

CBH BROOMEHILL ENVIRONMENTAL SURVEY

CBH Group

ecoscape



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SUMMARY

CBH Group is investigating options for the Broomehill Rail Outloading Project which will focus on improving grain storage capacity and outloading time. The potential works includes constructing sidings to accommodate longer trains to minimise the time that trains block access roads in the vicinity.

CBH appointed Ecoscape to conduct a detailed spring flora and vegetation survey and basic fauna survey to inform the environmental approvals process. The total extent of the survey area was 40.26 ha.

The significant findings of the desktop assessment were:

- the pre-European vegetation association intersecting the survey area has 9.80% of its original extent remaining at local government area scale, and 11.46% remaining at higher scales
- the survey area is included in mapped extents of the EPBC-listed Eucalypt Woodlands of the Western Australian Wheatbelt Threatened Ecological Community and its Western Australian equivalent Priority Ecological Community
- 18 Threatened Flora are known or likely to occur within 50 km of the survey area; 92 Priority Flora species have been recorded from within 50 km
- no Threatened or Priority-listed flora were known to occur within the survey area, although one TF and three PF were considered to have a Possible likelihood of occurring at desktop assessment stage.
- no Threatened, Priority-listed or otherwise conservation-listed fauna species were known to occur within the survey area, although one EPBC-listed species was considered a High likelihood of occurring at desktop assessment stage
- the survey area is within the mapped extent considered as Carnaby's Cockatoo breeding habitat, although none have been recorded from within 15 km of the site.

The flora and vegetation survey identified the following from the survey area:

- 191 vascular flora taxa recorded from nine floristic quadrats, six relevés and opportunistic observations:
 - no conservation-listed species, and none are considered likely to occur
 - 51 introduced species including one Declared Pest plant and WoNS species; **Asparagus asparagoides* (Bridal Creeper) that has no management requirements in relation to its presence
 - six flora species having significance according to the Flora and Vegetation Technical Guidance as range extensions or poorly known species
- six vegetation types:
 - **EaW**: *Eucalyptus astringens* mid woodland (1.32 ha, plus 1.58 ha as a mosaic with the following vegetation type)
 - **EwAhW**: *Eucalyptus wandoo* and *Allocasuarina huegeliana* mid woodland (15.98 ha); parts in slightly higher elevations and on more sandy soil were dominated by *Allocasuarina huegeliana*
 - **HvCtS**: *Hakea varia* and *Calytrix tetragona* tall open shrubland (0.61 h)
 - **JsApW**: *Jacksonia sternbergiana* and **Acacia pycnantha* low woodland (0.96 ha)
 - disturbed vegetation: **ApS**, **Acacia pycnantha* tall open shrubland (0.13 ha)
 - planted vegetation: **AaSsS**, *Acacia acuminata* and *Santalum spicatum* tall open (Sandalwood plantation; 2.73 ha).
- where meeting the extent and condition criteria, parts of vegetation types **EaW**, **EwAhW** (except where dominated by *Allocasuarina huegeliana*) and **HvCtS** were considered to represent the Eucalypt Woodlands of the Western Australian Wheatbelt TEC and PEC (11.23 ha)
- the vegetation condition ranged from Very Good to Degraded.

The vertebrate fauna survey that incorporated a Black Cockatoo habitat assessment identified the following from the survey area:

- 26 vertebrate fauna species including one introduced species (Rabbit) and two conservation-listed species:
 - *Merops ornatus* (Rainbow Bee-eater), protected as a migratory species under international agreements but not considered threatened
 - *Platycercus icterotis xanthogenys* (Western Rosella), listed as P4 by the DBCA.
- two fauna habitat types (Woodland and Shrubland)
- 395 trees of suitable size to be considered as Black Cockatoo habitat trees although only 27 of these had hollows that potentially may be suitable for nesting (noting that not all of these trees were within the portions that CBH is considering for its expansion)
- the Woodland habitat type (16.1 ha) was considered as 'valued' Black Cockatoo foraging habitat, however, there were few preferred foraging species present
- the post-survey likelihood considered that Black Cockatoo species (specifically Carnaby's Cockatoo) has a Very low likelihood of occurring within the survey area
- no conservation-listed fauna species (other than those recorded) are considered to have a High likelihood of occurring within the survey area.

ACRONYMS AND ABBREVIATIONS

Table 1: Acronyms and abbreviations

Acronyms and abbreviations	
BAM Act	Western Australian <i>Biosecurity and Agriculture Management Act 2007</i>
BC Act	Western Australian <i>Biodiversity Conservation Act 2016</i>
BoM	Bureau of Meteorology
C1, C2, C3	Declared Pest categories under the BAM Act
CD	Conservation Dependent (fauna; specially protected species under the Western Australian BC Act)
CR	Critically Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
DAWE	Commonwealth Department of Agriculture, Water and Environment (2020-)
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DBH	Diameter at Breast Height (1.3 m)
DEC	Western Australian Department of Environment and Conservation (2006-2013, now DBCA)
DEWHA	Commonwealth Department of the Environment, Water, Heritage and the Arts (2007-2010, now DAWE)
DMIRS	Western Australian Department of Mines, Industry Regulation and Safety
DPaW	Western Australian Department of Parks and Wildlife (2013-2017, now DBCA)
DotEE	Commonwealth Department of the Environment and Energy (2016-2020)
DPIRD	Western Australian Department of Primary Industries and Rural Development
DSEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities (2010-2013, now DAWE)
DWER	Western Australian Department of Water and Environmental Regulation
EN	Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
Ecoscape	Ecoscape (Australia) Pty Ltd
EP Act	Western Australian <i>Environmental Protection Act 1986</i>
EPA	Western Australian Environmental Protection Authority
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GDA 94	Geographic Datum of Australia 1994
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectare/hectares
IBRA	Interim Biogeographic Regionalisation for Australia
IUCN	International Union for Conservation of Nature
km	kilometre/kilometres
m	metre/metres
MGA	Map Grid of Australia
MI	Migratory species (fauna; specially protected species under the Western Australian BC Act)
NVIS	National Vegetation Inventory System
MNES	Matters of National Environmental Significance
OEPA	Office of the Environmental Protection Authority
OS	Other specially protected species (fauna; specially protected species under the Western Australian BC Act)
P; P1, P2, P3, P4, P5	Priority Flora and Fauna species rankings (P1-P4) or Priority Ecological Communities (P1-P5)
PEC	Priority Ecological Community
PF	Priority Flora
PMST	Protected Matters Search Tool (hosted by DAWE, used to search for MNES)

Acronyms and abbreviations	
sp.	Species (generally referring to an unidentified taxon or when a phrase name has been applied)
subsp.	Subspecies (infrataxon)
TEC	Threatened Ecological Community
TF	Threatened Flora (formerly termed Declared Rare Flora, DRF, in Western Australia)
var.	Variety (infrataxon)
VU	Vulnerable (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
WAH	Western Australian Herbarium
WAM	Western Australian Museum
WAOL	Western Australian Organism List
WoNS	Weeds of National Significance
*	Introduced flora species (i.e. weed)

1 INTRODUCTION

1.1 BACKGROUND

CBH Group is investigating options for the Broomehill Rail Outloading Project which will focus on improving grain storage capacity and outloading time. The potential works includes constructing sidings to accommodate longer trains to minimise the time that trains block access roads in the vicinity.

As clearing of native vegetation will be required CBH Group (CBH) appointed Ecoscape to conduct a spring flora, vegetation and fauna survey to inform the environmental approvals process.

1.2 SURVEY AREA

The CBH project area, known as the 'survey area' in this report, is located within the Shire of Broomehill-Tambellup in the Great Southern Region, approximately 300 km southwest of Perth (**Figure 1**). The survey area includes vegetated areas adjacent to Great Southern Highway and the railway, and a block of remnant bushland within the existing CBH facility. The total extent of the survey area is 40.26 ha.

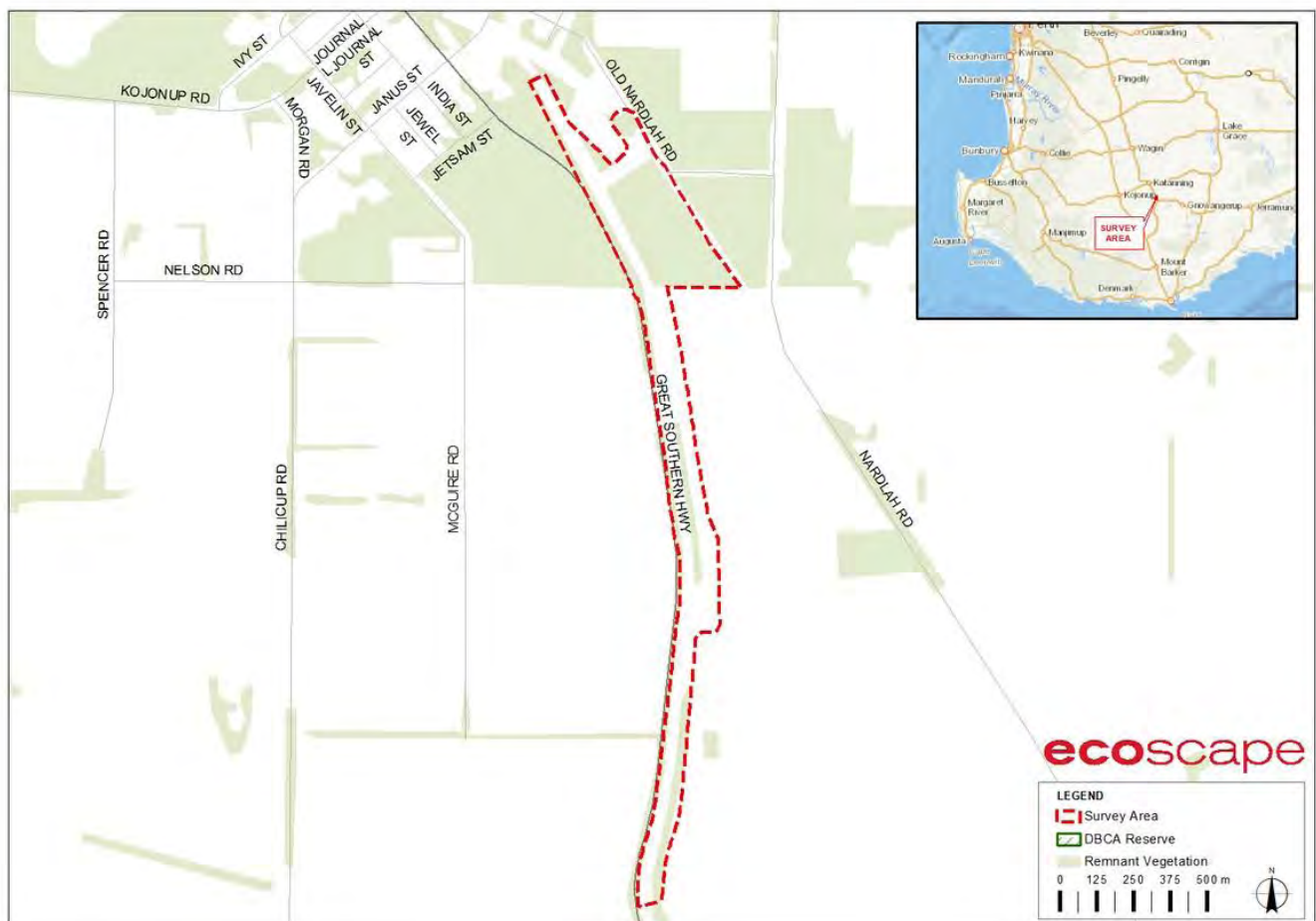


Figure 1: Survey area location

1.3 SURVEY REQUIREMENTS

CBH's requirements were to conduct environmental surveys that were:

- complaint with CBH OHS requirements
- compliant with current Western Australian legislation and guidelines.

1.4 COMPLIANCE

This environmental assessment was conducted in accordance with Commonwealth and State legislation and guidelines:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Western Australian *Environmental Protection Act 1986* (EP Act)
- Western Australian *Biodiversity Conservation Act 2016* (BC Act)
- Western Australian *Biodiversity Conservation Regulations 2018*
- Department of Environment, Water, Heritage and the Arts (DEWHA 2009) *Matters of National Environmental Significance. Significant impact guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999*
- Department of Sustainability Environment Water Population and Communities (DSEWPoC 2011a) *Survey guidelines for Australia's threatened mammals*
- DSEWPoC (2011b) *Survey guidelines for Australia's threatened reptiles*
- DEWHA (2010a) *Survey guidelines for Australia's threatened bats*
- DEWHA (2010b) *Survey guidelines for Australia's threatened birds*
- DSEWPoC (2012) *EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's cockatoo (vulnerable) *Calyptorhynchus baudinii*, Forest red-tailed black cockatoo (vulnerable) *Calyptorhynchus banksii* naso, known in this document as the Black Cockatoo Referral Guidelines*
- Commonwealth of Australia (2017) *Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo, known in this document as the Revised Draft Referral Guideline*
- Threatened Species Scientific Committee (TSSC 2015) *Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt.*

As well as those listed above, the assessment complied with Environmental Protection Authority (EPA) requirements for environmental survey and reporting in Western Australia, as outlined in:

- EPA (2020a) *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment*, known herein as the Fauna Technical Guidance
- EPA (2016) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, known herein as the Flora and Vegetation Technical Guidance
- EPA (2020b) *Statement of Environmental Principles, Factors and Objectives.*

1.4.1 COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The EPBC Act is a legal framework to protect and manage matters of national environmental significance (MNES) including important flora, fauna, ecological communities and heritage areas listed under the Act. Threatened taxa (flora and fauna) are protected under the EPBC Act, which lists species and ecological

communities that have been assessed as meeting the criteria to be listed as Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild, as detailed in **Table 15** in **Appendix One**. Threatened Ecological Communities are categorised as Critically Endangered, Endangered or Vulnerable, also detailed in this table.

1.4.2 WESTERN AUSTRALIAN ENVIRONMENTAL PROTECTION ACT 1986

The Western Australian EP Act was created to provide for an Environmental Protection Authority (the EPA) that has the responsibility for:

- prevention, control and abatement of pollution and environmental harm
- conservation, preservation, protection, enhancement and management of the environment
- matters incidental to or connected with the above.

The EPA is responsible for providing the guidance and policy under which environmental assessments are conducted. It conducts environmental impact assessments (based on the information provided by the proponent), initiates measures to protect the environment and provides advice to the Minister responsible for environmental matters.

1.4.3 WESTERN AUSTRALIAN BIODIVERSITY CONSERVATION ACT 2016

The Western Australian BC Act provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia.

Threatened species (both flora and fauna) and ecological communities that meet the categories listed within the BC Act are protected under this legislation and require authorisation by the Minister to take or disturb. These are known as Threatened Flora, Threatened Fauna and Threatened Ecological Communities. The conservation categories of Critically Endangered, Endangered and Vulnerable are detailed in **Table 16** in **Appendix One**; these categories align with those of the EPBC Act.

Flora and fauna species may be listed as being of special conservation interest if they have a naturally low population, restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. Migratory species and those subject to international agreement are also listed under the Act. These are known as specially protected species in the BC Act.

The most recent flora and fauna listings were published in the *Government Gazette* on 11 September 2018 (Government of Western Australia 2018a).

1.5 FLORA

1.5.1 THREATENED AND PRIORITY FLORA

Conservation significant flora species are those that are listed as TF (Threatened Flora) and (within Western Australia) as PF (Priority Flora). TF species are listed as Threatened by the Western Australian DBCA and protected under the provisions of the BC Act. Some State-listed TF are provided with additional protection as they are also listed under the Commonwealth EPBC Act (see **Table 15** in **Appendix One** for conservation status category descriptions).

Flora are listed as PF where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to TF categories. Whilst PF are not specifically listed

in the BC Act, some may qualify as being of special conservation interest and thereby have a greater level of protection than unlisted species.

There are seven categories covering Western Australian-listed TF and PF species which are outlined in **Table 16** in **Appendix One**. PF for Western Australia are regularly reviewed by the DBCA whenever new information becomes available, with species status altered or removed from the list when data indicates that they no longer meet the requirements outlined in **Table 16**.

1.5.2 OTHER SIGNIFICANT FLORA

According to the Flora and Vegetation Technical Guidance (EPA 2016) other than being listed as Threatened or Priority Flora, a species can be considered as significant if it is considered to be:

- locally endemic or association with a restricted habitat
- a new species or has anomalous features that indicate a potential new species
- at the extremes of range, recently discovered range extensions (generally considered greater than 100 km or in a different bioregion), or isolated outliers of the main range)
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

1.5.3 INTRODUCED FLORA

Introduced plant species, known as weeds, are plants that are not indigenous to an area and have been introduced either directly or indirectly (unintentionally) through human activity. Species are regarded as introduced if they are listed as 'alien' on *FloraBase* (Western Australian Herbarium [WAH] 1998-2020) and are designated with an asterisk (*) in this document.

1.5.3.1 Weeds of National Significance

At a national level there are 36 weed species listed as Weeds of National Significance (WoNS) (Weeds Australia & Centre for Invasive Species Solutions 2020). The Commonwealth *Australian Weeds Strategy 2017-2027* (Invasive Plants and Animals Committee 2016) describes broad goals and objectives to manage these species.

1.5.3.2 Declared Pest Plants

The Western Australian Organism List (WAOL) details organisms listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Under the BAM Act, Declared Pests are listed as one of the three categories, or exempt:

- C1 (exclusion), that applies to pests not established in Western Australia; control measures are to be taken to prevent their entry and establishment
- C2 (eradication), that applies to pests that are present in Western Australia but in low numbers or in limited areas where eradication is still a possibility
- C3 (management), that applies to established pests where it is not feasible or desirable to manage them in order to limit their damage
- exempt (no category).

1.6 ECOLOGICAL COMMUNITIES/VEGETATION

Most, although not all, conservation-listed ecological communities are defined by vegetation, usually within the context of a defined landform or unique habitat. Although 'vegetation' and 'ecological communities' are

not interchangeable terms, this assessment describes the vegetation of the survey area with conservation status taking into consideration the interactions of the vegetation with the biological and physical environment within which it occurs (i.e. the ecological community as a whole).

1.6.1 EPBC-LISTED THREATENED ECOLOGICAL COMMUNITIES

Ecological communities are naturally occurring biological assemblages associated with a particular type of habitat (DBCA 2020). At Commonwealth level, Threatened Ecological Communities (TECs) are protected under the Commonwealth EPBC Act. Ecological communities are categorised as Critically Endangered, Endangered and Vulnerable as described in **Table 15** in **Appendix One**.

1.6.2 WESTERN AUSTRALIAN THREATENED ECOLOGICAL COMMUNITIES

Western Australian TECs are protected under the BC Act. TECs are categorised much like those of the EPBC Act, shown in **Table 17** in **Appendix One**.

Currently described TECs are listed on the DBCA website, with the most recent list endorsed by the Minister for Environment in June 2018 (DBCA 2018).

1.6.3 WESTERN AUSTRALIAN PRIORITY ECOLOGICAL COMMUNITIES

DBCA maintains a list of Priority Ecological Communities (PECs). PECs include potential TECs that do not meet survey criteria, or that are not adequately defined. They are not protected under legislation but are taken into consideration as part of the environmental approvals process.

Currently described PECs are listed on the DBCA website, with the most recent list dated 28 July 2020 (Species and Communities Program DBCA 2020).

1.6.4 OTHER SIGNIFICANT VEGETATION

According to the Flora and Vegetation Technical Guidance (EPA 2016), other than being listed as a TEC or PEC, vegetation can be considered as significant if it is considered to have:

- restricted distribution
- a degree of historical impact from threatening processes
- a role as a refuge
- provides an important function required to maintain ecological integrity of a significant ecosystem.

1.7 FAUNA

1.7.1 EPBC-LISTED THREATENED FAUNA

At a Commonwealth level, Threatened Fauna are protected under the EPBC Act, which lists species and ecological communities that are considered Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild (detailed in **Table 15** in **Appendix One**).

Migratory species subject to international agreements are also protected under the EPBC Act. The definition of a migratory species under the Act follows that prescribed by the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (DotEE 2020):

Migratory species are the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries.

Species listed by the following international agreements are currently protected under the EPBC Act:

- *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention)
- *China-Australia Migratory Bird Agreement* (CAMBA)
- *Japan-Australia Migratory Bird Agreement* (JAMBA)
- *Republic of Korea-Australia Migratory Bird Agreement* (ROKAMBA).

1.7.2 WESTERN AUSTRALIAN BC ACT-LISTED FAUNA

Threatened fauna that meet the categories listed within the BC Act are protected and require authorisation by the Minister to take or disturb. The conservation categories of Critically Endangered, Endangered and Vulnerable have been aligned with those detailed in the EPBC Act.

Fauna species may be listed as being of special conservation interest if they have a naturally low population, restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. These are known as Specially Protected Species in the BC Act.

The categories covering State-listed threatened fauna species are outlined in **Table 16** in **Appendix One**.

1.7.3 WESTERN AUSTRALIAN PRIORITY FAUNA

Conservation significant fauna species are listed by the DBCA as Priority Fauna where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to threatened fauna categories. Whilst Priority Fauna are not specifically listed in the BC Act, these have a greater level of significance than other native species. The categories covering Priority Fauna species are outlined in **Table 16** in **Appendix One**.

1.8 ENVIRONMENTALLY SENSITIVE AREA

There are a number of areas around Western Australia identified as being of environmental significance within which the exemptions to the Native Vegetation Clearing Regulations do not apply. These are referred to as Environmentally Sensitive Areas (ESAs), and are declared under section 51B of the EP Act and described in the *Environmental Protection (Environmentally Sensitive Areas) Notice*.

1.9 CONSERVATION ESTATE

The National Reserve System is a network of protected areas managed for conservation under international guidelines. The objective of placing areas of bushland into the Conservation Estate is to achieve and maintain a comprehensive, adequate and representative reserve system for Western Australia. The Conservation and Parks Commission is the vesting body for conservation lands, forest and marine reserves that are managed by DBCA (Government of Western Australia 2018b).

2 EXISTING ENVIRONMENT (DESKTOP ASSESSMENT)

2.1 PHYSICAL ENVIRONMENT

2.1.1 CLIMATE

The southwest of Western Australia is generally described as having a Mediterranean-type climate of mild, wet winters and warm to hot, dry summers. The climate of the region is strongly influenced by the position of a band of high pressure known as the sub-tropical ridge. For much of the year the ridge is located to the south allowing the east or south easterly winds to prevail. During the cooler months the ridge periodically moves to the north allowing cold fronts to pass over the west coast and deliver much of the annual rainfall (Beard 1990).

According to the Köppen-Geiger climate classification, the survey area has a temperate climate with dry, warm summers (Class Csb) (Peel, Finlayson & McMahon 2007). This classification is considered to represent a Mediterranean climate where average summer maximum temperatures lie above 10 °C but are not exceeding 22°C and the coldest month maximum is below 4° C. Summer rainfall is less than one third of winter rainfall.

The closest Bureau of Meteorology (BoM) station with long term records for rainfall is Broomehill (BoM 2020, station no. 10525, operating since 1891). The mean annual rainfall is 445.4 mm with 43.03% falling during winter. However, there are no records available for 2020 from this station and the next closest station with recent records is Katanning (station 10916, operating since 1999), located 18.4 km to the north. Katanning's mean annual rainfall is 441.4 mm.

The closest BoM station with long term records for temperature is Wagin Broomehill (BoM 2020, station no. 10647, operating since 1891) located approximately 50 km north of the survey area. January is the hottest month with a mean maximum temperature of 31.1°C and minimum of 14.6°C. July is the coldest month with a mean maximum of 15.4°C and minimum of 5.6°C.

Figure 2 shows the average rainfall and temperatures of the survey area, with rainfall for the year preceding the field survey.

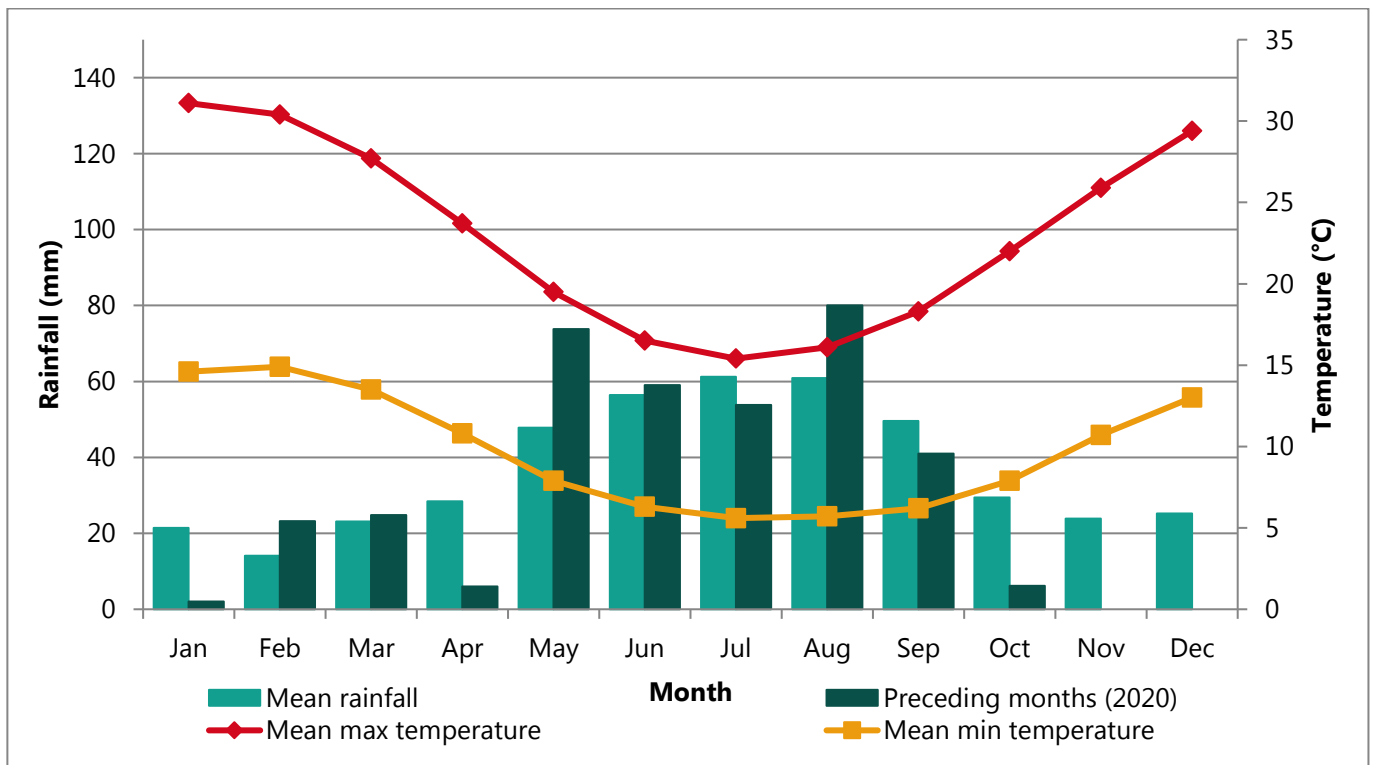


Figure 2: Rainfall (Katanning) and temperature (Wagin) data for the survey area (BoM 2020)

2.1.2 LAND SYSTEMS

According to Department of Primary Industries and Rural Development (DPIRD 2019a) soil landscape mapping, the following land systems intersect the survey area (**Table 2** and **Map 1**).

Table 2: Land systems (DPIRD 2019a)

Mapping unit	Land system	Description	Extent (ha)	%
257Ca_2	Carrolup 2 Subsystem	Grey sandy duplex soils on slopes, hill crests and less commonly minor drainage lines within the Carrolup system.	32.01	79.43
257Ca_3	Carrolup 3 Subsystem	Low hills and rises in the Carrolup system with sandy and loamy soils formed on shallow weathered granite and dolerite and small areas of rock outcrop.	8.29	20.57

2.1.3 GEOLOGY

The survey area is associated with the Dumbleyung map sheet (S150-07) of the 1:250,000 Geological Map of Western Australia (DMIRS 2020). The survey area intersects two geological units:

- Qc – described as Colluvium and minor alluvium – silt, sand and gravel; generally, on slopes adjoining rock and laterite outcrops
- Czc – described as Conglomerate – boulders of quartzite, granite and dolerite in sandstone or claystone matrix.

2.1.4 WETLANDS AND DRAINAGE

The survey area is largely in the Hardy Estuary Coblinine River catchment of the Blackwood River, and partly (in the southern portion) in the Nornalup Inlet Frankland River catchment of the Frankland River (Landgate 2020).

The survey area does not directly intersect any wetlands or significant drainage lines. No hydrological feature of significance is situated in close proximity to the survey area.

2.1.5 ENVIRONMENTALLY SENSITIVE AREAS

The survey area is not included in an ESA and no ESAs occur nearby.

2.1.6 CONSERVATION LANDS

The survey area does not intersect any conservation lands. There are three areas managed for conservation nearby:

- Broomehill Nature Reserve, approximately 5 km to the south-east of the survey area
- Peringillup Nature Reserve, approximately 10 km to the south of the survey area
- an unnamed class A Nature Reserve, approximately 13 km to the east of the survey area.

2.1.7 LAND USE HISTORY

The survey area is immediately adjacent to the township of Broomehill and includes remnant native vegetation adjacent to roads, railway and the CBH facility. Most of the surrounding area has been cleared for rural residential housing, transport and as dryland agriculture (Australian Government & BoM 2020; Department of Agriculture Water and the Environment 2020a).

2.2 BIOLOGICAL ENVIRONMENT

2.2.1 BIOGEOGRAPHIC REGION

Biogeographic regions are delineated on the basis of similar climate, geology, landforms, vegetation and fauna and are defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Department of Agriculture Water and the Environment 2020a).

The survey area is located in the Avon-Wheatbelt IBRA region in the Katanning subregion (AW2 – Rejuvenated Drainage subregion), described as (DPIRD 2019b):

The Avon Wheatbelt is an area of active drainage dissecting a Tertiary plateau in Yilgarn Craton. Gently undulating landscape of low relief. Proteaceous scrub-heaths, rich in endemics, on residual lateritic uplands and derived sandplains; mixed eucalypt, Allocasuarina huegeliana and Jam-York woodlands on Quaternary alluvials and eluvials. Within this, AW2 is the erosional surface of gently undulating rises to low hills with abrupt breakaways. Continuous stream channels that flow in most years. Colluvial processes are active. Soil formed in colluvium or in-situ weathered rock. Includes woodland of Wandoo, York Gum and Salmon Gum with Jam and Casuarina. The climate is Semi-arid (Dry) Warm Mediterranean, and area is 3,012,977 ha.

2.2.2 PRE-EUROPEAN VEGETATION

During the 1970s, John Beard and associates conducted a systematic survey of native vegetation, describing the vegetation systems in Western Australia at a scale of 1:250 000 in the south-west and at a scale of 1:1 000 000 in less developed areas.

Beard's vegetation maps attempted to depict the native vegetation as it was presumed to be at the time of settlement and is known as the pre-European vegetation type and extent. Beard's vegetation maps have since been developed in digital form by Shepherd, Beeston & Hopkins (2002) and updated by DPIRD (2019b). Extents are updated every two years by DBCA (2019a). This mapping indicates that the survey areas intersects one pre-European vegetation unit:

- Association 1085: described as Medium woodlands; wandoo and blue mallet (*Eucalyptus gardneri*).

The pre-European vegetation association identified from the survey area (DPIRD 2019b) and its pre-European and current extents are listed in **Table 3** (DBCA 2019a).

Table 3: Pre-European vegetation association representation (DBCA 2019a)

Region	Vegetation association	Original extent (ha)	Current extent (ha)	% remaining
Western Australia	1085	51786.78	5935.05	11.46
IBRA biogeographic region (Avon-Wheatbelt)	1085	51786.78	5935.05	11.46
IBRA biogeographic sub-region (Katanning)	1085	51786.78	5935.05	11.46
LGA (Shire of Broomehill-Tambellup)	1085	29278.48	2869.18	9.80

2.2.3 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

The Protected Matters Search Tool (PMST) search (Australian Government & DAWE 2020; search reference PMST_7SFIKO) using a 20 km buffer around a point approximating the centre of the survey area identified one EPBC-listed TECs that is 'likely to occur'; the critically endangered *Eucalypt Woodlands of the Western Australian Wheatbelt* TEC.

The DBCA database search (search reference 20-1020EC using a 20 km buffer) identified one PEC as occurring within the search buffer; the Priority 3 *Eucalypt Woodlands of the Western Australian Wheatbelt (Wheatbelt Woodlands)* PEC. The survey area intersects 10 mapped occurrences, noting that there is overlap in several of these and that they may have been indicatively mapped (TSSC 2015).

Map 2 shows the locations of ecological communities identified by the DBCA database search.

The above TEC and PEC are considered to be largely synonymous and are known herein as the Wheatbelt Woodlands TEC. Some TECs listed under the EPBC Act, including this (TSSC 2015), have detailed assessment methodologies to determine if vegetation is representative. A summary of the definitions and criteria used to identify the Wheatbelt Woodlands TEC is available in **Appendix Two**.

2.2.4 THREATENED AND PRIORITY FLORA

The PMST search (as above) identified three EPBC-listed TF that are 'known to occur' within the 20 km search buffer area and two as 'species or habitat likely to occur within area'.

The requested DBCA databases (search reference 47-0920FL) was conducted using a 50 km buffer around a point approximating the centre of the survey area. The results incorporate the TPFL List, taken from Threatened and Priority Flora Report Forms and DBCA surveys, and WA Herb, taken from vouchered specimens held in the Western Australian Herbarium.

The combined database searches identified the species listed in **Table 25** in **Appendix Three**, consisting of 18 TF (16 from records known to occur within the database search buffer and a further two from the PMST where

associated habitat may occur), 13 P1, 20 P2, 33 P3 and 26 P4. None have been recorded from within the survey area.

Map 2 shows the locations of conservation-listed flora identified by the DBCA database search.

2.2.4.1 Threatened and Priority Flora Likelihood Assessment

Ecoscape conducted a likelihood assessment to identify TF and PF species that have potential to occur within the survey area. The likelihood of a species occurring is based on the following attributes, as listed on *FloraBase* (WAH 1998-2020, 2020, including specimen collection information) and incorporating an assessment of habitats likely to be present in the survey area. The attributes taken into consideration were:

- broad soil type usually associated with the species
- broad landform usually associated with the species
- usual vegetation (characteristic species) with which the species is usually associated
- species having previously been recorded from within approximately 20 km of the survey area (considered as 'nearby') taking locational accuracy into account
- time since recorded (i.e. within the previous 25 years), taking into consideration land use changes since collection.

The likelihood rating is assigned using the categories listed in **Table 4**.

Table 4: Categories for likelihood of occurrence of TF and PF

Likelihood	Category
Recorded	Species recorded within the survey area.
Possible	May occur within the survey area (but has not been recorded); broadly, 2-4 of the required attributes (but always including records from nearby) are present in the survey area.
Unlikely	Could occur but is not expected; 1-3 of the required attributes are present in the survey area but: • it is not known from nearby, or • it is known from nearby but has no other required attributes, or • it is known from nearby but has at least one well-defined attribute that does not occur in the survey area (e.g. it is associated with a specific landform or soil type that does not occur in the survey area), or • it is known from nearby but: - o the record is old (>25 years), or - o the locational data is highly likely to be inaccurate, or - o the area has been significantly cleared at and around the location of the record and survey area and as such the habitat almost certainly no longer occurs within the survey area.
Highly unlikely	The species characteristics include only one or none of the required attributes of soil, landform, associated vegetation and having previously been recorded nearby, or a critical element (often landform) is not within the survey area and as such it almost certainly does not occur.

The likelihood assessment is available in **Table 25** in **Appendix Three**. One TF, one P2 and two P4 were identified as having a High likelihood of occurring based on the information available during the desktop assessment. These were considered the most likely to occur and were prioritised for field survey.

Following the field survey when actual survey area characteristics (vegetation types, vegetation condition, visibility for individual species) are better understood, and the level of survey effort was considered, the

likelihood of occurrence was re-evaluated. The post-survey likelihood is also incorporated into this table and discussed further in **Section 5.1.1.2**.

2.2.5 THREATENED AND PRIORITY FAUNA

2.2.5.1 NatureMap

NatureMap (DBCA 2007-2020) is maintained collaboratively by the DBCA and the WAM. These records represent a combination of vouchered museum specimens and records obtained via the Fauna Survey Returns Database maintained by the DBCA.

The *NatureMap* search identified 540 vertebrate fauna species previously recorded within the applied 30 km buffer area. Of these, 31 (20 birds, 10 mammals and one invertebrate) are conservation-listed. *NatureMap* results are incorporated into **Table 26** in **Appendix Three**.

2.2.5.2 DBCA Database Search

A search of the DBCA databases was conducted (search reference: 2020/000669 #6460) using a 30 km buffer around a point approximating the centre of the survey area. 29 conservation-listed were identified as having previously been recorded from within the search area buffer, consisting of:

- seven mammals
- 21 birds
- one invertebrate (noting that invertebrates were not included in the assessment).

The results incorporate the conservation-listed species identified from the *NatureMap* search (as above), with following additional species:

- *Ninox connivens connivens* (Barking Owl (South-west population)) – DBCA P3.

DBCA database search results are incorporated into **Table 26** in **Appendix Three** and shown on **Map 3**.

2.2.5.3 Protected Matters Search

The Protected Matters Search Tool (PMST) search (Australian Government & DAWE 2020; search reference PMST_7SFIKO) using a 20 km buffer around a point approximating the centre of the survey area, identified:

- three mammals: one 'species or species habitat known to occur within area', two 'species or species habitat may occur within area'
- 14 birds: four 'species or species habitat known to occur within area', five 'species or species habitat likely to occur within area', five 'species or species habitat may occur within area'

The PMST results are incorporated into **Table 26** in **Appendix Three**. Not all species identified by the PMST search have DBCA/Western Australian Museum (WAM) records (*NatureMap* and DBCA database searches; see below). The following were identified by the PMST search but not by the *NatureMap* and DBCA database searches:

- *Apus pacificus* (Fork-tailed Swift) – MI EPBC Act, MI BC Act
- *Falco hypoleucos* (Grey Falcon) – VU BC Act
- *Motacilla cinerea* (Grey Wagtail) – MI EPBC Act, MI BC Act
- *Numenius madagascariensis* (Eastern Curlew) – MI & CR EPBC Act, CR BC Act
- *Paratechinus apicalis* (Dibbler) – EN EPBC Act, EN BC Act
- *Pezoporus occidentalis* (Night Parrot) – EN EPBC Act, CR BC Act.

2.2.5.4 Threatened and Priority Fauna Likelihood Assessment

The likelihood of occurrence of significant fauna species identified by the database and literature searches was assessed using the following criteria:

- suitability of habitat types present within the survey area
- distance between previous record of conservation-listed species and the survey area
- frequency and number of records in the region
- date of record of conservation-listed species (recent or historical).

The following were also taken into consideration during the assessment:

- sufficiency of information
- behavioural and ecological characteristics such as cryptic behaviours
- record certainty.

The categories of likelihood of occurrence, assessed using the above criteria, are shown in **Table 5**.

Table 5: Categories for likelihood of occurrence of conservation-listed fauna

Likelihood	Category
Recorded	Species recorded within the survey area within a reasonable timeframe (0-25 years)
High	Species recorded in close proximity to the survey area (<5 km) within the past 25 years; and suitable habitat occurs within the survey area
Medium	Species historically recorded in close proximity (<5 km) to the survey area, more than 25 years ago; and suitable habitat may exist within the survey area
Low	Species not recorded in the proximity of the survey area or rarely recorded within 10 km of the survey area; and suitable habitat unlikely to occur within the survey area
Very Low	Species not recorded by multiple surveys/databases within 20 km of the survey area and suitable habitat does not occur within the survey area, however, species or suitable habitat is listed as potentially occurring in the wider region

The likelihood of species occurring within the survey area are indicated in **Table 26** in **Appendix Three**. One species was assessed as having a High likelihood of occurring within the survey area:

- *Phascogale calura* (Red-tailed Phascogale) – EPBC VU, DBCA CD.

Following the field survey when actual survey area characteristics are better understood, and the level of survey effort was considered, the likelihood of occurrence was re-evaluated. The post-survey likelihood is also incorporated into this table and discussed further in **Section 5.3.3.1**.

2.3 LITERATURE REVIEW

2.3.1 IBSA DATA SEARCH

A search of the Department of Water and Environmental Regulation's (DWER's) *Index of Biodiversity Surveys for Assessments (IBSA)* Portal (DWER 2020) was searched for recent environmental surveys in the vicinity of the survey area.

The search, conducted on 15 December 2020, identified four environmental surveys that have been conducted within 50 km of the survey area. Of these, two were in the vicinity of Katanning (approximately 18 km to the north northwest) and one along Albany Highway (approximately 44 km to the west), however, none had information available that could be reviewed i.e. they were records with metadata only.

The fourth IBSA listing was for a survey near Lake Ewlyamartup, approximately 20 km to the northeast (Strategen Environmental 2017). This survey, conducted in support of a Native Vegetation Clearing Permit, included a reconnaissance-level flora and vegetation survey that identified 32 vascular flora species from within the 36.7 ha survey area, none of which were conservation-listed, and seven vegetation types, none of which were assessed as being representative of a TEC or PEC. The entire survey area was described as having been grazed and was, at best, in Good condition (33.65% of the survey area) and largely Degraded or cleared. The report had little relevance to the CBH Broomehill survey area.

2.3.2 OTHER LITERATURE

No other documents have been located that provide contextual information for this assessment.

3 METHODS

3.1 SURVEY AIMS

The aims of the biological survey were to:

- conduct a detailed flora and vegetation survey
- conduct a Basic fauna survey
- identify Black Cockatoo breeding and foraging habitat.

3.2 GUIDING PRINCIPLES

The flora and vegetation survey was conducted as a detailed survey according to the Flora and Vegetation Technical Guidance (EPA 2016). The EPA considers that a detailed survey requires:

- a comprehensive survey design, including giving consideration to the survey timing that should be conducted during the primary season of survey for the bioregion and disturbance events, and the potential requirement for supplementary surveys
- a minimum of three quadrats (in proportion to the extent of the vegetation unit), located throughout each preliminary vegetation types sampled throughout its geographic range, with additional quadrats and rescoring during supplementary surveys to clarify vegetation unit boundaries
- regional surveys if there is insufficient information available (identified during the desktop assessment) to provide local and regional context
- the survey may include a number of sampling techniques including quadrats, relevés, transects and traverses, as well as opportunistic observations
- the flora inventory should be comprised of data collected from quadrats and relevés, supplemented by opportunistic observations, systematic surveys and targeted inspections of various habitat areas
- it may be appropriate to increase survey effort in areas of unusual habitat
- sampling sites that are placed at representative locations throughout the survey area considering landform, geology, elevation, slope, aspect, surface or groundwater expression and soil type, as well as vegetation structure, composition and condition.

Targeted searches were also conducted in areas of habitat suitable for TF and PF identified during the desktop assessment and previous surveys as having potential to occur.

The fauna and fauna habitat survey was conducted as a basic survey according to the Fauna Technical Guidance (EPA 2020a). The EPA recommends a basic survey should:

- be conducted as a low intensity survey to gather broad fauna and habitat information
- verify the adequacy of the desktop assessment
- map, describe and photograph habitats
- record opportunistic fauna observations
- identify possible future survey site locations, access and logistics
- determine if a detailed survey is required.

Targeted surveys were also conducted to gather information on significant fauna and/or habitats.

3.3 FLORA AND VEGETATION FIELD SURVEY

3.3.1 FIELD SURVEY METHODS

The methods utilised during the field survey followed those outlined in the Flora and Vegetation Technical Guidance (EPA 2016), conducted as a single phase survey.

Conservation criteria used in this assessment are included in **Table 15**, **Table 16** and **Table 17** in **Appendix One**.

Survey method details are outlined below.

3.3.1.1 Floristic Quadrats

Floristic quadrat ('quadrat') locations were selected using aerial photography, environmental values and field observations to represent the vegetation values existing at the site. The unmarked quadrats were 10 m x 10 m in dimension for mid and ground strata and 20 m x 20 m in dimension (effectively 5 m additional on all sides to the measured mid and ground stratum quadrat) for the upper stratum where present, as required according to the Flora and Vegetation Technical Guidance (EPA 2016). Where the vegetation consisted of a narrow linear corridor, quadrats were linear but of the same overall size i.e. 400 m² for the upper stratum.

The following information was collected from within each quadrat:

- observer
- date
- quadrat/site number
- GPS location (GDA94) of the northwest corner
- digital photograph (spatially referenced with a reference number), taken from the northwest corner, looking diagonally across the quadrat
- broad soil type and colour
- topography
- list of flora species recorded with the average height and total cover within the quadrat for each species
- vegetation description (as per below)
- vegetation condition.

At least three quadrats per vegetation type were recorded for the detailed survey where there was sufficient extent. Relevés, being an unmeasured area of approximately the same size as quadrats, were used to record vegetation in Degraded or Completely Degraded condition. Whilst unmeasured, the detail recorded for relevés was commensurate with that of quadrats.

All quadrat and relevé locations are displayed on the **Map 4** series.

3.3.1.2 Targeted Searches

Threatened and Priority Flora identified during the desktop analysis and previous surveys as known or having potential to occur were targeted for searches in areas of potential habitat. Linear habitat was traversed in its entirety. The majority of the remnant bushland block was traversed at approximately 20 m spacing (during the Black Cockatoo tree survey with concurrent searches for conservation-listed flora).

The locations of all targeted taxa collected were recorded using a handheld GPS with the following data recorded:

- observer, date and time

- reproductive status and other features such as health of plants, percentage flowering and fruiting
- local abundance/population size and/or population boundary
- landform
- brief vegetation community description
- representative photos of each species and habitat
- collection of representative specimens.

3.3.1.3 Introduced Species

Introduced species (weeds) were recorded during the collection of the overall flora inventory.

3.3.1.4 Vegetation Description and Classification

Vegetation was described from each of the quadrats using the height and estimated cover of dominant and characteristic species of each stratum based on the National Vegetation Information System, recorded at Level V (NVIS Technical Working Group & DotEE 2017) (**Table 18** and **Table 19** in **Appendix One**). Up to three species per stratum from each stratum (upper, mid and ground) were used to formulate vegetation descriptions for each quadrat and each vegetation type.

Vegetation type descriptions were created by combining quadrat descriptions and modifying, where necessary, based on the wider vegetation. Vegetation codes for these were formulated using the characteristic species of the highest stratum within the vegetation type that had >2% cover (i.e. not scattered) if present, with the first series of letter codes referring to the component species (upper case first letter referring to the genus, lower case one or two letters referring to the species, with the upper case letters at the end referring to the stratum structure e.g. **EwAhW** refers to *Eucalyptus wandoo* and *Allocasuarina huegeliana* mid woodland).

3.3.1.5 Vegetation Condition Assessment

Vegetation condition was assessed broadly and continuously throughout the survey area and at each quadrat using the Vegetation Condition Scale for the Southwest Botanical Province (EPA 2016) (**Table 20** in **Appendix One**). As quadrats are located in the best condition parts of a vegetation type, the condition rating of the quadrat may not match that of the broader vegetation type due to the scale of mapping.

3.3.1.6 Field Survey Timing

The field survey was conducted during 26-30 October 2020 which is within the optimal period for a primary survey within the bioregion according the Flora and Vegetation Technical Guidance (EPA 2016). The flora and vegetation survey was conducted concurrently with the fauna survey.

3.3.2 STATISTICAL ANALYSIS

3.3.2.1 Post-survey Likelihood Assessment

Following the field survey, a post-survey likelihood assessment was conducted to identify conservation-listed species that have potential to occur on site. This assessment was based on survey effort and habitat known to occur in the survey area and updated the desktop likelihood assessment.

3.3.2.2 Floristic Analysis

PATN© software (Belbin & Collins 2006) was used to undertake statistical analysis to generate floristic groups using the data collected from the quadrats and relevés, in order to better understand local significance of

floristic units. PATN analysis has been used for several local floristic analyses including Gibson *et al.* (1994) for the Swan Coastal Plain.

PATN is a multivariate analysis tool that generates estimates of association (resemblance, affinity, distance) between sets of objects described by a suite of variables (attributes), and classifies the objects into groups and condenses the information and displays the patterns in the data graphically. It offers a choice of data transformations prior to multivariate analysis.

Floristic groups, identified using a dendrogram output of the analysis, are used as a tool to inform vegetation type groups at various levels and scales.

For this project a variety of analyses were run. The most informative analysis used the Bray Curtis similarity coefficient for rows (species) and columns (sites) as this provides a good estimation of association for ecological applications (Belbin & Collins 2006). For this analysis we used a simple square root transformation of cover values for each species.

Interpretation of these purely floristic groups into recognisable and mappable on-ground units is a tool used to identify broad vegetation types. Generally, quadrats that are closely floristically related on the dendrogram form identifiable vegetation units, however, interpretation is frequently required for imperfect results. Vegetation types are therefore determined as a combination of floristic analysis and on-ground interpretation using dominant and characteristic species.

3.3.2.3 Adequacy of Sampling

In order to demonstrate adequacy of sampling, a species accumulation curve was generated by the software Species Diversity and Richness IV (Pisces Conservation Ltd 2010) using five random selections of sample order, using quadrat data only. Fauna Field Survey

3.3.3 FIELD SURVEY METHODS

The methods utilised during the field survey followed those outlined in the Fauna Technical Guidance (EPA 2020a), conducted as a basic survey.

Conservation criteria used in this assessment are included in **Table 15** and **Table 16** in **Appendix One**.

Survey method details are outlined below.

3.3.3.1 Fauna Survey

The basic fauna survey incorporated a number of survey techniques as per the Terrestrial Fauna Technical Guidance (EPA 2020a) including habitat assessment, active searches (day and night time), raking of spoil heaps and leaf litter, searches for secondary evidence such as scats and tracks, as well as opportunistic searches.

Terrestrial vertebrate fauna were the main targets of the field survey. Survey techniques included:

- opportunistic bird observations while moving through the survey area
- turning of surface debris (rocks, logs, vegetation spoil heaps) that reptiles and mammals may shelter beneath
- raking of litter beds to locate fossorial reptile species.

Fauna species were identified opportunistically based on sightings, calls, remains, diggings and other signs. Potential habitats for conservation significant species were identified and evaluated and their likelihood of occurrence assessed.

3.3.3.2 Fauna Habitat Assessment

The fauna habitats present within the survey areas were identified and mapped. Fauna habitats were described as an area which is distinguishable from its surrounding area by its land form, vegetation and fauna assemblage occupying the area. In addition, its likelihood to harbour specialised fauna species which are not found in adjacent areas was taken into consideration.

The following information was used to identify and map all fauna habitats within the survey area:

- previous fauna habitat mapping
- land systems
- vegetation type and condition mapping
- aerial imagery
- landforms
- soil characteristic
- fauna assemblage information.

The composition and characteristics of each fauna habitat type was recorded, including noting suitability for various fauna suites or conservation-listed species. Habitat types were delineated in the field and digitised upon return from the field survey.

3.3.3.3 Black Cockatoo Assessment Methods

Black Cockatoo Species (Carnaby's Cockatoo; Baudin's Cockatoo EN, Forest Red-tailed Black-cockatoo VU (EPBC Act, BC Act))

Potential and active (actual) Black Cockatoo breeding trees were assessed as per Commonwealth guidance (DSEWPaC 2012). Relevant aspects of the recent draft referral guidelines (Commonwealth of Australia 2017) were also incorporated into the survey as this allows data to be gathered that could potentially be used when the updated referral guidelines are finalised.

Potential and actual Black Cockatoo habitat trees are:

- listed tree species as provided in the Commonwealth guidance (DSEWPaC 2012)
- minimum size of 500 mm diameter at breast height (DBH) for most species, or 300 mm DBH for Salmon Gum and Wandoo.

The following were recorded for each potential and actual habitat tree:

- location, recorded using a handheld GPS device with an accuracy of approximately 5 m
- species
- identifying if tree hollows of suitable size and orientation are present, and recording evidence of use by cockatoos such as chewing at the hollow entrance
- habitat value according to the scoring system developed by Dr Mike Bamford (2016); this score reflects the existing value of the tree characteristics with respect to its potential to be used as a nesting tree (as per **Table 21 in Appendix One**)
- photograph of each tree in the rail and road corridor and Class 3 and above trees in the bushland block, showing hollows if possible
- known nesting trees as per DBCA data.

The suitability of the survey area for breeding (additional to the specific tree survey) and as foraging habitat (as per the Commonwealth (2017) scoring tool; **Table 22** in **Appendix One**) was also assessed and mapped, taking into consideration:

- the presence of species favoured for foraging (as listed in the Commonwealth guidance, including Proteaceous species, Eucalypt species, *Pinus* species etc.)
- evidence of foraging e.g. chewed Eucalypt nuts
- location of known nesting or night roosting trees
- surrounding vegetation, up to at least 12 km from the survey area and taking into consideration the proximity to any known breeding habitat and watering points
- presence of disease, such as *Phytophthora cinnamomi* or Marri Canker (*Quambalaria coyrecup*).

3.3.3.4 Tree Survey Area

During the field survey it became apparent that insufficient time had been allocated to assess the entire survey area. Discussions with CBH identified that the large bushland block within the survey area was not proposed to be entirely cleared and did not require a tree survey over its entire extent. The survey area for tree assessments was accordingly reduced to the portion likely to be included in the proposed development and therefore likely to be cleared. However, the extent included in the flora and vegetation assessment did not alter.

3.3.3.5 Field Survey Timing

The survey was conducted over 4.5 days during 26-30 October 2020, concurrently with the flora and vegetation survey.

4 FIELD SURVEY RESULTS

4.1 FLORA AND VEGETATION SURVEY

The flora and vegetation survey was conducted by Lyn Atkins (Principal Ecologist, Flora Collecting Permit FB62000003; Threatened Flora Collecting Permit TFL 73-1920) during 26-30 October 2020, concurrently with the fauna survey.

4.1.1 FLORA

4.1.1.1 Flora Inventory

Nine floristic quadrats and six relevés were recorded from within the survey area. The relevés were recorded in areas of Degraded-Completely Degraded condition vegetation and, whilst unmeasured, a similar level of detail was recorded from within as for quadrats.

A total of 191 vascular flora were recorded from 134 genera and 49 families from the quadrats, relevés, opportunistic observations and searches for conservation-listed flora. Of these, 51 were introduced (26.70%) and nine (5.26%) could not be identified to species level due to insufficient diagnostic reproductive material.

The most commonly represented families were Fabaceae (32 taxa), Poaceae (31) and Asteraceae (19). The most commonly represented genera were *Acacia* with 14 taxa, *Austrostipa* (five) and *Eucalyptus*, *Gastrolobium* and *Hakea* (four).

The number of species per quadrat ranged from six in relevé BHR01 to 37 in quadrat BHQ07, with an average species diversity per quadrat of 17.64. The most commonly recorded species were *Lomandra nigricans* recorded from 10 quadrats/relevés, **Briza maxima* and *Neurachne alopecuroides* (nine quadrats and relevés) and **Acacia pycnantha*, **Avena barbata*, *Dianella brevicaulis* and **Ehrharta longiflora* (eight quadrats/relevés).

The combined flora inventory is presented in **Table 27** in **Appendix Four**. Quadrat data is presented in **Appendix Five**.

4.1.1.2 Conservation-listed Flora

Threatened Flora

No Commonwealth EPBC Act or Western Australian BC Act-listed Threatened Flora were recorded during the field survey.

Priority Flora

No Priority-listed flora were recorded during the field survey.

4.1.1.3 Other Significant Flora

According to the criteria outlined in the Flora and Vegetation Technical Guidance (EPA 2016), the following taxa are considered to be significant (distances and distribution assessed using *NatureMap* (DBCA 2007-2020) mapping tools):

- *Austrostipa campylachne*; a minor range extension of approximately 50 km to the north and east of its mapped extent
- *Austrostipa mollis*; a range infill; nearest records are 40-50 km to the north, west and south

- *Chrysocephalum apiculatum*; this specimen could not be identified to subtaxa using available keys. Most records of this species *sens. lat.* are in the arid zone, however, there are two southern records approximately 50 km south and 60 km south southwest of the survey area, the latter from similar habitat (WAH specimen information). It is therefore significant as a minor range extension and as a poorly collected species.
- *Hyalosperma glutinosum* subsp. *glutinosum*; a range extension of approximately 85 km to the south of its mapped extent (although it is also known from approximately 115 km to the southeast)
- *Olearia incondita*; although there is a collection in the WAH from Broomehill the record is dated 1904. The nearest other records are 80-90 km to the east and north, thus this species is poorly collected.
- *Pelargonium havlasae*; this is a range infill and a new record for the Shire of Broomehill-Tambellup.

4.1.1.4 Flora of Taxonomic Interest

No flora of particular taxonomic interest were recorded during the field survey.

4.1.1.5 Introduced Flora

Fifty-one introduced flora species (weeds) were recorded during the field survey, representing 26.70% of the overall flora inventory. Most were agricultural or otherwise common weed species, with some (**Avena barbata*; Bearded Oat/Wild Oat, **Briza maxima*; Blowfly Grass, **Cynodon dactylon*; Couch Grass, **Ehrharta calycina*; Perennial Veldt Grass, **Ehrharta longifolia*; Annual Veldt Grass, **Eragrostis curvula*; African Love Grass, **Lolium rigidum*; Rye Grass, **Moraea setifolia*; Thread Iris, **Oxalis pes-caprae*; Sour Sob, **Romulea rosea*; Guildford Grass) occurring as dominant species in the ground stratum. **Acacia pycnantha*, Golden Wattle (**Image 1**), occurs frequently and, in more disturbed areas, is at times the dominant mid stratum species.

None of the above introduced flora have any specific significance i.e. none are Declared Pest plants or WoNS species. However, **Asparagus asparagoides*, Bridal Creeper (**Image 2**), was recorded at one location within the survey area. This species is a Declared Pest plant and WoNS species, however, there are no management requirements in relation to its presence.



Image 1: **Acacia pycnantha* (Golden Wattle)



Image 2: **Asparagus asparagoides* (Bridal Creeper)

4.1.2 VEGETATION

4.1.2.1 Vegetation Types

Six vegetation types were recorded from within the survey area (**Table 6, Map 4**) based on a combination of structural vegetation type as identified in the field, floristic analysis (see **Section 4.1.2.1**) and subsequent desktop review. Four of these are considered to represent native vegetation types with the other two representing disturbed or planted vegetation types.

The vegetation types within the survey area were:

- native vegetation:
 - **EaW**: *Eucalyptus astringens* mid woodland over **Ehrharta longiflora*, *Acacia erinacea* and **Avena barbata* low sparse grassland/shrubland, located on more clayey soils
 - **EwAhW**: *Eucalyptus wandoo* and *Allocasuarina huegeliana* mid woodland over *Gastrolobium parviflorum* and *Jacksonia sternbergiana* mid/tall sparse shrubland over *Acacia erinacea*, **Ehrharta calycina* and **Avena barbata* low shrubland/tussock grassland/grassland; parts in slightly higher elevations and on more sandy soil were dominated by *Allocasuarina huegeliana*
 - **HvCtS**: *Hakea varia* and *Calytrix tetragona* tall open shrubland over *Desmocladius asper*, *Borya sphaerocephala* and **Briza maxima* low rushland/forbland/grassland with *Eucalyptus wandoo* mid isolated trees, located within areas of slightly lower elevation that are winter-wet
 - **JsApW**: *Jacksonia sternbergiana* and **Acacia pycnantha* low woodland over *Gastrolobium parviflorum* mid sparse shrubland over *Dianella brevicaulis*, *Neurachne alopecuroidea* and **Ehrharta calycina* low forbland/tussock grassland
- disturbed vegetation: **ApS**, **Acacia pycnantha* tall open shrubland over **Romulea rosea*, *Neurachne alopecuroidea* and **Ehrharta calycina* low forbland/tussock grassland
- planted vegetation: **AaSsS**, *Acacia acuminata* and *Santalum spicatum* tall open shrubland over **Ehrharta longiflora*, **Romulea rosea* and **Oxalis pes-caprae* low closed grassland/forbland (Sandalwood plantation).

A narrow windbreak had been planted on the eastern side of the railway line, towards the south of the survey area (**Image 3**). This strip of revegetation was of mixed Eucalypt species, largely not native to the area. No quadrats were recorded within this part of the site.



Image 3: Revegetation

Table 6: Vegetation types

Bold font in the 'Floristic quadrats/relevés' column indicates the site in the representative photograph

Mapping unit	Vegetation type	Floristic quadrats/relevés	Representative photograph	Other characteristic species	Area (ha) and extent (%)
EaW	<i>Eucalyptus astringens</i> mid woodland over *<i>Ehrharta longiflora</i>, <i>Acacia erinacea</i> and *<i>Avena barbata</i> low sparse grassland/shrubland NVIS: U+ ^ <i>Eucalyptus astringens</i> ^tree\7\;G ^ ^ <i>Ehrharta longiflora</i>, <i>Acacia erinacea</i>, <i>Avena barbata</i> ^other grass, shrub\1\r	BHR01 BHR02 BHR03		<i>Austrostipa mollis</i> <i>Billardiera fusiformis</i> <i>Dianella brevicaulis</i> <i>Disphyma crassifolium</i> *<i>Ehrharta calycina</i> <i>Eucalyptus wandoo</i> *<i>Hordeum leporinum</i> <i>Hyalosperma glutinosum subsp. glutinosum</i> *<i>Lolium rigidum</i> <i>Lomandra nigricans</i> <i>Spergularia marina</i>	1.32 ha 3.28%
Mosaic	Mosaic of EaW and EwAhW				1.58 ha 3.92%
EwAhW	<i>Eucalyptus wandoo</i> and <i>Allocasuarina huegeliana</i> mid woodland over <i>Gastrolobium parviflorum</i> and <i>Jacksonia sternbergiana</i> mid/tall sparse shrubland over <i>Acacia erinacea</i>, *<i>Ehrharta calycina</i> and *<i>Avena barbata</i> low shrubland/tussock grassland/grassland NVIS: U+ ^ <i>Eucalyptus wandoo</i>, ^ <i>Allocasuarina huegeliana</i> ^tree\7\;M ^ ^ <i>Gastrolobium parviflorum</i>, <i>Jacksonia sternbergiana</i> ^shrub\4\;G ^ ^ <i>Acacia erinacea</i>, <i>Ehrharta calycina</i>, <i>Avena barbata</i> ^shrub, tussock grass, other grass\1\c	BHQ01 BHQ02 BHQ03 BHQ04 BHQ07 BHQ08		*<i>Acacia pycnantha</i> <i>Bossiaea eriocarpa</i> *<i>Briza maxima</i> <i>Desmodium asper</i> <i>Dianella brevicaulis</i> *<i>Disa bracteata</i> *<i>Ehrharta longiflora</i> <i>Lomandra nigricans</i> *<i>Lysimachia arvensis</i> *<i>Moraea setifolia</i> <i>Neurachne alopecuroides</i> <i>Oxalis exilis</i> *<i>Romulea rosea</i> <i>Rytidosperma setaceum</i> <i>Thysanotus patersonii</i> *<i>Ursinia anthemoides subsp. anthemoides</i>	16.16 ha 40.13%

Mapping unit	Vegetation type	Floristic quadrats/ relevés	Representative photograph	Other characteristic species	Area (ha) and extent (%)
HvCtS	<i>Hakea varia</i> and <i>Calytrix tetragona</i> tall open shrubland over <i>Desmocladius asper</i>, <i>Borya sphaerocephala</i> and <i>*Briza maxima</i> low rushland/forbland/grassland with Eucalyptus wandoo mid isolated trees NVIS: U ^ <i>Eucalyptus wandoo</i> ^ tree\7\bi;M+ ^ <i>Hakea varia</i>, ^ <i>Calytrix tetragona</i> ^ shrub\4\i;G ^ ^ <i>Desmocladius asper</i>, <i>Borya sphaerocephala</i>, <i>Briza maxima</i> ^ rush, forb, other grass\1\c	BHQ05 BHQ09 BHR06		<i>Austrostipa elegantissima</i> * <i>Avena barbata</i> * <i>Briza minor</i> * <i>Disa bracteata</i> * <i>Hypochaeris glabra</i> <i>Juncus pallidus</i> * <i>Lolium rigidum</i> * <i>Moraea setifolia</i> * <i>Romulea rosea</i> <i>Rytidosperma setaceum</i> * <i>Sonchus oleraceus</i>	0.61 ha 1.52%
JsApW	<i>Jacksonia sternbergiana</i> and <i>*Acacia pycnantha</i> low woodland over <i>Gastrolobium parviflorum</i> mid sparse shrubland over <i>Dianella brevicaulis</i>, <i>Neurachne alopecuroidea</i> and <i>*Ehrharta calycina</i> low forbland/tussock grassland NVIS: U+ ^ <i>Jacksonia sternbergiana</i>, ^ <i>Acacia pycnantha</i> ^ tree\6\i;M ^ <i>Gastrolobium parviflorum</i> ^ shrub\3\i;G ^ ^ <i>Dianella brevicaulis</i>, <i>Neurachne alopecuroidea</i>, <i>Ehrharta calycina</i> ^ forb, tussock grass\1\c	BHQ06		<i>Allocasuarina huegeliana</i> <i>Austrostipa elegantissima</i> * <i>Briza maxima</i> * <i>Hypochaeris glabra</i> * <i>Lolium rigidum</i> <i>Oxalis</i> sp. <i>Tricoryne elatior</i> * <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i> * <i>Wahlenbergia capensis</i>	0.78 ha 1.94%

Mapping unit	Vegetation type	Floristic quadrats/ relevés	Representative photograph	Other characteristic species	Area (ha) and extent (%)
AaSsS	Sandalwood Plantation <i>Acacia acuminata</i> and <i>Santalum spicatum</i> tall open shrubland over <i>Ehrharta longiflora</i> , <i>Romulea rosea</i> and <i>Oxalis pes-caprae</i> low closed grassland/forbland NVIS: M+ ^ <i>Acacia acuminata</i> , ^ <i>Santalum spicatum</i> \ ^ shrub \ 4 \ i; G ^ ^ <i>Ehrharta longiflora</i> , <i>Romulea rosea</i> , <i>Oxalis pes-caprae</i> \ ^ other grass, forb \ 1 \ d	BHR04		<i>*Bromus diandrus</i> <i>*Cynodon dactylon</i> <i>*Disa bracteata</i> <i>*Ehrharta calycina</i>	2.70 ha 6.71%
ApS	Disturbed Vegetation <i>*Acacia pycnantha</i> tall open shrubland over <i>*Romulea rosea</i> , <i>Neurachne alopecuroidea</i> and <i>*Ehrharta calycina</i> low forbland/tussock grassland NVIS: M+ ^ <i>Acacia pycnantha</i> \ ^ shrub \ 4 \ i; G ^ ^ <i>Romulea rosea</i> , <i>Neurachne alopecuroidea</i> , <i>Ehrharta calycina</i> \ ^ forb, tussock grass \ 1 \ c	BHR05		<i>Austrostipa elegantissima</i> <i>*Avena barbata</i> <i>Calytrix tetragona</i> <i>*Cynodon dactylon</i> <i>Dianella brevicaulis</i> <i>Lomandra nigricans</i> <i>Oxalis exilis</i> <i>Rytidosperma setaceum</i>	0.13 ha 0.31%
X	No native vegetation				16.10 ha 39.99%
R	Revegetation (not native vegetation)				0.88 ha 2.18%
TOTAL EXTENT					40.26 ha

4.1.2.1 Floristic Analysis

The floristic analysis dendrogram (**Figure 3**) indicates that vegetation types **EaW**, **AaSsS** and **HvCtS** form distinctive and discrete floristic groups.

However, the upper portion of the dendrogram indicates that vegetation types **EwAhW** (which occupies the largest portion of the native vegetation) was not floristically distinctive from vegetation types **ApS** (which was a disturbed vegetation type) and **JsApW** (also potentially disturbed, though less degraded, occurring on more sandy soils). The latter two have, however, been retained as discrete vegetation types due to their structural differences.

Of note, vegetation type **EwAhW** was mapped in the field as two vegetation types based on the dominance of the upper stratum species. The majority of the survey area was characterised by *Eucalyptus wandoo* as the dominant upper stratum species, with some patches on slightly more elevated areas and/or with sandier soil, characterised by *Allocasuarina huegeliana*, although these parts also had *Eucalyptus wandoo* as a sparse, subdominant species. As the floristics did not support this difference the two field mapping units were subsumed into the single vegetation type, with the only significance being in relation to TEC assessment (see below).

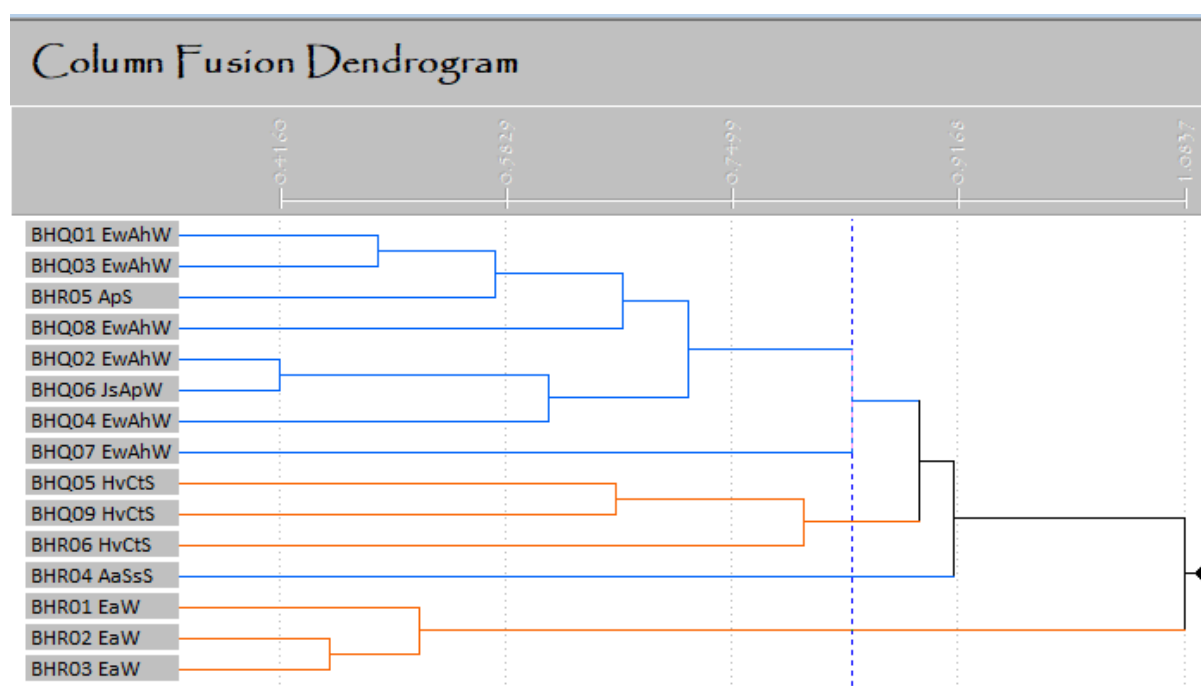


Figure 3: Floristic analysis dendrogram

4.1.2.2 Vegetation Significance

TECs and PECs

Database searches (**Section 2.2.3**) identified the EPBC-listed Wheatbelt Woodlands TEC and its Western Australian PEC equivalent has been mapped as corresponding with most of the survey area.

Taking the Approved Conservation Advice (TSSC 2015) for this community into consideration (see summary in **Appendix Two**), the following vegetation types have been assessed as being representative of the TEC (as a combination of Eucalypt Woodland types), with the following explanations:

- **EaW** (*Eucalyptus astringens* mid woodland), where in Good or better condition noting that the small patch of this vegetation type near the northwest of the survey area (including the location of relevé BHR03) may also be representative despite its vegetation condition if the vegetation condition of the majority of the patch within which it is located (i.e. between road and railway) is in Good condition or better. Within the survey area the patch of this vegetation type within the larger bush block is incorporated into the broadly described Eucalypt Woodland types that are representative of the TEC.
- **EwAhW** (*Eucalyptus wandoo* and *Allocasuarina huegeliana* mid woodland):
 - except where the upper stratum is dominated by *Allocasuarina huegeliana* i.e. not a Eucalypt Woodland (e.g. **Image 4**; quadrat BHQ07)
 - where in Good or better condition and meeting extent conditions i.e. the larger bush block
 - where in Degraded-Good condition i.e. where part of the vegetation type assessed as being in Degraded condition but retains important habitat features (but not where the vegetation condition is Completely Degraded or Degraded-Completely Degraded condition) i.e. where the vegetation condition is Degraded verging on Good, but not where in Degraded condition verging on Completely Degraded
 - where it forms a mosaic with vegetation type **EaW** in Good or better condition¹
 - where separated by gravel tracks but not by sealed roads or railway
- **HvCtS** (*Hakea varia* and *Calytrix tetragona* tall open shrubland) as there is a sparse tree component that meets the minimum requirement for numbers of mature trees (*Eucalyptus wandoo*) per unit area, considering also that the proximity to and small patch size of this vegetation type (**Image 5**).



Image 4: Vegetation type EwAhW patch characterised by *Allocasuarina huegeliana* (quadrat BHQ07)



Image 5: Vegetation type HvCtS showing sparse *Eucalyptus wandoo* trees

The total extent of vegetation considered to represent the Wheatbelt Woodlands TEC is 11.23 ha (27.90% of the survey area).

¹ The portion of vegetation meeting this set of conditions is linear, along the railway and does not meet extent conditions that are applicable to bushland blocks. It does, however, meet the width condition applicable to road reserves and, under the precautionary principle, railway corridors are herein considered in the same manner as road corridors.

4.1.2.3 Other Significant Vegetation

No vegetation having other significance according to the Flora and Vegetation Technical Guidance (EPA 2016) were recorded during the field survey.

4.1.2.4 Vegetation Condition

The vegetation condition within the survey area ranged from Very Good to Completely Degraded condition, with the majority of the vegetated portion in Degraded condition (**Table 7, Map 5**). The main factor affecting vegetation condition was weediness.

Table 7: Vegetation condition

Vegetation condition	Extent (ha)	Proportion (%)
Pristine	-	-
Excellent	-	-
Very Good	4.85	12.03
Good	4.21	10.46
Degraded	7.83	19.46
Completely Degraded	4.21	10.46
Not vegetated	16.98	42.18
TOTAL	40.26	100.00

4.1.2.5 Adequacy of Survey

Adequacy of survey can be demonstrated using a species accumulation curve; if the curve has reached (or almost reached) an asymptote it is considered that most species are likely to have been recorded from the survey area.

A species accumulation curve was generated using quadrat data (**Figure 4**). Opportunistic observations, which increase the number of species recorded, are not included in the analysis.

The species accumulation curve suggests that additional survey would have identified more flora species. However, the Bootstrap estimate of species richness is 128.7 which, when taking opportunistic records into account, is considerably lower than the 191 species recorded from the survey area, thus indicating that the survey is adequate to describe the flora of the survey area (noting that this large difference indicates a high species turnover in the area).

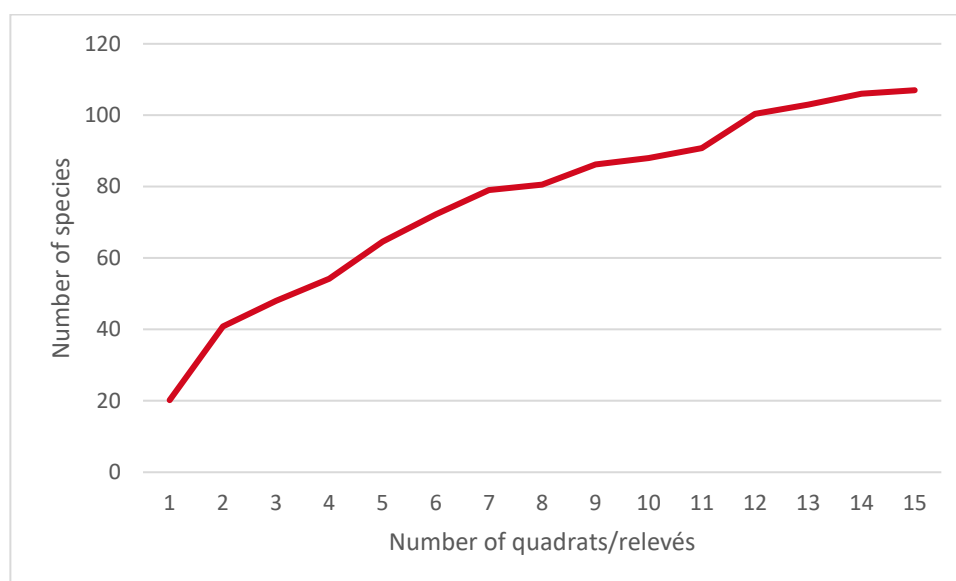


Figure 4: Species accumulation curve

4.1.3 BOTANICAL LIMITATIONS

Survey design: Single phase, quadrat-based flora and vegetation survey with extensive traverses searching for conservation significant flora.

Survey type: Detailed flora and vegetation survey with extensive searches for significant flora searches conducted over a single phase. All areas were adequately surveyed through the use of floristic quadrats to sample vegetation types, and targeted searches for conservation significant flora.

Type of vegetation classification system: Vegetation classified at NVIS Level V (NVIS Technical Working Group & DotEE 2017) using largely structural vegetation types defined using dominant and characteristic species and vegetation structure as recorded during the field surveys. Floristic analysis was used to identify major floristic groups and outlier groups of floristic interest.

A full summary of botanical limitations is presented in **Table 8**.

Table 8: Botanical limitations

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Availability of contextual information at a regional and local scale	Negligible	The survey area is located within a poorly understood part of Western Australia where few flora and vegetation surveys are known to have been conducted. However, the application of broad principles can be applied to understand the flora and vegetation values within the survey area.
Competence/experience of the team conducting the survey, including experience in the bioregion surveyed	No	The botanist conducting the field survey has been conducting flora and vegetation surveys in Western Australia for over 35 years. The plant taxonomist (Dr Udani Sirisena) has been conducting such works for over 15 years and sought the advice of specialists at the Western Australian Herbarium when required (Mike Hislop, Terry McFarlane).

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Proportion of the flora recorded and/or collected, and any identification issues	Negligible	191 vascular flora taxa were recorded during the field survey of which 5.26% could not be identified with certainty to species level due to the lack of diagnostic reproductive material. This is considered to be a negligible constraint as none of the unidentified taxa are considered likely to represent any conservation-listed flora from the region.
Was the appropriate area fully surveyed (effort and extent)	Negligible	The survey effort is considered sufficient to describe the flora and vegetation values of the survey area. Some vegetation types did not have three representative quadrats recorded from within them for the following reasons: • JsApW – insufficient vegetation in a large enough patch to have quadrats or relevés included. • AaSsS – not native vegetation: this is a Sandalwood Plantation and the single relevé was recorded to document the area only. • ApS – only a single representative patch in Completely Degraded condition.
Access restrictions within the survey area	No	The survey area was fully accessible.
Survey timing, rainfall, season of survey	Negligible	The field survey was conducted during October which is within the optimal period for a primary season for survey in the bioregion. The timing has only negligible constraints as most Orchid species had finished flowering by this time and could not, in most cases, be identified with certainty. However, none were likely to be representative of conservation-listed taxa. The rainfall in the 6 months prior to the field survey was (97.29% of the mean for this period (Figure 2), indicating no constraint.
Disturbance that may have affected the results of the survey e.g. fire, flood, clearing	No	There were no recent disturbances that would have affected the results of the survey. None of the survey area had been recently burnt or otherwise altered in the short term prior to the field survey.

4.2 VERTEBRATE FAUNA SURVEY

The fauna survey was conducted by Lyn Atkins (Principal Ecologist) during 26-30 October 2020, concurrently with the flora and vegetation survey. The survey was conducted in accordance with the requirements outlined in the Fauna Technical Guidance (EPA 2020a).

The entire site was traversed on foot and all habitats were assessed for quality and capability of supporting both locally common and significant fauna species,

4.2.1 FAUNA ASSEMBLAGE

Twenty-six vertebrate fauna species were recorded during the survey (**Table 9**), including two amphibians reported by site personnel.

Of these, one is an introduced species (*Oryctolagus cuniculus*; Rabbit) and two are conservation-listed:

- *Merops ornatus* (Rainbow Bee-eater), protected as a migratory species under international agreements
- *Platycercus icterotis xanthogenys* (Western Rosella; **Image 6**), listed as P4 by the DBCA.



Image 6: *Platycercus icterotis xanthogenys* (Western Rosella)

Table 9: Recorded fauna species

Species	Common name	EPBC Act status	Western Australian status	Observation type
Mammals				
<i>Oryctolagus cuniculus</i>	Rabbit			Scats, diggings
Birds				
<i>Acanthiza apicalis</i>	Inland Thornbill			Sighted
<i>Anthochaera lunulata</i>	Little Wattlebird			Sighted
<i>Artamus personatus</i>	Masked Woodswallow			Sighted
<i>Cacatua roseicapilla</i>	Galah			Sighted
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike			Sighted
<i>Corvus coronoides</i>	Australian Raven			Sighted
<i>Cracticus tibicen dorsalis</i>	Australian Magpie			Sighted
<i>Cracticus torquatus</i>	Grey Butcherbird			Sighted
<i>Gavialis virens</i>	Singing Honey-eater			Sighted
<i>Hirundo neoxena</i>	Welcome Swallow			Sighted
<i>Merops ornatus</i>	Rainbow Bee-eater		IA	Sighted
<i>Neophema elegans</i>	Elegant Parrot			Sighted
<i>Pachycephala rufiventris</i>	Rufous whistler			Sighted
<i>Pardalotus striatus</i>	Striated Pardalote			Sighted
<i>Petrochelidon nigricans</i>	Tree Martin			Sighted
<i>Phaps chalcoptera</i>	Common Bronzewing			Sighted
<i>Platycercus icterotis xanthogenys</i>	Western Rosella		P4	Sighted
<i>Platycercus zonarius zonarius</i>	Australian Ringneck			Sighted
<i>Polytelis anthopeplus</i>	Regent Parrot			Sighted
<i>Rhipidura leucophrys</i>	Willie Wagtail			Sighted
<i>Smicrornis brevirostris</i>	Weebill			Sighted
Reptiles				
<i>Tiliqua rugosa</i>	Bobtail			Sighted
<i>Varanus tristis</i>	Racehorse Goanna			Scratchings
Amphibians				
<i>Heleioporus albopunctatus</i>	Western Spotted Frog			Site report
<i>Myobatrachus gouldii</i>	Turtlefrog			Site report

4.2.2 FAUNA HABITAT

Two fauna habitat types were recorded within the survey area (**Table 10**):

- Woodland
- Shrubland.

The quality of each habitat type was based on the field surveyor's experience and takes into consideration the level of disturbance to habitats from weeds, the amount of native vegetation, vegetation cover (density) and the context of the habitat with the surrounding landscape.

Table 10: Fauna habitat types

Habitat type	Description	Photograph
Woodland	Eucalypt and Sheoak woodland The Woodland habitat consists largely of Eucalypt trees (most frequently Wandoo, occasionally Brown Mallet or introduced, planted species), or Sheoak in patches. The Eucalypt woodland provides shelter, including nest sites, and foraging for leaf gleaning insectivorous birds and to a lesser extent birds that forage on Eucalypt nuts. The Brown Mallet and planted species Woodlands are virtually bare at ground level and provide little to no cover or food sources, whereas the Wandoo woodland (and Sheoak woodland) have a low understorey of mostly grass species that provide food sources for granivore birds including parrots. There is very little shrub cover in any area, thus predation by introduced predators is highly likely, including domestic cats from the immediately adjacent townsite, as well as by aerial predators. In most cases the soil surface is relatively undisturbed, however, as there is a significant clay component the surface is hard and unsuitable for fossorial species that require or prefer sand. Wandoo trees provide an abundance of hollows, thus suiting hollow nesting birds including parrots, martins and woodswallows. Extent: 16.10 ha; 39.99%	
		

Habitat type	Description	Photograph
Shrubland	Degraded and disturbed vegetation shrubland without a tree component This habitat provides shelter for generalist bird species and suites that require shrubs for shelter or nesting. Granivore birds that forage for seeds are also favoured by this habitat type. However, the disturbed soil surface and weed cover in much of this habitat limits its use by ground-dwelling species. Overall, this habitat type is likely to be used by generalist fauna species that are common in the agricultural area Extent: 3.79 ha; 9.41%	
		

4.2.3 SIGNIFICANT FAUNA AND ASSOCIATED HABITAT

The significant fauna species observed during the field survey are discussed below with respect to each species' habitat requirements.

4.2.3.1 Western Rosella

A pair of Western Rosellas inland subspecies (*Platycercus icterotis xanthogenys*, P4) were observed in Wandoo Woodland during the field survey. P4 species are rare, near threatened or in need of monitoring but not currently considered as threatened (DBCA 2019b).

The Western Rosella has undergone a significant contraction in its distribution since the 1970s due to removal of its feeding and breeding habitat. Although they feed on Sheoak and Eucalypt seeds, Western Rosellas only consume a limited variety of introduced species (DEC 2009), unlike more common parrot species that were also recorded e.g. Australian Ringneck and Elegant Parrot, both of which were frequently observed foraging at ground level. They nest in tree hollows, with Wandoo being a favoured species (*ibid*), although the hollows are usually 1 m or more deep (Birdlife Australia 2020a).

The survey area provides suitable foraging and breeding habitat for this species, with suitable food sources present and potentially trees with hollows of a suitable size and orientation for nesting. It is not known if the observed pair nest within the survey area.

4.2.3.2 Rainbow Bee-eater

Rainbow Bee-eaters were heard calling and observed in Wandoo woodland. They are protected under international agreements as migratory species, however, they have no other conservation significance and are listed by the IUCN as Least Concern (DAWE 2020b).

Rainbow bee-eaters nest in sandy banks, digging long tunnels (Birdlife Australia 2020b). Only limited nesting sites are available within the survey area in the form of low embankments along track edges or old workings (e.g. clearing for telephone cables) in some of the more sandy sites near the railway, or possibly the railway embankments.

No nest holes were observed during the survey, and it is unlikely that the survey area is used for nesting although it does provide good foraging habitat for this insectivorous species.

4.2.4 BLACK COCKATOO HABITAT ASSESSMENT

The survey area is within the modelled breeding range of Carnaby's Cockatoo (DSEWPac 2012). The nearest record of this species as identified by the DBCA database search is approximately 15 km from the survey area.

4.2.4.1 Breeding Habitat

Black Cockatoo habitat trees were assessed according to the criteria outlined in Commonwealth guidelines (Commonwealth of Australia 2017; DSEWPac 2012), with additional information recorded using the Bamford (2016) grading classifications to identify the potential suitability of trees to be used for nesting based on the presence of, size and orientation of hollows (**Table 21** in **Appendix One**). Brown Mallet (*Eucalyptus astringens*) trees were not assessed as they do not form suitable hollows as their branches rapidly narrow as the trees get taller and the tree core rarely forms hollows.

A total of 395 trees met the criteria to be considered as potential nest trees in the modified tree survey area i.e. having a DBH of >300 mm if Wandoo (*Eucalyptus wandoo*; 364 trees) or 500 mm if other species (29 dead trees; two *Eucalyptus kondininensis*). Of these, 247 (62.5%) were assessed as being Class 5 trees that do not currently have large hollows, and 121 (30.6%) were assessed as being Class 4 trees that have large hollows, however, the hollows are not of a suitable orientation to be preferred for breeding by Black Cockatoo species. Twenty-seven trees (6.8%) had potentially suitable hollows (i.e. large and vertical) for Black Cockatoos although no evidence of use (i.e. no chew marks) was observed. The hollows were not investigated in detail thus may not be of sufficient depth or width below the opening to be used i.e. they are potentially suitable only. One of the Class 3 trees was dead; all others were Wandoo.

A total of 55 of the potential Black Cockatoo habitat trees were located within the road and railway corridor (i.e. the narrow southern corridor of the survey area). The remaining trees were located within the portions of the survey area closer to the existing facility, and included trees no longer considered as likely to be removed should expansion occur.

Tree locations are shown on **Map 6** and listed in **Table 28** in **Appendix Six**. Tree photographs are included in **Appendix Six**. All trees in the southern corridor were photographed; Class 3 trees were photographed elsewhere.

4.2.4.2 Foraging and Roosting Habitat

Both Woodland (16.1 ha) and Shrubland (3.79 ha) habitat types have the potential to be used as foraging by Carnaby's Cockatoo. A more detailed assessment of habitat quality, using the tool in the Revised Draft Referral Guidelines for the three Black Cockatoo species (Commonwealth of Australia 2017) was used for each habitat type (below).

Table 11: Foraging habitat scoring tool – Carnaby's Cockatoo (Woodland habitat)

Habitat Summary for Carnaby's Cockatoo Foraging Habitat		Score
Starting Score:		
Native Eucalypt woodland that has proteaceous species in the understorey ²		+7
Attributes improving functionality of foraging habitat:		
Impact area contains trees with potential to be used for breeding (DBH $\geq$ 300 mm)		+2
Attributes reducing functionality of foraging habitat:		
No clear evidence of feeding debris		-2
Is >12 km from known breeding location ³		-1
Is >12 km from known roosting site ⁴		-1
FINAL SCORE		5

Table 12: Foraging habitat scoring tool – Carnaby's Cockatoo (Shrubland habitat)

Habitat Summary for Carnaby's Cockatoo Foraging Habitat		Score
Starting Score:		
Individual foraging plants		+1
Attributes improving functionality of foraging habitat:		
None		0
Attributes reducing functionality of foraging habitat:		
No clear evidence of feeding debris		-2
Is >12 km from known breeding location ⁵		-1
Is >12 km from known roosting site ⁶		-1
FINAL SCORE		-3

The score (5 of a possible total of 21) indicated in **Table 11** identifies the Woodland habitat as a 'valued' habitat type for Carnaby's Cockatoo.

The score indicated in **Table 12** identifies the Shrubland habitat type as not being suitable for Carnaby's Cockatoo.

² Small areas having Hakea species occurred within the Woodland habitat type.

³ The nearest mapped breeding site is approximately 22 km south (Landgate 2020).

⁴ There are no confirmed or unconfirmed roosting sites within 50 km of the survey area (Landgate 2020).

⁵ The nearest mapped breeding site is approximately 22 km south (Landgate 2020).

⁶ There are no confirmed or unconfirmed roosting sites within 50 km of the survey area (Landgate 2020).

4.2.5 FAUNA SURVEY LIMITATIONS

Table 13: Fauna survey limitations

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Availability of data and information	Negligible	There are no known fauna surveys that have been conducted within the survey area or nearby.
Competency/experience of the survey team, including bioregion experience	Negligible	The ecologist conducting the survey has conducted similar surveys elsewhere in the Wheatbelt for 15 years.
Scope of survey e.g. excluded fauna groups	No	The scope of works indicated that all terrestrial vertebrate fauna species were included in the survey.
Timing, weather, season	No	The survey timing and season was suitable to conduct the fauna survey.
Disturbances that may have affected results	No	There were no recent disturbances that would have affected the results.
Proportion of fauna identified, recorded or collected	No	No fauna species that were recorded could not be identified to species level.
Adequacy of survey intensity and proportion of survey achieved	No	The survey was of sufficient intensity to adequately describe the fauna species and habitat present within the survey area.
Access	No	The survey area was entirely accessible.
Data and analysis issues including sampling biases	No	No significant data analysis was required.

5 DISCUSSION

5.1 FLORA SIGNIFICANCE

A total of 191 vascular flora species were recorded from within quadrats, relevés and observations.

5.1.1 LOCAL AND REGIONAL ASSESSMENT OF FLORA SIGNIFICANCE

5.1.1.1 Conservation-listed Flora

Threatened Flora

No TF listed for protection under the Commonwealth EPBC Act or Western Australian BC Act were recorded. None have previously been recorded from the survey area, as indicated by DBCA database searches (**Section 2.2.4**). None of the species that could not be identified with certainty resembled any currently described TF taxa.

Priority Flora

No PF were recorded during the field survey. None have previously been recorded from the survey area, as indicated by DBCA database searches (**Section 2.2.4**). None of the species that could not be identified with certainty resembled any currently described PF taxa.

5.1.1.2 Post-survey Likelihood Assessment

The likelihood of conservation significant flora occurring in the survey area was revised following the field survey. This revised likelihood, that took into account vegetation condition and other disturbances, actual habitat availability and search effort, is included in **Table 25** in **Appendix Three**.

Four taxa were considered at desktop assessment stage to have a Possible likelihood of occurring; their re-evaluated likelihood of occurring is discussed below.

Jacksonia velveta (TF)

Jacksonia velveta is a densely branching shrub to 2 m high that grows on loamy soils over laterite (DEWHA 2008). Given its size that would be unlikely to have been overlooked during the field survey, minimal suitability of the habitat available and that it has not been recorded from within 40 km of the survey area, it is unlikely that *Jacksonia velveta* occurs within the survey area. It has been re-evaluated as having a Highly unlikely likelihood.

Melaleuca ordinifolia (P2)

Melaleuca ordinifolia is a low shrub less than 1 m high, occurring in mallee shrublands on loam and clay soils (Quinn *et al.* 1992). Review of records in the WAH (2020) indicates this species has been recorded from *Eucalyptus astringens* vegetation (one record), which is present within the survey area, however, none of the other records, or combination of species listed in any records are present in the survey area. Therefore, based on the detailed evaluation of known ecology and taking survey effort into consideration, this taxon has been re-evaluated as having a Highly unlikely likelihood of occurring.

Hemigenia platyphylla (P4)

Hemigenia platyphylla is an erect or prostrate sprawling shrub to 1.5 m high that occurs on sandy and loamy soils. Detailed review of collection records in the WAH (2020) indicate the habitat available within the survey

area only superficially matches the habitat of known populations. Taking into consideration its ecology, low number of records in the vicinity (one) and survey effort, this taxon has been re-evaluated as having a Highly unlikely likelihood of occurring.

Jacksonia calycina (P4)

Jacksonia calycina is species having variable form, with *FloraBase* (WAH 1998-2020) indicating it to be erect or prostrate, although it can grow to 1.4 m high. No spindly boom-like shrubs were observed within the survey area and review of WAH (2020) records indicate few species associated with *Jacksonia calycina* occur within the survey area. Taking into consideration survey effort and that the habitat available only marginally matches its known habitat, this taxon has been re-evaluated as having a Highly unlikely likelihood of occurring.

5.1.1.3 Other Significant Flora

Six taxa are considered to be significant according to the criteria outlined in the Flora and Vegetation Technical Guidance (EPA 2016). Most are minor range extensions or range infills (and one significant as a poorly collected species), most likely a result of the lack of flora and vegetation surveys and therefore vouchered collections from the vicinity.

The significant flora are:

- *Austrostipa campylachne* (range extension)
- *Austrostipa mollis* (range infill)
- *Chrysocephalum apiculatum* (range extension and a poorly collected species)
- *Hyalosperma glutinosum* subsp. *glutinosum* (range extension)
- *Olearia incondita* (poorly collected)
- *Pelargonium havlasae* (range infill and a new record for the Shire of Broomehill-Tambellup).

None are conservation-listed.

5.1.1.4 Introduced Flora

Fifty-one introduced flora species (weeds) were recorded during the field survey, representing 26.70% of the overall flora inventory. One is a Declared Pest plant and WoNS species (**Asparagus asparagoides*, Bridal Creeper) although there are no management requirements in relation to its presence.

**Acacia pycnantha* (Golden Wattle, also known as Sydney Golden Wattle) is Australia's floral emblem, however, it is a significant weed through much of the survey area (see cover photograph, foreground).

5.2 VEGETATION SIGNIFICANCE

Six vegetation types were recorded from the survey area (not including a revegetated windbreak that was planted with non-native species):

- **EaW:** *Eucalyptus astringens* mid woodland over **Ehrharta longiflora*, *Acacia erinacea* and **Avena barbata* low sparse grassland/shrubland, located on more clayey soils
- **EwAhW:** *Eucalyptus wandoo* and *Allocasuarina huegeliana* mid woodland over *Gastrolobium parviflorum* and *Jacksonia sternbergiana* mid/tall sparse shrubland over *Acacia erinacea*, **Ehrharta calycina* and **Avena barbata* low shrubland/tussock grassland/grassland; parts in slightly higher elevations and on more sandy soil were dominated by *Allocasuarina huegeliana*

- **HvCtS:** *Hakea varia* and *Calytrix tetragona* tall open shrubland over *Desmocladius asper*, *Borya sphaerocephala* and **Briza maxima* low rushland/forbland/grassland with *Eucalyptus wandoo* mid isolated trees, located within areas of slightly lower elevation that are winter-wet
- **JsApW:** *Jacksonia sternbergiana* and **Acacia pycnantha* low woodland over *Gastrolobium parviflorum* mid sparse shrubland over *Dianella brevicaulis*, *Neurachne alopecuroidea* and **Ehrharta calycina* low forbland/tussock grassland
- disturbed vegetation: **ApS**, **Acacia pycnantha* tall open shrubland over **Romulea rosea*, *Neurachne alopecuroidea* and **Ehrharta calycina* low forbland/tussock grassland
- planted vegetation: **AaSSs**, *Acacia acuminata* and *Santalum spicatum* tall open shrubland over **Ehrharta longiflora*, **Romulea rosea* and **Oxalis pes-caprae* low closed grassland/forbland (Sandalwood plantation).

5.2.1 LOCAL AND REGIONAL ASSESSMENT OF VEGETATION SIGNIFICANCE

The significance of Eucalypt woodlands within the agricultural region of Western Australia is recognised by the listing of such woodlands as TEC protected under the EPBC Act (where they meet certain criteria).

The vegetation of the survey area was assessed against the criteria for inclusion in the Wheatbelt Woodlands TEC as outlined in the Approved Conservation Advice (TSSC 2015), resulting in three vegetation types considered to be representative in suitable areas (i.e. where meeting the condition and extent criteria):

- **EaW** where in Good or better condition (i.e. within the larger bush block where it is incorporated into the broadly described Eucalypt Woodland types that are representative of the TEC)
- **EwAhW** where in Good or better condition and Degraded-Good condition, except where the upper stratum is dominated by *Allocasuarina huegeliana* i.e. not a Eucalypt Woodland
- **HvCtS** where in Good or better condition as there is a sparse tree component that meets the minimum requirement for numbers of mature trees (*Eucalyptus wandoo*) per unit area.

The majority of the larger bush remnant within the survey area is considered to be representative of the Wheatbelt Woodlands TEC. A small part of the rail corridor is also considered likely to be representative. In total, the Wheatbelt Woodlands TEC is likely to occupy 11.23 ha (27.90% of the survey area). Similar vegetation, also likely to be representative of the TEC occurs to the east of the survey area, and west (over Great Southern Highway), and may be contiguous at the north-western portion of the survey area (if sufficient extent is in Good or better condition).

No parts of the survey area are considered to be representative of the Western Australian-listed equivalent PEC if they are not representative of the EPBC-listed TEC.

Therefore, these parts of the survey area are considered to be particularly locally and regionally significant.

5.2.2 VEGETATION CONDITION

The vegetation of the survey area ranged from Very Good to Degraded condition, although only 22.49% of the survey area was in Good or better condition (9.06 ha). The generally poor condition of the survey area is largely a result of weed invasion and disturbance from human activities along roads and railway. It is possible that the survey area could be grazed early in the town's history as the survey area is immediately adjacent to Broomehill townsite. Human disturbance, while not always obvious, may have been long-term as there was very little fallen timber suggesting that the site has, at least historically, been used as a timber source (although there was no evidence of tree felling).

The vegetation condition of the survey area was considered to be as expected (or slightly better than expected) for a site immediately adjacent to a townsite.

5.3 FAUNA SIGNIFICANCE

5.3.1 FAUNA HABITAT TYPES

Two fauna habitat types were recorded on site: Woodland (16.10 ha; 39.99% of the survey area) and Shrubland (3.79 ha; 9.41%).

The Woodland habitat type provides habitat suitable for a range of fauna species, including birds that feed in tree canopies (leaf gleaning insectivores and seed eaters), species that forage at ground level, including seed eaters that favour introduced grasses and other agricultural weeds. There is little shrub cover to provide shelter from predation or for nest sites, however, there are numerous trees that provide nesting habitat for birds, including hollows. There were very few fallen logs available as shelter for fossorial fauna species; it is likely that these have been removed over time for firewood due to the proximity of the survey area to town and human habitation.

The Shrubland habitat type is largely unsuitable for fauna species except those that are common in the agricultural area that forage for seeds or require shrubs for nesting. However, the lack of diversity in this habitat type is likely to restrict the species that utilise this habitat type due to lack of variety of food sources.

The Woodland habitat type in particular also included trees potentially suitable for use by Black Cockatoos for nesting. In total 395 trees met the size criteria to be considered as potential Black Cockatoo nesting trees, although only 27 of these (6.8%) currently have hollows of a suitable size and orientation to be used, noting that the hollows were not investigated in detail and may have been too shallow or of insufficient width below the opening to be used. No evidence of Black Cockatoo presence was recorded during the field survey.

It is unlikely that any conservation-listed fauna species is dependent on the habitat available within the survey area, although it is possible that one conservation-listed species recorded on site (Western Rosellas inland subspecies, *Platycercus icterotis xanthogenys*, P4) may nest within the Woodland.

5.3.2 FAUNA ASSEMBLAGE

Twenty-six vertebrate fauna species were recorded during the survey (**Table 9**); one is an introduced species (*Oryctolagus cuniculus*, Rabbit).

5.3.3 CONSERVATION-LISTED SPECIES

Two conservation-listed fauna species were recorded:

- *Merops ornatus* (Rainbow Bee-eater), protected as a migratory species under international agreements
- *Platycercus icterotis xanthogenys* (Western Rosella inland subspecies), listed as P4 by the DBCA.

The Western Rosella may nest within the survey area as suitable nest sites (hollows) are likely to occur. The survey area also provides suitable foraging conditions for this species which consumes Sheoak and Eucalypt seeds, as well as a limited range of introduced species (DEC 2009). However, its listing as P4 indicates that this species is not considered currently to be threatened.

Rainbow Bee-eaters are protected under international agreements as a migratory species but are not considered to be threatened. There is little habitat suitable for nesting within the survey area, thus they are

likely to only utilise the area for foraging and would not be dependent on any resources occurring within it as there is also contiguous similar habitat immediately adjacent.

5.3.3.1 Post-survey Likelihood Assessment

The remaining (i.e. those not recorded) conservation-listed fauna species identified during the desktop assessment as having a High or Medium likelihood of occurring are discussed below with respect to each species' habitat requirements, taking into consideration the findings of the field survey and survey effort. The post-survey likelihood assessment is incorporated into **Table 26** in **Appendix Three**.

Although not assessed as having a High or Medium likelihood of occurring with the survey area at either desktop assessment stage or following the field survey (post-survey likelihood), the survey area is located within the mapped breeding extent of Carnaby's Cockatoo. Therefore, this species is also discussed below.

No other fauna species are considered as a High or Medium likelihood of occurring.

Phascogale calura (Red-tailed Phascogale) – EPBC status VU; /DBCA status CD

High desktop likelihood of occurring; Low post-survey likelihood. Red-tailed Phascogale have not been previously recorded from within 15 km of the survey area (DBCA database search results).

The Red-tailed Phascogale is a small strongly arboreal dasyurid marsupial that inhabits Wandoo (*Eucalyptus wandoo*) and Sheoak (*Allocasuarina huegeliana*) woodlands, although preferring the latter (DEC 2012). Both habitat types occur within the survey area (18.16 ha in total), although within the survey area the cover provided is sparse where this species has a preference for dense cover.

Given that the survey area is immediately adjacent to the town of Broomehill and the major threat to this species is predation by cats (as well as foxes, plus habitat loss and fragmentation, *ibid.* and TSSC (2016a)), and the sparse and open nature of the available habitat, there is only a Low likelihood that this species actually occurs within the survey area.

Calyptrorhynchus latirostris (Carnaby's Cockatoo) – EPBC status EN; BC status EN

Very low desktop and post-survey likelihood of occurring. Not recorded during the field survey, and no evidence of having been present within the survey area. Despite numerous records identified by the DBCA database search from within 30 km, the nearest record is approximately 15 km from the survey area.

The survey area is within the modelled breeding range of Carnaby's Cockatoo (DSEWPaC 2012).

A Black Cockatoo habitat tree assessment was conducted during the field survey resulting in 395 trees that met the size criteria to be considered potentially suitable for nesting according to the criteria outlined in Commonwealth guidelines (Commonwealth of Australia 2017; DSEWPaC 2012). Of these, 27 had hollows potentially suitable for use by Carnaby's Cockatoo, although the hollows were not assessed in detail and may not have had sufficient depth of width to actually be used.

The Woodland habitat (16.1 ha) was assessed as being 'valued' habitat according to the tool in the Revised Draft Referral Guidelines for the three Black Cockatoo species (Commonwealth of Australia 2017). However, given the lack of nearby records of this species, the only marginally suitable habitat (there were only few preferred foraging species present) and proximity to human disturbance it is highly unlikely that Carnaby's Cockatoo actually occur on site (Very low likelihood).

***Leipoa ocellata* (Malleefowl) – EPBC status VU; BC status VU**

Medium desktop and post-survey likelihood of occurring. No Malleefowl nesting mounds were recorded, nor were the birds sighted in the survey area. It has not been recorded from within 20 km of the survey area within the last 20 years (DBCA database search results).

Malleefowl inhabit semi-arid to arid shrublands and woodland, particularly those with mallee (multi-stemmed Eucalypts) and *Acacia* species and require a sandy substrate and abundant leaf litter for nesting (Benshemesh 2007). None of these requirements are adequately met within the survey area.

Given the lack of suitable habitat meeting this species requirement, and the proximity to human disturbance, including domestic cats, there is only a Medium likelihood of them occurring, and only as transient visitors. They would not be dependent on the habitat available within the survey area.

***Cacatua pastinator pastinator* (Muir's Corella) – DBCA status CD**

Medium desktop and post-survey likelihood of occurring. Not recorded during the field survey, nor evidence of its presence noted (e.g. bark removed around tree hollows). It has not been recorded from within 50 km of the survey area within the previous 50 years (DBCA database search results).

Muir's Corella is a medium-sized, long-billed white bird occurring in the southwest of Western Australia (DEC & WAM 2008). This taxon was previously listed as Vulnerable under the EPBC Act, however, has since been de-listed (TSSC 2016b) as the species' population and range have been expanding.

Despite it not being recorded recently from close proximity to the survey area, given that Muir's Corella is expanding in its distribution and suitable habitat for foraging and breeding occurs within the survey area, it may occur (Medium likelihood) at some time.

6 DWER'S 10 CLEARING PRINCIPLES AND RECOMMENDATIONS

6.1 RECOMMENDATIONS

In Ecoscape's opinion, the significant environmental attribute of the survey area that may affect clearing approvals is its suitability to be representative of the *Eucalypt Woodlands of the Western Australian Wheatbelt* EPBC-listed TEC. Referrals will most likely be required to the Commonwealth Department of Agriculture, Water and the Environment (DAWE) for clearing in parts of the survey area representative of the TEC.

Whilst Ecoscape does not consider it to be a significant impact (given the low likelihood of Carnaby's Cockatoo actually occurring), it is preferable to discuss the Black Cockatoo survey findings with DAWE as removal of trees may also be considered as significant.

Western Australian clearing approvals will also be required.

6.2 DWER'S 10 CLEARING PRINCIPLES

The following table is provided to summarise the likely significant findings from the survey area and how they are likely to be assessed, based on DWER's 10 clearing principles (Department of Environment Regulation 2014).

Table 14: Assessment against DWER's 10 clearing principles

Principle	Assessment	Outcome
Principle (a) Native vegetation should not be cleared if it comprises a high level of biological diversity.	The survey area is located within the eastern part of the Avon Wheatbelt which is considered as a biodiversity hotspot. The flora survey resulted in 192 taxa of vascular flora being recorded. The floral diversity is likely to be considered to be high. The survey area contains vegetation considered representative of a Threatened Ecological Community, however, there is not a wide range of vegetation types present thus diversity at this level is unlikely to be considered high. The fauna survey resulted in 31 vertebrate fauna species being recorded. This is unlikely to be considered to represent a high diversity of this taxonomic group.	May be at variance
Principle (b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.	The survey area is located in an area that has been subject to significant clearing, with less than 20% of the pre-European vegetation association remaining at larger scales and less than 10% at local government scale. Therefore, it is possible that the habitat present within the survey area could be considered as significant habitat for indigenous fauna. The major fauna habitat type is Woodland, with an abundance of hollow trees suitable for a range of bird species. However, the survey area is adjacent to similar vegetation that would also provide this resource. No fauna species listed under the Commonwealth EPBC-Act or Western Australian BC Act are likely to be affected by clearing in the survey area.	May be at variance

Principle	Assessment	Outcome
Principle (c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No rare flora (TF listed for protection under the Commonwealth EPBC Act or Western Australian BC Act) have been recorded from the survey area.	Unlikely to be at variance
Principle (d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.	The survey area includes 11.23 ha that has been assessed as being suitable for representing the <i>Eucalypt Woodlands of the Western Australian Wheatbelt</i> EPBC-listed TEC.	At variance
Principle (e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.	There is less than 10% of the pre-European vegetation association (1085) remaining at local government scale, and only 11.46% remaining at other scales.	At variance
Principle (f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.	There are no significant watercourses or wetlands within or in close proximity to the survey area that would be affected by any clearing.	Unlikely to be at variance
Principle (g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The survey area does not have sandy soils that are susceptible to erosion, nor would any adjacent areas be significantly affected by clearing within the survey area.	Unlikely to be at variance
Principle (h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	The survey area is immediately to the east of a Shire reserve (Boot Rock Reserve), however, is not near any lands vested for conservation that would be affected by any works within the survey area.	Unlikely to be at variance
Principle (i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	Clearing and developing the site (or part thereof) is unlikely to have any affect on surface water (there are no major drainage lines nearby, only a small local stream) or underground water.	Unlikely to be at variance
Principle (j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.	Flooding is unlikely to be affected by any clearing or other works.	Unlikely to be at variance

REFERENCES

- Australian Government & Bureau of Meteorology 2020, *Groundwater Dependent Ecosystems Atlas*. Available from: <http://www.bom.gov.au/water/groundwater/gde/map.shtml>.
- Australian Government & Department of Agriculture Water and the Environment 2020, *Protected Matters Search Tool*. Available from: <http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf>.
- Bamford, M 2016, *Black Cockatoo potential nest tree grading system*.
- Beard, JS 1990, *Plant Life of Western Australia*, Kangaroo Press, Kenthurst, NSW.
- Belbin, L & Collins, A 2006, *PATN Version 3.11*.
- Benshemesh, J 2007, *National Recovery Plan for Malleefowl *Leipoa ocellata**.
- Birdlife Australia 2020a, *Western Rosella*. Available from: <https://www.birdsinbackyards.net/species/Platycercus-icterotis>.
- Birdlife Australia 2020b, *Rainbow Bee-eater*. Available from: <https://birdlife.org.au/bird-profile/rainbow-bee-eater>.
- Bureau of Meteorology 2020, *Climate Data Online*. Available from: <http://www.bom.gov.au/climate/data/>.
- Commonwealth of Australia (1999), *Environment Protection and Biodiversity Conservation Act 1999*.
- Commonwealth of Australia 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, Canberra. Available from: <https://www.environment.gov.au/system/files/consultations/1a21997c-5542-4cd6-ace9-561865bbff29/files/draft-revised-referral-guideline-black-cockatoos.pdf>.
- Department of Agriculture Water and the Environment 2020a, *Australia's bioregions (IBRA)*. Available from: <http://www.environment.gov.au/land/nrs/science/ibra>.
- Department of Agriculture Water and the Environment 2020b, *Species Profile and Threats Database*. Available from: <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>.
- Department of Biodiversity Conservation and Attractions 2007, *NatureMap: Mapping Western Australia's Biodiversity*. Available from: <https://naturemap.dbca.wa.gov.au/>.
- Department of Biodiversity Conservation and Attractions 2018, *List of Threatened Ecological Communities (TECs) endorsed by the Western Australian Minister for Environment (28 June 2018)*. Available from: https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/threatened_ecological_communities_endorsed_by_the_minister_for_the_environment_june_2018.pdf.
- Department of Biodiversity Conservation and Attractions 2019a, *DBCA Statewide Vegetation Statistics*. Available from: <https://catalogue.data.wa.gov.au/dataset/dbca-statewide-vegetation-statistics>.
- Department of Biodiversity Conservation and Attractions 2019b, *Conservation codes for Western Australian Flora and Fauna (3 January 2019)*. Available from: <https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Conservation code definitions.pdf>.
- Department of Biodiversity Conservation and Attractions 2020, *Threatened ecological communities*. Available from: <https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/wa-s-threatened-ecological-communities>.
- Department of Environment and Conservation 2009, *Fauna Notes. No. 24 Western Rosella*. Available from: <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjotfiu2t7tAhWgILcAHYRtCkwQFjAOegQICxAC&url=https%3A%2F%2Flibrary.dbca.wa.gov.au%2Fstatic%2FFullTextFiles%2F922919.pdf&usg=AOvVaw3iIjeKeYljsXSKMo9ts8VW>.
- Department of Environment and Conservation 2012, *Fauna profiles: Red-tailed Phascogale *Phascogale calura**

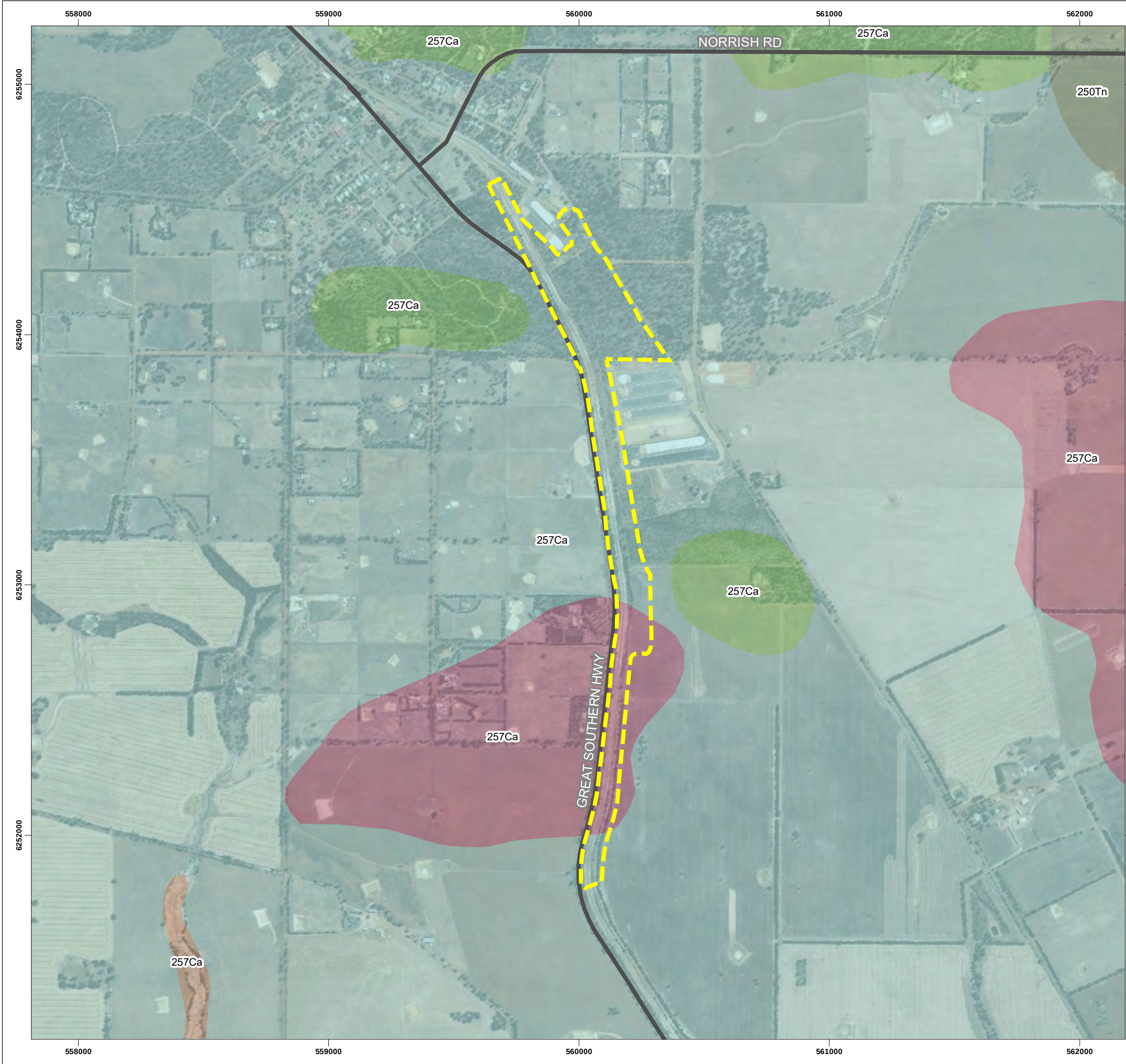
- (Gould, 1844). Available from:
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwih45Kkg-HtAhVFxzgGHTU-Df4QFjAEegQIBBAC&url=https%3A%2F%2Fwww.dpaw.wa.gov.au%2Fimages%2Fdocuments%2Fconservation-management%2Fpests-diseases%2Fred-tailed-phascogale_2012.pdf&usg=AOvVaw3lbi90TcplTagAkmfcxMer.
- Department of Environment and Conservation 2013, *Definitions, categories and criteria for Threatened and Priority Ecological Communities*. Available from: https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/definitions_categories_and_criteria_for_threatened_and_priority_ecological_communities.pdf.
- Department of Environment and Conservation & Western Australian Museum 2008, *Muir's Corella (Cacatua pastinator pastinator) Recovery Plan*. Available from:
<https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjk99qIi-HtAhXj73MBHSi0Dt0QFjABegQIARAC&url=https%3A%2F%2Flibrary.dbca.wa.gov.au%2Fstatic%2FJournals%2F080079%2F080079-61.pdf&usg=AOvVaw2TsCUWbMeC5sKLGURMjJxa>.
- Department of Environment Regulation 2014, *A guide to the assessment of applications to clear native vegetation under Part V Division 2 of the Environmental Protection Act 1986*. Available from:
https://www.der.wa.gov.au/images/documents/your-environment/native-vegetation/Guidelines/Guide2_assessment_native_veg.pdf.
- Department of Mines Industry Regulation and Safety 2020, *1:250,000 Geological series map - Dumbleyung (S150-07)*.
- Department of Parks and Wildlife 2015, *Roadside conservation value mapping program*. Available from:
<https://www.dpaw.wa.gov.au/management/off-reserve-conservation/roadside-conservation/132-%0ARoadside-conservation-value-mapping-program?showall=&limitstart=>.
- Department of Primary Industries and Rural Development 2019a, *Soil Landscape Mapping - Best Available (DPIRD-027)*.
- Department of Primary Industries and Rural Development 2019b, *Pre-European Vegetation (DPIRD-006)*. Available from: <https://catalogue.data.wa.gov.au/dataset/pre-european-dpird-006>.
- Department of Sustainability Environment Water Population and Communities 2011a, *Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999*. Available from:
<http://www.environment.gov.au/system/files/resources/b1c6b237-12d9-4071-a26e-ee816caa2b39/files/survey-guidelines-mammals.pdf>.
- Department of Sustainability Environment Water Population and Communities 2011b, *Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999*. Available from:
<http://www.environment.gov.au/system/files/resources/eba674a5-b220-4ef1-9f3a-b9ff3f08a959/files/survey-guidelines-reptiles.pdf>.
- Department of Sustainability Environment Water Population and Communities 2012, *EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (Calyptorhynchus latirostris), Baudin's cockatoo (Calyptorhynchus baudinii), Forest red-tailed black cockatoo (Calyptorhynchus banksii naso)*, Canberra.
- Department of the Environment and Energy 2020, *SPRAT EPBC Migratory List in Species Profile and Threats Database*. Available from: <http://www.environment.gov.au/cgi-bin/sprat/public/publicshowmigratory.pl>.
- Department of the Environment Water Heritage and the Arts; Commonwealth of Australia 2009, *Matters of National Environmental Significance. Significant impact guidelines 1.1 - Environment Protection and*

Biodiversity Conservation Act 1999.

- Department of the Environment Water Heritage and the Arts; Commonwealth of Australia 2010a, *Survey Guidelines for Australia's Threatened Bats: Guidelines for detecting bats listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999*. Available from: <http://www.environment.gov.au/epbc/publications/threatened-bats.html>.
- Department of the Environment Water Heritage and the Arts; Commonwealth of Australia 2010b, *Survey Guidelines for Australia's Threatened Birds: Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999*. Available from: <http://www.environment.gov.au/epbc/publications/threatened-birds.html>.
- Department of Water and Environmental Regulation 2020, *Index of Biodiversity Surveys for Assessments (IBSA)*. Available from: <https://biocollect.ala.org.au/ibsa#max%3D20%26sort%3DdateCreatedSort>.
- Department of the Environment Water Heritage and the Arts 2008, *Approved Conservation Advice for Jacksonia sp. Collie (C.J.Koch 177) (Collie Jacksonia)*.
- Environmental Protection Authority 2016, *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment*, EPA, Western Australia. Available from: <http://www.epa.wa.gov.au/policies-guidance/technical-guidance-flora-and-vegetation-surveys-environmental-impact-assessment>.
- Environmental Protection Authority 2020a, *Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment*, EPA, Perth, Western Australia. Available from: https://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/EPA-Technical-Guidance-Vertebrate-Fauna-Surveys.pdf.
- Environmental Protection Authority 2020b, *Statement of Environmental Principles, Factors and Objectives*. Available from: https://epa.wa.gov.au/sites/default/files/Policies_and_Guidance/Statement of Environmental Principles - 03.04.2020_0.pdf.
- Gibson, N, Keighery, BJ, Keighery, GJ, Burbidge, AH & Lyons, MN 1994, *A Floristic Survey of the southern Swan Coastal Plain*, Unpublished report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia (Inc.).
- Government of Western Australia (1986), *Environmental Protection Act 1986*.
- Government of Western Australia (2007), *Biosecurity and Agriculture Management Act 2007*.
- Government of Western Australia (2016), *Biodiversity Conservation Act 2016*.
- Government of Western Australia (2018), *Biodiversity Conservation Regulations 2018*.
- Government of Western Australia 2018a, *Government Gazette No. 135, 11 September 2018*. Available from: [https://www.slp.wa.gov.au/gazette/gazette.nsf/searchgazette/EF556EEFA23C70FA482583040013E0FC/\\$file/Gg135.pdf](https://www.slp.wa.gov.au/gazette/gazette.nsf/searchgazette/EF556EEFA23C70FA482583040013E0FC/$file/Gg135.pdf).
- Government of Western Australia 2018b, *Conservation and Parks Commission*. Available from: <https://www.conservation.wa.gov.au/>.
- Invasive Plants and Animals Committee 2016, *Australian Weeds Strategy 2017 to 2027*, Australian Government; Department of Agriculture and Water Resources Canberra.
- Jackson, K 2002, *Assessing roadsides: a guide for rating conservation value*. Available from: https://www.dpaw.wa.gov.au/images/documents/conservation-management/off-roadconservation/%0Arcc/assessing_roadsides.pdf.
- Keighery, BJ 1994, *Bushland Plant Survey - A Guide to Plant Community Survey for the Community*, Western Australia.
- Landgate 2020, *Shared Location Information Platform (SLIP)*. Available from: <https://maps.slip.wa.gov.au/landgate/locate/>.

- NVIS Technical Working Group & Department of the Environment and Energy 2017, *Australian Vegetation Attribute Manual: National Vegetation Information System, Version 7.0*, ed.MP Prep by Bolton deLacey, C.and Bossard, K.B.(Eds) , Canberra.
- Peel, MC, Finlayson, BL & McMahon, TA 2007, 'Updated world map of the Köppen-Geiger climate classification', *Hydrology and Earth System Sciences*, vol. 11, pp.1633–1644.
- Pisces Conservation Ltd 2010, *Species Diversity and Richness IV*.
- Quinn, F, Cowley, K, Barlow, B & Theile, K 1992, 'New names and combinations for some *Melaleuca* (Myrtaceae) species and subspecies from the south-west of Western Australia considered rare or threatened', *Nuytsia*, vol. 8, no. 3, pp.333–350.
- Shepherd, DP, Beeston, GR & Hopkins, AJM 2002, 'Native Vegetation in Western Australia: Extent, Type and Status', *Resource Management Technical Report 249*.
- Species and Communities Program; Department of Biodiversity Conservation and Attractions 2020, *Priority Ecological Communities for Western Australia Version 30. 28 July 2020*. Available from: [https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Priority Ecological Communities list.pdf](https://www.dpaw.wa.gov.au/images/documents/plants-animals/threatened-species/Listings/Priority%20Ecological%20Communities%20list.pdf).
- Strategen Environmental 2017, *Living Lakes - Ewlyamartup Lake NVCP Supporting Document* , Prepared for Wheatbelt NRM.
- Threatened Species Scientific Committee 2015, *Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt*, Department of the Environment, Canberra. Available from: <http://www.environment.gov.au/biodiversity/threatened/communities/pubs/128-conservation-advice.pdf>.
- Threatened Species Scientific Committee 2016a, *Conservation Advice Phascogale calura red-tailed phascogale*. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/316-conservation-advice-07122016.pdf>.
- Threatened Species Scientific Committee 2016b, *Listing Advice Cacatua pastinator pastinator Muir's Corella*. Available from: <http://www.environment.gov.au/biodiversity/threatened/species/pubs/25981-listing-advice-05052016.pdf>.
- Walker, J & Hopkins, M 1990, "Vegetation" in *Australian Soil and Land Survey. Field Handbook* , eds.R McDonald, R Isbell, J Speight, J Walker, & M Hopkins, Inkata Press, Inkata Press, Melbourne.
- Weeds Australia & Centre for Invasive Species Solutions 2020, *Weeds of National Significance (WONS)*. Available from: <https://weeds.org.au/weeds-profiles/>.
- Western Australian Herbarium 1998, *FloraBase - the Western Australian Flora. Department of Biodiversity, Conservation and Attractions*. Available from: <https://florabase.dpaw.wa.gov.au/>.
- Western Australian Herbarium 2020, *Descriptions by the Western Australian Herbarium, Department of Biodiversity, Conservation and Attractions*. Available from: <https://florabase.dpaw.wa.gov.au/help/copyrigh>.
- Western Australian Herbarium, Department of Biodiversity Conservation and Attractions & Shire of Dalwallinu 2019, *World Wide Wattle ver. 2*. Available from: <http://worldwidewattle.com/>.

MAPS



LEGEND

- Survey Area
- Roads

Soil Land Systems

- 250Tn 2 - Tieline 2 Subsystem: Very gently undulating slopes with grey sandy duplex soils and alkaline grey shallow sandy and loamy duplex soils with hardsetting topsoils and sodic clay subsoils
- 257Ca 1 - Carrolup 1 Subsystem: Gravelly soils capping hill crests and upper slopes in the Carrolup system
- 257Ca 2 - Carrolup 2 Subsystem: Grey sandy duplex soils on slopes, hill crests and less commonly minor drainage lines, within the Carrolup system
- 257Ca 3 - Carrolup 3 Subsystem: Low hills and rises in the Carrolup system with sandy and loamy soils formed on shallow weathered granite and dolerite and small areas of rock outcrop
- 257Ca 5 - Carrolup 5 Subsystem: Drainage lines and valley flats which are 100 - 300 m wide with mainly saline wet soils. Also includes some lower slopes

DATASOURCES :
SOURCE DATA: SOIL-LANDSCAPE MAPPING WESTERN AUSTRALIA – BEST AVAILABLE SOILS (2019)
AERIAL: ESRI BASEMAP (2019)
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AERGRID, IGN, AND THE GIS USER COMMUNITY

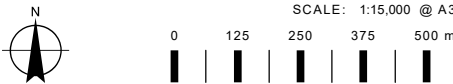


SOIL LANDSCAPE MAPPING

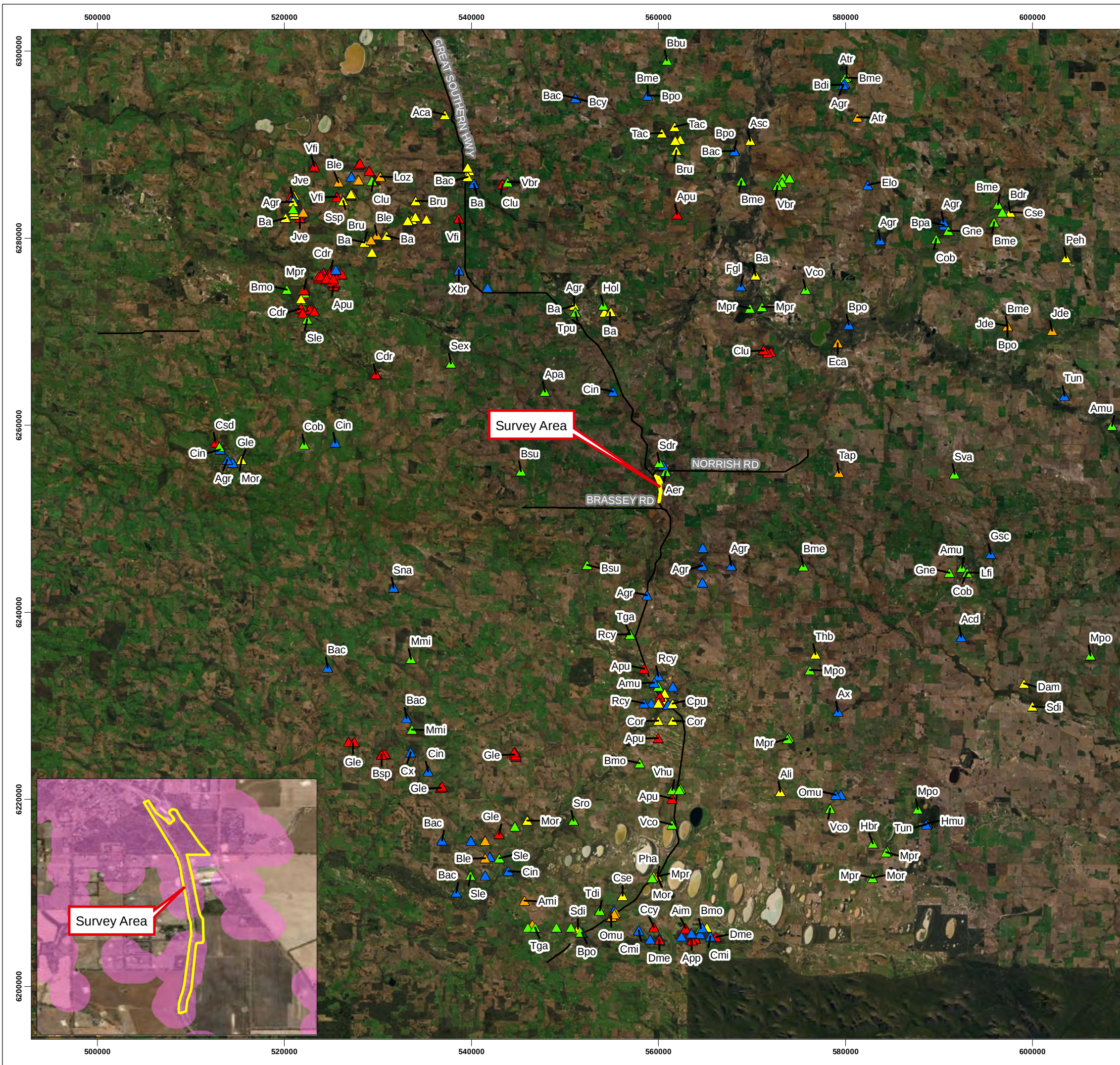
CBH BROOMEHILL
ENVIRONMENTAL SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER



PROJECT NO: 4571-20			
REV	AUTHOR	APPROVED	DATE
00	KP	SB	17/12/2020



LEGEND

Survey Area

Roads

Threatened

Priority 1

Priority 2

Priority 3

Priority 4

TEC/PEC (DBCA 2020)

Eucalypt Woodlands of the Western Australian Wheatbelt

Conservation Significant Flora (DBCA 2020)

Code	Taxon	Status	Code	Taxon	Status	Code	Taxon	Status
Ac	Acacia deculata	4	Cob	Calceolaria obtusa	3	Mpr	Melaleuca pritzelii	3
Ade	Acacia depressa	T	Cmi	Calothamnus microcarpus	4	Omu	Orthocentrus muelleri	4
Aer	Acacia errandina	3	Cpu	Calytrix pulchella	3	Peh	Persea hakeiformis	2
Ag	Acacia grisea	4	Cor	Chordiflex ornatus	2	Pec	Pterostylis echinulata	3
Aim	Acacia immanis	4	Cdr	Conostylis drummondii	T	Pha	Pterostylis hadra	1
Ami	Acacia microneura	1	Cse	Conostylis seorsiflora subsp. Nyabing (A. Coates s.n. 21/01/1988)	2	Rcy	Regelia cymbilolia	4
Amu	Acacia mutabilis subsp. rhyngophylla	3	Csd	Conostylis setigera subsp. dasy	T	Sna	Schoenus natans	4
Apr	Acacia parkerae	3	Dme	Darwinia meeboldii	T	Sva	Sphaerolobium validum	3
Asc	Acacia sclerophylla var. pilosa	2	Dam	Daviesia mesophylla	2	Sco	Stylidium coatesianum	2
At	Acacia trinalis	1	Ddr	Diuris drummondii	T	Sdi	Stylidium diuroides subsp. nanum	2
Ali	Adenanthos linearis	2	Eke	Eleocharis keigheryi	T	Sex	Stylidium exappendiculatum	3
Apu	Adenanthos pungens subsp. effusus	T	Eca	Eucalyptus calyerup	1	Sle	Stylidium lepidum	3
App	Adenanthos pungens subsp. pungens	T	Eer	Eucalyptus erectifolia	4	Sps	Stylidium pseudohirsutum	3
Ax	Adenanthos x cunninghamii	4	Elo	Eucalyptus loxophleba x wandoo	4	Srn	Stylidium rhpidium	3
Aca	Andersonia carinata	2	Ena	Eulalia nanophylla	3	Sro	Stylidium roseanum	3
Ama	Austroparmelia macrospora	3	Fgl	Frankenia glomerata	4	Sly	Stylidium tylosum	2
Ba	Baeckea sp. Younegin Hill (A.S. George 15772)	1	Gsc	Gahnia scleroides	4	SsW	Styphelia sp. Wandoo (F. & J. Hort 2441)	2
Ba	Banksia acanthopoda	2	Gle	Gastrolobium lehmannii	T	Sdr	Synaphea drummondii	3
Bac	Banksia acuminata	4	Gov	Gastrolobium ovalifolium	4	Ssp	Synaphea sp. Woodanilling (G.J. Keighery & N. Gibson 4614)	2
Bcy	Banksia cynaroides	4	Gne	Grevillea newbeyi	3	Tun	Tectocornia uniflora	4
Bdr	Banksia drummondii subsp. macrorufa	2	Hbr	Hakea brachyptera	3	Tap	Tetrastichia applanata	1
Ble	Banksia lepidorhiza	1	Hol	Hakea oldfieldii	3	Thb	Thomasia brachystachys	2
Bme	Banksia meganotia	3	Hpl	Hemigenia platyphylla	4	Tdi	Thomasia dielsii	1
Bol	Banksia oligantha	T	Hra	Hemigenia ramosissima	T	Tju	Thomasia julietae	1
Bpa	Banksia parva	4	Hri	Hemigenia rigida	1	Tac	Thysanotus acerosifolius	2
Bpo	Banksia porrecta	4	Hmu	Hydrocotyle muriculata	1	Tbr	Thysanotus brevifolius	2
Bru	Banksia rufistylis	2	Jca	Jacksonia calycina	4	Tcy	Thysanotus cymosus	3
Bse	Banksia senecifolia	4	Jde	Jacksonia debilis	1	Tga	Thysanotus gageoides	3
Bsu	Banksia subpinnatifida var. imberbis	3	Jve	Jacksonia velveta	T	Tsp	Thysanotus sp. Badgingarra (E.A. Griffin 2511)	2
Bbu	Beaufortia burbridgeae	3	Lfi	Lasiopetalum fitzgeraldii	3	Tpu	Tribonanthes purpurea	T
Bdi	Bossia divaricata	4	Lgr	Laxmannia grandiflora subsp. strilingensis	3	Vbr	Verticordia brevifolia subsp. brevifolia	3
Bsp	Bossia spinosa	3	Lli	Leucopogon florulentus	3	Vco	Verticordia coronata	3
Bmo	Brachyotoma mogin	3	Lla	Leucopogon lasiophyllus	4	Vli	Verticordia limbrilepis subsp. limbrilepis	T
Cin	Caladenia integra	4	Loz	Leucopogon ozothamnoides	1	Vhu	Verticordia huegelii var. tridens	3
Clu	Caladenia luteola	T	Mmi	Melaleuca micromera	3	Xbr	Xanthorrhoea brevistyla	4
Cx	Caladenia x triangularis	4	Mor	Melaleuca ordinifolia	2			
Cy	Calceolaria cyanea	T	Mpo	Melaleuca polyccephala	3			

DATASOURCES:
SOURCE DATA: CS FLORA AND TEC/PEC DATA (DBCA 2010); TRANSPORT ROAD CENTRELINES (MRWA 2012)
AERIAL: ESRI BASEMAP (2019)
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

FLORA & COMMUNITIES DATABASE SEARCH RESULTS

CBH BROOMEHILL ENVIRONMENTAL SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:400,000 @ A3

0

4

8

12

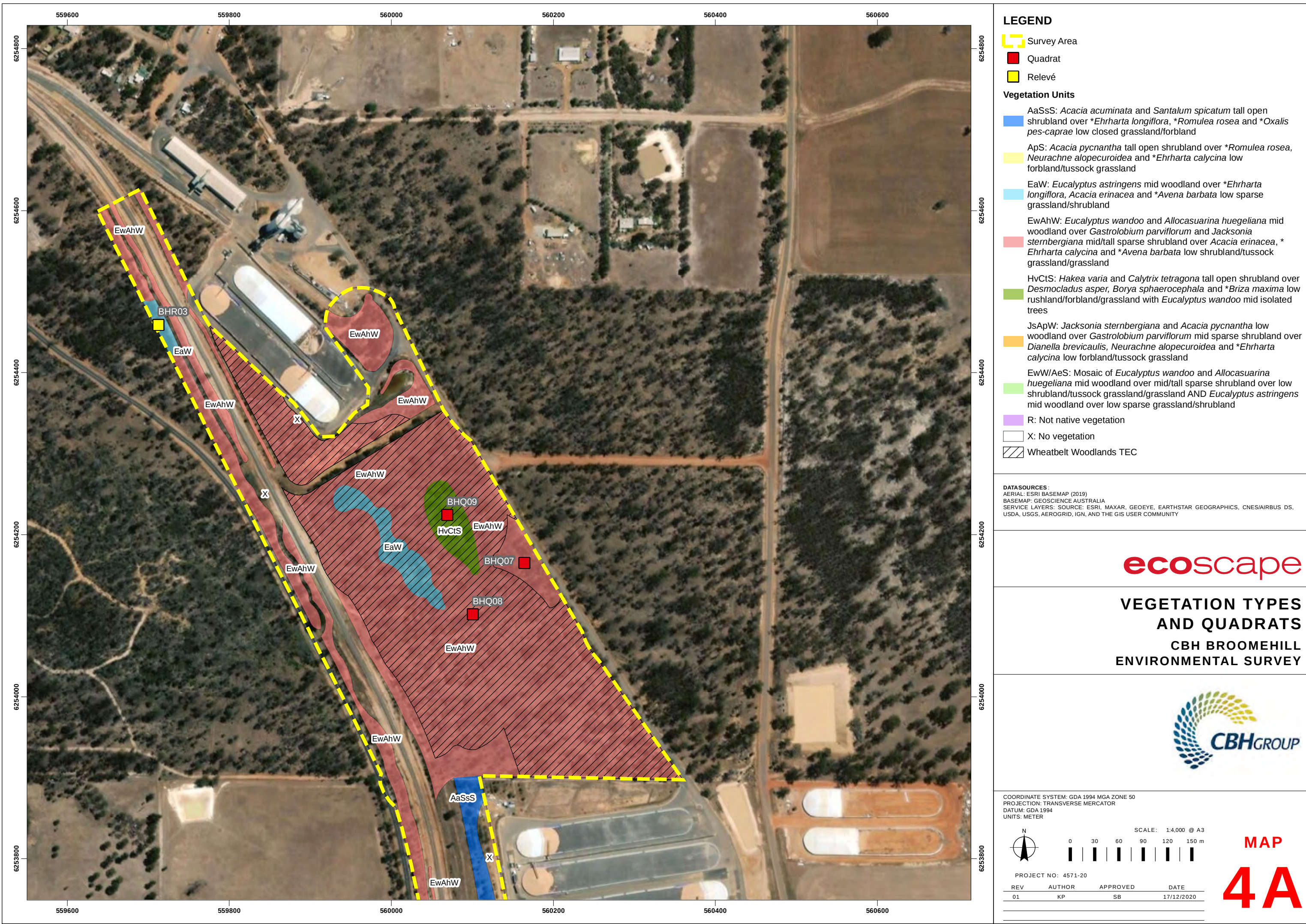
16 km

PROJECT NO: 4571-20

REV	AUTHOR	APPROVED	DATE
01	KP	SB	17/12/2020

MAP

2



LEGEND

Survey Area

Quadrat

Relevé

Vegetation Units

AaSSs: *Acacia acuminata* and *Santalum spicatum* tall open shrubland over **Ehrharta longiflora*, **Romulea rosea* and **Oxalis pes-caprae* low closed grassland/forbland

ApS: *Acacia pycnantha* tall open shrubland over **Romulea rosea*, *Neurachne alopecuroidea* and **Ehrharta calycina* low forbland/tussock grassland

EaW: *Eucalyptus astringens* mid woodland over **Ehrharta longiflora*, *Acacia erinacea* and **Avena barbata* low sparse grassland/shrubland

EwAhW: *Eucalyptus wandoo* and *Allocasuarina huegeliana* mid woodland over *Gastrolobium parviflorum* and *Jacksonia sternbergiana* mid/tall sparse shrubland over *Acacia erinacea*, **Ehrharta calycina* and **Avena barbata* low shrubland/tussock grassland/grassland

HvCtS: *Hakea varia* and *Calytrix tetragona* tall open shrubland over *Desmocladius asper*, *Borya sphaerocephala* and **Briza maxima* low rushland/forbland/grassland with *Eucalyptus wandoo* mid isolated trees

JsApW: *Jacksonia sternbergiana* and *Acacia pycnantha* low woodland over *Gastrolobium parviflorum* mid sparse shrubland over *Dianella brevicaulis*, *Neurachne alopecuroidea* and **Ehrharta calycina* low forbland/tussock grassland

EwW/AeS: Mosaic of *Eucalyptus wandoo* and *Allocasuarina huegeliana* mid woodland over mid/tall sparse shrubland over low shrubland/tussock grassland/grassland AND *Eucalyptus astringens* mid woodland over low sparse grassland/shrubland

R: Not native vegetation

X: No vegetation

Wheatbelt Woodlands TEC

DATASOURCES :
AERIAL: ESRI BASEMAP (2019)
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

**VEGETATION TYPES
AND QUADRATS**
**CBH BROOMEHILL
ENVIRONMENTAL SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:4,000 @ A3

PROJECT NO: 4571-20

REV	AUTHOR	APPROVED	DATE
01	KP	SB	17/12/2020

MAP

4A



LEGEND

Survey Area

Quadrat

Relevé

Vegetation Units

AaSsS: *Acacia acuminata* and *Santalum spicatum* tall open shrubland over **Ehrharta longiflora*, **Romulea rosea* and **Oxalis pes-caprae* low closed grassland/forbland

ApS: *Acacia pycnantha* tall open shrubland over **Romulea rosea*, *Neurachne alopecuroides* and **Ehrharta calycina* low forbland/tussock grassland

EaW: *Eucalyptus astringens* mid woodland over **Ehrharta longiflora*, *Acacia erinacea* and **Avena barbata* low sparse grassland/shrubland

EwAhW: *Eucalyptus wandoo* and *Allocasuarina huegeliana* mid woodland over *Gastrolobium parviflorum* and *Jacksonia sternbergiana* mid/tall sparse shrubland over *Acacia erinacea*, **Ehrharta calycina* and **Avena barbata* low shrubland/tussock grassland/grassland

HvCtS: *Hakea varia* and *Calytrix tetragona* tall open shrubland over *Desmocladius asper*, *Borya sphaerocephala* and **Briza maxima* low rushland/forbland/grassland with *Eucalyptus wandoo* mid isolated trees

JsApW: *Jacksonia sternbergiana* and *Acacia pycnantha* low woodland over *Gastrolobium parviflorum* mid sparse shrubland over *Dianella brevicaulis*, *Neurachne alopecuroides* and **Ehrharta calycina* low forbland/tussock grassland

EwW/AeS: Mosaic of *Eucalyptus wandoo* and *Allocasuarina huegeliana* mid woodland over mid/tall sparse shrubland over low shrubland/tussock grassland/grassland AND *Eucalyptus astringens* mid woodland over low sparse grassland/shrubland

R: Not native vegetation

X: No vegetation

Wheatbelt Woodlands TEC

DATASOURCES :
AERIAL: ESRI BASEMAP (2019)
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

VEGETATION TYPES AND QUADRATS

CBH BROOMEHILL
ENVIRONMENTAL SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:4,000 @ A3

PROJECT NO: 4571-20

REV	AUTHOR	APPROVED	DATE
01	KP	SB	17/12/2020

MAP

4B



LEGEND

Survey Area

Quadrat

Relevé

Vegetation Units

AaSS: *Acacia acuminata* and *Santalum spicatum* tall open shrubland over **Ehrharta longiflora*, **Romulea rosea* and **Oxalis pes-caprae* low closed grassland/forbland

ApS: *Acacia pycnantha* tall open shrubland over **Romulea rosea*, *Neurachne alopecuroidea* and **Ehrharta calycina* low forbland/tussock grassland

EaW: *Eucalyptus astringens* mid woodland over **Ehrharta longiflora*, *Acacia erinacea* and **Avena barbata* low sparse grassland/shrubland

EwAhW: *Eucalyptus wandoo* and *Allocasuarina huegeliana* mid woodland over *Gastrolobium parviflorum* and *Jacksonia sternbergiana* mid/tall sparse shrubland over *Acacia erinacea*, **Ehrharta calycina* and **Avena barbata* low shrubland/tussock grassland/grassland

HvCtS: *Hakea varia* and *Calytrix tetragona* tall open shrubland over *Desmocladius asper*, *Borya sphaerocephala* and **Briza maxima* low rushland/forbland/grassland with *Eucalyptus wandoo* mid isolated trees

JsApW: *Jacksonia sternbergiana* and *Acacia pycnantha* low woodland over *Gastrolobium parviflorum* mid sparse shrubland over *Dianella brevicaulis*, *Neurachne alopecuroidea* and **Ehrharta calycina* low forbland/tussock grassland

EwW/AeS: Mosaic of *Eucalyptus wandoo* and *Allocasuarina huegeliana* mid woodland over mid/tall sparse shrubland over low shrubland/tussock grassland/grassland AND *Eucalyptus astringens* mid woodland over low sparse grassland/shrubland

R: Not native vegetation

X: No vegetation

Wheatbelt Woodlands TEC

DATASOURCES :
AERIAL: ESRI BASEMAP (2019)
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

VEGETATION TYPES AND QUADRATS

CBH BROOMEHILL ENVIRONMENTAL SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:4,000 @ A3

0

30

60

90

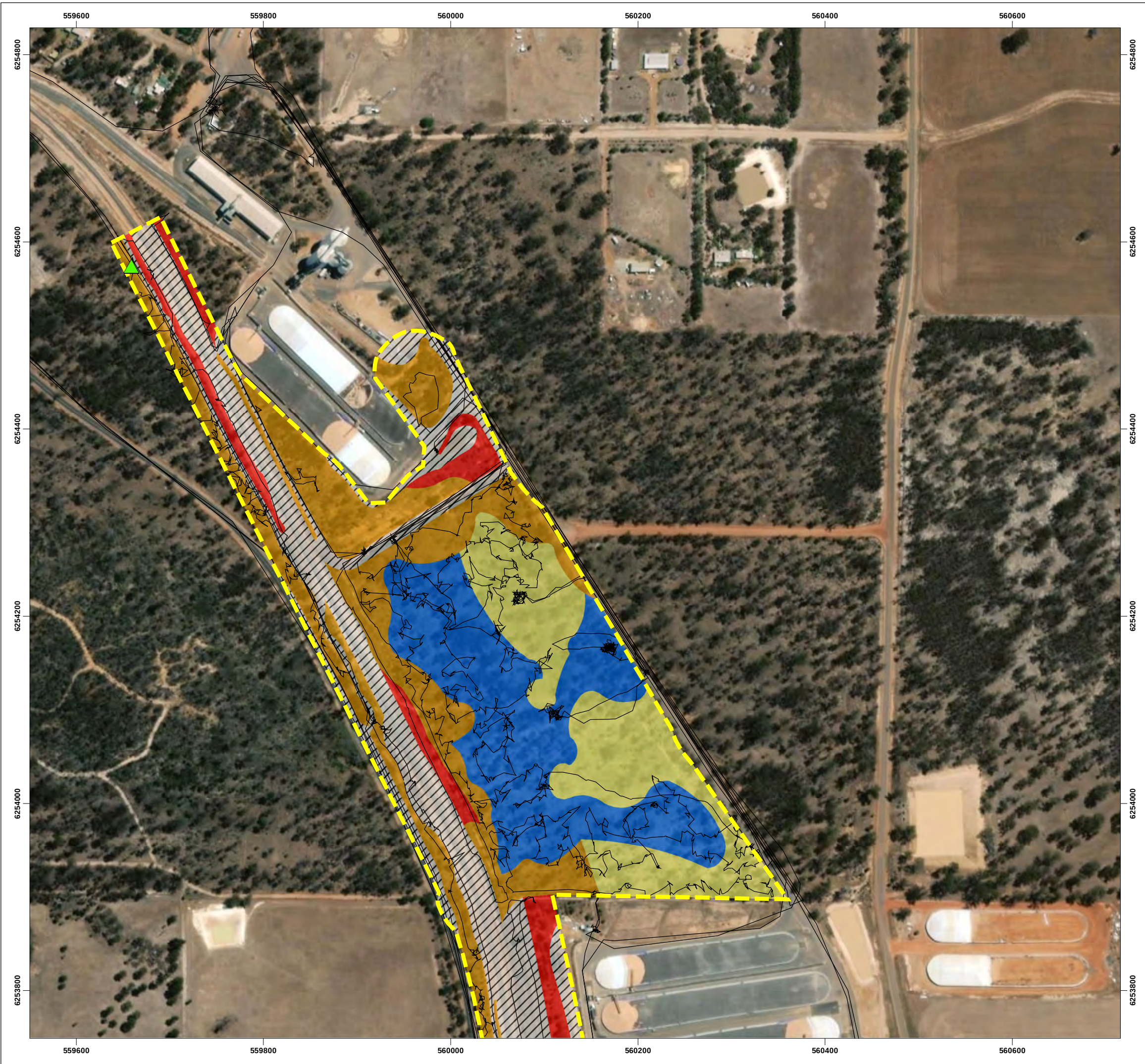
120

150 m

REV	AUTHOR	APPROVED	DATE
01	KP	SB	17/12/2020

MAP

4C



LEGEND
 Survey Area
 Survey Tracks
 **Asparagus asparagoides*
Vegetation Condition
 Very Good
 Good
 Degraded
 Completely Degraded
 N/A

DATASOURCES:
AERIAL: ESRI BASEMAP (2019)
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

**VEGETATION CONDITION AND
SIGNIFICANT WEEDS**
**CBH BROOMEHILL
ENVIRONMENTAL SURVEY**

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:4,000 @ A3

PROJECT NO: 4571-20

REV	AUTHOR	APPROVED	DATE
00	KP	SB	17/12/2020

MAP
5 A



LEGEND

- Survey Area
- Survey Tracks
- **Asparagus asparagoides*
- Vegetation Condition**
- Very Good
- Good
- Degraded
- Completely Degraded
- N/A

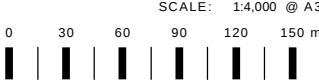
DATASOURCES :
AERIAL: ESRI BASEMAP (2019)
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRI, IGN, AND THE GIS USER COMMUNITY

ecoscape

VEGETATION CONDITION AND
SIGNIFICANT WEEDS
CBH BROOMEHILL
ENVIRONMENTAL SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER



PROJECT NO: 4571-20

REV	AUTHOR	APPROVED	DATE
00	KP	SB	17/12/2020

MAP
5B



LEGEND

- Survey Area
- Survey Tracks
- **Asparagus asparagoides*
- Vegetation Condition**
- Very Good
- Good
- Degraded
- Completely Degraded
- N/A

DATASOURCES:
AERIAL: ESRI BASEMAP (2019)
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

ecoscape

**VEGETATION CONDITION AND
SIGNIFICANT WEEDS**
**CBH BROOMEHILL
ENVIRONMENTAL SURVEY**



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER



PROJECT NO: 4571-20

REV	AUTHOR	APPROVED	DATE
00	KP	SB	17/12/2020

MAP
5C



LEGEND

- Survey Area
- Habitat Trees Survey Area
- Platycercus icterotis xanthogenys* (P4)
- Fauna Habitat Types**
 - Woodland
 - Shrubland
 - No habitat
- Habitat Trees**
 - Eucalyptus wandoo***
 - Class 3
 - Class 4
 - Class 5
 - Eucalyptus kondininensis***
 - Class 5
 - Dead Trees**
 - Class 3
 - Class 4
 - Class 5

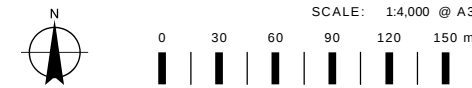
DATASOURCES:
AERIAL: ESRI BASEMAP (2019)
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

ecoscape

**FAUNA SITES, HABITAT &
SIGNIFICANT FAUNA LOCATIONS**
CBH BROOMEHILL
ENVIRONMENTAL SURVEY



COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER



PROJECT NO: 4571-20			
REV	AUTHOR	APPROVED	DATE
01	KP	SB	17/12/2020

MAP
6A



LEGEND

Survey Area

Habitat Trees Survey Area

Platycercus ictorotis xanthogenys (P4)

Fauna Habitat Types

Woodland

Shrubland

No habitat

Habitat Trees

Eucalyptus wandoo

Class 3

Class 4

Class 5

Eucalyptus kondininensis

Class 5

Dead Trees

Class 3

Class 4

Class 5

DATASOURCES:
AERIAL: ESRI BASEMAP (2019)
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRIID, IGN, AND THE GIS USER COMMUNITY

FAUNA SITES, HABITAT & SIGNIFICANT FAUNA LOCATIONS

CBH BROOMEHILL ENVIRONMENTAL SURVEY

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

SCALE: 1:4,000 @ A3

PROJECT NO: 4571-20			
REV	AUTHOR	APPROVED	DATE
01	KP	SB	17/12/2020

MAP

6C

APPENDIX ONE

DEFINITIONS AND CRITERIA

Table 15: EPBC Act categories for flora, fauna and ecological communities

Category	Threatened species	Threatened Ecological Communities
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.	n/a
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.	n/a
Critically Endangered (CE)	A native species is eligible to be included in the <i>critically endangered</i> category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>critically endangered</i> category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria
Endangered (EN)	A native species is eligible to be included in the <i>endangered</i> category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>endangered</i> category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	A native species is eligible to be included in the <i>vulnerable</i> category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the <i>vulnerable</i> category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.	n/a

Table 16: Conservation codes for Western Australian flora and fauna (DBCA 2019b)

Conservation Codes for Western Australian Flora and Fauna	
Threatened, Extinct and Specially Protected fauna or flora ¹ are species ² 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.	
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.	
Categories of Threatened, Extinct and Specially Protected fauna and flora are:	
T	Threatened species Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the <i>Biodiversity Conservation Act 2016</i> (BC Act). Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for Threatened Fauna. Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> 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.
CR	Critically endangered species Threatened species considered to be "<i>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</i>". 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 <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for critically endangered fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for critically endangered flora.
EN	Endangered species Threatened species considered to be "<i>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</i>". 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 <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for endangered fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for endangered flora.
VU	Vulnerable species Threatened species considered to be "<i>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</i>". 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 <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for vulnerable fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> 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.	
EX	Extinct species Species where "<i>there is no reasonable doubt that the last member of the species has died</i>", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i> for extinct fauna or the <i>Wildlife Conservation (Rare Flora) Notice 2018</i> for extinct flora.
EW	Extinct in the wild species Species that "<i>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</i>", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). 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.	

Conservation Codes for Western Australian Flora and Fauna	
MI	Migratory species Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). 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 <i>Convention on the Conservation of Migratory Species of Wild Animals</i> (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. Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
CD	Species of special conservation interest (conservation dependent fauna) Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.
OS	Other specially protected species 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). Published as other specially protected fauna under schedule 7 of the <i>Wildlife Conservation (Specially Protected Fauna) Notice 2018</i>.
P	Priority species 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.
1	Priority 1: Poorly-known species Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
2	Priority 2: Poorly-known species Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
3	Priority 3: Poorly-known species 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.

Conservation Codes for Western Australian Flora and Fauna	
4	Priority 4: Rare, Near Threatened and other species in need of monitoring
	(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.
	(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.
	(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
¹ The definition of flora includes algae, fungi and lichens.	
² Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).	

Table 17: DBCA definitions and criteria for TECs and PECs (DEC 2013)

Criteria	Definition
Threatened Ecological Communities	
Presumed Totally Destroyed (PD)	An ecological community that has been adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future. An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant and either of the following applies (A or B): A. Records within the last 50 years have not been confirmed despite thorough searches of known or likely habitats or B. All occurrences recorded within the last 50 years have since been destroyed
Critically Endangered (CR)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or that was originally of limited distribution and is facing severe modification or destruction throughout its range in the immediate future, or is already severely degraded throughout its range but capable of being substantially restored or rehabilitated. An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting any one or more of the following criteria (A, B or C): A. The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and either or both of the following apply (i or ii): i. geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 10 years); ii. modification throughout its range is continuing such that in the immediate future (within approximately 10 years) the community is unlikely to be capable of being substantially rehabilitated. B. Current distribution is limited, and one or more of the following apply (i, ii or iii): i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 10 years); ii. there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes; iii. there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes. C. The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Criteria	Definition
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future. An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C): A. The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii): i. the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years); ii. modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated. B. Current distribution is limited, and one or more of the following apply (i, ii or iii): i. geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years); ii. there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes; iii. there may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes. The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range. An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C): A. The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated. B. The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations. C. The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.
Priority ecological communities	
Priority One	<i>Poorly known ecological communities</i> Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority Two	<i>Poorly known ecological communities</i> Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, state forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities, but do not meet adequacy of survey requirements, and / or are not well defined, and appear to be under threat from known threatening processes.

Criteria	Definition
Priority Three	<i>Poorly known ecological communities</i> i. Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or; ii. Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; iii. Communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities, but do not meet adequacy of survey requirements and / or are not well defined, and known threatening processes exist that could affect them.
Priority Four	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. i. Rare. Ecological communities known from few occurrences 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 communities are usually represented on conservation lands. ii. Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. iii. Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority Five	<i>Conservation Dependent Ecological Communities</i> Ecological Communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Table 18: NVIS structural formation terminology, terrestrial vegetation (NVIS Technical Working Group; DotEE 2017)

Cover characteristics								
	Foliage cover *	70-100	30-70	10-30	<10	> 0 (scattered)	0-5 (clumped)	unknown
	Cover code	d	c	i	r	bi	bc	unknown
Growth Form	Height Ranges (m)	Structural Formation Classes						
tree, palm	<10,10-30, >30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	tree, palm
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	tree mallee
shrub, cycad, grass-tree, tree-fern	<1,1-2,>2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrub, cycad, grass-tree, tree-fern
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrub
heath shrub	<1,1-2,>2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrub
chenopod shrub	<1,1-2,>2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrub
samphire shrub	<0.5,>0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrub
hummock grass	<2,>2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grass
tussock grass	<0.5,>0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses	tussock grass
other grass	<0.5,>0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grass
sedge	<0.5,>0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedge
rush	<0.5,>0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rush
herb	<0.5,>0.5	closed herbland	herbland	open herbland	sparse herbland	isolated herbs	isolated clumps of herbs	herb
fern	<1,1-2,>2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns	fern
bryophyte	<0.5	closed bryophyte-land	bryophyte-land	open bryophyteland	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes	bryophyte
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichen
vine	<10,10-30, >30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vine

Table 19: NVIS height classes (NVIS Technical Working Group; DotEE 2017)

Height		Growth form				
Height Class	Height Range (m)	Tree, vine (M & U), palm (single-stemmed)	Shrub, heath shrub, chenopod shrub, ferns, samphire shrub, cycad, tree-fern, grass-tree, palm (multi-stemmed)	Tree mallee, mallee shrub	Tussock grass, hummock grass, other grass, sedge, rush, forbs, vine (G)	Bryophyte, lichen, seagrass, aquatic
8	>30	tall	NA	NA	NA	NA
7	10-30	mid	NA	tall	NA	NA
6	<10	low	NA	mid	NA	NA
5	<3	NA	NA	low	NA	NA
4	>2	NA	tall	NA	tall	NA
3	1-2	NA	mid	NA	tall	NA
2	0.5-1	NA	low	NA	mid	tall
1	<0.5	NA	low	NA	low	low

Source: (based on Walker & Hopkins 1990)

Table 20: Vegetation condition scale for the South West and Interzone Botanical Provinces (EPA 2016)

Condition rating	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

Table 21: Grading system for the assessment of potential nest trees for Black Cockatoos (Bamford 2016)

Class	Description of tree and hollows/activity
1	Active nest observed; adult (or immature) bird seen entering or emerging from hollow.
2	Hollow of suitable size and angle (i.e. near-vertical) visible with chew marks around entrance.
3	Potentially suitable hollow visible but no chew marks present; or potentially suitable hollow present (as suggested by structure of tree, such as large, vertical trunk broken off at a height of >10m).
4	Tree with large hollows or broken branches that might contain large hollows but hollows or potential hollows are not vertical or near-vertical; thus a tree with or likely to have hollows of sufficient size but not to have hollows of the angle preferred by Black Cockatoos.
5	Tree lacking large hollows or broken branches that might have large hollows; a tree with more or less intact branches and a spreading crown.

Table 22: Commonwealth Black Cockatoo foraging quality scoring tool (Commonwealth of Australia 2017)

	Foraging habitat for Carnaby's Cockatoo	Foraging habitat for Baudin's Cockatoo	Foraging habitat for Forest Red-tailed Black cockatoo
Starting Score			
10 (Very high quality)	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10	Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10
7 (High quality)	Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as Banksia spp. (including Dryandra spp.), Hakea spp. and Grevillea spp., as well as native eucalypt woodland and forest that contains foraging species, including along roadsides. Does not include orchards, canola, or areas under a RFA	Native eucalypt woodlands and forest, and proteaceous woodland and heath, particularly marri, including along roadsides. Does not include orchards or areas under a RFA	Jarrah and marri woodlands and forest, and edges of karri forests, including wandoo and blackbutt, within the range of the subspecies, including along roadsides. Does not include areas under a RFA
5 (Quality)	Pine plantation or introduced eucalypts	Pine plantation or introduced eucalypts	Pine plantation or introduced eucalypts
1 (Low quality)	Individual foraging plants or small stand of foraging plants	Individual foraging plants or small stand of foraging plants	Individual foraging plants or small stand of foraging plants

Additions	Foraging habitat for Carnaby's Cockatoo Context adjustor - attributes improving functionality of foraging habitat	Foraging habitat for Baudin's Cockatoo Context adjustor - attributes improving functionality of foraging habitat	Foraging habitat for Forest Red-tailed Black cockatoo Context adjustor - attributes improving functionality of foraging habitat
+3	Is within the Swan Coastal Plain (important foraging area).	Is within the known foraging area (see map).	Jarrah and/or marri show good recruitment (i.e. evidence of young trees).
+3	Contains trees with suitable nest hollows	Contains trees with suitable nest hollows	Contains trees with suitable nest hollows
+2	Primarily contains marri	Primarily contains marri	Primarily contains marri and/or jarrah
+2	Contains trees with potential to be used for breeding (dbh $\geq$ 500 mm or $\geq$ 300 mm dbh for salmon gum and wandoo)	Contains trees with potential to be used for breeding (dbh $\geq$ 500 mm or $\geq$ 300 mm dbh for salmon gum and wandoo)	Contains trees with potential to be used for breeding (dbh $\geq$ 500 mm or $\geq$ 300 mm dbh for salmon gum and wandoo)
+1	Is known to be a roosting site	Is known to be a roosting site	Is known to be a roosting site
Subtractions	Context adjustor - attributes reducing functionality of foraging habitat	Context adjustor - attributes reducing functionality of foraging habitat	Context adjustor - attributes reducing functionality of foraging habitat
-2	No clear evidence of feeding debris	No clear evidence of feeding debris	No clear evidence of feeding debris
-2	No other foraging habitat within 6 km	No other foraging habitat within 6 km	No other foraging habitat within 6 km
-1	Is > 12 km from a known breeding location	Is > 12 km from a known breeding location	Is > 12 km from a known breeding location
-1	Is > 12 km from a known roosting site	Is > 12 km from a known roosting site	Is > 12 km from a known roosting site
-1	Is > 2 km from a watering point	Is > 2 km from a watering point	Is > 2 km from a watering point
-1	Disease present (e.g. <i>Phytophthora cinnamomi</i> or marri canker)	Disease present (e.g. <i>Phytophthora cinnamomi</i> or marri canker)	Disease present (e.g. <i>Phytophthora cinnamomi</i> or marri canker)

APPENDIX TWO

WHEATBELT WOODLANDS TEC ASSESSMENT CRITERIA

The *Eucalypt Woodlands of the Western Australian Wheatbelt* is listed as a Critically Endangered TEC under the EPBC Act. This TEC occurs in the southwest of Western Australia, between the Darling Range and western edge of the goldfields, in the Avon Wheatbelt IBRA region and the Mallee IBRA subregion MAL02 Western Mallee. The TEC is defined as being dominated by eucalypt species with a tree or mallet form over a highly variable understorey (TSSC 2015).

The key characteristics for vegetation to be included in this TEC (TSSC 2015) are that:

- it occurs in the Western Australian Wheatbelt (and a few occurrences on adjacent IBRA regions), located on the Yilgarn Craton and receives less than 600 mm mean annual rainfall
- it has a tree canopy dominated by one or more of 31 taxa of *Eucalypt* (*Eucalyptus*) species having tree or mallet form (i.e. a single trunk) (Table 23). These *Eucalypts* do not include those that are limited to specified landscapes (e.g. granite outcrops, lateritic hills or other rocky rises) or whose main distribution is outside the Wheatbelt. Of note, *Eucalyptus loxophleba* subsp. *supralaevis* (known as Blackbutt York Gum and occurring mainly in the northern Wheatbelt) is specifically listed in the Approved Conservation Advice (TSSC 2015) as included in the TEC as a co-dominant or subdominant species, but (on its own) is not definitive of the TEC.
- the upper stratum (tree canopy) in a mature woodland must be greater than 10% crown cover (unless the loss of canopy cover is temporary e.g. fire)
- the associated non dominant (or not co-dominant) canopy species are listed; these include *Acacia acuminata* (Jam), *Allocasuarina huegeliana* (Rock Oak), *Corymbia calophylla* (Marri) and a number of other (mostly mallee-form) *Eucalyptus* species (although the list provided is not considered to be comprehensive)
- the understorey (mid and ground strata) is highly variable, and includes sparse to absent forms, herbs, scrubs and heaths, chenopods, thickets (predominantly *Melaleuca* species) and salt tolerant species (including *Tecticornia*). The species must be predominantly native.
- meets the condition threshold, according to the table below (Table 16)
- it includes the following DBCA-listed Priority Ecological Communities: Brown mallet (*Eucalyptus astringens*) communities in the western Wheatbelt on alluvial flats (Priority 1), Red Morrel woodland of the Wheatbelt (Priority 1), Yate (*Eucalyptus occidentalis*) dominated alluvial claypans of the Jingalup soil system (Priority 2).

Table 23: Key dominant or co-dominant *Eucalypt* species of the Wheatbelt Woodlands TEC (TSSC 2015)

Species		
<i>Eucalyptus accedens</i>	<i>Eucalyptus longicornis</i>	<i>Eucalyptus salicola</i>
<i>Eucalyptus aequioperta</i>	<i>Eucalyptus loxophleba</i> subsp. <i>loxophleba</i>	<i>Eucalyptus salmonophloia</i>
<i>Eucalyptus alipes</i>	<i>Eucalyptus melanoxydon</i>	<i>Eucalyptus salubris</i>
<i>Eucalyptus astringens</i> subsp. <i>astringens</i>	<i>Eucalyptus mimica</i> subsp. <i>continens</i>	<i>Eucalyptus sargentii</i> subsp. <i>sargentii</i>
<i>Eucalyptus capillosa</i>	<i>Eucalyptus mimica</i> subsp. <i>mimica</i>	<i>Eucalyptus singularis</i>
<i>Eucalyptus densa</i> subsp. <i>densa</i>	<i>Eucalyptus myriadena</i>	<i>Eucalyptus spathulata</i> subsp. <i>spathulata</i>
<i>Eucalyptus extensa</i>	<i>Eucalyptus occidentalis</i>	<i>Eucalyptus spathulata</i> subsp. <i>salina</i>
<i>Eucalyptus falcata</i>	<i>Eucalyptus ornata</i>	<i>Eucalyptus urna</i>
<i>Eucalyptus gardneri</i> subsp. <i>gardneri</i>	<i>Eucalyptus recta</i>	<i>Eucalyptus wandoo</i> subsp. <i>pulverea</i>
<i>Eucalyptus goniocarpa</i>	<i>Eucalyptus rudis</i> subsp. <i>rudis</i>	<i>Eucalyptus wandoo</i> subsp. <i>wandoo</i>
<i>Eucalyptus kondininensis</i>		

The following characteristics indicate that the TEC is unlikely to be present (i.e. contraindications):

- the dominant Eucalypts have a mallee form
- the dominant canopy tree is not a Eucalypt
- tree canopy is less than 10% cover
- the woodland is in an adjacent bioregion
- the woodland is on a granite outcrop or rocky rise, although woodlands at the base of outcrops may be included
- the woodland is a small, fragmented patch^A (including isolated paddock trees, narrow stands including windbreaks or shelterbelts)
- narrow roadside (or other) remnants <5 m wide including where the tree canopy is <10% cover or the understorey has lost considerable elements of its native structure or diversity.

Table 24: Minimum condition for patches of Eucalypt Woodlands of the Western Australian Wheatbelt TEC

Cover of exotic plants (weeds) AND	Mature trees (1) AND	Minimum patch size (non-roadside patches) (2) AND	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, available in DPaW 2015).			
Exotic plant species account for 0 to 30% of total vegetation cover in the understory layers (i.e. below the tree canopy).	Mature trees may be present or absent.	2 ha or more	5 m or more
Category B: Patches likely to correspond to a condition of Good (Keighery 1994) or a Medium-High RCV (RCC 2014, available in DPaW 2015) AND retains important habitat features.			
Exotic plant species account for more than 30, to 50% of total vegetation cover in the understory layers (i.e. below the tree canopy).	Mature trees are present with at least 5 trees per 0.5 ha.	2 ha or more	5 m or more
Category C: Patches likely to correspond to a condition of Good (Keighery 1994) or a Medium-High RCV (RCC 2014, available in DPaW 2015).			
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 ha or more	5 m 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, available in DPaW 2015) 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 ha or more	5 m or more

(1) Mature trees have a minimum diameter at breast height (DBH) of 30 cm.

(2) Minimum patch size thresholds apply to native vegetation remnants, not to road verges where width thresholds apply.

(3) This applies only to narrow roadside remnants and recognises their importance as wildlife corridors, habitats for threatened species or other reasons as defined by Jackson (2002) and RCC (DPaW 2015). The defined width is that of the native understorey component, not tree canopy width. Breaks of over 50 m or separation by a sealed road define separate 'patches'.

^A A 'patch' refers to an area of the same broad vegetation within a larger remnant. Remnants may have several patches of the same vegetation that are not joined i.e. they are separated by vegetation of a different type or significant roads.

For this TEC a 'patch' refers to a combined Eucalypt woodland regardless of characteristic species, and may include more than one woodland vegetation type the extents of which are combined (when adjacent) to form the extents used to calculate if the appropriate thresholds are met.

Assessment differences between the TEC and PEC

Although the EPBC-listed TEC and Western Australian-listed PEC are largely considered to be synonymous the requirements for inclusion in the TEC (see above) are more rigorous than for the PEC (Species and Communities Program DBCA 2020). The following are notable differences with regards to inclusion:

- the PEC is also defined by tree-form Eucalypts, however, there is no list of definitive species and other *Eucalyptus* species can be included if they meet the required form e.g. *Eucalyptus loxophleba* subsp. *supralaevis* can be definitive of the PEC if it is tree-form
- there are no extents applicable to the PEC so smaller areas can meet the requirements for inclusion in the PEC that are too small to be representative of the TEC. This includes road reserve width.

Both require vegetation to be in Good or better condition for inclusion.

APPENDIX THREE DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

Table 25: Flora database search results, habitat and likelihood assessment

Blue shading indicates high likelihood

DBCA*	PMST**	EPBC status	Species name	Habitat from: <i>FloraBase</i> (WAH 1998-2020) (for <i>Acacia</i> species) <i>World Wide Wattle</i> (WAH et al. 2019)	Flowering	Likelihood of occurrence	
						Desktop	Post-survey
			Threatened Flora***				
TP		VU	<i>Acacia depressa</i>	Lateritic gravelly soils. Low hills & rises.	Dec or Jan	Unlikely	Highly unlikely
WAH		X	<i>Acacia prismifolia</i> (presumed) extinct	Shrub, 0.15 – 0.5 m high. Rocky slopes.		Unlikely	Highly unlikely
TP/WAH	Known	EN	<i>Adenanthos pungens</i> subsp. <i>effusus</i>	White siliceous sand.	Aug – Nov	Unlikely	Highly unlikely
TP/WAH	Known	VU	<i>Adenanthos pungens</i> subsp. <i>pungens</i>	White / grey or pink sand and rocky soils (gypsum). Sand dunes and hillsides.	Aug – Nov	Unlikely	Highly unlikely
TP/WAH	Likely	EN	<i>Banksia oligantha</i>	Yellow or yellow brown sand.	Oct – Nov	Unlikely	Highly unlikely
	May	EN	<i>Banksia pseudoplumosa</i>	Gravelly soils.	Nov – Dec	Highly unlikely	Highly unlikely
TP/WAH	Known	CR	<i>Caladenia luteola</i>	Lateritic sand.	Sep	Unlikely	Highly unlikely
WAH		CR	<i>Calectasia cyanea</i>	White, grey or yellow sand, gravel.	Jun – Oct	Unlikely	Highly unlikely
TP		EN	<i>Conostylis drummondii</i>	White, grey or yellow sand, gravel.	Oct – Nov	Unlikely	Highly unlikely
WAH		CR	<i>Conostylis setigera</i> subsp. <i>dasys</i>	Sand, gravel, laterite.	Oct – Nov	Unlikely	Highly unlikely
TP		VU	<i>Darwinia meeboldii</i>	Peaty soils over quartzite on hill slopes.	Aug – Nov	Unlikely	Highly unlikely
WAH		VU	<i>Diuris drummondii</i>	Low-lying depressions or swamps.	Nov – Dec or Jan	Unlikely	Unlikely
TP/WAH		VU	<i>Eleocharis keigheryi</i>	Clay, sandy loam. Emergent in freshwater, creeks, claypans.	Aug – Nov	Unlikely	Unlikely
TP/WAH		VU	<i>Gastrolobium lehmannii</i>	Red clay, laterite on low hilltops of breakaway.	Sep – Oct	Unlikely	Highly unlikely
TP		CR	<i>Hemigenia ramosissima</i>	Lateritic soils, clay. Granite outcrops.	Nov to Dec or Jan	Unlikely	Highly unlikely
TP/WAH		EN	<i>Jacksonia velveta</i>	Brown gravelly loam, dry grey sand, ironstone. Slight hillslopes, ridges.	Dec	Possible	Highly unlikely
	Likely	EN	<i>Roycea pycnophylloides</i>	Sandy soils, clay. Saline flats.	Sep	Unlikely	Highly unlikely
WAH		VU	<i>Tribonanthes purpurea</i>	Seasonally wet soils in moss swards & herbfields among granite rocks.	Aug	Unlikely	Unlikely
TP/WAH		EN	<i>Verticordia fimbrialepis</i> subsp. <i>fimbrialepis</i>	Gravelly sandy or clayey soils. Flats, road verges.	Oct to Dec or Jan	Unlikely	Unlikely
			DBCA Priority 1				
TP			<i>Acacia microneura</i>	Sand to loam over granite. Heathlands and disturbed road verges.	Aug – Oct	Unlikely	Unlikely
TP/WAH			<i>Acacia trinalis</i>	Brown sand, clay loam. Salt lakes & flats, swampy areas.	Sep	Unlikely	Unlikely
WAH			<i>Baeckea</i> sp. Youndegin Hill (A.S. George 15772)	Yellow sand, red sandy clay, laterite. Along road verges.	Sep – Oct	Unlikely	Unlikely
TP/WAH			<i>Banksia lepidorhiza</i>	Gravelly sand or sandy loam.	Oct – Nov	Unlikely	Unlikely
TP/WAH			<i>Eucalyptus calyerup</i>	Pale brown sandy loam, granite. Around rock outcrops.	Oct – Dec	Unlikely	Unlikely

DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

DBCA*	PMST**	EPBC status	Species name	Habitat from: <i>FloraBase</i> (WAH 1998-2020) (for <i>Acacia</i> species) <i>World Wide Wattle</i> (WAH et al. 2019)	Flowering	Likelihood of occurrence	
						Desktop	Post-survey
WAH			<i>Hemigenia rigida</i>	Sandy soils, lateritic gravelly soils. Hillslopes, granite outcrops, flats, ironstone ridges.	Aug to Dec or Jan	Unlikely	Unlikely
WAH			<i>Hydrocotyle muriculata</i>	Margins of salt lakes and flats.	Sep	Unlikely	Highly unlikely
TP/WAH			<i>Jacksonia debilis</i>	White or grey clayey sand.	Sep – Oct	Unlikely	Unlikely
WAH			<i>Leucopogon ozothamnoides</i>	Gravelly soils, sandy clay loam.	Oct	Unlikely	Unlikely
WAH			<i>Pterostylis hadra</i>	No information available		Unlikely	Highly unlikely
WAH			<i>Tetratheca applanata</i>	Sand, brown gravelly clay, well-drained gravelly sandy clay. Well-exposed flat plain, slopes.		Unlikely	Unlikely
TP/WAH			<i>Thomasia dielsii</i>	Sand or gravelly loam. Flats.	Nov – Dec	Unlikely	Unlikely
WAH			<i>Thomasia julietiae</i>	Brown sandy loam over laterite. Upland on a slope.		Unlikely	Highly unlikely
			DBCA Priority 2				
TP			<i>Acacia sclerophylla</i> var. <i>pilosa</i>	Sandy loam or clay	Aug – Oct	Unlikely	Highly unlikely
TP			<i>Adenanthos linearis</i>	Sandy soils, gravel.	Jan – Mar	Unlikely	Highly unlikely
WAH			<i>Andersonia carinata</i>	White sand, gravelly lateritic soils. Plains.	Aug – Oct	Unlikely	Highly unlikely
TP/WAH			<i>Banksia acanthopoda</i>	Gravelly clay-sand over laterite. Low ridges.	Jul – Oct	Unlikely	Highly unlikely
TP			<i>Banksia drummondii</i> subsp. <i>macrorufa</i>	Sand & gravel.	Jan	Unlikely	Highly unlikely
TP/WAH			<i>Banksia rufistylis</i>	Gravelly loam or sand.	Jul – Aug	Unlikely	Highly unlikely
TP/WAH			<i>Chordifex ornatus</i>	Grey-white sand, sandy clay. Sandy rises.	Oct	Unlikely	Unlikely
TP			<i>Conostylis seorsiflora</i> subsp. Nyabing (A. Coates s.n. 2/10/1988)	Lateritic soils.		Unlikely	Highly unlikely
TP/WAH			<i>Daviesia mesophylla</i>	Peaty or white sand. Rocky slopes.	Jan – May	Unlikely	Highly unlikely
TP/WAH			<i>Melaleuca ordinifolia</i>	Sandy loam or clay.	Aug – Oct	Possible	Highly unlikely
WAH			<i>Persoonia hakeiformis</i>	Gravelly clay loam or sand over laterite. Lateritic ridges.	Oct to Dec or Jan	Highly unlikely	Highly unlikely
WAH			<i>Stylidium coatesianum</i>	Lateritic soils. Upper slopes, breakaways. Open woodland, mallee shrubland.	Sep – Nov	Unlikely	Highly unlikely
WAH			<i>Stylidium diuroides</i> subsp. <i>nanum</i>	Wet sand.	Oct	Unlikely	Highly unlikely
WAH			<i>Stylidium tylosum</i>	Sandy clay. Hillslopes, or adjacent to granite outcrops. Open woodland. Shrubland.	Oct – Nov	Unlikely	Unlikely
WAH			<i>Styphelia</i> sp. Wannadoo (F. & J. Hort 2441)	Grey brown sandy loam. (Winter damp) flat.		Unlikely	Unlikely
WAH			<i>Synaphea</i> sp. Woodanilling (G.J. Keighery & N. Gibson 4614)	White-grey sand, red-brown gravelly loam. Gentle slopes.	Sep – Nov	Unlikely	Unlikely
WAH			<i>Thomasia brachystachys</i>	Littered, organic brown soil.		Highly unlikely	Highly unlikely
TP/WAH			<i>Thysanotus acerosifolius</i>	Sand, laterite, clayey loam. Sandplains.	Dec	Unlikely	Unlikely
WAH			<i>Thysanotus brevifolius</i>	Gravel, sandy loam.	Nov	Unlikely	Unlikely
WAH			<i>Thysanotus</i> sp. Badgingarra (E.A. Griffin 2511)	Grey sand with lateritic gravel.	Dec	Unlikely	Highly unlikely
			DBCA Priority 3				
WAH			<i>Acacia errabunda</i>	Clay, loam, gravelly loam, sand. Undulating plains, clay flats.		Unlikely	Unlikely

DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

DBCA*	PMST**	EPBC status	Species name	Habitat from: <i>FloraBase</i> (WAH 1998-2020) (for <i>Acacia</i> species) <i>World Wide Wattle</i> (WAH et al. 2019)	Flowering	Likelihood of occurrence	
						Desktop	Post-survey
WAH			<i>Acacia mutabilis</i> subsp. <i>rhynchophylla</i>	Gravelly sand, sandy loam or loam.		Unlikely	Unlikely
WAH			<i>Acacia parkerae</i>	Red / brown clay loam over dolerite. Slopes and undulating plains, including road verges.		Unlikely	Unlikely
TP/WWAHAH			<i>Banksia meganotia</i>	Sand, sandy loam or clay loam over laterite.	Oct	Unlikely	Unlikely
WAH			<i>Banksia subpinnatifida</i> var. <i>imberbis</i>	Laterite.	Sep – Oct	Unlikely	Highly unlikely
WAH			<i>Beaufortia burbridgeae</i>	Yellow brown sandy loam over laterite. Flats and mid/upper slopes.		Unlikely	Highly unlikely
WAH			<i>Bossiaea spinosa</i>	Gravelly, sandy soils. Undulating plains.	Aug – Oct	Unlikely	Highly unlikely
WAH			<i>Brachyloma mogin</i>	Grey clayey sand. Swamp flat.	Jun	Unlikely	Unlikely
WAH			<i>Calectasia obtusa</i>	Sand, clay loam, gravel, laterite. Flats.	Aug – Sep	Unlikely	Unlikely
WAH			<i>Calytrix pulchella</i>	Grey or white sand over laterite. Ridges, flats.	Aug – Nov	Unlikely	Highly unlikely
WAH			<i>Eutaxia nanophylla</i>	Clayey sand, red clay, stony clayey loam. Low-lying areas, damp flats, slopes, undulating plains, low stony ridges.	Oct – Nov	Unlikely	Unlikely
TP/WAH			<i>Grevillea newbeyi</i>	Clay loam, sandy gravelly soils.	Jan or Jun or Sep to Nov	Unlikely	Unlikely
WAH			<i>Hakea brachyptera</i>	Sand, loam, clay.		Unlikely	Unlikely
WAH			<i>Hakea oldfieldii</i>	Red clay or sand over laterite. Seasonally wet flats.	Aug – Oct	Unlikely	Highly unlikely
WAH			<i>Lasiopetalum fitzgibbonii</i>	Sandy, clay loam, lateritic soils. Undulating plains, hills.	Sep – Nov	Unlikely	Unlikely
WAH			<i>Laxmannia grandiflora</i> subsp. <i>stirlingensis</i>	White sand, sandy clay. Winter-wet locations.	Sep – Nov	Unlikely	Unlikely
WAH			<i>Leucopogon florulentus</i>	White / grey or yellow sand, sandy clay, gravelly lateritic soils. Sandplains, gentle slopes.	Jun – Nov	Unlikely	Unlikely
TP/WAH			<i>Melaleuca micromera</i>	Gravelly sandy loam or clay.	Sep – Oct	Unlikely	Unlikely
WAH			<i>Melaleuca polycephala</i>	Sandy clay, clay.	Sep – Nov	Unlikely	Unlikely
TP/WAH			<i>Melaleuca pritzelii</i>	Sand or clayey soils. Swampy areas.	Aug – Oct or Dec	Unlikely	Unlikely
WAH			<i>Pterostylis echinulata</i>	Gravelly brown sandy clay. On flat ridges slopes, including road verges. In winter-wet flats.		Unlikely	Unlikely
WAH			<i>Sphaerolobium validum</i>	White-grey sand, red-brown clayey sand, laterite gravel and quartz pebbles. Gently undulating areas, flats, roadsides.	Sep	Unlikely	Unlikely
WAH			<i>Stylidium exappendiculatum</i>	Winter-wet flats; grey / brown sandy loam.		Unlikely	Unlikely
WAH			<i>Stylidium lepidum</i>	Gravelly sand or loam, clay. Winter-wet depressions.	Oct – Nov	Unlikely	Unlikely
WAH			<i>Stylidium pseudohirsutum</i>	Sandy clay. Lower hillslopes and depressions. Mallee, Acacia or myrtaceous shrub.	Nov – Dec	Unlikely	Unlikely
WAH			<i>Stylidium rhipidium</i>	Sandy soils. Wet creek flats, swamps, granite outcrops.	Oct – Nov	Unlikely	Unlikely
WAH			<i>Stylidium roseonanum</i>	Swamps.	Oct	Unlikely	Highly unlikely
WAH			<i>Synaphea drummondii</i>	Sand over laterite	Jul – Sep	Possible	Highly unlikely
WAH			<i>Thysanotus cymosus</i>	Clay, granite or lateritic sand.	Sep – Oct	Unlikely	Unlikely
WAH			<i>Thysanotus gageoides</i>	Sand, clay, granite, sandstone, laterite.	Oct – Nov	Unlikely	Unlikely
TP/WAH			<i>Verticordia brevifolia</i> subsp. <i>brevifolia</i>	Gravelly loam & clay. Road verges.	Oct – Nov	Unlikely	Unlikely

DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

DBCA*	PMST**	EPBC status	Species name	Habitat from: <i>FloraBase</i> (WAH 1998-2020) (for <i>Acacia</i> species) <i>World Wide Wattle</i> (WAH et al. 2019)	Flowering	Likelihood of occurrence	
						Desktop	Post-survey
WAH			<i>Verticordia coronata</i>	Clay loam, clay and sandy loam, sometimes gravelly.	Sep – Dec	Unlikely	Unlikely
TP/WAH			<i>Verticordia huegelii</i> var. <i>tridens</i>	Sand or gravelly loam. Winter-wet areas, low hills.	Sep – Nov	Unlikely	Unlikely
			DBCA Priority 4				
WAH			<i>Acacia declinata</i>	Loamy or sandy clay.	Aug – Sep	Unlikely	Unlikely
WAH			<i>Acacia grisea</i>	Lateritic gravelly loamy soils. Undulating plains, slopes.	Jun – Aug	Unlikely	Unlikely
WAH			<i>Acacia imparilis</i>	Rocky hills.	Oct	Highly unlikely	Highly unlikely
WAH			<i>Adenanthos x cunninghamii</i>	Coastal dunes & sandplains.	Mar or Sep – Oct	Unlikely	Highly unlikely
WAH			<i>Banksia acuminata</i>	Gravelly soils.	Oct	Unlikely	Highly unlikely
WAH			<i>Banksia cynaroides</i>	Gravelly sand or clay loam over laterite	Aug or Dec or Jan – Feb	Unlikely	Highly unlikely
TP			<i>Banksia parva</i>	White / grey sand, clay loam. On flats and lower slopes.		Unlikely	Unlikely
WAH			<i>Banksia porrecta</i>	White / grey sand, sandy loam.	Jul – Aug	Unlikely	Unlikely
WAH			<i>Banksia seneciifolia</i>	Sandy loam, sand. Rocky hillslopes.	Jun or Aug	Highly unlikely	Unlikely
TP			<i>Bossiaea divaricata</i>	Sandy lateritic soils.		Unlikely	Highly unlikely
TP/WAH			<i>Caladenia integra</i>	Clayey loam. Granite outcrops, rocky slopes.		Unlikely	Highly unlikely
WAH			<i>Caladenia x triangularis</i>	Loam. Undulating plain.		Unlikely	Unlikely
TP/WAH			<i>Calothamnus microcarpus</i>	Lateritic clay, sandy soils.	Sep to Nov	Unlikely	Unlikely
WAH			<i>Eucalyptus erectifolia</i>	White sand, sandy loam & gravel. Hillslopes and sandplains.	Mar – May	Unlikely	Unlikely
TP/WAH			<i>Eucalyptus loxophleba x wandoo</i>	Sandy clay or loam.		Unlikely	Unlikely
WAH			<i>Frankenia glomerata</i>	White sand.	Nov	Unlikely	Highly unlikely
WAH			<i>Gahnia sclerioides</i>	Loam, sandy soils. Moist shaded situations.		Unlikely	Unlikely
WAH			<i>Gastrolobium ovalifolium</i>	Sandy clay. Gravelly hills.	Aug – Sep	Unlikely	Unlikely
WAH			<i>Hemigenia platyphylla</i>	Sand & loamy soils. Granite rocks, slopes.	Sep – Nov	Possible	Highly unlikely
WAH			<i>Jacksonia calycina</i>	Gravelly sandy or clayey soils. Sandplains, low rises, hillslopes.	Sep – Nov	Possible	Highly unlikely
TP			<i>Leucopogon lasiophyllus</i>	Sandy loam over quartzite, sand over pink sandstone, stony soils. Hillsides.	Aug – Oct	Unlikely	Highly unlikely
TP/WAH			<i>Orthrosanthus muelleri</i>	Sand.	Sep – Oct	Unlikely	Highly unlikely
WAH			<i>Regelia cymbifolia</i>	White, grey or yellow sand. Undulating plains.	Aug – Nov	Unlikely	Highly unlikely
WAH			<i>Schoenus natans</i>	Winter-wet depressions.	Oct	Unlikely	Unlikely
WAH			<i>Tecticornia uniflora</i>	Clay, sandy clay, loam. Salt lakes and creeks.		Unlikely	Highly unlikely
WAH			<i>Xanthorrhoea brevistyla</i>	Sand, clay, laterite.	Oct – Dec	Unlikely	Unlikely

* WAH = herbarium record (vouchered specimen)

TP = Threatened and Priority Flora Report Form record; may be unconfirmed i.e. without vouchered specimen

** PMST likelihood of occurrence or likelihood of habitat occurring

Table 26: Fauna database results and likelihood assessments

Blue shading indicates high likelihood; darker blue indicates species is known (recorded) from the survey area

Species (*)	Common name	Conservation status		Database			Likelihood of occurrence	
		EPBC Act	Western Australian	PMST**	DBCA	NatureMap	Desktop	Post-survey
Mammals								
<i>Bettongia penicillata ogilbyi</i>	Brush-tailed Bettong	EN	CR		X	X	Very low	Very low
<i>Dasyurus geoffroyi</i>	Western Quoll	VU	VU	May	X	X	Very low	Very low
<i>Isoodon fusciventer</i>	South-western Brown Bandicoot		P4		X		Very low	Very low
<i>Macrotis lagotis</i>	Bilby	VU	VU			X	Very low	Very low
<i>Myrmecobius fasciatus</i>	Numbat	EN	EN		X	X	Very low	Very low
<i>Notamacropus eugenii derbianus</i>	Tammar Wallaby		P4			X	Very low	Very low
<i>Notamacropus irma</i>	Western Brush Wallaby		P4			X	Very low	Very low
<i>Parantechinus apicalis</i>	Dibbler	EN	EN	May			Very low	Very low
<i>Phascogale calura</i>	Red-tailed Phascogale	VU	CD	Known	X	X	High	Low
<i>Phascogale tapoatafa wambenger</i>	South-western Brush-tailed Phascogale		CD		X	X	Very low	Very low
<i>Pseudomys occidentalis</i>	Western Mouse		P4		X	X	Very low	Very low
Birds								
<i>Actitis hypoleucos</i>	Common Sandpiper	MI	MI	Known	X	X	Very low	Very low
<i>Apus pacificus</i>	Fork-tailed Swift	MI	MI	Likely			Very low	Very low
<i>Cacatua pastinator pastinator</i>	Muir's Corella		CD		X	X	Medium	Medium
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	MI	MI	Likely	X	X	Very low	Very low
<i>Calidris canutus rogersi</i>	Red Knot		MI & VU		X	X	Medium	Very low
<i>Calidris ferruginea</i>	Curlew Sandpiper	MI & CR	CR	May	X	X	Very low	Very low
<i>Calidris melanotos</i>	Pectoral Sandpiper	MI	MI	May	X	X	Very low	Very low
<i>Calidris ruficollis</i>	Red-necked Stint	MI	MI		X	X	Very low	Very low
<i>Calidris subminuta</i>	Long-toed Stint	MI	MI		X	X	Very low	Very low
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black Cockatoo	VU	VU	Known	X	X	Low	Very low
<i>Calyptorhynchus baudinii</i>	Baudin's Black Cockatoo	EN	EN		X	X	Very low	Very low
<i>Calyptorhynchus latirostris</i>	Carnaby's Black Cockatoo	EN	EN	Known	X	X	Very low	Very low

DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

Species (*)	Common name	Conservation status		Database			Likelihood of occurrence	
		EPBC Act	Western Australian	PMST**	DBCA	NatureMap	Desktop	Post-survey
<i>Falco hypoleucos</i>	Grey Falcon		VU	Likely			Very low	Very low
<i>Falco peregrinus</i>	Peregrine Falcon		OS		X	X	Very low	Low
<i>Leipoa ocellata</i>	Malleefowl	VU	VU	Likely	X	X	Medium	Medium
<i>Motacilla cinerea</i>	Grey Wagtail	MI	MI	May			Very low	Very low
<i>Ninox connivens connivens</i>	Barking Owl (south-west population)		P2		X		Very low	Very low
<i>Numenius madagascariensis</i>	Eastern Curlew	MI & CR	CR	May			Very low	Very low
<i>Oxyura australis</i>	Blue-billed Duck		P4		X	X	Very low	Very low
<i>Pezoporus occidentalis</i>	Night Parrot	EN	CR	May			Very low	Very low
<i>Platycerus icterotis xanthogenys</i>	Western Rosella (inland)		P4		X	X	Low	Recorded
<i>Plegadis falcinellus</i>	Glossy Ibis		MI		X	X	Very low	Very low
<i>Psophodes nigrogularis oregon</i>	Western Whipbird		P4		X	X	Very low	Very low
<i>Thinornis cucullatus</i>	Hooded Plover		P4	Known	X	X	Very low	Very low
<i>Tringa glareola</i>	Wood Sandpiper	MI	MI		X	X	Very low	Very low
<i>Tringa nebularia</i>	Common Greenshank	MI	MI	Likely	X	X	Very low	Very low
Invertebrates								
<i>Bothriembryon bradshawi</i>	Bradshaw's bothriembryontid land snail		P3		X	X	Very low	Very low

* introduced

** PMST likelihood of occurrence or likelihood of habitat occurring

APPENDIX FOUR FIELD SURVEY RESULTS

Table 27: Flora inventory (site x species)

Family	Species	Naturalised	Cons. status	BHQ01	BHQ02	BHQ03	BHQ04	BHQ05	BHQ06	BHQ07	BHQ08	BHQ09	BHR01	BHR02	BHR03	BHR04	BHR05	BHR06	Opp
Aizoaceae	<i>Disphyma crassifolium</i>													X					
	<i>Mesembryanthemum nodiflorum</i>	*																	X
Amaranthaceae	<i>Ptilotus drummondii</i>										X								
	<i>Ptilotus manglesii</i>			X															
Apiaceae	<i>Daucus glochidiatus</i>											X							
Araliaceae	<i>Trachymene cyanopetala</i>									X									
	<i>Trachymene pilosa</i>																		X
Asparagaceae	<i>Asparagus asparagoides</i>	*																	X
	<i>Laxmannia squarrosa</i>									X									
	<i>Lomandra effusa</i>											X							
	<i>Lomandra nigricans</i>			X	X	X	X			X	X			X	X		X	X	
	<i>Thysanotus manglesianus</i>									X									
	<i>Thysanotus patersonii</i>			X	X		X												
Asteraceae	<i>Arctotheca calendula</i>	*						X											
	<i>Blennospora drummondii</i>									X									
	<i>Brachyscome iberidifolia</i>																		X
	<i>Chrysocephalum apiculatum</i>										X								
	<i>Cotula bipinnata</i>	*																	X
	<i>Craspedia variabilis</i>																		X
	<i>Helichrysum leucopsidium</i>										X								
	<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>										X				X				
	<i>Hypochaeris glabra</i>	*					X	X	X									X	
	<i>Olearia incondita</i>				X						X								
	<i>Podolepis aristata</i> subsp. <i>aristata</i>																		X

Family	Species	Naturalised	Cons. status	BHQ01	BHQ02	BHQ03	BHQ04	BHQ05	BHQ06	BHQ07	BHQ08	BHQ09	BHR01	BHR02	BHR03	BHR04	BHR05	BHR06	Opp
	<i>Pseudognaphalium luteoalbum</i>																		X
	<i>Rhodanthe laevis</i>									X									
	<i>Rhodanthe manglesii</i>									X									
	<i>Sonchus oleraceus</i>	*						X				X							
	<i>Trichocline spathulata</i>											X							
	<i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	*		X	X		X	X	X	X	X								
	<i>Vellereophyton dealbatum</i>	*																	X
	<i>Waitzia acuminata</i>									X									
Boraginaceae	<i>Heliotropium curassavicum</i>																		X
Boryaceae	<i>Borya sphaerocephala</i>									X		X							
Brassicaceae	<i>Brassica tournefortii</i>	*																	X
	<i>Raphanus raphanistrum</i>	*																	X
Campanulaceae	<i>Isotoma hypocrateriformis</i>			X						X									
	<i>Isotoma scapigera</i>																		X
	<i>Monopsis debilis</i>	*																	X
	<i>Wahlenbergia capensis</i>	*			X				X										
	<i>Wahlenbergia gracilentia</i>											X							
Caryophyllaceae	<i>Spergularia marina</i>														X				
Casuarinaceae	<i>Allocasuarina huegeliana</i>			X	X	X	X		X	X									
	<i>Casuarina obesa</i>																		X
Celastraceae	<i>Stackhousia pubescens</i>																		X
Chenopodiaceae	<i>Atriplex semibaccata</i>																		X
	<i>Maireana brevifolia</i>																		X
	<i>Rhagodia preissii</i> subsp. <i>preissii</i>																		X
Convolvulaceae	<i>Convolvulus remotus</i>																		X
Crassulaceae	<i>Crassula colorata</i>																		X
Cyperaceae	<i>Chorizandra enodis</i>																		X

Family	Species	Naturalised	Cons. status	BHQ01	BHQ02	BHQ03	BHQ04	BHQ05	BHQ06	BHQ07	BHQ08	BHQ09	BHR01	BHR02	BHR03	BHR04	BHR05	BHR06	Opp
	<i>Eleocharis acuta</i>																		X
	<i>Ficinia nodosa</i>																	X	
	<i>Gahnia ancistrophylla</i>										X	X							
	<i>Lepidosperma</i> aff. <i>tuberculatum</i>									X									
	<i>Lepidosperma tuberculatum</i>									X									
Droseraceae	<i>Drosera glanduligera</i>																		X
	<i>Drosera subhirtella</i>									X		X							
Elaeocarpaceae	<i>Tetratheca virgata</i>																		X
Ericaceae	<i>Styphelia compacta</i>									X	X								
Fabaceae	<i>Acacia acuminata</i>															X			
	<i>Acacia chamaeleon</i>																		X
	<i>Acacia erinacea</i>			X							X		X		X				
	<i>Acacia ferocior</i>																		X
	<i>Acacia glaucoptera</i>																		X
	<i>Acacia iteaphylla</i>	*																	X
	<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>			X							X								
	<i>Acacia lullfitziorum</i>																		X
	<i>Acacia microbotrya</i>																		X
	<i>Acacia myrtifolia</i>									X									
	<i>Acacia pulviniformis</i>																		X
	<i>Acacia pycnantha</i>	*		X	X	X		X	X	X	X						X		
	<i>Acacia redolens</i>																		X
	<i>Bossiaea eriocarpa</i>			X						X	X								
	<i>Daviesia hakeoides</i>									X		X							
	<i>Daviesia incrassata</i>																		X
	<i>Daviesia purpurascens</i>																		X
	<i>Eutaxia empetrifolia</i>																		

Family	Species	Naturalised	Cons. status	BHQ01	BHQ02	BHQ03	BHQ04	BHQ05	BHQ06	BHQ07	BHQ08	BHQ09	BHR01	BHR02	BHR03	BHR04	BHR05	BHR06	Opp
	<i>Gastrolobium bilobum</i>																		X
	<i>Gastrolobium celsianum</i>																		X
	<i>Gastrolobium parviflorum</i>			X	X	X			X										
	<i>Gastrolobium parvifolium</i>							X											
	<i>Gompholobium marginatum</i>									X									
	<i>Jacksonia sternbergiana</i>				X		X		X										
	<i>Kennedia prostrata</i>			X	X			X											
	<i>Lotus subbiflorus</i>	*										X							
	<i>Mirbelia ovata</i>										X								
	<i>Templetonia sulcata</i>																		X
	<i>Trifolium arvense</i>	*										X							
	<i>Trifolium campestre</i>	*						X											
	<i>Trifolium glomeratum</i>	*																	X
Gentianaceae	<i>Centaurium tenuiflorum</i>	*																	X
Geraniaceae	<i>Erodium botrys</i>	*																	X
	<i>Pelargonium havlasae</i>																		X
Goodeniaceae	<i>Coopermookia strophilata</i>										X								
	<i>Dampiera juncea</i>																		X
	<i>Dampiera sacculata</i>									X									
	<i>Goodenia glareicola</i>																		X
	<i>Goodenia pulchella</i> subsp. <i>Wheatbelt</i> (L.W. Sage & F. Hort 795)			X			X												
	<i>Lechenaultia formosa</i>																		X
Haemodoraceae	<i>Conostylis seorsiflora</i> subsp. <i>seorsiflora</i>						X												
	<i>Haemodorum spicatum</i>																		X
	<i>Tribonanthes</i> sp.											X							
Haloragaceae	<i>Glischrocaryon</i> sp.									X									
Hemerocallidaceae	<i>Caesia micrantha</i>											X							X

Family	Species	Naturalised	Cons. status	BHQ01	BHQ02	BHQ03	BHQ04	BHQ05	BHQ06	BHQ07	BHQ08	BHQ09	BHR01	BHR02	BHR03	BHR04	BHR05	BHR06	Opp
	<i>Caesia</i> sp.						X												
	<i>Dianella brevicaulis</i>				X	X	X	X	X				X	X			X		
	<i>Tricoryne elatior</i>			X					X										
Iridaceae	<i>Babiana angustifolia</i>	*																	X
	<i>Freesia alba</i> x <i>leichtlinii</i>	*																	X
	<i>Moraea setifolia</i>	*		X			X	X			X	X							
	<i>Patersonia occidentalis</i>																		X
	<i>Romulea rosea</i>	*		X	X	X		X			X	X				X	X		
	<i>Watsonia meriana</i>	*																	X
Juncaceae	<i>Juncus capitatus</i>	*																	X
	<i>Juncus pallidus</i>							X										X	
Lamiaceae	<i>Salvia verbenaca</i>	*																	X
Linaceae	<i>Linum marginale</i>					X													
Loranthaceae	<i>Amyema miquelii</i>																		X
Montiaceae	<i>Calandrinia calyptrata</i>																		X
Myrtaceae	<i>Calytrix leschenaultii</i>																		X
	<i>Calytrix tetragona</i>						X	X		X		X					X		
	<i>Chamelaucium ciliatum</i>																		X
	<i>Eucalyptus astringens</i>												X	X	X				
	<i>Eucalyptus kondininensis</i>																		X
	<i>Eucalyptus salubris</i>																		X
	<i>Eucalyptus wandoo</i>				X	X	X				X	X	X						
	<i>Melaleuca acuminata</i>																		X
	<i>Melaleuca hamata</i>																		X
Orchidaceae	<i>Caladenia longicauda</i>										X								
	<i>Disa bracteata</i>	*		X		X	X	X		X		X				X			
	<i>Diuris corymbosa</i>									X									

Family	Species	Naturalised	Cons. status	BHQ01	BHQ02	BHQ03	BHQ04	BHQ05	BHQ06	BHQ07	BHQ08	BHQ09	BHR01	BHR02	BHR03	BHR04	BHR05	BHR06	Opp
	<i>Diuris</i> sp.																		X
	<i>Pterostylis sanguinea</i>																		X
	<i>Pterostylis</i> sp.																		X
	<i>Thelymitra</i> sp.																		X
Oxalidaceae	<i>Oxalis exilis</i>			X		X					X	X					X		
	<i>Oxalis pes-caprae</i>	*														X			
	<i>Oxalis</i> sp.								X										
Pittosporaceae	<i>Billardiera fusiformis</i>														X				
	<i>Billardiera venusta</i>																		X
Plantaginaceae	<i>Plantago coronopus</i> subsp. <i>commutata</i>	*																	X
Poaceae	<i>Aira cupaniana</i>	*		X				X		X									
	<i>Amphipogon turbinatus</i>									X									
	<i>Aristida contorta</i>																		X
	<i>Austrostipa campylachne</i>					X													
	<i>Austrostipa elegantissima</i>				X			X	X		X	X					X		
	<i>Austrostipa hemipogon</i>																		X
	<i>Austrostipa mollis</i>				X										X				
	<i>Austrostipa tenuifolia</i>																		X
	<i>Avena barbata</i>	*		X		X		X			X	X	X				X	X	
	<i>Briza maxima</i>	*		X	X	X	X	X	X	X	X	X							
	<i>Briza minor</i>	*						X				X							
	<i>Bromus diandrus</i>	*				X										X			
	<i>Bromus hordeaceus</i>	*																	X
	<i>Bromus rubens</i>	*										X							
	<i>Cenchrus clandestinus</i>	*																	X
	<i>Chloris truncata</i>							X											
	<i>Cynodon dactylon</i>	*														X	X	X	

Family	Species	Naturalised	Cons. status	BHQ01	BHQ02	BHQ03	BHQ04	BHQ05	BHQ06	BHQ07	BHQ08	BHQ09	BHR01	BHR02	BHR03	BHR04	BHR05	BHR06	Opp
	<i>Ehrharta calycina</i>	*			X	X	X		X					X		X	X		
	<i>Ehrharta longiflora</i>	*		X		X	X	X					X	X	X	X			
	<i>Eragrostis curvula</i>	*					X	X											
	<i>Hordeum leporinum</i>	*												X					
	<i>Lachnagrostis aemula</i>																		X
	<i>Lolium rigidum</i>	*				X		X	X						X			X	
	<i>Melinis repens</i>	*																	X
	<i>Neurachne alopecuroidea</i>			X	X	X	X		X	X	X	X					X		
	<i>Phalaris</i> sp.	*																X	X
	<i>Poa drummondiana</i>																		X
	<i>Rytidosperma setaceum</i>			X		X					X	X					X	X	
	<i>Triticum aestivum</i>	*																	X
	<i>Vulpia myuros</i>	*		X						X									
Polygalaceae	<i>Comesperma integerrimum</i>																		X
	<i>Comesperma polygaloides</i>										X								
Primulaceae	<i>Lysimachia arvensis</i>	*		X	X		X					X							
Proteaceae	<i>Hakea corymbosa</i>																		X
	<i>Hakea lissocarpa</i>									X	X								
	<i>Hakea preissii</i>																		X
	<i>Hakea varia</i>							X				X						X	
Restionaceae	<i>Desmocladius asper</i>				X					X	X	X							
	<i>Desmocladius fasciculatus</i>																		X
	<i>Desmocladius lateriflorus</i>									X									
Rubiaceae	<i>Galium murale</i>	*																	X
	<i>Opercularia vaginata</i>									X									
Santalaceae	<i>Choretrum glomeratum</i>																		X
	<i>Santalum spicatum</i>						X									X			

Family	Species	Naturalised	Cons. status	BHQ01	BHQ02	BHQ03	BHQ04	BHQ05	BHQ06	BHQ07	BHQ08	BHQ09	BHR01	BHR02	BHR03	BHR04	BHR05	BHR06	Opp
Sapindaceae	<i>Dodonaea humifusa</i>																		X
Scrophulariaceae	<i>Zaluzianskya divaricata</i>	*																	X
Stylidiaceae	<i>Stylidium leptophyllum</i>																		X
	<i>Stylidium piliferum</i>									X									
Xanthorrhoeaceae	<i>Chamaescilla corymbosa</i>									X									

BHQ01

Staff	LJA	Date	26/10/2020	Season	A
Revisit					
Type	Q 10 m x 10 m				
Location	CBH Broomehill				
MGA Zone		mE	mN	Lat.	Long.
Habitat	Mid-Slope				
Aspect	N	Slope	Very Gentle		
Soil Type	Grey sandy clay				
Rock Type	Laterite				
Loose Rock	<2 % cover;	6-20 mm in size	Litter	80 % cover ;	<1 cm in depth
Bare ground	10 % cover	Weeds	40 % cover		
Vegetation	U+ ^ <i>Allocasuarina huegeliana</i> ,^ <i>Acacia pycnantha</i> \^tree\6\i;M ^ <i>Gastrolobium parviflorum</i> \^shrub\3\i;G ^^ <i>Romulea rosea</i> , <i>Neurachne alopecuroidea</i> , <i>Avena barbata</i> \^forb,tussock grass,other grass\1\c				
Veg. Condition	Good				
Disturbance	Ripped for telephone cable; may have been seeded				
Fire Age	>10 years				
Notes	Trees in 20 m x 20 m (5 m around 10 m x 10 m)				



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia erinacea</i>		0.2	2	
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>		0.5	2	
* <i>Acacia pycnantha</i>		6	2	
* <i>Aira cupaniana</i>		0.1	<1	

<i>Allocasuarina huegeliana</i>	10	20
* <i>Avena barbata</i>	0.5	5
<i>Bossiaea eriocarpa</i>	0.4	<1
* <i>Briza maxima</i>	0.1	<1
* <i>Disa bracteata</i>	0.2	<1
* <i>Ehrharta longiflora</i>	0.4	2
<i>Gastrolobium parviflorum</i>	1.5	8
<i>Goodenia pulchella</i> subsp. <i>Wheatbelt</i> (L.W. Sage & F. Hort 795)	0.1	1
<i>Isotoma hypocrateriformis</i>	0.2	<1
<i>Kennedia prostrata</i>	0.1	<1
<i>Lomandra nigricans</i>	0.2	<1
* <i>Lysimachia arvensis</i>	0.1	<1
* <i>Moraea setifolia</i>	0.1	<1
<i>Neurachne alopecuroidea</i>	0.2	10
<i>Oxalis exilis</i>	0.1	2
<i>Ptilotus manglesii</i>	0.1	<1
* <i>Romulea rosea</i>	0.2	20
<i>Rytidosperma setaceum</i>	0.4	<1
<i>Thysanotus patersonii</i>	0.4	<1
<i>Tricoryne elatior</i>	0.3	<1
* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.3	<1
* <i>Vulpia myuros</i>	0.1	<1

BHQ02

Staff LJA **Date** 27/10/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location CBH Broomehill
MGA Zone 50 **560147 mE** **6252843 mN** **Lat.** -33.8630 **Long.** 117.6503
Habitat Mid-Slope
Aspect W **Slope** Very Gentle
Soil Type Grey clay
Rock Type Laterite
Loose Rock <2 % cover; 6-20 mm in size **Litter** 20 % cover ; <1 cm in depth
Bare ground 15 % cover **Weeds** 25 % cover
Vegetation U+ ^*Eucalyptus wandoo*,^*Allocasuarina huegeliana*^tree\6\r;M ^*Jacksonia sternbergiana*,
^*Gastrolobium parviflorum*^shrub\4\i;G ^^*Ehrharta calycina*,*Austrostipa elegantissima*,*Neurachne alopecuroidea*^tussock grass\1\c
Veg. Condition Good
Disturbance Road verge soil mounds
Fire Age >10 years
Notes Trees in 20 m x 20 m (5 m around 10 m x 10 m)



Species	WA Cons.	Height (m)	Cover (%)	Count
* <i>Acacia pycnantha</i>		0.5	<1	
<i>Allocasuarina huegeliana</i>		5	2	
<i>Austrostipa elegantissima</i>		0.5	8	
<i>Austrostipa mollis</i>		0.3	<1	

<i>*Briza maxima</i>	0.2	<1
<i>Desmocladius asper</i>	0.2	<1
<i>Dianella brevicaulis</i>	0.5	<1
<i>*Ehrharta calycina</i>	0.5	10
<i>Eucalyptus wandoo</i>	5	5
<i>Gastrolobium parviflorum</i>	1.2	8
<i>Jacksonia sternbergiana</i>	3	8
<i>Kennedia prostrata</i>	0.1	<1
<i>Lomandra nigricans</i>	0.4	<1
<i>*Lysimachia arvensis</i>	0.3	<1
<i>Neurachne alopecuroidea</i>	0.2	5
<i>*Romulea rosea</i>	0.2	8
<i>Thysanotus patersonii</i>	0.4	<1
<i>*Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.2	2
<i>*Wahlenbergia capensis</i>	0.3	<1

BHQ03

Staff LJA **Date** 27/10/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location CBH Broomehill
MGA Zone 50 **560148 mE** **6253007 mN** **Lat.** -33.8615 **Long.** 117.6503
Habitat Mid-Slope
Aspect W **Slope** Very Gentle
Soil Type Grey clay
Rock Type None
Loose Rock 0 % cover **Litter** 90 % cover ; <1 cm in depth
Bare ground 0 % cover **Weeds** 40 % cover
Vegetation U+ ^*Eucalyptus wandoo*,^*Allocasuarina huegeliana*^tree\7\i;M ^*Gastrolobium parviflorum*^shrub\3\bi;G ^^*Romulea rosea*,*Briza maxima*,*Avena barbata*^forb,other grass\1\c
Veg. Condition Degraded
Disturbance Road verge
Fire Age >10 years
Notes Trees in 20 m x 20 m (5 m around 10 m x 10 m)



Species	WA Cons.	Height (m)	Cover (%)	Count
* <i>Acacia pycnantha</i>		0.4	<1	
<i>Allocasuarina huegeliana</i>		6	5	
<i>Austrostipa campylachne</i>		0.3	<1	
* <i>Avena barbata</i>		0.4	4	
* <i>Briza maxima</i>		0.2	5	

<i>*Bromus diandrus</i>	0.1	<1
<i>Dianella brevicaulis</i>	0.3	<1
<i>*Disa bracteata</i>	0.1	<1
<i>*Ehrharta calycina</i>	0.4	<1
<i>*Ehrharta longiflora</i>	0.3	<1
<i>Eucalyptus wandoo</i>	10	10
<i>Gastrolobium parviflorum</i>	1	1
<i>Linum marginale</i>	0.3	<1
<i>*Lolium rigidum</i>	0.2	<1
<i>Lomandra nigricans</i>	0.3	1
<i>Neurachne alopecuroidea</i>	0.2	<1
<i>Olearia incondita</i>	0.3	<1
<i>Oxalis exilis</i>	0.1	<1
<i>*Romulea rosea</i>	0.1	20
<i>Rytidosperma setaceum</i>	0.2	1

BHQ04

Staff LJA **Date** 27/10/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location CBH Broomehill
MGA Zone 50 **560128 mE** **6253168 mN** **Lat.** -33.8601 **Long.** 117.6500
Habitat Mid-Slope
Aspect **Slope** N/A
Soil Type Grey sandy clay
Rock Type None
Loose Rock 0 % cover **Litter** 100 % cover ; 2-3 cm in depth
Bare ground 0 % cover **Weeds** 25 % cover
Vegetation U+ ^*Allocasuarina huegeliana*,^*Eucalyptus wandoo*\^tree\7\c;M ^*Jacksonia sternbergiana*\^shrub\4\;G ^^*Eragrostis curvula*,*Calytrix tetragona*,*Ehrharta calycina*\^tussock grass,shrub\2\c
Veg. Condition Degraded
Disturbance Road reserve, underground cable route, human litter
Fire Age >10 years
Notes Trees in 20 m x 20 m (5 m around 10 m x 10 m)



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Allocasuarina huegeliana</i>		12	50	
* <i>Briza maxima</i>		0.2	1	
<i>Caesia</i> sp.		0.3	<1	
<i>Calytrix tetragona</i>		0.7	6	

<i>Conostylis seorsiflora</i> subsp. <i>seorsiflora</i>	0.1	<1
<i>Dianella brevicaulis</i>	0.2	<1
* <i>Disa bracteata</i>	0.1	<1
* <i>Ehrharta calycina</i>	0.5	5
* <i>Ehrharta longiflora</i>	0.3	<1
* <i>Eragrostis curvula</i>	0.7	10
<i>Eucalyptus wandoo</i>	12	5
<i>Goodenia pulchella</i> subsp. <i>Wheatbelt</i> (L.W. Sage & F. Hort 795)	0.1	<1
* <i>Hypochaeris glabra</i>	0.2	<1
<i>Jacksonia sternbergiana</i>	4	5
<i>Lomandra nigricans</i>		<1
* <i>Lysimachia arvensis</i>	0.1	<1
* <i>Moraea setifolia</i>	0.3	2
<i>Neurachne alopecuroidea</i>	0.2	2
<i>Santalum spicatum</i>	0.6	<1
<i>Thysanotus patersonii</i>	1	<1
* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.2	<1

BHQ05

Staff LJA **Date** 27/10/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location CBH Broomehill
MGA Zone 50 **560067 mE** **6253584 mN** **Lat.** -33.8563 **Long.** 117.6493
Habitat Lower-Slope
Aspect N/A **Slope** N/A
Soil Type Grey clay
Rock Type None
Loose Rock 0 % cover **Litter** 90 % cover ; 1 cm in depth
Bare ground 2 % cover **Weeds** 95 % cover
Vegetation M+ ^Hakea varia\^shrub\4r;G ^^Eragrostis curvula,Calytrix tetragona,Briza minor\^tussock grass, shrub,other grass\2\c
Veg. Condition Completely Degraded
Disturbance Road verged, underground cable
Fire Age >10 years

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
*Acacia pycnantha		2	<1	
*Aira cupaniana		0.1	<1	
*Arctotheca calendula		0.2	<1	
Austrostipa elegantissima		0.8	1	
*Avena barbata		1.2	<1	

<i>*Briza maxima</i>	0.3	2
<i>*Briza minor</i>	0.2	5
<i>Calytrix tetragona</i>	0.8	5
<i>Chloris truncata</i>	0.2	<1
<i>Dianella brevicaulis</i>	0.5	<1
<i>*Disa bracteata</i>	0.1	<1
<i>*Ehrharta longiflora</i>	0.2	2
<i>*Eragrostis curvula</i>	1	90
<i>Gastrolobium parvifolium</i>	0.2	<1
<i>Hakea varia</i>	2.5	8
<i>*Hypochaeris glabra</i>	0.1	<1
<i>Juncus pallidus</i>	1	<1
<i>Kennedia prostrata</i>	0.1	<1
<i>*Lolium rigidum</i>	0.3	<1
<i>*Moraea setifolia</i>	0.2	<1
<i>*Romulea rosea</i>	0.2	2
<i>*Sonchus oleraceus</i>	0.3	<1
<i>*Trifolium campestre</i>	0.1	<1
<i>*Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.2	2

BHQ06

Staff LJA **Date** 28/10/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location CBH Broomehill
MGA Zone 50 **560145 mE** **6253264 mN** **Lat.** -33.8592 **Long.** 117.6502
Habitat Lower-Slope
Aspect N/A **Slope** N/A
Soil Type Grey sand
Rock Type None
Loose Rock 0 % cover **Litter** 80 % cover ; 1-2 cm in depth
Bare ground 0 % cover **Weeds** 30 % cover
Vegetation U+ ^*Jacksonia sternbergiana*,^*Acacia pycnantha*\^tree\6\i;M ^*Gastrolobium parviflorum*\^shrub\3\i;G ^^*Dianella brevicaulis*,*Neurachne alopecuroides*,*Ehrharta calycina*\^forb,tussock grass\1\c
Veg. Condition Good
Disturbance Underground cable
Fire Age >10 years
Notes Trees in 20 m x 20 m (5 m around 10 m x 10 m)



Species	WA Cons.	Height (m)	Cover (%)	Count
* <i>Acacia pycnantha</i>		3	2	
<i>Allocasuarina huegeliana</i>		3	<1	
<i>Austrostipa elegantissima</i>		0.5	5	
* <i>Briza maxima</i>		0.2	2	
<i>Dianella brevicaulis</i>		0.5	10	

<i>*Ehrharta calycina</i>	0.5	6
<i>Gastrolobium parviflorum</i>	1.5	3
<i>*Hypochaeris glabra</i>	0.2	<1
<i>Jacksonia sternbergiana</i>	5	15
<i>*Lolium rigidum</i>	0.3	2
<i>Neurachne alopecuroidea</i>	0.2	10
<i>Oxalis</i> sp.	0.1	<1
<i>Tricoryne elatior</i>	0.4	5
<i>*Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.2	<1
<i>*Wahlenbergia capensis</i>	0.3	<1

BHQ07

Staff LJA **Date** 30/10/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location CBH Broomehill
MGA Zone 50 **560164 mE** **6254165 mN** **Lat.** -33.8511 **Long.** 117.6504
Habitat Lower-Slope
Aspect W **Slope** Very Gentle
Soil Type Grey sandy clay
Rock Type None
Loose Rock 0 % cover; 2-6 mm in size **Litter** 95 % cover ; <1 cm in depth
Bare ground 5 % cover **Weeds** 5 % cover
Vegetation U+ ^*Allocasuarina huegeliana*^tree\6\i;M ^*Calytrix tetragona*^shrub\3\r;G ^^*Hakea lissocarpha*,
Acacia marginata,*Borya sphaerocephala*^shrub,forb\1\c
Veg. Condition Very Good
Disturbance Little
Fire Age >10 years
Notes Trees in 20 m x 20 m (5 m around 10 m x 10 m)



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia marginata</i>		0.4	5	
* <i>Acacia pycnantha</i>		0.5	<1	
* <i>Aira cupaniana</i>		0.1	<1	
<i>Allocasuarina huegeliana</i>		10	25	
<i>Amphipogon turbinatus</i>		0.1	<1	

<i>Blennospora drummondii</i>		<1
<i>Borya sphaerocephala</i>	0.1	5
<i>Bossiaea eriocarpa</i>	0.2	<1
* <i>Briza maxima</i>	0.3	<1
<i>Calytrix tetragona</i>	1.2	7
<i>Chamaescilla corymbosa</i>	0.1	<1
<i>Chamelaucium ciliatum</i>	0.1	<1
<i>Dampiera sacculata</i>	0.3	5
<i>Daviesia hakeoides</i>	0.3	3
<i>Desmocladus asper</i>	0.1	3
<i>Desmocladus lateriflorus</i>	0.1	5
* <i>Disa bracteata</i>	0.3	<1
<i>Diuris corymbosa</i>	0.3	<1
<i>Drosera subhirtella</i>	0.3	<1
<i>Glischrocaryon</i> sp.	0.1	<1
<i>Gompholobium marginatum</i>	0.1	<1
<i>Hakea lissocarpha</i>	0.4	5
<i>Isotoma hypocrateriformis</i>	0.2	<1
<i>Laxmannia squarrosa</i>	0.1	<1
<i>Lepidosperma tuberculatum</i>	0.3	2
<i>Lepidosperma tuberculatum</i>		<1
<i>Lomandra nigricans</i>	0.3	<1
<i>Neurachne alopecuroidea</i>	0.2	4
<i>Opercularia vaginata</i>	0.2	<1
<i>Rhodanthe laevis</i>	0.1	<1
<i>Rhodanthe manglesii</i>	0.1	<1
<i>Stylidium piliferum</i>	0.3	<1
<i>Styphelia compacta</i>	0.1	1
<i>Thysanotus manglesianus</i>	0.2	<1
<i>Trachymene cyanopetala</i>	0.1	<1
* <i>Ursinia anthemoides</i>	0.2	5
* <i>Vulpia myuros</i>	0.3	<1
<i>Waitzia acuminata</i>	0.2	<1

BHQ08

Staff LJA **Date** 30/10/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location CBH Broomehill
MGA Zone 50 **560101 mE** **6254102 mN** **Lat.** -33.8517 **Long.** 117.6497
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Grey clay
Rock Type None
Loose Rock 0 % cover **Litter** 75 % cover ; <1 cm in depth
Bare ground 15 % cover **Weeds** 5 % cover
Vegetation U+ ^*Eucalyptus wandoo*^tree\7\i;G ^^*Gahnia ancistrophylla*,*Acacia erinacea*,*Neurachne alopecuroidea*^sedge,shrub,tussock grass\1\c
Veg. Condition Very Good
Disturbance None obvious
Fire Age >10 years
Notes Trees in 20 m x 20 m (5 m around 10 m x 10 m)



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia erinacea</i>		0.1	8	
<i>Acacia lasiocarpa</i> var. <i>sedifolia</i>		0.3	2	
* <i>Acacia pycnantha</i>		2	<1	
<i>Austrostipa elegantissima</i>		0.3	<1	
* <i>Avena barbata</i>		0.4	1	

<i>Bossiaea eriocarpa</i>	0.1	<1
* <i>Briza maxima</i>	0,2	<1
<i>Caladenia longicauda</i>	0,1	<1
<i>Chrysocephalum apiculatum</i>		<1
<i>Comesperma polygaloides</i>	0.2	<1
<i>Cooperhooikia strophilata</i>	0.2	<1
<i>Desmocladius asper</i>	0.1	2
<i>Eucalyptus wandoo</i>	13	15
<i>Gahnia ancistrophylla</i>	0.3	10
<i>Hakea lissocarpha</i>	0.3	2
<i>Helichrysum leucopsidium</i>	0.2	<1
<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>	0.1	<1
<i>Lomandra nigricans</i>	0.2	2
<i>Mirbelia ovata</i>	0.3	1
* <i>Moraea setifolia</i>	0.2	<1
<i>Neurachne alopecuroides</i>	0.2	5
<i>Olearia incondita</i>	0.2	<1
<i>Oxalis exilis</i>	0.1	1
<i>Oxalis exilis</i>	0.1	<1
<i>Ptilotus drummondii</i>	0.1	<1
* <i>Romulea rosea</i>	0.1	<1
<i>Rytidosperma setaceum</i>	0.3	<1
<i>Styphelia compacta</i>	0.1	<1
* <i>Ursinia anthemoides</i> subsp. <i>anthemoides</i>	0.2	<1

BHQ09

Staff LJA **Date** 30/10/2020 **Season** A
Revisit
Type Q 10 m x 10 m
Location CBH Broomehill
MGA Zone 50 **560069 mE** **6254224 mN** **Lat.** -33.8506 **Long.** 117.6493
Habitat Flat
Aspect N/A **Slope** N/A
Soil Type Grey clay
Rock Type None
Loose Rock 0 % cover **Litter** 40 % cover ; <1 cm in depth
Bare ground 0 % cover **Weeds** 50 % cover
Vegetation U ^*Eucalyptus wandoo*^tree\7\r;M+ ^*Hakea varia*,^*Calytrix tetragona*^shrub\4\i;G
^*Desmocladius asper*,*Borya sphaerocephala*,*Moraea setifolia*^rush,forb\1\c
Veg. Condition Good
Disturbance None obvious
Fire Age >10 years
Notes Trees in 20 m x 20 m (5 m around 10 m x 10 m)



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Austrostipa elegantissima</i>		0.2	<1	
* <i>Avena barbata</i>		0.3	<1	
<i>Borya sphaerocephala</i>		0.1	15	
* <i>Briza maxima</i>		0.2	2	
* <i>Briza minor</i>		0.1	<1	

<i>*Bromus rubens</i>	0.2	<1
<i>Caesia micrantha</i>	0.2	<1
<i>Calytrix tetragona</i>	1.2	5
<i>Daucus glochidiatus</i>	0.2	<1
<i>Daviesia hakeoides</i>	0.3	<1
<i>Desmocladius asper</i>	0.2	25
<i>*Disa bracteata</i>	0.2	<1
<i>Drosera subhirtella</i>	0.3	<1
<i>Eucalyptus wandoo</i>	15	2
<i>Gahnia ancistrophylla</i>	0.2	2
<i>Hakea varia</i>	3	20
<i>Lomandra effusa</i>	0.3	<1
<i>*Lotus subbiflorus</i>	0.1	<1
<i>*Lysimachia arvensis</i>	0.1	<1
<i>*Moraëa setifolia</i>	0.2	5
<i>Neurachne alopecuroidea</i>	0.2	4
<i>Oxalis exilis</i>	0.1	<1
<i>*Romulea rosea</i>	0.2	2
<i>Rytidosperma setaceum</i>	0.2	<1
<i>*Sonchus oleraceus</i>	0.6	<1
<i>Tribonanthes</i> sp.	0.2	<1
<i>Trichocline spathulata</i>	0.3	<1
<i>*Trifolium arvense</i>	0.1	<1
<i>Wahlenbergia gracilentia</i>	0.3	<1

BHR01

Staff LJA **Date** 27/10/2020 **Season** A
Revisit
Type R 10 m x 10 m
Location CBH Broomehill
MGA Zone 50 **560014 mE** **6251898 mN** **Lat.** -33.8715 **Long.** 117.6489
Habitat Mid-Slope
Aspect E **Slope** Very Gentle
Soil Type Clay
Rock Type None
Loose Rock 0 % cover **Litter** 100 % cover
Bare ground 0 % cover **Weeds** 10 % cover
Vegetation U+ ^*Eucalyptus astringens*,^*Eucalyptus wandoo*\^tree\7\c;G ^*Avena barbata*,^*Acacia erinacea*\^other grass,shrub\1\r
Veg. Condition Completely Degraded
Disturbance Road verge
Fire Age
Notes Trees in 20 m x 20 m (5 m around 10 m x 10 m)



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia erinacea</i>		0.2	3	
* <i>Avena barbata</i>		0.3	10	
<i>Dianella brevicaulis</i>		0.3	<1	
* <i>Ehrharta longiflora</i>		0.2	<1	
<i>Eucalyptus astringens</i>		12	25	

Eucalyptus wandoo

8

10

BHR02

Staff LJA **Date** 27/10/2020 **Season** A
Revisit
Type R 10 m x 10 m
Location CBH Broomehill
MGA Zone 50 **560111 mE** **6253287 mN** **Lat.** -33.8590 **Long.** 117.6498
Habitat Mid-Slope
Aspect N/A **Slope** N/A
Soil Type Grey clay
Rock Type None
Loose Rock 0 % cover **Litter** 100 % cover
Bare ground 0 % cover **Weeds** 10 % cover
Vegetation U+ ^*Eucalyptus astringens*\^tree\7c;G ^*Ehrharta longiflora*,^*Ehrharta calycina*\^other grass, tussock grass\1r
Veg. Condition Completely Degraded
Disturbance Road reserve
Fire Age
Notes Trees in 20 m x 20 m (5 m around 10 m x 10 m)



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Dianella brevicaulis</i>		0.3	<1	
<i>Disphyma crassifolium</i>		0.1	<1	
* <i>Ehrharta calycina</i>		0.4	3	
* <i>Ehrharta longiflora</i>		0.3	5	
<i>Eucalyptus astringens</i>		12	30	

<i>*Hordeum leporinum</i>	0.1	<1
<i>Lomandra nigricans</i>	0.2	<1

BHR03

Staff LJA **Date** 28/10/2020 **Season** A
Revisit
Type R 10 m x 10 m
Location CBH Broomehill
MGA Zone 50 **559712 mE** **6254459 mN** **Lat.** -33.8485 **Long.** 117.6455
Habitat Lower-Slope
Aspect N/A **Slope** N/A
Soil Type Grey brown sandy clay
Rock Type None
Loose Rock 0 % cover **Litter** 100 % cover
Bare ground 0 % cover **Weeds** 10 % cover
Vegetation U+ ^*Eucalyptus astringens*\^tree\7i;G ^^*Ehrharta longiflora*,*Acacia erinacea*,*Hyalosperma glutinosum* subsp. *glutinosum*\^other grass,shrub,forb\1\r
Veg. Condition Degraded
Disturbance Logged
Fire Age
Notes Trees in 20 m x 20 m (5 m around 10 m x 10 m)



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia erinacea</i>		0.1	1	
<i>Austrostipa mollis</i>		0.3	<1	
<i>Billardiera fusiformis</i>		0.5	<1	
* <i>Ehrharta longiflora</i>		0.3	1	
<i>Eucalyptus astringens</i>		12	35	

<i>Hyalosperma glutinosum</i> subsp. <i>glutinosum</i>	0,2	<1
* <i>Lolium rigidum</i>	0.2	<1
<i>Lomandra nigricans</i>	0.3	<1
<i>Spergularia marina</i>	0.3	<1

BHR04

Staff LJA **Date** 28/10/2020 **Season** A
Revisit
Type R 10 m x 10 m
Location CBH Broomehill
MGA Zone 50 **560206 mE** **6253220 mN** **Lat.** -33.8596 **Long.** 117.6509
Habitat Lower-Slope
Aspect N/A **Slope** N/A
Soil Type Grey sand
Rock Type None
Loose Rock 0 % cover **Litter** 50 % cover
Bare ground 0 % cover **Weeds** 95 % cover
Vegetation M+ ^*Acacia acuminata*,^*Santalum spicatum*\^shrub\4i;G ^^*Ehrharta longiflora*,*Romulea rosea*,
Oxalis pes-caprae\^other grass,forb\1\ld
Veg. Condition Completely Degraded
Disturbance Former paddock now mounded and planted
Fire Age

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
<i>Acacia acuminata</i>		3.5	15	
* <i>Bromus diandrus</i>		0.4	5	
* <i>Cynodon dactylon</i>		0.1	5	
* <i>Disa bracteata</i>		0.3	1	
* <i>Ehrharta calycina</i>		0.5	10	

<i>*Ehrharta longiflora</i>	0.5	40
<i>*Oxalis pes-caprae</i>	0.1	20
<i>*Romulea rosea</i>	0.2	25
<i>Santalum spicatum</i>	3	2

BHR05

Staff LJA **Date** 28/10/2020 **Season** A
Revisit
Type R 10 m x 10 m
Location CBH Broomehill
MGA Zone 50 **560128 mE** **6253441 mN** **Lat.** -33.8576 **Long.** 117.6500
Habitat Lower-Slope
Aspect N/A **Slope** N/A
Soil Type Grey sandy clay
Rock Type None
Loose Rock 0 % cover **Litter** 80 % cover
Bare ground 2 % cover **Weeds** 70 % cover
Vegetation M+ ^Acacia pycnantha^shrub\4\i;G ^^Romulea rosea,Neurachne alopecuroidea,Ehrharta calycina^forb,tussock grass\1\c
Veg. Condition Completely Degraded
Disturbance Ripped and planted
Fire Age
Notes Not native vegetation



Species	WA Cons.	Height (m)	Cover (%)	Count
*Acacia pycnantha		4	10	
Austrostipa elegantissima		0.5	2	
*Avena barbata		0.5	<1	
Calytrix tetragona		0.6	1	
*Cynodon dactylon		0.1	<1	

<i>Dianella brevicaulis</i>	0.2	<1
<i>*Ehrharta calycina</i>	0.5	5
<i>Lomandra nigricans</i>	0.2	<1
<i>Neurachne alopecuroidea</i>	0.1	15
<i>Oxalis exilis</i>	0.1	<1
<i>*Romulea rosea</i>	0.1	50
<i>Rytidosperma setaceum</i>	0.3	<1

BHR06

Staff LJA **Date** 28/10/2020 **Season** A
Revisit
Type R 10 m x 10 m
Location CBH Broomehill
MGA Zone 50 **560104 mE** **6253564 mN** **Lat.** -33.8565 **Long.** 117.6498
Habitat Lower-Slope
Aspect N/A **Slope** N/A
Soil Type Grey clay
Rock Type None
Loose Rock 0 % cover **Litter** 20 % cover
Bare ground 20 % cover **Weeds** 60 % cover
Vegetation M+ ^*Hakea varia*^shrub\4\;G ^^*Cynodon dactylon*,*Avena barbata*,*Lolium rigidum*^tussock grass, other grass\1\c
Veg. Condition Completely Degraded
Disturbance Underground cable
Fire Age

Notes



Species	WA Cons.	Height (m)	Cover (%)	Count
* <i>Avena barbata</i>		0.5	10	
<i>Chorizandra enodis</i>		0.5	<1	
* <i>Cynodon dactylon</i>		0.1	40	
<i>Hakea varia</i>		4	30	
* <i>Hypochaeris glabra</i>		0.2	<1	

<i>Juncus pallidus</i>	0.5	<1
* <i>Lolium rigidum</i>	0.3	2
<i>Lomandra nigricans</i>	0.3	<1
* <i>Phalaris</i> sp.	0.2	<1
<i>Rytidosperma setaceum</i>	0.3	1

APPENDIX SIX

BLACK COCKATOO HABITAT TREES

Table 28: Black Cockatoo habitat tree locations

Tree Species	Tree No	Lat	Long
<i>Eucalyptus wandoo</i>	T395	-33.851	117.6485
<i>Eucalyptus wandoo</i>	T394	-33.851	117.6485
<i>Eucalyptus wandoo</i>	T393	-33.8512	117.6486
<i>Eucalyptus wandoo</i>	T392	-33.8511	117.6488
<i>Eucalyptus wandoo</i>	T391	-33.8513	117.6485
<i>Eucalyptus wandoo</i>	T390	-33.8513	117.6486
<i>Eucalyptus wandoo</i>	T389	-33.8513	117.6488
<i>Eucalyptus wandoo</i>	T388	-33.8515	117.6489
<i>Eucalyptus wandoo</i>	T387	-33.8515	117.6488
<i>Eucalyptus wandoo</i>	T386	-33.8514	117.6487
<i>Eucalyptus wandoo</i>	T385	-33.8515	117.6487
<i>Eucalyptus wandoo</i>	T384	-33.8516	117.6486
<i>Eucalyptus wandoo</i>	T384	-33.8516	117.6486
<i>Eucalyptus wandoo</i>	T383	-33.8515	117.6486
<i>Eucalyptus wandoo</i>	T382	-33.8515	117.6485
<i>Eucalyptus wandoo</i>	T381	-33.8515	117.6485
<i>Eucalyptus wandoo</i>	T380	-33.8517	117.6486
<i>Eucalyptus wandoo</i>	T379	-33.8517	117.6486
<i>Eucalyptus wandoo</i>	T378	-33.8518	117.6487
<i>Eucalyptus wandoo</i>	T377	-33.8517	117.6489
<i>Eucalyptus wandoo</i>	T376	-33.8517	117.649
<i>Eucalyptus wandoo</i>	T375	-33.8518	117.649
<i>Eucalyptus wandoo</i>	T374	-33.8518	117.6489
<i>Eucalyptus wandoo</i>	T373	-33.8518	117.6489
<i>Eucalyptus wandoo</i>	T372	-33.8519	117.6489
<i>Eucalyptus wandoo</i>	T371	-33.8519	117.649
<i>Eucalyptus wandoo</i>	T370	-33.852	117.6492
<i>Eucalyptus wandoo</i>	T369	-33.852	117.649
<i>Eucalyptus wandoo</i>	T368	-33.852	117.6489
<i>Eucalyptus wandoo</i>	T367	-33.8521	117.6489
<i>Eucalyptus wandoo</i>	T366	-33.8523	117.6489
<i>Eucalyptus wandoo</i>	T365	-33.8523	117.6491
<i>Eucalyptus wandoo</i>	T364	-33.8524	117.6491
<i>Eucalyptus wandoo</i>	T363	-33.8521	117.6492
<i>Eucalyptus wandoo</i>	T362	-33.852	117.6492
<i>Eucalyptus wandoo</i>	T361	-33.852	117.6493
<i>Eucalyptus wandoo</i>	T360	-33.8519	117.6492
<i>Eucalyptus wandoo</i>	T359	-33.8518	117.6493
<i>Eucalyptus wandoo</i>	T358	-33.8517	117.6492
<i>Eucalyptus wandoo</i>	T357	-33.8516	117.6491
<i>Eucalyptus wandoo</i>	T356	-33.8515	117.6494
<i>Eucalyptus wandoo</i>	T355	-33.8515	117.6495
<i>Eucalyptus wandoo</i>	T354	-33.8515	117.6495
<i>Eucalyptus wandoo</i>	T353	-33.8515	117.6495

Tree Species	Tree No	Lat	Long
<i>Eucalyptus wandoo</i>	T352	-33.8513	117.6496
<i>Eucalyptus wandoo</i>	T351	-33.8513	117.6496
<i>Eucalyptus wandoo</i>	T350	-33.8512	117.6497
<i>Eucalyptus wandoo</i>	T349	-33.8513	117.6491
<i>Eucalyptus wandoo</i>	T348	-33.8512	117.6493
<i>Eucalyptus wandoo</i>	T347	-33.8511	117.6492
<i>Eucalyptus wandoo</i>	T347	-33.851	117.6492
<i>Eucalyptus wandoo</i>	T346	-33.8509	117.6492
<i>Eucalyptus wandoo</i>	T345	-33.8509	117.6491
<i>Eucalyptus wandoo</i>	T344	-33.8506	117.6492
<i>Eucalyptus wandoo</i>	T342	-33.8505	117.6495
<i>Eucalyptus wandoo</i>	T341	-33.8503	117.6496
<i>Eucalyptus wandoo</i>	T340	-33.8503	117.6496
<i>Eucalyptus wandoo</i>	T339	-33.8502	117.6495
<i>Eucalyptus wandoo</i>	T338	-33.8502	117.6495
<i>Eucalyptus wandoo</i>	T337	-33.8502	117.6491
<i>Eucalyptus wandoo</i>	T336	-33.8503	117.6493
<i>Eucalyptus wandoo</i>	T335	-33.8504	117.6492
<i>Eucalyptus wandoo</i>	T334	-33.8504	117.6488
<i>Eucalyptus wandoo</i>	T333	-33.8504	117.6488
<i>Eucalyptus wandoo</i>	T332	-33.8505	117.6488
<i>Eucalyptus wandoo</i>	T331	-33.8505	117.6488
<i>Eucalyptus wandoo</i>	T329	-33.8506	117.649
<i>Eucalyptus wandoo</i>	T338	-33.8505	117.649
<i>Eucalyptus wandoo</i>	T327	-33.8509	117.6486
<i>Eucalyptus wandoo</i>	T326	-33.8508	117.6486
<i>Eucalyptus wandoo</i>	T325	-33.8507	117.6486
<i>Eucalyptus wandoo</i>	T322	-33.8507	117.6485
<i>Eucalyptus wandoo</i>	T324	-33.8507	117.6485
<i>Eucalyptus wandoo</i>	T323	-33.8507	117.6483
<i>Eucalyptus wandoo</i>	T321	-33.8506	117.6483
<i>Eucalyptus wandoo</i>	T320	-33.8507	117.6482
<i>Eucalyptus wandoo</i>	T319	-33.8485	117.6481
<i>Eucalyptus wandoo</i>	T318	-33.8526	117.6488
<i>Eucalyptus wandoo</i>	T317	-33.8525	117.6488
<i>Eucalyptus wandoo</i>	T316	-33.8525	117.6488
<i>Eucalyptus wandoo</i>	T315	-33.8524	117.6488
<i>Eucalyptus wandoo</i>	T314	-33.8524	117.6487
<i>Eucalyptus wandoo</i>	T313	-33.8523	117.6487
<i>Eucalyptus wandoo</i>	T312	-33.8521	117.6485
<i>Eucalyptus wandoo</i>	T311	-33.8521	117.6485
<i>Eucalyptus wandoo</i>	T310	-33.852	117.6486
<i>Eucalyptus wandoo</i>	T309	-33.852	117.6485
<i>Eucalyptus wandoo</i>	T308	-33.852	117.6485
<i>Eucalyptus wandoo</i>	T307	-33.8519	117.6484
<i>Eucalyptus wandoo</i>	T306	-33.8518	117.6485
<i>Eucalyptus wandoo</i>	T305	-33.8517	117.6484

Tree Species	Tree No	Lat	Long
<i>Eucalyptus wandoo</i>	T304	-33.8517	117.6483
<i>Eucalyptus wandoo</i>	T303	-33.8517	117.6483
<i>Eucalyptus wandoo</i>	T302	-33.8516	117.6482
<i>Eucalyptus wandoo</i>	T301	-33.8514	117.6483
<i>Eucalyptus wandoo</i>	T300	-33.8513	117.6482
<i>Eucalyptus wandoo</i>	T299	-33.8512	117.6481
<i>Eucalyptus wandoo</i>	T298	-33.8511	117.6481
<i>Eucalyptus wandoo</i>	T297	-33.851	117.6482
<i>Eucalyptus wandoo</i>	T296	-33.851	117.6483
<i>Eucalyptus wandoo</i>	T295	-33.8509	117.648
<i>Eucalyptus wandoo</i>	T294	-33.8509	117.648
<i>Eucalyptus wandoo</i>	T293	-33.8508	117.6481
<i>Eucalyptus wandoo</i>	T292	-33.8509	117.6481
<i>Eucalyptus wandoo</i>	T291	-33.8507	117.6477
<i>Eucalyptus wandoo</i>	T290	-33.8507	117.6476
<i>Eucalyptus wandoo</i>	T289	-33.8505	117.6476
<i>Eucalyptus wandoo</i>	T288	-33.8506	117.6476
<i>Eucalyptus wandoo</i>	T287	-33.8506	117.6478
<i>Eucalyptus wandoo</i>	T286	-33.8504	117.6479
<i>Eucalyptus wandoo</i>	T285	-33.8505	117.648
<i>Eucalyptus wandoo</i>	T284	-33.8504	117.648
<i>Eucalyptus wandoo</i>	T283	-33.8504	117.6482
<i>Eucalyptus wandoo</i>	T282	-33.8505	117.6484
<i>Eucalyptus wandoo</i>	T281	-33.8506	117.6485
<i>Eucalyptus wandoo</i>	T280	-33.8504	117.6485
<i>Eucalyptus wandoo</i>	T279	-33.8505	117.6484
<i>Eucalyptus wandoo</i>	T278	-33.8502	117.6485
<i>Eucalyptus wandoo</i>	T277	-33.8502	117.6485
<i>Eucalyptus wandoo</i>	T276	-33.8501	117.6487
<i>Eucalyptus wandoo</i>	T275	-33.8501	117.6488
<i>Eucalyptus wandoo</i>	T274	-33.85	117.6489
<i>Eucalyptus wandoo</i>	T273	-33.85	117.649
<i>Eucalyptus wandoo</i>	T272	-33.8499	117.6489
<i>Eucalyptus wandoo</i>	T269	-33.85	117.6493
<i>Eucalyptus wandoo</i>	T268	-33.85	117.6494
<i>Eucalyptus wandoo</i>	T267	-33.8502	117.6494
<i>Eucalyptus wandoo</i>	T266	-33.85	117.6496
<i>Eucalyptus wandoo</i>	T265	-33.8499	117.6495
<i>Eucalyptus wandoo</i>	T264	-33.8498	117.6492
<i>Eucalyptus wandoo</i>	T263	-33.8498	117.6492
<i>Eucalyptus wandoo</i>	T261	-33.8496	117.6493
<i>Eucalyptus wandoo</i>	T259	-33.8497	117.6492
<i>Eucalyptus wandoo</i>	T258	-33.8495	117.6491
<i>Eucalyptus wandoo</i>	T257	-33.8495	117.6492
<i>Eucalyptus wandoo</i>	T256	-33.8495	117.6492
<i>Eucalyptus wandoo</i>	T255	-33.8495	117.6491
<i>Eucalyptus wandoo</i>	T254	-33.8497	117.6488

Tree Species	Tree No	Lat	Long
<i>Eucalyptus wandoo</i>	T251	-33.85	117.6481
<i>Eucalyptus wandoo</i>	T250	-33.8502	117.6481
<i>Eucalyptus wandoo</i>	T249	-33.8504	117.6479
<i>Eucalyptus wandoo</i>	T248	-33.8503	117.6479
<i>Eucalyptus wandoo</i>	T247	-33.8504	117.6476
<i>Eucalyptus wandoo</i>	T246	-33.8504	117.6475
<i>Eucalyptus wandoo</i>	T245	-33.8524	117.6497
<i>Eucalyptus wandoo</i>	T244	-33.8524	117.6498
<i>Eucalyptus wandoo</i>	T243	-33.8525	117.6496
<i>Eucalyptus wandoo</i>	T239	-33.8526	117.6494
<i>Eucalyptus wandoo</i>	T238	-33.8526	117.6493
<i>Eucalyptus wandoo</i>	T237	-33.8524	117.6496
<i>Eucalyptus wandoo</i>	T236	-33.8522	117.6496
<i>Eucalyptus wandoo</i>	T235	-33.8523	117.6495
<i>Eucalyptus wandoo</i>	T234	-33.8524	117.6495
<i>Eucalyptus wandoo</i>	T233	-33.8523	117.6494
<i>Eucalyptus wandoo</i>	T232	-33.8524	117.6492
<i>Eucalyptus wandoo</i>	T231	-33.8525	117.6492
<i>Eucalyptus wandoo</i>	T230	-33.8525	117.6491
<i>Eucalyptus wandoo</i>	T229	-33.8526	117.6491
<i>Eucalyptus wandoo</i>	T228	-33.8526	117.6491
<i>Eucalyptus wandoo</i>	T227	-33.8526	117.649
<i>Eucalyptus wandoo</i>	T226	-33.8526	117.6489
<i>Eucalyptus wandoo</i>	T225	-33.8527	117.6489
<i>Eucalyptus wandoo</i>	T224	-33.8527	117.6489
<i>Eucalyptus wandoo</i>	T223	-33.8528	117.6489
<i>Eucalyptus wandoo</i>	T222	-33.8528	117.649
<i>Eucalyptus wandoo</i>	T221	-33.8527	117.6492
<i>Eucalyptus wandoo</i>	T220	-33.8528	117.6496
<i>Eucalyptus wandoo</i>	T219	-33.8527	117.6497
<i>Eucalyptus wandoo</i>	T218	-33.8527	117.6498
<i>Eucalyptus wandoo</i>	T217	-33.8527	117.6498
<i>Eucalyptus wandoo</i>	T216	-33.8527	117.65
<i>Eucalyptus wandoo</i>	T215	-33.8528	117.6499
<i>Eucalyptus wandoo</i>	T214	-33.8529	117.6499
<i>Eucalyptus wandoo</i>	T213	-33.853	117.6503
<i>Eucalyptus wandoo</i>	T212	-33.8529	117.6502
<i>Eucalyptus wandoo</i>	T211	-33.8526	117.6502
<i>Eucalyptus wandoo</i>	T210	-33.8528	117.6504
<i>Eucalyptus wandoo</i>	T208	-33.8528	117.6504
<i>Eucalyptus wandoo</i>	T207	-33.8529	117.6503
<i>Eucalyptus wandoo</i>	T206	-33.8527	117.6507
<i>Eucalyptus wandoo</i>	T205	-33.8528	117.6506
<i>Eucalyptus wandoo</i>	T204	-33.8528	117.6507
<i>Eucalyptus wandoo</i>	T203	-33.8528	117.6508
<i>Eucalyptus wandoo</i>	T202	-33.8528	117.6509
<i>Eucalyptus wandoo</i>	T200	-33.8526	117.651

Tree Species	Tree No	Lat	Long
<i>Eucalyptus wandoo</i>	T199	-33.8526	117.651
<i>Eucalyptus wandoo</i>	T198	-33.8526	117.6511
<i>Eucalyptus wandoo</i>	T197	-33.8525	117.6511
<i>Eucalyptus wandoo</i>	T196	-33.8523	117.6509
<i>Eucalyptus wandoo</i>	T195	-33.8524	117.6511
<i>Eucalyptus wandoo</i>	T194	-33.8525	117.6512
<i>Eucalyptus wandoo</i>	T193	-33.8526	117.6513
<i>Eucalyptus wandoo</i>	T192	-33.8527	117.6513
<i>Eucalyptus wandoo</i>	T191	-33.8529	117.6517
<i>Eucalyptus wandoo</i>	T190	-33.8529	117.6517
<i>Eucalyptus wandoo</i>	T189	-33.8528	117.6517
<i>Eucalyptus wandoo</i>	T188	-33.8527	117.6519
<i>Eucalyptus wandoo</i>	T187	-33.8528	117.6519
<i>Eucalyptus wandoo</i>	T186	-33.8528	117.6519
<i>Eucalyptus wandoo</i>	T185	-33.8529	117.6519
<i>Eucalyptus wandoo</i>	T184	-33.8529	117.6519
<i>Eucalyptus wandoo</i>	T184	-33.853	117.6519
<i>Eucalyptus wandoo</i>	T183	-33.8531	117.6519
<i>Eucalyptus wandoo</i>	T182	-33.853	117.652
<i>Eucalyptus wandoo</i>	T182	-33.853	117.6521
<i>Eucalyptus wandoo</i>	T181	-33.8531	117.6521
<i>Eucalyptus wandoo</i>	T180	-33.8531	117.652
<i>Eucalyptus wandoo</i>	T179	-33.8532	117.6519
<i>Eucalyptus wandoo</i>	T178	-33.8532	117.6518
<i>Eucalyptus wandoo</i>	T177	-33.8532	117.6518
<i>Eucalyptus wandoo</i>	T176	-33.8531	117.6516
<i>Eucalyptus wandoo</i>	T175	-33.8531	117.6515
<i>Eucalyptus wandoo</i>	T174	-33.8531	117.6514
<i>Eucalyptus wandoo</i>	T173	-33.8529	117.6514
<i>Eucalyptus wandoo</i>	T172	-33.8529	117.6514
<i>Eucalyptus wandoo</i>	T171	-33.8529	117.6513
<i>Eucalyptus wandoo</i>	T170	-33.8529	117.6513
<i>Eucalyptus wandoo</i>	T169	-33.8529	117.6507
<i>Eucalyptus wandoo</i>	T168	-33.853	117.6507
<i>Eucalyptus wandoo</i>	T167	-33.8532	117.651
<i>Eucalyptus wandoo</i>	T166	-33.8531	117.6509
<i>Eucalyptus wandoo</i>	T165	-33.8531	117.6508
<i>Eucalyptus wandoo</i>	T164	-33.8532	117.6507
<i>Eucalyptus wandoo</i>	T163	-33.8532	117.6505
<i>Eucalyptus wandoo</i>	T162	-33.8532	117.6506
<i>Eucalyptus wandoo</i>	T161	-33.8532	117.6505
<i>Eucalyptus wandoo</i>	T160	-33.8531	117.6504
<i>Eucalyptus wandoo</i>	T159	-33.8533	117.6504
<i>Eucalyptus wandoo</i>	T158	-33.8533	117.6503
<i>Eucalyptus wandoo</i>	T15	-33.8532	117.6503
<i>Eucalyptus wandoo</i>	T156	-33.8532	117.6502
<i>Eucalyptus wandoo</i>	T155	-33.8532	117.6502

Tree Species	Tree No	Lat	Long
<i>Eucalyptus wandoo</i>	T154	-33.8531	117.6502
<i>Eucalyptus wandoo</i>	T153	-33.8532	117.6501
<i>Eucalyptus wandoo</i>	T151	-33.8531	117.6501
<i>Eucalyptus wandoo</i>	T150	-33.8531	117.6501
<i>Eucalyptus wandoo</i>	T148	-33.8531	117.6501
<i>Eucalyptus wandoo</i>	T147	-33.853	117.6499
<i>Eucalyptus wandoo</i>	T146	-33.8532	117.6498
<i>Eucalyptus wandoo</i>	T145	-33.8531	117.6497
<i>Eucalyptus wandoo</i>	T144	-33.8531	117.6495
<i>Eucalyptus wandoo</i>	T143	-33.853	117.6496
<i>Eucalyptus wandoo</i>	T142	-33.8529	117.6496
<i>Eucalyptus wandoo</i>	T141	-33.8528	117.6497
<i>Eucalyptus wandoo</i>	T140	-33.8527	117.6497
<i>Eucalyptus wandoo</i>	T139	-33.8528	117.6496
<i>Eucalyptus wandoo</i>	T138	-33.8529	117.6493
<i>Eucalyptus wandoo</i>	T147	-33.8529	117.6493
<i>Eucalyptus wandoo</i>	T136	-33.8529	117.6493
<i>Eucalyptus wandoo</i>	T135	-33.8528	117.6492
<i>Eucalyptus wandoo</i>	T133	-33.853	117.6493
<i>Eucalyptus wandoo</i>	T132	-33.853	117.6491
<i>Eucalyptus wandoo</i>	T131	-33.8531	117.6491
<i>Eucalyptus wandoo</i>	T130	-33.8531	117.6492
<i>Eucalyptus wandoo</i>	T129	-33.8533	117.6493
<i>Eucalyptus wandoo</i>	T128	-33.8534	117.6493
<i>Eucalyptus wandoo</i>	T127	-33.8534	117.6503
<i>Eucalyptus wandoo</i>	T126	-33.8534	117.6503
<i>Eucalyptus wandoo</i>	T125	-33.8534	117.6505
<i>Eucalyptus wandoo</i>	T124	-33.8534	117.6506
<i>Eucalyptus wandoo</i>	T123	-33.8533	117.6507
<i>Eucalyptus wandoo</i>	T122	-33.8534	117.6507
<i>Eucalyptus wandoo</i>	T121	-33.8534	117.6507
<i>Eucalyptus wandoo</i>	T120	-33.8535	117.6509
<i>Eucalyptus wandoo</i>	T129	-33.8533	117.6511
<i>Eucalyptus wandoo</i>	T118	-33.8534	117.6511
<i>Eucalyptus wandoo</i>	T117	-33.8534	117.6513
<i>Eucalyptus wandoo</i>	T116	-33.8533	117.6513
<i>Eucalyptus wandoo</i>	T115	-33.8533	117.6514
<i>Eucalyptus wandoo</i>	T114	-33.8533	117.6515
<i>Eucalyptus wandoo</i>	T113	-33.8534	117.6516
<i>Eucalyptus wandoo</i>	T112	-33.8534	117.6517
<i>Eucalyptus wandoo</i>	T11	-33.8534	117.6517
<i>Eucalyptus wandoo</i>	T110	-33.8533	117.6519
<i>Eucalyptus wandoo</i>	T109	-33.8533	117.652
<i>Eucalyptus wandoo</i>	T108	-33.8533	117.652
<i>Eucalyptus wandoo</i>	T107	-33.8535	117.6523
<i>Eucalyptus wandoo</i>	T106	-33.8534	117.6523
<i>Eucalyptus wandoo</i>	T105	-33.8533	117.6523

Tree Species	Tree No	Lat	Long
<i>Eucalyptus wandoo</i>	T104	-33.8533	117.6523
<i>Eucalyptus wandoo</i>	T103	-33.8488	117.6464
<i>Eucalyptus wandoo</i>	T102	-33.8496	117.647
<i>Eucalyptus wandoo</i>	T101	-33.8494	117.647
<i>Eucalyptus wandoo</i>	T100	-33.8494	117.6468
<i>Eucalyptus wandoo</i>	T99	-33.8512	117.648
<i>Eucalyptus wandoo</i>	T98	-33.8514	117.648
<i>Eucalyptus wandoo</i>	T97	-33.8539	117.6493
<i>Eucalyptus wandoo</i>	T96	-33.8554	117.6497
<i>Eucalyptus wandoo</i>	T95	-33.8612	117.6508
<i>Eucalyptus wandoo</i>	T92	-33.8607	117.6507
<i>Eucalyptus wandoo</i>	T91	-33.8604	117.6507
<i>Eucalyptus wandoo</i>	T90	-33.8604	117.6507
<i>Eucalyptus wandoo</i>	T89	-33.8603	117.6506
<i>Eucalyptus wandoo</i>	T88	-33.8597	117.6505
<i>Eucalyptus wandoo</i>	T87	-33.8474	117.6449
<i>Eucalyptus wandoo</i>	T85	-33.8478	117.6451
<i>Eucalyptus wandoo</i>	T84	-33.8478	117.6451
<i>Eucalyptus wandoo</i>	T82	-33.8479	117.6452
<i>Eucalyptus wandoo</i>	T81	-33.8481	117.6454
<i>Eucalyptus wandoo</i>	T80	-33.8483	117.6454
<i>Eucalyptus wandoo</i>	T79	-33.8489	117.6458
<i>Eucalyptus wandoo</i>	T78	-33.8489	117.6459
<i>Eucalyptus wandoo</i>	T76	-33.8491	117.6459
<i>Eucalyptus wandoo</i>	T75	-33.8491	117.6459
<i>Eucalyptus wandoo</i>	T74	-33.8492	117.6459
<i>Eucalyptus wandoo</i>	T73	-33.8492	117.646
<i>Eucalyptus wandoo</i>	T72	-33.8493	117.646
<i>Eucalyptus wandoo</i>	T71	-33.8493	117.646
<i>Eucalyptus wandoo</i>	T70	-33.8494	117.6462
<i>Eucalyptus wandoo</i>	T69d	-33.8494	117.646
<i>Eucalyptus wandoo</i>	T68	-33.8495	117.6461
<i>Eucalyptus wandoo</i>	T67	-33.8496	117.6462
<i>Eucalyptus wandoo</i>	T66	-33.8496	117.6462
<i>Eucalyptus wandoo</i>	T65w4	-33.8496	117.6463
<i>Eucalyptus wandoo</i>	T63	-33.8498	117.6464
<i>Eucalyptus wandoo</i>	T62w5	-33.8497	117.6463
<i>Eucalyptus wandoo</i>	T61w5	-33.8498	117.6463
<i>Eucalyptus wandoo</i>	T60	-33.8499	117.6464
<i>Eucalyptus wandoo</i>	T59w4	-33.8502	117.6466
<i>Eucalyptus wandoo</i>	T58w5	-33.8503	117.6467
<i>Eucalyptus wandoo</i>	T56w5	-33.8504	117.6468
<i>Eucalyptus wandoo</i>	T55w4	-33.8504	117.6468
<i>Eucalyptus wandoo</i>	T55	-33.8507	117.647
<i>Eucalyptus wandoo</i>	T54w5	-33.8508	117.647
<i>Eucalyptus wandoo</i>	T53	-33.8509	117.6471
<i>Eucalyptus wandoo</i>	T49w3	-33.8548	117.649

Tree Species	Tree No	Lat	Long
<i>Eucalyptus wandoo</i>	T48w5	-33.8546	117.649
<i>Eucalyptus wandoo</i>	T47w5	-33.8546	117.649
<i>Eucalyptus wandoo</i>	T46w5	-33.8545	117.6489
<i>Eucalyptus wandoo</i>	T45w5	-33.8545	117.6489
<i>Eucalyptus wandoo</i>	T44w5	-33.8544	117.6489
<i>Eucalyptus wandoo</i>	T43w5	-33.8542	117.6488
<i>Eucalyptus wandoo</i>	T42w5	-33.8613	117.6502
<i>Eucalyptus wandoo</i>	T41w5	-33.861	117.6501
<i>Eucalyptus wandoo</i>	T40w5	-33.8606	117.65
<i>Eucalyptus wandoo</i>	T37w5	-33.8605	117.6501
<i>Eucalyptus wandoo</i>	T38w5	-33.8602	117.65
<i>Eucalyptus wandoo</i>	T37w5	-33.8594	117.6498
<i>Eucalyptus wandoo</i>	T36w5	-33.8594	117.6498
<i>Eucalyptus wandoo</i>	T35w5	-33.8572	117.6493
<i>Eucalyptus wandoo</i>	T34w5	-33.8571	117.6494
<i>Eucalyptus wandoo</i>	T33w5	-33.857	117.6493
<i>Eucalyptus wandoo</i>	T32w5	-33.8568	117.6493
<i>Eucalyptus wandoo</i>	T31w5	-33.8561	117.6492
<i>Eucalyptus wandoo</i>	T30w5	-33.8615	117.6502
<i>Eucalyptus wandoo</i>	T29w5	-33.8617	117.6503
<i>Eucalyptus wandoo</i>	T28w4	-33.8642	117.6501
<i>Eucalyptus wandoo</i>	T27w5	-33.8644	117.6502
<i>Eucalyptus wandoo</i>	T26w5	-33.8644	117.6502
<i>Eucalyptus wandoo</i>	T25w5	-33.8645	117.6501
<i>Eucalyptus wandoo</i>	T24w5	-33.8649	117.6501
<i>Eucalyptus wandoo</i>	T23w5	-33.865	117.6501
<i>Eucalyptus wandoo</i>	T21w5	-33.8654	117.65
<i>Eucalyptus wandoo</i>	T20w5	-33.8654	117.6501
<i>Eucalyptus wandoo</i>	T19w5	-33.8655	117.65
<i>Eucalyptus wandoo</i>	T18w5	-33.8656	117.65
<i>Eucalyptus wandoo</i>	T16w5	-33.8663	117.6499
<i>Eucalyptus wandoo</i>	T15w	-33.8663	117.6498
<i>Eucalyptus wandoo</i>	T12w5	-33.8679	117.6497
<i>Eucalyptus wandoo</i>	T11w4	-33.8681	117.6496
<i>Eucalyptus wandoo</i>	T10w5	-33.8685	117.6496
<i>Eucalyptus wandoo</i>	T09w5	-33.8686	117.6496
<i>Eucalyptus wandoo</i>	T08w5	-33.8702	117.6493
<i>Eucalyptus wandoo</i>	T07w4	-33.8705	117.6491
<i>Eucalyptus wandoo</i>	T004w4	-33.8676	117.6503
<i>Eucalyptus wandoo</i>	T002w5	-33.8677	117.6504
other (dead)	T343	-33.8504	117.6494
other (dead)	T330	-33.8505	117.649
other (dead)	T271	-33.8499	117.6491
other (dead)	T270	-33.8499	117.6491
other (dead)	T262	-33.8497	117.6492
other (dead)	T260	-33.8497	117.6493
other (dead)	T253	-33.8498	117.6487

Tree Species	Tree No	Lat	Long
other (dead)	T252	-33.85	117.6487
other (dead)	T242	-33.8525	117.6497
other (dead)	T241	-33.8525	117.6496
other (dead)	T240	-33.8526	117.6495
other (dead)	T209	-33.8528	117.6504
other (dead)	T201	-33.8526	117.6508
other (dead)	T152	-33.8531	117.6501
other (dead)	T149	-33.8531	117.6501
other (dead)	T134	-33.8529	117.6491
other (dead)	T94	-33.861	117.6508
other (dead)	T93	-33.8609	117.6507
other (dead)	T92	-33.8604	117.6507
other (dead)	T86	-33.8477	117.645
other (dead)	T77	-33.849	117.6459
other (dead)	T64d	-33.8498	117.6464
other (dead)	T57d4	-33.8504	117.6467
other (dead)	T52	-33.8511	117.6471
other (dead)	T51d4	-33.8513	117.6474
other (dead)	T50d4	-33.8513	117.6473
other (dead)	T006d4	-33.8617	117.6509
<i>other (Eucalyptus kondininensis)</i>	T22k5	-33.8652	117.65
<i>other (Eucalyptus kondininensis)</i>	T005kb5	-33.8653	117.6504



T002w5_Wandoo



T004w4_Wandoo



T005kb5_E kondininensis



T006d4 dead



T07w4_Wandoo



T08w5_Wandoo



T09w5_Wandoo



T10w5_Wandoo



T11w4_Wandoo



T12w5_Wandoo



T15w_Wandoo



T16w5_Wandoo



T18w5_Wandoo



T19w5_Wandoo



T20w5_Wandoo



T21w5_Wandoo



T22k5_E kondininensis



T23w5_Wandoo



T24w5_Wandoo



T25w5_Wandoo



T26w5_Wandoo



T27w5_Wandoo



T28w4_Wandoo



T29w5_Wandoo



T30w5_Wandoo



T31w5_Wandoo



T32w5_Wandoo

Southern corridor trees



T33w5_Wandoo



T34w5_Wandoo



T35w5_Wandoo



T36w5_Wandoo



T37w5_Wandoo.1



T37w5_Wandoo



T38w5_Wandoo



T40w5_Wandoo



T41w5_Wandoo



T42w5_Wandoo



T43w5_Wandoo



T44w5_Wandoo



T45w5_Wandoo



T46w5_Wandoo



T47w5_Wandoo



T48w5_Wandoo



T49w3_Wandoo



T88_Wandoo

Southern corridor trees



T89_Wandoo



T90_Wandoo



T91_Wandoo



T92_dead



T92_Wandoo



T93 dead



T94 dead



T95_Wandoo



T96_Wandoo



T97_Wandoo



T79_Wandoo



T114_Wandoo



T129_Wandoo



T139_Wandoo



T155_Wandoo



T159_Wandoo



T166_Wandoo



T180_Wandoo



T182_Wandoo

Class 3 trees (outside southern corridor)



T183_Wandoo



T184_Wandoo



T195_Wandoo



T202_Wandoo



T220_Wandoo



T228_Wandoo



T231_Wandoo



T250_Wandoo



T256_Wandoo

Class 3 trees (outside southern corridor)



T285_Wandoo



T291_Wandoo



T343_dead



T345_Wandoo



T351_Wandoo



T359_Wandoo



T361_Wandoo



T388_Wandoo

Class 3 trees (outside southern corridor)