Edith Cowan University

FLORA & VEGETATION SURVEY

Edith Cowan University South West Campus

September 2007

onshore
environmental consultants

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Cover photographs: a) Plot 2 EgEmCcBaAf - Hill Crests & Upper Hill Slopes (west), b) Priority 4 flora *Caladenia speciosa*, c) Plot 12 CcMpBl - Seasonally inundated dampland

Onshore Environmental Consultants P/L
ABN 41 095 837 120
83 Norfolk St
Dunsborough WA 6281
pf 08 97 567 073 m 0427 339 842
Email onshoreenv@westnet.com.au

EXECUTIVE SUMMARY

Onshore Environmental Consultants Pty Ltd was commissioned by Edith Cowan Univeristy to report on issues relating to terrestrial flora and vegetation within native remnant vegetation at the South West Campus.

A desktop search for flora of conservation significance previously collected from the survey locality was undertaken utilising the EPBC (Federal) and Department of Environment and Conservation (State) databases. One plant taxon was identified from the Federal database, listed as 'Vulnerable'. Ten plant taxa were identified from the State database, including one Declared Rare Flora (DRF).

A total of 250 plant taxa (including varieties and subspecies) from 58 families and 171 genera were recorded from the survey area, including 47 alien taxa. Species representation was greatest among the Asteraceae (21), Papilionaceae (20), Myrtaceae (20), Proteaceae (17), Poaceae (13), Orchidaceae (12), Anthericaceae (11), Cyperaceae (10) and Mimosaceae (10).

One plant taxon *(Caladenia speciosa* P4) was of State conservation significance. *C. speciosa* was collected from three separate locations on sandy flats between damplands to the west and lower dune slopes to the east. No plant taxa were gazetted as Declared Rare Flora pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950*), and no plant taxa recorded were listed under the EPBC Act.

Vegetation within the survey area consists of wetlands in the far west, a thin strip of 'sandy flats' that support *Corymbia calophylla, Banksia grandis* and *Banksia attenuata* that rise into mid dune slopes and then upper slopes and hill crests (supporting tuart). There are two vegetation associations on the 'sandy flat', partly due to prior tree clearing and disturbance from the old Rifle Range which has artificially created an open heathland. The Tuart Woodland complexes have been separated into 'Tuart over mixed woodlands' and 'Tuart over mixed low forest dominated by peppie', which mainly occurs in deep dune swales in the far south and far north of the survey area. On the east side of the dune system there is a localised area of hill slope vegetation supporting mixed low woodland, grading into the sandplains complex (jarrah-banksia).

While tuart itself is not considered threatened, some of the vegetation communities supporting tuart are under-represented in conservation reserves, or not adequately protected on private lands. Gibson *et al.* (1994) include vegetation of the survey area in Community type 21a 'Central *Banksia attenuata – Eucalyptus marginata* woodlands', which is described as sometimes supporting *Eucalyptus gomphocephala* as the dominant or codominant. The complex occurs on both the Bassendean Dunes and the Spearwood system across the entire extent of the southern Swan Coastal Plain, and is determined by Gibson *et al.* (1994) to be 'well reserved' with a 'low risk' conservation status. It is noted that a large proportion of the tuart complexes described at the ECU South West Campus support low visible disturbance understorey, particularly in southern parts. However, tuart communities at the ECU South West Campus occur within the most common soil system represented along the

tuart belt (Spearwood) and within the most common rainfall zone (800-900 mm), and do not form part of any Threatened Ecological Community. Future management considerations for remnant vegetation at the Campus should focus on maintaining vegetation condition, protecting the Priority 4 flora *Caladenia speciosa,* and maintaining connectivity between adjacent blocks of native vegetation at Hay Park (west side of SW Highway) and Manea Park (east side of College Grove).

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1 INTRODUCTION

1.1 Preamble

The South West Campus of Edith Cowan University is situated in close proximity to the City of Bunbury (Figure 1), occurring within a 46 ha block of remnant Tuart Woodland (of which approximately 12 ha supports existing infrastructure). As part of future planning initiatives, Onshore Environmental Consultants Pty Ltd was commissioned to undertake a terrestrial flora and vegetation survey of all remnant vegetation occurring within the Campus grounds.

1.2 Existing Environment

1.2.1 Climate

The Mediterranean climate of Bunbury is characterised by dry hot summers, and wet cool winters. Annual rainfall averages 840 mm with highest falls received between the months of May and September (winter dominant).

1.2.2 Landforms & Soils

The survey area forms part of the Swan Coastal Plain and has a predominantly western aspect. Soils are associated with two phases of the Spearwood Dunes (Qts) complex, which can be broadly described as siliceous yellow sands overlying Tamala Limestone (Churchward and McArthur 1980). The 'Spearwood S4c' phase is associated with a seasonally wet dampland occurring on flat to gently undulating plains along the western fringe of the survey area. Soils are deep yellow-brown or dark brown siliceous sands. The 'Spearwood S1b' phase occurs on elevated dune ridges with slopes up to 15%. Soils are deep siliceous yellow brown sands or pale sands with yellow-brown subsoil.

1.2.3 Vegetation

Beard (1981) described the limestone soils between Busselton and Bunbury as 'Tuart Tall Woodland'. *Eucalyptus gomphocephala* (tuart) is at the southern limit of its range within this phase, forming open stands between 30-40m tall. The western fringe of this complex is represented as a single dominant stand with a well developed lower tree layer of *Agonis flexuosa* and *Banksia* spp. to about 15m. Inland of the tall tuart complex Beard (1981) mapped a mixed woodland complex comprising a mosaic of *Eucalyptus marginata* (jarrah) and *Corymbia calophylla* (marri) woodland, *Banksia attenuata* and *Banksia grandis* low woodland, and *Melaleuca* spp. low woodland.

Heddle *et al*. (1980) mapped vegetation of the survey area as 'Karrakatta Complex - Central and South'. This complex is associated with the Spearwood Dune System, which extends from Yanchep in the north to Capel in the south. Vegetation is described as 'Predominantly open forest of *Eucalyptus gomphocephala* - *Eucalyptus marginata* - *Corymbia calophylla*, and woodland of *Eucalyptus marginata* - *Banksia* species'.

Gibson *et al.* (1994) include vegetation of the survey area in Community type 21a 'Central *Banksia attenuata* – *Eucalyptus marginata* woodlands', which is described as sometimes supporting *Eucalyptus gomphocephala* as the dominant or codominant.

The complex occurs on both the Bassendean Dunes and the Spearwood system, and is determined by Gibson *et al.* (1994) to be 'well reserved' and support a 'low risk' conservation status.

A flora and vegetation of the actual survey area has previously been completed as part of an Environmental Management Plan for the ECU South West Campus (ATA Environmental 2006). A total of 100 native plant species and 21 weed species were identified during this survey, with vegetation condition rated as 'Good' to 'Very Good'. Two Priority 4 species were recorded in the survey; *Acacia flagelliformis* (P4) and *Caladenia speciosa* (P4).

INSERT

Figure 1 Regional location plan for the Edith Cowan University Bunbury Campus.

2 OBJECTIVES

The objectives of the flora and vegetation survey were to:

- Complete a desktop survey of Department of Environment & Conservation (DEC) and *Environment Protection and Biodiversity Conservation (EPBC) Act* databases, to determine the presence of rare flora previously collected or likely to occur within or nearby to the survey area;
- Describe and map vegetation types present within the survey area (addressing requirements of the Environmental Protection Authority 2004 Guidance Statement No 51);
- Identify the location of rare flora with Federal and/or State conservation significance within the survey area; and
- Submit a written report summarising outcomes for above tasks.

3 METHODS

3.1 Field assessment

Reporting is based on data recorded during a three day field survey completed on 10-11 & 16 September 2007. Field assessment coincided with peak flowering period, and a variety of annual and ephemeral life forms were recorded in season.

Remnant vegetation in the study area was surveyed using methodology stated in Environmental Protection Authority (EPA) Guidance No 51 (2004). Prior to field work a variety of topographic, vegetation, and land system maps were used to provide preliminary vegetation classification of the site. A series of transects within remnant vegetation was ground truthed and variations recorded by GPS and marked on an aerial photograph. Temporary 10m x 10m quadrats were established using a compass and oriented due north. Quadrats were strategically placed to record variation in vegetation structure and composition (Figure 2). For each quadrat, the following information was recorded:

- GPS reading (WGS84) at the northwest corner of each quadrat;
- Digital photograph taken at the northwest corner of each quadrat;
- Topography & slope;
- Rock type, soil texture & soil colour, and surface layer description;
- Leaf litter cover & distribution;
- Wood litter cover & distribution;
- Vegetation condition using the Bush Forever rating (DEP 2000);
- Fire history (visual assessment);
- Disturbance information including details on dieback, grazing, access, erosion & weeds;
- Presence of Declared Rare or Priority Flora or other significant flora;
- Total flora list with record of individual species cover and height data; and
- A 10m wide area around the perimeter of each quadrat was also surveyed to record opportunistic flora additional to those observed within the plot.

The survey comprised a three day effort to identify flora, record identifiable changes in vegetation composition and structure, and assess vegetation condition. During the field survey a classification was developed as a basis for mapping. The resultant map, Figure 2, represents the ten major vegetation types subsequently described. Description of vegetation structure follows the height, life form and density classes of Muir (1977, Appendix 1). This is largely a structural classification suitable for broader scale mapping, but taking all ecologically significant strata into account. Vegetation condition was assessed using a six-point rating as used in Perth's Bushplan (DEP 2000, see Appendix 2).

Voucher specimens were taken for selected species to verify identification that could not be confidently substantiated in the field. Use was made of the Western Australian State Herbarium for confirmation of species identification. Nomenclature follows Green (1985 & 1987), Paczkowska and Chapman (2000) and the Western Australian Herbarium.

3.2 Assessment of conservation significance

At a National level, flora is protected under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Act lists flora that are considered to be of conservation significance under one of six categories (Appendix 3). A search of the EPBC database was undertaken to determine any flora of National conservation significance. The search co-ordinates given were 33.35411°S, 115.62867°E, 33.38143°S, 115.62867°E, 33.38143°S, 115.68057°E, 33.3541°S, 115.68057°E.

At a State level, native flora species are protected under the *Wildlife Conservation Act 1950 - Wildlife Conservation (Rare Flora) Notice 2007.* A number of plant species are assigned an additional level of conservation significance based on a limited number of known populations and the perceived threats to these locations. Species of the highest conservation significance are gazetted Declared Rare Flora (DRF) under subsection 2 of section 23F of the *Wildlife Conservation Act 1950*, while species which are believed to warrant a lesser level of protection are assigned to one of four Priority Flora categories (see Appendix 4). The flora in many areas of Western Australia is poorly collected and hence, continually being reviewed by relevant government departments and academic institutions. The Department of Environment and Conservation (DEC) regularly reviews and revises the schedule of Declared Rare and Priority Flora listings in Western Australia (Atkins 2007), and is responsible for collating and distributing this information.

As part of the field survey, a search was undertaken by DEC for information on rare flora previously collected or described within, or in close proximity to, the survey area. The database search was extended beyond the immediate survey limits to place the flora values into a regional context. The search co-ordinates given were: NW corner 373250E 6308200N, NE corner 378000E 6308200N, SW corner 373250E 6304325N and SE corner 378000E 6304325N. The search investigated three databases:

1. The DEC Threatened (Declared Rare) Flora Data-base;
2. The DEC Declared Rare and Priority Flora List - this list contains species that are declared rare (Conservation Codes R, X), poorly known (Conservation Codes 1, 2, 3), or require monitoring (Conservation Code 4); and

3. The Western Australian Herbarium Specimen Database for priority species opportunistically collected in the area of interest.

4 RESULTS

4.1 Flora

A total of 250 plant taxa (including varieties and subspecies) from 58 families and 171 genera were recorded from the survey area (Table 1, Appendix 5). Included in the collection were 47 alien taxa. Species representation was greatest among the Asteraceae (21), Papilionaceae (20), Myrtaceae (20), Proteaceae (17), Poaceae (13), Orchidaceae (12), Anthericaceae (11), Cyperaceae (10) and Mimosaceae (10).

Table 1 Statistics for plant taxa recorded from the ECU South West Campus survey area.

No. Families	58		
No. Genera	171		
No. Taxa	251		
No. Introduced Taxa	47		
No. Native Taxa	201		
other taxa (cultivated)	2		
Speciose Families		**Speciose Genera**	
ASTERACEAE	21	*Acacia*	10
MYRTACEAE	20	*Leucopogon*	6
PAPILIONACEAE	20	*Lomandra*	5
PROTEACEAE	17	*Hibbertia*	5
POACEAE	13	*Drosera*	5
ORCHIDACEAE	12	*Stylidium*	5
ANTHERICACEAE	11	*Thysanotus*	4
CYPERACEAE	10	*Melaleuca*	4
MIMOSACEAE	10	*Caladenia*	4
ERICACEAE	9	*Pterostylis*	4
DASYPOGONACEAE	8	*Daviesia*	4
STYLIDIACEAE	5	*Banksia*	4
APIACEAE	5	*Lepidosperma*	3
DILLENIACEAE	5	*Eucalyptus*	3
DROSERACEAE	5	*Opercularia*	3
HAEMODORACEAE	5		
IRIDACEAE	5		

4.2 Declared Rare and Priority Flora

A desktop search for flora of conservation significance previously collected from the survey locality was undertaken utilising the EPBC (Federal) and DEC (State) databases. There was one plant taxa identified from the Federal database, *Diuris drummondii,* listed as Vulnerable. A total of ten taxa were identified from the State database search including one DRF, four Priority 3 flora and five Priority 4 flora (see Table 2).

Following intensive sampling and ground truthing of the survey, one plant taxa of State conservation significance was recorded from three locations within the survey area; *Caladenia speciosa* P4 (Table 3, Figure 2). None of the plant taxa recorded were gazetted as Declared Rare Flora pursuant to subsection (2) of section 23F of the *Wildlife Conservation Act (1950*). None of the taxa recorded are listed under the EPBC Act.

Table 2 Flora of conservation significance previously collected from the vicinity of the ECU South West Campus.
SCC - State Conservation Code (*Wildlife Conservation Act 1999)* and DEC (2007)
FCC – Federal Conservation Code *(EPBC Act 1999)*

FAMILY Species	**SCC**	**FCC**
Acacia flagelliformis	4	
Aponogeton hexapetalus	4	
Caladenia speciosa	4	
Diuris drummondii	R	V
Eucalyptus rudis ssp. *cratyantha*	4	
Lasipetalum membranaceum	3	
Platysace ramosissima	3	
Pultenaea skinneri	4	
Schoenus benthamii	3	
Verticordia attenuata	3	

Table 3 Location of Priority 4 flora *Caladenia speciosa* within the ECU South West Campus.

GDA94		
Easting	**Northing**	**No. plants**
374538	6307240	1
374411	6307035	7
374373	6307025	5

4.3 Vegetation

Raw data from the fourteen sites assessed are presented as Appendix 6.

Vegetation within the survey area consists of wetlands in the far west, a thin strip of 'sandy flats' that support *Corymbia calophylla, Banksia grandis* and *Banksia attenuata* that rise into mid dune slopes and then upper slopes and hill crests (supporting tuart). There are two vegetation associations on the 'sandy flat', partly due to prior tree clearing and disturbance from the old Rifle Range which has artificially created an open heathland. The Tuart Woodland complexes have been separated into 'Tuart over mixed woodlands' and 'Tuart over mixed low forest dominated by peppie', which mainly occurs in deep dune swales in the far south and far north of the survey area. On the east side of the dune system there is a localised area of hill slope vegetation supporting mixed low woodland, grading into the sandplains complex (jarrah-banksia).

The following ten vegetation complexes were described and mapped (Figure 2):

1 EgEmCcBaAf
Tuart Open Woodland over Jarrah – Marri - *Banksia attenuata* - Peppermint Low Woodland
Hill Crests & Upper Hill Slopes

Sites 2, 5, 6, 8 & 9
Eucalyptus gomphocephala Open Woodland over *Eucalyptus marginata* ssp. *marginata, Corymbia calophylla, Agonis flexuosa, Banksia attenuata* Low Woodland A over *Agonis flexuosa, Banksia attenuata, Xylomelum occidentale* Open Low Woodland B over *Melaleuca thymoides, Xylomelum occidentale* Open Low Scrub B over *Macrozamia riedlei* Open Dwarf Scrub C over *Hibbertia hypericoides, Xanthorrhoea gracilis, Dasypogon bromeliifolius, Conostylis aculeata* Low Heath D over **Briza maxima* Very Open Low Grass over *Daucus glochidiatus, *Ursinia anthemoides, *Hypochaeris glabra, Chamaescilla corymbosa* Very Open Herbs

2 EgEmCcBaAf
Tuart - Marri Open Woodland over Peppermint – Jarrah – Marri - *Banksia attenuata* Low Open Forest (Peppermint dominated)
Hill Swales (major)

Sites 7 & 14
Eucalyptus gomphocephala, Corymbia calophylla Open Woodland over *Agonis flexuosa, Corymbia calophylla, Banksia attenuata, Eucalyptus marginata* ssp. *marginata* Low Forest A over *Eucalyptus marginata* ssp. *marginata, Agonis flexuosa, Corymbia calophylla* Low Woodland B over *Diplolaena dampieri, Acacia cyclops, Agonis flexuosa* Open Scrub over *Macrozamia riedlei* Open Dwarf Scrub C over *Hibbertia hypericoides, Xanthorrhoea gracilis* Dwarf Scrub D over **Briza maxima, *Briza minor, *Ehrharta calycina* Open Low Grass over *Hardenbergia comptoniana* Very Open Climbers over **Romulea rosea, *Ursinia anthemoides, *Hypochaeris glabra, Chamaescilla corymbosa* Open Herbs

3 EmCcBa
Jarrah – Marri - *Banksia attenuata* **Low Woodland**
Hill Slopes (south)

Site 3, 4 & 10
Corymbia calophylla, Eucalyptus marginata ssp. *marginata, Banksia attenuata, Xylomelum occidentale* Low Woodland A over *Corymbia calophylla, Eucalyptus marginata* ssp. *marginata, Banksia attenuata, Xylomelum occidentale* Open Low Woodland B over *Allocasuarina humilis, Nuytsia floribunda* Low Scrub A/B over *Melaleuca thymoides, Macrozamia riedlei, Xanthorrhoea gracilis, Daviesia divaricata, Leucopogon racemulosus* Open Dwarf Scrub C over *Hibbertia hypericoides* Low Heath D over **Briza maxima* Very Open Low Grass over *Daucus glochidiatus, Drosera stoloifera, *Ursinia anthemoides, *Romulea rosea, *Hypochaeris glabra* Very Open Herbs

4 EmCcBaAf
Marri Open Woodland over Jarrah – Marri - *Banksia attenuata* **- Peppermint Low Woodland**
Hill Slopes (north)

Site 1
Corymbia calophylla Open Woodland over *Banksia attenuata, Agonis flexuosa, Corymbia calophylla, Eucalyptus marginata* ssp. *marginata, Xylomelum occidentale* Low Woodland A over *Banksia attenuata, Agonis flexuosa, Corymbia calophylla, Eucalyptus marginata* ssp. *marginata* Open Low Woodland B over *Agonis flexuosa, Jacksonia furcellata* Open Low Scrub B over *Xanthorrhoea gracilis, Macrozamia riedlei* Open Dwarf Scrub C over *Hibbertia hypericoides, Stirlingia latifolia, Bossiaea eriocarpa* Low Heath D over *Lepidosperma squamatum, Orthrosanthus laxus* Very Open Low Sedges over **Briza maxima* Open Low Grass over *Daucus glochidiatus, *Ursinia anthemoides, *Romulea rosea* Very Open Herbs

5 EmCcBa
Jarrah - Marri Open Woodland over Jarrah – Marri - *Banksia attenuata* Low Woodland
Hill Slopes (east)

Releves O13 & R17
Corymbia calophylla, Eucalyptus marginata ssp. *marginata* Open Woodland A over *Corymbia calophylla, Eucalyptus marginata* ssp. *marginata, Banksia attenuata, Xylomelum occidentale* Low Woodland B over *Eucalyptus marginata* ssp. *marginata, Banksia attenuata* Open Scrub over *Xylomelum occidentale* Open Low Scrub A over *Melaleuca thymoides, Macrozamia riedlei* Open Low Scrub B over H*ibbertia hypericoides* Low Heath D over *Dasypogon bromeliifolius* Very Open Low Sedges over *Drosera erythrorhiza, *Romulea rosea, *Hypochaeris glabra* Very Open Herbs

6 EmBa
Jarrah - *Banksia attenuata* Low Woodland
Sandplain

Site 13
Eucalyptus marginata ssp. *marginata, Banksia attenuata, Xylomelum occidentale* Low Woodland A over *Eucalyptus marginata* ssp. *marginata, Banksia attenuata, Xylomelum occidentale* Open Low Woodland B over *Melaleuca incana* ssp. *incana* Open Scrub over *Melaleuca thymoides, Melaleuca incana* ssp. *incana, Jacksonia horrida* Open Low Scrub A over *Melaleuca thymoides* Low Scrub B over *Melaleuca thymoides* Dwarf Scrub C over *Hibbertia hypericoides, Dasypogon bromeliifolius, Stirlingia latifolia* Low Heath D over *Daucus glochidiatus, *Hypochaeris glabra, *Ursinia anthemoides* Very Open Herbs

7 CcMpBl
Marri - *Melaleuca preissiana* - *Banksia littorea* Low Woodland
Seasonally inundated dampland

Sites 11 & 12
Corymbia calophylla, Melaleuca preissiana, Banksia littorea Low Woodland A over *Corymbia calophylla, Banksia littorea, Melaleuca preissiana* Open Low Woodland B over *Melaleuca incana* ssp. *incana, Acacia pulchella, Daviesia physodes* Open Low Scrub A/B over *Xanthorrhoea preissii* Open Dwarf Scrub C over *Baumea juncea, Lomandra odora, Juncus pallidus* Dense Low Sedges

8 PeAm
Mixed heath (previously disturbed from old Rifle Range)
Sandy flats

Releve R15
Pericalymma ellipticum, Adenanthos meisneri Heath B over *Daviesia physodes, Platytheca galioides, Hypocalymma angustifolium, Xanthorrhoea preissii* Dwarf Scrub C over *Hypolaena exsulca, Baumea juncea, Dasypogon bromeliifolius* Open Low Sedges

9 CcBaBg
Marri Open Woodland over *Banksia grandis - B. attenuata* Low Woodland
Sandy flats

Releve R16 & CAL2
Corymbia calophylla Open Woodland over *Banksia attenuata, Banksia grandis* Low Woodland A over *Acacia pulchella, Daviesia physodes* Open Low Scrub B over *Platytheca galioides, Adenanthos meisneri, Bossiaea eriocarpa, Boronia dichotoma, Stirlingia latifolia* Open Dwarf Scrub C over *Baumea juncea, Xanthorrhoea gracilis* Low Sedges

10 Cleared Areas

Vegetation condition over the larger survey area was rated as 'Good' to 'Very Good', with minor ground disturbance and non-aggressive weed species typically recorded amongst otherwise intact native vegetation (Figure 3). 'Degraded' vegetation was primarily restricted to localised areas of ground disturbance that require minor management inputs to remedy.

INSERT

Figure 2 Vegetation map for the ECU South West Campus showing location of rare flora.

INSERT

Figure 3 Vegetation condition map for the ECU South West Campus.

4.4 Conservation Status of Tuart Communities Represented

Tuart (*Eucalyptus gomphocephala*) occurs predominantly on the near coastal Quindalup and Spearwood Dunes over a 400 kilometre range from the Sabina River near Ludlow in the south to Jurien Bay in the north (Keighery *et al*. 2002). In recent years the need to conserve tuart woodlands has been triggered by a growing awareness that:

- The physical extent of tuart dominated communities on the Swan Coastal Plain has been significantly reduced (by almost 65%) primarily in response to expansion of the State's population (Hopkins *et al*. 2001);
- For many areas of retained tuart woodland, secondary impacts including grazing, altered fire regimes, management based on forest silviculture and past timber harvesting have reduced vegetation condition, and hence the conservation value of retained tuart stands; and
- Large numbers of tuart trees between Mandurah and Bunbury have suffered severe foliage and crown dieback since 1990 with no confirmed causal agent yet identified.

While tuart itself is not considered threatened, some of the vegetation communities supporting tuart are under-represented in conservation reserves, or not adequately protected on private lands (Government of Western Australia 2002). The conservation status of tuart communities described at the ECU South West Campus is reviewed below with respect to three separate references.

4.4.1 Government of Western Australia 2003

Fine-scale mapping of the present-day extent of tuart, canopy density and understorey condition has been completed using aerial photo interpretation, and results are documented in 'An Atlas of Tuart Woodlands of the Swan Coastal Plain' (Government of Western Australia 2003). Consideration of the ECU South West Campus site confirms only a small proportion of tuart present within the southern limit of the current survey area has been mapped as supporting 'low visible disturbance understorey'. Areas supporting existing infrastructure or open canopy were inferred to have reduced understorey condition.

4.4.2 Ecoscape 2004

The conservation status of remnant tuart woodland at the ECU South West Campus site was further investigated with reference to the publication 'Tools for identifying indicative high conservation tuart woodlands' (Ecoscape 2004). Within this document, tuart occurrence and low disturbance understorey condition has been intersected with land categories, soil systems and rainfall zones to provide information on the size and location of areas of 'indicative high conservation' tuart woodlands (Ecoscape 2004). In summary, is was found that tuart complexes occurring on uncommon soil systems and rainfall zones were more likely to have unique vegetation communities, and were therefore ranked as 'indicative high conservation' tuart woodlands.

Primary criteria considered when determining conservation status included:

- The presence of low visible disturbance understorey; and
- Size of the tuart remnant.

Secondary criteria considered were:

- Representation on uncommon soil types; and
- Representation in uncommon rainfall zones.

A large proportion of the tuart complex described at the ECU South West Campus supports low visible disturbance understorey, as confirmed by field vegetation condition assessments (condition assessed as 'good' or 'very good'). The total area of remnant tuart woodland within the survey area approximated 25 ha, with the major intact block situated in the southern half. Existing infrastructure in the northern half of the survey area has directly reduced the total area of tuart, with secondary impacts reducing vegetation condition of dissected remnant vegetation (particularly with respect to the understorey component). These areas have not been mapped as part of the 'Tuart Atlas'.

In respect to secondary criteria, the entire survey area occurs within the most common soil system (Spearwood) and within the most common rainfall zone (800-900 mm). The remnant must satisfy both primary criteria and at least one secondary criterion to be rated as Priority one 'indicative high conservation' tuart woodlands. The survey area is therefore at best rated as Priority two 'indicative high conservation' tuart woodlands.

Consideration for further prioritisation can be made on the basis of (i) presence of threatened ecological communities (TEC's) and/or (ii) presence of threatened flora and fauna. There are no TEC's recorded within the survey area, and rare flora was restricted to the Priority 4 flora *Caladenia speciosa,* which has been well collected in the surrounding locality.

4.4.3 Gibson et al. 1994

Gibson *et al.* (1994) include vegetation of the survey area in Community type 21a 'Central *Banksia attenuata – Eucalyptus marginata* woodlands', which is described as sometimes supporting *Eucalyptus gomphocephala* as the dominant or codominant. The complex occurs on both the Bassendean Dunes and the Spearwood system across the entire extent of the southern Swan Coastal Plain, and is determined by Gibson *et al.* (1994) to be 'well reserved' with a 'low risk' conservation status.

4.4 Management Considerations to Maximise Biodiversity Conservation

The ECU South West Campus is currently zoned 'Educational' with a sub zoning of 'Tertiary Education'. Approximately 12 ha of the 46 ha site has already been developed with existing campus facilities. Growth of the Campus in future years will require expansion of existing facilities, and hence the requirement to clear additional areas of native vegetation. A number of management considerations relating to future expansion at the site are discussed below.

4.4.1 Protection of Rare Flora and Fauna

The Priority 4 flora *Caladenia speciosa* has been recorded at three locations within the survey area. Priority 4 is the lowest level of conservation significance. Where practicable, future development at the site should occur outside of the current identified range for *Caladenia speciosa*. Alternatively, translocation of the orchid could be implemented to reestablish plants at alternative locations outside of planned development footprint, in situations where the current location is impacted.

4.4.2 Maintaining Connectivity

Remnant vegetation at the ECU South West Campus site provides connectivity between adjacent blocks of native vegetation at Hay Park (west side of SW Highway) and Manea Park (east side of College Grove). This link is important not only locally, but also on a regional scale, as it contributes to a larger east west alignment of remnant vegetation that stretches for over 7 km from the ocean to the Preston River. Future planning consideration should be given to identifying a retained corridor of vegetation along the southern boundary of the Campus, or alternatively, ensure that the scale of future development does not break vegetation connectivity within this zone. An important consideration in this process will be the capacity of vegetation to survive threatening processes on the basis of the area retained, and associated requirement for active management to maintain ecological values.

5 STUDY TEAM

The flora and vegetation survey for the ECU Bunbury Campus was planned, coordinated and executed by the following personnel:

Onshore Environmental Consultants P/L
ABN 41 095 837 120
83 Norfolk St
Dunsborough WA 6281
pf 08 97 567 073 m 0427 339 842
Email onshoreenv@westnet.com.au

Project Staff

Dr Darren Brearley	PhD	Project Manager
Dr Jerome Bull	PhD	Senior Botanist

Licences

The field survey was conducted under the authorization of the following licence issued by the Department of Environment & Conservation:

- Darren Brearley, Onshore Environmental Consultants
  'Licence to take flora for scientific & other prescribed purposes' Licence No. SL007767
- Jerome Bull, Onshore Environmental Consultants
  'Licence to take flora for scientific & other prescribed purposes' Licence No. SL007739

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APPENDIX 1 Vegetation classification used for the flora and vegetation survey (from Muir 1977).

LIFE FORM / HEIGHT CLASS	Canopy Cover			
	DENSE 70 % - 100%	**MID DENSE 30% - 70%**	**SPARSE 10% - 30%**	**VERY SPARSE 2% - 10%**
Trees > 30 m	Dense Tall Forest	Tall Forest	Tall Woodland	Open Tall Woodland
Trees 15 – 30 m	Dense Forest	Forest	Woodland	Open Woodland
Trees 5 – 15 m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
Trees < 5 m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
Mallee tree form	Dense Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Mallee shrub form	Dense Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs > 2 m	Dense Thicket	Thicket	Scrub	Open Scrub
Shrubs 1.5 – 2 m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
Shrubs 1 - 1.5 m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
Shrubs 0.5 – 1 m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
Shrubs 0 - 0.5 m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
Mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
Hummock grass	Dense Hummock Grass	Mid-Dense Hummock Grass	Hummock Grass	Open Hummock Grass
Bunch grass > 0.5 m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
Bunch grass < 0.5 m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
Herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
Sedges > 0.5 m	Dense Tall sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
Sedges < 0.5 m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
Ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
Mosses, liverworts	Dense Mosses	Mosses	Open Mosses	Very Open Mosses

APPENDIX 2 Vegetation condition rating as used in Perth's Bushplan (Environmental Protection Authority, 1998).

CONDITION	SCALE	DESCRIPTION
Pristine	1	Pristine or nearly so, no obvious signs 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.
Good	4	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it.
Degraded	5	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.
Completely Degraded	6	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.

APPENDIX 3 Conservation categories described under the EPBC Act.

CATEGORY	DESCRIPTION
Extinct	A species is extinct if there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	A species is categorised as extinct in the wild if it is only known to survive in cultivations, in captivity, or as a naturalised population well outside its past range; or if it has not been recorded in its known/expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate ti its life cycle and form.
Critically Endangered	The species is facing an exteremly high risk of extinction in the wild and in the immediate future.
Endangered	The species is likely to become extinct unless the circumstances and factors threatening its abundance, survival, or evolutionary development cease to operate; or its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction.
Vulnerable	Within the next 25 years, the species is likely to become endangered unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate.
Conservation Dependent	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 4 Conservation Codes for Western Australian Flora (see Atkins 2007).

R: Declared Rare Flora - Extant Taxa

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.

1: Priority One - Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farm land, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need for further survey.

2: Priority Two - Poorly Known Taxa

Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need for further survey.

3: Priority Three - Poorly Known Taxa

Taxa which are known from several populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need for further survey.

4: Priority Four - Rare Taxa

Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

APPENDIX 5 Total flora recorded within the ECU South West Campus survey area; September 2007. * alien & naturalized

FAMILY	TAXON	COMMON NAME
ALLIACEAE	**Allium triquetrum*	Three Cornered Garlic
ANTHERICACEAE	*Agrostocrinum scabrum*	Blue Grass Lily
	Chamaescilla corymbosa	Blue Squill
	Dichopogon capillipes	
	Johnsonia lupulina	Hooded Lily
	Johnsonia pubescens	Pipe Lily
	Sowerbaea laxiflora	Purple Tassels
	Thysanotus arenarius	
	Thysanotus dichotomus	Branching Fringe Lily
	Thysanotus multiflorus	Many-flowered Fringe Lily
	Thysanotus patersonii	
	Tricoryne elatior	Yellow Autumn Lily
APIACEAE	*Centella asiatica*	
	Daucus glochidiatus	Australian Carrot
	Hydrocotyle blepharocarpa	
	Platysace tenuissima	
	Xanthosia huegelii	
ARACEAE	**Zantedeschia aethiopica*	Arum Lily
ASPHODELACEAE	**Trachyandra divaricata*	
ASTERACEAE	**Arctotheca calendula*	Cape Weed
	**Conyza albida*	
	**Cotula turbinata*	Funnel Weed
	**Dimorphotheca ecklonis*	
	**Dittrichia graveolens*	Stinkwort
	**Erodium botrys*	Long Storksbill
	**Hypochaeris glabra*	Smooth Catsear, Flatweed
	**Sonchus oleraceus*	Common Sowthistle
	**Ursinia anthemoides*	Ursinia
	Asteridea pulverulenta	Common Bristle Daisy
	Brachyscome ciliaris	
	Brachyscome iberidifolia	
	Craspedia variabilis	
	Lagenophora huegelii	
	Olearia axillaris	Coastal Daisy Bush
	Ozothamnus cordatus	
	Podolepis lessonii	
	Podotheca gnaphalioides	Golden Long-heads
	Quinetia urvillei	
	Rhodanthe citrina	
	Waitzia suaveolens	Fragrant Waitzia
BRASSICACEAE	**Brassica tournefortii*	Mediterranean Turnip
CAESALPINIACEAE	*Labichea punctata*	Lance-leaved Cassia

CARYOPHYLLACEAE	**Cerastium glomeratum*	Mouse Ear Chickweed
	**Petrorhagia dubia*	
	**Silene gallica*	French Catchfly
CASUARINACEAE	*Allocasuarina fraseriana* ^	
	Allocasuarina humilis	Dwarf Sheoak
CENTROLEPIDACEAE	*Centrolepis aristata*	Pointed Centrolepis
	Centrolepis drummondiana	
COLCHICACEAE	*Burchardia congesta*	Milkmaids
	Burchardia multiflora	Dwarf Burchardia
CRASSULACEAE	**Crassula glomerata*	
	Crassula colorata	Dense Stonecrop
CYPERACEAE	*Baumea juncea*	Bare Twigrush
	Gahnia trifida	Coast Saw-sedge
	Lepidosperma gracile	Slender Sword Sedge
	Lepidosperma longitudinale	Pithy Sword-sedge
	Lepidosperma squamatum	
	Lyginia barbata	
	Lyginia imberbis	
	Mesomelaena tetragona	Semaphore Sedge
	Schoenus efoliatus	
	Tetraria octandra	
DASYPOGONACEAE	*Calectasia narragara*	
	Dasypogon bromeliifolius	Pineapple Bush
	Lomandra caespitosa	Tufted Mat Rush
	Lomandra micrantha ssp. micrantha	Small-flower Mat-rush
	Lomandra nigricans	
	Lomandra odora	Tiered Matrush
	Lomandra suaveolens	
DILLENIACEAE	*Hibbertia huegelii*	
	Hibbertia hypericoides	Yellow Buttercups
	Hibbertia racemosa	Stalked Guinea Flower
	Hibbertia stellaris	Orange Stars
	Hibbertia vaginata	
DROSERACEAE	*Drosera erythrorhiza*	*Drosera erythrorhiza*
	Drosera macrantha	Bridal Rainbow
	Drosera menziesii	Pink Rainbow
	Drosera pallida	Pale Rainbow
	Drosera stolonifera	Leafy Sundew
ELAEOCARPACEAE	*Platytheca galioides*	
	Tetratheca hirsuta	Black Eyed Susan
ERICACEAE	*Astroloma pallidum*	Kick Bush
	Conostephium pendulum	Pearl Flower
	Leucopogon australis	Spiked Beard-heath
	Leucopogon capitellatus	

	Leucopogon conostephioides	
	Leucopogon propinquus	
	Leucopogon racemulosus	
	Leucopogon verticillatus	Tassel Flower
	Lysinema ciliatum	Curry Flower
EUPHORBIACEAE	*Aphelia cyperoides*	
	Phyllanthus calycinus	False Boronia
	Poranthera microphylla	Small Poranthera
FUMARIACEAE	**Fumaria muralis*	Wall Fumitory
GERANIACEAE	**Erodium botrys*	Long Stork's Bill
	**Pelargonium littorale*	
	Geranium retrorsum	
	Geranium solanderi	Native Geranium
GOODENIACEAE	*Dampiera linearis*	Common Dampiera
	Diaspasis filifolia	Thread-leaved Diaspasis
	Goodenia filiformis	Thread-leaved Goodenia
	Scaevola calliptera	
HAEMODORACEAE	*Anigozanthos manglesii*	Mangles Kangaroo Paw
	Anigozanthos viridis	Green Kangaroo Paw
	Conostylis aculeata	Prickly Conostylis
	Conostylis setosa	White Cottonhead
	Phlebocarya ciliata	
IRIDACEAE	**Chasmanthe floribunda*	African Cornflag
	**Romulea rosea var. australis*	Guildford Grass
	Orthrosanthus laxus	Morning Iris
	Patersonia occidentalis	Purple Flag
	Patersonia umbrosa ssp. xanthina	Yellow Flags
JUNCACEAE	*Juncus pallidus*	Pale Rush
JUNCAGINACEAE	*Triglochin trichophora*	
LAMIACEAE	**Mentha pulegium*	Pennyroyal
	Hemiandra pungens	Snakebush
LAURACEAE	*Cassytha racemosa*	Dodder Laurel
LOBELIACEAE	*Isotoma hypocrateriformis*	Woodbridge Poison
	Lobelia alata	Angled Lobelia
LOGANIACEAE	*Logania serpyllifolia*	
	Phyllangium paradoxum	
LORANTHACEAE	*Nuytsia floribunda*	Christmas Tree
MIMOSACEAE	*Acacia applanata*	
	Acacia cochlearis	Rigid Wattle
	Acacia cyclops	Coastal Wattle

	Acacia flagelliformis ^	
	Acacia longifolia	
	**Acacia podalyriifolia*	
	Acacia pulchella	Prickly Moses
	Acacia rostellifera	Summer-scented Wattle
	Acacia saligna	Acacia saligna
	Acacia stenoptera	Narrow Winged Wattle
MORACEAE	**Ficus carica*	Common Fig
MYOPORACEAE	*Eremophila glabra*	Tar Bush
	Eremophila glabra ssp. tomentosa	
MYRTACEAE	***Calothamnus quadrifidus*	One-sided Bottlebrush
	***Eucalyptus caesia*	
	**Chamelaucium uncinatum*	Geraldton Wax
	**Leptospermum laevigatum*	Coast Teatree
	Agonis flexuosa	Peppermint
	Astartea scoparia	
	Baeckea camphorosmae	Camphor Myrtle
	Calytrix flavescens	Summer Starflower
	Corymbia calophylla	Marri
	Eucalyptus gomphocephala	Tuart
	Eucalyptus marginata ssp. marginata	Jarrah
	Hypocalymma angustifolium	White Myrtle
	Hypocalymma robustum	Swan River Myrtle
	Kunzea ericifolia	Spearwood
	Kunzea recurva	
	Melaleuca incana ssp. incana	Grey Honeymyrtle
	Melaleuca preissiana	
	Melaleuca thymoides	
	Melaleuca viminea	Mohan
	Pericalymma ellipticum	Swamp Teatree
ORCHIDACEAE	**Disa bracteata*	
	Caladenia flava	Cowslip Orchid
	Caladenia latifolia	Pink Fairy Orchid
	Caladenia sp. 'striated green'	
	Caladenia speciosa	
	Elythranthera emarginata	Pink Enamel Orchid
	Microtis media	Tall Mignonette Orchid
	Pterostylis pyramidalis	Snail Orchid
	Pterostylis recurva	Jug Orchid
	Pterostylis sp. Slender Snail Orchid	
	Pterostylis vittata	Banded Greenhood
	Pyrorchis nigricans	Red Beaks
OXALIDACEAE	**Oxalis corniculata*	Yellow Wood Sorrel
	**Oxalis pes-caprae*	Soursob
PAPILIONACEAE	**Trifolium campestre*	Hop Clover
	**Trifolium glomeratum*	Cluster Clover
	Bossiaea eriocarpa	Common Brown Pea

	Chorizema diversifolium	
	Daviesia decurrens?	Prickly Bitter-pea
	Daviesia divaricata	Marno
	Daviesia incrassata	
	Daviesia physodes	
	Eutaxia virgata	
	Gastrolobium celsianum	
	Gompholobium ovatum	
	Gompholobium tomentosum	Hairy Yellow Pea
	Hardenbergia comptoniana	Native Wisteria
	Hovea trisperma	Common Hovea
	Isotropis cuneifolia	Granny Bonnets
	Jacksonia furcellata	Grey Stinkwood
	Jacksonia horrida	
	Kennedia coccinea	Coral Vine
	Kennedia prostrata	Scarlet runner
	**Lupinus cosentinii*	
PHORMIACEAE	*Dianella revoluta*	Blueberry Lily
PITTOSPORACEAE	*Billardiera variifolia*	
POACEAE	**Aira caryophyllea*	Silvery Hairgrass
	**Anthoxanthum odoratum*	Sweet Vernal Grass
	**Avena fatua*	Wild Oat
	**Briza maxima*	Blowfly Grass
	**Briza minor*	Shivery Grass
	**Bromus diandrus*	Great Brome
	**Cortaderia selloana*	Pampas Grass
	**Cynodon dactylon*	Couch
	**Ehrharta calycina*	Perennial Veldt Grass
	**Lolium rigidum*	Wimmera Ryegrass
	**Vulpia bromoides*	Squirrel Tail Fescue
	Austrostipa sp.	
	Tetrarrhena laevis	Forrest Ryegrass
POLYGALACEAE	*Comesperma confertum*	
PRIMULACEAE	**Anagallis arvensis*	Pimpernel
PROTEACEAE	*Adenanthos meisneri*	
	Adenanthos obovatus	
	Banksia attenuata	Slender Banksia
	Banksia grandis	Bull Banksia
	Banksia ilicifolia ^	Holly leaved Banksia
	Banksia littoralis	Swamp Banksia
	Conospermum boreale ^	
	Dryandra lindleyana	Couch Honeypot
	Grevillea manglesioides	
	Hakea trifurcata	Two-leaf Hakea
	Hakea varia	Variable-leaved Hakea
	Persoonia saccata	Snottygobble
	Persoonia longifolia	Snottygobble
	Petrophile linearis	Pixie Mops

	Stirlingia latifolia	Blueboy
	Synaphea spinulosa	
	Xylomelum occidentale	Woody Pear
RANUNCULACEAE	*Clematis pubescens*	Common Clematis
RESTIONACEAE	*Desmocladus fasciculatus*	
	Hypolaena exsulca	
	Loxocarya cinerea	
RHAMNACEAE	*Cryptandra arbutiflora*	Waxy Cryptandra
	Spyridium globulosum	Basket Bush
	Trymalium ledifolium var. rosmarinifolium	
RUBIACEAE	*Opercularia echinocephala*	Bristly Headed Stink Weed
	Opercularia hispidula	Hispid Stink Weed
	Opercularia vaginata	Dogweed
RUTACEAE	*Boronia dichotoma*	
	Diplolaena dampieri	Southern Diplolaena
	Philotheca spicata	Pepper and Salt
SOLANACEAE	**Solanum nigrum*	Black Berry Nightshade
STACKHOUSIACEAE	*Stackhousia monogyna*	
STYLIDIACEAE	*Stylidium brunonianum*	Pink Fountain Triggerplant
	Stylidium calcaratum	Book Triggerplant
	Stylidium junceum?	Reed Triggerplant
	Stylidium piliferum	Common Butterfly Triggerplant
	Stylidium violaceum?	Violet Triggerplant
THYMELAEACEAE	*Pimelea imbricata* ^	
	Pimelea rosea ssp. rosea	Rose Banjine
TYPHACEAE	**Typha orientalis*	Bulrush
VIOLACEAE	*Hybanthus calycinus*	Wild Violet
XANTHORRHOEACEAE	*Xanthorrhoea gracilis*	Graceful Grass Tree
	Xanthorrhoea preissii	Grass tree
ZAMIACEAE	*Macrozamia riedlei*	Zamia

APPENDIX 6 Site data sheets for the fourteen 10 m by 10 m plots formally assessed within the survey area.

Site 1

Corymbia calophylla **Open Woodland** over *Banksia attenuata, Agonis flexuosa, Corymbia calophylla, Eucalyptus marginata* ssp. *marginata, Xylomelum occidentale* **Low Woodland A** over *Banksia attenuata, Agonis flexuosa, Corymbia calophylla, Eucalyptus marginata* ssp. *marginata* **Open Low Woodland B** over *Agonis flexuosa, Jacksonia furcellata* **Open Low Scrub B** over *Xanthorrhoes gracilis, Macrozamia riedlei* **Open Dwarf Scrub C** over *Hibbertia hypericoides, Stirlingia latifolia, Bossiaea eriocarpa* **Low Heath D** over *Lepidosperma squamatum, Orthrosanthus laxus* **Very Open Low Sedges** over **Briza maxima* **Open Low Grass** over *Daucus glochidiatus, *Ursinia anthemoides, *Romulea rosea* **Very Open Herbs**

Date	17 September 2007
Location	50 374505E 6307332N
Topography	Hill Slope
Slope	Moderate
Soil texture	Sand
Soil colour	White, grey
Surface layer	Humus, loose soil
Rock type	Limestone
Leaf litter	Plentiful
Distribution	Widespread
Wood litter	Moderate
Vegetation condition	Good
Disturbance details	Volunteering of many annual grasses; *Watsonia* nearby
Fire History	Old

Vegetation Structure

Stratum	% Cover	Dominant Species (within each stratum)
Trees > 15m	2-10	*Corymbia calophylla*
Trees 5-15m	30-70	*Banksia attenuata, Agonis flexuosa, Corymbia calophylla, Eucalyptus marginata* ssp. *marginata, Xylomelum occidentale*
Trees < 5m	2-10	*Banksia attenuata, Agonis flexuosa, Corymbia calophylla, Eucalyptus marginata* ssp. *marginata*
Mallee trees		
Shrubs >2m		
Shrubs 1.5-2m		
Shrubs 1-1.5m	2-10	*Agonis flexuosa, Jacksonia furcellata*
Shrubs 0.5-1m	2-10	*Xanthorrhoes gracilis, Macrozamia riedlei*
Shrubs 0-0.5m	30-70	*Hibbertia hypericoides, Stirlingia latifolia, Bossiaea eriocarpa*
Climbers		
Herbs	2-10	*Daucus glochidiatus, *Ursinia anthemoides, *Romulea rosea*
Soft grasses	10-30	**Briza maxima*
Sedges	2-10	*Lepidosperma squamatum, Orthrosanthus laxus*

Site 2

Eucalyptus marginata ssp. *marginata, Eucalyptus gomphocephala, Corymbia calophylla* **Open Woodland** over *Agonis flexuosa, Banksia attenuata, Eucalyptus marginata* ssp. *marginata, Xylomelum occidentale* **Low Forest A** over *Agonis flexuosa, Banksia attenuata, Eucalyptus marginata* ssp. *marginata, Xylomelum occidentale* **Open Low Woodland B** over *Melaleuca thymoides, Xylomelum occidentale* **Open Low Scrub B** over *Macrozamia riedlei, Melaleuca thymoides, Leucopogon propinquus, Xanthorrhoea gracilis* **Open Dwarf Scrub C** over *Hibbertia hypericoides, Conostylis aculeata* **Low Heath D** over **Briza maxima* **Very Open Low Grass** over *Daucus glochidiatus, *Ursinia anthemoides* **Very Open Herbs**

Date	17 September 2007
Location	50 374608E 6306888N
Topography	Hill crest (dune)
Slope	Gentle
Soil texture	Sand
Soil colour	Yellow
Surface layer	Humus, loose soil
Rock type	Limestone
Leaf litter	Plentiful
Distribution	Widespread
Wood litter	Moderate
Vegetation condition	Very Good
Disturbance details	Weeds common but not impacting natives
Fire History	Old

Vegetation Structure

Stratum	% Cover	Dominant Species (within each stratum)
Trees > 15m	2-10	*Eucalyptus marginata* ssp. *marginata, Eucalyptus gomphocephala, Corymbia calophylla*
Trees 5-15m	30-70	*Agonis flexuosa, Banksia attenuata, Eucalyptus marginata* ssp. *marginata, Xylomelum occidentale*
Trees < 5m	2-10	*Agonis flexuosa, Banksia attenuata, Eucalyptus marginata* ssp. *marginata, Xylomelum occidentale*
Mallee trees		
Shrubs >2m		
Shrubs 1.5-2m		
Shrubs 1-1.5m	2-10	*Melaleuca thymoides, Xylomelum occidentale*
Shrubs 0.5-1m	2-10	*Macrozamia riedlei, Melaleuca thymoides, Leucopogon propinquus, Xanthorrhoea gracilis*
Shrubs 0-0.5m	30-70	*Hibbertia hypericoides, Conostylis aculeata*
Climbers		
Herbs	2-10	*Daucus glochidiatus, *Ursinia anthemoides*
Soft grasses	2-10	**Briza maxima*
Sedges		

Site 3

Banksia attenuata, Eucalyptus marginata ssp. *marginata, Xylomelum occidentale* **Low Woodland A** over *Eucalyptus marginata* ssp. *marginata, Xylomelum occidentale* **Open Low Woodland B** over *Allocasuarina humilis* **Low Scrub A** over *Allocasuarina humilis, Melaleuca thymoides* **Low Scrub B** over *Macrozamia riedlei* **Open Dwarf Scrub C** over *Hibbertia hypericoides, Baeckea camphorosmae* **Low Heath D** over **Briza maxima* **Very Open Low Grass** over *Daucus glochidiatus, *Ursinia anthemoides, *Romulea rosea* **Very Open Herbs**

Date	17 September 2007
Location	50 374470E 6307044N
Topography	Hill Slope (mid slope of dune)
Slope	Moderate
Soil texture	Sand
Soil colour	White, grey
Surface layer	Loose soil
Rock type	Limestone
Leaf litter	Plentiful
Distribution	Widespread
Wood litter	Sparse
Vegetation condition	Very good
Disturbance details	Rubbish evident
Fire History	Old

Vegetation Structure

Stratum	% Cover	Dominant Species (within each stratum)
Trees > 15m		
Trees 5-15m	10-30	*Banksia attenuata, Eucalyptus marginata* ssp. *marginata, Xylomelum occidentale*
Trees < 5m	2-10	*Eucalyptus marginata* ssp. *marginata, Xylomelum occidentale*
Mallee trees		
Shrubs >2m		
Shrubs 1.5-2m	10-30	*Allocasuarina humilis*
Shrubs 1-1.5m	10-30	*Allocasuarina humilis, Melaleuca thymoides*
Shrubs 0.5-1m	2-10	*Macrozamia riedlei*
Shrubs 0-0.5m	30-70	*Hibbertia hypericoides, Baeckea camphorosmae*
Climbers		
Herbs	2-10	*Daucus glochidiatus, *Ursinia anthemoides, *Romulea rosea*
Soft grasses	2-10	**Briza maxima*
Sedges		

Site 4

Corymbia calophylla **Open Woodland** over *Banksia attenuata, Corymbia calophylla, Xylomelum occidentale* **Low Woodland A** over *Banksia attenuata, Xylomelum occidentale, Eucalyptus marginata* ssp. *marginata* **Open Low Woodland B** over *Allocasuarina humilis, Nuytsia floribunda* **Open Low Scrub A/B** over *Melaleuca thymoides, Xanthorrhoea gracilis, Daviesia divaricata* **Open Dwarf Scrub C** over *Hibbertia hypericoides* **Low Heath D** over **Briza maxima* **Very Open Low Grass** over *Daucus glochidiatus, *Hypochaeris glabra, *Romulea rosea* **Very Open Herbs**

Date	17 September 2007
Location	50 374436E 6306865N
Topography	Hill Slope (mid slope of dune)
Slope	Moderate
Soil texture	Sand
Soil colour	White, grey
Surface layer	Loose soil
Rock type	Limestone
Leaf litter	Moderate
Distribution	Widespread
Wood litter	Sparse
Vegetation condition	Very good
Disturbance details	Annual grasses
Fire History	Old

Vegetation Structure

Stratum	% Cover	Dominant Species (within each stratum)
Trees > 15m	2-10	*Corymbia calophylla*
Trees 5-15m	10-30	*Banksia attenuata, Corymbia calophylla, Xylomelum occidentale*
Trees < 5m	2-10	*Banksia attenuata, Xylomelum occidentale, Eucalyptus marginata* ssp. *marginata*
Mallee trees		
Shrubs >2m		
Shrubs 1.5-2m	2-10	*Allocasuarina humilis, Nuytsia floribunda*
Shrubs 1-1.5m	2-10	*Allocasuarina humilis*
Shrubs 0.5-1m	2-10	*Melaleuca thymoides, Xanthorrhoea gracilis, Daviesia divaricata*
Shrubs 0-0.5m	30-70	*Hibbertia hypericoides*
Climbers		
Herbs	2-10	*Daucus glochidiatus, *Hypochaeris glabra, *Romulea rosea*
Soft grasses	2-10	**Briza maxima*
Sedges		

Site 5

Eucalyptus gomphocephala **Open Woodland** over *Corymbia calophylla, Banksia attenuata, Xylomelum occidentale* **Low Forest A** over *Xylomelum occidentale, Banksia attenuata, Eucalyptus marginata* ssp. *marginata, Agonis flexuosa* **Open Low Woodland B** over *Macrozamia riedlei* **Open Dwarf Scrub C** over *Hibbertia hypericoides, Xanthorrhoea gracilis, Dasypogon bromeliifolius* **Low Heath D** over **Briza maxima* **Open Low Grass** over **Romulea rosea, *Ursinia anthemoides* **Very Open Herbs**

Date	17 September 2007
Location	50 374485E 6306724N
Topography	Upper hill slope
Slope	Moderate
Soil texture	Sand
Soil colour	Grey, yellow
Surface layer	Loose soil
Rock type	Limestone
Leaf litter	Plentiful
Distribution	Widespread
Wood litter	Moderate
Vegetation condition	Very Good
Disturbance details	Annual grasses widespread
Fire History	Old

Vegetation Structure

Stratum	% Cover	Dominant Species (within each stratum)
Trees > 15m	2-10	*Eucalyptus gomphocephala*
Trees 5-15m	30-70	*Corymbia calophylla, Banksia attenuata, Xylomelum occidentale*
Trees < 5m	2-10	*Xylomelum occidentale, Banksia attenuata, Eucalyptus marginata* ssp. *marginata, Agonis flexuosa*
Mallee trees		
Shrubs >2m		
Shrubs 1.5-2m		
Shrubs 1-1.5m		
Shrubs 0.5-1m	2-10	*Macrozamia riedlei*
Shrubs 0-0.5m	30-70	*Hibbertia hypericoides, Xanthorrhoea gracilis, Dasypogon bromeliifolius*
Climbers		
Herbs	2-10	**Romulea rosea, *Ursinia anthemoides*
Soft grasses	2-10	**Briza maxima*
Sedges		

Site 6

Eucalyptus gomphocephala **Open Woodland** over *Banksia attenuata, Agonis flexuosa* **Low Woodland A** over *Banksia attenuata, Agonis flexuosa* **Open Low Woodland B** over *Macrozamia riedlei, Daviesia (E01.42)* **Open Dwarf Scrub C** over *Hibbertia hypericoides, Xanthorrhoea gracilis* **Low Heath D** over **Briza maxima* **Open Low Grass** over **Ursinia anthemoides, *Hypochaeris glabra* **Open Herbs**

Date	17 September 2007
Location	50 374681E 6307271N
Topography	Hill crest, upper hill slope (dune)
Slope	Gentle
Soil texture	Sand
Soil colour	Grey, yellow
Surface layer	Loose soil
Rock type	Limestone
Leaf litter	Plentiful
Distribution	Widespread
Wood litter	Moderate
Vegetation condition	Good
Disturbance details	Annual grasses widespread & common
Fire History	Old

Vegetation Structure

Stratum	% Cover	Dominant Species (within each stratum)
Trees > 15m	2-10	*Eucalyptus gomphocephala*
Trees 5-15m	10-30	*Banksia attenuata, Agonis flexuosa*
Trees < 5m	2-10	*Banksia attenuata, Agonis flexuosa*
Mallee trees		
Shrubs >2m		
Shrubs 1.5-2m		
Shrubs 1-1.5m		
Shrubs 0.5-1m	2-10	*Macrozamia riedlei, Daviesia (E01.42)*
Shrubs 0-0.5m	30-70	*Hibbertia hypericoides, Xanthorrhoea gracilis*
Climbers		
Herbs	10-30	**Ursinia anthemoides, *Hypochaeris glabra*
Soft grasses	10-30	**Briza maxima*
Sedges		

Site 7

Eucalyptus gomphocephala **Open Woodland** over *Corymbia calophylla, Banksia attenuata, Agonis flexuosa, Eucalyptus marginata* ssp. *marginata* **Low Forest A** over *Agonis flexuosa* **Open Low Woodland B** over *Macrozamia riedlei* **Open Dwarf Scrub C** over *Hibbertia hypericoides, Xanthorrhoea gracilis* **Dwarf Scrub D** over **Ehrharta calycina, *Briza maxima, *Briza minor* **Open Low Grass** over **Ursinia anthemoides, *Romulea rosea, *Hypochaeris glabra, Chamaescilla corymbosa, *Anagallis arvensis* **Open Herbs**

Date	17 September 2007
Location	50 374801E 6307339N
Topography	Lower hill slope
Slope	Gentle
Soil texture	Sand
Soil colour	Grey
Surface layer	Loose soil
Rock type	Limestone
Leaf litter	Plentiful
Distribution	Widespread
Wood litter	Plentiful
Vegetation condition	Degraded
Disturbance details	Numerous recent vehicle tracks, rubbish, trees pushed over
Fire History	Old

Vegetation Structure

Stratum	% Cover	Dominant Species (within each stratum)
Trees > 15m	2-10	*Eucalyptus gomphocephala*
Trees 5-15m	30-70	*Corymbia calophylla, Banksia attenuata, Agonis flexuosa, Eucalyptus marginata* ssp. *marginata*
Trees < 5m	2-10	*Agonis flexuosa*
Mallee trees		
Shrubs >2m		
Shrubs 1.5-2m		
Shrubs 1-1.5m		
Shrubs 0.5-1m	2-10	*Macrozamia riedlei*
Shrubs 0-0.5m	10-30	*Hibbertia hypericoides, Xanthorrhoea gracilis*
Climbers		
Herbs	10-30	**Ursinia anthemoides, *Romulea rosea, *Hypochaeris glabra, Chamaescilla corymbosa, *Anagallis arvensis*
Soft grasses	10-30	**Ehrharta calycina, *Briza maxima, *Briza minor*
Sedges		

Site 8

Eucalyptus gomphocephala, Corymbia calophylla **Open Woodland** over *Banksia attenuata, Corymbia calophylla, Agonis flexuosa* **Low Woodland A** over *Agonis flexuosa, Banksia attenuata, Xylomelum occidentale* **Low Woodland B** over *Macrozamia riedlei* **Open Low Scrub B** over *Macrozamia riedlei* **Open Dwarf Scrub C** over *Hibbertia hypericoides, Xanthorrhoea gracilis, Dasypogon bromeliifolius* **Low Heath D** over **Ehrharta calycina, *Briza maxima, *Briza minor* **Open Low Grass** over **Ursinia anthemoides, *Hypochaeris glabra, Chamaescilla corymbosa* **Very Open Herbs**

Date	17 September 2007
Location	50 374764E 6306943N
Topography	Hill crest, upper hill slope (dune)
Slope	Gentle
Soil texture	Sand
Soil colour	Grey, yellow
Surface layer	Loose soil
Rock type	Limestone
Leaf litter	Plentiful
Distribution	Widespread
Wood litter	Plentiful
Vegetation condition	Good
Disturbance details	Numerous localised cleared (open) areas
Fire History	Old

Vegetation Structure

Stratum	% Cover	Dominant Species (within each stratum)
Trees > 15m	2-10	*Eucalyptus gomphocephala, Corymbia calophylla*
Trees 5-15m	10-30	*Banksia attenuata, Corymbia calophylla, Agonis flexuosa*
Trees < 5m	10-30	*Agonis flexuosa, Banksia attenuata, Xylomelum occidentale*
Mallee trees		
Shrubs >2m		
Shrubs 1.5-2m		
Shrubs 1-1.5m	2-10	*Macrozamia riedlei*
Shrubs 0.5-1m	2-10	*Macrozamia riedlei*
Shrubs 0-0.5m	30-70	*Hibbertia hypericoides, Xanthorrhoea gracilis, Dasypogon bromeliifolius*
Climbers		
Herbs	2-10	**Ursinia anthemoides, *Hypochaeris glabra, Chamaescilla corymbosa*
Soft grasses	10-30	**Briza maxima*
Sedges		

Site 9

Eucalyptus gomphocephala, Corymbia calophylla **Open Woodland** over *Corymbia calophylla, Banksia attenuata, Xylomelum occidentale* **Low Woodland A** over *Eucalyptus marginata* ssp. *marginata, Banksia attenuata, Xylomelum occidentale* **Low Woodland B** over *Xylomelum occidentale* **Open Low Scrub B** over *Macrozamia riedlei* **Open Dwarf Scrub C** over *Hibbertia hypericoides, Xanthorrhoea gracilis* **Low Heath D** over **Briza maxima* **Very Open Low Grass** over **Hypochaeris glabra, *Romulea rosea, Lagenophora hugelii* **Very Open Herbs**

Date	17 September 2007
Location	50 374879E 6306834N
Topography	Hill crest, upper hill slope
Slope	Gentle
Soil texture	Sand
Soil colour	Grey, yellow
Surface layer	Loose soil
Rock type	Limestone
Leaf litter	Sparse
Distribution	Widespread
Wood litter	Moderate
Vegetation condition	Very good
Disturbance details	Evidence of large kangaroo numbers
Fire History	Old

Vegetation Structure

Stratum	% Cover	Dominant Species (within each stratum)
Trees > 15m	2-10	*Eucalyptus gomphocephala, Corymbia calophylla*
Trees 5-15m	10-30	*Corymbia calophylla, Banksia attenuata, Xylomelum occidentale*
Trees < 5m	2-10	*Eucalyptus marginata* ssp. *marginata, Banksia attenuata, Xylomelum occidentale*
Mallee trees		
Shrubs >2m		
Shrubs 1.5-2m		
Shrubs 1-1.5m	2-10	*Xylomelum occidentale*
Shrubs 0.5-1m	2-10	*Macrozamia riedlei*
Shrubs 0-0.5m	30-70	*Hibbertia hypericoides, Xanthorrhoea gracilis*
Climbers		
Herbs	2-10	**Hypochaeris glabra, *Romulea rosea, Lagenophora hugelii*
Soft grasses	2-10	**Briza maxima*
Sedges		

Site 10

Corymbia calophylla, Banksia attenuata, Xylomelum occidentale **Low Forest A** over *Corymbia calophylla, Banksia attenuata, Xylomelum occidentale* **Open Low Woodland B** over *Leucopogon racemulosus, Macrozamia riedlei, Xanthorrhoea gracilis* **Open Dwarf Scrub C** over *Hibbertia hypericoides* **Low Heath D** over **Briza maxima* **Very Open Low Grass** over *Drosera stoloifera, *Ursinia anthemoides, Daucus glochidiatus* **Very Open Herbs**

Date	17 September 2007
Location	50 374368E 6306728N
Topography	Hill slope (mid, dune)
Slope	Moderate
Soil texture	Sand
Soil colour	Grey
Surface layer	Loose soil
Rock type	Limestone
Leaf litter	Plentiful
Distribution	Mainly under shrubs
Wood litter	Moderate
Vegetation condition	Very good
Disturbance details	
Fire History	Old

Vegetation Structure

Stratum	% Cover	Dominant Species (within each stratum)
Trees > 15m		
Trees 5-15m	30-70	*Corymbia calophylla, Banksia attenuata, Xylomelum occidentale*
Trees < 5m	2-10	*Corymbia calophylla, Banksia attenuata, Xylomelum occidentale*
Mallee trees		
Shrubs >2m		
Shrubs 1.5-2m		
Shrubs 1-1.5m		
Shrubs 0.5-1m	2-10	*Leucopogon racemulosus, Macrozamia riedlei, Xanthorrhoea gracilis*
Shrubs 0-0.5m	30-70	*Hibbertia hypericoides*
Climbers		
Herbs	2-10	*Drosera stoloifera, *Ursinia anthemoides, Daucus glochidiatus*
Soft grasses	2-10	**Briza maxima*
Sedges		

Site 11

Corymbia calophylla, Banksia littorea, Melaleuca preissiana **Low Forest A** over *Corymbia calophylla, Banksia littorea, Melaleuca preissiana* **Open Low Woodland B** over *Acacia longifolia, Melaleuca incana* ssp. *incana* **Open Scrub** over *Melaleuca incana* ssp. *incana, Acacia pulchella* **Open Low Scrub A/B** over *Xanthorrhoea preissii, Xanthorrhoea gracilis* **Open Dwarf Scrub C** over *Baumea juncea*, *Lomandra odora* **Dense Low Sedges**

Date	17 September 2007
Location	50 374222E 6306778N
Topography	Winter-wet depression (seasonally inundated)
Slope	Negligible
Soil texture	Loamy sand
Soil colour	Dark grey
Surface layer	Loose soil
Rock type	Limestone
Leaf litter	Moderate
Distribution	Mainly under shrubs
Wood litter	Moderate
Vegetation condition	Very good
Disturbance details	Old rubbish (debris)
Fire History	Old

Vegetation Structure

Stratum	% Cover	Dominant Species (within each stratum)
Trees > 15m		
Trees 5-15m	40	*Corymbia calophylla, Banksia littorea, Melaleuca preissiana*
Trees < 5m	2-10	*Corymbia calophylla, Banksia littorea, Melaleuca preissiana*
Mallee trees		
Shrubs >2m	2-10	*Acacia longifolia, Melaleuca incana* ssp. *incana*
Shrubs 1.5-2m	<2	*Melaleuca incana* ssp. *incana, Acacia pulchella*
Shrubs 1-1.5m	<2	*Melaleuca incana* ssp. *incana, Acacia pulchella*
Shrubs 0.5-1m	2-10	*Xanthorrhoea preissii, Xanthorrhoea gracilis*
Shrubs 0-0.5m		
Climbers		
Herbs	4	*Daucus glochidiatus, *Anagallis arvensis, *Brassica* sp.
Soft grasses	3	**Briza maxima*
Sedges	80	*Baumea juncea*, *Lomandra odora*

Site 12

Corymbia calophylla **Open Woodland** over *Corymbia calophylla, Banksia littorea, Melaleuca preissiana* **Low Woodland A** over *Corymbia calophylla, Banksia littorea, Melaleuca preissiana* **Open Low Woodland B** over *Acacia pulchella, Daviesia physodes* **Open Low Scrub B** over *Xanthorrhoea preissii* **Dwarf Scrub C** over *Hypocalymma angustifolium* **Open Dwarf Scrub D** over *Baumea juncea*, *Lomandra odora, Juncus pallidus* **Dense Low Sedges**

Date	17 September 2007
Location	50 374230E 6306976N
Topography	Winter-wet depression (seasonally inundated)
Slope	Negligible
Soil texture	Loamy sand
Soil colour	Dark grey, black
Surface layer	Loose soil, humus
Rock type	Limestone
Leaf litter	Moderate
Distribution	Mainly under shrubs
Wood litter	Sparse
Vegetation condition	Very good
Disturbance details	Some standing water (shallow)
Fire History	Old

Vegetation Structure

Stratum	% Cover	Dominant Species (within each stratum)
Trees > 15m	2-10	*Corymbia calophylla*
Trees 5-15m	30	*Corymbia calophylla, Banksia littorea, Melaleuca preissiana*
Trees < 5m	2-10	*Corymbia calophylla, Banksia littorea, Melaleuca preissiana*
Mallee trees		
Shrubs >2m		
Shrubs 1.5-2m		
Shrubs 1-1.5m	<2	*Acacia pulchella, Daviesia physodes*
Shrubs 0.5-1m	15	*Xanthorrhoea preissii*
Shrubs 0-0.5m	2-10	*Hypocalymma angustifolium*
Climbers		
Herbs	2-10	**Anagallis arvensis, *Hypochaeris glabra*
Soft grasses	2-10	**Briza maxima*
Sedges	70	*Baumea juncea*, *Lomandra odora, Juncus pallidus*

Site 13

Eucalyptus marginata ssp. *marginata, Banksia attenuata, Xylomelum occidentale* **Low Woodland A** over *Eucalyptus marginata* ssp. *marginata, Banksia attenuata, Xylomelum occidentale* **Open Low Woodland B** over *Melaleuca incana* ssp. *incana* **Open Scrub** over *Melaleuca thymoides, Melaleuca incana* ssp. *incana, Jacksonia horrida* **Open Low Scrub A** over *Melaleuca thymoides* **Low Scrub B** over *Melaleuca thymoides* **Dwarf Scrub C** over *Hibbertia hypericoides, Dasypogon bromeliifolius, Stirlingia latifolia* **Low Heath D** over *Daucus glochidiatus, *Hypochaeris glabra, *Ursinia anthemoides* **Very Open Herbs**

Date	17 September 2007
Location	50 375096E 6306748N
Topography	Sandplain
Slope	Gentle
Soil texture	Sand
Soil colour	White grey
Surface layer	Loose soil
Rock type	Limestone
Leaf litter	Moderate
Distribution	Mainly under shrubs
Wood litter	Sparse
Vegetation condition	Very good
Disturbance details	
Fire History	Old

Vegetation Structure

Stratum	% Cover	Dominant Species (within each stratum)
Trees > 15m		
Trees 5-15m	10-30	*Eucalyptus marginata* ssp. *marginata, Banksia attenuata, Xylomelum occidentale*
Trees < 5m	2-10	*Eucalyptus marginata* ssp. *marginata, Banksia attenuata, Xylomelum occidentale*
Mallee trees		
Shrubs >2m	2-10	*Melaleuca incana* ssp. *incana*
Shrubs 1.5-2m	2-10	*Melaleuca thymoides, Melaleuca incana* ssp. *incana, Jacksonia horrida*
Shrubs 1-1.5m	10-30	*Melaleuca thymoides*
Shrubs 0.5-1m	10-30	*Melaleuca thymoides*
Shrubs 0-0.5m	55	*Hibbertia hypericoides, Dasypogon bromeliifolius, Stirlingia latifolia*
Climbers		
Herbs	2-10	*Daucus glochidiatus, *Hypochaeris glabra, *Ursinia anthemoides*
Soft grasses		
Sedges		

Site 14

Eucalyptus gomphocephala **Open Woodland** over *Eucalyptus gomphocephala, Agonis flexuosa, Eucalyptus marginata* ssp. *marginata, Corymbia calophylla* **Low Forest A** over *Eucalyptus gomphocephala, Agonis flexuosa, Eucalyptus marginata* ssp. *marginata, Corymbia calophylla* **Low Woodland B** over *Diplolaena dampiera, Acacia cyclops, Agonis flexuosa* **Open Scrub** over *Macrozamia riedlei* **Open Dwarf Scrub C** over *Hibbertia hypericoides, Xanthorrhoea gracilis* **Dwarf Scrub D** over **Briza maxima, *Briza minima* **Open Low Grass** over *Chamaescilla corymbosa, *Hypochaeris glabra, *Romulea rosea, *Ursinia anthemoides* **Open Herbs**

Date	17 September 2007
Location	50 374715E 6306760N
Topography	Hill slope (dune)
Slope	Moderate
Soil texture	Sand
Soil colour	Grey, yellow
Surface layer	Loose soil
Rock type	Limestone
Leaf litter	Moderate
Distribution	Mainly under shrubs
Wood litter	Moderate
Vegetation condition	Good
Disturbance details	Disturbed areas approximately 100 m to the south
Fire History	Old

Vegetation Structure

Stratum	% Cover	Dominant Species (within each stratum)
Trees > 15m	2-10	*Eucalyptus gomphocephala*
Trees 5-15m	50	*Eucalyptus gomphocephala, Agonis flexuosa, Eucalyptus marginata* ssp. *marginata, Corymbia calophylla*
Trees < 5m	10-30	*Eucalyptus gomphocephala, Agonis flexuosa, Eucalyptus marginata* ssp. *marginata, Corymbia calophylla*
Mallee trees		
Shrubs >2m	2-10	*Diplolaena dampiera, Acacia cyclops, Agonis flexuosa*
Shrubs 1.5-2m		
Shrubs 1-1.5m		
Shrubs 0.5-1m	2-10	*Macrozamia riedlei*
Shrubs 0-0.5m	10-30	*Hibbertia hypericoides, Xanthorrhoea gracilis*
Climbers		
Herbs	10-30	*Chamaescilla corymbosa, *Hypochaeris glabra, *Romulea rosea, *Ursinia anthemoides*
Soft grasses	10-30	**Briza maxima, *Briza minima*
Sedges		

N
W E
S

Figure 1 Location of the ECU South West Campus

0 415 830 1,660 2,490 Metres

Drawn : Darren Brearley	Originator : DB
Date : 31 October 2007	Version : 1

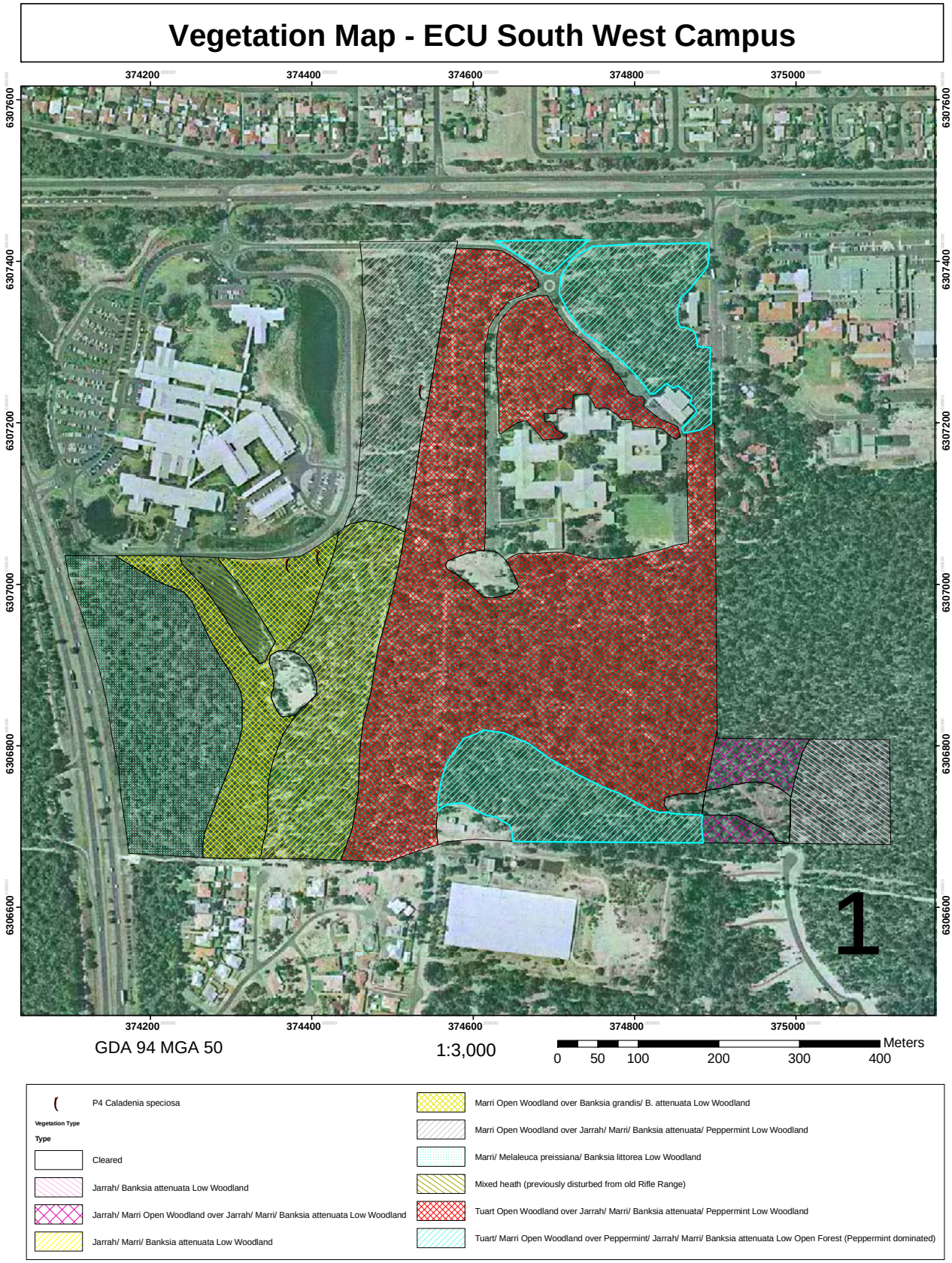
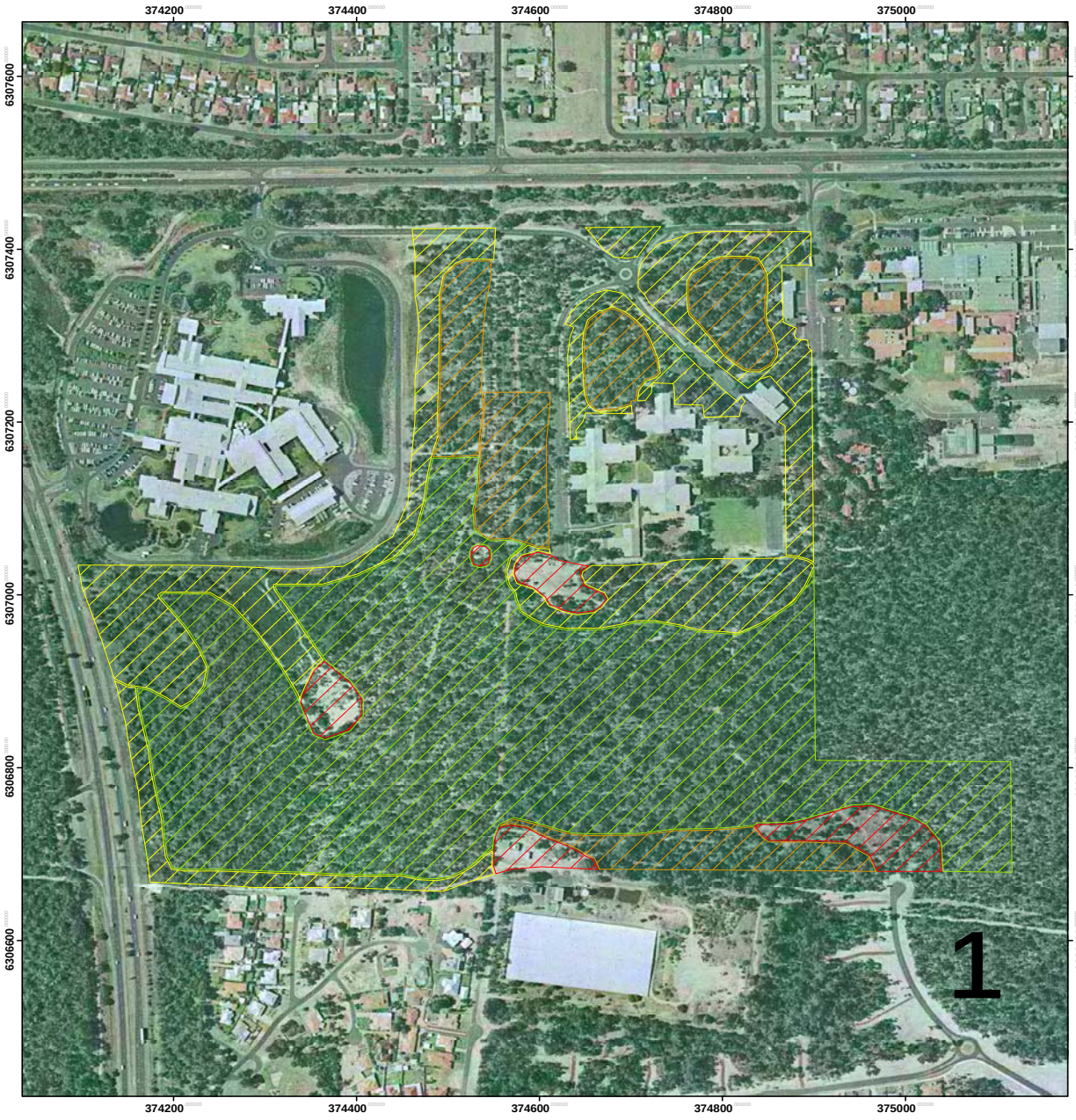

Vegetation Map - ECU South West Campus
374200
374400
374600
374800
375000
6307600
6307400
6307200
6307000
6306800
6306600
1
GDA 94 MGA 50
1:3,000
Meters
0 50 100 200 300 400
Vegetation Type
Type
P4 Caladenia speciosa
Cleared
Jarrah/ Banksia attenuata Low Woodland
Jarrah/ Marri Open Woodland over Jarrah/ Marri/ Banksia attenuata Low Woodland
Jarrah/ Marri/ Banksia attenuata Low Woodland
Marri Open Woodland over Banksia grandis/ B. attenuata Low Woodland
Marri Open Woodland over Jarrah/ Marri/ Banksia attenuata/ Peppermint Low Woodland
Marri/ Melaleuca preissiana/ Banksia littorea Low Woodland
Mixed heath (previously disturbed from old Rifle Range)
Tuart Open Woodland over Jarrah/ Marri/ Banksia attenuata/ Peppermint Low Woodland
Tuart/ Marri Open Woodland over Peppermint/ Jarrah/ Marri/ Banksia attenuata Low Open Forest (Peppermint dominated)

Figure 2

Vegetation Map - ECU South West Campus



- Completely Degraded
- Degraded
- Good
- Very Good

Meters
0 50 100 200 300 400
1:3,000

GDA 94 MGA 50

Figure 3