LEVEL 2 FLORA AND VEGETATION SURVEY

OF THE YANCHEP RIDGES

SURVEY AREA

Prepared for

WA LIMESTONE

Prepared by

Mattiske Consulting Pty Ltd

May 2014

WAL1301/057/13

Mattiske Consulting Pty Ltd

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ABBREVIATIONS

BOM	Bureau of Meteorology
DPaW	Department of Parks and Wildlife
DoE	Department of the Environment
EP Act	Environmental Protection Act 1986
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
FCT	Floristic Community Types
PEC	Priority Ecological Community
TEC	Threatened Ecological Community
WAPC	Western Australian Planning Commission
WC Act	Wildlife Conservation Act 1950

1. SUMMARY

Mattiske Consulting Pty Ltd was commissioned in November 2013 by WA Limestone to undertake a Level 2 flora and vegetation survey of the Yanchep Ridges survey area. The survey area consists of two distinctly different sections: the northern polygon, comprised of a former pine plantation and; the southern polygon, comprised of native bush (referred to as the intact area). A total of 36 permanent and 12 relevé survey sites were surveyed.

A total of 209 vascular plant taxa which are representative of 122 plant genera and 46 plant families were recorded within the Yanchep Ridges survey area. The majority of the taxa recorded were representative of the Fabaceae (22 taxa), Proteaceae (24 taxa) and Myrtaceae (21 taxa) families. Of the 209 plant taxa recorded within the survey area, 170 (82.1 %) were perennials, 30 (14.5 %) were annuals and 7 (3.4 %) were site dependent or short lived perennials.

No Threatened Flora species were recorded within the survey area. Three Priority Flora species were recorded within the survey area, namely *Baeckea* sp. Limestone (N. Gibson & M.N. Lyons 1425) (P1), *Beyeria cinerea* subsp. *cinerea* (P3) and *Leucopogon* sp. Yanchep (M. Hislop 1986) (P3).

A large population (>500) of *Baeckea* sp. Limestone (N. Gibson & M.N. Lyons 1425; P1) was recorded within an approximate 100 x 250 m area located on and around a limestone ridge in brown/orange sand over limestone. *Beyeria cinerea* subsp. *cinerea* (P3) and *Eucalyptus decipiens* (the only record from the current survey) were also recorded in this area. The presence of a large population of *Baeckea* sp. Limestone (N. Gibson & M.N. Lyons 1425) (P1) and the presence of a disjunct population of *Beyeria cinerea* subsp. *cinerea* (P3) suggest that this area may be locally significant.

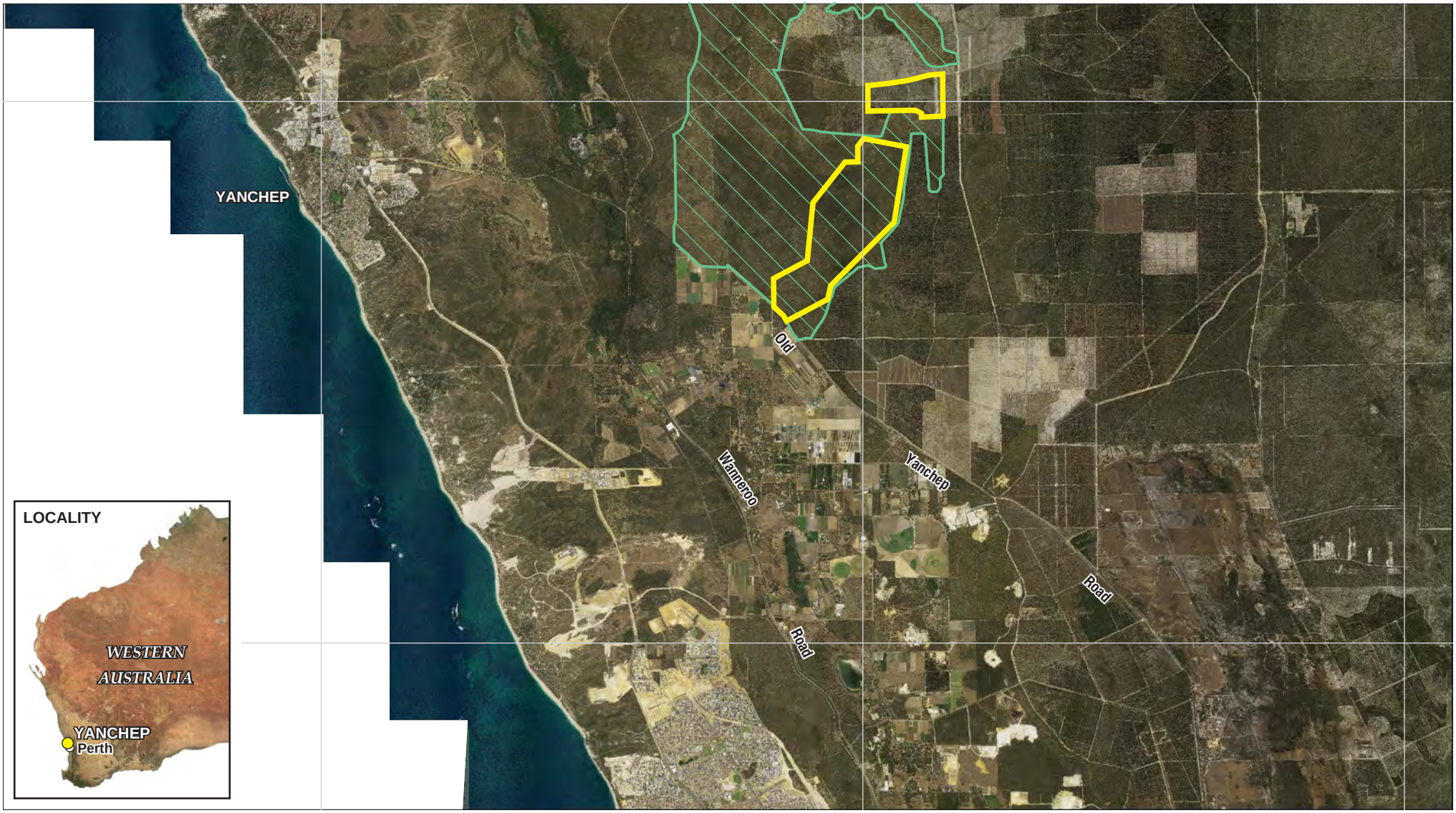
One Threatened Ecological Community occurs within the survey area, namely SCP 26a *Melaleuca huegelii – Melaleuca systena* (previously *M. acerosa*) shrublands on limestone ridges (EN). Two confirmed DPaW records of SCP 26a occur within the survey area, site ID MYHADR01 and MYHADR02. The estimated area of both DPaW recorded locations is approximately one hectare. In the current survey, dense patches of *Melaleuca huegelii* and *M. systena* on skeletal soils were sporadically observed along the main central limestone ridge. These areas were mapped as the A1 community in the current survey, with the boundaries of each inferred TEC location ground-truthed. Approximately 3.6 hectares of the A1 community was mapped within the survey area.

One Priority Ecological Community was inferred to occur within the survey area, this being SCP 24 Northern Spearwood shrublands and woodlands (P3). Floristic aspects of SCP 24 were inferred to be represented in the current survey area by vegetation community A. Approximately 104.9 hectares of vegetation community A were mapped, accounting for just over 23 % of the survey area.

Six vegetation communities were delineated and mapped within the survey area, four within the intact section (A – D) and one within the rehabilitated section (E). The intact section of the survey area generally comprised of structurally intact woodland vegetation on the lower and mid slopes with heathland vegetation on the ridges and upper slopes. Floristic aspects of SCP 28 were inferred to be represented within the survey area by woodland vegetation communities B, C and D.

Two broad Pre-European vegetation associations occurred within the survey area, namely Spearwood_949 and to a lesser extent Spearwood_6. With respect to the current proposal, representation of Spearwood_949 and Spearwood_6 vegetation associations across the Swan Coastal Plain Bioregion would be reduced by 3.8 % and 0.76 %, respectively. Two System 6 vegetation complexes occurred within the survey area, namely the Cottesloe Complex (north) and the Cottesloe Complex (central and south). With respect to the proposal, current representation of the Cottesloe Complexes would be reduced across the Swan Coastal Plain IBRA Region by 1.4 % and 0.2 %, respectively.

Much of the survey area is located within the Bush Forever site: Ridges and Adjacent Bushland, Yanchep/Nowergup (Bush Forever site number 381). Clearing of the intact section of the survey area is expected to reduce the total area of this Bush Forever site by 12.2 %. The majority of the rehabilitated section occurs outside of the Bush Forever Site, as such clearing of this area is only expected to further reduce Bush Forever site 381 representation by 0.01 %.



Legend

- Survey Area
- Bush Forever site: Ridges and Adjacent Bushland, Yanchep / Nowergup (Bush Forever site number 381)

Client: WA LIMESTONE

0 1.5km

Scale 1:100,000
MGA94 (Zone 50)

CAD Ref: g2135_f00.dgn
Date: Dec 2013 | Rev: A | A4

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Yanchep Ridges Area
Locality

Figure: 1

Vegetation condition within the intact section of the survey area was considered to be very good to excellent. While various forms of disturbances were evident, the structure and composition of the vegetation communities was generally intact. Disturbances included weed invasion, walking tracks, dumping of refuse and possibly dieback. Appropriate weed and exclusion management procedures should be developed and implemented to maintain vegetation condition across the project area, and mitigate potential impacts (e.g. spread of weeds) to adjacent bushland.

Of the 209 plant taxa recorded within the survey area, 26 species were introduced (exotic). Of these, one taxon; **Asparagus asparagoides* (Bridal Creeper) is a Declared Pest (s22; C3 Management) throughout the state. The incidence of weeds was widespread throughout the survey area but weed density was generally higher near roads, tracks, clearings and illegally dumped refuse.

2. INTRODUCTION

Mattiske Consulting Pty Ltd was commissioned in November 2013 by WA Limestone to undertake a Level 2 flora and vegetation survey of the Yanchep Ridges survey area (Figure 1). The survey area consists of two separate sections: the northern polygon, comprised of a former pine plantation and; the southern polygon, comprised of native bushland (referred to as the intact area).

2.1 Location and Scope of Proposal

The Yanchep Ridges survey area is located in the suburb of Yanchep on the Swan Coastal Plain, Perth Western Australia. It extends north-east for approximately 5.5 km from Old Yanchep Road at the junction of Haddrill Road and covers an area of 451.17 ha (Figure 1). The intact area is within Bush Forever site 381: Ridges and Adjacent Bushland, Yanchep/Nowergup and is part of State Forest 65 referred to as the 'Ridges', an area with long-standing recommendations to be added to Yanchep National Park (Department of Environment and Conservation 2012). The survey area lies in the Swan Coastal Plain Unit of the Drummond Botanical Subdistrict, part of the greater South-West Botanical District (Beard 1990). More recently, the vegetation of Western Australia has been assigned to bioregions and subregions under the Interim Biogeographic Regionalisation for Australia (IBRA), with the project area being within the Swan Coastal Plain subregion (SWA2; Department of the Environment 2014c).

The aim of the current survey was to define, quantify and qualify botanical values present within the Yanchep Ridges survey area.

2.2 Climate

The Swan Coastal Plain has a typically Mediterranean climate with hot, dry summers and mild wet winters (Gentilli 1972; Beard 1990; Gibson *et al*. 1994). Annual rainfall ranges from a low of 700 mm to the north and rises to over 1000 mm at the base of the scarp to the south, winter rains account for the majority of annual rainfall (Gibson *et al*. 1994). Figure 2 details rainfall and temperature data from the closest and most representative recording stations (Bureau of Meteorology 2013). Rainfall data were sourced from both Tamala Park (Mindarie) and the Wanneroo recording stations due to gaps in both data sets. Temperature data for 2013 was largely unavailable for surrounding recording stations, therefore the 2012 temperature data from the Perth Metro station were used (Figure 2). This survey was conducted in November 2013 following unseasonably higher rainfall in the preceding three months. Rainfall from February to June was unusual, exceeding the average in March and May and below average for April and June (Figure 2).

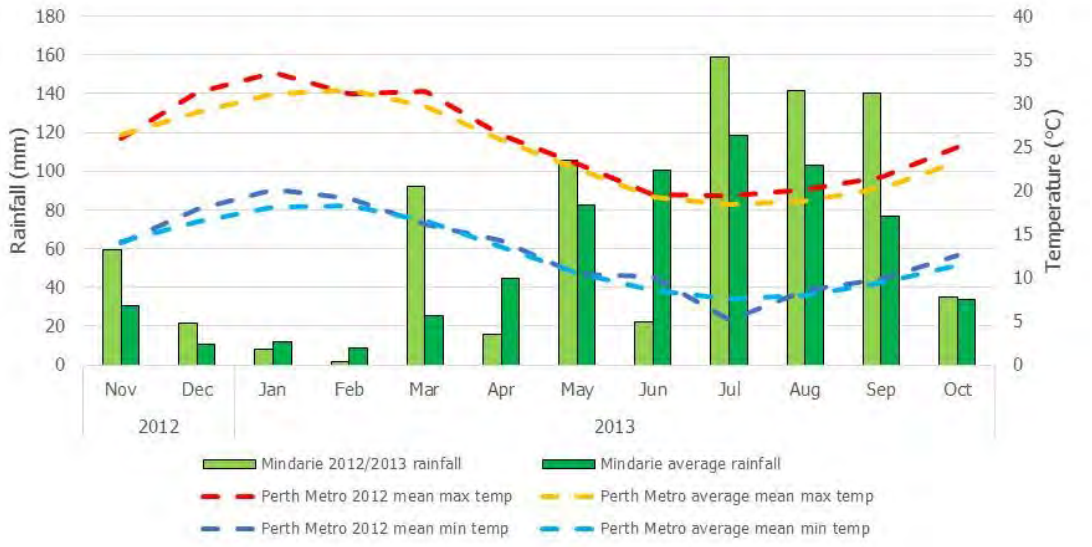


Figure 2: Rainfall and temperature data for the Tamala Park (Mindarie), Wanneroo and Perth Metro Recording Stations. Long term average rainfall and temperature data, together with monthly rainfall data for the period November 2012 to October 2013 are shown (Bureau of Meteorology 2013).

2.3 Soils and Topography

The Swan Coastal Plain is comprised of five major geomorphological systems that lie parallel to the coast, namely (from west to east) the Quindalup Dunes, Spearwood Dunes, Bassendean Dunes, Pinjarra Plain and Ridge Hill Shelf (Churchward and McArthur 1980; Gibson *et al*. 1994). Each major system is composed of further subdivisions in the form of detailed geomorphological units (Churchward and McArthur 1980; Semeniuk 1990; Gibson *et al*. 1994).

The survey area is situated on the Spearwood Dunes. The Spearwood dune and plain system consists of leached and podzolized surface sands and yellow to reddish brown deeper sands.

2.4 Regional Vegetation

The Drummond Botanical Subdistrict is characterised by low *Banksia* woodlands on leached sands; *Melaleuca* swamps on poorly-drained depressions; and *Eucalyptus gomphocephala* (tuart), *Eucalyptus marginata* (jarrah) and *Corymbia calophylla* (marri) woodlands on less leached soils (Beard 1990). The Drummond Botanical Subdistrict comprises of twelve physiographic units (systems), with the survey area situated within the Spearwood System (Figure 3).

The Spearwood System comprises of shore-line parallel calcarenite ridges mantled with yellow sands which gradually become more bleached and less calcareous to the east of the system. This system is characterised by two dominant overstorey associations namely *Eucalyptus gomphocephala* woodlands and *E. gomphocephala* -*Eucalyptus marginata* mixed woodlands. Outside these two major overstorey associations, frequent admixtures and transition zones occur in the form of *Banksia-Calothamnus* heaths, *Agonis flexuosa* low woodlands and *Melaleuca preissiana*, *Melaleuca rhaphiophylla* and/or *Banksia littoralis* in low lying and/or swampy areas.

Havel (1968) studied the landforms, soils and associated vegetation types as part of a study associated with defining suitable areas for the planting of *Pinus pinaster* for forestry operations. This work differentiated site-vegetation types on the basis of the sand soils types, the topography and the associated vegetation.

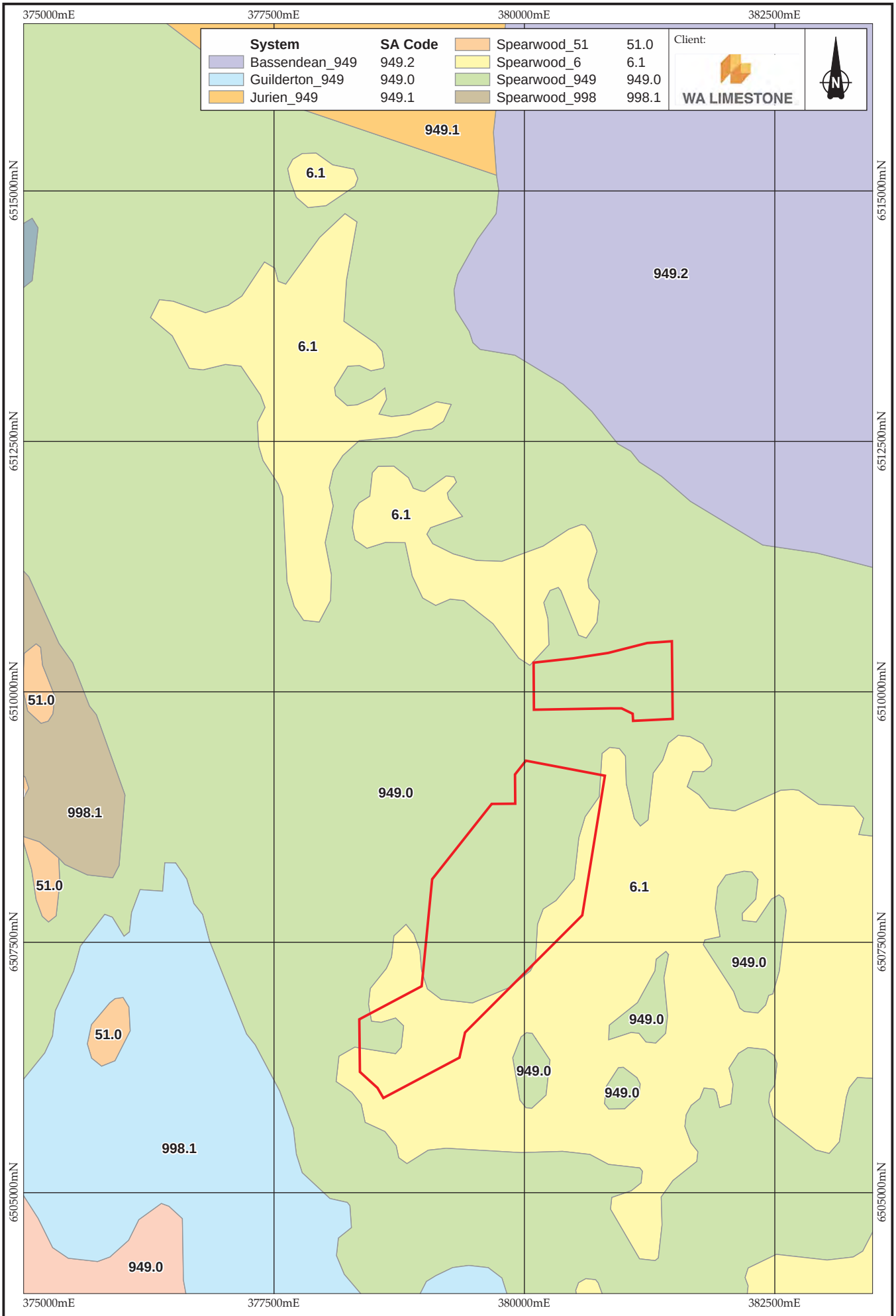
In more recent years, Mattiske Consulting Pty Ltd (2003) mapped the site-vegetation types over the Gnangara Mound area which overlaps with the Yanchep Ridges survey area. This work enabled studies

to be undertaken at a finer scale than the earlier regional vegetation studies by Heddle *et al.* (1980) which were associated with the System 6 process (Figure 4).

The latter work by Heddle *et al*. (1980) was done in parallel to the studies by Churchward and McArthur (1980) on the System 6 areas. On reviewing the latter mapping the vegetation associations within the survey area overlapped with two broad vegetation complexes namely the Cottesloe Complex (Central and South) and Cottesloe Complex (North) (Figure 4). A brief description of each vegetation complex is provided below:

- The Cottesloe Complex (North) is predominantly low open forest and low woodland of *Banksia attenuata* - *B. menziesii* - *Eucalyptus todtiana* with closed heath on the limestone outcrops.

- The Cottesloe Complex (Central and South) is predominantly a mixed Eucalypt forest consisting of *Eucalyptus gomphocephala, Eucalyptus marginata* and *Corymbia calophylla* with occasional dense stands of *Eucalyptus foecunda*. Common species in the second tree layer include *Banksia attenuata*, *Agonis flexuosa* and *Allocasuarina fraseriana*.



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Scale 1:50,000
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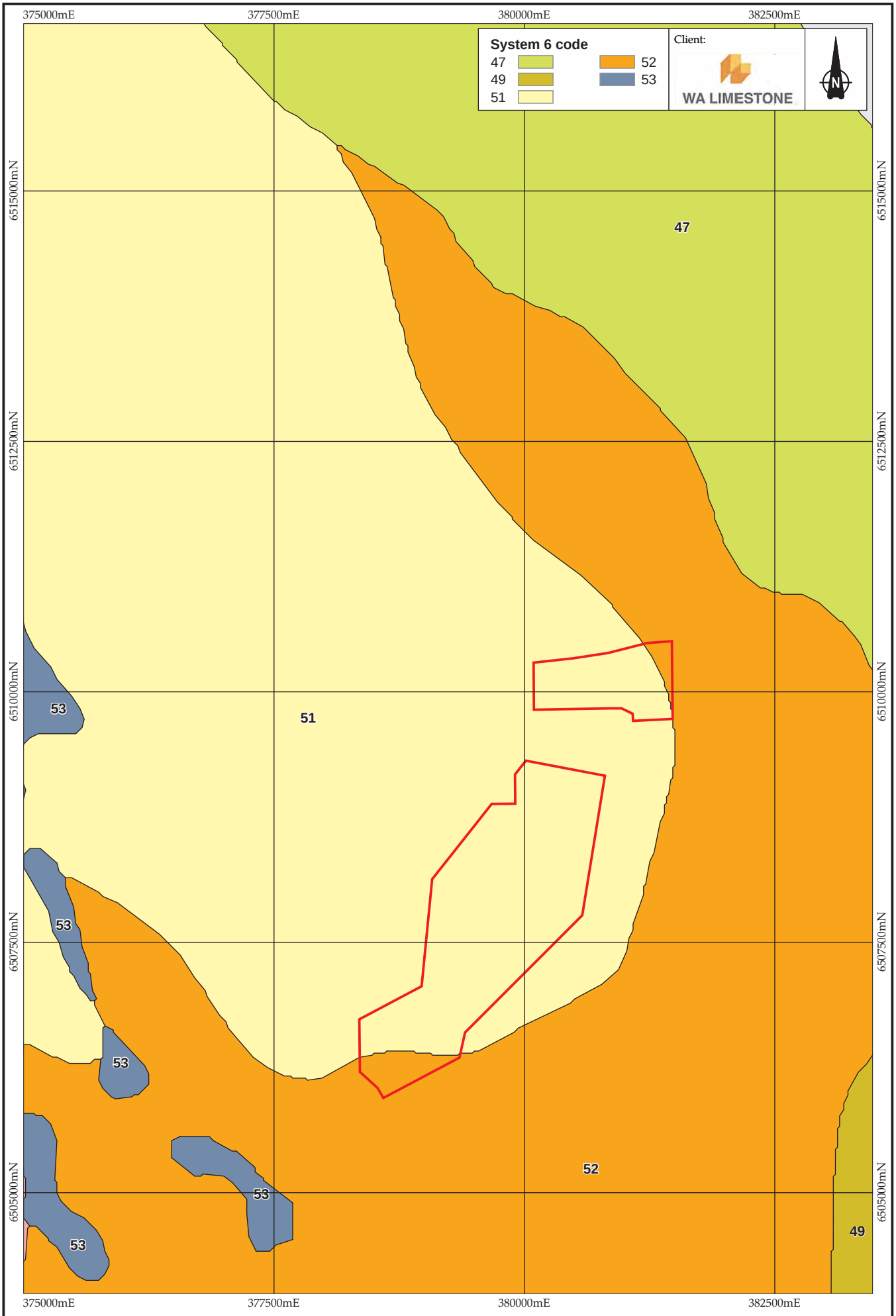
Yanchep Ridges Area

Pre-European Vegetation

Figure: 3



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Yanchep Ridges Area

System 6 Vegetation

Figure: **4**

2.5 Western Australia's Flora – A Legislative Perspective

Western Australia has a unique and diverse flora, and is recognised as one of the world's 34 biodiversity hotspots (Myers *et al.* 2000). In this context, Western Australia possesses a high degree of species richness and endemism. This is particularly pronounced in the south-west region of the state. There are currently over 12,000 plant species known to occur within Western Australia (DPaW 2014a), and scientific knowledge of many of these species is limited.

The legislative protection of flora within Western Australia is principally governed by three Acts. These are:

- The *Wildlife Conservation Act 1950*;
- The *Environmental Protection Act 1986*; and
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

The unique flora of Western Australia is potentially under threat due to historical clearing practices associated with agricultural, mining and human habitation activities. As a consequence of these historical clearing practices a number of flora species have become threatened or have the potential to become threatened as their habitat is impacted by human activity. In addition, some areas of the State have been affected by past clearing practices such that entire ecological communities are under threat.

The following sections describe these threatened and priority flora and ecological communities, and outline the legislative protection afforded to them.

At the State level, the *Wildlife Conservation Act 1950 (WC Act*) provides for taxa of native flora (and fauna) to be specially protected because they are subject to identifiable threats. Protection of these taxa has been identified as being warranted because they may become extinct, are threatened, or are otherwise in need of special protection. Ecological communities that are deemed to be threatened are afforded protection under the *Environmental Protection Act 1986 (EP Act)*. Listings of threatened species and communities are reviewed annually by the Western Australian Threatened Species Scientific Committee (TSSC), which is a body appointed by the Minister for the Environment and supported by the DPaW. The TSSC reviews threatened and specially protected flora (and fauna) listings on an annual basis. Recommendation for additions or deletions to the listings of specially protected flora (and fauna) is made to the Minister for the Environment by the TSSC, via the Director General of the DPaW, and the WA Conservation Commission. Under Schedule 1 of the *WC Act*, the Minister for the Environment may declare that a class or description of flora to be threatened flora throughout the State, by notice published in the *Government Gazette* (DPaW 2014b).

At the Commonwealth level, under the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*, a nomination process exists, to list a threatened species or ecological community. Additions or deletions to the lists of Threatened species and communities are made by the Minister for Sustainability, Environment, Water, Populations and Communities, on advice from the Federal Threatened Species Scientific Committee. *EPBC Act* lists of Threatened flora and ecological communities are published on the DSEWPC website (2014a, 2014b).

2.5.1 Threatened and Priority Flora

Flora within Western Australia that is considered to be under threat may be classed as either threatened flora or priority flora. Where flora has been gazetted as threatened flora under the *WC Act*, it is an offence "to take" such flora without the written consent of the Minister. The *WC Act* states that "to take" flora includes to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means.

Priority flora constitute species which are considered to be under threat, but for which there is insufficient information available concerning their distribution and/or populations to make a proper evaluation of their conservation status. Such species are considered to potentially be under threat, but do not have legislative protection afforded under the *WC Act*. The DPaW categorises priority flora according to their conservation priority, using five categories, P1 to P5, to denote the conservation priority status of such species, with P1 listed species being the most threatened, and P5 the least. Priority flora species are regularly reviewed, and may have their priority status changed when more

information on the species becomes available. Appendix A1 sets out definitions of both threatened and priority flora (DPaW 2014c).

At the Commonwealth level, under the *EPBC Act*, threatened species can be listed as extinct, extinct in the wild, critically endangered, endangered, vulnerable, or conservation dependent, by the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities. Refer to Appendix A2 for a description of each of these categories of threatened species. Under the *EPBC Act*, a person must not take an action that has or will have a significant impact on a listed threatened species without approval from the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities, unless those actions are not prohibited under the Act. The current *EPBC Act* list of Threatened flora may be found on the DoE (2014a) website.

2.5.2 Threatened and Priority Ecological Communities

An ecological community is defined as a naturally occurring biological assemblage that occurs in a particular type of habitat composed of specific abiotic and biotic factors. At the State level, ecological communities may be considered as threatened once they have been identified as such by the Western Australian Threatened Ecological Communities Scientific Advisory Committee. A TEC is defined, under the *EP Act*, as an ecological community listed, designated or declared under a written law or a law of the Commonwealth as threatened, endangered or vulnerable. There are four State categories TECs: presumed totally destroyed (PD); critically endangered (CR); endangered (EN); and vulnerable (VU) (DPaW 2014d). A description of each of these categories of TECs is presented in Appendix A3. TECs are gazetted as such (DPaW 2014d). A list of current TECs can be viewed at the DPaW (2014e).
At the Commonwealth level, some Western Australian TECs are listed as threatened, under the *EPBC Act*. Under the *EPBC Act*, a person must not take an action that has or will have a significant impact on a listed threatened ecological community without approval from the Commonwealth Minister for the Sustainability, Environment, Water, Population and Communities, unless those actions are not prohibited under the Act. A description of each of these categories of TECs is presented in Appendix A4. The current *EPBC Act* list of TECs can be located on the DoE (2014b) website.

Ecological communities identified as threatened, but not listed as TECs, can be classified as PECs. These communities are under threat, but there is insufficient information available concerning their distribution to make a proper evaluation of their conservation status. The DPaW categorises priority ecological communities according to their conservation priority, using five categories, P1 to P5, to denote the conservation priority status of such ecological communities, with P1 communities being the most threatened and P5 the least. Appendix A5 sets out definitions of priority ecological communities (DPaW 2014d). A list of current PECs can be viewed at the DPaW (2014f) website.

2.5.3 Clearing of Native Vegetation

Under the *EP Act*, the clearing of native vegetation requires a permit to do so, from the DPaW or the Department of Mines and Petroleum, unless that clearing is exempted under specific provisions listed in Schedule 6 of the Act, or are prescribed in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Under the *EP Act*, "native vegetation" means indigenous aquatic or terrestrial vegetation, and includes dead vegetation unless that dead vegetation is of a class declared by regulation to be excluded from this definition but does not include vegetation in a plantation. Under the *EP Act*, Section 51A, "clearing" means the killing or destruction of, the removal of, the severing or ringbarking of trunks or stems of, or the doing of any other substantial damage to, some or all of the native vegetation in an area, and includes the draining or flooding of land, the burning of vegetation, the grazing of stock, or any other act or activity, that causes any of the aforementioned consequences or results.

Under the *EP Act*, ten principles are set out, under which native vegetation should not be cleared. These principles state that native vegetation should not be cleared, if:

a. it comprises a high level of biological diversity;
b. it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia;
c. it includes, or is necessary for the continued existence of, threatened flora;
d. it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community;

e. it is significant as a remnant of native vegetation in an area that has been extensively cleared;

f. it is growing in, or in association with, an environment associated with a watercourse or wetland;

g. the clearing of the vegetation is likely to cause appreciable land degradation;

h. the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area;

i. the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water; or

j. the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

The *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, under Regulation 5, sets out prescribed clearing actions that do not require a clearing permit, as defined in Section 51C of the *EP Act*.

Under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, under Regulation 6 –"Environmentally sensitive areas" are defined as "the area covered by vegetation within 50 m of threatened flora, to the extent to which the vegetation is continuous with the vegetation in which the threatened flora is located".

Under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* - Regulation 6 (Environmentally sensitive areas), the area covered by a TEC, is similarly considered an Environmentally sensitive area and therefore non-permitted, unless Ministerial approval is granted.

2.6 Declared (Plant) Pest Organisms

The *Biosecurity and Agriculture Management Act 2007* (*BAM Act*), Section 22, makes provision for a plant taxa to be listed as a declared pest organism in respect of parts of, or the entire State. According to the *BAM Act*, a declared pest is defined as a prohibited organism (Section 12), or an organism for which a declaration under section 22 (2) of the Act is in force.

Under section 26 (1) of the *BAM Act*, a person who finds a declared plant pest must report, in accordance with subsection (2), the presence or suspected presence of the declared pest to the Director General or an inspector of the Department of Agriculture and Food Western Australia.

Under the *Biosecurity and Agriculture Management Regulations 2013*, declared plant pests are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Appendix A6). According to section 30 (3) of the *BAM Act*, the owner or occupier of land, or a person who is conducting an activity on the land, must take the prescribed control measures to control the declared pest if it is present on the land.

The current listing of declared pest organisms and their control category is available on the Western Australian Organism List, at the Biosecurity and Agriculture Management website of the Department of Agriculture and Food Western Australia (2014).

2.7 Local and Regional Significance

Flora or vegetation may be locally or regionally significant in addition to statutory listings by the State or Federal Government.

In regards to flora; species, subspecies, varieties, hybrids and ecotypes may be significant other than as threatened flora or priority flora, for a variety of reasons, including:

- a keystone role in a particular habitat for threatened species, or supporting large populations representing a significant proportion of the local regional population of a species;
- relic status
- anomalous features that indicate a potential new discovery;
- being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- the presence of restricted subspecies, varieties, or naturally occurring hybrids;
- local endemism/a restricted distribution; and
- being poorly reserved (Environmental Protection Authority 2004).

Vegetation may be significant because the extent is below a threshold level and a range of other reasons, including:

- scarcity;
- unusual species;
- novel combinations of species;
- a role as a refuge;
- a role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species;
- being representative of the range of a unit (particularly, a good local and/or regional example of a unit in "prime" habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- a restricted distribution (Environmental Protection Authority 2004).

Vegetation communities are locally significant if they contain Priority Flora species or contain a range extension of a particular taxon outside of the normal distribution. They may also be locally significant if they are very restricted to one or two locations or occur as small isolated communities. In addition, vegetation communities that exhibit unusually high structural and species diversity are also locally significant.

Vegetation communities are regionally significant where they are limited to specific landform types, are uncommon or restricted plant community types within the regional context, or support populations of threatened Flora. Determining the significance of flora and vegetation may be applied at various scales, for example, a vegetation community may be nationally significant and governed by statutory protection as well as being locally and regionally significant.

3. OBJECTIVES

The aim of the current survey was to undertake a Level 2 Flora and Vegetation assessment of the Yanchep Ridges survey area. Specifically, the objectives include:

- Collect and identify the vascular plant species present in the survey area;
- Collect and identify any Threatened and Priority vascular plant species ;
- Review the conservation status of the vascular plant species recorded by reference to current literature and current listings by the DPaW (2014a) and plant collections held at the Western Australian State, and listed on the DoE (2014a) under the *EPBC Act* (Commonwealth);
- Record information regarding the GPS co-ordinates and number of plants for any known or potential Threatened Flora and Priority Flora located during the survey;
- Undertake the flora survey to standards set out in Guidance Statement 51 (Environmental Protection Authority 2004);
- Lodge Threatened and Priority Flora Report Forms with the Department of Parks and Wildlife for all recorded localities of Threatened Flora and Priority Flora species;
- Identify Threatened and Priority Ecological Communities present and/or potentially present within the survey area;
- Define and map native vegetation communities and their condition;
- Review and provide recommendations on the local and regional significance of vegetation communities and vegetation associations recorded within the survey area; and
- Prepare a report summarising the findings.

4. METHODS

Prior to undertaking survey work, a desktop search for Threatened and Priority flora and Threatened and Priority Ecological Communities that have the potential to occur within the survey area was undertaken using Florabase and NatureMap (DPaW 2014a; 2014g).

Assessment of flora and vegetation of the survey area was undertaken by eight experienced Botanists from Mattiske Consulting Pty Ltd from the 18th to the 21th of November 2013. A total of 36 sampling sites were selected using high resolution aerial photographic maps of the survey area as supplied by CAD Resources and opportunistic field selection (Appendix B). Survey sites consisted of pegged 10 x 10 metre quadrats. All geographical coordinates cited in this report are based on the GDA94 datum. The survey was undertaken in accordance with the recommendations made in Guidance Statement 51 (Environmental Protection Authority 2004).

The flora and vegetation was described and sampled systematically at each survey site, and additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed. At each site the following floristic and environmental parameters were recorded:

- GPS location;
- topography;
- percentage and type of litter cover;
- soil type and colour;
- percentage of bare ground;
- outcropping rocks and their type;
- notes on disturbance and vegetation condition;
- site photograph;
- time since fire; and
- number, height and percentage cover of species.

Relevè survey sites in which the dominant plant species were recorded were also carried out in order to aid in the delineation of vegetation types and boundaries.

All plant specimens collected during the field surveys were dried and fumigated in accordance with the requirements of the Western Australian Herbarium. Plant species were identified through comparisons with pressed specimens housed at the Western Australian Herbarium. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded is in accordance with the DPaW (2014a; 2014c).

PRIMER v6 (Plymouth Routines in Multivariate Ecological Research) statistical analysis software was used to analyse species-by-site data and discriminate sites on the basis of their species composition (Clarke and Gorley 2006). To down weight the relative contributions of quantitatively dominant species a presence/absence transformation was applied to the data set. Introduced species were excluded from analysis. Singletons were excluded from analysis. Transformed data were analysed using a series of multivariate analysis routines including Hierarchical Clustering (CLUSTER), Analysis of Similarities (ANOSIM) and Similarity Percentages (SIMPER). Results were used to inform and support interpretation of aerial photography and delineate the plant communities. Combining these methods increased the understanding of site inter-relations and thus the ability to accurately delineate those sites based on species composition.

To identify possible TECs and PECs in the survey area, vegetation units were compared to Floristic Community Types (FCTs) defined by Gibson *et al.* (1994). Comparisons were made using appropriate multivariate analyses comparing current data to that of Gibson *et al.* (1994) species by quadrat data, and inferences based on dominant species and geomorphology. Areas were mapped based on extrapolated quadrat data from a single flora assessment, rather than accumulated species data over successive seasons within known vegetation community types as per Gibson *et al.* (1994).

An assessment of the survey against a range of factors which may have had an impact on the outcomes of the current survey was made (Table 1). Based on this assessment, the present survey may be subject to constraints which would affect the thoroughness of the survey, and the conclusions which have been formed.

Table 1: Potential Flora and Vegetation Survey Limitations for Survey Area

Potential Survey Limitation	Impact on Survey
Sources of information and availability of contextual information (*i.e.* pre-existing background versus new material)	**Not a constraint:** Adequate background information was sourced to provide detailed contextual information for the current project. Adequate supplementary material was utilised to compare and contrast current data with that of previous work across the Swan Coastal Plain (e.g. Floristic Community Types).
Scope (*i.e.* what life forms, *etc.*, were sampled)	**Not a constraint:** Vascular flora was the focus of the survey. These were thoroughly sampled.
Proportion of flora collected and identified (based on sampling, timing and intensity)	**Not a constraint:** The proportion of flora collected and identified was adequate for a level 2 flora and vegetation survey. It was estimated that approximately 83 % of the flora potentially present within the survey area were sampled. The majority of species would have been identified during this survey however, it is likely that species with a low abundance, or with a very restricted range in the survey area were not observed. For example, *Acacia benthamii* (P2), was previously recorded within the survey area by Mattiske (1996) but was not encountered during the current survey.
Completeness and further work which might be needed (was the relevant survey area fully surveyed?)	**Possibly a constraint:** Sites were pre-selected using aerial photography to ensure all vegetation communities subjectively identified were sampled, with multiple replications. Where necessary, additional sites were chosen in the field. To aid in future planning and development of the tenement further work to ground-truth the exact boundary of vegetation inferred to represent SCP 26a may be warranted. In addition, a targeted Threatened and Priority Flora search would aid in identifying areas of high environmental risk.
Mapping reliability	**Not a constraint:** Adequate coverage of the area was made during the present survey. High quality aerial maps were used for both the survey work and subsequent vegetation community mapping. Mapping boundaries were often discontinuous with mapping boundaries resembling admixtures of one or more vegetation communities. This is, however, a recognised limitation of vegetation mapping.
Timing, weather, season, cycle	**Not a constraint:** Surveys were conducted following above average rainfall in the three months preceding the survey. There were no interruptions to field work due to weather or timing issues.
Disturbances (fire flood, accidental human intervention, *etc.*)	**Not a constraint:** Tracks and illegal dumping of refuse occur within the survey area. Clearing associated with these factors, was considered minimal and constituted a relatively small area. As such they were not viewed as adversely impacting vegetation structure and thus the ability to delineate vegetation communities in the affected areas.
Intensity (in retrospect, was the intensity adequate?)	**Not a constraint:** Survey intensity was considered to have been adequate. More than adequate quantitative and spatial replication of sites was achieved within each vegetation community.
Resources (were there adequate resources to complete the survey to the required standard?)	**Not a constraint:** Resources, in terms of time, equipment, support and personnel were adequate to undertake and complete the survey.
Access problems (*i.e.* ability to access survey area)	**Not a constraint:** All sections of the survey area were easily accessible by foot.
Experience levels (*e.g.* degree of expertise in plant identification to taxon level)	**Not a constraint:** Ecologists and botanists have undertaken previous surveys in the local and wider area and were very familiar with the flora and vegetation.

5. RESULTS

5.1 Desktop Survey

5.1.1 Threatened and Priority Flora with Potential to Occur within the Survey Area

Two Threatened Flora species pursuant to Schedule 1 of the *WC Act* and as listed by the DPaW (2014b) were recorded within the bounds of the desktop search (Table 2). The bounds of the desktop search are defined as a 10 km search radius from the centre of the current survey area. Both of these species are also listed under the *EPBC Act* (DoE 2014a).

Seventeen Priority Flora species as listed by the DPaW (2014g) were identified by the desktop search as having the potential to occur within the survey area. This included three Priority 1, one Priority 2, nine Priority 3 and four Priority 4 flora species (Table 2).

Table 2: Threatened and Priority Flora with Potential to Occur in the Yanchep Ridges Survey Area

SCC = State Conservation Code (Appendix A1); FCC = Federal Conservation Code (Appendix A1)

SPECIES	FAMILY	SCC	FCC	HABITAT
Calectasia cyanea	Myrtaceae	T	CE	Yellow/grey sand over limestone or gravel
Eucalyptus argutifolia	Myrtaceae	T	VU	Slopes, gullies and limestone ridges of shallow sandy soils over limestone
Baeckea sp. Limestone	Myrtaceae	P1	-	Yellow/grey sand over limestone
Haloragis sp. Parrot Ridge	Haloragaceae	P1	-	Black sand over limestone on ridge
Leucopogon maritimus	Ericaceae	P1	-	White/grey sand in coastal dunes, associated with limestone
Acacia benthamii	Fabaceae	P2	-	Brown/grey sand on limestone breakaways
Adenanthos cygnorum subsp. *chamaephyton*	Proteaceae	P3		Grey sand or lateritic gravel
Conostylis bracteata	Haemodoraceae	P3	-	Sand over limestone on coastal dunes
Hibbertia spicata subsp. *leptotheca*	Dilleniaceae	P3	-	Sand over limestone in coastal areas
Lasiopetalum membranaceum	Malvaceae	P3		Sand over limestone on gentle slopes
Leucopogon sp. Yanchep (M. Hislop 1986)	Ericaceae	P3		Yellow/grey sand over limestone on the coastal plain
Pimelea calcicola	Thymelaeaceae	P3	-	Sand over limestone in coastal areas
Pithocarpa corymbulosa	Asteraceae	P3		Gravelly or sandy loam amongst granite outcrops near the coast
Sphaerolobium calcicola	Fabaceae	P3		Sand or sandy clay in seasonally wet areas.
Stylidium maritimum	Stylidiaceae	P3		Sand over limestone on dune slopes and flats
Conostylis pauciflora subsp. *euryrhipis*	Haemodoraceae	P4		White, grey or yellow sand on consolidated dunes
Conostylis pauciflora subsp. *pauciflora*	Haemodoraceae	P4		Grey sand over limestone on consolidated dunes and hillslopes
Hibbertia helianthemoides	Dilleniaceae	P4		Clayey sand over sandstone or loam over quartzite on hills and scree slopes
Lepidium pseudotasmanicum	Brassicaceae	P4		Loam, sand over limestone and granite

Descriptions of Threatened and Priority Flora identified by the desktop search (Table 2) are as follows:

Eucalyptus argutifolia **(Threatened) – Myrtaceae**
This species is described as a mallee growing to 4 m high, with smooth bark and producing white flowers from March to April. Generally found growing in grey/brown sand in association with limestone on breakaways, slopes and gullies. There are thirty nine records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). Eight of these records occur within 8 km north of the survey area and six records occur within 10 km south of the survey area. It is possible this species will occur within the survey area.

Calectasia cyanea **(Threatened) – Myrtaceae**
This species is described as rhizomatous, clump forming, woody perennial herb growing to 0.6 m high and has been recorded as producing blue/purple flowers from June to October. Generally growing on white, grey or yellow sand over gravel or limestone. There are seven records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). Five of these records occur approximately 430km away near Albany and the remaining two occur north of Jurien Bay, approximately 150 km away. This species is therefore unlikely to occur within the survey area.

Baeckea **sp. Limestone (Priority 1) – Myrtaceae**
This species is described as an erect compact or open shrub, growing to 2 m high and has been recorded as producing white to pinkish flowers from November to January. Generally recorded growing in yellow/grey sand in association with limestone on slopes and ridges. There are seventeen records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). One of the records occurs within the survey area. It is likely that this species will occur within the survey area.

Haloragis **sp. Parrot Ridge (Priority 1) – Haloragaceae**
This poorly collected species is known from only one record in the database of the Western Australian Herbarium (DPaW 2014a). It was recorded as growing on the northern margin of a ridge in black sand over limestone within 6 km of the survey area. It was described as an erect, perennial soft shrub or herb growing to 30 cm high and flowering in September to November.

Leucopogon maritimus **(Priority 1) – Ericaceae**
This species is described as a low spreading shrub growing to 0.3 m high, recorded producing white flowers from April to August and in November. Generally recorded growing in white/yellow sand on coastal dunes, often in association with limestone. There are seventeen records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). The closest of these records is 5 km to the east of the survey area. It is possible this species will occur within the survey area.

Acacia benthamii **(Priority 2) – Fabaceae**
This species is described as a shrub growing to 1m, producing yellow flowers from August to September. Typically growing on limestone breakaways, it is also found in grey/brown sand on variable topography along the Swan Coastal Plain. There are thirty four records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). The closest of these records occurs 5 km to the west of the survey area. *Acacia benthamii* was previously recorded within the survey by Mattiske Consulting (Mattiske 1996). It is likely this species will occur within the survey area.

Adenanthos cygnorum subsp. chamaephyton **(Priority 3) – Proteaceae**
This species is described as a prostrate, mat-forming, non-lignotuberous shrub growing to 0.3 m high. Generally found growing on grey sand or lateritic gravel, it flowers from July to January with a variety of flower colours ranging from white to pink to green. There are nineteen records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). The closest of these records is approximately 6.3 km to the east of the survey area. It is possible this species will occur within the survey area.

Conostylis bracteata **(Priority 3) – Haemodoraceae**
This species is described as a perennial, rhizomatous, tufted or shortly proliferous grass like herb, producing yellow flowers from August to September. Generally found growing in sand associated with limestone on sand dunes. There are eleven records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). The closest record occurs approximately 6 km to the north west of the survey area. It is possible this species will occur within the survey area.

***Hibbertia spicata* subsp*. leptotheca* (Priority 3) – Dilleniaceae**
This species is described as an erect or spreading shrub growing to 0.5 m high, producing yellow flowers from July to October. Generally growing in a variety of sand types, often associated with limestone, near the coast on ridges, outcrops and cliffs. There are thirty six records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). The closest record occurs approximately 5 km to the west of the survey area. It is possible this species will occur within the survey area.

***Lasiopetalum membranaceum* (Priority 3) – Malvaceae**
This species is described as a low multi-stemmed shrub growing to 1 m high. Generally found growing in sand over limestone, it flowers from September to December with a variety of flower colours ranging from pink to blue to purple. There are twenty nine records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). The closest of these records occurs approximately 3.5 km to the north west of the survey area. It is possible this species will occur within the survey area.

***Leucopogon* sp. Yanchep (M. Hislop 1986) (Priority 3) – Ericaceae**
This species is described as an erect shrub growing to 1 m high, producing white or pink flowers from June to September. It has been recorded growing in a variety of soils including light grey-yellow sand, brown loam, limestone, laterite and granite on coastal plains, breakaways, valley slopes and low hills. There are twenty records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). Five records occur within 8 km of the site. The closest of these records occur 3 km to the west of the survey area. It is possible this species will occur within the survey area.

***Pimelea calcicola* (Priority 3) – Thymelaeaceae**
This species is described as an erect to spreading shrub growing to 1m high, producing pink flowers from September to November. Generally growing in grey/yellow sand, often associated with limestone, on ridges and flats near the coast. There are twenty six records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). Two of these records occur approximately 6 km to the west of the survey area. It is possible this species will occur within the survey area.

***Pithocarpa corymbulosa* (Priority 3) – Asteraceae**
This species is described as an erect to scrambling perennial herb growing to 1 m high, producing white flowers from January to April. Generally growing on gravelly or sandy loam amongst granite outcrops near the coast. There are twenty two records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). The closest of these records occurs 10 km to the south east of the survey area. It is possible this species will occur within the survey area.

***Sphaerolobium calcicola* (Priority 3) – Fabaceae**
This species is described as a slender, multi-stemmed, scandent or erect shrub growing to 1.5 m high. It has been recorded as producing orange to red flowers from June to November. It is generally found growing on sand or sandy clay in seasonally wet areas. There are twenty records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). The closest of these records occurs 4.5 km to the west of the survey area. It is possible this species will occur within the survey area.

***Stylidium maritimum* (Priority 3) – Stylidiaceae**
This species is described as a caespitose perennial herb growing to 0.7 m high, producing white to purple flowers from September to November. Generally growing on sand over limestone on dune slopes and flats in coastal heath, shrubland and open Banksia woodland. There are thirty six records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). The closest of these records occurs 4.5 km to the south of the survey area. It is possible this species will occur within the survey area.

***Conostylis pauciflora subsp. euryrhipis* (Priority 4) – Haemodoraceae**
This species is described as a rhizomatous, perennial grass-like herb growing to 0.18 m high, producing yellow flowers from August to October. Generally growing on white, grey or yellow sand on consolidated dunes. There are twenty five records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). The closest two records of this taxon occur approximately 6.5 km to the north of the survey area. It is possible this species will occur within the survey area.

Conostylis pauciflora subsp. pauciflora **(Priority 4) – Haemodoraceae**
This species is described as a rhizomatous, perennial grass-like herb growing to 0.35 m high, producing yellow flowers from August to October. Generally growing on grey sand over limestone on consolidated dunes and hillslopes. There are fourteen records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). The closest of these records occurs 6.3 km to the west of the survey area. It is possible this species will occur within the survey area.

Hibbertia helianthemoides **(Priority 4) – Dilleniaceae**
This species is described as a spreading to erect, low or prostrate shrub growing to 0.3 m high. It produces yellow flowers from July to October and has been recorded growing on clayey sand over sandstone or loam over quartzite on hills and scree slopes. There are fifty five records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). The closest of these records occurs 6.8 km to the north west of the survey area. It is possible this species will occur within the survey area.

Lepidium pseudotasmanicum **(Priority 4) – Brassicaceae**
This species is described as an erect annual or biennial herb growing to 0.4 m high, producing white to green flowers from February to December. Generally found growing in loam or sand over granite or in seasonally wet areas. There are fourteen records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). The closest of these records occurs 5.8 km to the west of the survey area. It is possible this species will occur within the survey area.

5.1.2 Threatened and Priority Ecological Communities Potentially Occurring within the Yanchep Ridges Survey Area

Following relevant database and literature searches, two Threatened and four Priority Ecological Communities were identified as having the potential to occur within the proposed Yanchep Ridges survey area (DPaW 2014g); a brief description and details are provided below and in Table 3.

SCP 19b Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain (CE; TEC) occur on linear damplands and sumplands, between Holocene dune swales. This community typically comprises species including *Acacia rostellifera*, *Acacia saligna*, *Xanthorrhoea preissii*, *Baumea juncea*, *Ficinia nodosa*, *Lepidosperma gladiatum* and *Poa porphyroclados* (DEC 2011). DPaW records show the occurrence of this community approximately 2.5 km to the west of the survey area. The specific geomorphic requirements for this community make it unlikely to occur within the survey area.

SCP 26a *Melaleuca huegelii - Melaleuca systena* (previously *M. acerosa*) shrublands on limestone ridges (EN; TEC) occur on skeletal soils on ridge slopes and tops on the northern Swan Coastal Plain. The community is dominated by *Melaleuca huegelii*, *M. systena, Banksia sessilis* over *Grevillea preissii, Acacia lasiocarpa* and *Spyridium globulosum.* Other common species include: *Daucus glochidiatus, Desmocladus flexuosus* and *Trachymene pilosa* (Gibson *et al.* 1994; DEC 2005). Two confirmed DPaW records of SCP 26a occur within the survey area – site identification codes MYHADR01 and MYHADR02 (Figure 7). The estimated area of each recorded location is just over one hectare (DEC 2005). Additional DPaW records of SCP 26a occur approximately 4 km to the north-west and 3 km to the west of the survey area.

Table 3: Threatened and Priority Ecological Communities with Potential to Occur in the Yanchep Ridges Survey Area

(Mitchell *et al.* 2002; DPaW 2014d).
SCC = State Conservation Code; FCC = Federal Conservation Code (Appendix A1)

SCP	Description	SCC	FCC
19b	Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain	CE	EN
26a	*Melaleuca huegelii - Melaleuca acerosa* shrublands on limestone ridges (TEC)	EN	-
22	*Banksia ilicifolia* woodlands	P2	-
23b	Northern *Banksia attenuata – B. menziesii* woodlands	P3	-
24	Northern Spearwood shrublands and woodlands (PEC)	P3	-
30b	*Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands	P3	-

SCP 22 *Banksia ilicifolia* woodlands (P2) occur low lying areas that are occasionally seasonally waterlogged. Other common species include *Banksia attenuata, Petrophile linearis, Dasypogon bromeliifolius, Phlebocarya ciliata* and *Stylidium brunonianum*. No DPaW records occur in close proximity to the survey area, however, details provided in WAPC (2000b) support the occurrence of SCP 22 in the encompassing Bush Forever site 381.

SCP 23b Northern *Banksia attenuata – B. menziesii* woodlands (P3) occurs on the Bassendean System from Melaleuca Park to Gingin. Other common species include *Bossiaea eriocarpa, Calytrix flavescens, Eremaea pauciflora, Alexgeorgea nitens, Lyginia barbata* and *Xanthosia huegelii*. No DPaW records occur in close proximity to the survey area, however, details provided in WAPC (2000b) support the occurrence of SCP 23b in the encompassing Bush Forever site 381.

SCP 24 Northern Spearwood shrublands and woodlands (P3) (PEC) occur on the deeper soils of the Swan Coastal Plain north from Woodman Point, generally in the Cottesloe unit of the Spearwood system. Described as heath communities with scattered *Eucalyptus gomphocephala,* with the heath community typically consisting of; *Banksia sessilis, Calothamnus quadrifidus* and *Schoenus grandiflorus* (DPaW 2014f). Other common species include; *Hardenbergia comptoniana, Xanthorrhoea preissii, Conostylis aculeata* and *Lomandra maritima* (Gibson *et al*. 1994). SCP 24 has been recorded 5 km to the south west of the survey area and may possibly occur in the survey area.

FCT 30b is characterised by *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands of the Quindalup system, this community extends from the Leschenault Peninsular south to Busselton. Other common species include *Hibbertia cuneiformis, Geranium retrorsum, Dichondra repens, Hardenbergia comptoniana, Rhagodia baccata* and *Spyridium globulosum*. DPaW records show the occurrence of this community approximately 4 km to the north-west of the survey area.

5.1.3 Areas of Significant Vegetation Located within and/or Adjacent to the Survey Area

The following section provides an overview of areas identified during the desktop survey as holding significant and/or noteworthy vegetation either traversed by or adjacent to the survey area.

The intact section of the survey area is located within the Bush Forever site: Ridges and Adjacent Bushland, Yanchep/Nowergup (Bush Forever site number 381; WAPC 2000b). The Bush Forever site contains, or is inferred to contain, the Floristic Community Types (FCT); 14 Deeper wetlands on sandy soils, 22 *Banksia ilicifolia* woodlands, 23b Northern *Banksia attenuata – Banksia menziesii* woodlands, 26a *Melaleuca huegelii – M. acerosa* shrublands on limestone ridges, 26b Woodlands and mallees on limestone, 27 Species-poor mallees and shrublands on limestone, 28 Spearwood *Banksia attenuata* or *B.* attenuata – *Eucalyptus* woodlands.

The Bush Forever site is said to be part of a transition area between vegetation of Spearwood and Bassendean Dunes systems (WAPC 2000b). The site has adjacent bushland to the south and west (Bush Forever sites 288 and 396) and is considered part of Greenway 36 (Tingay, Alan & Associates 1998) and part of a regionally significant contiguous bushland/wetland linkage (Part A, Map 7, WAPC 2000b).

Bushland Forever site 381 has also been recommended for protection in the study of City of Wanneroo bushland (Trudgen 1996) and part of the site was recommended to be declared as an A-class Nature Reserve for the protection of flora and fauna in Gibson *et al.* 1994. It contains seven regional floristic groups and was included in the Gnangara Park proposal (Bailey 1997).

The survey area is part of State Forest 65 referred to as the 'Ridges', an area with long-standing recommendations to be added to Yanchep National Park (Department of Environment and Conservation 2012). It is said to contain significant conservation values including (DEC 2012):

- Species and communities restricted to limestone ridges (including threatened species and communities);
- Species and communities that are not well represented within the conservation reserve system;
- Occurrence of jarrah near the northern limits of its range (a small area of jarrah woodland occurs in Yanchep National Park);
- Important ecological value (Brown *et al.* 2009); and
- A seasonal wetland.

5.1.4 Previous Surveys of Relevance to the Yanchep Ridges Survey Area

Previous surveys relevant to this survey area include:

- "Botanical Survey Proposed Prospecting Lease Ridges Area - Yanchep" (Unpublished report prepared by Mattiske Consulting Pty Ltd for WA Limestone 1996)
- "Spring Flora Survey and Significant Tree Survey, 2010" (Unpublished draft report prepared by GHD for Landcorp 2010)

In November 1996 Mattiske Consulting Pty Ltd (Mattiske) conducted a flora and vegetation survey of the same survey area, excluding the rehabilitated section. No Threatened Flora species were recorded within the survey area. Two Priority Flora, *Acacia benthamii* (P2) and *Jacksonia sericea* (P4) were recorded within the survey area. A total of 186 flora species from 45 families and 110 genera were identified. Mattiske identified and mapped four vegetation communities within the survey area.

In September 2010 GHD conducted a Level 2 flora and vegetation survey and significant tree survey of Landcorp's Eglinton landholding, located approximately 5 km to the west of the Yanchep Ridges Survey Area. GHD's survey identified one TEC within the Study area, FCT 26a. Three Priority Ecological Communities (PECs) were recorded in the study area; FCT's 24, 29a and 30b. No Threatened Flora species were recorded in the study area. Three flora species of conservation significance were identified and recorded during the survey; *Leucopogon* sp. Perth coastal (A.S. George 17305) (P1), *Stylidium maritmum* (P3) and *Conostylis pauciflora* subsp. *pauciflora* (P4). Thirty-three trees at five separate locations in the study area were considered significant according to the criteria outlined in the City of Wanneroo Tree Preservation Policy. The majority of the significant tree species that were recorded during the survey were Tuart (*Eucalyptus gompohocephala*).

5.2 Field Survey

A total of 36 pegged survey sites, both pre-selected and opportunistic, were established in the Level 2 assessment of flora and vegetation of the Yanchep Ridges survey area. An additional 12 relevé sites were used to refine vegetation community boundaries and to collect taxa previously unrecorded. Refer to Appendix B for a list of the geographic locations for each survey sites.

5.2.1 Flora

A total of 209 vascular plant taxa which are representative of 122 plant genera and 46 plant families were recorded within the Yanchep Ridges survey area. The majority of the taxa recorded were representative of the Fabaceae (22 taxa), Proteaceae (22 taxa), Myrtaceae (21 taxa), Asparagaceae (15 taxa) and Poaceae (13 taxa) families (Appendix C). Of the 209 plant taxa recorded within the survey area, 26 species were introduced (exotic).

Of the 209 plant taxa recorded within the survey area, 170 (82.1 %) were perennials, 30 (14.5 %) were annuals and 7 (3.4 %) were site dependant or short lived perennials.

5.2.2 Accumulated Species – Sites Surveyed (Species-Area Curve)

A species accumulation plot using species accumulation analysis by Colwell (2006) was used to evaluate the adequacy of sampling (Figure 5). Data from sites located in the former pine plantation, relevé and opportunistic sites were excluded to maintain statistical validity. The species accumulation plot was compared to a theoretical asymptotic value determined using Michaelis-Menten (Chao 2004) modelling. As the number of survey sites increases, and correspondingly the size of the area surveyed increases, there should be a diminishing number of new species recorded. At some point, the number of new species recorded becomes essentially asymptotic. The survey effort can be considered adequate when the asymptotic value of the species accumulation plot approaches the theoretical asymptotic value.

The species accumulation curve (Figure 3), based on the species accumulation analysis of Colwell (2006) was used to evaluate the adequacy of sampling. The asymptotic value was determined using Michaelis-Menten modelling. Using this analysis, the incidence based coverage estimator of species richness (ICE) (Chao 2004) was calculated to be 202.72. Based on this value, and the total of 169 species recorded within permanent survey sites during the survey, approximately 83% of the flora species potentially present within the survey area were recorded.

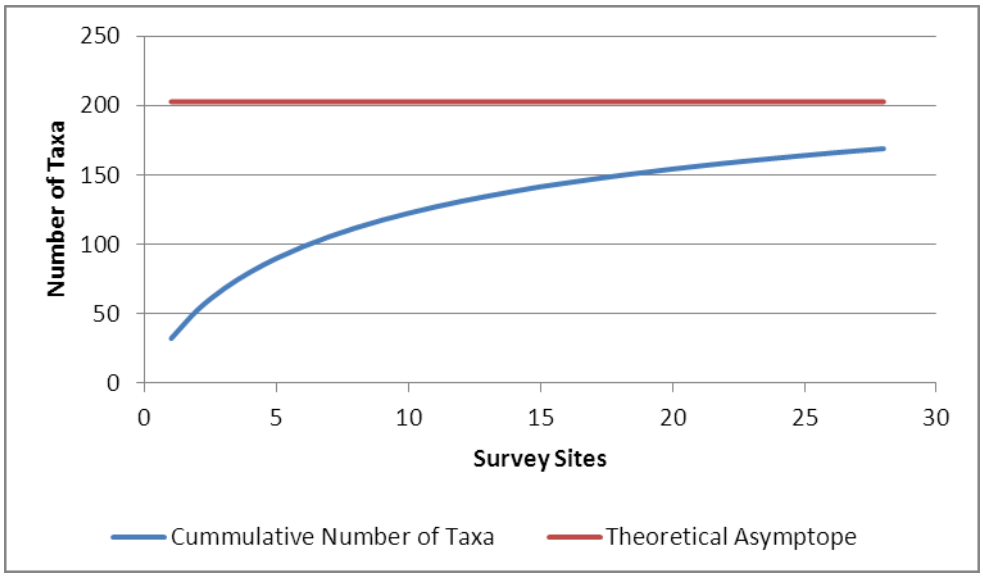

Figure 5: Species accumulation plot for the Yanchep Ridges Survey Area (former pine plantation area data excluded)
Field survey data were used to calculate both a species accumulation curve and a theoretical maximum number of species (asymptotic value) within the survey area.

5.2.3 Threatened and Priority Flora

No Declared Threatened Flora species pursuant to subsection (2) of section 23F of the *WC Act* and as listed by the DPaW (2014a) were recorded within the Yanchep Ridges survey area.

Three Priority Flora species pursuant to subsection (2) of section 23F of the *WC Act* and as listed by the DPaW (2014a) were recorded within the Yanchep Ridges survey area. One Priority 1 species *Baeckea* sp. Limestone (N. Gibson & M.N. Lyons 1425) and two Priority 3 species *Beyeria cinerea* subsp. *cinerea* and *Leucopogon* sp. Yanchep (M. Hislop 1986) were recorded; a brief description of these taxa and a table of their locations is listed below (Table 4).

***Baeckea* sp. Limestone (N. Gibson & M.N. Lyons 1425) (P1) – Myrtaceae**
This species is described as an erect compact or open shrub, growing to 2 m high and has been recorded as producing white to pinkish flowers from November to January. It has been recorded growing in yellow/grey sand in association with limestone on slopes and ridges. There are seventeen records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a).

***Beyeria cinerea* subsp. *cinerea* (P3) – Euphorbiaceae**
This species is described as a perennial compact shrub growing to 0.7m high with yellow flowers. It is generally found growing on white to brown/grey sand over limestone on upper slopes and ridges. There are thirty seven records of this taxon in the database of the Western Australian Herbarium with most occurring around Kalbarri or Leeman (DPaW 2014h). The closest records of *Beyeria cinerea* subsp. *cinerea* (P3) to the Yanchep Ridges survey area occur in Mosman Bay and Cottesloe. This record of *Beyeria cinerea* subsp. *cinerea* (P3) represents a disjunct population.

***Leucopogon* sp. Yanchep (M. Hislop 1986) (P3) – Ericaceae**
This species is described as an erect shrub growing to 1 m high, producing white or pink flowers from June to September. It has been recorded growing in a variety of soils including light grey-yellow sand, brown loam, limestone, laterite and granite on coastal plains, breakaways, valley slopes and low hills. There are twenty records of this taxon in the database of the Western Australian Herbarium (DPaW 2014a). Five records occur within 8 km of the site. The closest of these records occurs 3 km to the west of the survey area.

Table 4: Geographic Locations of Priority Species Recorded within the Yanchep Ridges Survey Area

Species	Survey Site	Geographic Location (GDA94_Z50)		Population
		Easting	Northing	
Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425) (P1)	YR27	379617	6507441	2-5
Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425) (P1)	Opportunistic site	379719	6507723	>500
Beyeria cinerea subsp. *cinerea* (P3)	Opportunistic site	379691	6507750	11-25
Leucopogon sp. Yanchep (M. Hislop 1986)	YR29	380564	6507825	2-5
Leucopogon sp. Yanchep (M. Hislop 1986)	YR32	379816	6508058	2-5
Leucopogon sp. Yanchep (M. Hislop 1986)	YR37	380016	6509149	2-5

5.2.4 Plants of Taxonomic Significance

Following formal communication with DPaW staff on the 18/12/13, Michael Hislop on behalf of sedge specialist Russell Barrett notes that this specimen will soon be known as *Lepidosperma* sp. Eneabba Swamps. It was considered unlikely to be of conservation concern. This species was recorded at sites YR10, YR28, YR29 and YR30 (Table 5).

Table 5: Plants of Taxonomic Significance Recorded within the Yanchep Ridges Survey Area

Species	Survey Site	Geographic Location (GDA94_Z50)		Population
		Easting	Northing	
Lepidosperma aff. *scabrum*	YR10	378889	6506924	1
Lepidosperma aff. *scabrum*	YR28	380193	6507647	1
Lepidosperma aff. *scabrum*	YR29	380564	6507825	1
Lepidosperma aff. *scabrum*	YR30	380653	6508859	2-5

5.2.5 Flora with Extensions to Their Range

No species recorded during the field survey represent an extension to their currently known range. The occurrence of range extensions was determined by comparing recorded locations in the current survey with that of species' distributions presented by WAH Florabase records.

5.2.6 Other Flora of Conservation Significance

A list of other flora of conservation significance recorded within the Yanchep Ridges survey area was compiled highlighting species near known northern or southernmost ranges and/or poorly collected species (Gibson *et al.* 1994; WAPC 2000b; DPaW 2014h; Table 6).

Table 6: Other Flora of Conservation Significance Recorded within the Yanchep Ridges Survey Area (DEC 2012, Gibson *et al*. 1994; WAPC 2000b; DPaW 2014h)

Species	Significance
Conostylis angustifolia	Southern extent of known range
Conostylis pusilla	Northern extent of known range
Conostylis caricina subsp. *caricina*	Northern extent of known range
Eucalyptus marginata	Northern extent of known range
Eucalyptus gomphocephala	Remaining stands in decline
Lechenaultia expansa	Northern extent of known range
Lechenaultia linarioides	Poorly reserved
Macrozamia riedlei	Northern extent of known range
Marianthus candidus	Northern extent of known range
Persoonia saccata	Northern extent of known range
Schoenus latitans	Southern extent of known range
Stylidium brunonianum	Northern extent of known range
Xanthorrhoea gracilis	Northern extent of known range

5.2.7 Threatened and Priority Ecological Communities

One Threatened Ecological Community occurs within the survey area, namely SCP 26a *Melaleuca huegelii – Melaleuca systena* shrublands on limestone ridges (EN; Table 7). Two confirmed DPaW records of SCP 26a occur within the survey area, site ID's MYHADR01 and MYHADR02 (Figure 7). The estimated area of each recorded location is approximately one hectare (DEC 2005). In the current survey, dense patches of *Melaleuca huegelii* and *M. systena* on skeletal soils were sporadically observed along the main central limestone ridge. These areas were mapped as the A1 community in the current survey, with the boundaries of each inferred TEC location ground-truthed. Approximately 3.6 hectares of the A1 was mapped across four small areas along the central limestone ridge.

Obvious limitations are associated with determining the presence of Floristic Community Types within the survey area. Significant groupings of quadrats and resultant delineation of vegetation communities are primarily determined *a-priori*. Comparing this type of data with that of Gibson *et al.* (1994), which contain accumulated species data over successive seasons within known vegetation communities across the Swan Coastal Plain, may be problematic. Unsurprisingly, comparative analysis between survey quadrats and vegetation communities in the current survey and that of Gibson *et al.* (1994) species by quadrat data show significant dissimilarities, a false negative (Appendix G; resemblance matrix and ANOSIM results can be provided upon request).

An inference based system has thus been applied, whereby floristic aspects of survey quadrats and vegetation communities delineated in the current survey are inferred to resemble key characteristics of FCTs as described by Gibson *et al.* (1994). Whilst results of comparative analysis have been used to support inferences, greater weight has been given to relating the frequency and dominance of key FCT defining species, with those species recorded in the current survey.

One Priority Ecological Community was inferred to occur within the Yanchep Ridges survey area, this being SCP 24 Northern Spearwood shrublands and woodlands (FCT 24; Gibson *et al.* 1994: SCC – P3; Table 7). Heathland sites within SCP 24 are typically characterised by taxa such as *Banksia sessilis, Calothamnus quadrifidus*, and *Schoenus grandiflorus.* Sites generally occur on deeper soils on the Cottesloe unit of the Spearwood system (Gibson *et al*. 1994; DPaW 2014f). Aspects of this community

are inferred to be represented in the current survey area by vegetation community A. Community A occurred on upper slopes and ridges within the survey area and predominately comprised of dense tall stands of *B. sessilis* and a number of other species consistent with that of SCP 24.

Table 7: Floristic Community Types Inferred to Occur within the Yanchep Ridges Survey Area (WAPC 2000b; DPaW 2014d)
SCC = State Conservation Code (Appendix A1); FCC = Federal Conservation Code (Appendix A1).

SCP	Description	SCC	FCC
26a	*Melaleuca huegelii – Melaleuca systena* shrublands on limestone ridges.	EN	-
24	Northern Spearwood shrublands and woodlands.	P3	-
28	Spearwood *Banksia attenuata* or *Banksia attenuata – Eucalyptus* woodlands	-	-

SCP28 is largely made up of *Banksia attenuata* woodlands, *Eucalyptus calophylla – B. attenuata* woodlands or *E. marginata – B. attenuata* woodlands. SCP 28 is well reserved and at low risk (Gibson *et al.* 1994). SCP28 generally occurs in the Karrakatta and Cottesloe units. Aspects of this community are inferred to be represented in the current survey by vegetation community B, C and D. To a lesser extent, floristic aspects of SCP24 were also inferred to be represented in community B, such a result highlights the frequent admixtures observed across the survey area. Details provided in WAPC (2000b) support the occurrence of SCP 28 in the encompassing Bush Forever site 381.

5.2.8 Introduced (Exotic) Plant Species

A total of 25 introduced (exotic) taxa were recorded within the Yanchep Ridges survey area (Appendix C). One of these taxon; **Asparagus asparagoides* is a Declared Pest (s22; C3 Management) throughout the state. **Asparagus asparagoides* (Bridal Creeper) is a rhizomatous and tuberous, perennial herb and climber growing to 5 m high. It produces white flowers from August to September and has been recorded growing in sand, loam, clay and granite (DPaW 2014h; Table 8).

Table 8: Geographic Locations of Declared Plant Species Recorded within the Survey Area

Species	Control Category	Survey Site	Geographic Location (GDA94_Z50)		Population
			Easting	Northing	
**Asparagus asparagoides* (Bridal Creeper)	C3	YR02	379451	6506828	1

Introduced species accounted for approximately 12.1 % (Appendix C) of taxa recorded within the survey area. The incidence of weeds was widespread throughout the survey area but weed density was generally higher near roads, tracks, clearings and illegally dumped refuse.

5.2.8 Statistical Analysis

Similarity Profile Analysis (SIMPROF) identified six significantly associated groups of quadrats (Pi = 4.62; p = <0.001; Figure 6). Generally for the purposes of vegetation mapping, i.e. extrapolating quadrat data to generalise vegetation communities over broad areas, an inclusive rather than exclusive approach is adopted for outliers and/or minor branchings. With such distinctive communities, however, *a-priori* groupings of quadrats generated by SIMPROF were seen to best represent vegetative variation at this small scale. Six significantly dissimilar vegetation communities were delineated within the survey area (Global R = 0.79; p = <0.001).

Six vegetation communities were delineated within the survey area, four within the intact section and one within the rehabilitated section of the survey area. The intact section of the survey area generally comprised of structurally intact woodland vegetation (communities B, C and D) on the lower and mid slopes, and heathland vegetation (community A and A1) on the ridges and upper slopes.

Vegetation of heathlands (community A) typically comprised of vegetation associated with shallow sands over limestone and contained admixtures, to varying degrees, of species including *Banksia sessilis*, *Xanthorrhoea preissii*, *Calothamnus quadrifidus, Hibbertia hypericoides*, *Banksia dallanneyi*, *Desmocladus flexuosus, Jacksonia calcicola, Mesomelaena pseudostygia, Lepidobolus preissianus* subsp. *preissianus* and *Adenanthos cygnorum* subsp. *cygnorum.* Community A1 was differentiated by the increased density of *Melaleuca huegelii* and *Melaleuca systena* and occurrence of skeletal soils and prominent limestone outcroppings.

Woodland vegetation communities B, C and D, were typically comprised of vegetation associated with deeper sands on mid slopes and lower slopes. Characteristic species of woodlands included *Banksia attenuata, Xanthorrhoea preissii*, *Hibbertia hypericoides*, *Conostylis pusilla* and *Mesomelaena pseudostygia*. Differences in the structure and dominance of species, particularly in the aforementioned, clearly differentiated each woodland community.

The rehabilitated section of the survey area (E) comprised of an artificial shrubland of *Acacia pulchella*, *Xanthorrhoea preissii*, *Gastrolobium linearifolium* and *Stirlingia latifolia* over *Hibbertia hypericoides*, *Gompholobium tomentosum* and *Scaevola repens* var*. repens.*

A summary of the six PRIMER groupings, species by vegetation community, is detailed in Appendix E. A photographic record of vegetation communities delineated within the survey area is detailed in Appendix F. A dendrogram of the 38 survey sites with assigned vegetation communities is depicted in Figure 6.

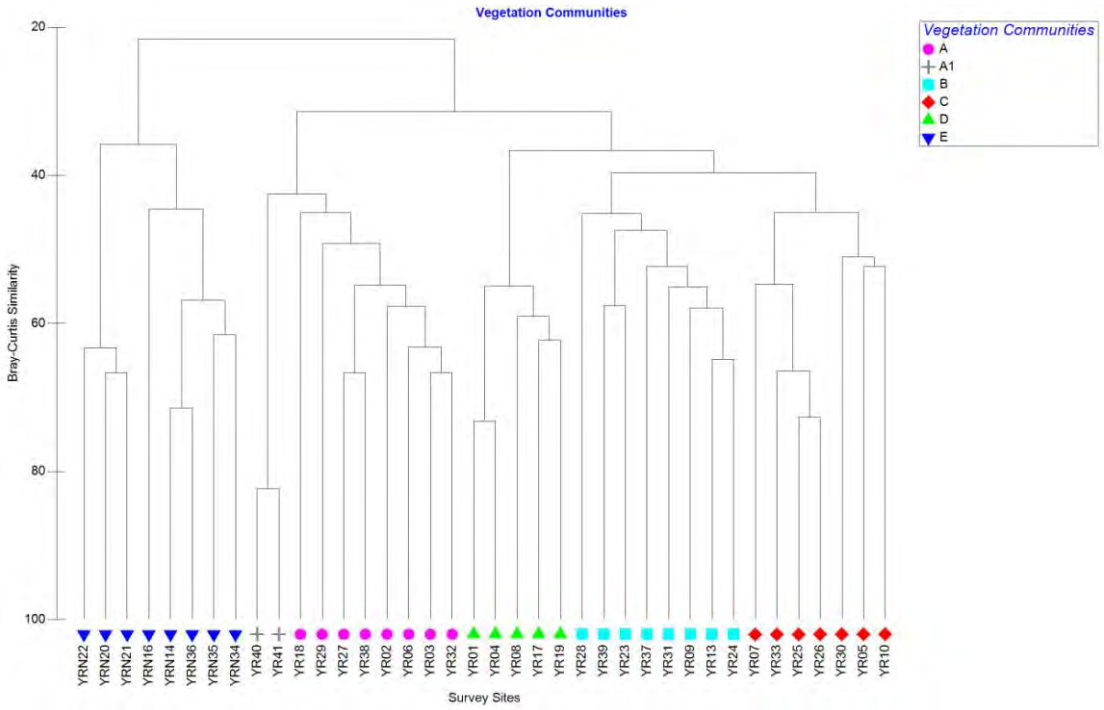

Figure 6: Cluster dendrogram of sites surveyed within the Yanchep Ridges survey area

5.2.9 Vegetation

Six plant communities were defined and mapped within the Yanchep Ridges survey area (Figure 7). Descriptions of each vegetation community, based on the Structural Forms of Australian Vegetation (Beard 1990) were summarised below:

A: Open heath of *Banksia sessilis*, *Xanthorrhoea preissii* and occasional *Calothamnus quadrifidus* over a low shrubland of *Hibbertia hypericoides*, *Banksia dallanneyi* on upper-slopes and ridges with shallow sands over limestone.

A1: Heathland of *Melaleuca huegelii*, *Melaleuca systena* and *Calothamnus quadrifidus* with occasional *Banksia sessilis* over *Grevillea preissii*, *Hibbertia hypericoides*, *Leucopogon parviflorus* and *Phyllanthus calycinus* on ridge tops with skeletal soils (SCP 26a).

B: Low open woodland of *Allocasuarina fraseriana* and *Banksia attenuata* over a tall shrubland of *Banksia sessilis* over *Xanthorrhoea preissii* over a low shrubland of *Hibbertia hypericoides*, *Conostylis pusilla* and *Mesomelaena pseudostygia* on mid-slopes with light brown to yellow sands.

C: Low open woodland of *Banksia attenuata* with occasional *Banksia menziesii* and *Eucalyptus todtiana* over a low shrubland of *Hibbertia hypericoides*, *Acacia pulchella* and *Mesomelaena pseudostygia* on flats and lower slopes with light brown to yellow sands.

D: Open woodland of *Eucalyptus marginata* and *Banksia attenuata* over *Xanthorrhoea preissii* and *Macrozamia riedlei* over a low shrubland of *Conostephium pendulum*, *Hibbertia hypericoides* and *Mesomelaena pseudostygia* on lower to mid-slopes with yellow sands.

E: Former pine plantation with a mixed shrubland of *Acacia pulchella*, *Xanthorrhoea preissii*, *Gastrolobium linearifolium* and *Stirlingia latifolia* over a low open shrubland of *Hibbertia hypericoides*, *Gompholobium tomentosum* and *Scaevola repens* var*. repens* on grey sands.

Other:

Pl: Pine plantation

5.2.10 Area Coverage of each Delineated Vegetation Community

The total area mapped and percentage cover for each delineated vegetation community (Figure 7) is shown in Table 9. Vegetation communities A, B and C were similarly represented within the survey area accounting for 23.32 % (105.19 ha), 21.78 % (98.78 ha) and 26.41 % (119.46 ha) of the survey area, respectively. Community D accounted for only 8.25 % (37.22 ha) of the survey area. The A1 community, inferred to represent the TEC SCP 26a, accounted for 0.8 % (3.63 ha) of the survey area.

Vegetation community E was restricted to the rehabilitated section and accounted for 18.31 % (82.63 ha) of the total survey area.

Table 9: Area Coverage (ha) of each Vegetation Community Type within the Survey Area

Vegetation Community	Total Mapped Area (ha)	Percentage of Survey Area
A	105.19	23.32
A1	3.63	0.80
B	98.27	21.78
C	119.16	26.41
D	37.22	8.25
E	82.63	18.31
Pl	5.08	1.13
Total	**451.17**	**100**

5.2.11 Regional and Local Extent of Vegetation

The Yanchep Ridges survey area comprises of two broad Pre-European vegetation associations, namely Spearwood_949 and to a lesser extent Spearwood_6 (Tables 10 and 11). As a result of the proposal, the representation of Spearwood_949 and Spearwood_6 across the Swan Coastal Plain Bioregion is expected to be reduced by 3.8 % and 0.76 %, respectively (Table 10). Vegetation within the rehabilitated section of the survey area has previously been cleared and does not represent Pre-European vegetation. The rehabilitated section was therefore omitted from calculations of potential impact to these vegetation associations.

379000mE 380000mE 381000mE 382000mE

6510000mN 6509000mN 6508000mN 6507000mN 6506000mN

Legend

Vegetation Communities

- **A** Open heathland of *Banksia sessilis*, *Xanthorrhoea preissii* and occasional *Calothamnus quadrifidus* over a low shrubland of *Hibbertia hypericoides*, *Banksia dallanneyi* on upper-slopes and ridges with shallow sands over limestone.
- **B** Low open woodland of *Allocasuarina fraseriana* and *Banksia attenuata* over a tall shrubland of *Banksia sessilis* over *Xanthorrhoea preissii* over a low shrubland of *Hibbertia hypericoides*, *Conostylis pusilla* and *Mesomelaena pseudostygia* on mid-slopes with light brown to yellow sands.
- **C** Low open woodland of *Banksia attenuata* with occasional *Banksia menziesii* and *Eucalyptus todtiana* over a low shrubland of *Hibbertia hypericoides*, *Acacia pulchella* and *Mesomelaena pseudostygia* on flats and lower slopes with light brown to yellow sands.
- **D** Open woodland of *Eucalyptus marginata* and *Banksia attenuata* over *Xanthorrhoea preissii* and *Macrozamia riedlei* over a low shrubland of *Conostephium pendulum*, *Hibbertia hypericoides* and *Mesomelaena pseudostygia* on lower to mid-slopes with yellow sands.
- **E** Former pine plantation with a mixed shrubland of *Acacia pulchella*, *Xanthorrhoea preissii*, *Gastrolobium linearifolium* and *Stirlingia latifolia* over a low open shrubland of *Hibbertia hypericoides*, *Gompholobium tomentosum* and *Scaevola repens* var. *repens* on grey sands.
- **PL** Pine Plantation.
- **A1** Heathland of *Melaleuca huegelii, Melaleuca systena* and *Calothamnus quadrifidus* with occasional *Banksia sessilis* over *Grevillea preissii, Hibbertia hypericoides, Leucopogon parviflorus* and *Phyllanthus calycinus* on ridge tops with skeletal soils (SCP 26a).

DPaW TEC/PEC Boundary

Limestone Ridges (SCP 26a)
Melaleuca huegelii - Melaleuca acerosa (currently M. systena) shrublands on limestone ridges (Gibson et al. 1994 type 26a)

Priority Species

- **Bcc** *Beyeria cinerea* subsp. *cinerea* (P3)
- **BkL** *Baeckea* sp. Limestone (N. Gibson & M.N. Lyons 1425) (P1)

Boundary of recorded species - *Baeckea* sp. Limestone (N. Gibson & M.N. Lyons 1425) (P1)

- **LsY** *Leucopogon* sp. Yanchep (M. Hislop 1986) (P3)

Proposed Mining Lease
Tenements - Live
Tenements - Pending
Roads

OLD YANCHEP ROAD

Client: WA LIMESTONE	0 300m Scale 1:15,000 MGA94 (Zone 50) CAD Ref: g2135_f08.dgn Date: Jun 2014 Rev: C A3	Mattiske Consulting Pty Ltd 28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640 Author: E M Mattiske MCPL Ref: WAL1301/057/13 Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202	**Yanchep Ridges Area** **Vegetation and Priority Flora** **May 2014**	Figure: **7**

Table 10: Extent of Pre-European Vegetation Associations across the Swan Coastal Plain IBRA Region and Percentage Impact Figures Associated with the Yanchep Ridges Survey Area

	Vegetation Association	
	Spearwood_949	**Spearwood_6**
Total Pre-1750 Extent (ha)	13216.23	54401.73
Total Current Extent (ha)	6918.74	13942.95
Total % Remaining from Pre-1750 Extent	52.35	25.63
Total Current Extent within DPaW Estate (ha)	4899.11	4997.68
Total Extent within Survey Area (ha)	263	106
% Impact	3.8	0.76

The Yanchep Ridges survey area comprises vegetation associations across two broad vegetation complexes within the Swan Coastal Plain Bioregion (System 6/part System 1 area; Heddle *et al.* 1980; Mattiske and Havel 1998; EPA 2006): the Cottesloe Complex (North) and to a lesser extent the Cottesloe Complex (Central & South) (Table 11). As a result of the proposal, the representation of the Cottesloe (North) and Cottesloe (Central & South) Complexes across the Swan Coastal Plain Bioregion is expected to be reduced by 1.36 % and 0.16 %, respectively (Table 11). The vegetation within the rehabilitated section of the survey area has previously been cleared and does not represent System 6 vegetation. The rehabilitated section was therefore omitted from calculations of potential impact to these vegetation associations.

Table 11: Extent of System 6 Vegetation Complexes across the Swan Coastal Plain IBRA Region and Percentage Impact Figures Associated with the Yanchep Ridges Survey Area

	Vegetation Complex	
	Cottesloe Complex (North)	**Cottesloe Complex (Central and South)**
Total Pre-1750 Extent (ha)	43474.30	45031.04
Total Current Extent (ha)	25235.01	15817.74
Total % Remaining from Pre-1750 Extent	58.05	35.13
Total Current Extent within DPaW Estate (ha)	16429.32	5877.46
Total Extent within Survey Area (ha)	343.27	25.27
% Impact	1.36	0.16

The survey area is located within the Bush Forever site: Ridges and Adjacent Bushland, Yanchep/Nowergup (Bush Forever site number 381) (WAPC 2000b). The majority of the intact section is located within Bush Forever site 381. Clearing of the intact section of the survey area is expected to reduce the total area of the Bush Forever site by 12.22 %. The majority of the rehabilitated section occurs outside of the Bush Forever Site, as such clearing of this area is only expected to further reduce Bush Forever site 381 representation by 0.01 %.

5.2.12 Vegetation Condition

Vegetation condition within the intact section of the survey area was considered to be very good to excellent (Figure 8). While various forms of disturbance were evident within the intact section, the structure and composition of the vegetation communities was considered to be intact. Disturbance included weed invasion, walking tracks, dumped rubbish and possibly dieback. Disturbance, particularly weed invasion, was more evident near roads and tracks. The western boundary of the survey area intersects a small pine plantation, this area accounted for the 5.08 ha (1.38 %) of degraded vegetation in the survey area (Table 13). As the rehabilitated section of the survey area was considered artificial in terms of composition and structure, the entire area was classified as degraded (82.63 ha).

Table 12: Area Coverage (ha) of each Vegetation Condition Rating within the Intact Section of the Yanchep Ridges Survey Area

Note: The rehabilitated area has not been included in the table below.

Vegetation Condition	Total Mapped Area (ha)	Percentage of Survey Area
Very Good to Excellent	363.47	98.62
Degraded	5.08	1.38
Total	**368.55**	**100**

379000mE 380000mE 381000mE 382000mE

6510000mN 6509000mN 6508000mN 6507000mN 6506000mN

Legend

- **VG/EX** Very Good / Excellent Condition
- **D** Degraded Condition
- Proposed Mining Lease
- Tenements - Live
- Tenements - Pending
- Roads

Condition rating scale from Bush Forever (Government of Western Australia 2000 based on Keighery 1994)

D

VG/EX

E70/1952

E70/1437

D

VG/EX

OLD YANCHEP ROAD

Client: WA LIMESTONE	0 300m Scale 1:15,000 MGA94 (Zone 50) CAD Ref: g2135_f09.dgn Date: Dec 2013 | Rev: B | A3	Mattiske Consulting Pty Ltd 28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640 Author: E M Mattiske | MCPL Ref: WAL1301/057/13 Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202	**Yanchep Ridges Area** **Vegetation Condition** **November 2013**

Figure: **8**

6. DISCUSSION

Mattiske Consulting Pty Ltd was commissioned in November 2013 by WA Limestone to undertake a Level 2 flora and vegetation survey of the Yanchep Ridges survey area. The survey area covers 451.17 hectares and is separated into two separate areas. The southern survey area consists of a largely intact polygon of native bushland with an area of 368.54 ha while the northern polygon consists of a former pine plantation with an area of 82.63 ha. The intact section of the survey area was generally comprised of structurally intact woodland vegetation (communities B, C and D) on the lower and mid slopes with heath (community A) occurring on the ridges and upper slopes. The rehabilitated section of the survey area comprised of an artificial shrubland of *Acacia pulchella*, *Xanthorrhoea preissii*, *Gastrolobium linearifolium* and *Stirlingia latifolia* over *Hibbertia hypericoides*, *Gompholobium tomentosum* and *Scaevola repens* var*. repens.*

A total of 209 vascular plant taxa which are representative of 125 plant genera and 46 plant families were recorded within the Yanchep Ridges survey area. The majority of the taxa recorded were representative of the Fabaceae (22 taxa), Proteaceae (22 taxa), Myrtaceae (21 taxa), Asparagaceae (15 taxa) and Poaceae (13 taxa) families (Appendix C).

No Threatened Flora species were recorded within the survey area. Three Priority Flora species were recorded within the survey area, namely *Baeckea* sp. Limestone (N. Gibson & M.N. Lyons 1425) (P1), *Beyeria cinerea* subsp. *cinerea* (P3) and *Leucopogon* sp. Yanchep (M. Hislop 1986) (P3).

A large population (>500) of *Baeckea* sp. Limestone (N. Gibson & M.N. Lyons 1425) (P1) was recorded within an approximate 100 x 250 m area located on and around a limestone ridge with brown/orange sand over limestone (Figure 7). Priority 3 species *Beyeria cinerea* subsp. *cinerea* and *Eucalyptus decipiens* (the only record within the current survey) were also recorded in this area. While other species in this area were similar to that of permanent sites located in Community A, the presence of *Baeckea* sp. Limestone (N. Gibson & M.N. Lyons 1425) (P1) in such high numbers and the presence of the disjunct population of *Beyeria cinerea* subsp. *cinerea* (P3) suggest that this area may be locally significant.

Acacia benthamii (P2) and *Jacksonia sericea* (P4) were previously recorded by Mattiske Consulting (1996) within the survey area, however, neither of these species were recorded in the current survey. *Acacia benthamii* (P2) was previously recorded on four occasions by Mattiske (1996). As *Acacia benthamii* (P2) was not recorded during the current survey, despite conducting 36 permanent survey sites and opportunistic collections, it suggests that these populations of *Acacia benthamii* within survey area are very restricted in their distribution. *Jacksonia sericea* (P4) was previously described as being common within the survey area which is congruent with the distribution of the taxonomically similar species, *Jacksonia calcicola*, observed within the current survey. *Jacksonia calcicola* was collected four times during the current survey and specimens were considered adequate for accurate identification.

One Threatened Ecological Community occurs within the survey area, namely SCP 26a *Melaleuca huegelii – Melaleuca systena* shrublands on limestone ridges (EN). Two confirmed DPaW records of SCP 26a occur within the survey area, site ID MYHADR01 and MYHADR02 (Figure 7). The estimated area of each recorded location is approximately one hectare (DEC 2005). In the current survey, dense patches of *Melaleuca huegelii* and *M. systena* on skeletal soils were sporadically observed along the main central limestone ridge (four distinct locations). These areas were mapped as the A1 community in the current survey, with the boundaries of each inferred TEC location ground-truthed. The total mapped area for vegetation inferred to represented SCP 26a was 3.63 hectares.

One Priority Ecological Community was inferred to occur within the survey area, SCP24 Northern Spearwood shrublands and woodlands (FCT 24; Gibson *et al*. 1994: SCC – P3). Floristic aspects of SCP 24 Northern Spearwood shrublands and woodlands (P3) were inferred to occur in areas mapped as Community A. These areas generally comprised of dense stands of *Banksia sessilis* with *Xanthorrhoea preissii*, often with *Calothamnus quadrifidus*, over *Hibbertia hypericoides* and *Banksia dallanneyi.* DPaW records confirm the occurrence of SCP 24 approximately 5 km to the south east of the survey area. Approximately 104.9 hectares of Community A was mapped inside the survey area.

A list of other flora of conservation significance recorded within the Yanchep Ridges survey area was compiled highlighting species near known northern or southernmost ranges and/or poorly collected species. The survey area constitutes the near known northern extent of a number of species recorded during the current survey. These include *Conostylis pusilla, Conostylis caricina* subsp. *caricina, Eucalyptus marginata, Lechenaultia expansa, Macrozamia riedlei, Marianthus candidus, Persoonia saccata, Stylidium brunonianum* and *Xanthorrhoea gracilis* (DPaW 2014h). The survey area constitutes

the near known southern extent of *Conostylis angustifolia* and *Schoenus latitans* (DPaW 2014h). One other species of taxonomic interest collected within the survey area was *Lepidosperma* aff. *scabrum* (SBR040, 18/11/2013). Western Australian Herbarium sedge specialist Russell Barrett has noted that this species will soon be known as *Lepidosperma* sp. Eneabba Swamps. It was considered unlikely to be of significant conservation value.

Six vegetation communities were delineated and mapped within the survey area, four within the intact section and one within the rehabilitated section of the survey area. Vegetation community boundaries were often discontinuous, with boundaries resembling admixtures of one or more community. The intact section of the survey area generally comprised of structurally intact woodland vegetation (communities B, C and D) on the lower and mid slopes with heath (community A) occurring on the ridges and upper slopes. These findings are consistent with results of the previous survey conducted by Mattiske (1996). Floristic aspects of FCT 28 are inferred to be represented within the survey area by woodland vegetation communities B, C and D (Gibson *et al.*, 1994). The rehabilitated section of the survey area comprised of an artificial shrubland of *Acacia pulchella*, *Xanthorrhoea preissii*, *Gastrolobium linearifolium* and *Stirlingia latifolia* over *Hibbertia hypericoides*, *Gompholobium tomentosum* and *Scaevola repens* var*. repens*, delineated as vegetation community E*.*

Two broad Pre-European vegetation associations occur within the survey area, namely Spearwood_949 and to a lesser extent Spearwood_6. With respect to the current proposal, representation of Spearwood_949 and Spearwood_6 vegetation associations across the Swan Coastal Plain Bioregion would be reduced by 3.8 % and 0.76 %, respectively (Table 11). Currently, representation of the Spearwood_949 vested in DPaW estate within the Swan Coastal Plain IBRA Region is 4899.11 ha, 37.1 % of the estimated Pre-European extent of this complex. Representation of the Spearwood_6 vested in DPaW estate within the Swan Coastal Plain IBRA Region is 4997.68 ha, 9.2 % of the estimated Pre-European extent of this complex.

Two System 6 vegetation complexes occur within the survey area, namely the Cottesloe Complex (north) and the Cottesloe Complex (central and south). With respect to the proposal, current representation of the Cottesloe Complex (north) would be reduced by 1.36 % across the Swan Coastal Plain IBRA Region. Currently, representation of the Cottesloe Complex (north) vested in DPaW estate within the Swan Coastal Plain IBRA Region is 16429.32 ha, 37.8 % of the estimated Pre-European extent of this complex. Representation of the Cottesloe Complex (central and south) would be reduced by 0.16 % across the Swan Coastal Plain IBRA Region. Currently, representation of the Cottesloe Complex (central and south) vested in DPaW estate within the Swan Coastal Plain IBRA Region is 5877 ha, 13.1 % of the estimated Pre-European extent of this complex.

The survey area is located within the Bush Forever site: Ridges and Adjacent Bushland, Yanchep/Nowergup (Bush Forever site number 381; WAPC 2000b). Clearing of the intact section of the survey area is expected to reduce the total area of the Bush Forever site by 12.22 %. In addition, the current proposal will fragment Bush Forever site 381 leaving strips of vegetation to the east and north of the intact section. Vegetation condition within these fragmented areas may deteriorate due to increased edge effects. The majority of the rehabilitated section occurs outside of the Bush Forever Site, as such clearing of this area is only expected to further reduce Bush Forever site 381 representation by 0.01 %.

Vegetation condition within the intact section of the survey area was considered to be very good to excellent (Figure 8). While various forms of disturbances were evident within the intact section, the structure and composition of the vegetation communities was considered to be intact. Disturbance included weed invasion, walking tracks, dumped rubbish and possibly dieback or drought and resulted in a mosaic of very good and excellent condition vegetation within the intact section. Disturbance, particularly weed invasion, was more evident near roads and tracks. Fragmentation of Bush Forever site 381 as a result of the proposal will invariably increase the likelihood of further weed invasions, the spread of dieback and loss of species i.e. increased edge effects. In particular, if the proposed development proceeds, the strip of vegetation running between the eastern boundary of the survey area and the adjacent pine plantation is likely to deteriorate from increased edge effect.

As the rehabilitated section of the survey area was considered artificial in terms of composition and structure, the entire area was classified as degraded (82.63 ha). The development and ongoing implementation of weed management procedures would be necessary to mitigate potential impacts associated with the proposal, particularly the spread of weeds from the rehabilitated section to the adjacent Bush Forever site 381.

Of the 209 plant taxa recorded within the survey area, 25 species were introduced (exotic). The introduced taxa were represented by 12 plant families, the most common of which was Poaceae (7 taxa), Asteraceae (3 taxa) and Fabaceae (3 taxa). One of these taxon; **Asparagus asparagoides* (Bridal Creeper) is a Declared Pest (s22; C3 Management) throughout the state. Under section 26 (1) of the *BAM Act*, a person who finds a declared plant pest must report, in accordance with subsection (2), the presence or suspected presence of the declared pest to the Director General or an inspector of the Department of Agriculture and Food Western Australia. According to section 30 (3) of the *BAM Act*, the owner or occupier of land, or a person who is conducting an activity on the land, must take the prescribed control measures to control the declared pest if it is present on the land (DAF 2014).

7. CONCLUSIONS AND RECOMMENDATIONS

Presence of the Threatened Ecological Community SCP 26a *Melaleuca huegelii – Melaleuca systena* shrublands on limestone ridges (EN) and the inferred presence of SCP 24 Northern Spearwood shrublands and woodlands (P3), in addition to records of *Baeckea* sp. Limestone (N. Gibson & M.N. Lyons 1425; P1) and *Beyeria cinerea* subsp. *cinerea* (P3) highlight the significance and high conservation value of vegetation occurring on the central limestone ridge area.

Vegetation throughout the survey area is generally in very good to excellent condition, efforts should be made maintain this by means of:

- Ground disturbance and clearing of vegetation should be limited to that which is essential;
- Maintain standard vehicle hygiene practices to minimise the risk of spreading introduced (exotic) weeds;
- Retain and stockpile topsoil for use in the later rehabilitation of roads and other areas cleared in the process of expansion;
- Maintain existing drainage systems, i.e. do not allow access tracks etc. to disrupt or divert historic water flow patterns. Where drainage systems are interrupted by earthworks, the use of culverts to assist in maintaining natural water flow patterns should be implemented;
- Avoid driving vehicles across undisturbed ground;
- The creation of new tracks should be restricted to that which is absolutely necessary, ensuring equipment blades are set above ground level to minimize disturbance to topsoil, rootstock and to reduce soil erosion.

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9. LIST OF PERSONNEL

The following Mattiske Consulting Pty Ltd personnel were involved in this project:

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Mr B. Ellery	Taxonomist	Plant identification	n/a
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APPENDIX A1: DEFINITION OF THREATENED AND PRIORITY FLORA SPECIES (Department of Parks and Wildlife 2014c)

Conservation Code	Category
T	**Threatened Flora (Declared Rare Flora – Extant)** "Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the *Wildlife Conservation Act 1950*). Threatened Flora (Schedule 1) are further ranked by the Department according to their level of threat using IUCN Red List criteria: • **CR:** Critically Endangered – considered to be facing an extremely high risk of extinction in the wild • **EN:** Endangered – considered to be facing a very high risk of extinction in the wild • **VU:** Vulnerable – considered to be facing a high risk of extinction in the wild."
P1	**Priority One – Poorly Known Species** "Species that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes."
P2	**Priority Two – Poorly Known Species** "Species that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes."
P3	**Priority Three – Poorly Known Species** "Species that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them."
P4	**Priority Four – Rare Threatened and other species in need of monitoring** "a. Rare - Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. b. Near Threatened - Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. c. Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy."
P5	**Priority Five – Conservation Dependent Species** "Species that are not threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years."

APPENDIX A2: DEFINITION OF THREATENED FLORA SPECIES (Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*)

Category Code	Category
Ex	**Extinct** Taxa which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild** Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered** Taxa which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered** Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable** Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent** Taxa which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

APPENDIX A3: DEFINITION OF THREATENED ECOLOGICAL COMMUNITIES (Department of Parks and Wildlife 2014d)

Category Code	Category
PTD	**Presumed Totally Destroyed** An ecological community will be listed as Presumed Totally Destroyed if there are no recent records of the community being extant and either of the following applies: (i) records within the last 50 years have not been confirmed despite thorough searches or known likely habitats or; (ii) all occurrences recorded within the last 50 years have since been destroyed.
CE	**Critically Endangered** An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting any one of the following criteria: (i) The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; (ii) The current distribution is limited ie. highly restricted, having very few small or isolated occurrences, or covering a small area; (iii) The ecological community is highly modified with potential of being rehabilitated in the immediate future.
E	**Endangered** An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. The ecological community must meet any one of the following criteria: (i) The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; (ii) The current distribution is limited ie. highly restricted, having very few small or isolated occurrences, or covering a small area; (iii) The ecological community is highly modified with potential of being rehabilitated in the short term future.
V	**Vulnerable** An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one of the following criteria: (i) The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; (ii) The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; (iii) The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

APPENDIX A4: DEFINITION OF THREATENED ECOLOGICAL COMMUNITIES (Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*)

Three categories exist for listing threatened ecological communities under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*

Listing Category	Explanation of Category
Critically endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

APPENDIX A5: DEFINITION OF PRIORITY ECOLOGICAL COMMUNITIES (Department of Parks and Wildlife 2014d)

Category Code	Category
P1	**Poorly-known ecological communities** Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist.
P2	**Poorly-known ecological communities** Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, un-allocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.
P3	**Poorly known ecological communities** (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.
P5	**Conservation Dependent ecological communities** Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

APPENDIX A6: CATEGORIES AND CONTROL OF DECLARED (PLANT) PESTS IN WESTERN AUSTRALIA (Department of Agriculture and Food 2014) (*Biosecurity and Agriculture Management Regulations 2013*)

Control Category	Control Measures
C1 (Exclusion) '(a) Category 1 (C1) — Exclusion: if in the opinion of the Minister introduction of the declared pest into an area or part of an area for which it is declared should be prevented' Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.	In relation to a category 1 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C2 (Eradication) '(b) Category 2 (C2) — Eradication: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is feasible' Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.	In relation to a category 2 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to destroy, prevent or eradicate the declared pest.
C3 (Management) '(c) Category 3 (C3) — Management: if in the opinion of the Minister eradication of the declared pest from an area or part of an area for which it is declared is not feasible but that it is necessary to — (i) alleviate the harmful impact of the declared pest in the area; or (ii) reduce the number or distribution of the declared pest in the area; or (iii) prevent or contain the spread of the declared pest in the area.' Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.	In relation to a category 3 declared pest, the owner or occupier of land in an area for which an organism is a declared pest or a person who is conducting an activity on the land must take such of the control measures specified in subregulation (1) as are reasonable and necessary to — (a) alleviate the harmful impact of the declared pest in the area for which it is declared; or (b) reduce the number or distribution of the declared pest in the area for which it is declared; or (c) prevent or contain the spread of the declared pest in the area for which it is declared.

APPENDIX A7: DEFINITION OF VEGETATION CONDITION SCALE (Keighery 1994)

Condition Rating	Description
Pristine (1)	Pristine or nearly so, no obvious sign of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good (4)	Vegetation structure significantly altered by obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback, grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

APPENDIX A8: DEFINITION OF STRUCTURAL FORMS OF AUSTRALIAN VEGETATION (Beard 1990)

Structural Forms of Australian Vegetation			
Growth Form of Tallest Stratum	**Foliage Cover of Tallest Stratum**		
	30 – 70%	**10 – 30%**	**less than 10%**
Tall Trees [greater than 30 m]	Tall Forest	Tall Woodland	Open Tall Forest
Medium Trees [10 – 30 m]	Forest	Woodland	Open Woodland
Low Trees [less than 10 m]	Low Forest	Low Woodland	Open Low Woodland
Tall Shrubs [greater than 2 m]	Thicket	Scrub	Open Scrub
Low Shrubs [less than 2 m]	Heath	Low Shrubland	Open Low Shrubland
Grassland [less than 1 m]	Closed Bunch Grassland	Open Bunch Grassland	Hummock Grassland

APPENDIX B: GPS LOCATION OF SITES WITHIN THE YANCHEP RIDGES SURVEY AREA, 2013

SITE TYPE	SURVEY SITE	(GDA 94 _50J)	
		EASTING	NORTHING
Permanent Survey Sites	YR01	378633	6505992
	YR02	379451	6506828
	YR03	378877	6506182
	YR04	378406	6506326
	YR05	378674	6506342
	YR06	378885	6506487
	YR07	378790	6506621
	YR08	378621	6506679
	YR09	379254	6506847
	YR10	378889	6506924
	YR13	379355	6507795
	YR17	380323	6507566
	YR18	380223	6507847
	YR19	380694	6508719
	YR23	379206	6507651
	YR24	379925	6507845
	YR25	379660	6508262
	YR26	379782	6508834
	YR27	379617	6507441
	YR28	380193	6507647
	YR29	380564	6507825
	YR30	380653	6508859
	YR31	379464	6507287
	YR32	379816	6508058
	YR33	379496	6508334
	YR37	380016	6509149
	YR38	379116	6507366
	YR39	379145	6506303
	YR40	380369	6508433
	YR41	379854	6507570
	YRN14	380800	6509903
	YRN16	381138	6509768
	YRN20	380178	6509856
	YRN21	380539	6510107
	YRN22	380134	6510226
	YRN34	380960	6510298
	YRN35	381426	6510387
	YRN36	381253	6510155

APPENDIX B: GPS LOCATION OF SITES WITHIN THE YANCHEP RIDGES SURVEY AREA, 2013

SITE TYPE	SURVEY SITE	(GDA 94 _50J)	
		EASTING	NORTHING
Relevé Survey Sites	MARMP000	378531	6506171
	MARMP002	379176	6506393
	MARMP003	379204	6506516
	MARMP005	379254	6506452
	MARMP006	379202	6506439
	MARMP008	380255	6507841
	MARMP009	380282	6507811
	MARMP011	379351	6507646
	MARMP012	379691	6508076
	MURD01	378756	6506202
	MURD02	378825	6506268
	MURD03	379118	6506095

APPENDIX C: SUMMARY OF VASCULAR PLANT SPECIES RECORDED WITHIN THE YANCHEP RIDGES SURVEY AREA, 2013

Note: * denotes introduced species and P1-P5 denote Priority Flora Species (DPaW 2014c).

FAMILY	SPECIES
Zamiaceae	*Macrozamia riedlei*
Pinaceae	* *Pinus radiata* *Pinus* sp.
Poaceae	* *Aira caryophyllea* * *Aira* sp. *Austrostipa flavescens* *Austrostipa macalpinei* *Austrostipa mollis* * *Avena barbata* * *Briza maxima* * *Briza minor* * *Ehrharta calycina* * *Ehrharta longiflora* *Poa drummondiana* * *Vulpia myuros* Poaceae sp.
Cyperaceae	*Lepidosperma* aff. *scabrum* *Lepidosperma calcicola* *Lepidosperma* sp. *Mesomelaena pseudostygia* *Mesomelaena tetragona* *Schoenus clandestinus* *Schoenus ?latitans* *Tetraria octandra*
Restionaceae	*Alexgeorgea nitens* *Desmocladus fasciculatus* *Desmocladus flexuosus* *Hypolaena exsulca* *Hypolaena pubescens* *Lepidobolus preissianus* subsp. *preissianus*
Anarthriaceae	*Lyginia barbata*
Haemodoraceae	*Anigozanthos humilis* subsp. *humilis* *Anigozanthos manglesii* *Conostylis aculeata* subsp. *aculeata* *Conostylis angustifolia* *Conostylis aurea* *Conostylis caricina* subsp. *caricina* *Conostylis pusilla* *Haemodorum laxum* *Haemodorum paniculatum* *Haemodorum* sp.
Asparagaceae	*Acanthocarpus preissii* * *Asparagus asparagoides* *Dichopogon capillipes* *Laxmannia sessiliflora* subsp. *australis* *Lomandra caespitosa* *Lomandra hermaphrodita* *Lomandra maritima* *Lomandra ?preissii*

APPENDIX C: SUMMARY OF VASCULAR PLANT SPECIES RECORDED WITHIN THE YANCHEP RIDGES SURVEY AREA, 2013

Note: * denotes introduced species and P1-P5 denote Priority Flora Species (DPaW 2014c).

FAMILY	SPECIES
Asparagaceae (cont.)	*Lomandra* ?*suaveolens*
	Lomandra sp.
	Sowerbaea laxiflora
	Thysanotus arenarius
	Thysanotus dichotomus
	Thysanotus triandrus
	Thysanotus sp.
Xanthorrhoeacae	*Xanthorrhoea gracilis*
	Xanthorrhoea preissii
Colchicacaeae	*Burchardia congesta*
Hemerocallidaceae	*Arnocrinum preissii*
	Corynotheca micrantha ?var. *micrantha*
	Dianella revoluta
	Tricoryne elatior
Iridaceae	* *Gladiolus caryophyllaceus*
	Orthrosanthus laxus
	Patersonia occidentalis
	* *Romulea rosea*
Casuarinaceae	*Allocasuarina fraseriana*
	Allocasuarina humilis
Proteaceae	*Adenanthos cygnorum* subsp. *cygnorum*
	Banksia attenuata
	Banksia dallanneyi
	Banksia grandis
	Banksia menziesii
	Banksia nivea
	Banksia sessilis
	Banksia sp.
	Conospermum canaliculatum subsp. *canaliculatum*
	Grevillea priessii
	Grevillea vestita subsp. *vestita*
	Hakea costata
	Hakea lissocarpha
	Hakea prostrata
	Hakea ruscifolia
	Hakea trifurcata
	Persoonia saccata
	Petrophile brevifolia
	Petrophile linearis
	Petrophile macrostachya
	Petrophile serruriae
	Stirlingia latifolia
	Synaphea spinulosa
	Synaphea spinulosa subsp. *spinulosa*
Loranthaceae	*Nuytsia floribunda*
Chenopodiaceae	*Rhagodia baccata* subsp. *baccata*

APPENDIX C: SUMMARY OF VASCULAR PLANT SPECIES RECORDED WITHIN THE YANCHEP RIDGES SURVEY AREA, 2013

Note: * denotes introduced species and P1-P5 denote Priority Flora Species (DPaW 2014c).

FAMILY	SPECIES
Azioaceae	* *Carpobrotus ?aequilaterus* * *Carpobrotus edulis*
Caryophyllaceae	* *Petrorhagia dubia*
Ranunculaceae	*Clematis pubescens*
Lauraceae	*Cassytha racemosa*
Brassicaceae	* *Brassica tournefortii* * *Heliophila pusilla*
Crassulaceae	*Crassula colorata* var. *colorata*
Pittosporaceae	*Marianthus ?candidus*
Fabaceae	*Acacia applanata* *Acacia ?cochlearis* * *Acacia longifolia* *Acacia pulchella* *Acacia pulchella* var. *glaberrima* *Acacia saligna* *Bossiaea eriocarpa* *Cristonia biloba* *Daviesia divaricata* *Daviesia podophylla* *Gastrolobium linearifolium* *Gompholobium aristatum* *Gompholobium tomentosum* *Hardenbergia comptoniana* *Hovea trisperma* *Jacksonia calcicola* *Jacksonia floribunda* *Jacksonia furcellata* *Jacksonia sternbergiana* *Kennedia prostrata* * *Trifolium arvense* * *Trifolium campestre*
Geraniaceae	* *Pelargonium capitatum*
Rutaceae	*Boronia ramosa* subsp. *anethifolia* *Philotheca ?spicata*
Euphorbiaceae	*Beyeria cinerea* subsp. *cinerea* (P3) *Monotaxis grandiflora* var. *grandiflora*
Phyllanthaceae	*Phyllanthus calycinus*
Celastraceae	*Tripterococcus brunonis*
Rhamnaceae	*Cryptandra ?pungens* *Stenanthemum notiale* subsp. *chamelum* *Trymalium ledifolium* var. *ledifolium*

APPENDIX C: SUMMARY OF VASCULAR PLANT SPECIES RECORDED WITHIN THE YANCHEP RIDGES SURVEY AREA, 2013

Note: * denotes introduced species and P1-P5 denote Priority Flora Species (DPaW 2014c).

FAMILY	SPECIES
Dilleniaceae	*Hibbertia huegelii* *Hibbertia hypericoides* *Hibbertia racemosa*
Thymelaeaceae	*Pimelea floribunda* *Pimelea sulphurea* *Pimelea* sp.
Myrtaceae	*Baeckea* sp. Limestone (N. Gibson & M.N. Lyons 1425) (P1) *Beaufortia elegans* *Calothamnus quadrifidus* *Calothamnus quadrifidus* subsp. *quadrifidus* *Calothamnus ?sanguineus* *Calothamnus* sp. *Calytrix angulata* *Calytrix ?flavescens* *Eremaea pauciflora* var. *pauciflora* *Eucalyptus decipiens* *Eucalyptus decipiens* subsp. *decipiens* *Eucalyptus gomphocephala* *Eucalyptus marginata* *Eucalyptus todtiana* *Hypocalymma angustifolium* *Kunzea glabrescens* *Leptospermum spinescens* *Melaleuca huegelii* subsp. *huegelii* *Melaleuca systena* *Scholtzia involucrata* *Verticordia densiflora* var. *densiflora*
Araliaceae	*Trachymene pilosa*
Apiaceae	*Daucus glochidiatus* *Xanthosia huegelii*
Ericaceae	*Astroloma macrocalyx* *Astroloma pallidum* *Conostephium pendulum* *Conostephium ?preissii* *Leucopogon parviflorus* *Leucopogon polymorphus* *Leucopogon propinquus* *Leucopogon* sp. Yanchep (M. Hislop 1986) (P3)
Primulaceae	* *Lysimachia arvensis*
Loganiaceae	*Phyllangium paradoxum*
Lamiaceae	*Hemiandra pungens*
Solanaceae	*Anthocercis ilicifolia* subsp. *ilicifolia*
Scrophulariaceae	*Eremophila glabra* subsp. *albicans*
Rubiaceae	*Opercularia vaginata*

APPENDIX C: SUMMARY OF VASCULAR PLANT SPECIES RECORDED WITHIN THE YANCHEP RIDGES SURVEY AREA, 2013

Note: * denotes introduced species and P1-P5 denote Priority Flora Species (DPaW 2014c).

FAMILY	SPECIES
Campanulaceae	*Isotoma hypocrateriformis*
	Lobelia gibbosa
	Lobelia rhombifolia
	Lobelia tenuior
	* *Wahlenbergia capensis*
	Wahlenbergia sp.
Goodeniaceae	*Lechenaultia expansa*
	Lechenaultia linarioides
	Scaevola repens
	Scaevola repens var. *repens*
	Verreauxia reinwardtii
Stylidiaceae	*Levenhookia pusilla*
	Levenhookia stipitata
	Stylidium brunonianum
	Stylidium crossocephalum
	Stylidium cygnorum
	Stylidium piliferum
	Stylidium schoenoides
Asteraceae	*Craspedia variabilis*
	Euchiton sphaericus
	* *Hypochaeris glabra*
	Lagenophora huegelii
	Olearia axillaris
	Podotheca angustifolia
	Podotheca gnaphalioides
	Siloxerus humifusus
	* *Sonchus oleraceus*
	* *Ursinia anthemoides*
	Waitzia suaveolens var. *suaveolens*

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED WITHIN THE YANCHEP RIDGES SURVEY AREA, 2013

Note: * denotes introduced species and P1-P5 denote Priority Flora Species (DPaW 2014c).
^ denotes species recorded as an opportunistic collection

Species	YR01	YR02	YR03	YR04	YR05	YR06	YR07	YR08	YR09	YR10	YR13	YR17	YR18	YR19	YR23	YR24	YR25	YR26	YR27	YR28	YR29	YR30	YR31	YR32	YR33	YR37	YR38	YR39	YR40	YR41	YRN14	YRN16	YRN20	YRN21	YRN22	YRN34	YRN35	YRN36
Acacia applanata				X																																		
Acacia ?cochlearis		X																																				
* *Acacia longifolia*																								X	X													
Acacia pulchella	X		X		X	X	X	X	X	X	X			X	X	X	X	X				X			X	X			X	X	X	X	X	X		X		X
Acacia pulchella var. *glaberrima*				X																								X										
*Acacia saligna^*																																						
Acanthocarpus preissii	X								X												X		X			X												
Adenanthos cygnorum subsp. *cygnorum*		X	X			X															X			X														
* *Aira caryophyllea*				X			X	X	X			X				X		X	X	X	X	X			X	X		X				X		X		X	X	X
* *Aira* sp.														X		X											X											
Alexgeorgea nitens				X				X	X			X		X																								
Allocasuarina fraseriana							X		X		X				X					X			X					X										
Allocasuarina humilis										X							X					X			X			X										
Anigozanthos humilis subsp. *humilis*										X																						X						
*Anigozanthos manglesii^*																																						
Anthocercis ilicifolia subsp. *ilicifolia^*																																						
Arnocrinum preissii																																						X
* *Asparagus asparagoides*		X																																				
Astroloma macrocalyx										X																												
Astroloma pallidum	X			X	X																																	
Austrostipa flavescens																											X											
Austrostipa macalpinei				X	X	X	X	X		X	X								X		X	X	X		X	X		X				X	X	X				
Austrostipa mollis					X																																	
* *Avena barbata*	X																																		X			
Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425) (P1)																			X																			
Banksia attenuata					X		X	X	X					X	X	X	X	X		X		X			X	X		X										
Banksia dallanneyi		X	X	X		X			X				X						X		X	X		X		X												
Banksia grandis												X																											
Banksia menziesii							X	X				X					X					X			X			X										
Banksia nivea																													X	X								
Banksia sessilis		X	X			X			X		X		X		X	X			X	X	X		X	X			X	X	X	X								
Banksia sp.				X																																		
*Beuafortia elegans^*																																						
Beyeria cinerea subsp. *cinerea* (P3)^																																						
Boronia ramosa subsp. *anethifolia*																																				X	X	
Bossiaea eriocarpa	X	X		X				X				X		X					X	X	X	X					X	X	X	X	X		X	X	X			
* *Brassica tournefortii^*																																						
* *Briza maxima*	X	X	X	X	X	X	X		X											X								X										
* *Briza minor*													X			X	X	X													X							
Burchardia congesta	X		X	X	X		X	X	X					X			X	X	X					X	X			X										
Calothamnus quadrifidus		X	X						X	X	X		X	X	X	X	X	X		X		X	X			X												
Calothamnus quadrifidus subsp. *quadrifidus*																			X					X					X	X								
Calothamnus ?sanguineus					X		X			X												X			X													
Calothamnus sp.				X				X						X			X																						
*Calytrix angulata^*																																						
Calytrix ?flavescens			X				X	X											X	X	X					X												
* *Carpobrotus ?aequilaterus*																																				X	X	
* *Carpobrotus edulis*	X			X								X											X															
Cassytha racemosa	X			X			X					X		X			X	X			X								X	X		X					X
Clematis pubescens													X																										
Conospermum canaliculatum subsp. *canaliculatum*		X																			X					X												
Conostephium pendulum	X			X	X			X		X		X		X																				X	X		X	
Conostephium ?preissii	X			X					X			X		X	X		X										X											
Conostylis aculeata subsp. *aculeata*	X			X				X																										X	X			

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED WITHIN THE YANCHEP RIDGES SURVEY AREA, 2013

Note: * denotes introduced species and P1-P5 denote Priority Flora Species (DPaW 2014c).
^ denotes species recorded as an opportunistic collection

Species	YR01	YR02	YR03	YR04	YR05	YR06	YR07	YR08	YR09	YR10	YR13	YR17	YR18	YR19	YR23	YR24	YR25	YR26	YR27	YR28	YR29	YR30	YR31	YR32	YR33	YR37	YR38	YR39	YR40	YR41	YRN14	YRN16	YRN20	YRN21	YRN22	YRN34	YRN35	YRN36
Conostylis angustifolia		X			X				X		X	X	X		X	X	X				X		X		X	X												
Conostylis aurea					X	X	X			X												X														X	
Conostylis caricina subsp. *caricina*									X																												
Conostylis pusilla	X			X	X		X		X		X				X	X	X	X		X	X	X	X		X	X	X	X							X	
Corynotheca micrantha ?var. *micrantha*																																			X		
Craspedia variabilis												X																									
Crassula colorata var. *colorata*																																			X	X	X
Cristonia biloba				X					X																												
Cryptandra ?*pungens*										X																											
Daucus glochidiatus		X	X			X			X					X					X	X	X	X	X	X		X	X	X							X		
Daviesia divaricata					X									X																	X				X	X	X
Daviesia podophylla																															X				X	X	X
Desmocladus fasciculatus														X																							
Desmocladus flexuosus	X			X		X	X	X	X		X	X	X	X	X	X	X		X	X	X			X			X	X	X	X							
Dianella revoluta	X		X	X	X					X																			X	X							
Dichopogon capillipes	X			X											X																X						
* *Ehrharta calycina*	X			X																																	
* *Ehrharta longiflora*						X																						X									
Eremaea pauciflora var. *pauciflora*					X															X		X								X							X
Eremophila glabra subsp. albicans^																																					
Eucalyptus decipiens^																																					
Eucalyptus decipiens subsp. *decipiens*^																																					
Eucalyptus gomphocephala	X								X																	X											
Eucalyptus marginata	X			X				X				X		X														X			X						
Eucalyptus todtiana							X	X							X	X	X	X							X							X					
Euchiton sphaericus														X																							
Gastrolobium linearifolium	X			X					X																		X			X	X			X	X	X	X
* *Gladiolus caryophyllaceus*	X		X	X	X	X	X	X		X		X		X	X	X		X				X				X								X	X	X
Gompholobium aristatum										X												X			X	X											
Gompholobium tomentosum	X			X			X	X	X			X		X	X		X	X			X					X	X			X	X	X	X	X	X	X	
Grevillea preissii																													X	X							
Grevillea vestita subsp. *vestita*																										X											
Haemodorum laxum										X																											
Haemodorum paniculatum									X						X													X									
Haemodorum sp.												X		X									X														
Hakea costata											X														X												
Hakea lissocarpha	X			X	X	X		X			X			X								X		X		X		X									
Hakea prostrata													X		X					X	X		X					X									
Hakea ruscifolia	X							X				X					X	X							X												
Hakea trifurcata													X		X														X								
Hardenbergia comptoniana	X	X	X	X		X			X			X			X													X									
* *Heliophila pusilla*																								X													
Hemiandra pungens^																																					
Hibbertia huegelii	X			X	X		X				X	X		X	X			X	X																		
Hibbertia hypericoides	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	
Hibbertia racemosa				X				X																														
Hovea trisperma	X			X																	X																
Hypocalymma angustifolium^																																					
* *Hypochaeris glabra*				X							X							X					X				X					X	X	X	X			
Hypolaena exsulca																	X	X																				
Hypolaena pubescens												X		X																								
Isotoma hypocrateriformis	X								X																										X	X		
Jacksonia calcicola		X	X						X		X					X			X			X			X		X	X	X								
Jacksonia floribunda																															X					X	X	

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED WITHIN THE YANCHEP RIDGES SURVEY AREA, 2013

Note: * denotes introduced species and P1-P5 denote Priority Flora Species (DPaW 2014c).
^ denotes species recorded as an opportunistic collection

Species	YR01	YR02	YR03	YR04	YR05	YR06	YR07	YR08	YR09	YR10	YR13	YR17	YR18	YR19	YR23	YR24	YR25	YR26	YR27	YR28	YR29	YR30	YR31	YR32	YR33	YR37	YR38	YR39	YR40	YR41	YRN14	YRN16	YRN20	YRN21	YRN22	YRN34	YRN35	YRN36
Jacksonia furcellata							X								X								X		X													
Jacksonia sternbergiana									X		X				X					X			X								X	X	X				
Kennedia prostrata				X				X																										X				
Kunzea glabrescens													X							X	X																	
Lagenophora huegelii												X																										
Laxmannia sessiliflora subsp. *australis*										X																												
Lechenaultia expansa^																																						
Lechenaultia linarioides^																																						
Lepidobolus preissianus subsp. *preissianus*	X	X	X		X				X		X	X			X		X		X	X	X		X	X	X	X												
Lepidosperma calcicola	X			X			X																															
Lepidosperma aff. scabrum										X										X	X	X																
Lepidosperma sp.													X																									
Leptospermum spinescens										X				X						X																X		
Leucopogon parviflorus		X				X				X										X		X		X	X				X	X								
Leucopogon polymorphus				X	X		X	X		X				X		X		X						X	X						X							
Leucopogon propinquus	X			X					X		X	X	X		X		X				X		X			X							X					
Leucopogon sp. Yanchep (M. Hislop 1986) (P3)																					X			X		X												
Levenhookia pusilla									X						X	X		X																				
Levenhookia stipitata					X		X		X	X												X				X												
Lobelia gibbosa										X																												
Lobelia rhombifolia		X	X			X													X	X	X		X			X												
Lobelia tenuior	X								X		X	X	X	X													X											
Lomandra caespitosa				X					X		X	X	X		X													X										
Lomandra hermaphrodita															X													X										
Lomandra maritima	X			X		X		X	X	X		X																X										
Lomandra ?*preissii*								X				X			X																	X						
Lomandra ?*suaveolens*				X																			X															
Lomandra sp.															X						X				X													
Lyginia barbata																																				X		
* *Lysimachia arvensis*		X	X	X		X			X				X						X	X			X			X	X	X							X			
Macrozamia riedlei	X			X				X	X	X	X	X	X	X		X	X	X				X	X		X	X	X	X					X		X			
Marianthus ?*candidus*	X			X																																		
Melaleuca huegelii subsp. *huegelii*			X										X											X			X		X	X								
Melaleuca systena		X				X							X																X	X								
Mesomelaena pseudostygia	X		X	X	X		X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X				X			
Mesomelaena tetragona					X		X			X																												
Monotaxis grandiflora var. *grandiflora*												X																										
Nuytsia floribunda										X			X		X			X							X													
Olearia axillaris																			X																			
Opercularia vaginata																			X																			
Orthrosanthus laxus				X																																		
Patersonia occidentalis				X			X			X		X										X									X			X			X	X
* *Pelargonium capitatum*																																		X		X		
Persoonia saccata	X							X	X												X																	
Petrophile brevifolia													X	X								X						X										
Petrophile linearis				X			X	X				X		X	X					X													X	X			X	X	
Petrophile macrostachya	X				X		X			X	X					X	X	X		X					X	X		X										
Petrophile serruriae																					X																	
* *Petrorhagia dubia*			X						X						X													X										
Philotheca ?*spicata*												X		X																								
Phyllangium paradoxum												X																										
Phyllanthus calycinus			X			X																	X	X		X			X	X								

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED WITHIN THE YANCHEP RIDGES SURVEY AREA, 2013

Note: * denotes introduced species and P1-P5 denote Priority Flora Species (DPaW 2014c).
^ denotes species recorded as an opportunistic collection

Species	YR01	YR02	YR03	YR04	YR05	YR06	YR07	YR08	YR09	YR10	YR13	YR17	YR18	YR19	YR23	YR24	YR25	YR26	YR27	YR28	YR29	YR30	YR31	YR32	YR33	YR37	YR38	YR39	YR40	YR41	YRN14	YRN16	YRN20	YRN21	YRN22	YRN34	YRN35	YRN36
Pimelea floribunda																					X																	
Pimelea sulphurea														X						X																		
Pimelea sp.	X			X				X				X		X																								
* *Pinus radiata*																															X							
Pinus sp.																																						X
Poa drummondiana					X			X						X	X							X						X										
Poaceae sp.																							X	X		X												
Podotheca angustifolia												X					X			X								X			X	X	X	X				
Podotheca gnaphalioides					X	X																				X	X								X	X	X
Rhagodia baccata subsp. *baccata*																												X									
* *Romulea rosea*									X																													
Scaevola repens	X																																					
Scaevola repens var. *repens*																															X	X	X			X	X	X
Schoenus clandestinus																		X																			
Schoenus ?latitans																												X									
Scholtzia involucrata																																X				X	
Siloxerus humifusus														X				X								X		X									
* *Sonchus oleraceus*		X	X			X					X				X					X	X						X			X	X	X			X		X
Sowerbaea laxiflora				X					X						X	X															X				X		
Stenanthemum notiale subsp. *chamelum*																			X																		
Stirlingia latifolia							X	X				X		X	X							X									X	X		X	X	X	X	X
Stylidium brunonianum	X								X	X					X	X	X			X		X		X	X	X		X									
Stylidium crossocephalum																																				X	
Stylidium cygnorum					X																				X												X
Stylidium piliferum								X																														
Stylidium schoenoides								X																														
Synaphea spinulosa																						X									X						
Synaphea spinulosa subsp. *spinulosa^*																																						
Tetraria octandra	X			X										X	X												X										
Thysanotus arenarius																							X														
Thysanotus dichotomus														X			X																				
Thysanotus triandrus																																				X		
Thysanotus sp.																			X																			
Trachymene pilosa	X						X	X	X				X			X	X															X	X					
Tricoryne elatior			X			X																	X															
* *Trifolium arvense*																												X							X	X	X
* *Trifolium campestre*	X		X	X																								X									
Tripterococcus brunonis																															X						
Trymalium ledifolium var. *ledifolium^*																													X									
* *Ursinia anthemoides*	X		X	X	X	X	X	X		X		X		X	X	X	X	X	X	X	X	X	X	X	X		X	X			X	X		X	X	X	X	X
*Verreauxia reinwardtii^*																																						
Verticordia densiflora var. d*ensiflora^*																																						
* *Vulpia myuros*																																				X	X	X
* *Wahlenbergia capensis*																																				X		
Wahlenbergia sp.																				X		X																
Waitzia suaveolens var. *suaveolens*	X						X		X	X		X			X	X		X	X	X	X		X		X	X	X	X									
Xanthorrhoea gracilis		X	X		X					X				X	X					X	X	X		X														
Xanthorrhoea preissii	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X			X		X	X	X		X	X
Xanthosia huegelii												X		X												X												

APPENDIX E: VASCULAR PLANT SPECIES BY VEGETATION COMMUNITY WITHIN THE YANCHEP RIDGES SURVEY AREA, 2013

Note: * denotes introduced species; P1 - P5 denotes Priority Flora Species (DPaW 2014b)

Species	Vegetation Community					
	A	A1	B	C	D	E
Acacia applanata					X	
Acacia ?cochlearis	X					
* *Acacia longifolia*	X					
Acacia pulchella	X	X	X	X	X	X
Acacia pulchella var. *glaberrima*			X		X	
Acacia saligna			X			
Acanthocarpus preissii	X		X		X	
Adenanthos cygnorum subsp. *cygnorum*	X					X
* *Aira caryophyllea*	X		X	X	X	X
* *Aira* sp.	X		X		X	
Alexgeorgea nitens			X		X	
Allocasuarina fraseriana			X	X		
Allocasuarina humilis	X		X	X	X	
Anigozanthos humilis subsp. *humilis*				X		X
Anigozanthos manglesii						X
Anthocercis ilicifolia subsp. *ilicifolia*	X		X			
Arnocrinum preissii						X
* *Asparagus asparagoides*	X					
Astroloma macrocalyx				X		
Astroloma pallidum				X	X	
Austrostipa flavescens	X					
Austrostipa macalpinei	X		X	X	X	X
Austrostipa mollis				X		
* *Avena barbata*					X	X
Baeckea sp. Limestone (N. Gibson & M.N. Lyons 1425) (P1)	X					
Banksia attenuata	X		X	X	X	
Banksia dallanneyi	X		X	X	X	X
Banksia grandis					X	
Banksia menziesii			X	X	X	
Banksia nivea		X				
Banksia sessilis	X	X	X		X	
Banksia sp.					X	
Beaufortia elegans				X		X
Beyeria cinerea subsp. *cinerea* (P3)	X					
Boronia ramosa subsp. *anethifolia*						X
Bossiaea eriocarpa	X	X	X	X	X	X
* *Brassica tournefortii*						X
* *Briza maxima*	X		X	X	X	
* *Briza minor*	X		X	X		X
Burchardia congesta	X		X	X	X	
Calothamnus quadrifidus	X		X	X	X	
Calothamnus quadrifidus subsp. *quadrifidus*	X	X				
Calothamnus ?sanguineus				X		

APPENDIX E: VASCULAR PLANT SPECIES BY VEGETATION COMMUNITY WITHIN THE YANCHEP RIDGES SURVEY AREA, 2013

Note: * denotes introduced species; P1 - P5 denotes Priority Flora Species (DPaW 2014b)

	Species	Vegetation Community					
		A	A1	B	C	D	E
	Calothamnus sp.				X	X	
	Calytrix angulata						X
	Calytrix ?flavescens	X		X	X	X	
*	*Carpobrotus ?aequilaterus*						X
*	*Carpobrotus edulis*			X		X	X
	Cassytha racemosa	X	X		X	X	X
	Clematis pubescens	X					
	Conospermum canaliculatum subsp. *canaliculatum*	X		X			X
	Conostephium pendulum				X	X	X
	Conostephium ?preissii			X	X	X	
	Conostylis aculeata subsp. *aculeata*					X	X
	Conostylis angustifolia	X		X	X	X	
	Conostylis aurea	X			X	X	X
	Conostylis caricina subsp. *caricina*					X	
	Conostylis pusilla	X		X	X	X	X
	Corynotheca micrantha ? var. *micrantha*						X
	Craspedia variabilis					X	
	Crassula colorata var. *colorata*						X
	Cristonia biloba			X		X	
	Cryptandra ?pungens				X		
	Daucus glochidiatus	X		X	X	X	X
	Daviesia divaricata				X	X	X
	Daviesia podophylla						X
	Desmocladus fasciculatus					X	
	Desmocladus flexuosus	X	X	X	X	X	
	Dianella revoluta	X	X		X	X	
	Dichopogon capillipes			X		X	X
*	*Ehrharta calycina*					X	
*	*Ehrharta longiflora*	X		X			
	Eremaea pauciflora var. *pauciflora*			X	X		X
	Eremophila glabra subsp. *albicans*	X					
	Eucalyptus decipiens	X					
	Eucalyptus decipiens subsp. *decipiens*	X					
	Eucalyptus gomphocephala	X		X		X	
	Eucalyptus marginata			X		X	X
	Eucalyptus todtiana			X	X	X	X
	Euchiton sphaericus					X	
	Gastrolobium linearifolium			X		X	X
*	*Gladiolus caryophyllaceus*	X		X	X	X	X
	Gompholobium aristatum			X	X		
	Gompholobium tomentosum	X		X	X	X	X
	Grevillea preissii		X				
	Grevillea vestita subsp. *vestita*	X		X			

APPENDIX E: VASCULAR PLANT SPECIES BY VEGETATION COMMUNITY WITHIN THE YANCHEP RIDGES SURVEY AREA, 2013

Note: * denotes introduced species; P1 - P5 denotes Priority Flora Species (DPaW 2014b)

	Species	Vegetation Community					
		A	A1	B	C	D	E
	Haemodorum laxum				X		
	Haemodorum paniculatum			X		X	X
	Haemodorum sp.			X		X	
	Hakea costata			X	X		
	Hakea lissocarpha	X	X	X	X	X	
	Hakea prostrata	X		X		X	
	Hakea ruscifolia				X	X	X
	Hakea trifurcata	X	X	X			
	Hardenbergia comptoniana	X		X		X	
*	*Heliophila pusilla*	X					
	Hemiandra pungens				X		
	Hibbertia huegelii			X	X	X	
	Hibbertia hypericoides	X	X	X	X	X	X
	Hibbertia racemosa					X	
	Hovea trisperma	X				X	
	Hypocalymma angustifolium			X		X	
*	*Hypochaeris glabra*	X		X	X	X	X
	Hypolaena exsulca				X		
	Hypolaena pubescens					X	
	Isotoma hypocrateriformis			X		X	X
	Jacksonia calcicola	X		X	X	X	
	Jacksonia floribunda						X
	Jacksonia furcellata				X		
	Jacksonia sternbergiana			X			X
	Kennedia prostrata					X	X
	Kunzea glabrescens	X		X			X
	Lagenophora huegelii					X	
	Laxmannia sessiliflora subsp. *australis*				X		
	Lechenaultia expansa						X
	Lechenaultia linarioides			X			
	Lepidobolus preissianus subsp. *preissianus*	X		X	X	X	
	Lepidosperma calcicola	X			X	X	X
	Lepidosperma aff. scabrum	X		X	X		
	Lepidosperma sp.	X					
	Leptospermum spinescens			X	X	X	X
	Leucopogon parviflorus	X	X	X	X		
	Leucopogon polymorphus	X		X	X	X	X
	Leucopogon propinquus	X		X	X	X	
	Leucopogon sp. Yanchep (M. Hislop 1986) (P3)	X		X			
	Levenhookia pusilla			X	X		
	Levenhookia stipitata			X	X	X	
	Lobelia gibbosa				X		

APPENDIX E: VASCULAR PLANT SPECIES BY VEGETATION COMMUNITY WITHIN THE YANCHEP RIDGES SURVEY AREA, 2013

Note: * denotes introduced species; P1 - P5 denotes Priority Flora Species (DPaW 2014b)

	Species	Vegetation Community					
		A	A1	B	C	D	E
	Lobelia rhombifolia	X		X			
	Lobelia tenuior	X		X		X	
	Lomandra caespitosa	X		X		X	
	Lomandra hermaphrodita			X			
	Lomandra maritima	X		X	X	X	
	Lomandra ?preissii			X		X	X
	Lomandra ?suaveolens			X		X	
	Lomandra sp.	X		X	X		
	Lyginia barbata						X
*	*Lysimachia arvensis*	X		X		X	X
	Macrozamia riedlei	X		X	X	X	X
	Marianthus ?candidus					X	
	Melaleuca huegelii subsp. *huegelii*	X	X				
	Melaleuca systena	X	X				
	Mesomelaena pseudostygia	X		X	X	X	X
	Mesomelaena tetragona				X		
	Monotaxis grandiflora var. *grandiflora*					X	
	Nuytsia floribunda	X		X	X		X
	Olearia axillaris	X					X
	Opercularia vaginata	X					
	Orthrosanthus laxus					X	
	Patersonia occidentalis				X	X	X
*	*Pelargonium capitatum*						X
	Persoonia saccata	X		X		X	
	Petrophile brevifolia	X		X	X	X	
	Petrophile linearis			X	X	X	X
	Petrophile macrostachya			X	X	X	
	Petrophile serruriae	X		X			
*	*Petrorhagia dubia*	X		X			
	Philotheca ?spicata					X	
	Phyllangium paradoxum					X	
	Phyllanthus calycinus	X	X	X			
	Pimelea floribunda	X					
	Pimelea sp.					X	
	Pimelea sulphurea			X		X	
*	*Pinus radiata*						X
	Pinus sp.						X
	Poa drummondiana			X	X	X	
	Poaceae sp.	X		X			
	Podotheca angustifolia			X	X	X	X
	Podotheca gnaphalioides	X		X	X		X
	Rhagodia baccata subsp. *baccata*			X			

APPENDIX E: VASCULAR PLANT SPECIES BY VEGETATION COMMUNITY WITHIN THE YANCHEP RIDGES SURVEY AREA, 2013

Note: * denotes introduced species; P1 - P5 denotes Priority Flora Species (DPaW 2014b)

Species	Vegetation Community					
	A	A1	B	C	D	E
* *Romulea rosea*			X			
Scaevola repens					X	
Scaevola repens var. *repens*						X
Schoenus ?latitans			X			
Schoenus clandestinus				X		
Scholtzia involucrata						X
Siloxerus humifusus			X	X	X	
* *Sonchus oleraceus*	X		X			X
Sowerbaea laxiflora			X		X	
Stenanthemum notiale subsp. *chamelum*	X					
Stirlingia latifolia			X	X	X	X
Stylidium brunonianum	X		X	X	X	
Stylidium crossocephalum						X
Stylidium cygnorum				X		X
Stylidium piliferum					X	
Stylidium schoenoides					X	
Synaphea spinulosa				X	X	X
Synaphea spinulosa subsp. *spinulosa*						X
Tetraria octandra			X		X	
Thysanotus arenarius			X			
Thysanotus dichotomus				X	X	
Thysanotus sp.	X					
Thysanotus triandrus						X
Trachymene pilosa	X		X	X	X	X
Tricoryne elatior	X		X			
* *Trifolium arvense*			X			X
* *Trifolium campestre*	X		X		X	
Tripterococcus brunonis						X
Trymalium ledifolium var. *ledifolium*	X	X	X			
* *Ursinia anthemoides*	X		X	X	X	X
Verreauxia reinwardtii						X
Verticordia densiflora var. *densiflora*			X			
* *Vulpia myuros*						X
* *Wahlenbergia capensis*						X
Wahlenbergia sp.			X	X		
Waitzia suaveolens var. *suaveolens*	X		X	X	X	
Xanthorrhoea gracilis	X		X	X	X	
Xanthorrhoea preissii	X		X	X	X	X
Xanthosia huegelii			X		X	

APPENDIX F: DESCRIPTION OF VEGETATION COMMUNITIES ON THE YANCHEP RIDGES SURVEY AREA, 2013

apping Code	Vegetation Community Description	Representative Plate of Community
A	Open heathland of *Banksia sessilis*, *Xanthorrhoea preissii* and occasional *Calothamnus quadrifidus* over a low shrubland of *Hibbertia hypericoides*, *Banksia dallanneyi*. **Other Associated Species:** *Desmocladus flexuosus, Jacksonia calcicola, Mesomelaena pseudostygia, Lepidobolus preissianus* subsp. *preissianus* and *Adenanthos cygnorum* subsp. *cygnorum* **Soils and Landform:** Upper slopes and ridges with shallow sands **Outcropping:** Limestone, Few to Moderate **Condition:** Very Good to Excellent **Plate Details:** Survey Site YR02 **No. of Quadrats:** 8 **Similarity Percentage:** 50.54	
A1 (SCP26a)	Heathland of *Melaleuca huegelii*, *Melaleuca systena* and *Calothamnus quadrifidus* with occasional *Banksia sessilis* over *Grevillea preissii*, *Hibbertia hypericoides*, *Leucopogon parviflorus* and *Phyllanthus calycinus*. **Other Associated Species:** *Acacia pulchella*, *Desmocladus flexuosus, Banksia nivea, Cassytha racemosa, Dianella revoluta, Hakea lissocarpha, Hakea trifurcata* and *Trymalium ledifolium.* **Soils and Landform:** Upper slopes and ridges with skeletal soils. **Outcropping:** Prominent limestone outcrops **Condition:** Very Good to Excellent **Plate Details:** Survey Site YR41 **No. of Quadrats:** 2 **Similarity Percentage:** 82.3	

APPENDIX F: DESCRIPTION OF VEGETATION COMMUNITIES ON THE YANCHEP RIDGES SURVEY AREA, 2013

Mapping Code	Vegetation Community Description	Representative Plate of Community
B	Low open woodland of *Allocasuarina fraseriana* and *Banksia attenuata* over a tall shrubland of *Banksia sessilis* over *Xanthorrhoea preissii* over a low shrubland of *Hibbertia hypericoides*, *Conostylis pusilla* and *Mesomelaena pseudostygia.* **Other Associated Species:** *Macrozamia riedlei, Conostylis angustifolia, Lepidobolus preissianus* subsp. *preissianus, Acacia pulchella* and *Stylidium brunonianum* **Soils and Landform:** Mid slopes with light brown to yellow sands **Outcropping:** Limestone, None to Few **Condition:** Very good to Excellent **Plate Details:** Survey Site YR28 **No. of Quadrats:** 8 **Similarity Percentage:** 50.14	
C	Low open woodland of *Banksia attenuata* with occasional *Banksia menziesii* and *Eucalyptus todtiana* over a low shrubland of *Hibbertia hypericoides*, *Acacia pulchella* and *Mesomelaena pseudostygia.* **Other Associated Species:** *Petrophile macrostachya, Conostylis pusilla, Macrozamia riedlei* and *Xanthorrhoea preissii* **Soils and Landform:** Flats and lower slopes with light brown to yellow sands **Outcropping:** N/A **Condition:** Very good to Excellent **Plate Details:** Survey Site YR05 **No. of Quadrats:** 7 **Similarity Percentage:** 50.68	

APPENDIX F: DESCRIPTION OF VEGETATION COMMUNITIES ON THE YANCHEP RIDGES SURVEY AREA, 2013

Mapping Code	Vegetation Community Description	Representative Plate of Community
D	Open woodland of *Eucalyptus marginata* and *Banksia attenuata* over *Xanthorrhoea preissii* and *Macrozamia riedlei* over a low shrubland of *Conostephium pendulum*, *Hibbertia hypericoides* and *Mesomelaena pseudostygia.* **Other Associated Species:** *Bossiaea eriocarpa, Desmocladus flexuosus, Gompholobium tomentosum* and *Pimelea sulphurea* **Soils and Landform:** Lower to mid slopes with yellow sands **Outcropping:** N/A **Condition:** Very good to Excellent **Plate Details:** Survey Site YR04 **No. of Quadrats:** 5 **Similarity Percentage:** 58.36	
E	Former pine plantation with a mixed shrubland of *Acacia pulchella*, *Xanthorrhoea preissii*, *Gastrolobium linearifolium* and *Stirlingia latifolia* over a low open shrubland of *Hibbertia hypericoides*, *Gompholobium tomentosum* and *Scaevola repens* var*. repens.* **Other Associated Species:** *Bossiaea eriocarpa, Petrophile linearis* and *Daviesia podophylla* **Soils and Landform:** Grey sands **Outcropping:** N/A **Condition:** Degraded **Plate Details:** Survey Site YRN35 **No. of Quadrats:** 8 **Similarity Percentage:** 45.32	

APPENDIX G: RELATIONSHIP BETWEEN SITES AND VEGETATION COMMUNITIES DEFINED WITHIN THE YANCHEP RIDGES SURVEY AREA AND SELECTED VEGETATION COMMUNITIES DEFINED BY GIBSON *et al.* 1994