may be real due particularly to the slightly more diverse vegetation in 17759. Both these estimates of richness are clearly below the total as few geophytes and herbs have been collected. There are likely to be quite a few orchids (S.D. Hopper pers. comm.) but only 6 are recorded.

The species composition of the main vegetation types was assessed using a qualitatively constructed phytosociological table (Appendix 3). This was done to help define the vegetation units and establish their floristic integrity. For this exercise 40 key species were selected from which group those used to discriminate between vegetation units were selected. The phytosociological table was partly prepared to highlight the gradient from lateritic uplands (Unit 2 - Jarrah Low Forest A) to clayey drainage depressions (Unit 8 - Melaleuca ? hamulosa Low Scrub A). All but site T16 were included in this analysis.

This data suggests a limited floristic accordance with the proposed gradient. Few species were confined to only one or two units. These are only in minor parts of the gradient. Eucalyptus astringens is confined to Unit 1, Nuytsia floribunda and Franklandia fucifolia to Unit 3, Gastrolobium bilobium to Unit 6 while Hakea prostrata is more or less confined to Unit 7 and Melaleuca ? hamulosa and Isolepis nodosus to Unit 8. The overwhelming impression is that most species occur in at least 3 of the major vegetation units recognised (i.e. Units 2-6). This tends to support the difficulty had in discriminating

between vegetation units.

Rare and Restricted Species

There were no Gazetted Rare species of plants found in either of the Jingalup reserves. This is in general accord with the low abundance of such species in the Jarrah forest. It may also reflect the grazing pressure the areas have received. The only species considered restricted by Rye (1982) (Tetratheca nuda) was recorded by K. Wallace in Reserve 17760. If this is a correct identification, it is a range extension for that species (previously Wooroloo to Canning River) and in that way it negates the classification of "restricted". Marchant and Keighery (1979) list only Lepidospermum leptostachyum as poorly collected.

Other Species

It was not possible to assess the distribution of all other species found, however, a couple of occurrences seem significant. Firstly Eucalyptus astringens is at its south western limit of its distribution and the stands in 17760 would therefore be valuable. E. celastroides is similarly at its SW limit. There are probably a few other species like this as the Kojonup area is near the boundary between the Darling and Avon Botanical Districts. The area is likely to be a significant one for orchids, particularly the Wandoo flats (S.D. Hopper pers. comm. 1985).

CONDITION OF VEGETATION

Much of the Jingalup reserves show evidence of impactive land uses. Besides the gravel pits and rubbish disposal (which are relatively localised) the most obvious evidence is the numerous stumps, mainly of Wandoo. This activity has clearly reduced the height of the forest, much of which would have been over 15 m tall rather than less. The greatest impact of grazing appears to have been in the clayey areas (vegetation units 6, 7 and 8). In these areas the incidence of annual weeds is greatest of all areas of the reserves. It is

probable that the grazing had significant affects on some species, but which species is uncertain. Gastrolobium bilobum appears to have been affected.

The drainage line units (7 and 8) appear to be affected by a reduction in moisture availability. This is attributed to a general decline in rainfall over the last 20 or more years. This general condition of moisture deficiency makes these units vulnerable to perturbations.

MANAGEMENT

The need for more management of the reserves is clear, at least to reduce the current illegal use of the area. The removal of gravel from the south east corner of 17760 was observed to have occurred in recent months. Disposal of rubbish in the reserve has been going on for some time. The latest obvious occurrence is that of sheep carcases in the north east corner of 17760 (coincidentally in the best stand of Mallett on the reserve). There is probably a need for making the local community aware of the damage they are doing to these reserves.

Firebreaks and Full Reduction Burnin

The location of tracks and firebreaks are shown in Figure 3. These show essentially a single firebreak at about the location boundary (approximately 20-50 m in from the edge of the roads). This may be adequate protection if the reserves are burnt every 7-10 years but probably not if parts are to be left unburnt for a long time. Consideration needs to be given for additional breaks (if possible by upgrading old tracks) where the reserves directly bound alienated land (for example as is along the western side of 17760 adjacent to location 7528). Such buffers so created could be burnt frequently (say up to every 5 years) with probably little additional damage to the flora than has already occurred in the past.

A fuel reduction burning programme has been suggested for these reserves. It could be argued that programme to burn the area every say 10 to 15 years will

not affect these reserves any more than has already happened, more thought needs to be given to the need for regeneration and protection. In both cases it is desirable that manageable compartments be created, even at the expense of new internal firebreaks being made. It is suggested that two unburnt cores be established in the first instance, one in each reserve. The one in 17759 should be centred on the wet depression (Units 8 and 7) and take in much of the central portion (including some Unit 2 and 3). This will give this area a chance to show whether it can benefit from fire exclusion for say another 10 years. The area in 17760 should centre on the major hill in the north central part of the reserve and take in much of the Units 3 and 4 in the vicinity and some of the Unit 6 NW of location 5841.

ACKNOWLEDGEMENTS

The work was conducted with the assistance of Ms C. Taylor. Mr K. Wallace provided information incorporated in this report. Dr J. Majer discussed the research which WAIT had conducted in the Kojonup area. Mr H. M. Churchward provided valuable assistance and comment in interpreting the soils and geology of the area. Mr G.J. Keighery (WARC) and members of the Staff of the WA Herbarium were helpful in identifying specimens.

REFERENCES

Beard, J.S. (1979) "Vegetation Survey of Western Australia. The vegetation of the Albany and Mt Barker Areas, Western Australia. Map and Explanatory Memoir. 1:250,000 Series" Vegmap Publications, Perth, 55 pp.

Beard, J.S. (1980) "Vegetation Survey of Western Australia. The vegetation of the Dumbleyung Area, Western Australia. Map and Explanatory Memoir. 1:250,000 Series" Vegmap Publications, Perth.

Beard, J.S. (1981) "Vegetation Survey of Western Australia. Swan 1:1,000,000 Vegetation Series, Explanatory Notes to Sheet 7." University of Western Australian Press, Perth, 222pp.

Christensen, P.E.S. (1980) "The Biology of Bettongia penicellata Gray, 1837, and Macropus eugenii (De Smarest, 1817) in Relation to Fire". Bulletin Forests Department of Western Australia 91, 90pp.

Gibbons, K. (1977) "A report on the flora of the Kojonup reserves" B. Appl. Sci. (Biology) Project report (unpublished). Western Australian Institute of Technology.

Griffin, E.A. (1984) "Vegetation Survey of three Nature Reserves in the Lake Unicup Complex (Lake Unicup, Kulunilup Lake and Yarnup Swamp)". Unpublished report for WA Department of Fisheries and Wildlife, 66pp.

Griffin, E.A. (1985) "Vegetation Survey of Bakers Junction and Millbrook Nature Reserves (Shire of Albany)". Unpublished report for WA Department of Conservation and Land Management 65pp.

Havel, J.J. (1975) "Site Vegetation mapping in the northern Jarrah Forest (Darling Range). 1 - Definition of site-vegetation types". Bulletin 86 Forests Department of Western Australia 115pp.

Majer, J.D. (1980) "Report on a Study of Invertebrates in Relation to the Kojonup Fire Management Plan". Department of Biology Bulletin Number 2 Western Australian Institute of Technology, Perth 22pp.

Marchant, N.G. and Keighery, G.J. (1979) "Poorly collected and presumably rare vascular plants of Western Australia." Kings Park Research Notes No. 5, Perth. 103pp.

Muhling, P.C. and Brakel, A.T. (1985) "Geological Survey of Western Australia. 1:250,000 Geological Series - Explanatory Notes. Mt. Barker - Albany, Western Australia (Sheets SI/50-10, 15)" Geological Survey of W.A., Perth.

Muir, B.G. (1977) "Biological Survey of the Western Australian Wheatbelt. Part2: Vegetation and Habitat of Bendering Reserve". Records of the W.A. Museum Supplement No. 3, Perth. 142pp.

Northcote, K.H., Bettenay, E., McArthur, W.M. and Churchward, H.M. (1967). "Dominant Soils of the Perth- Albany- Esperance area". Atlas of Australian Soils Sheet 5. CSIRO, Melbourne.

Rye, B.L. (1982) "Geographically Restricted Plants of Southern Western Australia". Department of Fisheries and Wildlife, Western Australia, Report 49, 63pp.

Smith, F.G. (1972) "Vegetation Survey of Western Australia. Vegetation Map Pemberton SI50-10 and Irwin Inlet SI50-14." Western Australian Department of Agriculture, Perth. 31pp.

Wilde, S.A. and Walker, I.W. (1984) "Geological Survey of Western Australia. 1:250,000 Geological Series - Explanatory Notes. Pemberton-Irwin Inlet, Western Australia (Sheets SU/50-10; SI/50-14)" Geological Survey of Western Australia, Perth 377pp.

TABLE 1: Monthly Climatic Data for Kojonup

Station Name: KOJONUP POST OFFICE WESTERN AUSTRALIA

Number 010582 Latitude 33 Deg 50 Min S Longitude 117 Deg 9 Min E Elevation 304.8M

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Maximum Temperature (C)													
Mean	29.3	28.8	25.9	21.3	17.7	14.9	14.3	14.5	16.4	19.7	23.4	28.0	21.2
86 Percentile	35.0	35.0	31.8	26.2	21.1	17.2	16.7	17.1	19.5	24.5	28.8	34.0	
14 Percentile	24.1	23.3	20.9	16.7	14.5	12.6	12.1	11.9	13.1	15.5	18.8	22.7	
Daily Minimum Temperature (C)													
Mean	13.4	14.2	12.6	10.3	8.3	7.0	6.0	5.7	6.0	7.7	9.6	12.3	9.4
86 Percentile	16.2	17.4	16.1	14.4	11.7	9.8	8.9	8.8	9.2	11.0	12.9	15.5	
14 Percentile	10.5	10.8	8.9	6.1	4.8	4.0	3.0	2.6	2.6	4.3	6.2	8.8	
Rainfall (mm)													
Mean	12	5	23	33	69	92	89	75	53	44	22	15	542
Median	5	6	13	26	64	85	87	71	50	38	17	10	527
Raindays (No.)													
Mean	3	3	5	8	14	17	19	17	14	12	7	4	123

TABLE 2: List of Vegetation Units Defined and Mapped in Survey

1. Eucalyptus astrin ens Low Forest A

2. Eucalyptus marginata Low Forest A (lateritic upland type)

3. Eucalyptus marginata Low Forest A (sandy slope type)

4. Eucalyptus marginata - Leptospermum erubescens Low Woodland A/Low Heath C

5. Eucalyptus marginata - E. wandoo Low Forest A

6. Eucalyptus wandoo Low Forest A

7. Eucalyptus wandoo - Hakea prostrata Low Forest A/Scrub B

8. Melaleuca ? hamulosa Low Scrub A

TABLE 3: Vegetation Classification Used in Survey
(from Muir 1977, page 11)

FORM/HEIGHT CLASS	CANOPY COVER			
	DENSE 70-100% d	MID-DENSE 30-70% c	SPARSE 10-30% i	VERY SPARSE 2-10% r
T Trees >30m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
T Trees 15-30m	Dense Forest	Forest	Woodland	Open Woodland
TA Trees 5-15m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
TB Trees <5m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
MT Mallee tree form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
MS Mallee shrub form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
S Shrubs >2m	Dense Thicket	Thicket	Scrub	Open Scrub
SA Shrubs 1.5-2.0m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
SB Shrubs 1.0-1.5 m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
SC Shrubs 0.5-1.0m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
SD Shrubs 0.0-0.5m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
P Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
H Hummock Grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
GT Bunch grass >0.5m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
GL Bunch grass <0.5m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
J Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
VT Sedges >0.5m	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
VL Sedges <0.5m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
X Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverwort	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

APPENDIX 1: Description of Vegetation Units in Jingalup Reserves

These units are based on a synthesis of the field observations of sites. Definition is necessarily subjective and influenced by the ability to recognise and map units consistently. The Diagnosis and Code is based on the scheme of Muir (1977) (Table 3). The key to the dominant species use din the code is located at the end of this Appendix.

1) Eucalyptus astringens Low Forest A

Site No: T1

Diagnosis: Low Forest A over Open Dwarf Scrub D

Code: e_1LAc. xSDr

Description:

Stratum 1. Low Forest A entirely of Eucalyptus astringens. Occasional E. marginata intrude at the boundary with the upland and E. wandoo at the lower slopes.

Stratum 2. A very open layer, nominally Open Dwarf Scrub D. The most commonly occurring species included the shrubs Acacia pulchella, Sollya heterophylla, Bossiaea eriocarpa and the sedge Lepidosperma leptostachyum.

Soil: This unit occurs on some breakaway slopes as is typical for Mallett. The soil is mainly a gravelly loam with some duricrust boulders present.

1) Eucalyptus marginata Low Forest A (lateritic upland type)

Site Nos: T2, T3, T8, T15, T18, T33, T40

Diagnosis: Low Forest A over Thicket over Low Heath D over Open Low Sedges

Code: e_3LAc. dSc. bo_2SDc.lVL

Description:

Stratum 1. Eucalyptus marginata Low Forest A rarely with E. wandoo and E. calophylla

Stratum 2. Dryandra sessilis Thicket (to Open Scrub) generally over 2 m tall. Banksia grandis (usually slightly taller) may occur in some areas and even form a distinct Open Low Woodland B.

Stratum 3. Bossiaea ornata is the most consistently occurring low shrub in the Low Heath D (occasionally Low Heath C). Other shrub species of importance are Stypellia tenuifolia, Xanthorrhoea preissii, and Hakea lissocarpha. Except for the Hakea, these species (and some others) are relatively restricted to this gravelly upland unit.

Stratum 4. Lepidospermum leptostachyum is a relatively common sedge which nominally forms a stratum of Open Low Sedges. Other sedges include L. angustatum (more common in sandy areas) and Loxocarya fasciculata.

Soil: The unit is mainly on the intact lateritic upland which has lateritic gravel and duricrust with a grey sandy/loamy matrix.

4. Eucalyptus marginata Low Forest A (sandy slopes type)

Site Nos: T9, T10, T19, T41

Diagnosis: Low Forest A over (discontinuous) Open Low Woodland B over Scrub over Low Heath D over Very Open Sedges.

Code: e_3LAc. bLBr. dSi. bo_1SDc. xVLr

Description:

Stratum 1. Eucalyptus marginata Low Forest A (in places Low Woodland A) with a few E. calophylla.

Stratum 2. Banksia grandis and in places Nuytsia floribunda form an Open Low Woodland B, particularly in the sandier lower slopes where the Jarrah is less dense.

Stratum 3. Dryandra sessilis is often present as an open stratum (Scrub) but is usually absent in the sandier areas.

Stratum 4. Bossiaea eriocarpa is the commonest shrub species of an important Low Heath D which is present, particularly in the sandier areas. Other shrub species important include Calytrix flavescens and Franklandia fucifolia which are relatively confined to this unit and Styphellia tenuifolia which is more widespread.

Stratum 5. In some areas there may be significant sedges. The commonest include Loxocarya fasciculata, Lyginia barbata and Lepidosperma angustatum. Nominally these form Very Open Low Sedges.

Soil: The soil here is generally shallow grey or yellow sand which varys in depth from very shallow (with gravel) on upper part of slopes to (?) deep at the foot.

4. Eucalyptus marginata - Leptospermum erubescens Low Woodland A/Low Heath C

Site Nos: T5, T6, T23, T27, T30, T31, T34.

Diagnosis: Low Woodland A over Scrub over Low Heath C over Dwarf Scrub D over Open Low Sedges.

Description:

Stratum 1. Low Woodland A (occasionally more open) mainly of E. marginata but usually with E. wandoo and E. calophylla in the larger patches.

Stratum 2. Dryandra sessilis may be present as a scrub in smaller patches and usually only fringing the larger patches.

Stratum 3. Leptospermum erubescens can form a Heath A but generally in these reserves where the extent of this unit is low, it is only a Low Heath C. It is essentially the only tall shrub other than D. sessilis in this unit.

Stratum 4. The lower shrub stratum is variable once again because of the limited size of the patches. The important species include Bossiaea ornata, Styphellia tenuifolia, Bossiaea eriocarpa, Hakea lissocarpha and Dryandra fraseri, all of which may be the dominant species in this stratum but they don't all occur together.

Stratum 5. The sedge layer is also variable in abundance with Loxocarya fasciculata and Lepidosperma leptostachyum the most commonly occurring species. Loxocarya cinerea may be dominant in some areas.

Soils: This is usually a sandy soil with varying amounts of lateritic and haemitic gravel. In places the soil appears to be shallow, overlaying gravel or duricrust. It usually occurs on slight slopes in the lower part of the landscape and along the sandier parts of some drainage lines.

Eucalyptus marginata - E. wandoo Low Forest A

Site Nos.: T4, T7, T11, T12, T13, T14, T20, T22, ?T24, T32, ?T35, T37, T39.

Diagnosis: Low Forest A over (occasionally) Open Scrub over Low Heath D over Open Low Sedges.

Code: e_3 e_4 LAc. dSr. bo_1 SDc. xVLi

Description:

Stratum 1. Eucalyptus marginata and E. wandoo Low Forest A occurs in a range of proportions of these species with E. marginata dominant on the upper slopes and E. wandoo on the lower. Some E. calophylla may be present.

Stratum 2. Dryandra sessilis is often present in this unit but not more than as a Scrub.

Stratum 3. Bossiaea eriocarpa is the most important low shrub species but not always so. Hakea lissocarpha, Hibbertia commutata and Acacia pulchella are also common. Brachysema praemorsa and Dryandra nivea occur principally in this unit.

Stratum 4. Lepidosperma leptostachyum and Loxocarya fasciculata are commonly present but not abundant. Loxocarya cinerea may occur in some areas.

Soils: The soil in this unit is generally a sandy or loamy gravel. This unit occurs mainly on the moderately eroded slopes but also on some broad sandy plains in the west of these reserves.

Comments: The definition of this unit had to be a very broad one since there is a range of landscapes included, but the floristic information collected did not justify a subdivision along landscape lines. The unit

also includes a gradient between Unit 2 and Unit 6.

6. Eucalyptus wandoo Low Forest A

Site Nos: T17, T21, T38, T42.

Diagnosis: Low Forest A over (occasional) Open Scrub over Dwarf Scrub D over Low Sedges

Code: e_4LAc. gSr. xSDi. lo_1VLc

Description:

Stratum 1. Eucalyptus wandoo Low Forest A with a few E. calophylla and rare E. marginata. E. rudis occurs in the centre of the principal gullys.

Stratum 2. Occasionally Gastrolobium bilobum and Acacia saligna form an Open Scrub. It appears that this stratum has probably been significantly reduced by the previous grazing.

Stratum 3. The low shrub stratum is also very sparse. The most common species included Hakea lissocarpha, Bossiaea eriocarpa, Acacia pulchella and Hibbertia commutata.

Stratum 4. Loxocarya cinerea is the dominant species beneath the E. wandoo and in places it can form a Dense Low Sedge layer.

Soil: Red to grey loamy, gravelly clays are important here, but quite variable. There are patches of country rock exposed (dolerite and quartzite) which gives testament to the origin of this unit. Topographically, this unit is the incised upper gullies.

Comments: In this unit there is also a very large amount of annual exotic grasses and weeds. These have not been sampled.

7. Eucalyptus wandoo - Hakea prostrata Low Forest A/Scrub B

Site Nos: T26, T28

Diagnosis: Low Forest A over (patchy) Scrub B over Open Dwarf Scrub D over Open Low Sedges.

Code: e_4LAc. h_2SBi. h_1SDr. lo_1VLi.

Description:

Stratum 1. Eucalyptus wandoo Low Forest A dominates the majority of this unit but there may be a few E. calophylla along the sandier margins.

Stratum 2. Hakea prostrata is a patchy stratum which may attain the status of Scrub A.

Stratum 3. Low shrubs are not common. Hakea lissocarpha is the most important of those present.

Stratum 4. Low Sedges are quite significant and this stratum is dominated by Loxocarya cinerea. Also found were L. fasciculata, Chamaexeros serra and Patersonia occidentalis.

Soil: The soil appears to be reasonably heavy. The few sites examined had a grey sandy loam on the surface. This area is the centre of old drainage lines and the soil mainly alluvium.

Comments: It seems that this unit probably has significant numbers of geophytes and therophytes which were not obvious at the time of sampling.

Melaleuca ? hamulosa Low Scrub A

Site Nos: T25, T36

Diagnosis: Low Scrub A over Dwarf Scrub D over Low Sedges

Code: mSAc. xSDi. iVLc

Description:

Stratum 1. Melaleuca ? hamulosa occurs as a Low Scrub A in a couple of places but probably once was a Heath A or Thicket. This change may have resulted from the grazing or the general drying out of the area. Acacia saligna, Hakea prostrata and H. varia are also present.

Stratum 2. The Dwarf Scrub D layer which includes Hypocalymma angustifolia and Acacia pulchella was probably once more abundant.

Stratum 3. Isolepis nodosus is very important, particularly in the heavier clays of the centre of these old drainage depressions. Here it is accompanied by the geophyte Tribonanthes ? longipetala. On the sandier margins, Conostylis serrulata and Patersonia occidentalis are common.

Soils: The soils are mainly heavy, grey sandy clays.

Species Key to Floristic Component of Code

b. - Banksia grandis

bo_1 - Bossiaea eriocarpa

bo_2 - Bossiaea ornata

d - Dryandra sessilis

e_1 - Eucalyptus astringens

e_2 - Eucalyptus calophylla

e_3 - Eucalyptus marginata

e_4 - Eucalyptus wandoo

g - Gastrolobium bilobum

h_1 - Hakea lissocarpha

h_2 - Hakea prostrata

i - Isolepis nodosus

l - Lepidosperma leptostachyum

le - Leptospermum erubescens

lo_1 - Loxocary cinerea

lo_2 - Loxocarya fasciculata

m - Melaleuca hamulosa

x - mixed

PENDIX 2 Combined Species List for Jingalup Reserves.

)ecies listed in alphabetical order. Nomenclature after Green (in prep.).)me species were unidentifiable to species level because the time of year in ıich the survey had been conducted meant that inadequate material was)llected in some cases. Most specimens are represented by specimens provided. ccurrences in each reserve are noted by +. Other observations were made as er the following code.:

1. K. Wallace
2. A Pearce
3. WAIT (per R. Powell and K. Newbey)

(Codings in brackets seem unlikely to be correct identifications)
* indicates alien species

Species	Jingalup	Jingalup South
Acacia nervosa DC	+	+
Acacia pulchella R.Br.	+	+
Acacia saligna (Labill.) H.L.Wendl	+	+
Acacia willdenowiana H.L. Wendl	+	+
Allocasuarina ? huegeliana (Miq.) L. Johnson	+	–
Allocasuarina humilis (Otto & Dietr) L. Johnston	+	+
Amphipogon ? debilis R. Br.	+	+
Anigozanthos sp. indet	+	+
Arctotheca calendula (L.) Levyns	+	+
Astroloma ciliatum (Lindley) Druce	+	+
Astroloma compactum R.Br.	+	+
Astroloma epacridis (DC.) Druce	+	+
Astroloma pallidum R.Br.	3	–
Baeckea camphorosmae Endl.	+	+
Banksia grandis Willd.	+	+
Billardiera ? variifolia DC.	–	+
Boronia spathulata Lindley	+	+
Borya nitida Labill.	+	–

Bossiaea eriocarpa Benth.	+	+
Bossiaea linophylla R.Br.	-	+
Bossiaea ornata (Lindley) Benth.	+	+
Brachysema praemorsa Meissner	+	+
*Briza maxima L.	+	-
*Briza minor L.	+	-
Burtonia conferta DC.	+	-
Caladenia filamentosa R.Br. var denticulata	+	-
Caladenia flava R.Br.	+	-
Caladenia gemmata Lindley	+	-
Calothamnus quadrifidus R.Br.	+	-
Calothamnus sanguineus Labill.	+	?1
Calytrix ? brachyphylla (Turcz.) Benth.	+	-
Calytrix flavescens Cunn.	+	+
Chamaescilla corymbosa (R.Br.) F. Muell.	3	-
Chamaexeros serra (Endl.) Benth.	+	-
Comesperma calymega Labill.	-	1
Conospermum caeruleum R.Br.	+	+
Conostylis serrulata R.Br.	+	+
Conostylis setigera R.Br.	+	+
Daviesia longifolia Benth.	+	+
Daviesia ? preissii Meissner	+	+
Dianella revoluta R.Br.	+	+
Dillwynia cinerascens R.Br.	1	-
Diuris longifolia R.Br.	1	-
Drosera erythrorrhiza Lindley	1	-
Drosera gigantea Lindley	1	-
Drosera macrantha Endl.	1	-
Drosera spp.	+	+
Dryandra arctotidis R.Br.	(3)	-
Dryandra armata R.Br.	+	-
Dryandra bipinnatifida R.Br.	+	+
Dryandra fraseri R.Br.	+	+
Dryandra nivea (Labill.) R.Br.	+	+
Dryandra pteridifolia R.Br.	?3	-
Dryandra sessilis (Knight) Domin	+	+

Eucalyptus astringens (Maiden) Maiden	–	+
Eucalyptus calophylla Lindley	+	+
Eucalyptus celastroides Turcz. spp. virella Brooker	+	1
Eucalyptus decipiens Endl.	+	–
Eucalyptus marginata Donn ex Smith	+	+
Eucalyptus rudis Endl.	–	–
Eucalyptus uncinata Turcz.	–	+
Eucalyptus wandoo Blakely	+	+
Franklandia fucifolia R.Br.	+	+
Gastrolobium bilobum R.B.r	+	+
Gastrolobium calycinum Benth.	+	+
Gompholobium ? aristatum Benth.	+	+
Gompholobium ? captitatum A. Cunn.	+	+
Gompholobium ? knightianum Lindley	+	+
Grevillea sp. indet.	–	+
Hakea lissocarpha R.Br.	+	+
Hakea prostrata R.Br.	+	–
Hakea ruscifolia Labill.	+	+
Hakea trifurcata (Smith) R.Br.	–	1
Hakea undulata R.Br.	+	+
Hakea varia R.Br.	+	–
Hardenbergia comptoniana (Andrews) Benth.	3	–
Helipterum manglesii (Lindley) F. Muell.	1	–
Hemiandra pungens R.Br.	+	+
Hibbertia ? amplexicaulis Stendl.	+	+
Hibbertia hypericoides (DC.) Benth	+	+
Hibbertia ? commutata Stendel	+	+
Hibbertia rupicola	+	+
Hypocalymma angustifolium Endl.	+	+
Isolepis nodosa (Rottb.) R.Br.	+	–
Isotropis cuneifolia (Smith) Benth.	1	–
Jacksonia ? horrida DC.	+	+
Kennedia sp.	–	1
Laxmannia ? sessiliflora Decne.	+	+
Lepidosperma angustatum R.Br.	+	+
Lepidosperma leptostachyum Benth.	+	+

Leptomeria ? pauciflorum R.Br.	+	+
Leptomeria squarrulosa R.Br.	+	+
Leptospermum erubescens Schauer	+	+
Leptospermum roei Benth	(3)	–
Leucopogon australis R.Br.	3	–
Leucopogon capitellatus DC	+	+
Leucopogon conostephioides DC.	+	–
Leucopogon oxycedrus Sander	+	–
Leucopogon propinquus R.Br.	+	+
Leucopogon ? obovatus (Labill.) R.Br.	+	–
Logania serpyllifolia R.Br.	–	3
Lomandra micrantha (Endl.) Ewart	+	+
Lomandra rupestris (Endl.) Ewart	+	+
Lomandra sericea (Endl.) Ewart	+	+
Loxocarya cinerea R.Br.	+	+
Loxocarya fasciculata (R.Br.) Benth.	+	+
Loxocarya flexuosa (R.Br.) Benth.	3	–
Lyginia barbata R.Br.	+	+
Macrozamia riedlei (Fischer ex Gaudich.) C. Gardner	+	+
Melaleuca ? hamulosa Turcz.	+	–
Mesomelaena stygia (R.Br.) Nees	+	+
Neurachne alopecuroidea R.Br.	+	+
Nuytsia floribunda (Labill.) R.Br. ex Fenzl.	+	+
Patersonia juncea Lindley	+	–
Patersonia occidentalis R.Br.	+	–
Patersonia pygmaea Lindley	+	–
Pericalymma ellipticum (Endl.) Schauer	3	–
Persoonia elliptica R.Br.	–	+
Persoonia longifolia R.Br.	–	+
Petrophile media R.Br.	–	+
Petrophile serruriae R.Br.	+	–
Phyllanthus calycinus Labill.	+	+
Pimelea rosea R.Br.	3	–
Pimelea sp.	–	1
Polypompholyx multifida (R.Br.) F. Muell.	1	–
Pterostylis recurva Benth.	1	–

Pultenea ericifolia Benth.	+	+
Restio megalotheca F. Muell.	+	+
*Romulaea rosea (L.) Ecklon	1	–
Scaevola striata R.Br.	1	1
Sollya heterophylla Lindley	–	+
Sowerbaea laxiflora Lindley	1	–
Stackhousia pubescens A.Rich.	?1	–
Stipa tricophylla Benth.	–	3
Stylidium affine Sonder	1	–
Stylidium brunonianum Benth. ssp brunonianum	+	+
Stylidium calcaratum R.Br.	1	–
Stylidium piliferum R.Br.	+	+
Stylidium schoenoides DC	+	+
Stypandra imbricata R.Br.	1	–
Styphelia tenuifolia Lindley	+	+
Synaphea petiolaris R.Br.	+	+
Synaphea reticulata (Smith) C. Gardner	+	–
Tetratheca nuda Lindley	–	1
Tetraria octandra (Nees) Kuek.	+	+
Thelymitra antennifera (Lindley) J.D. Hook	1	–
Thysanotus patersonii R.Br.	+	+
Trachymena pilosa Smith	1	–
Tribonanthes ? longipetala Lindley	+	–
Trymalium ledifolium Fenzl	+	+
Viminaria juncea (Schrader & Wendl.) Hoffsagg.	3	–
Waitzia paniculata (Steetz) F. Muell. ex Benth.	+	+
Wurmbea dioica (R.Br.) F.Muell. ssp alba T.D. McFarlane	1	–
Xanthorrhoea preissii Endl.	+	+

APPENDIX 3 Phytosociological Table for Vegetation Units recognised at Jingalup and Jingalup South Nature Reserves using 40 Key Species

VEGETATION UNITS

1. Eucalyptus astringens Low Forest A
2. Eucalyptus marginata Low Forest A (lateritic upland type)
3. Eucalyptus marginata Low Forest A (sandy slope type)
4. Eucalyptus marginata - Leptospermum erubescens
   Low Woodland A/Low Heath C
5. Eucalyptus marginata - E. wandoo
   Low Forest A
6. Eucalyptus wandoo Low Forest A
7. Eucalyptus wandoo - Hakea prostrata
   Low Forest A/Scrub B
8. Melaleuca ? hamulosa Low Scrub

Species Abundance Codes

- not found in unit
1 rarely present
2 often present
3 usually present
4 usually abundant

	1	2	3	4	5	6	7	8
Eucalyptus astringens	4	-	-	-	-	-	-	-
Petrophile serruriae	-	2	1	1	-	-	-	-
Styphellia tenuifolia	-	4	3	2	2	-	-	-
Xanthorrhoea preissii	-	3	1	1	1	-	-	-
Leucopogon propinquus	-	1	-	1	-	-	-	-
Allocasuarina humilis	-	1	-	1	-	-	-	-
Pultenara ericifolia	-	2	-	1	1	-	-	-
Nuytsia floribunda	-	-	3	-	-	-	-	-
Franklandia fucifolia	-	-	2	-	-	-	-	-

Calytrix flavescens	-	1	3	1	1	-	-	-
Lepidosperma angustatum	-	1	2	1	1	-	-	-
Banksia grandis	-	2	3	1	1	1	-	-
Bossiaea ornata	-	4	-	2	2	1	-	-
Dryandra sessilis	-	4	4	4	3	1	-	-
Eucalyptus marginata	-	4	4	4	4	1	-	-
Lepidosperma leptostachyum	1	4	1	3	3	1	-	-
Loxocarya fasciculata	-	3	3	3	3	-	1	-
Trymalium ledifolium	-	2	1	-	1	1	-	-
Bossiaea eriocephala	1	2	4	3	4	3	-	-
Hibbertia commutata	1	3	1	2	3	2	-	-
Astroloma epacridis	-	1	-	3	2	-	-	-
Baeckea camphorosmae	-	-	1	1	1	-	-	-
Dryandra nivea	-	1	-	1	2	-	-	-
Leptopspermum erubescens	-	-	1	4	-	1	-	-
Leucopogon capitellatus	-	1	-	2	1	1	-	-
Brachysema praemorsa	-	1	-	-	2	1	-	-
Dryandra fraseri	-	-	-	2	1	-	-	-
Hakea lissocarpha	-	3	1	3	3	3	3	1
Acacia pulchella	1	1	1	2	3	1	-	1
Eucalyptus decipiens	-	-	-	-	1	-	-	-
Hypocalymma angustifolia	-	-	1	-	1	-	-	1
Eucalyptus wandoo	-	2	-	3	4	4	4	1
Eucalyptus calophylla	-	-	1	3	3	3	4	1
Loxocarya cinerea	-	-	-	1	2	4	4	-
Gastrolobium bilobum	-	-	-	-	-	2	-	-
Acacia saligna	-	-	-	-	-	2	-	1
Hakea prostrata	-	-	-	-	-	-	4	1
Melaleuca ? hamulosa	-	-	-	-	1	-	1	4
Isolepis nodosus	-	-	-	-	-	-	1	4
Hakea varia	-	-	-	-	-	-	-	1

Vegetation Types Summary

Reserve 17759

* Type 2 - Jarrah dom Forest A (flat uplands) = 190 ha = 45%
* Type 3 - Jarrah ✓ ✓ ✓ (sandy slopes) = 9.5 ha = 2%
⊗ ✓ 5 - Jarrah Wandoo - dom Forest A = 176 ha = 42%
⊗ ✓ 6 - Wandoo dom Forest A = 31.5 ha = 7.5%
⊗ ✓ 7 - Wandoo (Hakea Prostrata) dom Forest A = 13.5 ha = 3%
✓ 8 - Melaleuca? hamulosa dom Scrub A = 2 ha = 0.5%

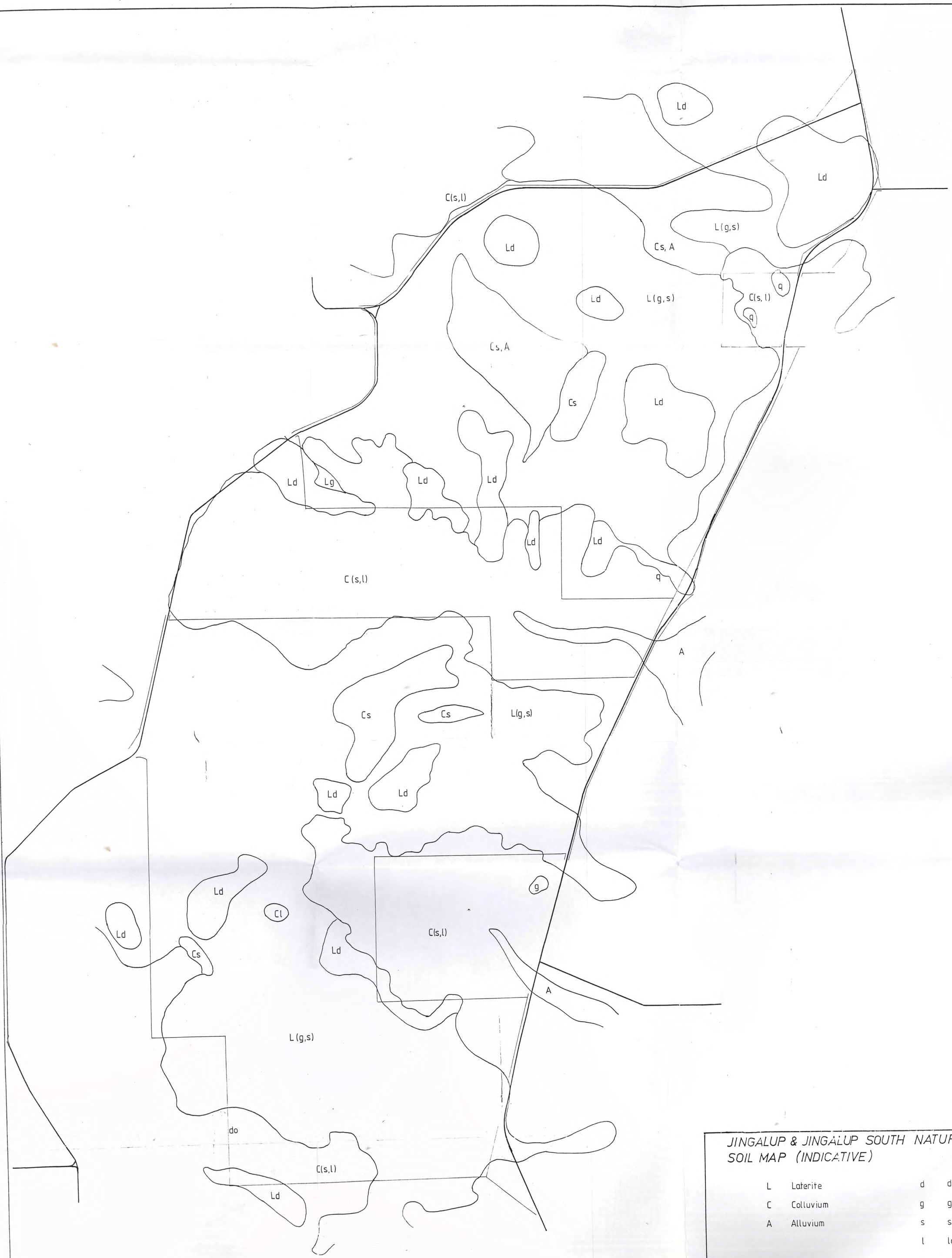
⊗ % of Wandoo dom Types = 52.5%
* % of Jarrah dom Types = 47%
% of others = 0.5%

Reserve 17760

Type 1 - Mallet dom Forest A = 2 ha = 0.5%
* ✓ 2 - Jarrah dom Forest A (flat uplands) = 308 ha = 56%
* ✓ 3 - Jarrah dom Forest A (sandy) = 22.5 ha = 4%
* ✓ 4 - Jarrah Leptospermum scrub/ Wood/Heath = 3 ha = 0.5%
⊗ ✓ 5 - Jarrah Wandoo dom Forest A = 144 ha = 26%
⊗ ✓ 6 - Wandoo dom Forest A = 71 ha = 13%

⊗ % of Wandoo dom types = 39%
* % of Jarrah dom types = 60.5%
% of others (Mallet) = 0.5%

These are rough approximations only



JINGALUP & JINGALUP SOUTH NATURE RESERVES
SOIL MAP (INDICATIVE)

L	Laterite	d	duricrust
C	Colluvium	g	gravel
A	Alluvium	s	sand
		l	loam
		q	quartzite
		do	dolerite
		g	granite

0 — 1.0
km

E.A. GRIFFIN AND ASSOCIATES

FIGURE 2

JINGALUP & JINGALUP SOUTH NATURE RESERVES
CONTOUR MAP AND SAMPLE SITES

-300- CONTOUR (m. amsl)

FORMED ROAD

TRACKS - MAJOR

" - INTER

" - MINOR

DISTURBANCES

23 SAMPLE SITES

0 1.0

km

E.A. GRIFFIN AND ASSOCIATES

FIGURE 3

JINGALUP & JINGALUP SOUTH NATURE RESERVES VEGETATION MAP

VEGETATION UNITS (See Appendix 1)

1 – Mallett Low Forest A

2 – Jarrah-Marri Low Forest A (laterite upland type)

3 – Jarrah-Marri Low Forest A (sandy slope type)

4 – Jarrah – Leptospermum erubescens Low woodland / Low Heathland C

5 – Jarrah – Wandoo Low Forest A

6 – Wandoo Low Forest A

7 – Wandoo - Hakea prostrate low forest A / Scrub B

8 – Melaleuca ? hamulosa Low Scrub A

0 1.0
km

E.A. GRIFFIN AND ASSOCIATES

FIGURE 5