HAWKINS ROAD BUSHLAND, JANDABUP/GNANGARA

Boundary Definition: protected area/bushland (part taken to cadastre) boundary (Areas of bushland within the boundaries of the Site are not accurately mapped.)

SECTION 1: LOCATION INFORMATION

Bush Forever Site no. 326 **Area (ha):** bushland 313.9
Map no. 29 **Map sheet series ref. no.** 2034–I SW, 2034–II NW
Other Names: East of Lake Jandabup, part Submission Area 298, part of proposed Gnangara Park
Local Authorities (Suburb): Shire of Wanneroo (Jandabup, Gnangara)
Includes CALM Managed Land: State Forest 65

SECTION 2: REGIONAL INFORMATION

LANDFORMS AND SOILS
Bassendean Dunes
Bassendean Sands (Qpb: S8)
Bassendean Dunes/Pinjarra Plain
Bassendean Sands over Guildford Formation (Qpb/Qpa: S10)
Wetlands (within the Bassendean Dunes/Pinjarra Plain)
Holocene Swamp Deposits (Qhw: Cps)

VEGETATION AND FLORA
Vegetation Complexes
Bassendean Dunes
Bassendean Complex — North
Bassendean Complex — Central and South (most northern occurrence)
Bassendean Complex — North Transition
Wetlands
Pinjar Complex

Floristic Community Types *not sampled, types inferred
Supergroup 2: Seasonal Wetlands
*4 *Melaleuca preissiana* damplands
*14 Deeper wetlands on sandy soils
Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau
23a Central *Banksia attenuata — B. menziesii* woodlands
*23b Northern *Banksia attenuata — B. menziesii* woodlands

REGIONAL WETLANDS
Wetland Types: dampland
Natural Wetland Groups
Bassendean Dunes
Gnangara (B.2)
Jandakot (B.3)
Wetland Management Objectives: Conservation (9.9ha), Multiple Use
Swan Coastal Plain Lakes EPP: none identified

THREATENED ECOLOGICAL COMMUNITIES
Not assessed, Data Deficient (floristic community type 14)

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: vegetated wetland, vegetated uplands
Vegetation and Flora: limited survey (Trudgen 1993a; part Site — Gibson *et al.* 1994 (Wirr 02), Trudgen 1995)
Structural Units: mapping (Trudgen 1993a)
Uplands: *Banksia attenuata*, *B. menziesii*, *Eucalyptus todtiana* and *Allocasuarina fraseriana* Low Woodland; *Banksia attenuata* and *B. menziesii* Low Open Forest; *Banksia attenuata* and *B. ilicifolia* Low Woodland; *Adenanthos cygnorum* Tall Open Shrubland; Low Shrublands to Open Heaths dominated by *Stirlingia latifolia, Leucopogon conostephioides*, *Acacia pulchella, Conospermum stoechadis*, *Hibbertia hypericoides*, *Calytrix fraseri* and *Xanthorrhoea preissii* and combinations of these
Wetlands: *Eucalyptus rudis* Woodland; *Melaleuca preissiana* and *Banksia ilicifolia* Low Woodland to Open Forest; Mixed Tall Shrubland; *Astartea* aff. *fascicularis* Open Heath to Closed Tall Scrub; *Pultenaea reticulata* Open Scrub, *Pericalymma ellipticum* Shrubland; *Hypocalymma angustifolium* Low Open Heath; *Cyathochaeta avenacea* Sedgeland

Scattered Native Plants: not assessed
Vegetation Condition: >30% Excellent to Pristine, <40% Very Good to Good and <30% Degraded, with areas of severe localised disturbance (mapping Trudgen 1993a)
Total Flora: 96 native taxa (part Site — Trudgen 1995) (estimated >50% expected flora)
Significant Flora: *Verticordia nitens* (Trudgen 1995)

Fauna: not known
Linkage: adjacent native vegetation to the south and west; part of a regionally significant fragmented bushland/wetland linkage (Part A, Map 7)
Other Special Attributes: recommended for protection in study of City of Wanneroo bushland (Trudgen 1996); part Site included in Gnangara Park proposal (Bailey 1997)

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Not listed

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

Criteria: Representation of ecological communities, General criteria for the protection of wetland, streamline and estuarine fringing vegetation and coastal vegetation
Recommendation: Part A: Site with Some Existing Protection; the existing care, control and management intent of CALM managed land is endorsed (Proposed 'Gnangara Park' - Cabinet 1996). Part B: Rural Complementary Mechanism (see Table 3, Volume 1).

HAWKINS ROAD BUSHLAND, JANDABUP/GNANGARA

Boundary Definition: protected area/bushland (part taken to cadastre) boundary (Areas of bushland within the boundaries of the Bushplan Site are not accurately mapped.)

SECTION 1: CADASTRAL INFORMATION

(Lots, locations and derived information to be updated in the public submission period)

Bushplan Site no. 326 **Map no.** 33, 39 **Map sheet series ref. no.** 2034–I SW, 2034–II NW

Other Names
East of Lake Jandabup, part Submission Area 298

Area (ha): total 334.5; bushland 313.9

Local Authorities (Suburb)
Shire of Wanneroo (Jandabup, Gnangara)

Zoning
MRS: State Forests, Rural, Parks and Recreation
TPS: Rural, Landscape

Ownership Categories
Local Government, Private (including commercial organisation), State Government

Lot/Location/Reserve numbers (Purpose), Street name
1, 9, 11, 17, 1577 Sydney Rd; 1534 Wirrega Rd; 7 Joyce Rd; 2, 3, 4, 5, 6, 8, 10, 12, 13, 14, 16, 19, 20, 22 Pine Crest Wy; 7, 65, 1792 street not identified

CALM Managed Land

State Forest 65

SECTION 2: REGIONAL INFORMATION

LANDFORMS AND SOILS

Bassendean Dunes
Bassendean Sands (Qpb: S8)

Bassendean Dunes/Pinjarra Plain
Bassendean Sands over Guildford Formation (Qpb/Qpa:S10)

Wetlands (within the Bassendean Dunes/Pinjarra Plain)
Holocene Swamp Deposits (Qhw: Cps)

VEGETATION AND FLORA

Vegetation Complexes

Bassendean Dunes
Bassendean Complex — North
Bassendean Complex — Central and South (most northern occurrence)
Bassendean Complex — North Transition

Wetlands
Pinjar Complex

Floristic Community Types *not sampled, type inferred

Supergroup 2: Seasonal Wetlands
*4 *Melaleuca preissiana* damplands
*14 Deeper wetlands on sandy soils

Supergroup 3: Uplands centred on Bassendean Dunes and Dandaragan Plateau
23a Central *Banksia attenuata* — *B. menziesii* woodlands
*23b Northern *Banksia attenuata* — *B. menziesii* woodlands

REGIONAL WETLANDS

Wetland Types: dampland

Natural Wetland Groups

Bassendean Dunes
Gnangara (B.2)
Jandakot (B.3)

Wetland Management Objectives: Conservation (9.9ha), Multiple Use

Swan Coastal Plain Lakes EPP: none identified

THREATENED ECOLOGICAL COMMUNITIES

Not assessed, Data Deficient (floristic community type 14)

SECTION 3: SPECIFIC SITE DETAIL

Landscape Features: vegetated wetland, vegetated uplands

Vegetation and Flora: limited survey (Trudgen 1993a; part Bushplan Site — Gibson *et al.* 1994 (Wirr 02), Trudgen 1995)

Structural Units: mapping (Trudgen 1993a)

Uplands: *Banksia attenuata*, *B. menziesii*, *Eucalyptus todtiana* and *Allocasuarina fraseriana* Low Woodland; *Banksia attenuata* and *B. menziesii* Low Open Forest; *Banksia attenuata* and *B. ilicifolia* Low Woodland; *Adenanthos cygnorum* Tall Open Shrubland; Low Shrublands to Open Heaths dominated by *Stirlingia latifolia*, *Leucopogon conostephioides*, *Acacia pulchella*, *Conospermum stoechadis*, *Hibbertia hypericoides*, *Calytrix fraseri* and *Xanthorrhoea preissii* and combinations of these

Wetlands: *Eucalyptus rudis* Woodland; *Melaleuca preissiana* and *Banksia ilicifolia* Low Woodland to Open Forest; Mixed Tall Shrubland; *Astartea* aff. *fascicularis* Open Heath to Closed Tall Scrub; *Pultenaea reticulata* Open Scrub, *Pericalymma ellipticum* Shrubland; *Hypocalymma angustifolium* Low Open Heath; *Cyathochaeta avenacea* Sedgeland

Scattered Native Plants: not assessed

Vegetation Condition: mapping (Trudgen 1993a) >30% Excellent to Pristine, <40% Very Good to Good and <30% Degraded, with areas of severe localised disturbance

Total Flora: 96 native taxa (estimated >50% expected flora) (part Bushplan Site — Trudgen 1995)

Significant Flora: *Verticordia nitens* (Trudgen 1995)

Fauna: no known information

Linkage: adjacent native vegetation to the south and west; part of a regionally significant fragmented bushland/wetland linkage (Volume 2A, Map 8)

Other Special Attributes: recommended for protection in study of City of Wanneroo bushland (Trudgen 1996); part Bushplan Site included in Gnangara Park proposal (Bailey 1997)

SECTION 4: INTERNATIONAL AND NATIONAL SIGNIFICANCE

Not listed

SECTION 5: SELECTION CRITERIA AND RECOMMENDATIONS

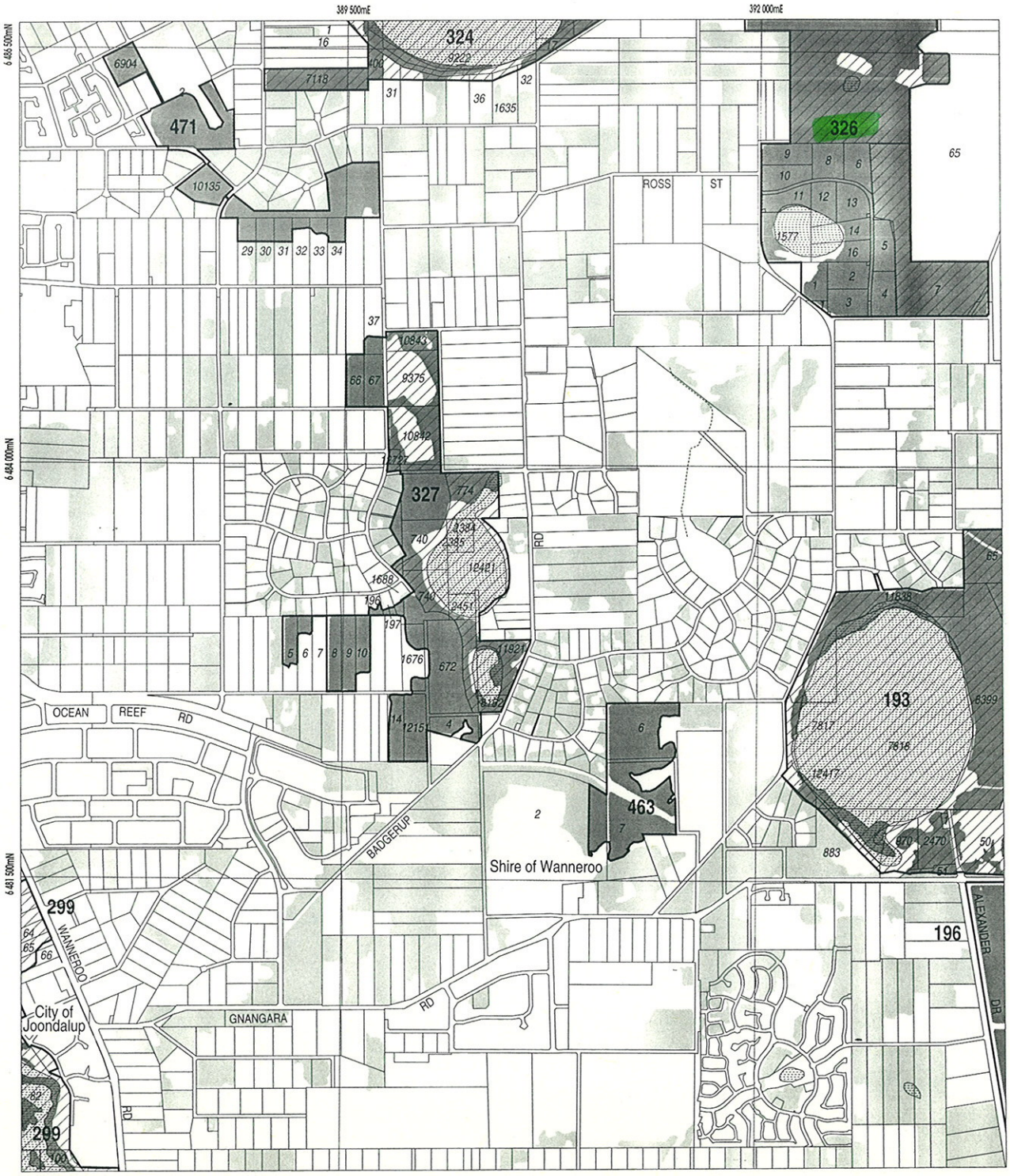
Criteria: Representation of ecological communities, General criteria for the protection of wetland, streamline and estuarine fringing and coastal vegetation

Opportunities and/or Constraints

Opportunities: Bushplan Site/part Bushplan Site subject to Gnangara Mound Crown Land EPP; location of conservation category wetlands; under MRS Parks and Recreation Reservation and TPS Landscape Zoning

Constraints: private land; under General Mineral Resource Area (sand)

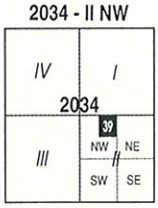
Recommendation: The existing care, control and management of CALM managed area of this Bushplan Site is endorsed. Part of this site lies within the proposed 'Gnangara Park' (concept announced by Cabinet in 1996) within which areas of remnant native vegetation, such as this Bushplan Site, should be managed in the future to retain and enhance their conservation values. The most appropriate mechanism for the protection of the remainder of this Bushplan Site to be considered through the public comment period in consultation with the land owner(s).



LEGEND

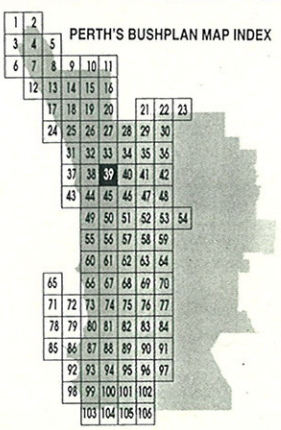
- **472** — Bushplan Sites With Regionally Significant Bushland
- Other Native Vegetation
- Conservation Category Wetlands
- Bushplan Sites With Some Existing Protection
- *696* — Lot Number, Location Number
- Channel Wetlands
- Local Government Boundary

2034 - II NW



1 : 25 000 AMG Reference Grid showing Perth's Bushplan Map Sheet Breakdown

PERTH'S BUSHPLAN MAP INDEX



N

SCALE

0 500 1000

Metres

Produced by Project Mapping Section
Land Information Branch, Ministry for Planning, Perth W.A. November 1998

ntw-map11//environ/bushplan//bushv2_39.dgn

Cadastral Data supplied by Department of Land Administration, W.A.

Wetlands Data supplied by Water and Rivers Commission

Native Vegetation Extent for Study Area supplied by Agriculture Western Australia

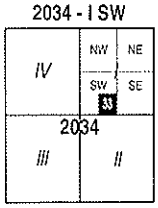
Bushplan Site Map

Map 39

LEGEND

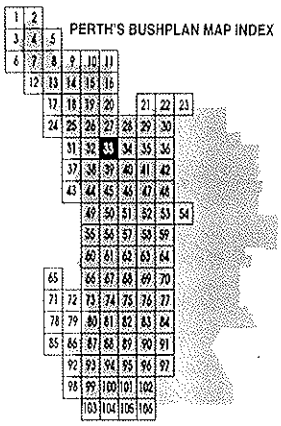
- 472 — Bushplan Sites With Regionally Significant Bushland
- Other Native Vegetation
- Conservation Category Wetlands
- Bushplan Sites With Some Existing Protection
- 696 — Lot Number, Location Number
- Channel Wetlands
- Local Government Boundary

2034 - I SW



1 : 25 000 AMG Reference Grid showing Perth's Bushplan Map Sheet Breakdown

PERTH'S BUSHPLAN MAP INDEX



N

SCALE

0 500 1000

Metres

Produced by Project Mapping Section
Land Information Branch, Ministry for Planning, Perth W.A. November 1998

ntw-map11//environ/bushplan//bushv2_33.dgn

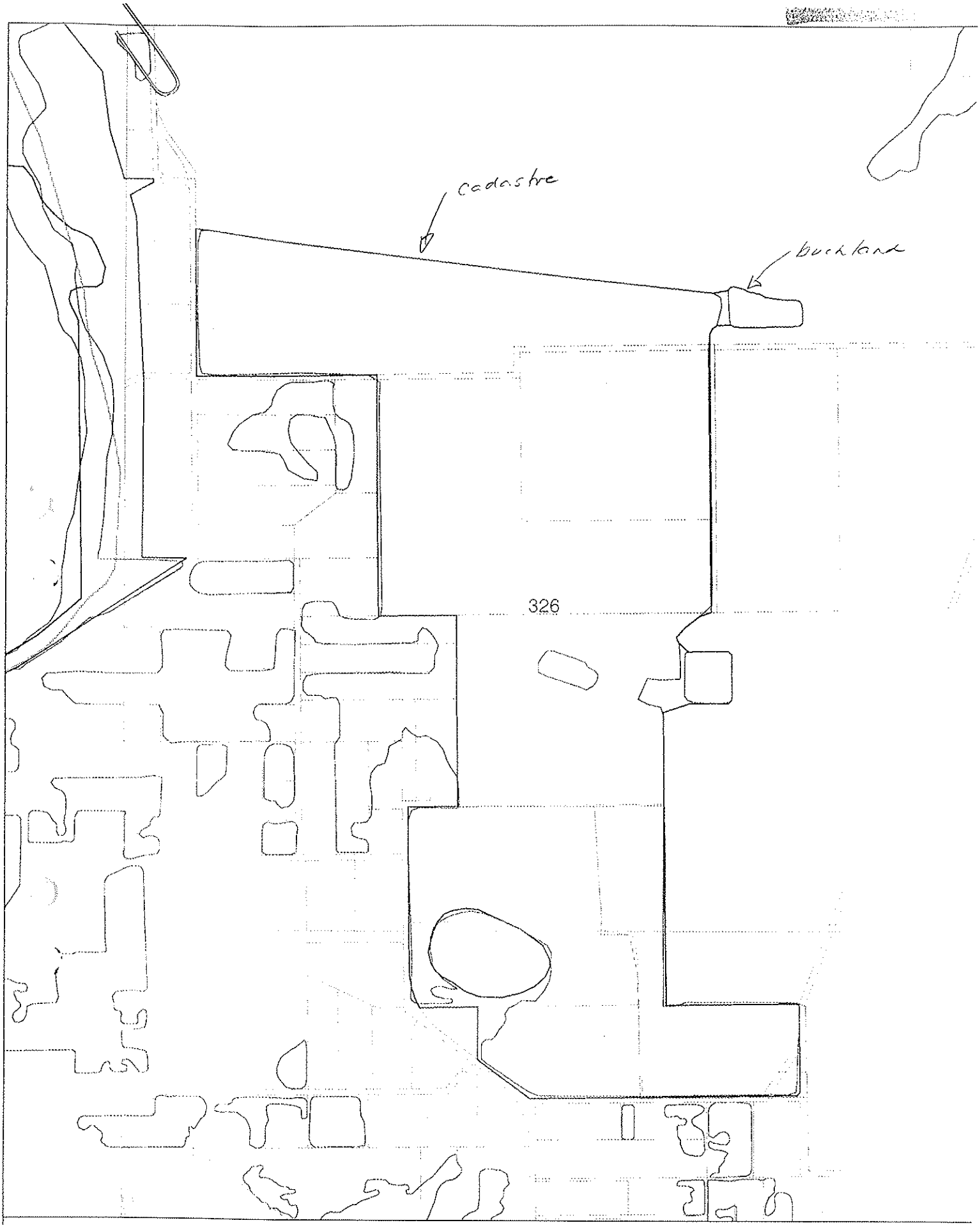
Cadastral Data supplied by Department of Land Administration, W.A.

Wetlands Data supplied by Water and Rivers Commission

Native Vegetation Extent for Study Area supplied by Agriculture Western Australia

Bushplan Site Map

Map 33



BUSHPLAN SITES CORRECTED

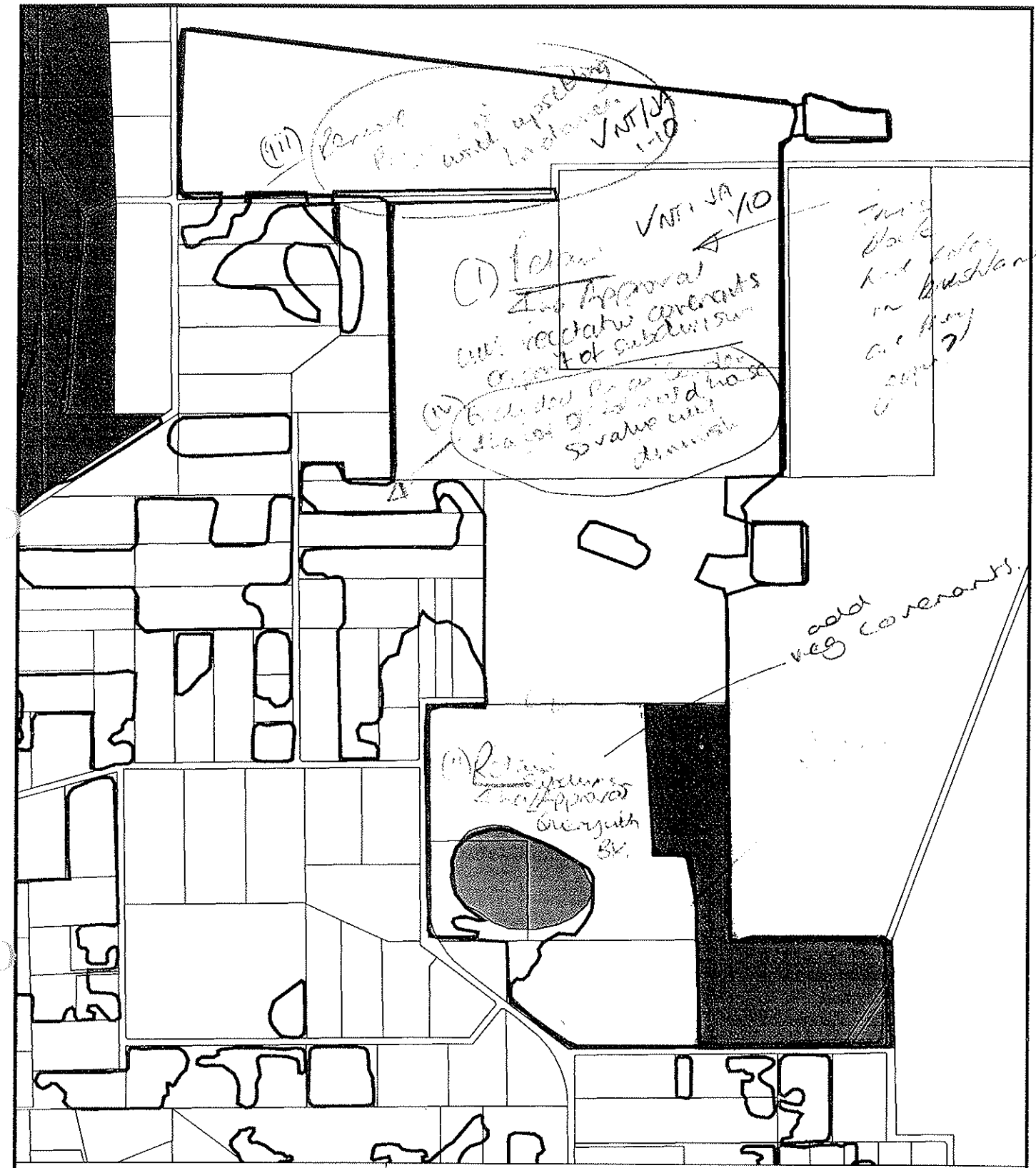
THE GOVERNMENT OF WESTERN AUSTRALIA

WESTERN AUSTRALIAN PLANNING COMMISSION

CUSTOMER FOCUS WESTERN AUSTRALIA

C TG/DK 22/10/98

N

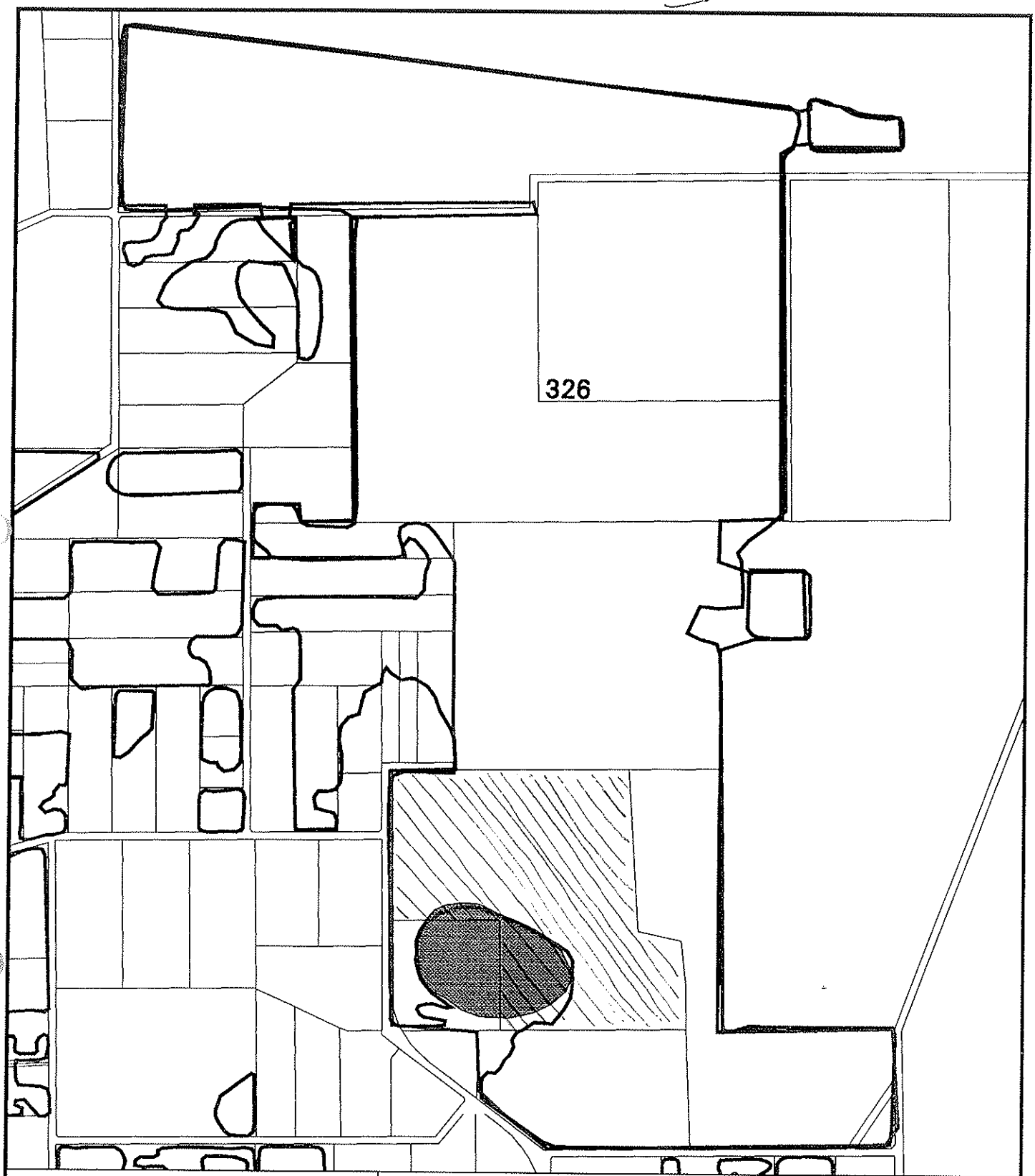


BP SITE 326

- Bushplan sites refno 1-500 SCP BOUNDARY THEME
- AG VEG 1998 - BOUNDARIES SCP
- cons category wetlands
- Cadastre
- PARKS & RECREATION

VA/NT 1/10 boundary ok. check veg mapping

MFP INTERNAL USE ONLY
Prepared By: Andrea Zappacosta
Prepared For:
Map Ident: plot980806_1
Date: 06 Aug 98
Scale 1:16336



bp site 326

AG VEG 1998 BOUNDARY THEME

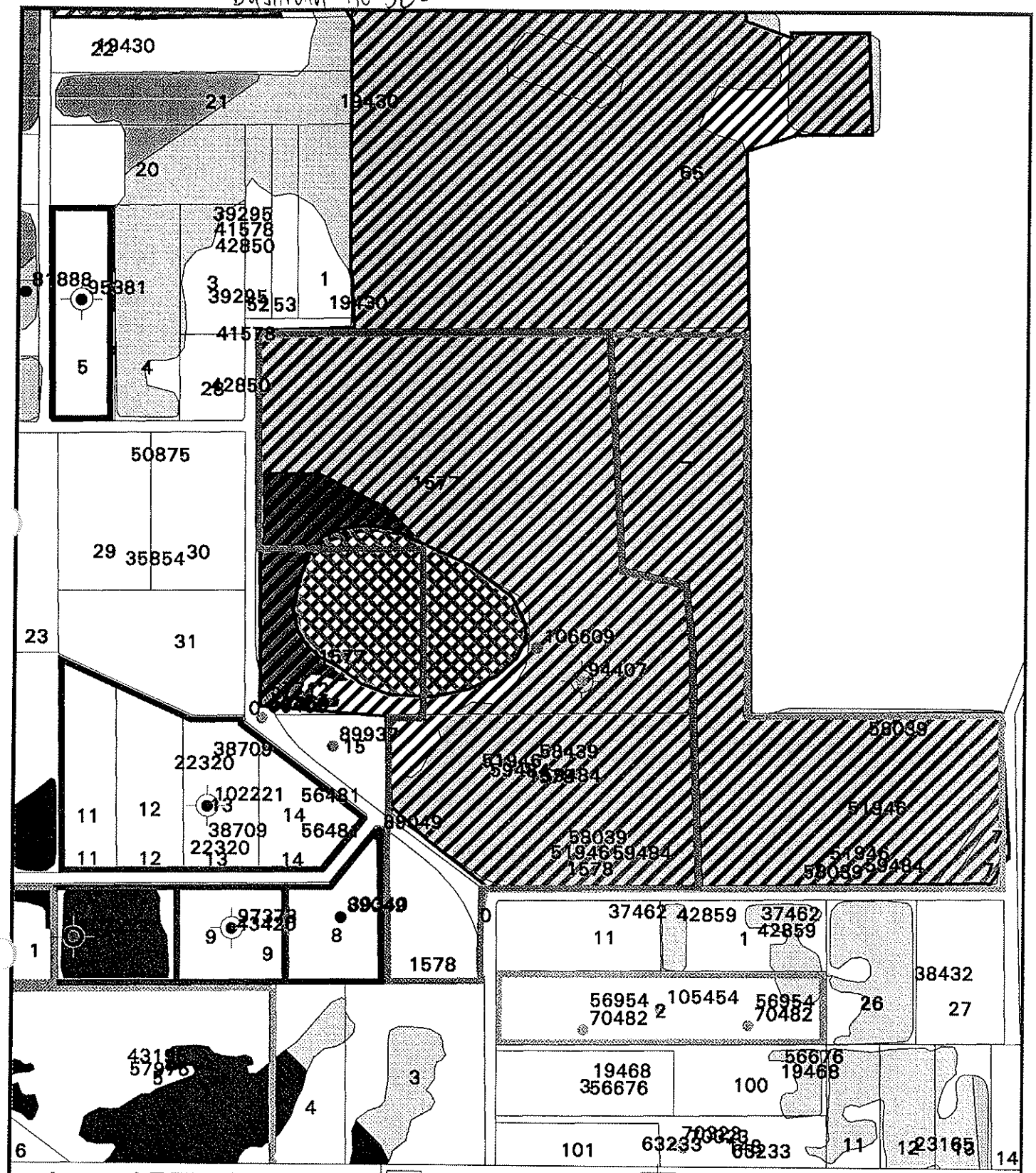
Cadastre

Bushplan sites refno 1-500 SCP BOUNDARY THEME

cons category wetlands

MFP INTERNAL USE ONLY
Prepared By: Andrea Zappacosta
Prepared For:
Map Ident: plot980529_1
Date: 29 May 98
Scale 1:14866

Bushplan site 326.



Lots 1577 & 1578
Sydney & Joyce Roads
Gnangara (Subdivision App
Perth's Bushplan

MFP INTERNAL USE ONLY
Prepared By: Clifford Lloyd
Prepared For: Reference
Map Ident: plot980805_1
Date: 05 Aug 98
Scale 1:10000

- Cadastre with Lot Numbers
- OUTSTANDING
- APPROVED
- REFUSED
- OUTSTANDING
- APPROVED
- REFUSED
- Appealed and decided
- Bassendean Complex-North
- Bassendean Complex-Central And South
- Bassendean Complex-North-Transition Vegetation Complex
- Pinjar Complex
- Bushplan Sites (Areas)
- cons category wetlands

A

FLORA

AND VEGETATION SURVEY

OF LOTS 1534 & 1792 WIRREGA ROAD,

JANDABUP

prepared for the

MINISTRY FOR PLANNING, Western Australia

by

Malcolm Trudgen, consultant botanist

April 1995

(Refer to: 805-2-30-11 & 94407 & 90823 MFP files)

CONTENTS

1.0 INTRODUCTION

1.1 Size and location of Lots 1534 and 1792 Wirrega Road

The study area is a roughly rectangular area about 1,250 metres from west to east and 850 metres from north to south. It consists of two lots, lot 1534 is a square and lot 1792 is L-shaped. Lot 1792 adjoins the western and southern boundaries of lot 1534, which extends slightly to the north of lot 1792. The western edge of the study area is located about 750 metres east of the lower third of Jandabup Lake. Little Dundabar swamp lies between the study area and Jandabup Lake but, is mostly cleared.

1.2 Topography, geomorphology and soils of Lots 1534 and 1792 Wirrega Road

Lots 1534 and 1792 Wirrega Road lie on the Basendean Dunes, a system of sand dunes composed of white and grey siliceous sands that occupy a broad band somewhat to the east of centre of the Swan Coastal Plain. The western and southern part of the area formed by lots 1534 and 1792 Wirrega Road has quite steep sand dunes of this dune system. However, there is a roughly crescent shaped seasonal wetland with a clayey-sand soil that starts roughly in the centre of the combined block and then goes north almost to the edge of the block turning as it goes north to end in the north-east corner of the combined block. This seasonal wetland occupies about one fifth of the area of the combined lots. On the eastern side of the north-south section of the seasonal wetland there is a low sand dune and east of this a swale that is probably seasonally damp.

1.3 Outline of regional botany

The study areas lie in the Drummond District of the South-West Botanical Province as defined by Beard (1980). This botanical district is more or less equivalent to the Swan Coastal Plain and has a considerable variety of vegetation types found in it in a large suite of habitats, including three major dunes sytems and wetlands. The vegetation types found on these dunes systems are generally restricted to them, i.e. they are only found in the the South West of Western Australia on these dune systems although, there are a few exceptions to this. Many of the species found in these vegetation types are also only found in the South West of Western Australia. However, most extend into other vegetation types although, some are much less abundant away from these dune systems and some are only found on them.

1.4 Regional studies of the vegetation

There have been several broadscale studies of vegetation that include the study area within their overall area. Four of these need to be considered here. They are

- work published as part of the "Atlas of the Darling System" by Heddle et al

Figure one. Recent aerial photgraph of the study area (outlined) and surrounding areas.

Note: 1. The good regeneration of the areas that appear cleared on 5/1/91 aerial photographs.

2. The good conditionof the vegetation in areas that had not been cleared but, most of which have now been recently burnt.

3. the extensive clearing for pine plantations surrounding the study area to the east and north.

(1980) which defines a series of "vegetation complexes" for a large part of the Swan Coastal Plain. This work has brief descriptions of the vegetation complexes and maps of their distribution at a scale of 1: 250,00. The approach taken is driven by grouping together vegetation types that occur together in repeating patterns linked to soil and geomorphology. The vegetation types are defined on a combination of structure and dominance of individual species. The distribution of the complexes generally corresponds with broadscale soil and geomorphological units which are also defined in the Atlas of the Darling System. However, there may be more than one complex defined for one geomorphological unit on the basis of soil sub-units or variation from north to south caused by changes in climate. For example, the Bassendean Sands has one complex on it south from Gnangara Lake (the Bassendean Vegetation Complex - Central and South) and two others north from Gnangara Lake, one of which is a transitional complex (the Bassendean Complex - North and the Bassendean Complex - North - Transition). These vegetation complexes can be viewed as broad ecosystems (or subsystems) with repeating patterns of vegetation types found on similar sites within a complex. Thus, they each contain a variety of plant associations and communities, with the associations and communities differing in the species contained in them and/or the relative abundance of the species found within them.

- work published as part of a defintion of the environment of the Gnangara water mound (McArthur and Mattiske 1985) which more closely defines the boundaries of some of the complexes in the area surrounding the current study area (partly re-interpreting some complexes) and subdivides the complexes on the Bassendean Dunes in this area into eight sub-units based on soil and geomorphology. Unfortunately, this study did not look at the boundaries of the complexes within the Bassendean Dunes. Three of the sub-units on the Bassendean Dunes occur in the current study area, these are the Jandakot unit which includes the hills and ridges (sand-dunes); the Joel unit which includes swampy areas and the Gavin unit which includes flat or gently undulating areas with relief of less than five metres (McArthur and Mattiske 1985). The seasonal wetland described above (section 1.2) is in the Joel unit, the steep dunes in the Jandakot unit and the low dune on the east side of the seasonal wetland in the Gavin unit although, it is area is too small to show on McArthur and Mattiske's map.

- work carried out for the East Wanneroo Natural Resources Mapping Study - Flora and Vegetation (Trudgen 1993). This work described a number of vegetation units (mostly vegetation communities) within the vegetation complexes and sub-units of Heddle et al (1980) and McArthur and Mattiske (1985) for an area that

includes the present study area. It provides a way of making assessments of the vegetation of the current study area at a finer scale than using the above publications. This work is based on a combination of the structure of the vegetation and the particular species which are dominant. It noted the presence of some closely similar vegetation communities in different vegetation complexes.

- a broadscale survey of the Swan Coastal Plain from Gingin to the Bunbury area (Gibson et al 1994) based on the assessment of the flora species occuring at five hundred and nine sites. The methodology used does not take into account the relative abundance of the species at the sites (i.e. species dominance and vegetation structure), just presence or absence. Thirty "floristic community types" were identified in the study (some with subtypes). The work is valuable in assessing the conservation value of sites for flora and obviously from that has implications for the values for vegetation but, these are obscure. The methodology of assessing an area to determine which floristic community type it would be assigned to is cumbersome in that it requires the complete listing of all species at a site (or sites if an area is large) and comparison of this data (using computer programmes) to the existing database; this is currently not readily available. There is no mapping of the distribution of the floristic site types although, there are maps showing the distribution of sites referred to each floristic community type or subtype which give a general guide to the distribution of each and which can be used with the descriptions to intuitively assign sites to a floristic community type. As annuals can be important in the outcome of the analysis, the data needs to be collected in spring/early summer and can require two or three visits to a site. The underlying concept that an analysis of the species present is fundamentally more important than the structure of the vegetation is not held by a majority of people who work with vegetation. A more commonly held view is that structure, dominance and the species present are important.

While this work gives another way of assessing conservation value, in many areas on the Swan Coastal Plain this is already very clearcut and the issue is not the merit of assessments but, the acceptance of any assessment.

1.5 Assessing the conservation status of the vegetation found on Lots 1534 and 1792 Wirrega Road

This needs to be done by assessing the vegetation in the terms of the available knowledge of the vegetation of the study area and of the surrounding areas and by assessing the value from the different viewpoints available on assessing the vegetation. This would then include issues such as

- which vegetation complex the area is in, where in the distribution of that vegetation complex it lies and how well reserved the complex is;

- below the vegetation complex level, what plant communities are present how widespread they are and how well reserved they are (this information is often not available);

- the relationship of the area to other bush areas (i.e. linkages to increase effective areas);

- what "floristic community type the area belongs to as a way of assessing (in a broad sense) its value for flora;

- the presence of rare or priority flora species (or potential presence if detailed spring surveys are not available).

1.6 Conservation status of the Bassendean Complex - North -Transition

The conservation status of the Bassendean Complex - North -Transition is good, with about 10,279 hectares in reserves in the CALM Swan Region, 1893 hectares in State Forest (but some of this has probably been cleared for pine plantations) and some other areas on Crown land and Government owned freehold (again, some of these may have been cleared) out of an original area of 17,618 hectares (P. Hanley pers comm.). However, it must be noted that all of the remaining areas are further north than the study area, which lies in one of two small areas of this vegetation complex at its southern limit. The eastern most of these two areas seems to have been cleared for planting pines.

1.7 Value of linkages

Conventional wisdom is that about 10% of an ecosystem should be retained for conservation, yet studies of the diversity of island ecosystems (relating the diversity found on islands to possible long term outcomes for maintenance of diversity in conservation reserves, treating the latter as essentially islands of vegetation in a cleared "sea" of agricultural/urban land) suggest that if 10% of the original extent of an ecosystem is retained, then this will in the long term only protect about 50% of the species found in the ecosystem. This is because over a period of time populations of some species die out because of the changed conditions under a situation where their population is changed from part of a large population in a large area of habitat to a small population in a small or relatively small area of

habitat. The process starts quickly, with large mammals being the first to go then other species of animals or plants depending on their individual reqirements for habitat area or their susceptibility to pertubations. For example, a species may happily exist in a remnant seemingly with no problems maintaining a fairly stable population until a severe fire occurs or until there are a series of very dry years and then its population crashes or starts to decline. Or, a species is susceptible to genetic problems associated with inbreeding and the population is too small to prevent these so it suffers a loss of vigour and then dies out.

In a landscape where a large area of native vegetation has been reduced to remnants by clearing for rural or urban development, it is believed that if these remnants are linked by corridors of vegetation then these will to some degree reduce the impact of clearing on the remnants by in effect making each a part of a larger area. This is likely to work best for animals as they are more mobile. However, animals are a major vector for the transport of the seeds of plants and so plants should be assisted as well. Also, insects, some birds and some mamals are important vectors for the movement of pollen and linking areas will thus help to provide sources (and transport mechanisms) of pollen for outbreeding. While some animals and insects will cross cleared areas this is not the case for many of them, and the more highly developed areas are, the less likely such crossings become. Thus, it seems likely that linking remnants will ameliorate but not overcome the impact of reducing large areas of vegetation to a series of "island like" remnants.

1.8 Value of adjoining pine plantation as a linkage

It might be argued that the adjoining pine plantation could act as part of a linkage between Jandabup Lake and Gnangara Lake. To a small degree this could be true as it would be useful to some birds and some larger mammals (and possibly some reptiles). However, pine plantations generally have very low ground cover and therefore little in the way of food resources and shelter for most birds and small animals. To be most effective a linkage has to be suitable habitat for the bird/animal that is moving through it and for the movement of insects that act as pollinators ideally needs to have species they are attracted to (needs to be noted here that for gene movement of plants via insects, these could move part way then be incorporated into a population then move further in a future generation).

1.9 Impact of fire

Fire causes very obvious, in fact seemingly catastrophic, changes in the native vegetation. This is especially the case if the fire is "hot" and consumes much of the standing vegetation rather than if the fire is "cool" when the fire tends to burn

patchily, leaving areas that are unburnt or scorched rather than consumed. However, the effects of infrequent fire is relatively short lived in terms of the time frames of the existence of the vegetation types found in the study area. That is, as far as we know, after fire the vegetation can regenerate to the same condition as long as the periodicity of the fire is such that it does not cause some environmental change. For example, frequent fire is thought to reduce nutrient levels (through volatilising nutrients held in the plants) and can effect population levels or vegetation structure if frequent enough to prevent plants maturing and producing seed.

Photograph one. Burnt area of unit Ja4 with more Blackboy (*Xanthorrhoea preissii*) than ususal. Note the death of some Blackboy individuals and of some trees. This sort of damage reduces the condition rating of burnt areas by half a level on the scale used. In ten to fifteen years, these areas will have regrown to appear similar to the photographs of unburnt vegetation below.

The key concept is that while fire is seemingly catastrophic, it is a pertubation that the vegetation can recover from, as it has developed with fire as a periodic part of its environment. For example, many species in *Banksia* woodland have underground woody rootstocks that can resprout quickly, others have bulbs or tubers and the trees themselves can usually resprout from the branches or from the base (or both depending on the species). In contrast, physical clearing of the vegetation with machinery has a much more significant impact, especially if the soil is disturbed, uprooting the woody rootstocks.

1.10 Previous recommendations affecting lots 1534 and 1792 Wirrega Road

In Trudgen 1993, there were a series of recommendations for protection of areas in the area covered in that survey. One of these recommendations was to protect a linkage from Jandabup Lake to Gnangara Lake. This recommendation included Lot 1792 but not Lot 1534. The reasons for selecting the particular areas in the linkage included the value as a linkage and values of the areas within it in their own right and can be summarised as:

- it contains a significant part of the southernmost areas of the Bassendean Complex - North -Transition vegetation complex;

- it contains vegetation types not seen elsewhere in the study area (e.g. Unit Ja4);

- it contains a (small?) population of the rare bronze coloured flower form of Banskia menziesii (next to the north-west track through lots 1534 and 1972);

- it contains some seasonal wetlands...;

- most of the area is in very good or excellent condition...;

- the area forms a link between Jandabup Lake and Gnangara Lake...;

- the vegetation on the area helps to protect the quality of ground water flowing into Jandabup Lake, as part of it lies to the east of that lake.

The reasons given in Trudgen 1993 are given in full in Appendix four with the reasons for protecting Jandabup Lake and Gnangara Lake. This is done because protection of the linkage will help to protect the values of the lakes as well as the areas in the likage and it is important to see the vegetated areas in the region as part of a system rather than as individual areas that have no connection.

2.0 METHODS AND LIMITATIONS OF THE SURVEY

2.1 Methods and limitations of the vegetation survey

Sites were recorded within different vegetation types to provide data on the floristic and structural variation in the vegetation. Due to the limited time available for the study, releve sites rather than quadrats were used. In this technique, a formal plot is not used, in this study releves were usually roughly circular areas of about 30 metres diameter. To obtain more representative data for the overstorey, this was estimated for a larger area than the releve used for the understorey. Where species at the releves were well known to the author they were not collected. Other species were collected, pressed, dried and identified at the Western Australian Herbarium. The site was visited on 22/3/95 and 2/4/95.

Unfortunately a large proportion of the study area was burnt not long before the field work for this survey. This significantly reduced the opportunity to locate vegetation types not located during the earlier work (Trudgen 1993) in the area as well as reducing the flora recorded. However, it was possible in some areas where plants were not completely consumed in the fire to identify some of the shrub strata and thus identify the presence of at least one vegetation community not noted during the earlier survey. Two others were located in the *Banksia* woodland areas remaining unburnt.

Some data from the earlier study (Trudgen 1993) have been incorporated in this report as well as data collected specifically for it, this data was collected in the same manner as for this report. Field work for the earlier study commenced in mid-winter and finished in early spring, also limiting the availability of annual and cryptophyte flora. The visit in the earlier study was limited to one traverse by foot along the north-south track through the study area, with a diversion to the edge of the wetland and another part way up the dune west of the wetland. Two sites were recorded, one completely and one partially during this visit and mapping data marked on aerial photographs.

The definition of vegetation types in Banksia woodland can be very difficult, requiring sophisticated computer analysis of floristics and abundance to fully differentiate all vegetation types. This type of study was beyond the scope of the present survey and the approach taken has been to differentiate those types that can be by carefull feild work and consideration of the data collected. It is arguable that this is sufficient depth of analysis for the purposes of the current study and it is unlikely that a more rigorous methodology would have significantly altered the recommendations of this report.

The system used in the definition of the vegetation types is a modified usage of the system of Specht as given by Aplin (1979). This system is usually used to define vegetation on the upper storey only. However, vegetation with similar upper storey composition and abundance can have very different lower shrub and herb layers. To cope with this complexity, as many layers of the vegetation have been used for the name of a vegetation type as was necessary to differentiate it from the vegetation types most similar to it.

2.2 Assessment of condition

Condition has been assessed using a scale with six categories from "completely degraded" to "excellent", as follows:

E = Excellent.
VG = Very good.
G = Good.
P = Poor.
VP = Very poor.
D = Completely degraded.

Definitions of the terms used in the scale are given in appendix three. Assessment of the condition of the survey area was complicated by the fact that a proportion of it had recently been burnt and other parts of it had been cleared about four years ago (these areas appear cleared on the 5-1-1991 aerial photographs).

Fortunately the burnt area had been rated on the same scale used in this report three years earlier (Trudgen 1993) and aerial photographs (5-1-1991) were available from before the burn.

Assessments of vegetation condition are usually made with the vegetation at a developed stage rather than shortly after a fire. So in one sense it is not appropriate to assess condition immediately after a fire, as the above ground parts of the vegetation is consumed and for a period after the fire the vegetation will be rapidly changing in structure and dominance. However, the intent of assessing condition is to provide a measure of the value of areas of vegetation for comparsion to other areas and this can still be done for the areas burnt if the following rationale is accepted. The area (and those to which it may be compared) has undoubtedly been burnt before, and had reached a state where its condition could be assessed at the high levels recorded in 1993, and so it is reasonable to presume that the vegetation has the potential to reach the same condition levels again. However, the fire has

had impacts such as killing some trees (particularly *Banksia menziesii* and *Banksia attenuata*) and reducing the condition of others (e.g. *Eucalyptus todtiana* - Prickly Bark), so it is reasonable that in the short term (say ten-fifteen years) the condition will be reduced somewhat but, in the absence of another fire would return to its pre-fire level. To take this into account, the condition ratings for the burnt areas should be reduced by half a level compared to what they were previouly assessed at.

2.3 Methods and limitations of the flora survey

Flora species were recorded and collected at the releves recorded and during transects made through the study area. Those not known to the author where identified at the Western Australian Herbarium. The timing of the survey in early autumn before any significant rainfall meant that no annual or cryptophyte flora species were available and that almost all other species were sterile. The study was restricted to flowering plants (excepot for *Macrozamia reidlei*) and the study area would also have a flora of fungi, mosses and liverworts although, the latter two groups would have few species.

Species recorded from the study area during an earlier study (Trudgen 1993) are incorporated in the list.

It is obvious that this survey could not record all species of native flowering plants that grow in the study area and it is thought that probably some 60% of the species that grow in the study area were recorded.

3.0 FLORA OF LOTS 1534 AND 1792

3.1 Flora recorded

One native gymnophyte, the Zamia Palm (*Macrozamia reidlei*) and one hundred and five native flowering plants were recorded in the study area. Of the native flowering plants, thirty-eight were monocotyledons and sixty-seven were dicotyledons. In the monocotyledons, the families with the most species were Cyperaceae (the true sedges) with eight species, the Anthericaceae (a lily family) with five species and the Restionaceae four species. In the dicotyledons, the families with the most species were Myrtaceae with fifteen species, Papilionaceae with twelve species and Proteaceae with ten species. In addition, seven introduced species were recorded but, many annual weeds would not have been obvious due to the time of the year.

A complete list of the flora recorded is given in appendix one. The native flora recorded is probably about sixty percent of the native flora of the study area.

Photograph two. *Calytrix fraseri* one of only two species noted flowering at the time of the survey, it is common in unit Ja1.

3.2 Species found in the study area that deserve particular consideration

Gazetted rare species are species that are protected by law. Priority species are species that while not gazetted "are poorly known and in need of high priority survey or are adequately surveyed but in need of monitoring." (Kelly et al 1993). No priority species and no gazetted rare species were recorded during the survey.

4.0 VEGETATION OF LOTS 1534 AND 1792

The vegetation will be described under the sub-units of the Bassendean Complex described by Macarthur and Mattiske (1985), representative stands of the regenerating areas will also be described. The units used are consistent with Trudgen 1993 and some descriptions from that study are included where they are based on information collected from the present study area, or where areas were assigned to the same unit used in Trudgen 1993 and have been recently burnt (with enough evidence remaining to decide which unit was present before the fire but not enough to collect a proper site description).

4.1 Vegetation on the Jandakot unit

The areas of the Jandakot unit in the current study area seem to belong to floristic community type 23b of Gibson et al (1994), while this would have to be confirmed by a complete site recording and comparison to their database, the fit to their description is quite good and the study area is near the southern end of their localities for this community type. Community type 23b is restricted to an area from about Wanneroo north to a point west of Gingin.

Ja1. *Banksia attenuata Banksia menziesii* low open forest over *Calytrix fraseri Macrozamia riedlei* open shrubland

The tree layer usually has a mixture of *Banksia attenuata* and *Banksia menziesii* with small amounts of *Banksia ilicifolia Nuytsia floribunda Melaleuca preissiana* and at lower sites some *Eucalyptus rudis* The tall shrub layer usually has small amounts of *Macrozamia riedlei* and *Jacksonia furcellata* about 5% of *Calytrix fraseri* and 1-2% of *Adenathos cygnorum Acacia pulchella* can have fairly high levels after fire. The only species in the medium shrub categorey was *Xanthorrhoea preissii* but, it usually has less than one percent cover. The lower shrub layer is generally quite open with species recorded including *Eremaea pauciflora Gonocarpus pithyoides Scholtzia involucrata Hemiandra pungens Macarthuria australis* and *Dampiera linearis* The herb/sedge layer was usually quite diverse, with twenty-two native species recorded in one stand. However, only two of these had more than one percent cover; *Alexgeorgia nitens* (< 5-10%) and *Loxocarya flexuosa* (5-15%). Other species present in this layer included *Anigosanthos humilus Conostylis aculeata Phlebocarya ciliata Burchardia umbellata Stylidium repens Lyginia barbata Patersonia occidentalis Burnettia nigricans* and a *Caladenia* species.

There are similar units on the Spearwood dunes (Ky1 and Ky1A) but, Ja1 has a denser tree layer. The water relations of the sites with these vegetation types (Ky1, Ky1A and Ja1) is probably a significant factor in their development.

This community often has populations of *Gonocarpus pithyoides* and *Cartonema philydroides*. It occurs on lower slopes adjacent to wetlands or damplands and on low dunes next to larger wetlands. (Description and discussion after Trudgen 1993.)

The area of this unit in the study area was assessed as being in excellent condition when visited in 1992 but had been recently burnt when visited in 1995, so its condition should now be assessed as very good to excellent.

Ja4/1. *Banksia attenuata Banksia menziesii* low open forest over *Xanthorrhoea preissii Hibbertia hypericoides Stirlingia latifolia* shrubland

This unit is an intermediate between units Ja4 and Ja1 and occurs on slopes above areas of Ja1. The upper layer has a low open forest of *Banksia attenuata* and *Banksia menziesii* with small amounts of *Eucalyptus todtiana* and *Allocasuarina fraseriana*. The only tall shrub species present were *Jacksonia sternbergiana* and *Adenathos cygnorum* but, these only had low cover. There were no medium height shrubs although, the *Xanthorrhoea* could exceed one metre in the absence of fire. The lower shrub layer was open and species poor with the only species having more than one percent cover being *Hibbertia hypericoides* (≤ 10%), *Xanthorrhoea preissii* (≤ 5-10%) and *Stirlingia latifolia* (<1-5%). Other species in this layer included *Calytrix flavescens Daviesia divaricata* and a *Persoonia* species. The herb/sedge layer was also fairly species poor, with the most abundant species being *Mesomelaena pseudostygia* (20-50%), *Alexgeorgia nitens* (10%) and *Loxocarya flexuosa* (1-5%). Other species in this layer included *Lagenifera huegelii Patersonia occidentalis Amphipogon turbinatus* and *Drosera erythrorhiza*.

No weed species were recorded at site 40. (Site: 40)

This description was taken from Trudgen 1993, the stand (site 40 is in the current study area) had been burnt when visted recently but, was assessed as in excellent condition when visited in 1992. So, it should now be rated as in very good to excellent conditon. This vegetation type was only seen at this one location during the survey carried out for the East Wanneroo Natural Resources Mapping Study - Flora and Vegetation (Trudgen 1993).

Ja4. *Banksia attenuata Banksia menziesii* low open forest over *Jacksonia densiflora* tall open shrubland over *Conospermum stoechadis* open shrubland to shrubland over *Hibbertia hypericoides Stirlingia latifolia Calothamnus quadrifidus* low open heath

The tree layer had somewhat more *Banksia attenuata* (20-25%) than *Banksia*

Photograph three. A stand of unit Ja4 in Lot 1792, note the diversity of the understorey layers.

menziesii (15-20%) and small amounts of *Eucalyptus todtiana* and *Allocasuarina fraseriana*. The only tall shrub species recorded at site 36 was *Jacksonia densiflora* (≤ 2%), which seems to increase in density with age after fire, as a nearby area had more (5-10%) of this species and appeared to have been unburnt for much longer. The medium shrub layer was also fairly open with only *Conospermum stoechadis* (5-10%) having more than 1% cover, the other species present in this layer being *Daviesia divaricata*, *Macrozamia reidlei*, *Allocasuarina humilis*, *Acacia pulchella* var. *glaberrima* and *Eremaea pauciflora*. The lower shrub layer was quite diverse but only *Hibbertia hypericoides* (≥ 35%) was abundant. Other species in this layer included *Calothamnus quadrifidus*, *Melaleuca* aff. *scabra*, *Bossiaea eriocarpa*, *Astroloma xerophila* and *Lysinema ciliatum*. The herb/sedge layer was quite diverse, with a major difference from unit Ja3 being the presence of 20-40% cover of *Mesomelaena pseudostygia*. Other species in this layer included *Loxocarya flexuosa* (≤ 5%), *Alexgeorgia nitens* (1-5%), *Amphipogon turbinatus* (5-10%), *Burchardia umbellata* and *Lyginia barbata*. In all sixty-two native species were recorded at site 36, while only one weed species (* *Gladiolus caryophyllaceus*) was recorded.

This unit occurs on a series of dunes north of Gnangara Lake, and could probably be split into several units in a more detailed study, for example, some areas on lower slopes have patches of *Phlebocarya ciliata* while others have *Eucalyptus marginata* and more *Xanthorrhoea preissii*.

A few individuals of the rare bronze colour form of *Banksia menziesii* were observed in this unit, just north of site 39 (more may be present, as no specific searches were made). (Sites: 36, 39)

This description was taken from Trudgen 1993, the stand in the study area (site 39 is in the current study area but site 36 is south of it) had been burnt when visited recently but, was assessed as in excellent condition when visited in 1992 and should now be assessed as in very good to excellent condition. This vegetation type was only seen in the proposed linkage between Jandabup Lake and Gnangara Lake during the survey carried out for the East Wanneroo Natural Resources Mapping Study - Flora and Vegetation (Trudgen 1993).

Ja4A. *Banksia attenuata Banksia menziesii* low woodland over *Adenathos cygnorum* closed scrub over *Xanthorrhoea preissii* open shrubland over *Leucopogon conostephioides Hibbertia hypericoides Gompholobium tomentosum* low open shrubland over *Scholtzia involucrata Calytrix flavescens* low open shrubland over *Alexgeorgea nitens Lomandra hermaea Amphipogon turbinatus* sedgeland/grassland.

Photograph four. Stand of unit Ja4A, note the open tree layer, the dense tall shrub layer (*Adenanthos cygnorum*) and the open lower shrub layer.

This unit was not sampled in the East Wanneroo Natural Resources Mapping Study - Flora and Vegetation survey (Trudgen 1993) but, was observed within areas of Ja4

and was presumed to be similar with the addition of the *Adenanthos*. However, when a stand was recorded in the current survey area it was found to actually vary significantly (apart from the *Adenanthos*) and the description has been changed to reflect this (it is possible that there is a lot of variation in such stands). Other species recorded included *Stipa compressa*, *Bossiaea eriocarpa*, *Petrophile linearis*, *Eremaea pauciflora*, *Mesomelaena stygia*, *Lomandra hermaphrodita*, *Burchardia umbellata*, *Patersonia occidentalis*, *Allocasuarina humilis*, *Schoenus sub-bulbosus* and *Daviesia triflora*. The stand was assessed as being in very good condition, with low weed invasion. Weeds recorded were * *Briza maxima* and * *Gladiolus caryophyllaceus*. The surface soil was grey sand and the subsoil was yellow sand. (Site 12/95.) A noticeable difference from unit Ja4 was the openness of the *Banksia* layer.

Ja6. *Banksia attenuata*, *Banksia menziesii* low open forest over *Beaufortia elegans* low shrubland to low open heath

The tree layer has equal amounts (≥ 15%) of *Banksia attenuata* and *Banksia menziesii* with a small amount of *Nuytsia floribunda*. There was no tall shrub layer and the medium height shrub layer was fairly open with *Beaufortia elegans* (10-20%) and *Regelia ciliata* (1-5%) the most abundant species and the only others recorded in this layer being *Jacksonia densiflora* and *Verticordia nitens*. The lower shrub layer was also not very diverse, with the most abundant species being *Stirlingia latifolia* (5%), *Leschenaultia exspansa* (1-5%) and *Calytrix flavescens* (1-2%). Other species in this layer included *Boronia purdieana*, *Leucopogon polymorphus*, *Hibbertia desmondensis*, *Leucopogon conostephioides*, *Conocarpus pithyoides* and *Scholtzia involucrata*. The herb/sedge layer was also not diverse, with the most abundant species being *Restio tremulus* (5-15%. Other species in this layer included *Lorocarya flexuosa*, *Patersonia occidentalis*, *Schoenus curvifolius*, *Lyginia* sp., a *Lepidosperma* species and *Drosera erythrorhiza*.

The site sampled was on the upper "shoulder" of the slope leading down to the east side of Lake Pinjar. Downslope the unit had more *Lyginia* sp. S.M 459 (to 15%) and *Boronia purdieana* as well as *Eucalyptus todtiana*, *Allocasuarina fraseriana* and *Boronia ramosa*. Towards the lower part of the slope it grades into Ja1/3 (see above). (Site: 91)

This description was taken from Trudgen 1993, the stand in the current study area was not recorded in 1992 (it was not intersected by the transect made) and had been burnt when visited recently but, there were enough remnants of the *Beaufortia elegans* shrub layer to indicate that this was the unit present before the fire. The area it is located in was assessed as in excellent condition in Trudgen (1993) on the

basis of aerial photograph interpretation using the transect referred to above as a guide. It should now be assessed as in very good to excellent condition (near the firebreak, weed invasion could be expected to be somewhat higher and there the condition could be very good). This vegetation type was only seen near the east edge of Lake Pinjar during earlier field work (Trudgen 1993) and is uncommon in the survey area for that report.

This unit is is very similar in structure and its dominant species to unit Ky6 which occurs on the Spearwood Dunes (Trudgen 1993) but, differs in the minor species present and in *Alexgeorgia nitens* being one of the dominant species in the herb/sedge layer rather than *Phlebocarya ciliata* In a similar fashion to the relationship between units Ky1 (see above) and Ja1, possibly units Ja7 and Ky6 should be viewed as vegetation communities that form a vegetation association (or part of one).

JaAh. *Banksia attenuata Banksia menziesii* low woodland over *Xanthorrhoea preissii Jacksonia densiflora* high open shrubland over *Allocasuarina humilis* heath

The tree layer is a mixture of *Banksia attenuata* and *Banksia menziesii* The upper shrub layer is quite open with scattered individuals of Blackboy (*Xanthorrhoea preissii*) and *Jacksonia densiflora* There is then a fairly desne layer of *Allocasuarina humilis* a shrub relative of the sheoak, beneath which there is a lower shrub layer in which *Leucopogon conostephioides Conostephium pendulum Hibbertia hypericoides* and *Calytrix flavescens* are prominent. The lower layer is a herbland/sedgeland of *Mesomelaena pseudostygia Patersonia occidentalis* and *Loxocarya flexuosa*

This unit was not described in the East Wanneroo Natural Resources Mapping Study - Flora and Vegetation survey (Trudgen 1993). *Allocasuarina humilis* does occur in Ja4 and JaAh occurs within that unit, suggesting that it represents a subunit of that broader unit. It was seen on a fairly high crest in the west of Lot 1972. The stand was assessed as being in excellent condition with low weed invasion. Weeds recorded were **Briza maxima* and **Gladiolus caryophyllaceus* Associated species were *Eriostemon spicatus Burchardia umbellata Daviesia triflora Nemcia reticulata Petrophile linearis Alexgeorgia nitens Acacia pulchella Hemiandra pungens* (glabrous and hirsute forms), *Eremaea pauciflora* and *Adenanthos cygnorum* The stand was not extensive, occurring in a mosaic with Ja4A in the area it was seen in. (Site 13/95.)

Photograph five. Stand of unit JaAh. Note the denser tree layer than in unit Ja4A and the dense low shrub layer, the two units occur in a mosaic fshion.

JAJ. *Acacia pulchella Jacksonia densiflora* open shrubland over *Stirlingia latifolia Leucopogon conostephioides Gompholobium tomentosum* low shrubland to open heath over *Alexgeorgia nitens Patersonia occidentalis Dampiera linearis* herbland/sedgeland.

This unit is regeneration after clearing, the presence of a number of species regnerating from rootstocks indicating that the clearing did not greatly disturb the soil. Others species recorded were *Daviesia triflora Melaleuca* cf. *trichophylla Acacia sessilis Scholtzia involucrata Lyginia barbata Synaphea spinulosa Petrophile linearis Bossiaea eriocarpa Lasmannia squarrosa Conostephium pendulum* and *Allocasuarina humilis* The stand was assessed as in very poor condition but, with potential to regenerate to poor to good condition in the long term. Weed invasion was low to moderate with * *Ehrharta calycina* and * *Briza maxima* recorded. About a third of the areas that had been cleared in lot 1534 were regeneration to vegetation like this unit although, it should be noted that the middle shrub layer was quite variable.

Photograph six. Unit JAJ in the foreground (regeneration) with undisturbed unit Ja4 in the background.

4.2 Vegetation of the Joel unit

The Joel unit was repreented by one seasonal wetland in the study area. The units described below are representative of the vegetation in this wetland, which is quite varied. Othere types observed included:

- *Pultenaea reticulata* open scrub;
- *Hypocalymma angustifolium* low open heath;
- *Cyathochaete avenacea* sedgeland;
- *Melaleuca preissiana* low woodland over *Xanthorrhoea preissiana*, *Pericalymma ellipticum* shrubland; and
- *Astartea* sp. Brixton Street open shrubland.

The seasonal wetland seems to belong to community type fourteen of Gibson et al (1994) none of which is in conservation reserves and whose conservation status is given as "insufficiently known" by Gibson et al. Assignment to this particular floristic community type would have to be confirmed by complete recording of a site or sites in the wetland and comparison to the database of Gibson et al.

Photograph seven. View in the seasonal wetland showing the diversity of vegetation types present and the good regeneration of areas disturbed before the 5/1/91 aerial photgraphs were taken.

JEr/Mp. *Eucalyptus rudis*, *Melaleuca preissiana* woodland to open forest over *Lepidosperma* sp. sedgeland

This unit was observed along the western and south-western border of the seasonal wetland, along the base of the sand dune (where there is about one to two metres,or less, of sand over the base of the seasonal wetland). It was observed in the earlier visit (Trudgen 1993) being mapped as ErMp (indicating that *Eucalyptus rudis* and *Melaleuca preissiana* were the dominants) but, was not recorded in detail, its condition was assessed then as poor to good. It has since been burnt, and the condition should be rated as poor. When visited in 1995, it had been recently burnt and so it was not possible to say if there is usually a shrub layer (the stand has had some physical disturbance, so this may have affected a shrub layer as well). *Lechenaultia expansa* was common in places. While weed invasion could not be properly assessed due to the fire there was some Couch Grass (**Cynodon dactylon*) and **Ehrharta calycina* was present in places. There was on pile of building rubble on the dune at the upper edge of this unit. Six Bronzewing pigeons were seen at this locality. Associated species included *Kunzea ericifolia*, *Lyginia barbata* and *Regelia ciliata*. *Cartonema philydroides* is likely to occur at the upper edge of this unit (Sites 6/95 and 7/95.) In places, small stands of *Astartea* sp. Brixton Street open shrubland at the lower edge of the stands of JEr/Mp that had escaped the fire.

Photograph eight. Stand of unit JEr/Mp with part of the cleared area of the seasonal wetland in the foreground and the left of the photograph. Note the regeneration since the fire.

JEr/Mp is quite similar to JEr (*Eucalyptus rudis* open woodland over *Jacksonia furcellata* open scrub over *Lepidosperma* sp. sedgeland) a unit sampled at the south-western corner of Jandabup Lake (Trudgen 1993), where it forms part of the strip of Joel next to the lake. There are also obvious similarities to units P4, P7, P7, P9 described from the margin of Lake Pinjar but, these also do not have *Melaleuca preissiana* with the *Eucalyptus rudis* and have little *Jacksonia*.

JMAA. *Melaleuca preissiana* low woodland to open forest over *Astartea* sp., *Acacia pulchella* open shrubland over *Cyathochaete avenacea*, *Lepidosperma* sp. open sedgeland to mid-dense sedgeland.

This unit was recorded in the north-east part of the seasonal wetland, the soil was a grey-brown clayey sand with a grey surface. There were scattered *Banksia littoralis* in the tree layer (although they were much shorter than the *Melaleuca preissiana*). Associated species included *Centrolepis aristatus Siloxerus humifusus Dianella divaricata, Thysanotus multiflorus* and a *Thelymitra* species (dead). There had been some disturbance in the area but, it was patchy with small areas not disturbed. The area had variable weed invasion with * *Briza maxima* * *Hypochaeris glabra* and * *Ehrharta calycina* recorded. (Site 11/95)

This vegetation type was not recorded in the survey of the East Wanneroo Natural Resources Mapping Study - Flora and Vegetation study area however, *Regelia ciliata* was present in several vegetation types recorded in that study. These included WS_{Ba}. (*Banksia littoralis* low open woodland over *Regelia ciliata* high shrubland to closed scrub) and WS_{Re} (*Melaleuca preissiana* low open woodland over *Regelia ciliata* shrubland to closed scrub).

GA. *Adenanthos cygnorum* high open shrubland to open scrub over *Verticordia nitens* open shrubland

Photograph nine. Unit GA in the foreground (regeneration) with undisturbed unit GBR in the background

This unit is regeneration after clearing, that is it is composed of native species but occurs only as a result of the disturbance of the area. It was seen on the lower slopes of a low sand rise on the east side of the north-south section of the seasonal wetland in an area that had not been recently burnt. About a third of the area that appear to be cleared on the 1991 aerial photographs of the study area are regenerating to vegetation like unit GA. This is not the vegetation present prior to the clearing but, these species must have been present for them to come up so prolifically. It is likely that over a period of time if the stands are not disturbed further that they will become closer to the original vegetation. Others species present included *Dampiera linearis*, *Hypocalymma angustifolium*, *Hypolaena exsulca*, *Phlebocarya ciliata*,

Stylidium repens *Lyginia barbata* *Xanthorrhoea preissii* *Scholtzia involucrata* *Regelia ciliata* *Petrophile linearis* and *Beaufortia elegans*. The stand was somewhat weedy with * *Briza maxima* * *Ursinia anthemoides* and a * *Vulpia* present. It was noticed that two species of birds were foraging on the *Adenanthos* indicating some value as habitat for birds. (Site 8/95)

5.0 RESULTS OF THE SURVEY

Major results of the survey are that:

- Lot 1792 has a more varied vegetation than was appreciated during the survey work carried out for the East Wanneroo Natural Resources Mapping Study - Flora and Vegetation (Trudgen 1993) survey. (It should be noted here that it was actually just outside the original boundary of that survey but, was visited briefly because of its obvious importance as part of a link between Jandabup Lake and Gnangara Lake.)

- Lots 1792 and 1534 have vegetation communities not recorded elswhere in the survey area for the East Wanneroo Natural Resources Mapping Study - Flora and Vegetation (e.g JaAh, Ja4/1), or uncommon in the survey area for that study (Ja6 and to a lesser extent Ja4).

- Parts of Lots 1534 and 1792 (including part of the floor of the seasonal wetland) which during the field work stage of the East Wanneroo Natural Resources Mapping Study - Flora and Vegetation survey were considered from aerial photograph interpretation to be cleared had in fact been cleared only shortly before the aerial photgraphs were taken and have regenerated extremely well considering the fairly short time since then.

- Part (about half) of the floor of the seasonal wetland was cleared at an earlier date, has been grazed and has not regenerated (there are scattered mature pine trees on this half of the wetland floor). The other part of the seasonal wetland has diverse vegetation forming a mosaic of small stands and is partly regeneration and partly uncleared.

- The seasonal wetland seems to belong to floristic community type fourteen of Gibson et al (1994), which is unreserved and whose conservation status is given as "insufficiently known" by Gibson et al.

- The *Banksia* woodlands in the study area seem to belong to floristic community type 23b of Gibson et al (1994). This floristic community type is unreserved in the context of their report (i.e. is not in a National Park or Nature reserve) but is in Melaleuca Park and areas of State Forest.

- The *Banksia* woodlands in the study area (which are on the Bassendean Dunes), while belonging to one "floristic community type" have a series of

6.0 VALUES OF LOTS 1534 AND 1792 AS PART OF A LINKAGE BETWEEN JANDABUP LAKE AND GNANGARA LAKE

The values of linkages between areas of bushland have been discussed in the introduction. If there is to be a linkage between bushland at Jandabup Lake and Gnangara Lake then (all or parts of) lots 1534 and 1792 are a critical part of that linkage and will benefit the fauna and flora values of these areas in the following ways:

- they will help to insulate flora and fauna populations at the lakes from gradual loss of diversity by making them effectively part of a larger area;

- they will provide a source of re-introduction of flora and fauna species lost at one or other of the lakes due to catastrophic events such as fires or disease.

- the presence of bushland on lots 1534 and 1792 helps to protect the bushland on parts of the linkage to the north and south of these lots by making them part of a larger area of buhland.

- the presence of a seasonal wetland on lot 1534 means that there are at least two significant sized wetland "staging points" in the proposed linkage that will facilitate the movement of wetland species between Jandabup and Gnangara Lakes (the other is on Lot 1577). {There is also a small wetland and some dampland on the land south of lot 1792.}

- the linkage itself has significant size that adds to the total size of the linked system increasing its viability.

- Lots 1534 and 1792 have significant values in their own right which add to the values of the linked system if they are protected.

In addition, the presence of bushland on lots 1534 and 1792 may help to protect the quality of the groundwater flowing toward Jandabup Lake.

9.0 OPTIONS AND RECOMMENDATIONS

In the brief for this report, advice was sought on three options (a, b and c below) for lots 1534 and 1792 in regard to their role as part of an ecological corridor (or linkage) between Jandabup Lake and Gnangara Lake:

a. "whether it is essential to reserve both lots 1534 and 1792 for Parks and Recreation"

In the light of the values identified for the lots as part of a linkage or ecological corridor between the two lakes it is considered essential to reserve both the lots for Parks and Recreation to make the ecological corridor most effective. The values of the vegetation of the lots in their own right should also be recognised. While Lot 1534 has been substantially affected by clearing, it has considerable value for the effectiveness of an ecological corridor between the lakes because of the presence of a seasonal wetland in it, facilitating use of the corridor by wetland species, and because of the good regeneration of the vegetation taking place. The wetland also has values in its own right.

Recommendation: both lots 1534 and 1792 be reserved for Parks and Recreation.

b. "subdivision of both lots 1534 and 1792 for rural living purposes (2.4 ha) and protecting conservation values by way of land use and management controls"

Subdivision of the two lots for rural living purposes (2.4 ha) would substantially reduce the value of the combined area as part of an ecological corridor because:

- it would mean fragmentation of the area into a number of smaller areas separated by fences with a firebreak on each side, a building envelope on each block and a system of roads and driveways to service the residences. The net result would be a substantial loss of the area of bushland and significant impediment to its use by animals.

- the network of roads and firebreaks would lead to substantial increases in the level of weeds in the area, effecting flora populations and possibly further effecting the ability of flora species to be moved through the area.

- the value of buildings would mean pressure for regular fuel reduction burning, reducing the density of bushland and effecting flora populations and the habitat value for fauna of the linkage (and hence the ability of fauna species

to use it as a corridor).

- the presence of a population of dogs and cats asociated with the residences would reduce the ability of fauna species to effectively use the corridor by subjecting them to increased predation (especially if bushland density was reduced by regular fuel reduction burning).

c. "reserving that part of the land identified as core conservation area (Lot 1792) and subdivision of the balance of the land for rural living purposes (2.4 ha) with recommendations on suitable management controls to protect the conservation values."

When the recommendation for the core conservation area were made (Trudgen 1993) it was thought from aerial photographs that lot 1534 was cleared except for some smaller areas. If the degree of regeneration that has taken place since the 1991 aerial photographs were taken was apparent then it would probably have been included in recommendation for the core area because of the presence of the seasonal wetland and its contribution to the value of the two lots as part of an ecological link (i.e., the wetland is a potential staging point for wetland species to enable them to use the linkage as an effective corridor).

Option "c" is certainly preferable to option "b" as it would still mean retention of a linkage without residences (and the network of roads and fences) in it. It is less desirable than option "a" as it would reduce the area of the linkage and exclude the seasonal wetland from it. If option "c" were to be taken up then it should be implemented in a way that reduces the impact on the bushland, and should include a prohibition on the keeping of dogs, cats, horses or other non-caged pets or livestock. Under this guideline:

- development would need to be restricted to small, defined building envelopes;

- building envelopes should be positioned to limit the length of driveways;

- there should be clearing bans on the areas outside the building envelopes and guidelines for maintaining vegetation condition, such as no dumping of garden rubbish in the bush;

- the roads should be kept to the eastern and northern boundaries or in the cleared part of the seasonal wetland as much as possible;

- as many as possible of the building envelopes should be in the cleared part of the seasonal wetland

- rather than separating blocks by fences and double firebreaks, they should be separated by single narrow firebreaks without fences (a better option would be to not separate them at all, but to mark boundaries at intevals with concrete markers, treating the area as one unit for fire control purposes, using existing tracks as firebreaks).

- houses should be positioned in their building envelopes to reduce risk to them by wildfire;

- there should be a fuel reduction programme based on buffer strips around the houses and leaving areas away from the houses unburnt.

Recommendation: If option "c" is taken, then the subdivision be subject to restrictions on animals and clearing in line with the suggestions above.

7.0 REFERENCES

Aplin, T.E.H. (1979). The Flora. Chapter three of "Environment and Science" Brian J. O'Obrien (Editor). University of W.A. Press.

Atkins, K.J. (1994). Declared rare and priority flora list. The Department of Conservation and Land Management. Como, Perth.

Beard, J. S. (1980). Western Australian Herbarium Research Notes. No. 3. pp. 37-58 and accompanying map.

Gibson, N., B. Keighery, G. Keighery, A. Burbidge & M. Lyons (1994). A floristic survey of the southern Swan Coastal Plain. Unpublished report prepared for the Western Australian Department of Conservation and Land Management, the Conservation Council of Western Australia and the Australian Heritage Commission.

Heddle, E.M., O.W. Loneragan & J.J. Havel (1980). Vegetation complexes of the Darling System, Western Australia. In: Atlas of natural resources, Darling System, Western Australia. Maps and explanatory text. Department of Conservation and Environment, Western Australia.

Kelly, A., Taylor, M.A. Langley, A. Spooner and D.J. Coates (1993). Declared rare flora and other plants in need of special protection in the metro area. Wildlife management programme number ten. Department of Conservation and Land Management.

McArthur, W.M. & Mattiske, E.M. (1985). The Gnangara Mound groundwater area landforms, Soils and vegetation. Appendix C of the Gnangara Mound ERMP published by the Water Authority of Western Australia. Prepared as a separate report for Dames and Moore.

Trudgen, M.E. (1993) East Wanneroo Natural Resources Mapping Study - Flora and Vegetation. Prepared for Bowman Bishaw Gorham Environmental Management Consultants (as consultants to The Department of Planning and Urban Development).

8.0 ACKNOWLEDGEMENTS

The curator of the Western Australian Herbarium (Department of Conservation and Land Management) kindly allowed access to the plant collections under his control.

APPENDIX ONE: Flora recorded for the study area

Species with an asterix (*) in front of them are introduced species.

GYMNOPHYTA

ZAMIACEAE

1 Macrozamia reidlei

ANGIOSPERMAE (flowering plants)

POACEAE

2 Amphipogon laguroides
3 Amphipogon turbinatus
*Briza maxima
*Cynodon dactylon
*Ehrharta calycina
4 Stipa compressa
*Vulpia sp. (dead)

CYPERACEAE

5 Baumea vaginalis
6 Cyathochaeta avenacea
7 Lepidosperma angustatum
8 Lepidosperma longitudinale
9 Lepidosperma sp. "coastal terete"
10 Mesomelaena pseudostygia
11 Schoenus curvifolius (sub-bulbosus?)
12 Schoenus rodwayanus

RESTIONACEAE

13 Alexgeorgia nitens
14 Hypolaena exsulca
15 Loxocarya flexuosa
16 Lyginia barbarta

CENTROLEPIDACEAE

17 Centrolepis aristatus

DASYPOGONACEAE

18 Calectasia cyanea
19 Dasypogon bromeliaefolius
20 Lomandra hermaphrodita

XANTHORRHOEACEAE

21 Xanthorrhoea preissii

PHORMIACEAE

22 Dianella divaricata

ANTHERICACEAE
- Laxmania squarrosa
- Thysanotus arenarius
- Thysanotus multiflorus
- Thysanotus sp.
- Tricoryne elatior

COLCHICACEAE
- Burchardia umbellata

HAEMODORACEAE
- Anigozanthos humilis
- Conostylis aculeata ssp.?
- Conostylis sp.
- Phlebocarya ciliata
- Haemodorum spicatum

IRIDACEAE
- Patersonia occidentalis
- Patersonia aff. umbrosa
- *Romulea rosea

ORCHIDACEAE
- Burnettia nigricans
- Caladenia sp. (material sterile)
- Thelymitra sp. (dead stem)

DICOTYLEDONS

CASUARINACEAE
- Allocasuarina fraseriana
- Allocasuarina humilis

PROTEACEAE
- Adenanathos cygnorum ssp. cygnorum
- Banksia attenuata
- Banksia ilicifolia
- Banksia littoralis
- Banksia menziesii (including the bronze colour form at one location)
- Conospermum stoechadis
- Persoonia sp.
- Petrophile linearis
- Stirlingia latifolia
- Synaphea spinulosa

SANTALACEAE
- Exocarpos sparteus

LORANTHACEAE

Nuytsia floribunda

AIZOACEAE
*Carpobrotus

LAURACEAE
Cassytha aurea

DROSERACEAE
Drosera erythrorhiza

MIMOSACEAE
Acacia huegelii
Acacia pulchella var. glaberrima
Acacia pulchella var. pulchella? (or possibly another taxon)
Acacia saligna
Acacia sessilis

PAPILIONACEAE
Aotus procumbens
Bossiaea eriocarpa
Daviesia divaricata
Daviesia triflora
Daviesia physodes
Euchilopsis linearis
Gompholobium tomentosum
Jacksonia densiflora
Jacksonia furcellata
Jacksonia sericea (a priority species, see flora section)
Nemcia reticulata
Pultenaea reticulata

RUTACEAE
Boronia ramosa
Eriostemon spicatus

POLYGALACEAE
Comesperma conferta? (material sterile)

STACKHOUSIACEAE
Stackhousia monogyna

DILLENIACEAE
Hibbertia hypericoides
Hibbertia subvaginata

THYMELAEACEAE
Pimelea sulphurea

MYRTACEAE

Astartea sp. Brixton Street?
Beaufortia elegans
Calothamnus quadrifidus
Calytrix angulata
Calytrix flavescens
Calytrix fraseri
Eremaea pauciflora
Eucalyptus rudis
Eucalyptus todtiana
Hypocalymma angustifolium
Kunzea ericifolia
Melaleuca preissiana
Melaleuca trichophylla
Regelia ciliata
Scholtzia involucrata
Verticordia nitens

APIACEAE
Xanthosia huegelii

EPACRIDACEAE
Astroloma pallidum
Conostephium pendulum
Leucopogon conostephioides
Leucopogon propinquus
Leucopogon sp.
Lysinema ciliatum

LAMIACEAE
Hemiandra pungens

GOODENIACEAE
Dampiera linearis
Lechenaultia expansa

STYLIDIACEAE
Stylidium repens

ASTERACEAE
*Hypochaeris glabra
Lagenifera hugelii

APPENDIX TWO: Vegetation communities described from the Jandakot, Gavin and Joel units of the Bassendean vegetation complexes in the Wanneroo area.

Trudgen (1992) described a series of vegetation communities from the vegetation complexes on the Bassendean Dunes (Bassendean Complex - North, Bassendean Complex North - Transition and Bassendean Complex Central and South). These were described under six of the eight sub-units on Bassendean Dunes distinguished by McArthur and Mattiske (1985). Three of which occur in the current study area, namely the:

- Jandakot (Ja, hills and ridges)
- Gavin (G, flat or gently undulating, < 5 m relief) and
- Joel (J, swampy)

units. The names of the communities (which are in effect a summary of their descriptions) described by Trudgen for the Jandakot, Gavin and Joel are reproduced to show the variation in the vegetation which occurs within these subunits.

Jandakot

Ja. *Banksia attenuata, Banksia menziesii* low open forest to low forest. (This code was used for areas that where on the Bassendean dunes but either were not visited or would need more detailed study to define their vegetation community.)

Ja1. *Banksia attenuata, Banksia menziesii* low open forest over *Calytrix fraseri, Macrozamia riedlei* open shrubland

Ja4/1. *Banksia attenuata, Banksia menziesii* low open forest over *Xanthorrhoea preissii, Hibbertia hypericoides, Stirlingia latifolia* shrubland

Ja1/3. *Banksia attenuata, Banksia menziesii* low woodland over *Macrozamia riedlei, Xanthorrhoea preissii* open shrubland to shrubland

Ja2. *Banksia attenuata, Banksia menziesii* low woodland to low open forest over *Petrophile macrostachya, Melaleuca seriata, Hibbertia hypericoides* low shrubland

Ja3. *Banksia attenuata, Banksia menziesii* low open forest over *Eremaea pauciflora* shrubland over *Hibbertia hypericoides, Stirlingia latifolia, Calothamnus quadrifidus* low open heath

Ja4. *Banksia attenuata*, *Banksia menziesii*low open forest over *Jacksonia densiflora* tall open shrubland over *Conospermum stoechadis*open shrubland to shrubland over *Hibbertia hypericoides*, *Stirlingia latifolia*, *Calothamnus quadrifidus*low open heath

Ja4A. *Banksia attenuata*, *Banksia menziesii*low open forest over *Adenathos cygnorum*closed scrub over *Conospermum stoechadis*open shrubland to shrubland over *Hibbertia hypericoides*, *Stirlingia latifolia*, *Calothamnus quadrifidus*low open heath

Ja5. *Banksia attenuata*, *Banksia ilicifolia*, *Allocasuarina fraseriana*low open forest over *Xanthorrhoea preissii*high shrubland

Ja6. *Banksia attenuata*, *Banksia menziesii*low open forest over *Beaufortia elegans* low shrubland to low open heath

Ja7. *Banksia menziesii*, *Banksia attenuata*low open woodland over *Beaufortia elegans* low open heath

Ja8. *Banksia attenuata*, *Banksia menziesii*low woodland to low open forest over *Xanthorrhoea preissii* shrubland

Ja9. *Banksia attenuata*, *Banksia menziesii*, *Banksia ilicifolia*, *Nuytsia floribunda*low open woodland over *Eremaea pauciflora*, *Beaufortia elegans*low shrubland

Ja10. *Banksia attenuata*, *Banksia menziesii*, *Banksia ilicifolia*, *Nuytsia floribunda* low open woodland over *Phlebocarya ciliata*, *Lyginia*sp., *Alexgeorgia nitens* herbland/sedgeland

Gavin

G. These are areas of vegetation on the Gavin sub-unit which due to lack of time it was not possible to visit, most of these areas are a mosaic of different units.

G1. *Banksia attenuata*, *Nuytsia floribunda*, *Banksia ilicifolia*, *Eucalyptus todtiana*, *Banksia menziesii*low open woodland over *Xanthorrhoea preissii*shrubland to open heath over *Eremaea pauciflora*low shrubland

G2. *Nuytsia floribunda*, *Banksia attenuata*, *Banksia menziesii*, *Eucalyptus todtiana* low open woodland over *Xanthorrhoea preissii*, *Eremaea pauciflora*open heath

G3. *Nuytsia floribunda*, *Eucalyptus todtiana*, *Banksia attenuata*, *Banksia menziesii*

low open woodland over *Adenanthos cygnorum* high open shrubland over *Calytrix fraseri*, *Melaleuca* sp. (S.M. 432), Xanthorrhoea shrubland

G_4. Mosaic of: *Hypocalymma angustifolia* low open shrubland to low open heath and *Xanthorrhoea preissii* low open heath

G_5. *Eucalyptus marginata* woodland over *Jacksonia furcellata*, *Jacksonia sternbergiana* high shrubland over *Hypocalymma angustifolia* low open shrubland to low shrubland

G_{5A}. *Eucalyptus marginata* open woodland over *Melaleuca preissiana*, *Banksia ilicifolia* low open woodland over *Xanthorrhoea preissiana*, *Hypocalymma angustifolia* shrubland to open heath

G_P. *Pericalymma ellíptica* open heath to closed heath

G_A. *Astartea fascicularis* open heath to closed heath

G_H. *Hypocalymma angustifolia* open to closed heath

G_K. *Kunzea ericifolia* open scrub to closed scrub

Joel

J_{RK}. Mosaic of *Regelia ciliata* and *Kunzea ericifolia* open to closed scrubs

J_K. *Kunzea ericifolia* open to closed scrub

J_R. *Regelia ciliata* open to closed scrub

J_{Er}. *Eucalyptus rudis* open woodland over *Jacksonia furcellata* open scrub over *Lepidosperma* sp. sedgeland

J_{EP} *Eucalyptus rudis* open woodland over *Hakea varia* high open shrubland over *Pericalymma ellíptica* closed heath

J_N. *Pultenaea reticulata* closed heath

J_{EN}. *Eucalyptus rudis* open woodland over *Pultenaea reticulata* open heath

J_X. *Xanthorrhoea preissii* open heath

J_{AK}. *Allocasuarina fraseriana* low open forest over *Kunzea ericifolia* high open shrubland over *Lyginia barbata* sedgeland.

J_1. *Banksia ilicifolia*, *Banksia attenuata* low woodland

J_{BK}. *Banksia ilicifolia* low woodland over *Kunzea ericifolia* open scrub

APPENDIX 3: Condition scale

E = Excellent. Pristine or nearly so, no obvious signs of damage caused by the

VG = Very good. Some relatively slight signs of damage caused by the activities of Europaen man. E.g. some signs of damage to tree trunks caused by repeated fire and the presence of some relatively non-agressive weeds such as Ursinia anthemoides or Briza spp., or occasional vehicle tracks.

G = Good. More obvious signs of damage caused by the activities of Europaen man, including some obvious impact on the vegetation structure such as caused by low levels of grazing or by selective logging. Weeds as above, possibly plus some more aggressive ones.

P = Poor. Still retains basic vegetation structure or ability to regenerate to it after very obvious impacts of activities of Europaen man such as grazing or partial clearing (chaining) or very frequent fires. Weeds as above, probably plus some more aggressive ones such as *Ehrharta*spp.

VP = Very poor. Severely impacted by grazing, fire, clearing or a combination of these activities. Scope for some regeneration but, not to a state approaching good condition without intensive management. Usually with a number of weed species including aggressive species.

D = Completely degraded. Areas that are completely or amost completely without native species in the structure of their vegetation. I.e. areas that are cleared or "parkland cleared" with their flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX FOUR: Reasons given in Trudgen 1993 for selecting areas including Lot 1534 Wirrega Road for recommendation for protection

This appendix reproduces the reasons given for proposing areas including Lot 1534 and areas that it helps to link should be protected. Lot 1792 was not included in those recommendations as it was though to be too degraded on the basis of aerial photograph interpretation to have sufficient value. Field studies carried out for this report have shown that the area in fact has a mixture of regenerated and remnant areas that have value.

7.3 Core areas selected on Map 4

7.3.1 The area of priority one east and south-east of Jandabup Lake was selected because:

- it contains a significant area of the southernmost areas of the Bassendean Complex - North -Transition vegetation complex. While this complex is relatively well represented in conservation reserves (see section 1.6.4) it is likely that the vegetation and flora found in it vary significantly over its length and therefore it is important to conserve areas of its southern extent. It should also be noted that this complex did not have a very large original extent.

- it contains vegetation types not seen elsewhere in the study area (e.g. units Ja4, Ja4A, DL1, Ws1).

- it contains a population of the rare bronze coloured flower form of *Banskia menziesii*

- it contains some seasonal wetlands, the larger one of which is degraded but the smaller one with its associated drainage line is in good condition. There are very few areas of the "drainage line" sub-unit of the Bassendean dunes in the study area so this example of this unit has particular value.

- most of the area is in very good or excellent condition and this adds to its value.

- the area forms a link between Jandabup Lake and Gnangara Lake, and while this link is not complete it is the best available (and maintains the option to improve the link in the future through rehabilitation of other areas to complete this link).

- the vegetation on the area helps to protect the quality of ground water flowing into Jandabup Lake, as part of it lies to the east of that lake.

7.3.2 The area of priority one including parts of Jandabup Lake and adjoining areas was selected because:

- it contains the undisturbed parts of this large wetland, which has areas that are permanent wetland and areas that are seasonal wetland. These ecological types have generally acknowledged conservation value on the Swan Coastal Plain due to the large proportion of them that have been cleared or substantially altered.

- it has areas adjoining it that are vegetated and many of the wetlands on the coastal plain have had their surrounding vegetation cleared.

- it has areas of the Karrakatta Complex - Central and South vegetation complex. This vegetation complex is very extensively cleared and should be considered a rare and threatened ecosystem and all areas of it have high conservation value (see sections 1.6.1 and 5.0). Also, there are few areas of this complex adjoining wetlands so the transition from wetlands to this complex is poorly conserved.

- it has populations of Acacia benthamii and Thomasia membranaceum in the areas of the Karrakatta Complex - Central and South on the west side of the lake and populations of poorly collected Utricularia species in the lake. Also the nature reserve at the south of the Lake has populations of Cartonema phillydroides and Gonocarpus pithyoides which while not rare are on the priority list (see section 3.2).

7.4 Areas recommended on Map 5

There are three areas of priority one, five areas of priority two and one area of priority three for the core area on map five.

7.4.1 The area of priority one which includes Gnangara Lake was selected because:

- it contains areas of the the northern-most part of the Bassendean Complex - Central and South vegetation complex. This is important for conservation for three reasons. Firstly this complex is very extensively cleared and should be considered a rare and threatened ecosystem with all areas of it having high conservation value (see sections 1.6.1 and 5.0). Secondly, the complex varies over its length in the species found in it, and presumably in the vegetation communities present and consequently this area, as it contains areas of the northern-most section of the complex, is of particular value as well as having the general value of any area of the complex that remains. Thirdly, this area contains the boundary to the adjoining area of Bassendean Complex - North - Transition vegetation complex. As it contains this boundary, the area has significant value for future scientific research into the variation of the vegetation of the Bassendean Dunes.

- it contains the southern limit of the Bassendean Complex - North - Transition vegetation complex. While this complex is relatively well represented in conservation reserves (see section 1.6.4) it is likely that the vegetation and flora found in it vary significantly over its length (and between the discrete areas of it) and therefore it is important to conserve areas of its southern extent.

- it contains Lake Gnangarra and some smaller seasonal wetlands. Due to the extensive loss of wetlands on the coastal plain, such areas have high conservation value. This value is increased by the fact that Gnangara Lake and the seasonal wetlands have areas of uncleared dry land vegetation abutting them, increasing their value (as many of the remaining wetlands on the coastal plain have had their surrounding vegetation cleared) and their ability to be maintained as this vegetation will help to protect the quality of the water flowing into them.

- it contains areas of the Karrakatta Complex - Central and South vegetation

complex. This vegetation complex is very extensively cleared and should be considered a rare and threatened ecosystem and all areas of it have high conservation value (see sections 1.6.1 and 5.0).

- it contains populations of the priority species Cartonema philydroides, Jacksonia sericea and Daviesia physodes.

- the areas of vegetation within it are amongst the largest in the study area and much of it is in very good to excellent condition. This is important as most of the vegetation of the study area has been cleared and the remainders are often small blocks which will require more intensive management than larger areas if they are to maintain conservation value.