Black Cockatoo Habitat Assessment Greenbushes Operations - Upcoming Clearing Approvals

Prepared for Talison Lithium Australia
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EXECUTIVE SUMMARY

Onshore Environmental Consultants Pty Ltd (Onshore Environmental) completed a black cockatoo habitat assessment across eleven blocks of native vegetation covering 47.75 hectares (ha) at the Greenbushes Mine between the 28th of March and the 5th of April 2024; herein this is referred to as the study area. The study area is within the distribution zone of three black cockatoo species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (BC Act):

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

There were two fauna habitat types recorded within the study area. Jarrah/Marri Forest on lateritic hill slopes and hill crests was the dominant habitat occurring over 27.0 ha (57% of the study area). The wetlands and drainage flats habitat occurred over 10.0 ha (21% of the study area) restricted to both sides of Spring Gully Road in the northern sector of the study area, and several minor drainage lines in the eastern sector of the study area. The majority of the study area was heavily impacted by disturbance related to active and historical mining operations, native rehabilitation, roads and other disturbances, with remnant vegetation condition rated as good or degraded.

The Forest Red-tailed Black Cockatoo was common within the study area, directly observed at eight locations with foraging evidence recorded at a further 34 locations. Baudin's Black Cockatoo was observed at one location outside the northern boundary of the study area, with foraging residue recorded at two locations within the eastern sector of the study area. Evidence of Carnaby's Black Cockatoo was restricted to one direct observation outside the northern boundary of the study area.

Seven trees recorded from the study area supported a hollow that was considered *suitable* for nesting by black cockatoos. However, there was no evidence of these hollows being actively or historically used for nesting. The density of potential habitat trees[1] within the study area averaged 30.3 trees per ha, which is high relative to previous assessments in the wider Greenbushes State Forest where tree density ranged from 10.6 to 21.7 trees per ha (Onshore Environmental 2018).

There were several water sources occurring within the study area (Austin's and South Hampton Dams) and nearby (Schwenke's and Cowan Dam) that may be utilised by black cockatoos. Trees occurring within close proximity to these dams represent potential roosting habitat.

[1] Diameter at breast height (DBH) >50 cm

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1.0 INTRODUCTION

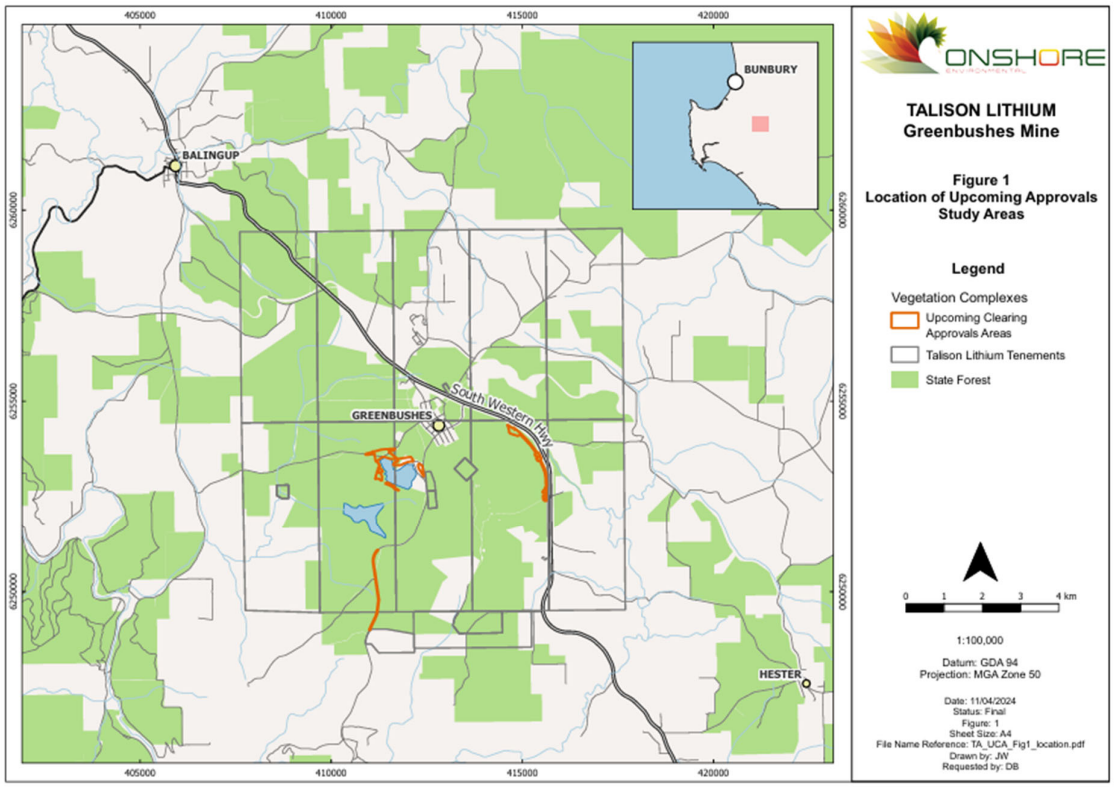
Talison is a Western Australian mining company with operations based adjacent to the town of Greenbushes in south-west Western Australia. The Greenbushes Mine is located approximately 250 km south of Perth and 80 km south-east of Bunbury (Figure 1). The site comprises a number of open cut mining operations for tantalum, tin and spodumene (lithium). An underground tantalum operation has also been developed but is currently under care and maintenance. The Greenbushes pegmatite 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.

Longer term mine planning has identified the requirement for further clearing at eleven native vegetation blocks covering a total of 47.75 hectares (ha). This includes four areas located east of Floyd's Waste Dump (12.50 ha), two areas along Maranup Ford Road to the south-west of the Mine Development Envelope (MDE) (4.34 ha), and five areas adjacent to Austin's and South Hampton Dams inside the north-west sector of the MDE (30.57 ha). There have been eleven vertebrate fauna surveys with a black cockatoo component completed at the Greenbushes Mine between 2011 and 2024. Cumulatively, these previous surveys intersect the major portion of the study area. However, a meeting in March 2024 with the Department of Climate Change, Energy, the Environment and Water (DCCEEW) regarding Talison's upcoming clearing approvals emphasised the requirement for ecological survey data to be maintained within a five year timeframe.

Subsequently, Onshore Environmental was commissioned by Talison to undertake a black cockatoo habitat assessment within the study area in early April 2024 to ensure survey data remained current. The study area is within the distribution zone of Carnaby's Black Cockatoo, Baudin's Black Cockatoo and Forest Red-tailed Black Cockatoo, which are listed as rare or likely to become extinct under the Western Australian BC Act, and have been given the status of Endangered and Vulnerable under the Commonwealth EPBC Act[2]. As per the referral guidelines for the three WA threatened black cockatoo species (DCCEEW 2022), a habitat assessment was undertaken within the study area. This assessment primarily aimed to identify the presence of breeding habitat (i.e. known, suitable, or potential nesting trees), and additionally to assess foraging and night roosting habitat potential within the study area.

[2] Conservation codes are listed in Appendix 1.

Figure 1 Location of the study area.



2.0 EXISTING ENVIRONMENT

2.1 Climate

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 nearby town of Bridgetown is 726.8 mm (approximately 10 km south-east of the study area) (Bureau of Meteorology [BOM] 2024), with most falls occurring during the winter months of June and July associated with cold fronts moving across the south-west of Western Australia. The rainfall total at Bridgetown for the three and six month periods prior to the early April 2024 field survey were 5% and 48% of the long term average respectively (Figure 2). The below average rainfall and Autumn timing for the field survey resulted in very dry seasonal conditions.

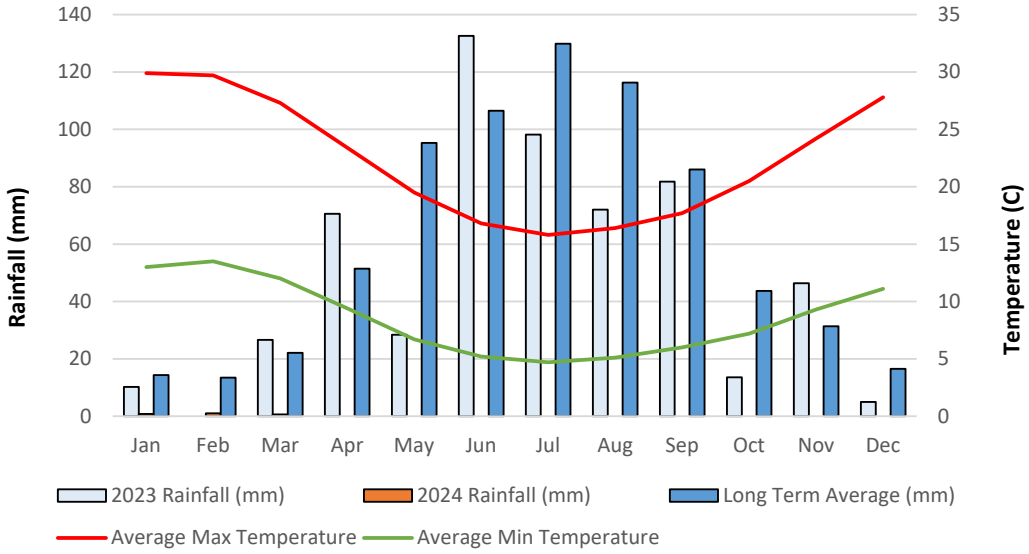


Figure 2 Rainfall (2023 and January-March 2024) and temperature data from the Bridgetown Weather Station (BOM 2024).

2.2 Biogeographic Regions

The study area is located within the Southern Jarrah Forest (JF2) sub-region of the Interim Biogeographic Regionalisation for Australia (IBRA7). 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 (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 in the Greenbushes region are state forest, residential, mining and agriculture. The study area intersects the Greenbushes State Forest with the majority excised for the current MDE. The two areas fringing Maranup Ford Road in the south-west sector of the study area occur outside of the MDE. Nearby towns include Bridgetown (10 km to the south-east) and Balingup (10 km to the north-west).

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.

The geology of the Greenbushes area is described as Archean granite of the Yilgarn Block (Wilde and Walker 1982) and the major soil types have been mapped by Tille (1961). The study area intersects two subsystems, all of the Darling Plateau system within the Western Darling Range zone:

- Dwellingup subsystem (DW) - broad, undulating lateritic divides with gravels and sands; and
- Yarragil (YG) - minor valleys in lateritic terrain with gentle to low slopes and swampy floors. Soils are mainly loamy gravels and sandy gravels with some loamy earths and deep sands.

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 km^2, of which 18,715 km^2 (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, Leucopogon, Macrozamia, Bossiaea, Daviesia, Grevillea, Patersonia, Styphelia* and *Kennedia.*

3.0 METHODOLOGY

3.1 Scope

The broad objective of the survey was to conduct a targeted investigation into the status of black cockatoos within the study area. This included assessing their presence within the study area and the extent and condition of foraging, breeding and roosting habitat.

Key components of the approach to achieving these objectives were to:

- Conduct desktop searches of Commonwealth and State fauna databases to identify which black cockatoo species were likely to occur and provide information on known roost sites.
- Undertake field investigations to:
    - assess the presence and abundance of black cockatoos within the study area through direct observation or foraging evidence;
    - develop descriptions of the areas that provide habitat for black cockatoos;
    - assess known, suitable and potential nesting trees for black cockatoos; and
    - evaluate foraging habitat for black cockatoos by using relevant assessment tools.

3.2 Legislation and Guidance Statements

The black cockatoo habitat assessment 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:

- DEWHA (2010) Survey Guidelines for Australia's Threatened Birds; and
- Department of Agriculture, Water and Environment (DAWE 2022) Referral guidelines for three WA threatened black cockatoo species.

3.3 Survey Methodology

The field survey was undertaken by Principal Ecologist Ms Jessica Waters and Ecologist Mr Thomas Mott on the 28th of March and between the 2nd and 5th of April 2024. The field assessment aimed to document ecological values for Carnaby's, Baudin's and Forest Red-tailed Black Cockatoos (referred to collectively as black cockatoos) within the study area, based on the definitions of breeding habitat, foraging habitat, and night roosting habitat as per the EPBC Act referral guidelines for black cockatoos (DAWE 2022).

3.3.1 Assessment of 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 has 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 1). 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 30 cm or greater for *Eucalyptus wandoo)*. Due to the large size of the study area all trees >50 cm were not identified and marked. 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 marked 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 chewed 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. 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 1).

Additionally, in order to determine approximate densities of potential future breeding habitat (i.e. trees with a DBH ≥50 cm, or ≥30 cm for *Eucalyptus wandoo*), tree counts were conducted at randomly located points within 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 1 Ranking 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.	Potential nesting trees	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	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.		

3.3.2 Assessment of Foraging Habitat

Vegetation within the study area was assessed for foraging value. Black cockatoos forage widely in suitable vegetation in the southwest region and leave distinctive marks on dropped feeding material such as Marri fruit. Targeted searches were made for these signs throughout the study area, and the location of recent feeding residue was recorded.

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.

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 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 2):

- 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.

Offset Habitat Scoring System - DCCEEW in consultation with species experts in Western Australia

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.

3.3.3 Assessment 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).

3.4 Constraints

The survey provides an assessment at the time of survey with no seasonal component. The survey was conducted within the recommended survey timing for assessment of breeding and foraging habitat for black cockatoos (DAWE 2022). Black cockatoos may utilise or investigate hollows at any time, and while there may be no evidence of them currently using hollows 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 suitable or known hollows within the study area (Whitford 2002). Various characteristics of the hollow may not be visible from the ground including the internal dimensions, opening size, obstructions, and signs of use. Additionally, hollows within trees may not be visible from ground level due to orientation or may be obstructed by branches and surrounding trees. Where possible a drone was utilised to further investigate hollows if required. The study area was extensively ground truthed, however all potential nesting trees over 50 cm DBH were not marked. The focus of the survey was to identify trees that were likely to contain suitable or known nesting hollows. Tree density assessments were undertaken to provide an estimate of the density of potential nesting trees occurring within the study area.

No significant access or timing restrictions impacted the survey, and the study area was adequately surveyed.

4.0 RESULTS

4.1 Previous Black Cockatoo Surveys

There have been eleven vertebrate fauna surveys with a black cockatoo survey component completed at the Greenbushes Mine between 2011 and 2024. Results from these surveys are summarised in Table 2. The surveys confirm that the Forest Red-tailed Black Cockatoo is encountered most frequently and is present year-round in the Greenbushes area. 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 2) 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 five 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 2). 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 four 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.

Table 2 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 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 nesting trees
Black Cockatoo Survey, Talison Mining, Greenbushes (Kirkby 2018)	22 January - 12 February 2018	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 nesting trees identified, including 24 known nesting hollows (showing signs of use)
Harewood (2018)	11th, 13th, 15th and 19th June 2018	Not reported	Not reported	14 known nesting trees (chewed) 16 suitable nesting trees
Greenbushes Targeted Vertebrate and SRE Invertebrate Fauna Survey (Biologic 2018)	12-21 February 2018	Forest Red-tailed Black Cockatoo (60 individuals were observed at eight locations). Two roost sites were located during the survey.	None	Not assessed

Survey Name	Field Survey Date	Direct Observation	Foraging Evidence	Habitat Trees
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 nesting tree (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 nesting trees
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 nesting trees
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 nesting trees
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 nesting tree
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 nesting tree
Detailed Vertebrate Fauna Survey - Additional Areas North (Onshore Environmental 2024)	25 November - 5 December 2023	Forest Red-tailed Black Cockatoo (heard or observed at seven locations)	Forest Red-tailed Black Cockatoo (16 locations), Baudin's Black Cockatoo (five locations), Carnaby's Black Cockatoo (one location)	8 suitable nesting trees

4.2 Fauna Habitat Types

There were two fauna habitat types recorded within the study area:

- Jarrah/Marri Forest on lateritic hill slopes and hill crests (Plates 1-2); and
- Wetlands and drainage flats (Plates 3-4).

The Jarrah/Marri Forest habitat was most extensive covering 27.0 ha (57% of the study area), with the wetlands and drainage flats habitat occurring over 10.0 ha (21% of the study area). The wetlands and drainage flats habitat bounded Spring Gully Road in the northern sector of the study area, and occurred along several minor drainage lines in the eastern sector of the study area. The remainder of the study area comprised roads and other cleared/disturbed ground (10.7 ha or 22% of the study area).

The majority of the study area was heavily impacted by disturbance as the eleven blocks were situated in close proximity to active mining operations, native rehabilitation, roads and other disturbances. The vegetation condition of remnant native vegetation was generally rated as good, and native rehabilitation and other disturbed areas were rated as degraded.


Plates 1-2 Jarrah/Marri Forest on lateritic hill slopes and hill crests fauna habitat.


Plates 3-4 Wetlands and drainage flats fauna habitat.

4.3 Presence of Black Cockatoos

4.3.1 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).

During the field survey a flock of 25-30 Carnaby's Black Cockatoos were observed to the south of Austin and South Hampton Dams, just outside the boundary of the study area (Figure 3, Appendix 4).

4.3.2 Baudin's and Forest Red-tailed Black Cockatoo

Baudin's Black Cockatoo and Forest Red-tailed Black Cockatoo (FRTBC) occur in the forested areas of the south-west with a generalised distribution between Perth to Albany and inland to Kojonup. Baudin's Black Cockatoo is listed as Endangered while the Forest Red-tailed Black Cockatoo is listed as Vulnerable under both the EPBC Act and BC Act.

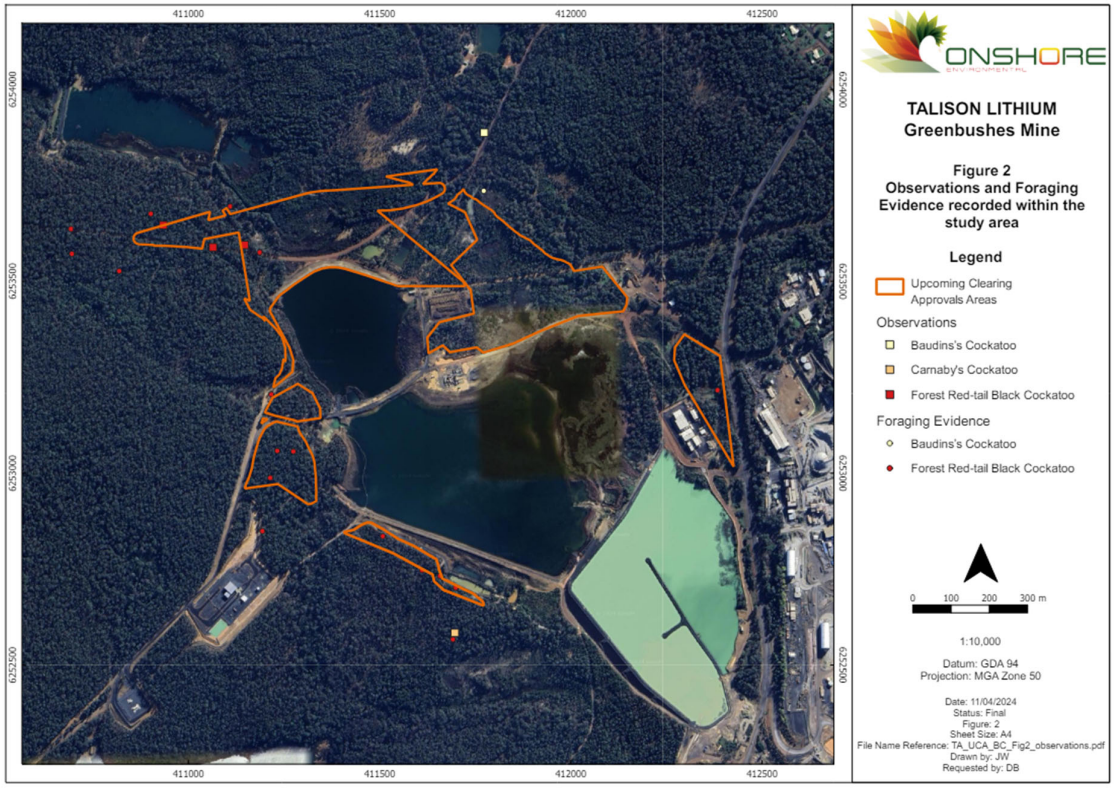
Both species have a diet comprising mainly seeds of Marri *(Corymbia calophylla),* with Baudin's Black Cockatoo also consuming seeds from Proteaceous species. Forest Red-tailed Black Cockatoos also consume Jarrah seeds and a range of other plant species that hold seeds in woody capsules. Habitat within the study area was suitable for foraging by both species.

The study area is within the known breeding range for both species (DAWE 2022). Nests are known to occur within large hollows of mature trees, predominantly Marri, with Jarrah, Wandoo and other *Eucalyptus* species also utilised (Saunders 1974a, Johnstone *et. al.* 2013). Baudin's Black Cockatoo breed between August and December (Johnstone *et. al.* 2011). The timing of breeding for the Red-tailed Black Cockatoo is less defined with breeding having been recorded in all months with peaks in winter to autumn and spring (Johnstone and Kirby 2019).

Forest Red-tailed Black Cockatoos were observed directly or identified from calls at eight locations within the study area (Figure 3). Additionally, foraging evidence on Marri nuts was observed at 34 locations throughout the study area (Figure 3, Appendix 4).

During the survey a flock of 10 Baudin's Black Cockatoos were observed just outside the boundary of the study area to the north of the Austin's and South Hampton Dams, with foraging evidence recorded nearby (Figure 3). Foraging evidence from Baudin's Black Cockatoo was recorded at two additional locations within the eastern sector of the study area adjacent to the South Western Highway (Figure 3).

Figure 3 Black cockatoo evidence from within the study area.



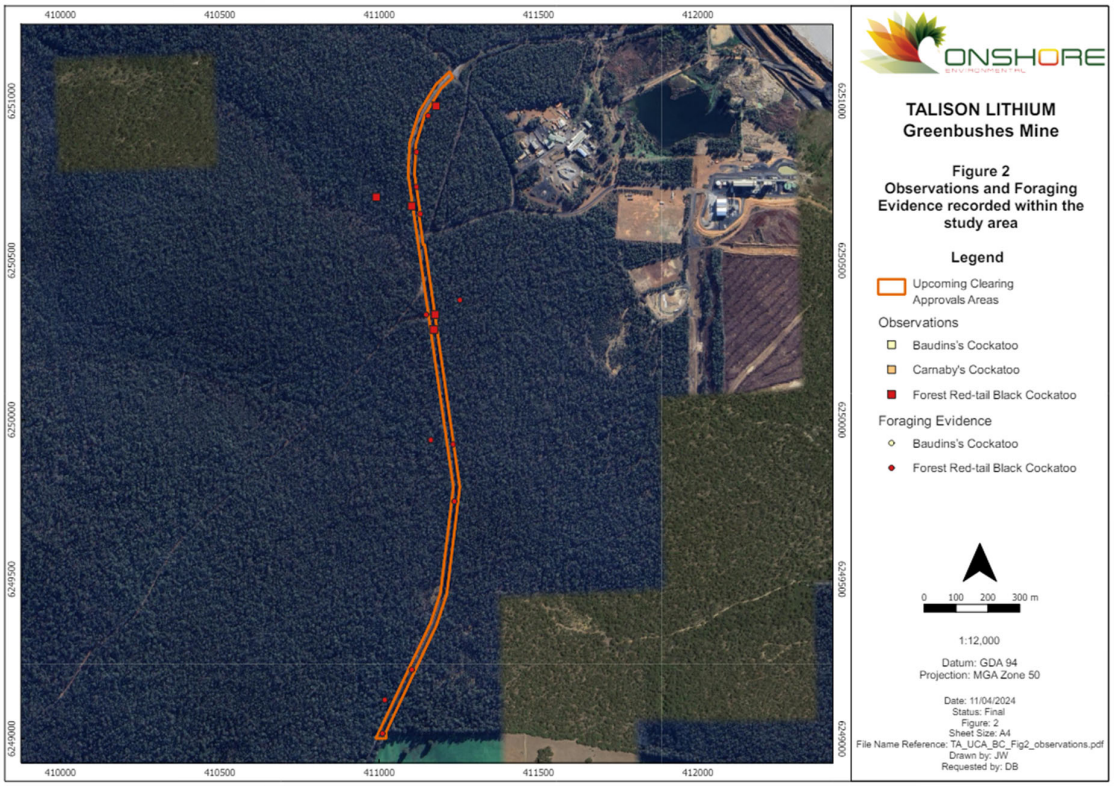

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Figure 2
Observations and Foraging Evidence recorded within the study area
Legend
Upcoming Clearing Approvals Areas
Observations
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Carnaby's Cockatoo
Forest Red-tail Black Cockatoo
Foraging Evidence
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Forest Red-tail Black Cockatoo
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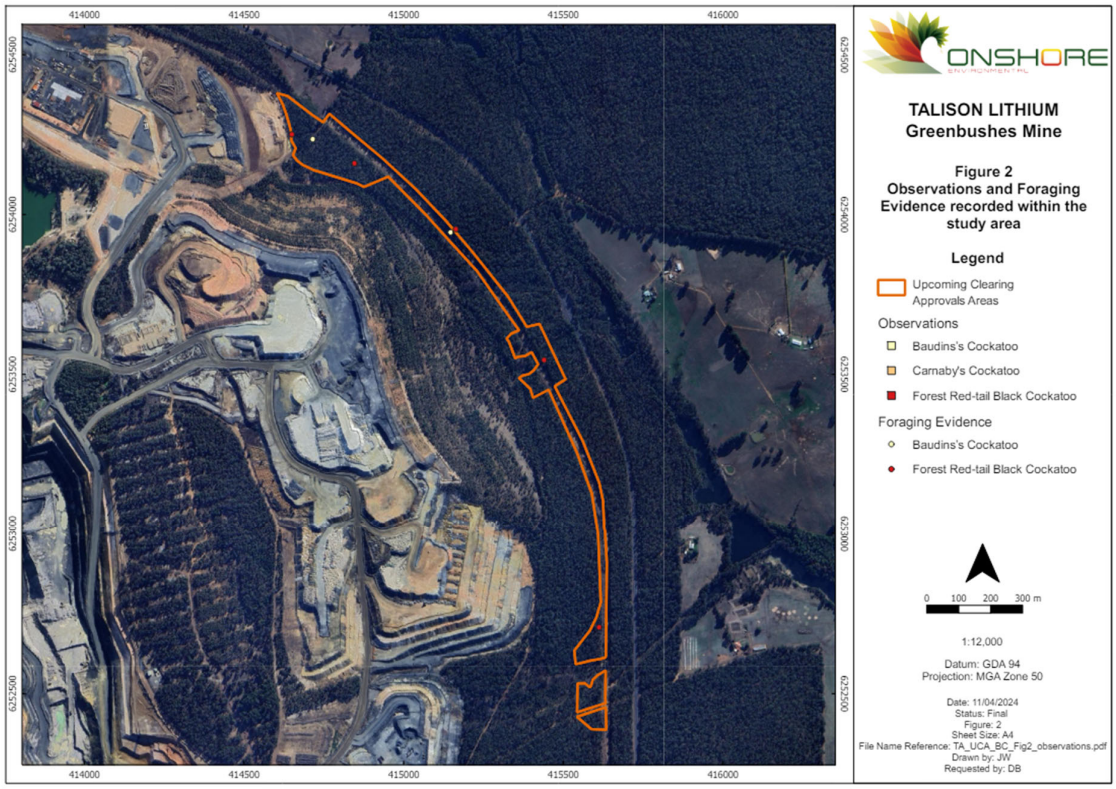
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Figure 2
Observations and Foraging Evidence recorded within the study area
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Baudins's Cockatoo
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4.4 Breeding Habitat Assessment

4.4.1 Habitat Tree Assessment

A total of 21 trees with the potential to represent known, suitable or potential nesting trees were identified during the field survey (Appendix 5, Figure 4). These trees were further assessed for suitability as nesting hollows for black cockatoos as per criteria outlined in Table 1.

None of the trees assessed were classified as *known nesting trees* (i.e., confirmed to have chewed hollows).

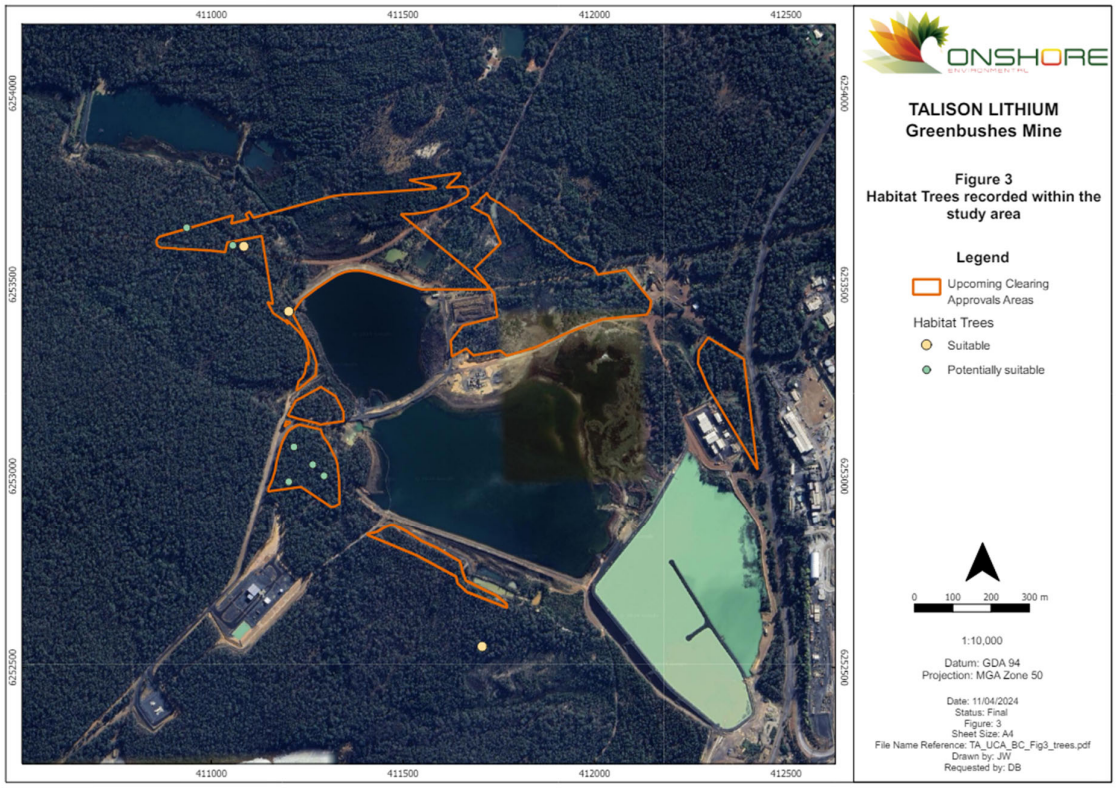
Seven trees within the study area were classified as *suitable nesting trees*, defined as supporting a hollow of suitable size and orientation considered to be of sufficient depth for use by black cockatoos. None of these hollows showed definitive evidence of being used by black cockatoos.

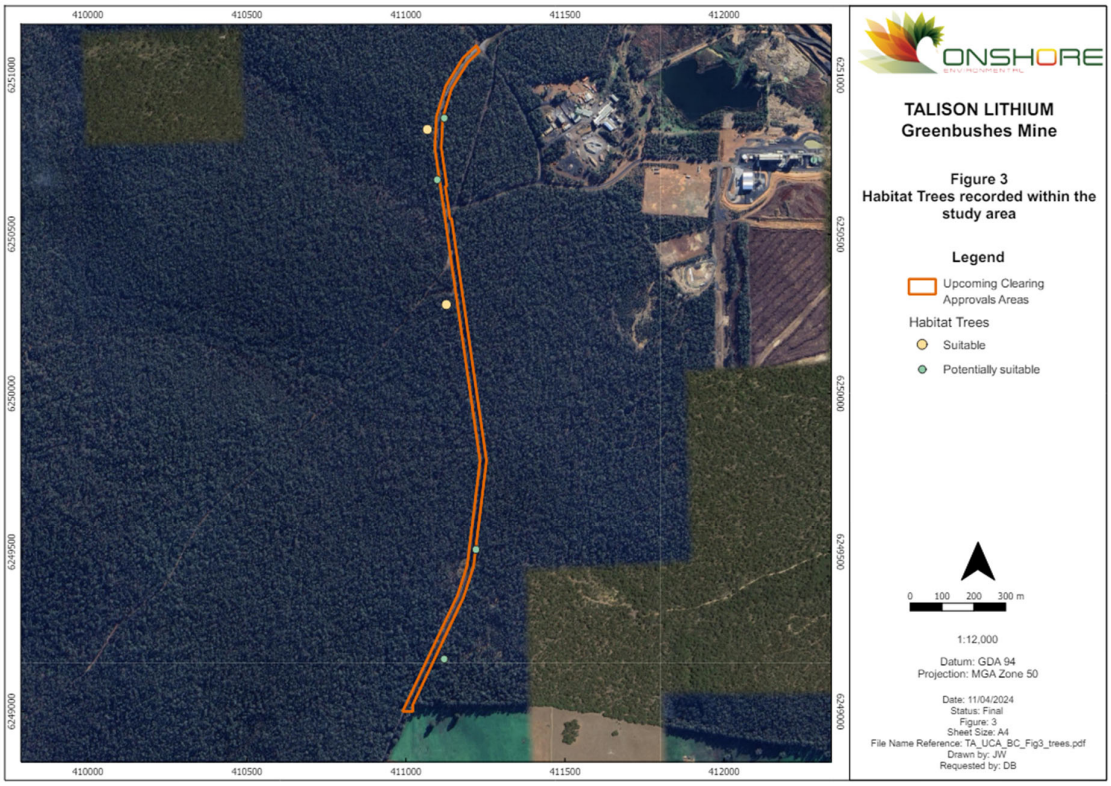
Fourteen trees were categorised as *potential nesting trees* (i.e., classified as potentially suitable or unsuitable). These trees supported hollows that were currently too small or of unsuitable orientation or depth to be used by black cockatoos for nesting, but with potential to become nest sites in the future.

4.4.2 Habitat Tree Density Assessment

The density of potential habitat trees (i.e., DBH >50 cm or >30 cm for *Eucalyptus wandoo*) were completed within seven quarter hectare plots distributed throughout the study area. The density of potential habitat trees averaged 30.3 trees per hectare, with the highest density recorded along Maranup Ford Road. The average potential habitat tree density within the study area was higher than previously recorded in the adjacent Greenbushes State Forest, where tree density ranged from 10.6 to 21.7 potential habitat trees per hectare (Onshore Environmental 2018).

Figure 4 Distribution of habitat trees within the study area.

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Greenbushes Mine
Figure 3
Habitat Trees recorded within the study area
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Upcoming Clearing Approvals Areas
Habitat Trees
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Potentially suitable
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Datum: GDA 94
Projection: MGA Zone 50
Date: 11/04/2024
Status: Final
Figure: 3
Sheet Size: A4
File Name Reference: TA_UCA_BC_Fig3_trees.pdf
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4.5 Foraging and Roosting Habitat

4.5.1 Foraging Habitat Score (DAWE 2022)

Based on the foraging quality scoring tool (DAWE 2022, Appendix 2) the study area was given a score of eight for Carnaby's Black Cockatoo and a score of ten for Baudin's Black Cockatoo and Forest Red-tailed Black Cockatoo (Table 3). Hence the study area was considered to support high quality foraging habitat for all three species (Table 3). There was evidence of Forest Red-tailed Black Cockatoos and Baudin's Black Cockatoos feeding on Marri and Jarrah nuts observed during the field survey, but no evidence of foraging by Carnaby's Black Cockatoo. However, 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 and surrounds, with Baudin's and Carnaby's Black Cockatoos are more seasonally mobile and likely to utilise the study area occasionally.

The availability and connectivity of nearby foraging habitat is important for successful breeding of black cockatoos (Saunders 1977, 1986). Approximately 44% (29,137.20 ha) of the land area within a 12 km radius of the study area comprised native vegetation (DPIRD 2017, Figure 5). The vast majority of this native vegetation is likely to be 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 present predominantly 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 eight known Carnaby's Black Cockatoo roost sites within a 12 km radius of the study area (DBCA 2022), with the nearest situated immediately north of the study area around the Greenbushes townsite (Figure 5). While there were no known roosting trees observed within the study area, it is possible that black cockatoos utilise the study area for roosting given the following:

- the close proximity of known roosting sites to the study area;
- the presence of potential roosting habitat within the study area including several dams and old mine voids with permanent water; and
- Red-tailed Black Cockatoos were observed within the study area at dusk during the field survey.

Baudin's and Carnaby's Black Cockatoos are known to breed within 50 km of the study area (DAWE 2022) and Forest Red-tailed Black Cockatoos are known to breed in close proximity to the study area (Onshore Environmental *unpublished data).* While there was no direct evidence of Baudin's and Carnaby's Black Cockatoos breeding in close proximity to the study area, there was large areas of suitable breeding habitat for both species within a 12 km radius.

Based on the above information, no points were deducted for proximity to roosting or breeding sites. While dieback was present at the site, no severe dieback or Marri canker disease was observed during the field survey, and no points were deducted for impacts resulting from significant plant disease.

Table 3 Scoring tool for determining quality of black cockatoo foraging habitat.

Score	Baudin's Cockatoo	Carnaby's Black Cockatoo	Forest Red-tail 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	-2	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* spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.	0	0	0
Final Score	**10**	**8**	**10**

4.5.2 Offset Habitat Scoring

The foraging habitat scoring system for black cockatoos developed by the DCCEEW to calculate the value of an offset site (Appendix 3) was applied to each of the ten vegetation types mapped within the study area, along with areas mapped as 'mine rehabilitation', 'cleared', and 'roads'.

Seven of the native vegetation types supporting high foraging value Jarrah-Marri forest and *Hakea* thicket were scored as a six for the site condition component (out of a possible total score of seven) (Table 4). Three localised vegetation types associated with low lying drainage zones (wetlands and drainage flats) provided low foraging value and had been historically disturbed, reflected by the lower site condition score of two (Table 4). The remaining cleared areas, roads and mine rehabilitation provided no foraging value and were scored zero for site condition (Table 4).

The 12 km buffer for regional foraging habitat is based upon the maximum distance from a nest that breeding birds are likely to travel (DEC 2012). Approximately 44% (29,137 ha) of the land area within a 12 km radius of the study area is native vegetation (DPIRD 2017) (Figure 5). The vast majority of this native vegetation is likely to comprise Jarrah/Marri Forest of moderate to high foraging value. Therefore, a score of three (out of a possible score of three) was adopted for all three species for site context (Table 4).

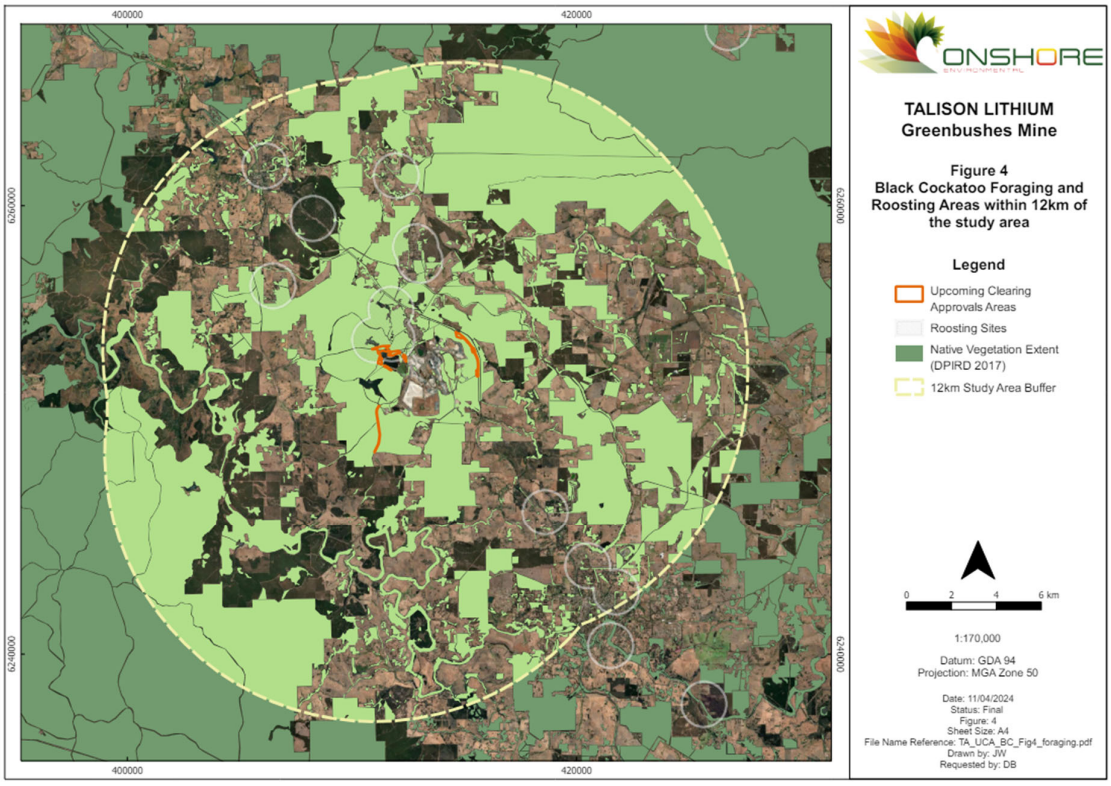
In order to confirm presence of black cockatoos within an area the scoring tool requires that the species is seen or reported regularly (intervals of every few days or weeks for at least several months of the year) and/or there is abundant foraging evidence, e.g. chewed nuts that can be identified as this species. The Forest Red-tailed Black Cockatoo was common within the study area, directly observed at eight locations with foraging evidence recorded at a further 34 locations. Based on the current survey effort and knowledge of the study area the regular presence of the Red-tailed Black Cockatoo was confirmed within the study area. Baudin's Black Cockatoo was observed at one location outside the northern boundary of the study area, with foraging residue recorded at two locations within the eastern sector of the study area. Evidence of Carnaby's Black Cockatoo was restricted to one direct observation outside the northern boundary of the study area. Based on the current survey effort and knowledge of the study area the regular presence of both Baudin's and Carnaby's Black Cockatoo was not confirmed within the study area.

Table 4 Foraging values of vegetation in the survey area for Baudin's, Carnaby's and Forest Red-tailed Black Cockatoos, based upon vegetation characteristics, context and species density.

SITE CONDITION						
Indicator	Score	Foraging Value	Reasoning	Impact - HS Xp, DF EpMpHp, HS Bg, HS Bo, HS Pd TpBl, DF TlHp, DL EpCc Tp (ha)	Impact (FL LrBr, FL To, WE Tl) Area (ha)	Impact (Rehab, Cleared, Road) Area (ha)
Vegetation condition & structure. Habitat features.	7	Very High				
	6	High	Marri-Jarrah forest vegetation types with >40% projected foliage cover. Low percentage (<10%) of tree deaths.	26.74		
	5	Moderate to High				
	4	Moderate				
	3	Low to Moderate				
	2	Low	Disturbed by alluvial tin mining and vegetation representative of historical wetland rehabilitation. Marri-Jarrah forest providing <5% projected foliage cover. Scattered food plants.		3.81	
	1	Negligible to Low				
	0	None				17.19
			Sub-Total	6	2	0
SITE CONTEXT						
Proximity of the site in relation to other habitat	3	<12km of other foraging resources with site condition of at least 3, or 6km of known breeding habitat		26.74	3.81	17.19
	2	<15km of other foraging resources with site condition of at least 4, or 12 km of known breeding habitat				
	1	15-20km of other foraging resources with site condition of at least 5, or <15km of known breeding habitat				
	0	>20km from other foraging resources, or >15km of known breeding habitat				
			Sub-Total	3	3	3
			FINAL TOTAL	9	5	3

	Indicator	Species Stocking Rate	Carnaby's	Baudin's	FRTBC
Confirm presence/ absence of species	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.			X
	No	Species is recorded or reported very infrequently and there is little or no foraging evidence.	X	X	

Figure 5 Black cockatoo foraging and roosting sites within 12 km of the study area.



5.0 STUDY TEAM

The black cockatoo habitat assessment was planned, co-ordinated and executed by the following personnel:

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Project Staff

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Mr Thomas Mott	BSc	Ecologist

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APPENDIX 1

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

APPENDIX 2

Foraging Habitat Score (DAWE 2022)

Table A1 Foraging quality scoring tool template

Starting score		Baudin's Cockatoo	Carnaby's Cockatoo	Forest Red-tailed Black-Cockatoo
10		**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 *Banksia* spp. (including *Dryandra* spp.), *Hakea* spp. and *Grevillea* 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	**-1**	**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	**-1**	**Subtract 1** if your site has disease present (e.g. *Phytophthora* 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. *Phytophthora* 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. *Phytophthora* spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.
Total score		*Enter score*	*Enter score*	*Enter score*
Appraisal		To support your habitat score, you should provide an overall appraisal of the habitat on the impact site and within 20km of the impact area to clearly explain and justify the score. It should include discussion on the foraging habitat's proximity to other resources (e.g. exact distance to proximate resources), frequency of use of proximate sites, the degree of evidence and description of vegetation type and condition.		

APPENDIX 3

Offset Habitat Scoring System -
DCCEEW in consultation with species experts in Western Australia

Habitat Scoring System for WA black cockatoo foraging habitat

This habitat scoring system describes elements indicative of suitable foraging habitat[1] 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 value	Details				
Vegetation condition and structure. Habitat features	**7**	Very High	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].				
			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.				
	6	High	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland (>25% projected foliage cover), banksia and eucalypt woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.				
			Baudin's Black Cockatoo				
			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.

[2] No 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.

Vegetation condition and structure. Habitat features	**5**	Moderate to high	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				
			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%).				
			Forest Red-tailed Black Cockatoo				
			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%).				
	4	Moderate	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland, banksia or eucalypt woodlands with 20-30% projected 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 with 40-60% projected foliage cover but vegetation condition reduced due to tree deaths (up to 30-40%).				
			Forest Red-tailed Black Cockatoo				
			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 tree deaths (up to 30-40%).				
	3	Low to moderate	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland, banksia or eucalypt woodlands with 10-20% projected foliage cover.				
			Baudin's Black Cockatoo				
			Marri-Jarrah Forest or woodlands with 5-20% projected foliage cover.				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with 5-20% projected foliage cover.				
	2	Low	Carnaby's Black Cockatoo				
			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, marri.				
			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.				

Vegetation condition and structure. Habitat features			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*.				
	1	Negligible to low	All species				
			Scattered specimens of known food plants but projected foliage cover of these is <2%. May include: paddocks or urban areas with scattered foraging trees.				
	0	None	All species				
			No Proteaceae, eucalypts or other potential sources of food. May include bare ground or developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).				
			Totals				

Site Context								
Proximity of the site in relation to other habitat.	**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.				
	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]	**Impact Site**			**Offset Site**		
			CBC	**BBC**	**FRT**	**CBC**	**BBC**	**FRT**
Confirm presence/ absence of species.	**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.						
	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.

APPENDIX 4

Details of Black Cockatoo records within and surrounding the study areas

Waypoint	Common Name	Abundance	Observation Method	Easting	Northing
CA- 7	Baudins's Cockatoo	0	Foraging evidence	414716	6254236
CA- 10	Baudins's Cockatoo	0	Foraging evidence	415147	6253944
CA- 20	Baudins's Cockatoo	0	Foraging evidence	411773	6253736
CA- 13	Baudins's Cockatoo	10	Observed	411774	6253887
CA- 33	Carnaby's Cockatoo	25-30	Observed	411697	6252584
CA- 4	Forest Red-tail Black Cockatoo	0	Call	411147	6253595
CA- 14	Forest Red-tail Black Cockatoo	2	Call	410934	6253646
CA- 23	Forest Red-tail Black Cockatoo	2	Call	411103	6250670
CA- 2	Forest Red-tail Black Cockatoo	0	Foraging evidence	411509	6252836
CA- 5	Forest Red-tail Black Cockatoo	0	Foraging evidence	411254	6250376
CA- 6	Forest Red-tail Black Cockatoo	0	Foraging evidence	414650	6254251
CA- 8	Forest Red-tail Black Cockatoo	0	Foraging evidence	414846	6254160
CA- 9	Forest Red-tail Black Cockatoo	0	Foraging evidence	415164	6253954
CA- 11	Forest Red-tail Black Cockatoo	0	Foraging evidence	415440	6253545
CA- 12	Forest Red-tail Black Cockatoo	0	Foraging evidence	415613	6252706
CA- 15	Forest Red-tail Black Cockatoo	3	Foraging evidence	410819	6253527
CA- 16	Forest Red-tail Black Cockatoo	0	Foraging evidence	410695	6253572
CA- 17	Forest Red-tail Black Cockatoo	0	Foraging evidence	410693	6253637
CA- 18	Forest Red-tail Black Cockatoo	0	Foraging evidence	410902	6253676
CA- 19	Forest Red-tail Black Cockatoo	0	Foraging evidence	411187	6253575
CA- 21	Forest Red-tail Black Cockatoo	0	Foraging evidence	412384	6253216
CA- 22	Forest Red-tail Black Cockatoo	0	Foraging evidence	411130	6250646
CA- 26	Forest Red-tail Black Cockatoo	0	Foraging evidence	411217	6253205
CA- 27	Forest Red-tail Black Cockatoo	0	Foraging evidence	411233	6253058
CA- 28	Forest Red-tail Black Cockatoo	0	Foraging evidence	411214	6252988
CA- 29	Forest Red-tail Black Cockatoo	0	Foraging evidence	411194	6252849
CA- 30	Forest Red-tail Black Cockatoo	0	Foraging evidence	411611	6252747
CA- 31	Forest Red-tail Black Cockatoo	0	Foraging evidence	411658	6252732
CA- 32	Forest Red-tail Black Cockatoo	0	Foraging evidence	411700	6252702
CA- 34	Forest Red-tail Black Cockatoo	2	Foraging evidence	411692	6252567
CA- 35	Forest Red-tail Black Cockatoo	0	Foraging evidence	411275	6253056
CA- 36	Forest Red-tail Black Cockatoo	0	Foraging evidence	411109	6253695
CA- 38	Forest Red-tail Black Cockatoo	0	Foraging evidence	411148	6250330
CA- 39	Forest Red-tail Black Cockatoo	0	Foraging evidence	411163	6249937
CA- 40	Forest Red-tail Black Cockatoo	0	Foraging evidence	411237	6249744
CA- 41	Forest Red-tail Black Cockatoo	0	Foraging evidence	411103	6249216
CA- 42	Forest Red-tail Black Cockatoo	0	Foraging evidence	411018	6249121
CA- 43	Forest Red-tail Black Cockatoo	0	Foraging evidence	411011	6249016
CA- 44	Forest Red-tail Black Cockatoo	0	Foraging evidence	411233	6249923
CA- 46	Forest Red-tail Black Cockatoo	0	Foraging evidence	411154	6250954
CA- 47	Forest Red-tail Black Cockatoo	0	Foraging evidence	411118	6250840
CA- 48	Forest Red-tail Black Cockatoo	0	Foraging evidence	411118	6250731
CA- 37	Forest Red-tail Black Cockatoo	2	Observed	411172	6250283
CA- 45	Forest Red-tail Black Cockatoo	8	Observed	411179	6250984
CA- 1	Forest Red-tail Black Cockatoo	5	Observed	411064	6253589
CA- 24	Forest Red-tail Black Cockatoo	4	Observed	410991	6250699
CA- 25	Forest Red-tail Black Cockatoo	2	Observed	411176	6250330

APPENDIX 5

Details of tree hollows present within the study area

Waypoint	Easting	Northing	Category (Onshore)	Category (DAWE 2022)	Tree species
CAT- 1	414669	6254325	Potentially suitable	Potential	Jarrah
CAT- 2	414646	6254270	Potentially suitable	Potential	Jarrah
CAT- 3	414700	6254218	Potentially suitable	Potential	Jarrah
CAT- 4	415611	6252741	Potentially suitable	Potential	Jarrah
CAT- 5	411295	6253002	Potentially suitable	Potential	Jarrah
CAT- 6	411057	6253604	Potentially suitable	Potential	Marri
CAT- 7	410937	6253650	Potentially suitable	Potential	Marri
CAT- 8	411100	6250673	Potentially suitable	Potential	Jarrah
CAT- 9	411217	6253078	Potentially suitable	Potential	Jarrah
CAT- 10	411203	6252987	Potentially suitable	Potential	Jarrah
CAT- 11	411222	6249508	Potentially suitable	Potential	Jarrah
CAT- 12	411122	6249166	Potentially suitable	Potential	Jarrah
CAT- 13	411122	6250866	Potentially suitable	Potential	Marri
CAT- 14	411266	6253031	Potentially suitable	Potential	Marri
CAT- 15	415177	6253965	Suitable	Suitable	Marri
CAT- 16	415293	6253780	Suitable	Suitable	Marri
CAT- 17	411086	6253602	Suitable	Suitable	Dead
CAT- 18	411069	6250830	Suitable	Suitable	Marri
CAT- 19	411129	6250281	Suitable	Suitable	Marri
CAT- 20	411708	6252556	Suitable	Suitable	Dead
ADT - 6	411202	6253430	Suitable	Suitable	Marri