VEGETATION AND FLORA
OF
EXPLORATION LICENCE 70/2407
KEYSBROOK
WESTERN AUSTRALIA

Prepared for:
MBS Environmental
4 Cooke Street
WEST PERTH 6005

Prepared by:
Bennett Environmental Consulting Pty Ltd

PO Box 341
KALAMUNDA 6926

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1. INTRODUCTION

1.1 Background

Bennett Environmental Consulting Pty Ltd was contracted by Martinick Bosch and Sell to undertake an overview of the flora and vegetation units of Exploration licence 70/2407 where it is proposed to undertake sand mining and processing operations (See Appendix E). The lease is situated along the eastern edge of the Swan Coastal Plain about 70 kilometers south of Perth and 4 kilometers west of the small township of Keysbrook.

1.2 Vegetation

Keysbrook is included in the Swan Coastal Plain subregion of the Southwest Botanical Province (Beard, 1990). This subdistrict is mainly *Banksia* Low Woodland on leached sands, with *Melaleuca* swamps where ill-drained; Woodland of Tuart (*Eucalyptus gomphocephala*), Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) on less leached soils.

Heddle *et al*., (1980) mapped the vegetation complexes of the Darling System. Keysbrook and to the west falls within 3 vegetation complexes:

1. **Forrestfield Complex –** Vegetation ranges from Open Forest of *Corymbia calophylla – Eucalyptus marginata – Eucalyptus wandoo* to Open Forest of *Eucalyptus marginata – Corymbia calophylla – Allocasuarina fraseriana – Banksia* species. Fringing Woodland of *Eucalyptus rudis* in the gullies that dissect this landform. 29 in Figure 1.
2. **Guildford Complex** – A mixture of Open Forest to Tall Open Forest of *Corymbia calophylla – Eucalyptus wandoo – Eucalyptus marginata* and Woodland of *Eucalyptus wandoo*. Minor components include *Eucalyptus rudis – Melaleuca cuticularis*. 32 in Figure 1
3. **Bassendean Complex – Central and South –** Vegetation ranges from Woodland of *Eucalyptus marginata – Allocasuarina fraseriana – Banksia* species to Low Woodland of *Melaleuca* species and sedgelands on moister sites. This complex includes the transition *of Eucalyptus marginata* to *Eucalyptus todtiana* in the vicinity of Perth. 44 in Figure 1.
4. **Southern River Complex –** Open Woodland of *Corymbia calophylla – Eucalyptus marginata – Banksia* species with fringing woodland of *Eucalyptus rudis – Melaleuca rhaphiophylla* along creek beds. 42 in Figure 1.

Figure 1. Heddle *et al.* (1980) Vegetation Complexes recorded for area

1.3 Wetlands

Wetlands are areas that are permanently, seasonally or intermittently waterlogged or inundated with water that may be fresh, saline, flowing or static (Water and Rivers Commission, 2004). In Western Australia, the term 'wetlands' is commonly used to refer to those water bodies that are in basin or flat form, with the term 'waterways' commonly used to describe those water bodies occurring in channel form. At least 80% of all of the wetlands that were once present on the Swan Coastal Plain prior to European settlement have either been cleared, filled or developed. An estimated 15% have retained high ecological values (ie conservation category wetlands).

Wetlands within the Keysbrook area are the Keysbrook Suite. These occur as alluvial fans along the foothills of the Darling Scarp and typically are clay overlying lateritic clay and sand.

1.4 Soils

The Swan Coastal Plain is of low relief and composed of Quaternary continental sediments. Its eastern boundary is marked by scarps and associated features, which in the vicinity of Keysbrook are the sandy and gravelly spurs of the Forrestfield unit. The alluvial terrain along the eastern edge of the Plain comprises material of different ages. The older layers, characterised by duplex soils is the Guildford unit. Of the Aeolian deposits the Bassendean Dunes are the oldest and furthest inland. The Bassendean unit has peaty podzols in the swamps and is separated from the Southern River unit where sand appears to have been blown over the alluvial soils, resulting in the swamps having a clay base.

1.5 Previous Survey

K. George of MBS recorded the vegetation unit and dominant species at several waypoints within the total lease. It was obvious from these results that the remnant vegetation on the lease was located on two properties, Mostert and Linga. The remainder of the lease was pasture with scattered or occasional clumps of native trees. The current survey was to record the vegetation units in the lease area so it was concentrated on the Mostert and Linga properties. The aerial photograph provided indicated the condition of most of the lease area but there were some small properties in the south west corner where areas of remnant bushland remained. These land owner had not agreed to access.

1.6 Scope of Works

There were two requirements with this contract.

i. Map the vegetation and list the flora of the lease.
ii. Locate and record the presence of any Declared Rare and Priority Flora

2. METHODS

The field assessment was undertaken on 27th and 28th October 2004. A large portion of the exploration licence has been cleared for agricultural use, with only small patches of remnant bushland remaining. Transects were walked through all remnant vegetation and a combination of 10m x 10m quadrats and relevees were used to describe the vegetation units at the site.

During the survey any Declared Rare or Priority Flora located were recorded with a GPS reading in WGS84, a photograph and an estimate of their number. Prior to undertaking the field work all listed Declared Rare and Priority Flora had been checked against specimens housed at the Western Australian Herbarium

Where plants were unknown in the field they were collected, pressed and later identified using appropriate keys and by comparison with collections housed at the Western Australian Herbarium.

A pressed collection of each species of Declared Rare and Priority Flora was submitted to the Western Australian Herbarium for incorporation in their collection and all data was forwarded to the Rare Flora Section of the Department of Conservation and Land Management.

3. RESULTS

The vegetation units recorded during the survey were described using the vegetation layers as given in Table 1.

Table 1. Vegetation layers. Adapted from: Bush Forever (Department of Environmental Protection, 2000)

Life Form/ Height Class	Canopy Cover			
	100-70%	**70-30%**	**30-10%**	**10-2%**
Trees over 30m	Tall Closed Forest	Tall Open Forest	Tall Woodland	Tall Open Woodland
Trees 10-30m	Closed Forest	Open Forest	Woodland	Open Woodland
Trees under 10m	Low Closed Forest	Low Open Forest	Low Woodland	Low Open Woodland
Tree mallee (8m tall)	Closed Tree Mallee	Tree Mallee	Open Tree Mallee	Very Open Tree Mallee
Shrub mallee (under 8m tall)	Closed Shrub Mallee	Shrub Mallee	Open Shrub Mallee	Very Open Shrub Mallee
Shrubs over 2m	Closed Tall Scrub	Tall Open Scrub	Tall Shrubland	Tall Open Shrubland
Shrubs 1-2m	Closed Heath	Open Heath	Shrubland	Open Shrubland
Shrubs under 1m	Closed Low Heath	Open Low Heath	Low Shrubland	Low 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

3.1 Vegetation Units

All the information for the quadrats and relevees is provided in Appendix B. A total of 21 quadrats and 3 relevees were surveyed but these represent 9 different vegetation units. The vegetation units and the variation within each are described below and the mapping units provided after the description. The vegetation units and vegetation condition are mapped in Appendix C. The Floristic Community Type (Gibson *et al*., 1994) is inferred for each vegetation unit but as most of the vegetation was altered the typical and common species listed for each Floristic Community Type were often not recorded during the survey.

3.1.1 Forests

Tall Closed Forest of *Corymbia calophylla* or occasionally *Eucalyptus patens* over Tall Shrubland of *Xanthorrhoea preissii* over weeds and bare ground (CcXp)
This was represented by quadrats 7 and 8 on Mostert property. This vegetation unit merged into remnant areas of the Low Open Woodland of *Corymbia calophylla* over Tall Shrubland of *Pericalymma ellipticum* over a Low Shrubland of *Hypocalymma angustifolium*.
This is inferred to be Floristic Community Type 3c.

Closed Forest of *Corymbia calophylla* over a Closed Grassland/Herbland of weeds (Cc)
This was represented by quadrat 20 and relevee C and was the vegetated remnant over pasture in many areas of the lease.
Too degraded to infer a Floristic Community Type.

Open Forest of *Corymbia calophylla* over Tall Open Shrubland of *Kingia australis* over Closed Grassland of weeds (CcKa)

This was represented by quadrat 11, only from Lanstal property.
This is inferred to be Floristic Community Type 3a.

Closed to Low Open Forest of *Banksia ilicifolia* and *Kunzea glabrescens* over Open Grassland (BiKg)
This was represented by quadrats 18 and 19 on Linga property.
This is inferred to be Floristic Community Type 21c.

Low Closed Forest of *Banksia attenuata* with scattered *Banksia menziesii* and *Eucalyptus marginata* subsp. *marginata* over Shrubland of *Xanthorrhoea brunonis* over Open Low Heath dominated by *Hibbertia hypericoides* (BaBm)
This was represented by quadrats 1, 2, 9, 10, 12 and 16.
This vegetation unit was recorded from the low sandy dunes in Mostert, Linga and Lanstal properties. This same vegetation unit in the remainder of the study area was completely degraded with remnant, scattered trees over pasture species.
This is inferred to be Floristic Community Type 20b.

Low Open Forest of *Melaleuca preissiana* over Sedgeland (Mp)
This was represented by quadrats 4, 17 and 21 and relevees A and B
The drains through the lease included several of the understorey species.
This is inferred to be Floristic Community Type 4.

3.1.2 Woodland

Low Open Woodland of *Corymbia calophylla* over Tall Shrubland of *Pericalymma ellipticum* over a Low Shrubland of *Hypocalymma angustifolium* (CcPe)
This was represented by quadrats 3 and 6.
The remnants of this vegetation unit were small as most of the lower lying areas are paddocks.
This is inferred to be Floristic Community Type 5.

3.1.3 Scrub

Closed Tall Scrub of *Regelia ciliata, Kunzea micrantha* subsp. *micrantha* and *Pericalymma ellipticum* (Rc)
This was represented by quadrats 13 and 15. This vegetation unit was only recorded from Linga property and consisted of vegetated areas with open areas between.
This is inferred to be Floristic Community Type 5.

3.1.4 Heath

Open Heath of *Astartea affinis* over Open Sedgeland/Grassland (Aa)
This was represented by quadrats 5 and 14.
Small remnants only of this vegetation unit remain, most has been developed as pasture.
This is inferred to be Floristic Community Type 5.

3.2 Vegetation Condition

The vegetation condition recorded for each of the quadrats is included in Appendix B and mapped in Appendix D.

Table 2 Explanation of Vegetation Condition Rating (Department of Environmental Protection, 2000)

Rating	Description	Explanation
1	Pristine	Pristine or nearly so, no obvious signs of disturbance.
2	Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
3	Very Good	Vegetation structure altered, obvious signs of disturbance.
4	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it.
5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.
6	Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.

Cattle, horses and kangaroos graze the whole lease area. All the remnants had cattle in them at the time of the survey or not long previously. Kangaroos were dominant in the remnant bushland and had caused damage to several plants. In particular, the drains crossing the paddocks still contained water and were heavily used by cattle. When the survey was undertaken many cattle had congregated in these areas.

Table 3 provides a summary of the vegetation condition recorded using the vegetation rating provided in Table 2. Some degraded areas had a good tree canopy but the understorey was completely or nearly completely replaced by weeds.

Table 3. Vegetation Condition recorded during the survey

Rating	Description	Quadrats (Q), Relevees (R)
2-3	Very good to excellent	Q13
3	Very good	Q1
3-4	Good to very good	Q2, Q5, Q14, Q17
3-5	Good to degraded	Q15
4	Good	Q3
4-5	Good to degraded	Q4, Q6, Q7, Q8, Q12
5	Degraded	Q18, Q19
5-6	Degraded to completely degraded	Q9. Q16. RC
6	Completely degraded	Q10, Q11, Q20, Q21, RA, RB

Most of the survey area was completely degraded varying to good with two quadrats recording very good to excellent vegetation condition.

3.3 Wetlands

Wetlands on the Swan Coastal Plain are described using the classification system developed by Seminuik (1987) an overview of which is provided in Table 6.

Table 4. Wetland types within the Swan Coastal Plain

Wetland Type	General Description
Basin Wetlands	Dampland - seasonally waterlogged basin. Sumpland - seasonally inundated basin. Lake - permanently inundated basin. Artificial basins (e.g. dams, reservoirs).
Flat Wetlands	Floodplain = seasonally inundated flat. Palusplain = seasonally waterlogged flat.

Within the study area the wetland types identified were flat wetlands namely floodplain and palusplain. Semeniuk (1996) described the natural wetland (cosanguineous) suites for the Swan Coastal Plain. The lease area is included in the Keysbrook Suite.

No significant wetland was recorded by Water and Rivers Commission (2004) for the study area. The wetland identified at the site consists of a mosaic of several of the vegetation units described in section 3.1. The variation within the wetland, the lower lying areas, varied from a forest unit to an open heath unit and include:

Floodplain

- Low Open Forest of *Melaleuca preissiana* over Sedgeland

Palusplain

- Low Open Woodland of *Corymbia calophylla* over Tall Shrubland of *Pericalymma ellipticum* over a Low Shrubland of *Hypocalymma angustifolium*
- Closed Tall Scrub of *Regelia ciliata, Kunzea micrantha* subsp. *micrantha* and *Pericalymma ellipticum*
- Open Heath of *Astartea affinis* over Open Sedgeland/Grassland

However the interzone between these lower vegetation unit and the higher ground vegetation units are also considered part of the wetland complex as these are very important as a buffer to ensure the wetland structure is maintained. This vegetation unit is:

- Closed to Low Open Forest of *Banksia ilicifolia* and *Kunzea glabrescens* over Open Grassland

This was the vegetation unit that surrounded the wetlands identified at the site.

3.4 Threatened Ecological Communities

Ecological communities are defined as naturally occurring biological assemblages that occur in a particular type of habitat (Department of Environmental Protection, 2000). English and Blythe (1997) have developed a procedure for identifying assigning TEC's to one of four categories depending upon the threat to the community (Table 5).

Table 5. Conservation categories for TEC recognised by CALM (English and Blythe, 1997)

CODE	DEFINITION
Presumed Totally Destroyed	An ecological community, which has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrences of it is likely to recover its species composition and/or structure in the foreseeable future.
Critically Endangered	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range but capable of being substantially restored or rehabilitated.
Endangered	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.
Vulnerable	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.

Commonwealth legislation also protects vegetation communities with the Environmental Protection and Biodiversity Conservation (EPBC) Act, 1999. Under this Act a person must not take any action that is likely to have a significant impact on a listed threatened ecological community without approval from the Minister for the Environment and Heritage. The definitions of these categories of TEC are listed in Table 6.

Table 6. Conservation Categories for Threatened Ecological Communities under the EPBC Act, 1999

CODE	DEFINITION
Critically Endangered	A community can be included in the Critically Endangered category if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	A community can be included in the Endangered category if, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	A community can be included in the Vulnerable category if, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

The following Floristic Community Types were inferred:

- Floristic Community Type 20b which is recorded as Endangered CALM (English, 2004)
- Floristic Community Type 3a which is recorded as Critical CALM (English, 2004) and Endangered (EPBC Act, 1999)
- Floristic Community Type 3c which is recorded as Critical CALM (English, 2004) and Endangered (EPBC Act, 1999)

The PATN analysis undertaken by E.A. Griffin and Associates (see Appendix F) concluded that the inferred Floristic Community Type 20b is incorrect and that it should be either Floristic Community Type 21a or 21c, neither of which are listed as Threatened Ecological Communities.

The quadrats where FCT3a or FCT3c was inferred were degraded to completely degraded so should not be considered worthy of conservation. The area of FCT3a was less than 0.25ha in size and although there were several *Corymbia calophylla*, there were very few *Kingia australis*. Most of the adjoining paddock would possibly have previously been representative of this Floristic Community Type. Floristic Community Type3c was of a larger area than FCT3a but it also adjoined paddocks with most of the understorey replaced by pasture (weed) plants.

3.5 Flora

A total of 40 vascular plant families, 119 genera and 169 taxa (species, subspecies and varieties) were recorded from this survey (Appendix A). The dominant plant families were: Poaceae with 21 taxa of which 15 are weeds; Myrtaceae with 13 taxa of which 1 is a weed; Asteraceae with 12 taxa of which 4 are weeds and Cyperaceae and Papilionaceae with 11 taxa of which 1 and 4 respectively are weeds. These 5 families represent 43% of the total number of taxa recorded during the survey.

3.6 Significant Flora

Species of flora are defined as rare or priority conservation status where their populations are restricted geographically or threatened by local processes. The Department of Conservation and Land Management recognises these threats of extinction and consequently has applied regulations towards population and species protection. Rare Flora are gazetted under subsection 2 of section 23F of the Wildlife Conservation Act (1950) and therefore it is an offence to "take" or damage rare flora without approval from the Mininster for the Environment.

Table 7 presents the definitions of Declared Rare and the four Priority Flora ratings under the Wildlife Conservation Act (1950) as extracted from Department of Conservation and Land Management (2003). Table 8 presents the definitions of the threatened species under the Commonwealth Environmental Protection and Diversity Conservation Act, 1999 (Environment Australia, 2001).

Table 7. Code and description of Rare and Priority Flora categories (Wildlife Conservation Act (1950)

Code	Code Declared Rare and Priority Flora Categories
R	DRF (Declared Rare Flora) -Extant Taxa. Taxa, which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection.
X	DRF (Declared Rare Flora) -Presumed Extinct Taxa. Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently.
1	Priority One -Poorly Known Taxa. Taxa, which are known from one or a few (generally <5) populations, which are under threat.
2	Priority Two -Poorly Known Taxa. Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat.
3	Priority Three -Poorly Known Taxa. Taxa, which are known from several populations, at least some of which are not believed to be under immediate threat.
4	Priority Four -Rare Taxa. Taxa which are considered to have been adequately surveyed and which whilst being rare, are not currently threatened by any identifiable factors.

Table 8. Categories of Threatened Flora Species (Environmental Protection and Biodiversity Conservation Act, 1999)

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

The list of significant flora provided by the Department of Conservation and Land Management for the survey area to MBS Environmental is set out below in Table 9.

Table 9. List of significant flora provided by the Department of Conservation and Land Management

Species	Status	Habitat and Comments
Anthocercis gracilis (Slender Tailflower)	Vulnerable - EPBC	Erect, spindly shrub, to 0.6(–1) m high. Fl. yellow, green, Sep–Oct. Sandy or loamy soils. Granite outcrops.
Caladenia sp. Jarrah forest **NOW** *Caladenia arrecta* Priority 4 species (Western Australian Herbarium 2004a)	Vulnerable - EPBC	Tuberous, perennial, herb, 0.12–0.35 m high. Fl. yellow, red, Aug–Oct. Loam, gravel, laterite. Moist situations.
Drakea elastica (Glossy leaved Hammer-orchid)	Endangered-EPBC	Tuberous, perennial, herb, 0.12–0.3 m high. Fl. red, green, yellow, Oct–Nov. White or grey sand. Low-lying situations adjoining winter-wet swamps.
Drakea micrantha	Vulnerable-EPBC	Tuberous, perennial, herb, 0.15–0.3 m high. Fl. red, yellow, Sep–Oct. White-grey sand.
Lasiopetalum pterocarpum	Endangered-EPBC	Open shrub 0.2-1.2 m high x ca 0.2-0.5 m wide, growing through other plants. Riverbank. Brown clay-sand over granite.
Synaphea sp. Pinjarra	DRF- WA Wildlife Act 1950	Compact shrub, to 0.4 m high, to 0.5 m wide. Fl. yellow, Sep. Grey clayey sand. Swamp. Recorded from Dandalup and Pinjarra.
Tetraria australiensis	DRF- WA Wildlife Act 1950	Rhizomatous, tufted perennial, grass-like or herb (sedge), to 1 m high. Fl. brown, Nov–Dec.
Acacia oncinophylla subsp. *patulifolia*	P2- WA Wildlife Act 1950	Shrub, 0.5–2.5(–3) m high, 'minni-ritchi' bark, phyllodes 4–9 cm long, 3–6 mm wide. Fl. yellow, Aug–Dec. Granitic soils, occasionally on laterite.
Anthotium junciforme	P4- WA Wildlife Act 1950	Open, erect to prostrate perennial, herb, 0.05–0.4 m high, leaves linear to terete, 0.5–1 mm wide; flowering stems 12–40 cm long. Fl. blue, violet, purple, Nov–Mar. Sandy clay, clay. Winter-wet depressions, drainage lines.
Aponogeton hexatepalus	P4- WA Wildlife Act 1950	Rhizomatous or cormous, aquatic perennial, herb, leaves floating. Fl. green, white, Jul–Oct. Mud. Freshwater: ponds, rivers, claypans
Boronia tenuis	P4- WA Wildlife Act 1950	Procumbent or erect & slender shrub, 0.1–0.5 m high. Fl. blue, pink, white, Aug–Nov. Laterite, stony soils, granite.
Calothamnus graniticus	P4- WA Wildlife Act 1950	Shrub, 1–2.5 m high. Fl. red, May–Aug. Skeletal sandy soils, clay, laterite. Granite outcrops, hillsides.

No significant flora were located during the survey.

3.7 Introduced Species

A total of 34 weeds were recorded from the site all of which have all been determined as weeds by the Department of Conservation and Land Management (1999). The rating allocated to each weed by CALM is based on three criteria:

Invasiveness – ability to invade natural bushland in good to excellent condition or ability to invade waterways.

Distribution – wide current or potential distribution including consideration of known history of wide spread distribution elsewhere in the world.

Environmental impacts – Ability to change the structure, composition and function of ecosystems. In particular an ability to form a monoculture in a vegetation community.

Ratings indicate the following.

High indicates this weed is prioritised for control and/or research ie prioritising funding to it.

Moderate indicates control or research effort should be directed to it if funds are available, however it should be monitored (possibly a reasonably high level of monitoring).

Mild indicates monitoring of the weed and control where appropriate.

Low indicates that this species would require a low level of monitoring.

Table 10. Weeds recorded during the survey classified according to Department of Conservation and Land Management (1999)

SCIENTIFIC NAME	COMMON NAME	CALM RATING	INVASIVENESS	IMPACTS
**Bromus diandrus*	Great brome	High	✓	✓
**Ehrharta calycina*	Perennial veldt grass	High	✓	✓
**Leptospermum laevigatum*	Victorian teatree	High	✓	✓
**Romulea rosea*	Guildford grass	High	✓	✓
**Aira caryophyllea*	Silvery hairgrass	Moderate	✓	
**Aira cupaniana*	Hairgrass	Moderate	✓	
**Arctotheca calendula*	Cape weed	Moderate	✓	
**Avena barbata*	Bearded oat	Moderate	✓	
**Briza maxima*	Blowfly grass	Moderate	✓	
**Briza minor*	Shivery grass	Moderate	✓	
**Callitriche stagnalis*	Common starwort	Moderate	✓	
**Carduus pycnocephalus*	Slender thistle	Moderate	✓	
**Cynodon dactylon*	Couch grass	Moderate	✓	
**Cyperus tenellus*	Tiny flat sedge	Moderate	✓	
**Disa bracteata*	South African orchid	Moderate	✓	
**Ehrharta longiflora*	Annual veldt grass	Moderate	✓	
**Hordeum leporinum*	Barley grass	Moderate	✓	
**Hypochaeris glabra*	Flat weed	Moderate	✓	
**Juncus bufonius*	Toad rush	Moderate	✓	
**Juncus capitatus*		Moderate	✓	
**Lolium rigidum*	Annual ryegrass	Moderate	✓	
**Orobanche minor*	Lesser broom rape	Moderate	✓	
**Parentucellia latifolia*	Red Bartsia	Moderate	✓	
**Solanum nigrum*	Black berry nightshade	Moderate	✓	
**Trifolium campestre*	Hop clover	Moderate	✓	
**Ursinia anthemoides*	Ursinia	Moderate	✓	
**Vulpia bromoides*	Squirrels tail fescue	Moderate	✓	
**Vulpia myuros*	Silvery grass	Moderate	✓	
**Rumex crispus*	Curled dock	Mild		

**Aira praecox*	Early hairgrass	Low		
**Bromus hordeaceus*	Soft brome	Low		
**Lotus suaveolens*	Hairy birdsfoot trefoil	Low		
**Ornithopus pinnatus*	Slender seradella	Low		
**Trifolium hirtum*	Rose clover	Low		

Only weeds recorded in the quadrats and relevees are recorded above and this list does not include all the pasture species. A total of 5 weeds were rated as high indicating these are the ones that should be targeted for removal, as these will have the greatest impact on the remnant bushland. One weed was rated as mild and 5 as low all the remainder were rated as having a moderate impact on the remnant bushland.

4. DISCUSSION

All remnant bushland identified from the supplied aerial photograph and by MBS Environmental (2004) were surveyed but most of the lease area is under pasture. The major areas of remnant vegetation were on Mostert and Linga properties where cattle wander through all the remnant vegetation. Generally it was observed that the cattle were less likely to wander through dense understorey vegetation. Cattle, horses and kangaroos have contributed to the degradation of the bushland with one quadrat recording a very good to excellent vegetation condition, another good to very good and the remainder varying from good to completely degraded.

MBS Environmental (2004) recorded the vegetation from several waypoints (Appendix E) and this information is correlated in Table 11 with the vegetation units of the quadrats/relevees data collected during this current survey. From Table 11 it is apparent that the current survey identified additional variations in the vegetation but the MBS survey recorded 54 waypoints, many more than the current survey.

Table 11. Vegetation locations, comparison between current survey and MBS survey

VEGETATION UNIT (See Section 3.1)	CURRENT SURVEY – QUADRATS AND RELEVEES	MBS ENVIRONMENTAL WAYPOINTS
CcXp	Q7, Q8	
Cc	Q20, RC	24, 40, 43, 44, 45, 60, 61, 63, 64
CcKa	Q11	25
BiKg	Q18, Q19	31-39
BaBm	Q1, Q2, Q9, Q10, Q12, Q16	11-15, 16, 18-22, 42, 45, 53-59
Mp	Q4, Q17, Q21, RA, RB	
CcPe	Q3, Q6	
Rc	Q13, Q15	41
Aa	Q5, Q14	46, 48

There were only a few vegetated remnants remaining on Mostert and Linga properties. Although there were groups of trees left on these and other properties these were very degraded. Except for the vegetated remnants the remainder of the lease recorded a vegetation condition of 6.

Table 12. Vegetation condition (see Table 2) comparison between current survey and MBS survey

VEGETATION UNIT (See Section 3.1)	CURRENT SURVEY – QUADRATS AND RELEVEES	MBS ENVIRONMENTAL WAYPOINTS
CcXp	4-5	
Cc	5-6, 6	3, 4, 5, 6
CcKa	6	5
BiKg	5	4
BaBm	3, 3-4, 4-5, 5-6, 6	2, 3, 5, 6
Mp	3-4, 4-5, 6	
CcPe	4, 4-5	

Rc	2-3, 3-5	4
Aa	3-4	3

Generally the vegetation condition allocated by MBS was rated higher than during the current survey (Table 12). The MBS survey was undertaken on 19th-20th May 2004 prior to the winter rains and germination of weeds. K. George (pers. comm.) stated there was a lot of bare ground in the survey area, indicating that all edible grasses had been eaten by the stock and kangaroos.

No declared rare or priority flora were located during the survey. Two of the vegetation units located during the survey were inferred to be potential threatened ecological communities. These were:

- Floristic Community Type 3a is recorded as Critical CALM (English, 2004) and Endangered (EPBC Act, 1999). This was Open Forest of *Corymbia calophylla* over Tall Open Shrubland of *Kingia australis* over Closed Grassland of weeds.
- Floristic Community Type 3c is recorded as Critical CALM (English, 2004) and Endangered (EPBC Act, 1999). This was Tall Closed Forest of *Corymbia calophylla* over Tall Shrubland of *Xanthorrhoea preissii.*

Both of these FCT's are degraded and of too small an area to be considered worthy of conservation.

Using Guidance Statement 51 prepared by the Environmental Protection Authority (EPA), 2003 the environmental potential of the area was assessed

- The site is in the vegetation complexes, Guildford, Forrestfield, Bassendean Central and South and Southern River of which 6%, 9%, 24% and 17% respectively are recorded as remaining as bushland in the Perth Metropolitan Area and is therefore above the 10% requirement (Department of Environmental Protection, 2000).
- The remnant vegetation is inferred to include Floristic Community Types 3a, 3c which are listed as Critical by Department of Conservation and Land Management and Endangered by the EPBC Act 1999.
- The vegetation condition of Floristic Community Types 3a and 3c, quadrats 11, 7 and 8 was recorded as mainly degraded to completely degraded and they are not considered worthy of conservation.
- Floristic Community Type 20b, quadrats 1, 2, 9, 10, 12, and 16 varied in vegetation condition from very good to completely degraded. Where the vegetation was recorded as very good the area was small and surrounded by degraded vegetation or pasture. The good to very good covers of this Floristic Community Type covered an area of under 2ha, less than the Urban Bushland Strategy's lowest preferred area limit of 20ha (EPA, 2003).
- There were no Declared Rare or Priority Flora recorded from the site.
- A total of 40 vascular plant families, 119 genera and 169 species were recorded from all remnant bushland surveyed.
- Nine different vegetation units, representing six Floristic Community Types (Gibson *et al*., 1994) were recorded from the lease area.
- The tree canopy of the remnant bushland typically was still intact. Deaths of Banksia trees were recorded where they persisted in the pasture.
- The remnant vegetation in good or better condition, quadrats 1, 2, 3, 5, 13, 14 and 17. occurred as small remnants within the larger degraded to completely degraded bushland and they were of an irregular shape. Elongate and irregular remnants are stated by the EPA (2003) to have value as connecting links, but the more extended are the remnants, the greater their susceptibility to weed invasion and disturbance.
- There is linkage with an adjoining property to the west of Mostert property but this when viewed from the Mostert boundary fence had the understorey severely disturbed.

From the above it would appear that the remnant bushland of the Exploration Licence 70/2407, Keysbrook, although having some elements worthy of conservation, is too small an area and too dissected for it to be considered worthy of conservation.

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APPENDIX A

Species listed according to vegetation areas

ABBREVIATION	EXPLANATION
subsp.	subspecies
var.	variety
sp.	species. Used where the genus but not the species is known
*	weed
Aa	Open Heath of *Astartea affinis* over Open Sedgeland/Grassland
BaBm	Low Closed Forest of *Banksia attenuata* with scattered *Banksia menziesii* and *Eucalyptus marginata* subsp. *marginata* over Shrubland of *Xanthorrhoea brunonis* over Open Low Heath dominated by *Hibbertia hypericoides*
BiKg	Closed to Low Open Forest of *Banksia ilicifolia* and *Kunzea glabrescens* over Open Grassland
Cc	Closed Forest of *Corymbia calophylla* over a Closed Grassland/Herbland of weeds
CcKa	Open Forest of *Corymbia calophylla* over Tall Open Shrubland of *Kingia australis* over Closed Grassland of weeds
CcPe	Low Open Woodland of *Corymbia calophylla* over Tall Shrubland of *Pericalymma ellipticum* over a Low Shrubland of *Hypocalymma angustifolium*
CcXp	Tall Closed Forest of *Corymbia calophylla* or occasionally *Eucalyptus patens* over Tall Shrubland of *Xanthorrhoea preissii* over weeds
Mp	Low Open Forest of *Melaleuca preissiana* over Sedgeland
Rc	Closed Tall Scrub of *Regelia ciliata, Kunzea micrantha* subsp. *micrantha* and *Pericalymma ellipticum*

FAMILY	SPECIES	VEGETATION UNIT								
		Aa	BaBm	BiKg	Cc	CcKa	CcPe	CcXp	Mp	Rc
ANTHERICACEAE	*Agrostocrinum scabrum*		+							+
	Caesia micrantha		+							
	Chamaescilla corymbosa		+				+			
	Sowerbaea laxiflora								+	
	Thysanotus patersonii			+						
	Thysanotus thyrsoideus		+							+
	Tricoryne elatior		+							+
CENTROLEPIDACEAE	*Aphelia brizoides*				+		+			+
	Aphelia cyperoides				+					
	Centrolepis aristatus									+
	Centrolepis drummondii							+		+
COLCHICACEAE	*Burchardia umbellata*		+	+						
CYPERACEAE	*Cyathochaeta avenacea*		+							+
	**Cyperus tenellus*	+			+		+		+	+
	Lepidosperma drummondii								+	
	Lepidosperma longitudinale								+	
	Lepidosperma tenue		+							
	Mesomelaena tetragona		+							+
	Schoenus plumosus	+								
	Schoenus asperocarpus						+			
	Schoenus curvifolius									+
	Schoenus efoliatus									+
	Tetraria octandra		+							
DASYPOGONACEAE	*Dasypogon bromeliifolius*		+				+			+
	Kingia australis					+	+			+
	Lomandra hermaphrodita		+	+						
	Lomandra micrantha									+
	Lomandra microcephala		+							
	Lomandra preissii		+							
HAEMODORACEAE	*Conostylis aculeata* subsp. *aculeata*						+			+
	Conostylis juncea									+
	Conostylis serrulata		+							
	Conostylis setigera		+							
	Conostylis setosa									+
	Haemodorum laxum		+							
	Phlebocarya ciliata									+
IRIDACEAE	*Patersonia occidentalis*		+							+
	**Romulea rosea*						+		+	
JUNCACEAE	**Juncus bufonius*							+	+	
	**Juncus capitatus*				+					
	Juncus pallidus	+	+		+				+	+
	Juncus pauciflorus				+					
JUNCAGINACEAE	*Triglochin calcitrapa*	+							+	
	Triglochin procera								+	

FAMILY	SPECIES	VEGETATION UNIT								
		Aa	BaBm	BiKg	Cc	CcKa	CcPe	CcXp	Mp	Rc
ORCHIDACEAE	*Caladenia flava*		+	+				+		
	**Disa bracteata*		+	+				+		
	Elythranthera emarginatum		+				+			
	Microtis media subsp. *media*			+			+		+	+
	Prasophyllum drummondii						+			
	Prasophyllum giganteum								+	
	Pterostylis recurva		+							
	Pyrorchis nigricans							+		+
	Thelymitra canaliculata		+							
	Thelymitra cornicina			+					+	+
	Thelymitra pauciflora						+			
POACEAE	**Aira caryophyllea*	+	+	+	+		+			
	**Aira cupaniana*	+			+				+	
	**Aira praecox*								+	
	Amphibromus nervosus	+	+							
	Austrostipa compressa		+							
	Austrostipa mollis						+			
	**Avena barbata*		+							
	**Briza maxima*		+	+	+		+		+	+
	**Briza minor*	+	+				+		+	+
	**Bromus diandrus*		+	+	+	+		+		
	**Bromus hordeaceus*	+					+			
	**Cynodon dactylon*	+							+	
	**Ehrharta calycina*		+							+
	**Ehrharta longiflora*		+	+	+	+		+	+	
	Eragrostis elongata	+								
	**Hordeum leporinum*		+		+				+	
	**Lolium rigidum*	+	+		+	+	+		+	+
	Microlaena stipoides		+	+					+	
	Neurachne alopecuroidea		+							
	**Vulpia bromoides*		+		+		+		+	+
	**Vulpia myuros*				+				+	
RESTIONACEAE	*Chaetanthus aristatus*									+
	Desmocladus fascicularis		+				+	+		+
	Hypolaena exsulca		+				+			+
	Loxocarya cinerea		+							+
	Lyginia inermis									+
	Meeboldina cana	+								
	Meeboldina coangustatus							+		
	Tremulina tremula						+			
XANTHORRHOEACEAE	*Xanthorrhoea brunonis*		+		+		+	+		+
	Xanthorrhoea preissii		+		+		+	+		+
APIACEAE	*Trachymene pilosa*		+							
	Xanthosia huegelii									+

FAMILY	SPECIES	VEGETATION UNIT								
		Aa	BaBm	BiKg	Cc	CcKa	CcPe	CcXp	Mp	Rc
ASTERACEAE	**Arctotheca calendula*		+				+		+	
	Asteridea pulverulenta		+							
	Brachyscome ciliaris	+								+
	Brachyscome iberidifolia									+
	**Carduus pycnocephalus*		+							
	Cotula coronopifolia	+							+	
	Hyalosperma cotula						+			
	**Hypochaeris glabra*	+	+	+	+	+	+	+	+	+
	Podolepis gracilis						+			
	Quinetia urvillei				+			+		+
	Siloxerus humifusus				+					+
	**Ursinia anthemoides*	+	+	+	+		+			
CALLITRICHACEAE	**Callitriche stagnalis*								+	
CASUARINACEAE	*Allocasuarina fraseriana*		+	+		+		+		
CRASSULACEAE	*Crassula colorata* subsp. *colorata*							+		
DILLENIACEAE	*Hibbertia huegelii*		+							
	Hibbertia hypericoides		+					+		
	Hibbertia vaginata		+							+
DROSERACEAE	*Drosera erythrorhiza*		+							
	Drosera glanduligera				+		+			+
	Drosera menziesii		+	+			+			+
	Drosera paleacea	+								
	Drosera stolonifera		+	+			+	+		+
EUPHORBIACEAE	*Monotaxis grandiflora*		+							
	Poranthera microphylla			+						
GOODENIACEAE	*Dampiera linearis*		+							+
	Goodenia micrantha	+								
HALORAGACEAE	*Myriophyllum drummondii*								+	
LOBELIACEAE	*Grammatotheca bergiana*						+			
LOGANIACEAE	*Mitrasacme paradoxa*									+
LORANTHACEAE	*Nuytsia floribunda*		+	+			+			
MIMOSACEAE	*Acacia huegelii*									+
	Acacia pulchella			+						
	Acacia stenoptera						+			+
MYRTACEAE	*Astartea affinis*	+					+			
	Corymbia calophylla		+		+	+	+	+	+	+
	Eucalyptus marginata subsp. *marginata*		+	+		+	+	+		+
	Eucalyptus patens							+		
	Hypocalymma angustifolium	+	+		+		+			
	Kunzea glabrescens			+						
	Kunzea micrantha subsp. *micrantha*	+								+
	**Leptospermum laevigatum*									+
	Melaleuca preissiana	+					+		+	+
	Melaleuca thymoides									+
	Pericalymma ellipticum						+			+
	Regelia ciliata									+
	Verticordia densiflora									+

FAMILY	SPECIES	VEGETATION UNIT								
		Aa	BaBm	BiKg	Cc	CcKa	CcPe	CcXp	Mp	Rc
OROBANCHACEAE	**Orobanche minor*		+							
PAPILIONACEAE	*Daviesia physodes*									+
	Euchilopsis linearis									+
	Gastrolobium capitatum									+
	Gompholobium acerosum									+
	Jacksonia furcellata		+							+
	Jacksonia sternbergiana						+			
	Kennedia prostrata		+					+		
	**Lotus suaveolens*	+	+		+		+		+	+
	**Ornithopus pinnatus*	+		+	+		+	+	+	+
	**Trifolium campestre*				+					
	**Trifolium hirtum*								+	+
PHILYDRACEAE	*Philydrella pygmaea*						+			+
PITTOSPORACEAE	*Billardiera variifolia*		+							
	Pronaya fraseri subsp. *fraseri*		+							
POLYGALACEAE	**Rumex crispus*								+	
PROTEACEAE	*Banksia attenuata*		+			+				
	Banksia grandis		+							
	Banksia ilicifolia		+	+						
	Banksia menziesii		+			+				
	Dryandra lindleyana						+			+
	Hakea prostrata						+			
	Persoonia elliptica		+							
	Stirlingia latifolia		+							
	Xylomelum occidentale		+					+		
RUTACEAE	*Boronia spathulata*									+
SCROPHULARIACEAE	*Gratiola peruviana*	+					+		+	+
	**Parentucellia latifolia*									+
SOLANACEAE	**Solanum nigrum*		+	+						
STYLIDIACEAE	*Stylidium brunonianum*			+						+
	Stylidium calcaratum	+					+			+
	Stylidium repens								+	+
THYMELAEACEAE	*Pimelea lehmanniana*		+							
VIOLACEAE	*Hybanthus calycinus*		+							

APPENDIX B

Quadrat and Relevee Data

ABBREVIATION	EXPLANATION
subsp.	subspecies
var.	variety
sp.	species. Used where the genus but not the species is known
*	weed
Opportunistic	recorded outside of the quadrat

QUADRAT 1

Location: Mostert Property
Datum (WGS84): 399727E; 6410445N
Soil: Grey sand
Vegetation Description: Low Closed Forest of *Banksia attenuata* with scattered *Banksia menziesii* and *Eucalyptus marginata* subsp. *marginata* over Shrubland of *Xanthorrhoea brunonis* over Open Low Heath dominated by *Hibbertia hypericoides*
Vegetation condition: 3, good
Other Notes: Several seedlings of *Banksia attenuata*
Lot of litter on ground
Heavily grazed by kangaroos

SPECIES	HEIGHT (cm)	% COVER	SPECIES	
Banksia attenuata	900	70	**Aira caryophyllea*	opportunistic
Banksia menziesii	800	10	*Allocasuarina fraseriana*	opportunistic
**Briza maxima*	40	3	*Asteridea pulverulenta*	opportunistic
Caladenia flava	30	<1	*Banksia grandis*	opportunistic
Conostylis serrulata	25	<1	**Bromus diandrus*	opportunistic
Dasypogon bromeliifolius	25	5	**Carduus pycnocephalus*	opportunistic
Desmocladus fascicularis	20	5	*Corymbia calophylla*	opportunistic
Drosera erythrorhiza	5	3	*Drosera stolonifera*	opportunistic
Eucalyptus marginata subsp. *marginata*	800	5	*Haemodorum laxum*	opportunistic
Hibbertia hypericoides	40	30	*Lomandra microcephala*	opportunistic
**Hypochaeris glabra*	40	1	*Microlaena stipoides*	opportunistic
Kennedia prostrata	Twiner	<1	*Neurachne alopecuroidea*	opportunistic
**Lotus suaveolens*	20	2	*Patersonia occidentalis*	opportunistic
Loxocarya cinerea	30	20	*Pterostylis recurva*	opportunistic
Monotaxis grandiflora	10	<1	*Thelymitra canaliculata*	opportunistic
Pimelea lehmanniana	40	1	*Tricoryne elatior*	opportunistic
Stirlingia latifolia	35	<1	**Ursinia anthemoides*	opportunistic
Tetraria octandra	30	1	**Vulpia bromoides*	opportunistic
Trachymene pilosa	10	<1		
Xanthorrhoea brunonis	120	10		
Xanthorrhoea preissii	120	5		
Xylomelum occidentale	500	1		

QUADRAT 2

Location: Mostert Property
Datum (WGS84): 399664E 6411230N
Soil: Grey sand
Vegetation Description: Low Woodland of *Banksia attenuata, Xylomelum occidentale* and *Allocasuarina fraseriana* over Low Shrubland dominated by *Hibbertia hypericoides*
Vegetation Condition: 3-4
Other Notes: Very open with only occasional dense areas
Some sections very weedy, dominated by **Briza maxima*

SPECIES	HEIGHT (cm)	% COVER	SPECIES	
**Aira caryophyllea*	10	<1	*Austrostipa compressa*	opportunistic
Allocasuarina fraseriana	900	5	*Banksia grandis*	opportunistic
Banksia attenuata	900	8	*Banksia menziesii*	opportunistic
**Briza maxima*	40	5	*Eucalyptus marginata* subsp. *marginata*	opportunistic
Caladenia flava	15	<1	*Hybanthus calycinus*	opportunistic
Chamaescilla corymbosa	15	<1	*Lomandra preissii*	opportunistic
Dasypogon bromeliifolius	30	5	*Pimelea lehmanniana*	opportunistic
Desmocladus fascicularis	25	<1	*Tetraria octandra*	opportunistic
Drosera stolonifera	45	5	*Thysanotus thyrsoideus*	opportunistic
Hibbertia hypericoides	40	15	*Xanthorrhoea preissii*	opportunistic
**Hypochaeris glabra*	25	<1		
Kennedia prostrata	Twiner	1		
**Lotus suaveolens*	20	<1		
Loxocarya cinerea	40	1		
Monotaxis grandiflora	15	<1		
Pronaya fraseri subsp. *fraseri*	Twiner	<1		
Thelymitra canaliculata	50	<1		
**Ursinia anthemoides*	50	<1		
Xanthorrhoea brunonis	110	1		
Xylomelum occidentale	600	5		

QUADRAT 3

Location: Mostert Property
Datum (WGS84): 399697E 6410877N
Soil: Sandy loam
Vegetation Description: Low Open Woodland of *Corymbia calophylla* over Tall Shrubland of *Pericalymma ellipticum* over a Low Shrubland of *Hypocalymma angustifolium*
Vegetation Condition: 4
Other Notes: Adjacent, damper pasture area includes *Cotula coronopifolia* and **Cyperus tenellus*

SPECIES	HEIGHT (cm)	% COVER	SPECIES	
Acacia stenoptera	30	<1	*Austrostipa mollis*	opportunistic
**Aira caryophyllea*	10	5	**Bromus diandrus*	opportunistic
Aphelia brizoides	5	5	*Chamaescilla corymbosa*	opportunistic
**Arctotheca calendula*	20	2	*Corymbia calophylla*	opportunistic
Astartea affinis	200	8	*Dasypogon bromeliifolius*	opportunistic
**Briza maxima*	30	60	*Drosera menziesii*	opportunistic
**Briza minor*	10	15	*Dryandra lindleyana*	opportunistic
Conostylis aculeata subsp. *aculeata*	40	<1	*Elythranthera emarginata*	opportunistic
Drosera glanduligera	5	<1	**Grammatotheca bergiana*	opportunistic
Drosera stolonifera	40	<1	*Philydrella pygmaea*	opportunistic
Gratiola peruviana	5	<1	*Prasophyllum drummondii*	opportunistic
Hyalosperma cotula	5	10	*Stylidium calcaratum*	opportunistic
Hypocalymma angustifolia	60	15	*Thelymitra pauciflora*	opportunistic
**Hypochaeris glabra*	40	5	*Tremulina tremula*	opportunistic
**Lolium rigidum*	30	<1	**Ursinia anthemoides*	opportunistic
**Lotus suaveolens*	30	10		
Microtis media	60	5		
**Ornithopus pinnatus*	20	15		
Pericalymma ellipticum	250	15		
**Romulea rosea*	30	5		
Schoenus asperocarpus	70	5		
Xanthorrhoea brunonis	40	1		
Xanthorrhoea preissii	100	1		

QUADRAT 4

Location: Mostert Property
Datum (WGS84): 399928E 6410725N
Soil: Grey sandy loam
Vegetation Description: Low Open Woodland of *Melaleuca preissiana* over a Closed Herbland of *Cotula coronopifolia* and **Lotus suaveolens*
Vegetation Condition: 4-5 good to degraded
Other Notes: Heavily grazed and used by cattle

SPECIES	HEIGHT (cm)	% COVER
**Arctotheca calendula*	5	<1
Cotula coronopifolia	25	50
**Cyperus tenellus*	5	1
Gratiola peruviana	5	<1
**Lolium rigidum*	15	5
**Lotus suaveolens*	20	30
Melaleuca preissiana	700	5
**Romulea rosea*	20	1
**Vulpia bromoides*	20	10
**Callitriche stagnalis*	opportunistic	
**Juncus bufonius*	opportunistic	
Myriophyllum drummondii	opportunistic	

QUADRAT 5

Location: Mostert Property
Datum (WGS84): 399909E 6411082N
Soil: Pale grey to white sand
Vegetation Description: Open heath of *Astartea affinis* over a Herbland/Grassland of weeds
Vegetation Condition: 3-4
Other Notes: A very small remnant only

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SPECIES	HEIGHT (cm)	% COVER
**Aira caryophyllea*	10	<1
**Aira cupaniana*	20	<1
Astartea affinis	200	70
**Bromus hordeaceus*	50	10
**Hypochaeris glabra*	50	<1
Juncus pallidus	70	<1
**Lolium rigidum*	50	<1
**Lotus suaveolens*	40	60
**Ursinia anthemoides*	25	1

QUADRAT 6

Location: Mostert Property
Datum (WGS84): 399907E 6411648N
Soil: Grey sand
Vegetation Description: Low Open Woodland of *Eucalyptus marginata* subsp. *marginata* and *Corymbia calophylla* over Tall Shrubland of *Pericalymma ellipticum* (most is dead) over a Herbland/Grassland of weeds
Vegetation Condition: 4-5, good to degraded
Other Notes: Area heavily grazed by stock and kangaroos
Majority of *Pericalymma ellipticum* shrubs are dead

SPECIES	HEIGHT (cm)	% COVER	SPECIES	
Aphelia brizoides	5	1	*Drosera glanduligera*	opportunistic
**Arctotheca calendula*	30	<1	*Drosera stolonifera*	opportunistic
**Briza minor*	20	20	*Dryandra lindleyana*	opportunistic
**Briza maxima*	5	5	*Hakea prostrata*	opportunistic
Corymbia calophylla	800	5	**Hypochaeris glabra*	opportunistic
**Cyperus tenellus*	5	30	*Hypolaena exsulca*	opportunistic
Dasypogon bromeliifolius	15	1	*Jacksonia sternbergiana*	opportunistic
Desmocladus fascicularis	15	2	*Melaleuca preissiana*	opportunistic
Drosera menziesii	Twiner	<1	*Nuytsia floribunda*	opportunistic
Elythranthera emarginatum	30	1	*Schoenus asperocarpus*	opportunistic
Eucalyptus marginata subsp. *marginata*	800	5	*Xanthorrhoea preissii*	opportunistic
**Gratiola peruviana*	5	3		
Kingia australis	300	10		
**Lotus suaveolens*	25	20		
Pericalymma ellipticum	250	2		
Podolepis gracilis	70	<1		
**Romulea rosea*	20	40		
**Vulpia bromoides*	40	10		

QUADRAT 7

Location: Mostert Property
Datum (WGS84): 400085E 6411474N
Soil: Grey sand
Vegetation Description: Tall Closed Forest of *Eucalyptus patens* over Tall Shrubland of *Xanthorrhoea preissii* over weeds or bare ground
Vegetation Condition: 4-5, good to degraded
Other Notes: Lot of litter and bare ground

SPECIES	HEIGHT (cm)	% COVER
Caladenia flava	15	<1
Centrolepis drummondii	5	<1
Desmocladus fascicularis	15	5
Drosera stolonifera	20	1
Eucalyptus patens	1600	60
Hibbertia hypericoides	20	5
**Hypochaeris glabra*	15	5
Kennedia prostrata	Twiner	<1
**Ornithopus pinnatus*	15	1
Pyrorchis nigricans	5	<1
Xanthorrhoea preissii	200	20
Allocasuarina fraseriana	opportunistic	
Corymbia calophylla	opportunistic	
Crassula colorata subsp. *colorata*	opportunistic	
**Disa bracteata*	opportunistic	
**Juncus bufonius*	opportunistic	
Meeboldina coangustatus	opportunistic	
Quinetia urvillei	opportunistic	

QUADRAT 8

Location: Mostert Property
Datum (WGS84): 400099E 6411059N
Soil: Grey sand
Vegetation Description: Closed Forest of *Corymbia calophylla* over Low Open Shrubland of *Xanthorrhoea preissii* over Very Open Herbland and Very Open Grassland of weeds
Vegetation Condition: 4-5, good to degraded
Other Notes: Lot of leaf litter
This unit fringes the damp area and the higher ground
Heavily grazed by kangaroos

SPECIES	HEIGHT (cm)	% COVER
**Bromus diandrus*	20	5
Corymbia calophylla	1800	80
**Ehrharta longiflora*	15	5
Xanthorrhoea brunonis	100	2
Xanthorrhoea preissii	100	5
Eucalyptus marginata subsp. *marginata*	opportunistic	
Xylomelum occidentale	opportunistic	

QUADRAT 9

Location: Mostert Property
Datum (WGS84): 400239E 6411134N
Soil: Grey sand
Vegetation Description: Open Forest of *Eucalyptus marginata* subsp. *marginata* over Low Open Woodland of *Xylomelum occidentale* over Low Open Shrubland dominated by *Hibbertia hypericoides*
Vegetation Condition: 5-6, degraded to completely degraded
Other Notes: Some tall trees with a great girth

SPECIES	HEIGHT (cm)	% COVER
Caladenia flava	10	<1
Desmocladus fascicularis	15	<1
Drosera erythrorhiza	5	<1
Drosera stolonifera	15	<1
Eucalyptus marginata subsp. *marginata*	1600	50
Hibbertia huegelii	30	<1
Hibbertia hypericoides	20	5
**Hypochaeris glabra*	5	5
Lepidosperma tenue	30	1
Lomandra hermaphrodita	40	<1
Tricoryne elatior	15	1
Xylomelum occidentale	800	10
Banksia attenuata	opportunistic	
Banksia menziesii	opportunistic	
Billardiera variifolia	opportunistic	
**Disa bracteata*	opportunistic	
Elythranthera emarginatum	opportunistic	
Xanthorrhoea preissii	opportunistic	

QUADRAT 10

Location: Lanstal Property
Datum (WGS84): 401504E 6406210N
Soil: Grey sand
Vegetation Description: Low Open Forest of *Banksia attenuata, Allocasuarina fraseriana, Xylomelum occidentale* and *Eucalyptus marginata* subsp. *marginata* over Closed Grassland of weeds
Vegetation Condition: 6, completely degraded
Other Notes: Sections where the tree cover is very good but the understorey has been completely replaced with weeds.

SPECIES	HEIGHT (cm)	% COVER
Allocasuarina fraseriana	800	20
**Arctotheca calendula*	10	2
Banksia attenuata	900	10
Banksia menziesii	600	10
**Bromus diandrus*	70	45
**Ehrharta longiflora*	40	2
**Hordeum leporinum*	50	20
**Lolium rigidum*	60	30
**Orobanche minor*	40	1
Xylomelum occidentale	900	10
**Avena barbata*	opportunistic	
Eucalyptus marginata subsp. *marginata*	opportunistic	

QUADRAT 11

Location: Lanstal Property
Datum (WGS84): 400925E 6406398N
Soil: Grey sand
Vegetation Description: Open Forest of *Corymbia calophylla* over Tall Open Shrubland of *Kingia australis* over Closed Grassland of weeds
Vegetation Condition: 6, completely degraded
Other Notes: Possibly a degraded remnant of Floristic Community Type 3a

SPECIES	HEIGHT (cm)	% COVER
**Bromus diandrus*	80	25
Corymbia calophylla	1800	70
**Ehrharta longiflora*	80	25
Kingia australis	300	10
**Lolium rigidum*	80	25
Allocasuarina fraseriana	opportunistic	
Banksia attenuata	opportunistic	
Banksia menziesii	opportunistic	
Eucalyptus marginata subsp. *marginata*	opportunistic	
**Hypochaeris glabra*	opportunistic	

QUADRAT 12

Location: Linga Property
Datum (WGS84): 399546E 6409973N
Soil: Grey sand
Vegetation Description: Open Forest of *Banksia attenuata, Banksia menziesii, Eucalyptus marginata* subsp. *marginata* and *Allocasuarina fraseriana* over Shrubland of *Xanthorrhoea brunonis*
Vegetation Condition: 4-5, Good to degraded
Other Notes: Large amount of timber lying on the ground
Several Banksia seedlings

SPECIES	HEIGHT (cm)	% COVER	SPECIES	
Allocasuarina fraseriana	1000	25	*Dampiera linearis*	opportunistic
Banksia grandis	1000	5	*Dasypogon bromeliifolius*	opportunistic
Banksia menziesii	1000	15	*Desmocladus fascicularis*	opportunistic
Burchardia umbellata	70	1	*Drosera erythrorhiza*	opportunistic
Caladenia flava	30	<1	*Drosera menziesii*	opportunistic
**Ehrharta longiflora*	60	50	*Drosera stolonifera*	opportunistic
Haemodorum laxum	70	1	*Eucalyptus marginata* subsp. *marginata*	opportunistic
Hibbertia hypericoides	30	1	*Hibbertia vaginata*	opportunistic
**Hypochaeris glabra*	40	15	*Hypocalymma angustifolia*	opportunistic
**Lolium rigidum*	60	5	*Hypolaena exsulca*	opportunistic
**Lotus suaveolens*	30	2	*Jacksonia furcellata*	opportunistic
Microlaena stipoides	40	20	*Juncus pallidus*	opportunistic
Patersonia occidentalis	80	1	*Mesomelaena tetragona*	opportunistic
Xanthorrhoea brunonis	150	30	**Solanum nigrum*	opportunistic
Xylomelum occidentale	700	5	*Thysanotus thyrsoides*	opportunistic
Agrostocrinum scabrum	opportunistic		*Tricoryne elatior*	opportunistic
Banksia attenuata	opportunistic			
Banksia ilicifolia	opportunistic			
**Briza maxima*	opportunistic			
**Briza minor*	opportunistic			
Caesia micrantha	opportunistic			
Conostylis setigera	opportunistic			
Cyathochaeta avenacea	opportunistic			

QUADRAT 13

Location: Linga Property
Datum (WGS84): 399537E 6410074N
Soil: Sandy loam
Vegetation Description: Closed Tall Scrub of *Regelia ciliata* and *Pericalymma ellipticum*
Vegetation Condition: 2-3 good to very good
Other Notes: Good condition bushland only patchy as surrounded by degraded bushland

SPECIES	HEIGHT (cm)	% COVER
Acacia stenoptera	40	<1
Aphelia brizoides	5	<1
Conostylis aculeata subsp. *aculeata*	30	1
Cyathochaeta avenacea	90	10
Dasypogon bromeliifolius	30	2
Desmocladus fascicularis	5	3
Drosera menziesii	Twiner	<1
Hypocalymma angustifolia	40	3
**Hypochaeris glabra*	20	1
Hypolaena exsulca	490	5
Juncus pallidus	120	1
**Lotus suaveolens*	15	1
Lyginia inermis	50	1
Mesomelaena tetragona	70	1
Microtis media subsp. *media*	70	<1
Pericalymma ellipticum	100	15
Regelia ciliata	250	80
Schoenus curvifolius	30	<1
Siloxerus humifusus	5	<1
Stylidium calcaratum	5	<1
**Vulpia bromoides*	20	1
Xanthorrhoea preissii	90	1
Agrostocrinum scabrum	opportunistic	
Boronia spathulata	opportunistic	
Brachyscome iberidifolia	opportunistic	
Centrolepis aristatus	opportunistic	

SPECIES	
Chaetanthus aristatus	opportunistic
Conostylis setosa	opportunistic
Corymbia calophylla	opportunistic
**Cyperus tenellus*	opportunistic
Dampiera linearis	opportunistic
Daviesia physodes	opportunistic
Drosera glanduligera	opportunistic
Drosera stolonifera	opportunistic
Dryandra lindleyana	opportunistic
**Ehrharta calycina*	opportunistic
Euchilopsis linearis	opportunistic
Gratiola peruviana	opportunistic
Hibbertia vaginata	opportunistic
Kingia australis	opportunistic
Kunzea micrantha subsp. *micrantha*	opportunistic
Lomandra micrantha	opportunistic
Loxocarya cinerea	opportunistic
Melaleuca preissiana	opportunistic
Mitrasacme paradoxa	opportunistic
Patersonia occidentalis	opportunistic
Philydrella pygmaea	opportunistic
Phlebocarya ciliata	opportunistic
Schoenus efoliatus	opportunistic
Stylidium brunonianum	opportunistic
Thysanotus thyrsoideus	opportunistic
**Trifolium hirtum*	opportunistic
Verticordia densiflora	opportunistic
Xanthosia huegelii	opportunistic

QUADRAT 14

Location: Linga Property
Datum (WGS84): 399766E 6409981N
Soil: Dark brown loam
Vegetation Description: Open Heath of *Astartea affinis* over Open Sedgeland/Grassland
Vegetation Condition: 3-4, good to very good
Other Notes: Ground damp at survey

SPECIES	HEIGHT (cm)	% COVER
Astartea affinis	175	50
Brachyscome ciliaris	20	1
8Briza minor	10	1
Cotula coronopifolia	10	15
**Cynodon dactylon*	10	5
**Cyperus tenellus*	5	5
Drosera paleacea	5	<1
**Eragrostis elongata*	30	10
Gratiola peruviana	5	<1
Hypocalymma angustifolia	40	1
Juncus pallidus	70	1
Kunzea micrantha subsp. *micrantha*	125	8
**Lolium rigidum*	70	1
**Lotus suaveolens*	30	40
Meeboldina cana	100	10
**Ornithopus pinnatus*	15	1
Schoenus plumosus	5	1
Stylidium calcaratum	15	<1
Triglochin calcitrapa	10	1
Amphibromus nervosus	opportunistic	
Goodenia micrantha	opportunistic	
Melaleuca preissiana	opportunistic	

QUADRAT 15

Location: Linga Property
Datum (WGS84): 399551E 6410145N
Soil: Grey sandy loam
Vegetation Description: Tall Open Scrub of *Kunzea micrantha* subsp. *micrantha, Pericalymma ellipticum* and *Regelia ciliata* over a Herbland/Sedgeland
Vegetation Condition: 3-5, good to very good

SPECIES	HEIGHT (cm)	% COVER	SPECIES	
Aphelia brizoides	5	5	*Corymbia calophylla*	opportunistic
Brachyscome ciliaris	10	5	*Desmocladus fascicularis*	opportunistic
**Briza maxima*	10	1	*Drosera stolonifera*	opportunistic
**Briza minor*	15	1	*Eucalyptus marginata* subsp. *marginata*	opportunistic
Centrolepis aristatus	5	5	*Gastrolobium capitatum*	opportunistic
Centrolepis drummondii	5	1	*Gompholobium acerosum*	opportunistic
Cyathochaeta avenacea	70	5	*Hypolaena exsulca*	opportunistic
**Cyperus tenellus*	5	60	*Jacksonia furcellata*	opportunistic
Dasypogon bromeliifolius	70	1	**Leptospermum laevigatum*	opportunistic
Drosera menziesii	Twiner	<1	*Lomandra micrantha*	opportunistic
Hypocalymma angustifolia	50	1	*Lyginia inermis*	opportunistic
**Hypochaeris glabra*	15	1	*Melaleuca thymoides*	opportunistic
Kunzea micrantha subsp. *micrantha*	100	10	**Ornithopus pinnatus*	opportunistic
**Lolium rigidum*	40	<1	**Parentucellia latifolia*	opportunistic
**Lotus suaveolens*	20	5	*Patersonia occidentalis*	opportunistic
Melaleuca preissiana	500	5	*Pyrorchis nigricans*	opportunistic
Pericalymma ellipticum	100	5	*Quinetia urvillei*	opportunistic
Regelia ciliata	300	40	*Stylidium brunonianum*	opportunistic
Stylidium repens	20	<1	*Thelymitra cornicina*	opportunistic
Acacia huegelii	opportunistic		*Tricoryne elatior*	opportunistic
Acacia stenoptera	opportunistic		*Xanthorrhoea brunonis*	opportunistic
Agrostocrinum scabrum	opportunistic			
Boronia spathulata	opportunistic			
Conostylis juncea	opportunistic			

QUADRAT 16

Location: Linga Property
Datum (WGS84): 399422E 6410179N
Soil: Grey sand
Vegetation Description: Low Woodland of *Banksia attenuata, Banksia menziesii, Banksia ilicifolia* and *Allocasuarina fraseriana* over understorey of weeds
Vegetation Condition: 5-6, degraded to completely degraded
Other Notes: Lot of timber on the ground

SPECIES	HEIGHT (cm)	% COVER
Allocasuarina fraseriana	900	2
Amphibromus nervosus	80	10
Banksia ilicifolia	800	5
Banksia menziesii	800	10
**Briza maxima*	40	10
Burchardia umbellata	50	<1
Dasypogon bromeliifolius	50	1
**Ehrharta calycina*	70	1
**Hypochaeris glabra*	60	20
Patersonia occidentalis	90	1
**Ursinia anthemoides*	50	2
Xanthorrhoea brunonis	90	2
Austrostipa compressa	opportunistic	
Banksia attenuata	opportunistic	
Loxocarya cinerea	opportunistic	
Nuytsia floribunda	opportunistic	
Persoonia elliptica	opportunistic	
Xylomelum occidentale	opportunistic	

QUADRAT 17

Location: Linga Property
Datum (WGS84): 399242E 6410041N
Soil: Moist sandy clay
Vegetation Description: Low Open Forest of *Melaleuca preissiana* over Sedgeland
Vegetation Condition: 3-4 good to very good

SPECIES	HEIGHT (cm)	% COVER
**Briza maxima*	60	2
**Briza minor*	40	2
**Hypochaeris glabra*	50	15
Juncus pallidus	150	50
Lepidosperma drummondii	100	15
**Lotus suaveolens*	40	10
Melaleuca preissiana	1000	50
Microlaena stipoides	40	1
Microtis media subsp. *media*	60	1
**Ornithopus pinnatus*	15	3
Sowerbaea laxiflora	60	<1
**Aira caryophyllea*	opportunistic	
**Aira praecox*	opportunistic	
Corymbia calophylla	opportunistic	
Cotula coronopifolia	opportunistic	
**Cynodon dactylon*	opportunistic	
Lepidosperma longitudinale	opportunistic	
**Lolium rigidum*	opportunistic	
Prasophyllum giganteum	opportunistic	
Stylidium repens	opportunistic	
Thelymitra cornicina	opportunistic	
Triglochin calcitrapa	opportunistic	

QUADRAT 18

Location: Linga Property
Datum (WGS84): 399384E 6409986N
Soil: Grey sand
Vegetation Description: Low Open Forest of *Banksia ilicifolia* and *Kunzea glabrescens* over Open Grassland of weeds
Vegetation Condition: 5 degraded
Other Notes: Very small area

SPECIES	HEIGHT (cm)	% COVER
**Aira caryophyllea*	30	15
Banksia ilicifolia	900	10
Burchardia umbellata	70	<1
Caladenia flava	20	<1
Drosera menziesii	Twiner	<1
Drosera stolonifera	40	2
**Ehrharta longiflora*	40	20
**Hypochaeris glabra*	40	2
Kunzea glabrescens	800	60
Lomandra hermaphrodita	15	<1
Microlaena stipoides	70	1
**Ornithopus pinnatus*	10	1
Poranthera microphylla	5	<1
**Ursinia anthemoides*	50	2
Banksia attenuata	opportunistic	
Banksia menziesii	opportunistic	
Nuytsia floribunda	opportunistic	

QUADRAT 19

Location: Linga Property
Datum (WGS84): 388520E 6409960N
Soil: Grey sand
Vegetation Description: Closed Forest of *Banksia ilicifolia* and *Kunzea glabrescens* over Open Grassland
Vegetation Condition: 5, degraded
Other Notes: Excellent tree cover
Dense litter cover of leaves

SPECIES	HEIGHT (cm)	% COVER
Banksia ilicifolia	1400	80
**Briza maxima*	40	10
**Bromus diandrus*	45	5
Burchardia umbellata	90	<1
Caladenia flava	40	1
**Ehrharta longiflora*	45	5
Kunzea glabrescens	1200	10
Lomandra hermaphrodita	30	<1
**Solanum nigrum*	10	<1
Thysanotus patersonii	Twiner	<1
Acacia pulchella	opportunistic	
Allocasuarina fraseriana	opportunistic	
**Disa bracteata*	opportunistic	
Eucalyptus marginata subsp. *marginata*	opportunistic	
Microtis media subsp. *media*	opportunistic	
Nuytsia floribunda	opportunistic	
Stylidium brunonianum	opportunistic	
Thelymitra cornicina	opportunistic	

QUADRAT 20

Location: Linga Property
Datum (WGS84): 388734E 6410064N
Soil: Grey sand
Vegetation Description: Closed Forest of *Corymbia calophylla* over a Closed Grassland/Herbland of weeds
Vegetation Condition: 6 completely degraded
Other Notes: Small area
Horses and cows roam through area

SPECIES	HEIGHT (cm)	% COVER
**Bromus diandrus*	50	20
Corymbia calophylla	1800	80
**Ehrharta longiflora*	30	70
**Hordeum leporinum*	30	1
**Lolium rigidum*	60	2

QUADRAT 21

Location: Lanstal Property
Datum (WGS84): 399862E 6410178N
Soil: Sandy loam
Vegetation Description: Low Open Forest of *Melaleuca preissiana* over Closed Grassland of weeds
Vegetation Condition: 6 completely degraded
Other Notes: Small areas of this vegetation unit scattered through paddocks

SPECIES	HEIGHT (cm)	% COVER
**Arctotheca calendula*	5	5
**Cynodon dactylon*	10	5
**Ehrharta longiflora*	40	5
**Hordeum leporinum*	45	40
**Lolium rigidum*	30	40
**Lotus suaveolens*	30	5
Melaleuca preissiana	700	60
**Trifolium hirtum*	40	5

RELEVEE A

Location: Mostert Property
Datum (WGS84): 399591E 6411712N
Soil: Sandy loam
Vegetation Description: Closed Grassland/Herbland dominated by weeds
Vegetation Condition: 6 degraded
Other Notes: Cattle watering area

SPECIES	HEIGHT (cm)	% COVER
Cotula coronopifolia	5	5
**Arctotheca calendula*	25	3
**Callitriche stagnalis*	IN WATER	10
**Cyperus tenellus*	15	1
*Grasses	IN WATER	60
Juncus pallidus	50	<1
**Lotus suaveolens*	25	30
Corymbia calophylla	opportunistic	
Melaleuca preissiana	opportunistic	
**Rumex crispus*	opportunistic	
Triglochin procera	opportunistic	

RELEVEE B

Location: Lanstal Property
Datum (WGS84): 401344E 6406834N
Soil: Sandy loam
Vegetation Description: Closed Grassland/Herbland dominated by weeds
Vegetation Condition: 6 completely degraded
Other Notes: Along the drain through the area
Very degraded site

SPECIES
Cotula coronopifolia
**Cynodon dactylon*
**Lotus suaveolens*
**Vulpia myuros*

RELEVEE C

Location: Linga Property
Datum (WGS84): 399282E 6410042N
Soil: Sandy loam
Vegetation Description: Open Woodland of *Corymbia calophylla* over Open Low Heath of *Hypocalymma angustifolium*
Vegetation Condition: 5-6, degraded to completely degraded
Other Notes: Small area only

SPECIES	HEIGHT (cm)	% COVER	SPECIES	
Aphelia brizoides	10	70	**Ursinia anthemoides*	opportunistic
Corymbia calophylla	1600	5	**Vulpia bromoides*	opportunistic
**Cyperus tenellus*	5	15	**Vulpia myuros*	opportunistic
Hypocalymma angustifolium	100	50	*Xanthorrhoea brunonis*	opportunistic
Juncus pallidus	15	10	*Xanthorrhoea preissii*	opportunistic
**Aira caryophyllea*	opportunistic			
**Aira cupaniana*	opportunistic			
Aphelia cyperoides	opportunistic			
**Briza maxima*	opportunistic			
Drosera glanduligera	opportunistic			
**Hypochaeris glabra*	opportunistic			
**Juncus capitatum*	opportunistic			
**Juncus pauciflorus*	opportunistic			
**Lotus suaveolens*	opportunistic			
**Ornithopus pinnata*	opportunistic			
Quinetia urvillei	opportunistic			
Siloxerus humifusus	opportunistic			
**Trifolium campestre*	opportunistic			

APPENDIX C

Vegetation Map

ABBREVIATION	EXPLANATION
Aa	Open Heath of *Astartea affinis* over Open Sedgeland/Grassland
BaBm	Low Closed Forest of *Banksia attenuata* with scattered *Banksia menziesii* and *Eucalyptus marginata* subsp. *marginata* over Shrubland of *Xanthorrhoea brunonis* over Open Low Heath dominated by *Hibbertia hypericoides*
BiKg	Closed to Low Open Forest of *Banksia ilicifolia* and *Kunzea glabrescens* over Open Grassland
Cc	Closed Forest of *Corymbia calophylla* over a Closed Grassland/Herbland of weeds
CcKa	Open Forest of *Corymbia calophylla* over Tall Open Shrubland of *Kingia australis* over Closed Grassland of weeds
CcPe	Low Open Woodland of *Corymbia calophylla* over Tall Shrubland of *Pericalymma ellipticum* over a Low Shrubland of *Hypocalymma angustifolium*
CcXp	Tall Closed Forest of *Corymbia calophylla* or occasionally *Eucalyptus patens* over Tall Shrubland of *Xanthorrhoea preissii* over weeds
Mp	Low Open Forest of *Melaleuca preissiana* over Sedgeland
Rc	Closed Tall Scrub of *Regelia ciliata, Kunzea micrantha* subsp. *micrantha* and *Pericalymma ellipticum*

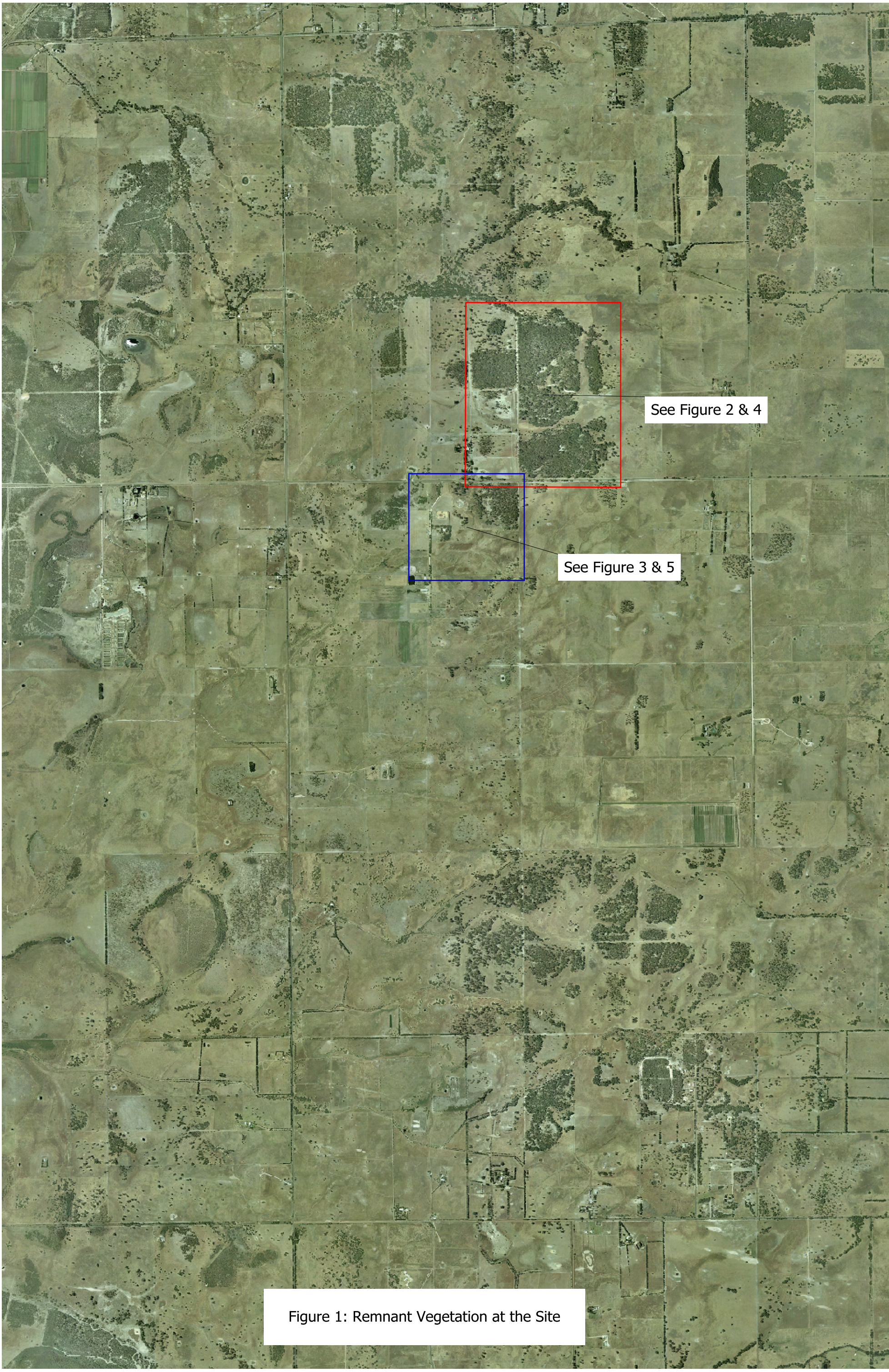

Figure 1: Remnant Vegetation at the Site

Figure 2. Remnant vegetation on Mostert property

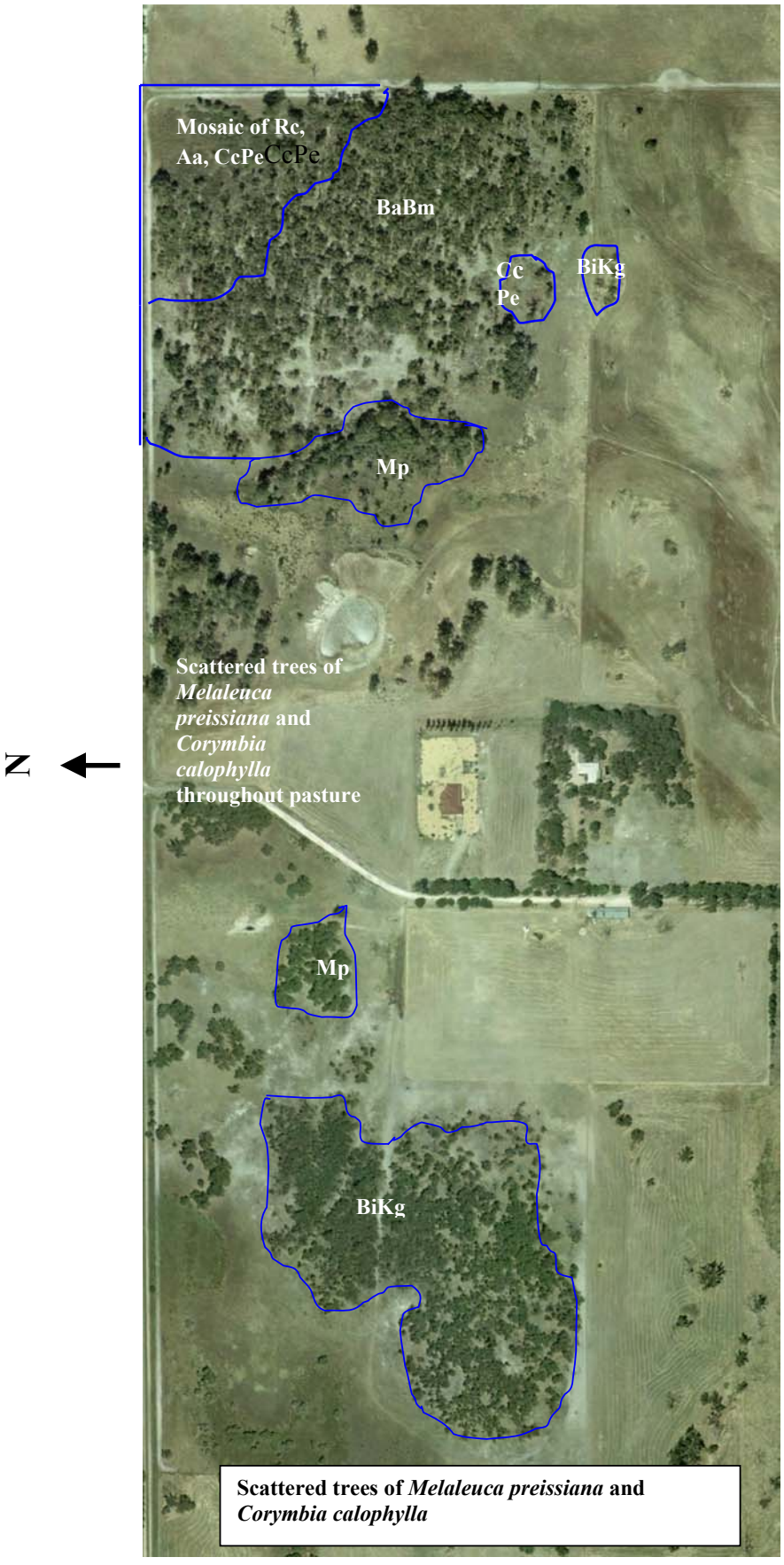

Figure 3: Remnant vegetation on Linga Property

APPENDIX D

Vegetation Condition Map

Rating	Description	Explanation
1	Pristine	Pristine or nearly so, no obvious signs of disturbance.
2	Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
3	Very Good	Vegetation structure altered, obvious signs of disturbance.
4	Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it.
5	Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management.
6	Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species.

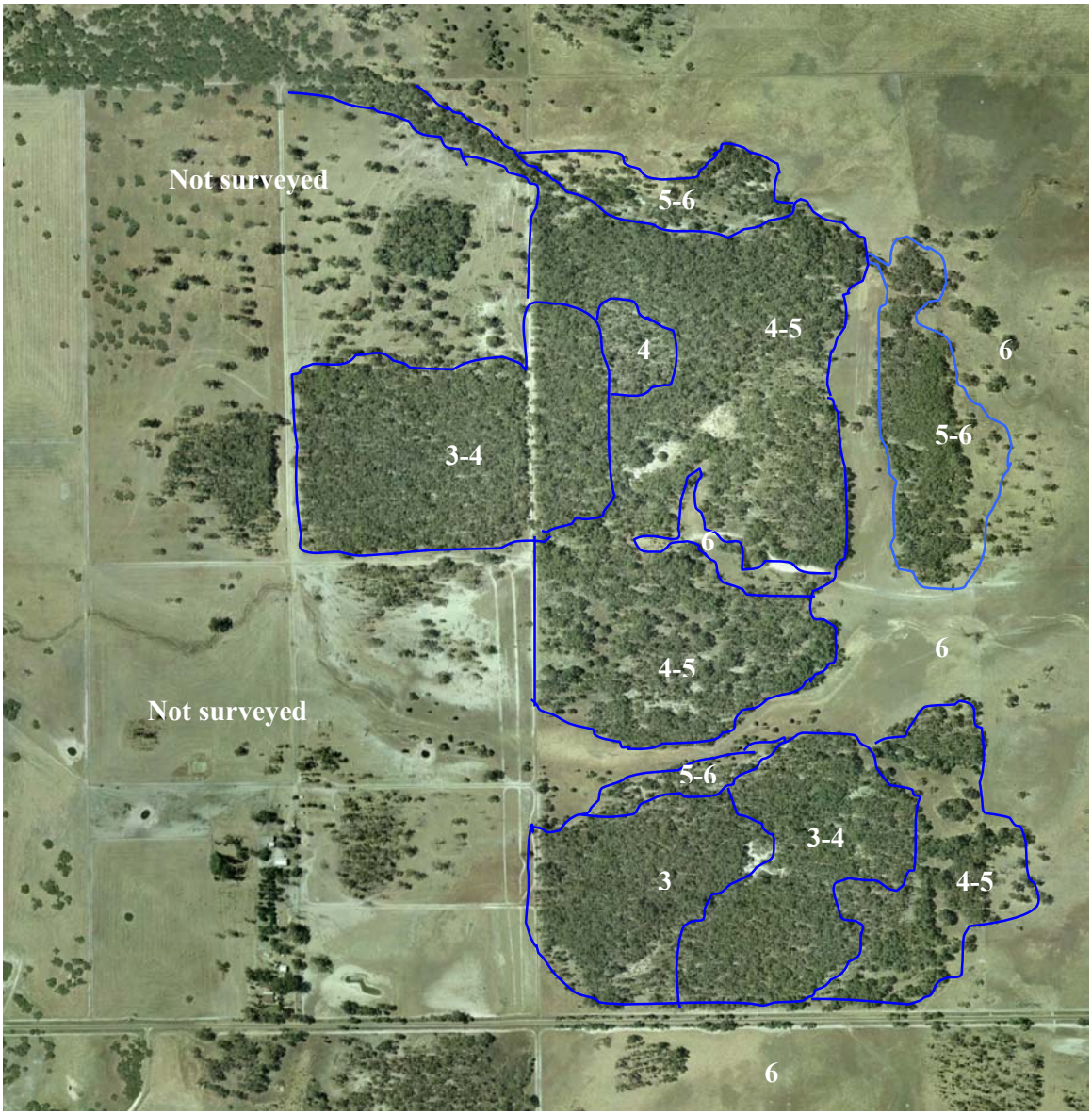

Figure 4. Vegetation condition on Mostert property

Figure 5: Vegetation condition on Linga Property

APPENDIX E

MBS Survey Sites


397000
398000
399000
400000
401000
402000
6412000
6411000
6410000
6409000
6408000
6407000
6406000
6405000
6404000
500 0 500 Meters
1:25000
Olympia Resources
Keysbrook
Vegetation Locations
Figure 1

APPENDIX F

PATN Analysis

E.A. Griffin and Associates

1.0 INTRODUCTION

1.1 Purpose of this report

The current report is intended to help clarify the assignment of Floristic Community type (FCT) designation to vegetation community (site) data. FCTs were defined by Gibson et al (1994) based on site data collected from vegetation on the Swan Coastal Plain. In particular, the potential that a Threatened Ecological Community (English and Blyth 1997) is represented by the data collected needs to be clarified.

1.2 Location of Sites

The sites were from an undisclosed location.

1.3 Brief background to floristic analysis of vegetation on the Swan Coastal Plain

Floristic analysis (ie., analysis of variation in vegetation based on the species present, rather than description of structural variation and dominance) as a significant component of the understanding of the variation present in the native vegetation of the Swan Coastal Plain dates to Gibson *et al* (1994 – all references to the SCP survey in the current report refer to this publication), the first publication to document the floristics of the vegetation of a large part of the Swan Coastal Plain. While the SCP survey is based on a very significant amount of work, it must be viewed as a "first pass" survey, limited, in the context of the great variety of vegetation present in the very large area surveyed, by the relatively limited number (509) of sites (quadrats) it is based on. To a limited degree, this limitation has subsequently been addressed in an "update" to the work of the SCP survey (which describes additional units). However, there is no detailed publication of the results of this update available and the additional data used are not readily available in an appropriate form (ie., one that would enable ready comparison of new data to the overall data set).

The units described by the SCP survey are a series of "floristic community types", a "unit" whose rank is defined by the use within a study. The SCP survey surveyed a very large survey area and defined a relatively small number of floristic community types. Consequently, the floristic community types they have described are of a very high order (see Trudgen 1999, volume 1, for further discussion of this point). This is an extremely important point to fully grasp in interpreting the analysis presented by the SCP survey and in understanding the meaning of analysis of other data sets when they are compared to the floristic community types of the SCP survey.

The important effects of the limited size data set used by the SCP survey and of the relatively small number of floristic community types defined by them, can be summarised by the following points:

1. the definition of all but two of the Threatened Ecological Communities for vegetation on the Swan Coastal Plain (English and Blyth 1997) has been based on the floristic community types of the SCP survey. It therefore follows that, with two exceptions, only vegetation units from one study that are different at a very high order of floristics are treated as rare by Government. No account is taken of other important differences, such as differences in structure and dominance;

2. for the definition of floristic community types to be robust, a sufficient sized database is needed to give adequate precision in their definition. About half of the floristics community types (or sub types) of the SCP survey are based on less than 10 sites. It is likely that with a larger data set there would be significant alteration in the classification of those floristic community types from the SCP survey based on small numbers of sites.

3. as noted above, many (if not most) of the floristic community types defined by the SCP survey are very broad. They contain very significant variation in floristics, structure and dominance. Some (or in more highly cleared parts of the Swan Coastal Plain much) of this variation may be rare by any reasonable definition, but it is currently "buried" within larger groups;

4. there is likely to be significant variation not sampled by the SCP survey. This includes some variation at a high level of floristic difference (see Trudgen 1999, volume 1, for an example of this) and undoubtedly quite significant (large!) amounts of variation at "medium" and "low" levels.

5. the document, and its use by Government, has focussed attention in the environmental impact assessment process on the high level of units described, deflecting attention from the layers of variation beneath these units that also have significant conservation value.

From these points it is obvious that there is a need for a major "upgrade" to the floristic analysis of the vegetation of the Swan Coastal Plain to provide a more detailed floristic classification that considers not only more of the variation present, but explicitly recognises more of the variation present in formally described units.

Obviously, such a reworking would have some effect on what vegetation is considered rare on the Swan Coastal Plain. It needs to be stressed that it would be very unlikely to find that any of the vegetation currently considered to be rare on the basis of the SCP survey*'s* classification was not rare. On the other hand, it is likely that such a review would very probably consider to be rare some vegetation which is not currently considered rare.

1.4 Data provided

It is very important in comparing different sets of floristic data that they are comparable in the application of names, in the intensity of the survey (ie., the effort of searching resulting in similar proportion of the flora at sites being recorded) and in the size of the site recorded. If the data from different data sets is not comparable in these ways, it reduces the clarity of the results of the analyses carried out. If the discrepancy in the comparability of the data sets is large, the results may become meaningless.

No information was provided on the area sampled at each location. Preliminary investigation suggested that the provided sites might be low in a number of species. The 6 sites had an average of 26 species with the richest 41. The FCT of particular interest (20b) had an average of 62. Such observations have already been made by the client (Bennett pers comm). Appendix 2 supports this and thus caution needs to be considered when making conclusions.

2.0 METHODS

1.6.1 2.1 Data Preparation

The data from the sites were provided in an excel table. These were incorporated into a standard MS Access based database designed for this type of data. One virtue of the database is that the species recorded at each site are stored against standard codes (numbers, those used by the Western Australian Herbarium) for each species. This facilitates ready comparison of data from different surveys stored in the same system.

After the data were incorporated into the database (containing the data from other projects), a process of reconciliation of flora species names with those used in the SCP survey was undertaken. This step was necessary at least because of changes in nomenclature over the last ten years and the potential of survey specific variations in the application of names. The reconciliation involved:

- reducing some infra-specific names to the relevant species name, (It was not possible to infer an appropriate infra-specific name for the SCP data.) and
- combining some taxa where confusion is known to have occurred in field observations and identifications.

The reconciliation process was relatively straight forward as most of the names had already been standardised. Most reconciliation was to conform with the methods that the SCP survey used to manage confusing taxa plus some nomenclatural changes (Appendix 1)

2.2 Comparability of datasets

It was concluded that sites 1 2 and 12 were may be reasonably compatible in nomenclature but the generally low richness suggests that there may have been taxa overlooked in the sites.

2.3 Comparisons made

The data from the sites plus the 509 sites from the SCP survey of the southern part of the Swan Coastal Plain (south of Gingin) were combined. This enabled various analyses to be performed.

The main purpose was intended to assign the individual sites to the Floristic Community Types (FCTs) defined in the SCP survey. These data are provided in PP.mdb.)

1.6.2 2.4 Analyses carried out

The approach was the use of numerical classification techniques (PATN) based on the similarity of the floristic composition of the sites to sites in the SCP survey data set.

2.4.1 PATN

Several modules of the numerical classification package PATN (Belbin 1987) were used for the analyses. The parameter values were the same as used by the SCP survey used to ensure consistency of analysis with that study.

The PATN modules used were ASO (calculation of similarity matrix), FUSE (classification based on the results of ASO), DEND (representation of classification) and NNB (determination of sites most similar to each site – nearest neighbours). The results of the analyses were imported into a database (UNK.mdb) so that site characteristics and previous classifications (eg., Floristic Community Types derived in earlier classifications) could be associated and various analyses based on these data could be performed.

The attempted assignment of floristic community types to the sites was made by summarising the results of two different methods:

- the classification, and
- the ten nearest neighbours.

Experience demonstrates that the results of these are likely to vary, but that from nearest neighbours is likely to make more sense for it is not directly influenced by group membership.

To the classification dendrogram of the combined dataset, the FCT assigned by the SCP survey was associated with the SCP survey sites. An attempt was made to assign FCTs to the sites by interpreting the position of these sites in the dendrogram (particularly by the way they joined to the SCP sites.

The 10 sites in the combined data set that were most similar to each of the sites were obtained from the nearest neighbour method (NNB). By associating those nearest neighbours from the SCP survey, the most likely FCTs for each of the sites were determined.

An attempt was then made to reconcile these different assignments of a Floristic Community Type.

3.0 LIMITATIONS

It has been found in earlier projects that the addition of new sites to the SCP survey data set to produce a combined classification disrupts the original classification. The more data added, the higher the level of the disruption. This problem can make it difficult to assign Floristic Community Types to new sites using this method.

Secondly, it is common for new data to group to their cohorts. In some cases this has proven to result from common deficiencies in the data, ie. whole groups of species missing. These absences tend to draw them together. The more sites in the added batch, the tighter they draw together. If they all have common deficiencies they also tend to draw together. This happened in this case.

The analyses are conducted without personal knowledge of the sites and no photographs were provided.

1.6.3 4.0 RESULTS

4.1 Determination of floristic community type by classification

The classifications indicated that the sites appeared to be the same plant community being located in one part of the dendrogram (Figure 1)

Figure 1. Relevant portion of Dendrogram

site	FCT	no	dendrogram
			0.2050 0.3644 0.5239 0.6833 0.8428 1.0022 1.16
			| | | | | |
1		41	_____
2		30	_____|_____
12		39	_____|_____
16		18	_____|____
9		18	_____|_____
10		12	_____ |
PRES-1	29a	23	_____|_____|_____
AMBR-3	4	57	_____ |
CAPEL-3	4	35	_____|_____ |
PAYNE-1	4	27	_____|_____ |

All new sites combined together, separately from the remainder of the SCP sites. The joining with PRES-1 is no indication that they belong to 29a (the FCT for PRES-1).

The influence of the depauperate sites was investigated by leaving out sites 9, 10 and 16. This produced a slightly different dendrogram which has the new sites grouping with each other and then with sites from FCT 3b.

site	FCT	no	dendrogram
			0.2050 0.3656 0.5261 0.6867 0.8472
			| | | | |
1		41	_____
2		30	_____|_____
12		39	_____|_____
BURNRD02	3b	45	_____ |
yarl03	3b	52	_____|_____ |
card12	3b	58	_____ | |
card13	3b	66	_____|_____ | |
waro 01	3b	74	_____ | | |
waro 02	3b	77	_____|___|_____ | |
DUNS-1	3b	65	_____ | | |
KOOLJ-5	3b	46	_____|_____|____|_____|_____
DUCK-1	3c	38	_____ |

Neither of these classifications produced results in which any confidence could be placed.

4.2 Determination of floristic community type using Nearest Neighbour method

The nearest neighbour analysis suggests that the sites have affinities with different communities even though they were more similar to each other than any other sites by a substantial amount. None of the (dis)similarity values for sites from the SCP data sets were low enough (<0.5) to give confidence in the analysis (Table 1). Few were even less than 0.6.

Table 1. Results of Nearest Neighbour analysis

s	s1	f1	v1	s2	f2	v2	s3	f3	v3	s4	f4	v4	s5	f5	v5
1	2		0.314	12		0.4937	**low04**	21a	0.5814	**low06a**	21c	0.5854	9		0.5862
2	1		0.314	12		0.5362	16		0.5417	9		0.5833	**low04**	21a	0.6053
9	2		0.583	1		0.5862	12		0.614	**low04**	21a	0.6563	AUSTRA-1	21a	0.6571
10	12		0.725	9		0.7333	16		0.7333	2		0.7619	1		0.7692
12	1		0.493	2		0.5362	**low06a**	21c	0.5802		3b	0.6	TWIN-8	21c	0.6049
16	2		0.541	12		0.614	1		0.6207	card11	6	0.6667	hymus04	21c	0.6818

Table 1 (cont)

s	s6	f6	v6	s7	f7	v7	s8	f8	v8	s9	f9	v9	s10	f10	v10
1	low12b	21a	0.5955	card7	21a	0.6098	16		0.620	low06b	21c	0.6322	low12a	21a	0.6364
2	card7	21a	0.6389	SHENT-1	28	0.6579	low06b	21c	0.662	low12a	21a	0.6667	AUSTRA-1	21a	0.6829
9	**low06a**	21c	0.6667	card7	21a	0.6667	HARRY-1	28	0.687	low06b	21c	0.6923	card9	20b	0.6944
10	PRES-1	29a	0.7714	KERO-2	24	0.8148	**low06a**	21c	0.814	WOODV-1	28	0.8214	WOODV-2	28	0.8276
12	16		0.614	9		0.614	card7	21a	0.629	BULLER-1	21a	0.6364	**low04**	21a	0.6471
16	**low04**	21a	0.6875	FL-5	21c	0.6949	low07	21c	0.694	hymus03	21c	0.7083	FL-6	21c	0.7143

s – the site being compared
VU- vegetation mapping unit
F- inferred FCT from VU
s1 to s10 – the 1st to 10th most similar sites
f1 to f10 – the FCT of the similar sites (only for SCP sites)
v1 to v10 – the dissimilarity value between the site and the similar sites (values above 0.6 tend to indicate low similarity)

Sites 1 and 12 appear modestly similar to low04 of FCT 21a and low06a of FCT 21c respectively. All other new sites have these sites amongst their most similar sites.

Appendix 2 lists the species in the new sites and the three most similar sites from SCP and the possible FCTs. (FCT 20b is a target FCT. The others are from the NNB analysis with FCT 21a and 21c the most likely.) The individual sites have Y indicating the presence of a species. Numbers represent the percentage of sites in each FCT with each species.

The new sites are missing many of the species common in sites from FCT 20b, 21a or 21c (see highlighted values.) Curiously, many of these (less than half) are also not present at low04 or low06a. These may form a distinct but unrecognised subgroup of FCT21.

4.4 Conclusion

It is concluded that the new sites are somewhat similar to the SCP "low" group of sites, many of which are attributed to FCT 21a or 21c. It is possible that they belong to FCT 20b but that does not seem as likely as it does that they belong to FCT 21a or 21c.

1.6.3.1 5.0 REFERENCES

1.6.3.2

1.6.3.3 Belbin, L. (1987) *PATN Reference Manual* (313p), *Users Guide* (79p), *Command Manual* (47p),

1.6.3.4 and *Example Manual* (108p). CSIRO Division of Wildlife and Ecology, Lynham, ACT.

1.6.3.5 English, V., and Blyth, J. (1997) *Identifying and conserving threatened ecological communities*

1.6.3.6 *(TECs) in the South West Botanical Province*. ANCA National Reserves System Cooperative Program: Project Number N702, Australian National Conservation Agency, Canberra

1.6.3.7 Gibson, N.G., Keighery, B.J., Keighery, G.J., Burbidge, A.H. and Lyons, M (1994). *A Floristic*

1.6.3.8 *Survey of the Southern Swan Coastal Plain*. Unpublished report by the Department of Conservation and Land Management and the Conservation Council of Western Australia to the Australian Heritage Commission.

1.6.3.9

1.6.3.10 Trudgen, M.E. (1999). *A flora and vegetation survey of Lots 46 and 47 Maralla Road and Lexia*

1.6.3.11 *Avenue, Ellenbrook*. Volumes 1-4. Unpublished report prepared for the Crown Solicitors Office, Government of Western Australia. December 1999.

1.6.3.12 APPENDIX 1

Species names combined for reconciliation purposes

Species_LUP.name	Species_LUP_1.name
Aira caryophyllea	Aira caryophyllea/cupaniana group
Amphibromus nervosus	Amphibromus neesii
Avena barbata	Avena barbata/fatua
Lepidosperma tenue	Lepidosperma sp. (Coastal terete BJK & NG 231)
Chamaescilla corymbosa	Chamaescilla spiralis/corymbosa
Burchardia umbellata	Burchardia umbellata/congesta
Disa bracteata	Monadenia bracteata
Drosera menziesii	Drosera menziesii subsp. menziesii
Pronaya fraseri var. fraseri	Pronaya fraseri
Eucalyptus marginata subsp. marginata	Eucalyptus marginata

APPENDIX 2
Species in Sites compared to selected FCTs

(numbers for FCTs are % of sites in FCT at which species is present)
(species in bold appear to be probably under represented in new sites)

FAM	name	1	2	12	9	10	16	low04	low06a	20b	21a	21c	6	3b	KOOLJ-5
011C	Pteridium esculentum										5				
016A	Macrozamia riedlei							Y			**64**	25		12	
031	Aira caryophyllea/cupaniana group	Y	Y					Y			46	31	11	62	Y
031	Aira praecox											12			
031	Amphibromus neesii						Y								
031	Amphipogon amphipogonoides										5				
031	Amphipogon turbinatus									**66**	12	12			
031	Austrodanthonia caespitosa											6			
031	Austrodanthonia occidentalis									11	**51**	25		37	
031	Austrodanthonia pilosa													12	
031	Austrodanthonia setacea													12	
031	Austrostipa compressa		Y				Y			11	7	18			
031	Austrostipa elegantissima												11		
031	Austrostipa flavescens										15	6		12	
031	Austrostipa pycnostachya													12	
031	Austrostipa									11	2			12	
031	Avena barbata/fatua					Y							22		
031	Briza maxima	Y	Y	Y			Y	Y		11	79	81	100	100	Y
031	Briza minor			Y							28	6		75	Y
031	Bromus diandrus	Y				Y					2		11		
031	Cynodon dactylon										2		11		
031	Dichelachne crinita										12			12	Y
031	Ehrharta calycina						Y				12	18	55		
031	Ehrharta longiflora			Y		Y				11	5	6	55	12	
031	Eragrostis curvula									11					
031	Eragrostis elongata												11		
031	Holcus setiger										2				
031	Hordeum leporinum					Y			Y			6			
031	Lolium perenne										2				
031	Lolium rigidum			Y		Y									
031	Microlaena stipoides	Y		Y					Y		28	31	11		
031	Neurachne alopecuroidea	Y								11		18	22	37	
031	Pentaschistis airoides/pallida									33	2		11	37	
031	Poa drummondiana										5				
031	Tetrarrhena laevis									11				12	
031	Vulpia bromoides	Y							Y		5	6	11		
031	Vulpia myuros										7	18		12	
032	Baumea juncea											6			
032	Cyathochaeta avenacea			Y					Y	11		12	33	50	
032	Cyathochaeta clandestina									11		6			
032	Isolepis cernua										5		33	12	
032	Isolepis marginata										7	18	22		
032	Isolepis oldfieldiana												11		
032	Lepidosperma							Y	Y	**66**	**84**	43	11	75	Y
032	Lepidosperma costale													12	
032	Lepidosperma longitudinale										2				
032	Lepidosperma scabrum										2				
032	Lepidosperma sp. (Coastal terete				Y						2	6			
032	Lepidosperma squamatum										7				

FAM	name	1	2	12	9	10	16	low04	low06a	20b	21a	21c	6	3b	KOOLJ-5
032	Mesomelaena graciliceps									22	5			37	Y
032	Mesomelaena pseudostygia									**66**	7	6	11		
032	Mesomelaena tetragona			Y						77	5	6	11	87	Y
032	Schoenus aff. brevisetis									44	2	6			
032	Schoenus clandestinus									11	2				
032	Schoenus curvifolius										5	37	11		
032	Schoenus discifer											6			
032	Schoenus grandiflorus											6			
032	Schoenus humilis												11		
032	Schoenus odontocarpus													12	
032	Schoenus pedicellatus											6			
032	Schoenus rigens											6	22		
032	Schoenus sp. aff. breviculmis									11	2	6			
032	Schoenus subbarbatus (Royce									11	2				
032	Schoenus subbulbosus									11		6			
032	Schoenus subflavus									11					
032	Schoenus unispiculatus													12	
032	Tetraria capillaris									11				25	
032	Tetraria octandra	Y	Y							100	7			100	Y
035	Zantedeschia aethiopica										10	6			
039	Alexgeorgea nitens											6			
039	Anarthria gracilis											6			
039	Chordifex sinuosus									**77**		6			
039	Desmocladus fasciculatus	Y	Y	Y	Y				Y	100	23	31		100	Y
039	Desmocladus flexuosus							Y			**69**	37	22		
039	Dielsia stenostachya											6	22		
039	Hypolaena exsulca			Y					Y	44	48	56	22	50	Y
039	Hypolaena fastigiata												11		
039	Lepidobolus preissianus									11					
039	Leptocarpus canus												11		
039	Leptocarpus coangustatus												22		
039	Lepyrodia macra											6			
039	Lepyrodia muirii												11		
039	Loxocarya cinerea	Y	Y				Y				2				
039	Loxocarya pubescens										2				
039	Lyginia barbata								Y	11	**66**	**87**	11	12	
039	Restio leptocarpoides												22		
040	Aphelia cyperoides												33	12	
040	Centrolepis alepyroides												11		
040	Centrolepis aristata									22	2		33	12	
040	Centrolepis drummondiana										12	31	22	25	
047	Cartonema philydroides										2	12			
050	Philydrella pygmaea													12	
052	Juncus bufonius												11		
052	Juncus capitatus												11	25	
052	Juncus pallidus			Y									11		
052	Luzula meridionalis										20			25	Y
054C	Calectasia cyanea									**55**	2	6			
054C	Dasypogon bromeliifolius	Y	Y	Y			Y	Y		100	71	56	22	12	
054C	Dasypogon obliquifolius									22					
054C	Kingia australis									44				37	
054C	Lomandra brittanii													25	
054C	Lomandra caespitosa							Y	Y	11	**66**	**81**	11	37	
054C	Lomandra hermaphrodita				Y			Y	Y	77	58	50	11	75	
054C	Lomandra micrantha	Y									28	12		12	Y
054C	Lomandra nigricans								Y	33	35	6			
054C	Lomandra preissii		Y							33	15				

FAM	name	1	2	12	9	10	16	low04	low06a	20b	21a	21c	6	3b	KOOLJ-5
054C	Lomandra purpurea									11	5			25	Y
054C	Lomandra sericea									**55**	**51**		11	25	
054C	Lomandra sonderi										2				
054C	Lomandra suaveolens										28	12			
054D	Xanthorrhoea brunonis	Y	Y	Y			Y				7	6			
054D	Xanthorrhoea gracilis									11		6		25	
054D	Xanthorrhoea preissii	Y	Y		Y			Y	Y	88	38	43	22	100	Y
054E	Dianella revoluta										10	6	11	12	Y
054E	Stypandra glauca									11	2		11		
054F	Agrostocrinum scabrum			Y						22	23			37	Y
054F	Arnocrinum preissii									11	5	12			
054F	Caesia micrantha			Y				Y			23		22	87	Y
054F	Caesia micrantha (Blue flowered										5		11		
054F	Caesia micrantha (Large swamp										2				
054F	Caesia occidentalis										12			25	
054F	Chamaescilla spiralis/corymbosa		Y					Y	Y	100	58	43	11	75	
054F	Corynotheca micrantha										7	6			
054F	Dichopogon capillipes							Y			30			37	
054F	Dichopogon preissii										2				
054F	Johnsonia aff. pubescens (GJK									33		6			
054F	Johnsonia pubescens									22					
054F	Laxmannia ramosa											6			
054F	Laxmannia sessiliflora subsp.									22		6			
054F	Laxmannia squarrosa							Y		22	20	12			
054F	Sowerbaea laxiflora							Y		22	**48**	6		75	Y
054F	Thysanotus arbuscula								Y		7	25			
054F	Thysanotus arenarius										5				
054F	Thysanotus multiflorus										12			12	
054F	Thysanotus							Y	Y	11	46	**81**	33		
054F	Thysanotus sparteus										17	6		12	Y
054F	Thysanotus thyrsoideus		Y	Y						11	10			62	Y
054F	Thysanotus triandrus									33	2			25	
054F	Tricoryne elatior	Y		Y	Y				Y	11	7	31		25	
054F	Tricoryne humilis									11					
054F	Tricoryne tenella							Y	Y		15	12			
054J	Burchardia bairdiae												22		
054J	Burchardia multiflora											6			
054J	Burchardia umbellata/congesta			Y			Y	Y	Y	88	82	56	11	87	Y
054L	Borya scirpoidea													12	
055	Anigozanthos humilis									22	2				
055	Anigozanthos manglesii									11	7	18		50	Y
055	Conostylis aculeata										**64**	37		25	Y
055	Conostylis aurea									11					
055	Conostylis juncea							Y	Y	**66**	**74**	43		75	Y
055	Conostylis serrulata	Y													
055	Conostylis setigera			Y						66		12		12	
055	Conostylis setosa									33	2				
055	Haemodorum laxum	Y		Y						66	2	6		50	
055	Haemodorum loratum									11				25	
055	Haemodorum simplex												11		
055	Haemodorum sparsiflorum									11				25	Y
055	Haemodorum spicatum									11	2				
055	Phlebocarya ciliata									44	**69**	25		25	
055	Phlebocarya filifolia									33	2				
055	Tribonanthes australis												22		
060	Gladiolus caryophyllaceus											25			
060	Hesperantha falcata												22		

FAM	name	1	2	12	9	10	16	low04	low06a	20b	21a	21c	6	3b	KOOLJ-5
060	Moraea flaccida												44		
060	Orthrosanthus laxus										2				
060	Patersonia juncea									33				25	
060	Patersonia occidentalis	Y		Y			Y	Y	Y		58	68		37	Y
060	Patersonia sp.Swamp										2		11		
060	Romulea rosea										7	6	55	25	
060	Watsonia meriana/bulbifera										2				
066	Caladenia discoidea									22	12				
066	Caladenia ferruginea													25	
066	Caladenia flava	Y	Y	Y	Y			Y	Y	55	69	56	11	62	Y
066	Caladenia paludosa										2		11		
066	Caladenia reptans								Y	22		6			
066	Caladenia sericea											6			
066	Caladenia speciosa										5				
066	Cyrtostylis huegelii										2				
066	Cyrtostylis robusta											6			
066	Diuris aff. amplissima										2				
066	Diuris longifolia										10			25	
066	Elythranthera brunonis								Y		12	12			
066	Elythranthera emarginata				Y										
066	Eriochilus dilatatus									11	20		11		
066	Leporella fimbriata							Y	Y	**55**	15	31		12	
066	Microtis media										5				
066	Microtis unifolia										2				
066	Monadenia bracteata				Y					11	12	6	55	25	
066	Prasophyllum drummondii													12	
066	Prasophyllum elatum										2				
066	Prasophyllum parvifolium									11				25	
066	Pterostylis aff nana								Y		30	37	11		
066	Pterostylis aff. sanguinea										2				
066	Pterostylis aff. vittata											6			
066	Pterostylis recurva	Y						Y	Y	11	15	12	11		
066	Pterostylis sanguinea										5				
066	Pterostylis vittata									33	33	18		50	Y
066	Pyrorchis nigricans									**55**	35	37		25	
066	Thelymitra aff. holmesii										2	6			
066	Thelymitra canaliculata	Y	Y												
066	Thelymitra crinita									22				25	
066	Thelymitra fuscolutea										2				
066	Thelymitra pauciflora												11		
070	Allocasuarina fraseriana	Y	Y	Y		Y	Y	Y	Y	11	28	12		12	
070	Allocasuarina humilis									**66**	5	6		25	
070	Allocasuarina thuyoides									11					
090	Adenanthos cygnorum											18			
090	Adenanthos meisneri									33	12	6		12	
090	Adenanthos obovatus										2				
090	Banksia attenuata	Y	Y	Y	Y	Y	Y	Y	Y	77	87	87	11		
090	Banksia grandis	Y	Y	Y					Y	22	12	6		12	
090	Banksia ilicifolia			Y			Y		Y		20	37			
090	Banksia menziesii	Y	Y	Y	Y	Y	Y	Y	Y	44	25	68	11		
090	Conospermum capitatum										2			12	
090	Conospermum stoechadis									22		6		12	
090	Dryandra nivea									**88**	7	12	33	75	
090	Grevillea bipinnatifida													25	
090	Grevillea crithmifolia										2				
090	Grevillea pilulifera									**55**				25	
090	Grevillea quercifolia													12	

FAM	name	1	2	12	9	10	16	low04	low06a	20b	21a	21c	6	3b	KOOLJ-5
090	Grevillea wilsonii									11				12	
090	Hakea candolleana											6			
090	Hakea lissocarpha									11	2		11		
090	Hakea ruscifolia									**66**				12	
090	Hakea stenocarpa									33					
090	Persoonia angustiflora									11		6			
090	Persoonia comata										2	6			
090	Persoonia elliptica						Y								
090	Persoonia saccata										20				
090	Petrophile linearis							Y	Y	**77**	**79**	**56**		12	
090	Petrophile macrostachya									11					
090	Petrophile media var. juncifolius Ms											12			
090	Petrophile serruriae													12	
090	Petrophile striata									11				12	
090	Stirlingia latifolia	Y						Y		66	30	18	22	12	
090	Synaphea spinulosa										7				
090	Xylomelum occidentale	Y	Y	Y	Y	Y	Y	Y		66	25				
092	Leptomeria cunninghamii										2				
092	Leptomeria empetriformis										2				
097	Nuytsia floribunda						Y			11	5	18	11	12	
103	Rumex acetosella										2	6			
106	Ptilotus drummondii							Y			2				
110	Carpobrotus edulis											6			
110A	Macarthuria aff. australis (Capel)											6			
110A	Macarthuria australis											6			
111	Calandrinia granulifera										2				
113	Cerastium glomeratum										5				
113	Petrorhagia velutina										20				
113	Silene gallica										5		11		
113	Stellaria media										5				
119	Ranunculus sessiliflorus var.													12	
131	Cassytha flava										10			12	
131	Cassytha glabella									11	2			12	
131	Cassytha micrantha									11					
131	Cassytha racemosa										12				
138	Heliophila pusilla										10		11		
138	Stenopetalum robustum										2				
143	Drosera erythrorhiza	Y		Y	Y				Y	100	64	56	22	75	Y
143	Drosera gigantea											6	33	12	
143	Drosera glanduligera									22			33	37	
143	Drosera macrantha							Y		**55**	28	12	22	12	
143	Drosera macrantha (Swan coastal										2			12	
143	Drosera marchantii subsp.													12	
143	Drosera menziesii subsp. menziesii			Y									33		
143	Drosera menziesii subsp.									33	25	31		25	
143	Drosera neesii subsp. neesii												11		
143	Drosera paleacea							Y		**55**	15	25	33		
143	Drosera pallida										33	6		12	
143	Drosera pulchella												11		
143	Drosera rosulata										2			12	
143	Drosera stolonifera	Y	Y	Y	Y			Y		44	61	18		75	Y
149	Crassula colorata									11	7	12	22	12	
149	Crassula decumbens												11		
149	Crassula pedicellosa											6			
149	Crassula peduncularis										2			12	
152	Billardiera variifolia				Y						20			12	
152	Pronaya fraseri		Y							44	7		11	62	

FAM	name	1	2	12	9	10	16	low04	low06a	20b	21a	21c	6	3b	KOOLJ-5
163	Acacia barbinervis subsp.									11				12	
163	Acacia cochlearis										2				
163	Acacia extensa										7				
163	Acacia flagelliformis										5				
163	Acacia huegelii										15	18			
163	Acacia lasiocarpa										2		11		
163	Acacia nervosa													12	
163	Acacia pulchella										28	18		12	
163	Acacia saligna										5		44		
163	Acacia semitrullata										2	6			
163	Acacia sessilis									22		6			
163	Acacia stenoptera									11	20			37	
163	Acacia willdenowiana									22	15			50	
164	Labichea punctata									**66**				12	
165	Aotus procumbens											6	11		
165	Bossiaea eriocarpa									**88**	**79**	25		100	Y
165	Bossiaea ornata									11					
165	Chorizema glycinifolium													12	
165	Daviesia decurrens									11				25	
165	Daviesia divaricata									22	7				
165	Daviesia physodes									44	10			12	
165	Daviesia preissii													12	
165	Daviesia triflora									22	5				
165	Euchilopsis linearis											6			
165	Gompholobium aristatum													12	
165	Gompholobium capitatum											6			
165	Gompholobium confertum									11	5				
165	Gompholobium knightianum									33				12	
165	Gompholobium marginatum													62	
165	Gompholobium polymorphum										2			25	
165	Gompholobium preissii									22					
165	Gompholobium tomentosum							Y	Y	**55**	**79**	**62**	11	25	Y
165	Hardenbergia comptoniana										38			12	
165	Hovea chorizemifolia									11					
165	Hovea pungens											6			
165	Hovea trisperma var. grandiflora									11				25	
165	Hovea trisperma var. trisperma									22	48			37	Y
165	Isotropis cuneifolia										30				
165	Jacksonia aff. sericea (swamp form)										2	12			
165	Jacksonia densiflora / floribunda											6			
165	Jacksonia furcellata			Y							25	37	11	12	
165	Jacksonia lehmannii									11					
165	Jacksonia										5				
165	Jacksonia sternbergiana									33	12	12	11		
165	Kennedia prostrata	Y	Y								28	12	11	50	Y
165	Lotus angustissimus													12	
165	Lotus suaveolens	Y	Y	Y					Y		2	6			
165	Nemcia aff. capitata										2				
165	Nemcia capitata										7			25	Y
165	Nemcia reticulata									11	2				
165	Ornithopus compressus										5		11	12	
165	Ornithopus pinnatus										2				
165	Sphaerolobium medium										2			12	
165	Sphaerolobium vimineum													25	
165	Templetonia biloba									11				25	
165	Trifolium arvense										2		11		
165	Trifolium campestre									11	23				

FAM	name	1	2	12	9	10	16	low04	low06a	20b	21a	21c	6	3b	KOOLJ-5
165	Viminaria juncea													12	
167	Erodium botrys												11		
175	Boronia crenulata								Y			6			
175	Boronia ramosa										2	12			
175	Philotheca spicata									**55**	**56**	12		62	
182	Platytheca galioides										5			12	
182	Tetratheca hirsuta									22	7	6		12	
182	Tetratheca hirsuta (glabrous)										10				
183	Comesperma calymega									11	5	12			
183	Comesperma confertum										5				
183	Comesperma virgatum									33	10			37	
185	Monotaxis grandiflora	Y	Y							11	2				
185	Monotaxis occidentalis										7			12	
185	Phyllanthus calycinus										10			25	
185	Poranthera microphylla								Y	11	12	37		12	
185	Stachystemon vermicularis									33	5				
202	Stackhousia monogyna									11	7			12	
202	Tripterococcus brunonis									11	2			12	
215	Cryptandra pungens													12	
223	Thomasia grandiflora													12	
226	Hibbertia acerosa									44	7			12	
226	Hibbertia amplexicaulis									11					
226	Hibbertia commutata												11	12	
226	Hibbertia cunninghamii										2			12	
226	Hibbertia huegelii				Y			Y		77	2	6			
226	Hibbertia hypericoides	Y	Y	Y	Y			Y		77	89	12		100	Y
226	Hibbertia racemosa										48	31			
226	Hibbertia rhadinopoda										5				
226	Hibbertia subvaginata										20	37			
226	Hibbertia vaginata			Y				Y		55	20	31		12	
243	Hybanthus calycinus		Y								5				
243	Hybanthus floribundus													12	
263	Pimelea imbricata var. piligera													25	
263	Pimelea lehmanniana	Y	Y												
263	Pimelea rosea										7			12	
263	Pimelea suaveolens									33				12	
263	Pimelea sulphurea									11					
273	Agonis flexuosa										15			12	
273	Astartea aff. fascicularis												11		
273	Baeckea camphorosmae									**55**	10		11	50	
273	Beaufortia macrostemon									11					
273	Calytrix angulata									22	2	6			
273	Calytrix flavescens									22	15	18	11		
273	Calytrix fraseri										7	12			
273	Eremaea asterocarpa									11					
273	Eremaea pauciflora									44	5	6	11		
273	Eucalyptus calophylla	Y								11	35	18	11	87	Y
273	Eucalyptus gomphocephala										10				
273	Eucalyptus marginata	Y	Y	Y	Y	Y		Y	Y	55	64	12		87	Y
273	Eucalyptus rudis											6	11		
273	Eucalyptus wandoo												11		
273	Hypocalymma angustifolium			Y							7	18	55	12	Y
273	Hypocalymma robustum									**55**	28				
273	Kunzea ericifolia							Y	Y		33	**50**			
273	Kunzea littericola Ms												22		
273	Melaleuca acerosa									11	5				
273	Melaleuca lateriflora subsp.												11		

FAM	name	1	2	12	9	10	16	low04	low06a	20b	21a	21c	6	3b	KOOLJ-5
273	Melaleuca preissiana											31	11		
273	Melaleuca rhaphiophylla												11		
273	Melaleuca scabra										2				
273	Melaleuca sp.B Perth											18	22		
273	Melaleuca thymoides									11	41	37			
273	Melaleuca viminea												22		
273	Pericalymma ellipticum										2	18	11		
273	Regelia ciliata											12	33		
273	Scholtzia involucrata								Y	33	10	**56**	11		
273	Verticordia densiflora											6	22		
276	Gonocarpus pithyoides										7	12			
281	Daucus glochidiatus										25	6			
281	Eryngium pinnatifidum subsp.													12	
281	Eryngium pinnatifidum subsp.										10			25	Y
281	Homalosciadium homalocarpum										33	12		62	Y
281	Hydrocotyle callicarpa										2				
281	Hydrocotyle capillaris											6			
281	Hydrocotyle pilifera var. pilifera													12	
281	Pentapeltis peltigera									22				12	
281	Platysace compressa										23	12			
281	Trachymene pilosa	Y						Y	Y	44	79	81	22	25	
281	Xanthosia ciliata										2				
281	Xanthosia huegelii									**66**	**56**	12		62	
288	Andersonia lehmanniana									22	5				
288	Astroloma ciliatum										10				
288	Astroloma pallidum									**55**	28		11	25	Y
288	Astroloma stomarrhena									44					
288	Brachyloma preissii										15	18			
288	Conostephium minus										2	6			
288	Conostephium pendulum									**77**	**51**	6	11		
288	Conostephium preissii									22	15	12			
288	Leucopogon conostephioides										12	**50**			
288	Leucopogon parviflorus										5				
288	Leucopogon polymorphus										2				
288	Leucopogon propinquus										33	6		25	
288	Leucopogon racemulosus										7				
288	Leucopogon squarrosus										10				
288	Lysinema ciliatum									22					
288	Styphelia tenuiflora									22					
293	Anagallis arvensis									11	23		22		
293	Samolus junceus												11		
302	Logania serpyllifolia									11	2			12	
302	Phyllangium paradoxum										5	12			
303	Cicendia filiformis												11	12	
313	Hemiandra pungens/linearis									11	25	6			
315	Solanum americanum										2				
315	Solanum nigrum			Y							2				
316	Bellardia trixago												11		
316	Dischisma capitatum												11		
316	Parentucellia latifolia												11	25	
316	Parentucellia viscosa												22		
320	Orobanche minor					Y					2			37	
323	Utricularia multifida												11		
323	Utricularia tenella												11		
331	Opercularia apiciflora										2			12	
331	Opercularia hispidula										12			37	Y
331	Opercularia vaginata										7				

FAM	name	1	2	12	9	10	16	low04	low06a	20b	21a	21c	6	3b	KOOLJ-5
339	Wahlenbergia preissii										12	6		12	
340	Isotoma hypocrateriformis										2				
340	Lobelia tenuior									11	30			12	
341	Dampiera alata									11					
341	Dampiera linearis			Y						33	46	18		37	
341	Goodenia pulchella												11		
341	Lechenaultia biloba									44				50	
341	Lechenaultia expansa											6			
341	Lechenaultia floribunda											6			
341	Scaevola calliptera									11	2			12	
341	Scaevola canescens										5				
341	Scaevola phlebopetala													37	
341	Scaevola repens var. repens									11	2				
341	Velleia trinervis									11					
343	Levenhookia pusilla									11	2			50	
343	Levenhookia stipitata							Y		11	15	6		12	
343	Stylidium adpressum/cygnorum										7				
343	Stylidium amoenum											6			
343	Stylidium brunonianum									**55**	33	**50**		12	
343	Stylidium calcaratum										5	12		37	
343	Stylidium carnosum										15	6		12	
343	Stylidium dichotomum												11	12	
343	Stylidium junceum										2	6			
343	Stylidium piliferum							Y		**66**	38	37		50	
343	Stylidium repens									22	7	**56**	33	12	
343	Stylidium schoenoides									33	48	12			
345	Arctotheca calendula					Y					2			12	Y
345	Asteridea pulverulenta	Y									23	6		12	
345	Brachyscome iberidifolia												11		
345	Carduus pycnocephalus	Y													
345	Conyza albida										2	6			
345	Craspedia sp.A Perth Flora										12			12	
345	Helipterum corymbosum										2				
345	Hyalosperma cotula									11	15	6	11	37	
345	Hypochaeris glabra	Y	Y	Y	Y		Y	Y	Y	44	87	81	100	100	Y
345	Lagenifera huegelii							Y		11	**74**	31		50	Y
345	Millotia tenuifolia										17	12			
345	Olearia elaeophila										2				
345	Olearia paucidentata													25	
345	Podolepis gracilis							Y		11	20			12	
345	Podolepis gracilis (Swamp form										2				
345	Podolepis lessonii												11		
345	Podotheca angustifolia										5	6			
345	Podotheca chrysantha										5	18			
345	Pseudognaphalium luteoalbum												11		
345	Pterochaeta paniculata							Y		11	2	6			
345	Quinetia urvillei									22	28	12	11	25	
345	Rhodanthe citrina										7			12	
345	Siloxerus humifusus									22	5	6	11		
345	Sonchus oleraceus										20	6	11		
345	Trichocline spathulata									11	2		11	12	
345	Ursinia anthemoides	Y	Y				Y	Y		55	56	50	66	37	
345	Vellereophyton dealbatum												11		
345	Waitzia suaveolens										5	6			