# CBH Moora expansion: Flora, vegetation and fauna survey

## CBH Group

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Template 2.8.1

# Contents

## List of Figures



## List of Tables

# Abbreviations

| Abbreviation | Description |
|---|---|
| BAM Act | State *Biosecurity and Agriculture Management Act 2007* |
| BC Act | State *Biodiversity Conservation Act 2016* |
| BoM | Bureau of Meteorology |
| CLUSTER | Hierarchical Clustering |
| CR | Critically Endangered |
| DAFWA | Department of Agriculture and Food Western Australia |
| DAWE | Department of Agriculture, Water and the Environment |
| DBCA | Department of Biodiversity, Conservation and Attractions |
| DBH | Diameter at Breast Height |
| DPIRD | Department of Primary Industries and Regional Development |
| ELA | Eco Logical Australia |
| EN | Endangered |
| EP Act | State *Environmental Protection Act 1986* |
| EPA | Environmental Protection Authority |
| EPBC Act | Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* |
| ESA | Environmentally Sensitive Area |
| ha | hectare |
| IBRA | Interim-Biogeographic Regionalisation for Australia |
| M | Migratory |
| mm | millimetres |
| NVIS | National Vegetation Information System |
| P | Priority |
| PEC | Priority Ecological Community |
| PMST | Protected Matters Search Tool |
| PRIMER | Plymouth Routines in Multivariate Ecological Research v6 |
| SEWPaC | Department of Sustainability, Environment, Water, Population and Communities |
| SIMPER | Similarity Percentage |
| T | Threatened |
| TEC | Threatened Ecological Community |
| VU | Vulnerable |
| WA | Western Australia |
| WAH | Western Australian Herbarium |
| WoNS | Weeds of National Significance |
| Wheatbelt Woodlands TEC | Eucalypt Woodlands of the Western Australian Wheatbelt Threatened Ecological Community |

# Executive Summary

Eco Logical Australia was engaged by CBH Group to conduct flora, vegetation and fauna surveys within a portion of road and rail reserves adjacent to the Moora CBH Depot. CBH is conducting a pre-feasibility study to upgrade the existing rail facilities at its Moora Depot for the Moora Rail Outloading Project (the project). Under the project, potential impacts include the clearance of extant native vegetation within the rail reserve. The project is located approximately 3 kilometres south from the Moora town site, in Western Australia.

ELA undertook an initial survey involving a Reconnaissance and Targeted flora and vegetation survey, Basic fauna survey and Targeted black cockatoo habitat assessment in June 2020 (ELA 2020). Based on these results, the survey area was modified to avoid an identified population of *Eremophila scaberula* (Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* [EPBC Act] and Critically Endangered under the State *Biodiversity Conservation Act 2016* [BC Act]). ELA subsequently undertook a Detailed and Targeted flora and vegetation survey, Basic fauna survey and Targeted black cockatoo habitat assessment within the modified survey area (the survey area) in September 2020 (22.02 ha).

The Detailed and Targeted flora and vegetation survey was undertaken in accordance with the Environmental Protection Authority (EPA) *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (2016). Vegetation communities were described through the establishment of nine 10 x 10 metre quadrats.

A total of 110 flora species were recorded within the survey area from both quadrats and opportunistic collections, including 84 native and 26 introduced (weed) species. One conservation significant species, *Eremophila glabra* subsp. *chlorella* (Endangered under the BC Act) was recorded within the survey area, from one population of seven individuals. Of the 98 conservation listed flora species identified as possibly occurring within the survey area, 30 were considered as having the potential to occur based on availability of suitable habitat and proximity to previous records. No Declared Pests under the *Biosecurity and Agriculture Management Act 2007* or Weeds of National Significance were recorded in the survey area.

Three vegetation communities were mapped across the survey area, covering a total area of 9.4 ha (42.69%). The remainder of the survey area comprises cleared areas (12.26 ha; 55.67%) and planted treeline (0.35 ha; 1.64%). Two of the three vegetation communities described within the survey area (EslW and EwW) are considered to represent the Eucalypt woodlands of the Western Australian Wheatbelt Threatened Ecological Community (TEC) (and subsequently, the associated State listed Priority Ecological Community [PEC]).

Vegetation within the survey area ranged from Excellent to Completely Degraded condition, with majority of vegetation classed as being in Completely Degraded condition (11.59 ha; 52.63% of the survey area).

The Basic fauna survey and Targeted black cockatoo habitat assessment was undertaken in accordance with the EPA *Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact*

*assessment* (2020) and the *EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species* (SEWPaC 2012).

A total of 21 vertebrate fauna species were recorded within the survey area, comprising 17 birds, three mammals and one reptile. One conservation significant fauna species, *Calyptorhynchus latirostris* (Carnaby's Cockatoo) listed as Endangered under the Commonwealth EPBC Act and the State BC Act was directly observed within the survey area. Five other conservation significant species were considered as having the potential to occur within the survey area, based on the availability of suitable habitat and close proximity of recent records.

One fauna habitat was recorded within the survey area: Open Salmon Gum, Wandoo, York Gum woodland over open shrubland and grassland on clay loam (9.4 ha; 42.69%). The remainder of the survey area comprises cleared areas (12.26 ha; 55.68%) and planted treeline (0.35 ha; 1.64%).

The black cockatoo breeding habitat assessment identified 186 potentially suitable breeding trees within the survey area (by diameter at breast height [DBH]). Of these, 15 contained potentially suitable hollows over 100 mm in diameter. Remnant native vegetation within the survey area, comprising 9.40 ha is considered as providing 'Poor' quality foraging habitat for all three black cockatoo species due to a lack of density of suitable or preferred foraging species (SEWPaC 2012).

# 1. Introduction

## 1.1 Project background

Eco Logical Australia (ELA) was engaged by CBH Group (CBH) to conduct flora, vegetation and fauna surveys within a portion of road and rail reserves adjacent to the Moora CBH Depot. CBH is conducting a pre-feasibility study to upgrade the existing rail facilities at its Moora Depot for the Moora Rail Outloading Project (the project). Under the project, potential impacts include the clearance of extant native vegetation within the rail reserve. The project is located approximately 3 kilometres (km) south from the Moora town site, in Western Australia (WA).

ELA undertook an initial survey (Figure 1) involving a Reconnaissance and Targeted flora and vegetation survey, Basic fauna survey and Targeted black cockatoo habitat assessment in June 2020 (ELA 2020). Based on these results, the survey area was modified to reflect potential project modifications to avoid an identified population of *Eremophila scaberula* (Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Critically Endangered under the State *Biodiversity Conservation Act 2016* [BC Act]). ELA subsequently undertook a Detailed and Targeted flora and vegetation survey, Basic fauna survey and Targeted black cockatoo habitat assessment of the modified survey area (the survey area) in September 2020 (22.02 ha; Figure 1). The survey area runs parallel to the existing rail line for approximately 1.5 km and includes remnant vegetation on either side of the rail and two patches north and south of the Moora CBH Depot.

This report provides results from quadrat and opportunistic flora sampling in spring (September 2020) as well as fauna (including black cockatoo tree data) from September 2020 and June 2020 (ELA 2020), where tree records overlap the survey area. Where considered relevant, June 2020 flora and vegetation survey results (ELA 2020) have been provided for additional context.

# Figure 1: Survey area location


**Legend**

- Initial survey area (June 2020)
- Modified survey area (September 2020)

0 250 500 1,000
Metres

Datum/Projection:
GDA 1994 MGA Zone 50

N

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# 2. Environmental setting

## 2.1 Climate

The survey area is located in the Avon Wheatbelt bioregion (Katanning [AVW02] subregion), as defined by the Interim Biogeographic Regionalisation for Australia (IBRA; DAWE 2020a). This region is described as having a semi-arid (dry) and warm Mediterranean Climate (Beecham 2001). Based on the nearby Bureau of Meteorology (BoM) Barberton weather station (station number 8005, climate data 1911-present; located approximately 7 km to the south of the survey area), the area receives, on average, a total of 448 mm of rainfall per year, with most rainfall occurring during the winter months of June, July and August (a mean of 83.5 mm, 83.2 mm and 63.9 mm respectively; BoM 2020; Table 1).

In the 12 months preceding the second survey in September 2020, the area received a total of 255.9 mm, which is below the long-term average (Table 1; BoM 2020). A total of 133.8 mm of rainfall was recorded in the three months prior to the second detailed flora and vegetation survey, which is less than the long-term average over the same time period (230.6 mm). Although below average, rainfall was sufficient to stimulate flowering across the majority of flora species occurring within the survey area. This resulted in very good survey conditions, with individual plants generally having reproductive material present (e.g. flowers, pods, seed), allowing for positive identification.

**Table 1: Rainfall data recorded at the Barberton weather station (8005) 12 months prior to the second survey compared to the long-term average (BoM 2020)**

| Rainfall (mm) | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average rainfall (mm) 1911-present | 38.2 | 23.6 | 13.3 | 9.1 | 14.2 | 16.0 | 18.6 | 23.4 | 56.7 | 83.5 | 83.2 | 63.9 | 448.0 |
| Rainfall (mm) 2019-2020 | 8.6 | 24.4 | 2.6 | 0.8 | 0.4 | 44.8 | 5.6 | 5.6 | 29.3 | 41.0 | 25.0 | 67.8 | 255.9 |

## 2.2 Landform, topography and soils

Beard (1990) describes the Avon Wheatbelt as a relatively uniform landscape as a result of underlying geological uniformity (Archaean granites with infolded metamorphics of the Yilgarn Block). Topography is characteristic of an undulating plateau, mostly with disorganised drainage.

Soils of the region are typically yellow earths on sandplain, with ironstone gravels peripheral to hard-setting loam soils on slopes and bottomlands, and saline soils in depressions.

## 2.3 Interim-Biogeographic Regionalisation for Australia

Under the current Version 7 of IBRA, the survey area is situated within the Avon Wheatbelt IBRA Bioregion and AVW02 Katanning subregion. The Avon Wheatbelt bioregion is described as a dissected plateau of Tertiary laterite in the Yilgarn Craton with a semi-arid (dry) warm Mediterranean climate (Beecham 2001). The AVW02 subregion is further described as being composed of gently undulating rises to low hills with abrupt breakaways; its drainage is rejuvenated and comprises continuous stream channels that flow in most years. Residual lateritic uplands and derived sandplains are covered by areas

of proteaceous scrub-heaths (which are rich in endemic species) and quaternary surfaces of erosional slopes and valley floors support woodlands of Wandoo, York Gum, Jam and Casuarina (Beecham 2001).

## 2.4 Regional vegetation

Vegetation type and extent have been mapped at a regional scale by Beard (1975) who categorised vegetation into broad vegetation associations. Based on this mapping at a scale of 1:1,000,000, the Department of Primary Industries and Regional Development (DPIRD) has compiled a list of vegetation extent and types across WA (Shepherd et al. 2002).

One vegetation association occurs within the survey area, namely Victoria Plains 142, described as 'Medium woodland; York gum & Salmon gum' (Government of Western Australia 2019). This vegetation association has 12.44% of its pre-European extent remaining in the Avon Wheatbelt subregion (Table 2; Government of Western Australia 2019)

**Table 2: Beard's (1975) vegetation associations of the survey area**

| Vegetation association | Description | Pre-European extent within Avon Wheatbelt IBRA region (ha) | Current extent within Avon Wheatbelt IBRA region (ha) | % remaining within Avon Wheatbelt IBRA region |
|---|---|---|---|---|
| Victoria Plains 142 | Medium woodland; York gum & Salmon gum | 637,707.53 | 79,309.95 | 12.44 |

## 2.5 Areas of conservation significance

Environmentally Sensitive Areas (ESAs) are defined in the Environmental Protection (Environmentally Sensitive Areas) Notice 2005 under s 51B of the State *Environmental Protection Act 1986* (EP Act). ESAs include areas declared as World Heritage, included on the Register of the National Estate, defined wetlands, and vegetation containing rare (Threatened) flora and Threatened Ecological Communities (TECs).

Priority Ecological Communities (PECs) are biological flora or fauna communities that are recognised by the WA Minister for Environment to be of significance, but which do not meet the criteria for a TEC. There are five categories of PECs, none of which are currently protected under State or Federal legislation.

A Department of Biodiversity, Conservation and Attractions (DBCA) Threatened and Priority communities' database search (DBCA 2020b) and a Protected Matters Search Tool (PMST) search (DAWE 2020b) identified three conservation significant ecological communities recorded within a 20 km radius of the survey area (Table 3). Of these, the buffer of a known occurrence of the *Eucalyptus woodlands of the Western Australian Wheatbelt* TEC, listed as Critically Endangered (CR) under the EPBC Act and P3 by DBCA, intersects 7.45 ha (33.82%) of the survey area.

**Table 3: Threatened and Priority ecological communities occurring within or in proximity to the survey area (DBCA 2020b)**

| Community ID | Community description | Conservation code | | Closest occurrence to the survey area |
|---|---|---|---|---|
| | | EPBC Act | Endorsed by the WA minister / listed by DBCA | |
| Wheatbelt woodlands | Eucalypt woodlands of the Western Australia Wheatbelt | CR | P3 | Overlaps sections of the survey area |
| Banksia WL SCP | Banksia Dominated Woodlands of the Swan Coastal Plain IBRA Region | EN | P3 | 6.3 km to the west |
| Coomberdale chert hills | Vegetation alliances on ridges and slops of the chert hills of the Coomberdale Floristic Region | - | EN | 1.8 km to the north-northeast |

# 3. Methodology

## 3.1 Desktop review

### 3.1.1 Database searches

Commonwealth and State databases were searched for information relating to conservation listed flora and ecological communities in order to compile and summarise existing data to inform the field survey (Table 4). The applied buffers shown are considered suitable based on flora and fauna assemblages expected to occur within the survey area. It should be noted that the buffers for the DBCA database searches are selected by DBCA on a case-by-case basis and are therefore not always consistent with other searches undertaken in the area.

**Table 4: Database searches undertaken for the survey area**

| Database | Reference | Buffer (km) |
|---|---|---|
| EPBC Act Protected Matters Search Tool (PMST) for Threatened species and communities listed under the EPBC Act. | DAWE 2020b | 20 |
| DBCA and Western Australian Museum (WAM) NatureMap online database for Threatened and Priority flora. | DBCA 2007-2020 | 20 |
| DBCA Threatened and Priority flora database searches for Declared Rare Flora (DRF) listed under the latest WA Wildlife Conservation (Rare Flora) Notice and Priority flora. | DBCA 2020a | 25 |
| DBCA Threatened and Priority Ecological Communities database search. | DBCA 2020b | 15 |
| DBCA Threatened and Priority fauna database searches for Scheduled fauna listed under the EPBC Act or latest WA Wildlife Conservation (Specially Protected Fauna) Notice and Priority Fauna. | DBCA 2020c | 15 |

### 3.1.2 Likelihood of occurrence assessment

A likelihood of occurrence assessment was undertaken to identify conservation listed flora species that possibly occur within the survey area, identified from a review of key datasets and literature outlined in above. Conservation codes, categories and criteria for flora and fauna protected under the EPBC Act and the BC Act are provided in Appendix A. Criteria used for this assessment are presented in Appendix B.

## 3.2 Field survey

### 3.2.1 Survey team and timing

The Detailed and Targeted flora and vegetation survey, Basic fauna survey and Targeted black cockatoo habitat assessment were undertaken by Daniel Brassington and Briana Wingfield over one day on 30 September 2020. The survey team's relevant qualifications, experience and licences are provided in Table 5.

**Table 5: Survey team**

| Name | Qualification | Relevant experience | Licences |
|---|---|---|---|
| Daniel Brassington | BSc. Hons. Environmental Science | Daniel has more than 10 years' experience in botanical surveys and environmental services throughout Western Australia. This includes baseline vegetation studies, threatened and priority flora surveys, weed surveys, rehabilitation and vegetation monitoring. | Flora scientific collection licence: SL012503<br>DRF permit: TFL 15-1920 |
| Briana Wingfield | BSc. Conservation and Wildlife Biology and Environmental Science (Hons) | Briana has seven years' experience conducting fauna surveys across Western Australia, including Basic fauna surveys and Targeted black cockatoo habitat assessments. | N/A |

### 3.2.2 Flora and vegetation survey

A Detailed and Targeted flora and vegetation survey was conducted in accordance with the Environmental Protection Authority (EPA) *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016).

For the Detailed flora and vegetation survey, nine quadrats were established within the survey area. The number of quadrats established to describe vegetation communities were informed using aerial imagery as well as being assessed in the field. The survey involved the establishment of 10 x 10 m quadrats as recommended for the Avon Wheatbelt bioregion (EPA 2016). Dominant vegetation communities were described and mapped in accordance with the National Vegetation Information System (NVIS) Level V (DAWE 2020c). Photos were taken from the north western corner of each quadrat. The following data was recorded within each quadrat:

- Site details (site name, number, observers, date and location);
- Environmental information including landform, soil type and colour, bare ground and leaf litter cover, rock outcropping and time since last fire event; and
- Biological information including vegetation structure, vegetation condition in accordance with EPA (2016), degree of disturbance, species present and species percentage cover.

The Targeted survey was undertaken within the survey area to identify any conservation significant flora or communities potentially occurring, including:

- TECs listed under the EPBC Act;
- Threatened (Declared Rare) flora listed under the latest WA Wildlife Conservation (Rare Flora) Notice under the BC Act;
- PECs endorsed by the WA Minister for the Environment; and
- Priority (P) flora listed by DBCA.

In addition, any encountered Declared Pests listed under the State *Biosecurity and Management Act 2007* (BAM Act) or Weeds of National Significance (WoNS) were recorded and mapped.

Survey methodology involved personnel walking transects across the survey area, with transects spaced 5-10 m on average, with spacing dependent on factors including suitable habitat, disturbance (e.g. cleared areas) and landform. Locations of survey transects are presented in Figure 2. Flora species able to be identified in the field were recorded, and voucher specimens of unfamiliar species were collected for later identification. All collections were assigned a unique collecting number. For conservation significant flora species identified in the field, the following was recorded:

- A colour photograph;
- GPS location;
- Population size estimate;
- Location of population boundaries;
- Associated habitat/landscape element;
- Time and date observed;
- Observer details; and
- A voucher specimen suitable for use as a reference specimen (where appropriate).

# Figure 2: Survey effort


**Legend**

- Modified survey area (September 2020)
- Transect
- Quadrat Location

0 60 120 240
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

N

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### 3.2.3 Fauna surveys

#### *3.2.3.1 Basic fauna survey*

The Basic fauna survey was conducted in accordance with the EPA *Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020). An assessment of fauna habitat in terms of its ability to support and sustain populations of fauna, along with an assessment of the likelihood of occurrence of conservation significant fauna species, was undertaken during the survey. The habitat characteristics and fauna database records used in assessing likelihood of occurrence for fauna included:

- Vegetation community, structure and condition;
- Soil and landform type;
- Extent and connectivity of bushland;
- Fauna species habitat preferences;
- Proximity of conservation significant fauna records; and
- Signs of species presence.

Opportunistic recordings of fauna species were made at all times during the field survey. These included visual sightings of active fauna such as reptiles and birds; records of bird calls; and signs of species presence such as tracks, diggings, burrows, scats and any other signs of fauna activity.

Nomenclature used for the vertebrate fauna species within this report follows the Western Australian Museum (WAM) Checklist of the Vertebrates of Western Australia (WAM 2020). Where common names were not stated for certain species, the following references were consulted:

- Amphibians and reptiles: Bush et al. (2010);
- Reptiles: Wilson and Swan (2013);
- Birds: Morcombe (2007); and
- Mammals: Menkhorst and Knight (2011).

#### *3.2.3.2 Black cockatoo habitat assessment*

The assessment of black cockatoo habitat was undertaken in accordance with the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) *EPBC Act referral guidelines for three threatened black cockatoo species* (SEWPaC 2012). This involved assessing all significant tree species known to support potential suitable breeding, roosting and foraging habitat. Significant breeding trees are defined as trees of suitable species with a Diameter at Breast Height (DBH) greater than 500 mm (> 300 mm for salmon gum and wandoo; SEWPaC 2012). Trees with a DBH greater than 500 mm (or >300 mm for Salmon Gum and Wandoo) are large enough to potentially contain hollows suitable for nesting black cockatoos or have the potential to develop suitable hollows over the next 50 years. Trees of this size may also be large enough to provide roosting habitat (i.e. trees which provide a roost or rest area for the birds). All potential breeding trees with a DBH of 500 mm or greater encountered within the survey area were recorded with a GPS.

Hollows were considered 'suitable' if the entrance was >100 mm in diameter, >300 mm deep and aligned near vertical. If it was not possible to determine if a hollow was suitable or not it was categorised as 'potentially suitable'. Hollows that did not meet any of the requirements were categorised as 'unsuitable'. Trees that met the required measurements were inspected from the ground for suitability

of hollows for nesting and/or roosting and evidences of current or previous occupancy, including wear and chew marks around the entrance.

Vegetation present within the survey area was assessed for its potential to provide foraging and roosting habitat for black cockatoos as per the SEWPaC guidelines (SEWPaC 2012), and the extent of potential suitable habitat within the survey area was mapped. Observations were also made of any black cockatoo foraging activity or feeding residue such as chewed Banksia, Jarrah and Marri nuts, and any black cockatoo individuals observed within the survey area.

## 3.3 Flora identification and nomenclature

Flora specimen identification was undertaken by ELA Botanist Daniel Brassington. Species identification utilised taxonomic literature and keys and where required specimens were confirmed using the WAH collection. Where considered appropriate, specimens that meet WAH specimen lodgement requirements (e.g. Threatened and Priority Flora, range extensions), may be submitted along with Threatened and Priority Report forms to DBCA. Nomenclature used for the flora species within this report follows the WA Plant Census as available on FloraBase (DBCA and WAH 2020).

## 3.4 Data analysis

### 3.4.1 Flora species accumulation curve

A flora species accumulation curve was undertaken to indicate adequacy of the survey effort (Clarke and Gorley 2006). As the number of survey sites increases, and correspondingly the size of the area surveyed increases, there should be a diminishing number of new species recorded. At some point, the number of new species recorded becomes essentially asymptotic. The asymptotic value was determined using Michaelis-Menten modelling and provided an incidence-based coverage estimator of species richness. When the number of new species being recorded for survey effort expended approaches this asymptotic value, the survey effort can be considered adequate.

### 3.4.2 Vegetation communities

Plymouth Routines in Multivariate Ecological Research v6 (PRIMER) statistical analysis software was used to analyse species-by-site data and discriminate survey sites based on their species composition (Clarke and Gorley 2006). A presence/absence transformation was applied to the dataset to align with Gibson et al. (1994). Introduced species (weeds), specimens not identified to species level and singletons (species recorded at a single quadrat and not forming a dominant structural component) were excluded from the data set prior to analysis. Computation of similarity matrices was based on the Bray-Curtis similarity measure. Data were analysed using a series of multivariate analysis routines including Hierarchical Clustering (CLUSTER) and Similarity Percentages (SIMPER). Results were used to inform and support interpretation of aerial photography and delineation of individual plant communities.

## 3.5 Limitations

EPA (2016) and EPA (2020) recommend including discussion of the constraints and limitations of the survey methods used. Constraints and limitations for the Reconnaissance, Detailed and Targeted flora and vegetation and surveys, Basic fauna surveys and Targeted black cockatoo habitat assessments for the survey area are summarised in Table 6. No constraints were identified.

**Table 6: Survey limitations**

| Potential survey limitation | Impact on survey |
|---|---|
| Sources of information and availability of contextual information (i.e. pre-existing background versus new material). | **Not a constraint**. Previous reports for the region were provided where applicable. Broad-scale vegetation mapping at a scale of 1:1,000,000 was available. Land system mapping at a scale of 1:2,000,000 and soil and landform mapping was also available. Available information was sufficient to provide context at varying scales and therefore were not considered a limitation. |
| Scope (i.e. what life forms, etc., were sampled). | **Not a constraint**. The survey met the requirements for Detailed and Targeted flora and vegetation surveys, Basic fauna surveys and black cockatoo habitat assessments in accordance with relevant State and Federal legislation and EPA guidance documents were adequately met. |
| Proportion of flora collected and identified (based on sampling, timing and intensity). | **Not a constraint**. Adequacy of the current sampling effort was tested via a species accumulation curve; approximately 69% of the flora species potentially present within the survey area were recorded. This result is influenced by the 46 opportunistic species that were not included in the analysis. Consideration of the result along with the additional 48 opportunistic species and additional species recorded within the June 2020 survey, indicates that the majority of flora potentially present within the survey area were recorded. |
| Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed). | **Not a constraint**. The area was surveyed to the satisfaction of the scope required for Detailed and Targeted flora and vegetation surveys, Basic fauna surveys and black cockatoo habitat assessments. |
| Mapping reliability. | **Not a constraint**. Coverage of the survey area was considered to be good. High quality aerial maps were used for both the survey and subsequent mapping. Due to the nature of vegetation in the survey area, mapping boundaries of individual communities were discrete, and thus are considered accurate. |
| Timing, weather, season, cycle. | **Not a constraint**. The survey area is located in the Avon Wheatbelt bioregion of Western Australia. Recommended survey timing for this region is in spring (September – November; EPA 2016). This suite of surveys was undertaken in September 2020. Many flora species were flowering at the time of the field surveys or had sufficient material (fruit) available to identify the dominant and target species. The timing was appropriate for conducting these levels of survey. |
| Disturbances (fire, flood, accidental human intervention, etc.). | **Not a constraint**: Disturbances within the survey area included fragmentation as a result of agricultural and transport infrastructure, with historical clearing in portions of the survey area, and weeds dominating the understory in areas. Disturbances did not impact the ability to undertake the level of survey required. |
| Intensity (in retrospect, was the intensity adequate). | **Not a constraint**. The survey effort was adequate for Detailed and Targeted flora and vegetation surveys, Basic fauna surveys and Targeted black cockatoo habitat assessments. |
| Resources (i.e. were there adequate resources to complete the survey to the required standard). | **Not a constraint**. The number of personnel conducting this field survey in the given time was adequate to undertake the required surveys. Additional resources, including equipment available, additional support and personnel were adequate. |
| Access problems (i.e. ability to access survey area). | **Not a constraint**. All relevant areas within the survey area were able to be accessed and surveyed. |
| Experience levels (e.g. degree of expertise in plant identification to taxon level). | **Not a constraint**. The personnel conducting this field survey were suitably qualified to identify flora, vegetation and fauna, having multiple years of field experience and previously undertaken flora and fauna surveys across Western Australia. |

# 4. Results

## 4.1 Desktop assessment

An initial 98 conservation listed flora species were identified as possibly occurring within the survey area, based on database searches undertaken in Section 3.1.1 and using criteria outlined in Appendix B. Conservation significant flora species identified from database searches undertaken include 33 species listed under the EPBC Act and/or BC Act as Threatened flora and 65 species listed as Priority flora by DBCA. The flora likelihood of occurrence assessment is presented in Appendix C.

Conservation significant fauna species identified from database searches undertaken include 20 species listed under the EPBC Act and/or BC Act as Threatened fauna, and five species listed as Priority fauna by DBCA. The fauna likelihood of occurrence assessment is presented in Appendix D.

## 4.2 Flora and vegetation

### 4.2.1 Flora overview

A total of 110 flora species, representing 37 families and 81 genera, were recorded within the survey area during the Detailed and Targeted flora and vegetation survey. This tally includes 64 species which were recorded in quadrats and 46 species which were recorded opportunistically. Families with the highest number of species included Poaceae (16 species), Fabaceae (15 species), Myrtaceae (9 species) and Asteraceae (9 species). *Acacia* and *Eucalyptus* were the best represented genera throughout the survey area with 12 and four taxa recorded from each genus respectively. A full species list is provided in Appendix E.

Average species richness per quadrat was 18.55, ranging from a high of 25 species within quadrat ELA01 to a low of 13 species within quadrat ELA08. Quadrat site data is presented in Appendix F.

### 4.2.2 Accumulated species – site surveyed (species-area curve)

A species accumulation curve (Figure 3) was used to evaluate the adequacy of sampling (Clarke and Gorley 2006). Only species data recorded from defined quadrats were used, no opportunistic flora collections were included. The asymptotic value was determined using Michaelis Menten modelling. Using this analysis, the incidence-based coverage estimator of species richness was calculated to be 92.73. Based on this value, and the total of 64 species recorded within the nine quadrats, approximately 69% of the flora species potentially present within the survey area were recorded. Consideration of the result along with the additional 46 opportunistic species (full flora species list in Appendix E), indicates that the majority of flora potentially present within the survey area were recorded.

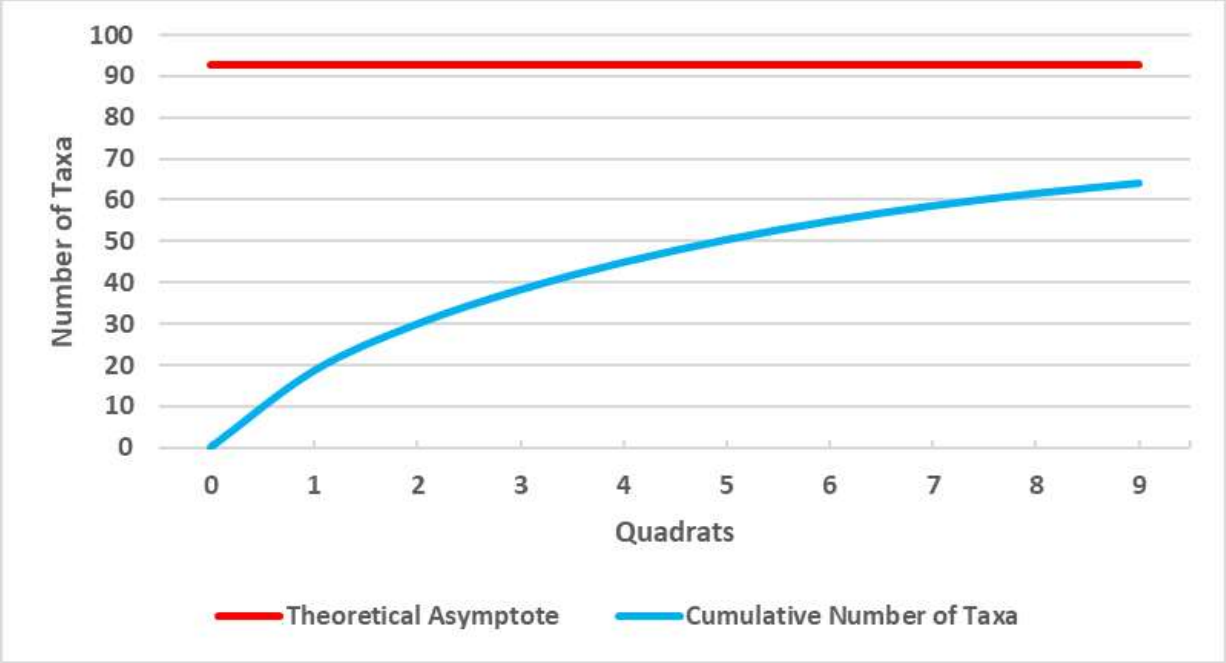


**Figure 3: Average randomised species accumulation curve**

Note: Only species recorded from quadrats were used to calculate the species accumulation curve and theoretical maximum number of species (asymptotic value).

### 4.2.3 Conservation significant flora

Of the 98 conservation listed flora species identified as possibly occurring within the survey area, one conservation significant species, *Eremophila glabra* subsp. *chlorella* (Endangered under the BC Act) was recorded.

Of the remaining 97 species, 29 are considered as having the potential to occur within the survey area. *Eremophila scaberula* was recorded outside of the survey area in the June 2020 survey (ELA 2020), and as it was not recorded in within the survey area during the September 2020 survey, is considered to not occur. This assessment is based on the proximity of previous records to the study area and on the availability of suitable habitat for these species within the survey area. The remaining 66 species are considered as being unlikely to occur.

*Eremophila glabra* subsp. *chlorella* (Plate 1) was recorded in the central portion of the survey area from one population of seven individuals (Figure 4). The population occurs on both sides of the existing railway line with three individuals east of the railway line and four to the west of the line. *E. glabra* subsp. *chlorella* was recorded within the survey area in *Eucalyptus salmonophloia* and *E. loxophleba* woodland.

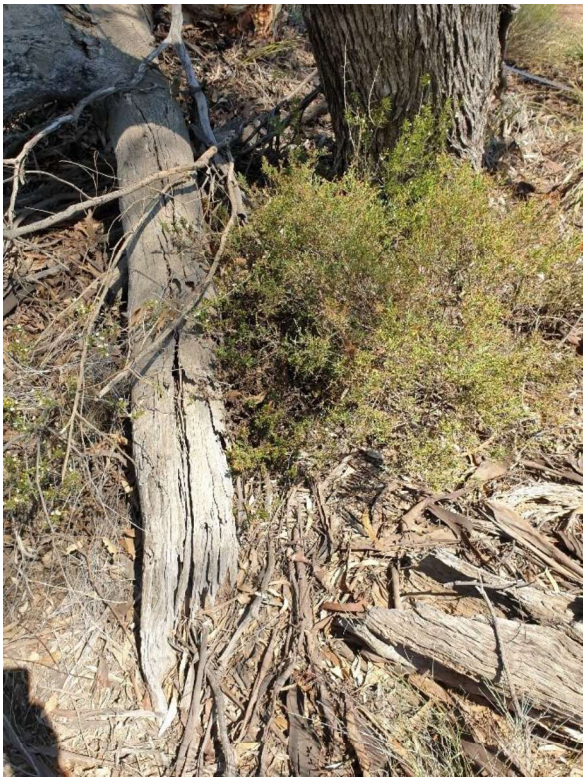

**Plate 1: Left - *Eremophila glabra* subsp. *chlorella* recorded within the survey area showing leaves and flowering material © Eco Logical Australia; Right - *Eremophila glabra* subsp. *chlorella* recorded within the survey area (small shrub between log and larger shrub) © Eco Logical Australia**

### 4.2.4 Introduced flora

A total of 26 introduced (weed) flora species were recorded from the survey area, none of which are listed as Declared Pests under the BAM Act or as WoNS. All introduced (weed) species recorded are listed on the Western Australian Organism List (WAOL) Database as S-11 (permitted) species, indicating that no specific management of these species is required. One of these species, **Eragrostis curvula* reached up to 40% cover in patches of the survey area. The full list of introduced species is detailed in Appendix E.

# Figure 4: Conservation significant flora recorded within the survey area

**Legend**

- Modified survey area (September 2020)
- *Eremophila glabra* subsp. *chlorella*

0 60 120 240

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

N

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### 4.2.5 Vegetation communities

A total of three vegetation communities were delineated and mapped within the survey area (Table 7; Figure 5). The most widespread vegetation community was EslW: *Eucalyptus salmonophloia* and *E. loxophleba* Woodland, which covered 28.94% (6.37 ha) of the survey area. Cleared areas, including roads, tracks and other cleared areas, covered 55.67% (12.26 ha) of the survey area.

Quadrat data and the results of the CLUSTER analysis used to delineate vegetation communities are provided in Appendix F and Appendix G respectively.

### 4.2.6 Conservation significant ecological communities

All three vegetation communities delineated within the survey area are composed of Eucalypt woodlands that have the potential to represented floristic and structural aspects of the Eucalypt Woodlands of the Western Australian Wheatbelt TEC (Wheatbelt Woodlands TEC), as indicated in the Department of Environment (DoE; now Department of Agriculture, Water and the Environment [DAWE]) *Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt* (DoE 2015). This TEC is also categorised as a Priority 3 PEC by DBCA.

In summary, the Wheatbelt Woodlands TEC is composed of Eucalypt-dominated woodlands in the Western Australian Wheatbelt region as defined by the IBRA Avon Wheatbelt 1 and 2 and Western Mallee subregions with the specific exceptions of woodlands and forests dominated by Jarrah (*Eucalyptus marginata*) or Marri (*Corymbia calophylla*) where they occur without York Gum present; and non-woodland communities dominated by eucalypts, specifically those dominated by eucalypts with a mallee growth form. The community is defined primarily by its structure as a woodland. The presence in the canopy layer of eucalypt trees - most commonly Salmon Gum (*E. salmonophloia*), York Gum (*Eucalyptus loxophleba*), Red Morrel (*E. longicornis*) or Gimlet (*E. salubris*) defines the Wheatbelt woodlands. Several of the other emergent eucalypt species which may be present as a defining species (e.g. Kondinin Blackbutt [*E. kondininensis*], *E. myriadena*, Salt River Gum [*E. sargentii*], Silver Mallet [*E. ornata*] and Mallet [*E. singularis*]) are found only in the Western Australian Wheatbelt.

An assessment, presented in Appendix G, has been undertaken utilising the key diagnostic characteristics of the Wheatbelt Woodlands TEC (DoE 2015). This key diagnostic assessment has concluded that 7.45 ha of vegetation (related to vegetation communities EslW and EwW) delineated within the survey area is characterised as representing the Eucalypt woodlands of the Western Australian Wheatbelt TEC (and subsequently, the associated State listed PEC). These areas are mapped in Figure 6.

Vegetation communities EslW and EwW extend outside of the survey area (ELA 2020), and these extensions are also inferred to represent the Eucalypt woodlands of the Western Australian Wheatbelt TEC.

Vegetation community EcG is not considered to represent the TEC (or PEC) as it is dominated by *Eucalyptus camaldulensis* which is not a key indicator species of the TEC.

**Table 7: Vegetation communities recorded within the survey area**

| Image | Vegetation community code | Vegetation community description | Quadrats | Extent (ha) within survey area | % of survey area |
|---|---|---|---|---|---|
|  | EslW | *Eucalyptus salmonophloia, Eucalyptus loxophleba* mid woodland over *Rhagodia preissii, Scaevola spinescens, Eremophila glabra* mid sparse shrubland over *Enchylaena tomentosa low sparse chenopod shrubland* and *Austrostipa elegantissima, *Avena barbata* low sparse tussock grassland. | ELA01<br>ELA05<br>ELA06 | 6.37 | 28.94% |
|  | EcG | *Eucalyptus camaldulensis* mid open woodland over *Grevillea biternata, Acacia leptospermoides* subsp. *leptospermoides, Stylobasium australe* mid sparse shrubland over *Dampiera lavandulacea* low sparse shrubland and **Eragrostis curvula, *Avena barbata* low open tussock grassland. | ELA02<br>ELA04<br>ELA09 | 1.95 | 8.87% |
|  | EwW | *Eucalyptus wandoo* mid woodland over *Rhagodia preissii, Exocarpos sparteus* mid sparse shrubland over *Enchylaena tomentosa* low isolated chenopod shrubs and *Dianella revoluta, Lomandra effusa* low sparse forbland. | ELA03<br>ELA07<br>ELA08 | 1.08 | 4.88% |
| Planted treeline | | | | 0.35 | 1.64% |
| Cleared | | | | 12.26 | 55.67% |
| **TOTAL** | | | | **22.02** | **100%** |

# Figure 5: Vegetation communities mapped within the survey area

**Legend**

- Modified survey area (September 2020)

**Vegetation Communities**

- EcG: *Eucalyptus camaldulensis* scattered trees on Grassland
- EslW: *Eucalyptus salmonophloia* and *Eucalyptus loxophleba* Woodland
- EwW: *Euclyptus wandoo* Woodland
- Planted treeline
- Cleared

0 60 120 240

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

N

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# Figure 6: Conservation significant ecological communities mapped within the survey area

**Legend**

- Modified survey area (September 2020)
- Eucalypt Woodlands of the Western Australian Wheatbelt TEC

0 60 120 240

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

N

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### 4.2.7 Vegetation condition

Vegetation within the survey area ranged from Excellent to Completely Degraded condition, based on the Keighery (1994) vegetation condition scale provided in EPA (2016) (Figure 7).

The majority of remnant vegetation within the survey area was classed as Completely Degraded condition (11.59 ha; 52.63% of the survey area). The remaining categories include; Very Good condition (5.13 ha; 23.3% of the survey area), Good condition (3.19 ha; 14.49% of the survey area) and Degraded condition (2.11 ha; 9.58%).

## 4.3 Fauna

### 4.3.1 Fauna overview

A total of 21 vertebrate fauna species were recorded as occurring within the survey area (Appendix I), comprising 17 birds, three mammals and one reptile. *Calyptorhynchus latirostris* (Carnaby's Black-Cockatoo), listed as Endangered (EN) under the EPBC Act and BC Act, were observed flying over the survey area during the field survey.

Of the 25 conservation listed fauna species identified from the desktop assessment as possibly occurring within the survey area, Carnaby's Black-Cockatoo were recorded in the survey area and five species are considered as having the potential to occur within the survey area, based on the availability of suitable habitat and close proximity of recent records:

- *Egernia stokesii* subsp. *badia* (Western Spiny-tailed Skink; listed as EN under the EPBC Act and as Vulnerable [VU] under the BC Act);
- *Idiosoma nigrum* (Shield-backed Trapdoor Spider; listed as VU under the EPBC Act and as EN under the BC Act);
- *Falco peregrinus* (Peregrine Falcon; listed as Other specially protected species under the BC Act);
- *Idiosoma dandaragan* (Dandaragan Plateau Shield-backed Trapdoor Spider; listed as P2 by DBCA); and
- *Platycercus icterotis* subsp. *xanthogenys* (Western Rosella; listed as P4 by DBCA).

The remaining 19 fauna species are considered as unlikely to occur or do not occur within the survey area, based on lack of suitable habitat for these species, adequacy of search effort undertaken within the survey area and proximity of previous records (DBCA 2007-2020). The fauna likelihood of occurrence assessment is provided in Appendix D.

Two introduced (pest) fauna species were recorded within the survey area, namely Feral Cat (*Felis catus*) and House Mouse (*Mus musculus*). Feral cat was observed from secondary signs (tracks), while House Mouse was directly observed within the survey area.

### 4.3.2 Fauna habitat

One natural fauna habitat was recorded within the survey area: Open Salmon Gum, Wandoo, York Gum woodland over open shrubland and grassland on clay loam. This habitat covers 42.69% (9.4 ha) of the survey area. The remainder of the survey area was cleared (12.26 ha; 55.68%) and planted treeline (0.36 ha; 1.64%) (Figure 8).

# Figure 7: Vegetation condition within the survey area

**Legend**

- Modified survey area (September 2020)

**Vegetation Condition**

- Very Good
- Good
- Degraded
- Completely Degraded

0 60 120 240

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

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# Figure 8: Fauna habitat mapped within the survey area

**Legend**

- Modified survey area (September 2020)

**Fauna Habitat**

- Open Salmon Gum, Wandoo, York Gum woodland over open shrubland and grassland on clay loam
- Planted treeline
- Nil

0 60 120 240

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

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### 4.3.3 Black cockatoo habitat assessment

#### *4.3.3.1 Foraging habitat*

Foraging habitat for black cockatoos is generally defined as the availability of plant food sources within an area (Finn 2012). Food availability for black cockatoos is a function of the diversity, abundance, distribution, energetic and nutritional qualities, and seasonality (phenology) of the food sources within a particular area. Black cockatoo foraging habitat within the survey area has been determined using vegetation associations defined in the vegetation assessment and from ground-truthing in the field (e.g. sheared off branches outlined in Appendix K). The quality of foraging habitat for black cockatoo species within the survey area (as defined in Table 8) has been assessed based on the availability and density of plant food sources as observed on site.

**Table 8: Definition and extent of black cockatoo foraging habitat quality within the survey area**

| Foraging quality | Justification | Extent (ha) within survey area | % of survey area |
|---|---|---|---|
| Poor | Low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 10-20%) and presence of food sources at only one stratum (i.e. canopy) | 9.40 | 42.69 |
| Nil | Cleared areas or no suitable vegetation present | 12.62 | 57.31 |
| Total | | 22.02 | 100 |

Remnant native vegetation within the survey area, comprising 9.40 ha, is considered as providing 'Poor' quality foraging habitat for all three black cockatoo species due to a lack of density of suitable or preferred foraging species. Planted treeline and cleared areas, comprising 12.62 ha, provide 'Nil' foraging habitat for black cockatoo species. Habitat foraging quality is presented in Figure 9. Although its native vegetation is now rated as 'Poor' quality foraging habitat, some past evidence of black cockatoo foraging was observed within the survey area (i.e. signs of foraging on infructescence).

#### *4.3.3.2 Breeding and roosting habitat*

The black cockatoo breeding habitat assessment identified 186 potentially suitable breeding trees within the survey area (by DBH); comprising (Appendix K):

- 151 *Eucalyptus salmonophloia* (Salmon Gum);
- 15 *Eucalyptus loxophleba* (York Gum);
- 14 *Eucalyptus wandoo;*
- One *Eucalyptus camaldulensis;* and
- Five stags.

All species have the potential to provide suitable roosting habitat for black cockatoos (SEWPaC 2012). Of these, 15 contained potentially suitable hollows over 100 mm in diameter (Figure 9). The remaining potentially suitable breeding trees contained no hollows, or no suitable hollows.

For context, ELA (2020) identified an additional 182 potentially suitable breeding trees and 19 potentially suitable hollows over 100 mm in diameter, surrounding the survey area (ELA 2020).

# Figure 9: Black cockatoo habitat mapped within the survey area

**Legend**

Modified survey area (September 2020)

**Forage Quality**

- Poor
- Nil

**Black Cockatoo Trees**

- Eucalyptus cameldulensis, DBH >50cm, No Hollow
- *Eucalyptus loxophleba* (York Gum), DBH >50cm, No Hollow
- *Eucalyptus loxophleba* (York Gum), DBH >50cm, Hollow Present
- *Eucalyptus salmonophloia* (Salmon Gum), DBH >30cm, No Hollow
- *Eucalyptus salmonophloia* (Salmon Gum), DBH >30cm, Hollow Present
- *Eucalyptus wandoo* (Wandoo), DBH >30cm, No Hollow
- Dead Stag, DBH >50cm, No Hollow
- Dead Stag, DBH >50cm, Hollow Present

0 60 120 240

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

N

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# 5. Discussion

## 5.1 Flora

A total of 110 flora species, representing 37 families and 81 genera were recorded within the survey area during the Detailed and Targeted flora and vegetation surveys. This figure was obtained from combining quadrat data and opportunistic collections. No Declared Pests under the BAM Act or WoNS were recorded in the survey area. Flora species recorded have been previously documented in the Wheatbelt region and the assemblage is considered typical of roadside vegetation that has been subject to degradation over a long period of time.

One population of *Eremophila glabra* subsp. *chlorella* (Endangered under the BC Act) was recorded, comprising seven individuals. This population represents a previously unknown record of the species. There are 41 records of this species from an area between Cannington and Eneabba and the two closest records are 11 km south from the survey area and 8.5 km east from the survey area (DBCA 2007-2020). The total population of this species is estimated to be between 6500 and 7000 individuals and the population at Mogumber (to the south) has the largest population on record with just over 5,000 plants.

*E. glabra* subsp. *chlorella* was recorded within the survey area in *Eucalyptus salmonophloia* and *E. loxophleba* woodland, while prior records (DBCA and WAH 2020) have recorded it growing commonly in *Eucalyptus camaldulensis* woodland, *Melaleuca* shrubland, *Casuarina obesa* woodland, *Eucalyptus loxophleba* woodland, *Eucalyptus wandoo* woodland and combinations of these vegetation types.

## 5.2 Vegetation

Broadly, the survey area comprised relatively open Eucalypt woodland over a suite of native shrubs and rushes. This vegetation has been subject to varying levels of degradation as a result of impacts and edge effects related to neighbouring land uses (e.g. agriculture, road, rail and grain storage).

All three vegetation communities described within the survey area comprise Eucalypt woodlands that may represent the Eucalypt Woodlands of the Western Australian Wheatbelt TEC (Wheatbelt Woodlands TEC), as indicated in the Department of Environment (DoE, now DAWE) *Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt* (DoE 2015). This TEC is also categorised as a Priority 3 PEC by DBCA.

Two of the three vegetation communities described within the survey area (EslW and EwW) have species composition and structure comprising elements that indicate the likely presence of the Wheatbelt Woodlands TEC, while vegetation community EcG has species composition and structure comprising elements that indicate the potential absence of the TEC (DoE 2015).

An assessment of the three vegetation communities against DoE (2015) has concluded vegetation communities EslW and EwW are likely to represent the Eucalypt woodlands of the Western Australian Wheatbelt TEC (and subsequently, the associated State listed PEC). Vegetation community EcG was not considered to represent the TEC (or PEC) as it is dominated by *Eucalyptus camaldulensis* which is not a key indicator species of the TEC.

Vegetation communities EslW and EwW extend outside of the survey area (ELA 2020), and these extensions are inferred to also be representative of the Eucalypt woodlands of the Western Australian Wheatbelt TEC.

## 5.3 Fauna

A total of 21 vertebrate fauna species were recorded within the survey area, of which *Calyptorhynchus latirostris* (Carnaby's Black-Cockatoo) is listed as Endangered under the EPBC Act and BC Act. One fauna habitat was recorded within the survey area: Open Salmon Gum, Wandoo, York Gum woodland over open shrubland and grassland on clay loam.

The survey area is in the breeding range of the Carnaby's Black-Cockatoo (DotEE 2017) and the black cockatoo breeding habitat assessment identified 186 potentially suitable breeding trees within the survey area, of these, 15 containing potentially suitable hollows over 100 mm in diameter.

Carnaby's Black-Cockatoo were observed flying over the survey area during the field survey and older foraging evidence was observed within the survey area. However, vegetation within the survey area was considered as 'Poor' quality foraging habitat for black cockatoo species.

# 6. References

Beard, J.S. 1975. *The vegetation survey of Western Australia.* Explanatory notes to Sheet 4, 1:1,000,000 Series Vegetation Survey of Western Australia. University of Western Australia Press, Nedlands.

Beard, J.S. 1990. *Plant Life of Western Australia*. Kangaroo Press. Kenthurst, NSW.

Beecham, B. 2001. *Avon Wheatbelt 2 (AW2 – Re-juvinated Drainage subregion).* In A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions in 2002. Department of Conservation and Land Management.

Bureau of Meteorology (BoM) 2020. *Climate Data Online*. Accessed online at http://www.bom.gov.au/climate/data/index.shtml

Bush, B., Maryan, B., Browne-Cooper, R. and Robinson, D. 2010. *Field Guide to Reptiles and Frogs of the Perth Region.* Western Australian Museum.

Department of Agriculture, Water and the Environment (DAWE). 2020a. *Australia's bioregions (IBRA)*. Available from: https://www.environment.gov.au/land/nrs/science/ibra.

Department of Agriculture, Water and the Environment (DAWE). 2020b. *EPBC Act Protected Matters Search Tool*. Available: http://www.environment.gov.au/epbc/pmst/index.html. Accessed June 2020.

Department of Agriculture, Water and the Environment (DAWE). 2020c. *Native Vegetation Information System (NVIS)*. Available from: https://www.environment.gov.au/land/native-vegetation/national-vegetation-information-system.

Department of Biodiversity, Conservation and Attractions and the Western Australian Herbarium (DBCA and WAH). 2020. *FloraBase—the Western Australian Flora*. Department of Biodiversity, Conservation and Attractions. Available from: https://florabase.dpaw.wa.gov.au/. Accessed March 2020.

Department of Biodiversity, Conservation and Attractions (DBCA). 2020a. *Threatened and Priority Flora database search*. Reference number 09-0620FL. Department of Biodiversity, Conservation and Attractions, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA). 2020b. *Threatened and Priority Communities database search*. Reference number 24-0620EC. Department of Biodiversity, Conservation and Attractions, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA). 2020c. *Threatened and Priority Fauna database search*. Reference number FAUNA#6358. Department of Biodiversity, Conservation and Attractions, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA). 2007-2020. *NatureMap*. Department of Biodiversity, Conservation and Attractions. Available at: https://naturemap.dpaw.wa.gov.au/default.aspx

Department of the Environment (DoE). 2015. *Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt*. Canberra: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/communities/pubs/128-conservation-advice.pdf. In effect under the EPBC Act from 04-Dec-2015.

Department of Sustainability, Environment, Water, Populations and Communities (SEWPaC). 2012. *EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's Black-Cockatoo (Endangered) Calyptorhynchus latirostris, Baudin's Cockatoo (Vulnerable) Calyptorhynchus baudinii, Forest Red-tailed Black cockatoo (Vulnerable) Calyptorhynchus banksii naso.* Australian Government Department of Sustainability, Environment, Water, Populations and Communities, Parkes, ACT.

Department of the Environment and Energy (DotEE). 2017. *Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo*. Commonwealth of Australia, 2017.

Eco Logical Australia (ELA). 2020. *Flora and fauna survey of CBH Moora*. Report prepared for CBH Group.

Environmental Protection Authority (EPA). 2020. *Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment*. Perth, Western Australia.

Environmental Protection Authority (EPA). 2016. *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment*. Perth, Western Australia.

Finn, H. 2012. *Assessment of habitat values for black-cockatoos within selected sites at Newmont Boddington Gold Mine*. Report prepared for Newmont Boddington Gold Pty Ltd.

Government of Western Australia. 2019. *2018 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of March 2019.* WA Department of Biodiversity, Conservation and Attractions, Perth, https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics

Keighery, B. J. 1994. *Bushland Plant Survey: A guide to plant community survey for the community.* Wildflower Society of Western Australia, Nedlands.

Menkhorst, P. and Knight, F. 2011. *Field Guide to Mammals of Australia.* Oxford University Press Australia, Melbourne.

Morcombe, M. 2003. *Field Guide to Australian Birds*. Steve Parish Publications, Brisbane.

Shepherd, D. P., Beeston, G. R. and Hopkins, A. J. M. 2002. *Native vegetation in Western Australia. Extent, type and status.* Department of Agriculture, South Perth, WA. Resource Management Technical Report 249.

Stack, G. and English, V. 1999. *Rough Emu Bush* (Eremophila scaberula) *Interim Recovery Plan 1999-2001. Interim Recovery Plan No. 28*. Department of Conservation and Land Management, Wanneroo, Western Australia. Available from: http://www.environment.gov.au/resource/rough-emu-bush-eremophila-scaberula-interim-recovery-plan-1999-2002. In effect under the EPBC Act from 09-Mar-2001.

Threatened Species Scientific Committee (TSSC). 2016. *Conservation Advice* Eremophila scaberula *rough emu bush*. Canberra: Department of the Environment. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/16729-conservation-advice-15072016.pdf. In effect under the EPBC Act from 15-Jul-2016.

Western Australian Museum (WAM). 2020. *Checklist of the Terrestrial Vertebrate Fauna of Western Australia*. Updated April 2020. Government of Western Australia.

Wilson, S., and Swan, G. 2010. *A Complete Guide to Reptiles of Australia*. Third Edition. New Holland Publishers, Sydney, Australia.

# Appendix A Framework for conservation significant flora and fauna ranking

**CATEGORIES OF THREATENED SPECIES UNDER THE ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 (EPBC ACT)**

Threatened fauna and flora may be listed in any one of the following categories as defined in Section 179 of the EPBC Act. Species listed as 'conservation dependent' and 'extinct' are not Matters of National Environmental Significance and therefore do not trigger the EPBC Act.

| Category | Definition |
|---|---|
| Extinct (EX) | There is no reasonable doubt that the last member of the species has died. |
| Extinct in the Wild (EW) | Taxa known to survive only in captivity or as a naturalised population well outside its past range; or taxa 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. |
| Critically Endangered (CE) | Taxa considered to be facing an extremely high risk of extinction in the wild. |
| Endangered (EN) | Taxa considered to be facing a very high risk of extinction in the wild. |
| Vulnerable (VU) | Taxa considered to be facing a high risk of extinction in the wild. |
| Near Threatened (NT) | Taxa has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future. |
| Least Concern (LC) | Taxa has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category. |
| Data Deficient (DD) | There is inadequate information to make a direct, or indirect, assessment of taxa's risk extinction based on its distribution and/or population status. |
| Not Evaluated (NE) | Taxa has not yet been evaluated against the criteria. |
| Migratory (M) | Not an IUCN category.<br>Species are defined as migratory if they are listed in an international agreement approved by the Commonwealth Environment Minister, including:<br>• the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animal) for which Australia is a range state;<br>• the agreement between the Government of Australian and the Government of the People's Republic of China for the Protection of Migratory Birds and their environment (CAMBA);<br>• the agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); or<br>• the agreement between Australia and the Republic of Korea to develop a bilateral migratory bird agreement similar to the JAMBA and CAMBA in respect to migratory bird conservation and provides a basis for collaboration on the protection of migratory shorebirds and their habitat (ROKAMBA). |

CONSERVATION CODES FOR WESTERN AUSTRALIA FLORA AND FAUNA

The Wildlife Conservation (Specially Protected Fauna) Notice 2018 and the Wildlife Conservation (Rare Flora) Notice 2018 have been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*.

Specially protected fauna or flora are species which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

Threatened species (T)

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 *Biodiversity Conservation Act 2016* (BC Act).

Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna.

Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

| Category | Code | Description |
|---|---|---|
| Critically Endangered species | CR | Threatened species considered to be "facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines".<br>Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora. |
| Endangered species | EN | Threatened species considered to be "facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines".<br>Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora. |
| Vulnerable species | VU | Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines".<br>Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) |

| Category | Code | Description |
|---|---|---|
| | | Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora. |

Extinct species

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild, as follows:

| Category | Code | Description |
|---|---|---|
| Extinct species | EX | Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora. |
| Extinct in the wild species | EW | 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).<br>Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice. |

Specially protected species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

Categories are detailed below.

| Category | Code | Description |
|---|---|---|
| Migratory species | M | Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an |

| Category | Code | Description |
|---|---|---|
| | | 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).<br>Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.<br>Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018. |
| Species of special conservation interest (conservation dependent fauna) | CD | 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).<br>Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018. |
| Other specially protected species | OS | 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).<br>Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018. |

Priority species (P)

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

| Category | Code | Definition |
|---|---|---|
| Priority 1 | P1 | Poorly-known species<br>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 |

| Category | Code | Definition |
|---|---|---|
| | | 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. |
| Priority 2 | P2 | Poorly-known species<br>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. |
| Priority 3 | P3 | Poorly-known species<br>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. |
| Priority 4 | P4 | Rare, Near Threatened and other species in need of monitoring<br>(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.<br>(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.<br>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy. |

# Appendix B Likelihood of occurrence assessment criteria

| Likelihood rating | Criteria |
|---|---|
| Recorded | The species has previously been recorded within survey area from DBCA database search results and/or from previous surveys of the survey area, and/or the species has been confirmed through a current vouchered specimen at WA Herbarium. |
| Likely | The species has not previously been recorded from within the survey area. However, (to qualify requires one or more criteria to be met):<br>the species has been recorded in close proximity to the survey area, and occurs in similar habitat to that which occurs within the survey area<br>core habitat and suitable landforms for the species occurs within the survey area either year-round or seasonally. In relation to fauna species, this could be that a host plant is seasonally present on site, or habitat features such as caves are present that may be used during particular times during its life cycle e.g. for breeding. In relation to both flora and fauna species, it may be there are seasonal wetlands present<br>there is a medium to high probability that a species uses the survey area |
| Potential | The species has not previously been recorded from within the survey area. However, (one or more criteria requires to be met):<br>targeted surveys may locate the species based on records occurring in proximity to the survey area and suitable habitat occurring in the survey area<br>the survey area has been assessed as having potentially suitable habitat through habitat modelling<br>the species is known to be cryptic and may not have been detected despite extensive surveys<br>the species is highly mobile and has an extensive foraging range so may not have been detected during previous surveys<br>The species has been recorded in the survey area by a previous consultant survey or there is historic evidence of species occurrence within the survey area. However, (one or more criteria requires to be met)<br>doubt remains over taxonomic identification, or the majority of habitat does not appear suitable (although presence cannot be ruled out due to factors such as species ecology or distribution)<br>coordinates are doubtful |
| Unlikely | The species has been recorded locally through DBCA database searches. However, it has not been recorded within the survey area and<br>it is unlikely to occur due to the site lacking critical habitat, having at best marginally suitable habitat, and/or being severely degraded<br>it is unlikely to occur due to few historic record/s and no other current collections in the local area.<br>The species has been recorded within the bioregion based on literature review but has not been recorded locally or within the survey area through DBCA database searches.<br>The species has not been recorded in the survey area despite adequate survey efforts, such as a standardised methodology or targeted searching within potentially suitable habitat. |
| Does not occur | The species is not known to occur within the IBRA bioregion based on current literature and distribution.<br>The conspicuous species has not been recorded in the survey area despite adequate survey efforts at an appropriate time of year to detect the species within potentially suitable habitat.<br>The survey area lacks important habitat for a species that has highly selective habitat requirements.<br>The species has been historically recorded within survey area or locally; however, it is considered locally extinct due to significant habitat changes such as land clearing and/or introduced predators. |

# Appendix C Flora likelihood of occurrence assessment

| Species | Conservation status | | Source | Likelihood of occurrence |
|---|---|---|---|---|
| | EPBC Act | BC Act / DBCA | | |
| *Acacia cochlocarpa* subsp. *velutinosa* | CR | CR | DAWE 2020a | Unlikely |
| *Banksia fuscobractea* | CR | CR | DAWE 2020a | Unlikely |
| *Dasymalla axillaris* | CR | CR | DAWE 2020a | Unlikely |
| *Haloragis platycarpa* | CR | CR | DBCA 2020a, DAWE 2020a, DBCA 2007-2020 | Potential |
| *Trithuria occidentalis* | CR | CR | DBCA 2020a | Unlikely |
| *Acacia cochlocarpa* subsp. *cochlocarpa* | EN | CR | DBCA 2020a, DAWE 2020a, DBCA 2007-2020 | Unlikely |
| *Chorizema humile* | EN | CR | PMST | Unlikely |
| *Eremophila scaberula* | EN | CR | DBCA 2020a, DAWE 2020a, DBCA 2007-2020 | Does not occur |
| *Eucalyptus absita* | EN | CR | DBCA 2020a, DAWE 2020a, DBCA 2007-2020 | Potential |
| *Eucalyptus dolorosa* | EN | CR | DAWE 2020a | Unlikely |
| *Eucalyptus impensa* | EN | CR | DAWE 2020a | Unlikely |
| *Gastrolobium hamulosum* | EN | CR | DBCA 2020a, PMST | Unlikely |
| *Grevillea pythara* | EN | CR | DAWE 2020a | Unlikely |
| *Hemiandra gardneri* | EN | CR | DBCA 2020a, DAWE 2020a, DBCA 2007-2020 | Unlikely |
| *Thelymitra dedmaniarum* | EN | CR | DAWE 2020a | Unlikely |
| *Verticordia staminosa* subsp. *staminosa* | EN | CR | DAWE 2020a | Unlikely |
| *Acacia aristulata* | EN | EN | DBCA 2020a, DAWE 2020a, DBCA 2007-2020 | Unlikely |
| *Conospermum densiflorum* subsp. *unicephalatum* | EN | EN | DBCA 2020a, DAWE 2020a, DBCA 2007-2020 | Potential |
| *Darwinia acerosa* | EN | EN | DBCA 2020a, DAWE 2020a, DBCA 2007-2020 | Potential |
| *Daviesia dielsii* | EN | EN | DBCA 2020a, DAWE 2020a, DBCA 2007-2020 | Potential |
| *Eucalyptus leprophloia* | EN | EN | DAWE 2020a | Unlikely |
| *Goodenia arthrotricha* | EN | EN | DBCA 2020a, DAWE 2020a, DBCA 2007-2020 | Unlikely |
| *Grevillea christineae* | EN | EN | DAWE 2020a | Unlikely |
| *Spirogardnera rubescens* | EN | EN | DAWE 2020a | Unlikely |

| Species | Conservation status | | Source | Likelihood of occurrence |
|---|---|---|---|---|
| | EPBC Act | BC Act / DBCA | | |
| *Synaphea quartzitica* | EN | EN | DBCA 2020a, DAWE 2020a, DBCA 2007-2020 | Unlikely |
| *Thelymitra stellata* | EN | EN | DAWE 2020a | Unlikely |
| *Chamelaucium lullfitzii* | EN | EN | DAWE 2020a | Unlikely |
| *Eucalyptus recta* | EN | VU | DBCA 2020a, DAWE 2020a | Unlikely |
| *Banksia serratuloides* subsp. *serratuloides* | VU | EN | DBCA 2020a, DAWE 2020a | Potential |
| *Gastrolobium appressum* | VU | EN | DAWE 2020a | Unlikely |
| *Eleocharis keigheryi* | VU | VU | DBCA 2020a, DAWE 2020a, DBCA 2007-2020 | Potential |
| *Acacia splendens* | - | CR | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Eremophila glabra* subsp. *chlorella* | - | EN | DBCA 2020a, DBCA 2007-2020 | Recorded |
| *Acacia congesta* subsp. *cliftoniana* | - | P1 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Caladenia dundasiae* | - | P1 | DBCA 2020a, DBCA 2007-2020 | Potential |
| *Calytrix ecalycata* subsp. *pubescens* | - | P1 | DBCA 2020a, DBCA 2007-2020 | Potential |
| *Micromyrtus rogeri* | - | P1 | DBCA 2020a | Unlikely |
| *Stylidium carnosum* subsp. *Narrow leaves (J.A. Wege 490)* | - | P1 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Verticordia dasystylis* subsp. *oestopoia* | - | P1 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Anigozanthos humilis* subsp. *Badgingarra (S.D. Hopper 7114)* | - | P2 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Boronia ericifolia* | - | P2 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Bossiaea moylei* | - | P2 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Dampiera tephrea* | - | P2 | DBCA 2020a | Potential |
| *Eremaea* sp. *Cairn Hill (B. Morgan 532)* | - | P2 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Gompholobium roseum* | - | P2 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Hemigenia curvifolia* | - | P2 | DBCA 2020a, DBCA 2007-2020 | Unlikely |

| Species | Conservation status | | Source | Likelihood of occurrence |
|---|---|---|---|---|
| | EPBC Act | BC Act / DBCA | | |
| *Hypocalymma serrulatum* | - | P2 | DBCA 2020a | Unlikely |
| *Hypocalymma* sp. *Cataby (G.J. Keighery 5151)* | - | P2 | DBCA 2020a | Unlikely |
| *Pertusaria trachyspora* | - | P2 | DBCA 2020a | Unlikely |
| *Stylidium* sp. *Moora (J.A. Wege 713)* | - | P2 | DBCA 2020a, DBCA 2007-2020 | Potential |
| *Synaphea rangiferops* | - | P2 | DBCA 2020a | Unlikely |
| *Synaphea sparsiflora* | - | P2 | DBCA 2020a | Unlikely |
| *Tricoryne* sp. *Wongan Hills (B.H. Smith 794)* | - | P2 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Acacia cummingiana* | - | P3 | DBCA 2007-2020 | Potential |
| *Acacia nodiflora* | - | P3 | DBCA 2007-2020 | Unlikely |
| *Acacia ridleyana* | - | P3 | DBCA 2020a | Potential |
| *Adenanthos cygnorum* subsp. *chamaephyton* | - | P3 | DBCA 2020a | Unlikely |
| *Austrostipa* sp. *Cairn Hill (M.E. Trudgen 21176)* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Potential |
| *Babingtonia cherticola* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Potential |
| *Babingtonia urbana* | - | P3 | DBCA 2007-2020 | Potential |
| *Banksia dallanneyi* subsp. *pollosta* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Potential |
| *Banksia pteridifolia* subsp. *vernalis* | - | P3 | DBCA 2020a | Unlikely |
| *Beaufortia bicolor* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Beaufortia eriocephala* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Blackallia nudiflora* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Potential |
| *Calytrix ecalycata* subsp. *brevis* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Chamelaucium* sp. *Wongan Hills (B.H. Smith 1140)* | - | P3 | DBCA 2020a | Unlikely |
| *Daviesia debilior* subsp. *sinuans* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Potential |
| *Eucalyptus macrocarpa* x *pyriformis* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Gastrolobium rotundifolium* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Potential |
| *Guichenotia alba* | - | P3 | DBCA 2020a | Unlikely |
| *Guichenotia tuberculata* | - | P3 | DBCA 2020a | Potential |

| Species | Conservation status | | Source | Likelihood of occurrence |
|---|---|---|---|---|
| | EPBC Act | BC Act / DBCA | | |
| *Isopogon autumnalis* | - | P3 | DBCA 2020a | Unlikely |
| *Isotropis cuneifolia* subsp. *glabra* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Meionectes tenuifolia* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Melaleuca sclerophylla* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Persoonia chapmaniana* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Petrophile biternata* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Potential |
| *Petrophile plumosa* | - | P3 | DBCA 2020a | Potential |
| *Stylidium periscelianthum* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Potential |
| *Stylidium sacculatum* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Potential |
| *Styphelia allittii (ex. Leucopogon allittii)* | - | P3 | DBCA 2007-2020 | Unlikely |
| *Styphelia tamminensis* (ex. *Leucopogon tamminensis* var. *tamminensis*) | - | P3 | DBCA 2007-2020 | Unlikely |
| *Verticordia huegelii* var. *tridens* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Potential |
| *Verticordia insignis* subsp. *eomagis* | - | P3 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Acacia alata* var. *platyptera* | - | P4 | DBCA 2020a | Potential |
| *Anigozanthos humilis* subsp. *chrysanthus* | - | P4 | DBCA 2020a | Unlikely |
| *Calothamnus accedens* | - | P4 | DBCA 2020a, DBCA 2007-2020 | Potential |
| *Calothamnus pachystachyus* | - | P4 | DBCA 2020a, DBCA 2007-2020 | Potential |
| *Desmocladus elongatus* | - | P4 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Diuris recurva* | - | P4 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Eucalyptus* x *carnabyi* | - | P4 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Grevillea drummondii* | - | P4 | DBCA 2020a | Unlikely |
| *Grevillea rudis* | - | P4 | DBCA 2020a, DBCA 2007-2020 | Unlikely |

| Species | Conservation status | | Source | Likelihood of occurrence |
|---|---|---|---|---|
| | EPBC Act | BC Act / DBCA | | |
| *Grevillea saccata* | - | P4 | DBCA 2020a, DBCA 2007-2020 | Unlikely |
| *Hibbertia miniata* | - | P4 | DBCA 2020a | Unlikely |
| *Persoonia sulcata* | - | P4 | DBCA 2020a | Potential |
| *Regelia megacephala* | - | P4 | DBCA 2020a, DBCA 2007-2020 | Potential |

# Appendix D Fauna likelihood of occurrence assessment

| Species | Common name | Conservation status | | Habitat | Source | Likelihood of occurrence | Justification |
|---|---|---|---|---|---|---|---|
| | | EPBC Act | BC Act / DBCA | | | | |
| *Calidris ferruginea* | Curlew Sandpiper | CR, M | CR, M | Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. | DAWE 2020a | Unlikely | No suitable habitat occurs within the survey area. |
| *Numenius madagascariensis* | Eastern Curlew | CR, M | CR, M | Inhabits a variety of habitats from coastal beaches, saltmarshes, mudflats, and natural or artificial wetlands inland. | DAWE 2020a | Unlikely | No suitable habitat occurs within the survey area. |
| *Calyptorhynchus latirostris* | Carnaby's Cockatoo | EN | EN | Carnaby's Black-Cockatoo occurs in uncleared or remnant native eucalypt woodlands and in shrubland or kwongan heathland. Forages seasonally in pine plantations, around Perth metropolitan, and forests containing Marri, Karri and Jarrah. | DAWE 2020a, DBCA 2007-2020 | **Recorded** | |
| *Rostratula australis* | Australian Painted Snipe | EN | EN | Inhabits a variety of freshwater habitats including temporary and permanent wetlands (shallows and mudbanks) where there is emergent low vegetation, tree-lined banks, or fallen or washed-up timber. | DBCA 2020c, DAWE 2020a | Unlikely | No suitable habitat occurs within the survey area. |
| *Egernia stokesii badia* | Western Spiny-tailed Skink | EN | VU | York Gum woodland, with some records in Gimlet (*E. salubris*) and Salmon Gum (*E. salmonophloia*). Populations persist in woodland patches as small as one ha and completely surrounded by wheat | DAWE 2020a | Potential | Potential habitat for this species occurs within the survey area. The survey area |

| Species | Common name | Conservation status | | Habitat | Source | Likelihood of occurrence | Justification |
|---|---|---|---|---|---|---|---|
| | | EPBC Act | BC Act / DBCA | | | | |
| | | | | fields. Sites with the greatest number of individuals contain numerous fallen logs and were subjected to low-intensity grazing by domestic stock. | | | occurs on the edge of this species modelled distribution. |
| *Idiosoma nigrum* | Shield-backed Trapdoor Spider | VU | EN | In the Wheatbelt, the Shield-backed Trapdoor Spider typically inhabits clay soils whereas the arid Midwest populations are associated with rocky habitats, primarily in positions with increased moisture retention properties like gullies and drainage lines on southern facing slopes. Leaf litter and twigs are extremely important to the species as it provides material for the burrows, reduced soil moisture loss and increased prey availability. | DAWE 2020a, DBCA 2007-2020 | Potential | The survey area occurs within the modelled distribution of this species, and suitable habitat for this species occurs within the survey area. |
| *Calyptorhynchus banksii naso* | Forest Red-tailed Black Cockatoo | VU | VU | Inhabits dense Jarrah, Karri and Marri forests which receive more than 600 mm average annual rainfall. Known to feed in more open agricultural areas and metropolitan Perth. | DBCA 2020c | Unlikely | The survey area occurs outside of the modelled current distribution of this species (100 km north). There is only one historic record known from 2 km northeast of the survey area. Foraging habitat for this species within the survey area is marginal. |
| *Dasyurus geoffroii* | Chuditch, Western Quoll | VU | VU | Chuditch use a range of habitats including forest, mallee shrublands, woodland and desert. The most dense populations have been found in riparian jarrah forest. Chuditch require adequate numbers of suitable den and refuge sites (horizontal hollow logs or earth burrows) and sufficient prey biomass (large invertebrates, reptiles and small mammals) to survive. | DBCA 2020c, DAWE 2020a, DBCA 2007-2020 | Unlikely | No suitable habitat occurs within the survey area. Nearby records for this species are historical. |

| Species | Common name | Conservation status | | Habitat | Source | Likelihood of occurrence | Justification |
|---|---|---|---|---|---|---|---|
| | | EPBC Act | BC Act / DBCA | | | | |
| *Leipoa ocellata* | Malleefowl | VU | VU | Occurs in scrubland and woodland dominated by mallee and wattle species. In Western Australia they are also found in some shrublands dominated by acacia, and occasionally in woodlands dominated by eucalypts such as Wandoo *E. wandoo*, Marri *Corymbia calophylla* and Mallet *E. astringens*. | DAWE 2020a | Unlikely | Habitat within the survey area is not suitable and would not provide enough cover and shelter for this species. |
| *Nannatherina balstoni* | Balston's Pygmy Perch | VU | VU | Balston's Pygmy Perch inhabits acidic, tannin-stained freshwater pools, streams and lakes in peat flats within 30 km of the coast of south-west Western Australia, preferring shallow water, and commonly associated with tall sedge thickets and inundated riparian vegetation. | DAWE 2020a | Does not occur within survey area | No suitable habitat occurs within the survey area. |
| *Phascogale calura* | Red-tailed Phascogale | VU | CD | Historically widespread throughout woodland habitats, however, now they are restricted to remnant mature *Eucalyptus wandoo* or *Allocasuarina huegeliana* woodlands in the south of the wheatbelt. A preference for unburnt habitat with a continuous canopy and the presence of tree hollows. | DAWE 2020a | Unlikely | The nearest record of this species is 150 km to the south of the survey area. This species distribution is limited to the southern wheatbelt. Only marginal habitat for this species occurs within the survey area. |
| *Actitis hypoleucos* | Common Sandpiper | M | M | Wide range of coastal wetlands and some inland wetlands. Is mostly found around muddy margins or rocky shores and rarely on mudflats. | DBCA 2020c, DAWE 2020a | Unlikely | No suitable habitat occurs within the survey area. One record of this species occurs 12.7 km to the north west of the survey area. |
| *Apus pacificus* | Fork-tailed Swift | M | M | In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas and cities. They mostly occur over dry or open | DAWE 2020a | Unlikely | This species, although has a wide variety of habitat requirements, is rarely recorded inland. |

| Species | Common name | Conservation status | | Habitat | Source | Likelihood of occurrence | Justification |
|---|---|---|---|---|---|---|---|
| | | EPBC Act | BC Act / DBCA | | | | |
| | | | | habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. | | | |
| *Calidris acuminata* | Sharp-tailed Sandpiper | M | M | In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms. | DBCA 2020c, DAWE 2020a, DBCA 2007-2020 | Unlikely | No suitable habitat occurs within the survey area. |
| *Calidris melanotos* | Pectoral Sandpiper | M | M | In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. | DBCA 2020c, DAWE 2020a, DBCA 2007-2020 | Unlikely | No suitable habitat occurs within the survey area. |
| *Motacilla cinerea* | Grey Wagtail | M | M | This species inhabits fast-flowing mountain streams and rivers with riffles and exposed rocks or shoals, often in forested areas. It is also found in more lowland watercourses, even canals, where there are artificial waterfalls, weirs, millraces or lock gates. Outside of the breeding season it occupies a wider variety of habitats, including farmyards, sewage farms, forest tracks, tea estates and even town centres. | DAWE 2020a | Unlikely | No suitable habitat occurs within the survey area. |
| *Pandion haliaetus* | Osprey | M | M | Inhabits inshore coastal and estuarine waters, and some inland lakes and rivers | DAWE 2020a | Unlikely | No suitable habitat occurs within the survey area. |

| Species | Common name | Conservation status | | Habitat | Source | Likelihood of occurrence | Justification |
|---|---|---|---|---|---|---|---|
| | | EPBC Act | BC Act / DBCA | | | | |
| *Plegadis falcinellus* | Glossy Ibis | M | M | The Glossy Ibis' preferred habitat for foraging and breeding are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. The species is occasionally found in coastal locations such as estuaries, deltas, saltmarshes and coastal lagoons. | DBCA 2020c | Unlikely | No suitable habitat occurs within the survey area. Nearest record occurs 12 km to the northwest of the survey area. |
| *Tringa nebularia* | Common Greenshank | M | M | Found within permanent and ephemeral wetlands (including swamps, lakes, dams, rivers and creeks). | DAWE 2020a | Unlikely | No suitable habitat occurs within the survey area. |
| *Falco peregrinus* | Peregrine Falcon | - | S | Peregrine falcons prefer open habitats, such as grasslands, tundra, and meadows. They are most common in tundra and coastal areas and rare in sub-tropical and tropical habitats. They nest on cliff faces and crevices. They have recently begun to colonize urban areas because tall buildings are suitable for nesting in this species, and because of the abundance of pigeons as prey items. | DBCA 2020c, DBCA 2007-2020 | Potential | This species has a wide range and preferred habitat type. One recent record from 4 km north of the survey area. |
| *Idiosoma dandaragan* | Dandaragan Plateau Shield-backed Trapdoor Spider | - | P2 | Trapdoor spiders live in stable environments that are in good condition. For trapdoor spiders, this means there is often shade, moisture and food. The most suitable habitat is one that has had minimal disturbance from humans, which also supports the spiders prey. Ants, beetles and other soil borne invertebrates are bountiful in places with deep leaf litter and low levels of erosion. | DBCA 2020c | Potential | Limited habitat information available for this species. Records of this species occur 2.8 km to the south of the survey area. Records are all historic (>60 years). |
| *Hydromys chrysogaster* | Rakali | - | P4 | Inhabits areas with access permanent water (semi-aquatic) within a broad range of terrestrial habitats. | DBCA 2020c, DBCA 2007-2020 | Unlikely | No suitable habitat occurs within the survey area. |

| Species | Common name | Conservation status | | Habitat | Source | Likelihood of occurrence | Justification |
|---|---|---|---|---|---|---|---|
| | | EPBC Act | BC Act / DBCA | | | | |
| *Oxyura australis* | Blue-billed Duck | - | P4 | The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed, but prefers to dive if approached. | DBCA 2020c, DBCA 2007-2020 | Unlikely | No suitable habitat occurs within the survey area. |
| *Platycercus icterotis subsp. xanthogenys* | Western Rosella | - | P4 | The south-west subspecies is found in eucalypt forests and woodlands among the wetter areas of Jurien to Green Range including areas containing flooded gum (*Eucalyptus rudis*), karri (*E. diversicolor*), marri (*Corymbia calophylla*) and paperbark (*Melaleuca* spp). The inland subspecies is found in eucalypt and sheoak woodlands and scrubs, especially those containing wandoo (*E. wandoo*), flooded gum, salmon gum (*E. salmonophloia*), tall mallee and rock sheoak (*Allocasuarina huegeliana*). Hybrid birds, with characteristics of both subspecies, are found in areas between the two subspecies. | DBCA 2020c, DBCA 2007-2020 | Potential | Potential habitat for this species occurs within the survey area. A nearby record is located 5 km to the west-northwest of the survey area. |
| *Thinornis rubricollis* | Hooded plover, hooded dotterel | - | P4 | It mainly occurs on wide beaches backed by dunes with large amounts of seaweed and jetsam, creek mouths and inlet entrances | DBCA 2020c | Unlikely | No suitable habitat occurs within the survey area. |

# Appendix E Flora species list

| Family | Species | Current survey (September 2020) | ELA 2020 (June 2020) |
|---|---|---|---|
| Amaranthaceae | *Ptilotus drummondii* | X | |
| | *Ptilotus manglesii* | X | |
| | *Ptilotus stirlingii* | X | X |
| Asparagaceae | *Acanthocarpus canaliculatus* | X | X |
| | *Arthropodium dyeri* | X | |
| | *Lomandra effusa* | X | |
| | *Lomandra* sp. | | X |
| Asphodelaceae | *Dianella revoluta* | X | |
| Asteraceae | **Arctotheca calendula* | X | X |
| | **Conyza bonariensis* | X | X |
| | **Gorteria personata* | X | |
| | **Hypochaeris glabra* | X | |
| | **Monoculus monstrosus* | X | |
| | *Olearia* sp. Eremicola (Diels & Pritzel s.n. PERTH 00449628) | X | X |
| | *Podolepis capillaris* | X | X |
| | *Podolepis lessonii* | X | |
| | **Ursinia anthemoides* | X | |
| Boraginaceae | *Halgania cyanea* | X | |
| | *Halgania sp.* | | X |
| Boryaceae | *Borya laciniata* | X | X |
| Brassicaceae | **Brassica barrelieri* | X | X |
| | **Brassica napus* | X | |
| | **Brassica tournefortii* | X | |
| | **Raphanus raphanistrum* | X | X |
| Casuarinaceae | *Allocasuarina campestris* | X | X |
| | *Casuarina obesa* | X | X |
| Chenopodiaceae | *Atriplex semibaccata* | X | |
| | *Dysphania melanocarpa* | X | X |
| | *Enchylaena tomentosa* | X | X |
| | *Maireana brevifolia* | X | X |
| | *Rhagodia preissii* | X | X |
| | *Salsola australis* | X | X |

| Family | Species | Current survey (September 2020) | ELA 2020 (June 2020) |
|---|---|---|---|
| | *Sclerolaena diacantha* | X | X |
| Colchicaceae | *Burchardia congesta* | X | |
| Crassulaceae | *Crassula colorata* | X | |
| Cyperaceae | *Fimbristylis* sp. | | X |
| | *Lepidosperma costale* | X | |
| | *Lepidosperma tenue* | X | |
| | *Mesomelaena preissii* | X | |
| | *Schoenus clandestinus* | X | |
| Euphorbiaceae | *Euphorbia drummondii* | X | X |
| Fabaceae | *Acacia acuminata* | X | X |
| | *Acacia bidentata* | X | X |
| | *Acacia enervia subsp. explicata* | X | |
| | *Acacia erinacea* | X | X |
| | *Acacia hemiteles* | X | X |
| | *Acacia leptospermoides subsp. leptospermoides* | X | X |
| | *Acacia lineolata* subsp. *lineolata* | X | X |
| | *Acacia microbotrya* | X | X |
| | *Acacia multispicata* | X | X |
| | *Acacia saligna* | X | X |
| | *Acacia* sp. | X | |
| | *Daviesia divaricata* | X | X |
| | *Jacksonia sternbergiana* | X | X |
| | *Templetonia sulcata* | X | X |
| Geraniaceae | *Erodium cygnorum* | X | |
| Goodeniaceae | *Dampiera lavandulacea* | X | X |
| | *Scaevola spinescens* | X | X |
| Hemerocallidaceae | *Corynotheca micrantha* | X | X |
| | *Dianella revoluta* | X | X |
| | *Tricoryne tenella* | X | X |
| Iridaceae | **Freesia alba x leichtlinii* | X | |
| | **Moraea setifolia* | X | |
| | **Romulea rosea* | X | X |
| Lauraceae | *Cassytha* sp. | X | X |
| Malvaceae | *Seringia velutina* | X | |

| Family | Species | Current survey (September 2020) | ELA 2020 (June 2020) |
|---|---|---|---|
| Marsileaceae | *Marsilea hirsuta* | X | |
| Montiaceae | *Calandrinia baccata* | X | |
| Myrtaceae | *Calytrix* sp. | X | X |
| | *Eucalyptus camaldulensis* | X | X |
| | *Eucalyptus loxophleba* | X | X |
| | *Eucalyptus salmonophloia* | X | X |
| | *Eucalyptus wandoo* | X | X |
| | *Melaleuca acuminata* | X | X |
| | *Melaleuca adnata* | X | X |
| | *Melaleuca stereophloia* | X | |
| | *Verticordia sp.* | X | |
| Orchidaceae | *Pterostylis picta* | X | |
| Oxalidaceae | **Oxalis pes-caprae* | X | X |
| Pittosporaceae | *Pittosporum angustifolium* | X | X |
| Poaceae | **Aira cupaniana* | X | |
| | *Aristida holathera* | X | X |
| | *Austrostipa elegantissima* | X | X |
| | *Austrostipa variabilis* | X | |
| | **Avena barbata* | X | X |
| | **Briza maxima* | X | |
| | **Bromus diandrus* | X | X |
| | **Bromus rubens* | X | X |
| | **Cynodon dactylon* | X | X |
| | ** Ehrharta calycina* | X | X |
| | **Ehrharta longiflora* | X | |
| | **Eragrostis curvula* | X | X |
| | **Eragrostis* sp. | | X |
| | **Hordeum leporinum* | X | X |
| | **Lolium rigidum* | X | |
| | *Neurachne alopecuroidea* | X | |
| | *Poaceae sp. (Indeterminate)* | X | |
| Polygalaceae | *Comesperma integerrimum* | X | |
| Polygonaceae | *Muehlenbeckia adpressa* | X | |
| Proteaceae | *Grevillea biternata* | X | X |

| Family | Species | Current survey (September 2020) | ELA 2020 (June 2020) |
|---|---|---|---|
| | *Grevillea huegelii* | X | X |
| | *Hakea commutata* | X | X |
| | *Hakea erinacea* | X | X |
| | *Hakea preissii* | X | X |
| Restionaceae | *Desmocladus asper* | X | X |
| Rhamnaceae | *Stenanthemum sp.* | X | |
| Rubiaceae | *Opercularia vaginata* | X | |
| Santalaceae | *Exocarpos sparteus* | X | X |
| Santalaceae | *Santalum acuminatum* | X | X |
| Scrophulariaceae | *Eremophila glabra* | X | X |
| | *Eremophila glabra subsp. chlorella* (T) | X | |
| | *Eremophila lehmanniana* | X | X |
| | *Eremophila scaberula* (T) | | X |
| Solanaceae | **Solanum nigrum* | X | X |
| Surianaceae | *Stylobasium australe* | X | X |
| **TOTAL** | | **110** | **72** |

| Family | Species | Current survey (September 2020) | ELA 2020 (June 2020) |
|---|---|---|---|
| Santalaceae | *Exocarpos sparteus* | X | |
| | *Santalum acuminatum* | X | |
| Scrophulariaceae | *Eremophila glabra* | X | |
| | *Eremophila glabra subsp. chlorella* | | |
| Surianaceae | *Stylobasium australe* | | |

# Appendix F Quadrat data

| Site name | Date | Site type | Observer |
|---|---|---|---|
| ELA01 | 30/09/2020 | Quadrat | DB |
| **Vegetation condition** | **Disturbance notes** | **Age since fire (years)** | **Vegetation community** |
| Excellent | Weeds, tracks, clearing | >20 | EslW |
| **Habitat description** | **Landform unit** | **Aspect** | **Slope %** |
| *Eucalyptus salmonophloia, Eucalyptus loxophleba* mid woodland | Flat | N/A | N/A |
| **Soil colour** | **Soil type** | **Soil condition** | **Litter (%)** |
| Brown | Clay loam | Dry | 10 |
| **Rock type** | **Outcropping (%)** | **Easting** | **Northing** |
| N/A | N/A | 405858 | 6605305 |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| **Aira cupaniana* | 0.01 | G | Grass |
| **Avena barbata* | 1 | G | Grass |
| **Bromus rubens* | 0.5 | G | Grass |
| **Ehrharta longiflora* | 0.01 | G | Grass |
| **Lolium rigidum* | 0.01 | G | Grass |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| **Monoculus monstrosus* | 0.01 | G | Herb |
| **Raphanus raphanistrum* | 0.01 | G | Herb |
| *Aristida holathera* | 0.01 | G | Grass |
| *Arthropodium dyeri* | 0.01 | c | Herb |
| *Austrostipa elegantissima* | 4 | G | Grass |
| *Austrostipa variabilis* | 0.5 | G | Grass |
| *Calandrinia baccata* | 0.1 | G | Herb |
| *Comesperma integerrimum* | 0.5 | G | Climber |
| *Crassula colorata* | 0.01 | G | Herb |
| *Enchylaena tomentosa* | 1 | G | Shrub |
| *Eremophila glabra* | 2 | G | Shrub |
| *Eucalyptus loxophleba* | 4 | U | Tree |
| *Eucalyptus salmonophloia* | 30 | U | Tree |
| *Exocarpos sparteus* | 5 | M | Shrub |
| *Lomandra effusa* | 0.1 | G | Herb |
| *Podolepis capillaris* | 0.1 | G | Herb |
| *Rhagodia preissii* | 5 | M | Shrub |
| *Santalum acuminatum* | 6 | M | Small tree, shrub |
| *Scaevola spinescens* | 4 | G | Shrub |
| *Sclerolaena diacantha* | 1 | M | Shrub |

| Site name | Date | Site type | Observer |
|---|---|---|---|
| ELA02 | 30/09/2020 | Quadrat | DB |
| **Vegetation condition** | **Disturbance notes** | **Age since fire (years)** | **Vegetation community** |
| Degraded | Weeds, tracks, clearing | >20 | EcG |
| **Habitat description** | **Landform unit** | **Aspect** | **Slope %** |
| *Eucalyptus camaldulensis* mid open woodland | Flat | N/A | N/A |
| **Soil colour** | **Soil type** | **Soil condition** | **Litter (%)** |
| Light grey | Clay loam | Dry | 5 |
| **Rock type** | **Outcropping (%)** | **Easting** | **Northing** |
| N/A | N/A | 405772 | 6605746 |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| **Aira cupaniana* | 0.01 | G | Grass |
| **Avena barbata* | 3 | G | Grass |
| **Ehrharta longiflora* | 0.1 | G | Grass |
| **Eragrostis curvula* | 8 | G | Grass |
| **Hypochaeris glabra* | 0.01 | G | Grass |
| **Monoculus monstrosus* | 0.1 | G | Herb |
| **Romulea rosea* | 8 | G | Herb |
| **Ursinia anthemoides* | 0.1 | G | Herb |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| *Acacia leptospermoides subsp. leptospermoides* | 6 | M | Shrub |
| *Austrostipa elegantissima* | 0.5 | G | Grass |
| *Austrostipa variabilis* | 0.1 | G | Grass |
| *Crassula colorata* | 0.01 | G | Herb |
| *Dampiera lavandulacea* | 3 | G | Herb |
| *Dianella revoluta* | 0.1 | G | Herb |
| *Eucalyptus camaldulensis* | 10 | U | Tree |
| *Grevillea biternata* | 2 | G | Shrub |
| *Hakea preissii* | 3 | M | Shrub |
| *Opercularia vaginata* | 0.01 | G | Herb |
| *Podolepis lessonii* | 0.01 | G | Herb |
| *Stylobasium australe* | 1 | M | Shrub |
| *Verticordia sp.* | 1.5 | M | Shrub |

| Site name | Date | Site type | Observer |
|---|---|---|---|
| ELA03 | 30/09/2020 | Quadrat | DB |
| **Vegetation condition** | **Disturbance notes** | **Age since fire (years)** | **Vegetation community** |
| Very good | Weeds, tracks., clearing | >20 | EwW |
| **Habitat description** | **Landform unit** | **Aspect** | **Slope %** |
| *Eucalyptus wandoo* mid woodland | Flat | N/A | N/A |
| **Soil colour** | **Soil type** | **Soil condition** | **Litter (%)** |
| Pale brown | Loam | Very good | 30 |
| **Rock type** | **Outcropping (%)** | **Easting** | **Northing** |
| N/A | N/A | 405723 | 6606048 |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| **Avena barbata* | 1 | G | Grass |
| **Bromus rubens* | 0.1 | G | Grass |
| **Ehrharta longiflora* | 0.1 | G | Grass |
| **Lolium rigidum* | 0.01 | G | Grass |
| **Monoculus monstrosus* | 0.01 | G | Herb |
| *Austrostipa elegantissima* | 1 | G | Grass |
| *Dampiera lavandulacea* | 3 | G | Herb |
| *Desmocladus asper* | 2 | G | Herb |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| *Dianella revoluta* | 2 | G | Herb |
| *Enchylaena tomentosa* | 0.1 | G | Shrub |
| *Eucalyptus wandoo* | 60 | U | Tree |
| *Exocarpos sparteus* | 5 | M | Shrub |
| *Lomandra effusa* | 1 | G | Herb |
| *Marsilea hirsuta* | 0.01 | G | Herb |
| *Muehlenbeckia adpressa* | 0.25 | G | Shrub or climber |
| *Neurachne alopecuroidea* | 0.1 | G | Grass |
| *Poaceae (Indeterminate)* | 1 | G | Herb |
| *Rhagodia preissii* | 3 | M | Shrub |

| Site name | Date | Site type | Observer |
|---|---|---|---|
| ELA04 | 30/09/2020 | Quadrat | DB |
| **Vegetation condition** | **Disturbance notes** | **Age since fire (years)** | **Vegetation community** |
| Degraded | Weeds, tracks, clearing | >20 | EcG |
| **Habitat description** | **Landform unit** | **Aspect** | **Slope %** |
| *Eucalyptus camaldulensis* mid open woodland | Flat | N/A | N/A |
| **Soil colour** | **Soil type** | **Soil condition** | **Litter (%)** |
| Light brown | Loam | Dry | 5 |
| **Rock type** | **Outcropping (%)** | **Easting** | **Northing** |
| N/A | N/A | 405689 | 6606216 |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| **Arctotheca calendula* | 0.01 | G | Grass |
| **Avena barbata* | 2 | G | Grass |
| **Bromus diandrus* | 5 | G | Grass |
| **Ehrharta longiflora* | 0.1 | G | Grass |
| **Eragrostis curvula* | 40 | G | Grass |
| **Hypochaeris glabra* | 0.3 | G | Grass |
| **Lolium rigidum* | 0.01 | G | Grass |
| **Monoculus monstrosus* | 0.01 | G | Herb |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| **Raphanus raphanistrum* | 0.3 | G | Herb |
| **Romulea rosea* | 0.5 | G | Herb |
| *Dampiera lavandulacea* | 0.1 | G | Herb |
| *Dianella revoluta* | 1 | G | Herb |
| *Erodium cygnorum* | 0.01 | G | Herb |
| *Grevillea biternata* | 6 | G | Shrub |
| *Lepidosperma costale* | 1 | G | Grass |
| *Lepidosperma tenue* | 0.5 | G | Grass |
| *Muehlenbeckia adpressa* | 3 | G | Shrub or climber |

| Site name | Date | Site type | Observer |
|---|---|---|---|
| ELA05 | 30/09/2020 | Quadrat | DB |
| **Vegetation condition** | **Disturbance notes** | **Age since fire (years)** | **Vegetation community** |
| Very good to Excellent | Weeds, tracks, clearing | >20 | EslW |
| **Habitat description** | **Landform unit** | **Aspect** | **Slope %** |
| *Eucalyptus salmonophloia, Eucalyptus loxophleba* mid woodland | Flat | N/A | N/A |
| **Soil colour** | **Soil type** | **Soil condition** | **Litter (%)** |
| Pale brown | Clay loam | Dry | 10 |
| **Rock type** | **Outcropping (%)** | **Easting** | **Northing** |
| N/A | N/A | 405634 | 6606471 |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| **Ehrharta longiflora* | 0.01 | G | Grass |
| **Lolium rigidum* | 0.01 | G | Grass |
| **Moraea setifolia* | 0.01 | G | Herb |
| *Atriplex semibaccata* | 0.01 | G | Grass |
| *Austrostipa elegantissima* | 1 | G | Grass |
| *Austrostipa variabilis* | 0.01 | G | Grass |
| *Calandrinia baccata* | 0.01 | G | Herb |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| *Crassula colorata* | 0.1 | G | Herb |
| *Dianella revoluta* | 0.5 | G | Herb |
| *Enchylaena tomentosa* | 0.1 | G | Shrub |
| *Eremophila glabra* | 1 | G | Shrub |
| *Eucalyptus loxophleba* | 25 | U | Tree |
| *Eucalyptus salmonophloia* | 8 | U | Tree |
| *Lomandra effusa* | 3 | G | Herb |
| *Rhagodia preissii* | 8 | M | Shrub |
| *Scaevola spinescens* | 2 | G | Shrub |
| *Sclerolaena diacantha* | 0.01 | M | Shrub |
| *Templetonia sulcata* | 1 | G | Shrub |

| Site name | Date | Site type | Observer |
|---|---|---|---|
| ELA06 | 30/09/2020 | Quadrat | DB |
| **Vegetation condition** | **Disturbance notes** | **Age since fire (years)** | **Vegetation community** |
| Good | Weeds, tracks, clearing | >20 | EslW |
| **Habitat description** | **Landform unit** | **Aspect** | **Slope %** |
| *Eucalyptus salmonophloia, Eucalyptus loxophleba* mid woodland | Flat | N/A | N/A |
| **Soil colour** | **Soil type** | **Soil condition** | **Litter (%)** |
| Pale brown | Loam | Dry | 10 |
| **Rock type** | **Outcropping (%)** | **Easting** | **Northing** |
| N/A | N/A | 405589 | 6606775 |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| **Avena barbata* | 1 | G | Grass |
| **Bromus diandrus* | 0.01 | G | Grass |
| **Ehrharta longiflora* | 0.1 | G | Grass |
| **Lolium rigidum* | 0.1 | G | Grass |
| *Atriplex semibaccata* | 0.01 | G | Grass |
| *Austrostipa elegantissima* | 1 | G | Grass |
| *Comesperma integerrimum* | 0.1 | M | Shrub or climber |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| *Dianella revoluta* | 0.5 | G | Herb |
| *Enchylaena tomentosa* | 2 | G | Shrub |
| *Eucalyptus loxophleba* | 30 | U | Tree |
| *Eucalyptus salmonophloia* | 30 | U | Tree |
| *Melaleuca adnata* | 3 | G | Shrub |
| *Ptilotus manglesii* | 0.1 | G | Herb |
| *Rhagodia preissii* | 3 | M | Shrub |

| Site name | Date | Site type | Observer |
|---|---|---|---|
| ELA07 | 30/09/2020 | Quadrat | DB |
| **Vegetation condition** | **Disturbance notes** | **Age since fire (years)** | **Vegetation community** |
| Very good | Weeds, tracks, clearing | >20 | EwW |
| **Habitat description** | **Landform unit** | **Aspect** | **Slope %** |
| *Eucalyptus wandoo* mid woodland | Flat | N/A | N/A |
| **Soil colour** | **Soil type** | **Soil condition** | **Litter (%)** |
| Light brown | Loam | Dry | 15 |
| **Rock type** | **Outcropping (%)** | **Easting** | **Northing** |
| N/A | N/A | 405673 | 6606003 |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| **Ehrharta longiflora* | 0.01 | G | Grass |
| **Lolium rigidum* | 0.01 | G | Grass |
| **Monoculus monstrosus* | 0.01 | G | Herb |
| **Romulea rosea* | 0.01 | G | Herb |
| *Acanthocarpus canaliculatus* | 1 | G | Herb |
| *Aristida holathera* | 0.01 | G | Grass |
| *Arthropodium dyeri* | 0.01 | G | Grass |
| *Atriplex semibaccata* | 0.01 | G | Saltbush |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| *Austrostipa elegantissima* | 2 | G | Grass |
| *Calandrinia baccata* | 0.01 | G | Herb |
| *Dianella revoluta* | 1 | G | Herb |
| *Enchylaena tomentosa* | 0.25 | G | Shrub |
| *Eucalyptus wandoo* | 70 | U | Tree |
| *Exocarpos sparteus* | 0.01 | M | Shrub |
| *Lomandra effusa* | 3 | G | Herb |
| *Poaceae (Indeterminate)* | 0.1 | G | Herb |
| *Ptilotus manglesii* | 0.01 | G | Herb |
| *Rhagodia preissii* | 8 | M | Shrub |
| *Sclerolaena diacantha* | 0.01 | M | Shrub |

| Site name | Date | Site type | Observer |
|---|---|---|---|
| ELA08 | 30/09/2020 | Quadrat | DB |
| **Vegetation condition** | **Disturbance notes** | **Age since fire (years)** | **Vegetation community** |
| Good | Weeds, tracks, clearing | >20 | EwW |
| **Habitat description** | **Landform unit** | **Aspect** | **Slope %** |
| *Eucalyptus wandoo* mid woodland | Flat | N/A | N/A |
| **Soil colour** | **Soil type** | **Soil condition** | **Litter (%)** |
| Pale brown | Clay loam | Dry | 15 |
| **Rock type** | **Outcropping (%)** | **Easting** | **Northing** |
| N/A | N/A | 405687 | 6605912 |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| **Avena barbata* | 0.01 | G | Grass |
| **Ehrharta longiflora* | 0.01 | G | Grass |
| **Lolium rigidum* | 0.01 | G | Grass |
| **Monoculus monstrosus* | 0.01 | G | Herb |
| **Romulea rosea* | 0.01 | G | Herb |
| *Austrostipa elegantissima* | 0.01 | G | Grass |
| *Dianella revoluta* | 1 | G | Herb |

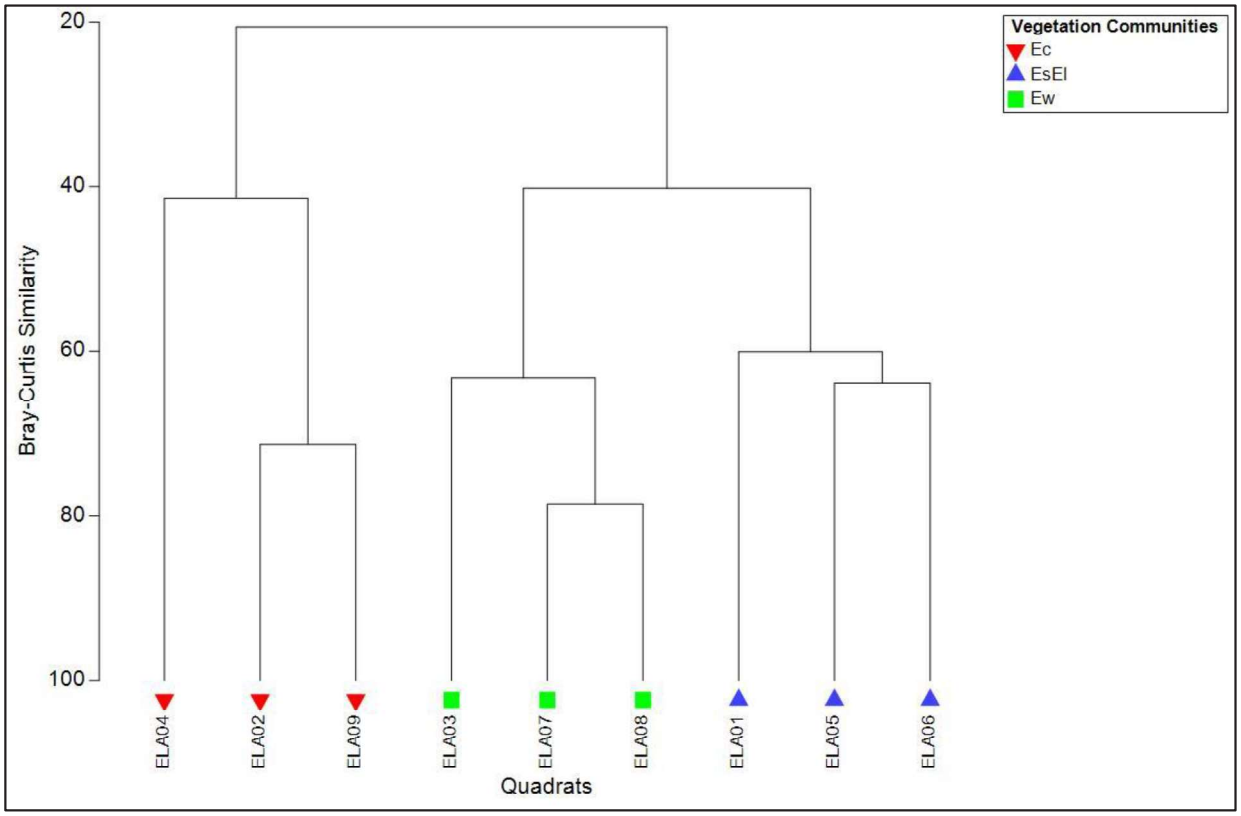
| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| *Enchylaena tomentosa* | 0.1 | G | Shrub |
| *Eucalyptus wandoo* | 60 | U | Tree |
| *Lomandra effusa* | 0.1 | G | Herb |
| *Ptilotus drummondii* | 1 | G | Herb |
| *Rhagodia preissii* | 5 | M | Shrub |
| *Sclerolaena diacantha* | 0.1 | M | Shrub |

| Site name | Date | Site type | Observer |
|---|---|---|---|
| ELA09 | 30/09/2020 | Quadrat | DB |
| **Vegetation condition** | **Disturbance notes** | **Age since fire (years)** | **Vegetation community** |
| Good | Weeds, tracks, clearing | >20 | EcG |
| **Habitat description** | **Landform unit** | **Aspect** | **Slope %** |
| *Eucalyptus camaldulensis* mid open woodland | Flat | N/A | N/A |
| **Soil colour** | **Soil type** | **Soil condition** | **Litter (%)** |
| Pale brown | Loam | Dry | 5 |
| **Rock type** | **Outcropping (%)** | **Easting** | **Northing** |
| N/A | N/A | 405714 | 6605826 |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| **Avena barbata* | 5 | G | Grass |
| **Briza maxima* | 0.01 | G | Grass |
| **Eragrostis curvula* | 2 | G | Grass |
| **Gorteria personata* | 2 | G | Herb |
| **Hordeum leporinum* | 0.5 | G | Grass |
| **Monoculus monstrosus* | 0.01 | G | Herb |
| **Oxalis pes-caprae* | 0.01 | G | Herb |
| **Romulea rosea* | 10 | G | Herb |

| Species | Cover (%) | Stratum (U=Upper, M=Middle, G=Ground) | Sub-Stratum |
|---|---|---|---|
| **Ursinia anthemoides* | 0.5 | G | Herb |
| *Acacia leptospermoides subsp. leptospermoides* | 3 | M | Shrub |
| *Acacia saligna* | 1 | M | Shrub |
| *Austrostipa elegantissima* | 1 | G | Grass |
| *Burchardia congesta* | 0.01 | G | Herb |
| *Dampiera lavandulacea* | 1 | G | Herb |
| *Desmocladus asper* | 1 | G | Herb |
| *Dianella revoluta* | 1 | G | Herb |
| *Eucalyptus camaldulensis* | 10 | U | Tree |
| *Exocarpos sparteus* | 10 | M | Shrub |
| *Halgania cyanea* | 1 | G | Shrub |
| *Neurachne alopecuroidea* | 0.01 | G | Grass |
| *Opercularia vaginata* | 0.3 | G | Herb |
| *Stylobasium australe* | 3 | M | Shrub |

# Appendix G Results of CLUSTER analysis



# Appendix H Assessment of the Eucalypt woodlands of the Western Australian Wheatbelt community

| Key diagnostic characteristics (DoE 2015) | Outcome |
|---|---|
| **Indicators** | |
| Location and physical environment<br>The distribution of the ecological community is limited to these IBRA bioregions and subregions:<br>• Avon Wheatbelt - subregions AVW01 Merredin and AVW02 Katanning;<br>• Mallee - MAL02 Western Mallee only; and<br>• Jarrah Forest – outlying patches in the eastern parts of JAF01 Northern Jarrah Forests and JAF02 Jarrah Forests adjacent to the Avon Wheatbelt, that are off the Darling Range, and receive less than 600 mm mean annual rainfall. They are effectively an extension of the Avon Wheatbelt landscape in that they comprise areas subject to similar climate, landscape and threats. | Yes.<br>The survey area is located in the Avon Wheatbelt IBRA Bioregion and AVW02 Katanning subregion. |
| Structure<br>The structure of the ecological community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10% (crowns measured as if they are opaque). | Yes.<br>Crown cover in the woodland vegetation communities EsEl, Ec and Ew is ≥10%. |
| Presence of key species<br>The key species of the tree canopy are species of Eucalyptus as identified in Table 2a (DoE 2015). These are species that typically have a single trunk. One or more of the tree species in Table 2a are dominant or co-dominant within a patch of the ecological community. If other species are present in the tree canopy (e.g. species in Table 2b or other taxa) then these collectively do not occur as dominants in the tree canopy. | Yes.<br>*Eucalyptus salmonophloia / E. loxophleba* and *E. wandoo* are dominants/co-dominants within vegetation communities EsEl and Ew respectively, and are listed in Table 2a.<br>Vegetation community Ec does not contain a dominant/co-dominant species listed in Table 2a, so is not considered to be the TEC. |
| Presence of understorey<br>A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs, as specified in section 2.3.2 and in Table A1 of Appendix A (DoE 2015). | Yes.<br>Native understorey is present. Twenty-six of the 74 taxa recorded in the survey area occur within Table A1 of Appendix A (DoE 2015). In addition, 13 of the weed species recorded within the survey area occur within Table A4 of Appendix A (DoE 2015).<br>It should be noted that the plant species list in Tables A1 and A4 of Appendix A (DoE 2015) do not include all plant species that may be encountered in the WA Wheatbelt woodland ecological community. |
| **Contra-indicators** | |
| A dominant presence of eucalypts with a mallee growth form. However, mallee species can occur as an understorey or minor canopy component of the ecological community, as noted in the diagnostic features, above. | No.<br>Mallee eucalypts are not dominant in vegetation communities EsEl or Ew. |

| Key diagnostic characteristics (DoE 2015) | Outcome |
|---|---|
| A dominant presence of non-eucalypt species in the tree canopy, for instance *Acacia acuminata* (jam) or *Allocasuarina huegeliana* (rock sheoak). However, these non-eucalypt species can be present as an understorey or minor canopy component of the ecological community. | No.<br>There are no dominant non-eucalypt species present in the tree canopy. |
| Shrublands or herblands in which the tree canopy layer is very sparse to absent, either naturally or maintained so through long-term disturbance. Native vegetation where a tree canopy was formerly present is often referred to as 'derived' or 'secondary' vegetation. These sites would fall below the 10 per cent minimum canopy cover threshold for a woodland, noted in the diagnostic features, above. | No.<br>Vegetation communities EsEl and Ew are woodlands with a tree canopy present. |
| Woodlands that have the same key eucalypt species but occur in adjacent bioregions, notably the Coolgardie, Esperance Sandplains, Yalgloo and Geraldton Sandplains bioregions. These are not part of the national ecological community. All woodlands that occur in bioregions outside the wheatbelt, as defined in this conservation advice, are not part of the WA Wheatbelt Woodland ecological community. | No.<br>The survey area is not located in the Coolgardie, Esperance Sandplains, Yalgloo or Geraldton Sandplains bioregions. |
| Woodlands dominated by eucalypts that are restricted to granite outcrops and rocky rises, for instance *Eucalyptus caesia* (caesia or gungurru). However, some woodlands occur on the base round rock outcrops, but not on the actual outcrop, and these may be part of the ecological community, for instance York gum – jam woodlands. | No.<br>The woodlands within the survey area do not occur on granite outcrops or rocky rises. |
| **Condition thresholds and minimum patch size** | |
| Where native vegetation meets the description and key diagnostic characteristics of the WA Wheatbelt Woodland ecological community, above, the condition thresholds and considerations in Table 3 (DoE 2015) apply. There are four categories a patch can be classified as:<br>• Category A: Patches likely to correspond to a condition of Pristine / Excellent / Very good (Keighery, 1994) or a High RCV (RCC, 2014).<br>• Category B: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014), AND retains important habitat features.<br>• Category C: Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014).<br>• Category D: Patches likely to correspond to a condition of Degraded to Good (Keighery, 1994) or a Medium-Low to Medium-High RCV (RCC, 2014) BUT retains important habitat features.<br>The criteria for these categories are listed below. | Yes.<br>Vegetation communities EsEl and EW meet the criteria for Category A:<br>• Exotic plant species account for 0 to 30% of total vegetation cover in the understorey layers (i.e. below the tree canopy);<br>• Mature trees are present;<br>• Roadside patch width >5 m. |

| Cover of exotic plants (weeds) AND | Mature trees[1] AND | Minimum patch size (non-roadside patches)[2] OR | Minimum patch width (roadside patches only)[3] |
|---|---|---|---|
| **Category A:** Patches likely to correspond to a condition of Pristine / Excellent / Very good (Keighery, 1994) or a High RCV (RCC, 2014). | | | |
| Exotic plant species account for 0 to 30% of total vegetation cover in the understorey layers (i.e. below the tree canopy). | Mature trees may be present or absent. | 2 hectares or more | 5 metres or more |
| **Category B:** Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014), AND retains important habitat features. | | | |
| Exotic plant species account for more than 30, to 50% of total vegetation cover in the understorey layers (i.e. below the tree canopy) | Mature trees are present with at least 5 trees per 0.5 ha. | 2 hectares or more | 5 metres or more |
| **Category C:** Patches likely to correspond to a condition of Good (Keighery, 1994) or a Medium-High RCV (RCC, 2014). | | | |
| Exotic plant species account for more than 30, to 50% of total vegetation cover in the understorey layers (i.e. below the tree canopy). | Mature trees either absent or less than 5 trees per 0.5 ha are present. | 5 hectares or more | 5 metres or more |
| **Category D:** Patches likely to correspond to a condition of Degraded to Good (Keighery, 1994) or a Medium-Low to Medium-High RCV (RCC, 2014) BUT retains important habitat features. | | | |
| Exotic plant species account for more than 50 to 70% of total vegetation cover in the understorey layers (i.e. below the tree canopy). | Mature trees are present with at least 5 trees per 0.5 ha. | 5 hectares or more | 5 metres or more |

[1] Mature trees have a DBH of 30 cm or above. Trunk diameter varies among eucalypt species, for instance gimlet and mallets tend to have slender trunks (Gosper et al. 2013b, as cited in DoE 2015). The DBH for mature trees aligns with the EPBC referral guidelines for the breeding habitat of threatened black cockatoo species (DSEWPaC 2012). These note that, for salmon gum and wandoo trees, suitable nest hollows can develop in trees with a DBH of 30 cm or more. Note that larger trees may be killed by factors such as intense fire or flood but the patch may still be in reasonable condition if there are immature trees regenerating.

[2] The minimum patch size thresholds apply to native vegetation remnants that do not occur along roadsides.

[3] Minimum patch width applies only to vegetation remnants along roadsides and tend to be long but narrow. This criterion recognises the importance of native vegetation remnants along road verges, e.g their value as wildlife corridors particularly if linking to other non-roadside remnants, habitat for threatened species and other reasons as detailed by Jackson (2002) and RCC (2015), as cited in DoE (2015). The width here is based on the native understorey component rather than width of the tree canopy. Some allowance must be made for small breaks or variations in native species cover along linear patches. Given the generally open nature of the tree canopy and some understorey structures, a break in the continuity of native vegetation cover of 50 metres or more, is likely to indicate that separate patches are present. An exception is for main, often bitumen-covered, roads that bisect otherwise continuous vegetation; most local government roads in the Wheatbelt have a road reserve of 20 metres. In these cases, native vegetation along either side of the road is considered to be a separate patch.

# Appendix I Fauna species list

| Species | Common name | Sign |
|---|---|---|
| *Anthochaera carunculata* | Red Wattlebird | Directly observed |
| *Barnardius zonarius* | Australian Ringneck | Directly observed |
| *Cacatua sanguinea* | Little Corella | Directly observed |
| *Calyptorhynchus latirostris* | Carnaby's Black Cockatoo | Directly observed |
| *Coracina novaehollandiae* | Black-faced Cuckoo Shrike | Directly observed |
| *Corvus coronoides* | Australian Raven | Directly observed |
| *Cracticus tibicen* | Australian Magpie | Directly observed |
| *Eolophus roseicapilla* | Galah | Directly observed |
| *Grallina cyanoleuca* | Magpie-lark | Directly observed |
| *Haliastur sphenurus* | Whistling kite | Directly observed |
| *Lichmera indistincta* | Brown honeyeater | Directly observed |
| *Lichenostomus virescens* | Singing honeyeater | Directly observed |
| *Malurus splendens* | Splendid Fairy-wren | Heard |
| *Manorina flavigula* | Yellow throated miner | Heard |
| *Ocyphaps lophotes* | Crested Pigeon | Directly observed |
| *Rhipidura leucophrys* | Willy Wagtail | Directly observed |
| *Smicrornis brevirostris* | Weebill | Directly observed |
| *Felis catus* | Feral Cat | Tracks |
| *Macropus fuliginosus* | Western Grey Kangaroo | Remains, tracks and scats |
| *Mus musculus* | House Mouse | Directly observed |
| *Tiliqua rugosa* | Bobtail Lizard | Directly observed |

# Appendix K Black cockatoo potentially suitable hollows recorded within the survey area

| Survey | Tree ID | Species | DBH (cm) | Coordinates | | Hollow type | Evidence of use | Foraging evidence |
|---|---|---|---|---|---|---|---|---|
| | | | | Easting | Northing | | | |
| September 2020 | 235 | *Eucalyptus salmonophloia* (Salmon Gum) | 124 | 405870 | 6605300 | NA | NA | NA |
| September 2020 | 236 | *Eucalyptus salmonophloia* (Salmon Gum) | 55 | 405872 | 6605310 | NA | NA | NA |
| September 2020 | 237 | *Eucalyptus loxophleba* (York Gum) | 64 | 405865 | 6605329 | NA | NA | NA |
| September 2020 | 238 | *Eucalyptus salmonophloia* (Salmon Gum) | 75 | 405861 | 6605359 | NA | NA | NA |
| September 2020 | 239 | *Eucalyptus salmonophloia* (Salmon Gum) | 104 | 405865 | 6605372 | NA | NA | NA |
| September 2020 | 240 | *Eucalyptus loxophleba* (York Gum) | 77 | 405860 | 6605401 | NA | NA | NA |
| September 2020 | 241 | *Eucalyptus salmonophloia* (Salmon Gum) | 72.5 | 405832 | 6605536 | NA | NA | NA |
| September 2020 | 242 | Stag | 75 | 405828 | 6605537 | NA | NA | NA |
| September 2020 | 243 | *Eucalyptus loxophleba* (York Gum) | 86 | 405822 | 6605550 | NA | NA | NA |
| September 2020 | 244 | *Eucalyptus loxophleba* (York Gum) | 64 | 405823 | 6605551 | NA | NA | NA |
| September 2020 | 245 | Stag | 85 | 405819 | 6605568 | NA | NA | NA |
| September 2020 | 246 | *Eucalyptus salmonophloia* (Salmon Gum) | 75.5 | 405832 | 6605576 | NA | NA | NA |
| September 2020 | 247 | *Eucalyptus salmonophloia* (Salmon Gum) | 88 | 405823 | 6605582 | NA | NA | NA |
| September 2020 | 248 | *Eucalyptus salmonophloia* (Salmon Gum) | 102 | 405811 | 6605644 | NA | NA | NA |

| Survey | Tree ID | Species | DBH (cm) | Coordinates | | Hollow type | Evidence of use | Foraging evidence |
|---|---|---|---|---|---|---|---|---|
| | | | | Easting | Northing | | | |
| September 2020 | 249 | *Eucalyptus cameldulensis* | 69 | 405779 | 6605750 | NA | NA | NA |
| September 2020 | 250 | *Eucalyptus wandoo* | 53 and 53.1 | 405736 | 6606062 | NA | NA | NA |
| September 2020 | 251 | *Eucalyptus wandoo* | 79.5 | 405737 | 6606074 | NA | NA | NA |
| September 2020 | 252 | *Eucalyptus wandoo* | 57 & 56 | 405739 | 6606074 | NA | NA | NA |
| September 2020 | 253 | *Eucalyptus wandoo* | 75 | 405714 | 6606113 | NA | NA | NA |
| September 2020 | 254 | *Eucalyptus loxophleba* (York Gum) | 70 | 405712 | 6606136 | NA | NA | NA |
| September 2020 | 255 | *Eucalyptus salmonophloia* (Salmon Gum) | 95 & 95 | 405684 | 6606274 | NA | NA | NA |
| September 2020 | 256 | *Eucalyptus salmonophloia* (Salmon Gum) | 72 | 405688 | 6606281 | NA | NA | Evidence of shearing branches |
| September 2020 | 257 | *Eucalyptus salmonophloia* (Salmon Gum) | 151 | 405678 | 6606319 | NA | NA | Evidence of shearing branches |
| September 2020 | 258 | *Eucalyptus salmonophloia* (Salmon Gum) | 108 | 405657 | 6606457 | NA | NA | Evidence of shearing branches |
| September 2020 | 259 | *Eucalyptus salmonophloia* (Salmon Gum) | 59 | 405645 | 6606493 | NA | NA | Evidence of shearing branches |
| September 2020 | 260 | *Eucalyptus salmonophloia* (Salmon Gum) | 73.5 | 405642 | 6606515 | NA | NA | Evidence of shearing branches |
| September 2020 | 261 | *Eucalyptus salmonophloia* (Salmon Gum) | 64 | 405641 | 6606544 | NA | NA | Evidence of shearing branches |
| September 2020 | 262 | *Eucalyptus loxophleba* (York Gum) | 77 | 405641 | 6606545 | NA | NA | Evidence of shearing branches |
| September 2020 | 263 | *Eucalyptus salmonophloia* (Salmon Gum) | 112 | 405635 | 6606588 | NA | NA | NA |
| September 2020 | 264 | *Eucalyptus loxophleba* (York Gum) | 50.5 | 405600 | 6606801 | NA | NA | NA |

| Survey | Tree ID | Species | DBH (cm) | Coordinates | | Hollow type | Evidence of use | Foraging evidence |
|---|---|---|---|---|---|---|---|---|
| | | | | Easting | Northing | | | |
| September 2020 | 265 | *Eucalyptus loxophleba* (York Gum) | 79 | 405597 | 6606817 | NA | NA | NA |
| June 2020 (ELA 2020) | 1555 | Eucalyptus *salmonophloia (Salmon Gum)* | >30 | 405536 | 6606763 | Spout | Nil | NA |
| June 2020 (ELA 2020) | 1556 | *Eucalyptus salmonophloia (Salmon Gum)* | >30 | 405545 | 6606730 | NA | NA | NA |
| June 2020 (ELA 2020) | 1557 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405549 | 6606706 | NA | NA | NA |
| June 2020 (ELA 2020) | 1559 | Eucalyptus loxophleba (York Gum) | >50 | 405580 | 6606532 | NA | NA | NA |
| June 2020 (ELA 2020) | 1560 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405581 | 6606521 | NA | NA | NA |
| June 2020 (ELA 2020) | 1561 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405579 | 6606515 | NA | NA | NA |
| June 2020 (ELA 2020) | 1562 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405579 | 6606511 | 1x trunk, 1x spout | Nil | NA |
| June 2020 (ELA 2020) | 1563 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405582 | 6606501 | NA | NA | NA |
| June 2020 (ELA 2020) | 1564 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405584 | 6606482 | Potential spout | Nil | NA |
| June 2020 (ELA 2020) | 1565 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405585 | 6606480 | NA | NA | NA |
| June 2020 (ELA 2020) | 1566 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405590 | 6606462 | NA | NA | NA |
| June 2020 (ELA 2020) | 1567 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405592 | 6606460 | NA | NA | NA |
| June 2020 (ELA 2020) | 1568 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405593 | 6606460 | NA | NA | NA |
| June 2020 (ELA 2020) | 1569 | Eucalyptus loxophleba (York Gum) | >50 | 405595 | 6606437 | NA | NA | NA |

| Survey | Tree ID | Species | DBH (cm) | Coordinates | | Hollow type | Evidence of use | Foraging evidence |
|---|---|---|---|---|---|---|---|---|
| | | | | Easting | Northing | | | |
| June 2020 (ELA 2020) | 1570 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405605 | 6606398 | NA | NA | NA |
| June 2020 (ELA 2020) | 1571 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405601 | 6606389 | NA | NA | NA |
| June 2020 (ELA 2020) | 1572 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405603 | 6606382 | NA | NA | NA |
| June 2020 (ELA 2020) | 1573 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405607 | 6606375 | Trunk | Nil | NA |
| June 2020 (ELA 2020) | 1575 | Eucalyptus loxophleba (York Gum) | >50 | 405611 | 6606368 | Spout | Nil | NA |
| June 2020 (ELA 2020) | 1576 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405624 | 6606299 | 2x spout | Nil | NA |
| June 2020 (ELA 2020) | 1577 | Eucalyptus loxophleba (York Gum) | >50 | 405624 | 6606294 | NA | NA | NA |
| June 2020 (ELA 2020) | 1578 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405622 | 6606290 | NA | NA | NA |
| June 2020 (ELA 2020) | 1579 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405624 | 6606284 | NA | NA | NA |
| June 2020 (ELA 2020) | 1580 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405625 | 6606277 | NA | NA | NA |
| June 2020 (ELA 2020) | 1581 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405625 | 6606273 | NA | NA | NA |
| June 2020 (ELA 2020) | 1582 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405626 | 6606272 | NA | NA | NA |
| June 2020 (ELA 2020) | 1583 | Stag | >50 | 405631 | 6606268 | Spout | Nil | NA |
| June 2020 (ELA 2020) | 1584 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405635 | 6606216 | NA | NA | NA |
| June 2020 (ELA 2020) | 1585 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405639 | 6606188 | Trunk | Nil | NA |

| Survey | Tree ID | Species | DBH (cm) | Coordinates | | Hollow type | Evidence of use | Foraging evidence |
|---|---|---|---|---|---|---|---|---|
| | | | | Easting | Northing | | | |
| June 2020 (ELA 2020) | 1586 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405649 | 6606159 | NA | NA | NA |
| June 2020 (ELA 2020) | 1587 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405655 | 6606144 | NA | NA | NA |
| June 2020 (ELA 2020) | 1588 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405654 | 6606139 | NA | NA | NA |
| June 2020 (ELA 2020) | 1589 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405655 | 6606136 | NA | NA | NA |
| June 2020 (ELA 2020) | 1590 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405659 | 6606117 | NA | NA | NA |
| June 2020 (ELA 2020) | 1591 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405658 | 6606117 | NA | NA | NA |
| June 2020 (ELA 2020) | 1592 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405658 | 6606111 | NA | NA | NA |
| June 2020 (ELA 2020) | 1593 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405659 | 6606107 | NA | NA | NA |
| June 2020 (ELA 2020) | 1594 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405660 | 6606105 | NA | NA | NA |
| June 2020 (ELA 2020) | 1595 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405660 | 6606103 | NA | NA | NA |
| June 2020 (ELA 2020) | 1596 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405660 | 6606097 | NA | NA | NA |
| June 2020 (ELA 2020) | 1597 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405657 | 6606095 | NA | NA | NA |
| June 2020 (ELA 2020) | 1598 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405661 | 6606055 | NA | NA | NA |
| June 2020 (ELA 2020) | 1599 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405668 | 6606031 | NA | NA | NA |
| June 2020 (ELA 2020) | 1600 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405670 | 6606029 | NA | NA | NA |

| Survey | Tree ID | Species | DBH (cm) | Coordinates | | Hollow type | Evidence of use | Foraging evidence |
|---|---|---|---|---|---|---|---|---|
| | | | | Easting | Northing | | | |
| June 2020 (ELA 2020) | 1601 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405671 | 6606027 | NA | NA | NA |
| June 2020 (ELA 2020) | 1602 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405674 | 6606011 | NA | NA | NA |
| June 2020 (ELA 2020) | 1603 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405677 | 6606008 | NA | NA | NA |
| June 2020 (ELA 2020) | 1604 | Eucalyptus wandoo (Wandoo) | >30 | 405676 | 6605990 | NA | NA | NA |
| June 2020 (ELA 2020) | 1605 | Eucalyptus wandoo (Wandoo) | >31 | 405679 | 6605986 | NA | NA | NA |
| June 2020 (ELA 2020) | 1606 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405681 | 6605986 | NA | NA | NA |
| June 2020 (ELA 2020) | 1607 | Eucalyptus wandoo (Wandoo) | >32 | 405683 | 6605981 | NA | NA | NA |
| June 2020 (ELA 2020) | 1608 | Eucalyptus wandoo (Wandoo) | >33 | 405681 | 6605972 | NA | NA | NA |
| June 2020 (ELA 2020) | 1609 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405683 | 6605970 | NA | NA | NA |
| June 2020 (ELA 2020) | 1610 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405684 | 6605969 | NA | NA | NA |
| June 2020 (ELA 2020) | 1611 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405687 | 6605968 | NA | NA | NA |
| June 2020 (ELA 2020) | 1612 | Eucalyptus wandoo (Wandoo) | >34 | 405686 | 6605966 | NA | NA | NA |
| June 2020 (ELA 2020) | 1613 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405687 | 6605964 | NA | NA | NA |
| June 2020 (ELA 2020) | 1614 | Eucalyptus wandoo (Wandoo) | >35 | 405688 | 6605955 | NA | NA | NA |
| June 2020 (ELA 2020) | 1615 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405689 | 6605953 | NA | NA | NA |
| June 2020 (ELA 2020) | 1616 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405690 | 6605950 | NA | NA | NA |

| Survey | Tree ID | Species | DBH (cm) | Coordinates | | Hollow type | Evidence of use | Foraging evidence |
|---|---|---|---|---|---|---|---|---|
| | | | | Easting | Northing | | | |
| June 2020 (ELA 2020) | 1617 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405690 | 6605949 | NA | NA | NA |
| June 2020 (ELA 2020) | 1618 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405696 | 6605921 | NA | NA | NA |
| June 2020 (ELA 2020) | 1619 | Eucalyptus wandoo (Wandoo) | >36 | 405695 | 6605920 | NA | NA | NA |
| June 2020 (ELA 2020) | 1620 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405695 | 6605917 | NA | NA | NA |
| June 2020 (ELA 2020) | 1621 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405692 | 6605905 | NA | NA | NA |
| June 2020 (ELA 2020) | 1622 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405693 | 6605902 | NA | NA | NA |
| June 2020 (ELA 2020) | 1623 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405694 | 6605901 | NA | NA | NA |
| June 2020 (ELA 2020) | 1624 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405695 | 6605891 | NA | NA | NA |
| June 2020 (ELA 2020) | 1625 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405707 | 6605897 | NA | NA | NA |
| June 2020 (ELA 2020) | 1626 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405719 | 6605834 | NA | NA | NA |
| June 2020 (ELA 2020) | 1627 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405724 | 6605827 | NA | NA | NA |
| June 2020 (ELA 2020) | 1628 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405702 | 6605829 | NA | NA | NA |
| June 2020 (ELA 2020) | 1629 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405707 | 6605815 | NA | NA | NA |
| June 2020 (ELA 2020) | 1630 | Eucalyptus wandoo (Wandoo) | >37 | 405725 | 6605766 | NA | NA | NA |
| June 2020 (ELA 2020) | 1631 | Eucalyptus wandoo (Wandoo) | >38 | 405742 | 6605710 | NA | NA | NA |

| Survey | Tree ID | Species | DBH (cm) | Coordinates | | Hollow type | Evidence of use | Foraging evidence |
|---|---|---|---|---|---|---|---|---|
| | | | | Easting | Northing | | | |
| June 2020 (ELA 2020) | 1632 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405745 | 6605685 | NA | NA | NA |
| June 2020 (ELA 2020) | 1633 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405735 | 6605658 | NA | NA | NA |
| June 2020 (ELA 2020) | 1634 | Stag | >50 | 405744 | 6605638 | Trunk | Nil | NA |
| June 2020 (ELA 2020) | 1635 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405752 | 6605619 | NA | NA | NA |
| June 2020 (ELA 2020) | 1636 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405753 | 6605616 | NA | NA | NA |
| June 2020 (ELA 2020) | 1637 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405752 | 6605610 | NA | NA | NA |
| June 2020 (ELA 2020) | 1638 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405752 | 6605599 | 6x spout, 1x branch | Nil | NA |
| June 2020 (ELA 2020) | 1639 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405760 | 6605582 | NA | NA | NA |
| June 2020 (ELA 2020) | 1640 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405765 | 6605561 | NA | NA | NA |
| June 2020 (ELA 2020) | 1641 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405767 | 6605524 | 2x branch, 1x spout | Nil | NA |
| June 2020 (ELA 2020) | 1642 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405770 | 6605501 | 2x spout | Nil | NA |
| June 2020 (ELA 2020) | 1643 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405771 | 6605502 | Spout | Nil | NA |
| June 2020 (ELA 2020) | 1644 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405772 | 6605481 | NA | NA | NA |
| June 2020 (ELA 2020) | 1645 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405775 | 6605460 | NA | NA | NA |
| June 2020 (ELA 2020) | 1646 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405780 | 6605446 | NA | NA | NA |

| Survey | Tree ID | Species | DBH (cm) | Coordinates | | Hollow type | Evidence of use | Foraging evidence |
|---|---|---|---|---|---|---|---|---|
| | | | | Easting | Northing | | | |
| June 2020 (ELA 2020) | 1647 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405780 | 6605444 | NA | NA | NA |
| June 2020 (ELA 2020) | 1648 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405788 | 6605421 | NA | NA | NA |
| June 2020 (ELA 2020) | 1649 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405785 | 6605419 | NA | NA | NA |
| June 2020 (ELA 2020) | 1651 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405800 | 6605363 | NA | NA | NA |
| June 2020 (ELA 2020) | 1652 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405798 | 6605348 | NA | NA | NA |
| June 2020 (ELA 2020) | 1653 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405800 | 6605342 | NA | NA | NA |
| June 2020 (ELA 2020) | 1654 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405804 | 6605331 | NA | NA | NA |
| June 2020 (ELA 2020) | 1655 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405805 | 6605314 | NA | NA | NA |
| June 2020 (ELA 2020) | 1656 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405809 | 6605296 | NA | NA | NA |
| June 2020 (ELA 2020) | 1816 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405861 | 6605271 | NA | NA | NA |
| June 2020 (ELA 2020) | 1817 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405861 | 6605276 | NA | NA | NA |
| June 2020 (ELA 2020) | 1818 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405828 | 6605417 | Spout | Nil | NA |
| June 2020 (ELA 2020) | 1819 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405819 | 6605445 | NA | NA | NA |
| June 2020 (ELA 2020) | 1820 | Stag | >50 | 405824 | 6605452 | NA | NA | NA |
| June 2020 (ELA 2020) | 1821 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405812 | 6605488 | NA | NA | NA |

| Survey | Tree ID | Species | DBH (cm) | Coordinates | | Hollow type | Evidence of use | Foraging evidence |
|---|---|---|---|---|---|---|---|---|
| | | | | Easting | Northing | | | |
| June 2020 (ELA 2020) | 1822 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405811 | 6605519 | NA | NA | NA |
| June 2020 (ELA 2020) | 1823 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405818 | 6605552 | NA | NA | NA |
| June 2020 (ELA 2020) | 1825 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405775 | 6605665 | NA | NA | NA |
| June 2020 (ELA 2020) | 1826 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405774 | 6605665 | NA | NA | NA |
| June 2020 (ELA 2020) | 1827 | Eucalyptus wandoo (Wandoo) | >39 | 405775 | 6605746 | NA | NA | NA |
| June 2020 (ELA 2020) | 1829 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405731 | 6605935 | NA | NA | NA |
| June 2020 (ELA 2020) | 1830 | Eucalyptus loxophleba (York Gum) | >50 | 405730 | 6605968 | NA | NA | NA |
| June 2020 (ELA 2020) | 1831 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405729 | 6605970 | NA | NA | NA |
| June 2020 (ELA 2020) | 1832 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405728 | 6605980 | NA | NA | NA |
| June 2020 (ELA 2020) | 1833 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405728 | 6605980 | NA | NA | NA |
| June 2020 (ELA 2020) | 1834 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405729 | 6605982 | NA | NA | NA |
| June 2020 (ELA 2020) | 1835 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405724 | 6605984 | NA | NA | NA |
| June 2020 (ELA 2020) | 1836 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405723 | 6605986 | NA | NA | NA |
| June 2020 (ELA 2020) | 1837 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405726 | 6605989 | NA | NA | NA |
| June 2020 (ELA 2020) | 1838 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405724 | 6605993 | NA | NA | NA |

| Survey | Tree ID | Species | DBH (cm) | Coordinates | | Hollow type | Evidence of use | Foraging evidence |
|---|---|---|---|---|---|---|---|---|
| | | | | Easting | Northing | | | |
| June 2020 (ELA 2020) | 1839 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405722 | 6605997 | NA | NA | NA |
| June 2020 (ELA 2020) | 1840 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405726 | 6606001 | NA | NA | NA |
| June 2020 (ELA 2020) | 1841 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405731 | 6606008 | NA | NA | NA |
| June 2020 (ELA 2020) | 1842 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405729 | 6606016 | NA | NA | NA |
| June 2020 (ELA 2020) | 1843 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405729 | 6606018 | NA | NA | NA |
| June 2020 (ELA 2020) | 1844 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405723 | 6606016 | Potential spout | Nil | NA |
| June 2020 (ELA 2020) | 1845 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405722 | 6606016 | NA | NA | NA |
| June 2020 (ELA 2020) | 1846 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405726 | 6606025 | NA | NA | NA |
| June 2020 (ELA 2020) | 1847 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405718 | 6606031 | NA | NA | NA |
| June 2020 (ELA 2020) | 1848 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405717 | 6606032 | NA | NA | NA |
| June 2020 (ELA 2020) | 1849 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405722 | 6606038 | NA | NA | NA |
| June 2020 (ELA 2020) | 1850 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405728 | 6606041 | NA | NA | NA |
| June 2020 (ELA 2020) | 1851 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405702 | 6606097 | NA | NA | NA |
| June 2020 (ELA 2020) | 1852 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405697 | 6606128 | NA | NA | NA |
| June 2020 (ELA 2020) | 1853 | Eucalyptus loxophleba (York Gum) | >50 | 405698 | 6606129 | NA | NA | NA |

| Survey | Tree ID | Species | DBH (cm) | Coordinates | | Hollow type | Evidence of use | Foraging evidence |
|---|---|---|---|---|---|---|---|---|
| | | | | Easting | Northing | | | |
| June 2020 (ELA 2020) | 1854 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405686 | 6606236 | NA | NA | NA |
| June 2020 (ELA 2020) | 1855 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405679 | 6606244 | NA | NA | NA |
| June 2020 (ELA 2020) | 1856 | Eucalyptus loxophleba (York Gum) | >50 | 405649 | 6606348 | NA | NA | NA |
| June 2020 (ELA 2020) | 1857 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405648 | 6606384 | NA | NA | NA |
| June 2020 (ELA 2020) | 1858 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405647 | 6606394 | NA | NA | NA |
| June 2020 (ELA 2020) | 1859 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405645 | 6606409 | NA | NA | NA |
| June 2020 (ELA 2020) | 1860 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405632 | 6606441 | NA | NA | NA |
| June 2020 (ELA 2020) | 1861 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405632 | 6606459 | NA | NA | NA |
| June 2020 (ELA 2020) | 1862 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405632 | 6606461 | NA | NA | NA |
| June 2020 (ELA 2020) | 1863 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405634 | 6606491 | NA | NA | NA |
| June 2020 (ELA 2020) | 1864 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405623 | 6606577 | NA | NA | NA |
| June 2020 (ELA 2020) | 1865 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405619 | 6606587 | NA | NA | NA |
| June 2020 (ELA 2020) | 1866 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405609 | 6606653 | NA | NA | NA |
| June 2020 (ELA 2020) | 1867 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405611 | 6606656 | NA | NA | NA |
| June 2020 (ELA 2020) | 1868 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405613 | 6606662 | NA | NA | NA |

| Survey | Tree ID | Species | DBH (cm) | Coordinates | | Hollow type | Evidence of use | Foraging evidence |
|---|---|---|---|---|---|---|---|---|
| | | | | Easting | Northing | | | |
| June 2020 (ELA 2020) | 1869 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405612 | 6606666 | NA | NA | NA |
| June 2020 (ELA 2020) | 1870 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405609 | 6606669 | NA | NA | NA |
| June 2020 (ELA 2020) | 1871 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405608 | 6606669 | NA | NA | NA |
| June 2020 (ELA 2020) | 1872 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405611 | 6606678 | NA | NA | NA |
| June 2020 (ELA 2020) | 1873 | Eucalyptus salmonophloia (Salmon Gum) | >30 | 405608 | 6606691 | NA | NA | NA |

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