ASSESSMENT OF FLORA, VEGETATION AND FAUNA VALUES

ON THE WA BLUEMETAL QUARRY SURVEY AREA

AT SERPENTINE

Prepared for:

WA Bluemetal Quarry

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1. SUMMARY

Mattiske Consulting Pty Ltd were commissioned to update the earlier studies on the WA Bluemetal Quarry near Serpentine. The initial work was undertaken in 2005 and this data was reviewed for any changes in current status of flora species and vegetation communities. In addition, a desktop assessment of potential flora, vegetation and fauna values was undertaken as part of this review in October 2017.

The leases involved include Lots 246 and 344 and M 70/1240 near Serpentine, Figure 1. The botanical values on the WA Bluemetal Quarry survey area were assessed systematically by Mattiske Consulting Pty Ltd during a prime flowering period in October 2005. Three experienced botanists from Mattiske Consulting Pty Ltd were involved in the field studies. Therefore the survey effort was undertaken at an appropriate time to maximise the return for effort. The recent studies have assessed other potential flora and vegetation community values that may have changed in this period.

The searches of the State and Federal databases highlighted a range of potential flora and fauna species that may occur in the area and several threatened ecological communities that may occur in the area. As some of these occur on the Swan Coastal Plain some of the potential values are not relevant for the survey area. The area under consideration occurs on the Darling Range and Darling Scarp (not the Swan Coastal Plain).

Wetlands of National Environmental Significance

- Peel Yalgorup System – unlikely to be impacted by any developments as 30-40m km downstream from Darling Scarp and survey area.

Potential Threatened Ecological Communities

- Three potential threatened ecological communities at the Federal level are all located on the Swan Coastal Plain and as such do not occur within the survey area.

Potential Threatened Fauna Species

- Seven threatened avifauna species were highlighted in the search of the Federal database. Of these the four threatened Black Cockatoos (Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksia naso*), Baudin's Cockatoo (*Calyptorhynchus baudinii*), Carnaby's CocKatoo (*Calyptorhynchus latriostris*) and the White-tailed Black Cockatoo (*Calyptorhynchus* sp.) are most likely to occur in the survey area.
- Three threatened mammals were highlighted in the search of the Federal database. Of these the Chuditch (*Dasyurus geoffroii*) is the most likely to occur in the survey area.
- One Freshwater Mussel was highlighted in the State database as potentially occurring in survey the area.

Potential Threatened and Priority Flora

- A total of 12 potential threatened and priority flora species twelve are listed at the State level and of these 3 species (*Lasiopetalum pterocarpum* (T), *Thelymitra stellata* (T) and *Pithocarpa corymbulosa* (P3) may occur at the site due to site preferences.
- A total of 11 potential threatened flora species are listed at the Federal level and of these 2 species (*Lasiopetalum pterocarpum* (E), *Thelymitra stellata* (E) may occur at the site due to site preferences.

Potential Migratory Species

- Of the potential migratory species the majority occur near wetlands and marine areas and therefore are not likely to occur in the survey area. Of the highlighted species the most likely is the Grey Wagtail (*Motacilla cinerea*).

Recorded Values - Flora

A total of 253 vascular plant taxa, including 244 species, from 154 plant genera and 56 families were recorded within three locations. Two of these locations are within the WA Bluemetal Quarry lease and the third is privately owned. No Declared Rare Flora species gazetted under the Wildlife Conservation Act (1950-1980) were located on the survey areas. No endangered or vulnerable species, pursuant to s179 of the Environmental Protection and Biodiversity Conservation Act (1999) were located during the survey. Two Priority taxa, as defined by the Department of Conservation and Land Management (2005a), were identified in the survey. These were *Millotia tenuifolia* var. *laevis* and *Pithocarpa* ?*corymbulosa*. Forty introduced species were identified during the survey, reflecting the proximity of agriculture, tracks and other environmental disturbance to the area.

Recorded Values - Vegetation

The four vegetation complexes that occur in the WA Blue Metal survey area included Darling Scarp (DS), Dwellingup 2 (D2), Murray 1 (My1) and Yarragil (Yg1) as defined by Heddle et al. (1980) and Mattiske and Havel (1998). The majority of the vegetation complexes are well represented (23.0%, 7.9%, 36.0% and 29.9% respectively) within the formal and informal reserve systems (Conservation Commission 2003). The exception to the latter is the Darling Scarp (7.9%), as it is largely in private landholdings. Any land swap that might include less disturbed sections of the Darling Scarp complex (with its associated vegetation on the shallow and granitic soils) would benefit the conservation of this complex in the regional context.

A total of ten site-vegetation types were defined and mapped for the WA Bluemetal Quarry survey area. In addition, the disturbed and pasture areas were defined and mapped. These units were based on the site-vegetation types as developed by Havel for the northern Jarrah forest (Havel 1975a and 1975b). All of the site-vegetation types are well represented in the conservation estate.

None of these site-vegetation types are listed as threatened ecological communities listed by the Department of Biodiversity Conservation and Attractions (2017c). None of these site-vegetation types are listed as threatened under the Environmental Protection and Biodiversity Conservation Act (1999).

The flora and vegetation values on the respective areas varies substantially largely in response to the differences between the underlying geology, landform and soils of the Darling Scarp (largely shallow granitic soils) and the Dwellingup (largely lateritic caprock and lateritic gravels) mapping units. There is a similar number of flora taxon on both M70/1240 and Loc 344, as both support a range of site conditions. The values of the native flora and vegetation on Loc 246 have been modified significantly by grazing activities. The condition of the vegetation on the survey area varied from "excellent" to "completely degraded", based on the scale as developed by Keighery (1994). A few local areas have been impacted by previous snigging tracks, dieback, clearing for agricultural activities and quarry activities.

WA Limestone

SERPENTINE VEGETATION

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2. INTRODUCTION

2.1 Background

Mattiske Consulting Pty Ltd was commissioned by WA Bluemetal Quarry to conduct a survey of flora and vegetation on Lots 246 and 344 and M 70/1240 near Serpentine (Figure 1) in 2005.

The WA Bluemetal Quarry survey area is situated in the Shire of Serpentine-Jarrahdale. The survey area consists of three locations, two of which are covered by the WA Bluemetal Quarry lease and the third privately owned. The two locations which are covered by the lease are known as M70/1240 (the most northern and eastern parcel of the three, towards the top of the Darling Scarp) and Location 344 (on a lower section of the Darling Scarp). The third (privately owned) area is Location 246, and is the most western and southern of the three parcels.

The botanical values on the WA Bluemetal Quarry survey area were assessed systematically by Mattiske Consulting Pty Ltd, during a prime flowering period in October 2005. Three experienced botanists from Mattiske Consulting Pty Ltd were involved in the field studies and the assessment would meet the detailed assessment level as delineated by EPA (2016a and 2016b).

The recent studies were associated with updated the potential values on the flora, vegetation and fauna as a result of the recent changes in listings of threatened species and communities at the State and Federal levels. This report provides an updated summary of the potential and recorded values.

2.2 Climate

Serpentine-Jarrahdale shire is approximately 40km south east of Perth in the southwest of Western Australia. The southwest has a warm dry Mediterranean climate with a defined seasonal pattern of cool, wet winters and hot, dry summers. Climate statistics from the Bureau of Meteorology weather stations situated at Karnet (on the Darling Scarp) is given below. Generally, winter rain occurs during June, July and August in Karnet. For Karnet, the mean annual rainfall is 925mm and the highest total monthly rainfall was in June at 520.4mm. Mean daily minimum and maximum temperatures in winter range from 6.3 to 16.4 for Karnet, and in summer from 13.5 ^{o}C to 30.7 ^{o}C for Karnet. Although these minima and maxima may seem to indicate a mild climate, temperature extremes lie well outside these ranges (Bureau of Meteorology 2017).

Table 1: Climate data for Karnet (Latitude 32.4400 S, Longitude 116.0744 E, elevation 286 m, for 1907 to 2017 (Rainfall) and 1965 to 2017 (Temperature); Bureau of Meteorology 2017)

Climate data	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean daily max temperature (C^{o})	30.7	30.5	27.8	23.3	19.2	16.4	15.4	15.9	17.6	20.8	24.5	28.2	22.6
Mean daily min temperature (C^{o})	15.4	15.8	14.2	11.8	9.0	7.3	6.3	6.3	7.2	9.0	11.4	13.5	10.6
Mean rainfall (mm)	9.7	12.9	17.3	48.2	127.8	185.5	180.7	140.1	89.9	56.2	24.5	13.8	925
Highest monthly rainfall (mm)	60.6	190.2	97.8	165.1	271.8	520.4	467.4	352.0	221.8	131.7	81.3	72.2	1389.0
Lowest monthly rainfall (mm)	0.0	0.0	0.0	0.0	3.8	21.8	0.0	25.8	1.6	0.0	0.0	0.0	500.4

2.3 Vegetation

The WA Bluemetal Quarry survey area lies within the Darling Botanical District of the South-western Botanical Province as recognized by Diels (1906) and later developed by Gardner (1942) and Beard (1979, 1980).

More recently, the vegetation of Western Australia has been assigned to bioregions under the Interim Biogeographical Regionalisation for Australia (IBRA) (Thackway and Cresswell 1995 and Environment Australia 2000, 2005). These subdivisions largely relied on the earlier physiographic work of Beard (1981). The WA Bluemetal Quarry survey area is within the Jarrah Forest bioregion, and has been summarised as having Jarrah-Marri forest on lateritic gravels, replaced by *Taxandria* shrublands on eluvial and alluvial soils and Wandoo-Marri on clayey soils to the east (Western Australian Herbarium 2005a).

Jarrah Forest is dominated by Jarrah *Eucalyptus marginata* subsp. *marginata*, with an understorey of small trees such as Sheoak *Allocasuarina fraseriana*, Bull Banksia *Banksia grandis* and Snottygobbles *Persoonia longifolia* and *Persoonia elliptica*. The groundcover is composed of woody shrubs such as Free Flowering Lasiopetalum (*Lasiopetalum floribundum)*, *Trymalium ledifolium* and Honey Bush (*Hakea lissocarpha)*, with Balga (*Xanthorrhoea preissii)*, Kingia (*Kingia australis)* and cycad (*Macrozamia riedlei)* (Beard 1990, Dell et al 1989).

Previous workers have stressed the significance of the climate, landforms and soils in determining the distribution of plant communities in this area (Diels 1906; Williams 1932, 1942; Speck 1952, 1958; Lange 1960; Churchill 1961, 1968; Smith 1974; Seddon 1972; Havel 1968, 1975a, 1975b; Heddle *et al*. 1980a; Beard 1981, Mattiske and Havel 1998).

In vegetation mapping it is necessary to define and map the plant communities into groups with common characteristics in structure and floristics. This grouping and classification has been achieved by:

- Havel on the Swan Coastal Plain (1968) and in the Northern Jarrah Forest (1975a, 1975b),
- Beard (1979) in the Pinjarra area (1:250,000),
- Heddle *et al*. (1980a) in the System 6 area; Perth, Pinjarra and Collie areas (1:250,000), and
- Mattiske and Havel (1998) in the vegetation mapping for the Regional Forest Agreement.

The classification system of Heddle *et al*. (1980a), which utilized the concept of vegetation complexes, emphasized the relationships between the underlying landforms, soils and the plant communities. This latter system incorporated linkages with the previous work by Havel (1975a and b). The following vegetation complexes occur within and near the survey area:

Darling Scarp

Mosaic of Open Forest of *Eucalyptus marginata* subsp. *marginata – Corymbia calophylla,* with some admixtures with *Eucalyptus laeliae* in the north (subhumid zone) and *Corymbia haematoxylon* in the south (humid zone) on deeper soils adjacent to outcrops, woodland of *Eucalyptus wandoo* (subhumid and semiarid zones), low woodland of *Allocasuarina huegeliana* on shallow soils over granite outcrops, closed heath of Myrtaceae – Proteaceae species and lithic complex on or near granite outcrops in all climate zones.

Dwellingup 2

Open Forest of *Eucalyptus marginata* subsp. *marginata - Corymbia calophylla on* lateritic uplands in subhumid and semiarid zones. Dominant vegetation-site types S, P; less consistently O, T and R.

Murray 1

Vegetation ranges from Open Forest of *Eucalyptus marginata* subsp. *marginata - Corymbia calophylla - Eucalyptus patens* on valley slopes to woodland of *Eucalyptus rudis – Melaleuca*

rhaphiophylla on the valley floors in humid and subhumid zones. Dominant vegetation types C, Q, U, T; less consistently D, O, R, W.

Yarragil 1

Open Forest of *Eucalyptus marginata* subsp. *marginata* - *Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors in humid and subhumid zones Dominant vegetation types C, D, W; less consistently Q, T, U.

The site-vegetation types defined by Havel (1975a, 1975b) for the Northern Jarrah Forest covered the variation of plant communities on this section of the Darling Range. Although the plant communities in this area form a continuum, it is possible to classify the site-vegetation types by incorporating site descriptions (e.g. soils, topography, slope, aspect, soil moisture regimes), floristic information and structural information.

In the last twenty years, subsequent studies by Mattiske and Havel in the Northern Jarrah Forest have recognised a series of new vegetation types not covered previously by Havel (1975a, 1975b). These include variations on the previously defined site vegetation types (e.g. ST, SW) as well as site-vegetation types which were not covered by Havel (e.g. X, refer E.M. Mattiske and Associates 1988, 1992, 1993a).

3. METHODS

3.1 Fieldwork

An initial search for the Declared Rare and Priority flora species known to occur in the region was made using the Department of the Environment and Heritage (2005a and 2005b) and the Department of Conservation and Land Management databases (Western Australian Herbarium 2005a and 2005b) and then updated by reviewing databases in August 2017 managed by the Department of the Environment and Energy (2017a, 2017b) and the Department of Biodiversity, Conservation and Attractions (2017a, 2017b and 2017c).

Photographs, location data and descriptions of these species were taken into the field in 2005 to assist in identifying rare plants and habitats where rare plants may be found.

The flora of the WA Bluemetal Quarry survey area was described and collected systematically at each survey site in three specific areas, from a grid overlaid on topographic maps with sites at 150m intervals, by three experienced botanists from Mattiske Consulting Pty Ltd in October 2005. Selective opportunistic collecting was further undertaken at additional sites in plant communities of like structure and floristic composition. Details on topography, percentage litter cover, soil ratio, percentage of bare ground, outcropping rocks and their type, pebble type and size, and time since fire, were recorded at each site. The average height and percent foliage cover of all species, alive and dead, was recorded at each site. Digital photographs were taken of some species such as orchids, instead of collecting, to minimise the impact on potentially rare or endangered species.

All plant specimens collected during the field surveys were pressed, dried and fumigated in accordance with the requirements of the Western Australian Herbarium. The plant species were identified and then compared with pressed specimens housed at the Western Australian Herbarium. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded follows the Western Australian Herbarium standards (2017d). Several species have changed names since the 2005 studies as a result of changes to taxonomic nomenclature, e.g. *Dryandra* species have been changed to *Banksia* species and *Austrodanthonia* species to *Rytidosperma* species.

3.2 Local and Regional Significance

The Environmental Protection Authority (2004) in Guidance Statements 51 and 56 stated that species, subspecies, varieties, hybrids and ecotypes may be significant for a variety of reasons, including:

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

Plant communities or vegetation may be significant for a range of reasons, other than a statutory listing as a Threatened Ecological Community or because the extent is below a threshold level. The Environmental Protection Authority (2004) in Guidance Statement 51 stated that significant vegetation may include communities that have:

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

The application of the degree of significance may apply at a range of scales.

3.3 Threatened and Priority Flora and Fauna

Species of flora and fauna are given threatened or priority conservation status when populations are restricted geographically or threatened by local processes. The Department of Biodiversity, Conservation and Attractions and the Department of the Environment and Energy recognise these threats of extinction and consequently applies regulations towards population and species protection, see Appendix A.

3.4 Threatened and Priority Ecological Communities

Ecological Communities are given threatened or priority conservation status when communities are restricted geographically or threatened by local processes. The Department of Biodiversity, Conservation and Attractions and the Department of the Environment and Energy recognise these threats of extinction and consequently applies regulations towards protection, see Appendix A.

3.5 Condition Rating

The condition of each plant community was rated according to the scale as developed by Keighery (1994) and as used for assessing Bush Forever sites (Government of Western Australia 2000). The scale is summarised in Table 2.

Table 2: Condition rating scale from Bush Forever (Government of Western Australia 2000), based on Keighery 1994

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. Disturbance to vegetation structure covers repeated fire, aggressive weeds, dieback, logging, grazing.
4	**Good**	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure covers frequent fires, aggressive weeds at high density, partial clearing, dieback and grazing.
5	**Degraded**	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure includes frequent fires, presence of very aggressive weeds, partial clearing, dieback and grazing.
6	**Completely degraded**	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas often described as "parkland cleared" with the flora comprising weed or crop species with isolated native trees or shrubs.

4. OBJECTIVES

In 2005, WA Bluemetal Quarry commissioned Mattiske Consulting Pty Ltd to undertake a flora and vegetation-mapping program of the WA Bluemetal Quarry survey area at Serpentine.

The specific objectives of this study were to:

- Define vegetation communities to enable mapping of the vegetation on the WA Bluemetal Quarry survey area,
- Assess the condition of all vegetation within the survey area,
- Produce maps of vegetation communities and vegetation condition within the survey area,
- Assess the conservation status of all vegetation communities and plant taxa, and
- Prepare a report summarising the findings.

In 2017, WA Bluemetal Quarry commissioned Mattiske Consulting Pty Ltd to review the values in relation to current listings.

5. RESULTS

5.1 Desktop Assessment

The searches of the State and Federal databases highlighted a range of potential flora and fauna species that may occur in the area and several threatened ecological communities that may occur in the area. As some of these occur on the Swan Coastal Plain some of the potential values are not relevant for the survey area. The area under consideration occurs on the Darling Range and Darling Scarp (not the Swan Coastal Plain).

The review ore State and Federal databases highlighted the following key biological values that have the potential to occur on the Serpentine survey area, see Appendices B and C.

Wetlands of National Environmental Significance

- Peel Yalgorup System – unlikely to be impacted by any developments as 30-40m km downstream from Darling Scarp and survey area.

Potential Threatened Ecological Communities

- Three potential threatened ecological communities at the Federal level are all located on the Swan Coastal Plain and as such do not occur within the survey area.

Potential Threatened Fauna Species

- Seven threatened avifauna species were highlighted in the search of the Federal and State databases. Of these the four threatened Black Cockatoos (Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksia naso*), Baudin's Cockatoo (*Calyptorhynchus baudinii*), Carnaby's CocKatoo (*Calyptorhynchus latriostris*) and the White-tailed Black Cockatoo (*Calyptorhynchus* sp.) are most likely to occur in the survey area.
- Three threatened mammals were highlighted in the search of the Federal and State databases. Of these the Chuditch (Dasyurus geoffroii) is the most likely to occur in the survey area.
- One Freshwater Mussel was highlighted in the State database as potentially occurring in survey the area.

Potential Threatened and Priority Flora

- A total of 12 potential threatened and priority flora species twelve are listed at the State level and of these 3 species (*Lasiopetalum pterocarpum* (T), *Thelymitra stellata* (T) and *Pithocarpa corymbulosa* (P3) may occur at the site due to site preferences.
- A total of 11 potential threatened flora species are listed at the Federal level and of these 2 species (*Lasiopetalum pterocarpum* (E), *Thelymitra stellata* (E) may occur at the site due to site preferences.

Potential Migratory Species

- Of the potential migratory species the majority occur near wetalnds and marine areas and therefore are not likely to occur in the survey area. Of the highlighted species the most likely is the Grey Wagtail (*Motacilla cinerea*).

5.2 Field Studies - Flora

A total of 253 vascular plant taxa from 154 plant genera and 56 families were recorded on the WA Bluemetal Quarry survey area in Location 246, Location 344 and M70/1240 (Mattiske Consulting Pty Ltd 2005).

No Declared Rare Flora species gazetted under the Wildlife Conservation Act (1950-1980) were located on the WA Bluemetal Quarry survey area. No endangered or vulnerable species, pursuant to s179 of the Environmental Protection and Biodiversity Conservation Act (1999) were located during the survey. However, two Priority taxa, as defined by the Department of Conservation and Land Management in 2005 were identified in the survey. These were *Millotia tenuifolia* var. *laevis* and *Pithocarpa*

?*corymbulosa* (Table 3). Neither of these species is restricted to the survey area; however both are relatively geographically restricted and are only known from 11 and 22 records respectively on the basis of State Herbarium records (Department of Biodiversity, Conservation and Attractions (2017b). The latter lack of collections also reflects the lack of survey effort in the wider region.

Table 3: Locations of Priority Flora species found during the WA Bluemetal Quarry survey

Species	GPS Location (GDA - Zone 50J)		Location
	Easting (mE)	Northing (mN)	
Pithocarpa ?corymbulosa P2	408980	6426520	Loc 344
Millotia tenuifolia var. *laevis* P2	409686	6428901	M70/1240
Millotia tenuifolia var. *laevis* P2	409700	6428764	M70/1240
Millotia tenuifolia var. *laevis* P2	409691	6428675	M70/1240
Millotia tenuifolia var. *laevis* P2	409168	6428464	M70/1240
Millotia tenuifolia var. *laevis* P2	409144	6427991	M70/1240
Millotia tenuifolia var. *laevis* P2	409280	6428120	M70/1240
Millotia tenuifolia var. *laevis* P2	409280	6428840	M70/1240

In M70/1240, 161 taxa from 47 Families, 105 genera and 159 species were collected. One Priority Two species was collected in this area; namely *Millotia tenuifolia* var. *laevis*. Eleven species of introduced plant (i.e. weeds) were found in M70/1240. This area was generally Jarrah *Eucalyptus marginata* subsp*. marginata* or Jarrah/Marri *Eucalyptus marginata* subsp. *marginata / Corymbia calophylla* forest with subdominant trees *Allocasuarina fraseriana*, *Banksia grandis* and occasionally *Persoonia longifolia* and *Nuytsia floribunda* on lateritic soils. Dominant understorey plants included the grasstrees *Xanthorrhoea preissii* and *Xanthorrhoea gracilis*, shrubs *Dryandra sessilis*, *Trymalium ledifolium* and *Hypocalymma angustifolium*. Other understorey plants included species from the genera *Drosera*, *Stylidium*, *Hibbertia* and *Conostylis*. Evidence of disturbance included old logging tracks, sawn logs and weeds. There were signs of dieback and storm damage in some places, particularly in the many "black gravel" areas. The pocket to the far south-east of M70/1240 (south-west of the creek) was generally in a better condition with healthier vegetation (less disturbance) than much of the remainder of the survey area.

In Location 344, 170 taxa were collected from 46 families, 113 genera and 166 species. One Priority Two species was found in the area, namely *Pithocarpa ?corymbulosa*. Twenty-nine introduced plant species were found. Location 344 was predominantly Marri (*Corymbia calophylla* forest with a disturbed understorey on loamy soils, and some large granite outcrops. Around the granite outcrops, there were *Acacia pulchella*, *Banksia sphaerocarpa*, *Melaleuca parviceps*, *Pimelea imbricata* var. *piligera*, *Stylidium dichotomum*, *Darwinia citriodora* and *Verticordia huegelii* var. *huegelii* but also weeds such as **Briza maxima* and **Trifolium campestre.* The forest nearest the creek (northern end of Location 344, at the bottom of the Darling Scarp) had a "parkland" appearance, with a severely degraded understorey consisting of *Xanthorrhoea preissii*, *Phyllanthus calycinus* and *Macrozamia riedlei* and weeds such as **Brachypodium distachyon* and **Briza maxima*. This is probably the result of historic grazing by cattle and may be being perpetuated due to the high density of Western Grey Kangaroos *Macropus fuliginosus* now inhabiting the area.

Location 246 was a highly degraded environment consisting of a few native trees (e.g. *Eucalyptus rudis*, *Corymbia calophylla*) over introduced grasses such as **Avena barbata*, **Briza maxima* and **Lolium rigidum*. There were 15 taxa (and 15 species) identified, from 7 families and 13 genera. No Priority species were found in Location 246. Thirteen weeds were identified in Location 246.

Thirty-nine introduced species were identified during the survey. This number largely reflects the proximity of agriculture and other disturbances on the area.

5.3 Field Studies - Vegetation

A total of ten site-vegetation types were defined and mapped for the WA Bluemetal Quarry survey area. In addition, the disturbed and pasture areas were defined and mapped. The native vegetation areas were based on the site-vegetation types that were defined by Havel (1975a and 1975b). These site-vegetation types are described in the following text and presented on the enclosed vegetation map (Figure 3).

CW - Woodland to Open Forest of *Eucalyptus rudis – Corymbia calophylla* with dense *Taxandria linearifolia* and *Astartea scoparia* in understorey on creek-lines and water-courses (this type is a variant of site-vegetation types C and W as defined by Havel (1975a) and in part reflects the narrow linear nature of the C type and the need to combine this type with the type W for mapping purposes (CW). This type occurs within the Murray and Yarragil complexes as defined by Heddle *et al.* (1980a) and Mattiske and Havel (1998).

This site-vegetation type occurs in the gullies and creek-beds of the western valley floors, which are dominated by loamy soils in the Darling Ranges. This site-vegetation type occurs in other conservation areas (Heddle *et al.* 1980b; Department of Conservation and Environment 1980; Department of Conservation and Land Management 1987) and tends to be dominated by sedges and specific shrub species which dominate the wetter lower slopes and creek-beds (e.g. *Astartea scoparia* and *Taxandria linearifolia*), as well as species which reflect the moister and fertile slopes of the valley systems (e.g. *Hypocalymma angustifolium, Eucalyptus patens* and *Acacia extensa* of site-vegetation type W).

D - Open Forest of *Eucalyptus marginata* subsp. *marginata – Corymbia calophylla* on lower slopes with mixed low understorey species, including *Baeckea camphorosmae* and *Acacia extensa* (site-vegetation type D as defined by Havel (1975a)). This type occurs mainly within the Yarragil and Swamp complexes as defined by Heddle *et al.* (1980a) and Mattiske and Havel (1998).
This site-vegetation type occur on the lower, less fertile slopes with sandy-clays to clay loams on the western valley systems in the Darling Ranges and also occur in other conservation areas (Heddle *et al.* 1980b; Department of Conservation and Environment 1980; Department of Conservation and Land Management 1987). This site-vegetation type tends to be dominated by specific shrub species, which dominate the moister and less fertile lower slopes of the valley systems (e.g. *Hypocalymma angustifolium* and *Baeckea camphorosmae* of site-vegetation type D).

PW - Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata* subsp. *marginata - Corymbia calophylla* with scattered understorey, including *Grevillea wilsonii, Adenanthos barbiger, Baeckea camphorosmae* and *Hypocalymma angustifolium* (this type is a variant of site-vegetation type P as defined by Havel (1975a) due to the presence of moisture indicators such as *Hypocalymma angustifolium* and *Baeckea camphorosmae*). This type occurs within the Dwellingup, Dwellingup-Hester and Yarragil complexes as defined by Heddle *et al.* (1980a) and Mattiske and Havel (1998).

This site-vegetation type occurs on the lower slopes and less commonly the mid slopes of the undulating hills on the Darling Ranges. The type is not well represented in the conservation estate as it appears to be a local variant of the P site-vegetation type (Heddle *et al.* 1980b; Department of Conservation and Environment 1980; Department of Conservation and Land Management 1987). This site-vegetation type tends to be dominated by specific shrub species which dominate the sandy-gravelly slopes and moist soil conditions of the Darling Ranges (e.g. *Lechenaultia biloba, Allocasuarina fraseriana* (formerly *Casuarina fraseriana), Adenanthos barbiger* and *Banksia grandis* of site-vegetation type P and *Hypocalymma angustifolium* and *Baeckea camphorosmae* of the site-vegetation type W which dominates moister soils in the nearby forest areas).

407000mE
408000mE
409000mE
6429000mN
6428000mN
6427000mN
6426000mN
VCL
2778
11
4223
45
4590
4592
100
4589
4591
4594
246
526
126
9
0
67
410
68
0
PS
D
SW
PW
PT
S
M70/1240
D
PS
PW
PS
SW
TS
S
CW
D
PS
PW
S
DISTURBED
TS
CW
D
G
D
R
D
344
G
G
R
G
R
D
G
G
PASTURE
CW
G
G
R
R
G
G
S
R
TS
PASTURE
S.F. No. 22

LEGEND

CW Woodland to Open Forest of *Eucalyptus rudis Corymbia calophylla* over dense *Taxandria linearifolia* and *Astartea scoparia* on creekand water

D Open Forest of *Eucalyptus marginata* subsp. *marginata Corymbia calophylla* over low understorey with *Baeckea camphorosmae* and *Acacia extensa* on lower slopes.

PW Open Forest of *Allocasuarina fraseriana Eucalyptus marginata* subsp. *marginata Corymbia calophylla* over *Grevillea wilsonii, Adenanthos barbiger, Baeckea camphorosmae* and *Hypocalymma angustifolium* on mid and upper slopes.

PT Open Forest of *Allocasuarina fraseriana Eucalyptus marginata* subsp. *marginata Corymbia calophylla Banksia grandis* over *Adenanthos barbiger, Leucopogon verticillatus* and *Clematis aristata* var. *occidentalis* on mid slopes.

PS Open Forest of *Allocasuarina fraseriana Eucalyptus marginata* subsp. *marginata Corymbia calophylla Banksia grandis* over *Adenanthos barbiger* on mid and upper slopes.

S Open Forest *of Eucalyptus marginata* subsp. *marginata Banksia grandis Allocasuarina fraseriana* over *Adenanthos barbiger, Leucopogon capitellatus* and *Styphelia tenuiflora* on upper slopes and ridges.

SW Open Forest of *Eucalyptus marginata* subsp. *marginata Corymbia calophylla Banksia grandis* over *Adenanthos barbiger, Hypocalymma angustifolium* and *Styphelia tenuiflora* on upper gullies and lower slopes.

TS Open Forest of *Eucalyptus marginata* subsp. *marginata Corymbia calophylla* over *Leucopogon verticillatus* and *Clematis aristata* var. *occidentalis* on mid and upper slopes.

R Open Woodland of *Eucalyptus marginata* subsp. *marginata Corymbia calophylla* on fringes of granite outcrops or shallow soils.

G - Closed Heath *Darwinia citriodora*, *Trymalium ledifolium, Phyllanthus calycinus, Acacia pulchella*, *Banksia sphaerocarpa*, *Melaleuca parviceps* and *Verticordia huegelii* var. *huegelii* and *Hypocalymma angustifolium* on granite outcrops or shallow soils.

Pasture - Cleared parkland with remnant trees over pastures.

Disturbed Previously cleared areas.

N

0 100m

Scale
MGA94 Zone 50

WA BLUEMETAL QUARRY

SERPENTINE PROJECT

VEGETATION

DECEMBER 2005

MATTISKE CONSULTING PTY LTD
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Drawn: CAD Resources ~ www.cadresources.com.au Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202		Figure: 1
CAD Ref: g1270_f01.dgn	Date: Dec 2005	Rev: B A1

Photograph 1: Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata* subsp. *marginata - Corymbia calophylla - Banksia grandis* over *Dryandra sessilis* (PW site-vegetation type).

PT - Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata* subsp. *marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Leucopogon verticillatus* and *Clematis aristata* var. *occidentalis* (this site type is a variant of the site-vegetation types P and T as defined by Havel (1975a)). This type occurs within the Dwellingup-Hester complex as defined by Heddle *et al.* (1980a) and Mattiske and Havel (1998).

This site-vegetation type occurs on the mid to upper slopes of the undulating hills on the Darling Ranges. This combined type of types P and T is relatively restricted in distribution within the Northern Jarrah Forest and is poorly represented in the conservation estate (Heddle *et al.* 1980b; Department of Conservation and Environment 1980; Department of Conservation and Land Management 1987).

This site-vegetation type tends to be dominated by specific shrub species which dominate the sandy-gravelly slopes of the Darling Ranges (e.g. *Allocasuarina fraseriana, Adenanthos barbiger, Clematis aristata* var. *occidentalis, Leucopogon verticillatus* and *Banksia grandis* of site-vegetation types P and T) but which lack some of the key indicators of the P type (e.g. *Grevillea wilsonii*) and includes species which occur on the gravelly soils (*Hovea chorizemifolia* and *Leucopogon verticillatus*).

Photograph 2: Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata* subsp*. marginata - Corymbia calophylla - Banksia grandis* over *Dryandra sessilis* (PS site-vegetation type).

PS - Open Forest of *Allocasuarina fraseriana - Eucalyptus marginata* subsp*. marginata - Corymbia calophylla - Banksia grandis* with scattered understorey, including *Adenanthos barbiger* (this site type is a variant of the site-vegetation types P and S as defined by Havel (1975a)). This type occurs within the Dwellingup and Dwellingup-Hester complexes as defined by Heddle *et al.* (1980a) and Mattiske and Havel (1998).

This site-vegetation type occurs on the mid to upper slopes of the undulating hills on the Darling Ranges. This combined type of types P and S is relatively widespread in distribution within the Northern Jarrah Forest and is well represented in the conservation estate (Heddle *et al.* 1980b; Department of Conservation and Environment 1980; Department of Conservation and Land Management 1987). This site-vegetation type tends to be dominated by specific shrub species which dominate the sandy-gravelly slopes of the Darling Ranges (e.g. *Allocasuarina fraseriana, Adenanthos barbiger, Leucopogon propinquus* and *Banksia grandis* of site-vegetation types P and S) but which lack some of the key indicators of the P type (e.g. *Grevillea wilsonii*) and includes species which occur on the gravelly soils (*Hovea chorizemifolia* and *Leucopogon capitellatus*).

S - Open Forest *of Eucalyptus marginata* subsp. *marginata - Banksia grandis - Allocasuarina fraseriana* with scattered understorey, *including Adenanthos barbiger, Leucopogon capitellatus* and *Styphelia tenuiflora* (site-vegetation type S as defined by Havel (1975a)). This type occurs within the Dwellingup and Dwellingup-Hester complexes as defined by Heddle *et al.* (1980a) and Mattiske and Havel (1998).

This site-vegetation type occurs on the upper slopes, and to a lesser degree mid slopes, of the undulating hills on the Darling Ranges. The type is widespread in distribution within the Northern Jarrah Forest and is well represented in the conservation estate (Heddle *et al.* 1980b; Department of Conservation and Environment 1980; Department of Conservation and Land Management 1987). This site-vegetation type tends to be dominated by specific shrub species, which dominate the gravelly slopes of the Darling Ranges (e.g. *Adenanthos barbiger, Leucopogon propinquus*, *Styphelia tenuiflora, Leucopogon capitellatus, Banksia grandis* and *Hovea chorizemifolia*).

SW - Open Forest of *Eucalyptus marginata* subsp. *marginata - Corymbia calophylla – Banksia grandis* with scattered understorey, including *Adenanthos barbiger, Hypocalymma angustifolium* and *Styphelia tenuiflora* (this type is a variant of site-vegetation type S as defined by Havel (1975a) due to the presence of moisture indicators such as *Hypocalymma angustifolium* and *Baeckea camphorosmae*). This type occurs within the Dwellingup, Dwellingup-Hester and Yarragil complexes as defined by Heddle *et al.* (1980a) and Mattiske and Havel (1998).

This type is not well represented in the conservation estate as it appears to be a local variant of the S site-vegetation type (Heddle *et al.* 1980b; Department of Conservation and Environment 1980; Department of Conservation and Land Management 1987). This site-vegetation type tends to be dominated by specific shrub species which dominate the gravelly slopes and moist soil conditions of the Darling Ranges (e.g. *Leucopogon capitellatus, Leucopogon propinquus, Hovea chorizemifolia, Adenanthos barbiger* and *Banksia grandis* of site-vegetation type S and *Hypocalymma angustifolium* and *Baeckea camphorosmae* of the site-vegetation type W which dominates moister soils in the nearby forest areas).

TS - Open Forest of *Eucalyptus marginata* subsp. *marginata - Corymbia calophylla* with scattered understorey, including *Leucopogon verticillatus* and *Clematis aristata* var. *occidentalis* (site-vegetation type T as defined by Havel (1975a)). This type occurs within the Helena, Murray, Dwellingup and Dwellingup-Hester complexes as defined by Heddle *et al.* (1980a) and Mattiske and Havel (1998).

This site-vegetation type occurs on the upper slopes, and to a lesser degree mid slopes, of the undulating hills on the Darling Ranges. This type is widespread in distribution within the Northern Jarrah Forest and is well represented in the conservation estate (Heddle *et al.* 1980b; Department of Conservation and Environment 1980; Department of Conservation and Land Management 1987). This site-vegetation type tends to be dominated by specific shrub species, which dominate the more fertile loams of the Darling Ranges (e.g. *Leucopogon verticillatus, Clematis aristata* var. *occidentalis* and *Hovea chorizemifolia*).

R - Open Woodland of *Eucalyptus marginata* subsp*. marginata - Corymbia calophylla* on fringes of granite outcrops or shallow soils (site-vegetation type R as defined by Havel 1975a) within the Cooke, Helena, Dwellingup and Dwellingup-Hester complexes as defined by Heddle *et al.* (1980a) and Mattiske and Havel (1998).

This site-vegetation type occurs on the shallow soils surrounding outcrops on the upland and valley systems on the Darling Ranges. This type is restricted in distribution within the Northern Jarrah Forest, but is well represented in the conservation estate, e.g. the Monadnocks near Mt Cooke and Mt Windsor (Heddle *et al.* 1980b; Department of Conservation and Environment 1980; Department of Conservation and Land Management 1987). This site-vegetation type tends to be dominated by specific shrub species, which reflect the soils and moisture associated with outcrops on the Darling Ranges (e.g. *Trymalium ledifolium, Phyllanthus calycinus* and *Hypocalymma angustifolium*).

G - Closed Heath of Myrtaceae – Proteaceae species on shallow soils of granite outcrops (site-vegetation type G as defined by Havel 1975b) within the Cooke, Helena and Darling Scarp vegetation complexes as defined by Heddle *et al.* (1980a) and Mattiske and Havel (1998).

This site-vegetation type occurs on the shallow soils associated with outcrops on the upland and valley systems on the Darling Ranges. This type is restricted in distribution within the Northern Jarrah Forest, but is well represented in the conservation estate, e.g. the Monadnocks near Mt Cooke and Mt Windsor (Heddle *et al.* 1980b; Department of Conservation and Environment 1980; Department of Conservation and Land Management 1987).

Photograph 3: Mosaic of Closed Heath of Myrtaceae – Proteaceae species (G site-vegetation type) and Open Forest of *Eucalyptus marginata* subsp*. marginata - Corymbia calophylla* on shallow soils (R site-vegetation type).

This site-vegetation type tends to be dominated by specific shrub species, which reflect the soils and moisture associated with outcrops on the Darling Ranges (e.g. *Darwinia citriodora*, *Trymalium ledifolium, Phyllanthus calycinus, Acacia pulchella*, *Banksia sphaerocarpa*, *Melaleuca parviceps*, *Pimelea imbricata* var. *piligera*, *Stylidium dichotomum* and *Verticordia huegelii* var. *huegelii* and *Hypocalymma angustifolium*).

Photograph 4: Disturbed, grazed and partly modified Open Forest of *Eucalyptus marginata* subsp. *marginata - Corymbia calophylla*.

5.4 Review of the Conservation Status of the Site-vegetation Types

A number of site-vegetation types were found to be locally and regionally significant. These site-vegetation types are:

- The site-vegetation types G and R are locally significant as they are associated with localised outcropping. Both site-vegetation types are well represented in the conservation estate (Heddle *et al.* 1980a).

- The valley types (CW) are also significant in providing habitat diversity for fauna species.

- The combinations PW and SW site-vegetation types have significant implications for the management of the *Phytophthora cinnamomi* infections in the area. It should be recognized that dieback infections are present on the upper slopes of Location M70/1240 and therefore there is still a need to introduce hygiene measures.

5.5 Review of Physiological Stress in the Survey Area

The condition of the vegetation on the survey area varied from "excellent" to "completely degraded", based on the scale as developed by Keighery (1994). A few local areas have been impacted by previous snigging tracks, dieback (mainly on M70/1240), clearing for agricultural activities (mainly Loc 246) and quarry activities (Loc 344).

6. DISCUSSION

Mattiske Consulting Pty Ltd was commissioned by WA Bluemetal Quarry to conduct an assessment of the flora and vegetation values on three locations near Serpentine. Mattiske Consulting Pty Ltd undertook the field studies during a prime flowering period in October 2005. Three experienced botanists from Mattiske Consulting Pty Ltd were involved in the field studies. Therefore the survey effort was undertaken at an appropriate time to maximise the return for effort.

Flora

- A total of 12 potential threatened and priority flora species twelve are listed at the State level and of these 3 species (*Lasiopetalum pterocarpum* (T), *Thelymitra stellata* (T) and *Pithocarpa corymbulosa* (P3) may occur at the site due to site preferences.
- A total of 11 potential threatened flora species are listed at the Federal level and of these 2 species (*Lasiopetalum pterocarpum* (E), *Thelymitra stellata* (E) may occur at the site due to site preferences.
- No Threatened Flora species gazetted under the Wildlife Conservation Act (1950-1980) were located on the WA Bluemetal Quarry survey area.
- No endangered or vulnerable species, pursuant to s179 of the Environmental Protection and Biodiversity Conservation Act (1999) were located during the survey.
- Two Priority taxa, as defined by the Department of Biodiversity, Conservation and Attractions (2017b), were identified in the survey. These were *Millotia tenuifolia* var. *laevis* and *Pithocarpa* ?*corymbulosa.* Neither of these species are restricted to the survey area; however both are relatively geographically restricted and were only known from 4 and 20 records respectively on the basis of State Herbarium records in 2005 (Department of Biodiversity, Conservation and Attractions 2017b). The latter lack of collections also reflects the lack of survey effort in the wider region.

Fauna

Seven threatened avifauna species were highlighted in the search of the Federal database. Of these the three threatened Black Cockatoos (Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksia naso*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and Carnaby's CocKatoo (*Calyptorhynchus latriostris*) are most likely to occur in the survey area.

Three threatened mammals were highlighted in the search of the Federal database. Of these the Chuditch (*Dasyurus geoffroii*) is the most likely to occur in the survey area.

Of the potential migratory species the majority occur near wetlands and marine areas and therefore are not likely to occur in the survey area. Of the highlighted species the most likely is the Grey Wagtail (*Motacilla cinerea*).

Vegetation Complexes

The four vegetation complexes that occur in the WA Blue Metal survey area included Dwellingup 2 (D2) Darling Scarp (DS), Murray 1 (My1) and Yarragil (Yg1). The majority of the vegetation complexes are well represented (23.0%, 7.9%, 36.0% and 29.9% respectively) within the formal and informal reserve systems (Conservation Commission 2003). The exception to the latter is the Darling Scarp (7.9%), as it is largely in private landholdings. Any land swap that might include less disturbed sections of the Darling Scarp complex (with its associated vegetation on the shallow and granitic soils) would benefit the conservation of this complex in the regional context.

Site-Vegetation Types

A total of ten site-vegetation types were defined and mapped for the WA Bluemetal Quarry survey area. In addition, the disturbed and pasture areas were defined and mapped. These units were a combination of Havel's (1975a and 1975b) site-vegetation types, and all of the site-vegetation types are well represented in the conservation estate. A total of ten site-vegetation types and two disturbed types (pasture and disturbed) were defined within the three survey areas, namely:

Table 4: Summary of Site - Vegetation Types recorded on the Survey Areas

Site-Vegetation Types	Location 246	Location 344	M70/1240
CW	X	X	X
D		X	X
G		X	
R		X	
S		X	X
SW			X
PW			X
PS			X
PT			X
TS		X	X
Pasture	X		
Disturbed		X	

The site-vegetation types varied between the respective areas and this in part reflects the differences between the underlying landforms and soils associated with the Darling Scarp and the Dwellingup mapping units (Table 4). Although there was some overlap between the site-vegetation types, the types differed in either key overstorey species or indicator species. All of the site-vegetation types occur in similar environments in adjacent areas of State Forest and National Parks.

Threatened Ecological Communities (State and Federal Listings)

None of these site-vegetation types are listed as threatened ecological communities listed by the Department of Biodiversity, Conservation and Attractions (2017c). None of these site-vegetation types are listed as threatened under the Environmental Protection and Biodiversity Conservation Act (1999). The potential threatened ecological communities occur on the nearby Swan Coastal Plain and as the survey area occurs in the Darling Ranges and on the Darling Scarp the potential Threatened Ecological Communities are not present in the survey area.

Vegetation Condition

The condition of the vegetation on the survey area varied from "excellent" to "completely degraded", based on the scale as developed by Keighery (1994). A few local areas have been impacted by previous snigging tracks, dieback, clearing for agricultural activities and quarry activities.

6.1 Review of Clearing Principles

The following is a review of the relevant clearing principles as it relates to native vegetation.

Principle (a): Native vegetation should not be cleared if it comprises a high level of biodiversity.

The property has sections that have been influenced by previous grazing and agricultural activities see Section 5.5. Although a range of species were recorded, the key values appear to occur on the less disturbed areas which have not been as intensively impacted by previous clearing activities associated with agriculture.

Consequently, clearing of native vegetation may be at variance with this Principle.

Principle (b): Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significant habitat for fauna indigenous to Western Australia.

In view of the potential of the area to be utilized by a range of threatened fauna species (including the listed Black Cockatoos and the Chuditch) the proposed activities may be at variance with this Principle.

Principle (c): Native Vegetation should not be cleared if it includes, or is necessary, for the continued existence of rare flora.

Despite searching, no Threatened flora species gazetted under the *Wildlife Conservation Act* (1950-1980) were located on the Serpentine survey area. Two Priority flora species were located on the Serpentine survey area.

Despite searching, no Threatened flora species, pursuant to s179 of the *Environment Protection and Biodiversity Conservation Act* (1999) were located during the survey.

Consequently, clearing of native vegetation is unlikely to be at variance with this Principle.

Principle (d): Native vegetation should not be cleared if it compromises the whole or part of, or is necessary for the maintenance of a threatened ecological community.

The site-vegetation types were based on the Havel's site-vegetation types for the Northern Jarrah Forest Region (Havel 1975a, 1975b). None of these communities are listed at threatened ecological communities or priority ecological communities (Department of Biodiversity, Conservation and Attractions 2017c; Department of the Environment and Energy 2017b).

Therefore the proposed clearing is unlikely to be at variance with this Principle.

Principle (e): Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.

As the Serpentine survey area abuts the State Forest and lands managed for water catchment and conservation the majority of the vegetation complexes on the survey area are well represented in the local and regional context. The Darling Scarp vegetation complex which is represented by 7.9% in informal and formal reserves occurs largely on private properties and therefore, clearing of native vegetation the Serpentine survey area is map be at variance with this Principle.

Principle (f): Native vegetation should not be cleared if it is growing in, or in association with, and environment associated with a watercourse or wetland.

A small section of the native vegetation on the Serpentine survey area occurs near a watercourse, although the area has been subjected to indirect impacts of agricultural activities. Although the survey

area occurs within the Peel Harvey catchment the proposed activities are some distance from the lower reaches of the water courses to the west. Therefore the proposed clearing is unlikely to be at variance with this Principle.

Principle (g): Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

Although the Serpentine survey area abuts State Forest and forested areas any clearing of native vegetation on the Serpentine survey area is unlikely to be at variance with this Principle.

Principle (h): Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.
As previous agricultural activities have been undertaken on sections of the Serpentine survey area and provided appropriate management strategies have been put in place, the proposed clearing is unlikely to be at variance with this Principle.

Principle (i): Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water

Clearing of native vegetation on the Serpentine survey area is not envisaged to cause deterioration in the quality of surface or underground water and is therefore not at variance with this Principle.

Principle (j): Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.

Clearing of native vegetation on the Serpentine survey area is not envisaged to cause or exacerbate the incidence of flooding and is therefore not at variance with this Principle.

7. ACKNOWLEDGMENTS

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8. LIST OF PARTICIPANTS

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

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THREATENED AND PRIORITY DEFINITIONS

Under section 179 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), threatened flora and fauna are categorised as extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent (Table A1.1).

Table A1.1 Federal definition of threatened species

Note: Adapted from section 179 of the EPBC Act.

CODE	CATEGORY	DEFINITION
Ex	**Extinct**	Species which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild**	Species 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**	Species which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered**	Species 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**	Species 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**	Species 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 *Wildlife Conservation Act 1950* (WC Act) provides for (amongst other things) the protection of flora and fauna likely to become extinct or rare or otherwise in need of special protection in Western Australia under section 23F. Threatened (or rare) flora and fauna are listed in the *Wildlife Conservation Notices* (under section 23F(2) of the WC Act; Department of Biodiversity, Conservation and Attractions 2017) and are categorised under Schedules 1-4 as critically endangered, endangered, vulnerable or extinct, respectively. Threatened flora and fauna are defined as "likely to become extinct or is rare, or otherwise in need of special protection", pursuant to section 23F(2) of the WC Act. Threatened species are categorised as critically endangered, endangered, vulnerable and presumed extinct (Table A1.2).

Table A1.2 State definition of threatened species

Note: Adapted from Department of Biodiversity, Conservation and Attractions (2017).

CODE	CATEGORY	DEFINITION
CR	**Critically endangered**	Species considered to be facing an extremely high risk of becoming extinct in the wild (listed under Schedule 1 of the *Wildlife Conservation (Rare Flora) Notice 2016*).
EN	**Endangered**	Species considered to be facing a very high risk of becoming extinct in the wild (listed under Schedule 2 of the *Wildlife Conservation (Rare Flora) Notice 2016*).
VU	**Vulnerable**	Species considered to be facing a high risk of becoming extinct in the wild (listed under Schedule 3 of the *Wildlife Conservation (Rare Flora) Notice 2016*).
EX	**Presumed extinct species**	Species that have been adequately searched for and there is no reasonable doubt that the last individual has died (listed under Schedule 4 of the *Wildlife Conservation (Rare Flora) Notice 2016*).

Priority species are defined as "possibly threatened species that do not meet the survey criteria, or are otherwise data deficient; or are adequately known, are rare but not threatened, meet criteria for near threatened or have recently been removed from the threatened species list for other than taxonomic reasons" (Department of Biodiversity, Conservation and Attractions 2017). Priority species are not afforded any protection under state or federal legislation, however are considered significant under the Environmental Protection Authority's *Environmental Factor Guideline: Flora and Vegetation*. The Department of Biodiversity, Conservation and Attractions categorises priority species into categories: Priority 1; Priority 2, Priority 3 and Priority 4 (Table A1.3).

Table A1.3: State definition of priority species

Note: Adapted from Department of Biodiversity, Conservation and Attractions (2017).

CODE	CATEGORY	DEFINITION
P1	**Priority 1:** Poorly-known species	Known from one or a few locations (< 5) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation; or are otherwise under threat of habitat destruction or degradation. In urgent need of further survey.
P2	**Priority 2:** Poorly-known species	Known from one or a few locations (< 5). Some occurrences are on lands managed primarily for nature conservation. In urgent need of further survey.
P3	**Priority 3:** Poorly-known species	Known from several locations and the species does not appear to be under imminent threat; or from few but widespread locations with either a large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. In need of further survey.
P4	**Priority 4:** 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) Other -** Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

THREATENED AND PRIORITY ECOLOGICAL COMMUNITY DEFINITIONS

Under section 181 of the EPBC Act, threatened ecological communities are categorised as critically endangered, endangered and vulnerable (Table A2.1).

Table A2.1 Federal definition of threatened ecological communities

Note: Adapted from section 181 and section 182 of the EPBC Act.

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

Currently there is no Western Australian legislation covering the conservation of state listed threatened ecological communities (TECs), however, a non-statutory process is in place, whereby the from Department of Biodiversity, Conservation and Attractions have been identifying and informally listing TECs since 1994. Some of these TECs are endorsed by the Federal Minister as threatened, and some of these are also listed under the EPBC Act and therefore afforded legislative protection at the Commonwealth level.

Table A2.2 State definition of threatened ecological communities

Note: Adapted from Department of Biodiversity, Conservation and Attractions (2017c)

CODE	CATEGORY	DEFINITION
PD	**Presumed Totally Destroyed**	An ecological community will be listed as PD if there are no recent records of the community being extant **and either** of the following applies: **1.** Records within the last 50 years have not been confirmed despite thorough searches or known likely habitats; or **2.** All occurrences recorded within the last 50 years have since been destroyed.
CR	**Critically Endangered**	An ecological community will be listed as CR when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the immediate future.
EN	**Endangered**	An ecological community will be listed as EN when it has been adequately surveyed and is not CR, but is facing a very high risk of total destruction in the near future. The ecological community must meet **any one or more of** the following criteria: **1.** The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; **2.** The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or **3.** The ecological community is highly modified with potential of being rehabilitated in the short term future.
VU	**Vulnerable**	An ecological community will be listed as VU when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet **any one or more of** the following criteria: **1.** The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; **2.** The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; or **3.** The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

Priority ecological communities (PECs) are defined as possible threatened ecological communities that do not meet the stringent survey criteria for the assessment of threatened ecological communities, and are listed by the Environmental Protection Authority (2016a) *Environmental Factor Guideline: Flora and Vegetation*. The Department of Biodiversity, Conservation and Attractions categorises priority ecological communities into five categories: Priority 1; Priority 2, Priority 3, Priority 4 and Priority 5 (Table A2.3).

Table A2.3 State definition of priority ecological communities

Note: Adapted from Department of Biodiversity, Conservation and Attractions (2017c)

CODE	CATEGORY	DEFINITION
P1	**Priority 1** (Poorly known ecological communities)	Ecological communities that are known from very few, restricted occurrences (generally ≤ 5 occurrences or a total area of ≤ 100 ha). Most of these occurrences are not actively managed for conservation (e.g. located within agricultural or pastoral lands, urban areas, or active mineral leases) and for which immediate threats exist.
P2	**Priority 2** (Poorly known ecological communities)	Communities that are known from few small occurrences (generally ≤ 10 occurrences or a total area of ≤ 200 ha). At least some occurrences are not believed to be under immediate threat of destruction or degradation.
P3	**Priority 3** (Poorly known ecological communities)	**1.** 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; **2.** Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat; or **3.** Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	**Priority 4** (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)	**1.** Rare – Communities known from few occurrences that are considered to have been adequately surveyed, sufficient knowledge is available, and are considered not to be currently threatened. **2.** Near Threatened – Communities considered to have been adequately surveyed and do not qualify for Conservation Dependent, but are close to qualifying for Vulnerable. **3.** Communities that have been removed from the list of threatened communities during the past five years.
P5	**Priority 5** (Conservation Dependent ecological communities)	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

CATEGORIES AND CONTROL MEASURES OF DECLARED PEST (PLANT) ORGANISMS IN WESTERN AUSTRALIA

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

Under the *Biosecurity and Agriculture Management Regulations 2013* (WA), declared pest plants are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Table A4.1). The current listing of declared pest organisms and their control category is through the Western Australian Organism List (Department of Agriculture and Food Western Australia 2017).

Table A3.1 Categories and control measures of declared pest (plant) organisms

Note: Adapted from *Biosecurity and Agriculture Management Regulations 2013*.

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

OTHER DEFINITIONS

Environmentally sensitive areas

Environmentally sensitive areas are declared by the State Minister under section 51B of the *Environmental Protection Act 1986* (EP Act) and are listed in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*, gazetted 8 April 2005. Specific environmentally sensitive areas relevant to this report include: a defined wetland and the area within 50 metres of the wetland; the area covered by vegetation within 50 metres of rare flora; the area covered by a threatened ecological community; a Bush Forever site – further areas and information are described in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*.

Conservation significant flora

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), flora may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority species;
- locally endemic or associated with a restricted habitat type (e.g. surface water or groundwater dependent ecosystems);
- new species or anomalous features that indicate a potential new species;
- representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids; or
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Conservation significant vegetation

Under the *Environmental Factor Guideline: Flora and Vegetation* (Environmental Protection Authority 2016a), vegetation may be considered significant for a range of reasons, including, but not limited to the following:

- being identified as threatened or priority ecological communities;
- restricted distribution;
- degree of historical impact from threatening processes;
- a role as a refuge; or
- providing an important function required to maintain ecological integrity of a significant ecosystem.

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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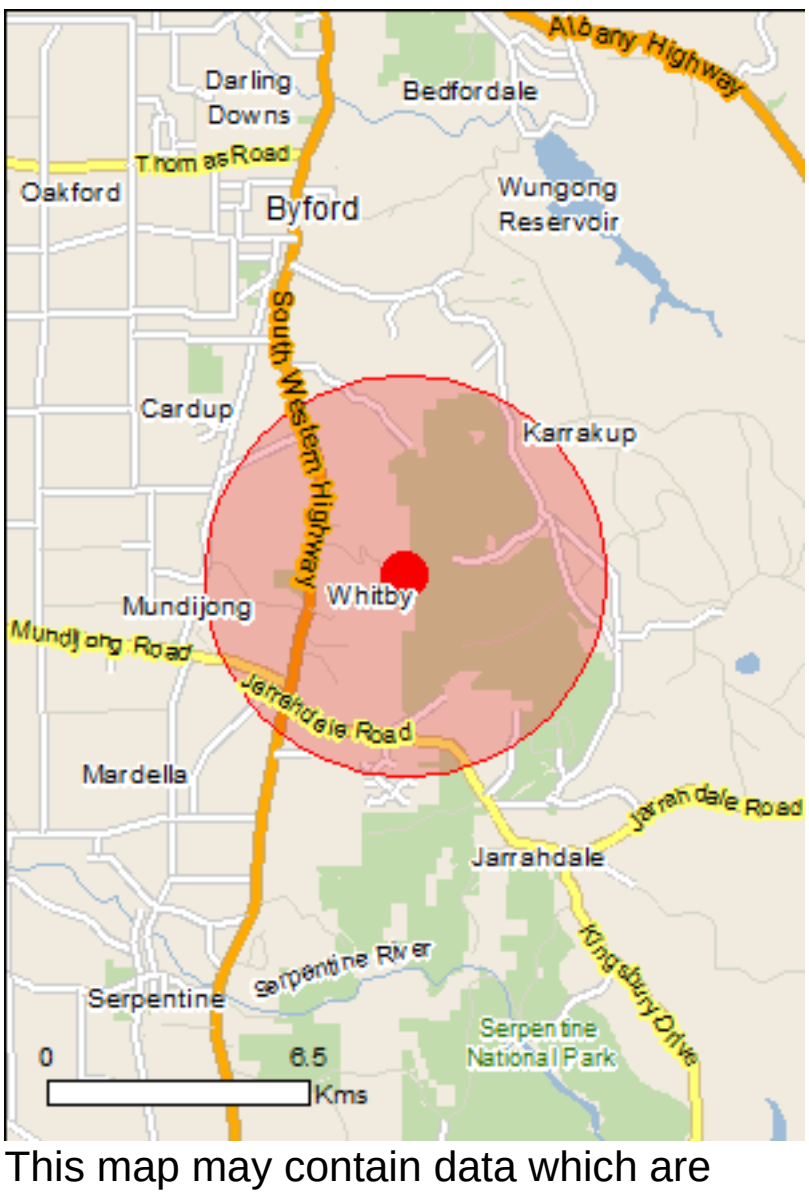

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Coordinates
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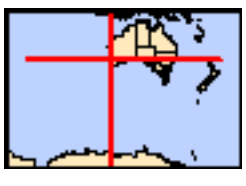

Summary

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:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	21
Listed Migratory Species:	8

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:	13
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	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:	4
Regional Forest Agreements:	1
Invasive Species:	38
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Peel-yalgorup system	30 - 40km upstream

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
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area
Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain	Endangered	Community known to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
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 likely to occur within area
Calyptorhynchus baudinii		
Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Vulnerable	Roosting known to occur within area
Calyptorhynchus latirostris		
Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Leipoa ocellata		
Malleefowl [934]	Vulnerable	Species or species habitat known to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Vulnerable	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat known to occur within area
Plants		
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	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 known to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat may occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat likely to occur within area
Lasiopetalum pterocarpum Wing-fruited Lasiopetalum [64922]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Tetraria australiensis Southern Tetraria [10137]	Vulnerable	Species or species habitat likely to occur within area
Thelymitra stellata Star Sun-orchid [7060]	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

Name	Threatened	Type of Presence
		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

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
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 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

Name	Threatened	Type of Presence
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
Rostratula benghalensis (sensu lato)		
Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Gooralong	WA
Serpentine	WA
Unnamed WA46818	WA
Watkins Road	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

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		
Acridotheres tristis		
Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos		
Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis		
European Goldfinch [403]		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
Passer domesticus		
House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus		
Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis		
Spotted Turtle-Dove [780]		Species or species habitat likely to occur

Name	Status	Type of Presence
		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
Turdus merula Common Blackbird, Eurasian Blackbird [596]		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
Capra hircus Goat [2]		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
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		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 norvegicus Brown Rat, Norway Rat [83]		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
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

Name	Status	Type of Presence
		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
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to 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
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		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
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		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

-32.28509 116.0337

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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NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Guest user on 02/11/2017

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 116° 02' 01" E,32° 17' 08" S
Buffer 5km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.	15429	*Acacia alata var. alata*			
2.	15466	*Acacia applanata*			
3.	3233	*Acacia barbinervis*			
4.	15469	*Acacia barbinervis subsp. barbinervis*			
5.	11926	*Acacia drewiana subsp. drewiana*			
6.	3409	*Acacia lasiocarpa (Panjang)*			
7.	3410	*Acacia lateriticola*			
8.	3454	*Acacia nervosa (Rib Wattle)*			
9.	17860	*Acacia podalyriifolia*	Y		
10.	3502	*Acacia pulchella (Prickly Moses)*			
11.	15481	*Acacia pulchella var. glaberrima*			
12.	15483	*Acacia pulchella var. pulchella*			
13.	3541	*Acacia sessilis*			
14.	3557	*Acacia stenoptera (Narrow Winged Wattle)*			
15.	3591	*Acacia urophylla*			
16.	24260	*Acanthiza apicalis (Broad-tailed Thornbill, Inland Thornbill)*			
17.	24261	*Acanthiza chrysorrhoa (Yellow-rumped Thornbill)*			
18.	24262	*Acanthiza inornata (Western Thornbill)*			
19.	24265	*Acanthiza uropygialis (Chestnut-rumped Thornbill)*			
20.	24560	*Acanthorhynchus superciliosus (Western Spinebill)*			
21.	25535	*Accipiter cirrocephalus (Collared Sparrowhawk)*			
22.	24281	*Accipiter cirrocephalus subsp. cirrocephalus (Collared Sparrowhawk)*			
23.	25536	*Accipiter fasciatus (Brown Goshawk)*			
24.	6205	*Actinotus leucocephalus (Flannel Flower)*			
25.	23474	*Agrostocrinum hirsutum*			
26.	1261	*Agrostocrinum scabrum (Blue Grass Lily)*			
27.	184	*Aira caryophyllea (Silvery Hairgrass)*	Y		
28.	185	*Aira cupaniana (Silvery Hairgrass)*	Y		
29.	1728	*Allocasuarina fraseriana (Sheoak, Kondil)*			
30.	1732	*Allocasuarina humilis (Dwarf Sheoak)*			
31.	18195	*Amanita carneiphylla*		P3	
32.	43543	*Amanita fibrillopes*		P3	
33.	38755	*Amanita ochroterrea*			
34.	43542	*Amanita wadjukiorum*		P3	
35.	200	*Amphipogon turbinatus*			
36.		*Aname tepperi*			
37.	24312	*Anas gracilis (Grey Teal)*			
38.	24316	*Anas superciliosa (Pacific Black Duck)*			
39.	1411	*Anigozanthos manglesii (Mangles Kangaroo Paw, Kurulbrang)*			
40.	11261	*Anigozanthos manglesii subsp. manglesii*			
41.	25449	*Antechinus flavipes (Yellow-footed Antechinus)*			
42.	24088	*Antechinus flavipes subsp. leucogaster (Yellow-footed Antechinus, Mardo)*			
43.	24561	*Anthochaera carunculata (Red Wattlebird)*			
44.	24562	*Anthochaera lunulata (Western Little Wattlebird)*			
45.	24599	*Anthus australis subsp. australis (Australian Pipit)*			
46.	1117	*Aphelia cyperoides*			
47.	24990	*Aprasia pulchella (Granite Worm-lizard)*			
48.	24991	*Aprasia repens (Sand-plain Worm-lizard)*			
49.	24285	*Aquila audax (Wedge-tailed Eagle)*			
50.		*Araneus senicaudatus*			
51.	33903	*Arbanitis inornatus (trapdoor spider (Darling Scarp))*		P1	
52.	7838	*Arctotheca calendula (Cape Weed, African Marigold)*	Y		
53.	24341	*Ardea pacifica (White-necked Heron)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
54.	25566	*Artamus cinereus (Black-faced Woodswallow)*			
55.	24353	*Artamus cyanopterus (Dusky Woodswallow)*			
56.		*Asadipus kunderang*			
57.	6334	*Astroloma pallidum (Kick Bush)*			
58.	17233	*Austrostipa campylachne*			
59.	17257	*Austrostipa variabilis*			
60.	231	*Avellinia michelii*	Y		
61.	36441	*Babingtonia camphorosmae (Camphor Myrtle)*			
62.		*Backobourkia heroine*			
63.		*Ballarra longipalpus*			
64.	32580	*Banksia dallanneyi var. dallanneyi*			
65.	32214	*Banksia kippistiana*			
66.	32202	*Banksia nivea (Honeypot Dryandra, Pudjarn)*			
67.	32053	*Banksia undata (Urchin Dryandra)*			
68.		*Barnardius zonarius*			
69.	739	*Baumea acuta (Pale Twig-rush)*			
70.	24162	*Bettongia penicillata subsp. ogilbyi (Woylie, Brush-tailed Bettong)*		T	
71.	25788	*Billardiera fraseri (Elegant Pronaya)*			
72.	3165	*Billardiera variifolia*			
73.	1273	*Borya sphaerocephala (Pincushions)*			
74.	3710	*Bossiaea eriocarpa (Common Brown Pea)*			
75.	3714	*Bossiaea ornata (Broad Leaved Brown Pea)*			
76.	18497	*Bossiaea sp. Waroona (B.J. Keighery & N. Gibson 229)*			
77.	10915	*Brachychiton populneus (Kurrajong)*	Y		
78.	244	*Briza maxima (Blowfly Grass)*	Y		
79.	245	*Briza minor (Shivery Grass)*	Y		
80.	12770	*Burchardia congesta*			
81.	1385	*Burchardia multiflora (Dwarf Burchardia)*			
82.	25715	*Cacatua roseicapilla (Galah)*			
83.	25716	*Cacatua sanguinea (Little Corella)*			
84.	25598	*Cacomantis flabelliformis (Fan-tailed Cuckoo)*			
85.	42307	*Cacomantis pallidus (Pallid Cuckoo)*			
86.	1276	*Caesia micrantha (Pale Grass Lily)*			
87.	1586	*Caladenia discoidea (Dancing Orchid)*			
88.	15348	*Caladenia flava subsp. flava*			
89.	19309	*Calectasia narragara*			
90.	4717	*Callitriche stagnalis (Common Starwort)*	Y		
91.	25717	*Calyptorhynchus banksii (Red-tailed Black-Cockatoo)*			
92.	24731	*Calyptorhynchus banksii subsp. naso (Forest Red-tailed Black-Cockatoo)*		T	
93.	24733	*Calyptorhynchus baudinii (Baudin's Cockatoo (long-billed black-cockatoo), Baudin's Cockatoo)*		T	
94.	24734	*Calyptorhynchus latirostris (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)*		T	
95.	48400	*Calyptorhynchus sp. (white-tailed black cockatoo)*		T	
96.	5458	*Calytrix flavescens (Summer Starflower)*			
97.	2952	*Cassytha glabella (Tangled Dodder Laurel)*			
98.	6539	*Centaurium erythraea (Common Centaury)*	Y		
99.	1121	*Centrolepis aristata (Pointed Centrolepis)*			
100.	1125	*Centrolepis drummondiana*			
101.	1280	*Chamaescilla corymbosa (Blue Squill)*			
102.	5498	*Chamelaucium uncinatum (Geraldton Wax)*			
103.	31	*Cheilanthes austrotenuifolia*			
104.	12818	*Cheilanthes sieberi subsp. sieberi*			
105.	24321	*Chenonetta jubata (Australian Wood Duck, Wood Duck)*			
106.	24431	*Chrysococcyx basalis (Horsfield's Bronze Cuckoo)*			
107.	6543	*Cicendia filiformis (Slender Cicendia)*	Y		
108.	7935	*Cichorium intybus (Chicory)*	Y		
109.	48177	*Cladia muelleri*			
110.	25675	*Colluricincla harmonica (Grey Shrike-thrush)*			
111.	24613	*Colluricincla harmonica subsp. rufiventris (Grey Shrike-thrush)*			
112.	24399	*Columba livia (Domestic Pigeon)*	Y		
113.	1882	*Conospermum stoechadis (Common Smokebush)*			
114.	15611	*Conospermum stoechadis subsp. stoechadis (Common Smokebush)*			
115.	6348	*Conostephium pendulum (Pearl Flower)*			
116.	6349	*Conostephium preissii*			
117.	1418	*Conostylis aculeata (Prickly Conostylis)*			
118.	11826	*Conostylis aculeata subsp. aculeata*			
119.	12109	*Conostylis aculeata subsp. preissii*			
120.	1436	*Conostylis juncea*			
121.	1455	*Conostylis setosa (White Cottonhead)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
122.	25568	*Coracina novaehollandiae (Black-faced Cuckoo-shrike)*			
123.	24363	*Coracina novaehollandiae subsp. subpallida (Black-faced Cuckoo-shrike)*			
124.	25592	*Corvus coronoides (Australian Raven)*			
125.	24417	*Corvus coronoides subsp. perplexus (Australian Raven)*			
126.	17104	*Corymbia calophylla (Marri)*			
127.	24671	*Coturnix pectoralis (Stubble Quail)*			
128.	24420	*Cracticus nigrogularis (Pied Butcherbird)*			
129.	25595	*Cracticus tibicen (Australian Magpie)*			
130.	24422	*Cracticus tibicen subsp. dorsalis (White-backed Magpie)*			
131.	25596	*Cracticus torquatus (Grey Butcherbird)*			
132.	13354	*Craspedia variabilis*			
133.	20271	*Crassula extrorsa*			
134.	15706	*Crassula natans var. minus*	Y		
135.	25398	*Crinia georgiana (Quacking Frog)*			
136.	25399	*Crinia glauerti (Clicking Frog)*			
137.	25400	*Crinia insignifera (Squelching Froglet)*			
138.	35838	*Cristonia biloba subsp. biloba*			
139.		*Crustulina bicruciata*			
140.	30893	*Cryptoblepharus buchananii*			
141.	25039	*Ctenotus fallens*			
142.	25047	*Ctenotus impar*			
143.	25049	*Ctenotus labillardieri*			
144.		*Cyclosa trilobata*			
145.	815	*Cyperus tenellus (Tiny Flatsedge)*	Y		
146.	30901	*Dacelo novaeguineae (Laughing Kookaburra)*	Y		
147.	7454	*Dampiera linearis (Common Dampiera)*			
148.	25673	*Daphoenositta chrysoptera (Varied Sittella)*			
149.	1218	*Dasypogon bromeliifolius (Pineapple Bush)*			
150.	24092	*Dasyurus geoffroii (Chuditch, Western Quoll)*		T	
151.	6218	*Daucus glochidiatus (Australian Carrot)*			
152.	19747	*Daviesia decurrens subsp. decurrens*			
153.	3815	*Daviesia horrida (Prickly Bitter-pea)*			
154.	16585	*Daviesia nudiflora subsp. nudiflora*			
155.	3832	*Daviesia physodes*			
156.	17691	*Desmocladus fasciculatus*			
157.	46362	*Desmocladus lateriflorus*			
158.	11636	*Dianella revoluta var. divaricata*			
159.	25607	*Dicaeum hirundinaceum (Mistletoebird)*			
160.	306	*Dichelachne crinita (Longhair Plumegrass)*			
161.	1287	*Dichopogon capillipes*			
162.	12943	*Diuris brumalis*			
163.	11049	*Diuris corymbosa*			
164.	1637	*Diuris purdiei (Purdie's Donkey Orchid)*		T	
165.	1639	*Drakaea elastica (Glossy-leaved Hammer Orchid)*		T	
166.	24470	*Dromaius novaehollandiae (Emu)*			
167.	13217	*Drosera erythrorhiza subsp. erythrorhiza*			
168.	3097	*Drosera gigantea (Giant Sundew)*			
169.	15453	*Drosera gigantea subsp. gigantea*			
170.	14298	*Drosera macrantha subsp. macrantha*			
171.	3118	*Drosera pallida (Pale Rainbow)*			
172.	29178	*Drosera porrecta*			
173.	3131	*Drosera stolonifera (Leafy Sundew)*			
174.	25096	*Egernia kingii (King's Skink)*			
175.		*Egretta novaehollandiae*			
176.	347	*Ehrharta calycina (Perennial Veldt Grass)*	Y		
177.		*Elanus axillaris*			
178.		*Eolophus roseicapillus*			
179.	24651	*Eopsaltria australis subsp. griseogularis (Western Yellow Robin)*			
180.	24652	*Eopsaltria georgiana (White-breasted Robin)*			
181.	24567	*Epthianura albifrons (White-fronted Chat)*			
182.	14104	*Eremaea pauciflora var. pauciflora*			
183.	15446	*Eryngium pinnatifidum subsp. pinnatifidum*			
184.	5690	*Eucalyptus lane-poolei (Salmon White Gum)*			
185.	5708	*Eucalyptus marginata (Jarrah, Djara)*			
186.	13547	*Eucalyptus marginata subsp. marginata (Jarrah)*			
187.	13548	*Eucalyptus marginata subsp. thalassica (Blue-leaved Jarrah)*			
188.	13511	*Eucalyptus rudis subsp. rudis*			
189.	5797	*Eucalyptus wandoo (Wandoo, Wondu)*			
190.	12906	*Eucalyptus wandoo subsp. wandoo*			
191.		*Eucyrtops latior*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
192.	25622	*Falco cenchroides (Australian Kestrel, Nankeen Kestrel)*			
193.	25624	*Falco peregrinus (Peregrine Falcon)*		S	
194.	24041	*Felis catus (Cat)*	Y		
195.	18392	*Freesia alba x leichtlinii*	Y		
196.	25727	*Fulica atra (Eurasian Coot)*			
197.	24765	*Gallirallus philippensis subsp. mellori (Buff-banded Rail)*			
198.	25530	*Gerygone fusca (Western Gerygone)*			
199.	24271	*Gerygone fusca subsp. fusca (Western Gerygone)*			
200.	6587	*Gomphocarpus fruticosus (Narrowleaf Cottonbush)*	Y		
201.	3950	*Gompholobium knightianum*			
202.	3951	*Gompholobium marginatum*			
203.	3954	*Gompholobium polymorphum*			
204.	3955	*Gompholobium preissii*			
205.	3957	*Gompholobium tomentosum (Hairy Yellow Pea)*			
206.	12551	*Goodenia micrantha*			
207.	24443	*Grallina cyanoleuca (Magpie-lark)*			
208.	1964	*Grevillea bipinnatifida (Fuchsia Grevillea)*			
209.	19628	*Grevillea bipinnatifida subsp. bipinnatifida*			
210.	2066	*Grevillea pilulifera (Woolly-flowered Grevillea)*			
211.	2080	*Grevillea quercifolia (Oak-leaf Grevillea)*			
212.	2122	*Grevillea wilsonii (Native Fuchsia)*			
213.	1465	*Haemodorum discolor*			
214.	1468	*Haemodorum laxum*			
215.	1472	*Haemodorum simplex*			
216.	2128	*Hakea amplexicaulis (Prickly Hakea)*			
217.	2175	*Hakea lissocarpha (Honey Bush)*			
218.	2179	*Hakea marginata*			
219.	2197	*Hakea prostrata (Harsh Hakea)*			
220.	2203	*Hakea ruscifolia (Candle Hakea)*			
221.	2206	*Hakea stenocarpa (Narrow-fruited Hakea)*			
222.	2216	*Hakea varia (Variable-leaved Hakea)*			
223.	25410	*Heleioporus eyrei (Moaning Frog)*			
224.	6839	*Hemiandra pungens (Snakebush)*			
225.	6856	*Hemigenia incana (Silky Hemigenia)*			
226.	5109	*Hibbertia amplexicaulis*			
227.	5114	*Hibbertia commutata*			
228.	19778	*Hibbertia glomerata subsp. darlingensis*			
229.	5134	*Hibbertia huegelii*			
230.	5135	*Hibbertia hypericoides (Yellow Buttercups)*			
231.	45534	*Hibbertia hypericoides subsp. hypericoides*			
232.	48381	*Hibbertia striata*			
233.	5176	*Hibbertia vaginata*			
234.	47965	*Hieraaetus morphnoides (Little Eagle)*			
235.	24491	*Hirundo neoxena (Welcome Swallow)*			
236.	6222	*Homalosciadium homalocarpum*			
237.	3964	*Hovea chorizemifolia (Holly-leaved Hovea)*			
238.	3968	*Hovea trisperma (Common Hovea)*			
239.	12741	*Hyalosperma cotula*			
240.	5216	*Hybanthus calycinus (Wild Violet)*			
241.	5221	*Hybanthus floribundus*			
242.	6223	*Hydrocotyle alata*			
243.	6226	*Hydrocotyle callicarpa (Small Pennywort)*			
244.	5817	*Hypocalymma angustifolium (White Myrtle, Kudjid)*			
245.	5825	*Hypocalymma robustum (Swan River Myrtle)*			
246.	8086	*Hypochaeris glabra (Smooth Catsear)*	Y		
247.	1070	*Hypolaena exsulca*			
248.	44926	*Ileodictyon gracile*			
249.	20200	*Isolepis cernua var. setiformis*			
250.	912	*Isolepis cyperoides*			
251.	917	*Isolepis marginata (Coarse Club-rush)*			
252.	919	*Isolepis oldfieldiana*			
253.	25478	*Isoodon obesulus (Southern Brown Bandicoot)*		P4	
254.	24153	*Isoodon obesulus subsp. fusciventer (Quenda, Southern Brown Bandicoot)*		P4	
255.	2221	*Isopogon asper*			
256.	7396	*Isotoma hypocrateriformis (Woodbridge Poison)*			
257.	4018	*Jacksonia lehmannii*			
258.	19632	*Johnsonia pubescens subsp. pubescens*			
259.	1178	*Juncus bufonius (Toad Rush)*	Y		
260.	1180	*Juncus capitatus (Capitate Rush)*	Y		
261.	4037	*Kennedia coccinea (Coral Vine)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
262.	4041	*Kennedia microphylla*			
263.	4044	*Kennedia prostrata (Scarlet Runner)*			
264.	5835	*Kunzea micrantha*			
265.	17461	*Kunzea micrantha subsp. micrantha*			
266.	3669	*Labichea punctata (Lance-leaved Cassia)*			
267.	13562	*Lachenalia aloides*	Y		
268.	18585	*Lagenophora huegelii*			
269.	14083	*Lambertia multiflora var. darlingensis*			
270.		*Lamponusa gleneagle*			
271.	1309	*Laxmannia squarrosa*			
272.	7568	*Lechenaultia biloba (Blue Leschenaultia)*			
273.	18074	*Lepidobolus preissianus subsp. preissianus*			
274.	41620	*Lepidosperma asperatum*			
275.	929	*Lepidosperma carphoides (Black Rapier Sedge)*			
276.	936	*Lepidosperma leptostachyum*			
277.	940	*Lepidosperma pubisquameum*			
278.	944	*Lepidosperma scabrum*			
279.		*Lepidosperma sp.*			
280.	5850	*Leptospermum laevigatum (Coast Teatree)*	Y		
281.	1088	*Lepyrodia macra (Large Scale Rush)*			
282.	25131	*Lerista distinguenda*			
283.	25133	*Lerista elegans*			
284.	6367	*Leucopogon capitellatus*			
285.	6400	*Leucopogon gracillimus*			
286.	6436	*Leucopogon propinquus*			
287.	6439	*Leucopogon pulchellus (Beard-heath)*			
288.	28302	*Leucopogon sp. Parkerville (A. Meebold 11654)*			
289.	25661	*Lichmera indistincta (Brown Honeyeater)*			
290.	24582	*Lichmera indistincta subsp. indistincta (Brown Honeyeater)*			
291.	4363	*Linum trigynum (French Flax)*	Y		
292.	7407	*Lobelia rhytidosperma (Wrinkled-seeded Lobelia)*			
293.	9356	*Logfia gallica*			
294.	1222	*Lomandra brittanii*			
295.	1223	*Lomandra caespitosa (Tufted Mat Rush)*			
296.	1228	*Lomandra hermaphrodita*			
297.	1234	*Lomandra nigricans*			
298.	1239	*Lomandra preissii*			
299.		*Lomandra sp.*			
300.	1245	*Lomandra spartea*			
301.	1246	*Lomandra suaveolens*			
302.		*Lophoictinia isura*			
303.	4059	*Lotus angustissimus (Narrowleaf Trefoil)*	Y		
304.	36375	*Lysimachia arvensis (Pimpernel)*	Y		
305.	24132	*Macropus fuliginosus (Western Grey Kangaroo)*			
306.	85	*Macrozamia riedlei (Zamia, Djiridji)*			
307.	25650	*Malurus elegans (Red-winged Fairy-wren)*			
308.	24551	*Malurus pulcherrimus (Blue-breasted Fairy-wren)*			
309.	25654	*Malurus splendens (Splendid Fairy-wren)*			
310.	24583	*Manorina flavigula (Yellow-throated Miner)*			
311.	17630	*Marianthus tenuis*			
312.	14985	*Melinis repens*	Y		
313.	25184	*Menetia greyii*			
314.	24598	*Merops ornatus (Rainbow Bee-eater)*		IA	
315.	955	*Mesomelaena pseudostygia*			
316.	957	*Mesomelaena tetragona (Semaphore Sedge)*			
317.	25693	*Microeca fascinans (Jacky Winter)*			
318.	485	*Microlaena stipoides (Weeping Grass)*			
319.	14337	*Millotia tenuifolia var. laevis*		P2	
320.	14344	*Millotia tenuifolia var. tenuifolia (Soft Millotia)*			
321.	7085	*Misopates orontium (Lesser Snapdragon)*	Y		
322.	37440	*Monopsis debilis var. depressa*	Y		
323.	19585	*Monotaxis grandiflora var. grandiflora*			
324.	25192	*Morethia obscura*			
325.	24223	*Mus musculus (House Mouse)*	Y		
326.	24738	*Neophema elegans (Elegant Parrot)*			
327.	492	*Neurachne alopecuroidea (Foxtail Mulga Grass)*			
328.	24407	*Ocyphaps lophotes (Crested Pigeon)*			
329.	8143	*Olearia paucidentata (Autumn Scrub Daisy)*			
330.	4114	*Ornithopus pinnatus (Slender Serradella)*	Y		
331.	4355	*Oxalis perennans*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
332.		*Ozarchaea westraliensis*			
333.	25680	*Pachycephala rufiventris (Rufous Whistler)*			
334.	24624	*Pachycephala rufiventris subsp. rufiventris (Rufous Whistler)*			
335.	25253	*Parasuta gouldii*			
336.	25255	*Parasuta nigriceps*			
337.	25681	*Pardalotus punctatus (Spotted Pardalote)*			
338.	25682	*Pardalotus striatus (Striated Pardalote)*			
339.	24628	*Pardalotus striatus subsp. murchisoni (Striated Pardalote)*			
340.	7089	*Parentucellia latifolia (Common Bartsia)*	Y		
341.	7090	*Parentucellia viscosa (Sticky Bartsia)*	Y		
342.	1542	*Patersonia babianoides*			
343.	1546	*Patersonia juncea (Rush Leaved Patersonia)*			
344.	1551	*Patersonia pygmaea (Pygmy Patersonia)*			
345.	40424	*Pentameris airoides subsp. airoides*	Y		
346.	6245	*Pentapeltis peltigera*			
347.	24155	*Perameles eremiana (Desert Bandicoot, walilya)*		X	
348.	16477	*Pericalymma ellipticum var. ellipticum*			
349.	2273	*Persoonia saccata (Snottygobble)*			
350.	48061	*Petrochelidon nigricans (Tree Martin)*			
351.	48066	*Petroica boodang (Scarlet Robin)*			
352.	24659	*Petroica goodenovii (Red-capped Robin)*			
353.	2299	*Petrophile linearis (Pixie Mops)*			
354.	2301	*Petrophile macrostachya*			
355.	24165	*Petropseudes dahli (Rock Ringtail Possum, Wogoit)*		P3	
356.	25698	*Phalacrocorax melanoleucos (Little Pied Cormorant)*			
357.	24409	*Phaps chalcoptera (Common Bronzewing)*			
358.	18529	*Philotheca spicata (Pepper and Salt)*			
359.	48071	*Phylidonyris niger (White-cheeked Honeyeater)*			
360.	24596	*Phylidonyris novaehollandiae (New Holland Honeyeater)*			
361.	16825	*Phyllangium divergens*			
362.	4675	*Phyllanthus calycinus (False Boronia)*			
363.		*Phytophthora cinnamomi*			
364.	5232	*Pimelea argentea (Silvery Leaved Pimelea)*			
365.	12041	*Pimelea suaveolens subsp. suaveolens*			
366.	8163	*Pithocarpa corymbulosa (Corymbose Pithocarpa)*		P3	
367.	25720	*Platycercus icterotis (Western Rosella)*			
368.	24747	*Platycercus spurius (Red-capped Parrot)*			
369.	25721	*Platycercus zonarius (Australian Ringneck, Ring-necked Parrot)*			
370.	571	*Poa annua (Winter Grass)*	Y		
371.	573	*Poa drummondiana (Knotted Poa)*			
372.	25703	*Podargus strigoides (Tawny Frogmouth)*			
373.	24907	*Pogona minor subsp. minor (Dwarf Bearded Dragon)*			
374.	25722	*Polytelis anthopeplus (Regent Parrot)*			
375.	24771	*Porzana tabuensis (Spotless Crake)*			
376.	24164	*Potorous platyops (Broad-faced Potoroo)*		X	
377.	24166	*Pseudocheirus occidentalis (Western Ringtail Possum, ngwayir)*		T	
378.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
379.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
380.	12217	*Pterostylis sanguinea*			
381.	1698	*Pterostylis vittata (Banded Greenhood)*			
382.	2742	*Ptilotus manglesii (Pom Poms, Mulamula)*			
383.		*Purpureicephalus spurius*			
384.	8195	*Quinetia urvillei*			
385.	24245	*Rattus rattus (Black Rat)*	Y		
386.		*Raveniella cirrata*			
387.	48096	*Rhipidura albiscapa (Grey Fantail)*			
388.	25614	*Rhipidura leucophrys (Willie Wagtail)*			
389.	13234	*Rhodanthe manglesii*			
390.	1556	*Romulea rosea (Guildford Grass)*	Y		
391.	3191	*Rubus ulmifolius (Blackberry)*	Y		
392.	7602	*Scaevola calliptera*			
393.	7613	*Scaevola glandulifera (Viscid Hand-flower)*			
394.	982	*Schoenus clandestinus*			
395.	991	*Schoenus grammatophyllus*			
396.	1006	*Schoenus odontocarpus*			
397.	1011	*Schoenus rigens*			
398.	1013	*Schoenus sculptus (Gimlet Bog-rush)*			
399.	1026	*Schoenus unispiculatus*			
400.	25534	*Sericornis frontalis (White-browed Scrubwren)*			
401.	24145	*Setonix brachyurus (Quokka)*		T	

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
402.	8224	*Siloxerus filifolius*			
403.	14583	*Siloxerus multiflorus*			
404.	30948	*Smicrornis brevirostris (Weebill)*			
405.	8230	*Sonchus asper (Rough Sowthistle)*	Y		
406.	1312	*Sowerbaea laxiflora (Purple Tassels)*			
407.	4207	*Sphaerolobium medium*			
408.	4716	*Stachystemon vermicularis*			
409.	4733	*Stackhousia monogyna*			
410.	9070	*Stackhousia pubescens (Downy Stackhousia)*			
411.	24426	*Strepera versicolor subsp. plumbea (Grey Currawong)*			
412.	25590	*Streptopelia senegalensis (Laughing Turtle-Dove)*	Y		
413.	30278	*Stylidium androsaceum*			
414.	7693	*Stylidium brunonianum (Pink Fountain Triggerplant)*			
415.	7694	*Stylidium bulbiferum (Circus Triggerplant)*			
416.	7696	*Stylidium calcaratum (Book Triggerplant)*			
417.	7699	*Stylidium carnosum (Fleshy-leaved Triggerplant)*			
418.	7702	*Stylidium ciliatum (Golden Triggerplant)*			
419.	7712	*Stylidium despectum (Dwarf Triggerplant)*			
420.	7713	*Stylidium dichotomum (Pins-and-needles)*			
421.	7718	*Stylidium diversifolium (Touch-me-not)*			
422.	7736	*Stylidium hispidum (White Butterfly Triggerplant)*			
423.	33106	*Stylidium recurvum*			
424.		*Stylidium sp.*			
425.	45594	*Stylidium tenue subsp. majusculum (Showy Fountain Triggerplant)*			
426.	1260	*Stypandra glauca (Blind Grass)*			
427.		*Supunna funerea*			
428.	24259	*Sus scrofa (Pig)*	Y		
429.	25902	*Symphyotrichum squamatum (Bushy Starwort)*	Y		
430.	2321	*Synaphea acutiloba (Granite Synaphea)*			
431.	2323	*Synaphea gracillima*			
432.	16864	*Synaphea petiolaris subsp. petiolaris*			
433.	2325	*Synaphea pinnata (Helena Synaphea)*			
434.	30751	*Synaphea sp. Pinjarra Plain (A.S. George 17182)*		T	
435.	28354	*Synaphea sp. Serpentine (G.R. Brand 103)*		T	
436.		*Synothele durokoppin*			
437.		*Synothele michaelseni*			
438.	25705	*Tachybaptus novaehollandiae (Australasian Grebe, Black-throated Grebe)*			
439.	24331	*Tadorna tadornoides (Australian Shelduck, Mountain Duck)*			
440.	24167	*Tarsipes rostratus (Honey Possum, Noolbenger)*			
441.	1033	*Tetraria australiensis*		T	
442.	1034	*Tetraria capillaris (Hair Sedge)*			
443.	1036	*Tetraria octandra*			
444.	1705	*Thelymitra crinita (Blue Lady Orchid)*			
445.	5080	*Thomasia foliosa*			
446.	24845	*Threskiornis spinicollis (Straw-necked Ibis)*			
447.	1338	*Thysanotus manglesianus (Fringed Lily)*			
448.	1343	*Thysanotus patersonii*			
449.	1357	*Thysanotus thyrsoideus*			
450.	25203	*Tiliqua occipitalis (Western Bluetongue)*			
451.	25519	*Tiliqua rugosa*			
452.	25549	*Todiramphus sanctus (Sacred Kingfisher)*			
453.	6280	*Trachymene pilosa (Native Parsnip)*			
454.	1481	*Tribonanthes australis*			
455.	8251	*Trichocline spathulata (Native Gerbera)*			
456.	25521	*Trichosurus vulpecula (Common Brushtail Possum)*			
457.	24157	*Trichosurus vulpecula subsp. arnhemensis (northern brushtail possum (Kimberley))*		T	
458.	24158	*Trichosurus vulpecula subsp. vulpecula (Common Brushtail Possum)*			
459.	1361	*Tricoryne elatior (Yellow Autumn Lily)*			
460.	1038	*Tricostularia neesii*			
461.	4293	*Trifolium cernuum (Drooping Flower Clover)*	Y		
462.	4295	*Trifolium dubium (Suckling Clover)*	Y		
463.	18587	*Triglochin nana*			
464.	1561	*Tritonia crocata*	Y		
465.	48147	*Turnix varius (Painted Button-quail)*			
466.	24852	*Tyto alba subsp. delicatula (Barn Owl)*			
467.		*Urodacus novaehollandiae*			
468.		*Urodacus woodwardii*			
469.	38388	*Ursinia anthemoides subsp. anthemoides*	Y		
470.	7157	*Utricularia violacea (Violet Bladderwort)*			
471.	24386	*Vanellus tricolor (Banded Lapwing)*			

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
472.	7665	*Velleia trinervis*			
473.		*Venator immansueta*			
474.	15618	*Verticordia plumosa var. plumosa*			
475.	24040	*Vulpes vulpes (Red Fox)*	Y		
476.	724	*Vulpia myuros (Rat's Tail Fescue)*	Y		
477.	17910	*Washingtonia filifera*	Y		
478.	13103	*Watsonia borbonica*	Y		
479.	34113	*Westralunio carteri (Carter's Freshwater Mussel)*		T	
480.	1253	*Xanthorrhoea gracilis (Graceful Grass Tree, Mimidi)*			
481.	1256	*Xanthorrhoea preissii (Grass tree, Palga)*			
482.	6284	*Xanthosia candida*			
483.	6289	*Xanthosia huegelii*			
484.	2331	*Xylomelum occidentale (Woody Pear, Djandin)*			
485.	25765	*Zosterops lateralis (Grey-breasted White-eye, Silvereye)*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT WITHIN THE WA LIMESTONE SURVEY AREA, SERPENTINE

Refer to Appendix A for State (SCC) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; JAF –Jarrah Forest; GES – Geraldton Sandplains; MAL – Mallee; SWA – Swan Coastal Plain; WAR - Warren

Taxon / Common Name	Family	SCC	FCC	Description and Habitat	Potential to Occur in Survey Area
Caladenia huegelii	ORCHIDACEAE	T	E	Habit: Tuberous, perennial, herb, 0.25 to 0.6 metres high Flowers: green, cream & red Flowering period: September to October Soils: Grey or brown sand, clay loam IBRA Distribution: JAF, SWA Florabase records: 41	Unlikely Preferred soils unlikely to be present in survey area.
Diuris micrantha	ORCHIDACEAE	T	V	Habit: Tuberous, perennial, herb, 0.25 to 0.6 metres high Flowers: yellow & brown Flowering period: September to October Soils: Brown loamy clay Winter-wet swamps, in shallow water. IBRA Distribution: JAF, SWA Florabase records: 6	Unlikely Preferred soils unlikely to be present in survey area.
Diuris purdiei	ORCHIDACEAE	T	E	Habit: Tuberous, perennial, herb, 0.15-0.35 metres high Flowers: yellow Flowering period: September to October Soils: Grey-black sand, moist. Located in winter-wet swamps. IBRA Distribution: JAF, SWA Florabase records: 11	Unlikely Preferred soils unlikely to be present in survey area.
Drakaea elastica	ORCHIDACEAE	T	E	Habit: Tuberous, perennial, herb, 0.12-0.3 metres high Flowers: red & green & yellow Flowering period: September to October Soils: Grey-black sand, moist. Located in winter-wet swamps. IBRA Distribution: SWA Florabase records: 18	Unlikely Preferred soils unlikely to be present in survey area.

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT WITHIN THE WA LIMESONE SURVEY AREA, SERPENTINE

Refer to Appendix A for State (SCC) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; JAF –Jarrah Forest; GES – Geraldton Sandplains; MAL – Mallee; SWA – Swan Coastal Plain; WAR - Warren

Taxon / Common Name	Family	SCC	FCC	Description and Habitat	Potential to Occur in Survey Area
Drakaea micrantha	ORCHIDACEAE	T	V	Habit: Tuberous, perennial, herb, 0.15 to 0.3 metres high Flowers: red & yellow Flowering period: September to October Soils: White-grey sand IBRA Distribution: JAF, SWA, WAR Florabase records: 45	Unlikely Preferred soils unlikely to be present in survey area.
Eleocharis keigheryi	CYPERACEAE	T	V	Habit: Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 metres high Flowers: green Flowering period: August to November Soils: Clay, sandy loam. Emergent in freshwater: creeks, claypans IBRA Distribution: GES, SWA Florabase records: 54	Unlikely Preferred soils unlikely to be present in survey area.
Eucalyptus x *balanites*	MYRTACEAE	T	E	Habit: Mallee to 5 metres high, with rough and flaky bark. Flowers: White Flowering period: October to December or January to February Soils: Sandy soils with lateritic gravel IBRA Distribution: GES, SWA Florabase records: 11	Unlikely Preferred soils unlikely to be present in survey area.
Lasiopetalum pterocarpum	MALVACEAE	T	E	Habit: Open, multi-stemmed shrub, to 1.2 metres high Flowers: pink Flowering period: August to December Soils: Dark red-brown loam or clayey sand over granite. Found on sloping banks near creeklines IBRA Distribution: JAF Florabase records: 11	Medium Preferred soils and associated vegetation potentially present in the survey area. Previously recorded in close proximity at Serpentine National Park.

APPENDIX D: ASSESSMENT OF THREATENED AND PRIORITY FLORA POTENTIALLY PRESENT WITHIN THE WA LIMESONE SURVEY AREA, SERPENTINE

Refer to Appendix A for State (SCC) and Federal (FCC; EPBC Act) conservation code definitions. IBRA Distribution: AVW – Avon Wheatbelt; JAF –Jarrah Forest; GES – Geraldton Sandplains; MAL – Mallee; SWA – Swan Coastal Plain; WAR - Warren

Taxon / Common Name	Family	SCC	FCC	Description and Habitat	Potential to Occur in Survey Area
Pithocarpa corymbulosa	ASTERACEAE	P3	-	Habit: Erect to scrambling perennial, herb, 0.5-1 metres high Flowers: white Flowering period: January to April Soils: Gravelly or sandy loam and located amongst granite outcrops. IBRA Distribution: GES, JAF, SWA Florabase records: 22	Medium Preferred soils and associated vegetation potentially present in the survey area. Previously recorded at Lot 334 at the survey area in 2005.
Synaphea sp. Fairbridge Farm (D. Papenfus 696)	PROTEACEAE	T	CE	Habit: Dense, clumped shrub, to 0.3 metres high and up to 0.4 metres wide Flowers: yellow Flowering period: October Soils: Sandy with lateritic pebbles. Located near winter-wet flats, in low woodland with weedy grasses. IBRA Distribution: JAF, SWA Florabase records: 30	Medium Preferred soils and landforms potentially present in survey area. Recorded in the local Government area previously.
Tetraria australiensis	CYPERACEAE	T	V	Habit: Rhizomatous, tufted perennial, grass-like or herb (sedge), to 1 metre high Flowers: Brown Flowering period: Nov to Dec. Soils: Sandy, grey/brown IBRA Distribution: JAF, SWA Florabase records: 34	Medium Preferred soils and landforms potentially present in survey area. Recorded in the local Government area previously.
Thelymitra stellata	ORCHIDACEAE	T	E	Habit: Tuberous, perennial, herb, 0.15-0.25 metres high Flowers: yellow & brown Flowering period: October to November Soils: Sand, gravel and lateritic loam. IBRA Distribution: AVW, GES, JAF, MAL, SWA Florabase records: 23	Medium Preferred soils potentially present in survey area.

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED WITHIN THE WA LIMESTONE SURVEY AREA , SERPENTINE, 2005

Note: * denotes introduced species; T denotes threatened flora and P1-P4 denote priority flora species (DBCA 2017a).

FAMILY	SPECIES	M 70/1240	Loc 344	Loc 246
PTERIDACEAE	*Adiantum aethiopicum*		x	
	Cheilanthes austrotenuifolia		x	
	Cheilanthes sieberi subsp. *sieberi*		x	
ZAMIACEAE	*Macrozamia riedlei*	x	x	
POACEAE	* *Aira caryophyllea*		x	
	* *Aira cupaniana*	x	x	
	* *Avena barbata*		x	x
	* *Brachypodium distachyon*		x	
	* *Briza maxima*	x	x	x
	* *Briza minor*	x	x	x
	* *Bromus diandrus*		x	x
	* *Bromus ?hordeaceus*			x
	* *Ehrharta longiflora*		x	
	* *Hordeum leporinum*			x
	* *Lolium rigidum*			x
	Microlaena stipoides	x		
	Neurachne alopecuroidea	x	x	
	Rytidosperma caespitosum	x	x	
	Rytidosperma pilosum		x	
	Tetrarrhena laevis	x	x	
	* *Vulpia myuros*	x		
CYPERACEAE	*Cyathochaeta avenacea*	x	x	
	Gahnia aristata		x	
	Gahnia decomposita	x		
	* *Isolepis prolifera*			x
	Lepidosperma drummondii		x	
	Lepidosperma effusum		x	
	Lepidosperma leptostachyum	x	x	
	Lepidosperma pubisquameum	x	x	
	Lepidosperma squamatum	x		
	Lepidosperma tetraquetrum	x	x	
	Mesomelaena tetragona	x		
	Tetraria capillaris	x	x	
	Tetraria octandra	x	x	
RESTIONACEAE	*Desmocladus asper*		x	
	Desmocladus fasciculatus	x	x	
	Hypolaena exsulca	x		
	Loxocarya cinerea		x	
CENTROLEPIDACEAE	*Centrolepis aristata*	x		
PHILYDRACEAE	*Philydrella pygmaea* subsp. *pygmaea*	x		
JUNCACEAE	* *Juncus articulatus*			x
	Luzula meridionalis		x	
ASPARAGACEAE	*Chamaescilla corymbosa*	x	x	
	Dichopogon capillipes	x	x	
	Laxmannia squarrosa	x		
	Lomandra caespitosa	x	x	
	Lomandra hermaphrodita	x		
	Lomandra micrantha subsp. *micrantha*	x	x	
	Lomandra sonderi	x	x	
	Sowerbaea laxiflora		x	
	Thysanotus dichotomus	x	x	
	Thysanotus fastigiatus	x		
	Thysanotus manglesianus	x	x	
	Thysanotus multiflorus	x	x	
	Thysanotus thyrsoideus	x	x	

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED WITHIN THE WA LIMESTONE SURVEY AREA , SERPENTINE, 2005

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FAMILY	SPECIES	M 70/1240	Loc 344	Loc 246
XANTHORRHOEACEAE	*Xanthorrhoea gracilis*	x	x	
	Xanthorrhoea preissii	x	x	
HEMEROCALLIDACEAE	*Agrostocrinum scabrum*		x	
	Caesia micrantha	x	x	
	Caesia micrantha/occidentalis		x	
	Dianella revoluta	x		
	Stypandra glauca		x	
COLCHICACEAE	*Burchardia congesta*	x	x	
	Burchardia multiflora	x		
HAEMODORACEAE	*Conostylis aculeata*	x	x	
	Conostylis aculeata subsp. *preissii*	x	x	
	Conostylis setigera	x		
	Conostylis setosa	x	x	
	Conostylis sp.	x		
	Haemodorum laxum	x	x	
	Haemodorum sp.		x	
DIOSCOREACEAE	*Dioscorea hastifolia*		x	
IRIDACEAE	* *Moraea flaccida*		x	
	Orthrosanthus laxus var. *laxus*		x	
	Patersonia occidentalis		x	
	Patersonia rudis	x		
	* *Romulea rosea*		x	
ORCHIDACEAE	*Caladenia ?magniclavata*	x		
	Caladenia flava	x	x	
	* *Disa bracteata*		x	
	Elythranthera brunonis	x		
	Eriochilus sp.	x		
	Pterostylis sp.	x		
	Pyrorchis nigricans		x	
	Thelymitra crinita	x	x	
CASUARINACEAE	*Allocasuarina fraseriana*	x		
	Allocasuarina humilis		x	
PROTEACEAE	*Adenanthos barbiger*	x	x	
	Banksia armata var. *armata*		x	
	Banksia dallanneyi	x	x	
	Banksia grandis	x	x	
	Banksia sessilis	x	x	
	Banksia sphaerocarpa		x	
	Grevillea bipinnatifida		x	
	Grevillea wilsonii	x		
	Hakea amplexicaulis	x		
	Hakea lissocarpha	x	x	
	Hakea stenocarpa	x	x	
	Hakea trifurcata		x	
	Hakea undulata		x	
	Persoonia elliptica		x	
	Persoonia longifolia	x		
	Petrophile biloba		x	
	Stirlingia latifolia	x		
LORANTHACEAE	*Nuytsia floribunda*	x		
AMARANTHACEAE	*Ptilotus manglesii*	x	x	
RANUNCULACEAE	*Clematis pubescens*	x	x	

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FAMILY	SPECIES	M 70/1240	Loc 344	Loc 246
RANUNCULACEAE (Continued)	*Ranunculus colonorum*		x	
LAURACEAE	*Cassytha ?glabella*		x	
DROSERACEAE	*Drosera bulbosa*	x		
	Drosera erythrorhiza	x	x	
	Drosera erythrorhiza subsp. *collina*	x		
	Drosera gigantea	x		
	Drosera glanduligera	x		
	Drosera hyperostigma	x		
	Drosera menziesii		x	
	Drosera menziesii subsp. *menziesii*		x	
	Drosera ?neesii		x	
	Drosera pallida		x	
	Drosera platystigma	x		
	Drosera rosulata	x		
	Drosera sp. (climbing)		x	
CRASSULACEAE	*Crassula colorata* var. *colorata*	x		
FABACEAE	*Acacia alata* var. *alata*	x	x	
	Acacia extensa	x		
	Acacia pulchella	x	x	
	Acacia urophylla		x	
	Bossiaea ornata		x	
	Chorizema dicksonii		x	
	Daviesia horrida		x	
	Gompholobium knightianum	x		
	Gompholobium marginatum	x	x	
	Hovea chorizemifolia		x	
	Kennedia coccinea	x		
	Kennedia prostrata		x	
	Labichea punctata	x		
	* *Lotus subbiflorus*		x	x
	Mirbelia dilatata		x	
	* *Trifolium campestre*		x	
	* *Trifolium campestre* var. *campestre*		x	
	* *Trifolium subterraneum*		x	
OXALIDACEAE	* *Oxalis corniculata*	x	x	
	* *Oxalis pes-caprae*		x	
LINACEAE	* *Linum trigynum*		x	
RUTACEAE	*Boronia fastigiata*	x		
	Philotheca spicata	x		
EUPHORBIACEAE	* *Euphorbia peplus*		x	
	Monotaxis grandiflora var. *grandiflora*	x	x	
PHYLLANTHACEAE	*Poranthera microphylla*	x		
	Phyllanthus calycinus	x	x	
STACKHOUSIACEAE	*Stackhousia monogyna*		x	
	Tripterococcus brunonis	x		
SAPINDACEAE	*Dodonaea ceratocarpa*		x	
RHAMNACEAE	*Trymalium ledifolium*	x		
	Trymalium odoratissimum Lindl. subsp. *odoratissimum*	x	x	
ELAEOCARPACEAE	*Tetratheca nuda*		x	
STERCULIACEAE	*Lasiopetalum floribundum*	x		

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FAMILY	SPECIES	M 70/1240	Loc 344	Loc 246
STERCULIACEAE (Continued)	*Lasiopetalum glabratum*	x		
DILLENIACEAE	*Hibbertia acerosa*	x		
	Hibbertia amplexicaulis	x	x	
	Hibbertia commutata	x		
	Hibbertia glomerata	x		
	Hibbertia glomerata subsp. *darlingensis*	x	x	
	Hibbertia huegelii		x	
	Hibbertia hypericoides		x	
	Hibbertia ?pachyrrhiza	x	x	
	Hibbertia rupicola	x		
THYMELAEACEAE	*Pimelea ciliata*		x	
	Pimelea imbricata var. *piligera*		x	
	Pimelea spectabilis		x	
	Pimelea suaveolens	x		
MYRTACEAE	*Astartea scoparia*	x	x	
	Babingtonia camphorosmae	x	x	
	Corymbia calophylla	x	x	x
	Darwinia citriodora		x	
	Eucalyptus marginata subsp. *marginata*	x	x	
	Eucalyptus patens	x		
	Eucalyptus rudis	x		x
	Eucalyptus wandoo	x		
	Hypocalymma angustifolium	x	x	
	Kunzea micrantha subsp. *micrantha*	x	x	
	Melaleuca parviceps		x	
	Melaleuca radula		x	
	Pericalymma ellipticum	x		
	Taxandria linearifolia	x	x	x
	Verticordia densiflora var. *?densiflora*	x		
	Verticordia huegelii var. *huegelii*	x	x	
	Verticordia pennigera		x	
APIACEAE	*Daucus glochidiatus*	x	x	
	Eryngium pinnatifidum		x	
	Hydrocotyle callicarpa	x	x	
	Pentapeltis peltigera	x	x	
	Platysace compressa	x		
	Trachymene pilosa	x	x	
	Xanthosia candida	x		
	Xanthosia huegelii	x		
EPACRIDACEAE	*Leucopogon capitellatus*	x	x	
	Leucopogon ?gracillimus		x	
	Leucopogon nutans	x	x	
	Leucopogon propinquus	x		
	Leucopogon verticillatus	x		
	Styphelia tenuiflora	x		
PRIMULACEAE	* *Anagallis arvensis*	x	x	
LOGANIACEAE	*Phyllangium paradoxum*	x		
ASCLEPIADACEAE	* *Gomphocarpus fruticosus*		x	x
BORAGINACEAE	* *Echium plantagineum*		x	
LAMIACEAE	*Hemigenia incana*		x	
	Hemigenia rigida (P1)	x		
	* *Mentha* sp.		x	
SOLANACEAE	* *Solanum nigrum*	x		

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OROBANCHACEAE	* *Bartsia trixago*		x	
	* *Orobanche minor*		x	
	* *Parentucellia* sp.	x		
RUBIACEAE	* *Galium murale*		x	
	Opercularia echinocephala	x	x	
	Opercularia hispidula		x	
CAMPANULACEAE	*Isotoma hypocrateriformis*	x		
	Wahlenbergia gracilenta	x		
GOODENIACEAE	*Dampiera linearis*	x	x	
	Goodenia micrantha		x	
	Lechenaultia biloba	x	x	
	Scaevola calliptera	x	x	
	Scaevola glandulifera		x	
STYLIDIACEAE	*Levenhookia pusilla*	x	x	
	Stylidium brunonianum	x	x	
	Stylidium calcaratum	x	x	
	Stylidium dichotomum	x	x	
	Stylidium hispidum	x	x	
	Stylidium junceum	x		
	Stylidium piliferum	x		
	Stylidium repens	x		
	Stylidium schoenoides	x		
ASTERACEAE	* *Arctotheca calendula*	x	x	x
	Craspedia variabilis	x	x	
	Hyalosperma cotula	x	x	
	* *Hypochaeris glabra*	x	x	
	Lagenophora huegelii	x	x	
	Millotia tenuifolia	x		
	Millotia tenuifolia var. *laevis* (P2)	x		
	Pithocarpa ?corymbulosa (P3)		x	
	Podolepis lessonii		x	
	Podotheca angustifolia	x		
	Pterochaeta paniculata	x		
	Rhodanthe citrina	x		
	Senecio hispidulus		x	
	Senecio hispidulus	x		
	Senecio pinnatifolius var. *pinnatifolius*	x		
	Siloxerus multiflorus		x	
	* *Sonchus oleraceus*		x	
	* *Tolpis barbata*		x	
	Trichocline spathulata	x		
	* *Ursinia anthemoides*	x	x	