Targeted Fauna Survey

&

Habitat Tree Assessment

of

Northcliffe Cemetery

(CPS 10157/1)

Shire of Manjimup

December 2023

Version 1

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SHIRE OF MANJIMUP
Manjimup • Northcliffe • Pemberton • Walpole

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SUMMARY

This report details the results of a targeted fauna survey and a black cockatoo habitat tree assessment carried out over sections of the Northcliffe Cemetery on behalf of the Shire of Manjimup (the Shire).

The Shire has applied for a permit to clear 0.75 ha of vegetation from within and near the cemetery (CPS 10157/1) (Figure 1). Upon review the Department of Water and Environmental Regulation (DWER 2023) have advised the Shire that in order to determine the impacts to conservation significant fauna, a fauna survey and habitat tree assessment of the application area is required.

This report details the results of a targeted fauna survey and black cockatoo habitat tree assessment carried out to fulfil this request.

A variety of methods were used in an attempt to determine if the application area was occupied by the fauna species of conservation significance identified by DWER as having the potential of being present (i.e. western ringtail possum, south-western brush-tailed phascogale, quenda, quokka and short-nosed snake).

The assessment has included a habitat assessment in addition to a series of day and night transects across the application area while searching for and recording any evidence of presence of the target species (i.e. calls, tracks, scats, runnels, dreys, tree hollows, individuals).

A day and night survey of the application area was carried out by Greg Harewood (Zoologist – 20 years' experience) on the 11 November 2023.

KEY FINDINGS

Evidence of Baudin's cockatoo foraging within the application area was found and diggings attributed to quenda was also located within the application area. No evidence of any other fauna species of conservation significance were recorded within the application area during the course of the survey.

Superficially sections of the application area, in particular the area of remnant native vegetation, appears to represent habitat that could be regarded as suitable for the other species of conservation significance identified by DWER as possible occurring. The presence of western ringtail possums and the quokka are generally easy to determine and the lack of evidence of these species suggest they were at the time of the survey absent from the application area.

South-Western brush-tailed phascogales can be difficult to detect even if present and also have relatively large home ranges. Whie not detected they may still frequent the application area at times though the number of hollow bearing trees (which thy use for daytime refuge) are limited in number.

Short-nosed snakes are very cryptic and their presence/absence is very difficult to determine. The dense groundcover present in the remnant bushland appears suitable habitat so their remains some probability that this species may occur.

With respect to black cockatoos in general two possibly suitable large hollows that may represent potential breeding habitat was identified, though no evidence of them actually been used for this purpose was obtained. Quality foraging habitat (marri/jarrah open forest) makes up about half of the application area. There is some potential roosting habitat, though no evidence of roosting activity by black cockatoos was observed.

Given the relatively small size of the application area (~0.75 ha), which is only partly vegetated and the large expanses of native bushland in surrounding areas it is the Authors opinion that that clearing can be carried out without significantly impacting on the status fauna species of conservation significance or existing black cockatoo breeding/foraging/roosting habitat.

It is recommended that, if and when clearing is undertaken, a suitably qualified and experience “fauna spotter” be employed to minimise the likelihood of animals being killed or injured during site works.

This report should be forwarded to DWER for their consideration.

1. INTRODUCTION

This report details the results of a targeted fauna survey and a black cockatoo habitat tree assessment carried out over sections of the Northcliffe Cemetery on behalf of the Shire of Manjimup (the Shire).

The Shire has applied for a permit to clear 0.75 ha of vegetation from within and near the cemetery (CPS 10157/1) (Figure 1). Upon review the Department of Water and Environmental Regulation (DWER 2023) have advised the Shire that in order to determine the impacts to conservation significant fauna, a fauna survey and habitat tree assessment of the application area is required.

This report details the results of a targeted fauna survey and black cockatoo habitat tree assessment carried out to fulfil this request.

2. SCOPE OF WORKS

DWER have defined the scope of works as:

- A fauna survey is required of the area proposed to be cleared – Target species include:
  - western ringtail possum (*Pseudocheirus occidentalis*)
  - quokka (*Setonix brachyurus*)
  - south-western brush-tailed phascogale (*Phascogale tapoatafa wambenger*)
  - quenda (*Isoodon fusciventer*)
  - short-nosed snake (*Elapognathus minor*)
- A black cockatoo habitat assessment survey is required for the area proposed to be cleared.

Note: For the purposes of this report the term black cockatoo is in reference to Baudin's cockatoo *Zanda baudinii*, Carnaby's cockatoo *Zanda latirostris* and the forest red-tailed black cockatoo *Calyptorhynchus banksii naso*.

3. METHODS

A day and night survey of the application area was carried out by Greg Harewood (Zoologist – 20 years' experience) on the 11 November 2023.

3.1 TARGETED FAUNA SURVEY

A variety of methods were used in an attempt to determine if the application area was occupied by the fauna species of conservation significance identified by DWER as having the potential

of being present (i.e. western ringtail possum, south-western brush-tailed phascogale, quenda, quokka and short-nosed snake).

The methods directed at detecting each species are detailed below:

3.1.1 Habitat Assessment

Vegetation units, landforms and soils observed during the field survey have been used to define broad fauna habitat types across the application area.

The objective of the habitat assessment was to assess if it were likely that the listed species of conservation significance would utilise the habitats identified within the application area.

During the field survey, fauna habitats present were assessed, and specific elements identified, which informed the likelihood of the listed conservation significant species utilising the area.

3.1.2 Day and Night Surveys

One day survey and one night survey were undertaken. The day survey included a series of transects across the application area while searching for and recording any evidence of presence of the target species (i.e. calls, tracks, scats, runnels, dreys, tree hollows, individuals) concurrent with the habitat assessment.

The night survey involved a series of transects across the application area using a LED head torch with the aim of detecting some of the nocturnal target species by way of eye shine.

The day surveys had the potential to detect individuals and/or secondary signs of all of the listed fauna species of conservation significance identified by DWER as potentially occurring.

The night survey specifically targeted the nocturnal mammal species (i.e. western ringtail possum, south-western brush-tailed phascogale, quenda and quokka).

3.2 BLACK COCKATOO HABITAT ASSESSMENT

The following methods were employed to comply with the defined scope of works and are based on Commonwealth of Australia (2012 and 2022) guidelines which state that surveys for Carnaby's, Baudin's and forest red-tailed black cockatoo habitat should:

- be done by a suitably qualified person with experience in vegetation or cockatoo surveys, depending on the type of survey being undertaken;
- maximise the chance of detecting the species' habitat and/or signs of use;
- determine the context of the site within the broader landscape—for example, the amount and quality of habitat nearby and in the local region (for example, within 10 km);
- account for uncertainty and error (false presence and absences); and
- include collation of existing data on known locations of breeding and feeding birds and night roost locations.

The Commonwealth of Australia (2012) places habitats used by black cockatoos into the following three categories:

- Breeding Habitat;
- Foraging Habitat; and
- Night Roosting Habitat.

3.2.1 Breeding Habitat Assessment

The black cockatoo breeding habitat assessment identified all suitable breeding tree species within the survey area that have a diameter at breast height (DBH) equal to or greater than 50cm. The DBH of each tree was estimated using a pre-made "caliper".

Target tree species included marri, jarrah, tuart and flooded gum and any other *Corymbia/Eucalyptus* species of a suitable size that was present. Peppermints, *Banksia*, sheoak and *Melaleuca* tree species (for example) were not assessed as they typically do not develop hollows used by black cockatoos.

The location of each tree identified as being over the threshold DBH will be recorded with a GPS and details on tree species, number and size of hollows (if any) noted. Trees observed to contain hollows (of any size/type) will be marked with "H" using spray paint.

Hollow/potential hollows were placed into one of four categories, based on the size of the apparent hollow entrance, these being:

- Small = ~<5cm diameter (i.e. entrance too small for a black cockatoo);
- Medium = ~5cm-10cm diameter (i.e. entrance too small for a black cockatoo);
- Large = ~>10cm diameter (entrance large enough for a black cockatoo but hollow appears unsuitable for nesting i.e. wrong orientation, appears too small, too low or too shallow); or
- Large (cockatoo) = ~>10cm diameter (entrance and apparent hollow appear big enough and suitably sized/orientated for a black cockatoo to use for nesting).

Based on this assessment, trees present within the survey area were placed into one of four categories:

- Tree <50cm DBH or an unsuitable species (these were not assessed/recorded);
- Tree ≥50cm DBH, no hollows seen;
- Tree ≥50cm DBH, one or more hollows seen, none of which were considered suitable for black cockatoos to use for nesting; or
- Tree ≥50cm DBH, one or more hollows seen, with at least one considered suitable for black cockatoos to use for nesting.

For the purposes of this assessment, a tree containing a potential black cockatoo nest hollow was defined as:

Generally, any tree which is alive or dead that contains one or more visible hollows (cavities within the trunk or branches) or possible hollows potentially suitable for occupation by black cockatoo for the purpose of nesting/breeding. Hollows or possible hollows that had an entrance greater than about 10cm in diameter and would allow the entry of a black cockatoo into a suitably orientated and sized branch/trunk, were recorded as a "potential nest hollow".

Identified hollows, if observed, were to be examined using binoculars for evidence of actual use by black cockatoos (e.g. chewing around hollow entrance, scarring and scratch marks on trunks and branches). Details recorded included hollow size, height, type, orientation, comments on suitability and any evidence of use.

3.2.2 Foraging Habitat Assessment

Foraging habitat is represented by plant species that are known to provide a food source for black cockatoos. This can be in the form of seeds, flowers and also boring grubs that are extracted from some plant species.

In addition to the vegetation/habitat mapping, the specific plant species present that represent potential foraging habitat have been documented. The location and nature of black cockatoo foraging activity (e.g. chewed fruits around base of trees) observed during the field survey was also recorded.

DWER in their request for additional information recommended the use the foraging quality scoring tool contained within Appendix A of the Referral guideline for 3 WA threatened black cockatoo species (Commonwealth of Australia 2022) to ascertain and quantify the quality of the foraging habitat. This tool is only of practical use for areas of vegetation over the 1 hectare threshold and is therefore not relevant to this particular project given the area of the entire application area is only 0.75 ha in size and only partly vegetated.

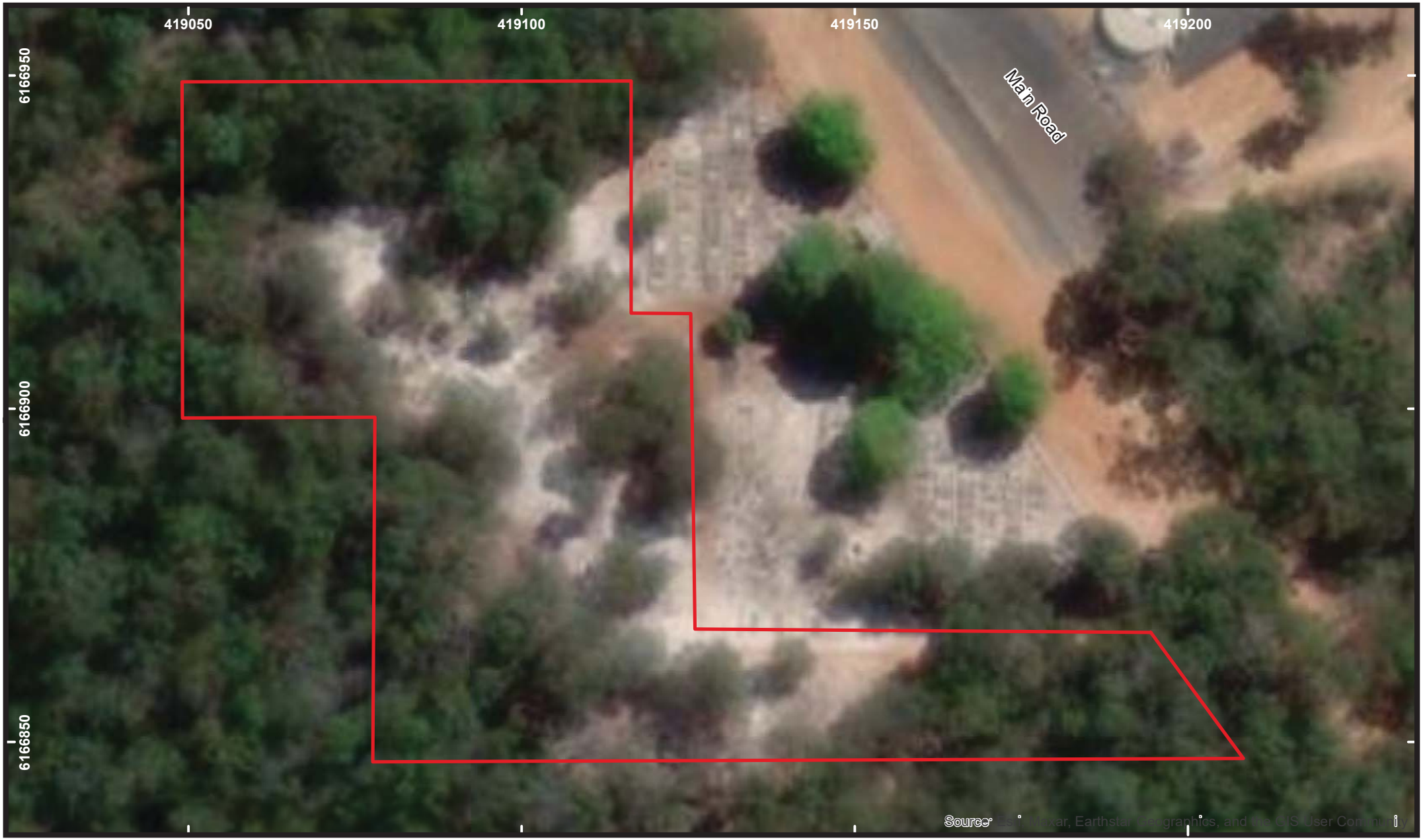
3.2.3 Night Roosting Habitat Assessment

Direct and indirect evidence of black cockatoos roosting within trees on site was noted where observed (e.g. branch clippings, droppings or moulted feathers).

4. SURVEY CONSTRAINTS

No seasonal sampling has been carried out as part of this fauna assessment. The conclusions presented are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of the field assessments. It should also be recognised that site conditions can change with time.

During the black cockatoo habitat survey trees with hollows were searched for. It should be noted that identifying hollows suitable for fauna species from ground level has limitations. Generally, the full characteristics of any hollow seen are not fully evident (e.g. internal dimensions). It is also difficult to locate all hollows within all trees as some are not observable from ground level, though to a certain extent some of these limitations can be overcome by using a drone or pole camera to examine possible hollows in more detail (where considered warranted and feasible).



Legend

Application Boundary

0 10 20 30 40 50

Metres

Fauna Survey

Drawn: G. Harewood

Date: Dec 2023

Scale: 1:750

Projection/Coordinate System: UTM/MGA Zone 50

Shire of Manjimup
CPS 10157/1
Northcliffe Cemetery

Aerial Photograph

Figure: 1

5. RESULTS

5.1 TARGETED FAUNA SURVEY

5.1.1 Habitat Assessment

The application area has a total extent of about 0.74 hectares. Approximately half the application area (~0.37 ha) is represented by the existing, largely cleared cemetery grounds, with the balance being made up of remnant native bushland.

The existing cleared/partly cleared areas contain scattered trees (mainly peppermint with minor marri and jarrah) over an open grassland with scattered bracken ferns and bare sand.

The remnant bushland areas consist of a marri/jarrah open forest over tall open scrub/open heath. Represents remnant bushland surrounding the existing cemetery. Makes up about 50 % (~0.37 ha) of the application area.

Superficially, all of the vegetated sections of the application area appear suitable for western ringtail possums given the presence of favoured plant species and a coherent midstorey element in most sections. There also appears to be suitable habitat for quenda, where ground cover is densest.

Habitat suitable for the south-western brush-tailed phascogales also appears to be present though there is an obvious paucity of hollow bearing trees which the species requires for daytime refuge and breeding. Habitat appears superficially to be suitable for quokkas given dense shrub layer within the remnant bushland.

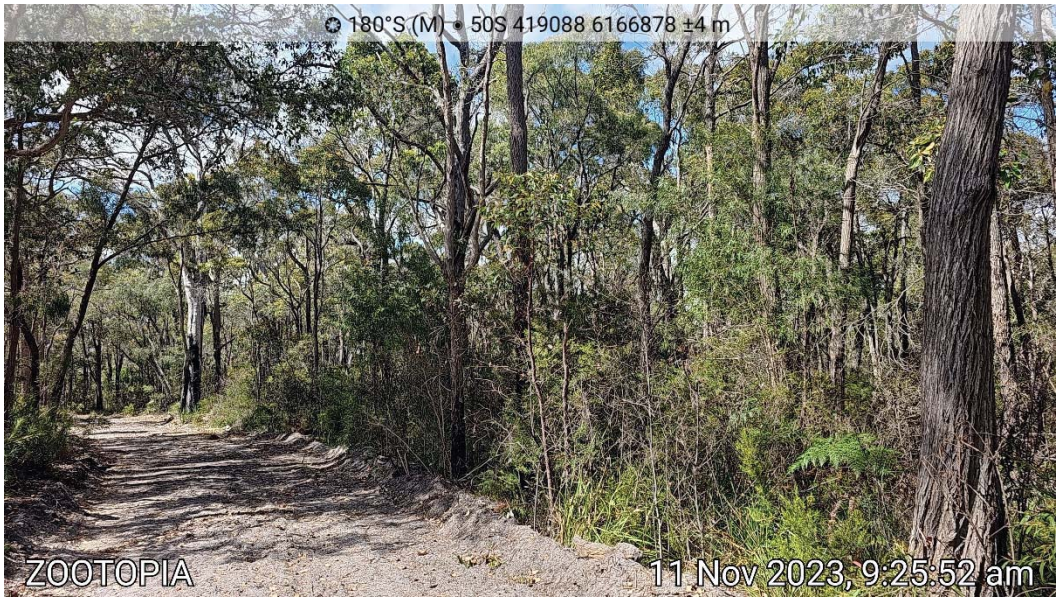
Some areas of habitat also superficially appear suitable for the short-nosed snake (i.e. very dense understory).

With respect to black cockatoos two possible large hollows that may represent potential breeding habitat were identified. Quality foraging habitat is present in the form of marri and jarrah and there is some potential roosting habitat (i.e. large trees).

Example images of the various fauna habitats present are provided in Table 1. This table also provides a brief assessment of the fauna habitat values of the various broad habitat types identified. Additional details on each fauna species can be found in Appendix A.

Table 1: Example Images of the fauna habitats within the application area

<table>
<tr><td> 
</td></tr>
<tr><td>Fauna Habitat Description: Scattered trees (mainly peppermint with minor marri and jarrah) over an open grassland with scattered bracken ferns and bare sand. Represents part of the existing largely cleared cemetery and cleared firebreak around the outside boundary. Makes up about 50 % (~0.37 ha) of the application area.</td></tr>
<tr><td>Black Cockatoo Habitat Value: Low value given paucity of favoured foraging trees (marri/jarrah/banksia), no hollow bearing trees with limited opportunity for roosting. No evidence of these species seen in this section of the application area.</td></tr>
<tr><td>Western Ringtail Possum Habitat Value: Superficially appears to be of moderate value given presence of some peppermint but canopy connectivity discontinuous. No evidence of these species seen in this section of the application area.</td></tr>
<tr><td>Quenda Habitat Value: Negligible/Low value given absence of coherent groundcover vegetation. May have some value as foraging habitat but open nature leaves individuals prone to predation. No evidence of these species seen in this section of the application area.</td></tr>
<tr><td>South-Western Brush-tailed Phascogale: Negligible/Low value given absence of hollow bearing trees. May have some value as foraging habitat but open nature leaves individuals prone to predation. No evidence of these species seen in this section of the application area.</td></tr>
<tr><td>Quokka Habitat Value: No value given absence of any coherent groundcover vegetation. This species would not utilise this section of the application area. No evidence of these species seen in this section of the application area.</td></tr>
<tr><td>Short-nosed Snake Habitat Value: No value given absence of coherent groundcover vegetation. This species would not utilise this section of the application area. No evidence of these species seen in this section of the application area.</td></tr>
</table>



Fauna Habitat Description: Marri/Jarrah Open Forest over Tall Open Scrub/Open Heath. Represents remnant bushland surrounding the existing cemetery. Makes up about 50 % (~0.37 ha) of the application area.
Black Cockatoo Habitat Value: High value given dominance of favoured foraging trees (Marri/Jarrah), two large hollow bearing trees identified though no evidence of use seen. Some potential for roosting habitat.
Western Ringtail Possum Habitat Value: Superficially appears to be of good value given presence of some peppermint and range of other favoured plant species with relatively continuous canopy connectivity. However, this section of the application area appears not to be in current use by this species.
Quenda Habitat Value: Good value given presence of dense and coherent groundcover vegetation. Evidence of this species seen in the form of diggings at several locations.
South-Western Brush-tailed Phascogale: Some habitat value given presence of some hollow bearing trees and coherent canopy connectivity. No evidence of this species seen in this section of the application area.
Quokka Habitat Value: Superficially appears to be of good value given presence of dense and coherent shrubby vegetation. Evidence of the species was not detected during the day and night survey and therefore it is considered highly unlikely to occur.
Short-nosed Snake Habitat Value: Superficially appears to be of good value given presence of some dense groundcover. No evidence of this species seen in this section of the application area. This species is very hard to detect.

5.1.2 Day and Night Surveys

Six fauna species were recorded during the course of the day surveys, these being:

- Baudin's Cockatoo (*Zanda baudinii*)
- Laughing Kookaburra (*Dacelo novaeguineae*)
- Fan-tailed Cuckoo (*(Cacomantis flabelliformis)*
- Grey Fantail (*Rhipidura fuliginosa*)
- Red Wattlebird (*Anthochaera carunculate*) and
- Quenda (*Isoodon fusciventer*)

As indicated, evidence of two fauna species of conservation significance were observed during the day surveys this being Baudin's cockatoo (*Zanda baudinii*) and the quenda (*Isoodon fusciventer*) . Evidence of Baudin's Cockatoo was found in the form of a small amount of foraging evidence attributed to this species at several locations (i.e. chewed marri fruits). Diggings attributed to foraging quenda were also observed in dense bushland at several locations.

No fauna species were observed during the nocturnal survey.

5.2 BLACK COCKATOO HABITAT ASSESSMENT

5.3 Breeding Habitat Assessment

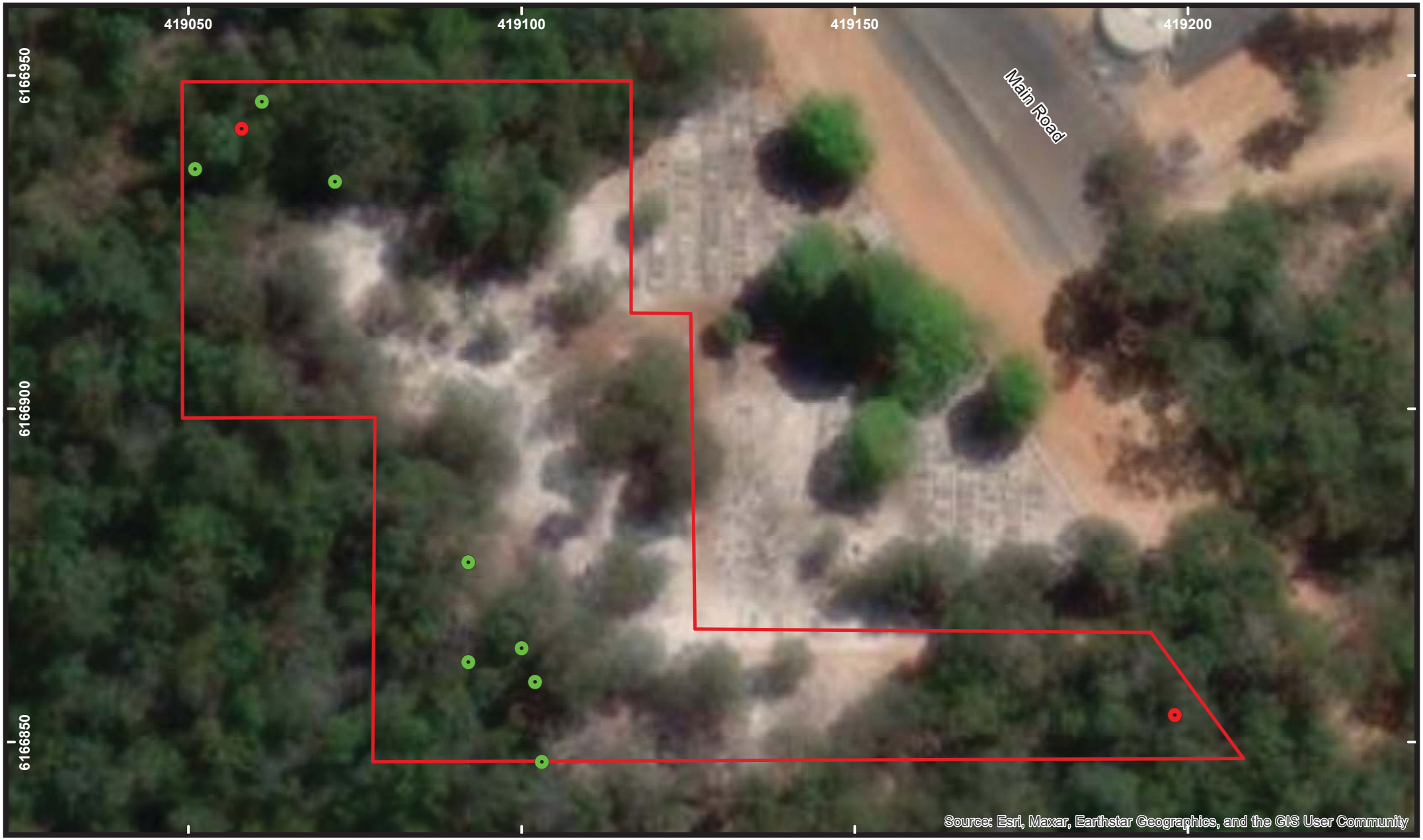
Trees considered potentially suitable for black cockatoos to use as nesting habitat (subject to a suitable hollow being present and other factors) found within the survey area comprised the following species:

- Marri – *Corymbia calophylla* and
- Jarrah – *Eucalyptus marginata*

A summary of the habitat trees observed is provided in Table 2. The locations of habitat trees are shown in Figure 2.

Table 2: Summary of habitat trees (DBH ≥50cm) recorded.

Total Number of Habitat Trees (DBH > 50cm)	Number of Habitat Trees with No Hollows Observed	Number of Habitat Trees with Possible Hollows considered Unsuitable for Black Cockatoos	Number of Habitat Trees with Possible Hollows considered Potentially suitable for Black Cockatoos	Tree Species	
				Jarrah	Marri
10	8	0	2	3	7



Legend

- Application Boundary
- Habitat Tree - No hollows observed
- Habitat Tree - 1 or more hollows observed. Some possibly suitable for black cockatoos

N

0 10 20 30 40 50

Metres

Fauna Survey

Shire of Manjimup
CPS 10157/1
Northcliffe Cemetery

Habitat Trees

Drawn: G. Harewood
Date: Dec 2023
Scale: 1:750
Projection/Coordinate System: UTM/MGA Zone 50

Figure: 2

The assessment identified a total of 10 trees within the survey area with a DBH of ≥50cm.

Most of the identified habitat trees (eight) did not appear to contain hollows of any size. Two trees appear to contain possible hollows that may potentially be suitable for black cockatoo to use for nesting purposes. Both possible large hollows were examined using a drone with neither showing any evidence (e.g. chew marks) of ever having been used by black cockatoos for breeding.

Additional details on each habitat tree observed can be found in Appendix B.

5.3.1 Foraging Habitat Assessment

The following flora species, known to be or potentially used as a direct food source (e.g. seeds, flowers, nectar, bark or grubs) by one or more species of black cockatoo were recorded within the survey area:

- Marri – *Corymbia calophylla*
- Jarrah – *Eucalyptus marginata* and
- Peppermint – *Agonis flexuosa*

It should be noted that most of the above-mentioned species (e.g. peppermint) while foraged upon on occasions would make up only a small proportion of any one bird's diet relative to more favoured plant species (e.g. marri).

A small amount of foraging evidence (chewed marri fruit) was found at several locations. This activity was attributed to Baudin's cockatoos based on the nature of the chew marks left on the fruit body.

It is estimated (based on canopy coverage visible in air photo) that the application area contains about ~0.4 hectares of quality foraging habitat in the form of marri/jarrah open forest.

5.3.2 Night Roosting Habitat Assessment

No evidence of black cockatoos roosting within trees located within the survey area was observed during the survey period.

6. CONCLUSION

The assessment reported on here was primarily undertaken to determine if any fauna species of conservation significance were present and to identify trees within the application area that contain hollows suitable for use by black cockatoos for nesting purposes.

Evidence of Baudin's cockatoo foraging within the application area was found and diggings attributed to quenda was also located within the application area. No evidence of any other fauna species of conservation significance were recorded within the application area during the course of the survey.

Superficially sections of the application area, in particular the area of remnant native vegetation, appears to represent habitat that could be regarded as suitable for the other species of conservation significance identified by DWER as possible occurring. The presence of western ringtail possums and the quokka are generally easy to determine and the lack of evidence of these species suggest they were at the time of the survey absent from the application area.

South-Western brush-tailed phascogales can be difficult to detect even if present and also have relatively large home ranges. Whie not detected they may still frequent the application area at times though the number of hollow bearing trees (which thy use for daytime refuge) are limited in number.

Short-nosed snakes are very cryptic and their presence/absence is very difficult to determine. The dense groundcover present in the remnant bushland appears suitable habitat so their remains some probability that this species may occur.

With respect to black cockatoos in general two possibly suitable large hollows that may represent potential breeding habitat was identified, though no evidence of them actually been used for this purpose was obtained. Quality foraging habitat (marri/jarrah open forest) makes up about half of the application area. There is some potential roosting habitat, though no evidence of roosting activity by black cockatoos was observed.

Given the relatively small size of the application area (~0.75 ha), which is only partly vegetated and the large expanses of native bushland in surrounding areas it is the Authors opinion that that clearing can be carried out without significantly impacting on the status fauna species of conservation significance or existing black cockatoo breeding/foraging/roosting habitat.

It is recommended that, if and when clearing is undertaken, a suitably qualified and experience “fauna spotter” be employed to minimise the likelihood of animals being killed or injured during site works.

This report should be forwarded to DWER for their consideration.

7. REFERENCES

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APPENDIX A

Species Profiles

Short-nosed Snake *Elapognathus minor*

Status and Distribution: Listed as Priority 2 by DBCA. Found north to Busselton and east to Two Peoples Bay (Storr *et al.* 2002). Secretive, poorly known and probably genuinely uncommon (Wilson and Swan 2021).

Habitat: Restricted to the humid coastal plains of the deep south west (Storr *et al.* 2002). Inhabits heaths edging swamps though also known to inhabit wet sclerophyll forest. Shelters in low dense vegetation such as tussocks and sedges (Wilson and Swan 2021)

Likely presence in Permit area: Status in the application area is difficult to determine however given the limited extent of vegetation remaining it is unlikely to represent habitat of significance to the species.

Potential impact of proposed clearing: Modification/loss of a very small area of possible habitat. Impacts are highly unlikely to be significant given the small impact area and the large areas of adjoining habitat.

Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*

Status and Distribution: Listed as Vulnerable under the *BC Act* and the *EPBC Act*. Found in the humid and subhumid south west, mainly hilly interior, north to Gingin and east to Mt Helena, Christmas Tree Well, North Bannister, Mt Saddleback, Rock Gully and the upper King River (Johnstone and Storr 1998).

Habitat: Eucalypt forests, feeds on marri, jarrah, blackbutt, karri, sheoak and snottygobble. The forest red-tailed black cockatoo nests in the large hollows of marri, jarrah and karri (Johnstone and Kirkby 1999). In marri, the nest hollows of the forest red-tailed black cockatoo range from 8-14m above ground, the entrance is 12 – 41cm in diameter and the depth is one to five metres (Johnstone and Storr 1998).

Breeding commences in winter/spring. There are few records of breeding in the forest red-tailed black cockatoo, but eggs are laid in October and November (Johnstone and Storr 1998). Recent data however indicates that breeding in all months of the year occurs with peaks in spring and autumn–winter (Ron Johnstone pers comms). Incubation period 29 – 31 days. Young fledge at 8 to 9 weeks (Simpson and Day 2004).

J	F	M	A	M	J	J	A	S	O	N	D

Period in which breeding is most likely to commence
Period in which fledging could extend through

Likely presence in Permit area: No evidence of this species observed during the survey period but likely to be present in the general area at times. All marri, and jarrah trees and a range of other plant species within the Permit area potential foraging habitat for this species. Larger trees (≥50cm DBH) are considered potential breeding habitat by DCCEEW (Commonwealth of Australia 2012, 2020). No evidence of roosting observed.

Potential impact of proposed clearing: Modification/loss of a very small area of possible habitat. Impacts are highly unlikely to be significant given the small impact area and the large areas of adjoining habitat.

Baudin's Cockatoo *Zanda baudinii*

Status and Distribution: Listed as Endangered under the *BC Act* and the *EPBC Act*. Confined to the south-west of Western Australia, north to Gidgegannup, east to Mt Helena, Wandering, Quindanning, Kojonup, Frankland and King River and west to the eastern strip of the Swan Coastal Plain including West Midland, Byford, Nth Dandalup, Yarloop, Wokalup and Bunbury (Johnstone and Storr 1998). On the southern Swan Coastal Plain this cockatoo is in some areas resident but mainly a migrant moving from the deep south-west to the central and northern Darling Range. Between March and September most flocks move north and are concentrated in the northern parts of the Darling Range. During this period birds forage well out onto the southern Swan Coastal Plain to areas such as Harvey, Myalup, Bunbury, Capel, Dunsborough and Meelup. While generally more common in the Darling Range this species can also be common on parts of the southern Swan Coastal Plain especially in mid-August – September when flocks begin to return to their breeding quarters (Johnstone 2008).

Habitat: Mainly eucalypt forests where it feeds primarily on the marri seeds, (Morcombe 2004), *Banksia, Hakea* and *Erodium* sp. Also strips bark from trees in search of beetle larvae (Johnstone and Storr 1998). This species of cockatoo nests in large tree hollows, 30–40 cm in diameter and more than 30 cm deep (Saunders 1974).

Baudin's cockatoo breeds in late winter and spring, from August to November or December (Saunders 1974). Eggs laid in October (Johnstone and Storr 1998). Based on observations at currently known nest sites breeding mainly occurs

within the October-December period (Ron Johnstone pers comms). Incubation is 28 – 30 days. Young fledge at 8 to 9 weeks (Simpson and Day 2004).

J	F	M	A	M	J	J	A	S	O	N	D

Period in which breeding is most likely to commence
Period in which fledging could extend through

Likely presence in Permit area: Foraging evidence attributed to this species found within the Permit area (chewed marri fruits). All marri, banksia trees and a range of other plant species within the Permit area represents potential foraging habitat for this species. Larger trees (≥50cm DBH) are considered potential breeding habitat by DCCEEW (Commonwealth of Australia 2012, 2020). No evidence of roosting observed.

Potential impact of proposed clearing: Modification/loss of a very small area of possible habitat. Impacts are highly unlikely to be significant given the small impact area and the large areas of adjoining habitat.

Carnaby's Cockatoo *Zanda latirostris*

Status and Distribution: Carnaby's cockatoo is listed as Endangered under the *BC Act* and the *EPBC Act*. Confined to the south-west of Western Australia, north to the lower Murchison River and east to Nabawa, Wilroy, Waddi Forest, Nugadong, Manmanning, Durokoppin, Noongar (Moorine Rock), Lake Cronin, Ravensthorpe Range, head of Oldfield River, 20 km ESE of Condingup and Cape Arid; also casual on Rottnest Island (Johnstone and Storr 1998).

Habitat: Forests, woodlands, heathlands, farms; feeds on *Banksia, Hakea* and Marri. Carnaby's cockatoo has specific nesting site requirements. Nests are mostly in smoothed-barked eucalypts with the nest hollows ranging from 2.5 to 12m above the ground, an entrance from 23-30cm diameter and a depth of 0.1-2.5m (Johnstone and Storr 1998).

Breeding occurs in winter/spring mainly in eastern forest and wheatbelt where they can find mature hollow bearing trees to nest in (Morcombe 2004). Judging from records in the Storr-Johnstone Bird Data Bank, this species is currently expanding its breeding range westward and south into the jarrah – marri forest of the Darling Scarp and into the Tuart forests of the Swan Coastal Plain including the region between Mandurah and Bunbury. Carnaby's Black Cockatoo has been known to breed close to the town of Mandurah, as well as at Dawesville, Lake Clifton and Baldivis (pers. comm., Ron Johnstone, WA Museum) and there are

small resident populations on the southern Swan Coastal Plain near Mandurah, Lake Clifton and near Bunbury. At each of these sites the birds forage in remnant vegetation and adjacent pine plantations (Johnstone 2008).

Carnaby's cockatoo lays eggs from July or August to October or November, with most clutches being laid in August and September (Saunders 1986). Most of the breeding is in September through to December (Ron Johnstone pers comms). Birds in inland regions may begin laying up to three weeks earlier than those in coastal areas (Saunders 1977). The female incubates the eggs over a period of 28-29 days. The young depart the nest 10–12 weeks after hatching (Saunders 1977; Smith & Saunders 1986).

J	F	M	A	M	J	J	A	S	O	N	D

Period in which breeding is most likely to commence
Period in which fledging could extend through

Likely presence in Permit area: No evidence of this species observed during the survey period but likely to be present in the general area at times. All marri, and jarrah trees and a range of other plant species within the Permit area potential foraging habitat for this species. Larger trees (≥50cm DBH) are considered potential breeding habitat by DCCEEW (Commonwealth of Australia 2012, 2020). No evidence of roosting observed.

Potential impact of proposed clearing: Modification/loss of a very small area of possible habitat. Impacts are highly unlikely to be significant given the small impact area and the large areas of adjoining habitat.

South-western Brush-tailed Phascogale *Phascogale tapoatafa wambenger*

Status and Distribution: Listed as Conservation Dependant (Scheduled 6) under the *BC Act*. Present distribution is believed to have been reduced to approximately 50 per cent of its former range. Now known from Perth and south to Albany, west of Albany Highway. Occurs at low densities in the northern Jarrah forest. Highest densities occur in the Perup/Kingston area, Collie River valley, and near Margaret River and Busselton (DBCA information pamphlet). Records are less common from wetter forests.

Habitat: This subspecies has been observed in dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover. A nocturnal carnivore relying on tree hollows as nest sites. The home range for a female Brush-tailed Phascogale is estimated at between 20 and 70 ha, whilst that

for males is given as twice that of females. In addition, they tend to utilise a large number of different nest sites (~ 20) throughout their range (Soderquist 1995).

Likely presence in Permit area: Status in the application area is difficult to determine as it was not detected however given the limited extent of vegetation remaining and the paucity of hollow bearing trees it is unlikely to represent habitat of significance to the species.

Potential impact of proposed clearing: Modification/loss of a very small area of possible habitat. Impacts are highly unlikely to be significant given the small impact area and the large areas of adjoining habitat. Some potential for individuals to be killed or injured during clearing if present.

Quenda *Isoodon fusciventer*

Status and Distribution: Listed as Priority 4 by DBCA. Widely distributed in the south west from near Cervantes north of Perth to east of Esperance, patchy distribution through the Jarrah and Karri forest and on the Swan Coastal Plain, and inland as far as Hyden. Has been translocated to Julimar State Forest, Hills Forest Mundaring, Tutanning Nature Reserve, Boyagin Nature Reserve, Dongolocking Nature Reserve, Leschenault Conservation Park, and Karakamia and Paruna Sanctuaries (DBCA information pamphlet - ND) and Nambung National Park (DBCA pers. comm.)

Habitat: Dense scrubby, often swampy, vegetation with dense cover up to one metre high, often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover. Populations inhabiting jarrah and wandoo forests are usually associated with watercourses. Quendas can thrive in more open habitat subject to exotic predator control (DBCA information pamphlet - ND).

Likely presence in Permit area: Diggings attributed to this species observed during the survey period, therefore potentially utilises densest groundcover vegetation during he day for refuge while foraging

Potential impact of proposed clearing: Modification/loss of a very small area of possible habitat. Impacts are highly unlikely to be significant given the small impact area and the large areas of adjoining habitat. Some potential for individuals to be killed or injured during clearing if present.

Western Ringtail Possum *Pseudocheirus occidentalis*

Status and Distribution: Listed as Critically Endangered under the *BC Act* and the *EPBC Act.* Common in suitable habitat (de Tores 2008). The highest densities of this species are recorded in peppermint tree habitat near Busselton area; relatively high densities are found in jarrah/marri forest at Perup (de Tores 2008). The species is also widespread and relatively common in vegetated remnants within the southern Swan Coastal Plain and along the Whicher Scarp between Bunbury and Busselton (G. Harewood per. obs.). Recent surveys have found the species to be more widespread and common than previously thought. With good populations recorded at various locations from Dawesville to Albany (Biota 2020).

The western ringtail was formerly more widespread: in the 1970s it was known from Casuarina woodlands in the wheatbelt near Pingelly (south-east of Perth), and it is thought to have once occurred throughout much of south-western Western Australia (but not necessarily continuously distributed) (Maxwell *et al*. 1996; de Tores 2008). Recent surveys have found the species to be more widespread and common than previously thought. With good populations recorded at various locations from Dawesville to Albany (Biota 2020).

Habitat: The western ringtail possum occurs in a variety of habitats including coastal peppermint, coastal peppermint-tuart, jarrah-marri associations, sheoak woodland, and eucalypt woodland and mallee. Coastal populations mostly inhabit peppermint-tuart associations with highest densities in habitats with dense, relatively lush vegetation. In these areas the main determinants of suitable habitat for WRPs appears to be the presence of *Agonis flexuosa* either as the dominant tree or as an understorey component of eucalypt forest or woodland (Jones *et al*. 1994a). In other inland areas the peppermint tree is naturally absent and jarrah-marri associations constitute the species refuge and foraging habitat. In areas where peppermint is absent or rare WRPs have been observed feeding predominately on young jarrah, *Nuytsia floribunda* and *Allocasuarina fraseriana* (G Harewood pers. obs.).

Likely presence in Permit area: No evidence of this species was found within the bounds of the Permit area during the day or night survey which suggests that the individuals were not present during the survey period. Habitat does however appear suitable though of limited extent.

Potential impact of proposed development: Modification/loss of a very small area of possible habitat. Impacts are highly unlikely to be significant given the small impact area and the large areas of adjoining habitat. Some potential for individuals to be killed or injured during clearing if present.

Quokka *Setonix brachyurus*

Status and Distribution: Listed as Vulnerable under the *BC Act* and the *EPBC Act*. Rare and restricted in south west W.A. from south of Perth to Two Peoples Bay. The distribution of the quokka includes Rottnest and Bald Islands, and at least 25 known sites on the mainland, including Two Peoples Bay Nature Reserve, Torndirrup National Park, Mt Manypeaks National Park, Walpole-Nornalup National Park, and various swamp areas through the south-west forests from Jarrahdale to Walpole.

Habitat: Mainland populations of this species are currently restricted to densely vegetated coastal heaths, swamps, riverine habitats including tea-tree thickets on sandy soils along creek systems where they are less vulnerable to predation. The species is nocturnal.

Likely presence in Permit area: No evidence of this species was found within the bounds of the Permit area during the day or night survey which suggests that the individuals were not present during the survey period. Habitat appears superficially to be suitable given dense shrub layer however the species is considered highly unlikely to occur.

Potential impact of proposed development: No impact on this species is anticipated as it is considered unlikely to be present.

APPENDIX B

Details of Habitat Trees

Habitat Trees (DBH >50cm)

Datum - GDA94

Entrance Size Ranges - Small = >5cm, Medium = 5 to 10cm, Large = >10cm

Waypoint Number	Zone	mE	mN	Tree Species	Tree Height (m)	DBH (cm)	Number of Hollows	Estimated Hollow Entrance Size	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow
wpt001	50H	419198	6166854	Marri	15-20	>50	2+	Small, Medium & Large (Cockatoo)	No Signs	No Signs	Yes
wpt002	50H	419103	6166847	Jarrah	15-20	>50	0				
wpt003	50H	419102	6166859	Marri	15-20	>50	0				
wpt004	50H	419092	6166862	Jarrah	15-20	>50	0				
wpt005	50H	419100	6166864	Marri	15-20	>50	0				
wpt006	50H	419092	6166877	Marri	15-20	>50	0				
wpt007	50H	419051	6166936	Marri	15-20	>50	0				
wpt008	50H	419058	6166942	Marri	15-20	>50	1	Large (Cockatoo)	No Signs	No Signs	Yes
wpt009	50H	419061	6166946	Jarrah	15-20	>50	0				
wpt010	50H	419072	6166934	Marri	15-20	>50	0				

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The conclusions are based upon field data and the environmental monitoring and/or testing carried out over a limited period of time and are therefore merely indicative of the environmental condition of the site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

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