Hyden Flora, Vegetation and Fauna Surveys

CBH Group

ecoscape

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EXECUTIVE SUMMARY

CBH Group is proposing to expand its Hyden grain receival facility. In order to facilitate environmental approvals, Ecoscape was engaged to conduct a Detailed flora and vegetation survey and Level 1 fauna survey to identify any significant environmental constraints that may affect the proposed works. Following an amendment to the area requiring clearing, a supplementary field survey was also conducted. This report documents the findings of both surveys.

The desktop assessment identified the following relevant aspects:

- the area is near (within 200 m) a Nature Reserve, however, it does not correspond with any Environmentally Sensitive Areas
- the survey area corresponds with two pre-European vegetation associations (519 and 945); the former has >50% of its original extent remaining, the latter has <20% remaining
- the survey area is largely within two mapped occurrences of the Commonwealth EPBC Act-listed critically endangered *Eucalypt Woodlands of the Western Australian Wheatbelt* Threatened Ecological Community or its buffers
- 58 Threatened or Priority Flora species have been recorded within 20 km of the survey area or may occur, as identified by database searches. One P3 species (*Daviesia implexa*) record was within 40 m of the additional area and within the overall CBH site, however, this species was not recorded from within this additional area during a 2010 survey that corresponded with much of the currently surveyed area
- 11 Threatened or Priority Fauna species have been recorded within 50 km or may occur, none have been recorded from within the survey area.

The field survey, conducted in September and November 2019 identified the following:

- 142 vascular flora species recorded from four quadrats, three detailed relevés and opportunistic observations
- no Threatened or Priority Flora species were recorded
- 26 introduced flora species (weeds) were recorded, all of which are common in the agricultural region although one was a Declared Pest plant (exempt category) that has no management requirements
- three vegetation types were recorded consisting of *Melaleuca hamata*, *Allocasuarina acutivalvis* and *Allocasuarina campestris* tall open shrubland, *Eucalyptus loxophleba* subsp. *gratiae* low mallee woodland and degraded *Maireana brevifolia* and *Acacia multispicata* mid sparse chenopod shrubland/shrubland, none of which are representative of any currently described Threatened or Priority Ecological Community
- 18 vertebrate fauna species were recorded including two introduced species, none of which were of conservation significance
- two main habitat types were recorded, none of which are of any particular significance
- the habitat of the survey area is not suitable for Carnaby's Cockatoo
- the habitat is broadly suitable for Malleefowl, however, the small extent, fragmented nature and proximity to human disturbance indicate that this species is unlikely to occupy the area (i.e. it is unlikely to be used for breeding) although individuals may visit the survey area on occasion.

Assessment against DWER's 10 clearing principles indicates that none are at variance or likely to be at variance in relation to the proposed works.

ACRONYMS AND ABBREVIATIONS

Table 1: Acronyms and abbreviations

Acronyms and abbreviations	
BAM Act	Western Australian *Biosecurity and Agriculture Management Act 2007*
BoM	Bureau of Meteorology
C1, C2, C3	Declared Pest categories under the BAM Act
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
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 DotEE)
DPaW	Western Australian Department of Parks and Wildlife (2013-2017, now DBCA)
DotEE	Commonwealth Department of the Environment and Energy
DPIRD	Western Australian Department of Primary Industries and Rural Development
DSEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities (2010-2013, now DotEE)
DWER	Western Australian Department of Water and Environmental Regulation
Ecoscape	Ecoscape (Australia) Pty Ltd
EP Act	Western Australian *Environmental Protection Act 1986*
EPA	Western Australian Environmental Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ha	hectare/hectares
IBRA	Interim Biogeographic Regionalisation for Australia
km	kilometre/kilometres
m	metre/metres
NVIS	National Vegetation Inventory System
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
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)
WAH	Western Australian Herbarium
WONS	Weeds of National Significance
*	Introduced flora species (i.e. weed)

1 INTRODUCTION

1.1 BACKGROUND

CBH Group operates within the Australian grain industry, dealing with grain storage, handling, transport, marketing and processing. It operates from a number of sites, with grain receival and transport facilities that handle approximately 90% of the grain produced in the Western Australian Wheatbelt.

At Hyden, CBH Group is proposing to enlarge its existing facility. Ecoscape was commissioned to conduct a flora, vegetation and fauna survey of parts of the site that are proposed for clearing. The majority of the site was surveyed in September 2019, however, following the identification of an additional area that is proposed for clearing a supplementary survey of a small portion was conducted in November 2019. The resultant survey findings and report will be used in support of the environmental approvals process.

Ecoscape conducted a similar survey in 2010 (Ecoscape 2010); part of the 2019 survey area overlaps with the earlier survey area.

1.2 SURVEY AREA

The CBH Group project area, known as the 'survey area' in this report, is located on the western edge of the town of Hyden within the Shire of Kondinin in the Mallee bioregion/Western Mallee subregion, approximately 290 km east southeast of Perth (**Figure 1**). The total area included in the survey is 5.39 ha.

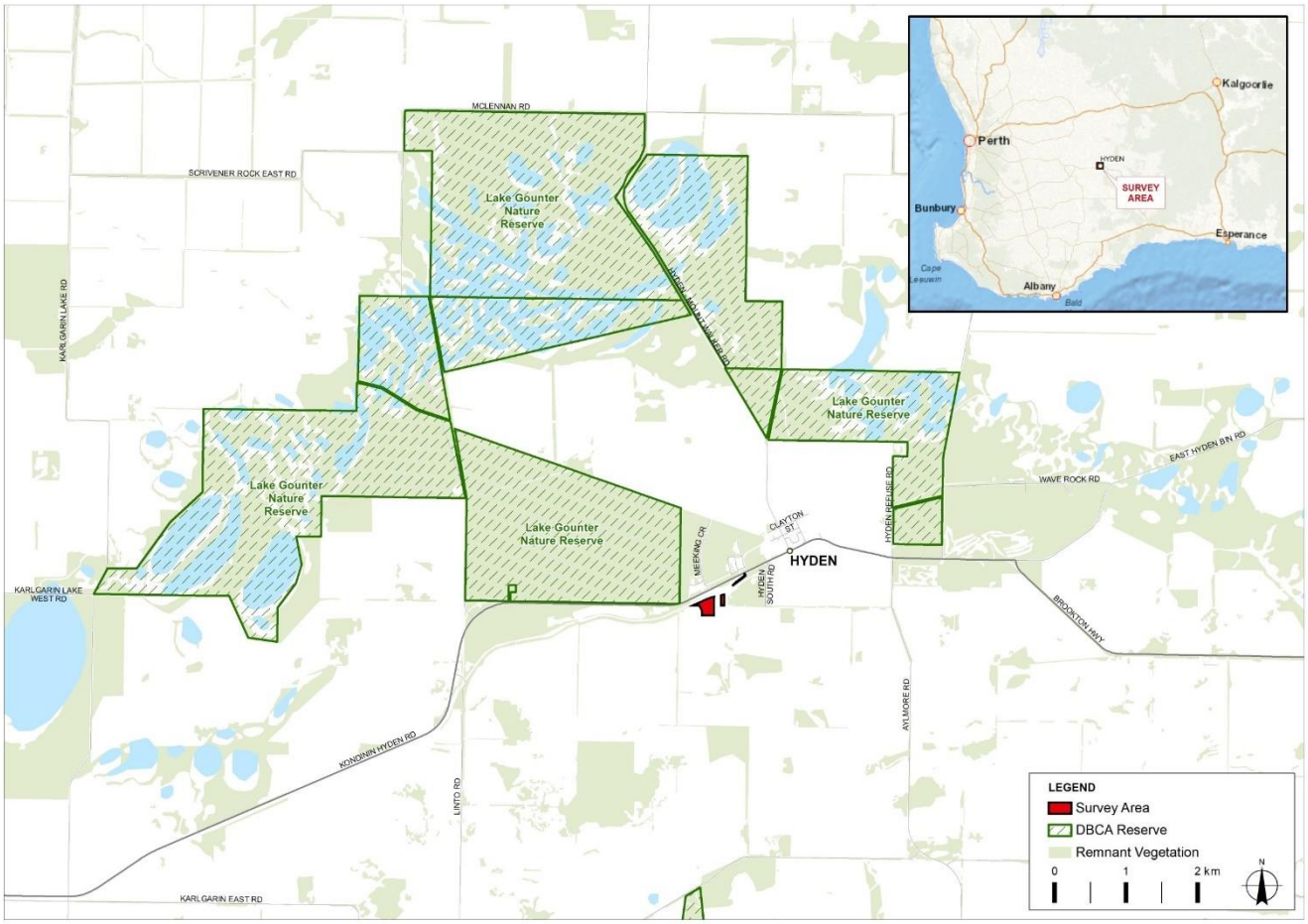


Figure 1: Survey area location

1.3 SURVEY REQUIREMENTS

The requirements of the survey were to conduct a flora, vegetation and fauna survey that is suitable for environmental approvals. The survey was conducted as a Detailed flora and vegetation survey and EPA Level 1 (reconnaissance) fauna survey, incorporating the following:

- desktop assessment of attributes that may affect the environmental approvals process
- mapping vegetation types and determination of significance e.g. for inclusion in the Eucalypt Woodlands of the Western Australian Wheatbelt TEC
- establishment and assessment of three florisitic quadrats per vegetation type (if sufficient extent occurs)
- vegetation condition assessment
- searches for conservation significant flora identified as likely to occur from database searches
- reconnaissance fauna survey describing fauna habitat types and determining their potential to be suitable for conservation significant species
- collecting an opportunistic inventory of fauna species occurring within the survey area at the time of survey
- recording the location and habitat value of trees that may be used by Black Cockatoo species (specifically Carnaby's Cockatoo in this area)
- reporting of the desktop assessment and field survey results, including an assessment of significance against the Commonwealth Matters of National Environmental Significance and Western Australian 10 Clearing Principles.

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)
- 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*
- 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 (2016d) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, known as the Flora and Vegetation Technical Guidance
- EPA (2016e) *Technical Guidance – Terrestrial Fauna Surveys*, known as the Fauna Technical Guidance
- EPA (2016f) *Technical Guidance – Sampling Methods for Terrestrial Vertebrate Fauna*
- EPA (2016c) *Statement of Environmental Principles, Factors and Objectives*.

1.4.1 COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

At a Commonwealth level, Threatened taxa (flora and fauna) are protected under the EPBC Act, which lists species that are considered Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild (detailed in **Table 12** in **Appendix One**).

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 included in environmental assessments and 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. It commenced on 1 January 2019.

Threatened species (both flora and fauna) and ecological communities that meet the categories listed within the BC Act are highly protected 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 have been aligned with those detailed in the EPBC Act and are detailed in **Table 13** in **Appendix One**.

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 2018b).

1.4.4 FLORA

1.4.4.1 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.

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 these have a greater level of protection than unlisted species.

There are seven categories covering State-listed TF and PF species (DBCA 2019) which are outlined in **Table 13** in **Appendix One**. In Western Australia PF 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 13**.

1.4.4.2 Other Significant Flora

According to the *Flora and Vegetation Technical Guidance* (EPA 2016d) 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 type (e.g. Groundwater Dependent Ecosystems, Sheet Flow Dependent Vegetation)
- 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.

1.4.4.3 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] 1998-2019) and are designated with an asterisk (*) in this document.

Weeds of National Significance

At a national level there are 32 weed species listed as Weeds of National Significance (WoNS) (Australian Government & DotEE 2018; Weeds Australia 2012). The Commonwealth *National Weeds Strategy: A Strategic Approach to Weed Problems of National Significance* (2012) describes broad goals and objectives to manage these species.

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).

1.4.5 ECOLOGICAL COMMUNITIES

1.4.5.1 EPBC-listed Threatened Ecological Communities

Ecological communities are naturally occurring biological assemblages associated with a particular type of habitat (Government of Western Australia 2016). At Commonwealth level, Threatened Ecological Communities (TECs) are protected under the Commonwealth EPBC Act. An ecological community may be categorised into one of the three sub-categories:

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

1.4.5.2 Western Australian Threatened Ecological Communities

The Western Australian DBCA also maintains a list of TECs which are further categorised into three subcategories much like those of the EPBC Act. The full details of DBCA criteria are shown in **Table 14** in **Appendix One**.

Currently described TECs are listed on the DBCA website, with the most recent list endorsed by the Minister for Environment on 28 June 2018 (DBCA 2018).

1.4.5.3 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.

Currently described PECs are listed on the DBCA website, with the most recent list dated 17 January 2019 (Species and Communities Program, DBCA 2019).

1.4.6 OTHER SIGNIFICANT VEGETATION

According to the *Flora and Vegetation Technical Guidance* (EPA 2016d), 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.

1.4.7 FAUNA

1.4.7.1 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 12** 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 2019):

> *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).

1.4.7.2 Western Australian-listed Threatened 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 13** in **Appendix One**.

1.4.7.3 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 13** in **Appendix One**.

1.4.8 ENVIRONMENTALLY SENSITIVE AREAS

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 (Government of Western Australia 2005).

1.4.9 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 2018a).

2 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 an arid-steppe climate with (relatively) cold summers (Class BSk) that border Mediterranean (or continental) climates in continental interiors some distance from the coast (Peel *et al.* 2007). This classification is considered to represent a cold semiarid climate where the average temperature is below 18° C, summer maximum temperatures are considered to be warm to hot and the coldest month maximum is above 0°C. Large diurnal temperature variations are a feature of this climate zone.

The closest Bureau of Meteorology (BoM) station with long term records is Hyden (BoM 2019, station 10568 operating since 1928; accessed 13 September 2019) located approximately 4 km northeast of the survey area. The mean annual rainfall is 343 mm, approximately 51% of which falls in winter, between May and August. The rainfall in the 4 month (winter) period preceding the survey in September 2019 was approximately 27.11% of the long-term mean for the May-August period.

January is the hottest month with a mean maximum temperature of 33.7° and minimum of 16.6°. July is the coldest month with a mean maximum of 16.5° and minimum of 4.6°.

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

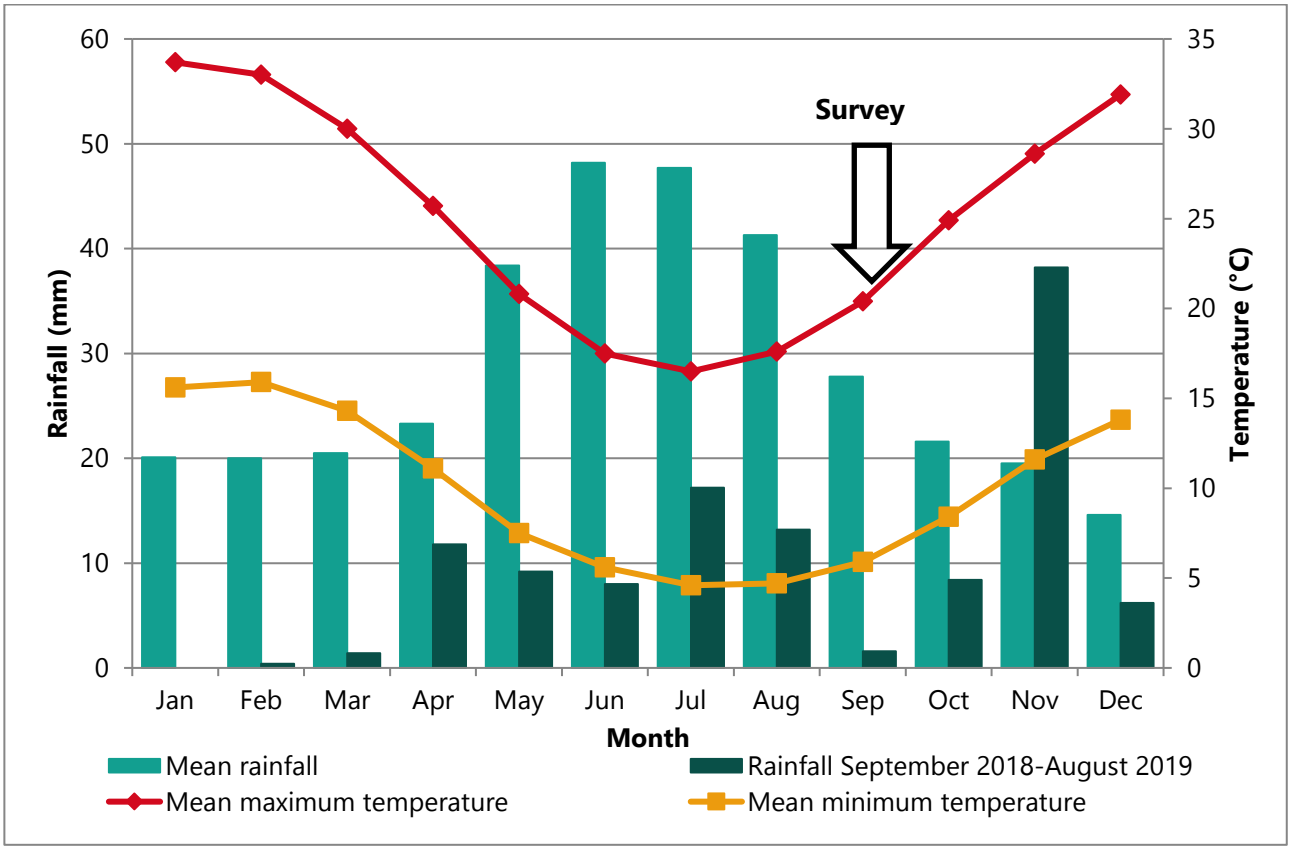


Figure 2: Rainfall and temperature data for the survey area (BoM 2019)

2.1.2 ENVIRONMENTALLY SENSITIVE AREAS

No Environmentally Sensitive Areas are associated with the survey area. The nearest ESA is approximately 19 km southeast and corresponds with Dragon Rocks Nature Reserve (Government of Western Australia & Department of Water and Environmental Regulation 2019).

2.1.3 CONSERVATION LANDS

The survey area does not correspond with any conservation lands. The nearest lands vested for conservation is Lake Gounter Nature Reserve immediately to the northwest (i.e. within 200 m) of the survey area (DBCA 2007).

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) (DotEE 2016).

The survey area is located in the Mallee IBRA region in the Western Mallee subregion, described as (Beecham & Danks 2001):

> *The Mallee bioregion is the south-eastern part of Yilgarn Craton. Its landscape is gently undulating, with partially occluded drainage. Mallee over myrtaceous-proteaceous heaths on duplex (sand over clay) soils are common. Melaleuca shrublands characterise alluvia, and Halosarcia low shrublands occur on saline alluvium. A mosaic of mixed eucalypt woodlands and mallee occur on calcareous earth plains and sandplains overlying Eocene limestone strata in the east. Landscape is fragmented with particular surface-types almost completely cleared as wheatfields.*
>
> *Western Mallee (MAL2) subregion has more relief than its eastern counterpart: main surface-types comprise clays and silts underlain by Kankar, exposed granite, sandplains and laterite pavements. Salt lake systems on a granite basement. Occluded drainage system. Mallee communities occur on a variety of surfaces; Eucalyptus woodlands occur mainly on fine textured soils, with scrub-heath on sands and laterite. The climate is warm Mediterranean and annual rainfall is 250-500mm. Total area of the subregion is 4,763,963 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 and has since been developed in digital form by Shepherd *et al.* (2002) and updated by DPIRD (2018). Extents are updated annually by DBCA (Government of Western Australia 2019). This mapping indicates that the survey area corresponds with two pre-European vegetation units:

- Association 519: Shrublands; mallee scrub, *Eucalyptus eremophila*, over the majority of the survey area
- Association 945: Mosaic: Medium woodland; salmon gum/Shrublands; mallee scrub, redwood & black marlock.

The pre-European vegetation associations identified from the survey area (DPIRD 2018) and their pre-European and current extents are listed in **Table 2** (Government of Western Australia 2019) and shown on **Map 1**.

Table 2: Pre-European vegetation association representation (Government of Western Australia 2019)

Region	Vegetation association	Original extent (ha)	Current extent (ha)	% Remaining
Western Australia	519	2,333,413.96	1,440,062.48	61.71
	945	176,611.70	32,672.36	18.50
IBRA biographic region (Mallee)	519	2,100,313.59	1,248,661.16	59.45
	945	141,353.72	27,748.20	19.63
IBRA biographic sub-region (Western Mallee)	519	1,563,571.27	783,034.13	50.08
	945	141,353.72	27,748.20	19.63
LGA (Shire of Kondinin)	519	247,349.24	134,392.13	54.33
	945	47,174.93	8,227.80	17.44

2.2.3 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

The PMST search (Australian Government and DotEE, search reference PMST_BW06DX, 2019) using a 20 km buffer around a point approximating the centre of the survey area, identified one EPBC-listed TEC or suitable habitat for such occur or are likely to occur within the search area buffers.

The DBCA database search (search reference Hyden_Ecoscape_TecPecSearchResults_05092019 using a 15 km buffer) identified 333 indicative occurrences of one Western Australian-listed PEC within the search area.

Both database searches identified the conservation significant ecological community as the *Eucalypt Woodlands of the Western Australian Wheatbelt*, listed as a Critically Endangered TEC under the EPBC Act and P3 PEC by DBCA.

2.2.4 THREATENED AND PRIORITY FLORA

The PMST search (as above) identified 15 EPBC-listed TF that are known to occur within the 20 km search buffer area.

A search of DBCA's databases was conducted (search reference 46-0819FL) using a 30 km buffer around the supplied shapefiles (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 DBCA database searches identified 58 TF and PF species that are known to occur within the search area buffer. Those nearby are shown on **Map 1**.

Combined, the database searches identified 15 TF, three P1, 14 P2, 25 P3 and nine P4 that may occur (from the PMST search) or are known to occur within 30 km of the survey area.

The combined database searches identified the species listed in **Table 20** in **Appendix Two**.

Ecoscape's previous survey of much of the current survey area in 2010 did not identify any conservation significant flora species (Ecoscape 2010).

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 1998-2019; 2019) or in more detailed documents e.g. Approved Conservation Advice, tailored to local populations, and information from recent nearby surveys.

The attributes 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 age of record and locational accuracy into account
- nearby records recent, considered as within the previous 25 years.

The likelihood rating is assigned using the categories listed in **Table 3**. The likelihood assessment took into consideration that the area had largely been previously surveyed by Ecoscape.

Table 3: Categories for likelihood of occurrence of TF and PF

Likelihood	Categories
Recorded	Species recorded within the survey area
High	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
Moderate	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) • it is known from nearby but the record is old (>25 years) or the locational data is potentially inaccurate or 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.
Low	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 20** in **Appendix Two**. One P2 (*Acacia concolorans*) and two P3 (*Daviesia implexa* and *Phebalium brachycalyx*) were identified as having a High likelihood of occurring based on the information available during the desktop assessment, and taking into consideration that the area had largely already been surveyed (Ecoscape 2010). These were considered the most likely to occur and were targeted for field survey. Of note, the additional area identified after the completion of the September 2019 survey as likely to be cleared is within 40 m of the *Daviesia implexa* record. As the locational accuracy of this record could not be verified, it is retained as having a High likelihood rather than being elevated to a Recorded (known) species.

2.2.5 THREATENED AND PRIORITY FAUNA

2.2.5.1 DBCA Database Searches

The DBCA database search (search reference FAUNA#6080 using a 50 km buffer) returned the following:

- eight mammals
- six birds
- no reptiles, amphibians or fish
- two invertebrates, noting that these are not included within the scope of the survey.

The full list is incorporated in **Table 21** in **Appendix Two**. Nearby records are shown on **Map 1**.

2.2.5.2 Protected Matters Search

The Protected Matters Search Tool (PMST) (Australian Government and DotEE, search reference PMST_BW06DX, 2019) using a 20 km buffer was used to identify conservation significant fauna and/or fauna habitat suitable for such species within the search area buffer. The PMST search identified:

- three mammals: one 'species or species habitat may occur within area', one 'species or species habitat likely to occur within area', and one known translocated species
- eight birds: four 'species or species habitat may occur within area', one 'species or species habitat likely to occur within area' and three 'species or species habitat known to occur within area'
- no reptiles, amphibians, fish or invertebrates were identified by the PMST search.

The PMST results are incorporated in **Table 21** in **Appendix Two**. Listed marine species, unless also listed as migratory, are not included in the above as there is no suitable habitat within the survey area.

2.2.5.3 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 habitats present within the survey area
- distance between previous record of significant species and the survey area
- frequency and number of records in the region
- date of record of significant species (recent or historical).

The sufficiency of information and behavioural and ecological characteristics, such as cryptic behaviours were also considered. Using the above criteria, the categories of likelihood of occurrence are shown in **Table 4**.

Table 4: Categories for likelihood of occurrence of significant vertebrate fauna

LIKELIHOOD	CATEGORIES
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

One species is considered to have a High likelihood of occurring based on the criteria above:

- *Calyptorhynchus latirostris* (Carnaby's Cockatoo).

The likelihood of species occurring within the survey area are indicated in **Table 21** in **Appendix Two**.

2.2.6 FAUNA HABITAT

Ecoscape's previous survey corresponding with much of the current survey (Ecoscape 2010) did not specifically map fauna habitat, however, no habitat suitable for perching by large birds was recorded.

2.3 LITERATURE REVIEW

The following documents were reviewed for relevance to the survey area:

- Ecoscape (2017) *Tampia Gold Flora and Fauna Report*. Detailed flora and vegetation and Level 1 fauna survey of farmland bush remnants south of Narembeen within an area of potential impact from gold mining activities.
- Department of Water (2009) *Waterway assessment of the Camm River: Lockhart River confluence to Hyden.* The survey and report were written by Ecoscape and included assessment of parts of Lake Gounter Nature Reserve corresponding with the waterway.
- Department of Water (2008) *Waterway assessment for the Lockhart River: Lake Kurrencutten to the Camm River confluence*. Survey predating the above, terminating near Kondinin.
- Ecoscape (2007) *Narrogin District Flora Surveys: Selected Hyden Reserves*, detailing conservation significant flora surveys in the Hyden area.
- Ecoscape (2006) *Assessment of Conservation Values of 35 Agricultural Area Wheatbelt Dam Reserves*, detailing biological surveys of Wheatbelt water reserves, including several near Hyden, that the Department of Environment and Conservation was considering adding to the conservation estate.
- Muir (1977a) *Biological Survey of the Western Australian Wheatbelt Part 2: Vegetation and Habitat of Bendering Reserve*

- Muir (1977b) *Biological Survey of the Western Australian Wheatbelt Part 3 & 4 Vertebrate Fauna of Bendering & West Bendering Nature Reserves & Vegetation of West Bendering Nature Reserve*.

2.3.1 PREVIOUS SURVEYS

Ecoscape conducted a Level 2 flora and vegetation survey and Level 1 fauna survey of much of the current survey area in 2010 (Ecoscape 2010). This survey identified two vegetation types, one of which was outside the current survey area. One potential P4 species was recorded but could not be confirmed amongst the 110 vascular flora species recorded. Seventeen vertebrate fauna species were recorded including one P4 bird species (that is no longer listed as being of conservation significance), however, at that time the area was not considered suitable for Black Cockatoo habitat.

665000 670000 675000 680000 685000

6420000 6415000 6410000 6405000 6400000

Roe Nature Reserve
Scriveners Nature Reserve
Lake Gounter Nature Reserve
Biglin Nature Reserve
MARSHALL ST
KONDININ HYDEN RD
BROOKTON HWY

MAP CODE	CONS STATUS	Taxon	MAP CODE	CONS STATUS	Taxon
Aar	2	*Acacia arcuatilis*	Eca	4	*Eucalyptus caesia* subsp. *caesia*
Aco	2	*Acacia concolorans*	Emy	1	*Eucalyptus myriadena* subsp. *parviflora*
Ade	3	*Acacia deflexa*	Fdr	3	*Frankenia drummondii*
Ala	3	*Acacia lanei*	Gpr	4	*Grevillea prostrata*
Aob	3	*Acacia obesa*	Gsc	T	*Grevillea scapigera*
Atu	2	*Acacia tuberculata*	Pbr	3	*Phebalium brachycalyx*
Bru	3	*Banksia rufa* subsp. *chelomacarpa*	Rto	3	*Rinzia torquata*
Dim	3	*Daviesia implexa*	Rpy	T	*Roycea pycnophylloides*
Die	3	*Dielsiodoxa leucantha* subsp. *leucantha*	Sja	2	*Stypandra jamesii*
Ebi	4	*Eremophila biserrata*	Vse	2	*Verticordia setacea*

SURVEY AREA ENLARGEMENT

LEGEND

- Survey_Area

Conservation Significant Flora (DBCA, 2019)
- Threatened
- Priority 1
- Priority 2
- Priority 3
- Priority 4

Conservation Significant Fauna (DBCA, 2019)

Endangered
- Numbat

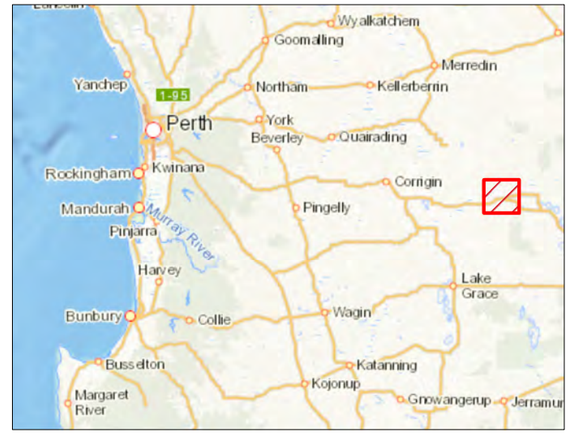
Vulnerable
- Malleefowl
- Chuditch
- Bilby

Migratory Birds Protected Under an International Agreement
- Common Sandpiper

Other Specially Protected
- Peregrine Falcon

Priority 4
- Quenda
- DBCA Legislated Lands and Waters
- Pre European Vegetation (DPIRD, 2018)

Priority Ecological Community (DBCA, 2019)
- Eucalypt woodlands of the Western Australian Wheatbelt (P3)



ecoscape

PRE EUROPEAN VEGETATION DBCA SEARCH RESULTS

HYDEN FLORA, VEGETATION AND FAUNA SURVEYS

DATASOURCES :
SOURCE DATA:
AERIAL:
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

CBH GROUP

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

N

SCALE: 1:100,000 @ A3

0 1 2 3 km

PROJECT NO: 4464-19

REV	AUTHOR	APPROVED	DATE
00	SB	LA	22/10/2019
01	SB	LA	02/12/2019

MAP 01

3 METHODS

3.1 SURVEY AIMS

The aims of the flora, vegetation and fauna survey were to identify if there were any significant environmental values that may affect proposed expansion of the Hyden CBH facility.

3.2 GUIDING PRINCIPLES

The flora and vegetation survey was conducted as a Detailed survey according to the Flora and Vegetation Technical Guidance (EPA 2016d). 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 survey was conducted as a Level 1 survey, taking into account:

- EPA (2016e) Fauna Technical Guidance
- EPA (2016f) *Technical Guidance – Sampling Methods for Terrestrial Vertebrate Fauna*
- background information on the survey area, fauna species and habitat likely to occur (i.e. desktop assessment, aerial imagery and other data).

The Fauna Technical Guidance recommends the following for a Level 1 fauna survey:

- desktop assessment to gather contextual information on the survey area from previous surveys, literature, database searches and map-based information
- site visit to be conducted to verify the accuracy of the desktop study, delineate and characterise the fauna and faunal assemblages present in the survey area
- survey to include low intensity sampling of fauna and faunal assemblages.

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 2016c), conducted as a single phase survey. The survey was within the period considered optimal for a primary season of survey within the bioregion.

Conservation criteria used in this assessment are included in **Table 12** and **Table 13** in **Appendix One**.

Survey method details are outlined below.

The initial field survey was conducted during September 2019. CBH identified an additional area proposed to be cleared after this survey was completed. Although this area had been surveyed in 2010 a Priority-listed flora location was recorded from within 40 m of the vegetation within this additional area, located on a roadway. The species associated with this point (*Daviesia implexa*, P3) had not been described in 2010 (Crisp *et al*. 2017) and no similar species were recorded by the Ecoscape (2010) survey, however, it was considered prudent to conduct a survey for this species and describe the vegetation in this part of the survey area.

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 survey area. The unmarked quadrats were 20 m x 20 m in dimension, as required according to the Flora and Vegetation Technical Guidance 2016. Where the vegetation consisted of a narrow linear corridor, quadrats were linear but of the same overall size i.e. 400 m^2.

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
- 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.

All quadrat locations are displayed on **Map 2**.

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. All areas of native vegetation in Good or better condition were grid searched at approximately 20 m (or closer) spacing which was adequate to determine the presence of most plants.

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, including outside the development envelopes where possible
- 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.

The field survey included searches for WONS and Declared Pest plants. Their locations and numbers/extents were recorded where noted during the field survey, and each WONS or Declared Pest plant species photographed.

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 2017) (**Table 15** and **Table 16** 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. **MhAaAcTOS** refers to ***M****elaleuca* ***h****amulosa*, ***A****llocasuarina* ***a****cutivalvis* and ***A****llocasuarina* ***c****ampestris* **t**all **o**pen **s**hrubland.

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 Provinces (EPA 2016d) (**Table 17** 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 September which is within the optimal period for a primary survey within the bioregion according the Flora and Vegetation Technical Guidance (EPA 2016d). The rainfall prior to the field survey was significantly below the mean (27.11% of the mean) for this period (**Figure 2**). Limitations associated with below average rainfall are described in **Section 3.5**.

3.4 STATISTICAL 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, the Kulczynski similarity coefficient was used as this provides a good estimation of association for ecological applications (Belbin & Collins 2006). For this analysis we used presence-absence data.

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.

3.5 BOTANICAL LIMITATIONS

Survey design: Single phase, quadrat-based flora and vegetation survey with extensive traverses searching for conservation significant flora. Results from previous surveys were considered as part of survey design and the desktop assessment.

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 and relevés 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 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.

Botanical limitations are presented in **Table 5**.

Table 5: Botanical limitations

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Availability of contextual information at a regional and local scale	No	Ecoscape had previously conducted a survey of much of the area, and had conducted a number of surveys in the Hyden area. There is sufficient available contextual information to adequately perform an environmental assessment of the area.
Competency/experience of the team conducting the survey, including experience in the bioregion surveyed	No	The lead botanist conducting the field survey has over 30 years' experience conducting flora and vegetation surveys in Western Australia, including the Avon Wheatbelt and Mallee IBRA regions.
Proportion of the flora recorded and/or collected, and any identification issues	Negligible	A total of 142 flora taxa were recorded during the field survey of which five (3.52% of the total) were not identifiable to species level. None are similar to any currently listed TF or PF.
Was the appropriate area fully surveyed (effort and extent)	No	The survey area was small and was grid searched in its entirety in areas of native vegetation, therefore was surveyed adequately to describe the flora and vegetation.
Access restrictions within the survey area	No	The survey area was fully accessible.
Survey timing, rainfall, season of survey	No – survey timing/season Moderate – rainfall	The initial field survey was conducted in September and the additional (supplementary) survey in November. Both surveys were within the optimal season for survey in the southwest region of Western Australia. The rainfall during the three months prior to the September field survey was approximately 27% of the long term average for the four months prior to the field survey, thus a constraint as many taxa were not flowering and could not be identified with certainty, and annuals and ephemerals were not present. However, much of the area had been surveyed previously
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.

3.6 FAUNA FIELD SURVEY

3.6.1 FIELD SURVEY METHODS

3.6.1.1 Level 1 Survey Methods

A Level 1 fauna survey as defined by the *Technical Guidance – Sampling methods for Terrestrial vertebrate fauna* (EPA 2016f) consists of a desktop study and basic ground truthing through a reconnaissance survey. The survey focused on mapping major fauna habitat types within the survey areas, particularly those habitat types likely to be utilised by conservation significant species identified as part of the desktop survey.

The fauna field assessment included identifying fauna and fauna habitat within the survey area. Techniques used to locate fauna included:

- opportunistic observations while moving through the survey area
- turning of surface debris (rocks, logs, vegetation spoil heaps) that reptiles and mammals may shelter beneath.

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.

3.6.2 TIMING OF THE FIELD SURVEY

The fauna survey was primarily conducted during September. Additional observations from a supplementary November survey added to this data. Survey timing is not critical for a Level 1 survey that is predominantly to ground truth desktop findings and describe the habitat within the survey area (EPA 2016f).

3.6.3 FAUNA HABITAT MAPPING

Fauna habitat types were assessed continuously throughout the survey and at each observation of fauna, in particular when conservation significant species were recorded. Fauna habitats were described as an area which is distinguishable from its surrounding area by its landform, vegetation structure and composition, soil characteristics and fauna assemblage that occur in the area. In addition, the likelihood to harbour specialised fauna species which are not found in adjacent areas was taken into consideration. The spatial extent of each habitat type was mapped using GIS software.

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

- vegetation type and condition mapping
- aerial imagery
- landforms
- soil characteristic
- fauna assemblage information.

3.6.4 BLACK COCKATOO SURVEY

The fauna survey for Black Cockatoo habitat followed the draft revised referral guideline for Black Cockatoo species (Commonwealth of Australia 2017). Habitat assessment is the primary technique used to inform decisions on significant impact for Black Cockatoos and is aimed at identifying habitat used for foraging, breeding or roosting.

3.6.4.1 Foraging Habitat

Within areas included in the modelled distribution of Black Cockatoo species, the scoring tool developed by the Commonwealth to determine if the impact area contains quality foraging habitat (**Table 18** in **Appendix One**) was used during this assessment. Habitat surveys must be sufficient to complete the scoring tool and provide a score and justification for foraging habitat quality.

The elements of the scoring tool require surveys to provide information on the following:

- the presence of all plant species that provide foraging, including non-native food sources used by Black Cockatoos

- the presence of tree species used for breeding
- use as a roosting site
- the vegetation present in the surrounding area i.e. at least 12 km from the impact area, including proximity to any breeding habitat, roosting sites or watering points
- breeding habitat, such as an estimate of the number of trees with a diameter at breast height (1.3 metres from the ground) of 500 mm, or 300 mm if Salmon Gum or Wandoo
- numbers of any known nesting trees
- presence of disease, such as *Phytophthora cinnamomi* or Marri Canker (*Quambalaria coyrecup*), noting that neither of these is expected in the survey area.

3.6.4.2 Nesting Habitat

Nesting habitat trees were scored for value using a scoring system developed by Dr Mike Bamford (2016), the score reflects the existing value of the tree characteristics with respect to its potential to be used as a nesting tree and therefore assists in more accurately assessing the real impact of disturbance (**Table 19** in **Appendix One**).

3.7 FAUNA SURVEY LIMITATIONS

Table 6: Summary of fauna survey limitations

Possible limitations	Constraints (yes/possible/no)	Comment
Competency/experience of the consultant conducting the survey	No	The ecologist conducting the field survey has adequate experience in the region to undertake a Level 1 fauna survey that concentrates on identifying habitat type and confirming if they are suitable for conservation significant species that may occur in the area.
Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions).	No	The survey was conducted at Level 1 and required observational records of fauna present and habitat assessment
Proportion of fauna identified, recorded and/or collected.	No	All observed fauna could be identified to a sufficient level to determine conservation significance.
Sources of information (previously available information as distinct from new data).	No	Sufficient information was available to provide context to this survey.
The proportion of the task achieved and further work which might be needed.	No	The survey was adequate to describe the survey area and determine its likelihood of use by conservation significant species.
Timing/weather/season/cycle.	No	The survey was conducted during fine, clear and warm weather. Any significant fauna species usually present in the area would have been present and observable at the time.
Disturbances which affected results of the survey (e.g. fire, flood, accidental human intervention).	No	The survey area consisted of small patches of bushland isolated from larger areas by roads and grain storage facilities. No disturbances were noted during the field survey
Intensity (in retrospect was the intensity adequate).	No	The survey intensity was adequate to describe the area.
Completeness (e.g. was relevant area fully surveyed), remoteness and/or access problems	No	The survey was adequately conducted with no access problems.
Resources (e.g. degree of expertise available in animal identification to taxon level).	No	No detailed taxonomic expertise was required as all observed fauna were readily identifiable.

4 RESULTS

4.1 FLORA AND VEGETATION SURVEY

The field survey was conducted by Lyn Atkins (Principal Ecologist, Flora Taking (Biological Assessment) Licence FB62000003) largely during 10-11 September 2019. A supplementary survey was conducted on 19 November 2019 (see below).

Following the completion of the initial (September) survey, an additional area (approximately 0.2 ha partly with native vegetation) was identified as likely to require clearing. A P3-listed species was identified by the DBCA database search as occurring within 40 m of this additional area. Despite no similar species being observed during the September 2019 or earlier (Ecoscape 2010) surveys, it was considered prudent to revisit the survey area for additional survey. This DBCA record predates the earlier (2010) survey (2004), however, the subject species, *Daviesia implexa*, was not described as a discrete species until 2017 (Crisp *et al.* 2017) although it was also conservation listed under its previous name. Of note, the DBCA record that indicates two plants were recorded is from a Threatened Flora Report Form (now TPFRF) and does not correspond with a vouchered specimen, nor is the collector identified. Additionally, no locational accuracy is available although the collecting site description of 'Private property (Lot 88). CBH area, Hyden. Shire of Kondinin.' indicates that it would have occurred within the greater CBH site. There has, however, been significant clearing at the survey area since 2004 and it may no longer exist.

4.1.1 FLORA

Three quadrats and three relevés were established during the initial field survey. Two of the relevés were in disturbed areas. One relevé (H19R2) was in a patch of vegetation that was approximately the size of a quadrat, however, establishing a regular-shaped quadrat would have resulted in two vegetation types corresponding with the area if only recording better condition vegetation. In this case, the entire patch where in Very Good condition was recorded. A supplementary quadrat was recorded in the additional survey area in November. Quadrat and relevé locations are shown on **Map 2**.

A total of 142 vascular flora were recorded from 41 families and 100 genera. The Ecoscape (2010) survey of a smaller but largely corresponding area identified 110 species.

The most commonly represented families were Poaceae with 20 taxa, Myrtaceae and Fabaceae (13 taxa and Asteraceae (11 taxa). The most commonly represented genera were *Acacia* with eight taxa, *Melaleuca* (six taxa) and *Drosera* and *Schoenus* (four taxa). Five taxa (3.52%) of the flora could not be identified with certainty due to the lack of reproductive material; none are similar to any of conservation significance.

The number of species per quadrat ranged from 44 (quadrat H1904) to 13 (relevé H19R1). The average species diversity per quadrat was 29.29 (35.6 in undisturbed vegetation) which is higher than the 2010 survey (species diversity of 24). The most frequently recorded taxa were *Spartochloa scirpoidea* (from six of seven quadrats/relevés) and *Borya constricta*, *Melaleuca hamata* and **Ehrharta longiflora* (five quadrats/relevés).

The combined flora inventory is presented in **Table 22** in **Appendix Three**. Quadrat data is presented in **Appendix Four**.

4.1.2 CONSERVATION SIGNIFICANT FLORA

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

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

4.1.2.1 Daviesia implexa search

No *Daviesia implexa* plants were located during the survey of the additional area which was, with adjacent native vegetation nearby (north, east and south of this area), intensively searched. A somewhat similar species, *Daviesia pachyloma* (**Plate 1**, **Plate 2**) was recorded during the survey with the individual closest to this record located approximately 60 m from this point (but not within the additional survey area; the nearest record within

the survey area was approximately 110 m distant). *Daviesia pachyloma* had both flowers and fruit (pods) present during the survey thus its identification is certain.

It was concluded that *Daviesia implexa* does not occur within the additional survey area.

Plate 1: *Daviesia pachyloma*

Plate 2: *Daviesia pachyloma* specimen scan

4.1.2.2 Revised Likelihood Assessment

Following field survey, when additional information is available regarding actual habitat availability and searches have been conducted, the likelihood of conservation significant flora occurring in the survey area was revised. This revised likelihood, that took into account vegetation condition, disturbances, actual habitat availability and search effort (including that the area had largely been surveyed previously), is included in **Table 20** in **Appendix Two**).

The revised likelihood assessment indicates that no TF or PF species are anticipated to occur in the survey area.

4.1.3 OTHER SIGNIFICANT FLORA

According to the criteria outlined in the Flora and Vegetation Technical Guidance (EPA 2016d), no recorded flora taxa are considered to be significant.

4.1.3.1 Flora of Taxonomic Interest

No flora having any specific taxonomic interest were recorded during the field survey. The inability to identify some species with certainty was due to lack of diagnostic reproductive material as a result of poor seasonal conditions, survey timing that did not correspond with the flowering period of the species or being a taxonomic group for which there is insufficient information to aid taxonomists.

4.1.4 INTRODUCED FLORA

Twenty six introduced flora species (weeds), representing 18.31% of the total flora species, were recorded during the field survey. **Ehrharta longiflora* (Annual Veldt Grass) and **Arctotheca calendula* (Cape Weed) were the most commonly recorded introduced species occurring in five and four quadrats and/or relevés respectively. Within largely intact vegetation they occurred in localised patches associated with rabbit dung mounds or under *Santalum acuminatum* (Quandong) trees; in disturbed areas (relevés H19R1 and H19R3, and opportunistic observations) they were a significant contributor to lowering vegetation condition ratings.

**Moraea miniata* (Two-leaf Cape Tulip) is a Declared Pest plant that was recorded opportunistically; it is in the exempt category and has no management requirements.

No WONS species were recorded.

4.2 VEGETATION

Three vegetation types were recorded from within the survey area (**Table 7**). These vegetation types were based on structural vegetation type as identified in the field. The extents of the vegetation types and representative quadrat locations are shown on **Map 2**.

The aerial image underlying **Map 2** indicates a dam that is not visible as such and not included as a vegetated part of the survey area. The aerial imagery predates construction of the dam which is illustrated in **Plate 3** and **Plate 4**.

Plate 3: Dam

Plate 4: Dam (Google Inc. 2019, imagery dated 28/10/2018)

Table 7: Vegetation types

Landform	Mapping Unit	Vegetation Type	Floristic Quadrats	Representative Photograph	Other Characteristic Species	Area (ha) and Extent (%) of Survey Area
Valley floor	**MhAaAcTOS**	*Melaleuca hamata*, *Allocasuarina acutivalvis* and *Allocasuarina campestris* tall open shrubland over *Borya constricta*, *Amphipogon caricinus* and *Lepidobolus preissianus* low forbland/tussock grassland/sedgeland M+ ^*Melaleuca hamata*,^*Allocasuarina acutivalvis*,^*Allocasuarina campestris*\^shrub\4\i;G^^*Borya constricta*,*Amphipogon caricinus*,*Lepidobolus preissianus*\^forb,tussock grass,sedge\1\c	**H1901** H1902 H1903		*Astroloma serratifolium* *Austrostipa elegantissima* *Cassytha glabella* *Comesperma volubile* *Cryptandra apetala* var. *anomala* *Cryptandra myriantha* *Diuris brachyscapa* *Drosera andersoniana* *Drosera macrantha* *Drosera moorei* **Ehrharta longiflora* *Ericomyrtus serpyllifolia* *Grevillea yorkrakinensis* *Hibbertia eatoniae* *Lepidosperma drummondii* *Leucopogon hamulosus* *Melaleuca laxiflora* *Melaleuca platycalyx* *Neurachne alopecuroidea* *Platysace effusa* *Santalum acuminatum* *Schoenus calcatus* *Spartochloa scirpoidea*	1.83 ha 33.97%

Landform	Mapping Unit	Vegetation Type	Floristic Quadrats	Representative Photograph	Other Characteristic Species	Area (ha) and Extent (%) of Survey Area
Valley floor	**ElLMW**	*Eucalyptus loxophleba* subsp. *gratiae* low mallee woodland over *Melaleuca hamata*, *Santalum acuminatum* and *Alyxia buxifolia* tall open shrubland over *Rytidosperma setaceum*, *Borya constricta* and *Neurachne alopecuroidea* low open tussock grassland/forbland U+ ^*Eucalyptus loxophleba* subsp. *gratiae*\^tree mallee\6\i;M ^^*Melaleuca hamata,Santalum acuminatum,Alyxia buxifolia*\^shrub\4\i;G ^*Rytidosperma setaceum.*^*Borya constricta,Neurachne alopecuroidea*\^tussock grass,forb\1\i	**H19R2** H1904		*Austrostipa elegantissima* **Brassica tournefortii* *Cassytha glabella* *Ehrharta longiflora* *Eucalyptus subangusta* subsp. *subangusta* *Lepidosperma drummondii* *Melaleuca laxiflora* *Platysace effusa* *Schoenus hexandrus* *Spartochloa scirpoidea* *Thysanotus patersonii*	0.21 ha 3.84%

Landform	Mapping Unit	Vegetation Type	Floristic Quadrats	Representative Photograph	Other Characteristic Species	Area (ha) and Extent (%) of Survey Area
Valley floor	**MbAcMSCSS**	*Maireana brevifolia* and *Acacia multispicata* mid sparse chenopod shrubland/shrubland over **Avena barbata*, **Arctotheca calendula* and **Hordeum leporinum* low grassland/forbland M+ ^*Maireana brevifolia*,^*Acacia multispicata*\^chenopod shrub,shrub\3\r;G ^^*Avena barbata,Arctotheca calendula,Hordeum leporinum*\^other grass,forb\1\c	H19R1 **H19R3**		*Acacia enervia* subsp. *explicata* *Acacia hemiteles* *Acacia lasiocalyx* *Austrostipa hemipogon* **Bromus rubens* **Cotula bipinnata* *Crassula* sp. *Cryptandra myriantha* *Dodonaea caespitosa* **Ehrharta longiflora* *Enchylaena tomentosa* *Gonocarpus nodulosus* **Hypochaeris glabra* **Mesembryanthemum crystallinum* **Pentameris airoides* *Sclerolaena diacantha* *Spartochloa scirpoidea* **Vulpia myuros*	1.17 ha 21.68%
	Not vegetated					2.18 ha 40.51%
	TOTAL					5.39 ha

4.2.1.1 Floristic Analysis

The floristic analysis dendrogram (**Figure 3**) for the PATN analysis (Belbin & Collins 2006) indicates that the floristics support the field-based structural composition vegetation types (quadrats H1901, H1902 and H1903 as one group, quadrat H1904 and relevé H19R2 as another group, relevés H19R1 and H19R3 as the third group).

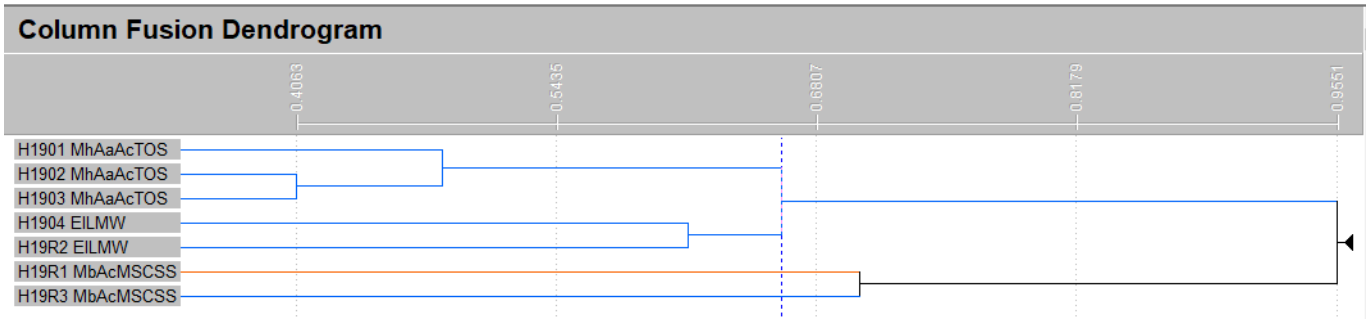


Figure 3: Floristic analysis (PATN dendrogram)

4.2.1.2 Vegetation Significance

None of the existing vegetation has any formal conservation significance i.e. none is considered representative of any currently described TEC or PEC.

The only potentially occurring conservation significant flora vegetation type (the Wheatbelt Woodlands TEC) does not occur within the survey area as no woodlands characterised by tree species occurred on the site.

None of the vegetation is considered to have any other particular significance as it is similar to widespread vegetation types in the local area.

4.2.1.3 Vegetation Condition

The vegetation of the survey area ranged from Excellent to Completely Degraded condition (**Table 8**, **Map 2**). The main factors influencing vegetation condition were previous clearing and localised weed invasion, usually along the edges and at times in the interior of otherwise Very Good or Excellent condition vegetation possibly as a result of rabbits, and also under *Santalum acuminatum* trees that provide areas of localised nutrient enrichment. The interior patches occurred at a scale too small to be mapped i.e. up to approximately 5 m^2.

Table 8: Vegetation condition extents

Vegetation condition	Extent (ha)	Extent (%)
Pristine	-	-
Excellent	1.55	28.84
Very Good	0.09	1.61
Good	0.33	6.14
Degraded	0.92	17.17
Completely Degraded	0.31	5.73
N/A (not vegetated)	2.18	40.51

4.3 VERTEBRATE FAUNA SURVEY

The fauna survey was conducted by Lyn Atkins (Principal Ecologist) during 10-11 September and 19 November 2019. The survey was conducted as a Level 1 survey according to the *Technical Guidance – Sampling Methods for Terrestrial Vertebrate Fauna* (EPA 2016f).

4.3.1 FAUNA ASSEMBLAGE

Seventeen vertebrate fauna species were recorded during the September field survey, with one additional species recorded in November totalling 18 species; the results are combined in **Table 9**. None are of conservation significance and two are introduced species. The Australian Shelducks (a breeding pair with chicks) were observed immediately adjacent to the survey area (dam and crossing the road towards the survey area) in September, and likely forage or shelter in it on occasion.

Table 9: Recorded fauna species

Species	Common name	Evidence
Mammals		
Macropus fuliginosus melanops	Western Grey Kangaroo	Scats (old)
Oryctolagus cuniculus	European Rabbit (introduced)	Diggings (old)
Birds		
Artamus cinereus	Black-faced Woodswallow	Sighted
Cacatua roseicapilla	Galah	Sighted
Chrysococcyx basalis	Horsfield's Bronze Cuckoo	Heard
Columba livia	Feral Pigeon (introduced)	Sighted
Coracina novaehollandiae	Black-faced Cuckoo-shrike	Sighted (November)
Corvus coronoides	Australian Raven	Sighted
Gavicalis virescens	Singing Honeyeater	Heard
Hirundo neoxena	Welcome Swallow	Sighted
Oreoica gutturalis	Crested Bellbird	Heard
Pardalotus striatus westraliensis	Striated Pardalote	Heard
Phaps chalcoptera	Common Bronzewing	Sighted
Platycercus zonarius	Port Lincoln Parrot	Sighted
Pomatostomus superciliosus	White-browed Babbler	Old roost
Rhipidura leucophrys	Willie Wagtail	Sighted
Tadorna tadornoides	Australian Shelduck	Sighted
Reptiles		
Tiliqua rugosa	Bobtail Skink	Sighted

4.3.2 CONSERVATION SIGNIFICANT FAUNA

No conservation significant fauna species were recorded.

White-browed Babbler was identified as a species of conservation significance that occurred within the survey area during the Ecoscape (2010) survey. It is no longer listed as being of conservation significance, however, the same roost as was observed in 2010 was still present (**Plate 5** and **Plate 6**), although there was no evidence of recent use or new roosts.

Plate 5: Babbler roost 2019

Plate 6: Babbler roost 2010

4.3.3 FAUNA HABITAT AND REVISED LIKELIHOOD ASSESSMENT

Two fauna habitat types (Shrubland, Chenopod shrubland) were recorded within the survey area (**Table 10**, **Map 2**). Both habitat types are suitable for generalist bird species without specific habitat requirements, and ground dwelling reptiles as described in **Table 10**.

The better quality habitat available within the survey area (Shrubland) is similar to adjacent areas in Lake Gounter Nature Reserve. More bird species including ground and canopy foraging species and nectivores are likely to utilise this habitat type and may breed in it if they nest in lower shrubs or on the ground. Smaller reptiles, including skinks and geckos, as well as the larger, mobile species (dragons, monitors, snakes) may occur on occasion but were not observed during the field survey. Due to the fragmented nature of the bushland, only smaller species with small home ranges are likely to breed in it.

The more degraded habitat type (Chenopod shrubland) is similar to habitats found in low-lying areas and along road verges in the area. Ground foraging birds and larger reptiles are likely to utilise this habitat on occasion but are unlikely to breed within it due to the lack of available shelter and the small extent of available habitat. The Chenopod shrubland is adjacent to a dam (**Plate 3**) in areas without vegetation; no evidence of use by any fauna species was noted although it is likely that it would be utilised as a drinking water source on occasion.

Small native mammals are unlikely to be present due to the small and fragmented nature of the available habitat. Whilst no evidence of cats was observed during the field survey that consisted of a daytime survey only, they are likely to be present due to the survey area's proximity to town (feral and wandering domestic cats) and likely food source of introduced rodents due to the grain stored within the CBH facility and spills during transport and transfer.

The habitat, when viewed in isolation, may be suitable for Malleefowl (*Leipoa ocellata*), however, as it is small and fragmented within the survey area, subject to periodic heavy vehicle traffic within its bounds, and more suitable and contiguous habitat occurs nearby (Lake Gounter Nature Reserve, immediately north), this species is unlikely to be more than a seasonal visitor attracted by spilled grain, if at all. Malleefowl was considered as having a High likelihood of occurring based on the desktop assessment; this likelihood has been revised to Medium following the field survey.

The habitat within the survey area is not suitable for Carnaby's Cockatoo (*Calyptorhynchus latirostris*) as no suitable large trees that could be used for roosting are present. Carnaby's Cockatoo was considered as having a High likelihood of occurring based on the desktop assessment; this likelihood has been revised to Low following the field survey. However, there are two large trees within the proposed development footprint that may be considered Black Cockatoo habitat trees. Neither are proposed to be removed during the proposed works thus were not assessed.

Table 10: Fauna habitat types

Habitat type	Description	Photo
Shrubland	*Melaleuca* and *Allocasuarina* (Sheoak) shrubland with occasional mallees. Habitat is suitable for generalist bird species including insect gleaners and ground dwelling reptiles. **Extent:** 2.04 ha **Percentage of survey area:** 37.81%	
Chenopod Shrubland (Degraded)	Degraded chenopod vegetation consisting of herbaceous and grassy weeds with patches of Bluebush and scattered *Acacia* shrubs. Vegetation has little structure and provides little shelter for any fauna species, so is only likely to be suitable for seed-eating ground foraging birds e.g. parrots (Ringnecks) and cockatoos (Galahs) and traverses by generalist reptiles (Bobtail Skinks, snakes). **Extent:** 1.17 ha **Percentage of survey area:** 21.68%	
Not habitat	Roads, cleared areas, not vegetated areas	2.18 ha, 40.51%

LEGEND

- Survey_Area

Flora Quadrats (Ecoscape, 2019)

- Quadrat
- Releve

Vegetation Condition (Ecoscape, 2019)

- Excellent (E)
- Very Good (VG)
- Good (G)
- Degraded (D)
- Completely Degraded (CD)

Vegetation Type (Ecoscape, 2019)

- *Eucalyptus loxophleba* subsp. *gratiae* low mallee woodland (EILMW)
- *Maireana brevifolia* and *Acacia multispicata* mid sparse chenopod shrubland/shrubland (MbAcMSCSS)
- *Melaleuca hamata, Allocasuarina acutivalvis* and *Allocasuarina campestris* tall open shrubland (MhAaAcTOS)

Fauna Habitat

MbAcMSCSS = Chenopod Shrubland
MhAaAcTOS and EILMW = Shrubland

ecoscape

SURVEY RESULTS

HYDEN FLORA, VEGETATION AND FAUNA SURVEYS

DATA SOURCES :
SOURCE DATA:
AERIAL: LANDGATE LOCATE MOSAIC
BASEMAP: GEOSCIENCE AUSTRALIA
SERVICE LAYERS:

CBH GROUP

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

N

SCALE: 1:3,000 @ A3

0 25 50 75 100 m

PROJECT NO: 4464-19

REV	AUTHOR	APPROVED	DATE
00	SB	LA	22/10/2019
01	SB	LA	02/12/2019

MAP 02

5 DISCUSSION

The survey area consisted of a number of small parcels of bushland and previously cleared areas separated by internal roads and grain receival infrastructure. Most of the survey area was assessed in September 2019, with an additional area identified and surveyed in November.

5.1 FLORA SIGNIFICANCE

A total of 142 vascular flora species recorded from four floristic quadrats and three relevés, and opportunistic searches over the two survey periods. Twenty six (18.31%) of these were introduced species. Five could not be identified with certainty due to lack of diagnostic reproductive material; none were similar to any currently described conservation significant species.

Based on surveyor experience (Department of Water 2008; 2009; Ecoscape 2006; 2007; 2010, noting that none of these surveys utilised detailed quadrat-based data assessments) the species diversity of the better condition quadrats within the survey area is likely to be similar to what would be expected in relatively undisturbed areas in the vicinity. A recent survey from an area approximately 50 km northwest (Ecoscape 2017) recorded lower species diversity (average of 16.33 for quadrats in Excellent or Very Good condition) than the quadrats and relevé in similar condition recorded in this survey (average of 32.5 species), noting that the Tampia survey (Ecoscape 2017) was largely of woodland vegetation types that are anticipated to have lower species diversity than shrublands..

5.1.1 RECORDED CONSERVATION SIGNIFICANT FLORA

No TF species listed for protection under the Commonwealth EPBC Act or Western Australian BC Act were recorded from the survey area. Seven TF species are known to occur within 20 km of the survey area (i.e. as identified by DBCA database searches), however, none have been previously recorded from within it. None were considered likely to occur (i.e. had been overlooked) within the survey area following the field survey.

No PF flora were identified from the survey area. Fifty one PF species have been previously recorded from within 20 km of the survey area (as identified by the DBCA database searches), however, none had been previously recorded from within it although one (*Daviesia implexa*, P3) was reported as occurring within the overall CBH site although not within the bushland considered as the survey area. This species was targeted for survey in November, however, it was not recorded within or in bushland in close vicinity to the small additional survey area. None were considered likely to occur following the field survey.

5.1.2 OTHER SIGNIFICANT FLORA

No flora recorded from within the survey area were considered to have any significance according to the criteria outlined in the Flora and Vegetation Technical Guidance (EPA 2016d).

5.1.3 INTRODUCED FLORA

Twenty six introduced flora were recorded during the field survey. All are considered to occur commonly within the agricultural region of Western Australia. One, *Moraea miniata* (Two-leaf Cape Tulip), is a Declared Pest plant, however, it is in the exempt category under the BAM Act and has no management requirements.

No WONS species were recorded.

5.2 VEGETATION SIGNIFICANCE

Three vegetation types were recorded as occurring in the survey area. Two were largely undisturbed i.e. close to their natural condition (vegetation types **MhAaAcTOS** and **EILMW**), however, one (vegetation type **MbAcMSCSS**) was a result of disturbance and was characterised by introduced weeds under shrub species (including chenopod shrubs) that are favoured by (e.g. *Maireana brevifolia*) or tolerant of disturbance (e.g. *Acacia* species, *Enchylaena tomentosa*).

5.2.1 SIGNIFICANT ECOLOGICAL COMMUNITIES

No vegetation was considered to represent currently described TECs or PECs occur within the survey area.

Much of the survey area is included in the mapped extent, including buffers, of two occurrences of the Wheatbelt Woodlands TEC. However, no vegetation meeting the basic descriptive requirement of having tree-form Eucalypts occurs within the survey area, therefore the TEC does not by definition occur.

No other TEC or any PEC are considered to occur within 20 km of the survey area according to the DBCA database search.

5.2.2 OTHER SIGNIFICANT VEGETATION

None of the vegetation occurring within the survey area is considered to have any particular significance according to the criteria outlined in the Flora and Vegetation Technical Guidance (EPA 2016d).

5.2.3 LOCAL AND REGIONAL SIGNIFICANCE

The vegetation within the survey area was assessed as having two similar relatively undisturbed vegetation types (a *Melaleuca* and *Allocasuarina*-dominated shrubland, **MhAaAcTOS**, and a mallee woodland, **EILMW**), as well as a degraded vegetation type (**MbAcMSCSS**). All characteristic species of the relatively undisturbed vegetation types commonly occur in the area, and the combination of species that define the vegetation types are also frequently observed. Similar vegetation occurs on the adjacent Lake Gounter Nature Reserve, although the reserve is likely to be more species rich as more Proteaceous species were observed. The disturbed vegetation type is similar to that found in low-lying areas and along degraded road verges throughout the agricultural region.

The pre-European vegetation association that corresponds with the majority (86.36%) of the survey area (vegetation association 519) is a shrubland that broadly meets the description of the vegetation within the survey area. It has more than 50% of its original extent remaining at all scales (**Table 2** in **Section 2.2.2**). Therefore, broadly similar vegetation is widespread within the region and state.

The other pre-European vegetation association corresponding with the survey area (vegetation association 945, occupying 13.62% of the survey area) has less than 20% of its original extent remaining at all scales. However, its description of *Medium woodland; salmon gum/Shrublands; mallee scrub, redwood & black marlock* (DPIRD 2018) indicates that it is primarily a woodland, which does not occur within the survey area although the lesser components (primarily *Shrublands/mallee scrub*) clearly do align. Only 0.53 ha of native vegetation corresponds with this vegetation association.

In summary, the vegetation within the survey area is not considered to have any particular local or regional significance.

5.3 VEGETATION CONDITION

A significant portion (2.18 ha, 40.51%) of the survey area did not have native vegetation as it corresponded with roads, completely cleared areas and a dam. A further 1.23 ha (22.90%) had some native vegetation present, however, was in Degraded and Completely Degraded condition and is not considered to represent extant native vegetation.

Vegetation in Good, Very Good and Excellent condition corresponded with 1.97 ha (36.59%) of the survey area. Areas in Very Good and Excellent condition had weed covers of <5%, however, the Good condition vegetation that was largely around the edges of the better condition areas had a significantly higher weed cover (although not mapped separately). All of the weeds occur commonly in the agricultural region of Western Australia. One, **Moraea miniata*, is a Declared Pest plant, however, it is in the exempt category under the BAM Act and has no management requirements.

5.4 FAUNA SIGNIFICANCE

5.4.1 SIGNIFICANT FAUNA HABITAT TYPES

Two fauna habitat types were recorded within the survey area: Shrubland and degraded Chenopod shrubland. Both habitat types are fragmented and form small areas surrounded by infrastructure including roads. Each of these habitat types supports a suite of birds and reptiles, although native mammals are unlikely to frequent them (old Western Grey Kangaroo scats were recorded).

No conservation significant fauna species were recorded, nor is the habitat suitable for any that are known from the vicinity.

While broadly suitable for Malleefowl breeding as it has shrubs, mallees and available leaf litter, the small and fragmented nature of the bushland within the survey area and frequent disturbance by nearby human activity (including being close to town) would discourage the birds from visiting the survey area and make it unsuitable for breeding. Contiguous bushland exists to the north and west of the survey area, in Lake Gounter Nature Reserve, and is more likely to be used by Malleefowl although unlikely to be used successfully for breeding due to its proximity to town and feral predators.

No trees suitable for roosting are present within the survey area nor is the survey area suitable for foraging, thus the area is unlikely to be suitable for Carnaby's Cockatoo. Use of the Commonwealth Black Cockatoo Foraging Quality Scoring Tool (**Table 18** in **Appendix One**) produces a negative score, indicating that the survey area does not represent foraging habitat for Carnaby's Cockatoo.

5.4.2 FAUNA ASSEMBLAGE

Eighteen vertebrate fauna species were recorded during the field survey.

Two of the recorded species were mammals, including Western Grey Kangaroo and the introduced European Rabbit, although the evidence of their presences was not recent. Although not recorded, Cats (feral and wandering domestic) and Foxes (and perhaps wandering domestic Dogs) are likely to be frequent visitors to the survey area and would predate smaller mammal species, including House Mouse that is likely to be present due to available food, reptiles and birds.

One reptile was observed, the Bobtail Skink. Smaller skinks and geckos would likely to be present, and larger species visit occasionally but were not observed, in part due to the cool conditions during the September survey.

Fifteen bird species were recorded. None are of conservation significance, and most are commonly encountered in rural and semirural areas.

5.4.3 CONSERVATION SIGNIFICANT FAUNA

No conservation significant fauna species were recorded. None are considered to have a High likelihood of occurring. Malleefowl is considered to have a Medium likelihood of occurrence but is not anticipated to be other than a seasonal visitor to the survey area and is not likely to breed within the survey area.

The survey area does not have habitat that has any particular significance to any species of conservation or other significance and is close to areas in better condition with more continuous (larger extents, not broken by roads and infrastructure) bushland that is more suitable as habitat.

6 CONCLUSIONS

6.1 FLORA AND VEGETATION FACTOR CONSIDERATIONS

Considerations for EIA for the factor *Flora and Vegetation* (EPA 2016a) include, but are not necessarily limited to:

- application of the mitigation hierarchy to avoid and minimise impacts to flora and vegetation, where possible
- the flora and vegetation affected by the proposal
- the potential impacts and the activities that will cause them, including direct and indirect impacts
- the implications of cumulative impacts
- whether surveys and analyses have been undertaken to a standard consistent with guidance
- the scale at which impacts to flora and vegetation are considered
- the significance of the flora and vegetation, and the risk to the flora and vegetation
- the current state of knowledge of flora and vegetation and the level of confidence underpinning the predicted residual impacts
- whether proposed management and mitigation approaches are technically and practically feasible
- whether the proposal area will be revegetated in a manner that promotes biological diversity and ecological integrity.

Various issues are frequently of significance within the environmental impact assessment process. These issues, and the potential impact from the proposed works, are summarised below.

6.1.1 HABITAT LOSS, DEGRADATION AND FRAGMENTATION

The survey area corresponds with two pre-European vegetation associations. One of these, vegetation association 945, has less than 20% of its original extent remaining. There is 32,672.36 ha of this vegetation association remaining in Western Australia (Government of Western Australia 2019) thus clearing 0.53 ha (<0.002% of its remaining Western Australian extent) is unlikely to have a significant impact on the vegetation association's overall area.

However, the majority of the survey area corresponds with vegetation association 519, described as Shrublands; mallee scrub, which has more than 50% of its original extent remaining. Therefore, clearing of 2.67 ha (some in Degraded or Completely Degraded condition) of a vegetation association that has over 130,000 ha remaining within the local government area (Government of Western Australia 2019) is unlikely to have a significant impact on habitat loss, degradation or fragmentation.

The survey area is surrounded on one side (south) by agricultural lands and on two sides by existing infrastructure (west and north); it therefore has a minimal role in landscape connectivity.

6.1.2 INVASIVE SPECIES

Twenty six introduced species (weeds) were recorded from the survey area, all of which are common within the agricultural region of Western Australia. Expanding the CBH facility is unlikely to significantly increase the weed cover or result in additional weed species in the survey area or its surrounds.

6.1.3 FIRE REGIMES

Fire occurs naturally in the landscape as a result of lightning strike and Australian vegetation has evolved to recover rapidly. However, fire is unlikely to be used as tool for fuel reduction within the survey area due to proximity to infrastructure (grain storage). Fire risk, frequency or intensity within the survey area and nearby areas is unlikely to be altered by any works associated with the proposed grain facility expansion.

6.1.4 CHANGING CLIMATE

DPIRD (2019) has recently released climate change projections for the Hyden area. These projections identify increased maximum temperatures including more days of extreme temperature, reduced growing season rainfall and variable and later starts to the growing season.

Climate change impacts on native flora and vegetation may be of importance as a cumulative impact when taking all changing factors into account, however, on its own, climate change is unlikely to be to be a significant factor in the survey area, particularly considering the small amount of clearing anticipated.

6.1.5 STATE OF KNOWLEDGE

There are no specific knowledge gaps that apply to the flora and vegetation values of the survey area.

It is considered the 'application of general ecological principles' are likely to be a reasonable guide to understanding the flora and vegetation of the survey area.

6.2 FAUNA FACTOR CONSIDERATIONS

Considerations for EIA for the factor Terrestrial Fauna (EPA 2016b) include, but are not necessarily limited to:

- application of the mitigation hierarchy to avoid and minimise impacts to terrestrial fauna, where possible
- the terrestrial fauna affected by the proposal
- the potential impacts and the activities that will cause them, including direct and indirect impacts
- the implications of cumulative impacts
- whether surveys and analyses have been undertaken to a standard consistent with EPA technical guidance
- the scale at which impacts terrestrial fauna are considered
- the significance of the terrestrial fauna and the risk to those fauna
- the current state of knowledge of the affected species/assemblages and the level of confidence underpinning the predicted residual impacts
- whether proposed management and mitigation approaches are technically and practically feasible.

Various issues are frequently of significance within the environmental impact assessment process. These issues, and the potential impact from the proposed works, are summarised below.

6.2.1 HABITAT LOSS, DEGRADATION AND FRAGMENTATION

The survey area is surrounded on one side (south) by agricultural lands and on two sides by existing infrastructure (west and north); it therefore has a minimal role in landscape connectivity.

The small amount of clearing required is unlikely to cause any significant habitat loss or degradation. All fauna species recorded from within the survey area have no specific conservation significance, and no conservation significant species are likely to utilise the survey area.

6.2.2 FIRE REGIMES

Fire risk, frequency or intensity within the survey area and nearby areas is unlikely to be altered by any works associated with the proposed grain facility expansion.

6.2.3 INVASIVE SPECIES

Invasive, or feral, pest species occur across the State at varying levels of density, with higher densities usually associated with human habitation (Frank *et al.* 2014). Invasive pests are impacting native fauna species ability to persist in the landscape.

European Rabbits and Feral Pigeons were the only invasive species recorded from the survey area although Cats (wandering domestic and feral), Red Foxes, wild or wandering domestic Dogs, Black Rats and House Mouse are likely to occur. Any proposed works is unlikely to significantly increase the numbers or effects of these on any native species.

6.2.4 CHANGING CLIMATE

Changing climate has the potential to affect the fauna corresponding with the survey areas, however, any potential works are not of sufficient scale to affect climate. Taking into consideration the cumulative effects of climate change and the other factors considered herein, climate change in *toto* is more significant than the localised impacts discussed, but outside the control of the proponent.

6.2.5 SHORT RANGE ENDEMISM

No short range endemic species are known to correspond with the survey area.

6.2.6 STATE OF KNOWLEDGE

There are no specific knowledge gaps that apply to the fauna and habitat values of the survey area.

It is considered the 'application of general ecological principles' are likely to be a reasonable guide to understanding the fauna of the survey area.

6.3 ASSESSMENT AGAINST THE 10 CLEARING PRINCIPLES

The following table sets out an assessment against the Department of Water and Environmental Regulation's 10 Clearing Principles (Department of Environment Regulation 2014).

Table 11: Assessment against the 10 clearing principles

Clearing Principle	Justification of Variance	References	Variance
A Native vegetation should not be cleared if it comprises a high level of biological diversity	The survey area is located within the southwest of Western Australia which, in general, is considered to represent an area of high biological diversity. However, the area has only moderate flora species richness and a relatively low fauna diversity due to its proximity to infrastructure and town. The survey area is also fragmented, thus restricting its habitat diversity. It is not part of any landscape linkages.	This report; Ecoscape (2010)	Unlikely to be at variance
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 does not have habitat that is significant for any conservation significant fauna species. The habitat available is of only a small extent and internally fragmented and is therefore unlikely to be significant for any fauna species.	This report; Ecoscape (2010)	Unlikely to be at variance
C Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora	No rare flora (TF) occur on the survey area. No Priority-listed flora species occur on the areas proposed for clearing.	This report; Ecoscape (2010); DBCA records	Unlikely to be at variance
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 vegetation of the survey area does not correspond with any currently described TEC.	This report; Ecoscape (2010)	Not at variance
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	The survey area corresponds with two pre-European vegetation associations. Vegetation association 945, which occupies only a small extent within the survey area, has less than 20% of its original extent remaining. Clearing the small, isolated patches of native vegetation corresponding with this vegetation association is unlikely to significantly affect the overall association's extent or viability. Vegetation association 519 which occupies the majority of the survey area has >50% of its original extent remaining.	This report	Unlikely to be at variance

Clearing Principle	Justification of Variance	References	Variance
F Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland	No natural wetlands or watercourses correspond with the survey area.	This report	Not at variance
G Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation	Clearing of approximately 3.20 ha of native bushland is unlikely to result in appreciable land degradation in areas adjacent to the survey area. Any development is unlikely to result in erosion, significant dust deposition, land contamination or any other aspect that may affect neighbouring lands.	Observation	Unlikely to be at variance
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 near (approximately 200 m) Lake Gounter Nature Reserve. However, this Reserve is separated from the survey area by a sealed road and buffer of roadside vegetation. Additionally, the Reserve is upslope of the survey area, thus any runoff from the site is unlikely to reach the Reserve.	This report; observation	Unlikely to be at variance
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	The survey area is low-lying but has no natural streams through or adjacent to it. With appropriate management any runoff from the proposed works could be retained on site, including during clearing and construction, without affecting adjacent farmlands. Underground water is not anticipated to be affected by the proposed clearing and works.	Observation	Unlikely to be at variance
J Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding	With appropriate management any runoff from the proposed works could be retained on site, including during clearing and construction, without affecting adjacent farmlands. Therefore there is no reason to consider that clearing native vegetation will alter the incidence or intensity of flooding.	Observation	Unlikely to be at variance

Referrals against Matters of National Environmental Significance

There are no relevant Matters of National Environmental Significance applicable to the survey area. Therefore, no EPBC referrals will be required.

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APPENDIX ONE DEFINITIONS AND CRITERIA

Table 12: EPBC Act categories for flora and fauna

EPBC Act category	Definition
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.
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.
Critically Endangered (CE)	A native species is eligible to be included in the critically endangered 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 endangered 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 vulnerable 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.

Table 13: Conservation codes for Western Australian flora and fauna (DBCA 2019)

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 *Biodiversity Conservation Act 2016* (BC Act). Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna. Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threatened Flora. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.
CR	**Critically endangered species** Threatened species considered to be "*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*". Listed as critically endangered undersection 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.
EN	**Endangered species** Threatened species considered to be "*facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.
VU	**Vulnerable species** Threatened species considered to be "*facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*". Listed as vulnerable undersection 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.
Extinct species Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.	
EX	**Extinct species** Species where "*there is no reasonable doubt that the last member of the species has died*", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act). Published as presumed extinct under schedule 4of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.
EW	Extinct in the wild species Species that "*is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*", and listing is otherwise in accordance with the ministerial guidelines (section 25of 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 15of 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 *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species. 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 14of the BC Act). Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.
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 18of the BC Act). Published as other specially protected fauna under schedule 7of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.
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.
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 14: 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).
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).

Criteria	Definition
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	*Poorly known ecological communities* 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	*Poorly known ecological communities* 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.
Priority Three	*Poorly known ecological communities* 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	*Conservation Dependent Ecological Communities* Ecological Communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Table 15: NVIS structural formation terminology, terrestrial vegetation (NVIS Technical Working Group 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 16: NVIS height classes (NVIS Technical Working Group 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 17: Vegetation Condition Scale for the South West and Interzone Botanical Provinces (EPA 2016d)

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 18: Commonwealth Black Cockatoo Foraging Quality Scoring Tool (Commonwealth of Australia 2017)

Starting Score	Foraging habitat for Carnaby's Cockatoo	Foraging habitat for Baudin's Cockatoo	Foraging habitat for Forest Red-tailed Black cockatoo
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 sore 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 sore 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 sore 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	**Context adjustor - attributes improving functionality of foraging habitat**	**Context adjustor - attributes improving functionality of foraging habitat**	**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 ≥ 500 mm or ≥ 300 mm dbh for salmon gum and wandoo)	Contains trees with potential to be used for breeding (dbh ≥ 500 mm or ≥ 300 mm dbh for salmon gum and wandoo)	Contains trees with potential to be used for breeding (dbh ≥ 500 mm or ≥ 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. *Phytophthora cinnamomi* or marri canker	Disease present (e.g. *Phytophthora cinnamomi* or marri canker)	Disease present (e.g. *Phytophthora cinnamomi* or marri canker)

Table 19: 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.

APPENDIX TWO DESKTOP ASSESSMENT RESULTS

Table 20: Flora database search results (PMST and DBCA database searches), likelihood and flora survey records

Database	PMST	Taxon	WA Cons. Code	EPBC Cons. Code	Habitat	Flowering	Likelihood	Revised Likelihood
WAHerb		*Acacia arcuatilis*	P2		Sand or sandy loam, sometimes with lateritic gravel. Undulating plains, rises.	Jun to Aug	Moderate	Low
WAHerb		*Acacia concolorans*	P2		Red/brown loam, clay. Low lateritic hills, flats.	Jul to Aug	High	Moderate
WAHerb		*Acacia deflexa*	P3		Yellow & gravelly lateritic sand, gravelly sandy loam. Plains.	Aug to Sep	Moderate	Low
WAHerb		*Acacia errabunda*	P3		Clay, loam, gravelly loam, sand. Undulating plains, clay flats.	Jul to Aug	Low	Low
WAHerb		*Acacia lanei*	P3		Clay, clay loam, gravelly loam. Along drainage lines & creeks.	Jul to Sep	Moderate	Low
	may occur	*Acacia lanuginophylla*	T	EN	White/grey sand, clayey sand, gravelly soils. Flats, along drainage lines.	Jul to Oct	Low	Low
WAHerb		*Acacia obesa*	P3		Yellow sand, gravelly loam.	Jul to Sep	Moderate	Low
WAHerb		*Acacia sedifolia* subsp. *pulvinata*	P3		Gravelly sand or clay. Laterite hills, gravelly ridges.	Jul to Aug	Low	Low
WAHerb		*Acacia tuberculata*	P2		Granite outcrops.	Sep	Low	Low
WAHerb		*Acacia undosa*	P3		Sandy clay loam, clayey sand. Undulating plains, low-lying areas.	Jul to Sep	Low	Low
WAHerb		*Anticoryne melanosperma*	P3		Sandplains, in sand over laterite or rarely associated with granite. Fl. white, Jul to Nov	Jul to Nov	Moderate	Low
TPFL		*Baeckea* sp. North Ironcap (R.J. Cranfield 10580)	P1		Red clay. Gently undulating sandplains	Oct	Low	Low
WAHerb		*Banksia rufa* subsp. *chelomacarpa*	P3		Sandy loam over gravel.	Jul to Oct	Moderate	Low
	likely	*Banksia sphaerocarpa* subsp. *dolichostyla*	T	VU	Lateritic gravel, grey sand.	Mar to May	Low	Low
	may occur	*Boronia capitata* subsp. *capitata*	T	EN	Sand, often over laterite. Sandplains.	Aug to Dec or Feb	Low	Low
WAHerb		*Bossiaea atrata*	P3		White sand or sandy loam over laterite or clay, quartzite sand, clay.	May to Aug	Moderate	Moderate
WAHerb		*Brachyloma elusum*	P2		Yellow sandy soils with granite at depth; tall heathland dominated by Allocasuarina campestris and Melaleuca spp.	Apr-Jul	Moderate	Moderate
TPFL	likely	*Caladenia graniticola*	T	EN	Gritty sandy clay, granite. Near low exposed rock outcrops.	Oct	Low	Low
TPFL	likely	*Calectasia pignattiana*	T	VU	Sand to sandy clay over granite or laterite, gravel. Plains and gentle slopes.	Aug to Oct	Moderate	Low
WAHerb		*Calytrix patrickiae*	P2		Heathland on sand or gravelly sand	Sep-Oct	Low	Low
WAHerb		*Daviesia implexa*	P3		Sand & laterite.	Sep	High	Low
TPFL		*Daviesia oxylobium*	P4		Sandy lateritic soils. Undulating plains.	Jul to Aug	Moderate	Low

Database	PMST	Taxon	WA Cons. Code	EPBC Cons. Code	Habitat	Flowering	Likelihood	Revised Likelihood
WAHerb		*Daviesia uncinata*	P3		Gravelly lateritic sand, loamy sand. Undulating plains.	Dec or Jan	Low	Low
WAHerb		*Desmocladus eludens*	P2		Sand, sometimes with laterite.	?	Low	Low
WAHerb		*Dielsiodoxa leucantha subsp. leucantha*	P3		Quartz, breakaway, quartz/clay, sand over granite; mallee-heath, heath	Oct	Low	Low
WAHerb		*Eremophila biserrata*	P4		Sandy or sandy clay soils. Alluvial flats, salt flats & lakes.	Sep to Nov or Mar	Low	Low
WAHerb		*Eremophila racemosa*	P4		Sandy or stony loam, clay loam. Undulating plains, roadsides.	Mar or Aug to Dec	Moderate	Low
TPFL	likely	*Eremophila verticillata*	T	EN	Clay loam, loam over limestone.	Nov to Dec	Low	Low
WAHerb		*Eucalyptus caesia* subsp. *caesia*	P4		Loam. Granite outcrops.	May to Sep	Low	Low
TPFL		*Eucalyptus myriadena* subsp. *parviflora*	P1		Loam. Swamps, plains.	Jan, Apr, Aug, Oct	Low	Low
WAHerb		*Eucalyptus ornata*	P3		Laterite. Ridges.	?	Low	Low
WAHerb		*Eucalyptus subangusta* subsp. *virescens*	P3		Yellow sand, white clay	Apr	Moderate	Low
WAHerb		*Eutaxia hirsuta*	P2		Gravelly sandplain; low heath.	Sep-Nov	Low	Low
WAHerb		*Frankenia drummondii*	P3		Prostrate shrub. Fl. white. Sand. Lake edges.	Oct-Dec	Low	Low
WAHerb		*Gastrolobium densifolium*	P4		Sandy soils. Undulating dunes.	Sep to Oct	Low	Low
	likely	*Gastrolobium diabolophyllum*	T	CR	Yellow-brown sand over laterite. Broadly undulating dunes.	Sep	Low	Low
	may occur	*Grevillea dryandroides* subsp. *hirsuta*	T	EN	White or yellow sand, laterite	May or Sep to Nov	Low	Low
WAHerb	likely	*Grevillea involucrata*	T	EN	Gravelly sand.	Jun or Oct	Low	Low
WAHerb		*Grevillea prostrata*	P4		White, grey or yellow sand, gravel. Sandplains.	Aug to Dec or Jan	Low	Low
WAHerb	likely	*Grevillea scapigera*	T	EN	Sandy or gravelly lateritic soils.	Feb or Oct to Nov	Moderate	Low
WAHerb		*Gyrostemon ditrigynus*	P4		Sand, sandy clay, loam. Plains, low ironstone ridges.	Oct-Dec	Low	Low
WAHerb		*Isoetes brevicula*	P3		Submerged in rock pools on granitic outcrops.	Sep to Nov	Low	Low
WAHerb		*Leucopogon* sp. Ironcaps (N. Gibson & K. Brown 3070)	P3		Skeletal sand, yellow sandy loam, rocky loam, gravel, laterite, ironstone. Gentle lower slopes, flat uplands, hill tops.	Aug	Low	Low
WAHerb		*Leucopogon* sp. Lake Magenta (K.R. Newbey 3387)	P1		Uplands; sand or sand over laterite	Nov	Low	Low

Database	PMST	Taxon	WA Cons. Code	EPBC Cons. Code	Habitat	Flowering	Likelihood	Revised Likelihood
WAHerb		*Melaleuca fissurata*	P4		White/grey sand, sandy loam. Samphire flats, salt pans.	Jul to Aug	Low	Low
WAHerb		*Persoonia hakeiformis*	P2		Gravelly clay loam or sand over laterite. Lateritic ridges.	Oct to Dec or Jan	Moderate	Low
WAHerb		*Phebalium brachycalyx*	P3		Sand, gravelly soils. Lateritic uplands, hills.	Aug to Sep	High	Moderate
WAHerb		*Pilostyles collina*	P4		On Oxylobium linearifolium, Nemcia leakeana & Gastrolobium velutinum.	Jan to Feb	Low	Low
WAHerb		*Prostanthera nanophylla*	P3		Yellow sand over laterite, rocky loam. Sandplains.	Aug to Nov	Low	Low
WAHerb		*Pterostylis zebrina*	P2		Granite; Casuarina and mallees	Oct	Low	Low
WAHerb		*Pultenaea indira* subsp. *monstrosita*	P3		Sand, sandy clay or loamy sand, gravel. Gentle slopes, flat to undulating plains, adjacent to salt lake.	Sep to Oct	Low	Low
WAHerb		*Rinzia torquata*	P3		Sand and laterite; mallee, shrublands	Oct	Moderate	Moderate
WAHerb	known	*Roycea pycnophylloides*	T	EN	Sandy soils, clay. Saline flats.	Sep	Low	Low
TPFL		*Stylidium rhipidium*	P3		Sandy soils. Wet creek flats, swamps, granite outcrops.	Oct to Nov	Low	Low
WAHerb		*Stylidium sejunctum*	P3		Clayey sand or loam, laterite. Outcrops, upper slopes, breakaways. Mallee and Allocasuarina shrubland.	Sep to Nov	Moderate	Low
WAHerb		*Stylidium* sp. Dragon Rocks (J.A. Wege & K.A. Shepherd JAW 2054)	P2		Sand, laterite; shrubland.	Nov	Low	Low
WAHerb		*Stylidium thylax*	P2		Sand. Gentle slopes and plains. Heath, mallee shrubland.	Oct	Low	Low
WAHerb		*Stypandra jamesii*	P2		Shallow soils. Crevices & fissures in granite rocks, around edges of outcrops	Oct to Nov	Low	Low
	likely	*Symonanthus bancroftii*	T	EN	Woodland, mallee. Clay, clay over granite, edge of wetland.	Sep	Low	Low
WAHerb		*Synaphea cervifolia*	P2		Sandy clay & gravel.	Jun to Oct	Moderate	Low
WAHerb		*Synaphea tripartita*	P3		Lateritic gravel, clay.	Jul to Oct	Moderate	Low
WAHerb		*Thysanotus cymosus*	P3		Clay, granitic or lateritic sand.	Sep to Oct	Low	Low
WAHerb	likely	*Tribonanthes purpurea*	T	VU	Seasonally wet soils in moss swards & herbfields among granite rocks.	Aug	Low	Low
WAHerb		*Verticordia setacea*	P2		Laterite, sand over laterite; kwongan heath.	Nov-Dec	Moderate	Low
	may occur	*Verticordia staminosa* var. *cylindracea*	T	EN	Soil pockets. Granite outcrops.	Jul to Oct	Low	Low

* WAH = herbarium record (vouchered specimen)
TPFL = Threatened Flora Report Form record i.e. not confirmed by vouchered specimen OR place name search result only i.e. not recorded within search buffer

** PMST likelihood of occurrence or likelihood of habitat occurring

Table 21: Combined vertebrate fauna database results and likelihood assessment

Database		Scientific Name	Common Name	Cons. code		Likelihood	
DBCA	PMST			DBCA	EPBC	Desktop	Revised
Mammals							
x	'may occur'	*Dasyurus geoffroii*	Chuditch, Western Quoll	VU	VU	Very low	Very low
x		*Isoodon fusciventer*	Quenda, Southern Brown Bandicoot	P4		Very low	Very low
x		*Macrotis lagotis*	Bilby, Dalgyte, Ninu	VU		Very low	Very low
x	'known - translocated'	*Myrmecobius fasciatus*	Numbat, Walpurti	EN	EN	Very low	Very low
x		*Notamacropus irma*	Western Brush Wallaby	P4		Low	Very low
x	'likely'	*Phascogale calura*	Red-tailed Phascogale, Kenngoor	CD	VU	Low	Very low
x		*Pseudomys occidentalis*	Western Mouse	P4		Very low	Very low
x		*Pseudomys shortridgei*	Heath Mouse, Heath Rat, Dayang	VU	EN	Very low	Very low
Birds							
x	'known'	*Tringa (Actitis) hypoleucos*	Common Sandpiper	IA	MI	Low	Very low
	'likely'	*Apus pacificus*	Fork-tailed Swift	IA	MI	Very low	Very low
	'may occur'	*Calidris acuminata*	Sharp-tailed Sandpiper	IA	MI	Very low	Very low
	'may occur'	*Calidris ferruginea*	Curlew Sandpiper	VU, IA	CR	Very low	Very low
	'may occur'	*Calidris melanotos*	Pectoral Sandpiper		MI	Very low	Very low
x	'known'	*Calyptorhynchus latirostris*	Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo	EN	EN	High	Low
x		*Falco peregrinus*	Peregrine Falcon	OS		Low	Very low
x	'known'	*Leipoa ocellata*	Malleefowl	VU	VU	High	Medium
	'may occur'	*Motacilla cinerea*	Grey Wagtail	IA		Very low	Very low
x		*Ninox connivens connivens (southwest subpop.)*	Barking Owl (southwest subpop.)	P3		Very low	Very low
x		*Platycercus icterotis xanthogenys*	Western Rosella (inland)	P4		Low	Very low
Invertebrates							
x		*Daphnia jollyi*	a water flea (inland south west)	P1		Very low	Very low
x		*Hylaeus globuliferus*	Woolybush Bee	P3		Very low	Very low

APPENDIX THREE FIELD SURVEY RESULTS

Table 22: Flora inventory (site x species)

Family	Species	Naturalised	Cons. code	H1901	H1902	H1903	H19R1	H19R2	H19R3	Opportunistic
Aizoaceae	*Carpobrotus edulis*	*								X
	Mesembryanthemum crystallinum	*					X			
	Mesembryanthemum nodiflorum	*								X
Amaranthaceae	*Ptilotus polystachyus*									X
Apiaceae	*Platysace effusa*			X	X			X		
Apocynaceae	*Alyxia buxifolia*							X		X
Araliaceae	*Trachymene cyanopetala*									X
Asparagaceae	*Chamaexeros fimbriata*				X					
	Lomandra effusa					X				
	Thysanotus patersonii				X			X		X
Asteraceae	*Actinobole uliginosum*									X
	Arctotheca calendula	*				X	X	X	X	
	Ceratogyne obionoides									X
	Cotula bipinnata	*					X			
	Hypochaeris glabra	*					X			
	Monoculus monstrosus	*						X		X
	Rhodanthe pygmaea							X		
	Sonchus oleraceus	*								X
	Vittadinia gracilis									X
Boryaceae	*Borya constricta*			X	X	X		X		
Brassicaceae	*Brassica tournefortii*	*						X		X
	Raphanus raphanistrum	*								X
Casuarinaceae	*Allocasuarina acutivalvis*			X		X				X
	Allocasuarina campestris				X					X
Chenopodiaceae	*Atriplex nummularia*									X
	Atriplex semibaccata									X
	Enchylaena tomentosa					X		X	X	X
	Maireana brevifolia						X		X	
	Maireana georgei									X
	Rhagodia drummondii									X
	Salsola australis									X
	Sclerolaena diacantha							X	X	X
Crassulaceae	*Crassula colorata*							X		
	Crassula sp.						X			
Cyperaceae	*Lepidosperma drummondii*			X		X		X		
	Lepidosperma pruinosum					X				
	Lepidosperma ?sp. Bandalup Scabrid (N. Evelegh 10798)			X						
	Schoenus calcatus			X	X					
	Schoenus hexandrus			X						
	Schoenus ?subflavus				X	X				

Family	Species	Naturalised	Cons. code	H1901	H1902	H1903	H19R1	H19R2	H19R3	Opportunistic
Dilleniaceae	*Hibbertia eatoniae*			X	X	X				
Droseraceae	*Drosera andersoniana*			X	X					
	Drosera bulbosa							X		
	Drosera macrantha			X	X	X				
	Drosera moorei			X		X				
Ericaceae	*Astroloma epacridis*									X
	Astroloma serratifolium			X	X	X				
	Leucopogon dielsianus			X						
	Leucopogon hamulosus					X				
Euphorbiaceae	*Beyeria brevifolia*									X
Fabaceae	*Acacia assimilis*									X
	Acacia beauverdiana									X
	Acacia enervia subsp. explicata								X	X
	Acacia hemiteles								X	X
	Acacia intricata									X
	Acacia lasiocalyx								X	X
	Acacia multispicata				X				X	X
	Gastrolobium parviflorum									X
	Jacksonia racemosa									X
	Leptosema daviesioides				X	X				
	Mirbelia microphylla				X					
Geraniaceae	*Erodium botrys*	*								X
	Erodium cygnorum									X
Goodeniaceae	*Dampiera stenophylla*					X				
	Dampiera lavandulacea									X
	Goodenia berardiana							X		
Haemodoraceae	*Haemodorum discolor*			X						
Haloragaceae	*Gonocarpus nodulosus*						X	X		
Hemerocallidaceae	*Dianella revoluta*									X
Iridaceae	*Moraea miniata*	*								X
Lamiaceae	*Westringia cephalantha*									X
	Westringia rigida							X		X
Lauraceae	*Cassytha* sp.			X		X		X		
Loganiaceae	*Phyllangium divergens*							X		
Myrtaceae	*Astus subroseus*							X		
	Cyathostemon heterantherus			X						
	Ericomyrtus serpyllifolia			X	X	X		X		
	Eucalyptus loxophleba subsp. *gratiae*							X		X
	Leptospermum erubescens					X				X
	Melaleuca acuminata									X
	Melaleuca conothamnoides									X
	Melaleuca depauperata			X						
	Melaleuca hamata			X	X	X		X		X
	Melaleuca laxiflora				X	X		X		X

Family	Species	Naturalised	Cons. code	H1901	H1902	H1903	H19R1	H19R2	H19R3	Opportunistic
	Melaleuca platycalyx			X		X				
	Verticordia chrysantha									X
Orchidaceae	*Caladenia dimidia*				X					X
	Caladenia flava							X		
	Caladenia hirta				X					
	Diuris brachyscapa			X		X				
	Eriochilus dilatatus							X		
	Pterostylis recurva									X
	Thelymitra sp.							X		
Pittosporaceae	*Billardiera coriacea*									X
	Cheiranthera filifolia					X		X		X
Poaceae	*Amphipogon caricinus*			X	X	X				
	Aristida contorta									X
	Austrostipa elegantissima				X	X		X		X
	Austrostipa hemipogon						X			X
	Austrostipa scabra									X
	Avena barbata	*					X		X	
	Bromus rubens	*					X			
	Chloris truncata									X
	Ehrharta longiflora	*			X	X		X	X	X
	Eragrostis curvula	*								X
	Hordeum leporinum	*					X	X	X	
	Lolium rigidum	*								X
	Neurachne alopecuroidea			X	X			X		
	Pentameris airoides	*					X			
	Rytidosperma setaceum							X		X
	Spartochloa scirpoidea			X	X	X		X	X	
	Triticum aestivum	*								X
	Vulpia myuros	*					X			
Polygalaceae	*Comesperma integerrimum*			X						
	Comesperma scoparium									X
	Comesperma volubile				X	X		X		X
Proteaceae	*Grevillea yorkrakinensis*			X	X	X				
	Hakea scoparia									X
	Persoonia trinervis			X						
	Petrophile seminuda									X
Restionaceae	*Lepidobolus preissianus*			X	X	X				
Rhamnaceae	*Cryptandra apetala* var. *anomala*			X	X					
	Cryptandra myriantha				X	X			X	X
	Cryptandra ?wilsonii									X
Rutaceae	*Phebalium tuberculosum*							X		X
Santalaceae	*Exocarpos aphyllus*			X						
	Santalum acuminatum				X	X		X		X
Sapindaceae	*Dodonaea caespitosa*								X	

Family	Species	Naturalised	Cons. code	H1901	H1902	H1903	H19R1	H19R2	H19R3	Opportunistic
Scrophulariaceae	*Eremophila drummondii*							X		X
	Zaluzianskya divaricata	*								X
Xanthorrhoeaceae	*Chamaescilla corymbosa*				X					

APPENDIX FOUR FLORISTIC QUADRAT DATA

Hyden Surveys

H1901

Staff LJA **Date** 10/09/2019 **Season** P

Revisit

Type Q 20 m x 20 m

Location

MGA Zone 50 673928 **mE** 6407415 **mN** **Lat.** -32.4569 **Long.** 118.8505

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Yellow brown clayey sand

Rock Type Laterite and quartz

Loose Rock <2 % cover; 6-20 mm in size **Litter** 10 % cover ; <1 cm in depth

Bare ground 55 % cover **Weeds** <1 % cover

Vegetation M+ ^*Allocasuarina acutivalvis*,^*Melaleuca hamata*\^shrub\4\i;G ^^*Lepidobolus preissianus*,*Borya constricta*,*Hibbertia eatoniae*\^sedge,forb,shrub\1\c

Veg. Condition Excellent

Disturbance None evident

Fire Age No evidence

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Allocasuarina acutivalvis		3	8	
Amphipogon caricinus		0.1	<1	
Astroloma serratifolium		0.6	<1	
Borya constricta		0.1	15	
Cassytha glabella		0.6	<1	
Comesperma integerrimum		0,5	<1	

		Hyden Surveys
Cryptandra apetala var. *anomala*	0.5	<1
Cyathostemon heterantherus	0.5	1
Diuris brachyscapa	0.2	<1
Drosera andersoniana	0.2	<1
Drosera macrantha	0.5	<1
Drosera moorei	0.5	<1
Ericomyrtus serpyllifolium	0.8	<1
Exocarpos aphyllus	0.8	<1
Grevillea yorkrakinensis	0.4	1
Haemodorum discolor	0.3	<1
Hibbertia eatoniae	0.5	2
Lepidobolus preissianus	0.2	20
Lepidosperma ?sp. Bandalup Scabrid (N. Evelegh 10798)	0.3	1
Lepidosperma drummondii	0.5	<1
Leucopogon dielsianus	0.3	<1
Leucopogon hamulosus	0.4	<1
Melaleuca depauperata	0.6	<1
Melaleuca hamata	2	7
Melaleuca platycalyx	0.5	<1
Neurachne alopecuroidea	0.2	<1
Persoonia trinervis	0.5	<1
Platysace effusa	0.5	2
Schoenus calcatus	0.01	1
Schoenus hexandrus	0.2	1
Spartochloa scirpoidea	0.7	1

Hyden Surveys

H1902

Staff LJA **Date** 10/09/2019 **Season** P

Revisit

Type Q 20 m x 20 m

Location

MGA Zone 50 674009 **mE** 6407462 **mN** **Lat.** -32.4564 **Long.** 118.8513

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Yellow grey sandy clay

Rock Type Laterite

Loose Rock <2 % cover; 6-20 mm in size **Litter** 20 % cover ; <1 cm in depth

Bare ground 60 % cover **Weeds** <1 % cover

Vegetation M+ ^*Allocasuarina campestris*,^*Melaleuca hamata*\^shrub\4\c;G ^^*Borya constricta*,*Amphipogon caricinus*,*Spartochloa scirpoidea*\^forb,tussock grass\1\c

Veg. Condition Excellent

Disturbance No evidence

Fire Age No evidence

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia multispicata		2	<1	
Allocasuarina campestris		2.3	20	
Amphipogon caricinus		0.2	5	
Astroloma serratifolium		0.3	<1	
Austrostipa elegantissima		04	<1	
Borya constricta		0.05	20	

		Hyden Surveys
Caladenia dimidia	0.3	<1
Caladenia hirta	0.1	<1
Chamaescilla corymbosa	0.1	<1
Chamaexeros fimbriata	0.3	<1
Comesperma volubile	1	<1
Cryptandra apetala var. *anomala*	0.4	<1
Cryptandra myriantha	0.3	<1
Drosera andersoniana	0.1	<1
Drosera macrantha	0.5	<1
**Ehrharta longiflora*	0.3	<1
Ericomyrtus serpyllifolium	0.8	<1
Grevillea yorkrakinensis	0.4	1
Hibbertia eatoniae	0.3	1
Lepidobolus preissianus	0.3	<1
Leptosema daviesioides	0.1	<1
Leucopogon hamulosus	0.2	<1
Melaleuca hamata	2.3	15
Melaleuca laxiflora	0.4	<1
Mirbelia microphylla	0.2	<1
Neurachne alopecuroidea	0.3	<1
Platysace effusa	0.5	1
Santalum acuminatum	2	<1
Schoenus ?subflavus	0.05	<1
Schoenus calcatus	0.01	2
Spartochloa scirpoidea	0.6	5
Thysanotus patersonii	0.5	<1

Hyden Surveys

H1903

Staff LJA **Date** 11/09/2019 **Season** P

Revisit

Type Q 40 m x 10 m

Location

MGA Zone 50 674188 **mE** 6407463 **mN** **Lat.** -32.4564 **Long.** 118.8532

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Yellow brown clayey sand

Rock Type Laterite

Loose Rock <2 % cover; 6-20 mm in size **Litter** 5 % cover ; <1 cm in depth

Bare ground 65 % cover **Weeds** 2 % cover

Vegetation M+ ^*Melaleuca hamata*,^*Allocasuarina acutivalvis*\^shrub\3\i;G ^^*Borya constricta*,*Amphipogon caricinus*,*Lepidobolus preissianus*\^forb,tussock grass,sedge\1\c

Veg. Condition Excellent

Disturbance Occasional rubbish

Fire Age No evidence

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Allocasuarina acutivalvis		2	2	
Amphipogon caricinus		0.2	5	
**Arctotheca calendula*		0.1	<1	
Astroloma serratifolium		0.5	<1	
Austrostipa elegantissima		0.5	<1	
Borya constricta		0.05	20	

		Hyden Surveys
Cassytha glabella	1.5	<1
Cheiranthera filifolia	0.4	<1
Comesperma volubile	0.3	<1
Cryptandra myriantha	0.3	<1
Dampiera juncea	0.4	<1
Diuris brachyscapa	0.2	<1
Drosera macrantha	0.3	<1
Drosera moorei	0.3	<1
**Ehrharta longiflora*	0.3	<1
Enchylaena tomentosa	0.3	<1
Ericomyrtus serpyllifolium	0.6	<1
Grevillea yorkrakinensis	0.2	<1
Hibbertia eatoniae	0.3	<1
Lepidobolus preissianus	0.3	2
Lepidosperma drummondii	0.3	<1
Lepidosperma pruinosum	0.2	<1
Leptosema daviesioides	0.1	<1
Leptospermum erubescens	0.8	<1
Leucopogon hamulosus	0.3	<1
Lomandra effusa	0.3	<1
Melaleuca hamata	2	25
Melaleuca laxiflora	1.2	<1
Melaleuca platycalyx	0.4	<1
Santalum acuminatum	2	<1
Schoenus ?subflavus	0.1	<1
Spartochloa scirpoidea	0.6	1

Hyden Surveys

H1904

Staff LJA **Date** 19/11/2019 **Season** P

Revisit

Type Q 50 m x 8 m

Location Hyden CBH

MGA Zone 50 674387 **mE** 6407706 **mN** **Lat.** -32.4542 **Long.** 118.8553

Habitat Lower-Slope

Aspect N/A **Slope** N/A

Soil Type Orange sandy loam

Rock Type Laterite

Loose Rock <2 % cover; 20-60 mm in size **Litter** 40 % cover ; <1 cm in depth

Bare ground 25 % cover **Weeds** 20 % cover

Vegetation U+ ^*Eucalyptus loxophleba* subsp. *gratiae*,^*Eucalyptus subangusta* subsp. *subangusta*\^tree mallee\6\r;M ^*Melaleuca hamata*,^*Santalum acuminatum*,*Melaleuca laxiflora*\^shrub\4\i;G ^^*Avena barbata*,*Schoenus hexandrus*,*Neurachne alopecuroidea*\^other grass,sedge,tussock grass\1\c

Veg. Condition Good

Disturbance Edge effects, weeds, some litter

Fire Age >10 years

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia dielsii		1	<1	
Acacia enervia subsp. *explicata*		4	1	
Allocasuarina campestris		1.8	1	
Alyxia buxifolia		1.5	2	
Amphipogon caricinus		0.2	<1	

		Hyden Surveys
Aristida contorta	0.2	<1
Austrostipa elegantissima	0.8	<1
Austrostipa scabra	0.6	<1
**Avena barbata*	0.5	15
Borya constricta	0.05	1
**Brassica tournefortii*	0.3	2
**Bromus diandrus*	0.2	<1
**Bromus rubens*	0.1	<1
Cassytha glabella	2	<1
Comesperma integerrimum	2	1
Cryptandra myriantha	0.7	<1
Dampiera lavandulacea	0.2	<1
Daviesia pachyloma	0.3	<1
**Ehrharta longiflora*	0.2	2
**Erodium botrys*	0.1	<1
Eucalyptus loxophleba subsp. *gratiae*	8	5
Eucalyptus subangusta subsp. *subangusta*	7	3
Grevillea yorkrakinensis	0.5	<1
**Hypochaeris glabra*	0.1	<1
Lepidobolus preissianus	0.1	<1
Lepidosperma ?sp. Bandalup Scabrid (N. Evelegh 10798)	0.3	<1
Lepidosperma drummondii	0.5	<1
Leptospermum erubescens	2	<1
Lomandra effusa	0.3	<1
Melaleuca hamata	2.5	15
Melaleuca laxiflora	1.5	2
**Moraea setifolia*	0.2	<1
Neurachne alopecuroidea	0.2	5
Opercularia vaginata	0.1	<1
**Pentameris airoides*	0.1	<1
Platysace effusa	0.4	<1
Rhagodia drummondii	2	2
Rytidosperma setaceum	0.3	<1
Santalum acuminatum	4	2
Schoenus hexandrus	0.3	5
Schoenus subflavus	0.1	<1
Spartochloa scirpoidea	1	<1
Thysanotus patersonii	1	<1
**Ursinia anthemoides*	0.2	<1

Hyden Surveys

H19R1

Staff LJA **Date** 10/09/2019 **Season** P

Revisit

Type R 20 m x 20 m

Location Hyden CBH

MGA Zone 50 673945 **mE** 6407330 **mN** **Lat.** -32.4576 **Long.** 118.8507

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Grey sandy clay

Rock Type None

Loose Rock 0 % cover **Litter** 20 % cover ; <1 cm in depth

Bare ground 5 % cover **Weeds** 75 % cover

Vegetation G+ ^^*Maireana brevifolia*,*Arctotheca calendula*,*Avena barbata*\^chenopod shrub,forb,other grass\1\d

Veg. Condition Completely Degraded

Disturbance Cleared

Fire Age No evidence

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
**Arctotheca calendula*		0.2	25	
Austrostipa hemipogon		0.4	1	
**Avena barbata*		0.5	20	
**Bromus rubens*		0.3	1	
**Cotula bipinnata*		0.1	1	
Crassula sp.		0.1	5	

		Hyden Surveys
Gonocarpus nodulosus	0.05	<1
**Hordeum leporinum*	0.2	5
**Hypochaeris glabra*	0.3	1
Maireana brevifolia	0.5	10
**Mesembryanthemum crystallinum*	0.2	5
**Pentameris airoides*	0.1	5
**Vulpia myuros*	0.2	5

Hyden Surveys

H19R2

Staff LJA **Date** 11/09/2019 **Season** P

Revisit

Type R 20 m x 20 m

Location

MGA Zone 50 674097 **mE** 6407484 **mN** **Lat.** -32.4562 **Long.** 118.8523

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Yellow grey sandy clay

Rock Type None

Loose Rock 0 % cover **Litter** 5 % cover

Bare ground 70 % cover **Weeds** 5 % cover

Vegetation U+ ^*Eucalyptus loxophleba* subsp. *gratiae*\^tree mallee\6\i;M ^^*Melaleuca hamata*,*Santalum acuminatum*,*Alyxia buxifolia*\^shrub\4\i;G ^^*Rytidosperma setaceum*,*Borya constricta*,*Neurachne alopecuroidea*\^tussock grass,forb\1\i

Veg. Condition Very Good

Disturbance Rabbits

Fire Age

Notes Insufficient extent to establish quadrat

Species	WA Cons.	Height (m)	Cover (%)	Count
Alyxia buxifolia		2.5	2	
**Arctotheca calendula*		0.2	<1	
Astus subroseus		0.8	<1	
Austrostipa elegantissima		0.4	<1	
Borya constricta		0.05	5	

		Hyden Surveys
**Brassica tournefortii*	0.3	<1
Caladenia flava	0.1	<1
Cassytha glabella	1.5	<1
Cheiranthera filifolia	0.3	<1
Comesperma volubile	0.3	<1
Crassula colorata	0.05	<1
Drosera bulbosa	0.01	<1
**Ehrharta longiflora*	0.3	1
Enchylaena tomentosa	0.2	<1
Eremophila drummondii	0.3	<1
Ericomyrtus serpyllifolium	0.3	<1
Eriochilus dilatatus	0.1	<1
Eucalyptus loxophleba subsp. *gratiae*	7	10
Gonocarpus nodulosus	0.05	<1
Goodenia berardiana	0.1	<1
**Hordeum leporinum*	0.2	2
Lepidosperma drummondii	0.4	<1
Leucopogon hamulosus	0.2	<1
Melaleuca hamata	2.5	15
Melaleuca laxiflora	1.2	<1
**Monoculus monstrosus*	0.2	<1
Neurachne alopecuroidea	0.2	2
Phebalium tuberculosum	0.5	<1
Phyllangium divergens	0.05	<1
Platysace effusa	0.4	<1
Pterostylis recurva	0.2	<1
Rhodanthe pygmaea	0.1	<1
Rytidosperma setaceum	0.3	5
Santalum acuminatum	3	2
Sclerolaena diacantha	0.2	<1
Spartochloa scirpoidea	0.6	1
Thelymitra sp.	0.2	<1
Thysanotus patersonii	0.3	<1
Westringia rigida	0.5	<1

Hyden Surveys

H19R3

Staff LJA **Date** 11/09/2019 **Season** P

Revisit

Type R 20 m x 20 m

Location

MGA Zone 50 674030 **mE** 6407339 **mN** **Lat.** -32.4575 **Long.** 118.8516

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Yellow brown sandy clay

Rock Type Laterite

Loose Rock 2-10 % cover **Litter** 5 % cover

Bare ground 30 % cover **Weeds** 40 % cover

Vegetation M+ ^*Maireana brevifolia*,^*Acacia multispicata*\^chenopod shrub,shrub\3\i;G ^^*Avena barbata*, *Arctotheca calendula*,*Hordeum leporinum*\^other grass,forb\1\c

Veg. Condition Degraded

Disturbance Previously cleared

Fire Age

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia enervia subsp. *explicata*		1.3	<1	
Acacia hemiteles		1.2	<1	
Acacia lasiocalyx		1.3	<1	
Acacia multispicata		1	2	
**Arctotheca calendula*		0.1	5	
**Avena barbata*		0.4	10	

		Hyden Surveys
Cryptandra myriantha	0.3	<1
Dodonaea caespitosa	0.2	<1
**Ehrharta longiflora*	0.2	2
Enchylaena tomentosa	0.2	<1
**Hordeum leporinum*	0.2	5
Maireana brevifolia	1.2	10
Sclerolaena diacantha	0.2	2
Spartochloa scirpoidea	0.4	<1