

Detailed Vertebrate Fauna Survey Additional Areas North

Prepared for Talison Lithium Australia 28 March 2024



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EXECUTIVE SUMMARY

Talison Lithium Pty Ltd (Talison) currently operates a lithium mine at Greenbushes, situated approximately 250 km south of Perth in south-west Western Australia. Talison is proposing to increase output from the Greenbushes Mine and requires approval for longer term requirements including expansion of waste rock landforms (WRL). To support longer term environmental approvals, Talison commissioned Onshore Environmental Consultants Pty Ltd (Onshore Environmental) to undertake a single phase detailed vertebrate fauna survey covering approximately 510 hectares (ha) of predominantly state forest vegetation situated east of the existing lithium mine and outside all mining operational areas (Figure 1).

The field survey was completed by a Principal Zoologist, Principal Ecologist and Ecologist from Onshore Environmental. The field survey was completed between the 25th of November and 5th of December 2023. A total of 87 vertebrate fauna species were recorded, including seven amphibians, nine reptiles, 54 birds and 17 mammals.

Three vertebrate fauna species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (BC Act) were recorded from the study area:

- Forest Red-tailed Black-Cockatoo *(Calyptorhynchus banksii naso)* listed as Vulnerable under the EPBC Act and BC Act;
- Baudin's Black Cockatoo (*Zanda baudinii*) listed as Endangered under the EPBC Act and BC Act; and
- Carnaby's Black Cockatoo (*Zanda latirostris*) listed as Endangered under the EPBC Act and BC Act.

Additionally, three Priority 4 fauna species, as recognised by the Department of Biodiversity Conservation and Attractions (DBCA) were recorded from the study area:

- Rakali/Water Rat (Hydromys chrysogaster);
- Quenda (Isoodon fusciventer); and
- Western Brush Wallaby (Notamacropus irma).

Another three conservation significant fauna species were determined as likely to occur within the study area, but were not recorded during the field survey period:

- Chuditch (Dasyurus geoffroii) listed as Vulnerable under the EPBC Act and BC Act;
- South-western Brush-tailed Phascogale *(Phascogale tapoatafa wambenger)* listed as Conservation Dependant under the BC Act; and
- Australasian Bittern (*Botaurus poiciloptilus*) listed as Endangered under the EPBC Act and BC Act.

Four introduced fauna species (feral animals) were recorded within the study area during the field survey; European Rabbit (*Oryctolagus cuniculus*), Red Fox (*Vulpes vulpes*), Cat (*Felis catus*) and Black Rat (*Rattus rattus*).

Two naturally occurring fauna habitats were mapped within the study area; hillslopes with Jarrah/Marri Forest and drainage lines. Neither habitat was determined to be regionally or

locally restricted. Habitat condition ranged from degraded to very good with disturbances including logging of hardwood timber, historical alluvial mining, clearing for farmland and plantation timber, and access roads and tracks.

Habitats within the study area were assessed for the use by, and suitability for, conservation significant fauna species. Native vegetation occurring across the study area was deemed to be high quality foraging habitat for black cockatoos. No known nesting trees (i.e. trees that contain hollows showing signs of use) were recorded within the study area. A total of eight trees were identified as having hollows considered suitable for use by black cockatoos.

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1.0 INTRODUCTION

1.1 Background

Talison is a Western Australian mining company with operations based adjacent to the town of Greenbushes in south-west Western Australia. The Greenbushes Mine is located approximately 250 km south of Perth and 80 km south-east of the port of Bunbury (Figure 1).

The site comprises a number of open cut mining operations for tantalum, tin and spodumene (lithium). An underground tantalum operation has also been developed but is currently under care and maintenance. The Greenbushes pegmatitie is the world's largest hard rock tantalum resource and the largest and highest-grade lithium minerals resource in the world. Minerals produced at Talison's Greenbushes Mine can be found in many different applications including mobile phones, computers, surgical implants, electronic devices, glassware, ceramics and batteries.

Talison is proposing to increase output from the Greenbushes Mine and requires approval for longer term requirements including expansion of WRL. To support environmental approvals, Talison commissioned Onshore Environmental to undertake a single-phase detailed vertebrate fauna survey covering the proposed Additional Areas North Project Area, herein referred to as the study area (Figure 1).

The study area encompasses approximately 510 ha of predominantly state forest vegetation situated east of the existing Greenbushes Mine. The study area is situated to the east of the South Western Highway and outside the current Mining Development Envelope (MDE) (Figure 1).



2.0 EXISTING ENVIRONMENT

2.1 Climate

The climate of south-west Western Australia is Mediterranean, with hot, dry summers and mild, wet winters. The study area occurs on a boundary between the dry Mediterranean region to the north which experiences six dry months per year, and the moderate Mediterranean region to the south which experiences four dry months per year (Beard 1981). The Greenbushes region has cool wet winters and hot dry summers. Average annual rainfall for the town of Greenbushes is 920.1 mm (Bureau of Meteorology [BOM] 2024), with the majority of falls occurring during the winter months of June and July. This winter rainfall is associated with cold fronts moving across the south-west of Western Australia.

The average summer maximum temperature for Bridgetown (approximately 10 km south-east of the study area) is 29.9°C during January, with average winter minimum temperatures dropping to 4.7°C during July. The survey was undertaken in November 2023 (Spring). The average maximum temperature for Bridgetown in November is 24.2°C, with a minimum average of 9.3°C (Figure 2). Total rainfall for Bridgetown for the six-month winter and spring period prior to and including the field survey was 445 mm. This total is below the long-term average of 513 mm for the same period (Figure 2). Rainfall during November 2023 was above average with 46 mm recorded before the survey period (Figure 2).



Figure 2 Rainfall and temperature data from the Bridgetown Weather Station (Bureau of Meteorology 2024).

2.2 Biogeographic Regions

The latest version of the Interim Biogeographic Regionalisation for Australia (IBRA7) divides Australia into 89 bioregions based on climate, geology, landform, native vegetation and species information, and includes 419 sub-regions (Department of the Environment and Energy [DoEE] 2018). The bioregions and sub-regions are the reporting unit for assessing the status of native ecosystems and their level of protection in the National Reserve System.

The study area is located within the Southern Jarrah Forest (JF2) sub-region. The sub-region is described as, "Duricrusted plateau of Yilgarn Craton characterised by Jarrah-Marri forest on laterite gravels and, in the eastern part, by Marri-Wandoo woodlands on clayey soils. Eluvial and alluvial deposits support *Agonis* shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species-rich shrublands. The climate is Warm Mediterranean" (Hearn *et al.* 2002).

The vegetation of the sub-region is described as "Jarrah-Marri forest in the west grading to Marri and Wandoo woodlands in the east. There are extensive areas of swamp vegetation in the south-east, dominated by Paperbarks and Swamp Yate. The understorey component of the forest and woodland reflects the more mesic nature of this area. The majority of the diversity in the communities occurs on the lower slopes or near granite soils where there are rapid changes in site conditions" (Hearn *et al.* 2002).

2.3 Land Use

The major land uses within the study area and surrounds are state forest, residential, mining and agriculture. The study area encompasses predominantly native vegetation within state forest, with smaller area of farmland (annual pasture and cleared plantation). Nearby towns include Bridgetown (approximately 10 km to the south-east) and Balingup (approximately 10 km to the north-west).

Agriculture is the oldest industry in the area with Bridgetown first settled by sheep farmers in 1857. The Bridgetown Agricultural Society was formed in 1885 and by this time the area had a well-established agricultural industry, including sheep, cattle, dairy products, timber, fruit and nuts. In 1889 the railway line was extended to Bridgetown allowing the expansion of the fruit and timber markets. Many of these agricultural industries remain operational with wineries and olive farms also established in the area.

Tourism is another major industry, with the scenery, historical sites, wineries, and galleries serving as the major attractions. Events such as the annual Blues at Bridgetown Festival also draw large numbers of people to the area.

The Greenbushes Mine is situated on the oldest mining tenement in Western Australia and has a long history of mining activities dating back to 1888. Tin was first reported in 1886 in a Government geological survey, and mining commenced in 1888. Since it was first discovered, tin has been mined almost continuously in the Greenbushes area, although in recent years the lower tin prices and emergence of tantalum and spodumene as the major revenue earners have relegated tin to the position of a by-product. The presence of tantalite was noted as far back as 1893 but at that time the mineral had no value in its own right and was seen as a

nuisance because it downgraded the value of tin. Although open cut mining began to be practiced on a small scale in the 1900s much of the tin mined in the early years by small operators came from underground workings to access weathered pegmatite below the caprock. Shafts were blasted in the surface rock and tunnels dug out into the tin bearing alluvium. The dirt was hauled to the surface and stockpiled during the summer months then puddled and sluiced in winter when there was an abundance of water. Tin mining continued as a cottage industry under the control of many small mining companies up to the early 1960s when, for the first time, a major mining company became involved in the tinfields.

For several years a dredge was used to recover surface deposits of tin and tantalum. By 1970 alluvial resources were dwindling and it was necessary to increase exploration activity. As a direct result of this work development of the weathered pegmatite commenced in 1974. This tin/tantalum source sustained the operation until 1992. Small parcels of tantalite were sold occasionally, but it was not until 1944, when war had stimulated interest in the element tantalite, that the mineral began to be produced steadily for use in telecommunications, electronics and radar equipment.

Spodumene, the major lithium mineral, was first identified by the Western Australian Government Survey in 1949 from a specimen collected in 1928 which was initially thought to be feldspar. During the extensive diamond drilling programme for tantalum that took place between 1977 and 1980, substantial spodumene rich zones were identified. Later drilling confirmed the existence of the richest spodumene orebody ever discovered, with resources sufficient to maintain production well into the 21st Century. However, being a new product, markets had to be developed, so it was not until 1983 that the initial development of the lithium ore body at Greenbushes commenced, and the first lithium processing plant was commissioned in 1985. Since that time, the lithium processing plant has been expanded several times to produce a range of lithium concentrates and the mine is currently undergoing a further major expansion.

2.4 Landforms and Soils

Tille (1996) has mapped soils of the Wellington-Blackwood District, which includes the town sites of Greenbushes and Bridgetown on its southern boundary. The study area occurs within the Hester Sub-system of the Darling Plateau System, and consists of undulating ridges and hill crests formed on laterite and gneiss which typically slope downwards off the main plateau into the surrounding Lowden Valleys System. The soils are mostly loamy gravels, sandy gravels and loamy earths.

2.5 Flora and Vegetation

The study area occurs in the Menzies Sub-district of the Darling Botanical District, in the South-West Botanical Province (Beard 1981). The Menzies Sub-district (southern jarrah forest) covers a total area of 26,572 km², of which 18,715 km² (70%) originally supported jarrah and jarrah-marri forest (Beard 1990). It is estimated that approximately 61% of the total area has been cleared since European settlement, mainly in the valleys which are free of laterite, leaving the forest intact on laterised higher plateau levels.

The Menzies Sub-district is characterised by Jarrah stands on laterite with some Marri and Wandoo woodlands. Valley soils are often richer and Blackbutt (*Eucalyptus patens*) is more dominant in these areas. Flooded Gum (*Eucalyptus rudis*) is common along stream banks and Bullich (*Eucalyptus megacarpa*) is also present in some areas. Within the Greenbushes area vegetation is dominated by Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) forest over the tall shrubs bull banksia (*Banksia grandis*) and snotty gobble (*Persoonia longifolia*). The lower understorey strata generally contains a range of plant genera including *Hakea, Acacia, Xanthorrhoea, Adenanthos, Hovea, Macrozamia, Leucopogon, Bossiaea, Daviesia, Grevillea, Patersonia, Styphelia* and Kennedia.

Vegetation of the study area was mapped by Beard during mapping of the Swan area (Beard 1981, Figure 3). Vegetation forms part of the Bridgetown 3 vegetation association described as Medium Jarrah-Marri forest.

Vegetation complexes of the southern jarrah forest have most recently been defined by Heddle *et al.* (1980) and updated by Mattiske and Havel (1998). Mattiske and Havel (1998) describe the study area as occurring within the Dwellingup, Balingup, Catterick and Grimwade complexes (Table 1, Figure 4). Vegetation of these complexes is generally Open Forest of *Eucalyptus marginata* subsp. *marginata-Corymbia calophylla* on lateritic uplands with *Eucalyptus rudis* and *Banksia littoralis* on valley floors.

Complex	Description
Dwellingup	Open forest of <i>Eucalyptus marginata</i> subsp. <i>marginata-Corymbia calophylla</i> on lateritic uplands in mainly humid and subhumid zones.
Balingup	Open forest of <i>Eucalyptus marginata</i> subsp. <i>marginata-Corymbia calophylla</i> on slopes and woodland of <i>Eucalyptus rudis</i> on the valley floor in the humid zone.
Catterick	Open forest of <i>Eucalyptus marginata</i> subsp. <i>marginata-Corymbia calophylla</i> mixed with <i>Eucalyptus patens</i> on slopes, <i>Eucalyptus rudis</i> and <i>Banksia littoralis</i> on valley floors in the humid zone.
Grimwade	Tall open forest to open forest of <i>Corymbia calophylla-Eucalyptus marginata</i> subsp. <i>marginata</i> with <i>Eucalyptus patens</i> on slopes and <i>Eucalyptus rudis</i> over some <i>Agonis flexuosa</i> on lower slopes in the humid zone.

Table 1 Vegetation complexes occurring within the study area (Mattiske and Havel 1998).

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6260000	-			-	TALISON LITHIUM Additional Areas North Figure 3 Beard (1981) vegetation associations represented within the study area
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3.0 METHODOLOGY

3.1 Legislation and Guidance Statements

The detailed vertebrate fauna survey was carried out in a manner that was compliant with EPA requirements for the environmental surveying and reporting of vertebrate fauna in Western Australia:

- Statement of Environmental Principles, Factors and Objectives (EPA 2020a);
- Technical Guidance Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020b); and
- Environmental Factor Guideline Terrestrial Fauna (EPA 2016).

Other guidelines relevant to the survey include:

- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010a) Survey Guidelines for Australia's Threatened Bats;
- DEWHA (2010b) Survey Guidelines for Australia's Threatened Birds;
- DCCEEW (2022) Referral guidelines for three WA threatened black cockatoo species;
- DEWHA (2010c) Survey Guidelines for Australia's Threatened Frogs;
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) (2011a) Survey Guidelines for Australia's Threatened Mammals; and
- DSEWPC (2011b) Survey Guidelines for Australia's Threatened Reptiles.

3.2 Desktop Assessment

3.2.1 Literature Review

A review of all relevant publicly available literature in close proximity to the study area was undertaken, including a search of the Department of Water and Environmental Regulation's Index of Biodiversity Surveys for Assessment (DWER 2023). Previous surveys were reviewed to provide context for the survey and to inform an assessment of habitat types potentially occurring within the study area.

Several previous vertebrate fauna surveys have been completed between 2018 and 2023 associated with Talison's recent expansion of mining operations in the Greenbushes area. Results from these surveys are described in more detail in Section 4.1.1. In addition to the above fauna survey work, Onshore Environmental has recently undertaken a detailed flora and vegetation survey of the study area (Onshore Environmental 2024). This survey provided fine-scale vegetation type mapping which was used to inform habitat mapping of the study area.

3.2.2 Database Searches

The desktop assessment included searches of several databases relating to significant fauna previously collected or described within, or in close proximity to, the study area. For this report

the search was extended beyond the study area to place fauna values into a local and regional context. The following databases were searched:

- DBCA Threatened and Priority Fauna database search (30 km radial search);
- Environment Protection Biodiversity Conservation (EPBC) Act Protected Matters database (50 km radial search);
- DBCA Dandjoo Biodiversity Repository (50 km radial search);
- BirdLife Australia's Birdata dataset (50 km radial search); and
- Atlas of Living Australia database (50 km radial search).

The results from the above database searches and the literature review were compiled to provide a list of fauna species that could potentially occur within or surrounding the study area.

3.2.3 Assessment of Likelihood of Occurrence in the Study Area

A list of conservation significant species occurring within a 50 km radius of the study area was compiled from the above database searches and literature review. The likelihood of each conservation significant species occurring within the study area was assessed based on habitat availability, the age and proximity and number of previous records, previous assessments, and the regional occurrence of the species (Table 2). Habitat availability and suitability was assessed based on aerial imagery and previous knowledge of the survey area and surrounds. Results are described in more detail in Section 4.1.3.

Table 2Ranking system used to assign the likelihood that a species would occur in the
study area.

Rank	Criteria
Recorded	The species has been recorded in the study area.
Likely to occur	Suitable habitat exists within the study area and the species has been recorded within 10km in the last 10 years.
Possible to occur	Suitable habitat exists within the study area and the species has been recorded within 10-20km in the last 20 years.
Unlikely to occur	No suitable habitat occurs within the study area; and/or there are no previous records within a 20 km radius of the study area and/or previous records are >20 years old.

3.2.4 Assessment of Conservation Significance

The conservation significance of fauna and ecological communities are classified at a Commonwealth, State and Local level on the basis of various Acts and Agreements, including:

International Level:

- IUCN: The IUCN 'Red List' lists species at risk under nine categories (status codes) (Appendix 1); and
- International Conventions: Migratory taxa listed under the Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA), Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA), and Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention).

Commonwealth Level:

• EPBC Act: The Department of Climate Change, Energy, the Environment and Water (DCCEEW) lists Threatened fauna which are determined by the Threatened Species Scientific Committee according to criteria set out in the Act. The Act lists fauna that are considered to be of conservation significance under one of six categories (Appendix 1).

State Level:

- Biodiversity Conservation (BC) Act: At a State level, native fauna species are protected under the BC Act - Wildlife Conservation Notice. A number of species are assigned an additional level of conservation significance based on a limited number of known populations and the perceived threats to these locations (Appendix 1); and
- DBCA Priority list: DBCA produces a list of Priority species that have not been assigned statutory protection under the BC Act. Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added under Priorities 1, 2 or 3. Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been removed from the threatened species list for other taxonomic reasons, are placed in Priority 4. These species require regular monitoring (see Appendix 1).

Local Level:

• Species may be considered of local conservation significance because of their patterns of distribution and abundance. Although not formally protected by legislation, such species are acknowledged to be in decline as a result of threatening processes, primarily habitat loss through land clearing.

3.3 Survey Methodology

3.3.1 Timing and Personnel

A single phase detailed terrestrial vertebrate fauna survey was undertaken by Principal Zoologist Mr Mike Brown, Principal Ecologist Ms Jessica Waters and Ecologist Dr Jerome Bull. The survey was completed over an eleven-day field trip between the 25th of November and the 5th of December 2023.

3.3.2 Surveying of Study Area

The fauna survey employed a variety of systematic and opportunistic sampling techniques. Systematic sampling refers to data methodically collected over a fixed time period in a discrete habitat type, using an equal or standardised sampling effort. Opportunistic sampling includes data collected non-systematically within and outside fixed sampling sites.

At all survey sites a combination of systematic and opportunistic sampling was conducted, including a combination of trapping, opportunistic searching, bird censusing and nocturnal surveying. More specifically, systematic sampling included:

- Pit-trap and drift fence;
- Elliot box traps;
- Funnel traps;

- Bioacoustics Audio Recorder (to detect bat echolocation calls); and
- Spotlighting (nocturnal searches).

To supplement the systematic sampling, other techniques employed over the wider study area included:

- Remote cameras;
- Searching for secondary evidence (tracks, scats, diggings, burrows and nests); and
- Opportunistic searching, sightings and call records.

The entire study area was ground truthed and assessed to document habitat characteristics including evaluation of the presence of habitats suitable to support conservation significant fauna. Suitable representative trapping sites were identified with reference to previously conducted vegetation type mapping and knowledge of the study area (Onshore Environmental 2024). A total of five trapping sites within the two naturally occurring habitat types were established. The survey recorded any observations of fauna species made via primary or secondary evidence. Targeted searches (as detailed below) were also undertaken for conservation significant fauna species identified during the database review.

3.3.3 Targeted Fauna Searches

Targeted searches were undertaken for conservation significant fauna species throughout the study area. The study area was traversed on foot, providing the ability to opportunistically record evidence of Threatened and Priority listed fauna and undertake closer examination of specific habitats likely to support conservation significant fauna.

The following parameters were recorded for all conservation significant fauna observed:

- Co-ordinate location;
- Description of habitat in which the species was located; and
- Photograph of the species, evidence of species and/or habitat.

Further details of specific methods used to target conservation significant species are described below.

3.3.4 Camera Traps

Motion sensor cameras with infrared illumination to 30 metres (Browning Spec Ops Elite HP5 model) were set up within habitats identified throughout the study area. Cameras were strategically placed to target habitat features that were most likely to be utilised by species of conservation significance, including potential den sites (Chuditch), trees with suitable hollows (Phascogales), and dense undergrowth in drainage areas (Quenda). Motion cameras were baited with universal bait. A total of 20 cameras were deployed between the 25th and 28th November 2023 with all cameras retrieved on the 4th of December 2024 (Figure 5, Appendix 2).

3.3.5 Trapping Program

Five trapping sites were established within the study area, with three sites within the hillslope habitat and two sites within the drainage line habitat (Figure 5, Appendix 2). The location of the trapping sites targeted high quality habitat with consideration of habitat features likely to support a variety of species. Each trapping site consisted of split trap lines comprising five drift fences. Trap lines were split to provide greater spatial representation within the habitat and to target areas of high-quality microhabitats (i.e. areas with shade, dense vegetation cover, logs and leaf litter cover). Each drift fence comprised two pit-fall traps (20 litre buckets), two funnel traps and one small Elliot (Elliot A) trap. Pit fall traps were located approximately four meters apart, with funnels at each end of the drift fence. A small Elliot trap was strategically located at each trap line. A total of 125 traps (50 pit-falls, 50 funnel and 25 small Elliot) were deployed for eight nights across the five sites. Funnel traps were covered with branches and debris was placed in the bottom of pit fall traps to provide shade for captures. Traps were checked early in the day and were cleared within four hours of sunrise.

3.3.6 Active Foraging

Active foraging, involving raking litter and turning over rocks, was completed while traversing the study area. All fauna species sighted during foraging were recorded.

3.3.7 Avifauna Surveying

Bird censusing was undertaken for a 20-minute interval in the vicinity of the trap sites. Additional 20-minute bird censuses were undertaken throughout the study area (Figure 5, Appendix 2). A total of 14 person-hours of bird censusing was undertaken across the eleven day survey period. Opportunistic observations of bird sightings and calls were also recorded whilst traversing the study area and surrounds.

3.3.8 Acoustic Bat Surveying

A Bioacoustics Audio Recorder (BAR) was used to record crepuscular audio within and surrounding the study area. The unit was deployed for three nights within the drainage line habitat (Figure 5). The BAR unit was set up to record from one hour before sunset through to one hour after sunrise.

3.3.9 Nocturnal Surveys

Nocturnal searches were undertaken within the study area on two evenings during the survey period. Each search period was two hours in duration. The nocturnal searches involved spotlighting at trapping sites and areas of interest as well as undertaking foot transects using a head torch. Additionally, tracks within the study area were driven at low speed and any fauna encountered were recorded.

3.3.10 Opportunistic Recordings

During the survey work non-systematic opportunistic searches were made and any observations recorded. These recordings focused primarily on the identification of conservation significant fauna and included secondary evidence such as tracks, scats, diggings and feeding signs.

3.3.11 Fauna Habitat Mapping

Habitat assessments were undertaken throughout the study area to document habitat characteristics and map the fauna habitat types. The fauna habitat mapping utilised high-resolution aerial photography of the study area at a scale of 1:10,000. Ground-truthing of the study area was completed during the survey with habitat characteristics recorded. Vegetation type mapping undertaken by Onshore Environmental during the detailed flora and vegetation survey was utilised to further aid in characterising habitat mapping across the full extent of the study area (Onshore Environmental 2024). The suitability of habitat and presence of habitat features for species of conservation significance was noted as part of the habitat assessment.

3.3.12 Assessment of Black Cockatoo Breeding Habitat

The DCCEEW provides guidelines for the study of actions that may result in impact to black cockatoos (for assessment under the EPBC Act). The survey and analysis reported here have been conducted with reference to the existing guidelines (DAWE 2022).

The suitability of habitat for breeding was assessed by recording known, suitable and potential nesting trees for black cockatoos within the study area. A ranking system developed by Onshore Environmental was utilised, with scores later converted to match categories as described within the EPBC Act referral guidelines for black cockatoos (DAWE 2022, Table 3). The field survey focused on identifying breeding habitat for black cockatoos assessed by targeting habitat trees that had a diameter at breast height (DBH) of 50 cm or greater (or 30cm or greater DBH for *Eucalyptus wandoo*). Due to the large size of the study area all trees >50cm DBH were not recorded. The survey focused on identifying trees of a size and structure likely to support large hollows. Target tree species included Marri, Jarrah and any other *Corymbia* and *Eucalyptus* species of a suitable size. Large trees with the potential to contain hollows were recorded using a handheld GPS. These trees were examined using binoculars to identify the presence of hollows and evidence of use by black cockatoos (e.g. chewing around hollow entrance, scarring and scratch marks on trunks and branches).

Where suitable or used hollows were identified, trees were further inspected using a drone where possible to further assess the suitability of hollows for nesting and to confirm signs of use (such as chewing of hollow entrances). The following data was recorded:

- tree location;
- tree species;
- DBH; and
- Nest tree rank and corresponding category defined in the EPBC Act referral guidelines for black-cockatoos (DAWE 2022, Table 3).

Additionally, in order to determine approximate densities of potential future breeding habitat (i.e. trees with DBH \geq 50 cm, or \geq 30 cm for *Eucalyptus wandoo*), tree counts were conducted at randomly located points across the study area. Tree counts provide an indication of the current and future value of fauna habitats for use as black cockatoo breeding habitat. Tree counts were conducted within a 0.25 hectare area and tree numbers within these areas were then extrapolated to provide an average density per hectare.

Table 3Ranking system used for the assessment of potential nest trees for black cockatoos (adapted from Bamford Consulting Ecologists
2021) and equivalent category defined in the federal referral guideline (DAWE 2022).

Adapted from Bamford Consulting Ecologists (2021)		Referral guideline for 3 WA threatened black cockatoo species (DAWE 2022)		
Category	Description	Category	Description	
Used	Black cockatoo breeding activity recorded	Known nesting trees	Trees (live or dead but still standing) which contains a hollow where black cockatoo breeding has been recorded or which demonstrates evidence of breeding (i.e. showing evidence of use through scratches, chew marks or feathers).	
Chewed	Hollow of suitable size and orientation for use by black cockatoos and shows evidence of chew marks on edge of hollow or trunk indicating likely recent or historical usage.			
Suitable	Tree with a hollow of suitable size and orientation considered to be of sufficient depth for use by black cockatoos. However, there is no evidence of use.	Suitable nesting trees	Trees with suitable nesting hollows present, although no evidence of use. Note that any species of tree may develop suitable hollows for breeding.	
		Suitable nest hollow	Any hollow with dimensions suitable for use for nesting by black cockatoos. Characteristics of hollows used by each species is available in the SPRAT database. Suitable nest hollows are only found in live trees with a DBH of at least 500 mm.	
Potentially suitable	 Tree contains a hollow that is potentially suitable for nesting i.e. diameter of 10 cm or greater. However, these hollows are considered unlikely to be used by black cockatoos as nesting sites for one or more of the following reasons: small entrance (generally <20cm); deemed unlikely to have a large internal space for nesting, or sufficient depth inside the hollow (i.e. less than 0.5 m); evidence of use by other competitive species i.e. bees or other birds; orientation of the hollow; and/or the presence of branches or other obstructions. While these hollows are not currently high-quality nest sites they have the potential to become nest sites in the future and may support other species of conservation significance 		Trees that have a suitable DBH to develop a nest hollow, but do not currently have hollows. Trees suitable to develop a nest hollow in the future are 300-500 mm DBH. Note that many species of eucalypt may develop suitable hollows for breeding.	
Unsuitable	Unsuitable Tree contains hollows unsuitable for nesting due to hollow entrance diameter <10cm or hollow examined by drone and determined to be unsuitable for nesting. These hollows may be utilised by other species and have the potential to become black cockatoo nest sites in the longer term.			

2.3.13 Assessment of Black Cockatoo Foraging Habitat

Vegetation within the study area was assessed for foraging value. Black cockatoos forage widely in suitable vegetation in the south-west region and leave distinctive marks on dropped feeding residue such as Marri fruit. Targeted searches were made for these signs throughout the study area.

Results from the field survey were used to calculate foraging habitat scores using two different methodologies:

- the foraging quality scoring tool template recommended within the EPBC Act referral guidelines for Black-Cockatoos (DAWE 2022); and
- the foraging habitat score recently developed by the DCCEEW in consultation with species experts in Western Australia and used to calculate the value of an offset site (not publicly available).

Foraging Habitat Quality Score - EPBC Act referral guidelines for black cockatoos (DAWE 2022)

The foraging quality scoring tool has been developed to allow habitat quality to be quantified. The assessment of foraging habitat tool identifies habitat as high-quality foraging habitat (score of 5-10) or lower quality foraging habitat (score of 0-4). If the survey area contains native vegetation used for foraging at any time by one or more of the black cockatoo species, and is larger than one hectare in size, it is considered at face value to be of very high quality, important for recovery and therefore as having a score of ten.

The scoring tool then considers the following five contextual factors that may lessen the quality of that habitat (Appendix 3):

- Foraging potential;
- Connectivity;
- Proximity to breeding;
- Proximity to night roosting; and
- Impacts from significant plant disease.

To provide a final habitat quality score points are subtracted (from the starting score of ten) for each of the contextual factors where the required evidence is not proven to occur at the site.

<u>Offset Habitat Scoring System - DCCEEW in consultation with species experts in Western</u> <u>Australia</u>

The score used to calculate the value of an offset provides a numerical value that reflects the significance of vegetation as foraging habitat for each of the black cockatoo species, and was recently developed by the DCCEEW in consultation with species experts in Western Australia. The foraging value of the vegetation depends upon the type, percentage foliar cover and health of trees and/or vegetation condition, and can be influenced by the context of the site such as the availability of foraging habitat nearby. The scoring system has three components drawn from the DCCEEW offset calculator (DCCEEW 2020, see Appendix 3):

- A score between zero and seven relating to site condition;
- A score between zero and three relating to site context; and
- Species stocking rate which is related to confirmation of presence or absence at the site for each of the three species of black cockatoo.

Site condition is considered the key factor in determining the quality of habitat for the three black cockatoo species. Species stocking rate is considered only in terms of presence or absence of the species and does not add to the total score. The species, or strong indicators of the species, must be present for an offset to be considered suitable.

2.3.14 Assessment of Black Cockatoo Night Roosting Habitat

DAWE (2022) defines known roosting trees as a tree (generally the tallest), native or introduced known to be used for night roosting or which demonstrates evidence of roosting. Potential roosting trees are defined as tall trees of any species within close proximity to water sources. Night roosting habitat is defined as habitat that contains one or more known or potential roosting trees. Known roosting trees are typically situated close to important water sources within areas of high-quality foraging habitat.

The availability of night roosting habitat within the study area was assessed during the field survey. Any evidence of roosting was noted during the field survey (e.g. branch clippings, droppings or moulted feathers) as well as the presence of black cockatoos within the study area or nearby at dawn and dusk.

Known night roosting habitat is recorded within databases managed by the DBCA, the Western Australian Museum and Birdlife Australia (Great Cocky Count). These records were accessed to determine if known sites occurred nearby to the study area and to assess regional context. Database searches were undertaken to determine known roosting locations within a 20 km radius of the study area (DBCA 2022).

3.3.15 Species Identification and Nomenclature

Vertebrate fauna species were identified at the time of capture or observation in the field. All species were able to be fully identified with no specimens needed to be taken for further examination. Nomenclature and conservation significance rankings used in this report are in accordance with the current listing of WA fauna recognised by the WA Museum (WAM), as listed on the Checklist of the Terrestrial Vertebrae of Western Australia (WAM 2022) for mammals and herpetofauna, and the Australian Faunal Directory for birds (ABRS 2022).

3.3.16 Survey Constraints

The EPA Technical Guidance (EPA 2020b) list potential limitations that field surveys may encounter. Limitations associated with the detailed vertebrate fauna survey are addressed in Table 4. No significant access or timing restrictions impacted the survey, and the study area was adequately surveyed. The survey provides an assessment of habitat and the species present at the time of survey during the single survey period with no seasonal component. A second phase survey is recommended to comply with the technical guidelines for detailed fauna surveys.

Variable	Impact on Survey Outcomes
Availability of data and information	The desktop searches provided an extensive species list, background information and regional context for the study area. Numerous fauna surveys have been completed in close proximity to the study area, including basic and detailed surveys previously completed by Onshore Environmental in surrounding areas. No significant issues with the reliability or accuracy of the desktop searches or previous surveys were identified. However, it is acknowledged that there may be errors in the data presented from these sources. Where required species lists from previous surveys and database searches were reviewed, nomenclature and conservation significance was updated. A small number of species recorded from database searches were well outside their current known distribution and hence were removed from the results.
Experience levels	The personnel who executed the survey are practitioners suitably qualified in their respective fields; Mr Mike Brown (Principal Zoologist >15 years' experience), Ms Jessica Waters (Principal Ecologist >10 years' experience) and Dr Jerome Bull (Ecologist >25 years' experience). All personnel have undertaken numerous surveys in the Greenbushes area and throughout Western Australia.
Scope (fauna groups sampled)	All allocated tasks were achieved during the survey, with trapping, acoustic surveys, foraging, nocturnal surveys, bird surveys and targeted searches undertaken.
Timing, weather, and season.	The survey was undertaken in November/December 2023 which is within the primary survey period for the region for reptiles, birds and mammals (EPA 2020b). Rainfall prior to the survey period was below average. The influence of seasonal conditions on the proportion of fauna recorded are discussed further in Section 5.2, however seasonal conditions were not considered a limiting factor. A second season survey would likely marginally increase the number of species recorded.
Disturbance to site which may affect survey results	None of the disturbances within the study area were a constraint to the completeness of the survey.
Adequacy of the survey intensity and proportion of survey achieved	Trapping was completed over eight nights for all sites. Seven nights is recommended under the technical guidelines (EPA 2020b). Additional tasks completed from the scope of works included camera trapping, nocturnal surveys, bioacoustics recordings and habitat mapping across the extent of the study area.
Remoteness and/or access	There were no access restrictions experienced during the survey. The study area was accessible by vehicle and on foot.
Proportion of fauna identified, recorded or collected	Discussed in Section 5. Not considered a significant limitation.
Problems with data and analysis, including sampling biases	Discussed further in Section 5, however no significant problems with the data recorded or the analysis of the data were identified during the survey.

Table 4 Relevance of limitations, as identified by EPA (2020b), to the vertebrate fauna survey.

The survey was within the recommended survey timing for assessment of breeding habitat for black cockatoos in the Jarrah Forest Region (DCCEEW 2022). Black cockatoos may move in to or investigate hollows at any time, and while there may be no evidence of them currently using a hollow, there remains a possibility that activity may commence in the future.

Trees were initially examined from the ground and as internal dimensions are difficult to determine the survey may overestimate or underestimate the number of hollows that are suitable for use within the study area (Whitford 2002). Various characteristics of hollows may not be visible from the ground including the internal dimensions, opening size, obstructions and signs of use. Hollows identified as *potentially suitable* reflect this uncertainty. Additionally, hollows within trees may not be visible from ground level due to orientation or may be obstructed by branches and surrounding trees. Due to the large number of trees surveyed, hollows within the study area were not assessed with a drone. Additional survey work utilising a drone to further investigate hollows that have been identified as suitable is recommended. It is likely that the number of suitable hollows would be reduced after examination with the drone, as some hollows identified as suitable may lack sufficient depth or internal space for use as nesting hollows.



4.0 RESULTS

4.1 Desktop Review

4.1.1 Previous Fauna Surveys

A number of fauna surveys have been completed in the active mining area and surrounding leases held by Talison at Greenbushes (Table 5, Figure 6). A large number of biological surveys have been completed within the general area, however these surveys are predominantly basic level (previously Level 1) and targeted fauna surveys. Two detailed vertebrate fauna surveys were undertaken by Onshore Environmental in 2022 and 2023 covering the New Water Storage project area (immediately west of the study area) and Floyd's Waste Rock Landform project area (4 km south-west of the study area). The results from all previous terrestrial vertebrate fauna surveys completed within the vicinity of the study area are summarised below and presented in Table 5 with locations shown in Figure 6).

In 2011 Biologic Environmental Survey completed a basic fauna survey of the Greenbushes mining operations (Biologic Environmental Survey 2011). The area surveyed occurred immediately west of the study area and comprises the majority of the MDE. Desktop assessments identified 196 vertebrate fauna species as potentially occurring within the project area. A total of 82 species of vertebrates were recorded from the field survey including four currently listed conservation significant fauna species: Forest Red-tailed Black Cockatoo, Baudin's Cockatoo, Carnaby's Cockatoo and South-western Brush-tailed Phascogale. Six broad fauna habitats were identified within the project area: Jarrah-Marri forest, Jarrah-Marri forest over Banksia dominated mid-storey, Marri-Blackbutt-Flooded Gum woodland over Banksia dominated mid-storey, *Typha* dense tall sedges, *Leptospermum* scrub, and Disturbed/rehabilitated areas.

In 2018 Biologic Environmental Survey was commissioned by Talison to undertake a targeted survey for vertebrate fauna of conservation significance within and surrounding the Greenbushes Mine (Biologic Environmental Survey 2018a). A total of 43 species were recorded during the survey directly and/or via secondary evidence, including five species of conservation significance: Chuditch, South-western Brush-tailed Phascogale, Quenda, Western Brush Wallaby and Forest Red-tailed Black Cockatoo. Scats possibly belonging to the Western Ringtail Possum (*Pseudocheirus occidentalis*), listed as Critically Endangered under the EPBC Act and BC Act, were also recorded but could not be confirmed as belonging to the species. Follow-up targeted surveys for Western Ringtail Possum by Harewood (2018c) and Onshore Environmental (2018) did not record any evidence of the species.

Black Cockatoo Surveys

There have been a variety of vertebrate fauna surveys with a black cockatoo survey component completed at Greenbushes since 2011. Results from these surveys are summarised in Table 6.

The surveys confirm that the Forest Red-tailed Black Cockatoo is encountered most frequently and is present year-round in the Greenbushes area (Table 6). Numerous direct observations are supported by frequent evidence of recent and old feeding residues.

Baudin's Black Cockatoo has been directly observed during two surveys of large consolidated native vegetation blocks at Greenbushes (Table 6) including the New Water Storage Area in April 2023 (Onshore Environmental 2023a) and the Old Mill Camp in October 2023 (Onshore Environmental 2023b). Foraging evidence from Baudin's Black Cockatoo was recorded during four surveys, noting that feeding residue was sparse and typically older indicating infrequent presence in the Greenbushes area.

Carnaby Black Cockatoo have been directly observed during a survey of large consolidated native vegetation blocks at Greenbushes (Table 6). A flock of 20 birds was observed flying over bushland immediately south of the tailings storage facility (TSF)4 in November 2021 (Onshore Environmental 2022). Foraging evidence from Carnaby's Black Cockatoo was recorded during three surveys, with very few (old) feeding residues confirming infrequent presence in the Greenbushes area.

The previous survey work identified a number of suitable hollows and known nesting hollows in the Greenbushes area indicating that breeding is occurring locally. Given the dominance of Forest Red-tailed Cockatoos it is likely that breeding hollows are being used by this species. In 2022 Forest Red-tailed Cockatoos were confirmed as breeding within a nesting hollow in the TSF4 area (approximately 3 km south-west of the study area) (Onshore Environmental *unpublished data*). The hollow was cleared with approval as part of the TSF4 development in 2022.

Survey Name	Field Survey Date	Direct Observation	Foraging Evidence	Habitat Trees
Greenbushes Level 1 Fauna Survey (Biologic 2011)	13-17 October 2011	Forest Red-tailed Black Cockatoo (nine individuals were observed at two locations).	Forest Red-tailed Black Cockatoo, Baudin's Black Cockatoo, Carnaby's Black Cockatoo.	75 suitable hollows
Black Cockatoo Survey, Talison Mining, Greenbushes (Kirkby 2018)	22 January - 12 February 2018 754.1 ha	Small numbers of Forest Red-tailed Black Cockatoos were seen or heard at most locations during the survey. The groups were small family groups or pairs. A larger group of ten birds was noted at Forest Park Avenue. No roost sites were located during the survey.	Approximate numbers of feeding residues recorded: Forest Red-tailed Black Cockatoo - 374 Baudin's Black Cockatoo - 61 Carnaby's Black Cockatoo - 5 Feeding residues from Forest Red- tailed Black Cockatoo ranged from fresh through to old and grey indicating the site is used throughout the year by this species. Feeding residues from Baudin's Black Cockatoo were older and indicate that they may only be present in the non-breeding season. Very few residues from Carnaby Black Cockatoo were located (Carnaby's Black Cockatoos were heard to the east of the survey area on one occasion).	50 suitable hollows identified, including 24 known nesting hollows (showing signs of use)
Harewood (2018a)	11 th , 13 th , 15 th and 19 th June 2018	Not reported	Not reported	14 known nesting trees (chewed) 16 suitable hollows

Table 5 Fauna surveys completed within consolidated native vegetation blocks at the Greenbushes Mine with a targeted black cockatoo survey component.

Survey Name	Field Survey Date	Direct Observation	Foraging Evidence	Habitat Trees
Greenbushes Targeted Vertebrate and SRE Invertebrate Fauna Survey (Biologic 2018a)	12-21 February 2018	Forest Red-tailed Black Cockatoo (60 individuals were observed at eight locations).	None	Not assessed
		the survey.		
Greenbushes Mine Expansion Area 2 and Area 4 Basic Vertebrate Fauna Survey (Onshore Environmental 2022)	26 October - 2 November 2021, 29 November 2021	Forest Red-tailed Black Cockatoo (5 locations) Carnaby's Black Cockatoo (flock of 20 birds seen flying overhead)	Forest Red-tailed Black Cockatoo	1 suitable hollow currently used by bees
New Water Storages Detailed Vertebrate Fauna Survey (Onshore Environmental 2023a)	18-28 October 2022, 12-20 April 2023	Forest Red-tailed Black Cockatoo (20 observations) Baudin's Black Cockatoo (17 individuals from four locations)	Forest Red-tailed Black Cockatoo	1 known nesting hollow (chewed) 24 suitable hollows
Floyd's Waste Rock Landform Extension Detailed Vertebrate Fauna Survey (Onshore Environmental 2023b)	18-28 October 2022, 12-20 April 2023	Forest Red-tailed Black Cockatoo (two locations)	Forest Red-tailed Black Cockatoo	1 known nesting tree (chewed) 3 suitable hollows
New Zealand Gully Black Cockatoo Habitat Tree Assessment (Onshore Environmental 2023c)	3-6 & 9 October 2023	Forest Red-tailed Black Cockatoo (nine locations) Baudin's Black Cockatoo (flock of 17 birds seen near the Old Mill Camp)	Forest Red-tailed Black Cockatoo (53 locations), Baudin's Black Cockatoo (7 locations) Carnaby's Black Cockatoo (one location)	2 known nesting trees (chewed) 12 suitable hollows
Black Cockatoo Habitat Tree Assessment Additional Clearing Areas at Water Storages (Onshore Environmental 2023d)	8-9 & 15-16 December 2022	Forest Red-tailed Black Cockatoo (eight locations)	Forest Red-tailed Black Cockatoos	2 known nesting trees (old chew marks) 1 suitable hollow
Mine Rehabilitation Stockpile and Haul Road Black Cockatoo Habitat Tree Assessment (Onshore Environmental 2023e)	10 October 2023	None	Forest Red-tailed Black Cockatoos (three locations), Baudin's Black Cockatoo (three locations)	1 suitable hollow

Western Ringtail Possum Surveys

Harewood (2018c) was commissioned to undertake a preliminary Western Ringtail Possum (*Pseudocheirus occidentalis*) survey within and around the Greenbushes MDE. Day time and nocturnal surveys were completed with no conclusive evidence of Western Ringtail Possums found during the survey. Much of the vegetation observed was assessed as representing poor or marginal habitat for Western Ringtail Possums. Large areas of forest surrounding the MDE have been historically logged and therefore lack a coherent mid-storey component which is a structural unit favoured by Western Ringtail Possums.

Recent Trapping Programs

As part of vegetation clearing works for the ongoing expansion of the Greenbushes Mine, Onshore Environmental has recently undertaken several pre-clearing trapping programs. The following species have been caught, relocated or observed during these trapping programs and fauna spotting for clearing works (Onshore Environmental *unpublished data*).

Mammals:

- Southern Brush-tailed Phascogale (*Phascogale tapaotafa wambenger*) Conservation Dependant;
- Quenda (*Isoodon fusciventer*) Priority 4;
- Common Brushtail Possum (Trichosurus vulpecula);
- Western Grey Kangaroo (Macropus fuliginosus);
- Rabbit (Oryctolagus cuniculus);
- Red Fox (Vulpes vulpes);
- Cat (*Felis catus*); and
- Pig (Sus scrofa).

Reptiles:

- Marbled Gecko (Christinus marmoratus);
- Shrubland Pale-flecked Morethia (Morethia obscura);
- Western Bobtail (*Tiliqua rugosa*);
- Heath Monitor (Varanus rosenbergii);
- South-western Crevice Skink (Egernia napoleonis);
- Four-toed Mulch Skink (Hemiergis peronii peronii); and
- Dugite (*Pseudonaja affinis*).

Birds:

• Australian Ringnecks (Barnardius zonarius).

Table 6 Results from vertebrate fauna surveys previously completed within the vicinity of the study area.

Survey	Field Survey Date	Survey Level	Conservation Significant Fauna Species
Greenbushes Level 1 Fauna Survey (Biologic Environmental Survey 2011)	13 - 17 Oct 2011	Basic	South-western Brush-tailed Phascogale (<i>Phascogale tapoatafa wambenger</i>) - Conservation Dependant Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>) –Vulnerable Baudin's Cockatoo (<i>Zanda baudinii</i>) - Endangered Carnaby's Cockatoo (<i>Zanda latirostris</i>) - Endangered
Black Cockatoo Survey (Kirkby 2018)	22 Jan - 12 Feb 2018	Targeted	Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>) - Vulnerable Baudin's Cockatoo (<i>Calyptorhynchus baudinii</i>) - Endangered Carnaby's Cockatoo (<i>Calyptorhynchus latirostris</i>) - Endangered
Black Cockatoo Habitat Quality Assessment (Ennovate Consulting 2018)	Not relevant	Desktop	Not recorded
Greenbushes Black Cockatoo Tree Hollow Review (Harewood 2018b)	11 - 19 Jun 2018	Targeted	None
Greenbushes Preliminary Western Ringtail Possum Surveys (Harewood 2018c)	11, 13, 15 June 2018	Targeted	South-western Brush-tailed Phascogale (<i>Phascogale tapoatafa wambenger</i>) - Conservation Dependant
Greenbushes Vertebrate Fauna, SRE and Subterranean Fauna Desktop Assessment (Biologic Environmental Survey 2018a)	Not relevant	Desktop	Not recorded
Greenbushes Targeted Vertebrate and SRE Invertebrate Fauna Survey (Biologic Environmental Survey 2018b)	12 - 21 Feb 2018	Targeted	Chuditch (<i>Dasyurus geoffroii</i>) - Vulnerable Western Ringtail Possum (<i>Pseudocheirus occidentalis</i>) - Critically Endangered ¹ South-western Brush-tailed Phascogale (<i>Phascogale tapoatafa wambenger</i>) - Conservation Dependant Southern Brown Bandicoot/Quenda (<i>Isoodon fusciventer</i>) - DBCA Priority 4 Western Brush Wallaby (<i>Notamacropus irma</i>) - DBCA Priority 4 Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>) - Vulnerable

¹ This record is of scats possibly belonging to the species, and therefore the record is unconfirmed.

Survey	Field Survey Date	Survey Level	Conservation Significant Fauna Species
Level 1 Vertebrate Fauna Survey Greenbushes Infrastructure Corridors (Onshore Environmental 2019)	4 - 7 October 2018	Basic	None
Basic Vertebrate Fauna Survey Greenbushes Mine Expansion Area 2 and Area 4 (Onshore Environmental 2022)	26 October - 2 November, 29 November 2021	Basic	Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>) - Vulnerable Carnaby's Cockatoo (<i>Zanda latirostris</i>) - Endangered South-western Brush-tailed Phascogale (<i>Phascogale tapoatafa wambenger</i>) - Conservation Dependant Western Brush Wallaby (<i>Notamacropus irma</i>) - DBCA Priority 4
New Water Storages Detailed Vertebrate Fauna Survey (Onshore Environmental 2023a)	18-28 October 2022, 12-20 April 2023	Detailed	Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>) - Vulnerable Baudin's Cockatoo (<i>Calyptorhynchus baudinii</i>) - Endangered Australasian Bittern (<i>Botaurus poiciloptilus</i>) - Endangered (500 m outside the study area) South-western Brush-tailed Phascogale (<i>Phascogale tapoatafa wambenger</i>) - Conservation Dependant Southern Brown Bandicoot/Quenda (<i>Isoodon fusciventer</i>) - DBCA Priority 4 Rakali/Water Rat (<i>Hydromys chrysogaster</i>) - DBCA Priority 4
Floyd's Waste Rock Landform Extension Detailed Vertebrate Fauna Survey (Onshore Environmental 2023b)	18-28 October 2022, 12-20 April 2023	Detailed	Forest Red-tailed Black Cockatoo (<i>Calyptorhynchus banksii naso</i>) - Vulnerable South-western Brush-tailed Phascogale (<i>Phascogale tapoatafa wambenger</i>) - Conservation Dependant Southern Brown Bandicoot/Quenda (<i>Isoodon fusciventer</i>) - DBCA Priority 4
Targeted Camera Trap Fauna Survey New Zealand Gully (Onshore Environmental 2023f)	3 October, 4 November 2023	Targeted	South-western Brush-tailed Phascogale (<i>Phascogale tapoatafa wambenger</i>) - Conservation Dependant Southern Brown Bandicoot/Quenda (<i>Isoodon fusciventer</i>) - DBCA Priority 4





TALISON LITHIUM Additional Areas North

Figure 6 Locations of previous surveys surrounding the study area

Legend

Previous Study Areas

- Biologic 2011
- Biologic 2018
- Onshore 2019
- Onshore 2022
- Onshore 2023a
- Onshore 2023b
- Onshore 2023f



1:80,000 Datum: GDA 94 Projection: MGA Zone 50 Date: 22/03/2024 Status: Final Status: Final Figure: 6 Sheet Size: A4 File Name Reference: TA_AAN_Fig6_surveys.pdf Drawn by: JW Requested by: DB
4.1.2 Potentially Occurring Significant Fauna Species

Database searches were undertaken (as detailed in Section 3.2.2) to identify conservation significant vertebrate fauna previously collected or identified within, or in the vicinity of, the study area.

The EPBC database search identified a total of 17 fauna species listed as Threatened Fauna under the EPBC Act or listed as Migratory species (DCCEEW 2023).

The DBCA searches identified a total of 30 significant fauna species including 15 species listed as Threatened Fauna under the BC Act, one species listed as Extinct, three Migratory bird species and eleven species listed as Priority fauna or other specially protected fauna under the BC Act (DBCA 2022) (Figure 7).

A total of 43 conservation significant species were identified from the combined desktop assessments, comprising 13 mammals, 29 birds, one reptile and one amphibian. Based on the known distribution and habitat preference of these species and comparison with the habitats identified and mapped within the study area, nine species were determined as being 'likely' to occur within the study area (Table 7):

- Forest Red-tailed Black Cockatoo (Calyptorhynchus banksii naso);
- Baudin's Black Cockatoo (Zanda baudinii);
- Carnaby's Black Cockatoo (Zanda latirostris);
- Australasian Bittern (*Botaurus poiciloptilus*);
- Chuditch (*Dasyurus geoffroii*);
- Water Rat/Rakali (Hydromys chrysogaster);
- Quenda (Isoodon fusciventer);
- Brush-tailed Phascogale (Phascogale tapoatafa wambenger); and
- Western Brush Wallaby (Notamacropus irma).

Further discussion of the suitability of habitat for these species is provided in Section 4.5. An additional eleven species were determined as 'possibly' occurring within the study area with the remaining 23 species identified as 'unlikely' to occur in the study area (Table 7).

Taxon Name	Common Name	EPBC Act	BC Act	DBCA	Habitat Preference	Suitable Habitat Present	Likelihood in the study area	Rationale
AMPHIBIANS		·						
Anstisia lutea	Walpole Frog			P4	Karri forest, swamps	No	Unlikely	Nearest record is 40km south-west
BIRDS								
Actitis hypoleucos	Common Sandpiper	Mi			Edge of sheltered waters, salt or fresh, estuaries, river pools, claypans, drying swamps (Johnstone & Storr 1998)	Yes	Possible	May occasionally utilise the study area. Nearest record 23 km south east
Aphelocephala leucopsis	Southern Whiteface	VU			Dry open woodland/forest, inland scrubs, mallee and mulga	No	Unlikely	No suitable habitat or recent records in close proximity.
Apus pacificus	Pacific Swift (Fork-tailed Swift)	MI			Entirely aerial species (Johnstone & Storr 1998)	Yes	Unlikely	May occasionally fly over the study area
Botaurus poiciloptilus	Australasian Bittern	EN	EN		Reedbeds, and other vegetation in water such as cumbungi, lignum and sedges	Yes	Likely	Small amount of marginal habitat. Recorded approximately 1km south (Onshore Environmental 2023)
Calidris acuminata	Sharp-tailed Sandpiper	MI			Coastal and inland areas saline and fresh or brackish wetlands (Geering et al. 2007)	Yes	Unlikely	No records in close proximity. Small amount of marginal habitat.
Calidris ferruginea	Curlew Sandpiper	CR & MI			Intertidal mudflats and ephemeral and permanent lakes	Yes	Unlikely	No records in close proximity. Small amount of marginal habitat.
Calidris melanotos	Pectoral Sandpiper	MI			Shallow fresh to saline wetlands	Yes	Unlikely	No records in close proximity. Small amount of marginal habitat.
Calyptorhynchus banksii naso	Forest Red-tailed Black-cockatoo	VU	VU		Eucalypt forests, areas of seeding Marri, Jarrah, Blackbutt, Karri and Sheoak (Johnstone & Storr 1998)	Yes	Likely	Recent records in close proximity.

Table 7 Significant fauna previously recorded from desktop searches surrounding the study area.

Taxon Name	Common Name	EPBC Act	BC Act	DBCA	Habitat Preference	Suitable Habitat Present	Likelihood in the study area	Rationale
Zanda baudinii	Baudin's Black Cockatoo	EN	EN		Eucalypt forest, areas of Marri, Karri and Wandoo (Johnstone & Storr, 1998, Johnstone & Kirkby 2008)	Yes	Likely	Recent records in close proximity.
Zanda latirostris	Carnaby's Black- cockatoo	EN	EN		Eucalypt woodlands and forests and adjacent area of <i>Proteaceous</i> scrubs and heaths (Johnstone & Storr 1998)	Yes	Likely	Recent records in close proximity.
Chlidonias Ieucopterus	White-winged Tern	Mi			Coastal and inland wetlands, estuaries, salt fields, coasts, sewage ponds	Yes	Unlikely	Record 13km north-east near Balingup. Small amount of marginal habitat. May occasionally occur
Dasyornis broadbenti litoralis	South-western Rufous Bristlebird	EX	EX		Poorly known, likely dense low coastal heath (DPAW 2014)	No	Unlikely	Presumed Extinct.
Falco hypoleucos	Grey Falcon	VU	VU		Shrubland, grassland and wooded watercourses, wetlands	No	Unlikely	No suitable habitat or recent records in close proximity. Study area is outside known distribution of this species
Falco peregrinus	Peregrine Falcon		OS		Inhabits areas with cliffs, gorges, timbered watercourses, drainage lines and rivers, wetlands, plains, and open woodlands.	Yes	Possible	Records in the general area. May occasionally utilise study area.
Ixobrychus dubius	Australian Little Bittern (Black- backed Bittern)			P4	Reeds and cumbungi in freshwater swamps, lakes, rivers and wetland areas (Pizzey and Knight 2022)	Yes	Unlikely	Historical record in close proximity
Ixobrychus flavicollis australis	Black Bittern			P2	Shadowy leafy waterside trees in areas like tidal creeks, sheltered mudflats and oyster-slats.	Yes	Unlikely	Historical record at Bridgetown.
Leipoa ocellata	Malleefowl	VU	VU		Semi-arid mallee scrub on the fringes of the relatively fertile areas of southern Australia	No	Unlikely	No suitable habitat or recent records in close proximity.
Lewinia pectoralis	Lewin's Rail		EX		Swamp woodlands, rushes, reeds, swamps, creeks and saltmarshes	No	Unlikely	Presumed Extinct

Taxon Name	Common Name	EPBC Act	BC Act	DBCA	Habitat Preference	Suitable Habitat Present	Likelihood in the study area	Rationale
Motacilla cinerea	Grey Wagtail	MI			Various habitats with open waterbodies (Johnstone & Storr 2004)	Yes	Unlikely	Not within current known distribution. No recent records in close proximity.
Ninox connivens	Barking Owl			P3	Open forest, woodlands and dense scrub	Yes	Unlikely	Nearby record is historical
Numenius madagascariensis	Eastern Curlew	CR & MI			Tidal mudflats, also reef flats, sandy beaches (Johnstone & Storr 1998)	No	Unlikely	No suitable habitat.
Oxyura australis	Blue-billed Duck			P4	Well vegetated dams, lakes and swamps	Yes	Possible	Records in the general area. Not recently recorded in close proximity.
Pandion haliaetus	Osprey	Mi			Sheltered seas around islands, tidal creeks, estuaries and saltwork ponds, and large river pools (Johnstone et al. 2013)	No	Unlikely	No suitable habitat.
Plegadis falcinellus	Glossy Ibis	MI			Lakes and wetlands	Yes	Unlikely	Non-breeding visitor to south-west. May occasionally occur within the study area
Thalasseus bergii	Crested Tern	MI			Ocean beaches, offshore islands, pelagic waters, estuaries, bays, harbours, coastal lagoons, inland on major rivers	No	Unlikely	No suitable habitat.
Tringa glareola	Wood Sandpiper	MI			Lakes and wetlands	Yes	Possible	Uncommon migrant. May occasionally utilise study area.
Tringa nebularia	Common Greenshank	Mi			Intertidal mudflats and ephemeral and permanent lakes	No	Unlikely	No suitable habitat.
Tyto novaehollandiae novaehollandiae	Masked Owl			P3	Forests, woodlands, timbered waterways and open country	Yes	Possible	Multiple records in close proximity.
MAMMALS								
Bettongia penicillata ogilbyi	Woylie	EN	CR		Woodlands and adjacent heaths with a dense understorey of shrubs (Woinarski et al. 2014)	Yes	Possible	Scattered records exist in the area, however most are >20 years old.

Taxon Name	Common Name	EPBC Act	BC Act	DBCA	Habitat Preference	Suitable Habitat Present	Likelihood in the study area	Rationale
Dasyurus geoffroii	Chuditch	VU	VU		Jarrah forest, in moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest particularly in riparian vegetation (Orell & Morris 1994)	Yes	Likely	Recorded nearby (Biologic 2018a).
Falsistrellus mackenziei	Western False Pipistrelle			P4	Wet sclerophyll forests of Karri, Jarrah and Tuart eucalypts	Yes	Possible	Multiple records in area, no recent records in close proximity
Hydromys chrysogaster	Water-rat			P4	Permanent bodies of fresh or brackish water, subalpine streams to lakes and farm dams (Van Dyck & Strahan 2008)	Yes	Likely	Recorded 200m outside the study area (Onshore Environmental 2023a)
Isoodon fusciventer	Quenda			P4	Jarrah forest and swamp habitats, preferring dense vegetation around wetland fringes and heathland (Cooper 1998, Woinarski et al. 2014).	Yes	Likely	Previous records in close proximity (Biologic 2018a, Onshore Environmental 2023).
Macrotis lagotis	Bilby	VU	VU		Mixture of woodland including Jarrah, Marri and Wandoo in the south-west (Abbott 2001).	Yes	Unlikely	Not within current known distribution. No recent records in close proximity.
Myrmecobius fasciatus	Numbat	EN	EN		Eucalypts forests and woodland, notably wandoo and jarrah woodland (Van Dyck & Strahan 2008)	Yes	Unlikely	Recorded <10km to the north-west of the study area in 2006 (DBCA 2022). Additional records in the general area, however none are recent.
Notamacropus eugenii derbianus	Tammar Wallaby			P4	Dense, low vegetation for daytime shelter and open grassy areas for feeding. This species inhabits coastal scrub, heath, dry sclerophyll forest and thickets in mallee and woodland (Maxwell et al. 1996)	Yes	Possible	Records within 50km.
Notamacropus irma	Western Brush Wallaby			P4	Wide-range of habitats including low Banksia woodlands, Jarrah/Marri woodlands and moist Melaleuca lowlands, favours open, grassy areas (Wann & Bell 1997, Woinarski et al. 2014)	Yes	Likely	Recorded nearby (Biologic 2018a, Onshore 2022).

Taxon Name	Common Name	EPBC Act	BC Act	DBCA	Habitat Preference	Suitable Habitat Present	Likelihood in the study area	Rationale
Phascogale calura	Red-tailed Phascogale	VU			Wandoo-rock sheoak uplands, and lowland habitat with riverine fringing	No	Unlikely	No suitable habitat.
					vegetation of swamp sheoak, York Gum and Wandoo (Short et al. 2011)			
Phascogale tapoatafa wambenger	Brush-tailed Phascogale		CD		Dry sclerophyll forests and open woodlands that contain hollow-bearing trees with a sparse ground cover (Woinarski <i>et al.</i> 2014).	Yes	Likely	Recorded nearby (Biologic 2018a, Onshore 2022, Onshore 2023)
Pseudocheirus occidentalis	Western Ringtail Possum	CR	CR		Coastal Agonis flexuosa forest or eucalypt woodland or forest with a mid-story of Agonis flexuosa (DPaW 2017, Jones et al. 1994). Additionally, inland forest areas that have been unlogged and unburnt for long periods (Wayne et al. 2006)	Yes	Possible	Scats possibly identified by Biologic (2018a), however targeted surveys have failed to locate the species and indicated that habitat in the general area is marginal for this species.
Setonix brachyurus	Quokka	VU	VU		Habitat varies, but prefer Acacia and Melaleuca thickets. Associated with <i>Taxandria linearifolia</i> in Jarrah Forest (de Tores 2008)	Yes	Possible	Recent records within 20km, however habitat within the study area is limited.
REPTILES								
Ctenotus delli	Darling Range South-west Ctenotus			P4	Jarrah and Marri woodlands with shrub dominated understorey on laterite, sand or clay soils (Bush <i>et al</i> 2010)	Yes	Possible	Historical record in close proximity.





TALISON LITHIUM Additional Areas North

Figure 7 Significant fauna species recorded from the desktop assessment.

Legend

Study Area

Significant Fauna

- Conservation Dependant
- Critically Endangered
- Endangered
- Extinct
- Migratory
- Other specially protected
- Priority 2
- Priority 3
- Priority 4
- Vulnerable



1:300,000

Datum: GDA 94 Projection: MGA Zone 50

Date: 22/03/2024 Status: Final Figure: 7 Sheet Size: A4 File Name Reference: TA_AAN_Fig7_DBCA.pdf Drawn by: JW Requested by: DB

4.2 Weather

Weather prior to and during the field survey period was slightly warmer than average for November/December based on observations at the Bridgetown weather station. The average maximum temperature for Bridgetown is 24.5°C during November and 27.8°C in December. Maximum temperatures during the field survey ranged from 25.4 to 33°C (average 29°C). The average minimum temperature is 9.3°C for November and 11.1°C for December. Minimum temperatures over the survey period were higher than the long term average, ranging between 10.4°C and 16.5°C (average 14.6°C, Figure 8).

Rainfall for November 2023 was slightly above average with 46.2 mm recorded compared to the long term average of 31.4 mm. Significant rainfall was recorded ten days before the start of the field survey (44.2 mm) with 0.2 mm recorded during the field survey period (Figure 8).



Figure 8 Temperature and rainfall observations for the Bridgetown weather station prior to and during the field survey period.

4.3 Fauna Habitats

Two naturally occurring fauna habitats were mapped and described within the study area during the field survey, Drainage lines and Hillslopes with Jarrah/Marri Forest (Tables 8 and 9, Figure 9). Plates 1-8 are representative of typical habitat occurring within the study area. The southern parts of the study area supported plantations including Blue gum and pine trees. There is also a small area of paddock in the eastern part of the study area comprising annual pasture and a private residence. These areas generally had little habitat value for native fauna species with the exception of the Pine plantation providing foraging resources for Black Cockatoos.

Jarrah/Marri Forest on hillslopes comprises 71 percent of the study area. Vegetation is Forest of Jarrah (*Eucalyptus marginata*) and Marri (*Corymbia calophylla*) occasionally with Bull Banksia (*Banksia grandis*) and an understory of mid and low shrubs. This habitat supports many large trees, logs and dense leaf litter. Large trees within this habitat support hollows representing potential nesting sites for Black Cockatoos and habitat for Brush-tailed Phascogales as well as other species of hollow dependant fauna.

Drainage line habitat comprises 3.4 percent of the study area and occurs in the north-west and southern parts of the study area (Figure 9). Drainage line habitat supported Flooded Gum (*Eucalyptus rudis*), Marri (*Corymbia calophylla*) and Blackbutt (*Eucalyptus patens*) with Pine trees also occurring in the southern drainage line. Much of the drainage line habitat has been disturbed particularly in the southern drainage line. The habitat provides several different structural elements creating a variety of refuges for small mammals and birds. These areas include dense sedges and *Taxandria* thickets and small reed beds. The drainage lines provide potential habitat for conservation significant species including Chuditch (Vulnerable), Water Rat/Rakali (Priority 4) and Quenda (Priority 4). Various species of waterbird were noted within this habitat and pools and dams may also occasionally support migratory or conservation significant waterbirds.

Fauna Habitat	Description	Features
Hillslopes	Jarrah/Marri Forest on hillslopes with mid- low shrubs. Soils are brown sandy loam with laterite gravels.	Habitat includes areas with large trees with hollows, logs and log piles and dense leaf litter.
Drainage line	Drainage lines and small pools. Vegetation is variable including areas of <i>Eucalyptus</i> <i>rudis</i> and <i>Eucalyptus patens, Taxandria</i> <i>linearifolia</i> and <i>*Pinus radiata.</i>	Water pools and running water, some areas of dense waterside vegetation including small areas of reed beds and shrub thickets.

 Table 8
 Descriptions of fauna habitats present within the study area.

Name	Description			
Hillslopes	Jarrah/Marri Forest on hillslo	opes with brown sandy loam		
Area (ha)	71.29			
Landform	Hillslopes and hillcrests			
Vegetation Description	Forest of <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over Low Woodland <i>A</i> Banksia grandis and Persoonia longifolia over Open Scrub of Bossiaea linoph over Low Scrub A of Pteridium esculentum over Dwarf Scrub D of Leucopo capitellatus, Bossiaea ornata and Hibbertia commutata			
	Rock	<2%		
% CroundCover	Leaf Litter	30-70%		
% GroundCover	Logs	2-10%		
	Vegetation	30-70%		
Books	Туре	Laterite		
ROCKS	Size	1 cm		
Soil	Туре	Sandy-loam		
301	Colour	Brown		
Habitat Features	Slope	Low		
Moderate logs and dense leaf litter,	Water	None		
larger trees with hollows	Woody Debris	Minor		
	Peeling Bark	Minor		
	Rock Crevices	Absent		
	Burrowing Suitability	Poor		
	Tree Hollows (<10cm)	Present		
	Tree Hollows (>10cm)	Present		
	Condition	Good-Very Good		
	Disturbances	Mining Exploration, fire, roads/access tracks,		
Condition		logging, firewood cutting, rubbish, weeds, feral animals.		
	Fire Age	Moderate-Old		
Plates 1-4 Representative photos	of hillslope habitat within th	ne study area.		
W. Martinet		NOT A COMPRESSION		

Table 9 Details of fauna habitats present within the study area.



Name

Description

Drainage line	Drainage lines and wetlands with <i>Eucalyptus rudis</i>					
Area (ha)	3.4					
Landform	Wetlands, dams and drainage	Wetlands, dams and drainage line				
Vegetation Description	Northern: Forest of <i>Eucalyptus rudis</i> , <i>E. patens</i> and <i>Corymbia calophylla</i> over Scrub of <i>Gastrolobium bilobum</i> , <i>G. spinosum</i> and <i>Acacia celastrifolia</i> over Low Scrub A of <i>A. pulchella</i> , <i>A. latericola</i> and <i>Billardiera fusiformis</i> over Dwarf Scrub C of <i>Hypocalymma angustifolium</i> Southern: Forest of <i>Eucalyptus rudis</i> and * <i>Pinus radiata</i> over Open Low Woodland A of <i>A. saligna</i> and <i>Melaleuca rhaphiophylla</i> over Open Scrub of <i>Taxandria</i> <i>linearifolia</i> over Low Scrub A of * <i>Rubus anglocandicans</i> over Open Tall Grass of * <i>Holcus lanatus</i> , * <i>Phalaris aquatica</i> and * <i>Avena barbata</i>					
	Rock	2-10%				
% Ground Cover	Leaf Litter	30-70%				
	Logs	<2%				
	Vegetation	30-70%				
Bocks	Туре	Laterite and granite				
	Size	1-5 cm with boulders in southern drainage line				
Soil	Туре	Loam, clay loam				
	Colour	Brown				
Habitat Features	Slope	Low				
Pools contain permenant water,	Water	None				
dense sedges and shrubs occuring	Woody Debris	Minor				
along some banks, some large trees	Peeling Bark	Minor				
surrounding drainage line. Small	Rock Crevices	Occasional				
areas of reed beds. Both drainages	Burrowing Suitability	Poor				
lines significantly impacted by	Tree Hollows (<10cm)	Occasional				
disturbance	Tree Hollows (>10cm)	Occasional				
	Condition	Good (northern), degraded (southern)				
	Disturbances	Altered drainage, mining exploration and				
Condition		rehabilitation, access tracks, logging, firewood				
		cutting, rubbish, weeds, feral animals.				
	Fire Age	Old				

Plates 5-8 Representative photos of drainage line habitat within the study area.



4.3.1 Fauna Habitat Condition

Fauna habitat condition for hillslopes within the study area was generally rated as 'very good' (Figure 10). Drainage line habitat condition was variable, with the northern drainage line in good condition and the southern drainage line in degraded condition. The major disturbances within the drainage line habitat included the presence of weeds such as Blackberry and Pine wildings, historical alluvial tin mining (and subsequent rehabilitation), and edge effects around the annual pasture and plantation blocks. Paddocks supporting annual pasture (northern block) and plantation (southern block) were rated as 'completely degraded'. The study area was dissected by a number of vehicle access tracks and had been impacted by logging, fire, alluvial tin mining, and weeds.









4.4 Vertebrate Fauna Assemblage

4.4.1 Fauna Assemblage

The combined desktop searches identified a total of 311 vertebrate fauna taxa including 19 amphibians, 43 reptiles, 209 birds and 40 mammals (see Appendix 4). A total of 87 vertebrate fauna species were recorded during the single-phase field survey, including seven amphibians, nine reptiles, 54 birds and 17 mammals. A list of all vertebrate fauna species recorded during the field survey is provided in Appendix 5. A comparison of the species recorded from the desktop searches and those recorded within the study area is presented in Appendix 6.

4.4.2 Trapped Fauna Assemblage

The results from the trapping program are presented in the appendices as a species by site matrix (Appendix 7) and species by trap type matrix (Appendix 8). A total of 16 species were recorded from the trapping program including seven amphibians, seven reptiles and two mammals. Bucket traps had the highest capture rate, followed by Funnel and Elliot traps. Two species were recorded at all five sites with one species occurring at four sites and eight species only recorded at one site.

The most commonly trapped species were amphibians including large numbers of the Clicking Frog (*Crinia glauerti*) and Ticking Frog (*Geocrinia leai*) recorded at Site 2. The Shrubland Morethia Skink (*Morethia obscura*) and Moaning Frog (*Heleioporus eyrei*) were also frequently captured. Only two mammal species were trapped: the Bush Rat (*Rattus fuscipes*) and the Quenda (*Isoodon fusciventer*).

4.4.3 Avifauna

A total of 45 species were recorded during systematic bird surveys with an additional nine species recorded from opportunistic observations throughout the study area. Species by site records are provided in Appendix 7. The most commonly recorded species were the Western Gerygone, Grey Fantail and Australian Ringneck.

4.4.4 Bats

Seven species of bat were recorded during the field survey using their echolocation calls. The results were analysed by Mr Bob Bullen. The species recorded within the study area were:

- White-striped Free-tailed Bat (Austronomus australis);
- Gould's Wattled Bat (Chalinolobus gouldii);
- Chocolate Wattled Bat Chalinolobus morio);
- Lesser Long-eared Bat (Nyctophilus geoffroyi geoffroyi);
- Greater Long-eared Bat (Nyctophilus major major);
- Western Free-tailed Bat (Ozimops kitcheneri); and
- Southern Forest Bat (Vespadelus regulus).

Examples of time versus frequency graphs for the calls are presented in Appendix 9. Calls were characterised by their shape, frequency (FC), frequency minimum (F_{min}), the frequency high point (F_{max}), duration (Dur), peak frequency (F_{peak}) (Appendix 9).

4.4.5 Motion Sensitive Cameras

A total of 16 species were identified from motion sensitive cameras within the study area including five birds, eight mammals and three reptiles. The mammals identified from the cameras included one species of conservation significance: Water Rat (*Hydromys chrysogaster*). Four introduced species were also recorded from the motion sensitive cameras: Cat (*Felis catus*), Red Fox (*Vulpes vulpes*), Black Rat (*Rattus rattus*) and Rabbit (*Oryctolagus cuniculus*). Cats were only recorded within the study area from motion sensitive cameras.



Plate 9 Common Brushtail Possum (*Trichosurus vulpecula*) identified from motion sensitive cameras.



Plate 10 Water Rat/Rakali (Hydromys chrysogaster) identified from motion sensitive camera.



Plate 11 Cat (*Felis catus*) identified from motion sensitive cameras.



Plate 12 Western Grey Kangaroos identified from motion sensitive cameras.

4.5 Fauna of Conservation Significance

4.5.1 Threatened Fauna listed under the EPBC Act and BC Act

Three vertebrate fauna species listed under the Commonwealth EPBC Act and the Western Australian BC Act were recorded from the study area; Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) listed as Vulnerable, and Baudin's Black Cockatoo (*Zanda baudinii*) and Carnaby's Black Cockatoo (*Zanda latirostris*) both listed as Endangered. The occurrence of these three species within the study area is discussed below.

Baudin's Black Cockatoo

Baudin's Black Cockatoo is currently listed as Critically Endangered on the international IUCN Red List, and Endangered under the Commonwealth EPBC Act and Western Australian BC Act. It occurs throughout the south western humid and subhumid zones, extending from the northern Darling Range and adjacent far east of the Swan Coastal Plain (south of the Swan River), south to Bunbury and east to Albany (Johnstone and Storr 1998). Baudin's Cockatoo

usually occur in small flocks of up to 30 birds, occasionally up to 50 birds, or rarely in aggregations of up to 1,200 birds (Johnstone and Kirkby 2008). The total population of Baudin's Cockatoo is estimated to be about 15,000 birds (Johnstone and Kirkby 2008).

This species forages primarily in eucalypt forest, where it feeds on Marri seeds, flowers, nectar and buds (Johnstone and Kirkby 2008). Baudin's Cockatoo also feed on a wide range of seeds of *Eucalyptus, Banksia* and *Hakea*, as well as the fruits of apples, pears, persimmons, pines, and beetle larvae from under the bark of trees (Johnstone and Kirkby 2008, Johnstone and Storr 1998). Marri seed provides a high energetic yield and Baudin's Cockatoo are able to quickly extract the seeds from the nut using their long bill (Cooper *et al.* 2002). Baudin's Black Cockatoo nests in tree hollows in the deep south-west of Western Australia. Primary nesting trees are Karri, Marri, and Wandoo. Baudin's Cockatoo is mostly a postnuptial nomad (Johnstone and Kirkby 2008) breeding from around October to December. After breeding, Baudin's Cockatoos leave nesting areas and amalgamate to form large foraging flocks. These flocks generally migrate north to the main non breeding wintering area in the northern Darling Range between Collie and Mundaring (Johnstone and Kirkby 2008).

Foraging evidence from Baudin's Black Cockatoo was observed at five locations within the study area (Figure 11). No individuals were observed during the survey but the species has been observed from two surveys in the Greenbushes area in 2023 (Onshore Environmental 2023a, 2023c).

Carnaby's Black Cockatoo

Carnaby's Black Cockatoo is one of two white-tailed black cockatoos listed as Endangered under the EPBC Act and BC Act. This species occurs in south-western Western Australia extending from Kalbarri to Cape Arid and inland to the Wheatbelt. Breeding habitat for the species generally occurs within the Wheatbelt region in hollows provided by smooth barked Eucalyptus species such as Wandoo and Salmon Gum (Saunders 1982). More recently there has been an expansion in the breeding range of Carnaby's Black Cockatoo to the west and south with breeding recorded from the Darling Scarp and as far south as Capel (Johnstone and Kirby 2019).

Foraging evidence from this species was recorded at one location within the study area (Figure 11). Previous surveys of the Greenbushes area have indicated that records of Carnaby's Black Cockatoos are generally uncommon with a flock of 20 birds observed in 2020 (Onshore Environmental 2020) and foraging evidence recorded at one location in 2023 (Onshore Environmental 2023c).

Forest Red-tailed Black Cockatoo

The Forest Red-tailed Black Cockatoo is currently listed as Least Concern on the international IUCN Red List, and Vulnerable under the Commonwealth EPBC Act and Western Australian BC Act. It occurs throughout the south western humid and subhumid zones, extending from Gingin in the north through the Darling Ranges and throughout the south-west from approximately Bunbury to Albany (Johnstone and Storr 1998). The population has been estimated at approximately 15,000 birds (Johnstone and Kirkby 1999).

Although not as highly mobile as Carnaby's and Baudin's Cockatoos, the Forest Red-tailed Black Cockatoo has been known to exhibit population fluctuations and movements in response

to food availability and fire. The Forest Red-tailed Black Cockatoo occurs in pairs or small flocks, or occasionally large flocks of up to 200 birds (Johnstone and Storr 1998). It inhabits dense Jarrah, Karri and Marri forests that receive more than 600 mm average annual rainfall (DSEWPaC 2012), and breeds (producing one or two eggs) in the south-west of Western Australia between October and November.

The Forest Red-tailed Black Cockatoo feeds primarily on Marri and Jarrah fruit (DSEWPaC 2012). They have also been known to feed on Blackbutt *(Eucalyptus patens),* Albany Blackbutt *(Eucalyptus staeri),* Karri, Sheoak *(Allocasuarina fraseriana)* and Snottygobble *(Persoonia longifolia).* Marri and Jarrah make up 90% of their diet (Johnstone and Kirkby 1999).

Forest Red-tailed Black Cockatoos were heard or observed on seven occasions during the survey period (Figure 11). Birds were recorded during systematic bird surveys and opportunistically within both the hillslopes and drainage line habitat. The presence of Forest Red-tailed Black Cockatoos was also noted from foraging evidence on Marri nuts at 16 locations within the study area.

4.5.2 Priority Fauna recognised by the DBCA

Three Priority 4 fauna species, as recognised by the DBCA, were recorded from the study area; Western Brush Wallaby (*Notamacropus irma*), Quenda (*Isoodon fusciventer*) and Water Rat/Rakali (*Hydromys chrysogaster*) (Figure 12).

Western Brush Wallaby

The Western Brush Wallaby inhabits a wide-range of habitats including low *Banksia* woodlands, Jarrah/Marri woodlands and moist *Melaleuca* lowlands, favouring open, grassy areas (Wann and Bell 1997, Woinarski *et al.* 2014). This species was observed opportunistically on hillslopes adjacent to a drainage line (Figure 12). The species has previously been recorded from within the MDE from Jarrah-Marri forest habitat type (Biologic Environmental Survey 2018a) and at Area 2/4 to the south-west of the study area (Onshore Environmental 2022).

<u>Quenda</u>

The Quenda (or Southern Brown Bandicoot) is listed as a Priority 4 fauna species by the DBCA. It has a wide but patchy distribution in the south-west of Western Australia, extending from Cervantes in the north to Esperance in the south and inland as far as Hyden. The species inhabits dense scrubby, often swampy, vegetation with dense cover up to one metre high. It often feeds in adjacent forest and woodland that is burnt on a regular basis, and in areas of pasture and cropland lying close to dense cover. Populations inhabiting Jarrah and Wandoo forests are usually associated with watercourses. Quenda were recorded from six locations within the study area (Figure 11). The records were from motion sensitive cameras, diggings and a single individual was caught in an Elliot trap.

Water Rat

The Water Rat is listed as Priority 4 by the DBCA. The species is widely distributed around Australia and its offshore islands, New Guinea and some adjacent islands. It occurs in fresh brackish water habitats in the south-west of Western Australia, and marine environments along the Pilbara coastline and offshore islands. Surveys in the south-west suggest this

species is relatively common and widespread, though difficult to capture (Christensen *et al.* 1985, How *et al.* 1987). The Water Rat occupies habitat near permanent water, including fresh brackish or marine. It is likely to occur in all major rivers and most of the larger streams, as well as bodies of permanent water in the lower south-west of Western Australia (Christensen *et al.* 1985).

A single Water Rat was recorded during the survey from a motion sensitive camera and tracks within the southern drainage line habitat. This species has also been recorded within the New Water Storage project area approximately 200 m to the north-west and outside the study area.

4.5.3 Threatened and Priority Fauna Potentially Occurring

Nine species of conservation significance were identified from the desktop searches as likely to occur within the study area, with six of these species recorded from the study area during the field survey. The suitability of habitat for the three species determined as likely to occur but not recorded during the survey is discussed below.

Australasian Bittern

The Australasian Bittern is listed as Endangered under the EPBC Act and BC Act. It occurs in the south-west of Western Australia with a separate sub-population extending between southeastern South Australia to southern Queensland and Tasmania. The Australasian Bittern is a heron-like bird that inhabits wetlands and floodplains favoring areas of dense vegetation, reed beds and sedges. Breeding occurs between September to December with the nests situated over water in reeds or other dense vegetation.

No evidence of this species was recorded within the study area. Calls from this species have been recorded approximately 1 km south of the study area during a previous survey of the New Water Storage project area by Onshore Environmental in 2023 (Onshore Environmental 2023a). Small amounts of suitable habitat for this species occur within the study area and given the close proximity of the previous record it is considered likely to occur within the drainage line habitat.

Brush-tailed Phascogale

The Brush-tailed Phascogale is listed as conservation dependant fauna under the Western Australian BC Act. The current distribution is believed to have been reduced to approximately 50% of its former range, extending west of a line from Perth to Albany. It occurs at low densities in the northern Jarrah forest and at highest densities in the Perup/Kingston area, Collie River valley, and near Margaret River and Busselton. Records are less common from wetter forests.

The Brush-tailed Phascogale has been observed in dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover. It relies on tree hollows as nest sites. The home range is estimated at between 20 - 70 ha for females, and double that area for males. In addition, they tend to utilise a large number (approximately 20) of different nest sites throughout their range (Soderquist and Rhind 2008).

Brush-tailed Phascogales were not recorded from the study area however they are common in the Greenbushes area having been recorded from multiple previous surveys and during fauna trapping and spotting programs during clearing stages at the mine site. They are considered likely to occur within the hillslope habitat were there are an abundance of hollow bearing trees suitable as nest sites for this species.

<u>Chuditch</u>

The Chuditch inhabits Jarrah forest, in moist, densely vegetated, steeply sloping forest and drier, open, gently sloping forest particularly in riparian vegetation (Orell and Morris 1994). Habitat within the study area is suitable for Chuditch and it has been previously recorded on camera traps approximately 5 km to the west (Biologic Environmental Services 2018). Motion sensitive cameras were deployed to target habitat likely to support this species, including along the rocky drainage line in the southern part of the study area. However, there was no evidence of Chuditch recorded from the study area. Chuditch have not been recorded during multiple recent surveys that have deployed numerous motion sensitive cameras in the Greenbushes area (Onshore Environmental 2022, 2023a, 2023b, 2023f). Chuditch are likely to occur at low densities in the Greenbushes area and may move through the study area when dispersing. It is determined that Chuditch may occasionally utilise the study area for foraging. However, the fragmented nature of vegetation, extent of historical disturbances and presence of feral predators have reduced the likelihood that Chuditch will occur and persist within the study area.

4.6 Black Cockatoo Habitat Assessment

4.6.1 Tree Hollow Assessment

Tree hollow assessments focused on identifying potential habitat trees within the hillslopes habitat. Large trees were identified and further assessed as to the suitability for breeding for black cockatoos as per criteria outlined in Table 3. Details of the trees and hollows assessed within the study area are provided in Appendix 10 and locations of the trees are shown in Figure 12.

A total of 45 trees were identified as *potentially suitable* (further classified as potentially suitable or unsuitable). These trees contained hollows that were above the minimum entrance size suitable for black cockatoos but were considered less likely to be suitable due to depth of hollow, orientation or other factors or where considered unsuitable for nesting by black cockatoos (see Table 3).

A total of eight trees were identified as *suitable* for use by black cockatoos. These hollows were considered of a size, orientation and depth to be suitable for use by black cockatoos as breeding hollows. Hollows were identified from the ground and not examined by drone, therefore some hollows may not be of sufficient depth to support breeding. None of the trees assessed within the study area were classified as known nesting trees as there were no conclusive signs of use by black cockatoos in the form of chew marks or scratch marks around hollows.

Additional factors may affect the suitability of the study area for breeding. These factors include the proximity of water sources and the availability of adequate foraging habitat in close proximity. The availability and connectivity of nearby foraging habitat is important for successful breeding of black cockatoos (Saunders 1977, 1986). There is extensive foraging habitat in close proximity to the study area (discussed further below). Pools and drainage lines

within the study area and dams on adjacent properties provide a reliable water resource for breeding black cockatoos potentially utilising the area.

4.6.2 Habitat Tree Density Assessment

A total of 91 potential habitat trees (with DBH >50 cm) were recorded within the 18 quarter hectare plots sampled, at an average density of 20 potential habitat trees per hectare. Tree plots were only located within the hillslopes habitat as the drainage line habitat contained few large trees with the potential to form hollows. The density of potential habitat trees for the Jarrah/Marri hillslopes habitat within the study area was generally higher than corresponding densities recorded during previous assessments of the wider Greenbushes State Forest, where potential habitat tree densities ranged from 10.6 to 21.7 trees (Onshore Environmental 2018).

4.6.3 Foraging Habitat Score (DAWE 2022)

Based on the foraging quality scoring tool (DAWE 2022, Appendix 3) the study area was given a score of ten for the three species of black cockatoo (Table 10). Hence the study area was considered to support high quality foraging habitat for all three species. Foraging evidence for all three species was recorded during the survey and all three species were considered likely to use the study area for foraging. Forest Red-tailed Black Cockatoos are likely resident within the study area, with Baudin's and Carnaby's Black Cockatoos are more seasonally mobile and are likely to utilise the study area occasionally; there was less foraging evidence recorded from these two species.

Factors that may affect the suitability of the study area for breeding habitat, including the proximity of water sources, availability of adequate foraging habitat in close proximity, and the presence of disease are discussed below.

The availability and connectivity of nearby foraging habitat is important for successful breeding of black cockatoos (Saunders 1977, 1986). Approximately 45% (26,331 ha) of the land area within a 12 km radius of the study area is native vegetation (DPIRD 2017) (Figure 13). The vast majority of this native vegetation is likely to comprise Jarrah-Marri Forest and therefore represents suitable foraging habitat for black cockatoos. The study area is situated immediately adjacent to significant continuous areas of suitable foraging habitat within state forest. Based on the proximity and connectivity of significant foraging resources, no points were deducted for connectivity.

Database searches indicate that there are nine known roost sites within a 12 km radius of the study area (DBCA 2022), with the nearest occurring 2.5 km to the west (Figure 13). There were no known roosting trees observed within the study area. Vegetation along the drainage line habitats represented potential roosting habitat, noting that large trees were sparse in this habitat. There is extensive habitat that is potentially suitable for breeding for all three species in close proximity to the study area. Based on the above information, no points were deducted for proximity to roosting or breeding sites.

While dieback is present at the site, no severe dieback or marri canker disease was observed during the field survey and no points were deducted for impacts from significant plant disease.

Score	Baudin's Cockatoo	Carnaby's Black Cockatoo	Forest Red- tailed Black Cockatoo
Initial Score	10	10	10
Foraging evidence			
Subtract 2 from your score if there is no evidence of feeding debris on your site.	0	0	0
Connectivity			
Subtract 2 from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.	0	0	0
Proximity to breeding			
Subtract 2 if you have evidence to conclude that your site is more than 12 km from breeding habitat	0	0	0
Proximity to roosting			
Subtract 1 if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.	0	0	0
Impact from significant plant disease			
Subtract 1 if your site has disease present (e.g.	_	_	_
Phytophthora) and the disease is affecting more than	0	0	0
50% of the preferred food plants present.			
Final Score	10	10	10

Table 10 Scoring tool for determining quality of black cockatoo foraging habitat.

4.6.4 Offset Habitat Scoring

The foraging habitat scoring system for black cockatoos developed by DCCEEW to calculate the value of an offset site (Appendix 3) was also applied to the study area. The final foraging habitat score for the study area was calculated at eight for each of the three species of black cockatoo (out of a possible score of ten) (Table 11).

The foraging value score was based on the projected foliage cover. While this was variable due to differences in vegetation type, logging history and soil/landform characteristics, foliar cover was estimated at 40-60%, correlating with a moderate to high foraging value score (score of five) for all species (Table 11).

The 12 km buffer for regional foraging habitat was based upon the maximum distance from a nest that breeding birds are likely to travel (DEC 2012). Approximately 45% (26,331 ha) of the land area within a 12 km radius of the study area is native vegetation (DPIRD 2017) (Figure 13). The vast majority of this native vegetation is likely to be comprised of Jarrah-Marri Forest of moderate to high foraging value. Therefore, a score of three (out of a possible score of three) was determined for all species for site context (Table 4).

In order for an offset site to be considered suitable the presence of black cockatoos within the area must be confirmed. The scoring tool requires that the species is seen or reported regularly (intervals of every few days or weeks for at least several months of the year) and/or there is abundant foraging evidence, e.g. chewed nuts that can be identified as belonging to the species. Based on the current survey effort and knowledge of the study area the regular presence of Carnaby's Black Cockatoo was not confirmed within the study area. Abundant foraging evidence and multiple sightings of the Forest Red-tailed Black Cockatoo and multiple locations with foraging evidence for Baudin's Black Cockatoo were noted during the survey, and these two species are therefore confirmed as regularly being present within the study area.

Table 11	Foraging values of vegetation in the study area for Baudin's, Carnaby's and Forest
	Red-tailed Black Cockatoos, based upon vegetation characteristics, context and
	species density.

Score	Baudin's Cockatoo	Carnaby's Cockatoo	Forest Red-tailed Black Cockatoo
Confirm presence/ absence of species	Yes	No	Yes
Foraging value	5 (Moderate to high)	5 (Moderate to high)	5 (Moderate to high)
Proximity of the site in relation to other habitat	3	3	3
Total	8	8	8

4.6.3 Night Roosting Habitat Assessment

Database searches indicate that there are 14 known roost sites within a 30 km radius of the study area (DBCA 2022), with the nearest occurring approximately 2.5 km to the west (DBCA 2019) (Figure 13). There was no evidence of roosting observed within the study area, however suitable habitat does exist within the drainage line habitat.





Additional Areas North Figure 11 Significant Fauna recorded within the study area. Legend Additional Areas North Study Area Significant Fauna Baudin's Cockatoo Carnaby's Cockatoo Forest Red-tailed Black Cockatoo -Observation Forest Red-tailed Black Cockatoo -Foraging evidence Quenda Water Rat Western Brush Wallaby 250 500 m

1:22,000

Datum: GDA 94 Projection: MGA Zone 50

Date: 22/03/2024 Status: Final Figure: 11 Sheet Size: A4 File Name Reference: TA_AAN_Fig11_sig_fauna.pdf Drawn by: JW Requested by: DB







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4.7 Introduced Fauna Species

Four introduced fauna species (feral animals) were observed within the study area during the field survey:

- European Rabbit (Oryctolagus cuniculus);
- Red Fox (Vulpes vulpes);
- Cat (Felis catus); and
- Black Rat (Rattus rattus).

Red Foxes, Cats and Black Rats were detected from camera traps deployed within the study area. Rabbits were directly observed during the field survey and the presence of burrows and latrines was also noted.

The Laughing Kookaburra (*Dacelo novaeguineae*) was also recorded during the survey. This species was previously referred to as an introduced species but is now considered naturalised in the region.

5.0 DISCUSSION

5.1 Regional Context

The vertebrate fauna assemblage recorded from the study area is typical of the bioregion with all species recorded during the field survey identified as potentially occurring from the database searches and previous surveys. The fauna assemblage is similar to those recorded at similar habitats at two nearby project areas (Onshore Environmental 2023a, 2023b).

5.2 **Proportion of Species Recorded**

The field survey identified 36% of potentially occurring amphibians (seven out of 19), 25% of potentially occurring bird species (54 out of 209), 42% of potentially occurring mammal species (17 out of 40), and 21% of potentially occurring reptile species (nine out of 43).

The species accumulation curves for trapped amphibians and reptiles are presented in Appendix 11. The species accumulation curves refer only to the trappable portion of fauna. Fauna may not be trappable due to size, absence (i.e. migratory or nomadic species), or inactivity (i.e. species that are weather dependent).

The species accumulation curve for amphibians has not reached an asymptote indicating that additional trapping nights may increase the number of species recorded. There are 12 potentially occurring amphibian species identified from database searches that were not recorded from the field survey. Nine of these are considered unlikely to occur based on the known distribution patterns. Therefore, three additional species could be expected to occur in the study area and may be recorded from additional trapping and/or recorded from surveys conducted during peak calling periods in Autumn and Winter. None of the 12 additional expected species have been recorded from previous detailed or basic level fauna surveys in the Greenbushes area.

The accumulation curve for reptiles is approaching an asymptote indicating that additional trapping nights may marginally increase the number of species recorded. An additional 33 species not recorded during the field survey were identified as potentially occurring from the database searches. Six of these potentially occurring species are considered likely to occur in the study area as they have been trapped or observed during previous surveys in the Greenbushes area. However, a total of 27 reptile species (or 62% of the expected reptile species) have not been recorded in the Greenbushes area from previous detailed or basic level fauna surveys over a variety of seasons. These surveys included two-season trapping surveys of the adjacent New Water Storages project area (Onshore Environmental 2023a) and Floyd's waste Rock Landform Expansion project area (Onshore Environmental 2023b). These species may not be present in the Greenbushes area or may be present only at very low densities, therefore a large trapping effort may be required to determine whether these species occur. Weather conditions during the current survey were warm and survey conditions were not considered a limiting factor.

Due to the low number of mammal species trapped (two species), a species accumulation curve was not calculated for mammals. The majority of potentially occurring mammal species

do not form part of the trappable portion of fauna and were surveyed using targeted methods such as motion sensor cameras. A total of 23 mammals species were identified as potentially occurring from the database searches but were not recorded during the field survey. Four of these species are likely to occur in the study area, having been recorded from previous detailed or basic level fauna surveys of the area: Brush-tailed Phascogale, Holt's Long-eared Bat, and the introduced House Mouse and Pig. Seven of these unrecorded species are rare and are unlikely to occur within the study area: Woylie, Numbat, Bilby, Tammar Wallaby, Red-tailed Phascogale, Western Ringtail Possum and Quokka.

Twelve additional mammal species may occur within the study area, however these species have not been recorded during multiple recent trapping programs in similar habitat, or from motion sensor camera surveys in the Greenbushes area: Chuditch, Yellow-footed Antechinus/Mardo, three species of Dunnart, Honey Possum, Western Pygmy-possum/Mundarda, Western Falsistrelle, Short-beaked Echidna, and the introduced species Goat, Fallow Deer and Dingo/Dog.

An additional 154 bird species were identified as potentially occurring from the database searches but were not recorded within the study area. Of these 29 species have been recorded from previous surveys or observed opportunistically in the Greenbushes area, and hence are likely to occur within the study area. A total of 22 species are considered unlikely to occur based on their known distribution (12 species) or as they are migratory and/or shorebirds (ten species). The remaining 103 species may occur within the study area but have not been recorded from previous surveys in the Greenbushes area.

A number of factors were determined to contribute to the proportion of species recorded from the study area, compared to the number of species identified during the database searches. The list from the database searches includes uncommon species, migratory or vagrant species, species on the edge of their distribution, and species with specialised habitat requirements. These species are unlikely to be found within the study area or would only utilise the study area occasionally. A second phase survey would likely marginally increase the number of species recorded within the study area as discussed above. Disturbances present within the study area and a long history of historical disturbance are likely to have negatively impacted the diversity and abundance of the fauna assemblage present within the study area. These include the fragmented and disturbed nature of vegetation (particularly within the southern drainage line habitat which was in degraded condition), the proximity to the South Western Highway, proximity to farmland and roads, and the presence of weeds and feral animals (particularly foxes and cats).

The survey was conducted within the recommended primary survey period. A second phase survey during Autumn is recommended and may increase the number of species recorded. At least two sites were sampled within each habitat type as recommended under the technical guidelines (EPA 2020b).

5.3 Comparison of Habitats

The variability between the trapped fauna assemblage confirmed the classification of two habitat types, with a different fauna assemblage recorded at the two habitats. There were also differences in the species assemblage recorded from the northern and southern drainage line

habitats, with the degraded condition of the southern drainage line contributing to reduced diversity and number of captures at this site. The drainage line habitat showed higher diversity overall with higher species richness of amphibians, mammals and birds recorded. A total of seven species of amphibian were trapped in the drainage line habitat compared to two species trapped at hillslope sites. The Quacking Frog (*Crinia georgiana*) and Western Banjo Frog (*Limnodynastes dorsalis*) were recorded from both habitats.

A total of 48 bird species were recorded from drainage lines with 37 recorded from hillslopes habitat. A total of 32 species were recorded from both habitats. Five bird species were recorded only from hillslopes and 16 species were only recorded from the drainage line habitat. The higher diversity of bird species recorded from the drainage line habitat reflects both the presence of water dependant species and the increased structural diversity of vegetation.

A total of 14 mammal species were recorded from drainage lines with six species recorded on hillslopes. Mammal species only recorded from the drainage line habitat included the Black Rat (*Rattus rattus*), Cat (*Felis catus*), Water Rat (*Hydromys chrysogaster*) and Quenda (*Isoodon fusciventer*). Species only recorded from hillslopes habitat included Red Fox (*Vulpes vulpes*), Common Brush-tailed Possum (*Trichosurus vulpecula*) and Western Brush Wallaby (*Notamacropus irma*).

The reptile assemblage was similar across the two habitats with a total of five species recorded from both habitats. Two species were only recorded from drainage lines: Western Three-lined Skink (*Acritoscincus trilineatus*) and the South-western Snake Necked Turtle (*Chelodina colliei*). The Marbled Gecko (*Christinus marmoratus*) and the Heath Monitor (*Varanus rosenbergi*) were only recorded from the hillslope habitat.

6.0 SUMMARY

The single-phase detailed vertebrate fauna survey of the Additional Areas North Study Area was completed in November and December 2023.

A total of 87 vertebrate fauna species were recorded during the field survey, including seven amphibians, nine reptiles, 54 birds and 17 mammals. The fauna assemblage was typical of the bioregion and reflective of recent nearby surveys in the Greenbushes area.

Six conservation significant species were recorded from the study area:

- Forest Red-tailed Black Cockatoo (Calyptorhynchus banksii naso);
- Baudin's Black Cockatoo (Zanda baudinii);
- Carnaby's Black Cockatoo (Zanda latirostris);
- Western Brush Wallaby (Notamacropus irma),
- Water Rat (Hydromys chrysogaster); and
- Quenda (Isoodon fusciventer).

Two naturally occurring fauna habitat types were described and mapped within the study area; hillslopes and drainage lines. Both fauna habitats were considered to be well represented in the bioregion.

7.0 STUDY TEAM

The detailed terrestrial vertebrate fauna survey was planned, co-ordinated and executed by the following personnel:

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Conservation codes for species and communities of conservation significance

Categories used under the EPBC Act					
Status	Code	Description			
Critically Endangered	Cr	Taxa considered to be facing an extremely high risk of extinction in the wild in the immediate future			
Endangered	En	Taxa considered to be facing a very high risk of extinction in the wild in the near future			
Vulnerable	Vu	Taxa considered to be facing a high risk of extinction in the wild in the medium-term future			
Migratory	Mi	Species that migrate to, over and within Australia and its external territories			

Conservation Codes used under the BC Act					
Status	Code	Description			
Critically Endangered	CR	Taxa rare or likely to become extinct, as critically endangered taxa			
Endangered	EN	Taxa rare or likely to become extinct, as endangered taxa			
Vulnerable	VU	Taxa rare or likely to become extinct, as vulnerable taxa			
Presumed Extinct	EX	Taxa presumed to be extinct			
Migratory	IA	Birds subject to international agreements relating to the protection of migratory birds			
Conservation Dependent	CD	Taxa of special conservation need, being species dependent on ongoing conservation intervention			
Special Protection	OS	Taxa in need of special protection			

Priority Flora and Fauna Under the BC Act						
Status	Code	Description				
Priority 1: Poorly-known Species	P1	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: Poorly-known Species	P2	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: Poorly-known Species	P3	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: Rare, Near Threatened and other species in need of monitoring	Ρ4	 (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. 				

Definition	Definitions, Categories and Criteria for Threatened and Priority Ecological Communities				
General Definitions					
Ecological Community	A naturally occurring biological assemblage that occurs in a particular type of habitat. Note: The scale at which ecological communities are defined will often depend on the level of detail in the information source, therefore no particular scale is specified.				
Threatened Ecological Community (TEC)	A threatened ecological community (TEC) is one which is found to fit into one of the following categories; "presumed totally destroyed", "critically endangered", "endangered" or "vulnerable". Possible threatened ecological communities that do not meet survey criteria are added to DEC's Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3. Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.				
Assemblage	An assemblage is a defined group of biological entities.				
Habitat	Habitat is defined as the areas in which an organism and/or assemblage of organisms lives. It includes the abiotic factors (e.g. substrate and topography), and the biotic factors.				
Occurrence	A discrete example of an ecological community, separated from other examples of the same community by more than 20 meters of a different ecological community, an artificial surface or a totally destroyed community. By ensuring that every discrete occurrence is recognised and recorded future changes in status can be readily monitored.				
Adequately Surveyed	An ecological community that has been searched for thoroughly in most likely habitats, by relevant experts.				
Community structure	The spatial organisation, construction and arrangement of the biological elements comprising a biological assemblage (e.g. <i>Eucalyptus salmonophloia</i> woodland over scattered small shrubs over dense herbs; structure in a faunal assemblage could refer to trophic structure, e.g. dominance by feeders on detritus as distinct from feeders on live plants).				

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

Definitions and C	riteria for Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable Ecological Communities
Endangered (EN)	An ecological community that has been adequately surveyed and found to have been subject to a major contraction in an area and/or was originally of limited distribution and is in danger of significant modification throughout it range or severe modification or destruction over most of its range in the near future
	An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):
	A) Geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply (i or ii):
	 i) the estimated geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term future (within approximately 20 years);
	ii) modification throughout its range is continuing such that in the short term future (within approximately 20 years) the community is unlikely to be capable of being substantially restored or rehabilitated.
	B) Current distribution is limited, and one or more of the following apply (I, ii, iii)
	 i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 20 years);
	 ii) There are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes;
	iii) There may be many occurrences but total area is small and all or most occurrences are small and/or isolated and very vulnerable to known threatening processes.
	C) The ecological community exists only as very modified occurrences that may be capable of being substantially restored or rehabilitated if such work begins in the short-term future (within approximately 20 years).

Definitions and C	riteria for Presumed Totally Destroyed, Critically Endangered, Endangered and Vulnerable Ecological Communities
Vulnerable (VU)	An ecological community that has been adequately surveyed and is found to be declining and/or has declined in distribution and/or condition and whose ultimate security has not yet been assured and/or a community that is still widespread but is believed likely to move into a category of higher threat in the near future if threatening processes continue or begin operating throughout its range.
	An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium (within approximately 50 years) to long-term future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B or C):
	A) The ecological community exists largely as modified occurrences that are likely to be capable of being substantially restored or rehabilitated.
	B) The ecological community may already be modified and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.
	C) The ecological community may be still widespread but is believed likely to move into a category of higher threat in the medium to long-term future because of existing or impending threatening processes.

Definitions and Criteria for Priority Ecological Communities

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community List under priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community. Ecological communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Priority 1 Poorly-known ecological communities	Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2 Poorly-known ecological communities	Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority 3 Poorly-known ecological communities	 i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat or habitat destruction or degradation ii) communities known forma few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; iii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system bit are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stick, and inappropriate fire regimes Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them
Priority 4 Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring	 a) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. c) Ecological communities that have been removed from the list of threatened communities during the past five years
Priority 5 Conservation Dependent ecological communities	Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result int eh community becoming threatened within five years

APPENDIX 2

Locations of sampling sites within the study area.

Site Name	Site Type	Effort	Start Date	End Date	Easting	Northing
S1	Bird census	20mins	25/11/2023	25/11/2023	416248	6254990
S2	Bird census	20mins	26/11/2023	26/11/2023	416133	6255125
S2	Bird census	20mins	26/11/2023	26/11/2023	415293	6254580
S3	Bird census	20mins	26/11/2023	26/11/2023	417611	6251966
S4	Bird census	20mins	26/11/2023	26/11/2023	416779	6253455
S2	Bird census	20mins	27/11/2023	27/11/2023	415267	6254641
S1	Bird census	20mins	27/11/2023	27/11/2023	416314	6255088
S5	Bird census	20mins	27/11/2023	27/11/2023	416830	6254195
S4	Bird census	20mins	27/11/2023	27/11/2023	416748	6253450
S3	Bird census	20mins	27/11/2023	27/11/2023	417576	6251987
Bc-11	Bird census	20mins	27/11/2023	27/11/2023	417085	6252234
Bc-13	Bird census	20mins	28/11/2023	28/11/2023	416317	6254931
S3	Bird census	20mins	28/11/2023	28/11/2023	417495	6251990
Bc-15	Bird census	20mins	28/11/2023	28/11/2023	417179	6254959
Bc-16	Bird census	20mins	29/11/2023	29/11/2023	415296	6254600
S1	Bird census	20mins	29/11/2023	29/11/2023	416252	6254929
Bc-18	Bird census	20mins	29/11/2023	29/11/2023	417586	6251989
Bc-18	Bird census	20mins	30/11/2023	30/11/2023	416331	6254052
Bc-19	Bird census	20mins	30/11/2023	30/11/2023	415553	6255372
Bc-21	Bird census	20mins	1/12/2023	1/12/2023	416683	6254599
S4	Bird census	20mins	1/12/3023	1/12/3023	416615	6253480
Bc-24	Bird census	20mins	2/11/2023	2/11/2023	417604	6251954
Bc-25	Bird census	20mins	2/12/2023	2/12/2023	416247	6255049
Bc-26	Bird census	20mins	3/12/2023	3/12/2023	415266	6254606
Bc-27	Bird census	20mins	3/12/2023	3/12/2023	416808	6253489
Bc-28	Bird census	20mins	3/12/2023	3/12/2023	417610	6251958
Bc-29	Bird census	20mins	4/12/2023	4/12/2023	415666	6254853
Bc-30	Bird census	20mins	5/12/2023	5/12/2023	416604	6252444
NS-01	Nocturnal search	1 hr	28/11/2023	28/11/2023	417010	6252202
NS-02	Nocturnal search	1 hr	28/11/2023	28/11/2023	415240	6254543
Ons01	Camera	7 nights	27/11/2023	4/12/2023	417270	6252115
Ons02	Camera	9 nights	25/11/2023	4/12/2023	416908	6253548
Ons03	Camera	7 nights	27/11/2023	4/12/2023	416556	6252909
Ons04	Camera	7 nights	27/11/2023	4/12/2023	416458	6254611
Ons06	Camera	9 nights	25/11/2023	4/12/2023	416889	6253724
Ons07	Camera	7 nights	27/11/2023	4/12/2023	417323	6253341
Ons08	Camera	6 nights	28/11/2023	4/12/2023	415782	6254223
Ons09	Camera	6 nights	28/11/2023	4/12/2023	417387	6253811
Ons10	Camera	7 nigths	27/11/2023	4/12/2023	416960	6252168

Site Name	Site Type	Effort	Start Date	End Date	Easting	Northing
Ons11	Camera	9 nights	25/11/2023	4/12/2023	417431	6252032
Ons12	Camera	7 nights	27/11/2023	4/12/2023	416479	6254012
Ons13	Camera	7 nights	27/11/2023	4/12/2023	417622	6252048
Ons15	Camera	7 nights	27/11/2023	4/12/2023	416823	6254646
Ons16	Camera	7 nights	27/11/2023	4/12/2023	416781	6252965
Ons17	Camera	7 nights	27/11/2023	4/12/2023	415663	6255055
Ons18	Camera	7 nights	27/11/2023	4/12/2023	415779	6254654
Ons19	Camera	7 nights	28/11/2023	4/12/2023	417174	6254857
Ons20	Camera	7 nights	25/11/2023	4/12/2023	417655	6252132
Ons21	Camera	7 nights	28/11/2023	4/12/2023	417366	6255044
Ons23	Camera	7 nights	28/11/2023	4/12/2023	417270	6253591
S1	Trapping	8 nights	24/11/2023	2/12/2023	416274	6255041
S2	Trapping	8 nights	25/11/2023	3/12/2023	415247	6254659
S3	Trapping	8 nights	25/11/2023	3/12/2023	417614	6252068
S4	Trapping	8 nights	25/11/2023	3/12/2023	416790	6253465
S5	Trapping	8 nights	26/11/2023	4/12/2023	416801	6254254
SM4	Bat Detector	3 nights	13/12/2023	16/12/2023	416950	6252221
S3	Bird census	20 mins	1/12/2023	1/12/2023	417614	6252068
S1	Bird census	20 mins	1/12/2023	1/12/2023	416274	6255041
6930	Bird census	20 mins	4/12/2023	4/12/2023	416767	6252226
6941	Bird census	20 mins	4/12/2023	4/12/2023	415743	6254303
S4	Bird census	20 mins	2/12/2023	2/12/2023	416790	6253465
S2	Bird census	20 mins	2/12/2023	2/12/2023	415247	6254659
S5	Bird census	20 mins	2/12/2023	2/12/2023	416801	6254254
H01	Bird census	20 mins	1/12/2023	1/12/2023	417333	6253848
6914	Bird census	20 mins	1/12/2023	1/12/2023	417438	6253843
6917	Bird census	20 mins	1/12/2023	1/12/2023	417561	6253361
AA-52	Bird census	20 mins	1/12/2023	1/12/2023	416664	6252305
S5	Bird census	20 mins	3/12/2023	3/12/2023	416801	6254254
6924	Bird census	20 mins	3/12/2023	3/12/2023	416935	6253415
S2	Bird census	20 mins	5/12/2023	5/12/2023	415247	6254659

APPENDIX 3

Foraging quality scoring tool

Starting score	1	Baudin's Cockatoo	Carnaby's Cockatoo	Forest Red-tailed Black-Cockatoo		
10 Attribute Sub-		Start at a score of 10 if your site is native eucalypt woodlands and forest, and proteaceous woodland and heath, particularly Marri, within the range of the species, including along roadsides and parkland cleared areas. Can include planted vegetation. This tool only applies to sites equal to or larger than 1 hectare in size.	Start at a score of 10 if your site is native shrubland, kwongan heathland or woodland, dominated by proteaceous plant species such as <i>Banksia</i> spp. (including <i>Dryandra</i> spp.), <i>Hakea</i> spp. and <i>Grevillea</i> spp., as well as native eucalypt woodland and forest that contains foraging species, within the range of the species, including along roadsides and parkland cleared areas. Also includes planted native vegetation. This tool only applies to sites equal to or larger than 1 hectare in size.	Start at a score of 10 if your site is Jarrah or Marri woodland and/or forest, or if it is on the edge of Karri forest, or if Wandoo and Blackbutt occur on the site, within the range of the subspecies, including along roadsides and parkland cleared areas. This tool only applies to sites equal to or larger than 1 hectare in size.		
Attribute	Sub- tractions	Context adjustor (attributes reducing functionality of foraging habitat)				
Foraging potential	-2	Subtract 2 from your score if there is no evidence of feeding debris on your site.	Subtract 2 from your score if there is no evidence of feeding debris on your site.	Subtract 2 from your score if there is no evidence of feeding debris on your site.		
Connectivity	-2	Subtract 2 from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.	Subtract 2 from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.	Subtract 2 from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.		
Proximity to breeding	-2	Subtract 2 if you have evidence to conclude that your site is more than 12 km from breeding habitat	Subtract 2 if you have evidence to conclude that your site is more than 12 km from breeding habitat.	Subtract 2 if you have evidence to conclude that your site is more than 12 km from breeding habitat.		
Proximity to roosting	4	Subtract 1 if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.	Subtract 1 if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.	Subtract 1 if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.		
Impact from significant plant disease	4	Subtract 1 if your site has disease present (e.g. <i>Phytophthora</i> spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.	Subtract 1 if your site has disease present (e.g. <i>Phytophthora</i> spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plantspresent.	Subtract 1 if your site has disease present (e.g. <i>Phylophthora</i> spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plantspresent.		
Total score		Enter score	Enter score	Enter score		
Appraisal		To support your habitat score, y impact site and within 20km of i should include discussion on th distance to proximate resource:	you should provide an overall ap; the impact area to clearly explain e foraging habitat's proximity to o s), frequency of use of proximate ps and condition	praisal of the habitat on the and justify the score. It other resources (e.g. exact sites, the degree of evidence		

Habitat Scoring System for WA black cockatoo foraging habitat

This habitat scoring system describes elements indicative of suitable foraging habitat¹ for the three WA black cockatoo species (Carnaby's Black Cockatoo, Baudin's Black Cockatoo and the Forest Red-tailed Black Cockatoo) in WA. Its use must be supported by survey information and reporting, undertaken by suitably qualified and experienced ecologists.

Appropriate scores will best fit a description. Where all components of the 'detail' column description are not met, this must be specified, and justification provided for that score to be accepted by the Department.

For an offset site to be considered by the Department, the offset site must have a start score of 1 for each indicator (e.g., there must be a species stocking rate score of at least 1).

Indicator	Score	Detail		Impact site	Offset start quality	Without offset	With offset
			Site Condition				
	Foraging Details						
			Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland (>30% projected foliage cover), banksia and eucalypt woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths ² .				
	7	Very High	Baudin's Black Cockatoo				
			Marri-Jarrah Forest and woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.				
Vegetation condition			Carnaby's Black Cockatoo				
and structure.	6		Native kwongan heath and shrubland (>25% projected foliage cover), banksia and eucalypt woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.				
Habitat features			Baudin's Black Cockatoo				
		High	Marri-Jarrah Forest and woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.				

¹ In some cases, an impact or offset site may contain or require both foraging and breeding habitat for one or more black cockatoos. Breeding habitat is species of trees known to support breeding within the range of the species which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow. For most species of trees, suitable DBH is 500 mm. For salmon gum and wandoo, suitable DBH is 300 mm.

²No tree deaths indicate robustness of habitat, unlikely for the habitat to decline in the medium-term. Tree deaths may be owing to disease, water stress, fire, etc.

			Carnaby's Black Cockatoo			
			Native kwongan heath and shrubland (>20% projected foliage cover), banksia and eucalypt			
			woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg.			
			condition reduced due to tree deaths (up to 20%).			
			Baudin's Black Cockatoo		[1
			Marri-Jarrah Forest or woodlands with 30-40% projected foliage cover; OR > 60% projected			
	_		foliage cover but veg. condition reduced due to tree deaths (up to 20%).			
	5	Moderate to	Forest Red-tailed Black Cockatoo	-		
		ingi	Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with 30-40%			
			projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree			
			deaths (up to 20%).			
			Calliaby's Black Cockatoo	[
			foliage cover. Moderate percentage of tree deaths (30-40%)			
			Baudin's Black Cockatoo			
			Marri-Jarrah Forest or woodlands with 20-30% projected foliage cover: OR Marri-Jarrah Forest			
	4	Moderate	with 40-60% projected foliage cover but vegetation condition reduced due to tree deaths (up to			
Vegetation			30-40%).			
condition and			Forest Red-tailed Black Cockatoo			
structure.			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with: 20-30%			
			projected foliage cover; OR 40-60% projected foliage cover but veg. condition reduced due to			
Habitat features			tree deaths (up to 30-40%).			
			Carnaby's Black Cockatoo			1
			Native kwongan heath and shrubland, banksia or eucalypt woodlands with 10-20% projected			
			Tollage Cover.			
	3	LOW to moderate	Baudin's Black Cockatoo			
		moderate	Forest Bed tailed Plack Coskates			
			Forest Red-tailed Black Cockatoo	[
			projected foliage cover			
			Carnaby's Black Cockatoo			I
			Native kwongan heath and shrubland, banksia and eucalypt woodlands with <10% projected			
			foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksias,			
	2	Low	marri.			
	2	LUW	Baudin's Black Cockatoo			
			Marri-Jarrah Forest or woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban			
			areas with scattered foraging trees such as banksia, hakea, dryandra.			

			Forest Red-tailed Black Cockatoo											
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with 1-5%											
			projected foliage cover; OR Paddocks and/or urban areas with scattered food plants such as											
			Cape Lilac, Eucalyptus caesia and E. erythrocorys.											
		Negligible to	Il species											
Vegetation	1	low	Scattered specimens of known food plants but projected foliage cover of these is <2%. May											
condition and		1011	include: paddocks or urban areas with scattered foraging trees.											
structure.		Nono	All species											
l labitat faatuuraa	0	None	No Proteaceae, eucalypts or other potential sources of food. May include bare ground or											
Habitat features			developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).											
			Totals											

	Site Context											
Proximity of	3	Site is within 6km of known breeding site.	or	Site is within 12km of other foraging resources with site condition of at least 3.								
the site in relation to other habitat.	2	Site is within 12km of known breeding site.	or	Site is within 15km of other foraging resources with site condition of at least 4.								
	1	Site is within 15km of known breeding site.	or	Site is between 15km and 20km of other foraging resources with site condition of at least 5.								
	0	Site is further than 15km from known breeding site.	or	Site is further than 20km from other foraging resources.								
Totals												

Final Totals

	Indicator	Species Stocking Rate ³	Impa	ct Site	Offset Site				
			CBC	BBC	FRT	CBC	BBC	FRT	
Confirm presence/ absence of	Yes Species is seen or reported regularly and/or there is abundant foraging evidence, e.g. chewed nuts can be identified as this species. Regularly is when the species is seen at intervals of every few days or weeks for at least several months of the year.								
species.	No	Species is recorded or reported very infrequently and there is little or no foraging evidence.							

³ Species stocking rate is indicated by yes or no to confirm if any of the species is frequently present or not. If yes, the presence must be for the species being impacted by the proposal, not for a species that will not be impacted.

Legend

If the site scores between 0-2 (low to no value) for site condition, 0 for the site context score, or is **No** for species stocking rate, it is extremely unlikely to be considered as suitable habitat. This would not be appropriate to use as an offset site.

The metrics used to determine Site Condition, Site Context, and Species Stocking Rate were developed by the Department of Climate Change, Energy, the Environment, and Water in consultation with species experts in WA.

A standard habitat quality scoring system for a species allocates scores out of 3 for both site condition and site context, and out of 4 for species stocking rate. However, as black cockatoos are very mobile, this HQS uses a score out of 7 for site condition and a score out of 3 for site context. Site condition is considered the key factor in determining the quality of habitat for these black cockatoo species. Species stocking rate is considered only in terms of presence or absence of the species and does not add to the total score. Note that the species, or strong indicators of the species, must be present, consistent with the presence/usage description above, for an offset to be considered suitable.

List of fauna species potentially occurring within and surrounding the study area.

Class	Scientific Name	Common Name	ALA	Birddata	Dandjoo	DBCA	PMST	MDE (Biologic 2018)	New Water Storage Onshore Environmental (2023a)	Floyds WRL Expansion Onshore Environmental (2023b)
Amphibians	Anstisia lutea	Walpole Frog	х		х					
Amphibians	Anstisia rosea	Roseate Frog	х		х					
Amphibians	Crinia georgiana	Quacking Frog	х		х				x	
Amphibians	Crinia glauerti	Clicking Frog	х		х				x	
Amphibians	Crinia insignifera	Squelching Froglet	х		х					
Amphibians	Crinia pseudinsignifera	Bleating Froglet	х		х					
Amphibians	Crinia subinsignifera	South Coast Froglet	х		х					
Amphibians	Geocrinia leai	Ticking Frog	х		х				x	
Amphibians	Heleioporus albopunctatus	Western Spotted Frog	х							
Amphibians	Heleioporus eyrei	Moaning Frog	х		х				x	
Amphibians	Heleioporus inornatus	Whooping Frog	х		х					
Amphibians	Heleioporus psammophilus	Sand Frog			х					
Amphibians	Limnodynastes dorsalis	Western Banjo Frog	х		х				x	х
Amphibians	Litoria adelaidensis	Slender Tree Frog	х		х			x	x	
Amphibians	Litoria moorei	Motorbike Frog	х		х			x	x	
Amphibians	Metacrinia nichollsi	Forest Toadlet	х		х					
Amphibians	Myobatrachus gouldii	Turtle Frog	х		х					
Amphibians	Neobatrachus albipes	White-footed Trilling Frog			х					
Amphibians	Pseudophryne guentheri	Crawling Toadlet	х		х					
Birds	Acanthiza apicalis	Inland Thornbill	х	x	х				x	х
Birds	Acanthiza inornata	Western Thornbill	х	х	х				x	х
Birds	Accipiter fasciatus	Brown Goshawk	х	x	х					х
Birds	Anas superciliosa	Pacific Black Duck	х	х	х				x	
Birds	Anthochaera carunculata	Red Wattlebird	х	x	х			x	x	х
Birds	Anthochaera lunulata	Western Little Wattlebird	х	х	х				x	
Birds	Aquila audax	Wedge-tailed Eagle	х	х	х			x		х
Birds	Barnardius zonarius	Australian Ringneck	х	x	х			x	x	х
Birds	Biziura lobata	Musk Duck	х	x	х			x	x	
Birds	Cacomantis flabelliformis	Fan-tailed Cuckoo	х	x	х				x	х
Birds	Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	х	х	х	x	х	x	x	х
Birds	Chalcites lucidus	Shining Bronze Cuckoo	х	x	х				x	х
Birds	Chenonetta jubata	Australian Wood Duck	х	x	х				x	
Birds	Climacteris rufus	Rufous Treecreeper	х	x	х				x	х
Birds	Colluricincla harmonica	Grey Shrikethrush	х	x	х				x	х
Birds	Coracina novaehollandiae	Black-faced Cuckooshrike	х	х	х				x	х
Birds	Corvus coronoides	Australian Raven	х	х	х			x	x	x
Birds	Dacelo novaeguineae	Laughing Kookaburra	х	х	х			х	х	x

Class	Scientific Name	Common Name	ALA	Birddata	Dandjoo	DBCA	PMST	MDE (Biologic 2018)	New Water Storage Onshore Environmental (2023a)	Floyds WRL Expansion Onshore Environmental (2023b)
Birds	Daphoenositta chrysoptera	Varied Sittella	х	х	х					Х
Birds	Dromaius novaehollandiae	Emu	х	х	х			х		Х
Birds	Egretta novaehollandiae	White-faced Heron	х	х				х	Х	
Birds	Elanus axillaris	Black-shouldered Kite	х	x	х					
Birds	Eopsaltria griseogularis	Western Yellow Robin	х	х	х			х	Х	Х
Birds	Fulica atra	Eurasian Coot	х	x					Х	
Birds	Gerygone fusca	Western Gerygone	х	x	х			х	Х	Х
Birds	Grallina cyanoleuca	Magpie-lark	х	x	х				Х	Х
Birds	Gymnorhina tibicen	Australian Magpie	х	х	х			х	Х	Х
Birds	Lalage tricolor	White-winged Triller	х	x	х					
Birds	Lichmera indistincta	Brown Honeyeater	х	x	х				Х	Х
Birds	Malurus elegans	Red-winged Fairywren	х	x	х			Х	Х	Х
Birds	Malurus splendens	Splendid Fairywren	х	x	х				Х	Х
Birds	Melithreptus chloropsis	Western White-naped Honeyeater	х		х				Х	Х
Birds	Pachycephala fuliginosa	Western Whistler	х	x	х				Х	Х
Birds	Pachycephala rufiventris	Rufous Whistler	х	x	х				Х	Х
Birds	Pardalotus punctatus	Spotted Pardalote	х	х	х				Х	Х
Birds	Pardalotus striatus	Striated Pardalote	х	x	х			х	Х	Х
Birds	Parvipsitta porphyrocephala	Purple-crowned Lorikeet	х	x	х			х	Х	Х
Birds	Petroica boodang	Scarlet Robin	х	x	х			х	х	Х
Birds	Phalacrocorax varius	Pied Cormorant	х	х						
Birds	Phaps chalcoptera	Common Bronzewing	х	x	х			х	Х	Х
Birds	Phylidonyris novaehollandiae	New Holland Honeyeater	х	x	х			х	Х	Х
Birds	Platycercus icterotis	Western Rosella	х	x	х				х	Х
Birds	Podargus strigoides	Tawny Frogmouth	х	х	х			Х	Х	Х
Birds	Porphyrio porphyrio	Purple Swamphen	х	х	х				Х	
Birds	Purpureicephalus spurius	Red-capped Parrot	х	x	х				Х	Х
Birds	Quoyornis georgiana	White-breasted Robin	х	x	х				Х	Х
Birds	Rhipidura albiscapa	Grey Fantail	х	x	х			х	х	Х
Birds	Rhipidura leucophrys	Willie Wagtail	х	х				х	Х	Х
Birds	Sericornis maculatus	Spotted Scrubwren	х	x	х			х	Х	Х
Birds	Stagonopleura oculata	Red-eared Firetail	х	x	х					
Birds	Todiramphus sanctus	Sacred Kingfisher	х	x	х				х	
Birds	Zanda baudinii	Baudin's Cockatoo	х	x	х	х	x			
Birds	Zanda latirostris	Carnaby's Cockatoo	х	х	х	х	x			
Birds	Zosterops lateralis	Grey-breasted White-eye	х	х	х				Х	Х
Birds	Acanthiza chrysorrhoa	Yellow-rumped Thornbill	х	х	х			x	x	х

Class	Scientific Name	Common Name	ALA	Birddata	Dandjoo	DBCA	PMST	MDE (Biologic 2018)	New Water Storage Onshore Environmental (2023a)	Floyds WRL Expansion Onshore Environmental (2023b)
Birds	Acanthiza uropygialis	Chestnut-rumped Thornbill	х							
Birds	Acanthorhynchus superciliosus	Western Spinebill	х	x	х					
Birds	Accipiter cirrocephalus	Collared Sparrowhawk	х	х	х					
Birds	Acrocephalus australis	Australian Reed Warbler	х	х	х				х	
Birds	Actitis hypoleucos	Common Sandpiper	х	х		x	x			
Birds	Aegotheles cristatus	Australian Owlet-nightjar	х	x	х			Х	х	
Birds	Anas castanea	Chestnut Teal	х	x						
Birds	Anas gracilis	Grey Teal	х	x						
Birds	Anas platyrhynchos	Mallard	х	х						
Birds	Anhinga novaehollandiae	Australasian Darter	х	x					х	
Birds	Anser anser	Greylag Goose		x						
Birds	Anthus australis	Australian Pipit	х	x	х					
Birds	Aphelocephala leucopsis	Southern Whiteface								
Birds	Apus pacificus	Pacific Swift					x			
Birds	Ardea alba	Great Egret	х	x	х					
Birds	Ardea pacifica	White-necked Heron	х	х						
Birds	Ardeotis australis	Australian Bustard	х							
Birds	Artamus cinereus	Black-faced Woodswallow	х	x	х					
Birds	Artamus cyanopterus	Dusky Woodswallow	х	x	х			Х	х	X
Birds	Artamus personatus	Masked Woodswallow	х							
Birds	Aythya australis	Hardhead	х	х						
Birds	Botaurus poiciloptilus	Australasian Bittern	х			x	х		x	
Birds	Bubulcus ibis	Cattle Egret	х							
Birds	Burhinus grallarius	Bush Stone-curlew	х		х					
Birds	Cacatua pastinator pastinator	Muir's Corella	х	x	х				x	
Birds	Cacatua sanguinea	Little Corella	х							
Birds	Cairina moschata	Muscovy Duck	х	х						
Birds	Calamanthus campestris	Rufous Fieldwren	х	x	х					
Birds	Calidris acuminata	Sharp-tailed Sandpiper					x			
Birds	Calidris ferruginea	Curlew Sandpiper					х			
Birds	Calidris melanotos	Pectoral Sandpiper					х			
Birds	Calidris ruficollis	Red-necked Stint	х							
Birds	Chalcites basalis	Horsfield's Bronze Cuckoo	х	x					x	х
Birds	Charadrius ruficapillus	Red-capped Plover	х	x						
Birds	Chlidonias leucopterus	White-winged Black Tern	х			x				
Birds	Chroicocephalus novaehollandiae	Silver Gull	х	x						
Birds	Cincloramphus cruralis	Brown Songlark	х	х						

Class	Scientific Name	Common Name	ALA	Birddata	Dandjoo	DBCA	PMST	MDE (Biologic 2018)	New Water Storage Onshore Environmental (2023a)	Floyds WRL Expansion Onshore Environmental (2023b)
Birds	Cincloramphus mathewsi	Rufous Songlark	х	x						
Birds	Circus approximans	Swamp Harrier	х	x						
Birds	Circus assimilis	Spotted Harrier	х	x	х					
Birds	Cladorhynchus leucocephalus	Banded Stilt		x						
Birds	Columba livia	Domestic Pigeon	х	x						
Birds	Coracina maxima	Ground Cuckooshrike	х		х					
Birds	Corvus bennetti	Little Crow	х							
Birds	Corvus splendens	House Crow	х							
Birds	Coturnix pectoralis	Stubble Quail	х	x	х					
Birds	Cracticus nigrogularis	Pied Butcherbird	х							
Birds	Cracticus torquatus	Grey Butcherbird	х	x						
Birds	Cygnus atratus	Black Swan	х	x	х			х		
Birds	Cygnus olor	Mute Swan	х							
Birds	Dendrocygna arcuata	Wandering Whistling Duck			х					
Birds	Dicaeum hirundinaceum	Mistletoebird	х	x						
Birds	Egretta garzetta	Little Egret	х							
Birds	Egretta sacra	Eastern Reef Heron	х							
Birds	Elseyornis melanops	Black-fronted Dotterel	х	x						
Birds	Eolophus roseicapilla	Galah	х	х						Х
Birds	Epthianura albifrons	White-fronted Chat	х	x						
Birds	Erythrogonys cinctus	Red-kneed Dotterel	х	x						
Birds	Eurostopodus argus	Spotted Nightjar	х		х					
Birds	Falco berigora	Brown Falcon	х	x	х					
Birds	Falco cenchroides	Australian Kestrel	х	x	х					х
Birds	Falco longipennis	Australian Hobby	х	x	х					
Birds	Falco peregrinus	Peregrine Falcon	х	x	х	х				
Birds	Falcunculus frontatus	Crested Shriketit	х	x						
Birds	Gallinula tenebrosa	Dusky Moorhen	х	x					х	
Birds	Gavicalis virescens	Singing Honeyeater	х	x						х
Birds	Gliciphila melanops	Tawny-crowned Honeyeater	х	x						
Birds	Haliaeetus leucogaster	White-bellied Sea-Eagle	х	x						
Birds	Haliastur sphenurus	Whistling Kite	х	x	х				x	
Birds	Heteroscenes pallidus	Pallid Cuckoo	х	x						
Birds	Hieraaetus morphnoides	Little Eagle	х	x	х				х	
Birds	Himantopus himantopus	Black-winged Stilt	х	x						
Birds	Hirundo neoxena	Welcome Swallow	х	x				Х	X	x
Birds	Hirundo rustica	Barn Swallow	х							

Class	Scientific Name	Common Name	ALA	Birddata	Dandjoo	DBCA	PMST	MDE (Biologic 2018)	New Water Storage Onshore Environmental (2023a)	Floyds WRL Expansion Onshore Environmental (2023b)
Birds	Hypotaenidia philippensis	Buff-banded Rail	х	x						
Birds	Ixobrychus dubius	Australian Little Bittern	х	x						
Birds	Ixobrychus flavicollis australis		х		х	х				
Birds	Leipoa ocellata	Malleefowl	х		х	х	х			
Birds	Lewinia pectoralis	Lewin's Rail	х		х	х				
Birds	Lophoictinia isura	Square-tailed Kite	х	х				х		
Birds	Malacorhynchus membranaceus	Pink-eared Duck	х	х						
Birds	Malurus assimilis	Purple-backed Fairywren	х							
Birds	Malurus pulcherrimus	Blue-breasted Fairywren	х							
Birds	Manorina flavigula	Yellow-throated Miner	х	x						
Birds	Melanodryas cucullata	Hooded Robin	х	х	х					
Birds	Melithreptus brevirostris	Brown-headed Honeyeater	х	x	х					
Birds	Melopsittacus undulatus	Budgerigar	х							
Birds	Merops ornatus	Rainbow Bee-eater	х	x	х					х
Birds	Microcarbo melanoleucos	Little Pied Cormorant	х	x	х					
Birds	Microeca fascinans	Jacky Winter	х	x						
Birds	Motacilla cinerea	Grey Wagtail					х			
Birds	Myiagra inquieta	Restless Flycatcher	х	x	х					
Birds	Neophema elegans	Elegant Parrot	х	х	х					Х
Birds	Ninox boobook	Boobook Owl	х	x	х			Х	X	х
Birds	Ninox connivens	Barking Owl	х		х					
Birds	Numenius madagascariensis	Far Eastern Curlew					х			
Birds	Numida meleagris	Helmeted Guineafowl	х	x						
Birds	Nycticorax caledonicus	Nankeen Night Heron	х	х	х					
Birds	Nymphicus hollandicus	Cockatiel	х							
Birds	Ocyphaps lophotes	Crested Pigeon	х	х	х					
Birds	Oxyura australis	Blue-billed Duck	х	x		х				
Birds	Pachyptila desolata	Antarctic Prion	х							
Birds	Pandion haliaetus	Osprey	х	х	х		х			
Birds	Pelecanus conspicillatus	Australian Pelican	х	х				х		
Birds	Petrochelidon ariel	Fairy Martin	х	x						
Birds	Petrochelidon nigricans	Tree Martin	х	x	х				x	Х
Birds	Petroica goodenovii	Red-capped Robin	х	х						
Birds	Phalacrocorax carbo	Great Cormorant	х	х						
Birds	Phalacrocorax sulcirostris	Little Black Cormorant	х	х	х				x	
Birds	Phaps elegans	Brush Bronzewing	х	х						
Birds	Phylidonyris niger	White-cheeked Honeyeater	х	х						

Class	Scientific Name	Common Name	ALA	Birddata	Dandjoo	DBCA	PMST	MDE (Biologic 2018)	New Water Storage Onshore Environmental (2023a)	Floyds WRL Expansion Onshore Environmental (2023b)
Birds	Platalea flavipes	Yellow-billed Spoonbill	х	x						
Birds	Platalea regia	Royal Spoonbill	х	х						
Birds	Plegadis falcinellus	Glossy Ibis	х	x						
Birds	Pluvialis fulva	Pacific Golden Plover	х							
Birds	Podiceps cristatus	Great Crested Grebe	х	х						
Birds	Poliocephalus poliocephalus	Hoary-headed Grebe	х	x						
Birds	Polytelis anthopeplus	Regent Parrot	х	х	х					
Birds	Pomatostomus superciliosus	White-browed Babbler	х	x						
Birds	Poodytes gramineus	Little Grassbird	х	х	х					
Birds	Porzana fluminea	Australian Spotted Crake	х							
Birds	Psephotellus varius	Mulga Parrot	х	x						
Birds	Psophodes nigrogularis	Western Whipbird	х							
Birds	Ptilotula ornata	Yellow-plumed Honeyeater	х	х	х					
Birds	Recurvirostra novaehollandiae	Red-necked Avocet	х	x						
Birds	Rostratula australis	Australian Painted Snipe		x						
Birds	Smicrornis brevirostris	Weebill	х	x	х					Х
Birds	Spatula rhynchotis	Australasian Shoveler	х	х						
Birds	Spilopelia chinensis	Spotted Turtle Dove	х							
Birds	Spilopelia senegalensis	Laughing Turtle Dove	х	x						
Birds	Stictonetta naevosa	Freckled Duck	х	x						
Birds	Stipiturus malachurus	Southern Emu-wren	х	х	х					
Birds	Strepera versicolor	Grey Currawong	х	x	х				x	Х
Birds	Sturnus vulgaris	Common Starling	х		х					
Birds	Synoicus ypsilophora	Brown Quail	х							
Birds	Tachybaptus novaehollandiae	Australasian Grebe	х	х	х					
Birds	Tadorna tadornoides	Australian Shelduck	х	х						
Birds	Taeniopygia castanotis	Australian Zebra Finch	х							
Birds	Thalasseus bergii	Greater Crested Tern	х	x						
Birds	Thinornis cucullatus	Hooded Plover	х	х						
Birds	Threskiornis molucca	Australian White Ibis	х	х						
Birds	Threskiornis spinicollis	Straw-necked Ibis	х	x						
Birds	Tribonyx ventralis	Black-tailed Nativehen	х	x						
Birds	Tringa glareola	Wood Sandpiper	х	х		х				
Birds	Tringa nebularia	Common Greenshank	х	х			x			
Birds	Turdus merula	Common Blackbird	х		х					
Birds	Turnix varius	Painted Buttonquail	х	х	х					
Birds	Turnix velox	Little Buttonquail	х	х						

Class	Scientific Name	Common Name	ALA	Birddata	Dandjoo	DBCA	PMST	MDE (Biologic 2018)	New Water Storage Onshore Environmental (2023a)	Floyds WRL Expansion Onshore Environmental (2023b)
Birds	Tyto javanica	Eastern Barn Owl	х		х					
Birds	Tyto novaehollandiae	Australian Masked Owl	х		х	x				
Birds	Vanellus tricolor	Banded Lapwing	х							
Birds	Zapornia pusilla	Baillon's Crake	х							
Birds	Zapornia tabuensis	Spotless Crake	х	х	х					
Mammals	Antechinus flavipes leucogaster	Yellow-footed Antechinus, Mardo	х		х					
Mammals	Austronomus australis	White-striped Free-tailed Bat	х		х				X	х
Mammals	Bettongia penicillata ogilbyi	Brush-tailed Bettong, Woylie	х		х	x	x			
Mammals	Canis familiaris	Dingo, Dog	х		х					
Mammals	Capra hircus	Goat	х							
Mammals	Cercartetus concinnus	Western Pygmy-possum, Mundarda	х		х			Х		
Mammals	Chalinolobus gouldii	Gould's Wattled Bat	х		х				X	Х
Mammals	Chalinolobus morio	Chocolate Wattled Bat	х		х				X	Х
Mammals	Dama dama	Fallow Deer	х							
Mammals	Dasyurus geoffroii	Chuditch	х		х	x	x	Х		
Mammals	Falsistrellus mackenziei	Western Falsistrelle	х		х	x				
Mammals	Felis catus	Cat	х		х			Х		Х
Mammals	Hydromys chrysogaster	Water Rat	х		х	x			x	
Mammals	Isoodon fusciventer	Quenda	х		х	x		Х	x	
Mammals	Macropus fuliginosus melanops	Western Grey Kangaroo	х		х			Х	x	х
Mammals	Macrotis lagotis	Bilby, Dalgyte	х		х	x				
Mammals	Mus musculus	House Mouse	х		х			Х		х
Mammals	Myrmecobius fasciatus fasciatus	Numbat, Walpurti	х		х	x	x			
Mammals	Notamacropus eugenii derbianus	Tammar Wallaby	х		х					
Mammals	Notamacropus irma	Western Brush Wallaby	х		х	x		Х		
Mammals	Nyctophilus geoffroyi geoffroyi	Lesser Long-eared Bat	х		х				X	Х
Mammals	Nyctophilus holtorum	Holt's Long-eared Bat	х							х
Mammals	Nyctophilus holtorum	Holt's Long-eared Bat								
Mammals	Nyctophilus major major	Greater Long-eared Bat	х		х				X	Х
Mammals	Oryctolagus cuniculus	Rabbit	х		х			Х	X	Х
Mammals	Ozimops kitcheneri	Western Free-tailed Bat							x	х
Mammals	Phascogale calura	Red-tailed Phascogale	х		х	x	x			
Mammals	Phascogale tapoatafa wambenger	Wambenger Brush-tailed Phascogale	х		х	x		Х	x	х
Mammals	Pseudocheirus occidentalis	Western Ringtail Possum	х		х	x	x	Х		
Mammals	Rattus fuscipes fuscipes	Western Bush Rat	х		х				X	
Mammals	Rattus rattus	Black Rat	х		х			Х	X	
Mammals	Setonix brachyurus	Quokka	х		х	х	х			

Class	Scientific Name	Common Name	ALA	Birddata	Dandjoo	DBCA	PMST	MDE (Biologic 2018)	New Water Storage Onshore Environmental (2023a)	Floyds WRL Expansion Onshore Environmental (2023b)
Mammals	Sminthopsis dolichura	Little long-tailed Dunnart	х							
Mammals	Sminthopsis fuliginosa fuliginosa	Grey-bellied Dunnart	х		х					
Mammals	Sminthopsis gilberti	Gilbert's Dunnart	х		х					
Mammals	Sus scrofa	Pig			х			х		Х
Mammals	Tachyglossus aculeatus acanthion	Short-beaked Echidna	х		х					
Mammals	Tarsipes rostratus	Honey Possum, Noolbenger	х							
Mammals	Trichosurus vulpecula hypoleucus	Common Brushtail Possum, Koomal	х		х			х	x	Х
Mammals	Vespadelus regulus	Southern Forest Bat	х		х				X	Х
Mammals	Vulpes vulpes	Red Fox	х		х			Х	X	Х
Reptiles	Acritoscincus trilineatus	Western Three-Lined Skink	х		х				x	Х
Reptiles	Anilios australis		х		х				x	
Reptiles	Anilios pinguis		х		х					
Reptiles	Aprasia pulchella		х		х					
Reptiles	Aprasia repens		х							
Reptiles	Chelodina colliei	South-western snake-necked turtle	х		х				x	
Reptiles	Christinus marmoratus	Marbled Gecko	х		х					Х
Reptiles	Cryptoblepharus buchananii		х		х					
Reptiles	Ctenotus delli		х		х	х				
Reptiles	Ctenotus impar		х		х					Х
Reptiles	Ctenotus labillardieri		х		х					Х
Reptiles	Diplodactylus calcicolus	South Coast Gecko	х		х					
Reptiles	Diplodactylus lateroides	Speckled Stone Gecko	х		х					
Reptiles	Echiopsis curta	Bardick	х		х					
Reptiles	Egernia kingii	King's Skink	х		х					Х
Reptiles	Egernia napoleonis	South-western Crevice Skink	х		х			Х		Х
Reptiles	Elapognathus coronatus	Crowned Snake	х							
Reptiles	Hemiergis gracilipes		х		х					
Reptiles	Hemiergis initialis initialis		х		х					
Reptiles	Hemiergis peronii	Four-toed Mulch Skink	х		х			х	x	Х
Reptiles	Hemiergis quadrilineatus		х		х					
Reptiles	Lerista distinguenda		х		х			х		Х
Reptiles	Lerista elegans		х		х					
Reptiles	Lerista microtis microtis		х		х					
Reptiles	Liopholis pulchra pulchra		х		х					
Reptiles	Lissolepis luctuosa	Western Swamp Skink	х		х					
Reptiles	Menetia greyii		х		х					Х
Reptiles	Morelia spilota imbricata		х							

Class	Scientific Name	Common Name	ALA	Birddata	Dandjoo	DBCA	PMST	MDE (Biologic 2018)	New Water Storage Onshore Environmental (2023a)	Floyds WRL Expansion Onshore Environmental (2023b)
Reptiles	Morethia lineoocellata		х		х					
Reptiles	Morethia obscura		х		х			x	x	х
Reptiles	Notechis scutatus	Tiger Snake	х		х			x		
Reptiles	Pogona minor minor	Western Bearded Dragon	х		х					
Reptiles	Pseudonaja affinis affinis		х		х				x	
Reptiles	Rhinoplocephalus bicolor	Square-nosed Snake	х		х					
Reptiles	Simoselaps bertholdi	Jan's Banded Snake	х		х					
Reptiles	Suta gouldii	Gould's Hooded Snake	х		х					
Reptiles	Suta nigriceps		х							
Reptiles	Tiliqua occipitalis	Western Bluetongue	х		х					
Reptiles	Tiliqua rugosa rugosa	Bobtail	х		х			x	x	х
Reptiles	Underwoodisaurus milii	Southern Barking Gecko	х							
Reptiles	Varanus gouldii	Bungarra or Sand Goanna	х		х					
Reptiles	Varanus rosenbergi	Heath Goanna	х		х			x		X
Reptiles	Varanus tristis	Racehorse Goanna			х					

Vertebrate fauna list from the study area

Group	Taxon Name	Common Name
Amphibian	Crinia georgiana	Quacking Frog
Amphibian	Crinia glauerti	Clicking Frog
Amphibian	Geocrinia leai	Ticking Frog
Amphibian	Heleioporus eyrei	Moaning Frog
Amphibian	Limnodynastes dorsalis	Western Banjo Frog
Amphibian	Litoria adelaidensis	Slender Tree Frog
Amphibian	Litoria moorei	Motorbike Frog
Bird	Acanthiza apicalis	Inland Thornbill
Bird	Acanthiza inornata	Western Thornbill
Bird	Accipiter fasciatus	Brown Goshawk
Bird	Anas superciliosa	Pacific Black Duck
Bird	Anthochaera carunculata	Red Wattlebird
Bird	Anthochaera lunulata	Western Little Wattlebird (Western Wattlebird)
Bird	Aquila audax	Wedge-tailed Eagle
Bird	Barnardius zonarius	Australian Ringneck
Bird	Biziura lobata	Musk Duck
Bird	Cacomantis flabelliformis	Fan-tailed Cuckoo
Bird	Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo
Bird	Chalcites lucidus	Shining Bronze Cuckoo
Bird	Chenonetta jubata	Australian Wood Duck
Bird	Climacteris rufus	Rufous Treecreeper
Bird	Colluricincla harmonica	Grey Shrikethrush
Bird	Coracina novaehollandiae	Black-faced Cuckooshrike
Bird	Corvus coronoides	Australian Raven
Bird	Dacelo novaeguineae	Laughing Kookaburra
Bird	Daphoenositta chrysoptera	Varied Sittella
Bird	Dromaius novaehollandiae	Emu
Bird	Egretta novaehollandiae	White-faced Heron
Bird	Elanus axillaris	Black-shouldered Kite
Bird	Eopsaltria griseogularis	Western Yellow Robin
Bird	Fulica atra	Eurasian Coot
Bird	Gerygone fusca	Western Gerygone
Bird	Grallina cyanoleuca	Magpie-lark
Bird	Gymnorhina tibicen	Australian Magpie
Bird	Lalage tricolor	White-winged triller
Bird	Lichmera indistincta	Brown Honeyeater
Bird	Malurus elegans	Red-winged Fairywren
Bird	Malurus splendens	Splendid Fairywren
Bird	Melithreptus chloropsis	Western White-naped Honeyeater
Bird	Pachycephala fuliginosa occidentalis	Western Golden Whistler (Western Whistler)
Bird	Pachycephala rufiventris	Rufous Whistler
Bird	Pardalotus punctatus	Spotted Pardalote
Bird	Pardalotus striatus	Striated Pardalote
Bird	Parvipsitta porphyrocephala	Purple-crowned Lorikeet
Bird	Petroica boodang	Scarlet Robin
Bird	Phalacrocorax varius	Pied Cormorant
Bird	Phaps chalcoptera	Common Bronzewing

Group	Taxon Name	Common Name
Bird	Phylidonyris novaehollandiae	New Holland Honeyeater
Bird	Platycercus icterotis	Western Rosella
Bird	Podargus strigoides	Tawny Frogmouth
Bird	Porphyrio melanotus	Australasian Swamphen
Bird	Purpureicephalus spurius	Red-capped Parrot
Bird	Quoyornis georgianus	White-breasted Robin
Bird	Rhipidura albiscapa	Grey Fantail
Bird	Rhipidura leucophrys	Willie Wagtail
Bird	Sericornis maculatus	Spotted Scrubwren
Bird	Stagonopleura oculata	Red-eared Firetail
Bird	Todiramphus sanctus	Sacred Kingfisher
Bird	Zanda baudinii	Baudin's Cockatoo
Bird	Zanda latirostris	Carnaby's Cockatoo
Bird	Zosterops lateralis	Grey-breasted White-eye (Silvereye)
Mammal	Austronomus australis	White-striped Free-tailed Bat
Mammal	Chalinolobus gouldii	Gould's Wattled Bat
Mammal	Chalinolobus morio	Chocolate Wattled Bat
Mammal	Felis catus	Cat
Mammal	Hydromys chrysogaster	Water Rat
Mammal	Isoodon fusciventer	Quenda
Mammal	Macropus fuliginosus melanops	Western Grey Kangaroo
Mammal	Notamacropus irma	Western Brush Wallaby
Mammal	Nyctophilus geoffroyi geoffroyi	Lesser Long-eared Bat
Mammal	Nyctophilus major major	Greater Long-eared Bat
Mammal	Oryctolagus cuniculus	Rabbit
Mammal	Ozimops kitcheneri	Western Free-tailed Bat
Mammal	Rattus fuscipes fuscipes	Western Bush Rat
Mammal	Rattus rattus	Black Rat
Mammal	Trichosurus vulpecula hypoleucus	Common Brushtail Possum, Koomal
Mammal	Vespadelus regulus	Southern Forest Bat
Mammal	Vulpes vulpes	Red Fox
Reptile	Acritoscincus trilineatus	Western Three-Lined Skink
Reptile	Chelodina colliei	South-western snake-necked turtle
Reptile	Christinus marmoratus	Marbled Gecko
Reptile	Egernia napoleonis	South-western Crevice Skink
Reptile	Hemiergis peronii	Lowlands Earless Skink
Reptile	Lerista distinguenda	Dwarf Four-Toed Slider
Reptile	Morethia obscura	Shrubland Morethia Skink
Reptile	Tiliqua rugosa rugosa	Bobtail
Reptile	Varanus rosenbergi	Heath Goanna

Comparison of species recorded from the desktop assessment and field survey

Group	Scientific Name	Common Name	Recorded
Amphibians	Anstisia lutea	Walpole Frog	
Amphibians	Anstisia rosea	Roseate Frog	
Amphibians	Crinia georgiana	Quacking Frog	x
Amphibians	Crinia glauerti	Clicking Frog	x
Amphibians	Crinia insignifera	Squelching Froglet	
Amphibians	Crinia pseudinsignifera	Bleating Froglet	
Amphibians	Crinia subinsignifera	South Coast Froglet	
Amphibians	Geocrinia leai	Ticking Frog	x
Amphibians	Heleioporus albopunctatus	Western Spotted Frog	
Amphibians	Heleioporus evrei	Moaning Frog	x
Amphibians	Heleioporus inornatus	Whooping Frog	
Amphibians	Heleioporus psammophilus	Sand Frog	
Amphibians	Limnodynastes dorsalis	Western Banio Frog	x
Amphibians	Litoria adelaidensis	Slender Tree Frog	x
Amphibians	Litoria moorei	Motorbike Erog	x
Amphibians	Metacrinia nichollsi	Forest Toadlet	
Amphibians	Myobatrachus gouldii	Turtle Frog	
Amphibians	Neobatrachus albines	White-footed Trilling Frog	
Amphibians	Pseudonhn/ne quentheri	Crawling Toadlet	
Birde	Acanthiza anicalis		×
Birde	Acanthiza chr/sorrhoa		^
Birdo	Acanthiza inornata		
Dirdo	Acanthiza momala	Chestnut rumped Thernhill	X
Birde			
Dirde			
Dirde	Accipiter Ciriocephaius		
Dirde		Blowill Gosilawk	X
Dirde	Actocephalus australis		
Dirde		Australian Qualet nightion	
Dirde	Aegolineles cristatus		
Birds			
Birds	Anas gracilis		
Birds	Anas platyrnynchos		
Birds	Anas supercillosa		X
Birds	Anhinga novaehollandiae	Australasian Darter	
Birds	Anser anser	Greylag Goose	
Birds	Anthochaera carunculata	Red Wattlebird	X
Birds	Anthochaera lunulata	Western Little Wattlebird	X
Birds	Anthus australis	Australian Pipit	
Birds	Aphelocephala leucopsis	Southern Whiteface	
Birds	Apus pacificus	Pacific Swift	
Birds	Aquila audax	Wedge-tailed Eagle	X
Birds	Ardea alba	Great Egret	
Birds	Ardea pacifica	White-necked Heron	
Birds	Ardeotis australis	Australian Bustard	
Birds	Artamus cinereus	Black-faced Woodswallow	
Birds	Artamus cyanopterus	Dusky Woodswallow	
Birds	Artamus personatus	Masked Woodswallow	
Birds	Aythya australis	Hardhead	
Birds	Barnardius zonarius	Australian Ringneck	x
Birds	Biziura lobata	Musk Duck	х

Group	Scientific Name	Common Name	Recorded
Birds	Botaurus poiciloptilus	Australasian Bittern	
Birds	Bubulcus ibis	Cattle Egret	
Birds	Burhinus grallarius	Bush Stone-curlew	
Birds	Cacatua pastinator pastinator	Muir's Corella	
Birds	Cacatua sanguinea	Little Corella	
Birds	Cacomantis flabelliformis	Fan-tailed Cuckoo	x
Birds	Cairina moschata	Muscovy Duck	
Birds	Calamanthus campestris	Rufous Fieldwren	
Birds	Calidris acuminata	Sharp-tailed Sandpiper	
Birds	Calidris ferruginea	Curlew Sandpiper	
Birds	Calidris melanotos	Pectoral Sandpiper	
Birds	Calidris ruficollis	Red-necked Stint	
Birds	Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	x
Birds	Chalcites basalis	Horsfield's Bronze Cuckoo	
Birds	Chalcites lucidus	Shining Bronze Cuckoo	x
Birds	Charadrius ruficapillus	Red-capped Plover	
Birds	Chenonetta jubata	Australian Wood Duck	x
Birds	Chlidonias leucopterus	White-winged Black Tern	
Birds	Chroicocephalus novaehollandiae	Silver Gull	
Birds	Cincloramphus cruralis	Brown Songlark	
Birds	Cincloramphus mathewsi	Rufous Songlark	
Birds	Circus approximans	Swamp Harrier	
Birds	Circus assimilis	Spotted Harrier	
Birds	Cladorhynchus leucocephalus	Banded Stilt	
Birds	Climacteris rufus	Rufous Treecreeper	x
Birds	Colluricincla harmonica	Grey Shrikethrush	x
Birds	Columba livia	Domestic Pigeon	
Birds	Coracina maxima	Ground Cuckooshrike	
Birds	Coracina novaehollandiae	Black-faced Cuckooshrike	x
Birds	Corvus bennetti	Little Crow	
Birds	Corvus coronoides	Australian Raven	x
Birds	Corvus splendens	House Crow	
Birds	Coturnix pectoralis	Stubble Quail	
Birds	Cracticus nigrogularis	Pied Butcherbird	
Birds	Cracticus torquatus	Grey Butcherbird	
Birds	Cygnus atratus	Black Swan	
Birds	Cygnus olor	Mute Swan	
Birds	Dacelo novaeguineae	Laughing Kookaburra	x
Birds	Daphoenositta chrysoptera	Varied Sittella	x
Birds	Dendrocygna arcuata	Wandering Whistling Duck	
Birds	Dicaeum hirundinaceum	Mistletoebird	
Birds	Dromaius novaehollandiae	Emu	x
Birds	Egretta garzetta	Little Egret	
Birds	Egretta novaehollandiae	White-faced Heron	x
Birds	Egretta sacra	Eastern Reef Heron	
Birds	Elanus axillaris	Black-shouldered Kite	x
Birds	Elseyornis melanops	Black-fronted Dotterel	
Birds	Eolophus roseicapilla	Galah	
Birds	Eopsaltria griseogularis	Western Yellow Robin	x
Birds	Epthianura albifrons	White-fronted Chat	

Group	Scientific Name	Common Name	Recorded
Birds	Erythrogonys cinctus	Red-kneed Dotterel	
Birds	Eurostopodus argus	Spotted Nightjar	
Birds	Falco berigora	Brown Falcon	
Birds	Falco cenchroides	Australian Kestrel	
Birds	Falco hypoleucos	Grey Falcon	
Birds	Falco longipennis	Australian Hobby	
Birds	Falco peregrinus	Peregrine Falcon	
Birds	Falcunculus frontatus	Crested Shriketit	
Birds	Fulica atra	Eurasian Coot	x
Birds	Gallinula tenebrosa	Dusky Moorhen	
Birds	Gavicalis virescens	Singing Honeyeater	
Birds	Gervaone fusca	Western Gervgone	x
Birds	Gliciphila melanops	Tawny-crowned Honeveater	
Birds	Grallina cvanoleuca	Magpie-lark	x
Birds	Gvmnorhina tibicen	Australian Magpie	x
Birds	Haliaeetus leucogaster	White-bellied Sea-Fagle	~
Birds	Haliastur sphenurus	Whistling Kite	
Birds	Heteroscenes nallidus	Pallid Cuckoo	
Birds	Hieraaetus morphnoides	l ittle Fagle	
Birds	Himantonus himantonus	Black-winged Stilt	
Birds	Hirundo neovena	Welcome Swallow	
Birde		Barn Swallow	
Birde	Hypotaepidia philippensis	Buff banded Bail	
Birde			
Dirdo		Plack Bittorn	
Birdo		Miler Wingod Trillor	×
Birdo		Recific Cull	^
Birdo		Mallasfaul	
Birdo			
Birdo		Provin Honovostor	×
Dirdo		Square teiled Kite	X
Birds		Square-tailed Kite	
Birds	Malacomynchus membranaceus	Plink-eared Duck	
Birds	Malurus assimilis	Purple-backed Fairywren	
Birds	Malurus elegans	Red-winged Fairywren	X
Birds	Malurus puicherrimus		
Birds	Maiurus spiendens		X
Birds	Manorina flavigula		
Birds	Melanodryas cuculiata		
Birds	Melithreptus brevirostris	Brown-neaded Honeyeater	
Birds	Melithreptus chloropsis	Western White-naped Honeyeater	X
Birds	Melopsittacus undulatus	Budgerigar	
Birds	Merops ornatus	Rainbow Bee-eater	
Birds	Microcarbo melanoleucos	Little Pied Cormorant	
Birds	Microeca fascinans	Jacky Winter	
Birds	Motacilla cinerea	Grey Wagtail	
Birds	Myiagra inquieta	Restless Flycatcher	
Birds	Neophema elegans	Elegant Parrot	
Birds	Ninox boobook	Boobook Owl	
Birds	Ninox connivens	Barking Owl	
Birds	Numenius madagascariensis	Far Eastern Curlew	
Group	Scientific Name	Common Name	Recorded
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Birds	Numida meleagris	Helmeted Guineafowl	
Birds	Nycticorax caledonicus	Nankeen Night Heron	
Birds	Nymphicus hollandicus	Cockatiel	
Birds	Ocyphaps lophotes	Crested Pigeon	
Birds	Oxyura australis	Blue-billed Duck	
Birds	Pachycephala fuliginosa	Western Whistler	x
Birds	Pachycephala rufiventris	Rufous Whistler	x
Birds	Pandion haliaetus	Osprey	
Birds	Pardalotus punctatus	Spotted Pardalote	x
Birds	Pardalotus striatus	Striated Pardalote	x
Birds	Parvipsitta porphyrocephala	Purple-crowned Lorikeet	x
Birds	Pelecanus conspicillatus	Australian Pelican	
Birds	Petrochelidon ariel	Fairy Martin	
Birds	Petrochelidon nigricans	Tree Martin	
Birds	Petroica boodang	Scarlet Robin	x
Birds	Petroica goodenovii	Red-capped Robin	
Birds	Phalacrocorax carbo	Great Cormorant	
Birds	Phalacrocorax sulcirostris	Little Black Cormorant	
Birds	Phalacrocorax varius	Pied Cormorant	x
Birds	Phaps chalcoptera	Common Bronzewing	x
Birds	Phaps elegans	Brush Bronzewing	
Birds	Phylidonyris niger	White-cheeked Honeyeater	
Birds	Phylidonyris novaehollandiae	New Holland Honeyeater	x
Birds	Platalea flavipes	Yellow-billed Spoonbill	
Birds	Platalea regia	Royal Spoonbill	
Birds	Platycercus icterotis	Western Rosella	x
Birds	Plegadis falcinellus	Glossy Ibis	
Birds	Pluvialis fulva	Pacific Golden Plover	
Birds	Podargus strigoides	Tawny Frogmouth	x
Birds	Podiceps cristatus	Great Crested Grebe	
Birds	Poliocephalus poliocephalus	Hoary-headed Grebe	
Birds	Polytelis anthopeplus	Regent Parrot	
Birds	Pomatostomus superciliosus	White-browed Babbler	
Birds	Poodytes gramineus	Little Grassbird	
Birds	Porphyrio porphyrio	Purple Swamphen	x
Birds	Porzana fluminea	Australian Spotted Crake	
Birds	Psephotellus varius	Mulga Parrot	
Birds	Psophodes nigrogularis	Western Whipbird	
Birds	Ptilotula ornata	Yellow-plumed Honeyeater	
Birds	Purpureicephalus spurius	Red-capped Parrot	x
Birds	Quoyornis georgiana	White-breasted Robin	x
Birds	Recurvirostra novaehollandiae	Red-necked Avocet	
Birds	Rhipidura albiscapa	Grey Fantail	x
Birds	Rhipidura leucophrys	Willie Wagtail	x
Birds	Rostratula australis	Australian Painted Snipe	
Birds	Sericornis maculatus	Spotted Scrubwren	x
Birds	Smicrornis brevirostris	Weebill	
Birds	Spatula rhynchotis	Australasian Shoveler	
Birds	Spilopelia chinensis	Spotted Turtle Dove	
Birds	Spilopelia senegalensis	Laughing Turtle Dove	

BirdsStagonopleura oculataRed-eared FiretailxBirdsSitictonelta naevosaFreckled DuckIIIIBirdsSitipitrus malachurusSouthem Enu-wrenIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	Group	Scientific Name	Common Name	Recorded
BirdsStictoreta naevosaFreekled DuckInc.BirdsStiplurus malachurusSouthem Emu-wenInc.BirdsStrepera versicolorGrey CurravongInc.BirdsStrumus vulgarisCommon StarlingInc.BirdsStrumus vulgarisBrown QuailInc.BirdsTachybaptus novaehollandiaeAustraliasian GrebeInc.BirdsTadona tadomoidesAustralian Abera FinchInc.BirdsTadona tadomoidesAustralian Zebra FinchInc.BirdsThalasseus bergiGreater Crested TernInc.BirdsThinornis cucullatusHooded PloverInc.BirdsThreskiomis spinicollisStraw-necked IbisInc.BirdsTofiramphus sanctusSacred KingfisherxBirdsTrihonyx ventralisBlack-tailed NativehenInc.BirdsTringa glareolaWood SandpiperInc.BirdsTurdus merulaCommon BlackbirdInc.BirdsTurnix variusPainted ButtonquailInc.BirdsTurnix valusEastern Barn OwlInc.BirdsTurnix variusBanded LapwingInc.BirdsZanda baudiniiBaulin's CockatooxBirdsZanda bauloniiBaulor's CrakeInc.BirdsZanda bauloniiBaillon's CrakeInc.BirdsZanda bauloniiBaulor's CrakeInc.BirdsZanda bauloniiBaulor's CrakeInc.BirdsZanda bauloniiBa	Birds	Stagonopleura oculata	Red-eared Firetail	x
Birds Stipiturus malachurus Southem Emu-wren Birds Strapera versicolor Grey Currawong Birds Stumus vulgaris Common Starling Birds Stynoicus ypsilophora Brown Quail Birds Tachybaptus noveehollandiae Australian Shelduck Birds Taeniopygia castanotis Australian Shelduck Birds Taeniopygia castanotis Australian Shelduck Birds Thneskiomis molucca Australian White Ibis Birds Threskiomis spinicolitis Straw-necked Ibis Birds Trobonyx ventralis Black-tailed Nativehen Birds Tribonyx ventralis Black-tailed Nativehen Birds Tribonyx ventralis Black-tailed Nativehen Birds Turdus merula Common Greenshank Birds Turdus merula Common Blackbird Birds Turdus merula Common Greenshank	Birds	Stictonetta naevosa	Freckled Duck	
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MammalsBettongia penicillata ogilbyiBrush-tailed Bettong, WoylieMammalsCanis familiarisDingo, DogMammalsCapra hircusGoatMammalsCercartetus concinnusWestern Pygmy-possum, MundardaMammalsChalinolobus gouldiiGould's Wattled BatxMammalsChalinolobus morioChocolate Wattled BatxMammalsDama damaFallow DeerMammalsDasyurus geoffroiiChuditchMammalsFalsistrellus mackenzieiWestern FalsistrelleMammalsFelis catusCatxMammalsHydromys chrysogasterWater RatxMammalsIsoodon fusciventerQuendaxMammalsMacropus fuliginosus melanopsWestern Grey KangarooxMammalsMus musculusHouse MouseMammalsMus musculusHouse MouseMammalsNotamacropus eugenii derbianusTammar Wallabyx	Mammals	Austronomus australis	White-striped Free-tailed Bat	x
MammalsCanis familiarisDingo, DogMammalsCapra hircusGoatMammalsCercartetus concinnusWestern Pygmy-possum, MundardaMammalsChalinolobus gouldiiGould's Wattled BatxMammalsChalinolobus morioChocolate Wattled BatxMammalsDama damaFallow DeerMammalsDasyurus geoffroiiChuditchMammalsFalsistrellus mackenzieiWestern FalsistrelleMammalsFelis catusCatxMammalsHydromys chrysogasterWater RatxMammalsIsoodon fusciventerQuendaxMammalsMacropus fuliginosus melanopsWestern Grey KangarooxMammalsMus musculusHouse MouseMammalsMus musculusHouse MouseMammalsNotamacropus eugenii derbianusTammar Wallabyx	Mammals	Bettongia penicillata ogilbyi	Brush-tailed Bettong, Woylie	
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MammalsChalinolobus gouldiiGould's Wattled BatxMammalsChalinolobus morioChocolate Wattled BatxMammalsDama damaFallow DeerMammalsDasyurus geoffroiiChuditchMammalsFalsistrellus mackenzieiWestern FalsistrelleMammalsFelis catusCatxMammalsHydromys chrysogasterWater RatxMammalsIsoodon fusciventerQuendaxMammalsMacropus fuliginosus melanopsWestern Grey KangarooxMammalsMacrotis lagotisBilby, DalgyteMammalsMus musculusHouse MouseMammalsNotamacropus eugenii derbianusTammar Wallabyx	Mammals	Cercartetus concinnus	Western Pvgmv-possum, Mundarda	
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MammalsDama damaFallow DeerMammalsDasyurus geoffroiiChuditchMammalsFalsistrellus mackenzieiWestern FalsistrelleMammalsFelis catusCatMammalsFelis catusCatMammalsHydromys chrysogasterWater RatMammalsIsoodon fusciventerQuendaMammalsMacropus fuliginosus melanopsWestern Grey KangarooMammalsMacrotis lagotisBilby, DalgyteMammalsMus musculusHouse MouseMammalsMyrmecobius fasciatus fasciatusNumbat, WalpurtiMammalsNotamacropus eugenii derbianusTammar WallabyMammalsNotamacropus irmaWestern Brush Wallabyx	Mammals	Chalinolobus morio	Chocolate Wattled Bat	x
MammalsDasyurus geoffroiiChuditchMammalsFalsistrellus mackenzieiWestern FalsistrelleMammalsFelis catusCatxMammalsHydromys chrysogasterWater RatxMammalsIsoodon fusciventerQuendaxMammalsMacropus fuliginosus melanopsWestern Grey KangarooxMammalsMacrotis lagotisBilby, DalgyteMammalsMus musculusHouse MouseMammalsMotamacropus fasciatus fasciatusNumbat, WalpurtiMammalsNotamacropus eugenii derbianusTammar Wallabyx	Mammals	Dama dama	Fallow Deer	
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MammalsHydromys chrysogasterWater RatxMammalsIsoodon fusciventerQuendaxMammalsMacropus fuliginosus melanopsWestern Grey KangarooxMammalsMacrotis lagotisBilby, DalgyteMammalsMus musculusHouse MouseMammalsMyrmecobius fasciatus fasciatusNumbat, WalpurtiMammalsNotamacropus eugenii derbianusTammar Wallabyx	Mammals	Felis catus	Cat	x
MammalsIsoodon fusciventerQuendaxMammalsMacropus fuliginosus melanopsWestern Grey KangarooxMammalsMacrotis lagotisBilby, DalgyteMammalsMus musculusHouse MouseMammalsMyrmecobius fasciatus fasciatusNumbat, WalpurtiMammalsNotamacropus eugenii derbianusTammar Wallabyx	Mammals	Hvdromvs chrvsogaster	Water Rat	x
MammalsMacropus fuliginosus melanopsWestern Grey KangarooxMammalsMacrotis lagotisBilby, DalgyteMammalsMus musculusHouse MouseMammalsMyrmecobius fasciatus fasciatusNumbat, WalpurtiMammalsNotamacropus eugenii derbianusTammar WallabyMammalsNotamacropus irmaWestern Brush Wallaby	Mammals	Isoodon fusciventer	Quenda	x
MammalsMacrotis lagotisBilby, DalgyteMammalsMus musculusHouse MouseMammalsMyrmecobius fasciatus fasciatusNumbat, WalpurtiMammalsNotamacropus eugenii derbianusTammar WallabyMammalsNotamacropus irmaWestern Brush Wallabyx	Mammals	Macropus fuliginosus melanops	Western Grev Kangaroo	x
Mammals Mus musculus House Mouse Mammals Myrmecobius fasciatus fasciatus Numbat, Walpurti Mammals Notamacropus eugenii derbianus Tammar Wallaby Mammals Notamacropus irma Western Brush Wallaby	Mammals	Macrotis lagotis	Bilby, Dalgyte	
MammalsMyrmecobius fasciatus fasciatusNumbat, WalpurtiMammalsNotamacropus eugenii derbianusTammar WallabyMammalsNotamacropus irmaWestern Brush Wallabyx	Mammals	Mus musculus	House Mouse	
Mammals Notamacropus eugenii derbianus Tammar Wallaby Mammals Notamacropus irma Western Brush Wallaby x	Mammals	Myrmecobius fasciatus fasciatus	Numbat, Walpurti	
Mammals Notamacropus irma Western Brush Wallaby x	Mammals	Notamacropus eugenii derbianus	Tammar Wallaby	
	Mammals	Notamacropus irma	Western Brush Wallaby	x
Mammals Nyctophilus geoffroyi geoffroyi Lesser Long-eared Bat x	Mammals	Nyctophilus geoffrovi geoffrovi	Lesser Long-eared Bat	x
Mammals Nyctophilus holtorum Holt's Long-eared Bat	Mammals	Nyctophilus holtorum	Holt's Long-eared Bat	

Group	Scientific Name	Common Name	Recorded
Mammals	Nyctophilus major major	Greater Long-eared Bat	Х
Mammals	Oryctolagus cuniculus	Rabbit	х
Mammals	Ozimops kitcheneri	Western Free-tailed Bat	х
Mammals	Phascogale calura	Red-tailed Phascogale	
Mammals	Phascogale tapoatafa wambenger	Wambenger Brush-tailed Phascogale	
Mammals	Pseudocheirus occidentalis	Western Ringtail Possum	
Mammals	Rattus fuscipes fuscipes	Western Bush Rat	Х
Mammals	Rattus rattus	Black Rat	х
Mammals	Setonix brachyurus	Quokka	
Mammals	Sminthopsis dolichura	Little long-tailed Dunnart	
Mammals	Sminthopsis fuliginosa fuliginosa	Grey-bellied Dunnart	
Mammals	Sminthopsis gilberti	Gilbert's Dunnart	
Mammals	Sus scrofa	Pig	
Mammals	Tachyglossus aculeatus acanthion	Short-beaked Echidna	
Mammals	Tarsipes rostratus	Honey Possum, Noolbenger	
Mammals	Trichosurus vulpecula hypoleucus	Common Brushtail Possum, Koomal	Х
Mammals	Vespadelus regulus	Southern Forest Bat	Х
Mammals	Vulpes vulpes	Red Fox	Х
Reptiles	Acritoscincus trilineatus	Western Three-Lined Skink	Х
Reptiles	Anilios australis		
Reptiles	Anilios pinguis		
Reptiles	Aprasia pulchella		
Reptiles	Aprasia repens		
Reptiles	Chelodina colliei	South-western snake-necked turtle	х
Reptiles	Christinus marmoratus	Marbled Gecko	х
Reptiles	Cryptoblepharus buchananii		
Reptiles	Ctenotus delli		
Reptiles	Ctenotus impar		
Reptiles	Ctenotus labillardieri		
Reptiles	Diplodactylus calcicolus	South Coast Gecko	
Reptiles	Diplodactylus lateroides	Speckled Stone Gecko	
Reptiles	Echiopsis curta	Bardick	
Reptiles	Egernia kingii	King's Skink	
Reptiles	Egernia napoleonis	South-western Crevice Skink	х
Reptiles	Elapognathus coronatus	Crowned Snake	
Reptiles	Hemiergis gracilipes		
Reptiles	Hemiergis initialis initialis		
Reptiles	Hemiergis peronii	Four-toed Mulch Skink	х
Reptiles	Hemiergis quadrilineatus		
Reptiles	Lerista distinguenda		х
Reptiles	Lerista elegans		
Reptiles	Lerista microtis microtis		
Reptiles	Liopholis pulchra pulchra		
Reptiles	Lissolepis luctuosa	Western Swamp Skink	
Reptiles	Menetia greyii		
Reptiles	Morelia spilota imbricata		
Reptiles	Morethia lineoocellata		
Reptiles	Morethia obscura		х
Reptiles	Notechis scutatus	Tiger Snake	
Reptiles	Pogona minor minor	Western Bearded Dragon	

Group	Scientific Name	Common Name	Recorded
Reptiles	Pseudonaja affinis affinis		
Reptiles	Rhinoplocephalus bicolor	Square-nosed Snake	
Reptiles	Simoselaps bertholdi	Jan's Banded Snake	
Reptiles	Suta gouldii	Gould's Hooded Snake	
Reptiles	Suta nigriceps		
Reptiles	Tiliqua occipitalis	Western Bluetongue	
Reptiles	Tiliqua rugosa rugosa	Bobtail	x
Reptiles	Underwoodisaurus milii	Southern Barking Gecko	
Reptiles	Varanus gouldii	Bungarra or Sand Goanna	
Reptiles	Varanus rosenbergi	Heath Goanna	х
Reptiles	Varanus tristis	Racehorse Goanna	

Species by Site Matrices

Species by Habitat Matrix - Avifauna

Taxon Name	Common Name	Drainage	Forest	Paddock	Plantation
Acanthiza apicalis	Inland Thornbill	x	х		
Acanthiza inornata	Western Thornbill	x	х		
Accipiter fasciatus	Brown Goshawk		х		
Anas superciliosa	Pacific Black Duck	x			
Anthochaera carunculata	Red Wattlebird	x	х	x	
Anthochaera lunulata	Western Little Wattlebird	x			
Aquila audax	Wedge-tailed Eagle		х		
Barnardius zonarius	Australian Ringneck	x	х	х	
Biziura lobata	Musk Duck	x			
Cacomantis flabelliformis	Fan-tailed Cuckoo		х		
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	x	х		
Chalcites lucidus	Shining Bronze Cuckoo	x	х		
Chenonetta jubata	Australian Wood Duck	x	х	x	
Climacteris rufus	Rufous Treecreeper	x	х		
Colluricincla harmonica	Grey Shrikethrush	x	х		
Coracina novaehollandiae	Black-faced Cuckooshrike	x	х		
Corvus coronoides	Australian Raven	x	х	x	
Dacelo novaeguineae	Laughing Kookaburra	x	х		
Daphoenositta chrysoptera	Varied Sittella	x	х		
Dromaius novaehollandiae	Emu	x	х		
Egretta novaehollandiae	White-faced Heron	x		x	
Elanus axillaris	Black-shouldered Kite				x
Eopsaltria griseogularis	Western Yellow Robin	x	х		
Fulica atra	Eurasian Coot	x			
Gerygone fusca	Western Gerygone	x	х		
Grallina cyanoleuca	Magpie-lark	x			
Gymnorhina tibicen	Australian Magpie	x	х	x	
Lalage tricolor	White-winged triller	x			
Lichmera indistincta	Brown Honeyeater	x	х		
Malurus elegans	Red-winged Fairywren	x	х		
Malurus splendens	Splendid Fairywren	х	х		
Melithreptus chloropsis	Western White-naped Honeyeater	х	х		
Pachycephala fuliginosa occidentalis	Western Golden Whistler	x	х		
Pachycephala rufiventris	Rufous Whistler	х			
Pardalotus punctatus	Spotted Pardalote	x	х		
Pardalotus striatus	Striated Pardalote	х	х		
Parvipsitta porphyrocephala	Purple-crowned Lorikeet	x	х		
Petroica boodang	Scarlet Robin	x	х		
Phalacrocorax varius	Pied Cormorant	x			
Phaps chalcoptera	Common Bronzewing	х	х		
Phylidonyris novaehollandiae	New Holland Honeyeater	х			х
Platycercus icterotis	Western Rosella	x	х		
Podargus strigoides	Tawny Frogmouth	x			
Porphyrio melanotus	Australasian Swamphen		х		
Purpureicephalus spurius	Red-capped Parrot	x	х		
Quoyornis georgianus	White-breasted Robin	x			
Rhipidura albiscapa	Grey Fantail	x	х		x
Rhipidura leucophrys	Willie Wagtail	x			
Sericornis maculatus	Spotted Scrubwren	x	x		x
Stagonopleura oculata	Red-eared Firetail	x			
Todiramphus sanctus	Sacred Kingfisher	x			
Zanda baudinii	Baudin's Cockatoo	x	x		
Zanda latirostris	Carnaby's Cockatoo		x		
Zosterops lateralis	Grey-breasted White-eye	х			

Group	Scientific Name	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5
Amphibian	Crinia georgiana	Quacking Frog		х			x
Amphibian	Crinia glauerti	Clicking Frog		х			
Amphibian	Geocrinia leai	Ticking Frog		х	х		
Amphibian	Heleioporus eyrei	Moaning Frog		х			
Amphibian	Limnodynastes dorsalis	Western Banjo Frog	х		x	х	x
Amphibian	Litoria adelaidensis	Slender Tree Frog		х			
Amphibian	Litoria moorei	Motorbike Frog		х			
Mammal	Isoodon fusciventer	Quenda		х			
Mammal	Rattus fuscipes fuscipes	Western Bush Rat		х			
Reptile	Acritoscincus trilineatus	Western Three-Lined Skink		х	x		
Reptile	Christinus marmoratus	Marbled Gecko					х
Reptile	Egernia napoleonis	South-western Crevice Skink	х	х	х	х	x
Reptile	Hemiergis peronii	Four-toed Mulch Skink	х	х	x	x	x
Reptile	Lerista distinguenda		х	х		х	
Reptile	Morethia obscura		х	х	x		
Reptile	Tiliqua rugosa rugosa	Bobtail		х			

Species by Site Matrix - Trapped Fauna Assemblage

Species recorded by method

Group	Scientific Name	Common Name	Bat Detector	Bird census - Call	Bird census - Observed	Camera	Nocturnal survey - Call	Nocturnal survey - Observed	Opportunistic - Call	Opportunistic - Hand caught	Opportunistic - Observed	Secondary Evidence	Trapping - Elliot	Trapping - Funnel	Trapping - Pit-fall
Amphibian	Crinia georgiana	Quacking Frog					X				х			x	x
Amphibian	Crinia glauerti	Clicking Frog		x			x		x					x	x
Amphibian	Geocrinia leai	Ticking Frog					x	x					x	x	x
Amphibian	Heleioporus evrei	Moaning Frog												x	x
Amphibian	Limnodynastes dorsalis	Western Banio Frog					x		X		x				x
Amphibian	Litoria adelaidensis	Slender Tree Frog					x		X	x	x				x
Amphibian	Litoria moorei	Motorbike Frog		x			X		X					x	
Bird	Acanthiza apicalis	Inland Thornbill		x	х						х				
Bird	Acanthiza inornata	Western Thornbill		x	x						x				-
Bird	Accipiter fasciatus	Brown Goshawk									x				
Bird	Anas superciliosa	Pacific Black Duck		x	x	x			x		x				
Bird	Anthochaera carunculata	Red Wattlebird		x	x				X		x				-
Bird	Anthochaera lunulata	Western Little Wattlebird									x				
Bird	Aquila audax	Wedge-tailed Eagle			x						x				1
Bird	Barnardius zonarius	Australian Ringneck		x	x			x	x		x				-
Bird	Biziura lobata	Musk Duck									x				1
Bird	Cacomantis flabelliformis	Fan-tailed Cuckoo									x				1
Bird	Calvptorbynchus banksii naso	Forest Red-tailed Black Cockatoo		x	x						x	F			
Bird	Chalcites lucidus	Shining Bronze Cuckoo		x	x				×		~				1
Bird	Chenonetta jubata	Australian Wood Duck		x	~				^ ^		x				1
Bird	Climacteris rufus	Rufous Treecreeper		x		×			×		x				
Bird	Colluricincia harmonica	Grev Shrikethrush		x	x	~			x		x				
Bird	Coracina novaehollandiae	Black-faced Cuckooshrike		x	x				^		~				
Bird	Convus coronoides	Australian Raven		×	^		×		×		Y				
Bird	Dacelo povaeguipeae			×	×		×		×		×				-
Bird	Daphoenositta chrysontera	Varied Sittella		×	×		^		^		×				
Dird	Daprideridanta chi yaoptera	Emu		^	^			~			^	6			-
Bird	Egretta povaebollandiae	White faced Heron			×			^			×	5			-
Bird	Elanue avillarie	Black-shouldered Kite			^						×				-
Bird	Eonsaltria ariseogularis	Western Vellow Robin		×	×	v					×				+
Bird	Eulios atra	Furacian Cost		~	X						X				
Dird	Converse fuere	Western Converse		×	~						~				+
Bird	Cralling evenelouse	Magpia lark		^	×				^		×				-
Bird	Cumporbing tibicon	Australian Magnia		×	×	~	~				×				
Bird	Gynnomina ubicen	Musicalian Magple		~	~	^	^		^		×				+
Bird	Lalage incolor	Rrown Honovostor		~											
Dird	Lichmera indisuncia	Brown Honeyeater		X					X						
Dird	Malurus elegans	Red-winged Fairywren		X	X				X		X				
Bird	Maiurus spiendens	Spiendid Fairywren		X	X						X				
Dird	Deshueenhele fuliginges assidentalia	Western Calden Whistler		~	×						×				
Dird	Pachycephala fuliginosa occidentalis	Reference Whiteler		X	X				X		X				
Dird	Pachycephala fullventris	Rulous Whistier		X											
Bird	Pardalotus purictatus	Spotled Pardalote		~	~		~		× ×		×				
Bird	Parulaiolus stilaius	Burple growped Larikoot		~	~		^		^						
Bird	Patrojos boodong	Societ Pobin		^	~						×				
Bird	Phalacrocoray varius	Died Cormorant	<u> </u>	1	^				1		~		1	1	+
Dird	Phalaciocorax varius	Pied Combrant									X				
Dird	Phaps chalcoplera	Common Bronzewing		X	X	× *					X				
Dird	Province interestion	Western Recelle		×	×			X	×		X				+
Dird	Platycel cus ictel olis	Teursu Freeme outh		*	X										-
Dird	Podargus strigoldes	Tawny Floghouth		X											
Bird	Purpuraiconholus apurius	Rustialasian Swamphen		~	~						×				
Dird	Purpureicepriaius spurius	Red-capped Parrol		X	X						X				
Dird	Quoyonnis georgianus	White-breasted Robin			X										
Bird	Rhipidura albiscapa	Grey Fantali		X	X			X	X		X				
Bird	Rnipidura ieucophrys	vville vvagtali		X	X			X			X				-
Dird	Senconiis maculatus	Spotted ScrubWren	L	<u> </u>	X						X				+
Dird	Stagonopieura oculata	Reu-eared Firetall			X										+
Bird	Tourianiphus sanctus	Sacred Kingrisher									X				+
Bird	Zanda baudinii	Daudin's Cockatoo												1	+
Bird	Zanda latirostris	Carnaby's Cockatoo										F			
Bird	∠osterops lateralis	Grey-breasted White-eye			x	I	-				X				+
Mammal	Austronomus australis	White-striped Free-tailed Bat	×												
Mammal	Chalinolobus gouldii	Gould's Wattled Bat	×												
Mammal	Chalinolobus morio	Chocolate Wattled Bat	x												
Mammal	reiis catus	Cat				X									+
wammal	myuromys cnrysogaster	water Rat	1	1	1	Х	1	1	1	1	1	1 1	1	1	1

Group	Scientific Name	Common Name	Bat Detector	Bird census - Call	Bird census - Observed	Camera	Nocturnal survey - Call	Nocturnal survey - Observed	Opportunistic - Call	Opportunistic - Hand caught	Opportunistic - Observed	Secondary Evidence	Trapping - Elliot	Trapping - Funnel	Trapping - Pit-fall
Mammal	Isoodon fusciventer	Quenda				х						D	x		
Mammal	Macropus fuliginosus melanops	Western Grey Kangaroo				х					х				
Mammal	Notamacropus irma	Western Brush Wallaby									х				
Mammal	Nyctophilus geoffroyi geoffroyi	Lesser Long-eared Bat	х												
Mammal	Nyctophilus major major	Greater Long-eared Bat	x												
Mammal	Oryctolagus cuniculus	Rabbit									х	B,S			
Mammal	Ozimops kitcheneri	Western Free-tailed Bat	x												
Mammal	Rattus fuscipes fuscipes	Western Bush Rat				х							x		
Mammal	Rattus rattus	Black Rat				x									
Mammal	Trichosurus vulpecula	Common Brushtail Possum				х		х				S			
Mammal	Vespadelus regulus	Southern Forest Bat	x												
Mammal	Vulpes vulpes	Red Fox				х						S			
Reptile	Acritoscincus trilineatus	Western Three-Lined Skink												x	x
Reptile	Chelodina colliei	South-western snake-necked turtle						x			х	R			
Reptile	Christinus marmoratus	Marbled Gecko													x
Reptile	Egernia napoleonis	South-western Crevice Skink				х					х			x	х
Reptile	Hemiergis peronii	Lowlands Earless Skink									x			x	x
Reptile	Lerista distinguenda	Dwarf Four-Toed Slider												x	х
Reptile	Morethia obscura	Shrubland Morethia Skink												x	x
Reptile	Tiliqua rugosa rugosa	Bobtail				x					x		x		x
Reptile	Varanus rosenbergi	Heath Goanna			х	х					х	Т			1

F = feeding sign

S = scats

B = burrows

R = remains

T=tracks

D= Diggings

Examples of time vs frequency graphs for the seven species of bats recorded within the study area

Austronomus australis



Chalinolobus gouldii



Chalinolobus morio



Nyctophilus geoffroyi geoffroyi



Nyctophilus major major



Ozimops kitcheneri



Details of tree hollows assessed within the study area.

Waypoint	Date Assessed	Category	Category (DAWE 2022)	DBH	Tree species	Easting	Northing
AAT- 1	28/11/2023	Potentially suitable	Potentially suitable		Jarrah	417379	6255046
AAT- 2	29/11/2023	Potentially suitable	Potentially suitable	85	Marri	416739	6254132
AAT- 4	29/11/2023	Potentially suitable	Potentially suitable	83	Jarrah	416406	6254039
AAT- 5	29/11/2023	Potentially suitable	Potentially suitable	97	Jarrah	416686	6254871
AAT- 6	29/11/2023	Potentially suitable	Potentially suitable	95	Marri	416715	6254842
AAT- 7	29/11/2023	Potentially suitable	Potentially suitable	84	Jarrah	416981	6255222
AAT- 8	30/11/2023	Potentially suitable	Potentially suitable	88	Jarrah	415828	6254013
AAT- 10	30/11/2023	Potentially suitable	Potentially suitable	70	Marri	416360	6253948
AAT- 11	30/11/2023	Potentially suitable	Potentially suitable	95	Marri	416379	6253839
AAT- 12	30/11/2023	Potentially suitable	Potentially suitable	85	Jarrah	416022	6254186
AAT- 13	30/11/2023	Potentially suitable	Potentially suitable	83	Jarrah	415782	6255138
AAT- 14	30/11/2023	Potentially suitable	Potentially suitable	80	Jarrah	415873	6255180
AAT- 15	30/11/2023	Potentially suitable	Potentially suitable	88	Jarrah	415784	6255373
AAT- 16	1/12/2023	Potentially suitable	Potentially suitable	135	Jarrah	416729	6254539
AAT- 19	1/12/2023	Potentially suitable	Potentially suitable	80	Jarrah	416302	6255053
AAT- 20	2/12/2023	Potentially suitable	Potentially suitable	110	Jarrah	415963	6254814
AAT- 21	2/12/2023	Potentially suitable	Potentially suitable	115	Jarrah	415950	6254811
AAT- 22	3/12/2023	Potentially suitable	Potentially suitable	90	Marri	416623	6253747
AAT- 24	3/12/2023	Potentially suitable	Potentially suitable	96	Jarrah	416668	6253749
AAT- 26	3/12/2023	Potentially suitable	Potentially suitable	130	Marri	416662	6253202
AAT- 27	4/12/2023	Potentially suitable	Potentially suitable	80	Jarrah	416996	6254582
AAT- 28	4/12/2023	Potentially suitable	Potentially suitable	110	Jarrah	417267	6254834
AAT- 29	4/12/2023	Potentially suitable	Potentially suitable	65	Jarrah	417195	6255022
AAT- 31	5/12/2023	Potentially suitable	Potentially suitable	80	Marri	416869	6252243
AAT- 32	5/12/2023	Potentially suitable	Potentially suitable	75	Marri	417170	6253232
NZT- 10	4/10/2023	Potentially suitable	Potentially suitable		Jarrah	415347	6254679
NZT- 11	4/10/2023	Potentially suitable	Potentially suitable		Jarrah	415439	6255181
NZT- 12	4/10/2023	Potentially suitable	Potentially suitable		Jarrah	415416	6255183
NZT- 13	4/10/2023	Potentially suitable	Potentially suitable		Marri	415416	6255255
JBT-05	1/12/2023	Potentially suitable	Potentially suitable	110	Jarrah	417188	6253452
JBT-01	1/12/2023	Potentially suitable	Potentially suitable	125	Marri	417203	6253873
JBT-02	1/12/2023	Potentially suitable	Potentially suitable	110	Marri	417269	6253770

Waypoint	Date Assessed	Category	Category (DAWE 2022)	DBH	Tree species	Easting	Northing
JB-12	3/12/2023	Potentially suitable	Potentially suitable	95	Dead	416868	6252249
JBT-13	3/12/2023	Potentially suitable	Potentially suitable	95	Flooded Gum	416865	6252213
JBT-03	1/12/2023	Potentially suitable	Potentially suitable	150	Jarrah	417116	6253701
JBT-09	3/12/2023	Potentially suitable	Potentially suitable	90	Jarrah	417071	6253391
JBT-10	3/12/2023	Potentially suitable	Potentially suitable	155	Jarrah	416982	6253769
JBT-08	3/12/2023	Potentially suitable	Potentially suitable	150	Jarrah	417008	6253571
AAT- 3	29/11/2023	Suitable	Suitable	70	Jarrah	416368	6254434
AAT- 9	30/11/2023	Suitable	Suitable	92	Dead	416297	6253926
AAT- 17	1/12/2023	Suitable	Suitable	85	Marri	416642	6253430
AAT- 18	1/12/2023	Suitable	Suitable	75	Marri	416605	6253471
AAT- 23	3/12/2023	Suitable	Suitable	81	Marri	416663	6253783
AAT- 25	3/12/2023	Suitable	Suitable	70	Marri	416675	6253150
NZT- 58	5/10/2023	Suitable	Suitable	90	Jarrah	415466	6254583
JBT-11	3/12/2023	Suitable	Suitable	130	Marri	416904	6253774
AAT- 30	4/12/2023	Unsuitable	Potentially suitable		Marri	417437	6253392
JBT-07	1/12/2023	Unsuitable	Potentially suitable	120	Marri	417469	6253295
6905	1/12/2023	Unsuitable	Potentially suitable		Marri	417061	6253833
6907	1/12/2023	Unsuitable	Potentially suitable		Marri	417188	6253850
6909	1/12/2023	Unsuitable	Potentially suitable		Marri	417159	6253600
6910	1/12/2023	Unsuitable	Potentially suitable		Marri	417384	6253560
6913	1/12/2023	Unsuitable	Potentially suitable		Marri	417522	6253753

Species accumulation curve for the reptiles and amphibians

Amphibians



Reptiles

