

**RANGES LINK
COMMUNITY ACTION GRANT
VEGETATION SURVEY**



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Disclaimer

Every effort has been made to ensure the accuracy of the information provided, however I do not accept responsibility for any omissions or errors or in how this information is used subsequently by others.

Cover photos

Top left: Remnant 1 (M & H Adams property)

Top right: Remnant 2 (A Adams property)

Bottom left: Remnant 3 (One of two sites located at Twin Creeks Conservation Reserve)

Bottom right: Remnant 5: (Kalgan Plains Nature Reserve)



Banksia gardneri taken at Site 3, Twin Creeks Conservation Reserve

Executive Summary

The Ranges Link Community Action Grant Vegetation Survey is the fourth vegetation survey undertaken by the author over a five year period for the Ranges Link: Stirling to Porongurup Group (Ranges Link), commissioned by the Oyster Harbour Catchment Group. The purpose of the surveys is to build understanding of the native vegetation that occurs in the Ranges Link area, as well as identify any weeds occurring within the areas surveyed.

Five remnants totalling an approximate area of 103 ha were surveyed in spring, 2016 and autumn, 2017. The remnants are located from 0.5 km to 7 km apart, located between Knight Rd, Porongurup Rd, Chester Pass Rd and Woogenellup Rd. Two of the remnants are located on private properties to the east and west of Knight Rd (Remnants 1 and 2 respectively, each around 8 ha in size); two are located at the Twin Creeks Conservation Reserve (Remnants 3 and 4 – 4 ha and 28.5 ha respectively) and one at Kalgan Plains Nature Reserve (Remnant 5 – 52.5 ha). This report provides detailed descriptions and maps of vegetation units, list of all species recorded listed by families, floristics, condition of remnants surveyed including weeds recorded and their location, results and discussion.

Similarly to the 2014 and 2015 surveys, the variable landforms, rock formations and soil types resulted in highly diverse vegetation structure and species composition. A total of 304 vascular species were identified in this survey effort, of which 259 met density or cover rules to be included in the dataset, and 2-way table floristics. Twenty seven vegetation associations determined from 45 relevés or sites, were grouped to form 15 vegetation units – based on variations of composition, structure and dominance that linked with changing landforms, soil types and hydrological conditions. The total species number and dataset species number identified in this survey are approximately 13.5% more species than the previous highest numbers of species (recorded in Bradshaw, 2014: 263 and 224 species respectively) over the total of four vegetation surveys carried out since spring, 2012.

Laterite geology was present to some degree at all remnants and is dominant at Remnants 2, 3 and 4. Remnant 1 was distinguished from all others by being predominantly granite geology and Remnant 5 by being predominantly Pallinup siltstone, often with lateritic gravel. A total of four units were mapped in Remnant 1; two in Remnant 2, one in Remnant 3 and five in Remnants 4 and 5.

The unit *Allocasuarina campestris/Callitris preissii* Tall Shrubland was first formally described in Bradshaw (2014) survey on upper-landscape siltstone outcropping and formally listed by Department of Parks and Wildlife in 2016 as a Priority Ecological Community. In this study, the unit *Allocasuarina campestris* Shrubland was formed on similar geology at Kalgan Plains Nature Reserve where no populations of *Callitris preissii* were found.

Similarly to the 2015 survey, the highest number of species was recorded on loamy soils in the Mixed Very Open Mallee/Proteaceous Low Heath (Unit 7 – 104 species, 5 relevés), followed Jarrah/Marri Woodland (Unit 13 – 86 species, 5 relevés) and *Eucalyptus occidentalis* Low Woodland and/or Mixed Very Open Mallee Heath (Unit 5 – 69 species, 4 relevés). Similarly to the 2015 survey, lower species numbers in deep sands (Unit 14 – *Banksia attenuata* Low Woodland, 48 species) is correlated with a lower survey site numbers – of only two sites in this survey.

A total of five priority species were recorded in the site and rapid survey data, including: *Hakea lasiocarpa* P3, *Leucopogon alternifolius* P3, *Stylidium lepidum* P3, *Synaphea preissii* P3 and *Orthrosanthus muelleri* P4. The four latter species haven't been recorded in any of the earlier surveys.

Vegetation was mostly in excellent to pristine condition, with only two relevés in good condition, where contributing factors appear to be edge effects (Site 35) and increasing salinity/waterlogging (Site 9). As indicated by signage on the east end of Remnant 4, *Phytophthora* dieback is known to occur in Remnant 4. This area was avoided for surveying to minimise the risk of spreading the dieback pathogen. As in previous surveys, senescence of obligate seeder species – *Banksia mucronulata* and sprouter species *Banksia pteridifolia* was observed in this survey – most notably near the south-western boundary of Remnant 5.

Most weed species recorded are non-aggressive or become dominant on edges which are inherently more disturbed such as annual grasses – particularly wild oats (*Avena* sp.). A few isolated records of the invasive species *Asparagus asparagoides* (bridal creeper) were recorded Remnant 1 and Remnant 5. GPS coordinates of all records are provided with site data in Appendix 5 or if recorded in rapid surveys for bridal creeper, under 3.4 in the results section.

South-western Australia is renowned nationally and internationally for its species diversity and endemism and is estimated to have 8,000 plant species, of which at least 75% are endemic. From the four surveys carried out for the Ranges Link over the last five years a total of around 482 different species have been used in datasets, recorded from remnants within a radius of approximately 7.5 km – representing over 6% of the South-west's plant species. The total of 304 species identified in this year's survey alone within a radius of around 4.5 km represents approximately 3.8% of the south-western Australia's total plant species.

The remnants or landscapes studied generally appear to fit under Hopper's (2009) OCBIL classification: old, climatically buffered, infertile landscapes. Plant communities in these landscapes are known to have evolved coping strategies such as water-foraging strategies, symbioses, carnivory, pollination and parasitism that confer resilience. Enhanced ability to persist in small fragmented populations associated with changing soil types and geological conditions brings with it great susceptibility to major soil disturbances because of the species inability to move elsewhere when conditions become adverse. The high species diversity and endemism identified in this and previous studies that are associated with OCBILs reinforce the complexity and importance of the native vegetation in the Ranges Link area and the challenges in managing them.

1. Introduction

This is the fourth vegetation survey undertaken for the Ranges Link – Stirling to Porongurup Group (Ranges Link) over a period of five years between 2012 and 2017. This work was commissioned by the Oyster Harbour Catchment Group for the Ranges Link Group.

As stated in previous reports, the aim of the Ranges Link is to identify, protect and enhance wildlife corridors in the Gondwana Link pathway between the Stirling Range and Porongurup National Parks. The vision of the Gondwana Link conservation initiative is to restore ecological resilience to a 1,000 km stretch in south-western Australia “from the wet karri forests in the far south to the mallee and woodland on the edge of the Nullarbor Plain to the east” (Ranges Link, 2011, p.2).

The purpose of this and previous vegetation surveys (Bradshaw, 2013; Bradshaw, 2014; Bradshaw, 2015) is to help build knowledge of the diverse native vegetation communities that occur between and around the Stirling Range National Park (SRNP) and the Porongurup Range National Park (PRNP) – in an area that is renowned for high levels of biodiversity and endemism. Remnants chosen for this study were prioritised by the Ranges Link Group.

Included in this report are survey location and vegetation maps, methods, limitations, results and discussion of results. Also included in the report are the vegetation survey recording sheet template used in this survey (Appendix 1); condition and structural classification systems used (Appendix 2); species list of vascular plants recorded in relevés listed by family (Appendix 3); detailed descriptions of vegetation units derived from floristics data (Appendix 4); relevé (site) data sheet results (excluding species that occur less than three times or occupy <5% of the relevé) (Appendix 5) and floristics (two-way table) (Appendix 6).

1.1 Area and location of sites

The remnants are located between approximately 0.5 km to 7 km apart, between Knight Rd, Porongurup Rd, Chester Pass Rd and Woogenellup Rd. The broad locations of the five remnants surveyed, in context with the Stirling and Porongurup Range National Parks are shown in Figure 1. Two of the remnants are located on private properties: Remnant 1 is located west of Uralla Rd and east of Knight Rd and Remnant 2 is located to the west of Knight Rd. Both Remnants 1 and 2 are approximately 8 ha each. Remnants 3 and 4 are located on Twin Creeks Conservation Reserve, east of Knight Rd. Although all part of one remnant, the survey sites are separated from each other and are therefore named separately for identification purposes only. The most westerly site is Remnant 3 (4 ha) and the easterly site Remnant 4 (28.5 ha). Kalgan Plains Nature Reserve (Remnant 5) is located south of Woogenellup Rd, east of Kalgan Plains Rd (52.5 ha).



Figure 1: Contextual location of remnants surveyed within the Ranges Link boundaries of the Stirling Range National Park to the north and the Porongurup Range National Park to the south

1.2 Geology

The context area is underlain by the Albany-Fraser Oregon composed of Proterozoic age (1200 to 1800 million years ago) gneissic and granitic rocks. Slumping of the south coast after Antarctica began to separate from Australia about 100 million years ago, caused the sea to cover the low-lying parts of the area, when the Stirling Range and Porongurups were islands. Silt and spongolite (Pallinup Siltstone) was deposited under the sea and swampy sediments (Werrilup Formation) were deposited in low lying areas in the Eocene (RAP & SCRIPT, 1996). Uplift and warping associated with the down-warps of the southern edge raised the land and caused faulting and shearing of the basement rocks, the rejuvenation of drainage lines and the formation of new surfaces along the ancient river systems (Mulcahy, 1960). Lateritisation occurred in the Tertiary (about 30 million years ago) (RAP & SCRIPT, 1996, p. 10).

The land surface of the context area is now a plain composed of sand and laterite that slopes gently south to the coast from the base of the Stirling Range, formed from the weathering of sediments and wind-blown sands over time. The lower parts of the plain are “broad, flat valleys containing lakes, sand dunes and erosional remnants of lateritized continental sandstone, Eocene spongolite and fossil wood”, drained at the southern edge by the headwaters of the Kalgan and Hay Rivers (Muhling *et al.* 1985, p. 2).

1.3 Climate

The study area lies between the 400mm and 500mm isohyet. The climate is Mediterranean, with generally cool and wet winters and warm, dry summers. The average rainfall for Mt Barker – the closest weather station with long-term records – is considerably higher with an average rainfall of 726 mm. The wettest months are May to October. Average monthly winter rainfall is 95 mm and average monthly summer rainfall is 26 mm. Average minimum and maximum summer temperatures are 12°C and 26°C and average

winter minimum and maximum temperatures are 6 °C and 15 °C respectively. Frosts are most likely to occur from June to September (Bureau of Meteorology, 2017). Climate statistics are shown in Table 1.

Table 1: Climate statistics for Mount Barker (Source: Bureau of Meteorology, June, 2017)

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years
Temperature														
Mean maximum temperature (°C)	26.3	26.1	24.2	21.3	17.8	15.3	14.4	15.1	16.8	18.9	21.9	24.2	20.2	99 1905 2017
Mean minimum temperature (°C)	12.8	13.1	12.4	10.7	8.8	7.1	6.1	6.1	7.0	8.1	9.9	11.4	9.5	99 1905 2017
Rainfall														
Mean rainfall (mm)	23.5	24.3	36.5	54.5	82.1	94.3	103.1	88.9	79.3	68.5	42.3	29.6	730.5	125 1886 2017
Decile 5 (median) rainfall (mm)	14.6	16.3	27.4	44.8	73.9	87.7	99.1	84.6	76.6	63.2	34.8	25.5	725.4	110 1886 2017
Mean number of days of rain ≥ 1 mm	3.9	3.8	5.3	7.4	10.6	12.1	13.3	12.3	10.9	9.7	6.6	4.8	100.7	106 1907 2017
Other daily elements														
Mean daily sunshine (hours)														
Mean number of clear days	8.5	6.9	5.7	3.6	4.1	3.8	3.7	3.9	2.9	3.2	4.6	6.4	57.3	39 1957 2009
Mean number of cloudy days	9.5	9.7	11.6	12.7	13.4	12.0	13.0	13.2	13.1	15.2	13.3	10.6	147.3	39 1957 2009

red = highest value blue = lowest value

2. Method

Spring-time vegetation surveys were carried out over a period of six days between 9 September and 4 November, 2016 and autumn surveys were carried out over a period of three days between 7 April and 13 April, 2017. Aerial photographs with eastings and northings were used to identify variations in vegetation cover and landscape topography which then guided pathways to traverse the remnants, with the aim of ensuring that obvious variations in vegetation structure were traversed. Autumn surveys targeted previous survey sites that aimed to pick up species that may have been missed in the spring survey and to assist with identification of species that flower at this time. Additional survey sites were added where there were found to be insufficient sampling of vegetation associations.

The relevé survey method was used. The relevé method has been shown to be an effective rapid survey method rather than marked quadrats where every species is recorded. Although marked quadrats contain more data, they are a lot more time consuming and would compromise the coverage of the targeted survey area. The relevé method was used for the Ravensthorpe Range (Craig et al. 2008), the Albany Regional Vegetation Survey (Sandiford & Barrett, 2010), Proteaceous Rich Vegetation Survey in the Forest to Stirlings section of the Gondwana Link (Sandiford, 2012), and for the Ranges Link Survey (Bradshaw, 2013, 2014 and 2015).

Site data records (Appendix 5) include vegetation association, stratum composition, percent cover and species dominance for each relevé or site area. Relevé area for trees, mallees and shrubs >2m in height strata are taken over an unmarked 20x20 m area and the remaining strata are recorded from an unmarked 10x10 m plot. Photographs and GPS waypoints were taken from the centre of each relevé. Rules governing inclusion of species in site data are that they are required to either project at least 5% canopy cover or be represented by at least three individuals in the relevé area to be included. If not, they are listed at the bottom as 'other species' and are included in the overall summary of species but not used in site data.

All remnants were traversed on foot using colour aerial photograph with Northings and Eastings marked, and using a compass and GPS as navigational tools. While traversing, in addition to relevés, rapid surveys were undertaken including species dominance and percent cover for each stratum with photographs. Rapid surveys were used to help record vegetation changes across the landscape and provide more detailed vegetation unit mapping data, as well as overall species composition information (Appendix 3b).

Vegetation structure was determined using Keighery (1994), adapted from Muir (1977) and Aplin (1979). Condition was determined using Keighery (1994) modified from Trudgen (1991) (Appendix 2). Site attributes including visual assessment of soil colour and type to a depth of 10cm, geology, percentage surface rock, land form, hydrology and drainage status were recorded, where known, as per relevé sheet (Appendix 1). The geology was checked using the relevant Geological Survey of Western Australia (Muhling *et al.* 1984) map sheet.

Samples of species that could not be identified in the field were collected, given a unique identifying name, and pressed for identification. Where possible, all species that could not be identified in the field were identified through cross referencing between Department of Conservation Florabase website, relevant plant identification keys/reference books, and the Albany Herbarium. Plants that were not able to be identified to species level were identified to genus level where possible. The genus of *Lepidosperma* is currently being revised with a large number of new species being named (pers. comm. E. Sandiford). These species were given a species number.

2.1 Limitations

While every effort was made to maximise the coverage of representative vegetation communities in remnants surveyed, due to time constraints it is not possible to say conclusively that all vegetation communities have been exhaustively covered in the survey process.

Soil and hydrology data was assessed briefly and subjectively and thus any conclusions regarding these attributes need to be treated with caution.

Not all species could be identified to species level due to lack of flowering/fruitlet material or current taxonomic uncertainties. Also the Albany Herbarium does not have a complete collection of flora from the area and some specimens in the herbarium are likely to be incorrectly named (pers. comm. E. Sandiford).

Vegetation maps are extrapolated from relevé and rapid survey site data only and have not been ground truthed. The complexity and variability of the vegetation in short distances makes the mapping highly subjective and the areas of each vegetation unit should be used as an indicative figure only.

3. Results

Following all field work, all relevés (sites) were reviewed. Results of all sites were clustered by common dominant upper, mid and lower storey dominants, landform and soil units. Site data was entered into a two-way table (Appendix 6) to show the transition of species presence/absence between vegetation types, linked to soil types. Vegetation is described to the level of associations (level V as defined in the National Vegetation Inventory System (NVIS) Information Hierarchy (ESCAVI, 2003)).

A total of six relevés (sites) were surveyed in Remnant 1 (8 ha), five sites in Remnant 2, three sites in Remnant 3 (4 ha), eight sites in Remnant 4 (28.5 ha), and 23 sites in Remnant 5 (52.5 ha) (Figure 7). Including the relevé and rapid survey sites, a total of 304 native vascular species were recorded representing 51 families (Appendix 3b). Of the 304 native species, the Myrtaceae family had the greatest species diversity (45 species), followed by Proteaceae (39 species), Fabaceae (34 species), Orchidaceae (22 species), Cyperaceae (15 species), Asteraceae and Ericaceae (13 species each), Restionaceae (11 species), and Poaceae, Goodeniaceae and Asparagaceae (10 species each). The remaining 40 families were represented by less than 10 species each. As described in the methods section, only species recorded three or more times or having a minimum of 5% canopy cover in relevé sites were used in the dataset (2-way table floristics - Appendix 6). The number of species recorded in the dataset was 259. In addition, over the entire survey, 18 weed species were identified from eight families.

3.1 Conservation species

Individuals or populations of five priority species were recorded at Twin Creeks Conservation Reserve and at Kalgan Plains Nature Reserve. The locations of priority species recorded in this survey are shown in Table 2 and vegetation maps (Figures 8 to 12) – together with remnant and site locations – and rapid survey GPS coordinates where relevant. All site (relevé) coordinates are shown with site data in Appendix 5.

Table 2: Priority species recorded with associated remnants, sites and GPS coordinates (for rapid survey sites only)

Species	Remnant & Site/Relevé No.
<i>Hakea lasiocarpa</i> P3	Twin Creeks CR Remnant 4, sites 15, 16; Kalgan Plains NR rapid survey 10 Located S-34°33'28.1" E117°56'05.3"
<i>Orthrosanthus muelleri</i> P4	Kalgan Plains NR, rapid survey 3 Located S-34°33'33.8" E117°55'52.2"
<i>Leucopogon alternifolius</i> P3	Twin Creeks CR Remnants 3 and 4, sites 12, 14, 19, 21
<i>Stylidium lepidum</i> P3	Kalgan Plains NR Sites 26, 28, 30
<i>Synaphea preissii</i> P3	Twin Creeks CR Remnant 4, sites 13, 17, 21 Kalgan Plains NR site 23

3.3 Vegetation associations and units

Following analysis of field observations and quantitative analysis using a two-way table and supported by rapid survey site information (not shown on maps or included in data), vegetation associations from sites were grouped according to common landscape positions, hydrological conditions and key vegetation structural and species dominance characteristics to form vegetation units (Appendix 4) and vegetation unit maps (Figures 8 to 12).

Following is a summary of the 15 vegetation units determined from site data, listed by landform and soil type:

1. **Mid to upper slope below granite outcrop on loam and gravelly sand**
Eucalyptus wandoo Granite Open Woodland/*Eucalyptus occidentalis* Low Woodland (Sites 5, 35, 36)
2. **Granite outcrop on ridge on loam**
Hypocalymma angustifolium Shrubland/*Spartochloa scirpoidea* Grassland (Sites 3, 6, 37)
3. **Skeletal loam soils on granite rocks on/near ridge**
Borya sphaerocephala Herbland/*Neurachne alopecuroidea* Grassland (Sites 2, 38)
4. **Mid-upper slope amongst granite rocks on loam**
Eucalyptus pleurocarpa Granite Very Open Mallee (Sites 1, 4)
5. **Flats/poorly drained lower landscape on loam soils**
Eucalyptus occidentalis Low Woodland and/or Mixed Very Open Mallee Heath (Sites 14, 15, 16, 18)
6. **Flat to gently undulating plains on loam to lateritic gravelly clay**
Mixed Laterite Mallee (Sites 29, 41, 44)
7. **Flat to gently undulating plains on loam to lateritic gravelly clay soils**
Mixed Very Open Mallee/Proteaceous Low Heath (Sites 13, 22, 23, 26, 30)

- 8. Flat to gently undulating plains on clay to gravelly clay**
Mixed Clay Open Low Heath (Sites 24, 25, 27)
- 9. Gentle to moderately steep slopes mid to upper landscape on Pallinup Siltstone rocky outcrops on clay loam to gravelly clay**
Allocasuarina campestris Shrubland (Sites 28, 34, 42, 43)
- 10. Moderately steep mid-upper landscape associated with Pallinup Siltstone rocky outcrops on loam soils**
Wandoo Siltstone Open Woodland/Mixed Mallee/*Allocasuarina trichodon* Tall Open Scrub (Sites 31, 32)
- 11. Moderate to steep slopes below Pallinup Siltstone rocky outcrops on loam soils**
Mixed Very Open Mallee/*Melaleuca pentagona* ssp. *pentagona* Siltstone Tall Open Scrub Complex (Sites 33, 45).
- Sub-units:
- Sub-unit 11a (Site 33): Wandoo Low Open Woodland/*Eucalyptus hebetifolia* very open mallee/*Melaleuca pentagona* ssp. *pentagona* Tall Open Scrub.
- Sub-unit 11b (Site 45): *Eucalyptus thamnoides* Very Open Mallee/*Melaleuca pentagona* ssp. *pentagona* Tall Closed Scrub with emergent *Acacia myrtifolia*
- Sub-unit 11c (Rapid survey only and not included in data – see Appendix 4 for detail): *Allocasuarina trichodon* Low Open Forest/*Eucalyptus ecostata* very open mallee/*Melaleuca pentagona* ssp. *pentagona* Tall Open Scrub
- 12. Gently undulating plains on sandy lateritic gravel soils**
Jarrah Woodland (Site 19, 20, 21)
- 13. Gently undulating plains on sandy soil on laterite geology**
Jarrah/Marri Woodland (Sites 7, 8, 10, 11, 12)
- 14. Gently undulating plains on deep sand**
Banksia attenuata Low Woodland (Sites 17, 39)
- 15. Lower landscape adjacent to creekline on sandy loam**
Moit Open Mallee/*Baumea juncea* Open Sedgeland (Site 9)

3.4 Species diversity and condition status

The condition status of relevés by site number, grouped by vegetation unit (unit) and showing the number of species recorded/site is shown in Table 3. The approximate/indicative area (hectares) covered by each unit is shown in Table 4, together with the approximate percent cover of each unit and the number of species recorded in each unit (derived from the Floristics Summary, Appendix 6).

The highest number of species was recorded in the Mixed Very Open Mallee/Proteaceous Low Heath (Unit 7 – 104 species, 5 sites), followed by Jarrah/Marri Woodland (Unit 13 – 86 species, 5 sites) and *Eucalyptus occidentalis* Low Woodland and/or Mixed Very Open Mallee Heath (Unit 5 – 69 species, 4 sites). Unit 7 was represented in Twin Creeks Conservation Reserve (Remnant 4) and Kalgan Plains Nature Reserve (Remnant 5) and occupies approximately 9 ha and 9% of the total area surveyed. Unit 13 was recorded most extensively at Remnant 2 and also at Remnant 4 (Site 12 only). Site 12 (Unit 13) had the highest species richness of all sites surveyed, with 52 species, followed by Site 23 (Unit 7) with 46 species and Site 29 (Unit 6) with 42 species.

Most survey sites are in excellent to pristine condition with the exception of Sites 9 and 35 which are in good condition – the former site appears to be affected by salinity/waterlogging and the latter from edge effects. Most weeds species recorded are non-aggressive weeds, including *Aira* sp. (hair grass), *Ursinia anthemoides* (South African daisy), *Briza minor* (shivery grass), *Hypochaeris* sp. (flat weed), *Parentucellia latifolia* (common bartsia), *Lysimachia arvensis* (pimpernel) and *Cyperus tenellus* (tiny flatsedge). Generally small populations of what appear to be more disturbance opportunists including *Avena* sp. (wild oats), *Trifolium* sp. (clover), *Ornithopus compressus* (yellow serradella), *Romulea rosea* (dock), *Arctotheca calendula* (cape weed), *Vulpia* sp. (silver grass), *Lagurus ovatus* (hare's tail grass), ?*Dactylis glomerata*/*Phararis aquatica* (cocksfoot/phellaris), *Helichrysum luteoalbum*, and *Disa bracteata* (South African Orchid) were also recorded with site data (Appendix 5).

A few isolated records of the invasive species *Asparagus asparagoides* (bridal creeper) were recorded: at Remnant 1, Site 4 (GPS location shown with site data in Appendix 5); and at rapid survey sites at Remnant 1 (S34°34'27.6" E 117°52'05.3"); Remnant 2 (S34°37'13.7", E117°51'38.3"); also at Kalgan Plains Nature Reserve on south boundary beneath solitary wandoo tree (S34°33'31.98", E117°55'58.24") (Figure 2).



Figure 2: Bridal creeper at base of wandoo tree on south boundary of Kalgan Plains Nature Reserve

As in previous surveys (Bradshaw, 2013, 2014, 2015), there was some evidence of senescence of obligate seeder species – most notably *Banksia mucronulata* and sprouter species *Banksia pteridifolia*. The latter species varied from apparently healthy to senescent/dead (Figure 3) with some recent deaths. As other surrounding proteaceous species appeared healthy, the deaths appear to be due to be more likely to be due to senescence rather than *Phytophthora* dieback. Senescence was most evident near the south-western boundary of the Kalgan Plains Nature Reserve (Figure 4).

There was only one area of all areas surveyed that appeared to be affected by *Phytophthora* dieback located to the south east of and appears to be confirmed by dieback affected signage on eastern edge of Remnant 4 on Twin Creeks Conservation Reserve (Figure 5).

There were some interesting diggings of what appear to be a native mammal – possibly quenda (*Isodon obesulus*) (Figure 6) recorded at Site 16 (see Appendix 5 for site data).



Figure 3: Remnant 5 dead/senescent *Banksia mucronulata* (centre-right) and *Banksia pteridifolia* (left foreground)



Figure 4: Remnant 5 recent deaths of *Banksia pteridifolia*



Figure 5: Possible *Phytophthora* dieback site to north of Site 12



Figure 6: Diggings at Site 16

Table 3: Condition status and species diversity from site data (relevés), grouped by vegetation unit

Relevé No.	Vegetation unit	Condition	No. species	Relevé No.	Vegetation unit	Condition	No. species
5	1	Excellent	21	24	8	Pristine	17
35	1	Good	16	27	8	Pristine	23
36	1	Excellent	21	25	8	Pristine	18
4	2	Excellent	21	28	9	Pristine	29
1	2	Pristine	32	42	9	Excellent	13
38	3	Excellent	8	43	9	Excellent	8
2	3	Excellent	11	34	9	Pristine	15
3	4	Pristine	18	31	10	Excellent	15
6	4	Pristine	20	32	10	Excellent	11
37	4	Excellent	6	33	11	Pristine	3
18	5	Excellent	23	45	11	Pristine	6
14	5	Excellent	23	19	12	Excellent	35
15	5	Pristine	30	20	12	Excellent	33
16	5	Pristine	33	21	12	Excellent	40
44	6	Pristine	25	7	13	Excellent	23
29	6	Pristine	42	8	13	Excellent	34
41	6	Excellent	23	10	13	Excellent	30
23	7	Excellent	46	11	13	Excellent	31
40	7	Excellent	17	12	13	Excellent	52
26	7	Pristine	47	39	14	Excellent	31
22	7	Pristine	38	17	14	Excellent	35
13	7	Excellent	50	9	15	Good	5
30	7	Pristine	21				

Table 4: Total area of vegetation units (units) per remnant, percent cover of each unit for total survey area, number of species recorded per unit

Veg unit no.	Vegetation Unit Name	Area (ha)/ remn't	% of Area of all remnants surveyed	Total no. species recorded/unit**
1	<i>Eucalyptus wandoo</i> Granite Open Woodland/ <i>Eucalyptus occidentalis</i> Low Woodland	1.9	1.9	39
2	<i>Hypocalymma angustifolium</i> Shrubland/ <i>Spartochloa scirpoidea</i> Grassland	1.3	1.3	32
3	<i>Borya sphaerocephala</i> Herbland/ <i>Neurachne alopecuroidea</i> Grassland	2.3	2.3	14
4	<i>Eucalyptus pleurocarpa</i> Granite Very Open Mallee	2.5	2.5	38
5	<i>Eucalyptus occidentalis</i> Low Woodland and/or Mixed Very Open Mallee Heath	5.5	5.6	69
6	Mixed Laterite Mallee	19.1	19.3	62
7	Mixed Very Open Mallee/Proteaceous Low Heath	8.7	8.8	104
8	Mixed Clay Open Low Heath with Emergent Mixed Mallee	7.8	7.9	31
9	<i>Allocasuarina campestris</i> Shrubland	3.5	3.5	40
10	Wandoo Siltstone Open Woodland/Mixed Mallee/ <i>Allocasuarina trichodon</i> Tall Open Scrub	5.5	5.6	21
11	Mixed Very Open Mallee/ <i>Melaleuca pentagona</i> ssp. <i>pentagona</i> Siltstone Tall Open Scrub Complex	6.3	6.4	8
12	Jarrah Woodland	10.6	10.7	55
13	Jarrah/Marri Woodland	16.5	16.7	86
14	<i>Banksia attenuata</i> Low Woodland	6.9	7	48
15	Moit Mallee/ <i>Baumea juncea</i> Open Sedgeland	0.4	0.4	5
	Total area surveyed (all remnants)	98.8		

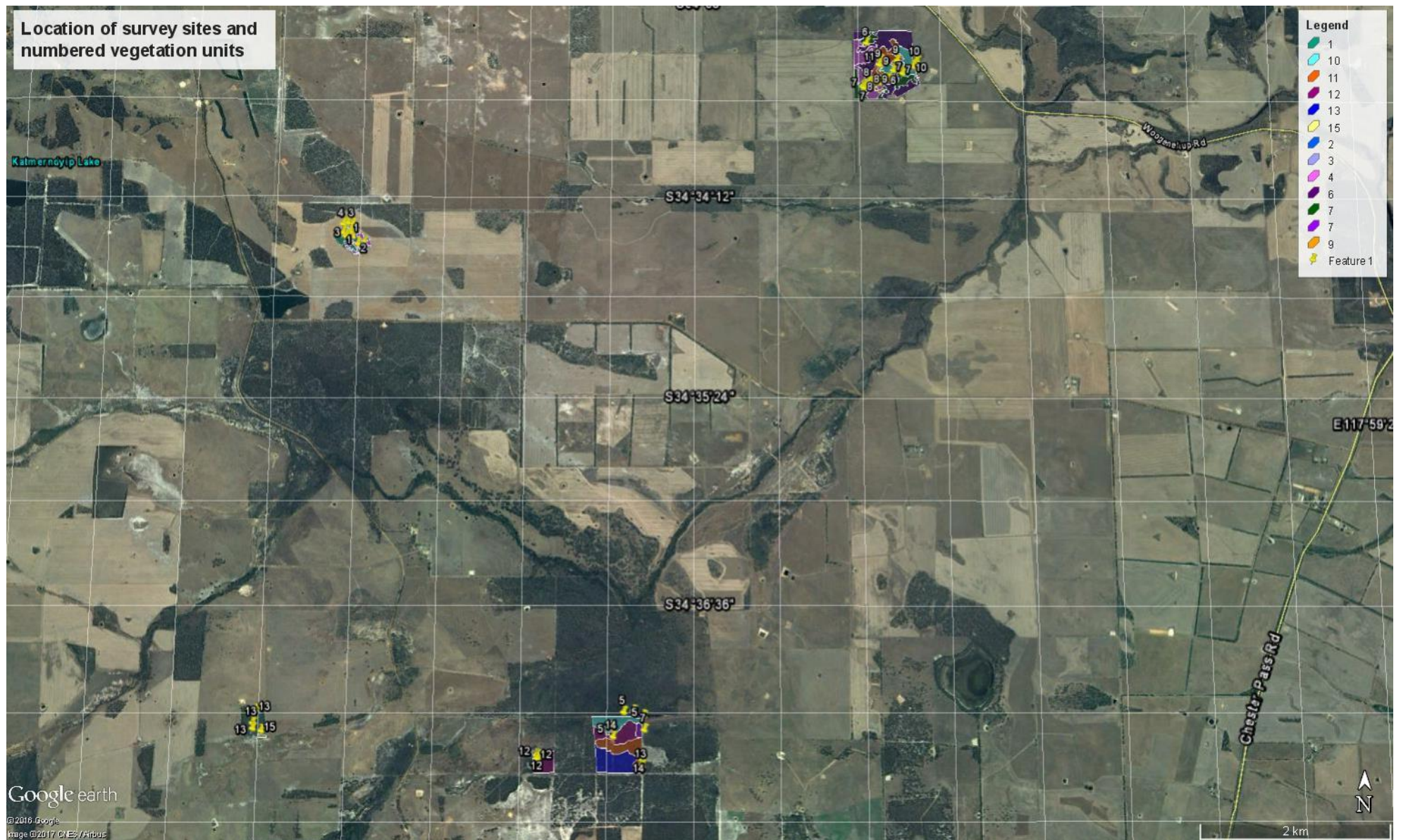


Figure 7: Location of relevé survey sites (yellow pin) numbered by their representative indicative vegetation unit located in Remnant 1 (top left), Remnant 2 (lower left), Remnants 3 and Remnant 4 (Twin Creeks Conservation Reserve) (lower centre and lower right respectively), and Remnant 5 (Kalgan Plains Nature Reserve) (top right)

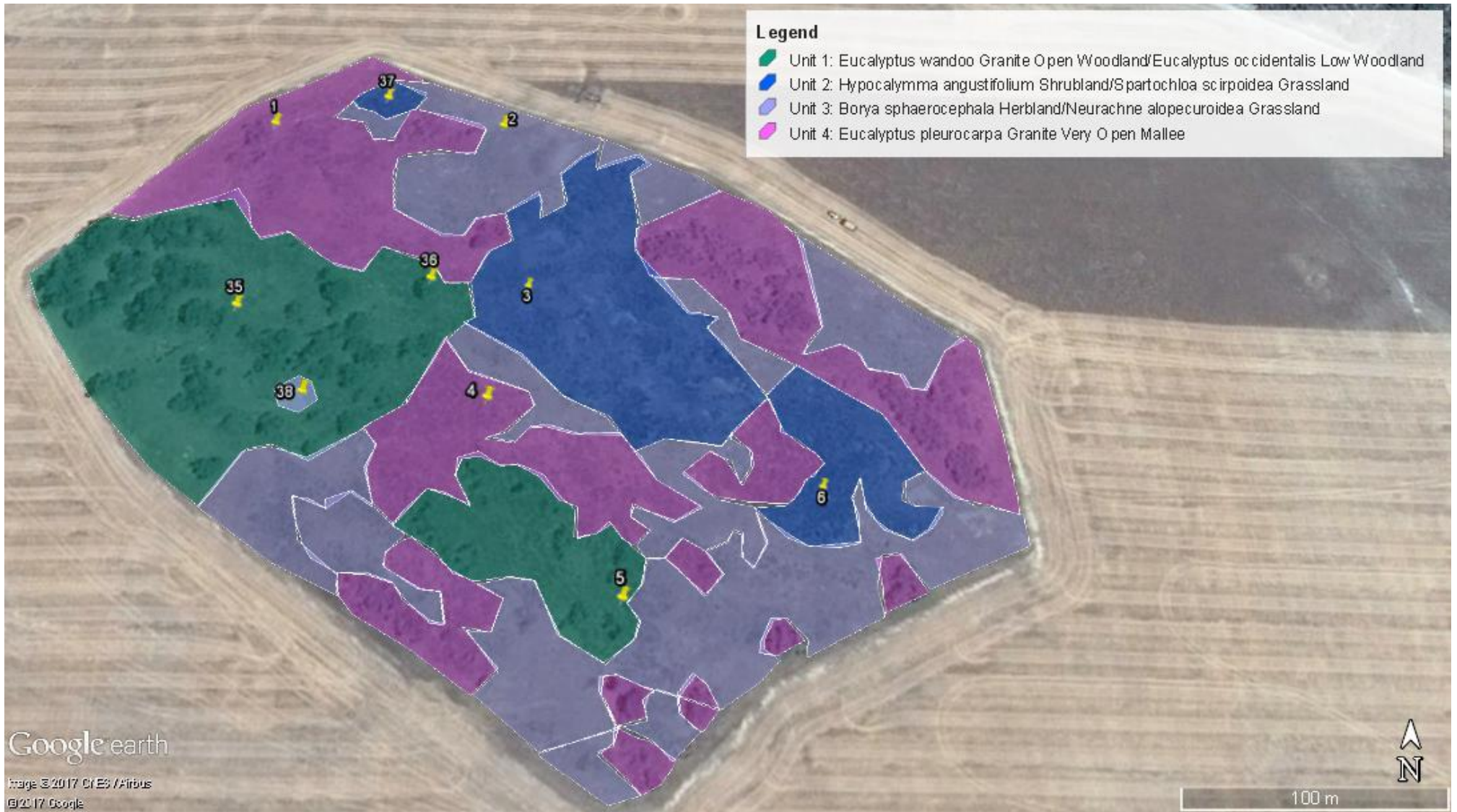


Figure 8: Vegetation map for Remnant 1 showing locations of relevé survey sites and indicative vegetation units

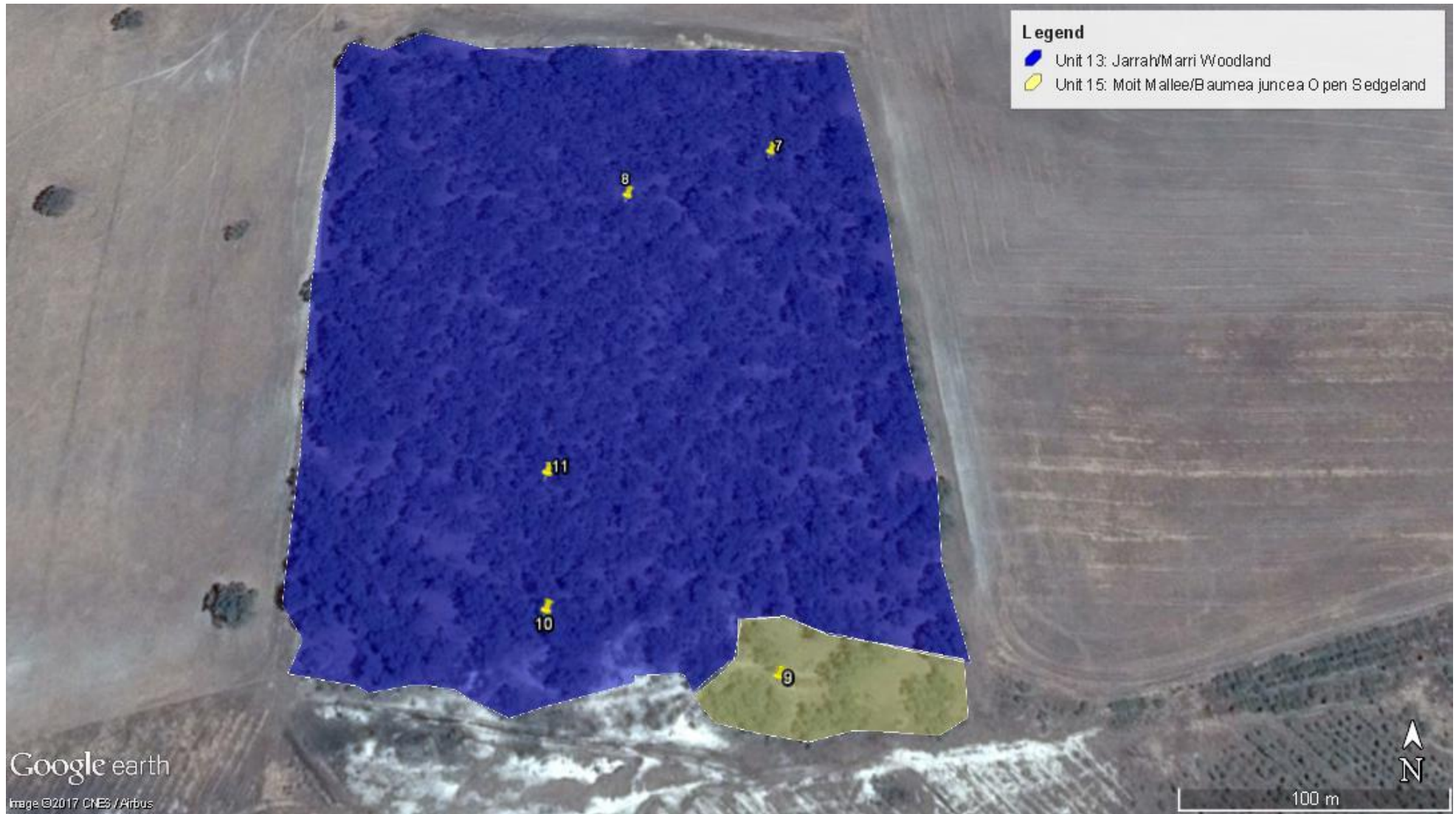


Figure 9: Vegetation map for Remnant 2 showing locations of relevé survey sites and indicative vegetation units



Figure 10: Vegetation map for Remnant 3, Twin Creeks Conservation Reserve showing locations of survey sites, indicative vegetation units and priority species

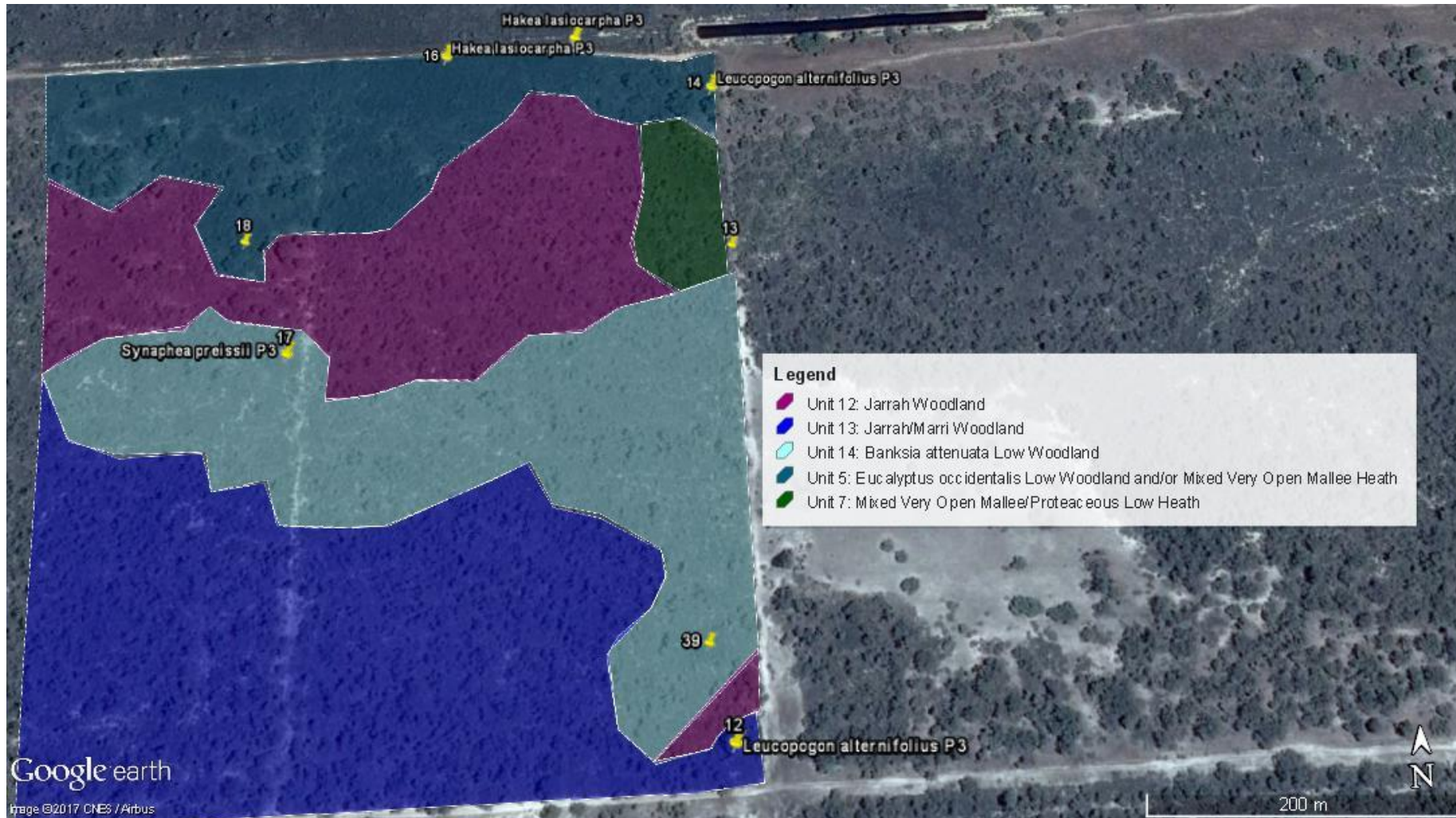


Figure 11: Vegetation map for Remnant 4, Twin Creeks Conservation Reserve showing locations of survey sites, indicative vegetation units and priority species

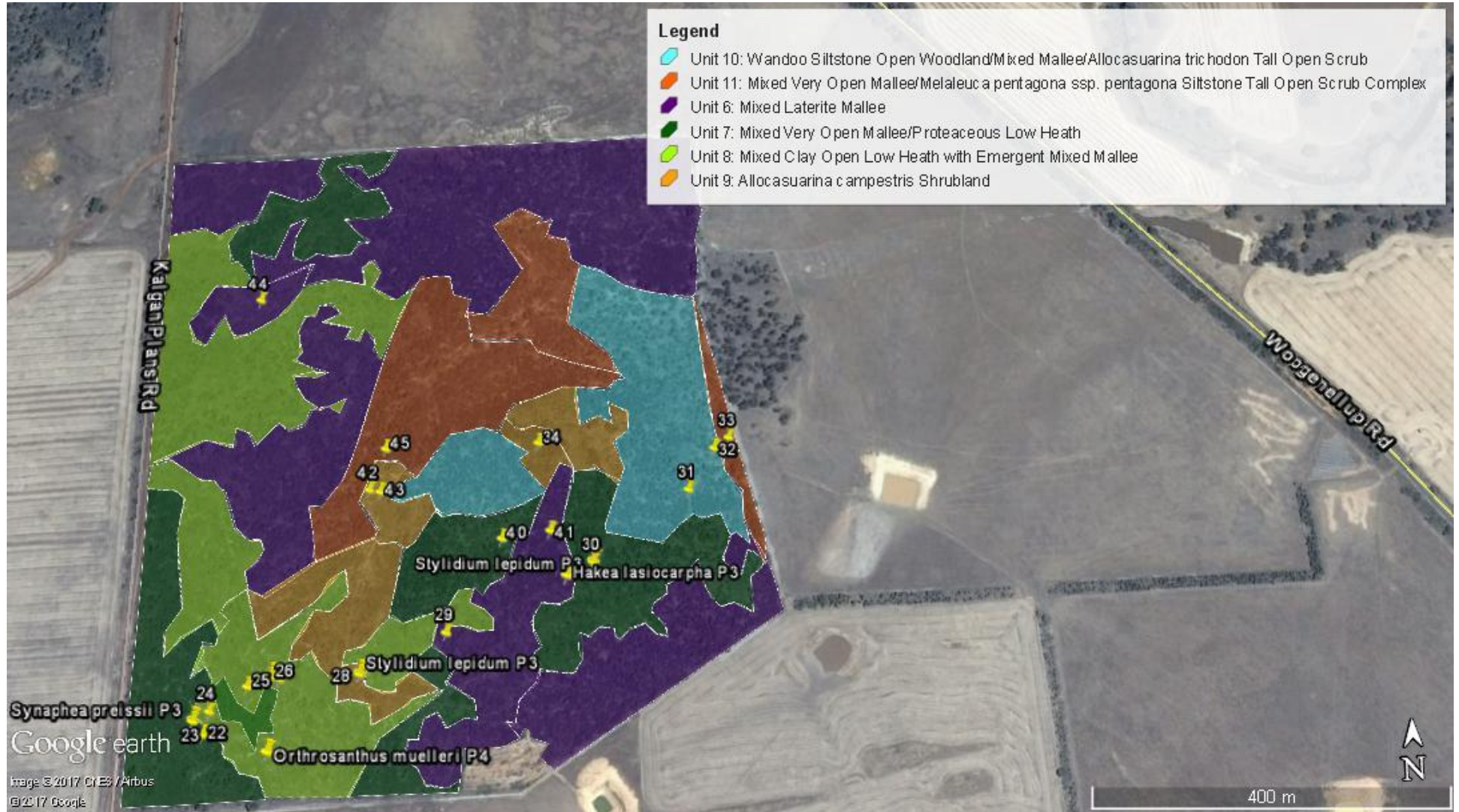


Figure 12: Vegetation map for Remnant 5 Kalgan Plains Nature Reserve showing locations of relevé survey sites, indicative vegetation units and priority species

4. Discussion

Similarly to the 2014 and 2015 surveys carried out by the author, this survey found that the variable landforms, rock formations and soil types surveyed resulted in highly diverse vegetation structure and composition. A total of 304 vascular species were identified of which 259 were included in the dataset, representing 27 vegetation associations and 15 vegetation units. A total of 13 and 17 units were identified in the two previous studies respectively (Bradshaw, 2014, 2015). The total species number and dataset species number identified in this survey are approximately 13.5% more than the previous highest numbers of species (recorded in Bradshaw, 2014: 263 and 224 species respectively and 13 units) over the total of four vegetation surveys carried out by the author since spring, 2012. In contrast, the lowest number of units and species were correlated with the 2012-2013 (Bradshaw, 2013) study where a total of six vegetation units and 196 species were identified on laterite geology and sand to sandy gravel soils alone. Although a similar survey effort has been made in each of the four surveys undertaken, a contributing factor to the higher species number found in this survey may be the repeat survey in autumn which earlier surveys did not have.

Laterite geology was present to some degree at all sites in this survey – mostly only visible in the form of gravelly soils or isolated floating rocks. There is generally a gradual transition of species between neighbouring units with many overlapping species. Particularly at Remnants 1 and 5, different suites of plants are particularly obviously associated with the different density and depths of rocks. Vegetation units at Remnant 1 – which was distinguished from other remnants by granite rock outcropping – followed changes in rock density and depth which influence hydrological conditions and depth of soil. *Eucalyptus wandoo* Granite Open Woodland/*Eucalyptus occidentalis* Low Open Woodland (Unit 1) was recorded on the edge or below the granite outcrop on mid-upper slope with less than 2% surface rock. *Eucalyptus pleurocarpa* Granite Very Open Mallee (Unit 4) was recorded on similar landscape to Unit 1 below the ridge where the percent cover of granite rock increases to 20-50%. *Hypocalymma angustifolium* Shrubland/*Spartochloa scirpoidea* Grassland (Unit 2) was recorded growing high in the landscape in gaps between rocks of the granite outcrop, in a poorly drained environment; and *Borya sphaerocephala* Herbland/*Neurachne alopecuroidea* Grassland (Unit 3) was recorded on shallow to skeletal loamy soils over granite sheet rock.

Remnant 5 has variable soil types and geology – which appears to be predominantly Pallinup siltstone, with or without laterite. Mixed Laterite Mallee (Unit 6, Remnant 5) is distinguished from other mallee units in this study by its well-drained gravelly sand to loamy gravel soil. Mixed Very Open Mallee/Proteaceous Low Heath (Unit 7 which was also recorded at Remnant 4) occurs on more loamy soils than Unit 6 and less clay than Unit 8 (Mixed Clay Open Low Heath with Emergent Mixed Mallee). Units 6, 7 and 8 occur on flat to gently undulating plains.

In the absence of *Callitris preissii* in this year's survey, the vegetation unit *Callitris preissii/Allocasuarina campestris* Tall Shrubland that was first formally described in the study area on siltstone geology in 2014 and 2015 was not found this year. Growing on what appeared to be similar geology – gentle to moderately steep slopes, associated with mid to upper landscape siltstone rocky outcrops and breakaways in Remnant 5 – the unit *Allocasuarina campestris* Shrubland (Unit 9) was formed instead. Wandoo Siltstone Open Woodland/Mixed Mallee/*Allocasuarina trichodon* Tall Open Scrub (Unit 10, Remnant 5) is associated with mid-upper moderately steep landscape Pallinup Siltstone outcrops (10->50% exposed rock) on loam soils. Mixed Very Open Mallee/*Melaleuca pentagona* ssp. *pentagona* Siltstone Tall Open Scrub (Unit 11, Remnant 5) was recorded on moderate to steep slopes below Pallinup Siltstone rocky outcrops that feature Units 9 or 10.

Twin Creeks Conservation Reserve (Remnants 3 and 4) occurs on a flat to gently undulating plain. Remnant 3 is dominated by laterite geology where Jarrah Woodland (Unit 12) occurs on sandy gravel. Soil types in Remnant 4 are more variable, ranging from gravelly clay to deep sand. *Eucalyptus occidentalis* Low Woodland and/or Mixed Very Open Mallee Heath (Unit 5) was recorded in Remnant 4 on laterite geology on loam to clay loam soils, with or without gravel on low/flat poorly drained sites. Unit 7 was also recorded in this remnant on gravelly clay, slightly higher in the landscape than Unit 5. Unit 12 is present in this remnant on the more gravelly soils, and Jarrah/Marri Woodland (Unit 13) is more common and was recorded on sandy soils on gently undulating plains with laterite geology. *Banksia attenuata* Low Woodland (Unit 14) occurs on deep sand in this remnant, with many overlapping species with Unit 13.

Finally, Remnant 2 occurs on laterite geology on a gently undulating slope and is dominated by Unit 13. A small area in the lower slope adjacent to a drainage line is the indicative unit Moit (*Eucalyptus decipiens*, *adsmophloia* IG) Mallee/*Baumea juncea* Open Sedgeland (Unit 15) but needs further work to consolidate this unit as it was determined from one site only.

Five priority species were recorded in this survey of which four had not been recorded in previous surveys. Species not recorded before include: *Leucopogon alternifolius* (P3), *Orthrosanthus muelleri* (P4), *Stylidium lepidum* (P3) and *Synaphea preissii* (P3). *Hakea lasiocarpa* (P3) was also recorded in 2014 and 2015 surveys also.

Vegetation was mostly in excellent to pristine condition, with only two relevés in good condition, where contributing factors appear to be associated with disturbance such as edge effect (Site 35) and increasing salinity/waterlogging (Site 9). As indicated by signage on the east end of Remnant 4, *Phytophthora* dieback is known to occur in Remnant 4. This area was avoided for surveying to minimise the risk of spreading the dieback pathogen. As in previous surveys, senescence of obligate seeder species – most notably *Banksia mucronulata* (Figure 5) and sprouter species *Banksia pteridifolia* (Figure 6) was observed in this survey – most notably near the south-western boundary of Remnant 5. This issue has been treated in some detail in Bradshaw, 2014. It appears that recent deaths of the latter species is due to senescence or other factors and not *Phytophthora* dieback as other susceptible species growing together with *Banksia pteridifolia* do not appear to be affected at this stage.

As discussed in Bradshaw (2105), the Fitzgerald River, Stirling Range (SRNP) and Mt Lesueur National Parks have been recognised as having the highest plant endemism in WA (Hopper & Goia, 2004, in prep.) and the Southwest Australian Floristic Region (SWAFR) has been listed among 25 global biodiversity hot spots (Hopper & Gioia, 2004). From the four surveys carried out over the last five years, a total of around 482 different species have been used in datasets recorded from remnants within around 7.5 km radius. A total of 259 species that were used in the data set for this study, were recorded within a radius of around 4.5km. Site 12 in this year's study recorded the highest species richness of all sites surveyed this year (52 species in 100 m²). To put these species numbers in context, the south-west of Australia is estimated to have 8,000 plant species, of which at least 75% are endemic (Hopper, 1992; Hopper et al., 1997). The total of 308 species identified in this year's survey represents approximately 3.8% of the south-west's total plant species and the 482 species that have been used in datasets in four surveys represent over 6%. These figures reinforce the complexity and importance of the native vegetation in the Ranges Link area.

With the possible exception of Unit 15, the remnants studied in this survey appear likely to fit under Hopper's (2009) OCBIL classification: Old, climatically buffered, infertile landscapes. Plant communities in these landscapes are known to have evolved coping strategies such as "water-foraging strategies, symbioses, carnivory, pollination and parasitism" (Hopper, 2009, p. 49). Enhanced ability to persist in small fragmented populations associated with changing soil types and geological conditions brings with it "great susceptibility to major soil disturbances" (ibid.) because of their inability to move when conditions change. OCBILs are differentiated from YODFELs which are young, often disturbed, fertile landscapes such as along

coastal/wetland margins which due to their different evolutionary history have different management implications (Hopper, 2009).

The persistence of the remnants studied in this survey mostly in excellent to pristine condition in spite of some of them being only small and isolated demonstrates their resilience as described under the OCBIL classification. Remnants 1, 2, and 5 are located mostly in a mosaic of cleared farmland with patches of remnant vegetation and revegetation – and variable connectivity and distance to other remnants. Remnant 1 is approximately 150 m from nearest remnant, Remnant 2 is linked to recent creekline revegetation which appears to link to remnant vegetation, and Remnant 5 – the largest remnant surveyed – is approximately 260 m from the nearest remnant. Remnants 3 and 4 form part of a larger reserve which is also connected to other remnant vegetation which in turn links to the Porongurup Range National Park as shown in aerial photograph in Figure 1. From a management point of view, the following hypotheses and strategies provide guidance about how to conserve OCBIL biodiversity adapted from Hopper (2009, p. 72) as follows:

- Every native vegetation remnant on OCBILs is valuable, no matter how small, and may have unique persisting communities – they are not interchangeable as often as are those of YODFELS
- Small insular areas are often as good as large connected areas for OCBIL biota, edge-effects aside
- Connecting isolated OCBIL communities through revegetated corridors is often unnecessary and might foster weed, feral animal and disease invasions
- Human disturbance is often detrimental. There is a need in OCBILs to:
 - Focus human disturbance on YODFELS, away from OCBILs;
 - Minimise soil removal via bulldozing etc
 - Minimise importation of nutrients
 - Minimise pollution causing climate change
 - Minimise importation of alien plants, animals and diseases, and control where possible
 - Minimise groundwater extraction
 - Minimise logging and removal of long-lived adult plants
 - Store seeds and other propagules
- In restoration of OCBIL vegetation, plant local seeds or cuttings

Evidence that a range of these strategies are being implemented by the Ranges Link Group is clear. The value of the care of the Ranges Link Group and their supporters to nurture, protect and enhance the bushland under their watch cannot be overstated in this biodiversity hotspot of hotspots. Their need for ongoing support is also strong as indicated by the delicate balancing act of managing species that become senescent and moribund when not exposed to fire within appropriate fire regimes with the bigger picture of maintaining the resilience that maintains the integrity of these OCBIL communities.

Conclusion

A total of 15 vegetation units were identified, described and mapped within a survey area of approximately 103 ha on five remnants during this project – including 304 species overall of which 259 species met cover/density rules to be included in floristics data. This survey was undertaken on similar underlying geology to the 2015 study which included Pallinup siltstone, granite and laterite, and resulted in a similar number of vegetation units as the previous study. This study has seen an increase of approximately 28% of species identified and species used in the dataset overall compared to the 2015 study, and 13.5% more than the previous most species-rich survey which was undertaken in 2014. Although a similar survey effort has been made in each of the four surveys undertaken, a contributing factor to the higher species number found in this survey may be the repeat survey in autumn which earlier surveys did not have.

In the absence of *Callitris preissii* growing with *Allocasuarina campestris* in this year's survey, the vegetation unit *Callitris preissii/Allocasuarina campestris* Tall Shrubland P1 that was first formally described in the study area on siltstone geology in 2014 and 2015 was not found this year. The unit *Allocasuarina campestris* Shrubland was formed instead.

The remnants surveyed this year are mostly in pristine to excellent condition. The only invasive species recorded were a few small infestations of bridal creeper noted in Remnants 1 and 5. *Phytophthora* Dieback is known to occur in part of Remnant 4. No other obvious signs of dieback were observed. As in previous surveys, senescence of obligate seeder species – most notably *Banksia mucronulata* (Figure 5) and sprouter species *Banksia pteridifolia* (Figure 6) was observed in this survey – most notably near the south-western boundary of Remnant 5.

South-western Australia is renowned nationally and internationally for its species diversity and endemism and is estimated to have 8,000 plant species, of which at least 75% are endemic. From the four surveys carried out for the Ranges Link by the author over the last five years a total of around 482 different species have been used in datasets, recorded from remnants within a radius of approximately 7.5 km – representing over 6% of the South-west's plant species. The total of 308 species identified in this year's survey within a radius of around 4.5 km represents approximately 3.8% of the south-western Australia's total plant species from this survey effort alone.

The remnants studied generally appear to fit under Hopper's OCBIL classification: Old, climatically buffered, infertile landscapes. Enhanced ability of OCBILs to persist in small fragmented populations associated with changing soil types and geological conditions brings with it great susceptibility to major soil disturbances because of their inability to move elsewhere when conditions become adverse. The high species diversity and endemism identified in this and previous studies reinforce the complexity and importance of the native vegetation in the Ranges Link area and the great challenges in managing them. The value of the work of the Ranges Link Group and their need for ongoing support in tackling these challenges to nurture, protect and enhance the bushland in their link cannot be overstated.

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Appendix 1 – Survey recording sheet template

		SITE_ID:		
Date:	Wp:	mE		
Recorder:	VegCode:	mN		
Location and Site Notes:				
Condition: Pristine Excellent Very Good Good Degraded --- RESIDUAL MODIFIED TRANSFORMED				
Aspect: N NE E SE S SW W NW		Slope: Flat Gentle Mod Steep		
Geology: Gnei Gran Lat Lime Silt		Rock: 0 <2 2-10 10-20 20-50 >50		
Soil Colour: Brown Grey Dark Brown Dark Grey Light Grey Light Brown Orange/Brown White Yellow Yellow/Grey		Soil Type: C CL CLS CS L LS S SCL SL SP ZCL ZL ZS P GL GS		
Hydrology: Good drain Poor drain Perm wet Seasonal wet		Landform: Breakaway Cliff Consolidated Dune Drainage Depression Dune Gully Hill Crest Riparian Bank Rock Outcrop Slope Lower Slope Middle Slope Upper Swale Swamp Tidal Flat Tor Valley Flat Berm Flat Plain Ridge		
Growth form	Ht	Cvr	NVIS/dominant	Others
T ₁	>30			
T ₂	10-30			
T ₃	<10			
M ₁	>8			
M ₂	<8			
S ₁	>2			
S ₂	1-2			
S ₃	0.5-1			
S ₄	<0.5			
V	NA			
H	NA			
G	NA			
Cover Codes: D >70% M 30-70% S 10-30% V 2-10% E <5% Emergent				
Other Species:				

Appendix 2 – 2a Growth Form Layer definitions, 1b Condition Scale and 1c Structural Classification

1a. Growth Form Layers (Perth Biodiversity Project Natural Area Initial Assessment Templates)

Adapted from Keighery 1994, McDonald et al. 1990 and Executive Steering Committee for Australian Vegetation Information 2003)

- Tree: woody plant with a single trunk and canopy, the canopy is less than or equal to $\frac{2}{3}$ of the height of the trunk, no lignotuber apparent
- Mallee: woody plant with many woody stems, canopy well above the base, lignotuber usually apparent, commonly of the genus *Eucalyptus*
- Shrub: woody plant with one or many woody stems, foliage all or part of the total height of the plant, includes grass trees (*Xanthorrhoea spp.*) and cycads (*Macrozamia spp.*)
- Herb: non-woody plant with stems, generally under 0.5 m tall and not a grass, sedge or rush
- Grass: non-woody plant that comes from the plant family Poaceae; all have inconspicuous individual flowers that are pollinated by wind; leaf sheath always split, ligule present, leaf usually flat, stem cross-section circular, evenly spaced internodes
- Sedge: non-woody, tufted or spreading plant that comes from the plant family Cyperaceae; most have inconspicuous flowers that are pollinated by wind; leaf sheath never split, usually no ligule, leaf not always flat, extended internode below inflorescence
- Rush: same as sedge but comes from the plant families Juncaceae, Restionaceae, Typhaceae or Xyridaceae; leaf sheath may be split in Restionaceae
- Climbers: plants that climb or scramble over other plants for support

2b. Classification System Used to Describe Vegetation Structure (Keighery 1994), as adapted from Muir (1977) and Aplin (1979)

Growth Form/ Height Class	Canopy Cover			
	100% to 70 %	70% to 30 %	30% to 10 %	10% to 2 %
Trees over 30 m	Tall Closed Forest	Tall Open Forest	Tall Woodland	Tall Open Woodland
Trees 10-30 m	Closed Forest	Open Forest	Woodland	Open Woodland
Trees under 10 m	Low Closed Forest	Low Open Forest	Low Woodland	Low Open Woodland
Mallee over 8 m (Tree Mallee)	Closed Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Mallee under 8 m (Shrub Mallee)	Closed Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub
Shrubs over 2 m	Closed Tall Scrub	Tall Open Scrub	Tall Shrubland	Tall Open Shrubland
Shrubs 1-2 m	Closed Heath	Open Heath	Shrubland	Open Shrubland
Shrubs under 1 m	Closed Low Heath	Open Low Heath	Low Shrubland	Very Open Shrubland
Grasses	Closed Grassland	Grassland	Open Grassland	Very Open Grassland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland

2c Condition Scale (Keighery, 1994)

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

Appendix 3 – Species names

Appendix 3a – Species difficult to identify

***Xanthorrhoea platyphylla* vs. *X. preissii*.** These two species are difficult to tell apart without examining the flowers (pers. comm. E. Sandiford). The phyllodes of *X. preissii* also appear narrower than *X. platyphylla* (Sandiford, 2012). No *Xanthorrhoea* plants were found flowering at the time of the survey and the phyllodes appear to be aligned with *X. platyphylla*. This species has been identified as *Xanthorrhoea platyphylla* in this study.

***Hibbertia amplexicaulis* vs *H. cunninghamii*.** In observing the differences between these species, E. Sandiford (2012) references J. Wheeler (pers comm.) that “these species are separated on leaf width though a whole range may be present within one site and the species separation may not be a valid one”. These species were recorded as *H. amplexicaulis*.

***Eucalyptus decipiens, adesmophloia* IG.** Previously known as *Eucalyptus decipiens* ssp. *chalara*, this species is now considered to be an intergrade between *Eucalyptus decipiens* and *Eucalyptus adesmophloia* and is now recorded as *Eucalyptus decipiens, adesmophloia* IG (pers. comm., M. French).

***Eucalyptus ecostata*.** Previously known as the mallee form of *Eucalyptus falcata*, this species has now been renamed *E. ecostata* and is distinguished from the related species *E. dorrieni* by its smooth buds and globular fruits (pers comm. M. French).

***Tetraria capillaris* vs *Tetraria* sp. Jarrah Forest (R. Davis 7391).** Reviewed voucher specimens of *Tetraria capillaris* at the Albany Herbarium have been changed to *Tetraria* sp. Jarrah Forest (R. Davis 7391). This species has been identified as *Tetraria* sp. Jarrah Forest (R. Davis 7391).

***Tetraria* sp. Jarrah Forest vs *Gahnia ancistrophylla*.** Reviewed voucher specimens of *Tetraria* sp. Jarrah Forest at the Albany Herbarium have been changed to *Gahnia ancistrophylla*. This species has been identified as *Gahnia ancistrophylla*.

Appendix 3b – Species list

Amaranthaceae

Ptilotus manglesii

Anarthriaceae

Anarthria gracilis

Anarthria laevis

Anarthria prolifera

Anarthria scabra

Lyginia barbata

Apiaceae

Xanthosia singuliflora

Araliaceae

Trachymene pilosa

Asparagaceae

**Asparagus asparagoides*

Chamaescilla corymbosa

Chamaexeros serra

Laxmannia minor

Laxmannia sessiliflora

Lomandra ?micrantha

Lomandra nigricans

Lomandra purpurea

Lomandra sericea

Thysanotus multiflorus

Thysanotus patersonii

Asteraceae

Argentipallium niveum

Asteridea athrixoides

**Arctotheca calendula*

Blennospora drummondii

**Carduus tenuiflorus*

Craspedia variabilis

Gnephosis drummondii

**Hypochaeris* sp.

Lagenophora huegelii

Millotia myosotidifolia

Myriocephalus pygmaeus

**Pseudognaphalium luteoalbum*

Pterochaeta paniculata

Quinetia urvillei

Rhodanthe heterantha

Trichocline spathulata

**Ursinia anthemoides*

Waitzia acuminata

Boryaceae

Borya sphaerocephala

Campanulaceae

Lobelia rhombifolia

Casuarinaceae

Allocasuarina campestris

Casuarinaceae (cont.)

Allocasuarina humilis

Allocasuarina microstachya

Allocasuarina thuyoides

Allocasuarina trichodon

Centrolepidaceae

Aphelia brizula

Centrolepis polygyna

Centrolepis pilosa

Celastraceae

Stackhousia monogyna

Colchicaceae

Burchardia congesta

Burchardia multiflora

Crassulaceae

Crassula decumbens

Crassula colorata var. *colorata*

Cyperaceae

Baumea juncea

Cyathochaeta avenacea

**Cyperus tenellus*

Gahnia ancistrophylla

**Juncus bufonius*

Lepidosperma sp. 1

Lepidosperma sp. 2

Lepidosperma sp. 3

Mesomelaena stygia

Schoenus breviculmis

Schoenus brevisetis

Schoenus caespititius

Schoenus nanus

Schoenus obtusifolius

Tricostularia sp.

Tetraria octandra

Tetraria sp. Jarrah Forest

Cupressaceae

Callitris pyramidalis

Dasyopogonaceae

Dasyopogon bromeliifolius

Dilleniaceae

Hibbertia amplexicaulis

Hibbertia hemigonsta

Hibbertia inconspicua

Hibbertia lineata

Hibbertia microphylla

Droseraceae

Drosera androsacea

Drosera erythorhiza

Drosera glanduligera

Appendix 3b – Species list continued

Droseraceae (cont.)

Drosera menziesii

Drosera pallida

Elaeocarpaceae

Platytheca gallioides

Tetratheca affinis

Ericaceae

Andersonia caerulea

Astroloma epacridis

Astroloma pallidum

Brachyloma baxteri

Leucopogon alternifolius P3

Leucopogon assimilis

Leucopogon corynocarpus

Leucopogon elegans ssp. *elegans*

Leucopogon ?hirsutus

Leucopogon oxycedrus

Leucopogon sp.

Leucopogon sp. *Coujinup*

Lysinema ciliatum

Euphorbiaceae

Stachystemon virgatus

Fabaceae

Acacia biflora

Acacia crispula

Acacia lasiocarpa var. *sedifolia*

Acacia leioderma

Acacia myrtifolia

Acacia pycnocephala

Acacia subcaerulea

Acacia saligna

Acacia triptycha

Acacia varia

Bossiaea ornata

Bossiaea rufa

Chorizema aciculare

Daviesia dilatata

Daviesia horrida

Daviesia preissii

Hovea chorizemifolia

Hovea pungens

Gastrolobium spinosum

Gastrolobium velutinum

Gompholobium capitatum

Gompholobium confertum

Gompholobium knightianum

Gompholobium marginatum

Gompholobium marginatum

Gompholobium scabrum

Fabaceae (cont.)

Hovea pungens

Hovea trisperma

Isotropis cuneifolia

Kennedia coccinea

Kennedia prostrata

Jacksonia capitata

Jacksonia spinose

Pultenaea strobilifera

Geraniaceae

Geranium solanderi

**Pelargonium capitatum*

Pelargonium harvlasae

Goodeniaceae

Dampiera alata

Dampiera pedunculata

Dampiera juncea

Dampiera sacculata

Cooperhooikia polygalacea

Goodenia concinna

Goodenia laevis

Lechenaultia formosa

Scaevola calliptera

Velleia trinervis

Haemodoraceae

Conostylis aculeata

Conostylis setigera

Haemodorum discolour

Haemodorum simplex

Haemodorum spicatum

Hemerocallidaceae

Agrostocrinum scabrum

Dianella revolute

Stypandra glauca

Tricoryne elatior

Hypoxidaceae

Pauridia occidentalis var. *quadriloba*

Iridaceae

Orthrosanthus muelleri P4

Patersonia occidentalis

Patersonia limbata

**Romulea rosea*

Lamiaceae

Hemiandra pungens

Prostanthera canaliculata

Lauraceae

Cassytha flava

Appendix 3b – Species list continued

Loganiaceae*Logania serpyllifolia***Loranthaceae***Nuytsia floribunda***Myrtaceae***Agonis theiformis**Astartea glomerulosa**Beaufortia anisandra**Beaufortia empetrifolia**Calothamnus affinis**Calothamnus quadrifidus**Calothamnus sanguineus**Calytrix flavescens**Calytrix leschenaultia**Calytrix tetragona**Corymbia calophylla**Darwinia vestita**Eucalyptus decipiens, adesmophloia* IG*Eucalyptus ecostata**Eucalyptus hebetifolia**Eucalyptus incrassata**Eucalyptus marginata**Eucalyptus occidentalis**Eucalyptus pachyloma**Eucalyptus pleurocarpa**Eucalyptus thamnoides**Eucalyptus uninata**Eucalyptus wandoo**Eucalyptus xanthonema* ssp. *apposite**Hypocalymma angustifolium**Hypocalymma asperum**Kunzea preissiana**Kunzea recurva**Melaleuca blaeriifolia**Melaleuca bracteosa**Melaleuca carrii**Melaleuca glaberrima**Melaleuca pentagona* ssp. *pentagona**Melaleuca spathulata**Melaleuca suberosa**Melaleuca subtrigona**Melaleuca thymoides**Melaleuca undulata**Melaleuca violacea**Taxandria parviceps**Taxandria spathulata**Regelia inops**Verticordia endlicheriana***Myrtaceae (cont.)***Verticordia habrantha**Verticordia plumosa***Orobanchaceae****Parentucellia latifolia***Orchidaceae***Caladenia barbarossa**Caladenia flava**Caladenia ?herberleana**Caladenia latifolia**Caladenia* sp.*Cryptostylis ovata***Disa bracteata**Diuris corymbosa**Elythranthera brunonis**Elythranthera emarginata**Eriochilus* sp.*Leporella fimbriata**Lyperanthus serratus**Microtis* sp.*Praecoxanthus aphyllus**Pterostylis recurva**Pterostylis vittata**Pyrorchis nigricans**Thelymitra antennifera**Thelymitra ?benthamiana**Thelymitra crinita**Thelymitra villosa**Tripterococcus brunonis***Pittosporaceae***Billardiera fusiformis**Billardiera variifolia**Marianthus erubescens***Poaceae****Aira* sp.*Amphipogon* sp.*Amphipogon turbinatus**Austrostipa elegansissima**Austrostipa hemipogon**Austrostipa mollis**Austrostipa stricta***Avena* sp.**Briza minor**?*Dactylis glomerata***Lagarus ovatus**Microlaena stipoides**Neurachne alopecuroidea**Rytidosperma setaceum*

Appendix 3b – Species list continued

Poaceae (cont.)

Spartochloa scirpoidea

**Vulpia* sp.

Phyllanthaceae

Phyllanthus calycinus

Polygonaceae

Muehlenbeckia adpressa

Proteaceae

Adenanthos cuneatus

Banksia armata

Banksia attenuata

Banksia brunnea

Banksia fraseri

Banksia gardneri

Banksia grandis

Banksia mucronulata

Banksia porrecta

Banksia pteridifolia

Banksia sessilis

Banksia sphaerocarpa var. *sphaerocarpa*

Franklandia fucifolia

Grevillea pulchella

Hakea corymbosa

Hakea cucullata

Hakea lasiocarpa P3

Hakea laurina

Hakea lissocarpa

Hakea marginata

Hakea nitida

Hakea pandanicarpa

Hakea prostrata

Hakea ruscifolia

Hakea sulcata

Hakea trifurcata

Isopogon buxifolius

Isopogon formosus

Isopogon longifolius

Isopogon teretifolius ssp. *petrophiloides*

Lambertia inermis

Persoonia striata

Petrophile longifolia

Petrophile media

Petrophile rigida

Petrophile serruriae

Petrophile squamata

Stirlingia latifolia

Synaphea preissii P3

Pteridaceae

Cheilanthes austrotenuifolia

Restionaceae

Chordifex sphaecelatus

Desmocladus fasciculatus

Desmocladus flexuosus

Harperia confertospicata

Harperia lateriflora

Hypolaena exsulca

Hypolaena fastigiata

?*Leptocarpus laxis*

Lepyrodia drummoniana

Lyginia barbata

Mesomylaena stygia

Rhamnaceae

Cryptandra arbutiflora var. *arbutiflora*

Cryptandra leucopogon

Trymalium ledifolium

Rubiaceae

Opercularia vaginata

Rutaceae

Boronia crassifolia

Boronia spathulata

Diplolaena microcephala

Santalaceae

Choretrum glomeratum

Exocarpos sparteus

Sapindaceae

Dodonaea amblyophylla

Stylidiaceae

Levenhookia pusilla

Stylidium lepidum P3

Stylidium repens

Stylidium schoenoides

Stylidium scandens

Stylidium tenue

Thymelaceae

Pimelea imbricata

Xanthorrhoeaceae

Xanthorrhoea platyphylla

Appendix 4: Summary of site data

Following are descriptions of the vegetation units determined from vegetation associations described in relevé or site data (floristics summary, Appendix 6).

1 *Eucalyptus wandoo* Granite Open Woodland/*Eucalyptus occidentalis* Low Open Woodland (Sites 5, 35, 36)

Description

Eucalyptus wandoo Granite Open Woodland/*Eucalyptus occidentalis* Low Open Woodland was recorded in Remnant 1 on the edge of or below a granite rock outcrop, mid to upper landscape on granitic loam to lateritic gravelly loam. Dominance of *Eucalyptus wandoo* (wandoo) is more common on gravelly loam (R. 36) and *Eucalyptus occidentalis* (flat-topped yate) becomes dominant as low open woodland on granitic loam where wandoo tends to drop out (Site 5). Traversing downslope on the gravelly loam, flat-topped yate drops out, grading to wandoo woodland (Site 35).

Commonly dominant species in the very open shrubland stratum are *Hakea lissocarpa* and *Acacia triptycha*. Other common species in this stratum include *Acacia lasiocarpa* var. *sedifolia* and *Astroloma epacridis*. Common species in the sedgeland stratum include *Gahnia ancistrophylla*, *Desmocladius flexuosus* and *Harperia lateriflora*. A very open herbland stratum is variable in dominance, with *Chamaescilla corymbosa*, *Dianella revoluta* and *Borya sphaerocephala* all represented.

Comments

This unit has affinity with Unit 8, having a common overstorey dominant wandoo. However, the different geological landscape brings with it a suite of different understorey species. For example, Unit 8 has associated mallees such as *Eucalyptus hebetifolia* and *Eucalyptus pachyloma*, and tall shrub to small tree *Allocasuarina trichodon* that are were not recorded in this unit. Due to the low sampling rate, further sampling on similar soil types and landscapes would help to further define this unit.

Floristic Summary

Lifeform	%cover	Species
Trees 10-30m	2-10	<i>Eucalyptus wandoo</i>
Trees <10m	2-10	<i>Eucalyptus occidentalis</i>
Mallees <8m	2-10	<i>Eucalyptus uncinata</i>
Shrubs 0-1m	2-10	<i>Hakea lissocarpa</i> , <i>Acacia triptycha</i> , <i>Dodonaea amblyophylla</i> , <i>Petrophile rigida</i> , <i>Astroloma epacridis</i> , <i>Hibbertia hemignosta</i> , <i>Phyllanthus calycinus</i> , <i>Acacia lasiocarpa</i> var. <i>sedifolia</i> , <i>Cryptandra arbutiflora</i> var. <i>arbutiflora</i>
Sedges	30-70	<i>Gahnia trifida</i> , <i>Desmocladius flexuosus</i> , <i>Anarthria laevis</i> , <i>Harperia lateriflora</i> , <i>Lepidosperma</i> sp. 1, <i>Mesomelaena stygia</i> , <i>Tetraria</i> sp. Jarrah Forest
Herbs	2-10	<i>Chamaescilla corymbosa</i> , <i>Opercularia vaginata</i> , <i>Asteridea athrixoides</i> , <i>Velleia trinervis</i> , <i>Pauridia occidentalis</i> var. <i>quadriloba</i> , <i>Drosera pallida</i> , <i>Geranium solanderi</i> , <i>Craspedia variabilis</i> , <i>Quinetia urvillei</i> , <i>Millotia myosotidifolia</i> , <i>Haemodorum discolor</i> , <i>Ptilotus manglesii</i> , <i>Dianella revoluta</i> , <i>Borya sphaerocephala</i> , <i>Laxmannia sessiliflora</i> , <i>Lyperanthus serratus</i>
Grasses	2-10	<i>Amphipogon turbinatus</i> , <i>Neurachne alopecuroidea</i> , <i>Austrostipa mollis</i> , <i>Rytidosperma setaceum</i> , <i>Austrostipa</i> ? <i>scabra</i>

Key identifying Features

- *Eucalyptus wandoo* and/or *Eucalyptus occidentalis* woodland to open low woodland upper stratum
- Occurs on granite loam or lateritic gravelly granitic loam mid to upper landscape
- Common species in the open to very open shrubland stratum include *Hakea lissocarpha* and *Astroloma epacridis*
- Common sedgeland to open sedgeland species include *Anarthria laevis*, *Gahnia ancistrophylla* and *Desmocladius flexuosus*
- Common open herbland species is *Opercularia vaginata*
- Common open grassland to emergent grassland species include *Neurachne alopecuroidea*, *Austrostipa mollis* and *Amphipogon turbinatus*.

Conservation species: None recorded

Unit 1: *Eucalyptus wandoo* Open Woodland/*Eucalyptus occidentalis* Low Open Woodland



Site 6



Site 35



Site 36

2 Hypocalymma angustifolium Shrubland/Spartochloa scirpoidea Grassland (Sites 3, 6, 37)

Description

Hypocalymma angustifolium Shrubland/*Spartochloa scirpoidea* Grassland was recorded on/near a ridge, growing high in the landscape in a poorly drained environment, amongst a granite rock outcrop on orange/brown loam in Remnant 1. *Acacia lasiocarpa* var. *sedifolia* is sub-dominant shrubland species, with or without *Dodonaea amblyocarpa*. Open to emergent sedgeland species are variable, with *Anarthria scabra* commonly dominant. The very open herbland stratum is variable in composition – commonly dominated by *Stypandra glauca*, with or without *Borya sphaerocephala* co-dominant. The grassland stratum is dominated by *Spartochloa scirpoides* with subdominants *Austrostipa mollis* and *Rytidosperma setaceum*.

Comment

This unit has affinities with Unit 3: both units are associated with granite rock outcrops and occur close to each other. Species common to both units are *Borya sphaerocephala* and *Stypandra glauca*. Key differences are that this unit appears to be found in association with gaps between rocks, whereas Unit 3 tends to occur on shallow soils overlying granite sheet rock.

Floristic Summary

Lifeform	%cover	Species
Shrubs <1m	10-30	<i>Hypocalymma angustifolium</i> , <i>Acacia lasiocarpa</i> var. <i>sedifolia</i> , <i>Dodonaea amblyocarpa</i> , <i>Acacia triptycha</i> , <i>Prostanthera canaliculata</i>
Sedges/rushes	30-70	<i>Anarthria scabra</i> , <i>Desmocladius flexuosus</i> , <i>Mesomelaena stygia</i> , <i>Tetraria</i> sp. Jarrah Forest (R. Davies 7391)
Herbs	2-10	<i>Borya sphaerocephala</i> , <i>Stypandra glauca</i> , <i>Chamaescilla corymbosa</i> , <i>Diuris corymbosa</i> , <i>Crassula decumbens</i> , <i>Agrostrocrinum scabrum</i> , <i>Dampiera juncea</i> , <i>Haemodorum discolor</i> , <i>Drosera pallida</i> , <i>Geranium solanderi</i> , <i>Opercularia vaginata</i> , <i>Velleia trinervis</i> , <i>Caladenia flava</i> , <i>Cheilanthes austrotenuifolia</i> , <i>Muehlenbeckia adpressa</i>
Grasses	30-70	<i>Spartochloa scirpoides</i> , <i>Rytidosperma setaceum</i> , <i>Austrostipa mollis</i> , <i>Austrostipa ?scabra</i>

Key identifying features:

- Occurs in poorly drained environment among granite rocks on red/brown loam soil
- *Hypocalymma angustifolium* commonly present in shrubland stratum
- *Spartochloa scirpoides* commonly dominant grassland species
- Herbs variable with *Stypandra glauca* and *Borya sphaerocephala* commonly dominant.

Conservation species: None recorded

Unit 2: Granite *Hypocalymma angustifolium* Shrubland/*Spartochloa scirpoidea* Grassland



Site 6



Site 37

3 *Borya sphaerocephala* Herbland/*Neurachne alopecuroidea* Grassland**(Sites 2, 38)****Description**

Borya sphaerocephala Herbland/*Neurachne alopecuroidea* Grassland was recorded on shallow to skeletal loamy soils on a granite rock outcrop in the upper landscape. This unit was recorded with an *Astroloma epacridis* emergent low shrubland stratum in both relevés. Common dominants in the open to emergent sedge/land stratum are *Desmocladius flexuosus* and *Anarthria laevis*. Common herbland species include *Stypandra glauca* and grassland species *Austrostipa ?scabra*.

Comment

The species composition of sedge, herb and grass strata appear to be influenced by the variable soil depths that are likely to occur within the area defined under this unit. This unit has affinities with Unit 2 which also is associated with granite rock outcrops, and also has *Borya sphaerocephala* and *Stypandra glauca* commonly recorded on shallow soils. However, Unit 2 differs from this unit – where key species such as *Spartochloa scirpoides* and *Hypocalymma angustifolium* appear to be associated with soil located between cracks in rocks and were not recorded in this unit. Due to the low sampling rate, further sampling on similar soil types and landscapes would help to further define this unit.

Floristic summary

Lifeform	%cover	Species
Shrubs <0.5m	<2e	<i>Astroloma epacridis</i>
Sedges/rushes	<2e-30	<i>Desmocladius flexuosus</i> , <i>Anarthria laevis</i> , <i>Anarthria scabra</i>
Herbs	30-70	<i>Borya sphaerocephala</i> , <i>Stypandra glauca</i> , <i>Drosera pallida</i> , <i>Dampiera sacculata</i> , <i>Opercularia vaginata</i>
Grasses	2-70	<i>Neurachne alopecuroidea</i> , <i>Rytidosperma setaceum</i> , <i>Austrostipa mollis</i> , <i>Austrostipa ?scabra</i> , <i>Amphipogon turbinatus</i>

Key identifying features:

- Occurs on shallow/skeletal soils on rock outcrops
- Herbland and grassland strata present with *Borya sphaerocephala* and *Neurachne alopecuroidea* likely to be dominant respectively
- *Astroloma epacridis* and *Stypandra glauca* common shrub and herb species respectively

Conservation species: None recorded



Site 2



Site 38

4 *Eucalyptus pleurocarpa* Granite Very Open Mallee

(Sites 1, 4)

Description

Eucalyptus pleurocarpa Granite Very Open Mallee was recorded in Remnant 1 in the mid-upper landscape in association with what appears to be deeper soils amongst a granite outcrop. It occurs as part of a transitioning continuum of granite outcrop below the ridge where the percent cover of rock reduces from >50% to 20-50%. *Eucalyptus pleurocarpa* very open mallee stratum was recorded over an open shrubland with variable dominant species including *Acacia triptycha* and *Calothamnus quadrifidus*. The low shrubland stratum is also variable, with dominance being recorded as *Petrophile rigida* or mixed species. Common shrub species include *Hypocalymma angustifolium*, *Prostanthera canaliculata*, *Hakea lissocarpha*, *Phyllanthus calycinus* and *Hibbertia hemignosta*. The open sedgeland variable dominants include *Tetraria* sp. Jarrah Forest and *Desmocladius flexuosus*. Open herbland stratum also features variable dominants which may include *Opercularia vaginata* and *Stypandra glauca*. *Neurachne alopecuroidea* is dominant in the emergent very open grassland stratum. Common sedge species is *Gahnia ancistrophylla* and common grass species are *Austrostipa mollis* and *Amphipogon* sp.

Comment

This unit is located on the catena between Unit 1 which tends to occur where rock cover is below 20%, and units higher on the slope/ridge (Units 2 and 3). It therefore has affinities with all other granite outcrop units but most with Unit 1 which has less rock exposed than the other granite outcrop-associated units. Rapid surveys showed that *Eucalyptus pachyloma* and *Eucalyptus decipiens*, *adesmophloia* IG may also be represented in this unit in the mallee stratum, possibly occurring on gravelly loam also.

Floristic Summary

Lifeform	%cover	Species
Mallees <8 m	2-10	<i>Eucalyptus pleurocarpa</i> , <i>Eucalyptus uncinata</i>
Shrubs 1-2m	10-30	<i>Acacia triptycha</i> , <i>Calothamnus quadrifidus</i>
Shrubs 0.5-1m	10-30	<i>Hypocalymma angustifolium</i> , <i>Astroloma epacridis</i> , <i>Hakea lissocarpha</i> , <i>Dodonaea amblyophylla</i> , <i>Petrophile rigida</i> , <i>Allocasuarina humilis</i> , <i>Acacia saligna</i>
Shrubs <0.5m	2-10	<i>Hibbertia hemignosta</i> , <i>Phyllanthus calycinus</i> , <i>Dampiera sacculata</i> , <i>Hovea pungens</i> , <i>Dampiera juncea</i> , <i>Prostanthera canaliculata</i> , <i>Chorizema aciculare</i> , <i>Allocasuarina thuyoides</i>
Sedges	2-10	<i>Desmocladius flexuosus</i> , <i>Gahnia ancistrophylla</i> , <i>Mesomelaena stygia</i> , <i>Anarthria scabra</i> , <i>Tetraria</i> sp. Jarrah Forest, <i>Anarthria laevis</i> , <i>Tetraria</i> sp. Jarrah Forest
Herbs	2-10	<i>Opercularia vaginata</i> , <i>Chamaescilla corymbosa</i> , <i>Drosera pallida</i> , <i>Haemodorum discolor</i> , <i>Stypandra glauca</i> , <i>Diuris corymbosa</i> , <i>Agrostrocrinum scabrum</i> , <i>Burchardia congesta</i> , <i>Lomandra sericea</i> , <i>Pellargonium harvlasae</i> , unidentified twiner species
Grasses	2-10	<i>Austrostipa ?scabra</i> , <i>Austrostipa mollis</i> , <i>Amphipogon</i> sp., <i>Neurachne alopecuroidea</i>

Key identifying Features

- Commonly found on granite rock outcrop cover of 20-50%
- Very open *Eucalyptus pleurocarpa* mallee stratum
- Variable, diverse shrubland to low shrubland strata with *Acacia triptycha* likely to be present
- Diverse open herbland stratum with *Opercularia vaginata* and *Stypandra glauca* likely to be present

Conservation species: None recorded

Unit 4: *Eucalypus pleurocarpa* Granite Very Open Mallee



Site 1



Site 4

5 *Eucalyptus occidentalis* Low Woodland and/or Very Open Mixed Mallee Heath (Sites 14, 15, 16, 18)

Description

Eucalyptus occidentalis Low Woodland and/or Mixed Very Open Mallee Heath was recorded in Remnant 4 on laterite geology on loam to clay loam soils, with or without gravel on low/flat poorly drained sites.

Eucalyptus occidentalis occurs as low woodland in isolated pockets amongst variably dominant mallees including *Eucalyptus incrassata* and *Eucalyptus pleurocarpa*. *Taxandria spathulata* is commonly dominant in the open to closed heath understorey stratum that is typical of this unit.

The tall open shrubland stratum may be present, with mixed dominance. Common species in this stratum are *Hakea cucculata*, *Lambertia inermis* and *Hakea lasiocarpa* P3. Other common shrubs in this unit include *Kunzea recurva*, *Melaleuca violacea*, and *Gastrolobium spinosum*. The sedgeland to very open sedgeland stratum most commonly dominant species is *Harperia lateriflora*. Common herbs in the emergent to very open herbland stratum are *Opercularia vaginata* and *Cyathochaeta avenacea*. The emergent to very open grassland stratum has variable dominant species, including *Neurachne alopecuroidea* and *Rytidosperma setaceum*.

Floristic Summary

Lifeform	%cover	Species
Trees <10m	10-30	<i>Eucalyptus occidentalis</i> , <i>Nuytsia floribunda</i>
Mallee <8m	2-30	<i>Eucalyptus incrassata</i> , <i>Eucalyptus pleurocarpa</i> , <i>Eucalyptus uncinata</i>
Shrubs >2m	<2e-10	<i>Hakea lasiocarpa</i> P3, <i>Hakea cucculata</i> , <i>Lambertia inermis</i>
Shrubs 1-2m	<2e-100	<i>Taxandria spathulata</i> , <i>Kunzea recurva</i>
Shrubs 0.5-1m	2-70	<i>Melaleuca suberosa</i> , <i>Gastrolobium spinosum</i> , <i>Allocasuarina humilis</i> , <i>Beaufortia anisandra</i> , <i>Melaleuca violacea</i> , <i>Calothamnus affinis</i> , <i>Banksia mucronulata</i> , <i>Gastrolobium velutinum</i> , <i>Leucopogon assimilis</i> , <i>Astartea glomerulosa</i> , <i>Leucopogon alternifolius</i> P3, <i>Melaleuca carrii</i> , <i>Xanthorrhoea platyphylla</i> , <i>Stirlingia latifolia</i> , <i>Isopogon buxifolius</i> , <i>Melaleuca spathulata</i>
Shrubs <0.5m	<2e-10	<i>Melaleuca carrii</i> , <i>Verticordia plumosa</i> , <i>Hovea pungens</i> , <i>Melaleuca spathulata</i> , <i>Hibbertia hemignosta</i> , <i>Hibbertia microphylla</i> , <i>Jacksonia capitata</i> , <i>Leucopogon elegans</i> ssp. <i>elegans</i> , <i>Daviesia dilatata</i> , <i>Hakea marginata</i> , <i>Banksia brunnea</i> , <i>Synaphea polymorpha</i> , <i>Leucopogon ?hirsutus</i> , <i>Lysinema ciliatum</i>
Sedges	2-30	<i>Gahnia ancistrophylla</i> , <i>Lepidosperma</i> sp. 1, <i>Tricostularia</i> sp., <i>Tetraria</i> sp. Jarrah Forest, <i>Harperia lateriflora</i> , <i>Desmocladus flexuosus</i> , <i>Mesomelaena stygia</i>
Herbs	<2e-70	<i>Cyathochaeta avenacea</i> , <i>Opercularia vaginata</i> , <i>Drosera pallida</i> , <i>Elythranthera brunonis</i> , <i>Caladenia barbarossa</i> , <i>Velleia trinervis</i> , <i>Caladenia flava</i> , <i>Microtis</i> sp., <i>Chamaescilla corymbosa</i> , <i>Lomandra effusa</i> , <i>Conostylis setigera</i> , <i>Haemodorum discolor</i> , <i>Cassytha flava</i> , <i>Dampiera alata</i> , <i>Dampiera pedunculata</i>
Grasses	<2e-10	<i>Neurachne alopecuroidea</i> , <i>Rytidosperma setaceum</i> , <i>Amphipogon</i> sp., <i>Austrostipa</i> sp.

Key identifying Features

- *Eucalyptus occidentalis* occurs as a low woodland in isolated pockets amongst the mixed very open mallee heath
- *Taxandria spathulata* is dominant in the commonly open to closed heath stratum
- Grows on flats/poorly drained sites on loam to clay loam soils.

Conservation species: *Leucopogon alternifolius* P3, *Hakea lasiocarpa* P3.

Unit 5: *Eucalyptus occidentalis* Low Woodland and/or Very Open Mixed Mallee Heath



Site 14



Site 15



Site 16



Site 18

6 Mixed Laterite Mallee

(Sites 29, 41, 44)

Description

Mixed Laterite Mallee was recorded in Remnant 5 (Kalgan Plains Reserve) on laterite/Pallinup Siltstone geology on well drained gravelly sand and gravelly loam soils. Dominant mallee species are variable and common species include *Eucalyptus pleurocarpa*, *Eucalyptus pachyloma* and *Eucalyptus incrassata*. An emergent to tall open shrubland may be present. Commonly dominant in the shrubland to open heath stratum is *Taxandria spathulata*. *Acacia triphycha* is recorded at all sites, +/- dominant. Shrubs recorded at least once as dominant in the low shrubland stratum, include *Petrophile rigida*, *Leucopogon* sp. Coujinup and *Melaleuca carrii*. The sedgeland to open sedgeland stratum is commonly dominated by *Harperia lateriflora*. The emergent to very open herbland stratum is dominated by *Opercularia vaginata*, and with *Conostylis setigera* commonly sub-dominant. The very open grassland stratum is commonly dominated by *Rytidosperma setaceum* and *Neurachne alopecuroidea*, with *Amphipogon* sp. subdominant.

Comment

This unit is distinguished from other mallee units in this study by its well drained gravelly sand to loamy gravel soil. It has overlap of species with adjoining units including similar mallees to Units 5 and 7, and dominance of the shrub *Taxandria spathulata* in Unit 5 and common ground layer species with including *Harperia lateriflora*, *Opercularia vaginata*, *Neurachne alopecuroidea* and *Rytidosperma setaceum*.

Floristic Summary

Lifeform	%cover	Species
Mallee <8m	2-70	<i>Eucalyptus pachyloma</i> , <i>Eucalyptus incrassata</i> , <i>Eucalyptus pleurocarpa</i> , <i>Eucalyptus xanthonema</i> ssp. <i>apposite</i>
Shrubs >2m	2-10	<i>Allocasuarina trichodon</i> , <i>Hakea pandanocarpa</i>
Shrubs 1-2m	10-70	<i>Taxandria spathulata</i> , <i>Acacia triptycha</i> , <i>Xanthorrhoea platyphylla</i> , <i>Melaleuca glaberrima</i> , <i>Allocasuarina campestris</i>
Shrubs 0.5-1m	2-10	<i>Kunzea preissiana</i> , <i>Trymalium ledifolium</i> , <i>Beaufortia anisandra</i> , <i>Gastrolobium spinosum</i>
Shrubs <0.5m	2-30	<i>Leucopogon</i> sp. Coujinup, <i>Petrophile rigida</i> , <i>Melaleuca carrii</i> , <i>Allocasuarina microstachys</i> , <i>Hibbertia microphylla</i> , <i>Acacia crispula</i> , <i>Calytrix tetragona</i> , <i>Jacksonia capitata</i> , <i>Acacia pycnocephala</i> , <i>Hibbertia hemignosta</i> , <i>Melaleuca spathulata</i> , <i>Verticordia habrantha</i> , <i>Acacia leioderma</i> , <i>Leucopogon</i> sp., <i>Hypocalymma asperum</i>
Sedges	10-70	<i>Tetraria</i> sp. Jarrah Forest, <i>Desmocladius flexuosus</i> , <i>Harperia lateriflora</i> , <i>Schoenus ?brevisetis</i> , <i>Schoenus obtusifolius</i> , <i>Desmocladius flexuosus</i> , <i>Lepidosperma</i> sp. 2, <i>Harperia confertospicata</i> , <i>Mesomelaena stygia</i> , <i>Desmocladius fasciculatus</i> , <i>Gahnia ancistrophylla</i> , <i>Lepidosperma</i> sp. 1, <i>Tetraria</i> sp. Jarrah Forest
Herbs	<2e-30	<i>Opercularia vaginata</i> , <i>Stylidium tenue</i> , <i>Drosera menziesii</i> , <i>Argentipallidum niveum</i> , <i>Crassula colorata</i> var. <i>colorata</i> , <i>Dampiera juncea</i> , <i>Conostylis setigera</i> , <i>Burchardia congesta</i> , <i>Billariera variifolia</i> , <i>Gnephosis drummondii</i> , <i>Elythranthera brunonis</i> , <i>Trachymene pilosa</i> , <i>Haemodorum discolor</i> , <i>Dianella revoluta</i> , <i>Lomandra ?micrantha</i> , <i>Stylidium repens</i> , <i>Chamaexeros serra</i> , <i>Centrolepis pilosa</i>
Grasses	<2e-10	<i>Rytidosperma setaceum</i> , <i>Amphipogon</i> sp., <i>Neurachne alopecuroidea</i> , <i>Austrostipa hemipogon</i>

Key identifying Features

- Occurs on gravelly sand to loam soils on plains, with any combination of *Eucalyptus pleurocarpa*, *Eucalyptus pachyloma* and *Eucalyptus incrassata* present in the mallee to very open mallee stratum
- *Acacia triptycha* commonly present as emergent in the emergent to tall open shrubland or shrubland strata, commonly occurring with *Taxandria spathulata*
- Common sedge species is *Harperia lateriflora*
- Common herbs include *Opercularia vaginata* and *Conostylis setigera*
- Common grasses include *Neurachne alopecuroidea*, *Rytidosperma setaceum* and *Amphipogon* sp.

Conservation species: None recorded

Unit 6: Mixed Laterite Mallee



Site 29



Site 41



Site 44

7 Mixed Very Open Mallee/Proteaceous Low Heath

(Sites 13, 22, 23, 26, 30, 40)

Description

Mixed Very Open Mallee/Proteaceous Low Heath was recorded in Remnants 3 and 5 on flat to gently sloping plains on loam to clay soil, with or without gravel, and often with siltstone. The very open to emergent mallee stratum species include *Eucalyptus thamnoides*, *E. incrassata*, *E. pleurocarpa*, *E. xanthonema* ssp. *apposita* and *E. uncinata*, with variable dominance and *E. incrassata* most commonly recorded. The low heath to low shrubland stratum is commonly dominated by *Banksia mucronulata* and less commonly with *B. pteridifolia* co-dominant. Common species include *Melaleuca spathulata*, *Isopogon buxifolius*, *Astartea glomerulosa*, *Beaufortia empetrifolia*, *Daviesia dilatata*, and *Melaleuca suberosa*. An *Allocasuarina trichodon* tall open shrubland stratum and/or shrubland stratum featuring *Taxandria spathulata* *Acacia triptycha* may also be present but does not appear typical and may indicate species transition or overlap between neighbouring units. Common dominant species in the open sedgeland stratum is *Gahnia ancistrophylla* and common species is *Lepidosperma* sp. 1. *Opercularia vaginata* is commonly dominant in the very open herbland stratum. *Neurachne alopecuroidea* is commonly dominant and *Rytidosperma setaceum* common species in the very open grassland stratum. Drainage generally appears to be impeded as indicated by species such as *Melaleuca spathulata*, *Harperia lateriflora* and *Mesomelaena stygia*.

Comment

There are a number of overlaps/similar species to units that are located on either side of this unit – such as Units 6 and 8. This unit 8 has heavier soils with poorer drainage and Unit 6 which is sandier and therefore appears to have better drainage.

Floristic Summary

Lifeform	%cover	Species
Mallee <8m	<2-10	<i>Eucalyptus thamnoides</i> , <i>E. incrassata</i> , <i>E. pleurocarpa</i> , <i>E. xanthonema</i> ssp. <i>apposita</i> , <i>E. uncinata</i>
Shrubs>2m	0-10	<i>Allocasuarina trichodon</i>
Shrubs 1-2m	10-30	<i>Taxandria spathulata</i> , <i>Acacia triptycha</i>
Shrubs 0.5-1m	30-70	<i>Banksia mucronulata</i> , <i>Banksia pteridifolia</i> , <i>Petrophile rigida</i> , <i>Xanthorrhoea platyphylla</i> , <i>Melaleuca spathulata</i> , <i>Melaleuca carrii</i> , <i>Kunzea recurva</i> , <i>Melaleuca suberosa</i> , <i>Beaufortia anisandra</i> , <i>Calothamnus affinis</i> , <i>Petrophile squamata</i> , <i>Leucopogon</i> sp., <i>Leucopogon</i> sp. Coujinup, <i>Astartea glomerulosa</i> , <i>Isopogon buxifolius</i> , <i>Daviesia dilatata</i> , <i>Beaufortia empetrifolia</i> , <i>Agonis theiformis</i> , <i>Isopogon teretifolius</i> ssp. <i>petrophiloides</i> , <i>Melaleuca undulata</i> , <i>Darwinia vestita</i> , <i>Hakea prostrata</i> , <i>Astroloma pallidum</i>
Shrubs <0.5m	10-30	<i>Acacia lasiocarpa</i> var. <i>sedifolia</i> , <i>Astroloma epacridis</i> , <i>Chorizema aciculare</i> , <i>Melaleuca violacea</i> , <i>Allocasuarina microstachya</i> , <i>Hibbertia microphylla</i> , <i>Jacksonia capitata</i> , <i>Leucopogon elegans</i> ssp. <i>elegans</i> , <i>Gompholobium capitatum</i> , <i>Banksia brunnea</i> , <i>Calytrix leschenaultii</i> , <i>Verticordia endlicheriana</i> , <i>Hakea marginata</i> , <i>Acacia crispula</i> , <i>Verticordia habrantha</i> , <i>Banksia fraseri</i> , <i>Hovea trisperma</i> , <i>Brachyloma baxteri</i> , <i>Melaleuca subtrigona</i> , <i>Lechenaultia formosa</i> , <i>Synaphea ?preissii</i> P3, <i>Gompholobium marginatum</i> , <i>Cooperookia polygalacea</i>
Sedges	<2e-30	<i>Gahnia ancistrophylla</i> , <i>Anarthria laevis</i> , <i>Harperia lateriflora</i> , <i>Anarthria gracilis</i> , <i>Mesomelaena stygia</i> , <i>Schoenus breviculmis</i> , <i>Lepidosperma</i> sp. 1, <i>Tricostularia</i> sp., <i>Schoenus obtusifolius</i> , <i>Desmocladius fasciculatus</i> , <i>Schoenus brevisetis</i> , <i>Schoenus nanus</i> , <i>Lepyrodia drummondiana</i> , <i>Lepidosperma</i> sp. 3, <i>Lepyrodia drummondiana</i> , <i>Tetraria</i> sp. Jarrah Forest,
Herbs	2-10	<i>Opercularia vaginata</i> , <i>Velleia trinervis</i> , <i>Drosera pallida</i> , <i>Borya sphaerocephala</i> , <i>Caladenia flava</i> , <i>Lyperanthus serratus</i> , <i>Cyathochaeta avenacea</i> , <i>Dampiera alata</i> , <i>Conostylis setigera</i> , <i>Eriochilus</i> sp., <i>Lomandra ?micrantha</i> , <i>Stylidium repens</i> , <i>Dampiera pedunculata</i> , <i>Stylidium lepidum</i> P3, <i>Thelymitra crinita</i> , <i>Pterochaeta paniculata</i> , <i>Stackhousia monogyna</i> , <i>Argentipallidum niveum</i> , <i>Billardiera variifolia</i> ,

		<i>Chamaexeros serra</i> , <i>Lomandra nigricans</i> , <i>Drosera menziesii</i> , <i>Trichocline spathulata</i> , <i>Aphelia brizula</i> , <i>Centrolepis polygyna</i> , <i>Drosera glanduligera</i> , <i>Goodenia concinna</i> , <i>Marianthus erubescens</i>
Grasses	2-10	<i>Neurachne alopecuroidea</i> , <i>Austrostipa mollis</i> , <i>Rytidosperma setaceum</i> , <i>Amphipogon</i> sp., <i>Austrostipa hemipogon</i>

Key identifying Features

- Mallees occur as emergent to very open stratum, that may occur with a range of species including *Eucalyptus incrassata*, *E. thamnoides*, *E. uncinata*, *E. pleurocarpa* and *E. xanthonema* ssp. *apposita*
- Occurs on flat to gentle slopes on loam to gravelly clay with an open low heath stratum with *Banksia mucronulata* commonly present, +/- dominant.
- Highly diverse unit, particularly in the low shrub and herb strata.

Conservation species: *Stylidium lepidum* P3, *Synaphea preissii* P3

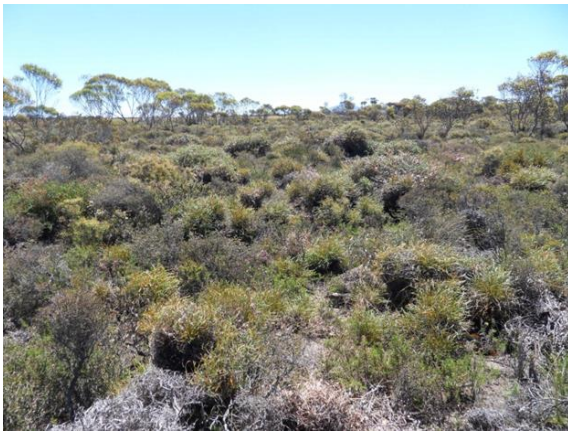
Unit 7: Mixed Very Open Mallee/Proteaceous Low Heath



Site 13



Site 22



Site 22



Site 23



Site 26



Site 40

8 Mixed Clay Open Low Heath with Emergent Mixed Mallee**(Sites 24, 25, 27)****Description**

Mixed Clay Open Low Heath with Emergent Mixed Mallee was recorded on clay to gravelly clay soils on flat to gently undulating plains. This unit has an emergent mallee stratum that may include *Eucalyptus incrassata*, *E. uncinata* and *E. thamnoides*. The low open heath stratum characteristically includes *Hakea marginata*, *Verticordia endlicheriana*, and *Melaleuca carrii* +/- dominant. *Petrophile rigida* is also commonly dominant but not present at all sites. *Harperia lateriflora*, *Opercularia vaginata*, *Neurachne alopecuroidea* and *Rytidosperma setaceum* are dominant and common open sedgeland, open herbland and open grassland species respectively. Other common species include *Kunzea recurva*, *Drosera menziesii* and *Drosera glanduligera*.

Comment

While there are a number of overlaps/similar species to other plains Units 6 and 7, this unit is most distinguished by the dominant stratum being open low heath which characteristically is <0.5m in height.

Floristic Summary

Lifeform	%cover	Species
Mallee <8m	<2e	<i>Eucalyptus incrassata</i> , <i>Eucalyptus thamnoides</i> , <i>Eucalyptus uncinata</i>
Shrubs <0.5m	30-70	<i>Verticordia endlicheriana</i> , <i>Melaleuca carrii</i> , <i>Allocasuarina microstachya</i> , <i>Jacksonia capitata</i> , <i>Kunzea recurva</i> , <i>Leucopogon elegans</i> ssp. <i>elegans</i> , <i>Calytrix leschenaultia</i> , <i>Astartea glomerulosa</i>
Sedges	10-30	<i>Harperia lateriflora</i> , <i>Mesomyllaena stygia</i> , <i>Lepidosperma</i> sp. 2, <i>Lepidosperma</i> sp. 1, <i>Tetraria</i> sp. Jarrah Forest
Herbs	10-30	<i>Opercularia vaginata</i> , <i>Borya sphaerocephala</i> , <i>Schoenus breviculmis</i> , <i>Thelymitra crinita</i> , <i>Pterochaeta paniculata</i> , <i>Stackhousia monogyna</i> , <i>Drosera menziesii</i> , <i>Aphelia brizula</i> , <i>Centrolepis polygyna</i> , <i>Drosera glanduligera</i> , <i>Thelymitra villosa</i> , <i>Tripterococcus brunonis</i> , <i>Cryptandra leucopogon</i>
Grasses	2-30	<i>Neurachne alopecuroidea</i> , <i>Amphipogon</i> sp.

Key identifying Features

- Grows on clay to gravelly clay soils on flat to gently undulating plains
- Has an emergent mallee stratum which may include any combination of *Eucalyptus incrassata*, *E. thamnoides*, and *E. uncinata*
- Has an open low heath stratum which characteristically includes *Verticordia endlicheriana*, *Melaleuca carrii* and *Hakea marginata*.
- Common dominant open sedgeland, open herbland, and open grassland species include *Harperia lateriflora*, *Opercularia vaginata* and *Neurachne alopecuroidea* respectively.

Conservation species: None recorded

Unit 8: Mixed Clay Open Low Heath**Site 24****Site 25****Site 27**

9 Allocasuarina campestris Shrubland**(Sites 28, 34, 42, 43)****Description**

Allocasuarina campestris Shrubland was recorded on gentle to moderately steep slopes, associated with mid to upper landscape Pallinup Siltstone rocky outcrops on clay loam to gravelly clay in Remnant 5. *Allocasuarina campestris* most commonly was recorded as shrubland stratum dominant, sometimes with other subdominants including *Allocasuarina trichodon*, *Acacia triptycha* and *Calothamnus quadrifidus*. A low shrubland stratum is also commonly present, where no species are commonly dominant. Common species in this stratum include *Melaleuca spathulata*, *Pimelea imbricata* and *Calytrix tetragona*. The sedge, herb and grass strata occur as emergent to very open sedgland, grassland and herbland. The most common and dominant species in these ground layer strata are *Lepidosperma* sp. 2, *Borya sphaerocephala* and *Neurachne alopecuroidea* respectively.

Comment

The density and composition of the shrub strata in this unit are influenced by the surface rock cover. Rock outcropping varies between 2-10% (e.g. Site 28) and greater than 50% (e.g. Site 42). The sites with less rock cover have recorded higher species diversity.

Floristic Summary

Lifeform	%cover	Species
Mallees <8m	<2e	<i>Eucalyptus pleurocarpa</i> , <i>Eucalyptus pachyloma</i>
Shrubs 1-2m	10-30	<i>Allocasuarina campestris</i> , <i>Acacia triptycha</i> , <i>Calothamnus quadrifidus</i> , <i>Allocasuarina trichodon</i>
Shrubs 0.5-1m	2-30	<i>Melaleuca spathulata</i> , <i>Hypocalymma angustifolium</i> , <i>Taxandria spathulata</i> , <i>Kunzea recurva</i> , <i>Beaufortia empetrifolia</i>
Shrubs <0.5m	10-30	<i>Melaleuca carrii</i> , <i>Hibbertia microphylla</i> , <i>Jacksonia capitata</i> , <i>Leucopogon elegans</i> ssp. <i>elegans</i> , <i>Verticordia endlicheriana</i> , <i>Leucopogon</i> sp. Coujinup, <i>Astartea glomerulosa</i> , <i>Calytrix tetragona</i> , <i>Pimelea imbricata</i> ,
Sedges	<2e-10	<i>Harperia lateriflora</i> , <i>Lepidosperma</i> sp. 2, <i>Schoenus brevisetis</i> ,
Herbs	<2e-10	<i>Opercularia vaginata</i> , <i>Borya sphaerocephala</i> , <i>Stypandra glauca</i> , <i>Caladenia flava</i> , <i>Elythranthera brunonis</i> , <i>Lomandra ?micrantha</i> , <i>Stylidium lepidum</i> P3, <i>Thelymitra crinita</i> , <i>Pterochaeta paniculata</i> , <i>Gnephosis drummondii</i> , <i>Stylidium tenue</i> , <i>Drosera glanduligera</i> , <i>Calendrinia calyptrata</i> , <i>Laxmannia minor</i>
Grasses	<2e-10	<i>Neurachne alopecuroidea</i> , <i>Amphipogon</i> sp., <i>Rytidosperma setaceum</i>

Key identifying Features

- Grows on slopes with Pallinup Siltstone outcropping which can vary from 2-50%
- *Allocasuarina campestris* is dominant shrubland to tall shrubland species
- Common species in the low shrubland stratum are *Calytrix tetragona*, *Melaleuca spathulata* and *Pimelea imbricata*
- May have emergent mallee stratum
- Commonly has sparse cover of sedges, herbs and grasses.

Conservation species: *Stylidium lepidum* P3

Unit 9: *Allocasuarina campestris* Shrubland



Site 28



Site 34



Site 42



Site 43

**10 Wandoo Siltstone Low Open Woodland/Mixed Mallee/*Allocasuarina trichodon* Tall Open Scrub
(Sites 31, 32)**

Description

Wandoo Siltstone Open Woodland/Mixed Mallee/*Allocasuarina trichodon* Tall Open Scrub is associated with mid-upper moderately steep landscapes on Pallinup siltstone outcrops and loam soils – recorded in Remnant 5. Common species in the very open mallee stratum are *Eucalyptus pachyloma* and *E. hebetifolia*. *Allocasuarina trichodon* may occur as an emergent to tall open scrub stratum. *Hypocalymma angustifolium* is commonly dominant emergent to very open shrubland species. *Shoenus nanus* is the only sedge recorded as an emergent stratum. The emergent herbland stratum is variable with common species including *Trachymene pilosa*, *Crassula colorata* var. *colorata* common. The mixed very open grassland stratum species may include *Neurachne alopecuroidea*, *Rytidosperma setaceum*, *Austrostipa hemipogon*.

Comment

This unit has affinities with Unit 9 in that it is associated with Pallinup siltstone rocky outcrops and differs in that this unit appears to have smaller exposed rocks or less sheet rock. It also has affinities with Unit 11 in its location – Unit 11 occurs on steep slopes just below rocky outcrops. Further study of this unit would help to define the attributes of this unit.

Floristic Summary

Lifeform	%cover	Species
Trees <10 m	2-10	<i>Eucalyptus wandoo</i>
Mallee <8m	<2e-10	<i>Eucalyptus pachyloma</i> , <i>E. hebetifolia</i>
Shrubs >2m	2-70	<i>Allocasuarina trichodon</i>
Shrubs 1-2m	0-<2e	<i>Taxandria spathulata</i> , <i>Xanthorrhoea platyphylla</i> , <i>Melaleuca blaeriifolia</i>
Shrubs 0.5-1m	<2e-10	<i>Hypocalymma angustifolium</i>
Shrubs <0.5m	<2e	<i>Platytheca gallioides</i> , <i>Hibbertia hemignosta</i>
Sedges	<2e	<i>Shoenus nanus</i>
Herbs	<2e	<i>Opercularia vaginata</i> , <i>Trachymene pilosa</i> , <i>Crassula colorata</i> var. <i>colorata</i> , <i>Calandrinia calyptrata</i> , <i>Levenhookia pusilla</i> , <i>Lomandra ?micrantha</i>
Grasses	2-10	<i>Neurachne alopecuroidea</i> , <i>Rytidosperma setaceum</i> , <i>Austrostipa hemipogon</i>

Key identifying Features

- Associated with loam soil and Pallinup siltstone outcrops but not exposed sheet rock on moderately steep mid-upper landscapes
- Wandoo usually occurs as a low open woodland stratum
- *Allocasuarina trichodon* and *Hypocalymma angustifolium* are typical dominant tall open shrubland to tall open scrub and low open shrubland species respectively.
- Sedge, herb and grass strata are emergent to very open

Conservation species: None recorded

Unit 10: Wandoo Siltstone Low Open Woodland/Mixed Mallee/*Allocasuarina trichodon* Tall Open Scrub**Site 31****Site 32**

11 Mixed Very Open Mallee/*Melaleuca pentagona* ssp. *pentagona* Siltstone Complex (Sites 33, 45)

Description

Mixed Very Open Mallee/*Melaleuca pentagona* ssp. *pentagona* Siltstone Complex was recorded on moderate to steep slopes below Pallinup siltstone rocky outcrops in Remnant 5. This unit tends to occur in small pockets and was recorded from two sites only. This unit is characterised by the presence of *Melaleuca pentagona* ssp. *pentagona* closed tall scrub to tall open scrub stratum. An open overstorey of *Eucalyptus wandoo* (wandoo) low open woodland may be present where wandoo occurs in adjacent vegetation such as Unit 10. A very open mallee stratum appears common, with *Eucalyptus thamnoides* or *Eucalyptus hebetifolia* being recorded at the two sites studied in this survey.

Sub-unit 11a (Site 33): Wandoo Low Open Woodland/*Eucalyptus hebetifolia* very open mallee/*Melaleuca pentagona* ssp. *pentagona* Tall Open Scrub. Other strata recorded include an emergent *Tetraria* sp. Jarrah Forest sedge stratum and mixed very open grassland including *Rytidosperma setaceum*, *Austrostipa elegantissima* and *Austrostipa hemipogon*.

Sub-unit 11b (Site 45): *Eucalyptus thamnoides* Very Open Mallee/*Melaleuca pentagona* ssp. *pentagona* Tall Closed Scrub with emergent *Acacia myrtifolia*

Sub-unit 11c (Rapid survey only and not included in data): *Allocasuarina trichodon* Low Open Forest/*Eucalyptus ecostata* very open mallee/*Melaleuca pentagona* ssp. *pentagona* Tall Open Scrub occurs as a small area adjacent to and below Sub-unit 11b associated with a gully on brown loam. This sub-unit displays a more diverse composition than the above sub-units where the following additional species were noted: *Nuytsia floribunda*, *Eucalyptus ecostata*, *Xanthorrhoea platyphylla*, *Lambertia inermis*, *Kunzea recurva*, *Acacia leioderma*, *Tetraria* sp. Jarrah Forest and *Cyathochaeta avenacea*.

Floristic Summary

Lifeform	%cover	Species
Trees <10 m	Nil-10	<i>Eucalyptus wandoo</i>
Mallee <8m	<2e-10	<i>Eucalyptus thamnoides</i> , <i>Eucalyptus hebetifolia</i>
Shrubs >2m	2-70	<i>Melaleuca pentagona</i> ssp. <i>pentagona</i>
Shrubs <0.5m	<2e	<i>Acacia myrtifolia</i>
Grasses	2-10	<i>Austrostipa hemipogon</i> , <i>Austrostipa elegantissima</i>

Key identifying features:

- Occurs below Pallinup siltstone rocky outcrops on moderate to steep slopes
- *Melaleuca pentagona* ssp. *pentagona* occurs as a tall closed scrub or tall open scrub species
- A very open mallee stratum that may include *Eucalyptus thamnoides* and/or *Eucalyptus hebetifolia*.

Conservation species: None recorded

Unit 11: Mixed Very Open Mallee/Melaleuca pentagona ssp. pentagona Siltstone Complex**Site 33****Site 45**

12 Jarrah Woodland**(Sites 19, 20, 21)****Description**

Jarrah Woodland occurs on sandy gravel on gently undulating plains, recorded at Twin Creeks Conservation Reserve (Remnant 1). *Corymbia calophylla* is sub-dominant to Jarrah (*Eucalyptus marginata*) in the woodland stratum. *Banksia sessilis* is dominant in the tall open shrubland to tall open scrub. *Agonis theiformis* is dominant in the often open heath stratum. *Hakea corymbosa* and *Petrophile serruriae* are commonly dominant in the low shrubland stratum. Commonly dominant sedge in the sedgeland to very open sedgeland stratum is *Tetraria octandra*. There are no common dominants in the mixed very open herbland stratum. No grassland stratum was recorded. Common species include *Xanthorrhoea platyphylla*, *Hibbertia hemignosta*, *Banksia fraseri*, *Brachyloma baxteri*, *Stirlingia latifolia*, *Bossiaea ornata*, *Gompholobium knightianum*, *Tetratheca affinis*, *Tetraria* sp. Jarrah Forest, *Lepidosperma* sp. 1, *Drosera pallida*, *Lyperanthus serratus*, and *Conostylis setigera*.

Comment

This unit has affinities with Unit 13 which occurs in similar landscapes but the topsoil is sandy rather than gravelly.

Floristic summary

Lifeform	%cover	Species
Trees 10-30m	10-30	<i>Eucalyptus marginata</i> , <i>Corymbia calophylla</i>
Shrubs >2m	2-70	<i>Banksia sessilis</i>
Shrubs 1-2m	10-70	<i>Allocasuarina humilis</i> , <i>Xanthorrhoea platyphylla</i> , <i>Agonis theiformis</i> , <i>Hakea corymbosa</i>
Shrubs 0.5-1m	2-30	<i>Leucopogon alternifolius</i> P3, <i>Kunzea recurva</i> , <i>Leucopogon hirsutus</i> , <i>Hakea ruscifolia</i> , <i>Petrophile serruriae</i> , <i>Pultenaea strobilifera</i> , <i>Melaleuca thymoides</i> , <i>Gompholobium confertum</i> , <i>Acacia varia</i>
Shrubs <0.5m	2-70	<i>Hibbertia hemignosta</i> , <i>Tetraria</i> sp. Jarrah Forest, <i>Gompholobium capitatum</i> , <i>Acacia crispula</i> , <i>Banksia fraseri</i> , <i>Hovea trisperma</i> , <i>Brachyloma baxteri</i> , <i>Stirlingia latifolia</i> , <i>Synaphea preissii</i> P3, <i>Bossiaea ornata</i> , <i>Banksia porrecta</i> , <i>Gompholobium knightianum</i> , <i>Tetratheca affinis</i> , <i>Boronia spathulata</i> , <i>Grevillea pulchella</i> , <i>Calothamnus sanguineus</i> , <i>Banksia gardneri</i> , <i>Persoonia striata</i> , <i>Nuytsia floribunda</i>
Sedges/rushes	2-70	<i>Mesomelaena stygia</i> , <i>Lepidosperma</i> sp. 1, <i>Desmocladius fasciculatus</i> , <i>Tetraria octandra</i> , <i>Chordifex sphaecelatus</i> , <i>Anarthria prolifera</i> , <i>Desmocladius flexuosus</i>
Herbs	<2e-10	<i>Chamaescilla corymbosa</i> , <i>Drosera pallida</i> , <i>Haemodorum discolor</i> , <i>Burchardia congesta</i> , <i>Lomandra sericea</i> , <i>Caladenia flava</i> , <i>Lyperanthus serratus</i> , <i>Conostylis setigera</i> , <i>Cassytha flava</i> , <i>Eriochilus</i> sp., <i>Stylidium tenue</i> , <i>Pterostylis vittata</i> , <i>Xanthosia singuliflora</i> , <i>Stylidium schoenoides</i> , <i>Synaphea preissii</i> P3

Key identifying features:

- Occurs on sandy gravels on gently undulating plains
- Jarrah is dominant in the woodland stratum
- *Banksia sessilis* is dominant in the tall shrubland to tall open scrub to tall open shrubland stratum
- Commonly dominant shrubs include *Agonis theiformis*, *Hakea corymbosa* and *Petrophile serruriae*.
- Commonly dominant sedgeland to very open sedgeland species is *Tetraria octandra*
- *Conostylis setigera* is common in the mixed very open herbland stratum
- No grassland stratum was recorded.

Conservation species: *Synaphea preissii* P3

Unit 12: Jarrah Woodland**Site 19****Site 20****Site 21**

13 Jarrah/Marri Woodland**(Sites 7, 8, 10, 11, 12)****Description**

Jarrah/Marri Woodland occurs on sandy soils on gently undulating plains with laterite geology, and was recorded in Remant 2 (Sites 7, 8, 10, 11) and Twin Creeks Conservation Reserve (Remnant 4, Site 12). Common strata in this unit include: *Agonis theiformis* shrubland, *Melaleuca thymoides* open low heath (Site 12) or mixed low shrubland (remainder), *Tetraria octandra* very open sedgeland, *Scaevola calliptera* open herbland, and mixed very open to open grassland. Common species include: *Hakea nitida*, *Acacia leioderma*, *Hibbertia amplexicaulis*, *Lepidosperma* sp. 1, *Chamaescilla corymbosa*, *Drosera pallida*, *Opercularia vaginata*, *Tetraria* sp. Jarrah Forest and *Austrostipa mollis*.

Comment

This unit has affinities with Unit 12 and is defined by having more sand loving species than gravel loving species. Site 12 is particularly diverse and in pristine condition. Unfortunately what appears to be *Phytophthora* Dieback occurs not far from this site and is a possible threat to this site.

Floristic summary

Lifeform	%cover	Species
Trees 10-30m	10-30	<i>Eucalyptus marginata</i> , <i>Corymbia calophylla</i>
Shrubs 1-2m	2-70	<i>Agonis theiformis</i> , <i>Hakea nitida</i> , <i>Acacia subcaerula</i>
Shrubs 0.5-1m	2-70	<i>Xanthorrhoea platyphylla</i> , <i>Agonis theiformis</i> , <i>Hakea corymbosa</i> , <i>Leucopogon alternifolius</i> P3, <i>Acacia leioderma</i> , <i>Melaleuca thymoides</i> , <i>Daviesia preissii</i> , <i>Isopogon formosus</i> , <i>Leucopogon oxycedrus</i>
Shrubs <0.5m	2-30	<i>Gompholobium capitatum</i> , <i>Acacia crispula</i> , <i>Hovea trisperma</i> , <i>Brachyloma baxteri</i> , <i>Stirlingia latifolia</i> , <i>Bossiaea ornata</i> , <i>Gompholobium knightianum</i> , <i>Tetratheca affinis</i> , <i>Boronia spathulata</i> , <i>Hibbertia amplexicaulis</i> , <i>Hibbertia inconspicua</i> , <i>Andersonia caerulea</i> , <i>Kennedia prostrata</i> , <i>Kennedia coccinea</i> , <i>Hovea chorizemifolia</i> , <i>Boronia crassifolia</i> , <i>Hibbertia lineata</i> , <i>Calytrix flavescens</i> , <i>Bossiaea rufa</i>
Sedges/rushes	2-70	<i>Harperia lateriflora</i> , <i>Tetraria</i> sp. Jarrah Forest, <i>Anarthria gracilis</i> , <i>Baumea juncea</i> , <i>Schoenus breviculmis</i> , <i>Lepidosperma</i> sp. 1, <i>Desmocladus fasciculatus</i> , <i>Tetraria octandra</i> , <i>Chordifex sphaecelatus</i> , <i>Anarthria prolifera</i> , <i>Hypolaena exsulca</i> , <i>Lyginia barbata</i> , <i>Schoenus caespititius</i>
Herbs	10-30	<i>Opercularia vaginata</i> , <i>Quinetia urvillei</i> , <i>Velleia trinervis</i> , <i>Geranium solanderi</i> , <i>Mylotia myosotidifolia</i> , <i>Chamaescilla corymbosa</i> , <i>Drosera pallida</i> , <i>Haemodorum discolor</i> , <i>Burchardia congesta</i> , <i>Lomandra sericea</i> , <i>Caladenia flava</i> , <i>Lyperanthus serratus</i> , <i>Microtis</i> sp., <i>Conostylis setigera</i> , <i>Cassytha flava</i> , <i>Lomandra ?micrantha</i> , <i>Stylidium repens</i> , <i>Billardiera variifolia</i> , <i>Lomandra nigricans</i> , <i>Trachymene pilosa</i> , <i>Aphelia brizula</i> , <i>Drosera glanduligera</i> , <i>Levenhookia pusilla</i> , <i>Pterostylis vittata</i> , <i>Xanthosia singuliflora</i> , <i>Scaevola calliptera</i> , <i>Isotropis cuneifolia</i> , <i>Thelymitra ?benthamiana</i> , <i>Cryptostylis ovata</i> , <i>Pyrorchis nigricans</i> , <i>Dasyopogon bromeliifolius</i> , <i>Patersonia limbata</i> , <i>Calytrix flavescens</i> , <i>Logania serpyllifolia</i> , <i>Elythranthera marginata</i> , <i>Lagenophora huegelii</i> , <i>Thelymitra antennifera</i> , <i>Waitzia acuminata</i> , <i>Rhodanthe heteranthera</i> , <i>Thysanotus patersonii</i> , <i>Stylidium scandens</i> , <i>Lomandra purpurea</i>
Grasses	10-30	<i>Austrostipa mollis</i> , <i>Neurachne alopecuroidea</i> , <i>Rytidosperma setaceum</i> , <i>Amphipogon turbinatus</i> , <i>Microlaena stipoides</i>

Key identifying features:

- Occurs on sandy soils with laterite geology
- Jarrah and Marri co-dominant woodland species
- Often has an *Agonis theiformis* shrubland
- When intact, is likely to have a diverse mix of low shrub and herb species in particular
- *Tetraria octandra* is a commonly dominant very open to sedgeland stratum species.

Conservation species: *Leucopogon alternifolius* P3

Unit 13: Jarrah/Marri Woodland



Site 7



Site 8



Site 10



Site 11



Site 12

14 *Banksia attenuata* Low Woodland**(Sites 17, 39)****Description**

Banksia attenuata Low Woodland occurs on deep sand on gently undulating plains, recorded at Twin Creeks Reserve (Remnant 4, Site 2). A jarrah very open mallee stratum may or may not be present. *Melaleuca thymoides* is commonly dominant in the shrubland to open heath stratum which commonly occurs over a mixed very open to low shrubland. *Anarthria prolifera* is common, +/- dominant in the sedgeland stratum. *Dasypogon bromeliifolius* is common, +/- dominant very open to open herbland stratum species. A grassland stratum was not recorded. Common species include: *Jacksonia spinosa*, *Adenanthos cuneatus*, *Isopogon formosus*, *Brachyloma baxteri*, *Andersonia caerulea*, *Anarthria prolifera*, *Hypolaena exsulca*, *Lyginia barbata*, *Tetraria* sp. Jarrah Forest, *Franklandia fucifolia*, *Lomandra sericea*, *Pyrorchis nigricans* and *Drosera androsacea*.

Comment

This unit has closest affinities with Unit 13 which occurs on less deep sand than this unit and there is many overlapping species that occur in both. The difference is the deep sand species which are particularly obvious in the low tree and shrubland strata.

Floristic summary

Lifeform	%cover	Species
Trees <10m	10-30	<i>Banksia attenuata</i>
Mallee <8m	0-10	<i>Eucalyptus marginata</i>
Shrubs 1-2m	0-70	<i>Melaleuca thymoides</i> , <i>Agonis theiformis</i> , <i>Jacksonia spinosa</i> , <i>Adenanthos cuneatus</i>
Shrubs 0.5-1m	2-30	<i>Xanthorrhoea playtphylla</i> , <i>Taxandria spathulata</i> , <i>Leucopogon alternifolius</i> P3, <i>Daviesia preissii</i> , <i>Stirlingia latifolia</i> , <i>Leucopogon ?hirsutus</i> , <i>Beaufortia empetrifolia</i> , <i>Synaphea ?preissii</i> P3, <i>Hypocalymma asperum</i> , <i>Gompholobium confertum</i> , <i>Acacia varia</i> , <i>Andersonia caerulea</i> , <i>Boronia spathulata</i> , <i>Isopogon formosus</i> , <i>Franklandia fucifolia</i> , <i>Banksia sphaerocarpa</i> var. <i>sphaerocarpa</i> , <i>Gompholobium scabrum</i>
Shrubs <0.5m	2-30	<i>Leucopogon elegans</i> ssp. <i>elegans</i> , <i>Brachyloma baxteri</i> , <i>Calytrix flavescens</i> , <i>Petrophile longifolia</i>
Sedges/rushes	30-70	<i>Lepidosperma</i> sp. 1, <i>Tetraria</i> sp. Jarrah Forest, <i>Schoenus brevisetis</i> , <i>Tetraria octandra</i> , <i>Anarthria prolifera</i> , <i>Hypolaena exsulca</i> , <i>Lyginia barbata</i> , <i>Hypolaena fastigiata</i>
Herbs	2-30	<i>Drosera pallida</i> , <i>Lomandra sericea</i> , <i>Cyathochaeta avenacea</i> , <i>Cassytha flava</i> , <i>Lomandra ?micrantha</i> , <i>Stylidium repens</i> , <i>Billardiera variifolia</i> , <i>Stylidium schoenoides</i> , <i>Pyrorchis nigricans</i> , <i>Dasypogon bromeliifolius</i> , <i>Patersonia limbata</i> , <i>Drosera androsacea</i> , <i>Praecoxanthus aphyllus</i> , <i>Caladenia</i> sp., <i>Leporella fimbriata</i> , <i>Haemodorum spicatum</i>

Key identifying features:

- Grows on deep sand plains
- *Banksia attenuata* present, with or without mallee form of jarrah
- *Melaleuca thymoides* likely to be open heath, shrubland or low shrubland stratum dominant
- Sedgeland stratum common with variable species dominant
- Very open to open herbland stratum with *Dasypogon bromeliifolius* likely to be present.
- Grass stratum insignificant or non-existent.

Conservation species: *Leucopogon alternifolius* P3

Unit 14: *Banksia attenuata* Low Woodland



Site 17



Site 39

15 Moit Open Mallee/*Baumea juncea* Open Sedgeland**(Site 9)****Description**

Moit (*Eucalyptus decipiens*, *adesmophloia* IG) Mallee/*Baumea juncea* Open Sedgeland is recorded from only one site where it occurred in a small area on lower landscape above a salt-affected drainage line, on sandy loam in Remnant 2 (A. Adams). The condition of the site is classified as good as there is little diversity with no shrub understorey. Due to the small sample number this unit is indicative only. All species found in this indicative unit are shown in the floristic summary.

Floristic summary

Lifeform	%cover	Species
Mallees <8m	10-30	<i>Eucalyptus decipiens</i> , <i>adesmophloia</i> IG
Sedges	2-10	<i>Baumea juncea</i>
Herbs	10-30	<i>Microtis</i> sp., <i>Lyperanthus serratus</i> , <i>Scaevola calliptera</i>

Key identifying features:

- Occurs low in the landscape on sandy or loamy soils
- *Eucalyptus decipiens* mallee stratum present
- Herb stratum present
- *Baumea juncea* present in sedge stratum

Conservation species: None recorded



Site 9

Appendix 5: Site Data (from relevés)

SITE 1

DATE 09/09/2016, 7/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.34'24" E 117.52'04"

LOCATION Remnant 1 (M. Adams)

VEGETATION TYPE *Eucalyptus pleurocarpa* open mallee over *Acacia triptycha* open shrubland over mixed low shrubland

LANDFORM Rock Outcrop

SLOPE Moderate

GEOLOGY Granite

ROCKS 20-50%

SOIL TYPE Loam

SOIL COLOUR Brown

HYDROLOGY Good drainage

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Shrub mallees <8m	2-10	<i>Eucalyptus pleurocarpa</i> <i>Eucalyptus uncinata</i>
Shrubs 1-2m	2-10	<i>Acacia triptycha</i>
Shrubs 0.5-1m	2-10 mix	<i>Hypocalymma angustifolium</i> <i>Allocasuarina humilis</i> <i>Banksia armata</i> <i>Acacia lasiocarpa</i> var. <i>sedifolia</i> <i>Xanthorrhoea platyphylla</i> <i>Hakea lissocarpha</i>
Shrubs <0.5m	10-30	<i>Petrophile rigida</i> <i>Chorizema aciculare</i> <i>Hibbertia hemignosta</i> <i>Astroloma epacridis</i> <i>Phyllanthus calycinus</i> <i>Prostanthera canaliculata</i> <i>Dodonea amblyophylla</i> <i>Hovea pungens</i> <i>Allocasuarina thuyoides</i>
Sedges	10-30	<i>Tetraria</i> sp. Jarrah Forest <i>Gahnia ancistrophylla</i> <i>Desmocladius flexuosus</i> <i>Mesomelaena stygia</i>
Herbs	10-30	<i>Opercularia vaginata</i> <i>Lomandra sericea</i> <i>Dampiera sacculata</i> <i>Chamaescilla corymbosa</i> <i>Haemodorum discolor</i> <i>Stypantra glauca</i> <i>Drosera pallida</i> <i>Agrostocrinum scabrum</i> <i>Diuris corymbosa</i> <i>Burchardia congesta</i> <i>*Hypochaeris</i> sp.
Grasses	<2e	<i>Neurachne aloperucoidea</i> <i>Austrostipa mollis</i> <i>Amphipogon turbinatus</i> <i>*Avena</i> sp.

SITE 2 DATE 09/09/2016, 7/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.34'24" E 117.52'.08"

LOCATION Remnant 1 (M. Adams)

VEGETATION TYPE *Borya sphaerocephala* herbland/mixed grassland with emergent *Astroloma epacridis*

LANDFORM Rock Outcrop

SLOPE Moderate

GEOLOGY Granite

ROCKS 10-20%

SOIL TYPE Shallow loam

SOIL COLOUR Brown

HYDROLOGY Poor drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Shrubs <0.5m	<2e	<i>Astroloma epacridis</i>
Sedges	10-30	<i>Desmocladius flexuosus</i>
Herbs	30-70	<i>Borya sphaerocephala</i> <i>Drosera pallida</i> <i>Dampiera sacculata</i> <i>Opercularia vaginata</i> <i>Stypandra glauca</i> * <i>Hypochaeris</i> sp. * <i>Ursinia anthemoides</i> * <i>Arctotheca calendula</i> * <i>Romulea rosea</i>
Grasses	<30-70 mix	<i>Neurachne aloperucoidea</i> <i>Austrostipa scabra</i> <i>Austrostipa mollis</i> <i>Amhipogon turbinatus</i>

SITE 3

DATE 09/09/2016, 7/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.34'26.8" E 117.52'08.7"

LOCATION Remnant 1 (M. Adams)

VEGETATION TYPE *Anarthria scabra* sedgeland over *Stylidium glauca*/*Chelianthes austrotenuifolia* herbland with emergent *Acacia* low shrubs

LANDFORM Rock Outcrop

SLOPE Gentle

GEOLOGY Granite

ROCKS >50%

SOIL TYPE Shallow loam

SOIL COLOUR Brown

HYDROLOGY Poor drainage

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Shrubs 0.5-1m	<2e mix	<i>Acacia triptycha</i> <i>Acacia lasiocarpa</i> var. <i>sedifolia</i> <i>Prostanthera canaliculata</i>
Shrubs <0.5m	<2e	<i>Hibbertia hemignosta</i> <i>Astroloma epacridis</i> <i>Hypocalymma angustifolium</i>
Sedges	30-70	<i>Anarthria scabra</i>
Herbs	10-30	<i>Stypandra glauca</i> <i>Cheilanthes austrotenuifolia</i> <i>Opercularia vaginata</i> <i>Borya sphaerocephala</i> <i>Muehlenbeckia adpressa</i> <i>Quinetia urvillei</i> <i>Millotia myosotidifolia</i> <i>Caladenia flava</i> * <i>Hypochaeris</i> sp. * <i>Ursinia anthemoides</i> * <i>Romulea rosea</i>
Grasses	<2e	<i>Austrostipa mollis</i> <i>Neurachne aloperucoidea</i> <i>Rytidosperma setaceum</i> * <i>Lagarus ovatus</i> * <i>Avena</i> sp.

SITE 4

DATE 09/09/2016, 7/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.34'28.5" E 117.52'08.2"

LOCATION Remnant 1 (M. Adams)

VEGETATION TYPE *Calothamnus quadrifidus* open heath over *Hakea lissocarpa* low shrubland

LANDFORM Rock Outcrop

SLOPE Moderate

GEOLOGY Granite

ROCKS 20-50%

SOIL TYPE Loam

SOIL COLOUR Brown

HYDROLOGY Good drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Shrubs 1-2m	30-70	<i>Calothamnus quadrifidus</i>
Shrubs 0.5-1m	10-30	<i>Hakea lissocarpa</i> <i>Hypocalymma angustifolium</i> <i>Acacia saligna</i> <i>Acacia triptycha</i> <i>Prostanthera canaliculata</i> <i>Acacia lasiocarpa</i> var. <i>sedifolia</i>
Shrubs <0.5m	2-10 mix	<i>Astroloma epacridis</i> <i>Phyllanthus calycinus</i> <i>Hibbertia hemignosta</i>
Sedges	10-30	<i>Desmocladius flexuosus</i> <i>Anarthria laevis</i>
Herbs	10-30	<i>Stypandra glauca</i> <i>Opercularia vaginata</i> <i>Chamaescilla corymbosa</i> <i>Drosera pallida</i> <i>Diuris corymbosa</i> <i>Pellargonium harvlasae</i> <i>*Hypochaeris</i> sp. <i>*Ursinia anthemoides</i> <i>*Asparagus asparagoides</i> <i>*Lysimachia arvensis</i> <i>*Erodium</i> sp.
Grasses	<2e	<i>Neurachne aloperucoidea</i> <i>Austrostipa mollis</i> <i>Austrostipa scabra</i> <i>Amphipogon</i> sp. <i>*Avena</i> sp.

SITE 5

DATE 09/09/2016, 7/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.34'31.1" E 117.52'10.4"

LOCATION Remnant 1 (M. Adams)

VEGETATION TYPE *Eucalyptus occidentalis* low open woodland over *Hakea lissocarpa* very open shrubland over *Anarthria laevis*/*Gahnia ancistrophylla* sedgeland

LANDFORM Mid-slope

SLOPE Moderate

GEOLOGY Granite

ROCKS <2%

SOIL TYPE Loam

SOIL COLOUR Brown

HYDROLOGY Poor drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees <10m	2-10	<i>Eucalyptus occidentalis</i>
Shrubs 0.5-1m	2-10	<i>Hakea lissocarpa</i> <i>Acacia lasiocarpa</i> var. <i>sedifolia</i> <i>Dodonaea amblyophylla</i>
Shrubs <0.5m	<2e	<i>Astroloma epacridis</i>
Sedges	30-70	<i>Anarthria laevis</i> <i>Gahnia ancistrophylla</i> <i>Desmocladius flexuosus</i> <i>Harperia lateriflora</i> <i>Anarthria gracilis</i>
Herbs	2-10	<i>Chamaescilla corymbosa</i> <i>Opercularia vaginata</i> <i>Asteridea athrixoides</i> <i>Velleia trinervis</i> <i>Pauridia occidentalis</i> var. <i>quadriloba</i> <i>Drosera pallida</i> <i>Geranium solanderi</i> <i>Craspedia variabilis</i> <i>Quinetia urvillei</i> <i>Millotia myosotidifolia</i> <i>Haemodorum simplex</i> <i>Ptilotus manglesii</i> * <i>Hypochaeris</i> sp. * <i>Romulea rosea</i> * <i>Lysimachia arvensis</i>
Grasses	<2e	<i>Neurachne alopecuroidea</i> <i>Austrostipa mollis</i> <i>Amphipogon turbinatus</i> * <i>Avena</i> sp.

SITE 6

DATE 09/09/2016, 7/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.34'29.6" E 117.52'13.4"

LOCATION Remnant 1 (M. Adams)

VEGETATION TYPE *Hypocalymma angustifolium* open low heath over mixed open sedgeland and *Spartochloa scirpoidea* open grassland

LANDFORM Rock Outcrop

SLOPE Moderate

GEOLOGY Granite

ROCKS >50%

SOIL TYPE Loam

SOIL COLOUR Brown

HYDROLOGY Poor drainage

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Shrubs 0.5-1m	30-70	<i>Hypocalymma angustifolium</i> <i>Acacia lasiocarpa</i> var. <i>sedifolia</i> <i>Dodonaea amblyocarpa</i>
Shrubs <0.5m	<2e	<i>Astroloma epacridis</i> <i>Hibbertia hemignosta</i> <i>Hovea pungens</i>
Sedges	<2e	<i>Tetraria</i> sp. Jarrah Forest <i>Desmocladus flexuosus</i> <i>Mesomelaena stygia</i>
Herbs	2-10	<i>Stypandra glauca</i> <i>Chamaescilla corymbosa</i> <i>Diuris corymbosa</i> <i>Crassula decumbens</i> <i>Borya sphaerocephala</i> <i>Agrostocrinum scabrum</i> <i>Dampiera juncea</i> <i>Haemodorum discolor</i> <i>Drosera pallida</i> <i>Geranium solanderi</i> <i>*Hypochaeris</i> sp.
Grasses	30-70	<i>Spartochloa scirpoidea</i> <i>Austrostipa mollis</i> <i>Rytidosperma setaceum</i>

SITE 7

DATE 28/09/2016, 7/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.37'12.3" E 117.51'36.6"

LOCATION Remnant 2 (A. Adams)

VEGETATION TYPE *Eucalypts marginata/Corymbia calophylla* woodland over *Hakea nitida* open shrubland

LANDFORM Mid-slope

SLOPE Gentle

GEOLOGY Laterite

ROCKS 0%

SOIL TYPE Loamy sand

SOIL COLOUR Grey

HYDROLOGY Good drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees 10-30m	10-30	<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i>
Shrubs 1-2m	2-10	<i>Hakea nitida</i> <i>Agonis theiformis</i>
Shrubs <0.5m	<2e mix	<i>Hibbertia amplexicaulis</i> <i>Hibbertia inconspicua</i> <i>Kennedia prostrata</i> <i>Kennedia coccinea</i> <i>Leucopogon oxycedrus</i> <i>Acacia leioderma</i>
Sedges	<2e	<i>Tetraria octandra</i> <i>Lepidosperma</i> sp. aff. <i>angustatum</i> <i>Tetraria</i> sp. Jarrah Forest (R. Davies 7391)
Herbs	2-10	<i>Scaevola calliptera</i> <i>Caladenia flava</i> <i>Drosera pallida</i> <i>Chamaescilla corymbosa</i> <i>Lomandra sericea</i> <i>Logania serpyllifolia</i>
Grasses	10-30	<i>Microlaena stipoides</i> <i>Austrostipa mollis</i> <i>Rytidosperma setaceum</i>

SITE 8

DATE 28/09/2016, 7/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.37'13.1" E 117.51'34.1"

LOCATION Remnant 2 (A. Adams)

VEGETATION TYPE *Eucalyptus marginata*/*Corymbia calophylla* woodland over *Agonis theiformis* open shrubland

LANDFORM Upper slope

SLOPE Gentle

GEOLOGY Laterite

ROCKS 0%

SOIL TYPE Loamy sand

SOIL COLOUR Yellow grey

HYDROLOGY Good drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees 10-30m	10-30	<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i>
Shrubs 1-2m	2-10	<i>Agonis theiformis</i>
Shrubs <0.5m	10-30 mix	<i>Isotropis cuneifolia</i> <i>Hibbertia amplexicaulis</i> <i>Hibbertia inconspicua</i> <i>Gompholobium knightianum</i> <i>Acacia leioderma</i>
Sedges	2-10	<i>Tetraria octandra</i> <i>Lepidosperma</i> sp. 1 <i>Harperia lateriflora</i> <i>Tetraria</i> sp. Jarrah Forest (R. Davies 7391)
Herbs	10-30	<i>Pyrorchis nigricans</i> <i>Thelymitra ?benthamiana</i> <i>?Elythranthera emarginata</i> <i>Lagenophora huegelii</i> <i>Thelymitra antennifera</i> <i>Drosera pallida</i> <i>Drosera glanduligera</i> <i>Chamaescilla corymbosa</i> <i>Scaevola calliptera</i> <i>Millotia myosotidifolia</i> <i>Caladenia flava</i> <i>Cryptostylis ovata</i> <i>Waitzia acuminata</i> <i>Helichrysum luteoalbum</i> <i>Pterostylis vittata</i> <i>Aphelia brizula</i> <i>Geranium solanderi</i> <i>Opercularia vaginatum</i> <i>Haemodorum discolor</i> <i>Lomandra nigricans</i> <i>*Ornithopus compressus</i> <i>*Hypochaeris</i> sp. <i>*Disa bracteata</i>
Grasses	10-30	<i>Austrostipa mollis</i> <i>Amhipogon</i> sp. <i>Neurachne alopecuroidea</i>

SITE 9

DATE 28/09/2016, 7/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.37'19.9" E 117.51'36.6"

LOCATION Remnant 2 (A. Adams)

VEGETATION TYPE *Eucalyptus decipiens* open mallee over *Baumea juncea* open sedgeland

LANDFORM Valley flat

SLOPE Gentle

GEOLOGY Laterite

ROCKS 0%

SOIL TYPE Sandy loam

SOIL COLOUR Dark grey

HYDROLOGY Seasonally wet

CONDITION Good

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	10-30	<i>Eucalyptus decipiens</i>, <i>Adesmophloia</i> IG
Sedges	2-10	<i>Baumea juncea</i>
Herbs	10-30	<i>Microtis</i> sp. <i>Lyperanthus serratus</i> <i>Scaevola calliptera</i> *<i>Hypochaeris</i> sp.
Grasses	10-30	*<i>Avena</i> sp.

SITE 10

DATE 28/09/2016, 7/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.37'19.1" E 117.51'33.1"

LOCATION Remnant 2 (A. Adams)

VEGETATION TYPE *Eucalyptus marginata/Corymbia calophylla* woodland over *Agonis theiformis* open heath

LANDFORM Lower slope

SLOPE Moderate

GEOLOGY Laterite

ROCKS 0%

SOIL TYPE Loamy sand

SOIL COLOUR Yellow grey

HYDROLOGY Good drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees 10-30m	10-30	<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i>
Shrubs 1-2m	30-70	<i>Agonis theiformis</i> <i>Hakea nitida</i>
Shrubs <0.5m	10-30	<i>Hovea chorizemifolia</i> <i>Acacia leioderma</i> <i>Bossiaea ornata</i> <i>Isotropis cuneifolia</i> <i>Hibbertia amplexicaulis</i> <i>Hibbertia inconspicua</i> <i>Gompholobium knightianum</i>
Sedges	2-10	<i>Tetraria octandra</i> <i>Lepidosperma</i> sp. 1 <i>Tetraria</i> sp. Jarrah Forest (R. Davies 7391)
Herbs	10-30	<i>Scaevola calliptera</i> <i>Stylidium repens</i> <i>Drosera pallida</i> <i>Chamaescilla corymbosa</i> <i>Xanthosia singuliflora</i> <i>?Rhodanthe heterantha</i> <i>Velleia trinervis</i> <i>Opercularia vaginata</i> <i>Quinetia urvillei</i> <i>Trachymene pilosa</i> <i>Microtis</i> sp. <i>*Hypochoeris</i> sp.
Grasses	10-30	<i>Amphipogon</i> sp. <i>Microlaena stipoides</i> <i>Neurachne alopecuroidea</i> <i>Austrostipa mollis</i> <i>Rytidosperma setaceum</i>

SITE 11 DATE 28/09/2016, 7/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.37'17.3" E 117.51'33"

LOCATION Remnant 2 (A. Adams)

VEGETATION TYPE *Eucalyptus marginata/Corymbia calophylla* woodland over *Agonis theiformis* open shrubland

LANDFORM Lower slope

SLOPE Moderate

GEOLOGY Laterite

ROCKS 0%

SOIL TYPE Loamy sand

SOIL COLOUR Yellow grey

HYDROLOGY Good drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees 10-30m	10-30	<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i>
Shrubs 1-2m	2-10	<i>Agonis theiformis</i> <i>Acacia subcaerulea</i>
Shrubs <0.5m	<2e	<i>Hibbertia amplexicaulis</i> <i>Hakea nitida</i> <i>Acacia leioderma</i> <i>Gompholobium capitatum</i> <i>Isotropis cuneifolia</i>
Sedges	2-10	<i>Tetraria octandra</i> <i>Desmocladius fasciculatus</i> <i>Harperia lateriflora</i> <i>Tetraria</i> sp. Jarrah Forest (R. Davies 7391)
Herbs	2-10 mix	<i>Scaevola calliptera</i> <i>Stylidium repens</i> <i>Opercularia vaginata</i> <i>Burchardia congesta</i> <i>Drosera pallida</i> <i>Drosera glanduligera</i> <i>Thysanotus patersonii</i> <i>Pyrorchis nigricans</i> <i>Chamaescilla corymbosa</i> <i>Thelymitra ?benthamiana</i> <i>Velleia trinervis</i> <i>Levenhookia pusilla</i> <i>Lomandra nigricans</i> <i>Quinetia urvillei</i> * <i>Hypochaeris</i> sp. * <i>Disa bracteata</i>
Grasses	10-30	<i>Neurachne alopecuroidea</i> <i>Austrostipa mollis</i> <i>Rytidosperma setaceum</i>

SITE 12

DATE 11/10/2016, 11/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.37'524" E 117.54'232"

LOCATION Twin Creeks Reserve Remnant 4

VEGETATION TYPE *Eucalyptus marginata/Corymbia calophylla* woodland over *Agonis theiformis* open heath

LANDFORM Mid-slope

SLOPE Gentle

GEOLOGY Laterite

ROCKS 0%

SOIL TYPE Sand

SOIL COLOUR Light grey

HYDROLOGY Good drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees 10-30m	10-30	<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i>
Mallees <8m	10-30	<i>Eucalyptus marginata</i>
Shrubs 1-2m	30-70	<i>Agonis theiformis</i> <i>Banksia grandis</i> (2 dead)
Shrubss 0.5-1m	2-10	<i>Hakea corymbosa</i> <i>Xanthorrhoea platyphylla</i>
Shrubs <0.5m	30-70	<i>Melaleuca thymoides</i> <i>Leucopogon alternifolius</i> P3 <i>Andersonia caerulea</i> <i>Boronia crassifolia</i> <i>Hibbertia lineata</i> <i>Boronia spathulata</i> <i>Gompholobium capitatum</i> <i>Acacia crispula</i> <i>Hakea corymbosa</i> <i>Calytrix flavescens</i> <i>Gompholobium knightianum</i> <i>Bossiaea rufa</i> <i>Hovea trisperma</i> <i>Brachyloma baxteri</i> <i>Bossiaea ornata</i> <i>Isopogon formosus</i> <i>Daviesia incrassata</i> <i>Stirlingia latifolia</i>
Sedges	30-70	<i>Anarthria prolifera</i> <i>Tetraria</i> sp. Jarrah Forest (R. Davies 7391) <i>Tetraria octandra</i> <i>Desmocladius fasciculatus</i> <i>Lyginia barbata</i> <i>Hypolaena exsulca</i> <i>Schoenus caespitius</i> <i>Schoenus breviculmis</i> <i>Anarthria gracilis</i> <i>Chordifex sphacelatus</i> <i>Lepidosperma</i> sp. 1
Herbs	2-10	<i>Dasyopogon bromeliifolius</i> <i>Caladenia flava</i> <i>Cryptostylis ovata</i> <i>Lomandra nigricans</i> <i>Lomandra purpurea</i> <i>Burchardia congesta</i> <i>Laxmannia sessiliflora</i> <i>Drosera pallida</i>

Pyrorchis nigricans
Conostylis setigera
Patersonia limbata
Chamaescilla corymbosa
Stylidium scandens
Stylidium repens
Opercularia vaginata
Billardiera variifolia
Tetratheca affinis
Xanthosia singuliflora
Lomandra sericea
Lomandra ?micrantha

SITE 13

DATE 11/10/2016, 11/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.37'328" E 117.54'245"

LOCATION Twin Creeks Reserve Remnant 4

VEGETATION TYPE *Eucalyptus incrassata* open mallee over *Banksia mucronulata* open low heath

LANDFORM Plain

SLOPE Gentle

GEOLOGY Laterite

ROCKS <2%

SOIL TYPE Gravelly clay loam

SOIL COLOUR Orange/brown

HYDROLOGY Poor drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	10-30	<i>Eucalyptus incrassata</i>
Shrubs 1-2m	<2e Mix	<i>Kunzea recurva</i> <i>Petrophile squamata</i> <i>Hakea prostrata</i>
Shrubs 0.5-1m	30-70	<i>Banksia mucronulata</i> <i>Daviesia preissii</i> <i>Xanthorrhoea playtphylla</i> <i>Calothamnus affinis</i> <i>Agonis theiformis</i> <i>Beaufortia anisandra</i> <i>Hovea trisperma</i> <i>Hakea marginata</i> <i>Darwinia vestita</i> <i>Taxandria spathulata</i>
Shrubs <0.5m	10-30	<i>Brachyloma baxteri</i> <i>Leucopogon</i> sp. <i>Acacia crispula</i> <i>Astroloma pallidum</i> <i>Banksia fraseri</i> <i>Chorizema aciculare</i> <i>Melaleuca spathulata</i> <i>Melaleuca suberosa</i> <i>Gompholobium capitatum</i> <i>Verticordia endlicheriana</i> <i>Hibbertia microphylla</i> <i>Verticordia habrantha</i> <i>Calytrix lechenaultii</i> <i>Jacksonia capitata</i> <i>Leucopogon</i> sp. <i>Coujinup</i> <i>Banksia brunnea</i> <i>Synaphea preissii</i> P3
Sedges	10-30	<i>Anarthria laevis</i> <i>?Leptocarpus laxus</i> <i>Anarthria gracilis</i> <i>Desmocladius fasciculatus</i> <i>Mesomelaena stygia</i> <i>Harperia lateriflora</i> <i>Schoenus obtusifolius</i> <i>Lepidosperma</i> sp. 1
Herbs	2-10	<i>Conostylis setigera</i> <i>Lomandra ?micrantha</i> <i>Stylidium repens</i> <i>Lyperanthus serratus</i> <i>Eriochilus</i> sp.

		<i>Opercularia vaginata</i>
		<i>Dampiera alata</i>
		<i>Cyathochaeta avenacea</i>
		<i>Haemodorum spicatum</i>
		<i>Stylidium repens</i>
		<i>Drosera pallida</i>
		* <i>Hypochaeris</i> sp.
Grasses	<2e	<i>Neurachne alopecuroidea</i>
		<i>Rytidosperma setaceum</i>

SITE 14 DATE 11/10/2016, 11/04/2017 RECORDERS W. Bradshaw

LAT/LONG S -34.37'252" E 117.54'240"

LOCATION Twin Creeks Reserve Remnant 4

VEGETATION TYPE *Eucalyptus occidentalis* low woodland over *Taxandria spathulata* open heath

LANDFORM Flat

SLOPE Gentle

GEOLOGY Laterite

ROCKS 0%

SOIL TYPE Loam

SOIL COLOUR Brown

HYDROLOGY Poor drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees <10m	10-30	<i>Eucalyptus occidentalis</i> <i>Nuytsia floribunda</i>
Mallees <8m	2-10	<i>Eucalyptus incrassata</i>
Shrubs 1-2m	30-70	<i>Taxandria spathulata</i>
Shrubs 0.5-1m	10-30	<i>Melaleuca violacea</i> <i>Leucopogon assimilis</i> <i>Leucopogon alternifolius</i> P3 <i>Gastrolobium spinosum</i> <i>Melaleuca carrii</i> <i>Allocasuarina microstachya</i>
Shrubs <0.5m	2-10	<i>Melaleuca spathulata</i> <i>Hovea pungens</i>
Sedges	10-30	<i>Harperia lateriflora</i> <i>Schoenus breviculmis</i> <i>Lepidosperma</i> sp. 2 <i>Tetraria</i> sp. Jarrah Forest <i>Desmodcladus flexuosus</i> <i>Chordifex sphacelatus</i>
Herbs	2-10	<i>Opecularia vaginata</i> <i>Chamaescilla corymbosa</i> <i>Lomandra effusa</i> <i>Dianella revoluta</i> <i>Cyathochaeta avenacea</i> <i>Microtis</i> sp. * <i>Trifolium</i> sp. * <i>Hypochaeris</i> sp.
Grasses	2-10	<i>Neurachne alopecuroidea</i> <i>Rytidosperma setaceum</i> <i>Austrostipa ?hemipogon</i> * <i>?Dactylis glomerata/Phalaris aquatica</i>

SITE 15

DATE 11/10/2016, 11/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.37'224" E 117.54'170"

LOCATION Twin Creeks Reserve Remnant 4

VEGETATION TYPE *Eucalyptus incrassata* very open mallee over *Hakea lasiocarpa*/*H. cucullata* tall open shrubland over *Taxandria spathulata* closed heath

LANDFORM Plain

SLOPE Flat

GEOLOGY Laterite

ROCKS 0%

SOIL TYPE Sandy clay-loam (gravel @ 10cm)

SOIL COLOUR Yellow brown

HYDROLOGY Seasonally wet

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	2-10	<i>Eucalyptus incrassata</i>
Shrubs >2m	2-10 mix	<i>Hakea lasiocarpa</i> P3 <i>Hakea cucullata</i> <i>Lambertia inermis</i>
Shrubs 1-2m	70-100	<i>Taxandria spathulata</i> <i>Kunzea recurva</i>
Shrubs 0.5-1m	2-10	<i>Melaleuca suberosa</i> <i>Gastrolobium spinosum</i> <i>Allocasuarina humilis</i> <i>Beaufortia anisandra</i> <i>Xanthorrhoea platyphylla</i>
Shrubs <0.5m	2-10	<i>Hibbertia hemignosta</i> <i>Hibbertia microphylla</i> <i>Gompholobium capitatum</i> <i>Leucopogon elegans</i> ssp. <i>elegans</i> <i>Jacksonia capitata</i>
Sedges	10-30	<i>Mesomelaena stygia</i> <i>Harperia lateriflora</i> <i>Lepidosperma</i> sp. 1 <i>Tetraria</i> sp. Jarrah Forest <i>Tricostularia</i> sp.
Herbs	e<2 mix	<i>Conostylis setigera</i> <i>Cyathochaeta avenacea</i> <i>Haemodorum discolor</i> <i>Lomandra ?micrantha</i> <i>Cassytha flava</i> <i>Elythrhanthera brunonis</i> <i>Opercularia vaginata</i> <i>Dampiera alata</i>
Grasses	2-10	<i>Rytidosperma setaceum</i>

SITE 16

DATE 11/10/2016, 11/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.37'230" E 117.54'103"

LOCATION Twin Creeks Reserve Remnant 4

VEGETATION TYPE *Eucalyptus pleurocarpa* open mallee over *Taxandria spathulata* closed heath

LANDFORM Plain

SLOPE Flat

GEOLOGY Laterite

ROCKS 0%

SOIL TYPE Clay-loam (gravel @ 10cm)

SOIL COLOUR Orange/brown

HYDROLOGY Seasonally wet

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	10-30	<i>Eucalyptus pleurocarpa</i> <i>Eucalyptus incrassata</i> <i>Eucalyptus uncinata</i>
Shrubs >2m	<2e	<i>Hakea lasiocarpa</i> P3
Shrubs 1-2m	70-100	<i>Taxandria spathulata</i>
Shrubs 0.5-1m	30-70	<i>Melaleuca suberosa</i> <i>Melaleuca violacea</i> <i>Calothamnus affinis</i> <i>Banksia mucronulata</i> <i>Gastrolobium velutinum</i> <i>Leucopogon assimilis</i> <i>Stirlingia latifolia</i> <i>Isopogon buxifolius</i> <i>Petrophile squamata</i> <i>Melaleuca spathulata</i>
Shrubs <0.5m	2-10	<i>Daviesia dilatata</i> <i>Hakea marginata</i> <i>Hibbertia microphylla</i> <i>Jacksonia capitata</i> <i>Banksia brunnea</i> <i>Synaphea polymorpha</i> <i>Leucopogon ?hirsutus</i> <i>Lysinema ciliatum</i>
Sedges	30-70	<i>Mesomelaena stygia</i> <i>Harperia lateriflora</i> <i>Lepidosperma</i> sp. 1 <i>Tetraria</i> sp. Jarrah Forest <i>Schoenus obtusifolius</i>
Herbs	2-10 mix	<i>Conostylis setigera</i> <i>Cyathochaeta avenacea</i> <i>Dampiera pedunculata</i> <i>Dampiera alata</i>
Grasses	e<2	<i>Rytidosperma setaceum</i>

SITE 17

DATE 11/10/2016, 11/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.37'366" E 117.54'031"

LOCATION Twin Creeks Reserve Remnant 4

VEGETATION TYPE *Banksia attenuata* low woodland over *Eucalyptus marginata* very open mallee over myrtaceous open heath

LANDFORM Mid-slope

SLOPE Gentle

GEOLOGY Laterite

ROCKS 0%

SOIL TYPE Sand

SOIL COLOUR Light grey

HYDROLOGY Good drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees <10m	10-30	<i>Banksia attenuata</i>
Mallees <8m	2-10	<i>Eucalyptus marginata</i>
Shrubs 0.5-1m	30-70	<i>Melaleuca thymoides</i> <i>Beaufortia empetrifolia</i> <i>Adenanthos cuneatus</i> <i>Gompholobium scabrum</i> <i>Taxandria spathulata</i> <i>Leucopogon ?hirsutus</i> <i>Jacksonia spinosa</i>
Shrubs <0.5m	10-30	<i>Brachyloma baxteri</i> <i>Petrophile longifolia</i> <i>Synaphea preissii</i> P3 <i>Isopogon longifolius</i> <i>Isopogon formosus</i> <i>Hypocalymma asperum</i> <i>Acacia varia</i> <i>Andersonia simplex</i> <i>Leucopogon elegans</i> ssp. <i>elegans</i> <i>Boronia spathulata</i>
Sedges	30-70	<i>Tetraria</i> sp. Jarrah Forest (R. Davies 7391) <i>Lyginia barbata</i> <i>Tetraria octandra</i> <i>Anarthria prolifera</i> <i>Hypolaena exsulca</i> <i>Hypolaena fastigiata</i>
Herbs	2-10	<i>Burchardia congesta</i> <i>Cyathochaeta avenacea</i> <i>Dasyopogon bromeliifolius</i> <i>Leporella fibriata</i> <i>Pyrorchis nigricans</i> <i>Haemodorum spicatum</i> <i>Stylidium schoenoides</i> <i>Drosera erythrorhiza</i> <i>Drosera androsacea</i> <i>Caladenia</i> sp. <i>Leporella fimbriata</i> <i>Drosera pulchella</i> <i>Stylidium repens</i>

SITE 18

DATE 21/10/2016, 11/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.37'18.9" E 117.54'00.4"

LOCATION Twin Creeks Reserve Remnant 4

VEGETATION TYPE *Eucalyptus incrassata* open mallee over *Nuytsia floribunda* tall open shrubland over mixed shrubland

LANDFORM Plain

SLOPE Gentle

GEOLOGY Laterite

ROCKS 0%

SOIL TYPE Clay-loam

SOIL COLOUR Brown

HYDROLOGY Poor drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	10-30	<i>Eucalyptus incrassata</i>
Shrubs >2m	2-10	<i>Nuytsia floribunda</i>
Shrubs 1-2m	<2e mix	<i>Taxandria spathulata</i> <i>Kunzea recurva</i> <i>Leucopogon assimilis</i>
Shrubs 0.5-1m	10-30	<i>Gastrolobium velutinum</i> <i>Astartea glomerulosa</i> <i>Melaleuca violacea</i> <i>Xanthorrhoea platyphylla</i>
Shrubs <0.5m	<2e	<i>Melaleuca carrii</i> <i>Verticordia plumosa</i>
Sedges	2-10	<i>Gahnia ancistrophylla</i> <i>Lepidopserma</i> sp. 1 <i>Tetraria octandra</i> * <i>Cyperus tenellus</i>
Herbs	30-70	<i>Opercularia vaginata</i> <i>Drosera pallida</i> <i>Cyathochaeta avenacea</i> <i>Elythranthera brononis</i> <i>Caladenia barbarossa</i> <i>Velleia trinervis</i> <i>Burchardia multiflora</i> <i>Caladenia flava</i> <i>Microtis</i> sp. <i>Chamaescilla corymbosa</i> * <i>Disa bracteata</i>
Grasses	2-10	<i>Neurachne alopecuroidea</i>

SITE 19

DATE 21/10/2016, 11/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.37'28" E 117.53'30.3"

LOCATION Twin Creeks Reserve Remnant 3

VEGETATION TYPE *Eucalyptus marginata* woodland over *Banksia sessilis* tall shrubland over proteaceous open shrubland

LANDFORM Mid-slope

SLOPE Gentle

GEOLOGY Laterite

ROCKS 2-10%

SOIL TYPE Gravelly sand

SOIL COLOUR Light grey

HYDROLOGY Good drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees 10-30m	10-30	<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i>
Shrubs >2m	10-30	<i>Banksia sessilis</i>
Shrubs 1-2m	30-70	<i>Agonis theiformis</i> <i>Allocasuarina humilis</i> <i>Xanthorrhoea platyphylla</i>
Shrubs 0.5-1m	2-10	<i>Petrophile serruriae</i> <i>Hakea corymbosa</i> <i>Melaleuca thymoides</i> <i>Pultenaea strobilifera</i> <i>Kunzea recurva</i> <i>Acacia varia</i> <i>Grevillea pulchella</i>
Shrubs <0.5m	10-30	<i>Banksia porrecta</i> <i>Bossiaea ornata</i> <i>Calothamnus sanguineus</i> <i>Gompholobium knightianum</i> <i>Gompholobium confertum</i> <i>Brachyloma baxteri</i> <i>Hibbertia hemignosta</i> <i>Isopogon longifolius</i> <i>Hovea trisperma</i> <i>Gompholobium capitatum</i> <i>Stirlingia latifolia</i> <i>Banksia fraseri</i>
Sedges	2-10	<i>Desmocladius fasciculatus</i> <i>Lepidopserma</i> sp. 1 <i>Tetraria octandra</i> <i>Tetraria</i> sp. Jarrah Forest <i>Desmocladius flexuosus</i>
Herbs	<2e	<i>Conostylis setigera</i> <i>Lyperanthus serratus</i> <i>Tetratheca affinis</i> <i>Drosera pallida</i> <i>Xanthosia singuliflora</i> <i>Chamaescilla corymbosa</i> <i>Stylidium tenue</i> <i>Conostylis serrulata</i> <i>Haemodorum discolor</i> <i>Lomandra sericea</i>

SITE 20

DATE 21/10/2016, 11/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.37'28.5" E 117.53'31"

LOCATION Twin Creeks Reserve Remnant 3

VEGETATION TYPE *Eucalyptus marginata* woodland over *Banksia sessilis* tall open scrub over *Agonis theiformis* open heath

LANDFORM Mid-slope

SLOPE Gentle

GEOLOGY Laterite

ROCKS <2%

SOIL TYPE Sandy gravel

SOIL COLOUR Light grey

HYDROLOGY Good drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees 10-30m	10-30	<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i>
Shrubs >2m	30-70	<i>Banksia sessilis</i>
Shrubs 1-2m	30-70	<i>Agonis theiformis</i> <i>Xanthorrhoea platyphylla</i>
Shrubs 0.5-1m	2-10	<i>Petrophile serruriae</i> <i>Bossiaea ornata</i> <i>Allocasuarina humilis</i> <i>Stirlingia latifolia</i> <i>Isopogon longifolius</i> <i>Pultenaea strobilifera</i> <i>Acacia varia</i>
Shrubs <0.5m	2-10	<i>Banksia fraseri</i> <i>Brachyloma baxteri</i> <i>Gompholobium knightianum</i> <i>Hibbertia hemignosta</i> <i>Nuytsia floribunda</i> <i>Boronia spathulata</i> <i>Hakea ruscifolia</i>
Sedges	30-70	<i>Tetraria octandra</i> <i>Choridfex sphacelatus</i> <i>Lepidopserma</i> sp. 1 <i>Tetraria</i> sp. Jarrah Forest
Herbs	2-10 mix	<i>Pterostylis vittata</i> <i>Stylidium tenue</i> <i>Caladenia flava</i> <i>Lyperanthus serratus</i> <i>Drosera pallida</i> <i>Tetratheca affinis</i> <i>Burchardia congesta</i> <i>Cassytha flava</i> <i>Conostylis setigera</i> <i>Eliochilus</i> sp. <i>Haemodorum discolor</i>

SITE 21

DATE 21/10/2016, 11/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.37'29.1" E 117.53'30.7"

LOCATION Twin Creeks Reserve Remnant 3

VEGETATION TYPE *Eucalyptus marginata* woodland over *Banksia sessilis* tall open shrubland over *Agonis theiformis*/*Xanthorrhoea platyphylla* shrubland over *Tetraria octandra*/*Chordifex sphacelatus* sedgeland

LANDFORM Mid-slope

SLOPE Gentle

GEOLOGY Laterite

ROCKS <2%

SOIL TYPE Sandy gravel

SOIL COLOUR Light grey

HYDROLOGY Good drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees 10-30m	10-30	<i>Eucalyptus marginata</i> <i>Corymbia calophylla</i>
Shrubs >2m	2-10	<i>Banksia sessilis</i>
Shrubs 1-2m	10-30	<i>Agonis theiformis</i> <i>Xanthorrhoea platyphylla</i> <i>Hakea ruscifolia</i>
Shrubs 0.5-1m	10-30	<i>Hakea corymbosa</i> <i>Melaleuca thymoides</i> <i>Bossiaea ornata</i> <i>Leucopogon ?hirsutus</i> <i>Isopogon longifolius</i> <i>Leucopogon alternifolius</i> <i>Acacia varia</i>
Shrubs <0.5m	30-70	<i>Banksia porrecta</i> <i>Synaphea preissii</i> P3 <i>Gompholobium knightianum</i> <i>Gompholobium capitatum</i> <i>Persoonia striata</i> <i>Brachyloma baxteri</i> <i>Hibbertia hemignosta</i> <i>Acacia crispula</i> <i>Calothamnus sanguineus</i> <i>Banksia gardneri</i> <i>Stirlingia latifolia</i> <i>Banksia fraseri</i> <i>Boronia spathulata</i>
Sedges	30-70	<i>Chordifex sphacelatus</i> <i>Desmocladus fasciculatus</i> <i>Tetraria octandra</i> <i>Tetraria</i> sp. Jarrah Forest <i>Lepidosperma</i> aff. <i>angustatum</i> <i>Anarthria prolifera</i> <i>Mesomelaena stygia</i>
Herbs	2-10 mix	<i>Constylis setigera</i> <i>Stylidium schoenoides</i> <i>Caladenia flava</i> <i>Lyperanthus serratus</i> <i>Drosera pallida</i> <i>Tetratheca affinis</i> <i>Cassytha flava</i> <i>Lomandra sericea</i>

SITE 22

DATE 3/11/2016, 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'33" E 117.55'49.4"

LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE *Eucalyptus thamnoides* very open mallee over proteaceous open low heath

LANDFORM Plain

SLOPE Gentle

GEOLOGY Laterite/siltstone

ROCKS <2%

SOIL TYPE Gravelly clay-loam

SOIL COLOUR Light brown

HYDROLOGY Poor drainage

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	2-10	<i>Eucalyptus thamnoides</i> <i>Eucalyptus incrassata</i>
Shrubs 0.5-1m	30-70	<i>Banksia mucronulata</i> <i>Banksia pteridifolia</i> <i>Petrophile squamata</i> <i>Isopogon buxifolius</i> <i>Calothamnus affinis</i> <i>Daviesia dilatata</i> <i>Kunzea recurva</i> <i>Beaufortia empetrifolia</i> <i>Melaleuca suberosa</i> <i>Astartea glomerulosa</i> <i>Melaleuca undulata</i>
Shrubs <0.5m	10-30	<i>Chorizema aciculare</i> <i>Verticordia endlicheriana</i> <i>Hibbertia microphylla</i> <i>Jacksonia capitata</i> <i>Gompholobium capitatum</i> <i>Melaleuca subtrigona</i> <i>Melaleuca carrii</i> <i>Leucopogon</i> sp. Coujinup <i>Acacia lasiocarpa</i> var. <i>sedifolia</i> <i>Petrophile rigida</i>
Sedges	2-10	<i>Gahnia ancistrophylla</i> <i>Anarthria gracilis</i> <i>Lepidosperma</i> aff. <i>angustatum</i>
Herbs	2-10	<i>Opercularia vaginata</i> <i>Cyathochaeta avenacea</i> <i>Stylidium repens</i> <i>Velleia trinervis</i> <i>Chamaexeros serra</i> <i>Dampiera alata</i> <i>Pterochaeta paniculata</i> <i>Thelymitra crinita</i> <i>Lomandra ?micrantha</i> <i>*Disa bracteata</i>
Grasses	2-10	<i>Neurachne alopecuroidea</i> <i>Austrostipa mollis</i> <i>Rytidosperma setaceum</i>

SITE 23

DATE 3/11/2016, 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'32.5" E 117.55'48.9"

LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE Mixed myrtaceous/proteaceous low shrubland over *Tetraria* sp. Jarrah Forest open sedgland with emergent mallee *Eucalyptus incrassata*

LANDFORM Plain

SLOPE Flat

GEOLOGY Siltstone

ROCKS 0%

SOIL TYPE Loamy clay

SOIL COLOUR Light brown

HYDROLOGY Poor drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	<2e	<i>Eucalyptus incrassata</i>
Shrubs 0.5-1m	10-30	<i>Petrophile squamata</i> <i>Melaleuca spathulata</i> <i>Beaufortia empetrifolia</i> <i>Banksia mucronulata</i> <i>Isopogon buxifolius</i> <i>Kunzea recurva</i>
Shrubs <0.5m	10-30	<i>Hakea marginata</i> <i>Melaleuca suberosa</i> <i>Astartea glomerulosa</i> <i>Chorizema aciculare</i> <i>Cooperookia polygalacea</i> <i>Daviesia dilatata</i> <i>Synaphea preissii</i> P3 <i>Lechenaultia formosa</i> <i>Hibbertia microphylla</i> <i>Jacksonia capitata</i> <i>Melaleuca subtrigona</i> <i>Acacia lasiocarpa</i> var. <i>sedifolia</i> <i>Astroloma epacridis</i> <i>Leucopogon</i> sp. Coujinup
Sedges	10-30	<i>Tetraria</i> sp. Jarrah Forest <i>Lepyrodia drummondiana</i> <i>Shoenus nanus</i> <i>Schoenus breviculmis</i> <i>Lepidosperma</i> sp. 1 <i>Lepidosperma</i> sp. 3
Herbs	2-10	<i>Opercularia vaginata</i> <i>Borya sphaerocephala</i> <i>Velleia trinervis</i> <i>Drosera glanduligera</i> <i>Drosera menziesii</i> <i>Thelymitra crinita</i> <i>Trichocline spathulata</i> <i>Goodenia concinna</i> <i>Marianthus erubescens</i> <i>Centrolepis polygyna</i> <i>Caladenia flava</i> <i>Aphelia brizula</i> <i>Lomandra ?micrantha</i> <i>*Ursinia anthemoides</i>
Grasses	<2e	<i>Neurachne alopecuroidea</i> <i>Rytidosperma setaceum</i> <i>Amphipogon</i> sp. <i>*Vulpia</i> sp.

SITE 24 DATE 3/11/2016, 13/04/2017
 LAT/LONG S -34.33'32.2" E 117.55'49.6"

RECORDERS W. Bradshaw
 LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE *Hakea marginata*/*Petrophile rigida* open low heath over *Harperia lateriflora* open sedgeland and *Neurachne alopecuroidea*/*Rytidosperma setaceum* open grassland with emergent mallee *Eucalyptus incrassata*

LANDFORM Plain

SLOPE Gentle

GEOLOGY Siltstone

ROCKS <2%

SOIL TYPE Clay

SOIL COLOUR Light brown

HYDROLOGY Poor drainage

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	<2e	<i>Eucalyptus incrassata</i> <i>Eucalyptus thamnoides</i>
Shrubs 0.5-1m	2-10	<i>Hakea marginata</i> <i>Petrophile rigida</i>
Shrubs <0.5m	30-70	<i>Melaleuca carrii</i> <i>Kunzea recurva</i> <i>Verticordia endlicheriana</i>
Sedges	10-30	<i>Harperia lateriflora</i> <i>Tetraria</i> sp. Jarrah Forest <i>Schoenus breviculmis</i>
Herbs	10-30	<i>Opercularia vaginata</i> <i>Borya sphaerocephala</i> <i>Drosera menziesii</i> <i>Centrolepis polygyna</i> <i>Aphelia brizula</i> <i>Thelymitra crinita</i> <i>Drosera glanduligera</i> * <i>Ursinia anthemoides</i> * <i>Parentucellia latifolia</i>
Grasses	10-30	<i>Neurachne alopecuroidea</i> <i>Rytidosperma setaceum</i> * <i>Aira</i> sp. * <i>Vulpia</i> sp. * <i>Hypochaeris</i> sp.

SITE 25

DATE 3/11/2016, 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'31.4" E 117.55'51.2"

LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE Mixed low shrubland over *Harperia lateriflora* open sedgeland and *Neurachne alopecuroidea*/*Rytidosperma setaceum* open grassland with emergent *Eucalyptus incrassata* and *Eucalyptus uncinata*

LANDFORM Plain

SLOPE Gentle

GEOLOGY Laterite/siltstone

ROCKS <2%

SOIL TYPE Gravelly clay

SOIL COLOUR Light brown

HYDROLOGY Poor drainage

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	e <2	<i>Eucalyptus uncinata</i> <i>Eucalyptus incrassata</i>
Shrubs <0.5m	10-30 Mix	<i>Hakea marginata</i> <i>Melaleuca carrii</i> <i>Melaleuca spathulata</i> <i>Kunzea recurva</i> <i>Verticordia endlicheriana</i> <i>Astartea glomerulosa</i> <i>Jacksonia capitata</i>
Sedges	10-30	<i>Harperia lateriflora</i> <i>Gahnia ancistrophylla</i> <i>Mesomelaena stygia</i>
Herbs	10-30	<i>Opercularia vaginata</i> <i>Drosera menziesii</i> <i>Centrolepis polygyna</i> <i>Aphelia brizula</i> <i>Thelymitra crinita</i> <i>Drosera glanduligera</i> <i>*Ursinia anthemoides</i> <i>*Hypochaeris sp.</i> <i>*Parentucellia latifolia</i>
Grasses	10-30	<i>Neurachne alopecuroidea</i> <i>Rytidosperma setaceum</i> <i>*Aira sp.</i> <i>*Vulpia sp.</i>

SITE 26

DATE 3/11/2016, 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'31.1" E 117.55'52.2"

LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE *Eucalyptus pleurocarpa*/*E. uncinata* very open mallee over *Taxandria spathulata* open shrubland over *Isopogon teretifolius* ssp. *petrophiloides* low shrubland

LANDFORM Plain

SLOPE Gentle

GEOLOGY Siltstone/spongelite

ROCKS <2%

SOIL TYPE Loam

SOIL COLOUR Orange/brown

HYDROLOGY ?Good drainage

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	2-10	<i>Eucalyptus pleurocarpa</i> <i>Eucalyptus uncinata</i>
Shrubs 1-2m	10-30	<i>Taxandria spathulata</i> <i>Melaleuca spathulata</i> <i>Acacia triptycha</i>
Shrubs 0.5-1m	10-30	<i>Isopogon teretifolius</i> ssp. <i>petrophiloides</i> <i>Calothamnus affinis</i> <i>Daviesia dilatata</i> <i>Banksia mucronulata</i> <i>Isopogon buxifolius</i>
Shrubs <0.5m	10-30	<i>Chorizema aciculare</i> <i>Beaufortia empetrifolia</i> <i>Allocasuarina microstachya</i> <i>Lechenaultia formosa</i> <i>Melaleuca suberosa</i> <i>Leucopogon</i> sp. Coujinup <i>Hibbertia microphylla</i> <i>Acacia crispula</i> <i>Jacksonia capitata</i> <i>Calytrix leschenaultii</i> <i>Leucopogon elegans</i> ssp. <i>elegans</i> <i>Leucopogon</i> sp. Coujinup <i>Gompholobium marginatum</i>
Sedges	2-10	<i>Harperia lateriflora</i> <i>Lepidosperma</i> sp. 1 <i>Shoenus</i> ? <i>brevisetis</i> <i>Tricostularia</i> sp.
Herbs	10-30	<i>Opercularia vaginata</i> <i>Stylidium repens</i> <i>Drosera glanduligera</i> <i>Argentipallidium niveum</i> <i>Chamaexeros serra</i> <i>Stackhousia monogynai</i> <i>Pterochaeta paniculata</i> <i>Thelymitra crinita</i> <i>Borya sphaerocephala</i> <i>Dampiera juncea</i> <i>Conostylis setigera</i> <i>Cyathochaeta avenacea</i> <i>Dampiera pedunculata</i> <i>Dampiera alata</i> <i>Lomandra</i> ? <i>micrantha</i> <i>Lomandra nigricans</i>

		<i>Stylidium lepidum</i> P3
		<i>Billardiera variifolia</i>
Grasses	2-10	<i>Neurachne alopecuroidea</i>
		<i>Rytidosperma setaceum</i>
		<i>Amhipogon</i> sp.

SITE 27

DATE 4/11/2016, 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'31.2" E 117.55'52.6"

LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE *Melaleuca carrii*/*Verticordia endlicheriana* open low heath over *Harperia lateriflora* open sedgeland and *Neurachne alopecuroidea*/*Rytidosperma setaceum* open grassland

LANDFORM Plain

SLOPE Flat

GEOLOGY Laterite/spongelite

ROCKS <2%

SOIL TYPE Gravelly clay

SOIL COLOUR Orange-brown

HYDROLOGY Poor drainage

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Shrubs <0.5m	30-70	<i>Melaleuca carrii</i> <i>Verticordia endlicheriana</i> <i>Kunzea recurva</i> <i>Calytrix leschenaultii</i> <i>Leucopogon elegans</i> ssp. <i>elegans</i> <i>Allocasuarina microstachya</i> <i>Hakea marginata</i> <i>Jacksonia capitata</i> <i>Cryptandra leucopogon</i>
Sedges	2-10	<i>Harperia lateriflora</i> <i>Lepidosperma</i> sp. 2 <i>Mesomelaena stygia</i>
Herbs	10-30	<i>Borya sphaerocephala</i> <i>Thelymitra villosa</i> <i>Tripterococcus brunonis</i> <i>Stackhousia monogynai</i> <i>Pterochaeta paniculata</i> <i>Opercularia vaginata</i> <i>Drosera menziesii</i> <i>Aphelia brizula</i> <i>Drosera glanduligera</i> <i>*Ursinia anthemoides</i> <i>*Parentucellia latifolia</i>
Grasses	2-10	<i>Neurachne alopecuroidea</i> <i>Rytidosperma setaceum</i> <i>*Aira</i> sp. <i>*Vulpia</i> sp. <i>*Hypochaeris</i> sp.

SITE 28

DATE 4/11/2016, 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'31.2" E 117.55'56.1"

LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE *Allocasuarina campestris* open heath over *Melaleuca carrii* very open shrubland with emergent *Eucalyptus pleurocarpa*

LANDFORM Plain

SLOPE Flat

GEOLOGY Siltstone/spongelite

ROCKS 2-10%

SOIL TYPE Shallow clay-loam

SOIL COLOUR Light brown

HYDROLOGY Poor drainage

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	<2e	<i>Eucalyptus pleurocarpa</i>
Shrubs 1-2m	30-70	<i>Allocasuarina campestris</i>
Shrubs 0.5-1m	<2e	<i>Leucopogon</i> sp. Coujinup <i>Acacia triptycha</i> <i>Kunzea recurva</i> <i>Beaufortia empetrifolia</i> <i>Melaleuca spathulata</i>
Shrubs <0.5m	2-10	<i>Melaleuca carrii</i> <i>Leucopogon elegans</i> ssp. <i>elegans</i> <i>Verticordia endlicheriana</i> <i>Melaleuca spathulata</i> <i>Jacksonia capitata</i> <i>Astartea glomerulosa</i> <i>Calytrix tetragona</i> <i>Hibbertia microphylla</i> <i>Pimelia imbricata</i>
Sedges	2-10	<i>Harperia lateriflora</i> <i>Lepidosperma</i> sp. 2 <i>Schoenus brevisetis</i>
Herbs	2-10	<i>Borya sphaerocephala</i> <i>Gnephosis drummondii</i> <i>Opercularia vaginata</i> <i>Laxmannia minor</i> <i>Stylidium lepidum</i> P3 <i>Thysanotus multiflorus</i> <i>Drosera glanduligera</i> <i>Elythranthera brunonis</i> <i>Drosera menziesii</i> <i>Thelymitra crinita</i> <i>Caladenia flava</i> <i>Lomandra ?micrantha</i>
Grasses	2-10	<i>Neurachne alopecuroidea</i> <i>Rytidosperma setaceum</i> <i>Amhipogon</i> sp.

SITE 29

DATE 4/11/2016, 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'29.9" E 117.55'59.9"

LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE *Eucalyptus pleurocarpa* mallee over *Allcasuarina trichodon*/*Hakea pandanica*rpa tall shrubland over *Taxandria spathulata* shrubland

LANDFORM Plain

SLOPE Gentle

GEOLOGY Laterite/spongelite

ROCKS <2%

SOIL TYPE Gravelly clay sand

SOIL COLOUR Light brown

HYDROLOGY Good drainage

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	30-70 Mix	<i>Eucalyptus pleurocarpa</i> <i>Eucalyptus incrassata</i> <i>Eucalyptus xanthonema</i> ssp. <i>xanthonema</i> <i>Eucalyptus pachyloma</i>
Shrubs >2m	2-10 Mix	<i>Allcasuarina trichodon</i> <i>Hakea pandanica</i> rpa
Shrubs 1-2m	10-30	<i>Taxandria spathulata</i> <i>Xanthorrhoea platyphylla</i> <i>Acacia triptycha</i> <i>Melaleuca glaberrima</i> <i>Gastrolobium spinosum</i>
Shrubs <0.5m	2-10	<i>Melaleuca carrii</i> <i>Leucopogon</i> sp. Coujinup <i>Hibbertia microphylla</i> <i>Beaufortia empetrifolia</i> <i>Acacia crispula</i> <i>Acacia leioderma</i> <i>Jacksonia capitata</i> <i>Calytrix tetragona</i> <i>Leucopogon</i> sp. <i>Acacia pycnocephala</i> <i>Hibbertia recurvifolia</i> <i>Melaleuca spathulata</i> <i>Allocasuarina microstachya</i> <i>Verticordia habrantha</i>
Sedges	30-70	<i>Harperia lateriflora</i> <i>Schoenus brevisetis</i> <i>Schoenus obtusifolius</i> <i>Desmocladius flexuosus</i> * <i>Cyperus tenellus</i>
Herbs	2-10	<i>Opercularia vaginata</i> <i>Stylidium tenue</i> <i>Drosera menziesii</i> <i>Argentipallium niveum</i> <i>Crassula colorata</i> var. <i>colorata</i> <i>Dampiera juncea</i> <i>Conostylis setigera</i> <i>Burchardia congesta</i> <i>Billardiera variifolia</i> <i>Gnephosis drummondii</i> <i>Elythranthera</i> sp. <i>Trachymene pilosa</i>
Grasses	2-10	<i>Neurachne alopecuroidea</i>

Rytidosperma setaceum

Amphipogon sp.

Austrostipa hemipogon

SITE 5 WP 30

DATE 4/11/2016, 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'27.6" E 117.56'06.5"

LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE Myrtaceous open low heath over *Anarthria laevis* open sedgeland with emergent *Eucalyptus xanthonema* ssp. *apposita*

LANDFORM Plain

SLOPE Gentle

GEOLOGY Laterite/siltstone

ROCKS <2%

SOIL TYPE Gravelly clay

SOIL COLOUR Light brown

HYDROLOGY Poor drainage

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	<2e	<i>Eucalyptus xanthonema</i> ssp. <i>apposita</i>
Shrubs >2m	<2e	<i>Allacasuarina trichodon</i>
Shrubs 0.5-1m	30-70	<i>Beaufortia empetrifolia</i> <i>Melaleuca violacea</i> <i>Banksia mucronulata</i> <i>Astartea glomerulosa</i> <i>Melaleuca spathulata</i>
Shrubs <0.5m	2-10	<i>Leucopogon elegans</i> ssp. <i>elegans</i> <i>Lechenaultia formosa</i>
Sedges	10-30	<i>Anarthria laevis</i> <i>Tetraria</i> sp. Jarrah Forest (R. Davis 7391)
Herbs	2-10	<i>Opercularia vaginata</i> <i>Trichocline spathulata</i> <i>Lomandra ?micrantha</i> <i>Cassytha flava</i> <i>Styliidium lepidum</i> P3
Grasses	2-10 mix	<i>Neurachne alopecuroidea</i> <i>Rytidosperma setaceum</i> <i>Austrostipa</i> sp.

SITE 31

DATE 4/11/2016, 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'25" E 117.56'11"

LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE *Eucalyptus wandoo* open woodland over *Allocasuarina trichodon* low open forest

LANDFORM Lower slope

SLOPE Moderate

GEOLOGY Spongelite

ROCKS >50%

SOIL TYPE Loam

SOIL COLOUR Light grey

HYDROLOGY Good drainage

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees <10m	2-10	<i>Eucalyptus wandoo</i>
Trees <10m	30-70	<i>Allocasuarina trichodon</i>
Mallees <8m	<2e	<i>Eucalyptus hebetifolia</i> <i>Eucalyptus pachyloma</i>
Shrubs 1-2m	<2e	<i>Taxandria spathulata</i> <i>Xanthorrhoea platyphylla</i> <i>Melaleuca blaeriifolia</i>
Shrubs <0.5m	<2e	<i>Platytheca gallioides</i> <i>Hypocalymma angustifolium</i> <i>Bossaia ornata</i>
Sedges	<2e	<i>Schoenus nanus</i>
Herbs	<2e	<i>Crassula colorata</i> var. <i>colorata</i> <i>Trachymene pilosa</i> <i>Calandrinia calyptata</i> <i>Opercularia vaginata</i> <i>Lomandra ?micrantha</i> <i>*Helichrysum luteoalbum</i>
Grasses	2-10	*<i>Aira</i> sp. *<i>Vulpia</i> sp. <i>Austrostipa hemipogon</i>

SITE 32

DATE 4/11/2016, 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'23.4" E 117.56'12.3"

LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE *Eucalyptus wandoo* open woodland over *Eucalyptus pachyloma* very open mallee over *Allocasuarina trichodon* tall open shrubland

LANDFORM Mid-slope

SLOPE Moderate

GEOLOGY Spongelite

ROCKS 10-20%

SOIL TYPE Loam

SOIL COLOUR Brown

HYDROLOGY Good drainage

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees 10-30m	2-10	<i>Eucalyptus wandoo</i>
Mallees <8m	2-10	<i>Eucalyptus pachyloma</i>
Shrubs >2m	2-10	<i>Allocasuarina trichodon</i>
Shrubs 0.5-1m	2-10	<i>Hypocalymma angustifolium</i>
Shrubs <0.5m	<2e	<i>Hibbertia hemignosta</i>
Sedges	<2e	*<i>Cyperus tenellus</i>
Herbs	<2e mix	<i>Pterochaeta paniculata</i> <i>Crassula colorata</i> var. <i>colorata</i> <i>Trachymene pilosa</i> <i>Opercularia vaginaa</i> <i>Levenhookia pusilla</i> <i>Lobelia rhombifolia</i>
Grasses	2-10	*<i>Aira</i> sp. <i>Neurachne alopecuroidea</i> <i>Rytidosperma setaceum</i> <i>Austrostipa hemipogon</i> *<i>Vulpia</i> sp.

SITE 33

DATE 4/11/2016, 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'23" E 117.56'13"

LOCATION Kalgan Plains Reserve

VEGETATION TYPE *Eucalyptus wandoo* low open woodland over *Eucalyptus hebetifolia* very open mallee over *Melaleuca pentagona* ssp. *pentagona* tall open scrub

LANDFORM Lower slope

SLOPE Steep

GEOLOGY Spongelite

ROCKS <2%

SOIL TYPE Loam

SOIL COLOUR Brown

HYDROLOGY Good drainage

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees <10m	2-10	<i>Eucalyptus wandoo</i>
Mallees <8m	2-10	<i>Eucalyptus hebetifolia</i> <i>Eucalyptus pleurocarpa</i>
Shrubs >2m	30-70	<i>Melaleuca pentagona</i> ssp. <i>pentagona</i>
Sedges	<2e	<i>Tetraria</i> sp. Jarrah Forest (R. Davis 7391)
Grasses	2-10	<i>Rytidosperma setaceum</i>
	Mix	<i>Austrostipa elegantissima</i> <i>Austrostipa hemipogon</i>

SITE 34

DATE 4/11/2016, 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'22.8" E 117.56'04.1"

LOCATION Kalgan Plains Reserve

VEGETATION TYPE *Allocasuarina campestris* open shrubland over *Calothamnus quadrifidus* low shrubland over *Borya nitida* very open herbland and *Neurachne alopecuroidea*/*Rytidosperma setaceum* very open grassland

LANDFORM Mid-slope

SLOPE Gentle

GEOLOGY Laterite/spongelite

ROCKS 10-20%

SOIL TYPE Gravelly clay

SOIL COLOUR Orange/brown

HYDROLOGY Poor drainage

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees <10m	<2e	<i>Allocasuarina trichodon</i>
Mallees <8m	<2e	<i>Eucalyptus pachyloma</i>
Shrubs 1-2m	2-10	<i>Allocasuarina campestris</i> <i>Acacia triptycha</i>
Shrubs 0.5-1m	10-30	<i>Calothamnus quadrifidus</i> <i>Hypocalymma angustifolia</i>
Shrubs <0.5m	10-30	<i>Verticordia endlicheriana</i> <i>Jacksonia capitata</i> <i>Melaleuca carrii</i> <i>Calytrix tetragona</i>
Herbs	2-10	<i>Borya sphaerocephala</i> <i>Pterochaeta paniculata</i> <i>Stylidium tenue</i> <i>*Hypochaeris sp.</i>
Grasses	2-10	<i>Neurachne alopecuroidea</i> <i>Rytidosperma setaceum</i> <i>*Aira sp.</i>

SITE 35

DATE 7/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.34'27.1" E 117.52'04"

LOCATION Remnant 1 (M Adams)

VEGETATION TYPE *Eucalypts wandoo* woodland over *Eucalyptus uncinata* very open mallee over *Hakea lissocarpa* very open shrubland over *Gahnia ancistrophylla* open sedgeland/*Neurachne alopecuroidea* open grassland

LANDFORM Mid-slope

SLOPE Moderate

GEOLOGY Laterite

ROCKS <2%

SOIL TYPE Gravelly sand

SOIL COLOUR Light brown

HYDROLOGY Good drainage

CONDITION Good

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees 10-30m	10-30	<i>Eucalyptus wandoo</i>
Mallees <8m	2-10	<i>Eucalyptus uncinata</i>
Shrubs <0.5m	2-10	<i>Hakea lissocarpa</i> <i>Astroloma epacridis</i> <i>Dodonaea amblyophylla</i> <i>Cryptandra arbutiflora</i> var. <i>arbutiflora</i>
Sedges	10-30	<i>Gahnia ancistrophylla</i> <i>Desmocladius flexuosus</i> <i>Anarthria laevis</i>
Herbs	2-10	<i>Dianella revoluta</i> <i>Borya sphaerocephala</i> <i>Haemodorum discolor</i> <i>Opercularia vaginata</i> * <i>Disa bracteata</i> * <i>Ursinia anthemoides</i> * <i>Romulea rosea</i>
Grasses	10-30	<i>Neurachne alopecuroidea</i> <i>Austrostipa mollis</i> <i>Rytidosperma setaceum</i> <i>Austrostipa ?scabra</i> <i>Amhipogon</i> sp. * <i>Avena</i> sp. * <i>Briza minor</i>

SITE 36

DATE 7/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.34'26.7" E 117.52'07.1"

LOCATION Remnant 1 (M. Adams)

VEGETATION TYPE *Eucalypts wandoo* open woodland over *Eucalyptus occidentalis* low open woodland over *Acacia triptycha* very open shrubland over *Gahnia ancistrophylla* sedgeland/*Amphipogon* sp. open grassland

LANDFORM Mid-slope

SLOPE Gentle

GEOLOGY Laterite

ROCKS <2%

SOIL TYPE Loam

SOIL COLOUR Brown

HYDROLOGY Good drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees 10-30m	2-10	<i>Eucalyptus wandoo</i>
Trees <10m	2-10	<i>Eucalyptus occidentalis</i>
Shrubs 0.5-1m	2-10	<i>Acacia triptycha</i> <i>Dodonaea amblyophylla</i>
Shrubs <0.5m	2-10	<i>Hakea lissocarpa</i> <i>Petrophile rigida</i> <i>Astroloma epacridis</i> <i>Hibbertia hemignosta</i> <i>Phyllanthus calycinus</i> <i>Acacia lasiocarpa</i> var. <i>sedifolia</i>
Sedges	30-70	<i>Gahnia ancistrophylla</i> <i>Desmocladius flexuosus</i> <i>Anarthria laevis</i> <i>Harperia lateriflora</i> <i>Lepidosperma</i> aff. <i>angustatum</i> <i>Mesomelaena stygia</i> <i>Tetraria</i> sp. Jarrah Forest (R. Davis 7391)
Herbs	2-10	<i>Borya sphaerocephala</i> <i>Laxmannia sessiliflora</i> <i>Opercularia vaginata</i> <i>Lyperanthus serratus</i> * <i>Disa bracteata</i> * <i>Ursinia anthemoides</i> * <i>Romulea rosea</i>
Grasses	10-30	<i>Amphipogon</i> sp. <i>Neurachne alopecuroidea</i> <i>Austrostipa mollis</i> <i>Rytidosperma setaceum</i> * <i>Briza minor</i>

SITE 37

DATE 7/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.34'23.5" E 117.52'05.9"

LOCATION Remnant 1 (M Adams)

VEGETATION TYPE *Hypocalymma angustifolia* very open shrubland over *Spartochloa scirpoides*
grassland/*Anarthria scabra* open sedgeland

LANDFORM Rock outcrop

SLOPE Gentle

GEOLOGY Granite

ROCKS 20-50%

SOIL TYPE Loam

SOIL COLOUR Orange/brown

HYDROLOGY Poor drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Shrubs 0.5-1m	2-10	<i>Hypocalymma angustifolia</i> <i>Acacia lasiocarpa</i> var. <i>sedifolia</i>
Sedges	10-30	<i>Anarthria scabra</i>
Herbs	2-10	<i>Borya sphaerocephala</i> <i>Stypandra glauca</i> * <i>Disa bracteata</i>
Grasses	30-70	<i>Spartochloa scirpoides</i> * <i>Aira</i> sp.

SITE 38

DATE 7/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.34'28.4" E 117.52'05.3"

LOCATION Remnant 1 (M Adams)

VEGETATION TYPE *Borya sphaerocephala* herbland/*Neuroachne alopecuroidea* open grassland with emergent *Astroloma epacridis*

LANDFORM Rock outcrop

SLOPE Moderate

GEOLOGY Granite/laterite

ROCKS 20-50%

SOIL TYPE Loam

SOIL COLOUR Orange/brown

HYDROLOGY Poor drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Shrubs <0.5m	<2e	<i>Astroloma epacridis</i>
Sedges	<2e	<i>Anarthria laevis</i> <i>Anarthria scabra</i>
Herbs	30-70	<i>Borya sphaerocephala</i> <i>Stypandra glauca</i>
Grasses	10-30	<i>Neuroachne alopecuroidea</i> <i>Rytidosperma setaceum</i> <i>Austrostipa ?scabra</i>

SITE 39

DATE 11/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.37'29.3" E 117.54'13.4"

LOCATION Twin Creeks Reserve Site 2

VEGETATION TYPE *Banksia attenuata* low woodland over *Melaleuca thymoides* open heath

LANDFORM Mid-slope

SLOPE Gentle

GEOLOGY Laterite

ROCKS 0%

SOIL TYPE Sand

SOIL COLOUR Light grey

HYDROLOGY Good drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Trees <10m	10-30	<i>Banksia attenuata</i>
Shrubs 1-2m	30-70	<i>Melaleuca thymoides</i> <i>Agonis theiformis</i> <i>Adenanthos cuneatus</i> <i>Jacksonia spinosa</i>
Shrubs 0.5-1m	10-30 Mix	<i>Gompholobium confertum</i> <i>Leucopogon alternifolius</i> P3 <i>Andersonia caerulea</i> <i>Banksia sphaerocarpa</i> var. <i>sphaerocarpa</i> <i>Franklandia fucifolia</i> <i>Xanthorrhoea platyphylla</i>
Shrubs <0.5m	10-30	<i>Calytrix flavescens</i> <i>Brachyloma baxteri</i> <i>Acacia biflora</i> <i>Stirlingia latifolia</i> <i>Daviesia preissii</i> <i>Isopogon formosus</i> <i>Acacia varia</i>
Sedges	30-70	<i>Anarthria prolifera</i> <i>Lepidosperma</i> sp. 1 <i>Tetraria</i> sp. Jarrah Forest (R. Davies 7391) <i>Lyginia barabata</i> <i>Hypolaena exsulca</i> <i>Shoenus brevisetis</i>
Herbs	2-10	<i>Dasypogon bromeliifolius</i> <i>Lomandra sericea</i> <i>Lomandra ?micrantha</i> <i>Praecoxanthus aphyllus</i> <i>Pyrorchis nigricans</i> <i>Drosera pallida</i> <i>Billardiera variifolia</i> <i>Drosera androsacea</i> <i>Cassytha flava</i> <i>Patersonia limbata</i>

SITE 40

DATE 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'26.5" E 117.56'02.4"

LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE *Allocasuarina trichodon* low woodland over *Eucalyptus thamnoides* very open mallee over *Taxandria spathulata* shrubland

LANDFORM Plain

SLOPE Gentle

GEOLOGY Spongelite

ROCKS <2%

SOIL TYPE Loam

SOIL COLOUR Light brown

HYDROLOGY Good drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	2-10	<i>Eucalyptus thamnoides</i> <i>Eucalyptus pleurocarpa</i> <i>Eucalyptus incrassata</i>
Shrubs >2m	10-30	<i>Allocasuarina trichodon</i>
Shrubs 1-2m	10-30	<i>Taxandria spathulata</i>
Shrubs 0.5-1m	2-10	<i>Xanthorrhoea platyphylla</i> <i>Isopogon buxifolius</i>
Shrubs <0.5m	10-30	<i>Banksia pteridifolia</i> <i>Daviesia dilatata</i> <i>Banksia mucronulata</i> <i>Astartea glomerulosa</i> <i>Melaleuca spathulata</i> <i>Cryptandra leucopogon</i>
Sedges	e <2	<i>Gahnia ancistrophylla</i>
Herbs	e <2	<i>Lomandra ?micrantha</i> <i>Dampiera alata</i>
Grasses	e <2	<i>Rytidosperma setaceum</i> <i>Neurachne alopecuroidea</i> <i>Austrostipa hemipogon</i>

SITE 41

DATE 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'26.3" E 117.56'04.6"

LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE *Eucalyptus pachyloma* very open mallee over *Taxandria spathulata* open heath over *Tetraria* sp. Jarrah Forest/*Harperia lateriflora* open sedgeland

LANDFORM Plain

SLOPE Gentle

GEOLOGY Laterite/Spongelite

ROCKS <2%

SOIL TYPE Gravelly loam

SOIL COLOUR Light brown

HYDROLOGY Good drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	2-10	<i>Eucalyptus pachyloma</i>
Shrubs 1-2m	30-70	<i>Taxandria spathulata</i> <i>Acacia triptycha</i> <i>Xanthorrhoea platyphylla</i>
Shrubs 0.5-1m	2-10	<i>Beaufortia anisandra</i> <i>Gastrolobium spinosum</i>
Shrubs <0.5m	2-10	<i>Leucopogon</i> sp. Coujinup
Sedges	10-30	<i>Tetraria</i> sp. Jarrah Forest (R. Davies 7391) <i>Harperia lateriflora</i> <i>Lepidosperma</i> sp. 2 <i>Harperia confertospicata</i> <i>Desmocladius flexuosus</i> <i>Desmocladius fasciculatus</i> <i>Mesomelaena stygia</i> <i>Schoenus ?brevisetis</i>
Herbs	<2e mix	<i>Lomandra ?micrantha</i> <i>Centrolepis pilosa</i> <i>Conostylis setigera</i> <i>Stylidium repens</i>
Grasses	2-10 mix	<i>Rytidosperma setaceum</i> <i>Neurachne alopecuroidea</i> <i>Amphipogon turbinatus</i>

SITE 42

DATE 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'24.3" E 117.55'56.3"

LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE *Allocasuarina campestris* shrubland over mixed very open shrubland

LANDFORM Rocky outcrop

SLOPE Steep

GEOLOGY Laterite/Spongelite

ROCKS >50%

SOIL TYPE Clay loam

SOIL COLOUR Brown

HYDROLOGY Good drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Shrubs 1-2m	10-30	<i>Allocasuarina campestris</i> <i>Calothamnus quadrifidus</i>
Shrubs 0.5-1m	2-10 mix	<i>Hypocalymma angustifolium</i> <i>Leucopogon elegans</i> ssp. <i>elegans</i> <i>Leucopogon</i> sp. Coujinup <i>Melaleuca spathulata</i> <i>Taxandria spathulata</i>
Shrubs <0.5m	<2e	<i>Hibbertia microphylla</i> <i>Calytrix tetragona</i>
Sedges	<2e	<i>Lepidosperma</i> sp. 2
Herbs	<2e	<i>Stypandra glauca</i> <i>Calandrinia calytrata</i>
Grasses	<2e	* <i>Aira</i> sp.

SITE 43

DATE 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'24.4" E 117.55'56.8"

LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE *Allocasuarina campestris* tall shrubland over *Melaleuca spathulata* open shrubland

LANDFORM Rocky outcrop

SLOPE Depression

GEOLOGY Spongelite/siltstone

ROCKS 10-20

SOIL TYPE Loam

SOIL COLOUR Brown

HYDROLOGY Good drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Shrubs >2m	10-30	<i>Allocasuarina campestris</i>
Shrubs 1-2m	2-10	<i>Melaleuca spathulata</i> <i>Allocasuarina trichodon</i>
Shrubs <0.5m	10-30	<i>Kunzea recurva</i> <i>Pimelea imbricata</i> <i>Calytrix tetragona</i>
Grasses	2-10	<i>Neurachne alopecuroidea</i> <i>Rytidosperma setaceum</i> <i>*Briza minor</i>

SITE 44

DATE 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33'16.2" E 117.55.50.8"

LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE *Eucalyptus pleurocarpa* mallee over *Allocasuarina campestris* open shrubland over *Kunzea preissiana* open low heath

LANDFORM Plain

SLOPE Gentle

GEOLOGY Laterite/spongelite

ROCKS 10-20%

SOIL TYPE Gravelly loam

SOIL COLOUR Orange/brown

HYDROLOGY Good drainage

CONDITION Pristine

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	30-70	<i>Eucalyptus pleurocarpa</i> <i>Eucalyptus incrassata</i>
Shrubs >2m	<2e	<i>Acacia triptycha</i>
Shrubs 1-2m	2-10	<i>Allocasuarina campestris</i>
Shrubs 0.5-1m	10-30	<i>Kunzea preissiana</i> <i>Trymalium ledifolium</i>
Shrubs <0.5m	10-30	<i>Petrophile rigida</i> <i>Melaleuca carrii</i> <i>Hypocalymma asperum</i> <i>Allocasuarina microstachya</i> <i>Melaleuca spathulata</i>
Sedges	30-70	<i>Tetraria</i> sp. Jarrah Forest (R. Davies 7391) <i>Lepidosperma</i> sp. 1 <i>Lepidosperma</i> sp. 2 <i>Harperia lateriflora</i> <i>Mesomelaena stygia</i> <i>Harperia confertospicata</i>
Herbs	<2e	<i>Opercularia vaginata</i> <i>Chamaexeros serra</i> <i>Dianella revoluta</i> <i>Constylis setigera</i> <i>Haemodorum discolor</i>
Grasses	2-10	<i>Neurachne alopecuroidea</i> <i>Rytidosperma setaceum</i> <i>Amhipogon</i> sp.

SITE 45

DATE 13/04/2017

RECORDERS W. Bradshaw

LAT/LONG S -34.33.22'7" E 117.55'57"

LOCATION Kalgan Plains Nature Reserve

VEGETATION TYPE *Eucalyptus thamnoides* very open mallee over *Melaleuca pentagona* ssp. *pentagona* tall closed scrub over emergent low shrub *Acacia myrtifolia*

LANDFORM Rock outcrop

SLOPE Gentle

GEOLOGY Granite

ROCKS 20-50%

SOIL TYPE Loam

SOIL COLOUR Orange/brown

HYDROLOGY Poor drainage

CONDITION Excellent

VEG LAYER	% COVER	SPECIES (Bold = dominant)
Mallees <8m	2-10	<i>Eucalyptus thamnoides</i>
Shrubs >2m	70-100	<i>Melaleuca pentagona</i> ssp. <i>pentagona</i>
Shrubs <0.5m	<2e	<i>Acacia myrtifolia</i>

