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CONSULTING MANAGEMENT SERVICES

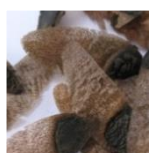
Shire of Goomalling

Flora and Vegetation Survey

Calingiri-Goomalling Road: SLK 0.00 – SLK 30.32

13 January 2020

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Executive Summary

Natural Area Consulting Management Services (Natural Area) was contracted by the Shire of Goomalling to undertake a level 2 flora and vegetation survey, with opportunistic fauna being noted, between SLK 0.00 and SLK 30.32 along the Calingiri-Goomalling Road. Outcomes of the survey activities will inform a clearing permit application to enable road widening activities to occur.

The flora and vegetation survey included the identification of native and non-native flora species present, along with an assessment of vegetation type and condition. The flora survey confirmed:

- a total of 199 flora species from 50 families present; including 157 dicotyledons, 40 monocotyledons and two conifers, of which 147 were native and 52 were introduced species
- one declared pest listed under the *Biosecurity and Agriculture Management Act 2007* (WA) was recorded, namely *Echium plantagineum* (Paterson's Curse) with no weeds of national significance (WoNS) recorded
- the presence of two vegetation types, *Eucalyptus* Woodland and Samphire Open Low Heath
- vegetation condition ranging from Completely Degraded to Very Good, with the majority of the site being Degraded
- one conservation significant species, the Priority 3 *Eucalyptus sargentii* subsp. *onesis* was recorded.

Opportunistic fauna observations included direct observation and noting evidence of their presence such as tracks, scats and calls, and confirmed the presence of:

- 15 vertebrate fauna species, of which ten were birds, two were mammals and three were reptiles
- the European Red Fox (*Vulpes vulpes*) was recorded; this species is listed as a category C3 declared pest under the *Biosecurity and Agriculture Management Act 2007* (WA)
- no conservation significant species were recorded.

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1.0 Introduction

Natural Area Consulting Management Services (Natural Area) was contracted by the Shire of Goomalling to undertake a level 2 flora and vegetation survey along a 30km stretch of Calingiri-Goomalling Road between SLK 0.00 and SLK 30.32 within the Shire of Goomalling. The survey was undertaken to determine flora and vegetation communities present, including conservation significant species and communities, vegetation condition; opportunistic fauna observations were noted. Survey outcomes will inform a clearing permit for road widening purposes.

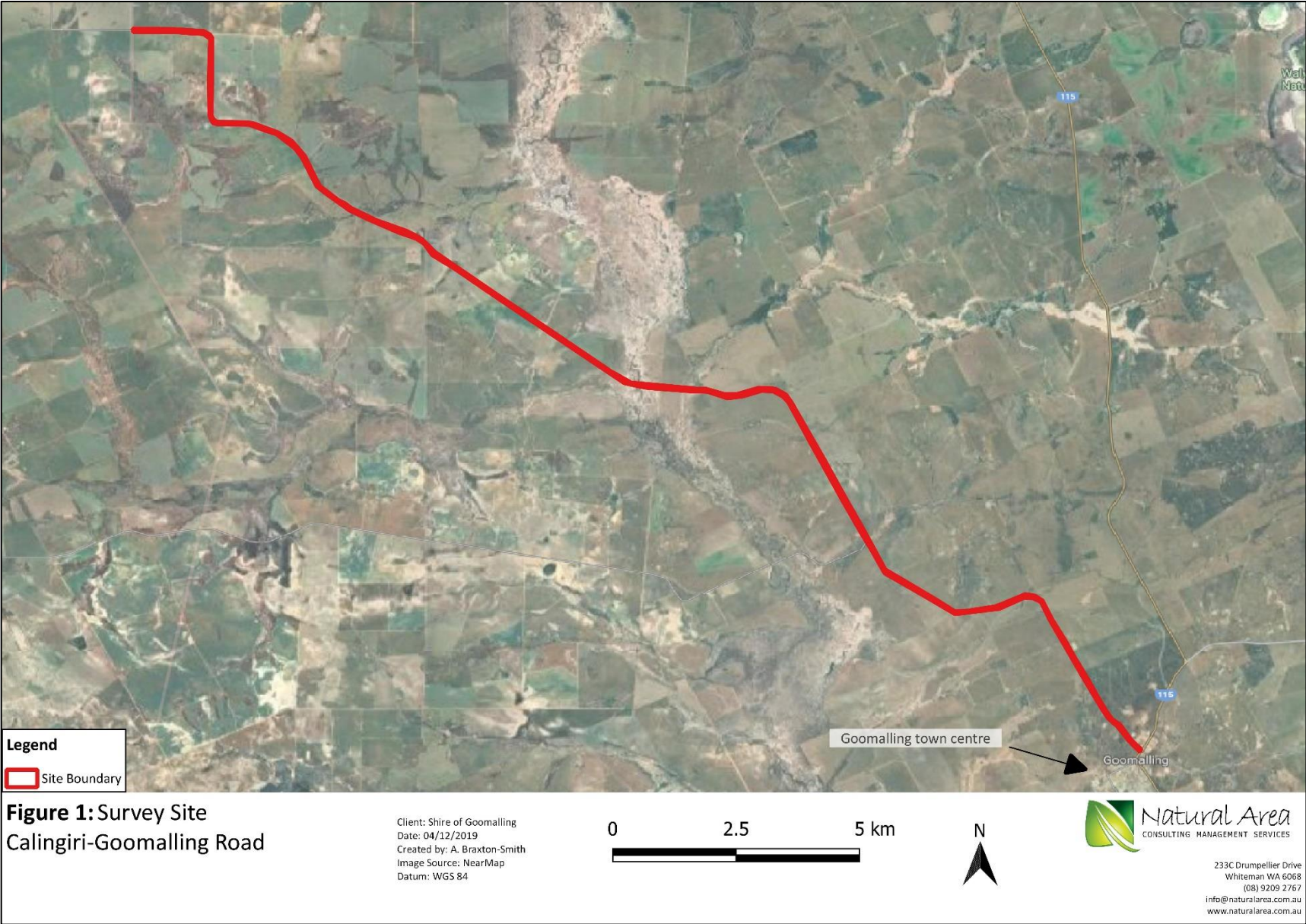
1.1 Location

As seen in Figure 1 the survey site is approximately 30 km in length along the Calingiri-Goomalling Road reserve, starting in the town of Goomalling (SLK 0.00) and ending at the Shire of Goomalling's border (SLK 30.32).

1.2 Scope

Natural Area's scope of works included:

- desktop database searches to identify flora, fauna, and ecological communities that may be present at the site, including any conservation significant species and ecological communities
- a desktop review of available data for the site including vegetation complex, soils characteristics, and topography
- a site survey to:
 - install three quadrats per vegetation type, recording landform, soil complex, leaf litter and the abundance of each species within the quadrat
 - determine native and non-native flora species present
 - opportunistically sight or observe evidence of fauna species
 - record vegetation condition and type
 - undertake a targeted search for conservation significant flora likely to be present
- documenting survey outcomes in a report that will inform the clearing permit application process.



2.0 Site Characteristic

2.1 Regional Context

The site is located within the northern portion of the Avon Wheatbelt 2 (AW2) IBRA subregion. This region is characterised by gently undulating landscapes, with some breakaways. Soils are generally comprised of lateritic uplands and sandplain lowlands, with formation through in situ weathering or colluvial action (Beecham, 2001). Eucalyptus woodlands with Casuarina and Jam Wattle are typical of this area (Beecham, 2001).

2.2 Climate

The climate experienced in the area is semi-arid warm Mediterranean, with dry, hot summers and cool, dry winters (Beecham, 2001). According to the Bureau of Meteorology (2019), Goomalling (Site number 010058) climate and weather averages include:

- rainfall of 365 mm pa, with the majority falling between May and August
- average maximum temperatures ranging from 17.2 °C in winter to 34.8 °C in summer, with the highest recorded being 46.9 °C
- average minimum temperatures ranging from 6.3 °C in winter to 17.4 °C in summer, with the lowest recorded being -1.5 °C
- winds are predominantly from the west or north-west during winter and the east or south-east during summer, with average speeds ranging from 5.9 – 10.8 km/h, with gusts of more than 100 km/h possible during storm events.

2.3 Soils

According to the Natural Resource Information (NRInfo) data maintained by the Department Primary industries and Regional Development (DPIRD) (2019), eight soil types are present along the Calingiri – Goomalling Road within the survey site (Table 1, Figure 2).

Table 1: Soil type descriptions

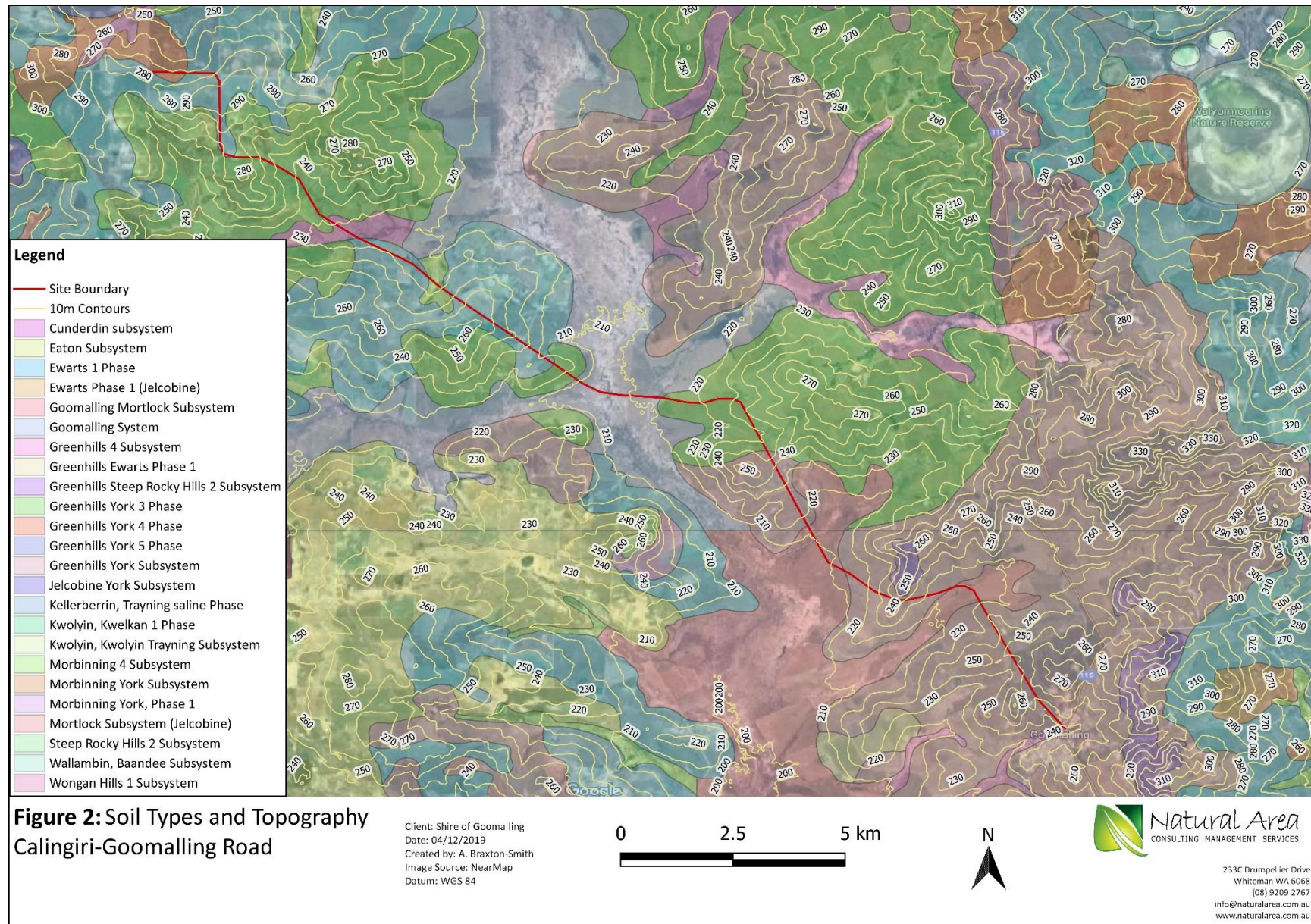
Code	Name	Description
256GhYO4	Greenhills York 4 Phase	Gradual rise to undulating low hills of mainly sandy and loamy duplex soils, alkaline sandy and loamy duplex, sandy earth; associated with York Gum, Wandoo, Salmon Gum, Jam Wattles.
256GhYO3	Greenhills York 3 Phase	Undulating rises to undulating low hills on Migmataitic rocky outcrops in the sandy earth, shallow and deep sandy duplex, shallow to deep loamy duplex, deep sandy gravel and stony soil. Associated with York Gum, wandoo, Salmon Gum, Jam Wattles.
256MbES1	Greenhills Ewerts 1 Phase	Hillslopes containing sand and loamy sand over yellowish clay soils, with some gravel ridges, and some heavier soils that often occur immediately below a breakaway.

Code	Name	Description
256Gh_4	Greenhills 4 Subsystem	Tributaries of the Mortlock river, expressing as flat narrow valleys with saline soils, semi-wet soils and grey sandy duplexes, vegetated by Wandoo-Salmon-York Gum woodlands, east of Northam and Beverley.
256Go	Goomalling System	Poorly drained valley flats, in the northern Zone of Rejuvenated Drainage, with grey deep sandy duplex (sometimes alkaline) and saline wet soil. Associated with York Gum-Jam-Wandoo-Salmon Gum-Sheoak woodland.
256GhYO	Greenhills York Subsystem	Areas of soils derived from freshly exposed rock. This unit is typified by the red soils of the Avon Valley but also includes areas of similar, but often greyer and lighter textured soils to the east of the valley.
256GoMO	Goomalling Mortlock Subsystem	Valley floors of the Mortlock River and other similar creeks that predominantly contain sand over yellowish clay soils. Prone to salinity and waterlogging.
256Mb_4	Morbinning 4 Subsystem	Narrow tributary valleys of the Goomalling system with duplex soils under Wandoo vegetation.

2.4 Topography

The site is located on an undulating landscape, from 210 m Australian Height Datum (AHD) in the valley floors to approximately 250 m at several points along the road with a single peak of 290 m at the north west end of the site (Figure 2).

Shire of Goomalling
Calingiri-Goomalling Road Flora Survey



3.0 Methodology

3.1 Desktop and Literature Review

The desktop survey for the fauna and flora survey components included reviewing online databases to determine preliminary site characteristics, including:

- National Map to determine soil types (Department of Primary Industries and Regional Development) and IBRA subregions
- NatureMap to indicate the flora and fauna species (native and introduced) that could potentially occur (Appendix 1)
- Protected Matters Search Tool to assess the determine if any matters of national environmental significance were likely (Appendix 2)
- the Department of Biodiversity, Conservation and Attractions database search for flora, fauna and ecological communities previously recorded in the local area
- FloraBase to review the habitat associated with conservation significant species to infer the likelihood of their presence within the survey boundary.

3.2 Flora and Vegetation On-ground Methodology

The flora and vegetation survey activities were carried out in accordance with *EPA Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (Environmental Protection Authority, 2016), and included a desktop review of literature and databases before undertaking the on-ground survey.

3.2.1 Field Assessment

Natural Area personnel Harley Taylor and Aster Braxton-Smith undertook the on-ground level 2 flora survey over two days on 20 and 26 September 2019, with activities including:

- setting up of three transects/quadrats per vegetation type within the road reserve, with a total of six installed; 100 m² transects/quadrats were used to assess understorey species and 400 m² to assess overstorey species
- recording GPS coordinates in the north-west corner of each quadrat/transect using GDA94 datum
- recording landscape characteristics including soil types and colour, aspect, slope, presence of surface rock, topography and drainage using a modified recording sheets based on the NAIA templates developed for the Perth Biodiversity Project
- determining leaf litter depth, percentage cover, and percentage of bare ground
- recording vegetation type based on dominant over, middle and understorey species (Government of Western Australia, 2000)
- recording vegetation condition using the scale attributed to Keighery (Government of Western Australia, 2000)
- recording the presence of significant flora
- for each flora species in the quadrats, the following was recorded:
 - percentage cover and height
 - habit and life form
- recording any opportunistic sightings or evidence of fauna use within the sites.

3.2.2 Flora Species

Flora species were recorded within transects, with additional species recorded whilst the site was being traversed. The list of potential declared rare or priority flora species (Appendix 3) was used to guide targeted searches for those species.

3.2.3 Vegetation Type

The vegetation type was determined using the structural classes described in *Bush Forever Volume 2* (Government of Western Australia, 2000), and records dominant over, middle and understorey species. A tablet equipped with GPS mapping software was used to mark the change in vegetation type across the site. A description of the various structural classes is provided in Table 2.

Table 2: Vegetation structural classes

Life Form/Height Class	Canopy Percentage Cover			
	100 – 70%	70 – 30%	30 - 10%	10 – 2 %
Trees over 30 m	Tall closed forest	Tall open forest	Tall woodland	Tall open woodland
Trees 10 – 30 m	Closed forest	Open forest	Woodland	Open woodland
Trees under 10 m	Low closed forest	Low open forest	Low woodland	Low open woodland
Tree Mallee	Closed tree mallee	Tree mallee	Open tree mallee	Very open tree mallee
Shrub Mallee	Closed shrub mallee	Shrub mallee	Open shrub mallee	Very open shrub mallee
Shrubs over 2 m	Closed tall scrub	Tall open scrub	Tall shrubland	Tall open shrubland
Shrubs 1 – 2 m	Closed heath	Open heath	Shrubland	Open shrubland
Shrubs under 1 m	Closed low heath	Open low heath	Low shrubland	Low open shrubland
Grasses	Closed grassland	Grassland	Open grassland	Very open grassland
Herbs	Closed herbland	Herbland	Open herbland	Very open herbland
Sedges	Closed sedgeland	Sedgeland	Open sedgeland	Very open sedgeland

(Source: Government of Western Australia, 2000)

3.2.4 Vegetation Condition

Vegetation condition was assessed using the rating scale attributed to Keighery in *Bush Forever Volume 2* (Government of Western Australia, 2000); Table 3 provides a description of the rating scale. A tablet equipped with GPS mapping software was used to mark the vegetation condition across the site.

Table 3: Vegetation condition rating scale

Category		Description
1	Excellent	Pristine or nearly so, no obvious signs of damage caused by human activities since European settlement.
2	Very Good	Some relatively slight signs of damage caused by human activities since European settlement. For example, some signs of damage to tree trunks caused by repeated fire, the presence of some relatively non-aggressive weeds, or occasional vehicle tracks.
3	Good	More obvious signs of damage caused by human activities since European settlement, including some obvious impact on the vegetation structure such as that caused by low levels of grazing or slightly less aggressive weeds.
4	Poor	Still remains basic vegetation structure or ability to regenerate to it after very obvious impacts of human activities since European settlement, such as grazing, partial clearing, frequent fires or aggressive weeds.
5	Very Poor	Severely impacted by grazing, very frequent fires, clearing or a combination of these activities. Scope for some regeneration but not to a state approaching good condition without intensive management. Usually with a number of weed species present including very aggressive species.
6	Completely Degraded	Areas that are completely or almost completely without native species in the structure of their vegetation; i.e. areas that are cleared or 'parkland cleared' with their flora comprising of weed or crop species with isolated native trees or shrubs.

(Source: Government of Western Australia, 2000)

3.2.5 Limitations

A number of limitations associated with both desktop and on-site flora surveys exist, including:

- database searches provide an indication of what flora species may be present, with on ground surveys required to confirm those actually present
- the differing databases are reliant on information submitted via various reporting mechanisms, so all records of a particular species or ecological community within a specified area may not be complete
- information on flora species provided on some databases include out-of-date species names, meaning that names need to be checked for currency
- herbarium records are largely limited to vouchered specimens
- plant species flower at different times and are not always able to be identified
- not all species flower every year.

Despite these limitations, Natural Area estimates that 80 – 90% of species within the Calingiri-Goomalling Road survey area have been identified.

4.0 Results

4.1 Desktop Survey – Flora Species

A review of NatureMap (2019c) with a 20 km search radius around the site indicated the potential for 574 flora species, of which 408 were dicotyledons, 160 monocotyledons, two gymnosperms and four ferns within the study area. Of these, 29 were listed as conservation significant (approximately 5%), including four species listed as Declared Rare Flora (Table 4, Appendix 1). A review of species listed as matters of national environmental significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) was undertaken using the Protected Matters Search Tool (PMST) using a 20 km search radius ; 21 species were listed as having the potential to occur (Table 4, Appendix 2). A review of the DBCA database of conservation significant flora indicated 21 species which have previously been recorded in the area (Table 4). Overall, these database searches indicated the combined potential for 48 conservation significant species occurring within the survey area.

Available information relating to those species listed as conservation significant, including photographs where possible, was obtained from FloraBase (2019) and summarised in a field reference guide (Appendix 3). For those species without a description or a photograph, a visit to the WA herbarium was undertaken prior to the field survey and photos of voucher specimens taken for plants for these taxa. Of the conservation significant flora listed in the databases, the habitat may be suitable for 38 species (Table 4). Targeted searches were undertaken for all taxa for which habitat suitability could not be determined. A description of the conservation codes is provided in Appendix 4.

Table 4: Threatened and Priority flora species listed by NatureMap and PMST

Species	Cons Code	NM	PMST	DBCA	Likelihood of occurrence on site
<i>Acacia ataxiphylla</i> subsp. <i>magna</i>	T	X		X	Soils may be suitable
<i>Acacia campylophylla</i>	P3	X			Soils may be suitable
<i>Acacia cochlocarpa</i> subsp. <i>cochlocarpa</i>	T		X		Soils may be suitable
<i>Acacia cochlocarpa</i> subsp. <i>velutinos</i>	CR		X		Soils may be suitable
<i>Acacia trinalis</i>	P1	X		X	Soils may be suitable
<i>Acacia vassalii</i>	T		X		Soils may be suitable
<i>Banksia horrida</i>	P3	X			Soils may be suitable
<i>Caladenia drakeoides</i>	T/EN	X	X	X	Soils may be suitable
<i>Caladenia huegelii</i>	EN		X		Soils may be suitable
<i>Chorizema humile</i>	EN		X		Soils may be suitable
<i>Conospermum eatoniae</i>	P3	X		X	Soils may be suitable
<i>Conostylis caricina</i> subsp. <i>elachys</i>	P1	X		X	Soils may be suitable
<i>Cryptandra beverleyensis</i>	P3	X		X	Soils may be suitable
<i>Dasymalla axillaris</i>	CR		X		Occurs approx. 270km north
<i>Daviesia dielsii</i>	T		X		Soils may be suitable
<i>Daviesia euphorbioides</i>	T/EN	X	X	X	Soils may be suitable

Species	Cons Code	NM	PMST	DBCA	Likelihood of occurrence on site
<i>Daviesia nudiflora</i> subsp. <i>drummondii</i>	P3	X		X	Soils may be suitable
<i>Eucalyptus macrocarpa</i> x <i>pyriformis</i>	P3	X		X	Soils may be suitable
<i>Eucalyptus recta</i>	T		X		Soils may be suitable
<i>Eucalyptus sargentii</i> subsp. <i>onesis</i>	P3	X		X	Soils may be suitable
<i>Frankenia glomerata</i>	P4	X		X	Soils may be suitable
<i>Gastrolobium appressum</i>	T		X		Soils may be suitable
<i>Gastrolobium hamulosum</i>	EN		X		Soil suitable but usually occurs more North
<i>Grevillea christineae</i>	T/EN	X	X	X	Soils may be suitable
<i>Grevillea dryandroides</i> subsp. <i>hirsuta</i>	EN		X		Soils may be suitable
<i>Grevillea roycei</i>	P3				Soils may be suitable
<i>Grevillea</i> sp. <i>Trayning</i>	P1	X		X	Soils may be suitable
<i>Guichenotia impudica</i>	P3	X		X	Soils may be suitable
<i>Hemiandra gardneri</i>	T		X		Soils may be suitable
<i>Hibbertia leptopus</i>	P2	X		X	Soils may be suitable
<i>Hydrocotyle lemnoides</i>	P4	X		X	Soils not suitable
<i>Jacksonia debilis</i>	P1	X			Soils may be suitable
<i>Jacksonia rubra</i>	P2	X		X	Soils may be suitable
<i>Lepidosperma</i> sp. <i>Meckering</i>	P3	X		X	Soils may be suitable
<i>Lilaeopsis polyantha</i>	P2	X		X	Soils not suitable
<i>Lysiosepalum abollatum</i>	CR/T		X		Soils may be suitable
<i>Lysiosepalum aromaticum</i>	P2	X	X		Soils may be suitable
<i>Melaleuca sciotostyla</i>	EN				Soils may be suitable
<i>Persoonia chapmaniana</i>	P3	X			Soils may be suitable
<i>Philothea wonganensis</i>	T		X		Soil not suitable
<i>Roycea pycnophylloides</i>	EN		X		Soils may be suitable
<i>Scaevola tortuosa</i>	P1	X			Soils may be suitable
<i>Schoenus capillifolius</i>	P3	X			Soils not suitable
<i>Schoenus natans</i>	P4	X		X	Soils not suitable
<i>Scholtzia halophila</i> subsp. <i>mortlockensis</i>	P3	X		X	Soils not suitable
<i>Symonanthus bancroftii</i>	EN		X		Soils not suitable
<i>Thomasia tenuivestita</i>	P3	X			Soils not suitable
<i>Verticordia staminosa</i> subsp. <i>staminosa</i>	EN		X		Soils may be suitable

(Source: Department of Biodiversity, Conservation and Attractions, 2019b; Department of the Environment and Energy, 2019).

4.2 Desktop Survey – Ecological Communities

A review of the priority and threatened ecological community database held by the Department of Biodiversity, Conservation and Attractions indicated the presence of one conservation significant ecological community in proximity to the survey site (Table 5). Each listing includes a designated 200 m buffer around the ecological community, with the Calingiri-Goomalling Road most likely being within the buffer area for the community rather than having the community present within the road reserve in most instances.

Table 5: Conservation significant ecological community

Name	Description	WA Cons Code	Cwlth Cons Code
Eucalypt Woodlands of the Western Australian Wheatbelt	The dominant trees are eucalypts that usually have a single trunk (not mallee) and occur as a complex mosaic of around 30 different species depending where they are found topographically, for example, <i>Eucalyptus recta</i> in breakaways and gravel rises, <i>Eucalyptus salmonophloia</i> in plains and valley floors, and <i>Eucalyptus loxophleba</i> and <i>Eucalyptus rudis</i> near water courses and wetlands. The understory is quite variable and can range from wildflowers, mixed herbs to more grassy and even bare.	P3	CE

(Department of Environment and Energy, 2016)

4.3 Field Survey Results

4.3.1 Flora

A total of 199 flora species were recorded from 50 families during the field survey. Of the 199 species, 157 were dicotyledons, 40 were monocotyledons and two were conifers. Of these, 147 were species native to Avon Wheatbelt 2 bioregion and 52 were introduced species. Examples of native flora species recorded are provided in Figure 3 and non-native species in Figure 4; the flora species list is provided in Appendix 5 and quadrat data in Appendix 6.

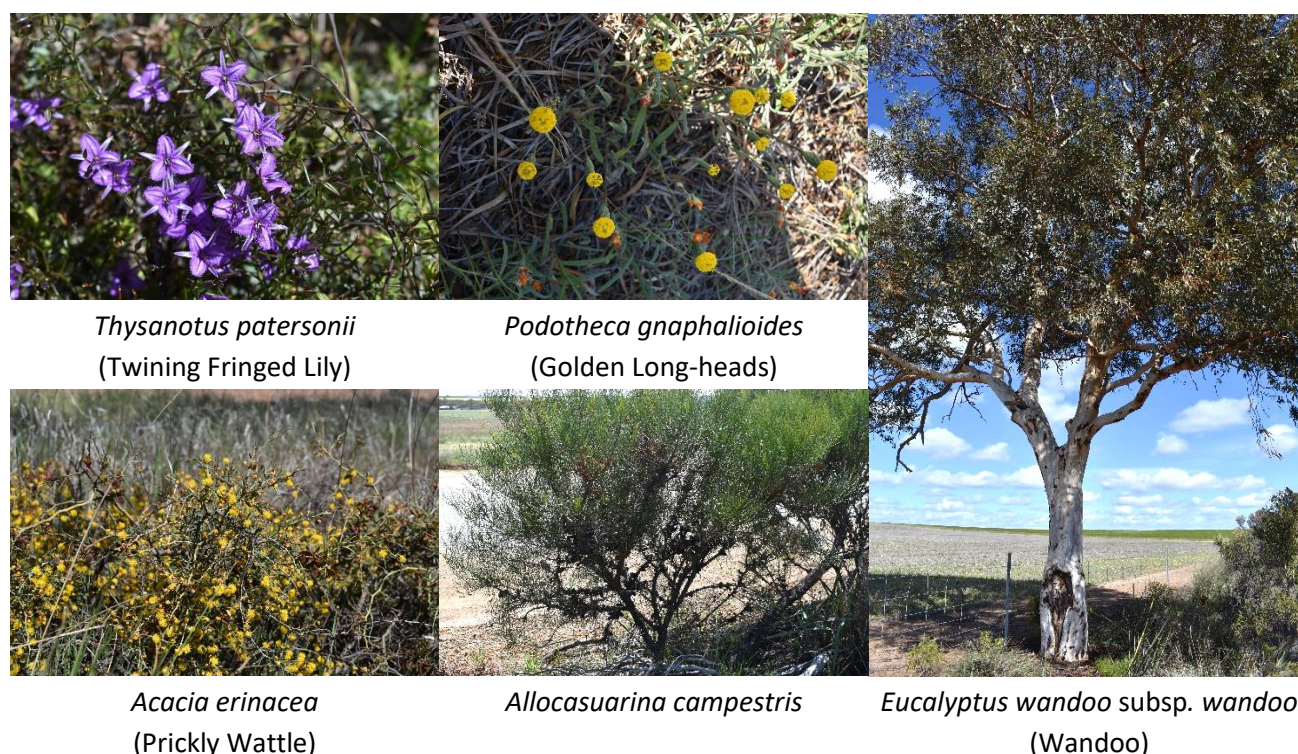


Figure 3: Examples of native flora species recorded

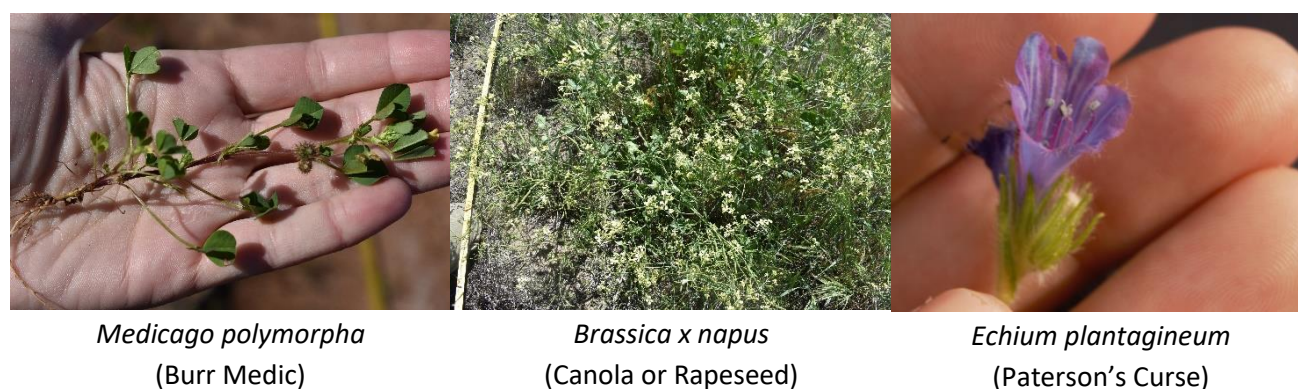


Figure 4: Examples of weed flora species recorded

4.3.2 Conservation significant species

One conservation significant flora species was confirmed, the Priority 3 *Eucalyptus sargentii* subsp. *onesis* (Figure 5). Two individuals of this species was recorded in or adjacent to quadrat 5 ('Q5' in Figure 6) in association with the Eucalyptus Woodland; as the identification of this species was not confirmed in the field, it is uncertain how many additional plants are present in the area.



Figure 5: Priority 3 *Eucalyptus sargentii* subsp. *onesis*



4.3.3 Vegetation Type

Two vegetation types were recorded along the road reserves of Calingiri-Goomalling Road (Table 6), namely:

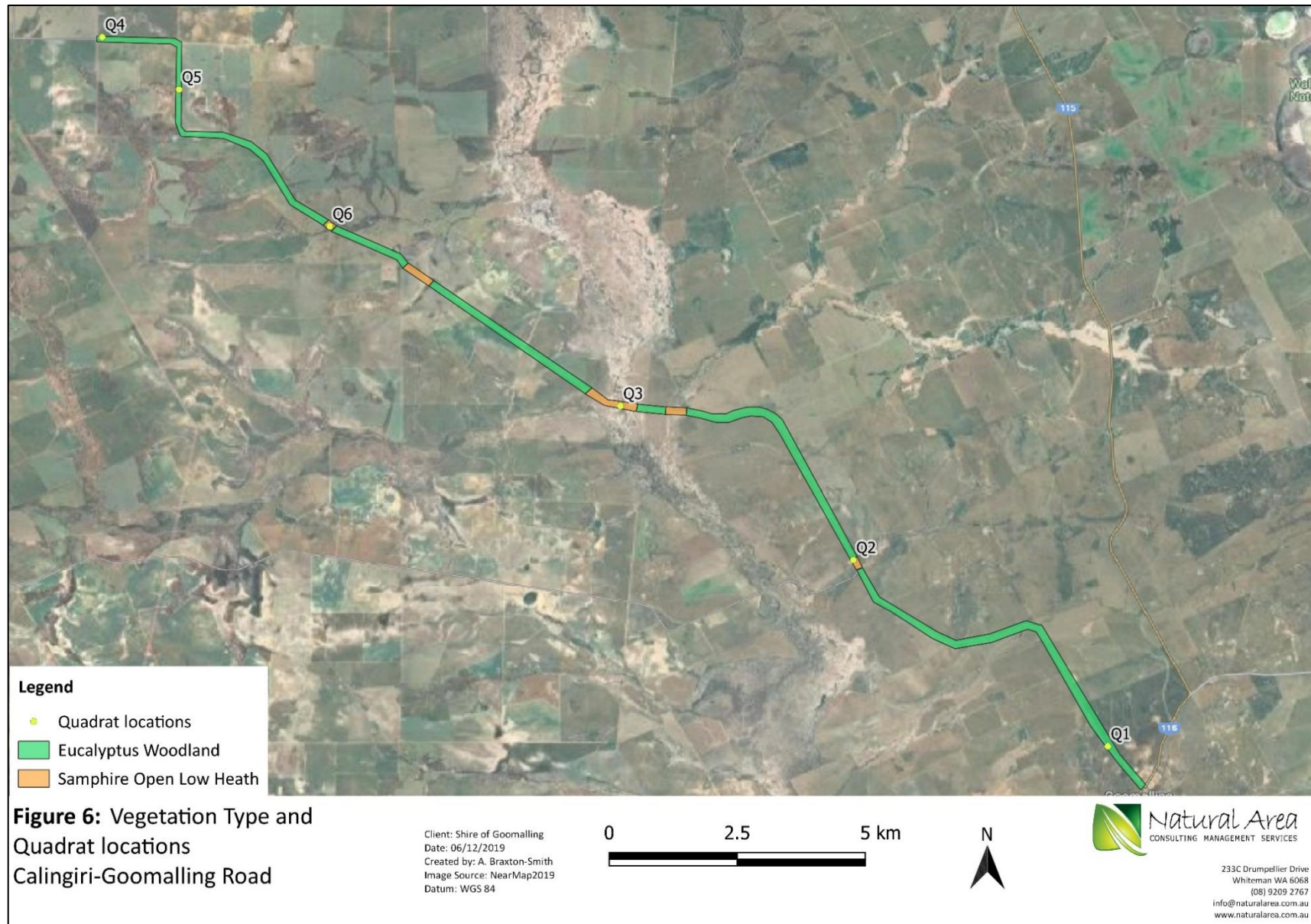
- Eucalyptus Woodland
- Samphire Open Low Heath.

As per Figure 6, the dominant vegetation type along Calingiri-Goomalling Road is the Eucalyptus Woodland, with five small pockets of Samphire Open Low Heath in the lower lying areas (Figure 6; note the vegetation type boundaries have been extrapolated for ease of viewing).

Table 6: Vegetation types within the site

Vegetation Type	Description	Photo
Eucalyptus Woodland	<i>Eucalyptus</i> woodland dominated by <i>Eucalyptus</i> spp., over <i>Acacia acuminata</i> , <i>Santalum spicatum</i> , <i>Grevillea</i> spp. and <i>Allocasuarina</i> spp., with an understory of mixed <i>Acacia</i> spp. shrubs, <i>Dianella revoluta</i> , <i>Austrostipa</i> spp. and a mix of herbs and weedy grasses.	
Samphire Open Low Heath	Samphire Open Low Heath dominated by <i>Tecticornia</i> spp., * <i>Juncus acutus</i> over <i>Atriplex</i> spp., <i>Cotula cotuloides</i> and a mix of weedy grasses and herbs.	

*Denotes introduced flora species



4.3.4 Vegetation Condition

Vegetation condition ranged from Completely Degraded to Very Good, with the majority of the site being Degraded (47.04%) to Completely Degraded (23.77%) with a few pockets of Good (23.45%) and Very Good (5.75%) (Table 7, Figure 8). The Vegetation Condition boundaries in Figure 8 have been extrapolated for ease of viewing.

Table 7: Vegetation condition

Vegetation Condition	Excellent	Very Good	Good	Degraded	Completely Degraded	Total
Area (ha)	0	10.53	42.97	86.20	43.56	183.26
Area (%)	0	5.75	23.45	47.04	23.77	100

Note: These are based on estimates due to the quality of the aerial imagery and the linear nature of the site.

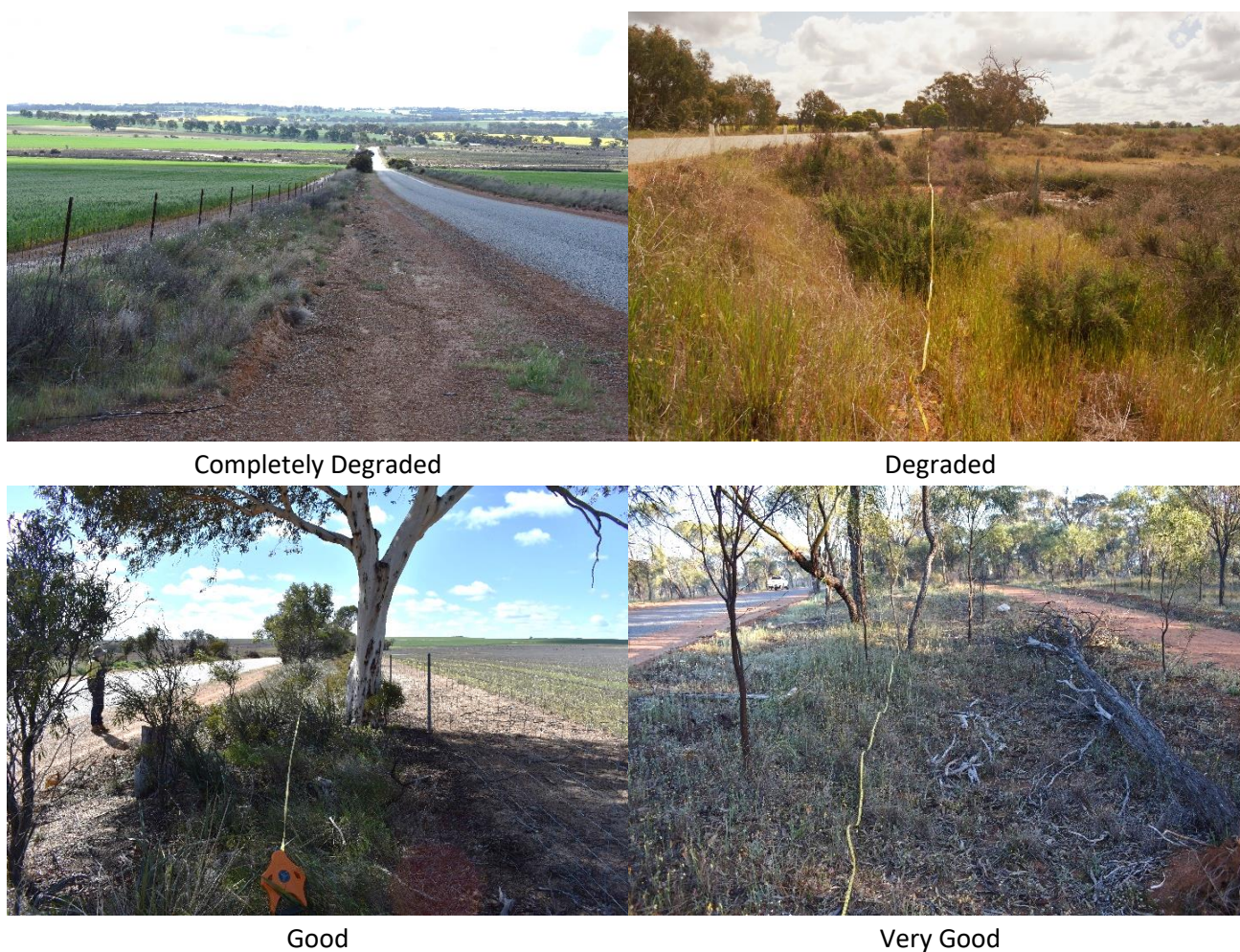
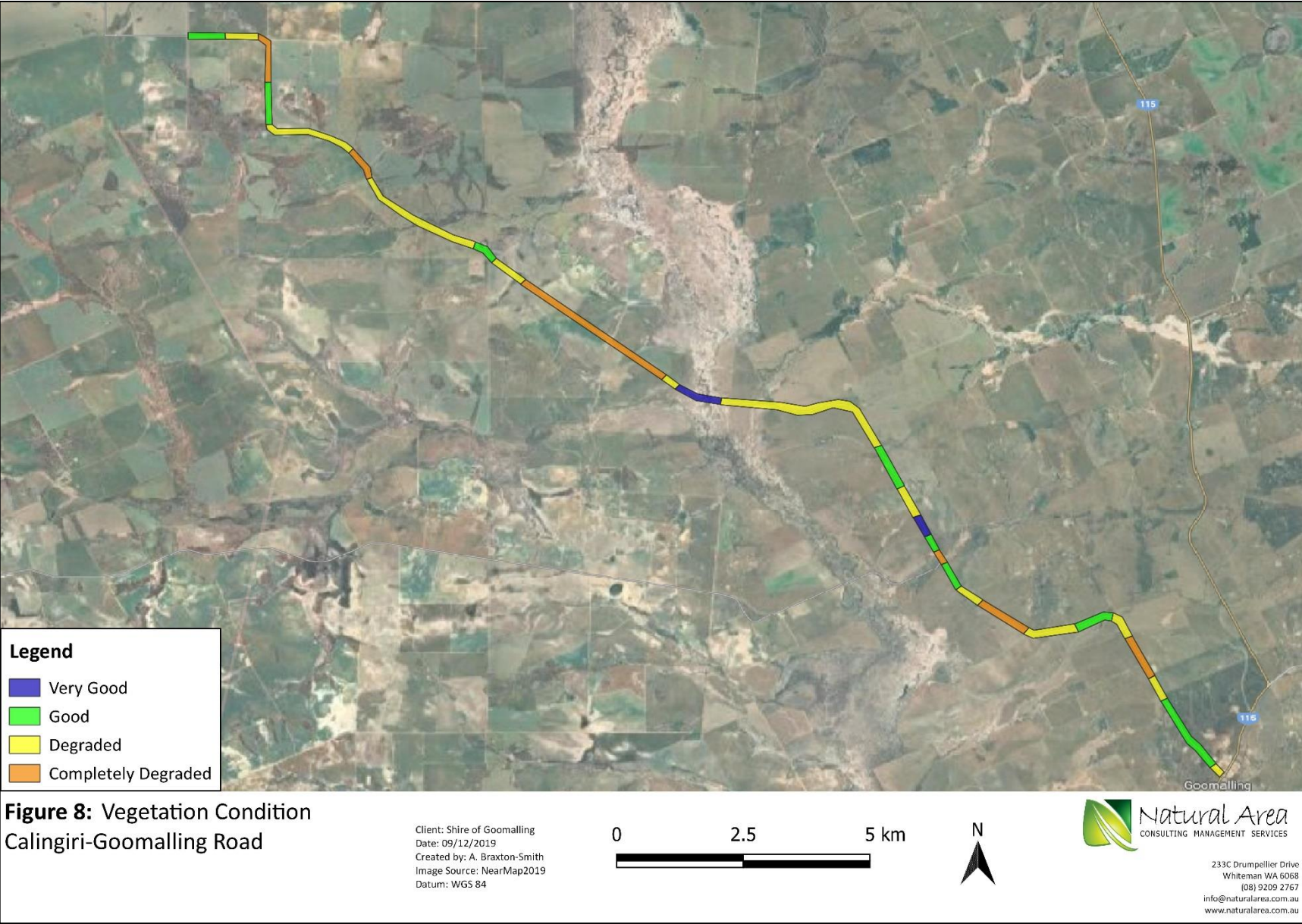


Figure 7: Examples of Vegetation Condition along Calingiri-Goomalling Road



4.3.5 Ecological Communities

The September 2019 survey confirmed that no priority or threatened ecological communities present within the Calingiri-Goomalling Road. It is recognised that while the *Eucalypt Woodland of the Western Australian Wheatbelt* ecological community is present within nearby bushland areas, and was probably present within the area cleared for the Calingiri-Goomalling Road and its associated road reserve, the level of disturbance and degradation means the vegetation present no longer meets the description of that community type.

4.3.6 Fauna

A total of 15 vertebrate species were recorded via observation or other signs of their presence along Calingiri-Goomalling Road. Of these, ten were birds, two were mammals and three were reptiles (Table 8, Figure 9). No conservation significant fauna species were recorded for the site.

Table 8: Incidental recorded fauna species within Calingiri- Goomalling survey area

Vertebrate Group	Family	Species	Common Name
Mammal	Canidae	<i>*Vulpes vulpes</i>	Red Fox
	Macropodidae sp		Kangaroo (tracks)
Bird	Cacatuidae	<i>Cacatua roseicapilla</i>	Galah
	Cacatuidae	<i>Cacatua sanguinea</i>	Little Corella
	Campephagidae	<i>Coracina novaehollandiae</i>	Black Faced Cuckoo Shrike
	Columbidae	<i>Phaps chalcoptera</i>	Common Bronzewing
	Corvidae	<i>Corvus coronoides</i>	Australian Raven
	Cracticidae	<i>Cracticus tibicen</i>	Australian Magpie
	Cracticidae	<i>Cracticus torquatus</i>	Grey Butcherbird
	Falconidae	<i>Falco berigora berigora</i>	Brown Falcon
	Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow
	Psittacidae	<i>Platycercus zonarius</i>	Australian Ringneck
Reptile	Elapidae	<i>Pseudechis australis</i>	Mulga Snake
	Scincidae	<i>Cryptoblepharus buechananii</i>	Buchanan's Snake-eyed Skink
	Scincidae	<i>Tiliqua rugosa rugosa</i>	Bobtail Lizard

*Denotes introduced Species



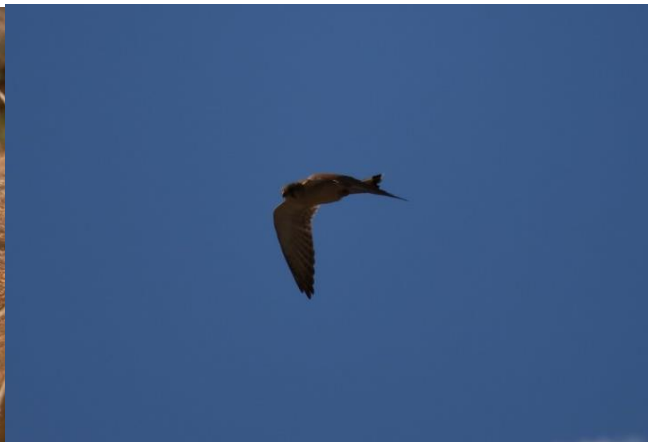
Mulga Snake



Bobtail Lizard



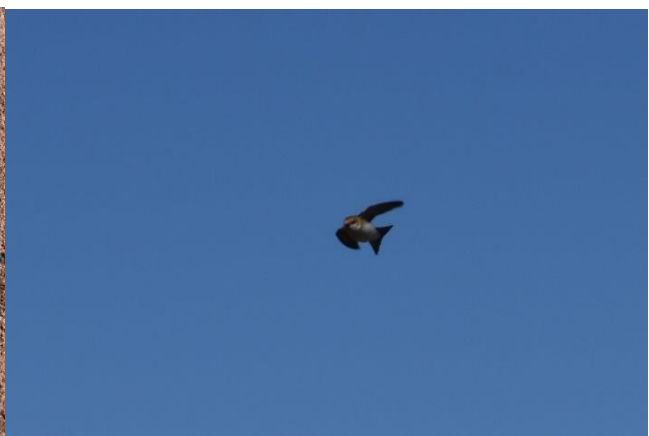
Buchanan's Snake-eyed Skink



Brown Falcon



Kangaroo



Welcome Swallow

Figure 9: Examples of Fauna species recorded

5.0 Implications of Results

5.1 Flora and Vegetation

Natural Area's September 2019 survey of the Calingiri-Goomalling Road recorded 199 flora species from 50 families, of which 147 were native and 52 were introduced. This represents a high level of flora diversity that is probably due to the length and linear nature of the survey site. Two vegetation types were identified, namely *Eucalyptus* Woodland and Samphire Open Low Heath. Vegetation condition ranged from Completely Degraded to Very Good, with the majority of the site (70%) being assessed as Degraded or Completely Degraded. The areas identified as Degraded and Completely Degraded are the result of previous road clearing activities and agricultural land use in the adjoining properties.

5.2 Significant Flora

The DBCA database search (2019d) identified the presence of threatened and priority flora within a 20 km radius of the survey site, with two species previously recorded along the road reserve, namely the Priority 1 *Acacia trinalis* and the threatened *Daviesia euphorbioides*, but the survey confirmed these individuals are no longer present. No declared rare or threatened flora species were found during the September 2019 survey, although one priority flora species was identified, namely the Priority 3 *Eucalyptus sargentii* subsp. *onesis*. If possible, the presence of these individuals will be avoided; where that is not possible, the feasibility of collecting seed from these species will be considered according to the timing of the collection, seed maturity and availability.

Two individuals of *Eucalyptus sargentii* subsp. *onesis* were found in Quadrat 5, within the *Eucalyptus* Woodland vegetation type. GPS coordinates are available in Appendix 6 for the location of Quadrat 5. The DBCA has recorded this species within the vicinity of the survey site, with a plant recorded approximately 2 km to the west (2019d). This species is known from the Goomalling and surrounding local government areas, including Lake Grace some 325km to the south. On the basis of the range of the recorded population, the loss of these individuals within the road reserve is unlikely to have a significant impact.

There was a single individual of a *Frankenia* sp. found within Quadrat 3 of the Samphire Open Low Heath vegetation type, and while it could not be identified down to species level it cannot be ruled out as potentially being the Priority 4 *Frankenia glomerata*, which has a preferred soil type of white sand (DBCA, 2019b) as found within the survey site. According to the DBCA database search (2019d), the closest recorded *F. glomerata* individual was found 3 km to the south of Quadrat 3 along the edge of a saline river with lightly compacted grey sand. Quadrat 3 where the *Frankenia* sp. was recorded, the soil type present was a light grey silty sand or clay. Accordingly, the nature of the soil type and the recording of the species in a similar habitat type nearby means that Natural Area cannot rule out the possibility that this species is the Priority 4 *Frankenia glomerata*. According to FloraBase (2019b), this species has been previously recorded in Goomalling and surrounding local government area, including over 800 km to the east as far as Laverton and 900 km to the north as Wiluna. In the event that the *Frankenia* is the P4 listed species, based on the range of the recorded population, the loss of one individual within the road reserve is unlikely to have a significant impact on the population.

5.3 Threatened Ecological Communities

The DBCA threatened and priority ecological community database search identified the presence of the *Eucalypt Woodlands of the Western Australian Wheatbelt* that is listed as Priority 3 under the *Biodiversity Conservation Act 2016* (WA) and Critically Endangered under the *EPBC Act 1999* (Cwlth) within 200 m of the Calingiri-Goomalling Road. However, the road reserve itself was within the designated buffer zone around the community rather than being located within the community itself.

The survey confirmed that there were no threatened or priority ecological communities present within the Calingiri-Goomalling Road site. Of the 10 Eucalypt species identified during the survey, the *Eucalyptus salmonophloia* (Salmon Gum) and *Eucalyptus loxophleba* (York Gum) are listed as being dominant species of the *Eucalypt Woodlands of the WA Wheatbelt* ecological community. However, associated middle and understorey species for this community were absent, the patch size was small, and the dominant condition of the survey area was Degraded or Completely Degraded (70% of the site), meaning that the vegetation on site does not meet the definition of this community type.

5.4 Fauna

A total of 15 vertebrate fauna species (ten birds, two mammals and three reptiles) were recorded during the September 2019 survey with no conservation significant species identified nor indicators of their presence found. A review of the flora species identified during the survey identified few species that are preferred by threatened black cockatoo species as a food source. The absence of sufficient number and variety of flora species used for foraging along with the largely degraded nature of the site suggests that impacts to conservation significant fauna is unlikely.

5.5 Assessment Against Clearing Principles

An assessment of survey outcomes against the Western Australian clearing principles is provided in Table 9. Based on that the outcomes suggest that the clearing application may be at variance to one of the ten clearing principles (Table 9). As the clearing is occurring in the Western Australian Wheatbelt which is an area that has already been extensively cleared, the condition of the site is primarily Degraded to Completely Degraded (70% of the site). Although the site has a high diversity of native flora species and one priority flora species was identified, this is most likely a reflection of the length and linear nature of the site.

Table 9: Assessment against clearing principles

Clearing Principle	Comment
<p>A Native vegetation should not be cleared if it comprises a high level of biological diversity.</p>	<p>The area to be cleared may be at variance with this principle:</p> <ul style="list-style-type: none"> 147 native species were recorded within the road reserve that comprised the survey area; however, this is probably a reflection of the long, linear nature of the survey area 30% of the area is in Good or Very Good condition one Priority listed species was recorded (Priority 3 <i>Eucalyptus sargentii</i> subsp. <i>onesis</i> (a few individuals); being recorded in surrounding local government areas previously areas within the proposed clearing footprint are located within a designated road reserve
<p>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.</p>	<p>The area to be cleared is not likely to be at variance with this principle:</p> <ul style="list-style-type: none"> fauna observations during the survey were limited no conservation significant fauna species were identified, nor indicators of their presence during the survey activities the flora survey recorded few species that are recognised as a preferred food source by threatened black cockatoos, indicating that the site is not likely to be a significant foraging location for these species
<p>C Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.</p>	<p>The area to be cleared is not likely to be at variance with this principle:</p> <ul style="list-style-type: none"> the September 2019 survey recorded no declared rare or threatened flora species the DBCA database search (2019d) identified the presence of threatened and priority flora within a 20 km radius of the survey site, with the two species previously recorded directly along the road reserve, namely the Priority 1 <i>Acacia trinalis</i> and the Threatened <i>Daviesia euphorbioides</i>, but the survey confirmed these individuals are no longer present one Priority listed species was recorded (Priority 3 <i>Eucalyptus sargentii</i> subsp. <i>onesis</i> (a few individuals); being recorded in surrounding local government areas previously
<p>D Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance</p>	<p>The area to be cleared is not likely to be at variance with this principle:</p> <ul style="list-style-type: none"> the DBCA threatened and priority ecological community database search identified the presence of the Eucalypt Woodlands of the Western Australian Wheatbelt that is listed as Priority 3 ecological community under the <i>Biodiversity Conservation Act 2016</i> (WA) and Critically Endangered under the <i>EPBC Act 1999</i> (Cwlth) was present within 200 m of Calingiri-Goomalling Road; however, the road reserve itself was within some of the designated buffers but outside of the actual community boundary

Clearing Principle	Comment
of a threatened ecological community.	<ul style="list-style-type: none"> no threatened or priority ecological communities were recorded during the September 2019 survey
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.	<p>The area to be cleared is not likely to be at variance with this principle:</p> <ul style="list-style-type: none"> the area surrounding the site includes vegetated areas and cleared agricultural land the predominant condition of the vegetation within the road reserve is Degraded or Completely Degraded (70% of the site) several areas of remnant bushland are present adjacent to and in close proximity to the proposed clearing footprint
F Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	<p>The area to be cleared is not likely to be at variance to this principle:</p> <ul style="list-style-type: none"> the Calingiri-Goomalling Road is an existing road constructed over or near to several inter-linked water courses, with widening unlikely to result in a significant increase in impact to their hydrology or the presence of riparian vegetation as long as the drains adjacent to or beneath the roads are adequately retained/upgraded
G Native Vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	<p>The area to be cleared is not likely to be at variance with this principle:</p> <ul style="list-style-type: none"> the widening of the Calingiri-Goomalling Road is unlikely to result in an increased level of land degradation as the clearing will occur within the gazetted road reserve and constructed in accordance with Shire engineering standards for roads
H 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.	<p>The area to be cleared is not likely to be at variance with this principle</p> <ul style="list-style-type: none"> the area surrounding the site is includes vegetated areas and cleared agricultural land the predominant condition of the vegetation within the road reserve is Degraded or Completely Degraded (70% of the site) several areas of remnant bushland are present adjacent to and in proximity to the proposed clearing footprint the road reserve is located within the nominated buffer area of several locations of the Eucalypt Woodland of the WA Wheatbelt, but is outside of the actual ecological community area
I Native vegetation should not be cleared if the clearing of	<p>The area to be cleared is not likely to be at variance with this principle:</p> <ul style="list-style-type: none"> the Calingiri-Goomalling Road is an existing road constructed over or near to several inter-linked water courses, with widening unlikely to result in a significant increase in impact to water quality

Clearing Principle		Comment
the vegetation is likely to cause deterioration in the quality of surface or underground water.		
J	Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence of flooding.	The area to be cleared is an extension of the area cleared when the road was originally constructed, with the management of flooding considered during that process

6.0 References

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Appendix 1: NatureMap Report (20 km buffer)

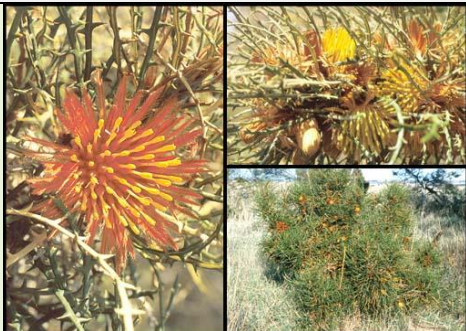


Appendix 2: Protected Matters Search Tool Report



Appendix 3: Potential Conservation Significant Flora


Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
 <p><i>Acacia ataxiphylla</i> subsp. <i>magna</i> Photos: J.M. Collins</p>	Large-fruited Tammin Wattle	Spreading to ascending shrub, 0.3-0.6 m high. Fl. yellow	Jun to Jul	Sandy soils. Lateritic ironstone rises, flats	EN/T	Y	Soils may be suitable
 <p><i>Acacia campylophylla</i> Photo: S.D. Hopper</p>		Dense, rigid, spreading shrub, 0.1-0.6 m high. Fl. yellow	Jul to Aug	Lateritic gravelly soils	P3	Y	Soils may be suitable, recorded in local area


Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
 <p><i>Acacia cochlocarpa</i> subsp. <i>cochlocarpa</i> Photos: B.R. Maslin & D. Papenfus</p>	Spiral fruited wattle	Glabrous, sprawling shrub, 0.3-0.7(-1.5) m high. Fl. yellow.		Clayey, sandy, often gravelly soils.	T	Y	Soils may be suitable
 <p><i>Acacia cochlocarpa</i> subsp. <i>velutinos</i> Photos: S.J. Patrick</p>	Velvety Spiral Pod Wattle	Velutinous, sprawling shrub, 0.3-0.7(-1.5) m high. Fl. yellow.		Sandy clay or laterite.	CR/T	Y	Soils may be suitable




Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
 <p><i>Acacia trinalis</i></p>		Dense, rounded, bushy shrub or tree, 1.5-4 m high. Fl. yellow	Sep	Brown sand, clay loam. Salt lakes & flats, swampy areas	P1	Y	Soils suitable, recorded in local area previously
 <p><i>Acacia vassalii</i></p> <p>Photos: P. Roberts & R. Evans</p>	Vassal's Wattle	Semi-prostrate, spreading, rounded shrub, 0.15-0.3 m high. Fl. yellow	Jun to Jul	Grey/brown or yellow sand, sandy loam.	T	Y	Soils may be suitable




Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
 <p><i>Banksia horrida</i> Photos: M. Pieroni</p>	Prickly Dryandra	Upright, lignotuberous shrub, 0.6-1.6 m high. Fl. yellow-orange	Apr to Jun or Aug	Sand, sometimes with gravel	P3	Y	Soils may be suitable
 <p><i>Caladenia drakeoides</i> Photos: I & M Greeve, A.P. Brown & S.D. Hopper</p>	Hinged Dragon Orchid	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. green	Sep to Oct.	Grey clayey sand, red sandy loam, in damp situations. Margins of salt lakes	EN/T	Y	Drainage line in area, soils may be suitable
 <p><i>Caladenia huegelii</i> Photos: I. & M. Greeve & J.L. Robson</p>	Grand Spider Orchid	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red	Sep to Oct	Grey or brown sand, clay loam	EN/T	Y	Soils may be suitable



Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
 <p><i>Chorizema humile</i> Photos: A. Doley & D. Papenfus</p>	Prostrate Flame Pea	Sprawling, prostrate or decumbent shrub. Fl. yellow & red/brown	Jul to Sep	Sandy clay or loam. Plains	EN/T	Y	Soils may be suitable, occurs in adjacent LGA
 <p><i>Conospermum eatoniae</i> Photo: C. Chapman</p>		Spreading, intricately branched shrub, 0.3-1 m high. Fl. blue	Aug to Oct	Deep white sand, sandy clay loam	P3	Y	Soils may be suitable
	<i>Conostylis caricina</i> subsp. <i>elachys</i>	Rhizomatous, tufted perennial, grass-like or herb, 0.05-0.1 m high. Fl. cream-yellow	Jul to Aug	Gravel, clayey loam, sand	P1	Y	Soils may be suitable
	<i>Cryptandra beverleyensis</i>	Shrub, 0.4-1.3 m high, branchlets not spinescent		Clay soils with sand, laterite gravel.	P3	Y	Soils may be suitable


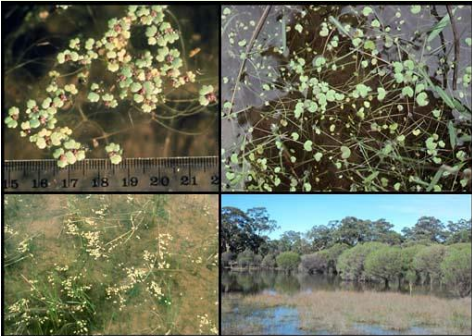
Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
				Undulating landscape, plains			
<i>Dasymalla axillaris</i>	Native Foxglove	low, diffuse shrub that can grow to 0.3 m high. The flowers are red to yellowish-scarlet, vivid in appearance	July to December	Sandy soils	CR	N	Occurs in the Morawa, app 275 km north
 <p><i>Daviesia dielsii</i></p> <p><small>Photos: S.D. Hopper, A. Doley & J.A. Cochrane</small></p>	Diels Daviesia	Divaricate shrub, 0.5-0.9 m high. Fl. orange & red	Jul	Sandy, often gravelly soils	T	Y	Soils may be suitable



Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
 <p><i>Daviesia euphorbioides</i> Photos: S.D. Hopper</p>	Wongan Cactus	Shrub, 0.4-0.8 m high. Fl. yellow & red	Jul to Sep	Clayey sand, sandy gravel. Flats, sandplains	EN/T	Y	Soils may be suitable, occurs within 50 km of site
	<i>Daviesia nudiflora</i> subsp. <i>drummondii</i>	Bushy shrub, 0.3-1.5 m high. Fl. orange/yellow & red	Jul to Aug	White or grey sand. Undulating low rises	P3	Y	Soils may be suitable
	<i>Eucalyptus macrocarpa</i> x <i>pyriformis</i>	Erect, open mallee tree, 1.2-6m high. Fl. red	Apr or Aug to Oct	Sand, lateritic sandy soils. Hills, rocky ironstone ridges, sandplains	P3	Y	Soils may be suitable
	<i>Eucalyptus recta</i>	Tree, to 15 m high, bark smooth		Sandy laterite	T	Y	Soils may be suitable



Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
 <p><i>Eucalyptus sargentii</i> subsp. <i>onesis</i></p>		Mallee to 6 m tall, smooth greenish grey to coppery bark, green to blue green slightly glossy leaves	Aug- Nov.	Associated with salt lakes and creeks	P3	Y	Soils may be suitable
 <p><i>Frankenia glomerata</i> (jeans_photo)</p>	Cluster Head Frankenia	Prostrate shrub. Fl. pink-white	Nov.	White sand	P4	Y	Soils may be suitable
 <p><i>Gastrolobium appressum</i> Photos: S.J. Patrick</p>	Scale-leaf Poison	Erect shrub, to 0.3 m high. Fl. yellow, orange, red, purple.	Aug to Dec	White/yellow sand with quartz gravel. Sandplains, low rises.	T	Y	Soils may be suitable





Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
 <p><i>Gastrolobium hamulosum</i> Photos: J.A. Cochrane, A.D. Crawford & S.D. Hopper</p>	Hook-point Poison	Low shrub, 0.2-0.45 m high. Fl. Yellow & orange & red & purple	Aug to Oct	Sandy, often gravelly soils or clay. Flats, slopes, ridges	EN/T	N	Distribution further north (> 75 km)
 <p><i>Grevillea christineae</i> Photos: S.F. Patrick</p>	Christine's Grevillea	Erect, wiry shrub, 0.5-0.6 m high. Fl. white-cream	Aug to Sep.	Clay loam, sandy clay, often moist	EN/T	Y	Soils may be suitable, recorded in local area
 <p><i>Grevillea dryandroides</i> subsp. <i>hirsuta</i> Photos: A.P. Brown, S. Harper & S.J. Patrick</p>	Hairy Phalanx Grevillea	Prostrate, vigorously suckering shrub, 0.05-0.3 m high. Fl. red/pink-red	May or Sep to Nov	White or yellow sand, laterite	EN/T	Y	Within area of extent, can exist in roadsides


Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
<i>Grevillea roycei</i>		Erect to spreading shrub, 1.2-2.1 m high. Fl. white	Aug to Oct	White or yellow sand	P3	Y	Previously recorded in local area
 <i>Grevillea</i> sp. Trayning (W. Johnston WJ017)		Compact shrub, to 1 m high (to 1m wide). Fl. green/cream	Dec	White sandy clay. Plains, disturbed road verges.	P1	Y	Site location is a road reserve, with parts being disturbed.
<i>Guichenotia impudica</i>		Shrub, 0.25-1 m high. Fl. pink-purple	Aug to Oct	Laterite	P3	Y	Soils may be suitable
 <i>Hemiandra gardneri</i>	Red Snakebush	Prostrate, pungent shrub, 0.1-0.2 m high, to 1 m wide. Fl. red/pink-red	Aug to Oct	Grey or yellow sand, clayey sand. Sandplains.	T	Y	Soil type may be suitable



Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
 <p><i>Hibbertia leptopus</i> (Kevin Thiele)</p>		Erect shrubs to 0.5 m high; Leaves erect to spreading, somewhat fasciculate on short shoots, not petiolate, slightly expanded and stem-clasping at the base, linear to very narrowly obovate, (8–)10–15(–30) mm long; Flowers solitary, axillary	Unknown		P2	Y	Previously recorded in local area
 <p><i>Hydrocotyle lemnooides</i> Photos: S.D. Hopper & J.L. Robson</p>	Aquatic Pennywort	Aquatic, floating annual, herb. Fl. purple	Aug to Oct.	Swamps.	P4	N	Road doesn't intersect any swamps



Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
 <p><i>Jacksonia debilis</i> Photos: J Chappill</p>		Prostrate shrub. Fl. yellow & red	Sep to Oct.	White or grey clayey sand.	P1	Y	Soil type may be suitable
 <p><i>Jacksonia rubra</i> Photos: M. Griffiths</p>		Tangled dwarf shrub, ca 0.2 m high. Fl. orange.	Oct	Clayey sand	P2	Y	Soil type may be suitable close to Samphire veg type.
<i>Lepidosperma</i> sp. Meckering (R. Davis WW 27-32)					P3	Y	Previously recorded in local area.
<i>Lilaeopsis polyantha</i>		Rhizomatous, perennial, herb, 0.02-0.25(-0.4) m high. Fl. purple/red-brown	Nov.	Sandy mud. Lake margins.	P2	N	Soil type not suitable

Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
<i>Lysiosepalum aromaticum</i>		Thick, bushy shrub, to 0.75 m high, with a peppery scent. Fl. pink-purple	Nov.	Brown loam over granite. Slopes, moist area at foot of outcrops	P2	Y	Occurs in LGA, soils may be suitable
 <i>Lysiosepalum abollatum</i> <small>Photos: J.A. Cochrane</small>	Woolly Lysiosepalum	Dense, erect shrub, to 1.5 m high. Fl. pink-blue-purple	Aug to Sep	Red clay	CR/T	Y	Occurs in adjacent LGA, soils may be suitable
 <i>Melaleuca sciotostyla</i> <small>Photo: P. Brown</small>	Wongan Melaleuca	Spreading shrub, 0.6-1.5 m high	Aug	Orange clayey sand with lateritic pebbles. Scree slopes	EN	Y	Soils may be suitable

Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
  <p><i>Persoonia chapmaniana</i></p>		Erect, spreading shrub, 1-2 m high. Fl. yellow	Sep to Nov.	White sandy clay, yellow sand. Vicinity of salt lakes.	P3	Y	Soil type may be suitable
  <p><i>Philotheca wonganensis</i></p>	Wongan Eriostemon	Erect shrub, 0.3-1 m high. Fl. white & pink	Aug to Oct.	Red sandy soils.	T	N	Soil type not suitable

Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
 <p><i>Roycea pycnophylloides</i> Photos: P. Roberts & L. Sweedman</p>	Saltmat	Perennial, herb, forming densely branched, silvery mats to 1 m wide	Sep	Sandy soils, clay. Saline flats	EN/T	Y	Soils may be suitable
<i>Scaevola tortuosa</i>	Tortuous-stem Scaevola	Ascending perennial, herb, 0.1-0.2m high. Fl. blue/purple/pink	Oct	Margins of Salt Lakes	P1	Y	Some saline areas present
<i>Schoenus capillifolius</i>		Semi-aquatic tufted annual, grass-like or herb (sedge), 0.05 m high. Fl. green	Oct-Nov	Brown mud. Claypans	P3	N	Soil type not suitable

Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
 <p><i>Schoenus natans</i> Photos: G.J. Keighery & J.L. Robson</p>	Floating Bog-rush	Aquatic annual, grass-like or herb (sedge), 0.3 m high. Fl. brown	Oct	Winter-wet depressions	P4	N	Soil type not suitable
<i>Scholtzia halophila</i> subsp. <i>mortlockensis</i>		See paper for Key			P3		No information available
 <p><i>Symonanthus bancroftii</i> Photo: G. Durell</p>		Shrub, 0.15-0.25 m high. Fl. white	Sep.		EN	N	Not recorded in the region

Picture	Common Name	Description	Flowering Period	Habitat Type	Cons Code	Likelihood (Y/N)	Comment
 <p><i>Thomasia tenuivestita</i> Photos: J.A. Cochrane</p>		Shrub, 0.6-2.5 m high. Fl. purple-pink	Jul to Oct.	Granite, loam.	P3	N	Soil type not suitable
 <p><i>Verticordia staminosa</i> subsp. <i>staminosa</i> Photos: S.D. Hopper, E.A. George & B. & B. Wells</p>	Wongan Featherflower	Spreading shrub, 0.15-0.6 m high. Fl. green-yellow/yellow-brown	Jul to Oct	Soil pockets. Granite outcrops	EN	Y	Soils may be suitable

Appendix 4: Conservation Codes

Conservation codes are used to describe the status of species and ecological communities that are no longer common and under threat of extinction. Species and communities can be listed under state legislation and/or commonwealth legislation.

Western Australia

Conservation Code	Name	Description
T	Threatened	Flora and fauna listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the <i>Biodiversity Conservation Act 2016</i> (BC Act).
EX	Extinct species	Flora or fauna Species where “there is no reasonable doubt that the last member of the species has died”, and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).
EW	Extinct in the wild species	Species that “is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form”, and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).
MI	Migratory Species	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).
CD	Species of special conservation interest (conservation dependent fauna)	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).
OS	Specially Protected	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).
<i>Schedule 1 species that are ranked by the DBCA according to their level of threat using IUCN Red List criteria</i>		
CR	Critically endangered	Species facing an extremely high risk of extinction in the wild in the immediate future
EN	Endangered	Species facing a very high risk of extinction in the wild in the near future

Conservation Code	Name	Description
VU	Vulnerable	Species considered to be facing a high risk of extinction in the wild in the medium-term future
<i>Taxa that have not been adequately surveyed for listing under Schedule 1 or 2 of the Wildlife Protection Act are added to the Priority Lists under priorities 1, 2 or 3, according to the priority for further survey and evaluation of their conservation status.</i>		
1	Priority One	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey
2	Priority Two	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
3	Priority Three	Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
4	Priority Four	(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 are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Conservation Code	Name	Description
		Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

(Source: Department of Biodiversity Conservation and Attractions, 2019)

Commonwealth

Category	Description
Critically Endangered	Taxa facing an extremely high risk of extinction in the wild in the immediate future
Endangered	Taxa facing a very high risk of extinction in the wild in the near future
Vulnerable	Taxa facing a high risk of extinction in the wild in the medium term

(Source: Department of the Environment and Energy, 2019)

Appendix 5: Flora Species List

Below is the complete list of flora species recorded during the 2019 Spring survey at the Calingiri-Goomalling Road site; list is sorted by species and * denotes introduced species, with introduced species listed first.

Family	Species Name	Common Name
Fabaceae	* <i>Acacia iteaphylla</i>	Flinders Range Wattle
Poaceae	* <i>Aira cupaniana</i>	Silvery Hairgrass
Asteraceae	* <i>Arctotheca calendula</i>	Capeweed
Poaceae	* <i>Avena barbata</i>	Wild Oat
Brassicaceae	* <i>Brassica tournefortii</i>	Mediterranean Turnip
Brassicaceae	* <i>Brassica x napus</i>	Canola
Poaceae	* <i>Briza maxima</i>	Blowfly Grass
Poaceae	* <i>Bromus driandrus</i>	Great Brome
Poaceae	* <i>Bromus hordaceus</i>	Soft Brome
Poaceae	* <i>Bromus rubens</i>	Red Brome
Fabaceae	* <i>Chamaecytisus palmensis</i>	Tagasaste
Poaceae	* <i>Chloris gayana</i>	Rhodes Grass
Asteraceae	* <i>Conyza sumatrensis</i>	Fleabane
Asteraceae	* <i>Cotula bipinnata</i>	Ferny Cotula
Asteraceae	* <i>Cotula coronopifolia</i>	Water Buttons
Poaceae	* <i>Cynodon dactylon</i>	Couch Grass
Boraginaceae	* <i>Echium plantagineum</i>	Paterson's Curse
Poaceae	* <i>Ehrharta longiflora</i>	Annual Veldt Grass
Poaceae	* <i>Eragrostis curvula</i>	African Lovegrass
Geraniaceae	* <i>Erodium botrys</i>	Long Storksbill
Myrtaceae	* <i>Eucalyptus camaldulensis</i> subsp. <i>camaldulensis</i>	Murray Red gum
Myrtaceae	* <i>Eucalyptus leucoxylon</i> subsp. <i>megalocarpa</i>	Large-fruited yellow or Blue Gum
Poaceae	* <i>Hordeum leporinum</i>	Barley Grass
Asteraceae	* <i>Hypochaeris radicata</i>	Flatweed
Juncaceae	* <i>Juncus acutus</i>	Spiny Rush
Plumbaginaceae	* <i>Limonium sinuatum</i>	Perennial Sea Lavender
Poaceae	* <i>Lolium rigidum</i>	Rye grass
Fabaceae	* <i>Lupinus cosentinii</i>	
Fabaceae	* <i>Medicago polymorpha</i>	Burr Medic
Aizoaceae	* <i>Mesembryanthemum crystallinum</i>	Iceplant
Aizoaceae	* <i>Mesembryanthemum nodiflorum</i>	
Asteraceae	* <i>Monoculus monstrosus</i>	Stinking Roger
Iridaceae	* <i>Moraea lewisiae</i>	
Iridaceae	* <i>Moraea setifolia</i>	
Fabaceae	* <i>Ornithopus compressus</i>	Yellow Serradella
Oxalidaceae	* <i>Oxalis pes-caprae</i>	Soursob
Pinaceae	* <i>Pinus radiata</i>	Radiata Pine
Plantaginaceae	* <i>Plantago coronopus</i> subsp. <i>commutata</i>	
Brassicaceae	* <i>Raphanus raphanistrum</i>	Wild Radish

Family	Species Name	Common Name
Iridaceae	<i>*Romulea rosea</i>	Guilford Grass
Caryophyllaceae	<i>*Sagina apetala</i>	Annual Pearlwort
Brassicaceae	<i>*Sisymbrium orientale</i>	Indian Hedge Mustard
Solanaceae	<i>*Solanum nigrum</i>	Blackberry Nightshade
Solanaceae	<i>*Sonchus asper</i>	Rough Sowthistle
Asteraceae	<i>*Sonchus oleraceus</i>	Common Sowthistle
Fabaceae	<i>*Trifolium resupinatum</i>	Shaftal Clover
Fabaceae	<i>*Trifolium tomentosum</i>	Woolly Clover
Asteraceae	<i>*Ursinia anthemoides</i>	Ursinia
Poaceae	<i>*Vulpia bromoides</i>	Squirrel Tail Fescue
Poaceae	<i>*Vulpia myuros</i>	Rat's Tail Fescue
Campanulaceae	<i>*Wahlenbergia capensis</i>	Cape Bluebell
Scrophulariaceae	<i>*Zaluzianskya divaricata</i>	Spreading Night Phlox
Fabaceae	<i>Acacia acutaria</i>	
Fabaceae	<i>Acacia acuminata</i>	Jam Wattle
Fabaceae	<i>Acacia aestivalis</i>	
Fabaceae	<i>Acacia ericksoniae</i>	
Fabaceae	<i>Acacia erinacea</i>	Prickly Wattle
Fabaceae	<i>Acacia jennerae</i>	
Fabaceae	<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	
Fabaceae	<i>Acacia microbotrya</i> subsp. <i>microbotrya</i>	Manna Wattle
Fabaceae	<i>Acacia moirii</i> subsp. <i>recurristipula</i>	
Fabaceae	<i>Acacia multispicata</i>	Spiked Wattle
Fabaceae	<i>Acacia restiacea</i>	
Fabaceae	<i>Acacia saligna</i>	Orange Wattle
Fabaceae	<i>Acacia sulcata</i> var. <i>platyphylla</i>	
Fabaceae	<i>Acacia lineolata</i> subsp. <i>lineolata</i>	
Casuarinaceae	<i>Allocasuarina campestris</i>	
Casuarinaceae	<i>Allocasuarina huegeliana</i>	Rock Sheoak
Loranthaceae	<i>Amyema preissii</i>	Wireleaf Mistletoe
Asparagaceae	<i>Arthropodium dyer</i>	
Ericaceae	<i>Astroloma serratifolium</i>	Kondrung
Chenopodiaceae	<i>Atriplex exilifolia</i>	
Chenopodiaceae	<i>Atriplex hymenotheca</i>	
Chenopodiaceae	<i>Atriplex semibaccata</i>	Berry Saltbush
Chenopodiaceae	<i>Atriplex semilunaris</i>	
Poaceae	<i>Austrostipa elegantissima</i>	
Poaceae	<i>Austrostipa tenuifolia</i>	
Proteaceae	<i>Banksia fraseri</i>	
Hemerocallidaceae	<i>Caesia occidentalis</i>	
Montiaceae	<i>Calandrinia eremaea</i>	Twining Purslane
Cupressaceae	<i>Callitris arenaria</i>	Sandplain Cypress
Lauraceae	<i>Cassytha glabella</i>	Tangled Dodder Laurel

Family	Species Name	Common Name
Poaceae	<i>Chloris gayana</i>	Rhodes Grass
Ranunculaceae	<i>Clematis delicata</i>	
Polygalaceae	<i>Comesperma integerrimum</i>	
Haemodoraceae	<i>Conostylis androstemma</i>	Trumpets
Convolvulaceae	<i>Convolvulus remotus</i>	
Hemerocallidaceae	<i>Corynotheca micrantha</i>	Sand Lily
Asteraceae	<i>Cotula coronopifolia</i>	Waterbuttons
Asteraceae	<i>Cotula cotuloides</i>	Smooth Cotula
Crassulaceae	<i>Crassula colorata</i> var. <i>colorata</i>	
Crassulaceae	<i>Crassula decumbens</i> var. <i>decumbens</i>	
Rhamnaceae	<i>Cryptandra nutans</i>	
Goodeniaceae	<i>Dampiera lavandulacea</i>	
Goodeniaceae	<i>Dampiera tenuicaulis</i> var. <i>tenuicaulis</i>	
Fabaceae	<i>Daviesia brachyphylla</i>	
Fabaceae	<i>Daviesia divaricata</i> subsp. <i>divaricata</i>	
Fabaceae	<i>Daviesia triflora</i>	
Fabaceae	<i>Daviesia hakeoides</i> subsp. <i>subnuda</i>	
Restionaceae	<i>Desmocladus asper</i>	
Hemerocallidaceae	<i>Dianella revoluta</i>	Blueberry Lily
Chenopodiaceae	<i>Didymanthus roei</i>	
Orchidaceae	<i>Diuris hazeliae</i>	Donkey Orchid
Chenopodiaceae	<i>Enchylaena lanata</i>	
Chenopodiaceae	<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	Barrier Saltbush
Poaceae	<i>Eragrostis dielsii</i>	Mallee Lovegrass
Scrophulariaceae	<i>Eremophila lehmanniana</i>	
Scrophulariaceae	<i>Eremophila decipiens</i> subsp. <i>decipiens</i>	
Myrtaceae	<i>Eucalyptus astringens</i> subsp. <i>astringens</i>	Brown Mallee
Myrtaceae	<i>Eucalyptus camaldulensis</i> subsp. <i>arida</i>	River Red Gum
Myrtaceae	<i>Eucalyptus camaldulensis</i>	Red River Gum
Myrtaceae	<i>Eucalyptus capillosa</i>	Wheatbelt Wandoo
Myrtaceae	<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	York Gum
Myrtaceae	<i>Eucalyptus myriadena</i>	
Myrtaceae	<i>Eucalyptus obtusiflora</i>	Dongara Mallee
Myrtaceae	<i>Eucalyptus rudis</i>	Flooded Gum
Myrtaceae	<i>Eucalyptus salmonophloia</i>	Salmon Gum
Myrtaceae	<i>Eucalyptus sargentii</i> subsp. <i>onesis</i>	Mallee Salt Gum
Myrtaceae	<i>Eucalyptus sporadica</i>	Burngup Mallee
Myrtaceae	<i>Eucalyptus stricklandii</i>	Strickland's Gum
Myrtaceae	<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	Wandoo
Santalaceae	<i>Exocarpos aphyllus</i>	Leafless Ballart
Frankeniaceae	<i>Frankenia</i> sp.	
Fabaceae	<i>Gastrolobium asperum</i>	
Fabaceae	<i>Gastrolobium obovatum</i>	Boat-leaved Posion

Family	Species Name	Common Name
Fabaceae	<i>Gastrolobium spinosum</i>	Prickly Poison
Haloragaceae	<i>Glischrocaryon aureum</i>	Common Popflower
Haloragaceae	<i>Gonocarpus nodulosus</i>	
Goodeniaceae	<i>Goodenia drummondii</i> subsp. <i>Drummondii</i>	
Proteaceae	<i>Grevillea eriostachya</i>	Yellow Flame Grevillea
Proteaceae	<i>Grevillea huegelii</i>	Comb Grevillea
Proteaceae	<i>Grevillea paniculata</i>	Vanilla-scented Grevillea
Proteaceae	<i>Hakea marginata</i>	
Proteaceae	<i>Hakea scoparia</i> subsp. <i>scoparia</i>	
Dilleniaceae	<i>Hibbertia hypericoides</i>	Yellow Buttercups
Dilleniaceae	<i>Hibbertia exasperata</i>	
Asteraceae	<i>Hyalochlamys globifera</i>	
Araliaceae	<i>Hydrocotyle pilifera</i>	
Fabaceae	<i>Jacksonia foliosa</i>	
Asteraceae	<i>Lawrencella rosea</i>	
Cyperaceae	<i>Lepidosperma pubisquameum</i>	
Cyperaceae	<i>Lepidosperma squamatum</i>	
Cyperaceae	<i>Lepidosperma tenue</i>	
Myrtaceae	<i>Leptospermum erubescens</i>	Roadside Teatree
Asparagaceae	<i>Lomandra effusa</i>	Scented Matrush
Chenopodiaceae	<i>Maireana brevifolia</i>	Small Leaf Bluebush
Chenopodiaceae	<i>Maireana enchylaenoides</i>	
Chenopodiaceae	<i>Maireana marginata</i>	
Myrtaceae	<i>Melaleuca concreta</i>	
Myrtaceae	<i>Melaleuca hamata</i>	
Myrtaceae	<i>Melaleuca haplantha</i>	
Myrtaceae	<i>Melaleuca lateriflora</i>	Gorada
Myrtaceae	<i>Melaleuca marginata</i>	
Myrtaceae	<i>Melaleuca radula</i>	Graceful Honeymyrtle
Myrtaceae	<i>Melaleuca scalena</i>	
Myrtaceae	<i>Melaleuca thyoides</i>	
Myrtaceae	<i>Melaleuca viminalis</i>	
Myrtaceae	<i>Melaleuca viminea</i>	Mohan
Myrtaceae	<i>Melaleuca halmaturorum</i>	
Cyperaceae	<i>Mesomelaena stygia</i>	
Asteraceae	<i>Millotia tenuifolia</i>	Soft Millotia
Polygalaceae	<i>Muehlenbeckia adpressa</i>	Climbing Lignum
Poaceae	<i>Neurachne alopecuroidea</i>	Foxtail Mulga Grass
Asteraceae	<i>Olearia sp Eremicola</i>	
Rubiaceae	<i>Opercularia vaginata</i>	Dog Weed
Loganiaceae	<i>Phyllangium sulcatum</i>	Rock Mitrewort
Asteraceae	<i>Podolepis capillaris</i>	Wiry Podolepis
Asteraceae	<i>Podolepis lessonii</i>	

Family	Species Name	Common Name
Asteraceae	<i>Podotheca gnaphalioides</i>	Golden Long-heads
Asteraceae	<i>Pogonolepis stricta</i>	Stiff Angianthus
Amaranthaceae	<i>Ptilotus divaricatus</i>	Climbing Mulla Mulla
Amaranthaceae	<i>Ptilotus polystachyus</i>	Prince of Wales Feather
Chenopodiaceae	<i>Rhagodia drummondii</i>	
Chenopodiaceae	<i>Rhagodia preissii</i>	
Chenopodiaceae	<i>Rhagodia preissii</i> subsp. <i>preissii</i>	
Asteraceae	<i>Rhodanthe citrina</i>	
Poaceae	<i>Rytidosperma acerosum</i>	
Santalaceae	<i>Santalum spicatum</i>	Sandalwood
Myrtaceae	<i>Scholtzia drummondii</i>	
Myrtaceae	<i>Scholtzia involucrata</i>	Spiked Scholtzia
Fabaceae	<i>Senna artemisioides</i> subsp. <i>filifolia</i>	
Malvaceae	<i>Seringia integrifolia</i>	Common Firebush
Rhamnaceae	<i>Stenanthemum notiale</i>	
Surianaceae	<i>Stylobasium australe</i>	
Chenopodiaceae	<i>Tecticornia indica</i>	
Chenopodiaceae	<i>Tecticornia pergranulata</i> subsp. <i>divaricata</i>	
Fabaceae	<i>Templetonia smithiana</i>	
Asparagaceae	<i>Thysanotus manglesianus</i>	Fringed Lily
Asparagaceae	<i>Thysanotus thyrsoides</i>	
Asparagaceae	<i>Thysanotus patersonii</i>	Twining Fringed Lily
Araliaceae	<i>Trachymene cyanopetala</i>	
Araliaceae	<i>Trachymene ornata</i>	Spongefruit
Hemerocallidaceae	<i>Tricoryne elatior</i>	Yellow Autumn Lily
Juncaginaceae	<i>Triglochin calcitrapa</i>	
Rhamnaceae	<i>Trymalium ledifolium</i> var. <i>rosmarinifolium</i>	
Myrtaceae	<i>Verticordia acerosa</i> var. <i>preissii</i>	
Apocynaceae	<i>Vincetoxicum lineare</i>	Bush Bean
Campanulaceae	<i>Wahlenbergia gracilentia</i>	Annual Bluebell
Asteraceae	<i>Waitzia acuminata</i> var. <i>acuminata</i>	

Appendix 6: Quadrat Data

*Locations are found in Figure 6.

Quadrat Number: 1
Survey Date: 20/09/2019
Personnel: HT, ABS
Latitude: -31.2873
Longitude: 116.8246
Location: Calingiri-Goomalling Road
Topography: Upper slope
Aspect: North north west
Slope: 1-3%
Soil: Red/Brown silty sandy clay
Rock: 0%
Leaf Litter: 2%
Bare Ground: 1%
Drainage: Well drained
Condition: Very Good



Notes: Eucalyptus Woodland

Native Species	Cover (%)	Height (m)	Native Species	Cover (%)	Height (m)
<i>Acacia acuminata</i>	40	5	<i>Wahlenbergia gracilentia</i>	0.1	0.1
<i>Austrostipa elegantissima</i>	1	0.5	<i>Waitzia acuminata</i> var. <i>acuminata</i>	7	0.1
<i>Austrostipa tenuifolia</i>	0.5	0.2	<i>Vincetoxicum lineare</i>	0.5	0.5
<i>Calandrinia eremaea</i>	0.1	0.1	Invasive Species	Cover (%)	Height (m)
<i>Diuris hazeliae</i>	0.5	0.2	* <i>Aira cupaniana</i>	2	0.1
<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>	0.5	0.1	* <i>Arctotheca calendula</i>	0.5	0.1
<i>Eucalyptus myriadena</i>	10	14	* <i>Avena barbata</i>	0.1	0.5
<i>Gonocarpus nodulosus</i>	0.1	0.1	* <i>Briza maxima</i>	7	0.2
<i>Grevillea paniculata</i>	4	1	* <i>Bromus rubens</i>	0.5	0.2
<i>Hydrocotyle pilifera</i>	0.1	0.1	* <i>Cotula bipinnata</i>	0.1	0.1
<i>Millotia tenuifolia</i>	0.5	0.1	* <i>Erodium botrys</i>	0.5	0.1
<i>Phyllangium sulcatum</i>	0.1	0.1	* <i>Hypochaeris radicata</i>	5	0.2
<i>Podolepis lessonii</i>	2	0.1	* <i>Lupinus cosentinii</i>	0.1	0.2
<i>Rytidosperma acerosum</i>	20	0.1	* <i>Monoculus monstrosus</i>	0.1	0.2
<i>Thysanotus patersonii</i>	0.1	0.5	* <i>Moraea lewisiae</i>	0.5	0.1
<i>Trachymene cyanopetala</i>	3	0.1	* <i>Moraea setifolia</i>	0.1	0.1
<i>Trachymene ornata</i>	2	0.1	* <i>Oxalis pes-caprae</i>	0.1	0.1
<i>Tricoryne elatior</i>	0.5	0.2	* <i>Ursinia anthemoides</i>	0.1	0.2

Quadrat Number: 2
Survey Date: 20/09/2019
Personnel: HT, ABS
Latitude: -31.248183
Longitude: 116.771746
Location: Calingiri-Goomalling Road
Topography: Basin
Aspect: Flat
Slope: 0%
Soil: Brown silty clay
Rock: 0%
Leaf Litter: 0%
Bare Ground: 0%
Drainage: Poorly drained
Condition: Good



Note: Samphire Open Low Heath

Native Species	Cover (%)	Height (m)	Invasive Species	Cover (%)	Height (m)
<i>Cotula cotuloides</i>	2	0.1	* <i>Arctotheca calendula</i>	0.5	0.1
<i>Eragrostis dielsii</i>	0.5	0.1	* <i>Bromus driandrus</i>	0.1	0.2
<i>Eucalyptus obtusiflora</i>	1	2	* <i>Bromus rubens</i>	15	0.2
<i>Maireana brevifolia</i>	2	1	* <i>Lolium rigidum</i>	1	0.2
<i>Stylobasium australe</i>	0.5	0.3	* <i>Medicago polymorpha</i>	3	0.1
<i>Tecticornia indica</i>	15	0.5	* <i>Mesembryanthemum nodiflorum</i>	5	0.1
			* <i>Plantago coronopus</i> subsp. <i>commutata</i>	0.1	0.1
			* <i>Trifolium tomentosum</i>	0.1	0.1

Quadrat Number: 3
Survey Date: 20/09/2019
Personnel: HT, ABS
Latitude: -31.21660
Longitude: 116.72399
Location: Calingiri-Goomalling Road
Topography: Basin
Aspect: East
Slope: 0%
Soil: Light grey silty sandy clay
Rock: 0%
Leaf Litter: 0%
Bare Ground: 40%
Drainage: Poorly drained
Condition: Very Good



Note: Samphire Open Low Heath

Native Species	Cover (%)	Height (m)	Invasive Species	Cover (%)	Height (m)
<i>Atriplex hymenotheca</i>	1	0.3	* <i>Arctotheca calendula</i>	0.1	0.1
<i>Crassula colorata</i> var. <i>colorata</i>	0.5	0.1	* <i>Bromus hordaceus</i>	0.5	0.2
<i>Frankenia</i> sp	0.5	0.5	* <i>Cotula coronopifolia</i>	5	0.1
<i>Hyalochlamys globifera</i>		0.1	* <i>Lolium rigidum</i>	1	0.2
<i>Pogonolepis stricta</i>	5	0.1	* <i>Monoculus monstrosus</i>	0.1	0.2
<i>Tecticornia indica</i>	20	0.5	* <i>Plantago coronopus</i> subsp. <i>commutata</i>	0.1	0.1
<i>Tecticornia pergranulata</i> subsp. <i>divaricata</i>	10	1	* <i>Romulea rosea</i>	1	0.1
<i>Triglochin calcitrapa</i>	0.1	0.1	* <i>Trifolium tomentosum</i>	0.5	0.1

Quadrat Number: 4
Survey Date: 20/09/2019
Personnel: HT, ABS
Latitude: -31.140878
Longitude: 116.617756
Location: Calingiri-Goomalling Road
Topography: Mid slope
Aspect: West
Slope: 1-3%
Soil: Light brown silty sand
Rock: 0%
Leaf Litter: 4%
Bare Ground: 1%
Drainage: Well drained
Condition: Very Good



Note: Eucalyptus Woodland

Native Species	Cover (%)	Height (m)	Native Species	Cover (%)	Height (m)
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>	1.5	1	<i>Opercularia vaginata</i>	1	0.2
<i>Acacia sulcata</i> var. <i>platyphylla</i>	1	1	<i>Rhagodia drummondii</i>	4	0.8
<i>Allocasuarina campestris</i>	25	2	<i>Rhagodia preissii</i>	2	1
<i>Astroloma serratifolium</i>	0.5	0.5	<i>Santalum spicatum</i>	10	3
<i>Austrostipa elegantissima</i>	25	0.5	<i>Scholtzia drummondii</i>	1	1
<i>Austrostipa tenuifolia</i>	2	0.2	Invasive Species	Cover (%)	Height (m)
<i>Caesia occidentalis</i>	0.1	0.3	<i>*Arctotheca calendula</i>	0.5	0.1
<i>Dampiera lavandulacea</i>	1.5	0.2	<i>*Bromus rubens</i>	5	0.2
<i>Desmodcladus asper</i>	1	0.2	<i>*Ehrharta longiflora</i>	10	1
<i>Dianella revoluta</i>	10	0.8	<i>*Eragrostis curvula</i>	3	0.8
<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>	10	20	<i>*Hordeum leporinum</i>	0.5	0.2
<i>Hakea scoparia</i> subsp. <i>scoparia</i>	5	2.5	<i>*Monoculus monstrosus</i>	0.5	0.2
<i>Lepidosperma tenue</i>	0.1	0.4	<i>*Moraea setifolia</i>	0.5	0.2
<i>Lomandra effusa</i>	4	0.2	<i>*Ornithopus compressus</i>	0.1	0.1
<i>Melaleuca concreta</i>	1.5	1	<i>*Raphanus raphanistrum</i>	0.1	0.5
<i>Melaleuca hamata</i>	1.5	2	<i>*Trifolium tomentosum</i>	0.5	0.1
<i>Melaleuca marginata</i>	5	1			

Quadrat Number: 5
Survey Date: 20/09/2019
Personnel: HT, ABS
Latitude: -31.151620
Longitude: 116.633480
Location: Calingiri-Goomalling Road
Topography: Lower slope
Aspect: South
Slope: 1-3%
Soil: Light brown silty sand
Rock: 0%
Leaf Litter: 5% 2 cm
Bare Ground: 0%
Drainage: Well drained
Condition: Very Good



Note: Eucalyptus Woodland

Native Species	Cover (%)	Height (m)	Invasive Species	Cover (%)	Height (m)
<i>Austrostipa elegantissima</i>	3	0.5	* <i>Aira cupaniana</i>	0.1	0.1
<i>Austrostipa tenuifolia</i>	1	0.3	* <i>Arctotheca calendula</i>	1	0.1
<i>Calandrinia eremaea</i>	0.1	0.1	* <i>Bromus rubens</i>	0.5	0.2
<i>Comesperma integerrimum</i>	0.5	0.3	* <i>Cotula coronopifolia</i>	0.1	0.1
<i>Dianella revoluta</i>	0.5	0.5	* <i>Ehrharta longiflora</i>	20	1
<i>Enchylaena lanata</i>	0.1	0.2	* <i>Hypochaeris radicata</i>	0.1	0.2
<i>Eucalyptus sargentii</i> subsp. <i>onesis</i>	20	4	* <i>Lolium rigidum</i>	0.1	0.3
<i>Eucalyptus sporadica</i>	10	4	* <i>Mesembryanthemum crystallinum</i>	0.5	0.1
<i>Melaleuca haplantha</i>	7	2	* <i>Monoculus monstrosus</i>	0.1	0.2
<i>Melaleuca marginata</i>	4	1.6			
<i>Melaleuca scalena</i>	10	2.2			
<i>Santalum spicatum</i>	2	1.5			
<i>Thysanotus manglesianus</i>	0.1	0.6			
<i>Trachymene cyanopetala</i>	0.5	0.1			

Quadrat Number: 6
Survey Date: 26/09/2019
Personnel: HT, ABS
Latitude: -31.179708
Longitude: 116.664392
Location: Calingiri-Goomalling Road
Topography: Drainage line
Aspect: North
Slope: Flat
Soil: Brown sandy clay
Rock: 0%
Leaf Litter: 0%
Bare Ground: 6%
Drainage: Poorly drained
Condition: Degraded



Note: Samphire Open Low Heath

Native Species	Cover (%)	Height (m)	Invasive Species	Cover (%)	Height (m)
<i>Atriplex semilunaris</i>	0.5		* <i>Hordeum leporinum</i>	3	
<i>Maireana brevifolia</i>	10		* <i>Hypochaeris radicata</i>	0.5	
<i>Rhagodia drummondii</i>	0.1		* <i>Juncus acutus</i>	4	1
<i>Tecticornia indica</i>	8		* <i>Lolium rigidum</i>	20	
Invasive Species	Cover (%)	Height (m)	* <i>Mesembryanthemum nodiflorum</i>	0.1	
* <i>Arctotheca calendula</i>	1		* <i>Monoculus monstrosus</i>	0.1	
* <i>Avena barbata</i>	1		* <i>Moraea setifolia</i>	0.1	
* <i>Cotula bipinnata</i>	0.5		* <i>Ornithopus compressus</i>	0.1	
* <i>Cynodon dactylon</i>	4		* <i>Sagina apetala</i>	0.1	
* <i>Ehrharta longiflora</i>	7.5		* <i>Trifolium resupinatum</i>	0.5	
* <i>Eragrostis curvula</i>	1		* <i>Trifolium tomentosum</i>	0.1	