Stream Environment and Water

Flora and vegetation assessment, Lot 75 Haag Road Yelverton

SURVEY OF PROPOSED SAND EXTRACTION AREAS
DECEMBER, 2018

PREPARED FOR: THREADGOLD ARCHITECTURE

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Contents

1 Introduction

1.1 Scope and Objectives

Stream Environment and Water Pty Ltd (Stream Environment and Water) were commissioned by Threadgold Architecture Pty Ltd to undertake a flora and vegetation survey of Lot 75, Haag Road Yelverton. Threadgold Architecture Pty Ltd propose to clear part of Lot 75 for the purposes of sand extraction. Focused Vision Consulting Pty Ltd were also engaged to provide specialist botanical taxonomic and field support given the potential occurrence of threatened orchid species.

The scope of the survey was to complete a flora and vegetation survey of 24ha on Lot 75. The broad objective of the survey was to provide information to support application for a clearing permit for the proposed development area. In doing so, the survey was designed and undertaken to identify whether any Matters of National Environmental Significance (as listed under the Commonwealth Environmental Protection and Biodiversity Conservation (EPBC) Act 1999) or State listed (Wildlife Conservation Act 1950) threatened species or communities are present within the survey area. Further details on the approach taken to meet the scope and objectives are provided in section 3 (Methods).

1.2 Site location and details

The survey area is located on the southern portion of Lot 75 Haag Road, Yelverton (Figure 1). The total survey area is 24ha, comprised of the proposed development area (14ha) and an additional area of native vegetation to be retained(~10ha).

The site is located at the south westerly limit of the Swan Coastal Plain on the Whicher Scarp. The property is within the City of Busselton local government area.

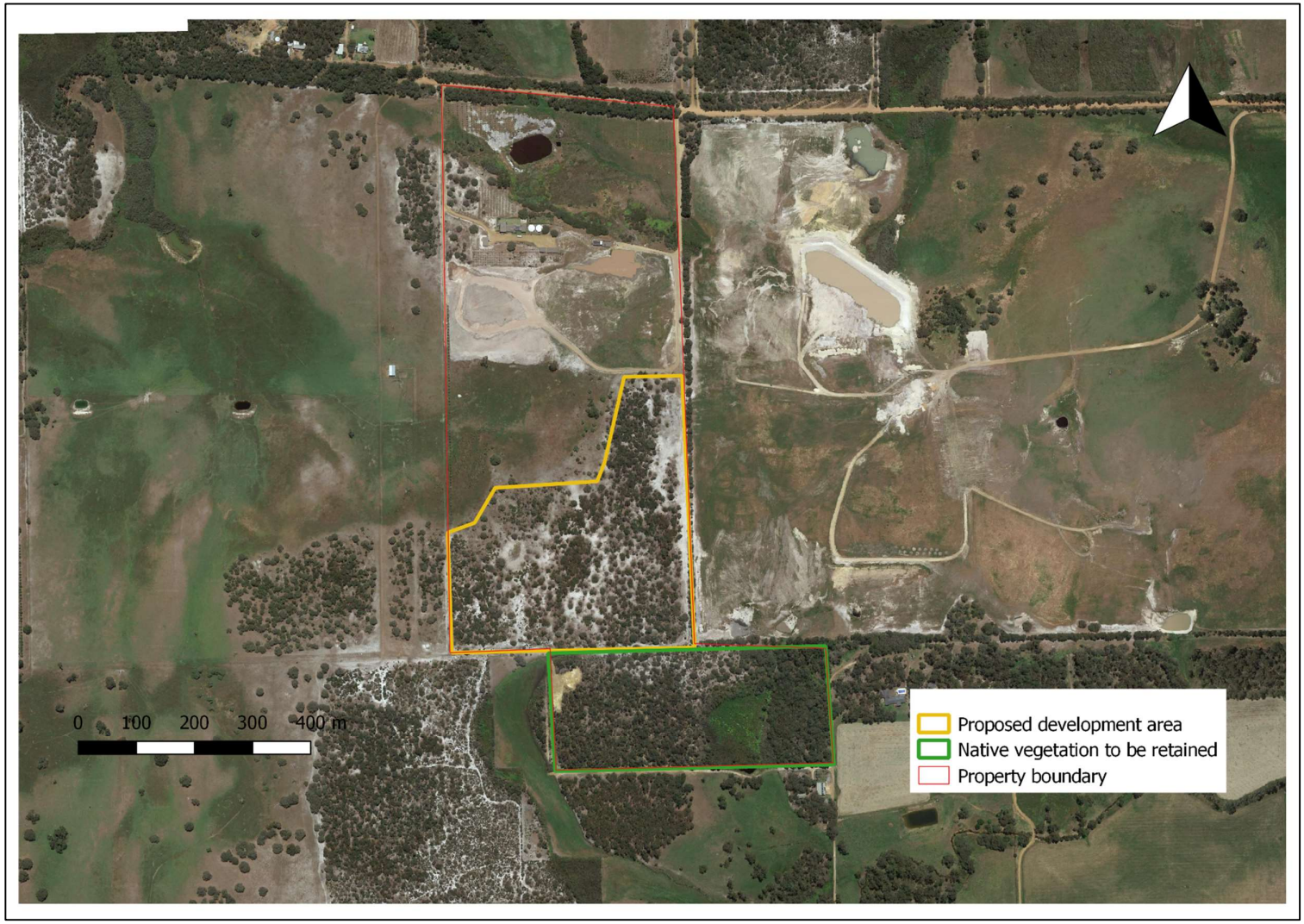

Figure 1: Survey area showing proposed development area

2 Background information

2.1 Soils and landforms

The survey area occurs on the Yelverton Shelf land system on the Whicher Scarp at the north western margin of the Blackwood Plateau. To the north of the survey area the Swan Coastal Plain extends to the coast of Geographe Bay. To the west of the survey area the Leeuwin – Naturaliste Ridge runs north-south.

Soil mapping by the Department of Agriculture and Food (Tille and Lantzke 1990) identifies three soil units within the survey area:

- Yelverton deep sandy flats phase - Level to gently undulating raised shelf, lying 10-40 m above the Swan Coastal Plain. The soils are mainly sands.
- Yelverton wet flats phase - Poorly drained depressions on the shelf surface. Soils are non-saline wet soils and grey-brown sands and loams.
- Yelverton very gentle slopes phase - Undulating terrain. Duplex sandy gravels, semi-wet soils, yellow deep sands and sandy earths and loamy gravels

2.2 Vegetation

The vegetation of the survey area is predominantly remnant native vegetation with varying degrees of disturbance. There has been some historical clearing associated with agricultural development and grazing, particularly in the proposed development area. Some impacts (numerous dead mature trees), possibly as a result of dieback are also evident. A previous dieback assessment indicated that dieback was likely to occur within the project area (Harewood 2018).

Vegetation complexes in the area were mapped by Webb *et al.* (2009) as an extension of earlier work by Mattiske and Havel (1998) and revised through Webb *et al.* (2016). Three vegetation complexes are mapped and described across the site (Figure 2, Table 1).

The State and Federal governments' policies to manage environmental impacts and clearing, apply a target to retain >30% of pre-clearing extent for ecological communities (DER 2014). Vegetation complex mapping is used to represent ecological communities in the south west of Western Australia. Of the vegetation complexes in the current project area, only the Yelverton valleys (Yw) complex has less than 30% the pre-clearing extent intact.

Table 1: Vegetation complexes mapped for the project area

Vegetation complex	Description	% pre-European extent remaining
Yelverton uplands, Yd	Woodland of *Allocasuarina fraseriana-Eucalyptus marginata* subsp. *marginata-Xylomelum occidentale-Banksia attenuata* on sandy slopes in the humid zone.	55.7
Yelverton valleys, Yw	Woodland of *Allocasuarina fraseriana-Nuytsia floribunda-Agonis flexuosa-Banksia attenuata* on slopes and open forest of *Corymbia calophylla-Eucalyptus patens-Eucalyptus marginata* subsp. *marginata* on the lower slopes and woodland of *Eucalyptus rudis-Melaleuca rhaphiophylla* on valley floors in the humid zone.	29.7
Yelverton uplands , Y	Woodland of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla-Allocasuarina fraseriana-Agonis flexuosa* and open woodland of *Corymbia calophylla* on low undulating uplands in the humid zone.	35.8

The vegetation communities of part of the current project area have previously been mapped at a finer scale as part of approvals processes for earlier stages of development (Eco Logic Environmental Services Pty Ltd 2013). Four of the vegetation communities described were mapped within the current study area. These were:

OFBaBiAfEmAf- Open Forest of *Banksia attenuata, Banksia illicifolia, Allocasuarina fraseriana*, *Eucalyptus marginata,* and *Agonis flexuosa* over an Open Shrubland/Scattered shrubs of *Podocarpus drouynianus* over a Herbland of **Hypochearis* sp., *Chamaescilla corymbosa* and *Burchardia congesta*.

OFEmAfBaXo - Open Forest of *Eucalyptus marginata, Allocasuarina fraseriana and Banksia attenuata and Xylomelon occidentale over an Open Heath of Taxandria parviceps and* over low scattered shrubs of *Hibbertia racemosa and Podocarpus drouynianus over a Very Open Herbland of Rhodanthe citrina, *Arctotheca calendula and Pyrorchis nigricans.*

OFAfBaAf- Open Forest of *Allocasuarina fraseriana, Banksia attenuata and Agonis flexuosa over an Open Herbland of *Zanthedeschia aethiopica, *Arctotheca calendula, Hypochaeris sp., Chamaescilla corymbosa and Open Grassland of *Ehrharta longiflora*, **Hordeum leporium.*

OFAfBaBiAf- Open Forest of *Allocasuarina fraseriana, Banksia attenuata Banksia illicifolia and Agonis flexuosa over a Shrubland/Open Heath of Kunzea glabrescens, Hibbertia ferruginea over a Herbland of Chamaescilla corymbosa, Caladenia flava, *Hypochaeris sp., and Burchardia congesta.*

Eco Logic Environmental Services Pty Ltd (2013) also assessed vegetation condition (using the scale developed by Keighery 1994) within the current study area and found the vegetation condition to range from good to completely degraded.

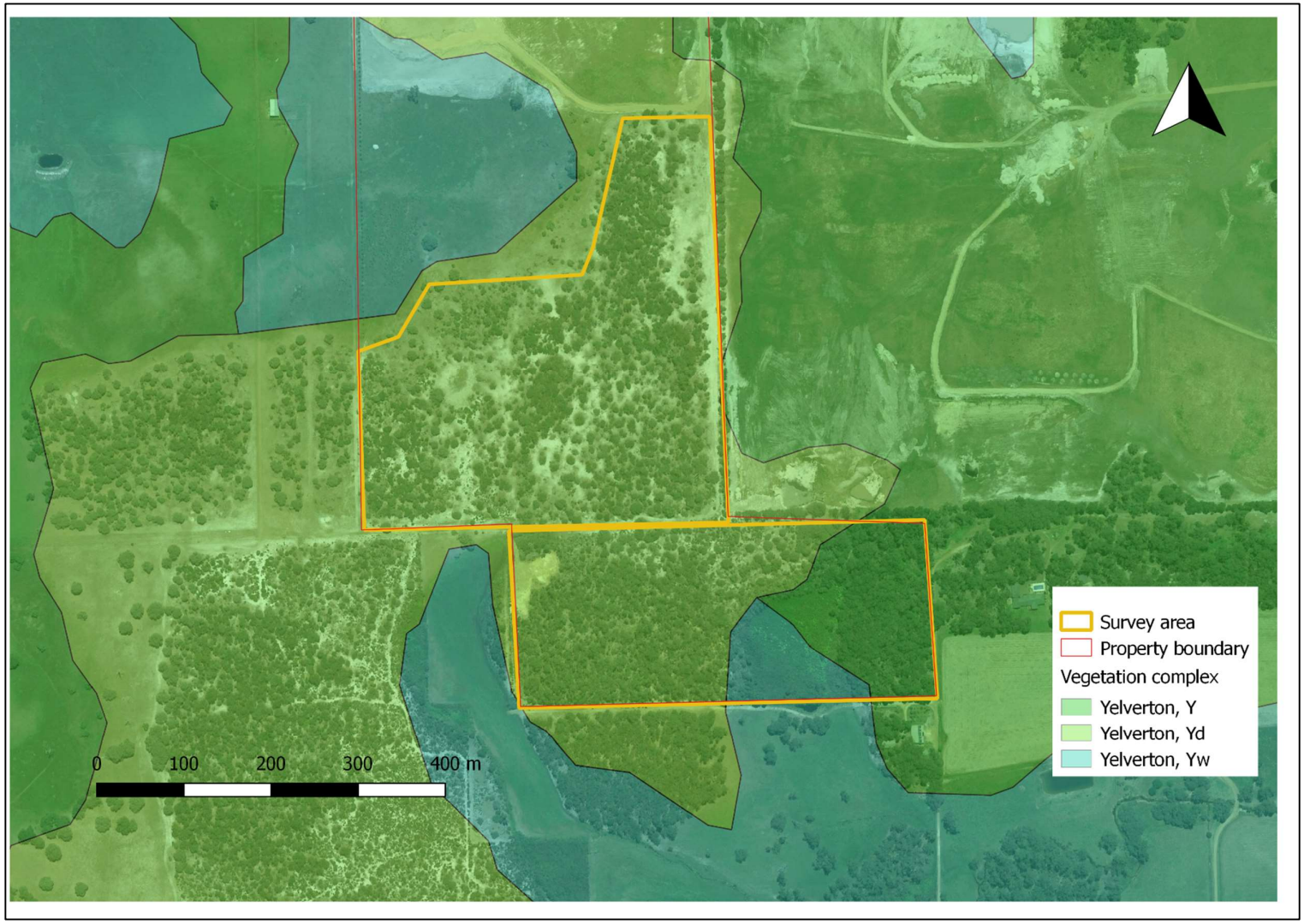

Figure 2: Vegetation complexes for project area and surrounds (Webb et al. *2016).*

2.3 Threatened Ecological Communities

Ecological communities are defined as naturally occurring groups of plants, animals and other organisms interacting in a unique habitat. The Department of Biodiversity, Conservation and Attractions (DBCA) identifies and lists ecological communities as a threatened ecological community (TEC) if the community is presumed to be totally destroyed or at risk of becoming totally destroyed. Under the State framework, the listing of TECs is currently non-statutory, however the State government policy framework for environmental impact assessment (EIA) identifies direct impacts to TECs as a potential trigger for referral and formal assessment.

Threatened communities can be classed (see Appendix A for details) as:

- critically endangered (CR)
- endangered (EN)
- vulnerable (VU)
- presumed totally destroyed (PD).

Where communities are considered rare but not (currently) threatened or there is insufficient information available for the community to be considered a TEC, communities can be listed as priority ecological communities (PECs) (definitions of priority classes are provided in Appendix A).

The EPBC Act provides statutory listing and protection for TECs at a Federal level. Under the EPBC Act TECs can be listed as critically endangered, endangered, or vulnerable (Appendix A). Communities listed under the EPBC Act as threatened have statutory protection.

2.4 Threatened and priority flora

Whilst all species of native flora are protected under state legislation, native flora species that are geographically restricted or threatened by local processes may be identified by the DBCA and allocated an elevated conservation status.

The Wildlife Conservation Act (1950) provides for the listing and protection of flora species as 'threatened' if they are under identifiable threat of extinction, rare or otherwise in need of special protection. It is an offence to ‘take’ (defined under the Act as “…gather, pick, cut, pull up, destroy, remove or injure the flora or to cause or permit the same to be done by any means”) threatened or Declared Rare Flora (DRF)species gazetted under Subsection 2 of Section 23F of the Act, without Ministerial approval.

Species may also be identified as priority flora species where they are under consideration for future listing as DRF but there is insufficient information, or they are not currently threatened but could become so if circumstances change (Appendix B).

Flora species can also be listed under the EPBC Act as threatened species and are classed as either extinct, extinct in the wild, critically endangered, endangered, vulnerable or conservation dependant (Appendix B). Any actions likely to have significant impact on

species (or communities) listed under the EPBC Act require referral for assessment and approval from the Federal Minister for the Environment.

3 Survey Methods

3.1 Desktop Survey

A desktop review was completed ahead of field surveys using publicly available datasets to identify potential environmentally significant flora species and vegetation types. Database searches were performed using the Department of the Environment and Energy's Protected Matters Search Tool (Appendix C) and using Nature Map (Appendix D).

A search of the DBCA's threatened flora databases was conducted to identify potential threatened plant species occurring within the survey area. An additional search of Nature Map based on a search area with a radius of 5km was conducted to identify potential flora species (including threatened species) occurring within the project area. The species list from previous survey (Eco Logic Environmental Services 2013) completed at the site was also reviewed to compile a list of potential plant species occurring within the survey area. Key features of threatened flora species identified as likely to occur in the project area were reviewed as part of preparation for the targeted field survey.

Mapping of vegetation associations (eg Beard 1981) and vegetation complexes (Webb *et al*. 2016), and other available regional studies, were reviewed to identify potential vegetation types occurring within the study area. Potential threatened ecological communities were identified through searches of NatureMap and the Protected Matters Search Tool and supplemented through review of relevant literature (eg Keighery *et al*. 2008) and results of previous searches of the DBCA Communities database undertaken in the area.

Soil mapping from Tille and Lantzke (1990) was used to identify soil types and relevant literature utilised to develop a description of the landforms and geomorphology of the project area.

3.2 Field Survey

A field survey incorporating detailed quadrat-based survey and targeted flora searches was completed by Stream Environment and Water, Principal Mike Braimbridge and Lisa Chappell from Focused Vision Consulting Pty Ltd on 15 and 16 September 2018. To maximise the likelihood of recording threatened orchid species, a follow up targeted site visit and traverses were undertaken on 12 October.

Assessment and description of vegetation communities was completed using information collected from 100m^2 (10x10m) quadrats and additional unmarked relevé sampling. At each location the following information was recorded using standardised field sheets:

- Location and Coordinates
- Soil description and landforms
- Vegetation structure and community description in accordance with the National Vegetation Information System (NVIS) structure and floristics
- Vascular plant species (denoting native and introduced species)
- Height and percentage cover of dominant species in each strata

- Vegetation condition (according to Keighery 1994)

Analysis of floristic community types using a classification analysis was not undertaken as much of the vegetation in the proposed development area was in a degraded (or worse) condition – see section 4.

Targeted searches for threatened flora species was completed through foot traverses of the proposed development area over two field surveys (15,16 September and 12 October) to maximise opportunity of recording target threatened species. Where located, the coordinates of threatened and priority flora species were recorded along with the number of plants.

Observations on vegetation condition were recorded during foot traverses and species lists for community descriptions were supplemented by opportunistic recording of additional species.

Any flora species that were not able to be identified in the field were collected or photographed. Relevant taxonomic literature and databases were used to identify collected specimens.

3.3 Survey Limitations

The survey limitations were considered consistent with EPA Technical Guidance (EPA 2016) and are summarised in Table 2.

Table 2: Assessment of survey limitations

Aspect	Constraint	Comment
Available regional and local information	Negligible	The region is well surveyed with regional vegetation association and complex mapping available. Previous relevant local vegetation survey reports were also available.
Competency of personnel	Negligible	The survey was completed by Mike Braimbridge who has >20 years' experience in conducting flora and vegetation surveys in the Western Australia, including the Swan Coastal Plain and south west. Additional specialist botanical field support was provided by Lisa Chappell from Focused Vision Consulting Pty Ltd who has >15 years' experience in botanical field work across WA.
Proportion of flora identified	Low	The survey was completed during spring flowering period. Where required specimens were collected or photographed and identified using relevant taxonomic literature.
Survey effort and extent	Negligible	Targeted searching effort involved two botanists during initial field visit over two days. An additional site visit was undertaken to cover the potential flowering period of threatened species. Quadrats were replicated in vegetation units and results supplemented using releves and opportunistic sampling. Floristic analysis was not undertaken due to the (generally poor) condition of the vegetation in the target development area.
Accessibility	Negligible	Access to site was provided by landholder

Survey timing and season	Negligible	The survey was completed in mid-September with an additional follow up visit in October to cover likely flowering period for the maximum number of species.
Disturbance	Negligible	Negligible recent disturbances.

4 Results

4.1 Desktop survey

4.1.1 Potential threatened communities and species

The desktop survey identified one federally listed Threatened Ecological Community (TEC) (which is also a state listed PEC) as potentially occurring within the study area and an additional three state listed Priority Ecological Communities (Table 3). The Banksia Woodland of the Swan Coastal Plain TEC was identified as likely to occur based on the previous vegetation descriptions, soils and landforms of the site.

The Banksia Woodlands ecological community typically occurs on well drained, low nutrient soils, commonly on deep Bassendean and Spearwood sands, occasionally on Quindalup sands and on the Whicher Scarp (Commonwealth of Australia 2016).

Table 3: Federally listed Threatened Ecological Communities potentially occurring within the study area.

Community	Typical soil and landform	Consistent with previous vegetation descriptions	Likely to occur	Status (EPBC)	Status (WA)
Banksia Woodlands of the Swan Coastal Plain	Well drained sands; Typically Bassendean and Spearwood, occasionally Quindalup sands; Swan Coastal Plain (Commonwealth of Australia 2016)	Yes, previous vegetation community described potentially consistent with TEC, vegetation complex (Karrakatta Central and South) also potentially consistent with TEC.	Yes	EN	P3
West Whicher Scarp Banksia attenuata woodland (community B2)	West Whicher Scarp on grey/white sands	Potentially consistent with previously described Banksia communities.	Yes	Component of Banksia woodland of SCP	P1
Shrublands of near permanent wetlands in creeklines of the Whicher Scarp (Whicher Scarp community G2	Sumplands in broad valleys associated with groundwater seepage.	No – not consistent with any descriptions from areas previously surveyed.	Potential on property outside of proposed development area	NA	P1
Swan Coastal Plain paluslope wetlands	Associated with areas of groundwater seepage from the sandy low hills at the base of the Whicher Scarp	No – not consistent with any descriptions from areas previously surveyed.	Unlikely	NA	P1

The results of the threatened flora database searches (from DBCA) identified 43 threatened flora species potentially occurring within the site. Based on a review of the soils, landforms and previous vegetation mapping, 7 species were identified with a high likelihood, and 14 with a moderate likelihood of occurring in habitats found within the project area (Table 4).

Table 4: Threatened and priority flora species potentially occurring within the study area

Taxon	Status (WA)	Status (EPBC)	Likely†	Notes
Acacia flagelliformis	4		M	Erect multi-stemmed shrub to 1 m. Flowers yellow, in full flower. Seasonally wet areas. White sand to brown clay/loam.
Acacia inops	3		M	Twining scandent shrub 40 cm - 1 m, flowers very pale cream. Swamp, black peaty sand over clay.
***Acacia lateriticola* var. Glabrous variant (B.R.Maslin 6765)**	3		M	Hillside. Dry, brown ironstone gravel. Old soil disturbance.
***Andersonia* sp. Echidna (A.R. Annels ARA 5500)**	2		M	Low, spreading sub-shrub, 20 x 20 cm. Flowers pink calyx, white corolla, anthers purple. Grey/white sands.
Caladenia busselliana	T		M	Creamy gold yellow colouration and labellum lamina uniform in colour, sepals terminating in golden yellow clubs. Sandy loam over clay.
Caladenia procera	T		M	Erect tuberous herb 40 cm high. Flowers greenish-yellow with heavily clubbed sepals, labellum with a purple tip. Sandy clay soils
Caladenia viridescens			M	
Calothamnus lateralis* var. *crassus			M	
Cyathochaeta teretifolia	3		M	Herb 130 cm high. Winter wet flats. Brown sandy clay.
Daviesia elongata	T		M	Spreading shrub to 50 cm tall by up to 1 m wide with bright green, flat, straight phyllodes. Tangled stems come from a common rootstock. Grey sandy loam.
Lepyrodia heleocharoides	3		M	Rhizomatous herb to 10 cm diameter. Sands.
Pimelea ciliata* subsp. *longituba	3		M	Slender open erect shrub 30-70 cm, flowers pink. Grey sand over clay.
Synaphea decumbens	3		M	Shrub 35 cm. White grey sand.
Verticordia lehmannii	4		M	1 ft high. Sand.
Actinotus whicheranus	2		N	Tufted sub-shrub, 30/60 cm high x 20 cm wide. Flowers white, in full flower. Winter wet slopes. Red sandy clay over laterite.
Andersonia ferricola	1		N	Straggling shrub to 50 cm. Flowers pale lilac, no smell. Seasonally wet flats. Red clayey sand over ironstone.
Banksia nivea* subsp. *uliginosa			N	Shallow winter wet soil over ironstone.
Banksia squarrosa* subsp. *argillacea	T		N	Tall shrub to 3 m. Yellow flowers. Black sandy loam over ironstone.
Calothamnus quadrifidus* subsp. *teretifolius	4		N	Erect shrub to 3 m. Winter wet plain. Orange brown sandy clay loam over ironstone.
***Chamelaucium* sp. S coastal plain (R.D.Royce 4872)**	T		N	Flowers white, low shrub 12 - 18 inches tall. Creek bank. Dry sandy clay.

Taxon	Status (WA)	Status (EPBC)	Likely†	Notes
Chordifex gracilior	3		N	Rhizomatous herb to 30 cm x 60 cm. In fruit. Winter wet flats, grey brown sand over clay.
Gahnia sclerioides	4		N	Very soft textured leaves. Sandy with surface laterite upslope.
Gastrolobium argyrotrichum	T		N	Erect shrub ca 1 m tall. Dry brown loam with outcropping granite.
Gonocarpus pusillus	4		N	Slender herb to 10 cm. On edges of winter wet swamp in grey sandy clay.
Grevillea brachystylis* subsp. *brachystylis	3		N	Decumbent shrub 20 cm x 1 m, flowers red. Flats, grey sand over clay.
Hakea oldfieldii	3		N	Erect, compact, perennial tree with sweet smell, 5 m high x 7 m wide. Flowers cream. Wetland. Wet brown sandy loam. Brown loam over ironstone
Isopogon formosus* subsp. *dasylepis	3		N	Erect slender shrub 0.5 - 1.5 m, flowers pink. Low, winter wet, red clay over ironstone.
Lasiopetalum laxiflorum	3		N	Lax shrub 1.5 m high. Flowers purple. Brown laterite.
Loxocarya magna	3		N	Rhizomatous perennial sedge. Seasonally wet poorly drained. Red sandy clay over sheet ironstone
Pultenaea pinifolia	3		N	Tall shrub, to 3 m tall, flowers orange-yellow, eye yellow surrounded by red line. Along creekline, in sand over clay.
***Schoenus* sp. Jindong (R.D. Royce 2485)**	1		N	Moist red loamy soil on banks of stream.
Stylidium leeuwinense	4		N	Slender erect perennial herb. Seasonally wet poorly drained flat. White sandy clay
Synaphea hians	3		N	Prostrate shrub 1 m diam., flowers yellow. Wetland. Sand over clay.
Synaphea petiolaris* subsp. *simplex	3		N	Plants young with very high number of simple red +/- glabrous young leaves. Some plants with leaves divided into three lobes. Red-brown laterite sandy loam.
Thysanotus isantherus	4		N	Erect tuberous herb, 15 cm high. Purple flowers. Ironstone gravel.
Verticordia plumosa* var. *ananeotes	T		N	Multstemmed shrub to 0.7 m high x 0.9 m wide. Flowers pink. Brown loam.
Acacia semitrullata	4		Y	Slender shrub to 0.6m. Grey/brown sand.
Boronia capitata* subsp. *gracilis	3		Y	Divaricating shrub 0.3 m high. Petals bright deep pink, with central crimson stripe. Staminal filaments pale pink. Anthers grey with white appendages pollen pale yellow. Pale grey sand.
Caladenia excelsa	T		Y	Perianth cream, labellum white and maroon.
Drakaea micrantha	T		Y	Upright orchid, 250 mm high x 20 mm wide. Grey sand.
Johnsonia inconspicua	3		Y	Herb 20 cm high. White sand.
Laxmannia jamesii	4		Y	Stilted perennial herb. Grey sand.
Thysanotus glaucus	4		Y	Caespitose perennial herb to 15 cm; flowers purple, largely in bud. Grey sand.

†Likelihood categorised as Y (yes likely), M (moderate likelihood), N (not likely).

4.1.2 Other conservation considerations

The vegetation on the site occurs within one of the areas identified as a corridor in the South West Ecological Linkage study by Molloy *et al* (2009). The linkages identify patches of native vegetation that form "stepping stones for flora and fauna between regionally significant areas" (Molloy *et al.* 2009).

The linkages do not have statutory protection but are recognised as a consideration in relevant EPA and planning policies.

4.2 Field Survey

4.2.1 Flora

The field survey recorded 108 taxa of vascular plants from 37 families (Appendix E). Thirteen of the 108 taxa are introduced. An additional 11 species (including 4 introduced species) were recorded in the previous survey by Ecological Environmental Services (2013) but were not recorded during the current project. The dominant families in terms of number of taxa recorded (including all species from both surveys) were Myrtaceae with 12 taxa, Asteraceae with 10, Poaceae and Fabaceae both with 9 taxa.

Threatened species

No state listed DRF or priority flora species, or federally listed threatened flora species were recorded in the project area in the current survey. The previous survey by Eco Logic Environmental Services (2013) recorded the priority 3 species *Stylidium loweriana*.

Searches via foot traverses thoroughly covered the proposed development area (Figure 3).

Five taxa recorded during this survey were identified by Keighery *et al.* (2008) as significant taxa (Table 5).

Declared Weeds

Two of the thirteen introduced flora species recorded during the survey, are listed as declared pest plants under the *Biosecurity and Agriculture Management Act* (2007), *Asparagus asparagoides* (bridal creeper) and *Zantedeschia aethiopica* (Arum lily).

Weed species were not mapped for this project.

Table 5: Significant taxa identified by Keighery et al 2008 recorded during current survey.

Taxa	Reason for significance (adapted from Keighery et al 2008)	Community recorded in (see Table 6).
Homalospermum firmum	Disjunct population (West Whicher Scarp), Significant population, uncommon in area, restricted to freshwater seepages.	Wetland Shrubland (HfAf)
Dampiera linearis	Morphological variant, genetic variant.	Jarrah-Marri Woodland (EmCcAf)
Hibbertia acerosa	Disjunct population, Significant population, Uncommon in area.	Jarrah-Marri Woodland (EmCcAf)
Hibbertia ferruginea	Recently recognised taxa, NB population west of Vasse Highway common.	Previously recorded by Eco Logic Environmental Services (2013) in Banksia Woodland (BaBiKg) equivalent.
Hypolaena exsulca	Morphological variant	Marri Forest (CcEmBg) and Wetland Shrubland (HfAf)

4.2.2 Vegetation communities

Seven vegetation units were identified within the survey area, including one which is cleared or predominantly cleared and six which are predominantly native vegetation communities (Figure 4). Community descriptions for the six native vegetation communities are based on the results of quadrats (and releves where relevant) surveyed in each, supplemented by additional opportunistic recording of additional species during targeted searches (Table 6)(Quadrat data provided in Appendix F).

The vegetation communities identified were generally consistent with those described for the area by Eco Logic Environmental Services (2013). Additional vegetation communities described for the southern portion of the property in this study were not surveyed by Eco Logic Environmental Services (2013).

Vegetation of conservation significance

Both the Banksia Woodland (BaBiKg) and the Sheoak-Banksia Woodland (AfBaBi) are consistent with the diagnostic characteristics of the Banksia Woodland of the Swan Coastal Plain TEC (listed under EPBC Act as Endangered and under State policy as Priority 3). The TEC structure is typically low woodland to forest with a canopy dominated or co-dominated by a number of Banksia species, including as in this case *Banksia attenuata* (Commonwealth of Australia 2016). None of the contra-indicators i.e. dominant or co-dominant species such as *Bankia littoralis* are present in this community.

The Sheoak-Banksia Woodland (AfBaBi) has affinities with the State listed Priority 1 West Whicher Scarp *Banksia attenuata* woodland (B2) (which is a component of the EPBC listed Banksia Woodland of the Swan Coastal Plain TEC). However, the poor condition of the vegetation and disturbed nature of the understorey in particular, meant that definitive identification of the priority ecological community is difficult.

The wetland area mapped as Wetland Shrubland (HfAsf) has possible affinities to the Priority 1 Shrublands of near permanent wetlands in creeklines of the Whicher Scarp (G2) vegetation community. The landform is consistent with the description given by Keighery *et al.* (2008) for west Whicher Scarp valley wetlands of vegetation communities associated with permanent/near permanent wetlands fed by persistent freshwater seepages. Further survey (to assess additional quadrats) and analysis of floristic community types using regional datasets would be required to confirm the community described as the priority 1 ecological community.

4.2.3 Vegetation condition

Vegetation condition across the survey area ranged from completely degraded to very good (Figure 5). In general, the condition of the northern portion of the survey area was poor compared to the southern portion. Historical grazing and potentially dieback have affected the structure of the vegetation in much of the potential development area. In this area the understorey has relatively poor diversity and cover of native species, in particular, a perennial native shrub layer is lacking in many areas. The overstorey is generally intact, however there are sparse patches and dead trees.

The condition of the Banksia Woodland communities (AfBaBi and BaBiKg) generally poor and ranged from completely degraded to good condition (Figure 5). Of the total 11.9ha of combined Banksia Woodland communities, 1.3ha was in good condition, 2ha was mapped as degraded/good, 8.1ha as degraded and 0.5ha as completely degraded condition.

In contrast most of the vegetation in the southern portion of the property was mapped as good to very good condition (Figure 5).

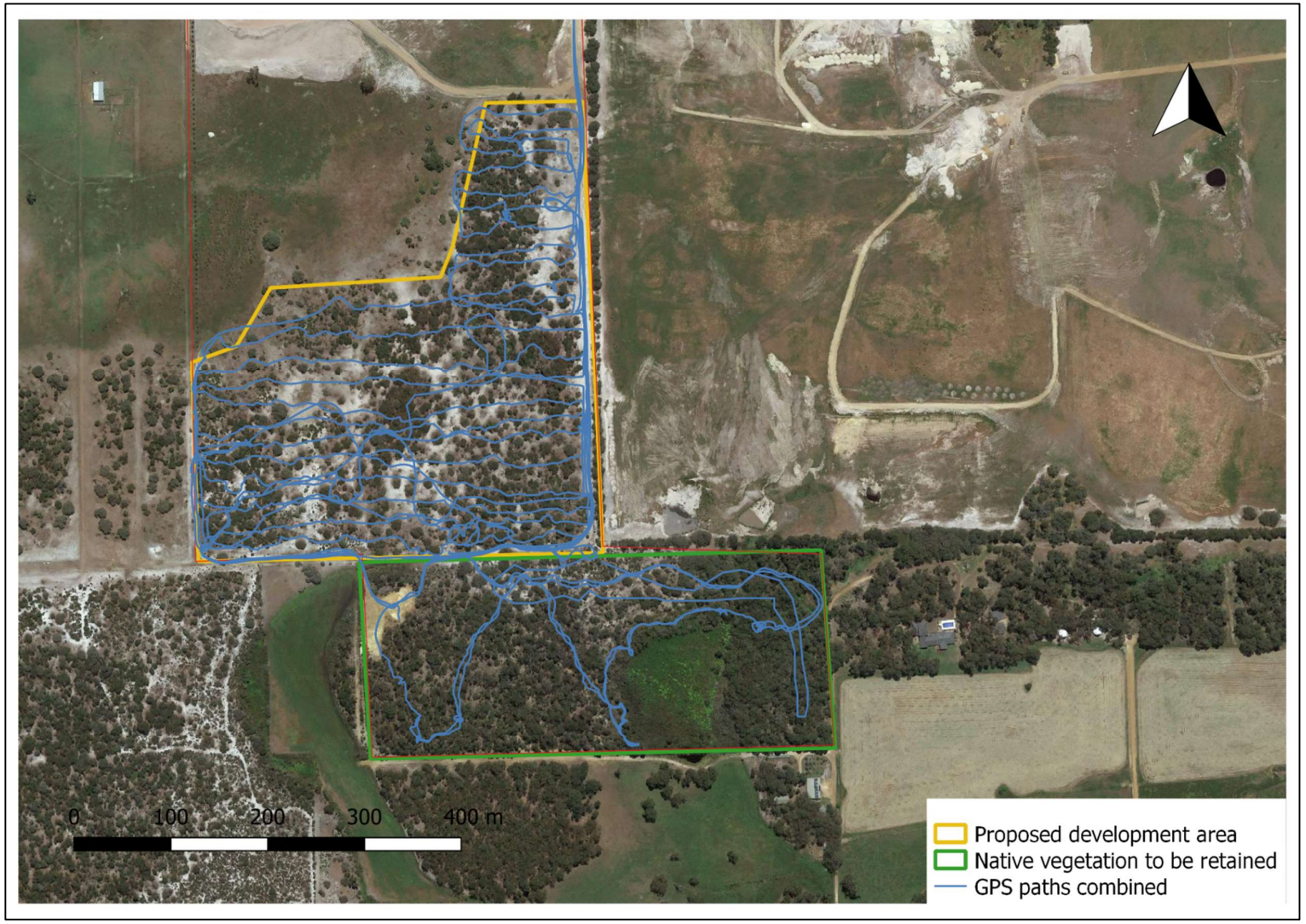

Figure 3: GPS tracks for foot traverses of study area.

Table 6: Vegetation communities described for the project area.

Community description	Quadrats	Code	NVIS Code (level IV sub-formation)
Cleared or parkland cleared		Cl	NA
Banksia Woodland Open forest of *Banksia attenuata, B. ilicifolia* and *Agonis flexuosa* over open shrubland of *Kunzea glabrescens* over grassland of *Briza* minor with sparse forbland of *Chamaescilla corymbosa* and *Hypochaeris glabra*.	6,9,11	BaBiKg	+*Banksia* open forest*Kunzea* low open shrubland*Chamaescilla* low sparse forbland
Sheoak-Banksia Woodland Open forest of *Allocasuarina fraseriana, Banksia attenuata, B. ilicifolia* and *Agonis flexuosa* over sparse shrubland of *Podocarpus drouynianus* and *Taxandria parviceps* over sparse forbland of *Burchardia congesta, Chamaescilla corymbosa* and *Ursinia anthemoides.*	R7,8,10	AfBaBi	+*Allocasuarina* open forest*Podocarpus* low sparse shrubland\ *Ursinia* low sparse forbland
Peppermint-Sheoak woodland Open forest of *Agonis flexuosa* and *Allocasuarina fraseriana* over open shrubland of *Kunzea glabrescens* over grassland of *Briza maxima* and *Anthoxanthum odoratum* and sparse forbland of *Arctotheca calendula, Chamaescilla corymbosa, Burchardia congesta* and *Ursinia anthemoides.*	R12	AgAfKg	+*Agonis* open forest*Kunzea* low open shrubland*Briza* open grassland
Jarrah-Marri woodland Woodland of *Eucalyptus marginata, Corymbia calophylla* and *Allocasuarina fraseriana* over open shrubland of *Hibbertia hypericoides, Kingia australis, Xanthorhoea gracilis* and *Podocarpus drouynianus* over sparse sedgeland of *Schoenus* sp. and open forbland of *Dampiera lineris, Chamaescilla corymbosa* and *Scaevola calliptera*	1,2	EmCcAf	+*Eucalyptus* woodland*Hibbertia* low open shrubland*Schoenus* sparse sedgeland.
Marri Forest Tall open forest of *Corymbia calophylla* and *Eucalyptus marginata* over open woodland of *Banksia grandis* over open shrubland of *Kingia australis, Xanthorrhoea preissii, Taxandria parviceps* and *Xanthorrhoea gracilis* and sedgeland of *Lepidosperma pubisquamatum* and *Mesomelaena tetragona*	5,13	CcEmBg	+*Corymbia* tall open forest*Banksia* open woodland*Lepidosperma* sedgeland
Wetland Shrubland Closed shrubland of *Homalospermum firmum* and *Astartea fascicularis* over sedgeland of *Baumea vaginalis.*	3,4[†]	HfAsf	+*Homalospermum* closed shrubland*Baumea* open sedgeland

[†]Northern section of the wetland appeared to have historically been disturbed and vegetation was dominated by *Pteridium esculentum*

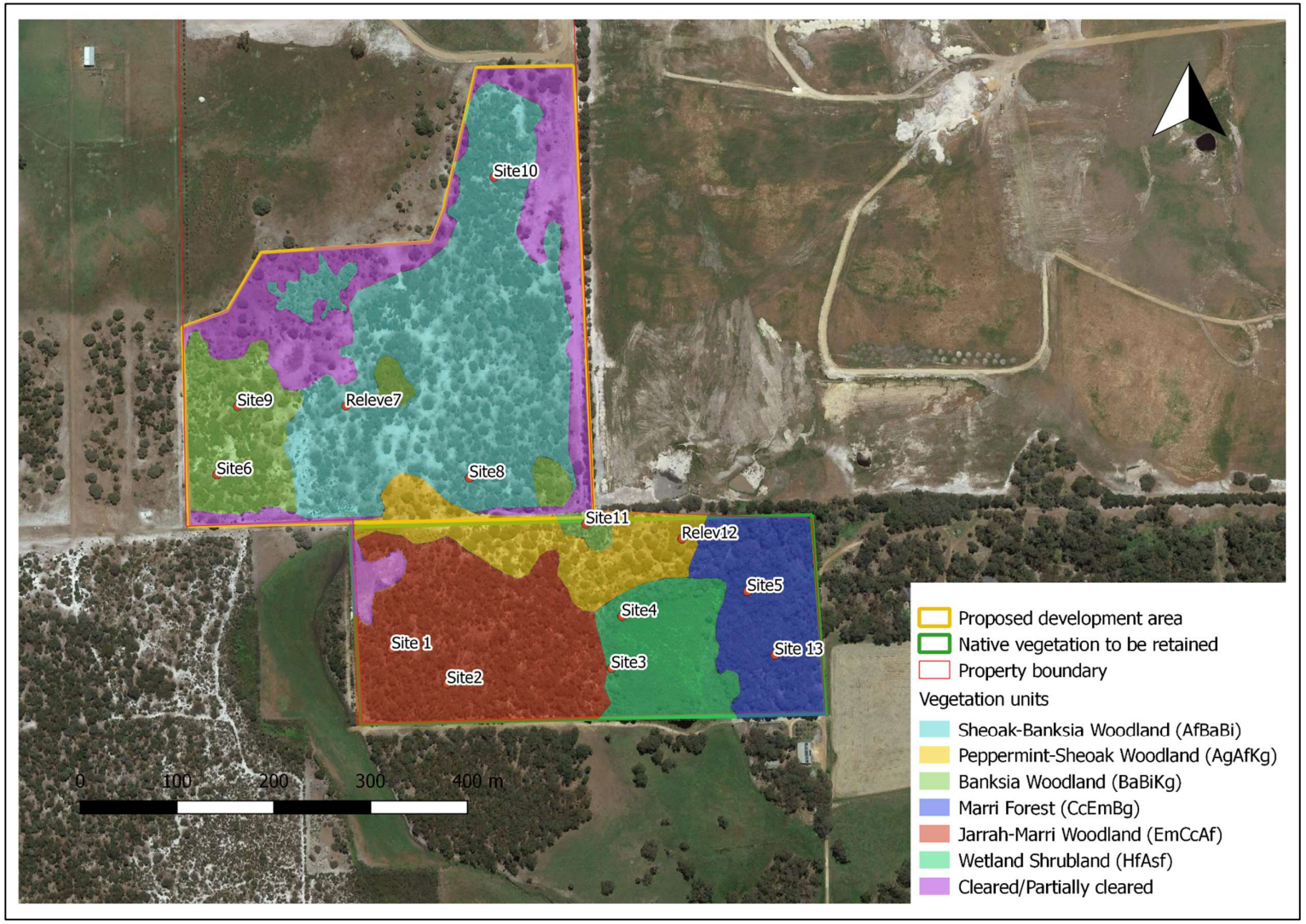

Figure 4: Vegetation communities for the survey area.

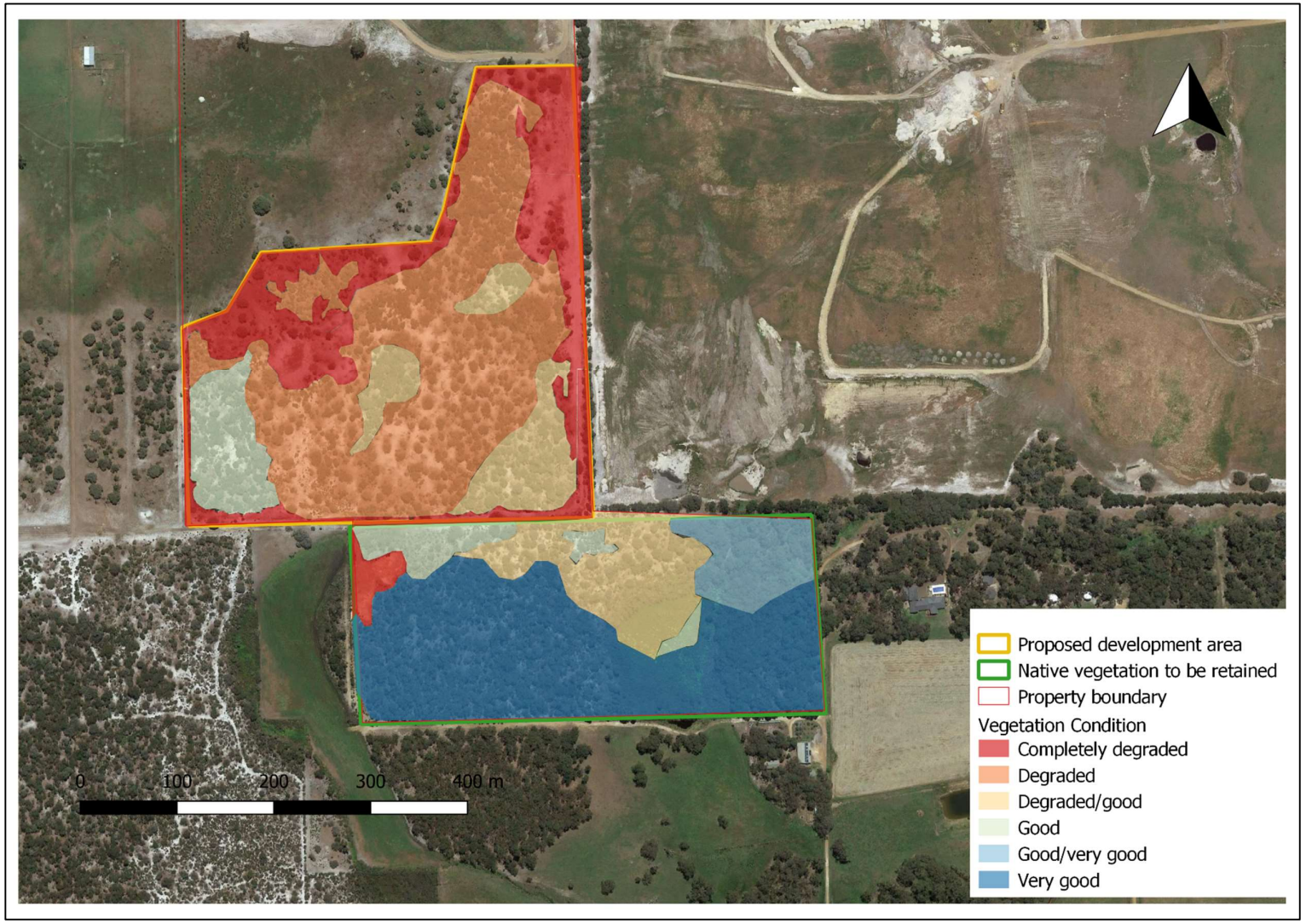

Figure 5: Vegetation condition for survey area.

5 Discussion

The results of the current study were generally consistent with the previous survey of the area by Eco Logic Environmental services in 2013 and what would be expected to occur based on a review of regional studies. The dominance of Myrtaceae and Fabaceae families is typical of vegetation complexes in the area. The prevalence of Asteraceae and Poaceae is a consequence historical disturbance with 5 of the 10 species of Asteraceae species and 5 of 9 Poaceae species recorded were introduced.

None of the species recorded were listed threatened species under State or Federal legislation. The timing of the survey maximised the potential for positively identifying the majority of threatened species, including threatened orchid species such as *Drakaea micrantha* and *Caladenia excelsa*. Several orchid species (such as *Caladenia latifolia, Drakaea glyptodon* and *Paracaleana nigrita*) with similar flowering periods were recorded during the survey.

Five species of 'other conservation significance' (as identified in Keighery *et al.* 2008) were identified in the survey. Of these, *Hibbertia acerosa* and *Homalospermum firmum* are possibly the most noteworthy. Both are identified as of elevated conservation significance in the Whicher Scarp because populations in the Whicher Scarp are disjunct (Keighery *et al.* 2008). Both of these species were found in vegetation communities in the southern portion of property which will be retained under current development plans.

The wetland community in this southern portion of 'vegetation to be retained' is also of potential conservation significance. It is mapped as part of the Yelverton Valleys vegetation complex which has less than 30% of its pre-European extent remaining and the shrubland community has potential affinities with the Priority 1 Shrublands of near permanent wetlands in creeklines of the Whicher Scarp (G2). Florisitc analysis would be required to confirm this.

The other vegetation communities identified are consistent with previous local and regional surveys. The two Banksia woodland communities are consistent with the diagnostic characteristics of the Banksia woodlands of the Swan Coastal Plain TEC. As identified in the previous survey (Eco Logic Environmental Services 2013), the Sheoak-Banksia Woodland also has possible affinities with the state listed priority 1 West Whicher Scarp *Banksia attenuata* woodland (B2). However, confirmation of this is made difficult by the poor condition of the vegetation and general lack of understorey species. All of the areas mapped as this community were in degraded-good to completely degraded condition.

Overall the condition of the proposed area for development was poor. Only 1.3ha of the combined 11.9ha of Banksia woodland (both communities combined) was found to be in good condition and meet minimum criteria for listing of the TEC. The conservation advice for the Banksia Woodland TEC identifies a minimum condition threshold of 'good' for vegetation with the relevant characteristics to be considered as the Banksia TEC. For vegetation with a condition of 'good' a minimum patch size for "consideration of a patch as

part of the listed ecological community for EPBC Act referral, assessment and compliance purposes" is set at 2ha (Commonwealth of Australia 2016).

Conclusions

- The survey identified and mapped vegetation communities consistent with what would be expected to occur in the local area.
- No formally listed species of threatened flora were found during the survey.
- Five species of potential conservation significance were recorded including *Homalospermum firmum* and *Hibbertia acerosa* in the southern portion of the survey area.
- 11.9ha of Banksia woodland consistent with the characteristics of the federally listed Banksia Woodlands of the Swan Coastal plain threatened ecological community was mapped in the potential development area. Of this 1.3ha was in good condition and therefore meets the minimum requirement to be classified as the TEC but is under the minimum patch size of 2ha. The remainder in degraded/good to degraded condition and therefore does not meet the minimum requirements to be classified as the TEC.
- No statistical analysis of floristic community types was undertaken due to the poor condition of vegetation in the potential development area.
- The condition of vegetation in the southern area identified to be retained on site was in general better than the northern section.
- One community of potential conservation significance, i.e. wetland community with affinities to the Priority 1 Shrublands of near permanent wetlands in creeklines of the Whicher Scarp (G2) was recorded in the southern portion of the survey area. Florisitc analysis would be required to confirm this.

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Appendix A: Categories and definitions for threatened and priority ecological communities.

State Threatened and Priority Ecological Community Categories

Category	Description
Threatened	
Presumed totally Destroyed (PD)	An ecological community that has been adequately searched for but for which no representative occurrences have been located.
Critically Endangered (CR)	An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future.
Endangered (EN)	An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high riskof total destruction in the near future.
Vulnerable (VU)	An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium (within approximately 50 years) to long-term future.
Priority	
Priority 1 (P1) – Poorly known	Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist.
Priority 2 (P2) – Poorly known	Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation.
Priority 3 (P3) – Poorly known	Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat(within approximately 10 years), or; made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range
Priority 4 (P4) – Adequately known	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.
Priority 5 (P5) – Conservation dependent	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

EPBC Act conservation categories for threatened ecological communities

Category	Description
Critically Endangered (CR)	An ecological community that is facing an extremely high risk of extinction in the wild in the immediate future (indicative timeframe being the next 10 years)
Endangered (EN)	An ecological community that is not critically endangered but is facing a very high risk of extinction in the wild in the near future (indicative timeframe being the next 20 years).
Vulnerable (VU)	an ecological community is not critically endangered or endangered, but is facing a high risk of extinction in the wild in the medium–term future (indicative timeframe being the next 50 years).

Appendix B: Categories and definitions for threatened and priority flora species

CONSERVATION CODES FOR WESTERN AUSTRALIAN FLORA

T: Threatened Flora - Specially protected under the Wildlife Conservation Act 1950, listed under Schedules 1, 2 and 3 of the Wildlife Conservation (Rare Flora) Notice (which may also be referred to as Declared Rare Flora). Taxa which have been adequately searched for and are deemed to be, in the wild, either rare, at risk of extinction, or otherwise in need of special protection, and have been gazetted as such. The assessment of the conservation status of these species is based on their national extent. Ranking: CR · Schedule 1 - taxa that are extant and considered likely to become extinct or rare, as critically endangered flora, and therefore in need of special protection. EN · Schedule 2 - taxa that are extant and considered likely to become extinct or rare, as endangered flora, and therefore in need of special protection. VU · Schedule 3 - taxa that are extant and considered likely to become extinct or rare, as vulnerable flora, and therefore in need of special protection.
EX: Presumed extinct Flora - Specially protected under the *Wildlife Conservation Act 1950,* listed under Schedule 4 of the Wildlife Conservation (Rare Flora) Notice (which may also be referred to as Declared Rare Flora). Taxa which have been adequately searched for and there is no reasonable doubt that the last individual has died, and have been gazetted as such. Threatened flora are ranked according to their level of threat using IUCN Red List categories and criteria. EX · Schedule 4 - taxa that are presumed to be extinct in the wild and therefore in need of special protection.
Priority Flora
Taxa that may be threatened or near threatened, but are data deficient or have not yet been adequately surveyed to be listed under the Wildlife Conservation (Rare Flora) Notice, are added to the Priority Flora List under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status, so that consideration can be given to their declaration as threatened flora. Taxa that are adequately known and are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These taxa require regular monitoring.
1: Priority One: Poorly-known species
Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations, but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
2: Priority Two: Poorly-known species
Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations, but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
3: Priority Three: Poorly-known species
Species that are known from several locations, and the species do not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations, but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
4: Priority Four: Rare, Near Threatened and other species in need of monitoring

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.
(b) Near Threatened. Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.
(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

EPBC Act conservation categories (follow IUCN Red List categories)

Category	Description
Extinct (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual.
Extinct in the wild (EW)	A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual.
Critically Endangered (CR)	A taxon is Critically Endangered when the best available evidence indicates that it is considered to be (according to specified criteria) facing an extremely high risk of extinction in the wild.
Endangered (EN)	A taxon is Endangered when it is considered (according to specified criteria) to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	A taxon is Vulnerable when the best available evidence indicates that it is considered (according to specified criteria) to be facing a high risk of extinction in the wild.
Conservation dependent (CD)	A taxon is conservation dependent if, at a particular time, it is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered.

Appendix C: Protected Matters database search results

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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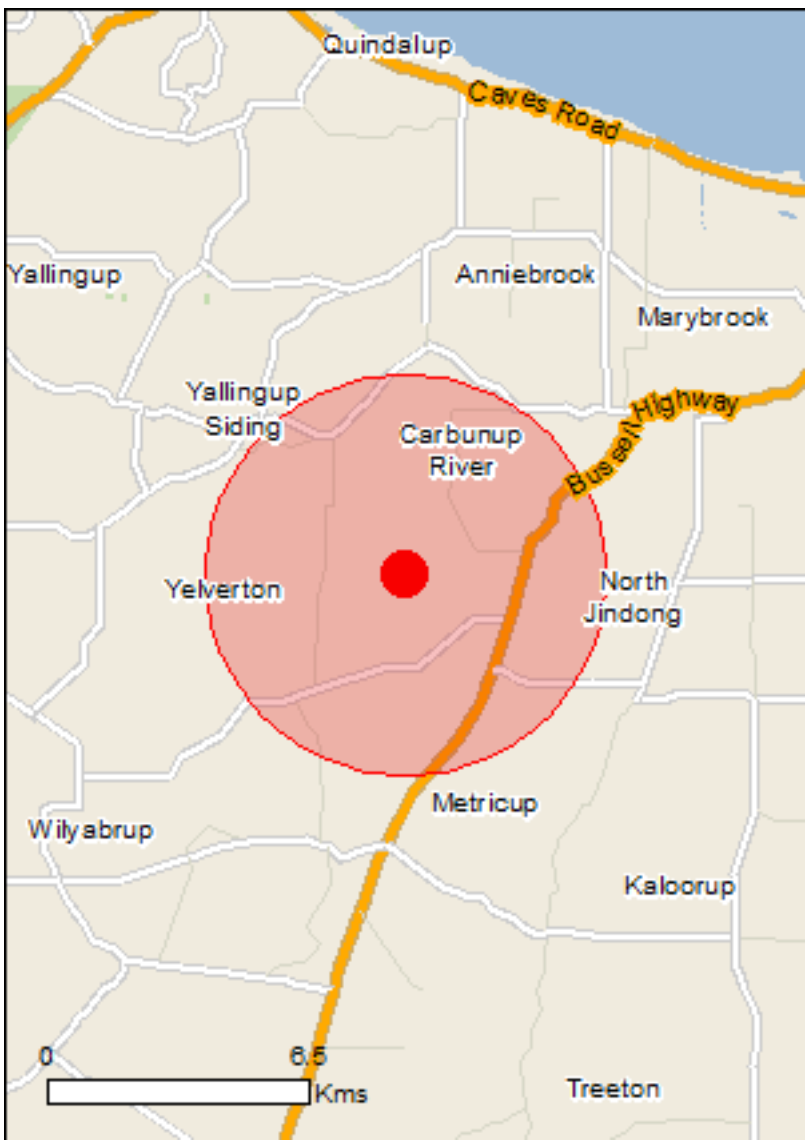

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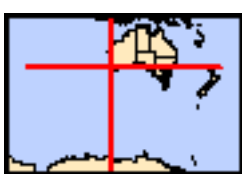

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	29
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	6
Regional Forest Agreements:	1
Invasive Species:	25
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Name	Status	Type of Presence
[Pseudocheirus occidentalis](#) Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat known to occur within area
Other		
[Westralunio carteri](#) Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat likely to occur within area
Plants		
[Banksia nivea subsp. uliginosa](#) Swamp Honeypot [82766]	Endangered	Species or species habitat may occur within area
[Banksia squarrosa subsp. argillacea](#) Whicher Range Dryandra [82769]	Vulnerable	Species or species habitat may occur within area
[Brachyscias verecundus](#) Ironstone Brachyscias [81321]	Critically Endangered	Species or species habitat may occur within area
[Caladenia busselliana](#) Bussell's Spider-orchid [24369]	Endangered	Species or species habitat likely to occur within area
[Caladenia huegelii](#) King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat may occur within area
[Caladenia procera](#) Carbunup King Spider Orchid [68679]	Critically Endangered	Species or species habitat may occur within area
[Caladenia viridescens](#) Dunsborough Spider-orchid [56776]	Endangered	Species or species habitat may occur within area
[Chamelaucium sp. S coastal plain (R.D.Royce 4872)](#) Royce's Waxflower [87814]	Vulnerable	Species or species habitat may occur within area
[Daviesia elongata subsp. elongata](#) Long-leaved Daviesia [64883]	Vulnerable	Species or species habitat known to occur within area
[Diuris micrantha](#) Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
[Drakaea elastica](#) Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat may occur within area
[Drakaea micrantha](#) Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
[Eucalyptus x phylacis](#) Meelup Mallee [87817]	Endangered	Species or species habitat may occur within area
[Gastrolobium papilio](#) Butterfly-leaved Gastrolobium [78415]	Endangered	Species or species habitat may occur within area
[Grevillea brachystylis subsp. grandis](#) Large-flowered Short-styled Grevillea [85001]	Critically Endangered	Species or species habitat likely to occur within area
[Lambertia echinata subsp. occidentalis](#) Western Prickly Honeysuckle [64528]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Petrophile latericola		
Laterite Petrophile [64532]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat may occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Haag	WA
NTWA Bushland covenant (0116A)	WA
NTWA Bushland covenant (0116B)	WA
NTWA Bushland covenant (0148)	WA
NTWA Bushland covenant (0149)	WA
Yelverton	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Crustaceans		
Engaewa reducta Dunsborough Burrowing Crayfish [82675]	Critically Endangered	Species or species habitat known to occur within area
Fish		
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area

Name	State
South West WA RFA	Western Australia

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area

Name	Status	Type of Presence
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.72832 115.13804

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix D: Nature Map database search results (threatened species)

	Name ID	Species Name	Conservation Code
501	16258	*Schoenus* sp. Jindong (R.D. Royce 2485)	P1
54	41767	*Andersonia* sp. Echidna (A.R. Annels ARA 5500)	P2
7	3386	*Acacia inops*	P3
9	14930	*Acacia lateriticola* var. Glabrous variant (B.R.Maslin 6765)	P3
87	11612	*Boronia capitata* subsp. *gracilis*	P3
125	35799	*Calothamnus lateralis* var. *crassus*	P3
143	17686	*Chordifex gracilior*	P3
178	16245	*Cyathochaeta teretifolia*	P3
257	14011	*Grevillea brachystylis* subsp. *brachystylis*	P3
270	2190	*Hakea oldfieldii*	P3
313	16522	*Isopogon formosus* subsp. *dasylepis*	P3
317	1296	*Johnsonia inconspicua*	P3
331	45084	*Lasiopetalum laxiflorum*	P3
355	1086	*Lepyrodia heleocharoides*	P3
454	12077	*Pimelea ciliata* subsp. *longituba*	P3
488	4179	*Pultenaea pinifolia*	P3
537	16937	*Synaphea decumbens*	P3
540	16769	*Synaphea hians*	P3
543	16862	*Synaphea petiolaris* subsp. *simplex*	P3
6	3339	*Acacia flagelliformis*	P4
19	3537	*Acacia semitrullata*	P4
127	35796	*Calothamnus quadrifidus* subsp. *teretifolius*	P4
238	17744	*Gahnia sclerioides*	P4
253	6162	*Gonocarpus pusillus*	P4
333	1302	*Laxmannia jamesii* (James' Paperlily)	P4
523	17411	*Stylidium leeuwinense*	P4
570	1334	*Thysanotus glaucus*	P4
571	1336	*Thysanotus isantherus*	P4
598	6093	*Verticordia lehmannii*	P4
78	32046	*Banksia squarrosa* subsp. *argillacea*	T
110	13615	*Caladenia busselliana*	T
113	13619	*Caladenia excelsa*	T
119	18038	*Caladenia procera*	T
121	13622	*Caladenia viridescens*	T
141	43980	*Chamelaucium* sp. S coastal plain (R.D.Royce 4872)	T
189	3808	*Daviesia elongata*	T
208	13635	*Drakaea micrantha*	T
240	44440	*Gastrolobium argyrotrichum*	T
258	19414	*Grevillea brachystylis* subsp. *grandis*	T
276	6867	*Hemigenia ramosissima*	T
599	12448	*Verticordia plumosa* var. *ananeotes*	T

Appendix E: Vascular plants species recorded for survey area

Family	Genus	Species	Naturalised	Threatened	Community						
					BaBiKg	AfBaBi	AgAfKg	EmCcAf	CcEmBg	HfAf	Previous†
Anarthriaceae	*Anarthria*	*prolifera*						+		+	
	Lyginia	*barbata*			+		+			+	
Apiaceae	*Daucus*	*glochidiatus*									#
	Pentapeltis	*peltigera*						+	+		
	Xanthosia	*candida*						+			
Araceae	*Zantedeschia*	*aethiopica*	*		+					+	#
Araliaceae	*Trachymene*	*pilosa*			+	+					
Asparagaceae	*Lomandra*	*micrantha*						+			
	Lomandra	*nigricans*				+			+		
	Lomandra	sp.						+			
	Sowerbaea	*laxiflora*				+					
	Thysanotus	*manglesianus*									#
Asteraceae	*?Ptilotus*	*manglesii*						+			
	Arctotheca	*calendula*	*		+	+	+				#
	Hypochaeris	*glabra*	*		+	+	+	+	+		
	Hypochaeris	sp.									#
	Lagenophera	*huegelii*						+	+		
	Quinetia	*urvillei*			+	+					
	Rhodanthe	*citrina*				+					#
	Soliva	*pterosperma*	*		+		+				
	Sonchus	*oleraceus*	*			+					
	Ursinia	*anthemoides*	*		+	+	+				
Casuarinaceae	*Allocasuarina*	*fraseriana*			+	+	+	+	+	+	#
Colchicaceae	*Burchardia*	*congesta*			+	+	+	+			#
Cyatheaceae	*Cyathea*	*?cooperi*	*							+	
Cyperaceae	*Baumea*	*vaginalis*								+	
	Lepidosperma	*leptostachyum*									#
	Lepidosperma	*pubisquamatum*							+		

Family	Genus	Species	Naturalised	Threatened	Community						
					BaBiKg	AfBaBi	AgAfKg	EmCcAf	CcEmBg	HfAf	Previous†
	Lepidosperma	*squamatum*							+		
	Mesomelaena	*tetragona*						+	+		
	Schoenus	sp.						+			
	Tetraria	*capillaris*						+	+		
	Tetraria	*octandra*						+	+		
Dasypogonaceae	*Dasypogon*	*bromeliifolius*			+					+	
	Kingia	*australis*						+	+	+	
Dennstaedtiaceae	*Pteridium*	*esculentum*							+	+	
Dilleniaceae	*Hibbertia*	*acerosa*						+			
	Hibbertia	*ferruginea*									#
	Hibbertia	*hypericoides*			+			+	+		
	Hibbertia	*notibractea*			+						
	Hibbertia	*racemosa*									#
Droseraceae	*Drosera*	*micrantha*			+						
	Drosera	*stolonifera*						+			
Ericaceae	*Leucopogon*	*australis*								+	
	Leucopogon	*capitellatus*						+			
Fabaceae	*Acacia*	*divergens*							+		
	Acacia	*pulchella*			+				+		
	Chorizema	*rhombeum*						+			
	Hovea	*chorizemifolia*						+			
	Hovea	*pungens*									#
	Isotropis	*cuneifolia*			+						
	Jacksonia	*furcellata*				+					
	Lotus	*angustissimus*									#
	Mirbelia	*dilitata*								+	
Geraniaceae	*Geranium*	*solanderi*					+				
Goodeniaceae	*Dampiera*	*linearis*						+			
	Scaevola	*calliptera*						+			
Haemodoraceae	*Anigozanthus*	sp.								+	
	Conostylis	*setosa*						+			

Family	Genus	Species	Naturalised	Threatened	Community						
					BaBiKg	AfBaBi	AgAfKg	EmCcAf	CcEmBg	HfAf	Previous†
	Haemodoraceae	sp.						+			
Hemerocallidaceae	*Caesia*	*micrantha*						+	+		
Iridaceae	*Patersonia*	*occidentalis*							+		
	Romulea	*rosea*			+		+				
Lauraceae	*Cassytha*	sp.								+	
Lindsaeaceae	*Lindsaea*	*linearis*							+		#
Loranthaceae	*Nyutsia*	*floribunda*			+	+		+			
Myrtaceae	*Agonis*	*flexuosa*			+	+	+	+	+		#
	Astartea	*fascicularis*								+	
	Corymbia	*calophylla*						+	+		
	Eucalyptus	*marginata*				+		+	+	+	#
	Eucalyptus	*patens*								+	
	Homalospermum	*firmum*								+	
	Hypocalymma	*angustifolium*						+	+		
	Hypocalymma	*robustum*								+	
	Kunzea	*glabrescens*			+		+			+	#
	Kunzea	*recurva*								+	
	Melaleuca	*?systena*			+						
	Taxandria	*parviceps*				+			+		#
Orchidaceae	*Caladenia*	*flava*			+			+	+	+	#
	Caladenia	*latifolia*							+		
	Drakaea	*glyptodon*				+					
	Paracaleana	*nigrita*				+					
	Pterostylis	*pyramidalis*							+		
	Pterostylis	sp. Crinkled leaf						+	+		
	Pyrorchis	*nigricans*			+	+					#
Pittosporaceae	*Billardiera*	*variifolia*						+			
Poaceae	*Amphipogon*	sp.						+			
	Anthoxanthum	*odoratum*	*				+		+		
	Avena	sp.	*		+	+	+	+			

Family	Genus	Species	Naturalised	Threatened	Community						
					BaBiKg	AfBaBi	AgAfKg	EmCcAf	CcEmBg	HfAf	Previous†
	Briza	*maxima*	*				+				
	Briza	*minor*	*		+	+					
	Ehrharta	*longiflora*	*		+	+					#
	Hordeum	*leporium*									#
	Neurachne	*alopecuroidea*						+			
	Tetrarrhena	*laevis*						+	+		
Podocarpaceae	*Podocarpus*	*drouynianus*				+		+			#
Polygonaceae	*Rumex*	sp.	*		+						
Primulaceae	*Lysimachia*	*arvensis*									#
Proteaceae	*Banksia*	*attenuata*			+	+					#
	Banksia	*grandis*							+		
	Banksia	*ilicifolia*			+	+					#
	Hakea	*amplexicaulis*						+	+		
	Xylomelum	*occidentale*				+					#
Restionaceae	*Desmocladus*	*fasciculatus*						+	+		
	Desmocladus	*flexuosus*							+		
	Hypolaena	*exsulca*							+	+	
	Loxocarya	*cinerea*			+			+			
Rubiaceae	*Opercularia*	*echinocephala*						+			
	Opercularia	*hispidula*							+		
Stylidiaceae	*Stylidium*	*?spathulatum*			+	+					
	Stylidium	*amoenum*				+		+			
	Stylidium	*repens*			+						
	Stylidium	*loweriana*									#
Unknown	Indet.	HA15						+			
Unknown	Indet.	HA32			+	+					
Xanthorrhoeaceae	*Chamaescilla*	*corymbosa*			+	+	+	+			#
	Xanthorrhoea	*gracilis*						+	+		
	Xanthorrhoea	*preissii*						+	+	+	
Zamiaceae	*Macrozamia*	*riedlei*			+		+	+			

†Species recorded in previous survey by Eco Logic Environmental Services (2013).

Appendix F: Quadrat details

Note: All coordinates for quadrats are for north west corner and provided in GDA 94 Zone 50. Height and cover recorded for dominant species only. Opp – species recorded opportunistically in community outside of formal quadrats.

Site	1	**Easting**	327515
Date	15/9/2018	**Northing**	6265897
Recorder	Lisa Chappell	**Landscape position**	Upper slope
Soil	Orange/brown lateritic gravel and sand	**Condition**	Very good
Community	Woodland of *Eucalyptus marginata, Corymbia calophylla* and *Allocasuarina fraseriana* over open shrubland of *Hibbertia hypericoides, Kingia australis, Xanthorhoea gracilis* and *Podocarpus drouynianus* over sparse sedgeland of *Schoenus* sp. and open forbland of *Dampiera linearis, Chamaescilla corymbosa* and *Scaevola calliptera*		

Genus	**Species**	**Height (m)**	**% Cover**
Allocasuarina	*fraseriana*	10	2
Amphipogon	sp.		+
Anarthria	*prolifera*		opp
Avena	sp.		opp
Burchardia	*congesta*		+
Caladenia	*flava*		+
Chamaescilla	*corymbosa*		+
Chorizema	*rhombeum*		+
Conostylis	*setosa*		+
Corymbia	*calophylla*	20	5
Dampiera	*linearis*		+
Desmocladus	*fasciculatus*		+
Drosera	*stolonifera*		+
Eucalyptus	*marginata*	20	10
Haemodoraceae	sp.		+
Hakea	*amplexicaulis*		opp
Hibbertia	*acerosa*		+
Hibbertia	*hypericoides*	0.5	30
Hovea	*chorizemifolia*		+
Hypocalymma	*angustifolium*		opp
Hypochaeris	*glabra*		+
Kingia	*australis*	3	5
Lagenophera	*huegelii*		+
Lomandra	*micrantha*		+
Lomandra	sp.		+
Macrozamia	*riedlei*		opp
Mesomelaena	*tetragona*		+
Opercularia	*echinocephala*		+
Pentapeltis	*peltigera*		+
Podocarpus	*drouynianus*		opp
Scaevola	*calliptera*		+
Stylidium	*amoenum*		+
Tetraria	*capillaris*		+
Tetraria	*octandra*		+
Xanthorrhoea	*gracilis*		+
Xanthosia	*candida*		+

Photo site 1

Site	2	**Easting**	327572
Date	15/9/2018	**Northing**	6265862
Recorder	Lisa Chappell	**Landscape position**	Upper slope
Soil	Orange/brown lateritic gravel and sand	**Condition**	Very good
Community	Woodland of *Eucalyptus marginata, Corymbia calophylla* and *Allocasuarina fraseriana* over open shrubland of *Hibbertia hypericoides, Kingia australis, Xanthorhoea gracilis* and *Podocarpus drouynianus* over sparse sedgeland of *Schoenus* sp. and open forbland of *Dampiera linearis, Chamaescilla corymbosa* and *Scaevola calliptera*		

Genus	**Species**	**Height (m)**	**% Cover**
?Ptilotus	manglesii		+
Agonis	flexuosa		opp
Allocasuarina	fraseriana	12	20
Billardiera	variifolia		+
Caesia	micrantha		+
Caladenia	flava		+
Corymbia	calophylla	15	35
Dampiera	linearis		+
Desmocladus	fasciculatus		+
Drosera	stolonifera		+
Eucalyptus	marginata	15	5
Hakea	amplexicaulis	1.8	1
Hibbertia	hypericoides	0.5	4
Hypochaeris	glabra		+
Lagenophera	huegelii		+
Leucopogon	capitellatus		+
Lomandra	sp.		+
Loxocarya	cinerea		+
Macrozamia	riedlei		+
Mesomelaena	tetragona		+
Neurachne	alopecuroidea		+
Nyutsia	floribunda		opp
Pentapeltis	peltigera		+
Podocarpus	drouynianus	1.8	1
Pterostylis	sp. Crinkled leaf		+
Schoenus	sp.	0.5	3
Tetraria	octandra		+
Tetrarrhena	laevis		+
Xanthorrhoea	gracilis	0.5	5
Xanthorrhoea	preissii	1.8	0.5
Xanthosia	candida		+
Indet.	HA15		+

Photo Site 2

Site	3	**Easting**	327741
Date	15/9/2018	**Northing**	6265878
Recorder	Lisa Chappell	**Landscape position**	Valley floor
Soil	Dark grey sand	**Condition**	Very good
Community	Closed shrubland of *Homalospermum firmum* and *Astartea fascicularis* over sedgeland of *Baumea vaginalis.*		

Genus	**Species**	**Height (m)**	**% Cover**
Anarthria	prolifera		+
Anigozanthus	sp.		+
Astartea	fascicularis	3	30
Baumea	vaginalis	2	15
Cassytha	sp.		+
Cyathea	?cooperi		opp
Dasypogon	bromeliifolius		opp
Eucalyptus	marginata	20	30
Homalospermum	firmum	3	50
Hypolaena	exsulca		opp
Kingia	australis		opp
Kunzea	glabrescens		opp
Kunzea	recurva		opp
Leucopogon	australis		+
Lyginia	barbata		opp
Mirbelia	dilitata		opp
Pteridium	esculentum		opp
Xanthorrhoea	preissii		+

Photo Site 3

Site	4	**Easting**	327751
Date	15/9/2018	**Northing**	6265931
Recorder	Lisa Chappell	**Landscape position**	Valley floor
Soil	Black sandy loam	**Condition**	Degraded/good
Community	Closed shrubland of *Homalospermum firmum* and *Astartea fascicularis* over sedgeland of *Baumea vaginalis* (Disturbed).		

Genus	**Species**	**Height (m)**	**% Cover**
Allocasuarina	fraseriana	20	5
Anarthria	prolifera		opp
Caladenia	flava		opp
Cyathea	?cooperi		opp
Dasypogon	bromeliifolius		opp
Eucalyptus	patens		opp
Hypocalymma	robustum		opp
Kingia	australis		opp
Kunzea	glabrescens	2.5	2
Pteridium	esculentum	1.8	85
Zantedeschia	aethiopica		opp

Photo Site 4

Site	5	**Easting**	327882
Date	15/9/2018	**Northing**	6265957
Recorder	Lisa Chappell	**Landscape position**	Lower slope
Soil	Dark brown clay loam	**Condition**	Very good
Community	Tall open forest of *Corymbia calophylla* and *Eucalyptus marginata* over open woodland of *Banksia grandis* over open shrubland of *Kingia australis, Xanthorrhoea preissii, Taxandria parviceps* and *Xanthorrhoea gracilis* and sedgeland of *Lepidosperma pubisquamatum* and *Mesomelaena tetragona*		

Genus	**Species**	**Height (m)**	**% Cover**
Agonis	flexuosa		+
Allocasuarina	fraseriana	12	4
Caesia	micrantha		+
Caladenia	flava		+
Corymbia	calophylla	20	55
Eucalyptus	marginata	20	10
Hypochaeris	glabra		+
Hypolaena	exsulca		+
Kingia	australis	5	12
Lepidosperma	pubisquamatum	0.75	50
Lindsaea	linearis		+
Lomandra	nigricans		+
Mesomelaena	tetragona	0.75	5
Patersonia	occidentalis		+
Pentapeltis	peltigera		+
Pteridium	esculentum	1.25	5
Taxandria	parviceps		+
Tetraria	capillaris		+
Tetraria	octandra		+
Tetrarrhena	laevis		+
Xanthorrhoea	gracilis	0.75	6

Photo Site 5

Site	6	**Easting**	327334
Date	15/9/2018	**Northing**	6266078
Recorder	Lisa Chappell	**Landscape position**	Mid slope
Soil	Grey-white sand	**Condition**	Good
Community	Open forest of *Banksia attenuata, B. ilicifolia* and *Agonis flexuosa* over open shrubland of *Kunzea glabrescens* over grassland of *Briza* minor with sparse forbland of *Chamaescilla corymbosa* and *Hypochaeris glabra*.		
Genus	**Species**	**Height (m)**	**% Cover**
Acacia	pulchella		+
Agonis	flexuosa	3	20
Allocasuarina	fraseriana		opp
Avena	sp.		+
Banksia	attenuata	5	30
Banksia	ilicifolia	6	25
Briza	minor		+
Burchardia	congesta		+
Caladenia	flava		+
Chamaescilla	corymbosa	0.05	5
Drosera	micrantha		+
Ehrharta	longiflora		+
Hibbertia	notibractea		+
Hypochaeris	glabra	0.02	1
Indet.	HA32		+
Isotropis	cuneifolia		opp
Kunzea	glabrescens	2	2
Loxocarya	cinerea		+
Nyutsia	floribunda		opp
Quinetia	urvillei		+
Romulea	rosea		+
Rumex	sp.		+
Stylidium	?spathulatum		+
Trachymene	pilosa		+
Ursinia	anthemoides		+

Photo Site 6

Site	7 (Releve)	**Easting**	327467
Date	15/9/2018	**Northing**	6266148
Recorder	Lisa Chappell	**Landscape position**	Mid slope
Soil	Grey-white sand	**Condition**	Degraded
Community	Open forest of *Allocasuarina fraseriana, Banksia attenuata, B. ilicifolia* and *Agonis flexuosa* over sparse shrubland of *Podocarpus drouynianus* and *Taxandria parviceps* over sparse forbland of *Burchardia congesta, Chamaescilla corymbosa* and *Ursinia anthemoides.*		

Genus	**Species**	**Height (m)**	**% Cover**
Agonis	flexuosa	6	5
Allocasuarina	fraseriana	6	25
Arctotheca	calendula	0.2	1
Banksia	attenuata	6	10
Banksia	ilicifolia	6	5
Chamaescilla	corymbosa		+
Eucalyptus	marginata		+
Hypochaeris	glabra	0.02	0.5
Indet.	HA32		+
Nyutsia	floribunda		+
Podocarpus	drouynianus		+
Quinetia	urvillei		+
Sowerbaea	laxiflora		+
Stylidium	?spathulatum		+
Trachymene	pilosa		+
Ursinia	anthemoides	0.5	5
Agonis	flexuosa	6	5

Photo Site 7

Site	8	**Easting**	327595
Date	15/9/2018	**Northing**	6266074
Recorder	Lisa Chappell	**Landscape position**	Mid slope
Soil	Grey-white sand	**Condition**	Good
Community	Open forest of *Allocasuarina fraseriana, Banksia attenuata, B. ilicifolia* and *Agonis flexuosa* over sparse shrubland of *Podocarpus drouynianus* and *Taxandria parviceps* over sparse forbland of *Burchardia congesta, Chamaescilla corymbosa* and *Ursinia anthemoides.*		

Genus	**Species**	**Height (m)**	**% Cover**
Agonis	flexuosa	5	8
Allocasuarina	fraseriana	6	25
Arctotheca	calendula	0.2	2
Banksia	attenuata	5	2
Briza	minor	0.3	4
Burchardia	congesta		+
Chamaescilla	corymbosa	0.05	1
Drakaea	glyptodon		opp
Ehrharta	longiflora		+
Hypochaeris	glabra		+
Lomandra	nigricans		+
Podocarpus	drouynianus	2	20
Quinetia	urvillei		+
Sonchus	oleraceus		+
Taxandria	parviceps	1.8	5
Ursinia	anthemoides	0.2	2

Photo Site 8

Site	9	**Easting**	327355
Date	15/9/2018	**Northing**	6266148
Recorder	Lisa Chappell	**Landscape position**	Mid slope
Soil	Grey-white sand	**Condition**	Good
Community	Open forest of *Banksia attenuata, B. ilicifolia* and *Agonis flexuosa* over open shrubland of *Kunzea glabrescens* over grassland of *Briza* minor with sparse forbland of *Chamaescilla corymbosa* and *Hypochaeris glabra*.		

Genus	**Species**	**Height (m)**	**% Cover**
Agonis	flexuosa		+
Allocasuarina	fraseriana	6	2
Banksia	attenuata	6	50
Banksia	ilicifolia	6	5
Briza	minor		+
Burchardia	congesta		+
Chamaescilla	corymbosa	0.05	1
Hypochaeris	glabra	0.05	0.5
Kunzea	glabrescens	1.5	30
Nyutsia	floribunda		+
Pyrorchis	nigricans		+
Quinetia	urvillei		+
Romulea	rosea		+
Stylidium	?spathulatum		+
Stylidium	repens		+

Photo Site 9

Site	10	**Easting**	327620
Date	15/9/2018	**Northing**	6266385
Recorder	Lisa Chappell	**Landscape position**	Mid slope
Soil	Grey-white sand	**Condition**	Degraded
Community	Open forest of *Allocasuarina fraseriana, Banksia attenuata, B. ilicifolia* and *Agonis flexuosa* over sparse shrubland of *Podocarpus drouynianus* and *Taxandria parviceps* over sparse forbland of *Burchardia congesta, Chamaescilla corymbosa* and *Ursinia anthemoides.*		

Genus	**Species**	**Height (m)**	**% Cover**
Agonis	flexuosa	6	15
Allocasuarina	fraseriana	6	40
Arctotheca	calendula		+
Avena	sp.		opp
Banksia	attenuata	6	30
Banksia	ilicifolia	5	18
Burchardia	congesta	0.2	0.05
Chamaescilla	corymbosa	0.05	0.5
Hypochaeris	glabra		+
Indet.	HA32		opp
Jacksonia	furcellata		opp
Paracaleana	nigrita		+
Pyrorchis	nigricans		+
Quinetia	urvillei		+
Rhodanthe	citrina		opp
Stylidium	amoenum		+
Trachymene	pilosa		opp

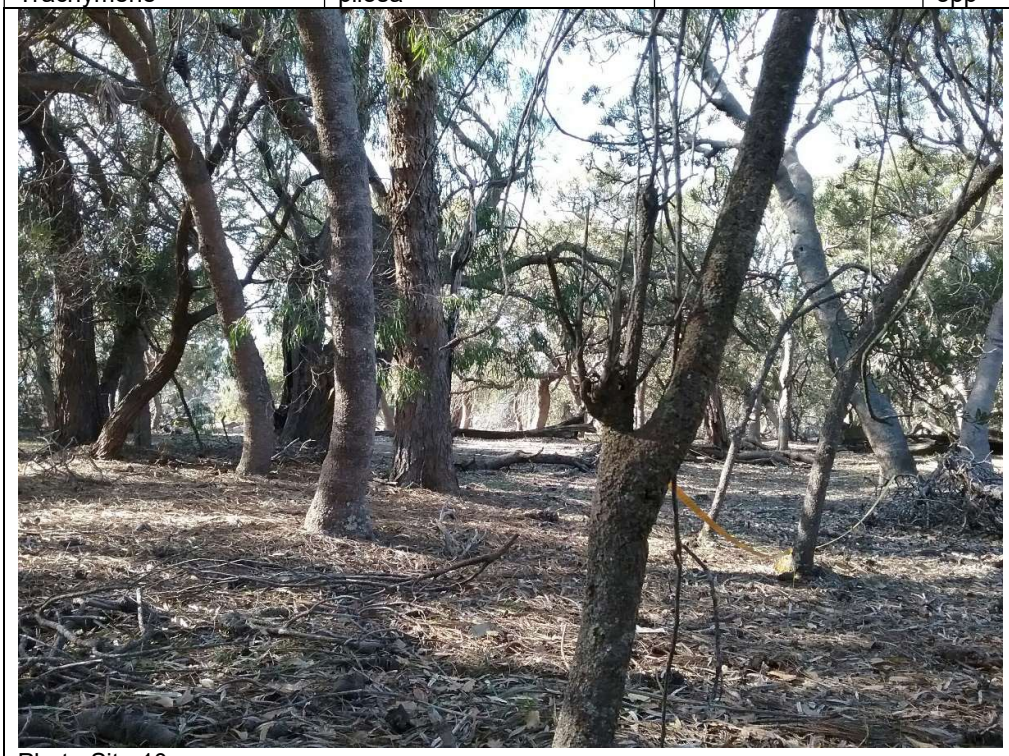

Photo Site 10

Site	11	**Easting**	327715
Date	15/9/2018	**Northing**	6266027
Recorder	Lisa Chappell	**Landscape position**	Upper slope
Soil	Grey-white sand	**Condition**	Degraded-good
Community	Open forest of *Banksia attenuata, B. ilicifolia* and *Agonis flexuosa* over open shrubland of *Kunzea glabrescens* over grassland of *Briza* minor with sparse forbland of *Chamaescilla corymbosa* and *Hypochaeris glabra*.		

Genus	**Species**	**Height (m)**	**% Cover**
Agonis	flexuosa		opp
Arctotheca	calendula		+
Avena	sp.		+
Banksia	ilicifolia	5	30
Briza	minor	0.3	15
Burchardia	congesta		+
Caladenia	flava		opp
Chamaescilla	corymbosa		+
Dasypogon	bromeliifolius		+
Drosera	micrantha		+
Hibbertia	hypericoides		+
Hypochaeris	glabra	0.05	2
Indet.	HA32		+
Kunzea	glabrescens	3	25
Lyginia	barbata		+
Macrozamia	riedlei		opp
Melaleuca	?systena	0.7	10
Nyutsia	floribunda		opp
Soliva	pterosperma		+
Ursinia	anthemoides	0.2	1
Zantedeschia	aethiopica		opp

Photo Site 11

Site	12(Releve)	**Easting**	327814
Date	12/10/2018	**Northing**	6266011
Recorder	Mike Braimbridge	**Landscape position**	Mid slope
Soil	Grey sand	**Condition**	Degraded-good
Community	Open forest of *Agonis flexuosa* and *Allocasuarina fraseriana* over open shrubland of *Kunzea glabrescens* over grassland of *Briza maxima* and *Anthoxanthum odoratum* and sparse forbland of *Arctotheca calendula, Chamaescilla corymbosa, Burchardia congesta* and *Ursinia anthemoides.*		
Genus	**Species**	**Height (m)**	**% Cover**
Agonis	flexuosa	8	55
Allocasuarina	fraseriana	8	10
Anthoxanthum	odoratum		+
Arctotheca	calendula		+
Avena	sp.		+
Briza	maxima		+
Burchardia	congesta		+
Chamaescilla	corymbosa		+
Geranium	solanderi		+
Hypochaeris	glabra		+
Kunzea	glabrescens		+
Lyginia	barbata		+
Macrozamia	riedlei		+
Romulea	rosea		+
Soliva	pterosperma		+
Ursinia	anthemoides		+
NA Photo Site 12			

Site	13	**Easting**	327910
Date	12/10/2018	**Northing**	6265891
Recorder	Mike Braimbridge	**Landscape position**	Lower slope
Soil	Brown sandy loam	**Condition**	Very good
Community	Tall open forest of *Corymbia calophylla* and *Eucalyptus marginata* over open woodland of *Banksia grandis* over open shrubland of *Kingia australis, Xanthorrhoea preissii, Taxandria parviceps* and *Xanthorrhoea gracilis* and sedgeland of *Lepidosperma pubisquamatum* and *Mesomelaena tetragona*		
Genus	**Species**	**Height (m)**	**% Cover**
Acacia	divergens		+
Acacia	pulchella		+
Anthoxanthum	odoratum		+
Banksia	grandis	8	5
Caladenia	latifolia		+
Corymbia	calophylla	30	50
Desmocladus	fasciculatus		+
Desmocladus	flexuosus		+
Eucalyptus	marginata	30	25
Hakea	amplexicaulis		+
Hibbertia	hypericoides		+
Hypocalymma	angustifolium		+
Hypochaeris	glabra		+
Hypolaena	exsulca		+
Kingia	australis	3	1
Lagenophera	huegelii		+
Lepidosperma	squamatum		+
Mesomelaena	tetragona		+
Opercularia	hispidula		+
Patersonia	occidentalis		+
Pentapeltis	peltigera		+
Pterostylis	pyramidalis		+
Pterostylis	sp. Crinkled leaf		+
Taxandria	parviceps		+
Tetraria	capillaris		+
Tetraria	octandra		+
Tetrarrhena	laevis		+
Xanthorrhoea	gracilis	0.5	3
Xanthorrhoea	preissii	2	3
NA Photo Site 13			