MEMORANDUM			
TO	Jordan Watts		
FROM	Jeni Morris, Daniel Brassington and Daniel Panickar		
DATE	2 July 2020	PURPOSE	For Information
SUBJECT	Flora and Fauna Survey of CBH Moora		

1. Introduction

1.1 Project background

Eco Logical Australia (ELA) was engaged by CBH Group (CBH) to conduct a Reconnaissance and Targeted flora and vegetation survey and a Level 1 fauna survey and black cockatoo habitat assessment of a 3.3 kilometre (km) portion of rail reserve adjacent to the Moora CBH Depot. CBH is conducting a pre-feasibility study to upgrade the existing rail facilities at its Moora Depot for the Moora Rail Outloading Project. Under the project, potential impacts include the clearance of extant native vegetation within the rail reserve.

The survey area runs parallel to the existing rail line for approximately 3.3 km and includes remnant vegetation on either side of the rail and adjacent to the Bindoon-Moora Road. It is located approximately 3 km south from the Moora town site, in Western Australia (WA) and comprises 22.7 hectares (ha; **Figure 1-1**).

The scope of work for this survey included the following tasks:

- Undertake a desktop assessment to identify the potential occurrence of any conservation listed flora and fauna species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), State *Biodiversity Conservation Act 2016* (BC Act) and by the Department of Biodiversity, Conservation and Attractions (DBCA);
- Undertake a Targeted survey for conservation listed flora and fauna species identified from the desktop assessment as possibly occurring within the survey area;
- Undertake a Reconnaissance vegetation survey to describe dominant vegetation communities, with respect to dominant species, structure and overall condition;
- Undertake a Level 1 fauna survey and targeted black cockatoo habitat assessment;
- Preparation of a standalone summary report detailing the findings of the desktop assessment and field survey; and
- Provision of data, including relevant mapping at an appropriate scale and associated data files.

Figure 1-1: Survey area location

Legend

- Survey Area
- Town

Road Network

- Distributor Road
- Access Road

0 1 2
Kilometers
Datum/Projection:
GDA 1994 MGA Zone 50

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2. Methodology

2.1 Desktop assessment

2.1.1 Database searches

The following Commonwealth and State databases were searched for information relating to conservation listed flora and ecological communities in order to compile and summarise existing data to inform the field survey. Database searches undertaken for the survey area are provided in **Table 2-1** below. Applied buffers below are considered suitable based on flora and fauna assemblages expected to occur within the survey area. It should be noted that the buffers for the DBCA database searches are selected by DBCA on a case-by-case basis and are therefore not always consistent with other searches undertaken in the area.

Table 2-1: Database searches undertaken for the survey area

Database	Reference	Buffer (km)
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Protected Matters Search Tool (PMST) for Threatened species and communities listed under the EPBC Act.	DAWE 2020a	20
Department of Biodiversity, Conservation and Attractions (DBCA) and Western Australian Museum (WAM) NatureMap online database for Threatened and Priority flora.	DBCA 2007-2020	20
DBCA Threatened and Priority flora database searches for Declared Rare Flora (DRF) listed under the latest WA Wildlife Conservation (Rare Flora) Notice and Priority flora.	DBCA 2020a	25
DBCA Threatened and Priority Ecological Communities database search.	DBCA 2020b	15
DBCA Threatened and Priority fauna database searches for Scheduled fauna listed under the EPBC Act or latest WA Wildlife Conservation (Specially Protected Fauna) Notice and Priority Fauna.	DBCA 2020c	15

2.2 Likelihood of occurrence assessment

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

2.3 Field survey

A Reconnaissance and Targeted flora and vegetation survey, a Level 1 fauna survey and a targeted black cockatoo habitat assessment were undertaken over one day on 5th June 2020. The survey team's relevant qualifications, experience and licences are provided in **Table 2-2** below. There was no rainfall recorded during the field survey (Bureau of Meteorology [BoM] 2020).

Table 2-2: Survey team

Name	Qualification	Relevant experience	Licences
Daniel Brassington	BSc. Hons. Environmental Science	Daniel has more than 10 years' experience in botanical surveys and environmental services throughout Western Australia. This includes baseline vegetation studies, threatened and priority flora surveys, weed surveys, rehabilitation and vegetation monitoring.	Flora scientific collection licence: SL012503 DRF permit: TFL 15-1920
Jeni Morris	BSc. Conservation and Wildlife Biology	Jeni has over four years' experience conducting flora, vegetation and fauna surveys across a range of Western Australian bioregions, including within the Swan Coastal Plain.	Flora scientific collection licence: FB62000070 DRF permit: TFL 13-1920

2.3.1 Flora and vegetation survey

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

A total of 12 relevés were established across the survey area (**Figure 2-1**). Dominant vegetation communities were described with respect to dominant species, structure and overall condition. The following data was recorded within each relevé:

- Site details (site name, number, observer/s, date and location;
- Broad vegetation type survey based on an assessment of the dominant flora species for the three traditional strata (upper, mid and ground) and mapping extent; and
- Vegetation condition in accordance with the Keighery (1994) vegetation condition scale, as provided in the EPA Technical Guidance (EPA 2016a).

A Targeted flora and vegetation survey was completed within the survey area to identify any conservation significant flora or communities potentially occurring, including:

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

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

Survey methodology involved personnel walking transects across the survey area, with transects spaced 10-50 metres (m) on average, with spacing dependent on factors including suitable habitat, disturbance

(e.g. cleared areas) and landform. Locations of survey transects are presented in **Figure 2-1** below. Flora species able to be identified in the field were recorded, and voucher specimens of unfamiliar species were collected for later identification. All collections were assigned a unique collecting number. For conservation significant flora species identified in the field, the following was recorded:

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

2.3.2 Fauna survey

The Level 1 fauna survey was conducted in accordance the EPA *Technical Guidance: Terrestrial Fauna Surveys* (EPA 2016b). An assessment of fauna habitat in terms of its ability to support and sustain populations of fauna, along with an assessment of the likelihood of occurrence of conservation significant fauna species, was undertaken during the survey. The habitat characteristics and fauna database records used in assessing likelihood of occurrence for fauna included:

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

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

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

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

2.3.2.1 Black cockatoo habitat assessment

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

Hollows were considered 'suitable' if the entrance was >100 mm in diameter, >300 mm deep and aligned near vertical. If it was not possible to determine if a hollow was suitable or not it was categorised as 'potentially suitable'. Hollows that did not meet any of the requirements were categorised as 'unsuitable'. Trees that met the required measurements were inspected from the ground for suitability of hollows for nesting and/or roosting and evidences of current or previous occupancy, including wear and chew marks around the entrance.

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

2.4 Limitations

The EPA *Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016a) recommends including discussion of the constraints and limitations of the survey methods used. Constraints and limitations for the Reconnaissance and Targeted flora and vegetation and survey and the Level 1 fauna survey and black cockatoo habitat assessment for the survey area summarised in **Table 2-3** below.

One constraint was identified. This relates to the completeness of the survey based on the results which indicate further survey may be required to support an environmental impact assessment.

Table 2-3: Survey limitations

Potential survey limitation	Impact on survey
Sources of information and availability of contextual information (i.e. pre-existing background versus new material).	**Not a constraint**. Previous reports for the region were provided where applicable. Broad-scale vegetation mapping at a scale of 1:1,000,000 was available. Land system mapping at a scale of 1:2,000,000 and soil and landform mapping was also available. Available information was sufficient to provide context at varying scales and therefore were not considered a limitation.
Scope (i.e. what life forms, etc., were sampled).	**Not a constraint**. The survey requirement of a Reconnaissance and Targeted flora and vegetation survey and a Level 1 fauna survey and black cockatoo habitat assessment in accordance with relevant State and Federal legislation and EPA guidance documents was adequately met.
Proportion of flora collected and identified (based on sampling, timing and intensity).	**Not a constraint**. A Reconnaissance level survey records the dominant and abundant species, with little requirement for a comprehensive account of species richness. Data recorded was sufficient for this level of survey.
Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).	**Constraint**. The survey area was fully covered to meet requirements of a Reconnaissance level flora and vegetation survey, as outlined in the scope of work. However, due to the presence of Threatened flora species, and the likely presence of the Eucalypt Woodlands of the Western Australian Wheatbelt TEC, a Spring Detailed and Targeted flora and vegetation survey is recommended.
Mapping reliability.	**Not a constraint**. Coverage of the survey area was considered to be good. High quality aerial maps were used for both the survey and subsequent vegetation mapping. Due to the nature of vegetation in the survey area, mapping boundaries of individual communities were discrete, and thus are considered accurate.
Timing, weather, season, cycle.	**Not a constraint**. The field survey was undertaken out of season, as specified by the EPA *Technical Guidance*: *Flora and Vegetation Surveys for Environmental Impact Assessment* (2016a), with rainfall in the three months prior to the survey significantly below the long-term average, limiting the presence and flowering of species present. This did not impact the ability to describe the dominant species present to the level of survey required.
Disturbances (fire, flood, accidental human intervention, etc.).	**Not a constraint**: Disturbances within the survey area included fragmentation as a result of agricultural and transport infrastructure, with historical clearing in portions of the survey area, and weeds dominating the understory in areas. Disturbances did not impact the ability to undertake the level of survey required.
Intensity (in retrospect, was the intensity adequate).	**Not a constraint**. The survey effort was adequately met for a Reconnaissance and Targeted level flora and vegetation survey and a Level 1 fauna survey and black cockatoo habitat assessment.
Resources (i.e. were there adequate resources to complete the survey to the required standard).	**Not a constraint**. The number of personnel conducting this field survey in the given time was adequate to undertake the required level of survey. Additional resources, including equipment available, additional support and personnel were adequate.
Access problems (i.e. ability to access survey area).	**Not a constraint**. All relevant areas within the survey area were able to be accessed and surveyed.
Experience levels (e.g. degree of expertise in plant identification to taxon level).	**Not a constraint**. The personnel conducting this field survey were both suitably qualified to identify specimens, having multiple years of field experience and previously undertaken flora and fauna surveys across Western Australia.

Figure 2-1: Survey effort - Map 1 of 4

Legend

- Transect
- Releve Location
- Survey Area

0 25 50 100
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

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Figure 2-1: Survey effort - Map 2 of 4

Legend

- Transect
- Releve Location
- Survey Area

0 25 50 100
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

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Figure 2-1: Survey effort - Map 3 of 4

Legend

- Transect
- Releve Location
- Survey Area

0 25 50 100
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

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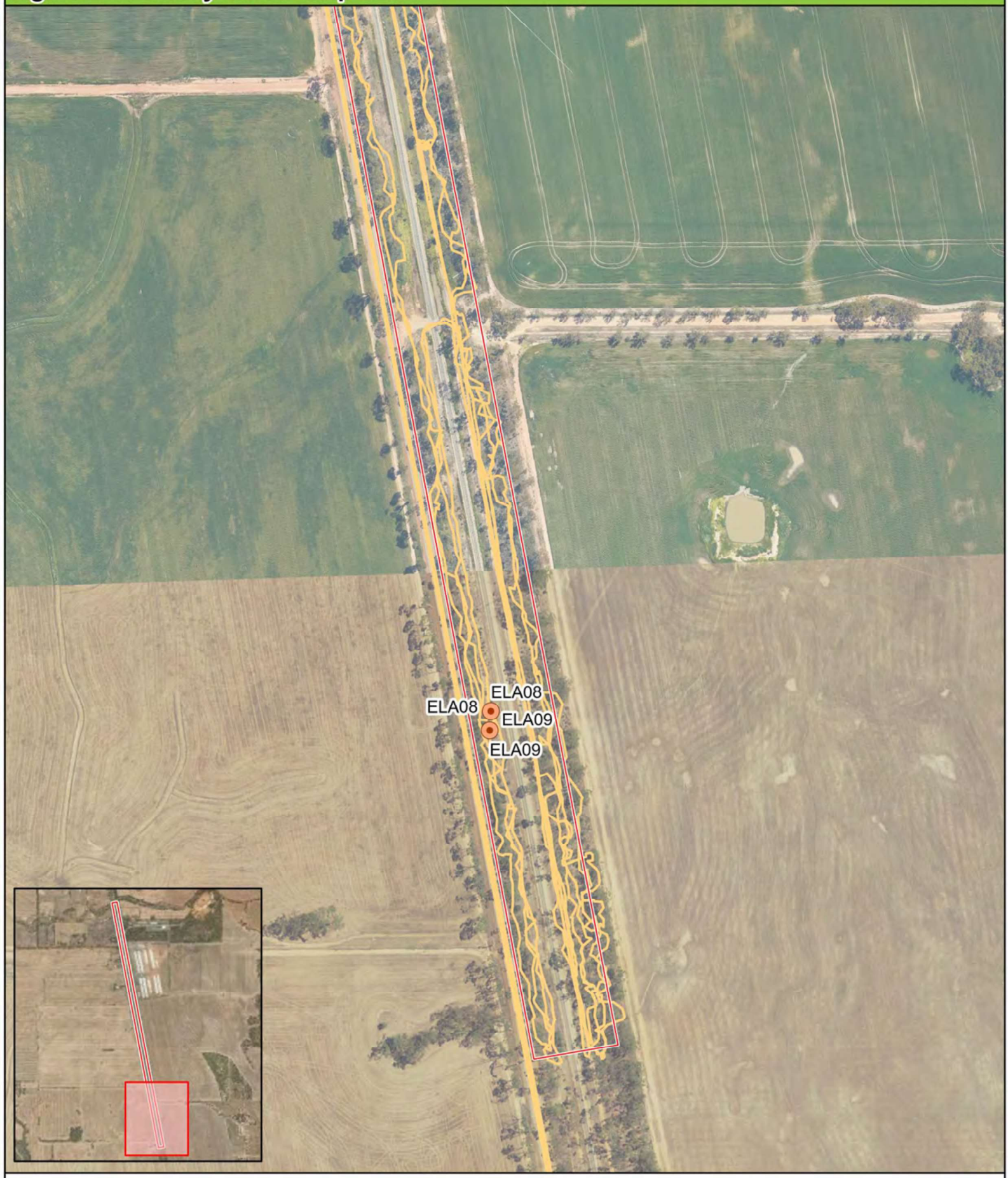
Figure 2-1: Survey effort - Map 4 of 4



Legend

- Transect
- Releve Location
- Survey Area

0 25 50 100
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

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3. Results

3.1 Desktop assessment

3.1.1 Climate

The survey area is located in the Avon Wheatbelt bioregion (Katanning [AVW02] subregion), as defined by the Interim Biogeographic Regionalisation for Australia (IBRA; DAWE 2020b). This region is described as having a semi-arid (dry) and warm Mediterranean Climate (Beecham 2001). Based on the nearby Bureau of Meteorology (BoM) Barberton weather station (station number 8005, climate data 1911-present; located approximately 7 km to the south of the survey area), the area receives, on average, a total of 444.5 mm of rainfall per year, with most rainfall occurring during the winter months of June, July and August (83.5 mm, 83.7 mm and 63.8 mm respectively; BoM 2020; **Table 3-1**).

In the 12 months preceding the field survey in June 2020, the area received a total of 321.5 mm which is below the long-term average (BoM 2020). In the three months preceding the field survey, a total of 40.5 mm of rainfall was recorded from the survey area, which is below the long-term average for the same time period (98.7 mm).

Table 3-1: Rainfall data recorded at the Barberton weather station (8005) 12 months prior to the field survey compared to the long-term average (BoM 2020)

Rainfall (mm)	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Total
Average rainfall (mm) 1911-present	83.5	83.7	63.8	38.4	23.8	13.3	9.1	14.2	16.0	18.6	23.4	56.7	**444.5**
Rainfall (mm) 2019-2020	104.2	43.8	51.4	8.6	24.4	2.6	0.8	0.4	44.8	5.6	5.6	29.3	**321.5**

3.1.2 Interim Biogeographic Regionalisation for Australia

Under the current Version 7 of IBRA, the survey area is situated within the Avon Wheatbelt IBRA Bioregion and AVW02 Katanning subregion. The Avon Wheatbelt bioregion is described as a dissected plateau of Tertiary laterite in the Yilgarn Craton with a semi-arid (dry) warm Mediterranean climate (Beecham 2001). The AVW02 subregion is further described as comprised of gently undulating rises to low hills with abrupt breakaways, its drainage is rejuvenated and comprises continuous stream channels that flow in most years. Residual lateritic uplands and derived sandplains are covered by areas of proteaceous scrub-heaths (which are rich in endemic species) and quaternary surfaces of erosional slopes and valley floors support woodlands of Wandoo, York gum, Jam and Casuarina (Beecham 2001).

3.1.3 Beards (1975) vegetation mapping

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

One vegetation association occurs within the survey area, namely Victoria Plains 142, described as 'Medium woodland; York gum & Salmon gum (Government of Western Australia 2019). This vegetation

association has 12.44% of its pre-European extent remaining in the Avon Wheatbelt subregion (**Table 3-2**; Government of Western Australia 2019).

Table 3-2: Beard's (1975) vegetation associations of the survey area

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

3.1.3.1 Flora and fauna species of s conservation significance

An initial 98 conservation listed flora species and 25 conservation listed fauna species were identified as possibly occurring within the survey area, based on database searches undertaken in Section 2.1.1 and using criteria outlined in **Appendix B**.

Conservation significant flora species identified from database searches undertaken include 33 species listed under the EPBC Act and/or BC Act as Threatened flora and 65 species listed as Priority flora by DBCA. The flora likelihood of occurrence assessment is presented in **Appendix C**.

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

3.1.3.2 Areas of conservation significance

Environmentally Sensitive Areas (ESAs) are defined in the Environmental Protection (Environmentally Sensitive Areas) Notice 2005 under section 51B of the State *Environmental Protection Act 1986* (EP Act). ESAs include areas declared as World Heritage, included on the Register of the National Estate1, defined wetlands, and vegetation containing rare (Threatened) flora and TECs.

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

A DBCA Threatened and Priority communities' database search (DBCA 2020b) and a PMST search (DAWE 2020b) identified three conservation significant ecological communities recorded within a 20 km radius of the survey area (**Table 3-3**). Of these, the buffer of a known occurrence of the TEC, *Eucalyptus woodlands of the Western Australian Wheatbelt*, listed as Critically Endangered (CR) under the EPBC Act and P3 by DBCA, occurs across 20 ha (87.9%) of the survey area.

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

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

3.2 Flora and Vegetation

3.2.1 Flora overview

A total of 72 flora species, representing 26 families and 53 genera, were recorded from the 12 relevés established within the survey area. Families with the highest number of species included Fabaceae (12 species), Poaceae (10 species) and Myrtaceae (7 species). *Acacia*, *Eucalyptus, Eremophila* and *Hakea* were the best represented genera throughout the survey area with nine, four, three and three taxa recorded, respectively. A full species list is provided in **Appendix E**.

3.2.2 Conservation significant flora

One population of the conservation significant flora species *Eremophila scaberula*, listed as Endangered (EN) under the EPBC Act and as Critically Endangered (CR) under the BC Act, was recorded within the survey area (**Figure 3-1**).

This species was recorded at the southern end of the survey area from two sub-populations, Population 2A and Population 2B, with 85-point locations recorded, totalling 204 individuals. Population 2A, on the western side of the rail line, comprised 38-point locations totalling 39 individuals, while Population 2B, on the eastern side of the rail line, comprised 47 point-locations totalling 165 individuals. Population 2B also extended outside of the survey area, with an additional 65-point locations totalling 90 individuals recorded adjacent to the east of the study area (**Figure 3-2**). These populations are historically known by DBCA, first recorded in 1995 (DBCA and WAH 2020). A second population was known from the survey area, but was not found during the current survey.

Eremophila scaberula was recorded within Vegetation Community EslW: *Eucalyptus salmonophloia* and *E. loxophleba*. This species had finished flowering at the time of the field survey, with old flowering material found on individual plants.

Figure 3-1: Left: *Eremophila scaberula* recorded within the survey area from population 2A showing leaves and old flowering material © Eco Logical Australia; Right: *Eremophila scaberula* (DBCA and WAH 2020)

Of the 98 conservation significant flora species identified as possibly occurring within the survey area, one species, *Eremophila scaberula*, as described above, was recorded. Of the remaining 97 species, 32 are considered as having the potential to occur within the survey area. This assessment is based on the proximity of previous records to the study area and on the availability of suitable habitat for these species within the survey area. The remaining 65 species are considered as being unlikely to occur. A Spring Targeted flora survey will be able to further refine the likelihood of occurrence of conservation significant flora species within the survey area.

3.2.3 Introduced flora

A total of 13 introduced (weed) flora species were recorded from the survey area, none of which are listed as Declared Pests under the BAM Act or as WoNS. All introduced (weed) species recorded are listed on the Western Australian Organism List (WAOL) Database as S-11 (permitted) species, indicating that no specific management of these species is required. Two of these species, **Eragrostis curvula* and **Oxalis pes-caprae* reached a cover of up to 70% cover and 10% cover respectively, in patches of the survey area. The full list of introduced species is detailed in **Appendix E**.

3.2.4 Vegetation communities

A total of three communities were delineated and mapped within the survey area (**Table 3-4**). The most widespread vegetation community was EslW: *Eucalyptus salmonophloia* and *E. loxophleba* Woodland, which covered 51.5% (11.7 ha) of the survey area. Cleared areas, including roads, tracks and other cleared areas, covered 38.8% (8.8 ha) of the survey area. Vegetation communities are described in **Table 3-4** and presented in **Figure 3-3** below.

Table 3-4: Vegetation communities recorded within the survey area

Photo	Relevé/s	Description	Total area (ha)	Proportion of the survey area (%)
	ELA01, ELA02, ELA03, ELA04, ELA05, ELA07, ELA08, ELA09, ELA12	Code: EslW *Eucalyptus salmonophloia* and *E. loxophleba* Woodland (8-16m, 25-40% cover) over *Exocarpos sparteus*, *Acacia lineolata* subsp. *lineolata, Grevillea biternata*, *Rhagodia preissii* and *Dianella revoluta* mid-shrubland (1-2m, 15-25% cover), over Annual grasses (indeterminate), *Austrostipa elegantissima*, *Sclerolaena diacantha* and *Lomandra* sp. low shrubland/grassland (0.3m, 5-20% cover).	11.7	51.5
	ELA06	Code: EwW *Eucalyptus wandoo* Woodland (10-14m, 30% cover) *Hakea preissii*, *Grevillea biternata*, *Rhagodia preissii* and *Dianella revoluta* mid-shrubland (1-2m, 15-25% cover), over Annual grasses (indeterminate), *Austrostipa elegantissima*, *Sclerolaena diacantha, Acanthocarpus canaliculatus* and *Lomandra* sp. low shrubland/grassland (0.3m, 5-20% cover).	0.8	3.5

Photo	Relevé/s	Description	Total area (ha)	Proportion of the survey area (%)
	ELA10, ELA11	Code: EcG Scattered *Eucalyptus camaldulensis* trees (10-12m, 5%) over *Hakea preissii* tall very open shrubland (3-5m, 5-10% cover) over *Acacia saligna, A. leptospermoides* subsp. *leptospermoides*, *Grevillea biternata, Allocasuarina campestris* and *Rhagodia preissii* mid shrubland (1-2m, 15-30% cover) over *Eragrostis curvula* tall grassland (1m 20-50% cover).	1.4	6.2
		Cleared areas	8.8	38.8
		Total	**22.7**	**100**

3.2.5 Conservation significant ecological communities

3.2.5.1 Eucalypt Woodlands of the Western Australian Wheatbelt Threatened Ecological Community

Two vegetation communities described within the survey area, namely EslW: *Eucalyptus salmonophloia* and *E. loxophleba* Woodland and EwW: *Eucalyptus wandoo* Woodland, have species composition and structure comprising elements that indicate the likely presence of the Eucalypt Woodlands of the Western Australian Wheatbelt TEC, as indicated in the Department of Environment (DoE) *Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt* (DoE 2015). This assessment is based on the following key diagnostic characteristics for the TEC:

- The distribution of the ecological community is within the Avon Wheatbelt IBRA region;
- The structure of the ecological community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10%;
- The key species of the tree canopy are species of *Eucalyptus* as identified in Table 2a of the Approved Conservation Advice document (DoE 2015). These are species that typically have a single trunk; and
- A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs.

Vegetation community EcG, although species composition and structure comprises elements that indicate the potential presence of the TEC, may not meet the criteria due to the dominance of the weedy grass *Eragrostis curvula* in the understory.

3.2.6 Vegetation condition

Vegetation within the survey area ranged from Very Good to Completely Degraded condition, based on the Keighery (1994) vegetation condition scale provided in the EPA *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessmen*t (EPA 2016a).

The majority of remnant vegetation within the survey area was classed as Very Good condition (9.0 ha; 39.6% of the survey area) and as Good condition (3.6 ha; 15.9% of the survey area). Cleared areas, including roads/tracks and areas cleared for infrastructure or rail were classed as being in Completely Degraded condition (7.5 ha; 33.0% of the survey area). Vegetation condition is presented in **Table 3-5** and **Figure 3-4** below.

Primary disturbances within the survey area included clearing for tracks and infrastructure and the presence of introduced (weed) species. Numerous access tracks dissect the survey area, including a rail access track running almost the full length of the survey area. In the northern section of the survey area, rail sidings, turn-around bays and road infrastructure have removed the native vegetation and grassy weeds invaded these areas

Table 3-5: Vegetation condition recorded within the survey area

Condition	Total area (ha)	Proportion of the survey area (%)
Very Good	9.0	39.6
Good	3.6	15.9
Degraded	2.6	11.5
Completely Degraded	7.5	33.0
Total	**22.7**	**100.0**

Figure 3-2: *Eremophila scaberula* recorded within the survey area

Legend

Survey Area

***Eremophila scaberula* (T) location**

Population 2A

Population 2B

0 25 50

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

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Figure 3-3: Vegetation communities recorded within the survey area - Map 1 of 4

Legend

Survey Area

Vegetation Communities

EslW: *Eucalyptus salmonophloia* and *Eucalyptus loxophleba* Woodland

Cleared

0 25 50 100

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

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Figure 3-3: Vegetation communities recorded within the survey area - Map 2 of 4

Legend

Survey Area

Vegetation Communities

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

0 25 50 100
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

N

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Figure 3-3: Vegetation communities recorded within the survey area - Map 3 of 4

Legend

Survey Area

Vegetation Communities

EcG: *Eucalyptus camaldulensis* scattered trees on Grassland

EslW: *Eucalyptus salmonophloia* and *Eucalyptus loxophleba* Woodland

Cleared

0 25 50 100

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

N

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Figure 3-3: Vegetation communities recorded within the survey area - Map 4 of 4

Legend

Survey Area

Vegetation Communities

EslW: *Eucalyptus salmonophloia* and *Eucalyptus loxophleba* Woodland

Cleared

0 25 50 100

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

N

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Figure 3-4: Vegetation condition recorded within the survey area - Map 1 of 4

Legend

- Survey Area

Vegetation Condition

- Very Good
- Good
- Degraded
- Completely Degraded

0 25 50 100
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

N

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Figure 3-4: Vegetation condition recorded within the survey area - Map 2 of 4

Legend

- Survey Area

Vegetation Condition

- Very Good
- Good
- Degraded
- Completely Degraded

0 25 50 100
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

N

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Figure 3-4: Vegetation condition recorded within the survey area - Map 3 of 4

Legend

- Survey Area

Vegetation Condition

- Very Good
- Good
- Degraded
- Completely Degraded

0 25 50 100
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

N

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Figure 3-4: Vegetation condition recorded within the survey area - Map 4 of 4

Legend

- Survey Area

Vegetation Condition

- Very Good
- Degraded
- Completely Degraded

0 25 50 100
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

N

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3.3 Fauna

3.3.1 Fauna habitat

One fauna habitat was recorded within the survey area: Open Salmon Gum, Wandoo, York Gum woodland over open shrubland and grassland on clay loam. This habitat covers 61.2% (13.9 ha) of the survey area. Cleared areas account for the remaining 38.8% (8.8 ha) of the survey area (**Figure 3-6**).

3.3.2 Fauna overview

A total of 16 vertebrate fauna species were recorded as occurring within the survey area, comprising 12 birds, three mammals and one reptile. No direct (observations) or indirect (scats, tracks, diggings) evidence of conservation significant fauna species were recorded within the survey area.

Of the 25 conservation listed fauna species identified from the desktop assessment as possibly occurring within the survey area, six species are considered as having the potential to occur within the survey area, based on the availability of suitable habitat and close proximity of recent records:

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

The remaining 18 fauna species are considered as unlikely to occur or do not occur within the survey area, based on lack of suitable habitat for these species, adequacy of search effort undertaken within the survey area and proximity of previous records (DBCA 2007-2020). The fauna likelihood of occurrence assessment is provided in **Appendix D**.

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

3.3.3 Black cockatoo habitat assessment

There were no black cockatoo individuals observed within the survey area during the field survey.

3.3.3.1 Foraging habitat

Foraging habitat for black cockatoos is generally defined as the availability of plant food sources within an area (Finn 2012). Food availability for black cockatoos is a function of the diversity, abundance, distribution, energetic and nutritional qualities, and seasonality (phenology) of the food sources within a particular area. Black cockatoo foraging habitat within the survey area has been determined using vegetation associations defined in the vegetation assessment and from ground-truthing in the field. The quality of foraging habitat for black cockatoo species within the survey area (as defined in **Table 3-6**

below) has been assessed based on the availability and density of plant food sources as observed on site.

Table 3-6: Definition and extent of black cockatoo foraging habitat quality within the survey area

Foraging quality	Justification	Extent (ha) within survey area	% of survey area
Poor	Low density of species suitable for foraging by black cockatoos (i.e. foliage cover of suitable species 10-20%) and presence of food sources at only one stratum (i.e. canopy)	13.9	61.2
Nil	Cleared areas or no suitable vegetation present.	8.8	38.8
Total		**22.7**	**100**

Remnant vegetation within the survey area, comprising 13.9 ha, is considered as providing 'Poor' quality foraging habitat for all three black cockatoo species (SEWPaC 2012) due to a lack of density of suitable or preferred foraging species. Cleared areas, comprising 8.8 ha, provide Nil' foraging habitat for black cockatoo species. Habitat foraging quality is presented in **Figure 3-7** below. No evidence of black cockatoo foraging was observed within the survey area.

3.3.3.2 Breeding and roosting habitat

The black cockatoo breeding habitat assessment identified 337 potentially suitable breeding trees within the survey area comprising 303 *Eucalyptus salmonophloia* (Salmon Gum), 12 *Eucalyptus loxophleba* (York Gum), 12 Stag trees (unidentifiable) and 10 *Eucalyptus wandoo*. An overview of potentially suitable black cockatoo breeding trees is provided in **Table 3-7** and **Figure 3-7** below. Of these, 34 contained potentially suitable hollows over 100 mm in diameter (**Appendix F**). Two examples of potentially suitable hollows identified within the survey area are presented in **Figure 3-5**. The remaining potentially suitable breeding trees contained no hollows, or no suitable hollows.

All potential breeding trees recorded from the survey area also provide potential suitable roosting habitat for black cockatoos as defined by the referral guidelines (SEWPaC 2012; **Table 3-7**). Although not directly observed during the field survey, Carnaby's Cockatoo (*Calyptorhynchus latirostris*) is considered as having the potential to occur within the survey area, due to the availability of potentially suitable breeding and roosting trees, and the nearby proximity of several known records of this species.

Table 3-7: Overview of potentially suitable black cockatoo habitat trees within the survey area

Tree species	Suitability for breeding (SEWPaC 2012)	Suitability for night roosting (SEWPaC 2012)	Number of trees	Number with suitable hollows
Eucalyptus salmonophloia (Salmon Gum)	Carnaby's Cockatoo	Carnaby's Cockatoo	303	26
Eucalyptus loxophleba (York Gum)	Carnaby's Cockatoo	-	12	1
Eucalyptus wandoo (Wandoo)	Baudin's Cockatoo, Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo	Carnaby's Cockatoo	10	Nil
Stag (unidentifiable)	Baudin's Cockatoo, Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo	Baudin's Cockatoo, Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo	12	7
Total			**337**	**34**

Figure 3-5: Examples of potentially suitable hollows located in trees within the survey area

Figure 3-6: Fauna habitat recorded within the survey area - Map 1 of 4

Legend

Survey Area

Fauna Habitat

Open Salmon Gum, Wandoo, York Gum woodland over open shrubland and grassland on clay loam

Nil

0 25 50 100

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

N

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Figure 3-6: Fauna habitat recorded within the survey area - Map 2 of 4

Legend

Survey Area

Fauna Habitat

Open Salmon Gum, Wandoo, York Gum woodland over open shrubland and grassland on clay loam

Nil

0 25 50 100

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

N

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Figure 3-6: Fauna habitat recorded within the survey area - Map 3 of 4

Legend

Survey Area

Fauna Habitat

Open Salmon Gum, Wandoo, York Gum woodland over open shrubland and grassland on clay loam

Nil

0 25 50 100

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

N

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Figure 3-6: Fauna habitat recorded within the survey area - Map 4 of 4

Legend

Survey Area

Fauna Habitat

Open Salmon Gum, Wandoo, York Gum woodland over open shrubland and grassland on clay loam

Nil

0 25 50 100

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

N

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Figure 3-7: Potential suitable black cockatoo habitat within the survey area - Map 1 of 4

Legend

Survey Area

Forage Quality

Poor

Nil

Black Cockatoo Trees

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

0 25 50 100

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

N

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Figure 3-7: Potential suitable black cockatoo habitat within the survey area - Map 2 of 4

Legend

- Survey Area

Forage Quality

- Poor
- Nil

Black Cockatoo Trees

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

0 25 50 100
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

N

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Figure 3-7: Potential suitable black cockatoo habitat within the survey area - Map 3 of 4

Legend

- Survey Area

Forage Quality

- Poor
- Nil

Black Cockatoo Trees

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

0 25 50 100
Metres
Datum/Projection:
GDA 1994 MGA Zone 50

N

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Figure 3-7: Potential suitable black cockatoo habitat within the survey area - Map 4 of 4

Legend

Survey Area

Forage Quality

Poor

Nil

Black Cockatoo Trees

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

0 25 50 100

Metres

Datum/Projection:
GDA 1994 MGA Zone 50

N

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4. Discussion and recommendations

4.1 Flora

A total of 72 flora species, representing 26 families and 53 genera, were recorded from 12 relevés established within the survey area. Families with the highest number of species included Fabaceae (12 species), Poaceae (10 species) and Myrtaceae (7 species). *Acacia*, *Eucalyptus*, *Eremophila* and *Hakea* were the best represented genera throughout the survey area with nine, four, three and three taxa recorded, respectively.

A total of 13 introduced (weed) flora species were recorded from the survey area, none of which are listed as Declared Pests under the BAM Act or as WoNS. All introduced (weed) species recorded are listed on the Western Australian Organism List (WAOL) Database as S-11 (permitted) species, indicating that no specific management of these species is required.

4.1.1 Conservation significant flora

One population of the Threatened flora species *Eremophila scaberula*, listed as EN under the EPBC Act and as CR under the BC Act was recorded within the survey area.

Eremophila scaberula is a low-growing shrub with solitary flowers on thick axillary pedicels (TSSC 2016). It is found on rich loam or clay flats that support open low *Eucalyptus salmonophloia* woodland over open low scrub of *Scaevola spinescens*, a variety of *Acacia* species, and grasses (Stack and English 1999). It is currently known from 41 records in Western Australia, majority of which are restricted to an area south of Moora in Western Australia over a range of less than 20 km, with a small number of records located approximately 170 km to the east of Moora (Threatened Species Scientific Committee [TSSC] 2016; DBCA 2007-2020).

Within the survey area, this species was recorded at the southern end from two known sub-populations, Population 2A and Population 2B, with 85-point locations recorded, totalling 204 individuals. Population 2A, on the western side of the rail line, comprised 38-point locations totalling 39 individuals, while Population 2B, on the eastern side of the rail line, comprised 47 point-locations totalling 165 individuals. Population 2B also extended outside of the survey area, with an additional 65-point locations totalling 90 individuals recorded adjacent to the east of the study area. These populations are historically known by DBCA, first recorded in 1995 (DBCA and WAH 2020).

A second population is known from the survey area (DBCA 2007-2020), but was not found during the current survey. This may have been due to the somewhat obscure nature of the species, being inconspicuous in the understory when not in flower, or the population may have declined through natural senescence over the last few decades.

Of the additional 97 conservation significant flora species identified from the desktop assessment as possibly occurring within the survey area, 32 are considered as having the potential to occur, based on proximity of previous records and availability of suitable habitat within the survey area. It is recommended that a Spring Targeted flora survey be undertaken to further refine the likelihood of occurrence of conservation significant flora species within the survey area.

4.2 Vegetation

A total of three vegetation communities were recorded within the survey area.

- EslW: *Eucalyptus salmonophloia* (Salmon Gum) and *E. loxophleba* (York Gum) Woodland;
- EwW: *Eucalyptus wandoo* (Wandoo) Woodland; and
- EcW: *Eucalyptus camaldulensis* (River Gum) scattered trees on *Eragrostis* Grassland.

The most widespread vegetation community was EslW: *Eucalyptus salmonophloia* and *E. loxophleba* Woodland, which covers 51.5% (11.7 ha) of the survey area.

4.2.1 Conservation significant vegetation communities

Vegetation communities EslW and EwW have species composition and structure comprising elements that indicate the likely presence of the *Eucalypt Woodlands of the Western Australian Wheatbelt* Threatened Ecological Community, while vegetation community EcW has species composition and structure comprising elements that indicate the potential presence of the TEC, as indicated in the Department of Environment (DoE) *Approved Conservation Advice (including listing advice) for the Eucalypt Woodlands of the Western Australian Wheatbelt* (DoE 2015). This assessment is based on the following key diagnostic characteristics for the TEC:

- The distribution of the ecological community is within the Avon Wheatbelt IBRA region;
- The structure of the ecological community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10%;
- The key species of the tree canopy are species of *Eucalyptus* as identified in Table 2a of the Approved Conservation Advice document (DoE 2015). These are species that typically have a single trunk; and
- A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs.

A number of additional conditions are required to be met to classify vegetation within the survey area as the TEC, some of which include landform type, native vegetation understory, minimum condition ratings, Roadside Conservation Value ratings and minimum patch size requirements. It is recommended that a Spring Detailed and Targeted flora and vegetation survey are undertaken to assess the extent of the *Eucalypt Woodlands of the Western Australian Wheatbelt* TEC within the survey area. In particular, statistical analysis of vegetation communities present within the survey area is recommended to qualify their place within the TEC.

4.3 Fauna

One fauna habitat was recorded within the survey area: Open Salmon Gum, Wandoo, York Gum woodland over open shrubland and grassland on clay loam. This habitat type covers 61.2% (13.9 ha) of the survey area. Cleared areas account for the remaining 38.8% (8.8 ha) of the survey area.

A total of 16 vertebrate fauna species were recorded within the survey area, none of which are listed as conservation significant under the EPBC Act, the BC Act or by DBCA. Two introduced (pest) fauna species were recorded within the survey area, namely Feral Cat (*Felis catus*) and House Mouse (*Mus musculus*).

A total of 337 potentially significant black cockatoo breeding trees were recorded within the survey area, comprising 303 *Eucalyptus salmonophloia* (Salmon Gum), 12 *Eucalyptus loxophleba* (York Gum), 12 Stag trees (unidentifiable) and 10 *Eucalyptus wandoo*. Of these, 34 contained potentially suitable hollows over 100 millimetres in diameter. All potential breeding trees recorded within the survey area provide suitable roosting habitat for black cockatoos as defined by the Department of Sustainability, Environment, Water, Population and Communities guidelines: *EPBC Act referral guidelines for three threatened black cockatoo species*.

No foraging evidence was observed within the survey area. Vegetation within the survey area was considered as 'Poor' quality foraging habitat for Black Cockatoo species. Although not directly observed during the field survey, Carnaby's Cockatoo (*Calyptorhynchus latirostris*) is considered as having the potential to occur within the survey area, due to the availability of potentially suitable breeding and roosting trees, and the nearby proximity of several known records of this species.

Additional fauna surveys within the survey area are unlikely to be required at this stage.

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Appendix A Framework for conservation significant flora and fauna ranking

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

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

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

CONSERVATION CODES FOR WESTERN AUSTRALIA FLORA AND FAUNA

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

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

Threatened species (T)
Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act).

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

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

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

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

Category	Code	Description
Vulnerable species	VU	Threatened species considered to be "facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines". Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.

Extinct species

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

Category	Code	Description
Extinct species	EX	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.
Extinct in the wild species	EW	Species that "is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act). Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species

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

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

Categories are detailed below.

Category	Code	Description
Migratory species	M	Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the 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.
Species of special conservation interest (conservation dependent fauna)	CD	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.
Other specially protected species	OS	Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.

Priority species (P)

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

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

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

Category	Code	Definition
Priority 1	P1	*Poorly-known species* 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.
Priority 2	P2	*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.
Priority 3	P3	*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.
Priority 4	P4	*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.

Appendix B Likelihood of occurrence assessment criteria

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

Appendix C Flora likelihood of occurrence assessment (initial assessment)

Species	Conservation status		Source	Likelihood of occurrence
	EPBC Act	BC Act / DBCA		
Acacia cochlocarpa subsp. *velutinosa*	CR	CR	PMST	Unlikely
Banksia fuscobractea	CR	CR	PMST	Unlikely
Dasymalla axillaris	CR	CR	PMST	Unlikely
Haloragis platycarpa	CR	CR	DBCA 2020a, PMST, Naturemap	Potential
Trithuria occidentalis	CR	CR	DBCA 2020a	Unlikely
Acacia cochlocarpa subsp. *cochlocarpa*	EN	CR	DBCA 2020a, PMST, Naturemap	Unlikely
Chorizema humile	EN	CR	PMST	Unlikely
Eremophila scaberula	EN	CR	DBCA 2020a, PMST, Naturemap	Known
Eucalyptus absita	EN	CR	DBCA 2020a, PMST, Naturemap	Potential
Eucalyptus dolorosa	EN	CR	PMST	Unlikely
Eucalyptus impensa	EN	CR	PMST	Unlikely
Gastrolobium hamulosum	EN	CR	DBCA 2020a, PMST	Unlikely
Grevillea pythara	EN	CR	PMST	Unlikely
Hemiandra gardneri	EN	CR	DBCA 2020a, PMST, Naturemap	Unlikely
Thelymitra dedmaniarum	EN	CR	PMST	Unlikely
Verticordia staminosa subsp. *staminosa*	EN	CR	PMST	Unlikely
Acacia aristulata	EN	EN	DBCA 2020a, PMST, Naturemap	Unlikely
Conospermum densiflorum subsp. *unicephalatum*	EN	EN	DBCA 2020a, PMST, Naturemap	Potential
Darwinia acerosa	EN	EN	DBCA 2020a, PMST, Naturemap	Potential

Species	Conservation status		Source	Likelihood of occurrence
	EPBC Act	BC Act / DBCA		
Daviesia dielsii	EN	EN	DBCA 2020a, PMST, Naturemap	Potential
Eucalyptus leprophloia	EN	EN	PMST	Unlikely
Goodenia arthrotricha	EN	EN	DBCA 2020a, PMST, Naturemap	Unlikely
Grevillea christineae	EN	EN	PMST	Unlikely
Spirogardnera rubescens	EN	EN	PMST	Unlikely
Synaphea quartzitica	EN	EN	DBCA 2020a, PMST, Naturemap	Unlikely
Thelymitra stellata	EN	EN	PMST	Unlikely
Chamelaucium lullfitzii	EN	EN	PMST	Unlikely
Eucalyptus recta	EN	VU	DBCA 2020a, PMST	Unlikely
Banksia serratuloides subsp. *serratuloides*	VU	EN	DBCA 2020a, PMST	Potential
Gastrolobium appressum	VU	EN	PMST	Unlikely
Eleocharis keigheryi	VU	VU	DBCA 2020a, PMST, Naturemap	Potential
Acacia splendens	-	CR	DBCA 2020a, Naturemap	Unlikely
Eremophila glabra subsp. *chlorella*	-	EN	DBCA 2020a, Naturemap	Potential
Acacia congesta subsp. *cliftoniana*	-	P1	DBCA 2020a, Naturemap	Unlikely
Caladenia dundasiae	-	P1	DBCA 2020a, Naturemap	Potential
Calytrix ecalycata subsp. *pubescens*	-	P1	DBCA 2020a, Naturemap	Potential
Micromyrtus rogeri	-	P1	DBCA 2020a	Unlikely
Stylidium carnosum subsp. Narrow leaves (J.A. Wege 490)	-	P1	DBCA 2020a, Naturemap	Unlikely
Verticordia dasystylis subsp. *oestopoia*	-	P1	DBCA 2020a, Naturemap	Unlikely
Anigozanthos humilis subsp. Badgingarra (S.D. Hopper 7114)	-	P2	DBCA 2020a, Naturemap	Unlikely
Boronia ericifolia	-	P2	DBCA 2020a, Naturemap	Unlikely

Species	Conservation status		Source	Likelihood of occurrence
	EPBC Act	BC Act / DBCA		
Bossiaea moylei	-	P2	DBCA 2020a, Naturemap	Unlikely
Dampiera tephrea	-	P2	DBCA 2020a	Potential
Eremaea sp. Cairn Hill (B. Morgan 532)	-	P2	DBCA 2020a, Naturemap	Unlikely
Gompholobium roseum	-	P2	DBCA 2020a, Naturemap	Unlikely
Hemigenia curvifolia	-	P2	DBCA 2020a, Naturemap	Unlikely
Hypocalymma serrulatum	-	P2	DBCA 2020a	Unlikely
Hypocalymma sp. Cataby (G.J. Keighery 5151)	-	P2	DBCA 2020a	Unlikely
Pertusaria trachyspora	-	P2	DBCA 2020a	Unlikely
Stylidium sp. Moora (J.A. Wege 713)	-	P2	DBCA 2020a, Naturemap	Potential
Synaphea rangiferops	-	P2	DBCA 2020a	Unlikely
Synaphea sparsiflora	-	P2	DBCA 2020a	Unlikely
Tricoryne sp. Wongan Hills (B.H. Smith 794)	-	P2	DBCA 2020a, Naturemap	Unlikely
Acacia cummingiana	-	P3	Naturemap	Potential
Acacia nodiflora	-	P3	Naturemap	Unlikely
Acacia ridleyana	-	P3	DBCA 2020a	Potential
Adenanthos cygnorum subsp. *chamaephyton*	-	P3	DBCA 2020a	Unlikely
Austrostipa sp. Cairn Hill (M.E. Trudgen 21176)	-	P3	DBCA 2020a, Naturemap	Potential
Babingtonia cherticola	-	P3	DBCA 2020a, Naturemap	Potential
Babingtonia urbana	-	P3	Naturemap	Potential
Banksia dallanneyi subsp. *pollosta*	-	P3	DBCA 2020a, Naturemap	Potential
Banksia pteridifolia subsp. *vernalis*	-	P3	DBCA 2020a	Unlikely
Beaufortia bicolor	-	P3	DBCA 2020a, Naturemap	Unlikely
Beaufortia eriocephala	-	P3	DBCA 2020a, Naturemap	Unlikely
Blackallia nudiflora	-	P3	DBCA 2020a, Naturemap	Potential
Calytrix ecalycata subsp. *brevis*	-	P3	DBCA 2020a, Naturemap	Unlikely
Chamelaucium sp. Wongan Hills (B.H. Smith 1140)	-	P3	DBCA 2020a	Unlikely

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

Species	Conservation status		Source	Likelihood of occurrence
	EPBC Act	BC Act / DBCA		
Eucalyptus x carnabyi	-	P4	DBCA 2020a, Naturemap	Unlikely
Grevillea drummondii	-	P4	DBCA 2020a	Unlikely
Grevillea rudis	-	P4	DBCA 2020a, Naturemap	Unlikely
Grevillea saccata	-	P4	DBCA 2020a, Naturemap	Unlikely
Hibbertia miniata	-	P4	DBCA 2020a	Unlikely
Persoonia sulcata	-	P4	DBCA 2020a	Potential
Regelia megacephala	-	P4	DBCA 2020a, Naturemap	Potential

Appendix D Fauna likelihood of occurrence assessment

Species	Common name	Conservation status		Habitat	Source	Likelihood of occurrence	Justification
		EPBC Act	BC Act / DBCA				
Calidris ferruginea	Curlew Sandpiper	CR, M	CR, M	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand.	PMST	Unlikely	No suitable habitat occurs within the survey area.
Numenius madagascariensis	Eastern Curlew	CR, M	CR, M	Inhabits a variety of habitats from coastal beaches, saltmarshes, mudflats, and natural or artificial wetlands inland.	PMST	Unlikely	No suitable habitat occurs within the survey area.
Calyptorhynchus latirostris	Carnaby's Cockatoo	EN	EN	Carnaby's Cockatoo occurs in uncleared or remnant native eucalypt woodlands and in shrubland or kwongan heathland. Forages seasonally in pine plantations, around Perth metropolitan, and forests containing Marri, Karri and Jarrah.	PMST, NatureMap	Potential	This species has been recorded occurring 20 m to the east of the survey area, with numerous additional records occurring within 25 km of the survey area. Suitable roosting and nesting habitat and somewhat marginal feeding habitat is present within the survey area.
Rostratula australis	Australian Painted Snipe	EN	EN	Inhabits a variety of freshwater habitats including temporary and permanent wetlands (shallows and mudbanks) where there is emergent low vegetation, tree-lined banks, or fallen or washed-up timber.	DBCA 2020c, PMST	Unlikely	No suitable habitat occurs within the survey area.

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

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

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

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

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

Appendix E Flora species list

Family	Species	Introduced (weed) species
Amaranthaceae	*Ptilotus stirlingii*	
Asparagaceae	*Acanthocarpus canaliculatus*	
Asparagaceae	*Lomandra* sp.	
Asteraceae	*Arctotheca calendula*	
Asteraceae	*Conyza bonariensis*	*
Asteraceae	*Olearia* sp. Eremicola (Diels & Pritzel s.n. PERTH 00449628)	
Asteraceae	*Podolepis capillaris*	
Boraginaceae	*Halgania* sp.	
Boryaceae	*Borya laciniata*	
Brassicaceae	*Brassica barrelieri*	*
Brassicaceae	*Raphanus raphanistrum*	*
Casuarinaceae	*Allocasuarina campestris*	
Casuarinaceae	*Casuarina obesa*	
Chenopodiaceae	*Dysphania melanocarpa*	
Chenopodiaceae	*Enchylaena tomentosa*	
Chenopodiaceae	*Maireana brevifolia*	
Chenopodiaceae	*Rhagodia preissii*	
Chenopodiaceae	*Salsola australia*	
Chenopodiaceae	*Sclerolaena diacantha*	
Cyperaceae	*Fimbristylis* sp.	
Euphorbiaceae	*Euphorbia drummondii*	
Fabaceae	*Acacia acuminata*	
Fabaceae	*Acacia bidentata*	
Fabaceae	*Acacia erinacea*	
Fabaceae	*Acacia hemiteles*	
Fabaceae	*Acacia leptospermoides* subsp. *leptospermoides*	
Fabaceae	*Acacia lineolata* subsp. *lineolata*	
Fabaceae	*Acacia microbotrya*	
Fabaceae	*Acacia multispicata*	
Fabaceae	*Acacia saligna*	
Fabaceae	*Daviesia divaricata*	
Fabaceae	*Jacksonia sternbergiana*	
Fabaceae	*Templetonia sulcata*	
Goodeniaceae	*Dampiera lavandulacea*	
Goodeniaceae	*Scaevola spinescens*	
Hemerocallidaceae	*Corynotheca micrantha*	
Hemerocallidaceae	*Dianella revoluta*	

Family	Species	Introduced (weed) species
Hemerocallidaceae	*Tricoryne tenella*	
Iridaceae	*Romulea rosea*	*
Lauraceae	*Cassytha* sp.	
Myrtaceae	*Calytrix* sp.	
Myrtaceae	*Melaleuca acuminata*	
Myrtaceae	*Melaleuca adnata*	
Myrtaceae	*Eucalyptus camaldulensis*	
Myrtaceae	*Eucalyptus loxophleba*	
Myrtaceae	*Eucalyptus salmonophloia*	
Myrtaceae	*Eucalyptus wandoo*	
Oxalidaceae	*Oxalis pes-caprae*	*
Pittosporaceae	*Pittosporum angustifolium*	
Poaceae	*Aristida holathera*	
Poaceae	*Austrostipa elegantissima*	
Poaceae	*Avena barbata*	*
Poaceae	*Bromus diandrus*	*
Poaceae	*Bromus rubens*	*
Poaceae	*Cynodon dactylon*	*
Poaceae	*Ehrharta calycina*	*
Poaceae	*Eragrostis curvula*	*
Poaceae	*Eragrostis* sp.	
Poaceae	*Hordeum leporinum*	*
Proteaceae	*Grevillea biternata*	
Proteaceae	*Grevillea huegelii*	
Proteaceae	*Hakea commutata*	
Proteaceae	*Hakea erinacea*	
Proteaceae	*Hakea preissii*	
Restionaceae	*Desmocladus asper*	
Santalaceae	*Exocarpos sparteus*	
Santalaceae	*Santalum acuminatum*	
Scrophulariaceae	*Eremophila glabra*	
Scrophulariaceae	*Eremophila lehmanniana*	
Scrophulariaceae	*Eremophila scaberula* (T)	
Solanaceae	*Solanum nigrum*	*
Surianaceae	*Stylobasium australe*	

Appendix F Black cockatoo potentially suitable hollows recorded within the survey area

Species	DBH (mm)	Coordinates		Hollow type	Evidence of use
		Easting	Northing		
Eucalyptus salmonophloia (Salmon Gum)	>300	405501	6607186	Spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405498	6607196	Spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405487	6607238	Spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405445	6607254	Spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405434	6607319	Potential spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405536	6606763	Spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405579	6606511	1x trunk, 1x spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405584	6606482	Potential spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405607	6606375	Trunk	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405624	6606299	2x spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405639	6606188	Trunk	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405752	6605599	6x spout, 1x branch	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405767	6605524	2x branch, 1x spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405770	6605501	2x spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405771	6605502	Spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405843	6605141	Trunk	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405869	6604980	Spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405982	6604386	Trunk	Nil

Species	DBH (mm)	Coordinates		Hollow type	Evidence of use
		Easting	Northing		
Eucalyptus salmonophloia (Salmon Gum)	>300	406063	6604206	Potential trunk	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	406022	6604447	Potential spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405970	6604682	Trunk	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405968	6604715	2x spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405957	6604823	Spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405886	6605133	Spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405828	6605417	Spout	Nil
Eucalyptus salmonophloia (Salmon Gum)	>300	405723	6606016	Potential spout	Nil
Eucalyptus loxophleba (York Gum)	>500	405611	6606368	Spout	Nil
Stag (unidentifiable)	>500	405508	6607150	Spout	Nil
Stag (unidentifiable)	>500	405631	6606268	Spout	Nil
Stag (unidentifiable)	>500	405744	6605638	Trunk	Nil
Stag (unidentifiable)	>500	405859	6605047	Trunk	Nil
Stag (unidentifiable)	>500	406001	6604510	Spout	Nil
Stag (unidentifiable)	>500	405962	6604741	Spout	Nil
Stag (unidentifiable)	>500	405881	6605161	2x spout, 1x branch	Nil