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Black Cockatoo Habitat Assessment, Roe Highway

Final Report

Prepared for
Main Roads
by Strategen

September 2018

Black Cockatoo Habitat Assessment, Roe Highway

Final Report

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September 2018

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Client: Main Roads

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1. Introduction

Strategen Environmental (Strategen) was commissioned by Main Roads Western Australia (Main Roads) to undertake a Black Cockatoo habitat assessment for the Kalamunda Road Roe Highway upgrade.

Strategen understands that Main Roads is proposing to construct a grade separation at the intersection of Roe Highway and Kalamunda Road in Maida Vale (Survey Area), with construction expected to commence in late 2018 (Figure 1). The Survey Area is 80 ha in total and covers approximately 4.6 km with additional areas associated with intersections.

The proposed development of the site has the potential to impact native vegetation and as such, a Black Cockatoo habitat assessment was deemed necessary to determine the environmental values of the potential clearing area.

Clearing of vegetation may result in the removal of vegetation potentially containing habitat for Forest Red-tailed Black-Cockatoos (FRTBC), Baudin's Black Cockatoos (BBC) and Carnaby's Black-Cockatoos (CBC). All three species of Black Cockatoos are listed as Threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the *Wildlife Conservation Act 1950* (WC Act). Given this, an assessment of the habitat values is required to support potential future assessment and approval requirements and to inform development design.

This report presents the findings of the Black Cockatoo habitat assessment undertaken for the Survey Area.

1.1 Objectives

The objectives of the work undertaken were to:

- undertake a Black Cockatoo habitat assessment
- define and map Black Cockatoo habitat within the Survey Area
- prepare a report summarising the findings.

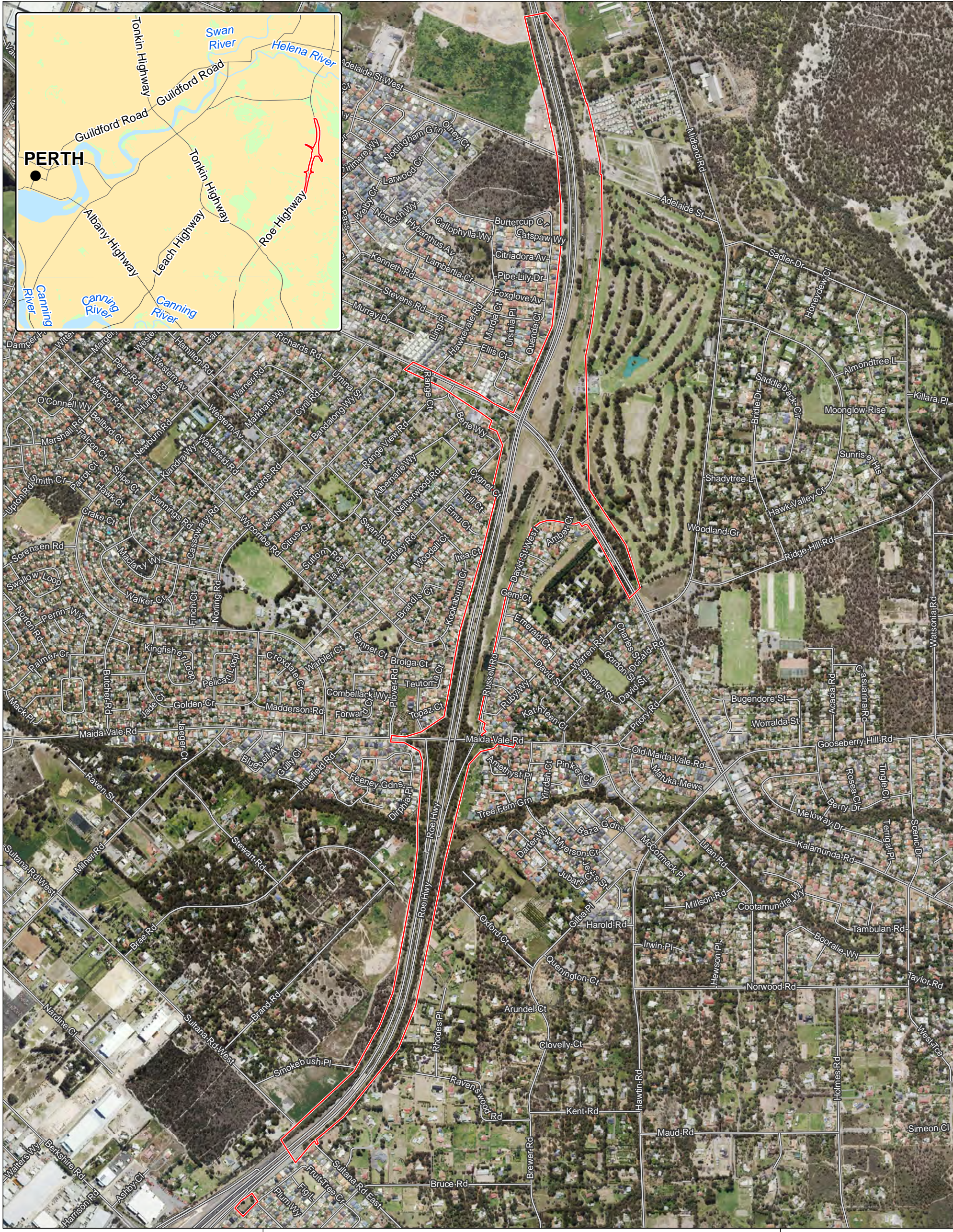


Figure 1: Site location

Scale 1:14,000 at A3

0 50 100 150 200 250 Meters

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 5/02/2018

Author: DWhite

Source: Proposed environmental boundary, 24/01/2018 Main Roads 2018; Aerial: Landgate 2018.



Proposed environmental boundary

Roads



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1.2 Background to Protected Fauna

Western Australian flora and fauna is protected formally and informally by various legislative and non-legislative measures, which are as follows:

Legislative measures:

- Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)
- Wildlife Conservation Act 1950 (WC Act)
- Environmental Protection Act 1986 (EP Act)
- Biosecurity and Agriculture Management Act 2007 (BAM Act).

Non-legislative measures:

- Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) Priority lists for flora, ecological communities and fauna
- Weeds of National Significance
- Recognition of locally significant populations by the DBCA.

A short description of each is given below. Other definitions, including species conservation categories, are provided in Appendix 1.

1.2.1 EPBC Act

The EPBC Act aims to protect matters of national environmental significance (MNES). Under the EPBC Act, the Commonwealth Department of the Environment and Energy (DEE) lists threatened species and communities in categories determined by criteria set out in the Act (www.environment.gov.au/epbc/index.html) (Appendix 1).

Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) and Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) are listed as Endangered under the EPBC Act. The Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (FRTBC) is classified as Vulnerable.

Projects likely to cause a significant impact on MNES should be referred to the DEE for assessment under the EPBC Act.

1.2.2 WC Act

The WA DBCA lists flora and fauna under the provisions of the WC Act as protected according to their need for protection (Appendix 1).

Under the WC Act Fauna are classified as Schedule 1 to Schedule 7 according to their need for protection. Under the WC Act both Carnaby's Black Cockatoo and Baudin's Black Cockatoo are listed as Endangered (Schedule 2) and the FRTBC is listed as Vulnerable (Schedule 3).

1.2.3 DBCA Priority Lists

The DBCA lists 'Priority' flora and fauna that have not been assigned statutory protection as Declared Rare or 'Scheduled' under the WC Act, but which are under consideration for declaration as DRF or 'Scheduled' fauna. Flora and fauna assessed as Priority 1-3 are in urgent need of further survey. Priority 4 flora and fauna require monitoring every 5-10 years and Priority 5 flora and fauna are subject to a specific conservation programme (Appendix 1).

The DBCA maintains a list of PECs which identifies ecologically valuable communities that need further investigation before possible nomination for TEC status. Once listed, a community is a PEC, and when endorsed by the Western Australian Minister of Environment becomes a TEC, and protected as an ESA under Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (Appendix 1).

1.3 Background Ecological Information for Black Cockatoos

All three species of Black Cockatoo (Carnaby's Cockatoo, Baudin's Cockatoo and FRTBC) could potentially occur in the Survey Area. The distribution of all three species can be seen in the 2017 DEE distribution maps in Appendix 2.

1.3.1 Carnaby's Black Cockatoo

Carnaby's Cockatoo is endemic to south-west WA, and is distributed from the Murchison River to Esperance and inland to Coorow, Kellerberrin and Lake Cronin (Cale 2003). The species was once common, but the population has declined significantly in the last half century, and is now locally extinct in some areas (Johnstone & Storr 1998; Shah 2006). In the last 45 years (prior to Cale 2003) the species has suffered a 50% reduction in its abundance (Cale 2003). More recent information suggests this decline has continued. This reduction is due to the clearing of core breeding habitat in the wheatbelt, the deterioration of nesting hollows, and clearing of food resources on the Swan Coastal Plain (SCP) (Cale 2003). The total population of Carnaby's Cockatoo was estimated to be 40,000 in 2008 (Johnstone & Kirkby 2008). Since then, trend analyses of the seven Great Cocky Counts 2010 – 2016 identified strong indications that the population of Carnaby's Black-Cockatoo inhabiting the Perth-Peel Coastal Plain continues to decline.

Carnaby's Cockatoos feed on seeds, nuts and flowers of a variety of native and exotic plants. Food plants include a variety of Eucalyptus species, such as Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*), Swan River Blackbutt (*Eucalyptus patens*), Coastal Blackbutt (*Eucalyptus todtiana*), Caesia (*Eucalyptus caesia*) and Salmon Gum (*Eucalyptus salmonophloia*), as well as Pine trees (*Pinus* sp.), Grevillea, Allocasuarina, and Hakea species (Shah 2006). Marri nuts that are damaged extensively, especially on the main body of the nut, are likely to have been chewed by Carnaby's Cockatoo. The 'levering' of Marri nuts by Carnaby's Cockatoos tends to leave different marks on the fruit casings, particularly in the location of indentations by the lower mandible and in the amount of damage caused to the rim of the fruit casing. Carnaby's Cockatoos also generally feed on green Marri nuts that are soft enough for their beaks to manipulate. The seeds from a variety of Banksia species and the cones of Pine trees provide the highest energetic yield (Cooper *et al.* 2002).

Breeding has been recorded from early July to mid-December, and primarily occurs in the wheatbelt in the semi-arid and subhumid interior (Johnstone & Storr 1998). However, this species is currently expanding its breeding range westward and south into the Jarrah-Marri forests of the Darling Scarp (e.g. Wungong Dam Catchment) and into the Tuart (*Eucalyptus gomphocephala*) forests of the SCP including Yancheap, Baldivis, Lake Clifton and near Bunbury (Johnstone & Kirkby 2011).

Carnaby's Cockatoo display strong pair bonds and mate for life. They nest in hollows of smooth-barked eucalypts particularly Salmon Gum and Wandoo (*Eucalyptus wandoo*) but nests have also been found in other Eucalypt species including York Gum (*Eucalyptus loxophleba*), Flooded Gum (*Eucalyptus rudis*), the rough-barked Marri and Tuart (Johnstone & Kirkby 2011). In most nests in Tuart, eggs are laid on a mat of wood chips at the bottom of a large hollow (mostly top entry hollows) ranging from a few cm's to five m deep (Johnstone & Kirkby 2011). Clutch size is 1–2 eggs, more typically two; only one young is reared (Saunders 1986). Incubation lasts for 29 days and only the female incubates and broods. The nestling is brooded by the female during which time both rely on food from the male. Once brooding is complete, the female then leaves the nest each day at dawn, sometimes returning mid-morning (with the male) to feed the chick (Johnstone & Kirkby 2011). After approximately three weeks she ceases to brood and the chick is fed by one or both parents in the morning and in the late evening (Johnstone & Kirkby 2011).

Approximately 87% (525,732 ha) of potential Carnaby's Cockatoo habitat (i.e. areas of vegetation that contain flora species and vegetation types that could support the species' breeding, feeding and night roosting activities) has been cleared in the wheatbelt since European settlement (DEC 2012). The south-west region is now a severely fragmented landscape and the further loss of foraging habitat, the lack of suitable breeding sites, climate change, alterations in the landscape, changing forest structure with almost every part of the Jarrah-Marri forest logged in the past and with most trees too young to form hollows, and competition with exotic species, exacerbate the future conservation of Carnaby's Cockatoo (Johnstone & Kirkby 2011).

1.3.2 Baudin's Black Cockatoo

This species is distributed through the south-western humid and subhumid zones, from the northern Darling Range and adjacent far east of the SCP (south of the Swan River), south to Bunbury and across to Albany (Johnstone & Kirkby 2011). Baudin's Cockatoo rarely occurs near the coast north of Mandurah, and rarely occurs north of the Swan River (Johnstone & Kirkby 2008, Johnstone & Storr 1998). Baudin's Cockatoo usually occur in small flocks of up to 30, or occasionally up to 50 and rarely in aggregations of up to 1200 (Johnstone & Kirkby 2008). Baudin's Cockatoo is distinguished from Carnaby's Cockatoo by its longer bill and slightly different call.

This species forages primarily in Eucalypt forest, where it feeds on Marri seeds, flowers, nectar and buds. They also feed on a wide range of seeds of Eucalyptus, Banksia, Hakea and Pines (*Pinus* sp.) as well as fruiting apples and pears and beetle larvae from under the bark of trees (Johnstone & Kirkby 2008, Johnstone & Storr 1998). Baudin's Cockatoo forages at all levels of the forest, from the canopy to the ground, often feeding in the understorey on proteaceous trees and shrubs, especially Banksia, and in orchards both in trees and on dropped or fallen fruit on the ground.

The breeding biology of this species is poorly known. It has been recorded breeding in the deep south-west, north to the Whicher Range and Lowden and also isolated records at Wungong Catchment, Serpentine (hills area) and east to Kojonup and near Albany (Johnstone & Kirkby 2008). They nest in large, mostly vertical, hollows of Karri (*E. diversicolor*), Marri, Wandoo, and Bullich (*E. megacarpa*). Baudin's Cockatoos display strong pair bonds are monogamous and most likely mate for life (Johnstone & Kirkby 2008). The pair remains together all year round except when the female is incubating and brooding. Both adults play a part in selecting the nest hollow, but only the female is responsible for renovation and preparing the hollow for breeding. Preparation of the hollow consists of chewing around the entrance of the hollow and down one part of the interior wall. Pairs have also been recorded prospecting for hollows in most months and outside the breeding range (Johnstone & Kirkby 2008).

1.3.3 Forest Red-tailed Black Cockatoo

The FRTBC is distributed through the humid and subhumid south-west of WA from Gingin through the Darling Ranges to the south-west from Bunbury to Albany (primarily in the hilly interior) (Johnstone & Storr 1998, Johnstone *et al.* 2013a). In these areas, the FRTBC inhabits dense Jarrah, Karri, and Marri forests that receive more than 600 mm average annual rainfall (Johnstone & Storr 1998). However, in recent years the FRTBC has moved on to the SCP to forage in the Perth metropolitan area (Johnstone & Kirkby 2011). The FRTBC occurs in pairs or small flocks, or occasionally large flocks of up to 200 birds (Johnstone & Storr 1998).

The FRTBC feeds primarily on Marri and Jarrah fruit, but also Tuart and to a lesser extent on Blackbutt, Albany Blackbutt (*E. staeri*), Karri, Sheoak (*Allocasuarina fraseriana*) and Snottygobble (*Persoonia longifolia*) (Johnstone *et al.* 2013b). The FRTBC can obtain energy faster when feeding on Marri and Jarrah than other food sources (Cooper *et al.* 2002), and these two-plant species make up most of their diet (Johnstone *et al.* 2013b).

FRTBC shear the base of Marri nuts at a 45° angle to remove seeds (the 'bottom slice' method), while Baudin's Cockatoos use their elongated upper mandible to pry seeds out, leaving the nut intact (the 'lever') (Johnstone & Kirkby 1999, Cooper *et al.* 2002). Carnaby's Cockatoos may use either technique to feed on Marri nuts, but generally with some modification, e.g. the 'slicing' of fruits may occur along the side of the fruit casing.

The FRTBC is monogamous and pairs nest in tree hollows from 6.5 – 33 m above ground and most nests are in large and old mature Marri, and these trees are the most important nesting tree throughout the FRTBC range (Johnstone *et al.* 2013a). Nest trees of the FRTBC have a mean circumference at breast height of 2.79 m, a mean estimated age of 222 years and a mean overall height of 20.24 m (Johnstone *et al.* 2013a).

Breeding has been recorded in all months, with peaks in April-June and August-October. Only one egg is laid, which the female incubates for 29 to 31 days, before a nestling hatches and weighs between 27 and 32 g. The female remains in the hollow during incubation and only leaves for a short period in the evening to be fed by the male, usually at dusk (Johnstone *et al.* 2013b). Brooding is for up to 10 days, after which the female leaves the nest between dawn and dusk. Pairs of birds appear to recognise each other by calls, not responding to calls by others in the area. Chicks only respond when the parent is heard and are fully feathered at 48 days (Johnstone *et al.* 2013b).

2. Methods

The Black Cockatoo habitat assessment was undertaken on 29 and 30 January 2018 by two Strategen personnel with relevant experience as specified by the *EPBC Act Revised draft referral guidelines for three threatened black cockatoo species* (DEE 2017).

The habitat assessment involved traversing the Survey Area by foot. Any trees meeting the following criteria for potential breeding and foraging habitat were recorded, marked and electronically logged using a hand held Global Positioning System (GPS) unit:

- native trees (e.g. Jarrah, Tuart, Marri)
- diameter at breast height (DBH) ≥ 500 mm (≥ 300 mm for Wandoo and Salmon Gum)
- suitable sized nest hollow i.e. large enough entrance and adequate depth
- evidence of feeding (chewed cones, seed and nut material)
- opportunistic observations of Black Cockatoos in the Survey Area.

As stated above, the Black Cockatoo habitat assessment considered the recently revised draft referral guidelines for three threatened Black Cockatoo species (DEE 2017) and the previous referral guidelines where relevant (DSEWPaC 2012). These draft guidelines include an assessment of Black Cockatoo foraging habitat quality, by attributing a habitat quality score. The quality score included the elements above as well as the following:

- the presence of all plant species that provide foraging, including non-native food sources used by Black Cockatoos
- use as a roosting site
- the vegetation present in the surrounding area (i.e. at least 12 km from the impact area, including proximity to any breeding habitat, roosting sites or watering points)
- numbers of any known nesting trees.

Revisit – hollow inspection

At the request of Main Roads an additional assessment was undertaken on the 30 August 2018 to reinspect five hollows (originally observed from the ground) in four potential breeding trees. The hollows were inspected in greater detail which included undertaking the following (some of which was undertaken during the original assessment [see dot points above]):

- measure the size of the hollow opening
- height of the hollow off the ground
- angle of the hollow
- depth of the hollow
- examine hollows in detail with binoculars
- assess and photograph hollows in detail with a Canon long lens camera (75 – 300 mm).

If the hollows were identified as being too small from the ground for Black Cockatoos to be able to enter and therefore to potentially breed in, the trees were not climbed for further inspection.

Further to this, please note that not all the hollow features outlined above might be measurable, particularly hollow depth if the tree is deemed unsafe to climb or if the aspect/direction of the hollow makes it too difficult to measure (because it is obstructed in some way).

3. Results

During the habitat assessment, numerous (approximately 30) FRTBC were heard calling from many locations, seen flying overhead and observed feeding on Marri nuts and Cape Lilac in the Survey Area (Plate 1).



Plate 1: FRTBC Feeding in Cape lilac in the Survey Area.

3.1 Potential Breeding Habitat

Four species of Eucalypts, Marri (*Corymbia calophylla*), Jarrah (*Eucalyptus marginata*), Tuart (*Eucalyptus gomphocephala*) and Wandoo (*Eucalyptus wandoo*) recorded in the Survey Area, are considered Black Cockatoo potential breeding habitat when DBH is ≥ 500 mm (≥ 300 mm for Wandoo). The Survey Area contains 547 potential breeding trees with a DBH ≥ 500 mm (≥ 300 for Wandoo) - Marri (418), Jarrah (84), Tuart (18) and Wandoo (27). The dimensions and the locations of the potential breeding trees are displayed in Figure 2 and Appendix 3.

There were few observable hollows present in these trees when viewed from the ground. A total of five hollows were detected from the ground across four potential breeding trees i.e. trees that had a DBH ≥ 500 mm (Appendix 3). Of these five hollows, two were considered to have entrances that were high enough or large enough for Black Cockatoos to utilise (> 5 m and > 100 mm diameter). From the ground, however, it was considered unlikely that any of the five hollows were deep enough for Black Cockatoos to breed in, or European honey bees were present.

Revisit – hollow inspection

The five hollows in the four trees were re-examined. Measurements were estimated and photos were taken to help illustrate the hollows assessed (Table 1, Appendix 3 & Appendix 4). None of the hollows were deemed large enough for Black Cockatoos to enter and therefore to potentially breed in.

Table 1: Reinspected hollows and their related dimensions (measurements are in cm and m). N/A = not applicable because hollow opening was not large enough to warrant further inspection.

| *Tree Number | #Hollow opening | Depth of hollow | Height of hollow | Angle of hollow |
|----------------|---|-----------------|------------------|-----------------|
| 28 | 8 x 8 cm | N/A | 11 m | 45° |
| 116 (hollow 1) | 7 x 5 cm | N/A | 10 m | 90° |
| 116 (hollow 2) | Not a hollow but a large linear opening | N/A | 7 m | 90° |
| 398 | 8 x 8 cm | N/A | 9 m | 45° |
| 420 | 7 x 7 cm | N/A | 5 m | 60° |

*See Appendix 3 for species and location details.

See Appendix 4 for photos of hollows.

3.2 Foraging Habitat

There is a total of 33 ha of foraging habitat in the Survey Area (Figure 2).

Foraging species in the Survey Area consist of, Coastal Blackbutt (*Eucalyptus todtiana*), *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina* spp., *Acacia* spp., *Callistemon* spp., *Xanthorrhoea preissii* and the introduced Cape Lilac (*Melia azedarach*). It is important to note that the majority of the Survey Area is regrowth, from previous clearing undertaken during road construction.

The same potential breeding trees (above) are also considered foraging species and includes trees that are of various sizes, however, all are considered mature (i.e. had fruit or large enough to produce fruit). Chewed Marri nuts with markings considered likely to be from all three species of Black Cockatoo were observed throughout the site, particularly under Marri trees (Plate 3 and Plate 3). Chewed Jarrah, *Allocasuarina*, Coastal Blackbutt and Cape Lilac nuts were also observed throughout the Survey Area. As noted above, FRTBC were observed feeding on Marri and Cape Lilac nuts in the Survey.

No roosts were identified in the Survey Area during the assessment. The Great Cocky Count data from 2017 was examined and more than 36 roosting sites were within 12 km of the Survey Area, five of which were within 1.5 km (Birdlife 2017).

3.3 Foraging Habitat Quality Score

The Draft Black Cockatoo foraging habitat scoring tool (DEE 2017) was used to determine the quality of Black Cockatoo foraging habitat in the Survey Area (Table 2). As per the scoring tool, the Survey Area has an overall score of either 8 or 10, giving it a habitat quality score of "Very High Quality". The aspects of the table that are applicable to the Survey Area have been highlighted in bold text. The Survey Area contains 6.45 ha of habitat quality score 8 and 26.08 ha of habitat quality score of 10 (Figure 3).

High quality foraging habitat, particularly in proximity to roosting sites and/or breeding sites, demands protection. Foraging habitat with a score of 7 or above is considered high quality and is important for the long-term survival and recovery of Black Cockatoos. Impacts to high quality foraging habitat should be referred.

As previously stated, it is important to note that these guidelines are currently in draft form. As such, the foraging habitat quality score has the potential to be altered in the future, if the final guidelines change considerably.

Table 2: DEE Black Cockatoo foraging habitat scoring tool (DEE 2017).

| Starting Score | Foraging habitat for Carnaby's Cockatoo | Foraging habitat for Baudin's Cockatoo | Foraging habitat for FRTBC |
|------------------------|--|--|---|
| 10 (Very high quality) | Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10 . | Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of, successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10 . | Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10 . |
| 7 (High quality) | Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as Banksia spp. (including Dryandra spp.), Hakea spp. and Grevillea spp., as well as native eucalypt woodland and forest that contains foraging species, including along roadsides. Does not include orchards, canola, or areas under a RFA. | Native eucalypt woodlands and forest, and proteaceous woodland and heath, particularly marri, including along roadsides. Does not include orchards or areas under a RFA. | Jarrah and marri woodlands and forest, and edges of karri forests, including wandoo and blackbutt, within the range of the subspecies, including along roadsides. Does not include areas under a RFA. |
| 5 (Quality) | Pine plantation or introduced eucalypts. | Pine plantation or introduced eucalypts. | Introduced eucalypts as well as the introduced Cape lilac (<i>Melia azedarach</i>). |
| 1 (Low quality) | Individual foraging plants or small stand of foraging plants. | Individual foraging plants or small stand of foraging plants. | Individual foraging plants or small stand of foraging plants. |
| Additions | Context adjustor – attributes improving functionality of foraging habitat | Context adjustor – attributes improving functionality of foraging habitat | Context adjustor – attributes improving functionality of foraging habitat |
| +3 | Is within the Swan Coastal Plain (important foraging area). | Is within the known foraging area. | Jarrah and/or marri show good recruitment (i.e. evidence of young trees). |
| +3 | Contains trees with suitable nest hollows. | Contains trees with suitable nest hollows. | Contains trees with suitable nest hollows. |
| +2 | Primarily contains Marri. | Primarily contains Marri. | Primarily contains Marri and/or Jarrah. |
| +2 | Contains trees with potential to be used for breeding (DBH > 500 mm). | Contains trees with potential to be used for breeding (DBH > 500 mm). | Contains trees with potential to be used for breeding (DBH > 500 mm). |
| +1 | Is known to be a roosting site. | Is known to be a roosting site. | Is known to be a roosting site |
| Subtractions | Context adjustor – attributes reducing functionality of foraging habitat | Context adjustor – attributes reducing functionality of foraging habitat | Context adjustor – attributes reducing functionality of foraging habitat |
| -2 | No clear evidence of feeding debris. | No clear evidence of feeding debris. | No clear evidence of feeding debris. |
| -2 | No other foraging habitat within 6 km. | No other foraging habitat within 6 km. | No other foraging habitat within 6 km. |
| -1 | Is > 12 km from a known breeding location. | Is > 12 km from a known breeding location. | Is > 12 km from a known breeding location. |
| -1 | Is > 12 km from a known roosting site. | Is > 12 km from a known roosting site. | Is > 12 km from a known roosting site. |
| -1 | Is > 2 km from a watering point. | Is > 2 km from a watering point. | Is > 2 km from a watering point. |

| Starting Score | Foraging habitat for Carnaby's Cockatoo | Foraging habitat for Baudin's Cockatoo | Foraging habitat for FRTBC |
|------------------------|--|--|---|
| 10 (Very high quality) | Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10 . | Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of, successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10 . | Foraging habitat that is being managed for black cockatoos such as habitat that is the focus of successful rehabilitation, and/or has some level of protection from clearing, and/or is quality habitat described below with attributes contributing to meet a score of ≥ 10 . |
| 7 (High quality) | Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as Banksia spp. (including Dryandra spp.), Hakea spp. and Grevillea spp., as well as native eucalypt woodland and forest that contains foraging species, including along roadsides. Does not include orchards, canola, or areas under a RFA. | Native eucalypt woodlands and forest, and proteaceous woodland and heath, particularly marri, including along roadsides. Does not include orchards or areas under a RFA. | Jarrah and marri woodlands and forest, and edges of karri forests, including wandoo and blackbutt, within the range of the subspecies, including along roadsides. Does not include areas under a RFA. |
| 5 (Quality) | Pine plantation or introduced eucalypts. | Pine plantation or introduced eucalypts. | Introduced eucalypts as well as the introduced Cape lilac (<i>Melia azedarach</i>). |
| -1 | Disease present (e.g. <i>Phytophthora cinnamomic</i> or marri canker). | Disease present (e.g. <i>Phytophthora cinnamomic</i> or marri canker). | Disease present (e.g. <i>Phytophthora cinnamomic</i> or marri canker). |



Plate 2: Evidence of foraging on Marri nuts by FRTBC in the Survey Area



Plate 3: Evidence of foraging on Marri nuts by FRTBC in the Survey Area

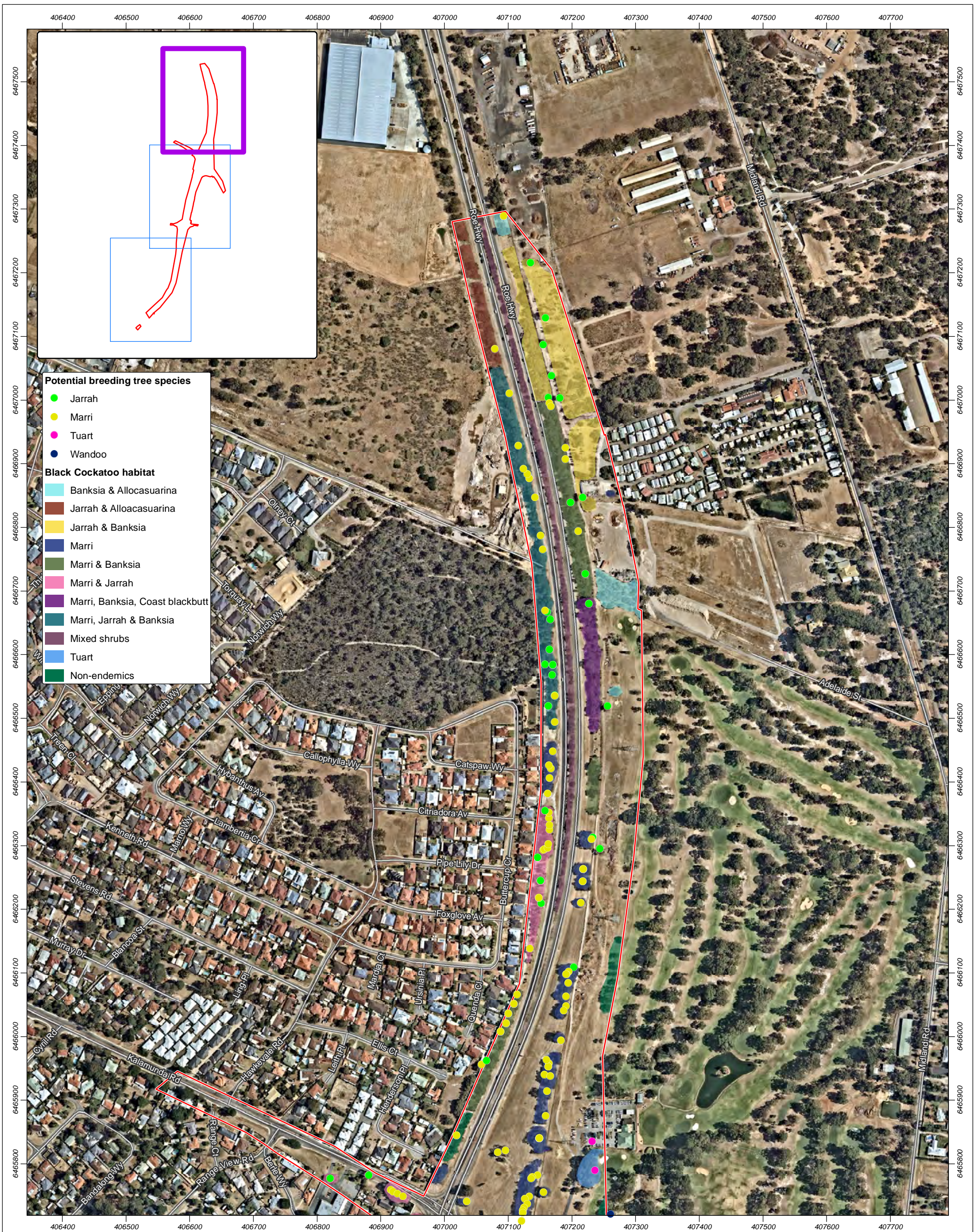
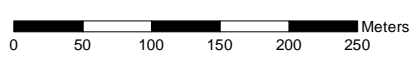


Figure 2: Black Cockatoo foraging and potential breeding habitat

Scale 1:5,500 at A3



Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 5/02/2018

Author: DWhite

Source: Proposed environmental boundary, 24/01/2018 Main Roads 2018; Aerial: Nearmaps 2017/12; Roads: Main Roads 2017.

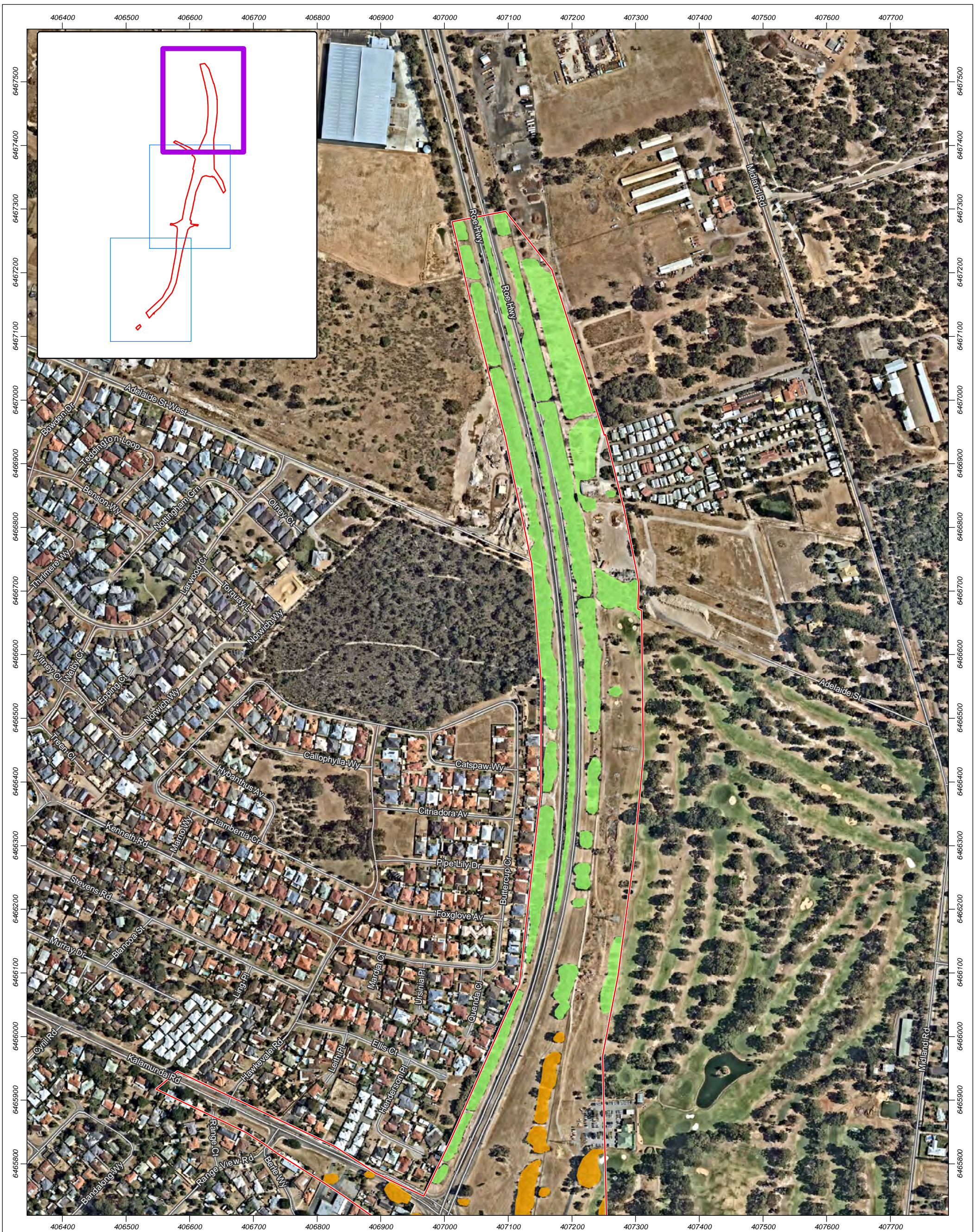
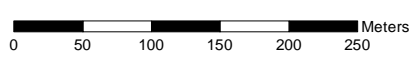


Figure 3: Black Cockatoo foraging quality score

Scale 1:5,500 at A3



- Proposed environmental boundary
- Roads

Black Cockatoo foraging quality score

- 8
- 10

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 5/02/2018

Author: DWhite

Source: Proposed environmental boundary, 24/01/2018 Main Roads 2018; Aerial: Nearmaps 2017/12; Roads: Main Roads 2017.



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4. Discussion

During the Black Cockatoo habitat assessment, potential foraging and breeding habitat was identified in the Survey Area.

4.1 Potential Breeding Habitat

Black Cockatoos breed in large hollow-bearing trees, generally within woodlands or forests (Johnstone *et al.* 2013a). The size of the tree can be a useful indication of the hollow-bearing potential of the tree. Trees of suitable DBH are potentially important for maintaining breeding in the long-term, through maintaining the integrity of the habitat and allowing trees to provide future nest hollows. Maintaining the long-term supply of trees of a size to provide suitable nest hollows is particularly important in woodland stands that are known to support Black Cockatoo breeding (DSEWPac 2012).

The Black Cockatoo habitat assessment revealed that the Survey Area contains Marri, Jarrah, Tuart and Wandoo trees which have reached a size to be considered potential future hollow bearing trees, therefore potential breeding trees (i.e. ≥ 500 mm [≥ 300 mm for Wandoo]) according to the EPBC Act revised draft referral Black Cockatoo guidelines.

In total, 547 trees were recorded which met the criteria to be classed as a potential breeding tree. This suggests that these trees may develop hollows and have the potential to be used for breeding in the future. To be suitable for Black Cockatoos, the hollow entrances need to be large enough for cockatoos to enter and of adequate depth (and the hollows need to have a large enough and relatively flat floor space) (Johnstone *et al.* 2013a).

A total of five hollows in four trees were identified during the first habitat assessment and were not considered suitable for nesting. A reinspection of these hollows, but in greater detail was undertaken and this reinspection also determined that these five hollows were unsuitable for Black Cockatoos to nest in. Primarily because their entrance opening were too small. The minimum entrance size of a hollow to be considered suitable for FRTBC to breed in is 10 x 12 cm and the mean size is 30 x 34 cm (all hollow openings were below the minimum size) (see Table 1 and Appendix 4). Work undertaken on CBC indicate that their hollows have a vertical opening of about 27 cm (Saunders & Dawson 2017) – again all the hollow openings examined during this survey were much smaller (see Table 1 and Appendix 4). In addition, the hollow entrances on all four trees were between five and 11 m above ground and therefore likely too low to be suitable, as Black Cockatoos generally use hollows that are on average at 14.5 m above the ground (Johnstone *et al.* 2013).

4.2 Foraging Habitat

There were other Marri, Jarrah, Tuart and Wandoo trees in the Survey Area, however, they all had a DBH of < 500 mm (< 300 mm for Wandoo) and therefore are not considered as potential breeding trees. These trees, however, are all considered to be foraging habitat. The Survey Area also contained other known foraging species including Coastal Blackbutt, *Banksia attenuata*, *Banksia menziesii*, *Allocasuarina* spp., *Acacia* spp., *Callistemon* spp., *Xanthorrhoea preissii* and Cape Lilac.

All three Black Cockatoo species leave unique feeding patterns on Marri nuts as they extract the seeds. Each species has a different style – from the inelegant “chomp-chomp” style of the FRTBC and Carnaby’s Cockatoo to the delicate style of the Baudin’s Cockatoo which use their long upper beak to extract the Marri seeds (WAM 2013).

During the habitat assessment, approximately 30 FRTBC were heard calling from many locations, seen flying overhead and observed feeding on Marri nuts and Cape Lilac in the Survey Area. Evidence of FRTBC and Carnaby’s foraging was recorded throughout the Survey Area, with many chewed Marri, Cape Lilac and Coastal Blackbutt nuts, as well as Banksia cones were observed (Plate 4 and Plate 5).

No roosts were identified in the Survey Area during the assessment. The Great Cocky Count data from 2017 was examined and five roosts were within 1.5 km of the Survey Area (Birdlife 2017).



Plate 4: Evidence of foraging on Cape lilac nuts by FRTBC in the Survey Area



Plate 5: Evidence of foraging on Marri nuts by FRTBC in the Survey Area

4.3 Habitat Quality

The DEE 2017 foraging habitat scoring tool was used to determine the quality of the habitat. The quality of foraging habitat varies depending upon how Black Cockatoos use that habitat in that location.

Black cockatoos rely on foraging resources to provide sufficient energy for their movements across their range. Availability of foraging habitat plays a particularly critical role in the post-breeding period, when birds need to build condition after breeding, and are teaching juveniles where these foraging resources are located. Losing foraging resources across the range increases the likelihood that birds won't regain condition after breeding, and won't breed again the following season, and that juveniles won't survive to become part of the adult population (DEE 2017).

The Survey Area was given two quality score ratings 8 or 10. Both scores however, result in a classification of "Very High Quality" for the Survey Area. The Survey Area contains 6.45 ha of habitat quality score 8 and 26.08 ha of habitat quality score 10 (Figure 3).

The habitat score was attributed to the Survey Area from applicable starting scores and then additions and subtractions based on functionality of foraging habitat. The difference in the score is mainly because of some areas being considered native shrubland and/or woodland, containing native eucalypts (score 10), or being considered individual trees and small stands of Marri and Jarrah (score 8) at different locations.

Adjustors were applied regarding attributes improving functionality of the foraging habitat. These included location (Swan Coastal Plain) as well as presence of potential breeding habitat and foraging habitat (including Marri and Jarrah). Adjustors were also applied regarding attributes reducing functionality of the foraging habitat, including distance to breeding and roosting sites. It was found that, for example, more than 36 roosting sites from the great Cocky Count 2017 were within 12 km of the Survey Area, five of which were within 1.5 km (Birdlife 2017).

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Appendix 1
Conservation significant flora, fauna
and ecological community definitions

Conservation Codes for Western Australian Flora and Fauna (Parks and Wildlife 2017)

Specially protected fauna or flora are species which have been adequately searched for and are deemed to be, in the wild, either rare, at risk of extinction, or otherwise in need of special protection, and have been gazetted as such.

Categories of specially protected fauna and flora are:

T Threatened species

Published as Specially Protected under the Wildlife Conservation Act 1950, and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora).

Threatened fauna is that subset of 'Specially Protected Fauna' declared to be 'likely to become extinct' pursuant to section 14(4) of the Wildlife Conservation Act.

Threatened flora is flora that has been declared to be 'likely to become extinct or is rare, or otherwise in need of special protection', pursuant to section 23F(2) of the Wildlife Conservation Act.

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

CR Critically endangered species

Threatened species considered to be facing an extremely high risk of extinction in the wild. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

EN Endangered species

Threatened species considered to be facing a very high risk of extinction in the wild. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

VU Vulnerable species

Threatened species considered to be facing a high risk of extinction in the wild. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.

EX Presumed extinct species

Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.

IA Migratory birds protected under an international agreement

Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice.

CD Conservation dependent fauna

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice.

OS Other specially protected fauna

Fauna otherwise in need of special protection to ensure their conservation. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.

Priority Flora and Fauna

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

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

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

1 Priority 1: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

2 Priority 2: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

3 Priority 3: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

4 Priority 4: Rare, Near Threatened and other species in need of monitoring:

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.

(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent.

(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Definition of Threatened Ecological Communities (DEC 2013)

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".

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 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:

- 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)
- 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:

- 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)
- there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes
- there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes.

C) The ecological community exists only as highly modified occurrences that may be capable of being rehabilitated if such work begins in the immediate future (within approximately 10 years).

Endangered (EN)

An ecological community that has been adequately surveyed and found to have been subject to a major contraction in area and/or was originally of limited distribution and is in danger of significant modification throughout its range or severe modification or destruction over most of its range in the near future.

An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information by it meeting any one or more of the following criteria (A, B, or C):

A) The geographic range, and/or total area occupied, and/or number of discrete occurrences have been reduced by at least 70% since European settlement and either or both of the following apply:

- 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)
- 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”

- 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)
- there are few occurrences, each of which is small and/or isolated and all or most occurrences are very vulnerable to known threatening processes
- 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).

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.

Definition of Priority Ecological Communities (DEC 2013)

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 One: Poorly-known ecological communities

Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly-known ecological communities

Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

- Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation
- communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat
- communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four

Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. These include:

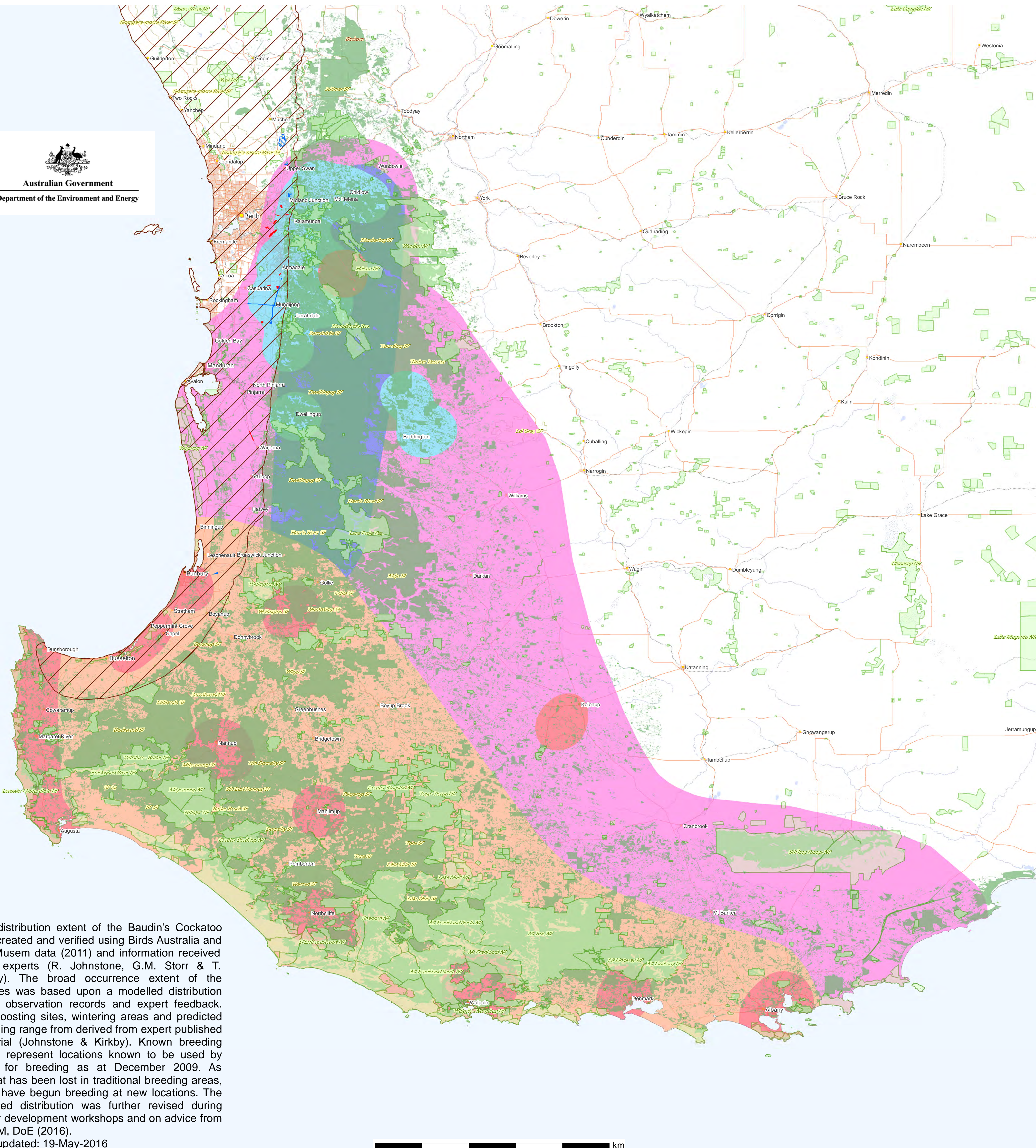
- a) Rare.** Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities 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 Five: Conservation Dependent ecological communities

Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Appendix 2
Black Cockatoo distribution maps

Map 2: Modelled distribution for Baudin's Cockatoo (*Calyptorhynchus baudinii*)



INDICATIVE MAP ONLY: For the latest departmental information, please refer to the Protected Matters Search Tool and the Species Profiles & Threats Database at <http://www.environment.gov.au/biodiversity/threatened/index.html>

Produced by:
 Environmental Resources Information Network 2016

Contextual data source:
 National Vegetation Information System (NVIS 4.2) 2016
 Interim Biogeographic Regionalisation for Australia (IBRA) version 7 2012
 Collaborative Australian Protected Area Database (CAPAD) 2014
 Geoscience Australia GEODATA TOPO 250K Topographic Data Series 3 2006

Projection: Geographic
 Datum: GDA94

Ecological Communities

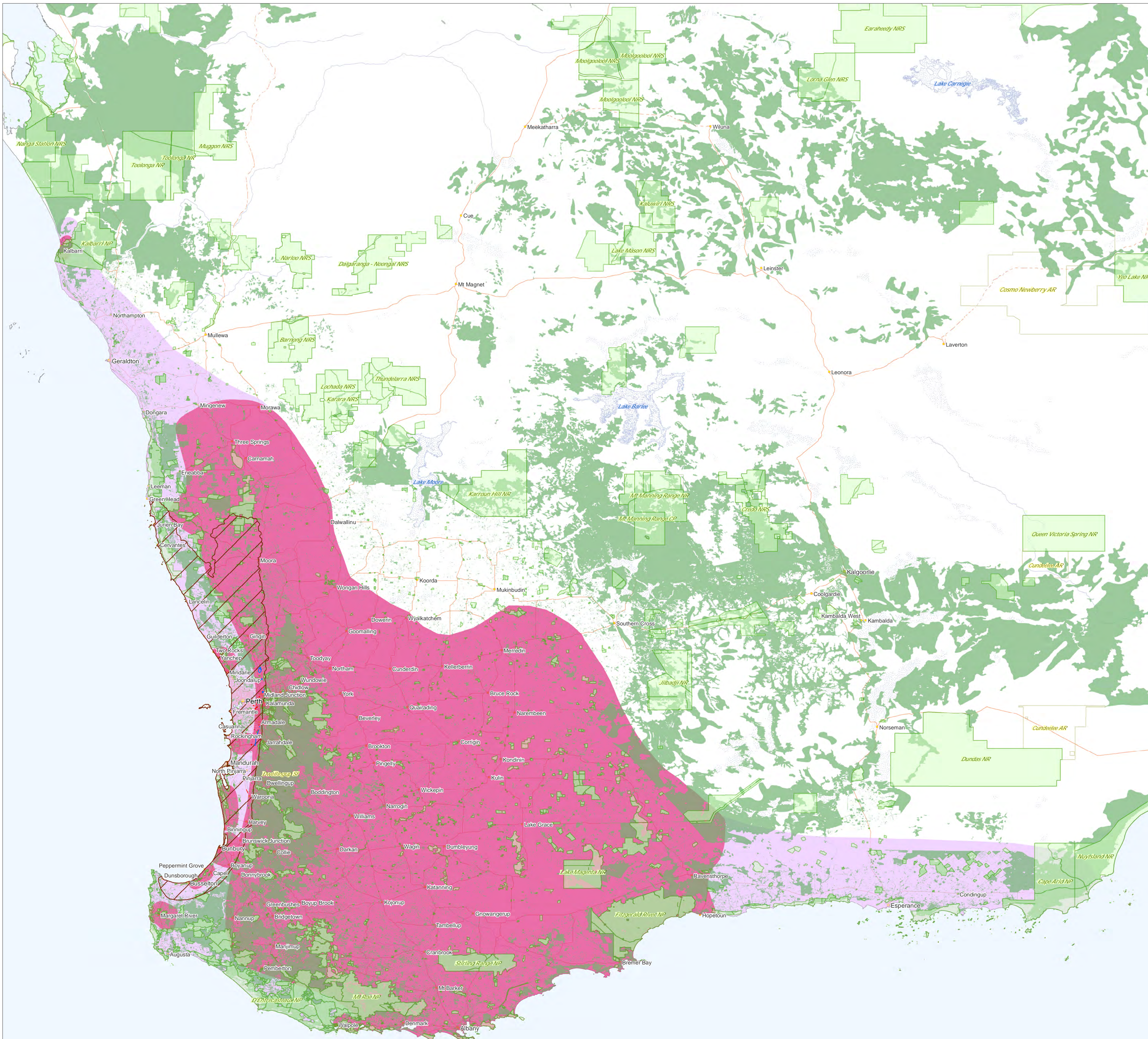
- Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain
- Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain
- Banksia Woodlands of the Swan Coastal Plain
- Conservation Areas
- Jarrah, Karri and Marri (NVIS 4.2)

Species

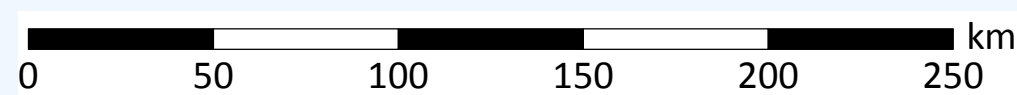
- Known Breeding Areas
- Predicted Breeding Range
- Known Foraging Areas
- Main Wintaring Area
- Species Likely to Occur

- Cities & Towns
- Roads (sealed)
- Roads (unsealed)
- Railways
- State Border
- Major Rivers
- Lakes/Reservoirs
- Non-perennial Lakes

Map 3: Modelled distribution for Carnaby's Cockatoo (*Calyptorhynchus latirostris*)



The distribution extent of the Carnaby's Cockatoo was created and verified using Birds Australia and WA Museum data (2016) and information received from experts (R. Johnstone, 2011). The broad occurrence extent of the species was based upon a modelled distribution using observation records and expert feedback. The mapped distribution was revised during policy development workshops and on advice from WHaM, DoE (2016). Last updated: 19-May-2016.



© Commonwealth of Australia 2016

INDICATIVE MAP ONLY: For the latest departmental information, please refer to the Protected Matters Search Tool and the Species Profiles & Threats Database at <http://www.environment.gov.au/biodiversity/threatened/index.html>

Produced by:
Environmental Resources Information Network 2016

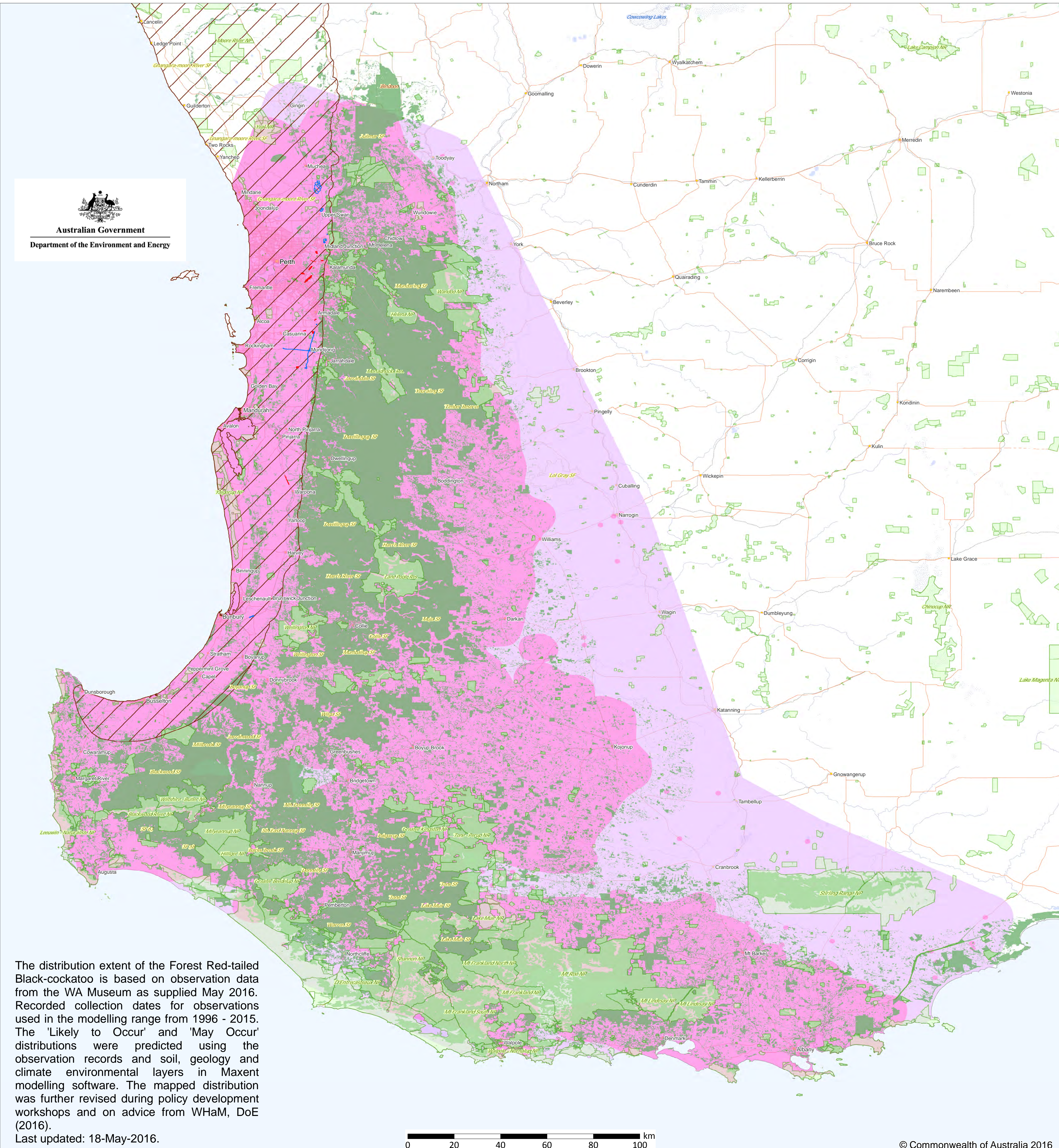
Contextual data source:
National Vegetation Information System (NVIS 4.2) 2016
Interim Biogeographic Regionalisation for Australia (IBRA) version 7 2012
Collaborative Australian Protected Area Database (CAPAD) 2014
Geoscience Australia GEODATA TOPO 250K Topographic Data Series 3 2006

Projection: Geographic
Datum: GDA94

- Conservation Areas
- Jarrah, Karri, Marri, Salmon Gum, Wandoo, Banksia, Grevillea, Dryandra and Hakea (NVIS 4.2)
- Species**
- Breeding Range
- Non-breeding Range
- Ecological Communities**
- Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain
- Corymbia calophylla* - *Kingia australis* woodlands on heavy soils of the Swan Coastal Plain
- Banksia Woodlands of the Swan Coastal Plain

- Cities & Towns
- Roads (sealed)
- Roads (unsealed)
- State Border
- Major Rivers
- Lakes/Reservoirs
- Non-perennial Lakes

Map 4: Modelled distribution for Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)



The distribution extent of the Forest Red-tailed Black-cockatoo is based on observation data from the WA Museum as supplied May 2016. Recorded collection dates for observations used in the modelling range from 1996 - 2015. The 'Likely to Occur' and 'May Occur' distributions were predicted using the observation records and soil, geology and climate environmental layers in Maxent modelling software. The mapped distribution was further revised during policy development workshops and on advice from WHaM, DoE (2016).
Last updated: 18-May-2016.



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INDICATIVE MAP ONLY: For the latest departmental information, please refer to the Protected Matters Search Tool and the Species Profiles & Threats Database at <http://www.environment.gov.au/biodiversity/threatened/index.html>

Produced by:
Environmental Resources Information Network 2016

Contextual data source:
National Vegetation Information System (NVIS 4.2) 2016
Interim Biogeographic Regionalisation for Australia (IBRA) version 7 2012
Collaborative Australian Protected Area Database (CAPAD) 2014
Geoscience Australia GEODATA TOPO 250K Topographic Data Series 3 2006

Projection: Geographic
Datum: GDA94

- Conservation Areas
- Jarrah, Karri and Marri (NVIS 4.2)
- Species**
- Likely to Occur
- May Occur
- Ecological Communities**
- Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands of the Swan Coastal Plain
- Corymbia calophylla* - *Kingia australis* woodlands on heavy soils of the Swan Coastal Plain
- Banksia* Woodlands of the Swan Coastal Plain
- Cities & Towns
- Roads (sealed)
- Roads (unsealed)
- Railways
- State Border
- Major Rivers
- Lakes/Reservoirs
- Non-perennial Lakes

Appendix 3
Black Cockatoo Potential Breeding
Trees

| Tree No. | Species | Easting | Northing | DBH Size | No. Hollows | Hollow Size | Notes |
|----------|---------|---------|----------|----------|-------------|-------------|--------------|
| 1 | Marri | 407093 | 6467289 | A | 0 | N/A | |
| 2 | Marri | 407093 | 6467289 | A | 0 | N/A | |
| 3 | Jarrah | 407159 | 6467129 | A | 0 | N/A | |
| 4 | Jarrah | 407155 | 6467087 | A | 0 | N/A | |
| 5 | Jarrah | 407168 | 6467038 | A | 0 | N/A | |
| 6 | Jarrah | 407163 | 6467004 | B | 0 | N/A | |
| 7 | Marri | 407165 | 6466995 | A | 0 | N/A | |
| 8 | Marri | 407167 | 6466990 | A | 0 | N/A | |
| 9 | Jarrah | 407181 | 6467003 | B | 0 | N/A | |
| 10 | Marri | 407174 | 6467960 | A | 0 | N/A | |
| 11 | Marri | 407190 | 6466925 | A | 0 | N/A | |
| 12 | Marri | 407190 | 6466907 | A | 0 | N/A | |
| 13 | Jarrah | 407217 | 6466847 | A | 0 | N/A | |
| 14 | Jarrah | 407198 | 6466839 | A | 0 | N/A | |
| 15 | Marri | 407210 | 6466794 | A | 0 | N/A | |
| 16 | Jarrah | 407221 | 6466727 | A | 0 | N/A | |
| 17 | Jarrah | 407227 | 6466680 | B | 0 | N/A | |
| 18 | Jarrah | 407256 | 6466519 | A | 0 | N/A | Burnt |
| 19 | Jarrah | 407233 | 6466313 | A | 0 | N/A | |
| 20 | Marri | 407231 | 6466310 | A | 0 | N/A | |
| 21 | Jarrah | 407244 | 6466295 | A | 0 | N/A | |
| 22 | Marri | 407218 | 6466263 | A | 0 | N/A | |
| 23 | Marri | 407218 | 6466263 | A | 0 | N/A | |
| 24 | Marri | 407218 | 6466263 | A | 0 | N/A | |
| 25 | Marri | 407217 | 6466244 | A | 0 | N/A | |
| 26 | Marri | 407217 | 6466244 | A | 0 | N/A | |
| 27 | Marri | 407214 | 6466210 | A | 0 | N/A | |
| 28 | Jarrah | 407203 | 6466109 | B | 1 | <100 mm | |
| 29 | Marri | 407195 | 6466102 | A | 0 | N/A | Splits at 2m |
| 30 | Marri | 407192 | 6466098 | A | 0 | N/A | Chewed nuts |
| 31 | Marri | 407191 | 6466098 | A | 0 | N/A | Chewed nuts |
| 32 | Marri | 407194 | 6466084 | A | 0 | N/A | Chewed nuts |
| 33 | Marri | 407191 | 6466063 | A | 0 | N/A | Chewed nuts |
| 34 | Marri | 407191 | 6466048 | A | 0 | N/A | Chewed nuts |
| 35 | Marri | 407187 | 6466041 | A | 0 | N/A | Chewed nuts |
| 36 | Marri | 407183 | 6465994 | A | 0 | N/A | Chewed nuts |
| 37 | Marri | 407164 | 6465958 | A | 0 | N/A | Chewed nuts |
| 38 | Marri | 407163 | 6465953 | A | 0 | N/A | Chewed nuts |
| 39 | Marri | 407163 | 6465953 | A | 0 | N/A | Chewed nuts |
| 40 | Marri | 407160 | 6465963 | A | 0 | N/A | Chewed nuts |
| 41 | Marri | 407157 | 6465940 | A | 0 | N/A | Chewed nuts |
| 42 | Marri | 407166 | 6465938 | A | 0 | N/A | Chewed nuts |
| 43 | Marri | 407161 | 6465914 | A | 0 | N/A | Chewed nuts |
| 44 | Marri | 407159 | 6465875 | A | 0 | N/A | Chewed nuts |
| 45 | Marri | 407149 | 6465840 | A | 0 | N/A | Chewed nuts |
| 46 | Marri | 407149 | 6465840 | A | 0 | N/A | Chewed nuts |
| 47 | Marri | 407149 | 6465840 | A | 0 | N/A | Chewed nuts |
| 48 | Marri | 407149 | 6465840 | A | 0 | N/A | Chewed nuts |
| 49 | Marri | 407149 | 6465840 | A | 0 | N/A | Chewed nuts |
| 50 | Marri | 407096 | 6465821 | A | 0 | N/A | Chewed nuts |
| 51 | Marri | 407084 | 6465818 | A | 0 | N/A | Chewed nuts |
| 52 | Marri | 407146 | 6465782 | A | 0 | N/A | Chewed nuts |

| | | | | | | | |
|-----|-------|--------|---------|---|---|-----|-------------|
| 53 | Marri | 407138 | 6465779 | A | 0 | N/A | Chewed nuts |
| 54 | Marri | 407136 | 6465777 | A | 0 | N/A | Chewed nuts |
| 55 | Marri | 407133 | 6465749 | A | 0 | N/A | Chewed nuts |
| 56 | Marri | 407126 | 6465745 | A | 0 | N/A | Chewed nuts |
| 57 | Marri | 407130 | 6465737 | A | 0 | N/A | Chewed nuts |
| 58 | Marri | 407125 | 6465731 | A | 0 | N/A | Chewed nuts |
| 59 | Marri | 407123 | 6465727 | A | 0 | N/A | Chewed nuts |
| 60 | Marri | 407123 | 6465723 | A | 0 | N/A | Chewed nuts |
| 61 | Marri | 407123 | 6465723 | A | 0 | N/A | Chewed nuts |
| 62 | Marri | 407121 | 6465710 | A | 0 | N/A | Chewed nuts |
| 63 | Marri | 407121 | 6465710 | A | 0 | N/A | Chewed nuts |
| 64 | Marri | 407118 | 6465697 | A | 0 | N/A | Chewed nuts |
| 65 | Marri | 407113 | 6465674 | A | 0 | N/A | Chewed nuts |
| 66 | Marri | 407114 | 6465668 | A | 0 | N/A | Chewed nuts |
| 67 | Marri | 407111 | 6465657 | A | 0 | N/A | Chewed nuts |
| 68 | Marri | 407107 | 6465653 | A | 0 | N/A | Chewed nuts |
| 69 | Marri | 407035 | 6465741 | A | 0 | N/A | Chewed nuts |
| 70 | Marri | 407019 | 6465845 | A | 0 | N/A | Chewed nuts |
| 71 | Marri | 407019 | 6465845 | A | 0 | N/A | Chewed nuts |
| 72 | Marri | 407059 | 6465641 | A | 0 | N/A | Chewed nuts |
| 73 | Marri | 407058 | 6465956 | A | 0 | N/A | Chewed nuts |
| 74 | Jarra | 407066 | 6465962 | A | 0 | N/A | Chewed nuts |
| 75 | Marri | 407088 | 6466008 | A | 0 | N/A | Chewed nuts |
| 76 | Marri | 407088 | 6466008 | A | 0 | N/A | Chewed nuts |
| 77 | Marri | 407097 | 6466021 | A | 0 | N/A | Chewed nuts |
| 78 | Marri | 407097 | 6466021 | A | 0 | N/A | Chewed nuts |
| 79 | Marri | 407100 | 6466036 | A | 0 | N/A | Chewed nuts |
| 80 | Marri | 407100 | 6466036 | A | 0 | N/A | Chewed nuts |
| 81 | Marri | 407109 | 6466051 | A | 0 | N/A | Chewed nuts |
| 82 | Marri | 407109 | 6466051 | A | 0 | N/A | Chewed nuts |
| 83 | Marri | 407114 | 6466066 | A | 0 | N/A | Chewed nuts |
| 84 | Marri | 407134 | 6466138 | A | 0 | N/A | Chewed nuts |
| 85 | Jarra | 407152 | 6466209 | A | 0 | N/A | Chewed nuts |
| 86 | Marri | 407148 | 6466218 | A | 0 | N/A | Chewed nuts |
| 87 | Marri | 407148 | 6466218 | A | 0 | N/A | |
| 88 | Jarra | 407151 | 6466245 | A | 0 | N/A | |
| 89 | Jarra | 407151 | 6466245 | A | 0 | N/A | |
| 90 | Jarra | 407146 | 6466281 | A | 0 | N/A | |
| 91 | Jarra | 407146 | 6466281 | A | 0 | N/A | |
| 92 | Marri | 407155 | 6466293 | A | 0 | N/A | |
| 93 | Marri | 407157 | 6466294 | A | 0 | N/A | |
| 94 | Marri | 407162 | 6466296 | A | 0 | N/A | |
| 95 | Marri | 407163 | 6466302 | A | 0 | N/A | |
| 96 | Marri | 407165 | 6466325 | A | 0 | N/A | |
| 97 | Marri | 407165 | 6466332 | A | 0 | N/A | |
| 98 | Marri | 407164 | 6466343 | A | 0 | N/A | |
| 99 | Marri | 407164 | 6466352 | A | 0 | N/A | |
| 100 | Jarra | 407158 | 6466355 | A | 0 | N/A | |
| 101 | Marri | 407162 | 6466382 | A | 0 | N/A | |
| 102 | Marri | 407165 | 6466406 | A | 0 | N/A | |
| 103 | Marri | 407167 | 6466421 | A | 0 | N/A | |
| 104 | Marri | 407164 | 6466426 | A | 0 | N/A | |
| 105 | Marri | 407170 | 6466448 | A | 0 | N/A | |

| | | | | | | | |
|-----|--------|--------|---------|---|---|--|--|
| 106 | Marri | 407173 | 6466494 | A | 0 | N/A | |
| 107 | Jarrah | 407163 | 6466519 | A | 0 | N/A | |
| 108 | Jarrah | 407173 | 6466536 | A | 0 | Stag | |
| 109 | Marri | 407173 | 6466535 | A | 0 | N/A | |
| 110 | Jarrah | 407169 | 6466568 | A | 0 | N/A | |
| 111 | Jarrah | 407170 | 6466584 | A | 0 | N/A | |
| 112 | Jarrah | 407170 | 6466584 | A | 0 | N/A | |
| 113 | Jarrah | 407158 | 6466585 | A | 0 | N/A | |
| 114 | Jarrah | 407165 | 6466608 | A | 0 | N/A | |
| 115 | Jarrah | 407166 | 6466655 | A | 0 | N/A | |
| 116 | Jarrah | 407161 | 6466667 | B | 2 | 1x > 100 mm. Not suitable. 1 x < 100 mm | |
| 117 | Marri | 407158 | 6466669 | A | 0 | N/A | |
| 118 | Marri | 407154 | 6466765 | A | 0 | N/A | |
| 119 | Marri | 407151 | 6466787 | A | 0 | N/A | |
| 120 | Marri | 407142 | 6466847 | A | 0 | N/A | |
| 121 | Marri | 407133 | 6466877 | A | 0 | N/A | |
| 122 | Marri | 407130 | 6466884 | A | 0 | N/A | |
| 123 | Marri | 407124 | 6466892 | A | 0 | N/A | |
| 124 | Marri | 407116 | 6466928 | A | 0 | N/A | |
| 125 | Marri | 407102 | 6467010 | A | 0 | N/A | |
| 126 | Marri | 407079 | 6467080 | A | 0 | N/A | |
| 127 | Tuart | 407111 | 6465348 | A | 0 | N/A | |
| 128 | Tuart | 407110 | 6465350 | A | 0 | N/A | |
| 129 | Tuart | 407113 | 6465358 | A | 0 | N/A | |
| 130 | Tuart | 407118 | 6465351 | A | 0 | N/A | |
| 131 | Jarrah | 407141 | 6465349 | A | 0 | N/A | |
| 132 | Jarrah | 407144 | 6465344 | A | 0 | N/A | |
| 133 | Wandoo | 407163 | 6465348 | A | 0 | N/A | |
| 134 | Wandoo | 407171 | 6465346 | A | 0 | N/A | |
| 135 | Wandoo | 407171 | 6465346 | A | 0 | N/A | |
| 136 | Wandoo | 407171 | 6465346 | A | 0 | N/A | |
| 137 | Wandoo | 407171 | 6465346 | A | 0 | N/A | |
| 138 | Wandoo | 407171 | 6465346 | A | 0 | N/A | |
| 139 | Wandoo | 407196 | 6465343 | A | 0 | N/A | |
| 140 | Wandoo | 407196 | 6465343 | A | 0 | N/A | |
| 141 | Wandoo | 407196 | 6465343 | A | 0 | N/A | |
| 142 | Wandoo | 407224 | 6465342 | A | 0 | N/A | |
| 143 | Wandoo | 407224 | 6465342 | A | 0 | N/A | |
| 144 | Wandoo | 407224 | 6465342 | A | 0 | N/A | |
| 145 | Wandoo | 407222 | 6465367 | A | 0 | N/A | |
| 146 | Wandoo | 407221 | 6465373 | A | 0 | N/A | |
| 147 | Wandoo | 407218 | 6465376 | A | 0 | N/A | |
| 148 | Wandoo | 407209 | 6465377 | A | 0 | N/A | |
| 149 | Wandoo | 407199 | 6465381 | A | 0 | N/A | |
| 150 | Marri | 407196 | 6465392 | A | 0 | N/A | |
| 151 | Wandoo | 407192 | 6465401 | A | 0 | N/A | |
| 152 | Wandoo | 407186 | 6465426 | A | 0 | N/A | |
| 153 | Jarrah | 407174 | 6465454 | A | 0 | N/A | |
| 154 | Jarrah | 407156 | 6465461 | A | 0 | N/A | |
| 155 | Wandoo | 407129 | 6465470 | A | 0 | N/A | |
| 156 | Wandoo | 407116 | 6465556 | A | 0 | N/A | |
| 157 | Wandoo | 407092 | 6465563 | A | 0 | N/A | |
| 158 | Wandoo | 407093 | 6465554 | A | 0 | N/A | |

| | | | | | | | |
|-----|--------|--------|---------|---|---|-----|--|
| 159 | Jarrah | 407057 | 6465515 | A | 0 | N/A | |
| 160 | Marri | 407044 | 6465510 | A | 0 | N/A | |
| 161 | Marri | 407036 | 6465500 | A | 0 | N/A | |
| 162 | Marri | 407034 | 6465494 | A | 0 | N/A | |
| 163 | Jarrah | 407032 | 6465491 | A | 0 | N/A | |
| 164 | Jarrah | 407026 | 6465483 | A | 0 | N/A | |
| 165 | Marri | 407031 | 6465478 | A | 0 | N/A | |
| 166 | Marri | 407033 | 6465471 | A | 0 | N/A | |
| 167 | Marri | 407037 | 6465469 | A | 0 | N/A | |
| 168 | Jarrah | 407037 | 6465468 | A | 0 | N/A | |
| 169 | Marri | 407035 | 6465465 | A | 0 | N/A | |
| 170 | Jarrah | 407035 | 6465460 | A | 0 | N/A | |
| 171 | Jarrah | 407034 | 6465461 | A | 0 | N/A | |
| 172 | Marri | 407026 | 6465453 | A | 0 | N/A | |
| 173 | Jarrah | 407020 | 6465449 | A | 0 | N/A | |
| 174 | Marri | 407020 | 6465448 | A | 0 | N/A | |
| 175 | Marri | 407016 | 6465424 | A | 0 | N/A | |
| 176 | Marri | 407015 | 6465424 | A | 0 | N/A | |
| 177 | Marri | 407012 | 6465417 | A | 0 | N/A | |
| 178 | Marri | 407011 | 6465413 | A | 0 | N/A | |
| 179 | Marri | 407010 | 6465403 | A | 0 | N/A | |
| 180 | Marri | 406995 | 6465389 | A | 0 | N/A | |
| 181 | Marri | 406996 | 6465393 | A | 0 | N/A | |
| 182 | Marri | 406977 | 6465461 | A | 0 | N/A | |
| 183 | Marri | 406976 | 6465436 | A | 0 | N/A | |
| 184 | Marri | 406979 | 6465410 | A | 0 | N/A | |
| 185 | Marri | 406955 | 6465409 | A | 0 | N/A | |
| 186 | Marri | 406951 | 6465393 | A | 0 | N/A | |
| 187 | Marri | 406956 | 6465385 | A | 0 | N/A | |
| 188 | Marri | 406959 | 6465383 | A | 0 | N/A | |
| 189 | Marri | 406982 | 6465368 | A | 0 | N/A | |
| 190 | Marri | 406981 | 6465368 | A | 0 | N/A | |
| 191 | Marri | 406983 | 6465362 | A | 0 | N/A | |
| 192 | Marri | 406982 | 6465337 | A | 0 | N/A | |
| 193 | Jarrah | 406961 | 6465324 | A | 0 | N/A | |
| 194 | Marri | 406961 | 6465324 | A | 0 | N/A | |
| 195 | Jarrah | 406966 | 6465320 | A | 0 | N/A | |
| 196 | Jarrah | 406949 | 6465287 | A | 0 | N/A | |
| 197 | Marri | 406948 | 6465286 | A | 0 | N/A | |
| 198 | Jarrah | 406944 | 6465272 | A | 0 | N/A | |
| 199 | Marri | 406943 | 6465271 | A | 0 | N/A | |
| 200 | Marri | 406943 | 6465260 | A | 0 | N/A | |
| 201 | Marri | 406943 | 6465252 | A | 0 | N/A | |
| 202 | Marri | 406939 | 6465254 | A | 0 | N/A | |
| 203 | Marri | 406935 | 6465251 | A | 0 | N/A | |
| 204 | Marri | 406935 | 6465251 | A | 0 | N/A | |
| 205 | Marri | 406935 | 6465251 | A | 0 | N/A | |
| 206 | Marri | 406929 | 6465249 | A | 0 | N/A | |
| 207 | Marri | 406918 | 6465218 | A | 0 | N/A | |
| 208 | Marri | 406920 | 6465209 | A | 0 | N/A | |
| 209 | Marri | 406920 | 6465209 | A | 0 | N/A | |
| 210 | Jarrah | 406918 | 6465198 | A | 0 | N/A | |
| 211 | Marri | 406922 | 6465193 | A | 0 | N/A | |
| 212 | Marri | 406913 | 6465184 | A | 0 | N/A | |

| | | | | | | | |
|-----|-------|--------|---------|---|---|-----|--|
| 213 | Marri | 406913 | 6465184 | A | 0 | N/A | |
| 214 | Marri | 406908 | 6465173 | A | 0 | N/A | |
| 215 | Marri | 406901 | 6465150 | A | 0 | N/A | |
| 216 | Marri | 406903 | 6465146 | A | 0 | N/A | |
| 217 | Marri | 406900 | 6465141 | A | 0 | N/A | |
| 218 | Marri | 406900 | 6465130 | A | 0 | N/A | |
| 219 | Marri | 406898 | 6465125 | A | 0 | N/A | |
| 220 | Marri | 406899 | 6465105 | A | 0 | N/A | |
| 221 | Marri | 406898 | 6465101 | A | 0 | N/A | |
| 222 | Marri | 406898 | 6465101 | A | 0 | N/A | |
| 223 | Marri | 406897 | 6465087 | A | 0 | N/A | |
| 224 | Marri | 406897 | 6465087 | A | 0 | N/A | |
| 225 | Marri | 406894 | 6465077 | A | 0 | N/A | |
| 226 | Marri | 406890 | 6465065 | A | 0 | N/A | |
| 227 | Marri | 406872 | 6465046 | A | 0 | N/A | |
| 228 | Marri | 406873 | 6465035 | A | 0 | N/A | |
| 229 | Marri | 406873 | 6465022 | A | 0 | N/A | |
| 230 | Marri | 406871 | 6465014 | A | 0 | N/A | |
| 231 | Marri | 406871 | 6465014 | A | 0 | N/A | |
| 232 | Marri | 406869 | 6465006 | A | 0 | N/A | |
| 233 | Marri | 406859 | 6464992 | A | 0 | N/A | |
| 234 | Marri | 406859 | 6464992 | A | 0 | N/A | |
| 235 | Marri | 406859 | 6464992 | A | 0 | N/A | |
| 236 | Marri | 406859 | 6464992 | A | 0 | N/A | |
| 237 | Marri | 406859 | 6464992 | A | 0 | N/A | |
| 238 | Marri | 406859 | 6464992 | A | 0 | N/A | |
| 239 | Marri | 406849 | 6464943 | A | 0 | N/A | |
| 240 | Marri | 406848 | 6464940 | A | 0 | N/A | |
| 241 | Marri | 406848 | 6464910 | A | 0 | N/A | |
| 242 | Marri | 406837 | 6464892 | A | 0 | N/A | |
| 243 | Marri | 406838 | 6464884 | A | 0 | N/A | |
| 244 | Marri | 406839 | 6464882 | A | 0 | N/A | |
| 245 | Marri | 406837 | 6464862 | A | 0 | N/A | |
| 246 | Marri | 406837 | 6464862 | A | 0 | N/A | |
| 247 | Marri | 406837 | 6464849 | A | 0 | N/A | |
| 248 | Marri | 406837 | 6464849 | A | 0 | N/A | |
| 249 | Marri | 406837 | 6464849 | A | 0 | N/A | |
| 250 | Marri | 406833 | 6464843 | A | 0 | N/A | |
| 251 | Marri | 406827 | 6464828 | A | 0 | N/A | |
| 252 | Marri | 406830 | 6464824 | A | 0 | N/A | |
| 253 | Marri | 406830 | 6464824 | A | 0 | N/A | |
| 254 | Marri | 406825 | 6464818 | A | 0 | N/A | |
| 255 | Marri | 406825 | 6464818 | A | 0 | N/A | |
| 256 | Marri | 406824 | 6464806 | A | 0 | N/A | |
| 257 | Marri | 406824 | 6464806 | A | 0 | N/A | |
| 258 | Marri | 406824 | 6464806 | A | 0 | N/A | |
| 259 | Marri | 406824 | 6464799 | A | 0 | N/A | |
| 260 | Marri | 406816 | 6464786 | A | 0 | N/A | |
| 261 | Marri | 406814 | 6464782 | A | 0 | N/A | |
| 262 | Marri | 406810 | 6464755 | A | 0 | N/A | |
| 263 | Marri | 406809 | 6464742 | A | 0 | N/A | |
| 264 | Marri | 406808 | 6464733 | A | 0 | N/A | |
| 265 | Marri | 406806 | 6464732 | A | 0 | N/A | |
| 266 | Marri | 406806 | 6464732 | A | 0 | N/A | |

| | | | | | | | |
|-----|-------|--------|---------|---|---|-----|--|
| 267 | Marri | 406800 | 6464717 | A | 0 | N/A | |
| 268 | Marri | 406800 | 6464709 | A | 0 | N/A | |
| 269 | Marri | 407661 | 6464555 | A | 0 | N/A | |
| 270 | Marri | 406805 | 6464695 | A | 0 | N/A | |
| 271 | Marri | 406804 | 6464694 | A | 0 | N/A | |
| 272 | Marri | 406801 | 6464674 | A | 0 | N/A | |
| 273 | Marri | 406798 | 6464672 | A | 0 | N/A | |
| 274 | Marri | 406792 | 6464669 | A | 0 | N/A | |
| 275 | Marri | 406792 | 6464633 | A | 0 | N/A | |
| 276 | Marri | 406791 | 6464629 | A | 0 | N/A | |
| 277 | Marri | 406790 | 6464625 | A | 0 | N/A | |
| 278 | Marri | 406646 | 646445 | A | 0 | N/A | |
| 279 | Marri | 406785 | 6464608 | A | 0 | N/A | |
| 280 | Marri | 406643 | 6464446 | A | 0 | N/A | |
| 281 | Marri | 406781 | 6464571 | A | 0 | N/A | |
| 282 | Marri | 406774 | 6464564 | A | 0 | N/A | |
| 283 | Marri | 406772 | 6464553 | A | 0 | N/A | |
| 284 | Marri | 406801 | 6464532 | A | 0 | N/A | |
| 285 | Marri | 406658 | 6464370 | A | 0 | N/A | |
| 286 | Marri | 406658 | 6464370 | A | 0 | N/A | |
| 287 | Marri | 406658 | 6464370 | A | 0 | N/A | |
| 288 | Marri | 406697 | 6464342 | A | 0 | N/A | |
| 289 | Marri | 406697 | 6464342 | A | 0 | N/A | |
| 290 | Marri | 406697 | 6464342 | A | 0 | N/A | |
| 291 | Marri | 406712 | 6464342 | A | 0 | N/A | |
| 292 | Marri | 406622 | 6464503 | A | 0 | N/A | |
| 293 | Marri | 406622 | 6464505 | A | 0 | N/A | |
| 294 | Marri | 406627 | 6464508 | A | 0 | N/A | |
| 295 | Marri | 406636 | 6464512 | A | 0 | N/A | |
| 296 | Marri | 406645 | 6464505 | A | 0 | N/A | |
| 297 | Marri | 406643 | 6464522 | A | 0 | N/A | |
| 298 | Marri | 406647 | 6464532 | A | 0 | N/A | |
| 299 | Marri | 406685 | 6464528 | A | 0 | N/A | |
| 300 | Marri | 406691 | 6464529 | A | 0 | N/A | |
| 301 | Marri | 406695 | 6464524 | A | 0 | N/A | |
| 302 | Marri | 406707 | 6464540 | A | 0 | N/A | |
| 303 | Marri | 406633 | 6464523 | A | 0 | N/A | |
| 304 | Marri | 406633 | 6464523 | A | 0 | N/A | |
| 305 | Marri | 406633 | 6464523 | A | 0 | N/A | |
| 306 | Marri | 406633 | 6464523 | A | 0 | N/A | |
| 307 | Marri | 406715 | 6464543 | A | 0 | N/A | |
| 308 | Marri | 406718 | 6464554 | A | 0 | N/A | |
| 309 | Marri | 406701 | 6464555 | A | 0 | N/A | |
| 310 | Marri | 406717 | 6464598 | A | 0 | N/A | |
| 311 | Marri | 406717 | 6464598 | A | 0 | N/A | |
| 312 | Marri | 406719 | 6464612 | A | 0 | N/A | |
| 313 | Marri | 406719 | 6464619 | A | 0 | N/A | |
| 314 | Marri | 406719 | 6464623 | A | 0 | N/A | |
| 315 | Marri | 406726 | 6464634 | A | 0 | N/A | |
| 316 | Marri | 406725 | 6464636 | A | 0 | N/A | |
| 317 | Marri | 406729 | 6464662 | A | 0 | N/A | |
| 318 | Marri | 406732 | 6464663 | A | 0 | N/A | |
| 319 | Marri | 406732 | 6464663 | A | 0 | N/A | |
| 320 | Marri | 406738 | 6464671 | A | 0 | N/A | |

| | | | | | | | |
|-----|-------|--------|---------|---|---|-----|-------------|
| 321 | Marri | 406738 | 6464671 | A | 0 | N/A | |
| 322 | Marri | 406734 | 6464680 | A | 0 | N/A | |
| 323 | Marri | 406736 | 6464690 | A | 0 | N/A | |
| 324 | Marri | 406738 | 6464714 | A | 0 | N/A | |
| 325 | Marri | 406740 | 6464729 | A | 0 | N/A | |
| 326 | Marri | 406738 | 6464735 | A | 0 | N/A | |
| 327 | Marri | 406744 | 6464746 | A | 0 | N/A | |
| 328 | Marri | 406751 | 6464777 | A | 0 | N/A | |
| 329 | Marri | 406750 | 6464789 | A | 0 | N/A | |
| 330 | Marri | 406750 | 6464800 | A | 0 | N/A | |
| 331 | Jarra | 406756 | 6464809 | A | 0 | N/A | |
| 332 | Jarra | 406757 | 6464827 | A | 0 | N/A | |
| 333 | Marri | 406763 | 6464836 | A | 0 | N/A | |
| 334 | Marri | 406761 | 6464854 | A | 0 | N/A | |
| 335 | Marri | 406772 | 6464871 | A | 0 | N/A | |
| 336 | Marri | 406769 | 6464872 | A | 0 | N/A | |
| 337 | Marri | 406798 | 6465021 | A | 0 | N/A | |
| 338 | Marri | 406803 | 6465031 | A | 0 | N/A | |
| 339 | Marri | 406811 | 6465033 | A | 0 | N/A | |
| 340 | Marri | 406831 | 6465136 | A | 0 | N/A | |
| 341 | Marri | 406406 | 6465014 | A | 0 | N/A | |
| 342 | Marri | 406849 | 6465192 | A | 0 | N/A | |
| 343 | Marri | 406871 | 6465255 | A | 0 | N/A | |
| 344 | Marri | 406871 | 6465284 | A | 0 | N/A | |
| 345 | Marri | 406875 | 6465310 | A | 0 | N/A | |
| 346 | Marri | 406883 | 6465331 | A | 0 | N/A | |
| 347 | Marri | 406890 | 6465368 | A | 0 | N/A | |
| 348 | Marri | 406956 | 6465626 | A | 0 | N/A | |
| 349 | Jarra | 406957 | 6465642 | A | 0 | N/A | |
| 350 | Marri | 406955 | 6465652 | A | 0 | N/A | |
| 351 | Marri | 406959 | 6465658 | A | 0 | N/A | |
| 352 | Marri | 406959 | 6465658 | A | 0 | N/A | |
| 353 | Marri | 406961 | 6465663 | A | 0 | N/A | |
| 354 | Marri | 406964 | 6465680 | A | 0 | N/A | |
| 355 | Marri | 406965 | 6465688 | A | 0 | N/A | |
| 356 | Marri | 406767 | 6464502 | A | 0 | N/A | |
| 357 | Marri | 406767 | 6464502 | A | 0 | N/A | |
| 358 | Marri | 406769 | 6464498 | A | 0 | N/A | |
| 359 | Marri | 406765 | 6464506 | A | 0 | N/A | |
| 360 | Marri | 406768 | 6464515 | A | 0 | N/A | |
| 361 | Marri | 406754 | 6464472 | A | 0 | N/A | |
| 362 | Marri | 406757 | 6464461 | A | 0 | N/A | Chewed nuts |
| 363 | Marri | 406757 | 6464461 | A | 0 | N/A | Chewed nuts |
| 364 | Marri | 406758 | 6464463 | A | 0 | N/A | |
| 365 | Marri | 406774 | 6464465 | A | 0 | N/A | Chewed nuts |
| 366 | Marri | 406787 | 6464459 | A | 0 | N/A | Chewed nuts |
| 367 | Marri | 406788 | 6464453 | A | 0 | N/A | Chewed nuts |
| 368 | Marri | 406760 | 6464437 | A | 0 | N/A | |
| 369 | Marri | 406752 | 6464433 | A | 0 | N/A | |
| 370 | Marri | 406749 | 6464426 | A | 0 | N/A | |
| 371 | Marri | 406746 | 6464423 | A | 0 | N/A | |
| 372 | Marri | 406774 | 6464416 | A | 0 | N/A | |
| 373 | Marri | 406740 | 6464390 | A | 0 | N/A | |
| 374 | Marri | 406754 | 6464366 | A | 0 | N/A | |

| | | | | | | | |
|-----|--------|--------|---------|---|---|------------------------|----------------|
| 375 | Marri | 406805 | 6464417 | A | 0 | N/A | Burnt |
| 376 | Marri | 406794 | 6464403 | A | 0 | N/A | Burnt |
| 377 | Marri | 406794 | 6464403 | A | 0 | N/A | |
| 378 | Tuart | 406774 | 6464355 | A | 0 | N/A | |
| 379 | Marri | 406752 | 6464320 | A | 0 | N/A | |
| 380 | Marri | 406752 | 6464281 | A | 0 | N/A | |
| 381 | Marri | 406750 | 6464262 | A | 0 | N/A | |
| 382 | Marri | 406734 | 6464256 | A | 0 | N/A | Chewed nuts |
| 383 | Marri | 406742 | 6464225 | A | 0 | N/A | |
| 384 | Marri | 406739 | 6464215 | A | 0 | N/A | |
| 385 | Marri | 406732 | 6464197 | A | 0 | N/A | |
| 386 | Marri | 406711 | 6464088 | A | 0 | N/A | |
| 387 | Marri | 406692 | 6464016 | A | 0 | N/A | |
| 388 | Marri | 406688 | 6463995 | A | 0 | N/A | |
| 389 | Jarrah | 406676 | 6463968 | A | 0 | N/A | |
| 390 | Jarrah | 406677 | 6463949 | A | 0 | N/A | |
| 391 | Jarrah | 406663 | 6463919 | A | 0 | N/A | |
| 392 | Jarrah | 406662 | 6463911 | A | 0 | N/A | |
| 393 | Marri | 406661 | 6463900 | A | 0 | N/A | |
| 394 | Marri | 406658 | 6463871 | A | 0 | N/A | Chewed nuts |
| 395 | Marri | 406654 | 6463863 | A | 0 | N/A | |
| 396 | Jarrah | 406658 | 6463863 | A | 0 | N/A | |
| 397 | Jarrah | 406654 | 6463844 | A | 0 | N/A | |
| 398 | Jarrah | 406654 | 6463824 | A | 1 | < 100 mm. Not suitable | |
| 399 | Marri | 406641 | 6463774 | A | 0 | N/A | |
| 400 | Marri | 406623 | 6463744 | A | 0 | N/A | |
| 401 | Marri | 406623 | 6463740 | A | 0 | N/A | |
| 402 | Marri | 406623 | 6463740 | A | 0 | N/A | |
| 403 | Marri | 406611 | 6463697 | A | 0 | N/A | |
| 404 | Marri | 406607 | 6463688 | A | 0 | N/A | |
| 405 | Marri | 406599 | 6463616 | A | 0 | N/A | |
| 406 | Jarrah | 406604 | 6463613 | A | 0 | N/A | |
| 407 | Marri | 406601 | 6463559 | A | 0 | N/A | |
| 408 | Marri | 406584 | 6463534 | A | 0 | N/A | Chewed nuts |
| 409 | Marri | 406584 | 6463533 | A | 0 | N/A | |
| 410 | Jarrah | 406584 | 6463529 | A | 0 | N/A | |
| 411 | Marri | 406573 | 6463513 | A | 0 | N/A | |
| 412 | Marri | 406571 | 6463503 | A | 0 | N/A | |
| 413 | Marri | 406567 | 6463469 | A | 0 | N/A | Chewed nuts |
| 414 | Marri | 406564 | 6463463 | A | 0 | N/A | |
| 415 | Marri | 406553 | 6463443 | A | 0 | N/A | |
| 416 | Jarrah | 406553 | 6463442 | A | 0 | N/A | |
| 417 | Marri | 406547 | 6463427 | A | 0 | N/A | |
| 418 | Marri | 406550 | 6463414 | A | 0 | N/A | |
| 419 | Jarrah | 406550 | 6463389 | A | 0 | N/A | |
| 420 | Jarrah | 406475 | 6463248 | A | 1 | <100 mm | Bees in hollow |
| 421 | Jarrah | 406475 | 6463248 | A | 0 | N/A | |
| 422 | Jarrah | 406471 | 6463240 | A | 0 | N/A | |
| 423 | Jarrah | 406449 | 6463208 | A | 0 | N/A | |
| 424 | Jarrah | 406441 | 6463193 | A | 0 | N/A | |
| 425 | Jarrah | 406434 | 6463175 | A | 0 | N/A | |
| 426 | Marri | 406397 | 6463130 | A | 0 | N/A | |
| 427 | Marri | 406380 | 6463103 | A | 0 | N/A | |

| | | | | | | | |
|-----|--------|--------|---------|---|---|-----|------------------|
| 428 | Marri | 406367 | 6463106 | A | 0 | N/A | |
| 429 | Jarrah | 406350 | 6463091 | A | 0 | N/A | |
| 430 | Tuart | 406359 | 6463076 | A | 0 | N/A | |
| 431 | Tuart | 406347 | 6463057 | A | 0 | N/A | |
| 432 | Marri | 406328 | 6463040 | A | 0 | N/A | |
| 433 | Marri | 406314 | 6463046 | A | 0 | N/A | |
| 434 | Marri | 406304 | 6463030 | A | 0 | N/A | |
| 435 | Jarrah | 406291 | 6463011 | B | 0 | N/A | Chewed nuts |
| 436 | Marri | 406283 | 6463005 | A | 0 | N/A | |
| 437 | Jarrah | 406273 | 6462998 | A | 0 | N/A | |
| 438 | Marri | 406255 | 6462994 | A | 0 | N/A | |
| 439 | Marri | 406252 | 6462992 | A | 0 | N/A | |
| 440 | Marri | 406164 | 6462925 | B | 0 | N/A | Chewed nuts |
| 441 | Marri | 406161 | 6462910 | A | 0 | N/A | |
| 442 | Marri | 406170 | 6463007 | A | 0 | N/A | |
| 443 | Marri | 406173 | 6463009 | A | 0 | N/A | |
| 444 | Marri | 406202 | 6463042 | A | 0 | N/A | |
| 445 | Marri | 406213 | 6463050 | A | 0 | N/A | |
| 446 | Marri | 406225 | 6463055 | A | 0 | N/A | |
| 447 | Marri | 406244 | 6463065 | A | 0 | N/A | |
| 448 | Marri | 406245 | 6463072 | A | 0 | N/A | |
| 449 | Marri | 406250 | 6463076 | A | 0 | N/A | |
| 450 | Marri | 406263 | 6463086 | A | 0 | N/A | |
| 451 | Marri | 406278 | 6463099 | A | 0 | N/A | |
| 452 | Marri | 406300 | 6463115 | A | 0 | N/A | |
| 453 | Marri | 406302 | 6463134 | A | 0 | N/A | |
| 454 | Marri | 406300 | 6463140 | A | 0 | N/A | |
| 455 | Marri | 406310 | 6463141 | A | 0 | N/A | |
| 456 | Marri | 406327 | 6463150 | A | 0 | N/A | |
| 457 | Marri | 406331 | 6463154 | A | 0 | N/A | |
| 458 | Marri | 406338 | 6463170 | A | 0 | N/A | |
| 459 | Marri | 406343 | 6463179 | A | 0 | N/A | |
| 460 | Jarrah | 406425 | 646326 | A | 0 | N/A | |
| 461 | Marri | 406450 | 6463369 | A | 0 | N/A | |
| 462 | Marri | 406459 | 6463380 | A | 0 | N/A | |
| 463 | Marri | 406463 | 6463385 | A | 0 | N/A | |
| 464 | Marri | 406472 | 6463395 | A | 0 | N/A | |
| 465 | Marri | 406470 | 6463409 | A | 0 | N/A | 2 branches > 500 |
| 466 | Marri | 406472 | 6463416 | A | 0 | N/A | |
| 467 | Marri | 406476 | 6463418 | A | 0 | N/A | Chewed nuts |
| 468 | Marri | 406482 | 6463421 | A | 0 | N/A | |
| 469 | Jarrah | 406481 | 6463431 | A | 0 | N/A | 3 branches > 500 |
| 470 | Marri | 406488 | 6463440 | A | 0 | N/A | |
| 471 | Marri | 406493 | 6463478 | A | 0 | N/A | |
| 472 | Marri | 406517 | 6463516 | A | 0 | N/A | |
| 473 | Marri | 406526 | 6463550 | A | 0 | N/A | Chewed nuts |
| 474 | Marri | 406526 | 6463550 | A | 0 | N/A | Chewed nuts |
| 475 | Jarrah | 406524 | 6463563 | A | 0 | N/A | |
| 476 | Marri | 406527 | 6463585 | A | 0 | N/A | Chewed nuts |
| 477 | Marri | 406553 | 6463700 | A | 0 | N/A | |
| 478 | Marri | 406566 | 6463788 | A | 0 | N/A | Chewed nuts |
| 479 | Marri | 406586 | 6463906 | A | 0 | N/A | |
| 480 | Jarrah | 406585 | 6463923 | A | 0 | N/A | |
| 481 | Jarrah | 406586 | 6463948 | A | 0 | N/A | |

| | | | | | | | |
|-----|--------|--------|---------|---|---|-----|------------------|
| 482 | Jarrah | 406583 | 6463951 | A | 0 | N/A | |
| 483 | Jarrah | 406585 | 6463953 | A | 0 | N/A | |
| 484 | Jarrah | 406591 | 6463965 | A | 0 | N/A | |
| 485 | Marri | 406600 | 6463972 | A | 0 | N/A | |
| 486 | Marri | 406599 | 6463978 | A | 0 | N/A | |
| 487 | Jarrah | 406600 | 6463998 | A | 0 | N/A | |
| 488 | Marri | 406601 | 6464002 | A | 0 | N/A | |
| 489 | Marri | 406600 | 6464010 | A | 0 | N/A | |
| 490 | Marri | 406603 | 6464043 | A | 0 | N/A | |
| 491 | Marri | 406608 | 6464048 | A | 0 | N/A | |
| 492 | Marri | 406597 | 6464076 | A | 0 | N/A | |
| 493 | Jarrah | 406608 | 6464093 | A | 0 | N/A | |
| 494 | Marri | 406608 | 6464093 | A | 0 | N/A | |
| 495 | Marri | 406609 | 6464104 | A | 0 | N/A | |
| 496 | Marri | 406608 | 6464109 | A | 0 | N/A | |
| 497 | Wandoo | 406598 | 6464114 | A | 0 | N/A | |
| 498 | Wandoo | 406598 | 6464116 | A | 0 | N/A | |
| 499 | Marri | 406611 | 6464192 | A | 0 | N/A | |
| 500 | Marri | 406611 | 6464209 | A | 0 | N/A | |
| 501 | Marri | 406614 | 6464253 | A | 0 | N/A | |
| 502 | Marri | 406621 | 6464259 | A | 0 | N/A | |
| 503 | Marri | 406628 | 6464271 | A | 0 | N/A | |
| 504 | Marri | 406617 | 6464298 | A | 0 | N/A | |
| 505 | Jarrah | 406609 | 6464459 | A | 0 | N/A | |
| 506 | Marri | 406628 | 6464455 | A | 0 | N/A | Chewed |
| 507 | Marri | 406636 | 6464463 | A | 0 | N/A | |
| 508 | Marri | 406637 | 6464473 | A | 0 | N/A | |
| 509 | Marri | 406641 | 6464449 | A | 0 | N/A | Chewed nuts |
| 510 | Marri | 406653 | 6464371 | A | 0 | N/A | |
| 511 | Marri | 406658 | 6464327 | A | 0 | N/A | |
| 512 | Jarrah | 406662 | 6464326 | A | 0 | N/A | |
| 513 | Marri | 406673 | 6464341 | A | 0 | N/A | |
| 514 | Marri | 406676 | 6464370 | A | 0 | N/A | |
| 515 | Marri | 406687 | 6464410 | A | 0 | N/A | |
| 516 | Marri | 406686 | 6464421 | A | 0 | N/A | Chewed nuts |
| 517 | Marri | 406703 | 6464466 | A | 0 | N/A | |
| 518 | Marri | 406703 | 6464466 | A | 0 | N/A | |
| 519 | Tuart | 407232 | 6465835 | B | 0 | N/A | |
| 520 | Tuart | 407236 | 6465790 | B | 0 | N/A | |
| 521 | Wandoo | 407261 | 6465721 | A | 0 | N/A | |
| 522 | Jarrah | 407255 | 6465684 | B | 0 | N/A | |
| 523 | Marri | 407259 | 6465669 | B | 0 | N/A | |
| 524 | Wandoo | 407236 | 6465660 | A | 0 | N/A | |
| 525 | Tuart | 407300 | 6465407 | B | 0 | N/A | 4 branches > 500 |
| 526 | Tuart | 407416 | 6465111 | A | 0 | N/A | |
| 527 | Marri | 407390 | 6465200 | A | 0 | N/A | |
| 528 | Tuart | 407373 | 6465231 | A | 0 | N/A | |
| 529 | Tuart | 407377 | 6465238 | A | 0 | N/A | |
| 530 | Tuart | 407385 | 6465254 | A | 0 | N/A | |
| 531 | Tuart | 407365 | 6465287 | A | 0 | N/A | |
| 532 | Tuart | 407345 | 6465300 | A | 0 | N/A | |
| 533 | Tuart | 407327 | 6465304 | A | 0 | N/A | |
| 534 | Marri | 407251 | 6465413 | A | 0 | N/A | |
| 535 | Tuart | 407179 | 6465571 | B | 0 | N/A | |

| | | | | | | | |
|-----|--------|--------|---------|---|---|-----|-------------|
| 536 | Marri | 407413 | 6465080 | B | 0 | N/A | Chewed nuts |
| 537 | Marri | 407408 | 6465086 | A | 0 | N/A | Chewed nuts |
| 538 | Marri | 407396 | 6465106 | A | 0 | N/A | Chewed nuts |
| 539 | Marri | 407385 | 6465118 | A | 0 | N/A | Chewed nuts |
| 540 | Jarrah | 407135 | 6467215 | A | 0 | N/A | |
| 541 | Marri | 407155 | 6465755 | A | 0 | N/A | |
| 542 | Marri | 406916 | 6465759 | A | 0 | N/A | |
| 543 | Marri | 406919 | 6465756 | A | 0 | N/A | |
| 544 | Marri | 406926 | 6465753 | A | 0 | N/A | |
| 545 | Marri | 406935 | 6465749 | A | 0 | N/A | |
| 546 | Jarrah | 406881 | 6465782 | A | 0 | N/A | |
| 547 | Jarrah | 406821 | 6465777 | A | 0 | N/A | |

Appendix 4
Hollow Photo

Jarrah 28

Plate 12: Hollow < 100 mm



Plate 13: Hollow < 100 mm



Jarraah 116

Plate 6: Hollow < 100 mm



Plate 7: Hollow < 100 mm



Jarraah 116

Plate 8: Hollow > 100 mm



Plate 9: Hollow > 100 mm



Jarrah 398

Plate 14: Hollow < 100 mm



Plate 15: Hollow < 100 mm



Jarrah 420

Plate 10: Hollow < 100 mm



Plate 11: Hollow < 100 mm

