



## CLEARING PERMIT

Granted under section 51E of the Environmental Protection Act 1986

### PERMIT DETAILS

Area Permit Number: 8694/1

File Number: DWERT3608

Duration of Permit: From 14 September 2020 to 14 September 2022

### PERMIT HOLDER

Shire of Wandering

### LAND ON WHICH CLEARING IS TO BE DONE

Fourteen Mile Brook Road Reserve (PIN 11374316), Wandering

Fourteen Mile Brook Road Reserve (PIN 11374318), Wandering

### AUTHORISED ACTIVITY

The Permit Holder shall not clear more than 0.135 hectares of native vegetation within the area cross-hatched yellow on attached Plans 8694/1(a), 8694/1(b) and 8694/1(c).

### CONDITIONS

#### 1. Avoid, minimise and reduce the impacts and extent of clearing

In determining the amount of native vegetation to be cleared authorised under this Permit, the Permit Holder must have regard to the following principles, set out in order of preference:

- (a) avoid the clearing of native vegetation;
- (b) minimise the amount of native vegetation to be cleared; and
- (c) reduce the impact of clearing on any environmental value.

#### 2. Dieback and weed control

When undertaking any clearing or other activity authorised under this Permit, the Permit Holder must take the following steps to minimise the risk of the introduction and spread of *weeds* and *dieback*:

- (a) clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared;
- (b) ensure that no *dieback* or *weed*-affected soil, *mulch*, *fill* or other material is brought into the area to be cleared; and
- (c) restrict the movement of machines and other vehicles to the limits of the areas to be cleared.

#### 3. Application

This Permit allows the Permit Holder to authorise persons, including employees, contractors and agents of the Permit Holder, to clear native vegetation for the purposes of this Permit subject to compliance with the conditions of this Permit and approval from the Permit Holder.

#### 4. Fauna Management – *Black cockatoo Species*

- (a) Within 48 hours prior to undertaking any clearing authorised under this Permit:
  - (i) the area shaded yellow on attached Plans 8694/1(a), 8694/1(b) and 8694/1(c) shall be inspected by a *fauna specialist* who shall inspect *black cockatoo breeding trees*; and
  - (ii) each *black cockatoo breeding tree* identified shall be inspected by a *fauna specialist* for evidence of current or past breeding use by *Black cockatoo species*.
- (b) Where a *black cockatoo breeding tree(s)* with evidence of current breeding use by *Black cockatoo species* is identified and cannot be avoided in accordance with condition 1(a) of this Permit, that

tree(s) shall be monitored by a *fauna specialist* to determine when it is no longer in use for that breeding season.

- (c) Any *black cockatoo breeding tree(s)* with *evidence* of current breeding use by black cockatoo species shall not be cleared whilst it is in use for that breeding season as determined by the *fauna specialist* under condition 4(b) of this Permit.
- (d) Where a *black cockatoo breeding tree(s)* with *evidence* of past breeding use by black cockatoo species is identified and cannot be avoided in accordance with condition 1(a) of this Permit, that tree(s) shall only be cleared:
  - (i) outside the *black cockatoo species breeding season*; or
  - (ii) later the same day of the inspection required by condition 4(a)(ii) of this Permit; or
  - (iii) later the same day of a repeat inspection undertaken by a *fauna specialist* if that inspection does not identify *evidence* of current breeding use.
- (e) For each *black cockatoo breeding tree* with *evidence* of current or past breeding use by *black cockatoo species* identified, that cannot be avoided in accordance with condition 1(a) of this Permit, the Permit Holder shall install an artificial black cockatoo nest hollow.
- (f) Each artificial black cockatoo nest hollow required by condition 4(e) of this Permit must be installed prior to commencement of the next *black cockatoo species breeding season* following clearing of the related *black cockatoo breeding tree*.
- (g) The artificial black cockatoo nest hollow(s) required by condition 4(e) of this Permit must:
  - (i) be installed within Fourteen Mile Brook Road Reserves (PINs 11374316 and 11374318), Wandering;
  - (ii) be designed and placed in accordance with the guidelines provided in Schedule 1 to this Permit; and
  - (iii) be monitored and maintained in accordance with the guidelines provided in Schedule 2 to this Permit, for a period of at least ten years.

**5. Fauna management – *red-tailed phascogale***

- (a) Within 48 hours prior to undertaking any clearing authorised under this Permit:
  - (i) the area shaded yellow on attached Plans 8694/1(a), 8694/1(b) and 8694/1(c) shall be inspected by a *fauna specialist* who shall identify *red-tailed phascogale habitat trees*; and
  - (ii) each *red-tailed phascogale habitat tree* identified shall be inspected by a *fauna specialist* for *evidence* of use by red-tailed phascogale (*Phascogale calura*).
- (b) Where a *red-tailed phascogale habitat tree(s)* occupied by red-tailed phascogale is identified and cannot be avoided in accordance with condition 1(a) of this Permit, that tree(s) shall only be cleared:
  - (i) immediately after a repeat inspection undertaken by a *fauna specialist* if that inspection confirms it is not occupied by red-tailed phascogale.
- (c) Where a *red-tailed phascogale habitat tree(s)* with *evidence* of use (but not occupied) by red-tailed phascogale is identified and cannot be avoided in accordance with condition 1(a) of this Permit, that tree(s) shall only be cleared:
  - (ii) immediately after the inspection; or
  - (iii) immediately after a repeat inspection undertaken by a *fauna specialist* if that inspection confirms it is not occupied by red-tailed phascogale.
- (d) For each *red-tailed phascogale habitat tree*, that cannot be avoided in accordance with condition 5(b) and 5(c) of this Permit, the Permit Holder shall install a nest box.

- (e) The nest boxes (s) required by condition 5(d) of this Permit must:
  - (i) be installed within Fourteen Mile Brook Road Reserves (PINs 11374316 and 11374318), Wandering; and
  - (ii) be designed and placed in accordance with the guidelines provided in Schedule 3 to this Permit.

#### 6. Records must be kept

The Permit Holder must maintain the following records in relation to the clearing of native vegetation authorised under this Permit:

- (a) the location where the clearing occurred, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings or decimal degrees;
- (b) the date(s) that the area was cleared;
- (c) the size of the area cleared (in hectares);
- (d) actions taken to avoid, minimise and reduce the impacts and extent of clearing in accordance with condition 1 of this Permit;
- (e) actions taken to minimise the risk of the introduction and spread of dieback and weeds in accordance with condition 2 of this Permit;
- (f) actions taken in accordance with condition 4 of this Permit; and
- (g) actions taken in accordance with condition 5 of this Permit.

#### 7. Reporting

- (a) At least 48 hours prior to commencing clearing authorised under this Permit, the Permit Holder shall advise the *CEO* in writing of the date that clearing is scheduled to commence.
- (b) On or before 30 June of each year following the commencement of clearing authorised under this Permit, the Permit Holder must provide to the *CEO* a written report of records required under condition 6 of this Permit.
- (c) If no clearing authorised under this Permit was undertaken between 1 January to 31 December of the preceding calendar, a written report confirming that no clearing under this permit has been
- (d) carried out, must be provided to the *CEO* on or before 30 June of each year.  
Prior to 14 June 2022, the Permit Holder must provide to the *CEO* a written report of records required under condition 6 of this Permit where these records have not already been provided under condition 7(b) of this Permit.

#### DEFINITIONS

The following meanings are given to terms used in this Permit:

***black cockatoo breeding season*** means the known breeding season of all black cockatoo species;

***black cockatoo breeding tree/s*** means trees that have a diameter, measured at 1.5 metres from the base of the tree, of 50 centimetres or greater (or 30 centimetres or greater for *Eucalyptus salmonophloia* or *Eucalyptus wandoo*) that contain hollows suitable for breeding by black cockatoo species;

***black cockatoo species*** means forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*) and Carnaby's cockatoo (*Calyptorhynchus latirostris*);

***CEO*** means the Chief Executive Officer of the Department responsible for the administration of the clearing provisions under the *Environmental Protection Act 1986*;

***dieback*** means the effect of *Phytophthora* species on native vegetation;

***evidence*** means showing chew marks or scratchings on the habitat tree representative of the species being surveyed, the presence of the species entering or leaving the habitat tree, and/or the presence of chicks/young.

**fauna specialist:** means a person who holds a tertiary qualification specializing in environmental science or equivalent, and has a minimum of 2 years work experience in fauna identification and surveys of fauna native to the region being inspected or surveyed, or who is approved by the *CEO* as a suitable fauna specialist for the bioregion, and who holds a valid fauna licence issued under *the Biodiversity Conservation Act 2016*;

**fill** means material used to increase the ground level, or fill a hollow;

**mulch** means the use of organic matter, wood chips or rocks to slow the movement of water across the soil surface and to reduce evaporation;

**red-tailed phascogale habitat tree(s)** means a tree of the *Eucalyptus* genus that contains a hollow(s) suitable to be used by red-tailed phascogale (*Phascogale calura*);

**weed/s** means any plant -

- (a) that is a declared pest under section 22 of the *Biosecurity and Agriculture Management Act 2007*;  
or
- (b) published in a Department of Biodiversity, Conservation and Attractions Regional Weed Rankings Summary, regardless of ranking; or
- (c) not indigenous to the area concerned.



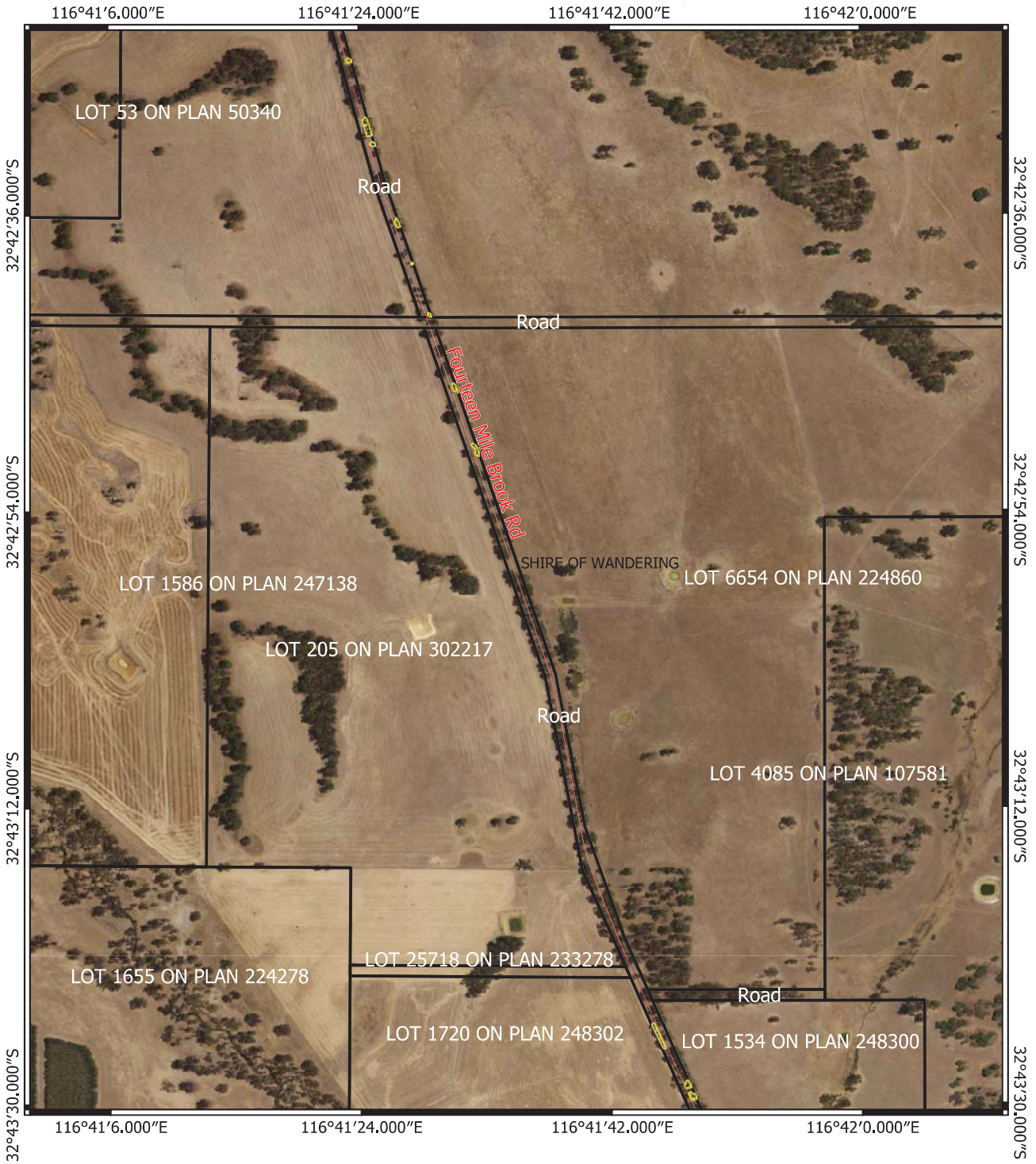
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Meenu Vitarana  
A/MANAGER  
NATIVE VEGETATION REGULATION

*Officer delegated under Section 20  
of the Environmental Protection Act 1986*

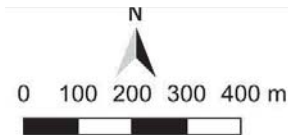
19 August 2020

# Plan 8694/1(a)



## Legend

-  CPS areas approved to clear
-  Road Centrelines
-  Cadastre - LGATE 218
-  Local Government Authorities



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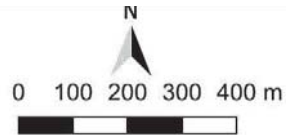


# Plan 8694/1(b)



## Legend

-  CPS areas approved to clear
-  Road Centrelines
-  Cadastre - LGATE 218
-  Local Government Authorities



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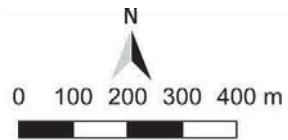
GOVERNMENT OF  
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# Plan 8694/1(c)



## Legend

-  CPS areas approved to clear
-  Road Centrelines
-  Cadastre - LGATE 218
-  Local Government Authorities



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Environmental Protection Act 1986



GOVERNMENT OF  
WESTERN AUSTRALIA

## Artificial hollows for Carnaby's cockatoo



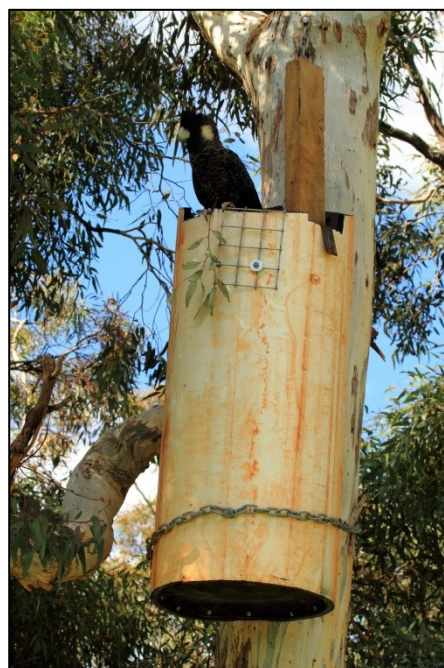
## How to design and place artificial hollows for Carnaby's cockatoo

Artificial hollows can be used to help conserve the threatened Carnaby's cockatoo by enabling the cockatoos to breed in areas where natural hollows are limited.

A wide variety of artificial hollow designs have been used with mixed success. Evidence suggests that, while the hollow must meet some basic requirements, other factors such as proximity to existing breeding areas may be more important in determining the success of artificial hollows. Before using this information sheet to construct or install an artificial hollow, you should refer to the criteria listed in the separate information sheet; *When to use artificial hollows for Carnaby's cockatoo*.

This information sheet contains broad guidelines for the design and placement of artificial hollows for Carnaby's cockatoo.

Below are three examples of successful artificial hollows used by Carnaby's cockatoo for nesting. Artificial hollows made from a natural log with cut side entrance (left), white industrial pipe with top entrance (centre) and natural log with natural side entrance (right).



Photos by Christine Groom (left and right) and Rick Dawson (centre)



## Walls

The walls of the artificial hollow need to be constructed from a material that is;

- Durable enough to withstand exposure to elements for an extended period of time (i.e. 20+ years).
- Able to simulate the thermal properties of a natural tree hollow.
- Not less than 380 mm in internal diameter.
- Preferably 1.2 m deep overall and 1m deep to top of substrate/nesting material.

Successful artificial hollows have been constructed from sections of salvaged natural hollow, black and white industrial pipe. When using non-natural materials care must be taken to ensure there are no toxic residues and that the materials are safe to ingest.

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## Base

The base of the artificial hollow must be;

- Able to support the adult and nestling(s).
- Durable enough to last the life of the nest.
- Free draining.
- At least 380 mm in diameter.
- Covered with 200 mm of sterile, dry, free draining material such as charcoal, hardwood woodchips or wood debris.

### **Do not use:**

- Saw dust or fibre products that will retain moisture.

Example materials that could be used for artificial hollow bases include heavy duty stainless steel, galvanised or treated metal (e.g. Zinalume ®), thick hardwood timber slab or marine ply (not chipboard or MDF). The base material must be cut to size to fit internally with sharp or rough edges ground away or curled inwards and fixed securely to the walls.



Carnaby's cockatoo eggs in an artificial hollow.  
*Photo by Rick Dawson*

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## Entrance

The entrance of the artificial hollow must;

- Have a diameter of at least 270 mm).
- Preferably be top entry which will minimise use by non-target species.

Top entry hollows are unattractive to nest competitors such as feral bees, galahs and corellas. Side entry hollows have been successful in areas where feral bees are not a problem and where galahs and corellas are deterred.

## Ladder

For artificial hollows made of non-natural materials, or of processed boards, it is necessary to provide a ladder to enable the birds to climb in and out of the hollow easily.

The ladder must be;

- Securely mounted to the inside of the hollow.
- Made from an open heavy wire mesh such as WeldMesh™ with mesh size of 30 - 50 mm, or heavy chain.

### Do not use:

- A material that the birds can chew.
- Galvanized because the birds may grip or chew the ladder and ingest harmful compounds.

If using mesh for the ladder, the width will depend on the curvature of the nest walls. A minimum width of about 60 - 100 mm is recommended.

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## Sacrificial chewing posts

For artificial hollows made of non-natural materials, or of processed boards, it is necessary to provide sacrificial chewing posts. The birds chew material to prepare a dry base on which to lay their egg(s).

The sacrificial chewing posts must:

- Be made of untreated hardwood such as jarrah, marri or wandoo
- Be thick enough to satisfy the birds' needs between maintenance visits.
- Extend beyond the top of the hollow as an aid to see whether the nest is being used.
- Be placed on the inside of the hollow.
- Be attached in such a way that they are easy to replace e.g. hook over the top of hollow or can slide in/out of a pair of U bolts fitted to the side of the hollow.

It is recommended that at least two posts are provided. Posts 70 x 50 mm have been used, but require replacing at least every second breeding season when the nest is active. Birds do vary in their chewing habits and therefore the frequency at which the chewing posts require replacement will also vary.



Bottom of an artificial hollow showing ladder that is fixed to the wall and a chewed sacrificial post which is 200 mm from the floor.

Photo by Rick Dawson

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## Mountings

The artificial hollows must be mounted such that:

- The fixings used will last the duration of the nest e.g. galvanized bracket or chain fixed with galvanized coach screws.
- It is secured by more than one anchor for security and stability.
- It is positioned vertically or near vertically.

## Placement

Sites should be chosen within current breeding areas and where they can be monitored, but preferably not conspicuous to the general public. It is important that artificial hollows are placed where they will be accessible for future monitoring and maintenance. For more detail refer to the separate information sheet; *When to use artificial hollows for Carnaby's cockatoo*.

The height at which artificial hollows should be placed is variable. The average height of natural hollows in dominant tree species in the area is a good guide. Natural hollows used by Carnaby's cockatoos have been recorded as low as 2 m above the ground. If located on private property the hollows can be placed lower to the ground so they are accessible by ladder or a rope and pulley system can be used. Where public access is possible artificial hollows should be placed at least 7 m high (i.e. higher than most ladders) and on the side of the tree away from public view to reduce the chance of interference or poaching.

Carnaby's cockatoo show no preference for aspect of natural hollows, however, it may still be beneficial to place artificial hollows facing away from prevailing weather and where they receive the most shade and protection.

Artificial hollows to be placed in trees require:

- Accessibility of the tree for a vehicle, elevated work platform or cherry picker.
- A section of trunk 2-3 m long suitable for attaching the hollow

If necessary, artificial hollows may be placed on poles, but this may result in excessive exposure to sun during very hot weather. When erected on poles there should be:

- A hinge at the bottom of the pole that can be secured when the pole is in the upright position.
- Access for a vehicle to assist raising the pole.

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## Safety

Care needs to be taken when placing artificial hollows to ensure safety is considered at all times. Artificial hollows are heavy and require lifting and manoeuvring into position up to 7 m above the ground.

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## Maintenance and monitoring

Once artificial hollows have been placed they require monitoring and maintenance to ensure they continue to be useful for nesting by Carnaby's cockatoo. It is important to monitor artificial hollows to determine use by Carnaby's cockatoo, other native species as well as pest species. By undertaking monitoring the success of the design and placement of artificial hollows can be determined and areas for improvement identified for future placement of artificial hollows.

Monitoring can also assess whether any maintenance is required. Without regular maintenance artificial hollows are unlikely to achieve their objective (that is, they will fail to provide nesting opportunities for threatened cockatoos). Therefore it is important to continue a regime of regular maintenance while the artificial hollow is required. It may be several (to many) decades until a natural replacement hollow is available.

For further advice on monitoring and maintenance of artificial hollows please refer to the separate information sheet; *How to monitor and maintain artificial hollows for Carnaby's cockatoo*.



Carnaby's cockatoo female prospecting an artificial hollow.  
Photo by Rick Dawson



Example fixing for artificial hollow  
Photo by Christine Groom

### **Acknowledgements**

This information sheet is a joint initiative of Birdlife Australia, the Western Australian Museum and the Department of Parks and Wildlife. Many individuals have contributed to its preparation. Special acknowledgement is made for the contributions of Ron Johnstone from the WA Museum, Alan Elliott from the Serpentine-Jarrahdale Land care Centre and Denis Saunders. This updated version was compiled by Rick Dawson Department of Parks and Wildlife).

### **Other information sheets in the series: Artificial hollows for Carnaby's cockatoo**

- *How to design and place artificial hollows for Carnaby's cockatoo*
- *How to monitor and maintain artificial hollows for Carnaby's cockatoo*

Information sheets available on the *Saving Carnaby's cockatoo* webpage:

<http://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-animals/208-saving-carnaby-s-cockatoo>

## Artificial hollows for Carnaby's cockatoo



## How to monitor and maintain artificial hollows for Carnaby's cockatoo

It is important to monitor and maintain artificial hollows after they have been erected. Monitoring ensures that the effectiveness of the artificial hollow can be determined. It also means that problems with pest species or any maintenance requirements can be identified and resolved.

Without regular maintenance, artificial hollows are likely to fail to achieve their objective (that is, they will fail to provide nesting opportunities for threatened cockatoos). Therefore it is important to continue a regime of regular maintenance while the artificial hollow is required. It may be several (to many) decades until a natural replacement hollow is available.

Monitoring should be undertaken in order to detect:

- Use by Carnaby's cockatoo
- Maintenance requirements
- Use by other native species
- Use by pest species (e.g. feral bees, galahs, corellas etc.)



Carnaby's cockatoo female prospecting an artificial hollow.  
*Photo by Rick Dawson*

### **How do I monitor artificial hollows?**

Before undertaking monitoring of artificial hollows for Carnaby's cockatoo it is recommended that you seek advice from BirdLife Australia, the WA Museum or the Department of Parks and Wildlife. It is also important to contact Parks and Wildlife, Wildlife Licensing Section, to determine if a scientific licence is required ([wildlifelicencing@dpaw.wa.gov.au](mailto:wildlifelicencing@dpaw.wa.gov.au)).

Monitoring artificial hollows requires keen observation and naturalist skills. It is often not possible to observe evidence of breeding directly (i.e. nestlings or eggs) and inferences must be made based on observation. There are many techniques available to monitor artificial hollows. A combination of several is likely to achieve the best results.

### **Looking for signs of use**

Cobwebs covering the entrance to the hollow will indicate that the hollow has not been used recently. This would also apply to other light debris that may have fallen to cover the opening partially. Signs of recent use or interest in the hollow include evidence of chewing.

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### **Observing parent behaviour around the hollow**

The behaviour of parent birds around a hollow will indicate an approximate age of young in the nest.

<b>Parent behaviour</b>	<b>Approximate age/stage of young</b>
Prospecting for hollow	Unborn
Male only seen out of hollow	Egg or very young nestling (< 3 - 4 weeks)
Both parents seen entering/exiting the hollow	Nestling(s) have hatched (> 3 - 4 weeks)

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### **Observing feeding flocks**

Flocks of all male birds indicate that the females are incubating eggs. When flocks are mixed it suggests the birds have either not laid yet or that the nestlings have hatched and no longer require brooding (approximately 3 - 4 weeks old).

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### **Tapping**

When females are sitting on eggs they will usually respond to tapping at the base of their tree (or pole) by appearing at the entrance or flying from the hollow opening. This is not a guarantee of breeding activity, but an indication that it is possibly occurring in the hollow.

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### **Observing insect activity around nest**

The faecal matter produced by nestlings in a nest attracts insects, especially flies and ants. The type and number of these insects will help indicate how old any nestlings present may be. Factors such as temperature and humidity will also affect insect activity and so observations of insect activity should only be used as supporting evidence for other indications of age/use. Blowflies around a nest usually indicate that a death has occurred.

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### **Listening for nestlings**

With experience it is possible to determine if one or two nestlings are present and a broad estimate of age based on the type and loudness of noises they make.

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### **Looking inside the nest**

This can be achieved either with the aid of a telescopic pole and camera or mirror, or with the use of a ladder or other climbing equipment. This method can obtain the most detailed monitoring information for artificial hollows. However it is also the most time consuming and difficult to organise. Special equipment is likely to be needed depending on the height and positioning of artificial hollows. There are also safety issues associated with ladder or rope climbing options to reach nests to undertake observations.

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### **How often should I monitor artificial hollows?**

The minimum frequency of monitoring and the techniques used will be determined by the aims of the monitoring and the resources available. It is important to limit disturbance to breeding birds and this should be considered when determining the techniques used and frequency.

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### **How do I maintain artificial hollows?**

Artificial hollows require maintenance to ensure they continue to have the greatest chance of them being used by Carnaby's cockatoos. Periodic maintenance checks should be undertaken at least every two years, preferably annually. These checks should be undertaken prior to the breeding season which is between July and January with breeding occurring later in this period in southern areas. It is important to maintain a regime of regular maintenance as long as the artificial hollow is required. It may take several (to many) decades until a natural replacement hollow is available.

Maintenance checks should assess the following as a minimum:

- Condition of chewing posts (if present)
- Condition of attachment points
- Condition of hollow bases
- Stability of tree or pole used to mount the artificial hollow



Artificial hollow base needing repair.  
*Photo by Christine Groom*

### **Repairing hollows**

Any problems identified during maintenance checks should be addressed, and any repairs required done, as soon as possible. If breeding is currently occurring, maintenance may need to be delayed if it is likely to disturb the parents or nestling. Likely maintenance needs include replacement of chewing posts (frequently) or nest bases (occasionally) and repairing of any cracks (infrequently). Maintenance concerns regarding the security of attachment points or the stability of the tree or pole should be addressed as a priority for safety reasons.

For artificial hollows known to be used, spare chewing posts should be taken into the field when undertaking maintenance checks.

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**Monitoring of artificial hollows:**

Monitoring aim	Frequency of visits	Monitoring techniques
<b>To determine possible use by Carnaby's cockatoo</b>	At least once during peak breeding season (i.e. between September and December)	<ul style="list-style-type: none"> <li>• Observing behaviour of adults around hollow</li> <li>• Tapping to see if female will flush from hollow (best undertaken between 10am and 3pm when females most likely to be sitting)</li> <li>• Listening for nestlings</li> <li>• Looking for evidence of chewing</li> <li>• Looking inside nest</li> </ul>
<b>To confirm use by Carnaby's cockatoo</b>	At least two visits during peak breeding season (i.e. between September and December)	<p>To observe at least two of the following:</p> <ul style="list-style-type: none"> <li>• Breeding behaviour of adults around hollow or evidence of chewing</li> <li>• Female flushed from hollow</li> <li>• Noises from nestlings in hollow</li> </ul> <p>Or to observe:</p> <ul style="list-style-type: none"> <li>• Nestlings or eggs in nest</li> </ul>
<b>To determine nesting success by Carnaby's cockatoo</b>	The more visits, the better. Preferably fortnightly visits between July and December. As a minimum, at least 3 visits spread throughout breeding season.	<ul style="list-style-type: none"> <li>• Looking inside nest to observe eggs or nestlings.</li> </ul>
<b>To determine use by any species</b>	As often as possible.	<ul style="list-style-type: none"> <li>• Inspection from ground as a minimum.</li> <li>• Looking inside nest for detailed observations.</li> </ul>
<b>To determine maintenance requirements</b>	At least every two years and preferably annually if hollow fitted with sacrificial chewing posts, can be longer if without.	<ul style="list-style-type: none"> <li>• A basic maintenance check can be undertaken from the ground. A ladder or elevated work platform will be required for a comprehensive check and to replace sacrificial chewing posts</li> </ul>

**Acknowledgements**

This information sheet is a joint initiative of Birdlife Australia, the Western Australian Museum and the Department of Parks and Wildlife. Many individuals have contributed to its preparation. The updated version was compiled by Rick Dawson (Department of Parks and Wildlife) with assistance from Denis Saunders.

**Other information sheets in the series: Artificial hollows for Carnaby's cockatoo**

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- *How to monitor and maintain artificial hollows for Carnaby's cockatoo*

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## Nest Boxes for Red-tailed Phascogales

The red-tailed phascogale (*Phascogale calura*), also known as Kengoor, is Specially Protected under Western Australia's State legislation as Conservation Dependent. This means that the species requires ongoing conservation intervention to prevent them from becoming a threatened species again.

The species was once known from much of arid and semi-arid Australia but is now only found in remnant vegetation in the southern Wheatbelt. One of the current threats to the species is nest hollow shortages due to habitat loss and degradation from land clearing and fire, and competition with native and pest birds and feral European honey bees.

Nest boxes can be used to help conserve red-tailed phascogales by enabling them to breed in areas where natural hollows are limited. This information sheet provides advice on how to select an appropriate site, broad guidelines on how to design and place a nest box, and general advice on how to maintain and monitor nest boxes.

It is important to remember that the retention of both old and dead trees that have suitable hollows for red-tail phascogales is important for breeding and hence the long-term survival of the species. The installation of nest boxes should not be used to justify the removal of natural hollow-bearing trees.



Photo: Meredith Spencer/Bush Heritage Australia

### When to Use Nest Boxes

Nest boxes may be useful at sites where natural hollows are limited, such as where existing hollows are degrading and not being replaced quickly enough due to lack of tree regeneration. However, red-tailed phascogales don't always use nest boxes when provided. There are ways to select sites for nest boxes that will increase the chance that they will be used by red-tailed phascogales.

### Where and when do red-tailed phascogales nest?

Red-tailed phascogales are largely found in old-growth woodlands, predominantly dominated by Wandoo and York Gum and associated with Red Sheoak. Red-tailed phascogales have a preference for habitats that contain numerous tree hollows, have semi-continuous canopy and are long unburnt. Red-tailed phascogales are known to nest in hollow logs, tree hollows, and the skirts and stumps of Grass Trees.

Phascogales use nesting hollows all year round for sleeping during the day as they are a nocturnal species that is active during the night. They may use several hollows within their home range. Mating occurs during a three-week period in July, and young are born 28-30 days later. The young remain dependent on the mother from August to October.

### Is my site suitable for nest boxes?

It is recommended that nest boxes be used in known nesting areas where there has been a decrease in the availability of natural nesting hollows. To decide if your site is suitable for nest boxes you need to consider the following criteria (Table 1). Protecting habitat, revegetating and controlling competitive pest species are alternative conservation actions that can also be used to complement the placement of artificial hollows.

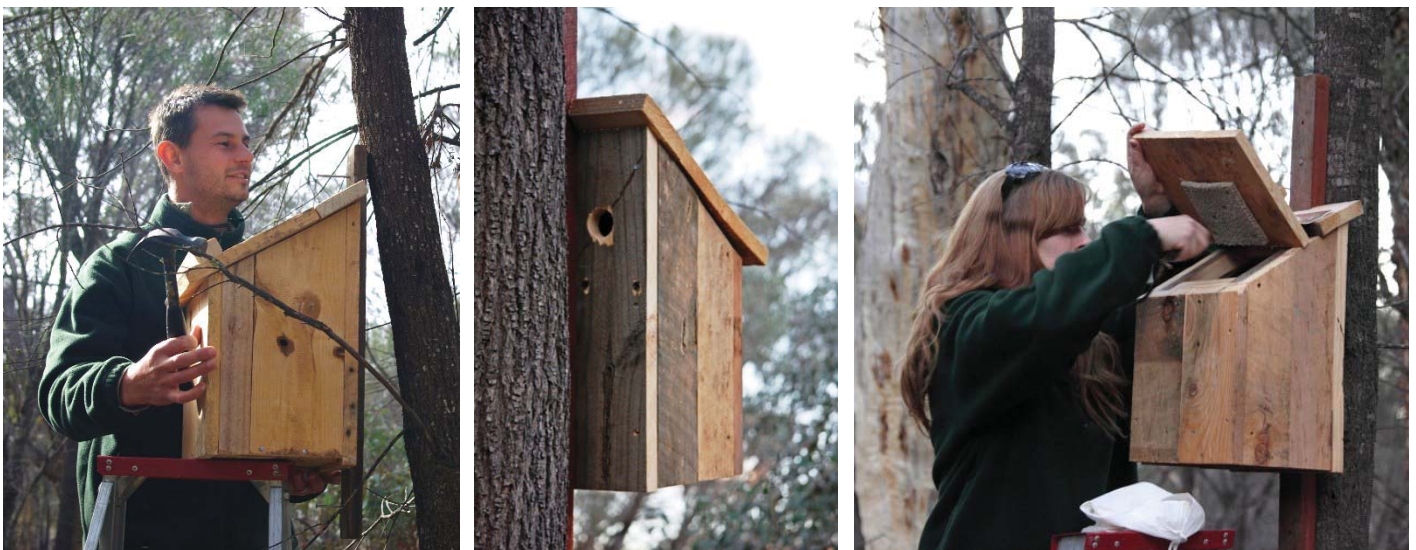
**Table 1: Criteria to determine if a site is suitable for the placement of nest boxes**

1.	<b>The site contains suitable habitat within the known breeding range of the species</b>	
	<i>Important consideration</i>	Red-tailed phascogales generally nest in woodlands dominated by Wandoo and York Gum and associated with Red Sheoak. The species is currently only known to persist in the southern Wheatbelt.
2.	<b>The site is in an area where it is suspected or known that there is a lack of available tree hollows preventing breeding that would otherwise occur, due to the loss of suitable hollow-bearing trees (either through clearing or natural die-off).</b>	
	<i>Important consideration</i>	Indirect evidence that may indicate a lack of available tree hollows includes sightings of red-tailed phascogales within rural buildings.
3.	<b>The hollows are placed in secure locations and the owner/manager of these areas is supportive and willing to provide the necessary long-term security and annual maintenance for the entire time that the artificial hollow will be in place.</b>	
	<i>Important consideration</i>	For advice on the monitoring and maintenance requirements, please refer to the section on how to monitor and maintain nest boxes.
4.	<b>A suitable artificial hollow design is used.</b>	
	<i>Important consideration</i>	For greatest chance of success, please refer to the section on how to design and place nest boxes

## How to Design and Place Nest Boxes

There are various designs for nest boxes available but it best to tailor the design of the nest box to the specific nesting requirements of the red-tailed phascogale. This will encourage red-tailed phascogales to use the nest box while discouraging other species.

It is recommended that multiple nest boxes are placed at 50 m intervals around a site as red-tailed phascogales are known to regularly move between several nesting hollows.



Nest boxes being attached with nails (left), with a rear entrance (centre), and with a hinged lid and carpet (right).  
 Photo: Angela Sanders/Bush Heritage Australia (left), DBCA (centre and right)

## Nest box design

With any nest box design for red-tailed phascogales, it is important to ensure that it fits the following general specifications (Table 2). A diagram is also provided of a recommended design by Bush Heritage Australia, which they have successfully used to monitor red-tailed phascogales in Kojonup.

**Table 2: General specifications for red-tailed phascogale nest boxes**

Component	Specification
Material	Rough-sawn untreated Jarrah or other native Australian hard woods with > 15mm thickness ensures that it is durable enough to last > 5 years and provides adequate thermal insulation. Softwoods, like marine ply, can be used as long as they are not treated with toxic preserving chemicals like copper or arsenic. <u>DO NOT USE</u> : treated timber, chipboard, pine, interior ply, any materials under 15 mm thickness, toxic/smelly paint.
Joinery	Long, galvanised screws or nails. Make sure that there are no projecting nails or screws. Non-toxic waterproof glue can also be used. <u>DO NOT USE</u> : Toxic/smelly glues
Entrance hole	Rear entrance hole with a diameter of 30 - 40 mm
Cavity	Cavity size approximately 20 - 30 mm x 20 - 30 mm x 20 - 30 mm. Weatherproof and dark. Toe holds on inside walls enabling animals to climb out (i.e. walls should be made from rough-sawn timber or notched with a circular saw)
Base	Recessed inside walls. Three small (<10 mm) drainage holes.
Lid	Hinged lid to allow for inspection but well-secured to prevent brush-tailed possums from gaining access. A piece of carpet or perspex glued to the inside of the lid to discourage bees. Sloped from the back and overhanging the front and side by 25 mm for weather protection.
Nesting material	Weathered wood chips, shredded Jarrah bark or Paperbark, and/or untreated sheep's wool. Filled to cover the base of the internal cavity.

## Mounting and placement

It is important that nest boxes are placed where they will be accessible for future monitoring and maintenance, but preferably not conspicuous to the general public.

Nest boxes should be mounted on rough-barked trees, preferably Wandoo, York Gum or Red Sheoak, with a diameter of ≥ 30 cm. DO NOT place nest boxes on trees that have existing hollows.

Nest boxes should be mounted so that that it is vertical and securely fastened to a tree at a height of 3 - 5 m above ground level. Red-tailed phascogales show no preference for aspect of nest boxes, but they should preferably be positioned to provide shelter from prevailing weather, particularly from sun and rain.

The best way to secure a nest box to a tree is by using two to four long galvanised screws or nails and securing it directly into the tree. One or two of the screws/nails should be through the pre-drilled holes at the back of the box.

## Safety

Care needs to be taken when placing nest boxes to ensure human safety is considered at all times. Nest boxes are heavy and require lifting and manoeuvring into position.

## How to Monitor and Maintain Nest Boxes

It is important to monitor and maintain nest boxes after they have been erected to:

- determine if the nest box is being used by red-tailed phascogales or other species (native or pest),
- determine the effectiveness of the design and placement of the nest box,
- identify any problems with pest species or maintenance requirements, and
- resolve any problems to ensure the nest box continues to be useful for nesting by red-tailed phascogale.

It is important to continue a regime of regular maintenance while the nest box is required.



Red-tailed phascogales inside a nest box.  
Photo: Angela Sanders/Bush Heritage Australia

## How do I monitor nest boxes?

Before undertaking monitoring of nest boxes for red-tailed phascogales, it is recommended that you seek advice from the Department of Biodiversity, Conservation and Attractions. It is also important to contact the Department's Wildlife Licensing Section to determine if a licence to disturb fauna is required ([wildlifelicensing@dbca.wa.gov.au](mailto:wildlifelicensing@dbca.wa.gov.au)).

Monitoring nest boxes requires keen observation and naturalist skills. It is often not possible to observe direct evidence of use and therefore inferences must be made based on other observations. There are a variety of techniques available to monitor nest boxes, and a combination of several is likely to achieve the best results (Table 3).

Keep in mind that it is important to limit disturbance to any animals using the nest box, particularly during the breeding season. Animals should not be physically disturbed or handled.

When monitoring a nest box, always ensure that it is done as quickly and quietly as possible to avoid disturbing any animals that may be using it. Phascogales are nocturnal animals and therefore it is best to monitor them near sunrise or sunset. Therefore, if a phascogale is disturbed during the monitoring and leaves the nest box, the sun is not too bright, and it is not too hot.

Nest boxes can be left for long-periods of time without checking but ideally should be monitored once a year during the early mating season (July).

The information collected from the monitoring should be written down and reported. There are standard fauna report forms available on the Department's website (<https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-animals>) that can be used to record the details of your sighting.

Alternatively, if you are frequently monitoring a larger number of nest boxes, you can put the details into a spreadsheet. Records should be submitted to the Department by emailing [fauna@dbca.wa.gov.au](mailto:fauna@dbca.wa.gov.au). The Department will put the records into the Threatened and Priority Fauna Database and it will be used to inform conservation and management decisions.

Any other opportunistic sightings of Threatened and Priority species are always appreciated and can also be reported via the same email.

Important information to record includes: observer's name and contact details, date and time, location, fauna species, description of the animal or a photo, vegetation description, and observation description (i.e. details about nest box monitoring, signs of use, animal behaviour etc.).

**Table 3: Techniques for monitoring nest boxes**

Technique	Description of Technique
Observation from the ground – looking for signs of use outside the nest box	<p>Look for signs of recent use from the outside, particularly noting any chew or scratch marks, and any discolouration around the entrance hole(s).</p> <p>Cobwebs covering the entrances will indicate that the nest box has not been used recently.</p> <p>A light piece of string nailed over the entrance hole is a useful way to determine if an animal is inside the nest box because animals entering the box will push the end of the string in with them.</p>
Observation from the ground – observing insect activity outside the nest box	<p>Faecal matter produced by animals attracts insects, especially flies and ants.</p> <p>Blowflies around a nest usually indicates that a death has occurred.</p>
Observation from the ground – stag watching	<p>Stag watching is when you watch the nest box for a certain period of time to see if any animals exit the nest box. The following methodology is recommended:</p> <ul style="list-style-type: none"> <li>• Choose a place to sit within 2 -5 m of the nest box and within sight of its entrance holes</li> <li>• Sit quietly from at least 10 minutes before dusk until at least 30 minutes after sunset.</li> <li>• When movement is observed, see if you can identify the animal in any natural light available by observing its shape and size. If this is not possible, use a torch to illuminate the animal to see its distinguishing features.</li> <li>• Take notes of the important information (see above).</li> </ul>
Observation via a camera – telescopic camera	<p>To avoid disturbing any animals that may be using the nest box, look inside the nest via the entrance holes with the aid of a telescopic pole and camera or mirror.</p>
Observation via a camera (long-term monitoring) – remote camera	<p>Cameras can be installed in or nearby a nest box to watch remotely to see if the nest box is used. This technique allows for monitoring/information to be gathered throughout the year, including throughout the breeding season.</p> <p>When installing a camera nearby a nest box, make sure it is in sight of the entrance holes at the rear of the nest box. If you are installing a camera inside the nest box, make sure it is prepared before the nest box is mounted to a tree so that the camera can easily be turned on and off without disturbing any animals inside the nest box.</p> <p>There are various types of nest-box camera kits with infra-red lights that can be used.</p>
Observation via a ladder – looking for signs of use inside the nest box	<p>If the nest box appears to be empty (confirmed by the use of a camera), quietly approach the nest box using a ladder and open the hinged lid slowly.</p> <p>If there is an animal in the nest box, quietly close the lid and leave the area as quietly as possible to reduce any further disturbance.</p> <p>If there are no animals in the nest box, the inside of the nest box can be checked for signs of use, particularly noting any feathers, fresh or old scats, scratch marks, discolouration, and new or disturbed nesting material.</p> <p><u>DO NOT</u> approach the nest box if there are bees present. Research has found that bees will move out by themselves and so won't have a long-term impact on nest box use, particularly if you have several nest boxes at your site.</p> <p>Watch out for spiders, ants and other insects that may be using the nest box and can inflict stings or bites when disturbed.</p>

## How do I maintain nest boxes?

Nest boxes can be left for long periods of time, but they may still require maintenance to ensure they continue to have the greatest chance of being used by red-tailed phascogale. Therefore, it is best to make periodic maintenance checks at least every two years. Maintenance checks can be undertaken while monitoring, but it is preferable that they are undertaken prior to the breeding season so that any problems identified can be addressed before breeding occurs. If breeding is occurring, maintenance should be delayed if it is likely to disturb the animals. Maintenance concerns regarding the security of attachment points or the stability of the tree or pole should be addressed as a priority for safety reasons.

At a minimum, maintenance checks should assess the following:

- Condition of attachment points,
- Stability of tree or pole used to mount the nest box,
- Presence of black rats,
- Presence of feral bees,
- Presence of dead animals,
- Condition of nest box, particularly the base, and
- Condition of nesting material.

Likely maintenance includes:

- Control of black rats using rat traps (weekly if black rats are present);
- Control of feral bees with the help of an apiarist (only if bees become an issue);
- Adjustment of nest box placement (only if rains entering or excessive heat in the summer is an issue);
- Replacement of nest box due to deterioration (rarely for hard woods, occasionally for soft woods); and

Replacement of wet and mouldy nesting material (rarely if using hard woods with holes drilled into the base).

## Further Reading

Bush Heritage Australia's species webpage: [Red-tailed Phascogales](#)

## Acknowledgements

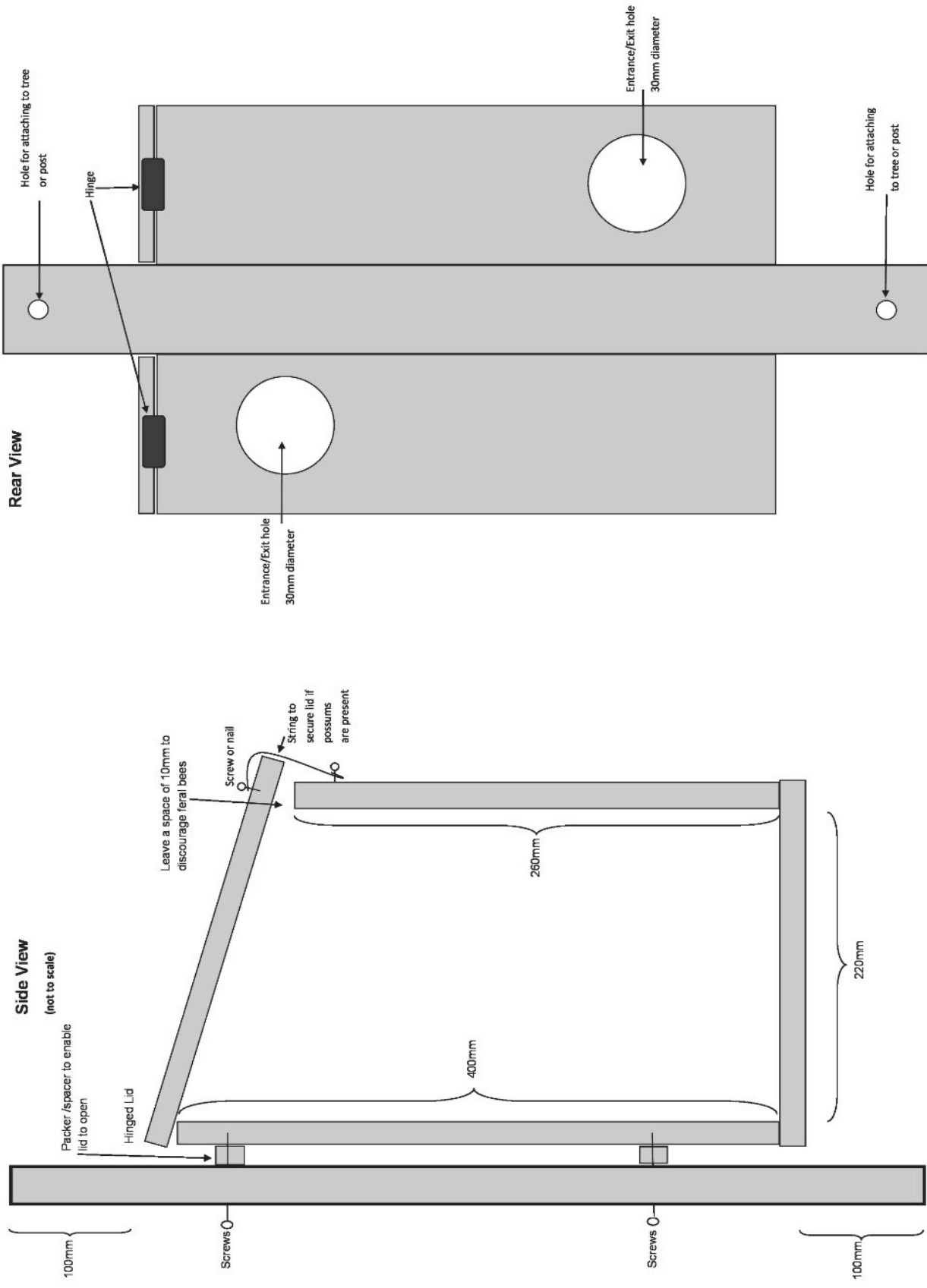
This information sheet was developed with contributions on monitoring methods and nest box design from Bush Heritage Australia.

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Side view (left) and rear view (right) of a red-tailed phascogale nest box design. Image: Bush Heritage Australia



## 1. Application details

### Permit application details

Permit application No.: CPS 8694/1  
Permit type: Area Permit

### Applicant details

Applicant's name: Shire of Wandering  
Application received date: 11 October 2019

### Property details

Property: Fourteen Mile Brook Road Reserve (PIN 11374316), Wandering  
Fourteen Mile Brook Road Reserve (PIN 11374318), Wandering  
Local Government Authority: Shire of Wandering  
Localities: Wandering

### Application

Clearing Area (ha)	No. Trees	Method of Clearing	For the purpose of:
0.135	-	Mechanical	Road upgrades and construction

### Decision on application

Decision on Permit Application: Granted  
Decision Date: 19 August 2020

Reasons for Decision: The clearing permit application received has been assessed against the clearing principles, planning instruments and other matters in accordance with section 51O of the *Environmental Protection Act 1986*. It has been concluded that the proposed clearing is may be at variance with principle (b) and is not likely to be at variance with the remaining clearing principles.

Although no evidence of use by fauna has been identified, it has been determined that the proposed clearing may result in impacts to potential breeding habitat for the forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*), Carnaby's cockatoo (*Calyptorhynchus latirostris*) and the red-tailed phascogale (*Phascogale calura*). A fauna management condition has been placed on the clearing permit to require inspection of habitat trees immediately prior to and during clearing, to minimise these impacts.

Through the assessment it was identified that the proposed clearing may impact surrounding native vegetation through the introduction and spread of weeds and dieback. A weed management and dieback control condition has been placed on the clearing permit to minimise the risk of weeds and dieback spreading into adjacent areas of remnant vegetation.

In determining to grant a clearing permit subject to conditions, the Delegated Officer considered that the proposed clearing is not likely to lead to an unacceptable risk to the environment.

## 2. Site Information

### Clearing Description

The application is for the proposed clearing of 0.135 hectares of native vegetation, within Fourteen Mile Brook Road Reserve (PINs 11374316 and 11374318) in Wandering, for the purpose of road widening to improve road safety.

### Vegetation Description

The vegetation within the application area is mapped South West Forests Michibin vegetation complex, described as open woodland of *Eucalyptus wandoo* over *Acacia acuminata* with some *Eucalyptus loxophleba* (York gum) on valley slopes, with low woodland of *Allocasuarina huegeliana* on or near shallow granite outcrops in arid and perarid zones (Mattiske and Havel, 1998). The application area comprises the clearing of twelve trees, including *Corymbia calophylla* (marri), *Eucalyptus wandoo* (wandoo) and other *Eucalyptus* spp., in addition to a small patch of five *Acacia* sp. individuals.

### Vegetation Condition

The vegetation condition of the application area was determined through a site inspection undertaken by DWER environmental officers (DWER, 2020b). The condition of the vegetation within the application area is degraded to completely degraded (Keighery, 1994), described as:



- Degraded: Basic vegetation structure severely impacted by disturbance, scope for regeneration but not to a state approaching good condition without intensive management (Keighery, 1994).
- Completely degraded: The structure of the vegetation is no longer intact and the area is completely or almost completely without native species (Keighery, 1994).

**Soil Type:**

The soil type within the application area is mapped as:

- Michibin Subsystem (Quindanning; 253QdMN), described as hillslopes containing soils formed by the weathering of fresh rock. Rock outcrop is common (DPIRD, 2017).
- Norrine Subsystem (Quindanning; 253QdNO), described as a complex of lateritic residuals and associated pediment; gravely sand, sand, duplex yellow soils and duricrust (DPIRD, 2017).

**Local Area:**

The local area referred to in the assessment of this application is defined as a 10 kilometre radius measured from the outer perimeter of the application areas. The local area retains approximately 29 per cent remnant vegetation.

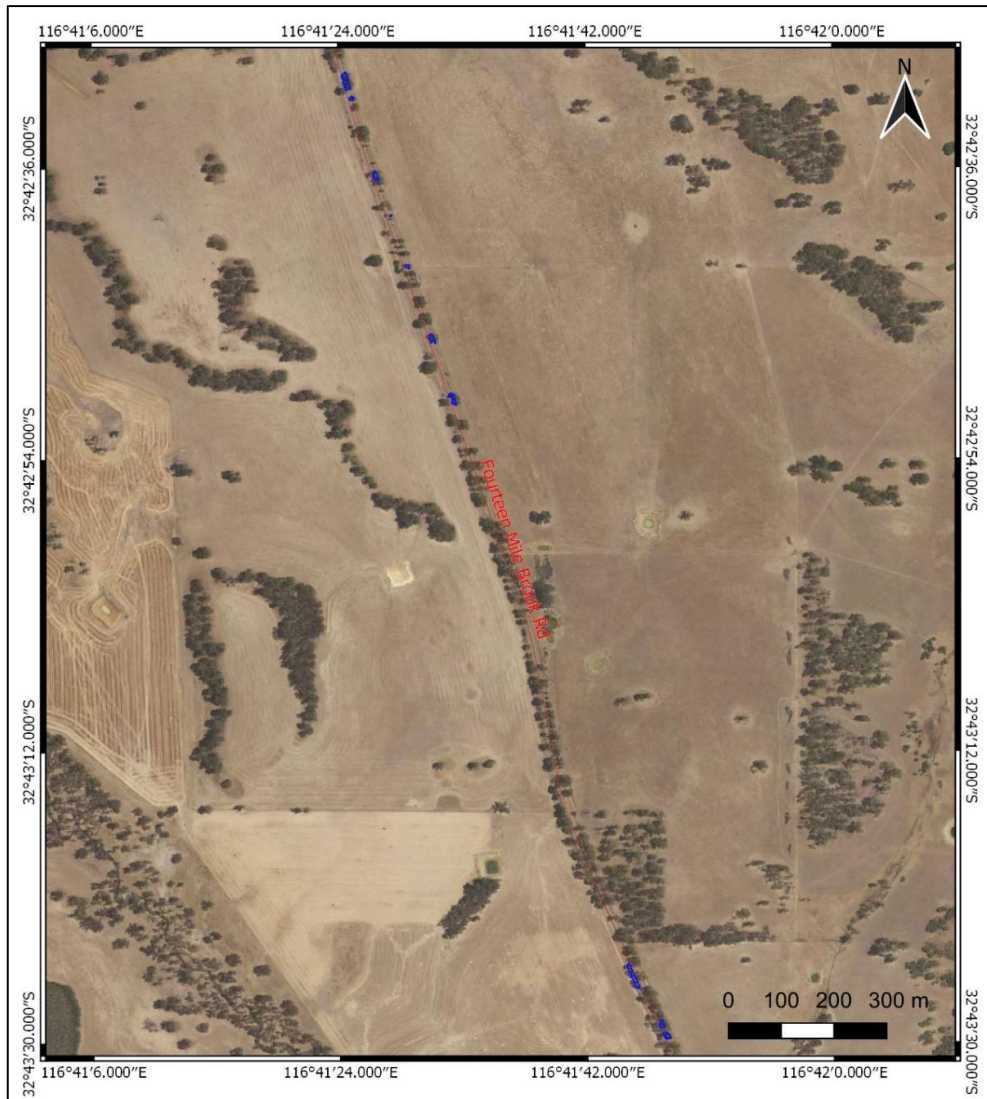


Figure 1. Application area (hatched in blue)



Figure 2. A *Eucalyptus* sp. individual within the application area (Shire of Wandering, 2020a)



Figure 3. A *Eucalyptus* sp. individual within the application area (Shire of Wandering, 2020a)



Figure 4. A hollow-bearing marri individual within the application area (Shire of Wandering, 2020a)



Figure 5. A *Eucalyptus* sp. individual within the application area (Shire of Wandering, 2020a)



Figure 6. *Eucalyptus* sp. within the application area (Shire of Wandering, 2020a)



Figure 7. *Wandoo* within the application area (Shire of Wandering, 2020a)



Figure 8. A marri individual within the application area (Shire of Wandering, 2020a)



Figure 9. A marri individual within the application area (Shire of Wandering, 2020a)



Figure 10. Wandoo within the application area (Shire of Wandering, 2020a)



Figure 11. Wandoo within the application area (Shire of Wandering, 2020a)



Figure 12. Wandoo within the application area (Shire of Wandering, 2020a)



Figure 13. *Acacia* sp. in the application area (Shire of Wandering, 2020b)

### 3. Avoidance and minimisation measures

The initial application to clear submitted to DWER by the applicant comprised 13 trees (Shire of Wandering, 2019). The Shire of Wandering (2020a,b) advised that subsequent to further revaluation and reassessment of the road design, one tree, referred to as 'Tree 4' was removed from the application area and will be retained (Shire of Wandering, 2020a,b).

During the site inspection conducted by DWER environmental officers, the Shire of Wandering representative in attendance advised that the Shire of Wandering is committed to retaining native vegetation and had considered the following in the design of the widening of the road and applying for a permit to clear (DWER, 2020b):

- restricting the road-widening design to one side of the Fourteen Mile Brook Road reserve to minimise impacts and the amount of native vegetation required to be cleared.
- restricting vegetation clearing to the minimum amount necessary to improve road safety along Fourteen Mile Brook Road.

- applying to selectively clear individual trees as required by the road design, rather than applying to clear a large area within the wider road reserve, with the objective to avoid clearing understorey vegetation and retain trees within the Fourteen Mile Brook Road reserve.

During the site inspection, DWER environmental officers identified two hollow-bearing trees within the application area, including one marri (Figure 4) within the centre of the application area extent and one wandoo situated towards the southern extent of the application area (DWER, 2020b). During the site inspection, the Shire of Wandering representative in attendance indicated that the branches of the marri tree could potentially be pruned to retain the trunk of the marri tree which comprised the hollow (DWER, 2020b). The Shire of Wandering representative indicated the potential to divert the road design around the hollow-bearing wandoo individual (DWER, 2020b).

DWER sought clarification from the Shire of Wandering regarding the potential to further avoid and minimise impacts from the proposed clearing (DWER, 2020a). The Shire of Wandering further reviewed the road design to determine if there were any amendments that could be made to the road design to minimise impacts to mature eucalypts on the eastern extent of the Fourteen Mile Brook road reserve, and confirmed the following:

- The Shire of Wandering (2020b) advised that the marri with the potential hollow could not be avoided by the road design. The Shire of Wandering (2020b) confirmed that the marri with a potential hollow may only require pruning, and as such, it may be possible to retain the trunk with the hollow. However, due to the extent of pruning potentially required and uncertainty regarding whether the pruning may result in the potential death of the marri, the applicant opted for the marri to remain part of the application to clear (Shire of Wandering, 2020b).
- The Shire of Wandering confirmed that the road design could be diverted around the wandoo tree with a potential hollow, and into a small patch of *Acacia* sp. situated opposite to the wandoo individual within the Fourteen Mile Brook Road reserve (Shire of Wandering 2020b). The wandoo with the potential hollow was removed from the application to clear and will be retained within the Fourteen Mile Brook road reserve. The application to clear was amended to include the small patch of *Acacia* sp.

The revised clearing permit application area was readvertised on the DWER website on 10 June 2020. No submissions were received.

#### 4. Assessment of application against clearing principles

##### (a) Native vegetation should not be cleared if it comprises a high level of biological diversity.

###### Proposed clearing is not likely to be at variance with this principle

A review of available databases determined that no threatened flora and nine priority flora have been recorded within the local area, comprising one Priority 1 (P1), one Priority 2 (P2), four Priority 3 (P3) and three Priority 4 (P4) flora (Western Australian Herbarium, 1998-). None of these records occur within the application area. The nearest record is *Hibbertia hortiorum* (P1) and occurs approximately 3.8 kilometres from the application area. Given the habitat preferences of the above species, including soil type and vegetation association, the application area is not likely to comprise suitable habitat for these priority flora taxa. As assessed under Principle (c), no threatened flora taxa have been recorded within the local area and the application area is not likely to comprise suitable habitat for threatened flora.

The DWER site inspection determined that the vegetation within the application area primarily comprises mature wandoo, marri and other *Eucalyptus* spp., and is in degraded (Keighery, 1994) to completely degraded (Keighery, 1994) condition (DWER, 2020b). The understorey within the application area is heavily disturbed and predominantly absent of native species (DWER, 2020b). Further, the applicant has opted to selectively clear individual trees to enable retention of understorey species (DWER, 2020b). Noting the above, the habitat preferences and distribution of conservation significant flora within the local area, and the degraded to completely degraded (Keighery, 1994) vegetation condition, the application area is not likely to comprise suitable habitat for conservation significant flora and is not likely to comprise a high level of floristic diversity.

As assessed under Principle (d), according to available datasets one conservation significant ecological community is mapped within the local area. The nearest mapped ecological community is the 'Eucalypt woodlands of the Western Australian Wheatbelt', a critically endangered Commonwealth Threatened Ecological Community (TEC) and Priority 3 state-listed Priority Ecological Community (PEC) located approximately 4.5 kilometres northeast from the application area. Given the degraded (Keighery, 1994) to completely degraded (Keighery, 1994) condition of the vegetation within the application area and the width of the roadside vegetation remnant is less than five metres (DWER, 2020b), the vegetation proposed to be cleared is not likely to be representative of this community. Given the above, the vegetation within the application area is not likely to comprise the whole or part of, or be necessary for the maintenance of a conservation ecological community.

As assessed under Principle (b), the application area may comprise suitable habitat for four conservation significant fauna species. This includes potential breeding habitat for forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*), Carnaby's cockatoo (*Calyptorhynchus latirostris*) and the red-tailed phascogale (*Phascogale calura*), in addition to potential foraging habitat for black cockatoo species, including forest-red-tailed black cockatoo, Baudin's cockatoo (*Calyptorhynchus baudinii*) and Carnaby's cockatoo. A site inspection undertaken by DWER environmental officers determined that one marri within the application area comprised potential hollows that may be suitable for use as breeding habitat for black cockatoos and red-tailed phascogale (DWER, 2020b). The site inspection did not record evidence of use of the hollows or vegetation within the application by black cockatoos, red-tailed phascogale, or other fauna.

Whilst the vegetation within the application and surrounding road reserve comprises remnant vegetation in degraded to completely degraded (Keighery, 1994) condition, it does provide ecological linkage and connectivity within the road reserve and a fragmented landscape. Noting that the applicant proposes to selectively clear individual trees over an extensive area, the Shire of Wandering has tried to retain larger *Eucalyptus* spp. individuals through the road design, and due to the small extent and dispersed nature of clearing proposed, the clearing is not likely to sever ecological linkage, and connectivity within the road reserve will be maintained. Fauna management conditions will mitigate potential impacts to fauna as detailed further under Principle (b).

Whilst the application area may provide suitable habitat for conservation significant fauna, the vegetation proposed to be cleared does not comprise conservation significant ecological communities, is in degraded to completely degraded (Keighery, 1994) condition, and comprises minimal floristic diversity. Given the above, the vegetation within the application area is not likely to comprise a high level of biological diversity and the proposed clearing is not likely to be at variance with this principle.

**(b) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna.**

**Proposed clearing is may be at variance with this principle**

According to available databases, twelve threatened fauna species have been recorded within the local area, including seven threatened fauna, three priority fauna, one species of special conservation interest (conservation dependent fauna), and one fauna species presumed to be extinct (DBCA, 2007-). None of these records occur within the application area. Given the existing records, habitat preferences and habitat requirements, the application area may comprise suitable habitat for four conservation significant fauna species, including Carnaby's cockatoo (Endangered), forest red-tailed black cockatoo (Vulnerable) and Baudin's cockatoo (Endangered), collectively herein referred to as black cockatoos, and red-tailed phascogale (Vulnerable).

Black cockatoo

Black cockatoos breed in large hollow-bearing trees, generally within woodlands, forests, or isolated trees (Commonwealth of Australia, 2012). Black cockatoo breeding habitat is described as trees of species known to support breeding within the range of black cockatoos, which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow. Suitable DBH for nest hollows is 500 millimetres for most tree species, however, is reduced to 300 millimetres for wandoo and *Eucalyptus salmonophloia* (Commonwealth of Australia, 2012). According to available databases, the vegetation within the application area is situated within an area mapped for Carnaby's cockatoo feeding habitat within the Jarrah Forrest Interim Biogeographic Regionalisation for Australia (IBRA) region (DBCA, 2007-). One unconfirmed roost site is mapped less than 500 metres from the application area (DBCA, 2007-). The presence of mapped potential black cockatoo roosting and feeding habitat recorded within 12 kilometres of the application area, makes it a suitable location for breeding if appropriate hollows are present. Further, the application area is mapped within the predicted breeding and occurrence range for both Carnaby's cockatoo and the forest red-tailed black cockatoo (Commonwealth of Australia, 2012). The application area is mapped outside the predicted breeding range for Baudin's cockatoo (Commonwealth of Australia, 2012) and therefore is not expected to provide significant breeding habitat for this species.

The site inspection undertaken by DWER environmental officers identified two hollow-bearing trees within the application area, including one marri and one wandoo that may be suitable for nesting by black cockatoo species (DWER, 2020b). Following further consideration of the road design, the Shire of Wandering removed the hollow-bearing wandoo from the application area, and diverted the road design into a small patch of five *Acacia* sp. situated within the opposite side of the road reserve to the wandoo individual (Shire of Wandering, 2020b). The Shire of Wandering (2020b) advised that the marri with the potential hollow could not be completely avoided by the road design. The Shire of Wandering (2020b) advised the potential to prune the marri and retain the trunk with the hollow (Section 3). It should be noted that if the potential pruning of the marri does kill the marri, this may not alter the quality of the breeding habitat trees, as black cockatoos are known to utilise dead trees for breeding (Commonwealth of Australia, 2012). Nevertheless, the marri has been assessed for its ecological value in its entirety. The potential habitat trees and vegetation within the application area did not show any signs of use by any fauna, including black cockatoos and red-tailed phascogale (DWER, 2020b).

Whilst no evidence of use by conservation significant fauna has been identified within the application area (DWER, 2020b), the application area may provide breeding habitat for black cockatoos. A fauna management condition requiring inspection of habitat trees immediately prior to the clearing, is considered to mitigate impacts to black cockatoo species.

Black cockatoo species forage on a range of plant species, predominantly the seeds and flowers of marri, jarrah (*Eucalyptus marginata*) and proteaceous species such as *Banksia*, *Hakea* and *Grevillea* species (Commonwealth of Australia, 2012). In the absence of these species, black cockatoos have also been known to forage on the seeds of various *Eucalyptus* spp, including wandoo (Commonwealth of Australia, 2012). No evidence of foraging by black cockatoo species was observed during the DWER site inspection (DWER, 2020b). Whilst the vegetation within the application area is considered to be degraded to completely degraded (Keighery, 1994) condition, the canopy cover within the road reserve is good and vegetation within the application area may provide foraging values for black cockatoos.

Given the above, the vegetation within the application area comprises suitable foraging habitat for black cockatoos. However, noting the extent of clearing, and that the application area comprises selective clearing of dispersed *Eucalyptus* spp. and *Acacia* sp., and the extent and distribution of remnant vegetation remaining within road reserve and local area (29 per cent; Principle e), the proposed clearing is not likely to significantly impact black cockatoo foraging habitat. Given the above, the proposed clearing has the potential to result in significant impacts to fauna habitat if the application area is used for breeding by the Carnaby's cockatoo and the forest red-tailed black cockatoo. A fauna management condition requiring inspection of habitat trees immediately prior to and for the duration of clearing, is considered to mitigate impacts to black cockatoos.

### Red-tailed phascogale

The red-tailed phascogale is an arboreal, carnivorous marsupial typically associated with long unburnt woodlands with continuous canopy, dominated by *Allocasuarina* species and hollow-producing eucalypts, particularly wandoo and York gum (Threatened Species Scientific Committee, 2016). The DWER (2020b) site inspection identified that vegetation within the application area may provide suitable habitat for red-tailed phascogale. In particular, two hollow-bearing trees (marri and wandoo) with the potential to provide diurnal refugia and breeding habitat was observed (DWER, 2020b). The wandoo with the potential hollow was removed from the application area (shire of Wandering 2020b; Section 3). No signs of red-tailed phascogales or other fauna species (e.g. scats or scratchings) were observed for any potential habitat tree during the site inspection (DWER, 2020b). The application area comprises vegetation in degraded to completely degraded (Keighery, 1994) condition with an understorey primarily absent of native species and is isolated from larger expanses of better quality native vegetation. Noting the above, the hollow-bearing trees within the application area are not likely to provide significant habitat for the red-tailed phascogale. Given no evidence of use by conservation significant fauna has been identified within the application area (DWER, 2020b) and it is unlikely that the application area provides significant habitat for the species, a fauna management condition requiring inspection of habitat trees immediately prior to and for the duration of clearing, is considered to mitigate impacts to the red-tailed phascogale.

As discussed in Principle (a), the application area is a remnant of native vegetation within a highly fragmented landscape. Whilst the vegetation within the application area and surrounding road reserve comprises remnant vegetation in degraded to completely degraded (Keighery, 1994) condition, the remnant vegetation provides ecological linkage, canopy connectivity and refuge for fauna in a fragmented landscape. Noting that the applicant proposes to selectively clear individual trees over an extensive area, and has tried to retain larger *Eucalyptus* spp. individuals through the road design, and due to the small and dispersed nature of clearing proposed, the clearing is not likely to sever the ecological linkage, and the connectivity within the road reserve will be maintained. On this basis, the proposed clearing is not likely to impact fauna moving through the landscape.

Given the vegetation within the application area contains potential breeding habitat for black cockatoo species and the red-tailed, the proposed clearing is may be at variance with this principle.

Fauna management conditions requiring inspection of habitat trees immediately prior to and for the duration of clearing, are considered to mitigate impacts to black cockatoos and red-tailed phascogale.

### **(c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, Threatened flora.**

#### **Proposed clearing is not likely to be at variance with this principle**

According to available databases, no records of threatened flora occur within the application area or local area (Western Australian Herbarium, 1998-). As discussed in Principle (a), the vegetation within the application area primarily comprises mature *Eucalyptus wandoo*, marri and other *Eucalyptus* species in degraded to completely degraded (Keighery, 1994) condition (DWER, 2020b). Noting the absence of threatened flora records within the local area, the absence of native understorey species and the vegetation condition observed (DWER, 2020b), the vegetation within the application area is not likely to provide suitable habitat for threatened flora.

Given the above, the proposed clearing is not likely to be at variance with this principle.

### **(d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.**

#### **Proposed clearing is not likely to be at variance with this principle**

According to available databases, no state-listed TECs are mapped within the local area. The nearest mapped state-listed TEC is 'Perched wetlands of the Wheatbelt region with extensive stands of living Swamp Sheoak (*Casuarina obesa*) and Paperbark (*Melaleuca strobophylla*) across the lake floor', a critically endangered state-listed TEC that occurs approximately 58 kilometres north from the application area. The vegetation within the application area does not represent this conservation significant ecological community.

Given the above, the application area is not likely to comprise the whole or a part of, or be necessary for the maintenance of a state-listed TEC and the proposed clearing is not likely to be at variance with this principle.

### **(e) Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.**

#### **Proposed clearing is not likely to be at variance with this principle**

The national objectives and targets for biodiversity conservation in Australia has a target to prevent clearance of ecological communities with an extent below 30 per cent of that present pre-1750, below which species loss appears to accelerate exponentially at an ecosystem level (Commonwealth of Australia, 2001).

The application area is located within the Jarrah Forest IBRA Bioregion which retains approximately 53.25 per cent of its pre-European vegetation extent (Government of Western Australia, 2019; Table 1). The mapped Michbin (185) vegetation complex retains approximately 25.59 per cent of its pre-European vegetation extent (Government of Western Australia, 2018) and the local area retains approximately 28.38 per cent native vegetation cover (Table 1).

Whilst the vegetation within the application and surrounding road reserve comprises remnant vegetation in degraded to completely degraded (Keighery, 1994) condition, it does provide ecological linkage and connectivity within the road reserve and a fragmented landscape. Noting that the vegetation within the application area potentially comprises suitable habitat for conservation significant fauna, the vegetation within the application area may be considered a significant remnant.

Noting the applicant proposes to selectively clear individual trees, over an extensive area, and the Shire of Wandering (2020b) has attempted to retain larger *Eucalyptus* spp. individuals in the design of the road, and due to the small extent (0.135 hectares) and dispersed nature of clearing proposed, the clearing is not likely to sever the ecological linkage and canopy connectivity within the road reserve will be maintained. The Michibin vegetation complex is slightly below the 30 per cent threshold (25.6 percent), however noting the degraded to completely degraded (Keighery, 1994) vegetation condition, the loss of vegetation structure and the isolated, linear characteristics of the vegetation, the vegetation within the application area is not likely to completely represent the mapped vegetation complex.

Noting the above, and given the extent of remnant vegetation within the Jarrah Forest IBRA region and the local area exceed or are approximately equal to the 30 per cent threshold, the absence of conservation significant flora and communities, the degraded to completely degraded (Keighery, 1994) vegetation condition, the vegetation within the application area is not considered to be a significant remnant within an extensively cleared area, and not likely to be at variance with this principle.

**Table 1: Vegetation representation statistics (Government of Western Australia, 2019a,b)**

	Pre-European (ha)	Current Extent (ha)	Remaining (%)	Current Extent in DBCA Managed Lands	
				(ha)	(%)
<b>IBRA Bioregion</b>					
Jarrah Forest	4,506,660.25	2,399,838.15	53.3	1,673,614.25	37.14
<b>South West vegetation complex</b>					
Michibin (185)	168,040.13	42,996.09	25.6	8,512.22	5.07
<b>Local Area</b>					
10 kilometre radius	35,274.14	10,205.09	29.0	-	-

**(f) Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.**

**Proposed clearing is not likely to be at variance with this principle**

According to available datasets, no watercourses or wetlands are mapped within the application area. The nearest mapped watercourse is Wandering Brook, a non-perennial watercourse located approximately 550 metres southwest of the application area. The DWER site inspection recorded no evidence of a watercourse or any distinct riparian vegetation within the application area (DWER, 2020b). Noting the above, the vegetation present within the application area is not likely to be growing in, or in association with, an environment associated with a watercourse or wetland.

Given the above, the proposed clearing is not likely to be at variance with this principle.

**(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.**

**Proposed clearing is not likely to be at variance with this principle**

The northern extent of the application area is mapped as Michibin Subsystem (Quindanning) (253QdMN), described as hillslopes containing soils formed by the weathering of fresh rock. Rock outcrop is common (DPIRD, 2017). The southern extent of the application area is mapped as the Norrine Subsystem (Quindanning) (253QdNO), described as a complex of lateritic residuals and associated pediment; gravely sand, sand, duplex yellow soils and duricrust (DPIRD, 2017).

As indicated in Table 2, the soil type mapped within the application area presents a low risk of land degradation, except for subsurface acidification and wind erosion risk, which present a high risk. Given the extent of the proposed clearing, the landscape is extensively cleared, and vegetation within the application area is in degraded to completely degraded (Keighery, 1994) condition (DWER, 2020b), the proposed clearing is not likely to pose significant erosion risks or significantly impact subsurface acidification.

Given the above, the proposed clearing is not likely to cause appreciable land degradation and is not likely to be at variance with this principle.

**Table 2: Land degradation risk levels**

Risk categories	Michibin Subsystem (Quindanning) (253QdMN)	Norrine Subsystem (Quindanning)
Water Erosion	3-10% of map unit has a high to extreme water erosion risk	10-30% of map unit has a high to extreme water erosion risk
Wind Erosion	10-30% of the map unit has a high to extreme hazard	50-70% of map unit has a high to extreme wind erosion risk
Phosphorus export	10-30% of map unit has a high to extreme phosphorus export risk	10-30% of map unit has a high to extreme phosphorus export risk
Salinity	<3% of map unit has a moderate to high salinity risk or is presently saline	<3% of map unit has a moderate to high salinity risk or is presently saline



Flood risk	<3% of the map unit has a moderate to high hazard	<3% of the map unit has a moderate to high hazard
Waterlogging	<3% of the map unit has a moderate to very high to risk	<3% of the map unit has a moderate to very high to risk
Subsurface Acidification	>70% of the map unit has a high susceptibility	>70% of the map unit has a high susceptibility

**(h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.**

**Proposed clearing is not likely to be at variance with this principle**

According to available databases, there are no conservation areas within or directly adjacent to the application area. The nearest conservation area is an unnamed Timber Reserve, located approximately 5.1 kilometres north from the application area.

As discussed under Principles (a) and (b), the application area provides canopy connectivity within the road reserve and may function as an ecological linkage between areas of remnant vegetation in the local area. However, given the distance between the application area and nearby conservation areas, and the small extent of the proposed clearing, the proposed clearing is not likely to will impact the environmental values of any adjacent or nearby conservation area.

Noting the above, the proposed clearing is not likely to be at variance with this principle.

**(i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.**

**Proposed clearing is not likely to be at variance with this principle**

The application area lies within the Murray River System, a proclaimed surface water area under the *Rights in Water and Irrigation Act 1914*. As discussed in Principle (f), the closest mapped watercourse to the application area is Wandering Brook, a non-perennial watercourse, located approximately 550 metres southwest from the application area. Given the distance to the nearest mapped surface watercourse and the selective clearing approach proposed, the proposed clearing is not likely to cause deterioration in the quality of surface water.

Groundwater salinity within the application area is mapped between 3,000 to 7,000 milligrams per litre total dissolved solids. The application area does not lie within any groundwater areas proclaimed under the *Rights in Water and Irrigation Act 1914*. Noting the above, the extent of the proposed clearing, and that the vegetation within the application area is in degraded to completely degraded (Keighery, 1994) condition, the proposed clearing is not likely to cause deterioration in the quality of underground water.

Given the above, the proposed clearing is not likely to be at variance with this principle.

**(j) Native vegetation should not be cleared if clearing the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.**

**Proposed clearing is not likely to be at variance with this principle**

The mean annual rainfall for the local area is 600 millimetres. As discussed in Principle (g), the application area has a low risk of flooding and waterlogging. Noting the soil type, the vegetation is in degraded to completely degraded (Keighery, 1994) condition, the extent of the proposed clearing, and the relatively low annual rainfall in the local area, the proposed clearing is not likely to cause, or exacerbate, the incidence or intensity of flooding.

The proposed clearing is not likely to be at variance with this principle.

**Planning instruments and other relevant matters.**

The clearing permit application was advertised on the DWER website on 18 November 2019, inviting submissions from the public within a 14-day period. No submissions were received. The revised clearing permit application area (Section 3) was readvertised on the DWER website on 10 June 2020, inviting submissions from the public within a seven-day period. No submissions were received.

According to available databases, no Aboriginal sites of significance have been mapped within the application area. It is the applicant's responsibility to comply with the *Aboriginal Heritage Act 1972* and ensure that no unauthorised impacts to Sites of Aboriginal Significance occur through the clearing process.

The application area lies within the Murray River System proclaimed under the *Rights in Water and Irrigation Act 1914*. It is the applicant's responsibility to ensure any obligations in an area proclaimed under the *Rights in Water and Irrigation Act 1914* are fulfilled.

It is noted that road widening upgrades will provide a public benefit including improved road safety.

## 5. References

- Commonwealth of Australia (2001) National Objectives and Targets for Biodiversity Conservation 2001-2005, Canberra.
- Commonwealth of Australia (2012) EPBC Act referral guidelines for three threatened black cockatoo species, Canberra.
- Department of Biodiversity, Conservation and Attractions (DBCA; 2007-) NatureMap: Mapping Western Australia's Biodiversity. Department of Parks and Wildlife. Available from: <http://naturemap.dpaw.wa.gov.au/> (accessed January 2020).
- Department of Primary Industries and Regional Development (DPIRD) (2017) NRInfo Digital Mapping. Department of Primary Industries and Regional Development. Available from: <https://maps.agric.wa.gov.au/nrm-info/> (accessed January 2020). Government of Western Australia.
- Department of Water and Environmental Regulation (DWER) (2020a) Correspondence regarding proposed changes to application area, dated 13 February 2020 (DWER Reference: A1867893).
- Department of Water and Environmental Regulation (DWER) (2020b) Site inspection report for clearing permit application CPS 8694/1, undertaken 8 January 2020 (DWER Reference: A1868642).
- Environmental Protection Authority (EPA) (2019) EPA Technical Report: Carnaby's Cockatoo in Environmental Impact Assessment in the Perth and Peel Region Advice of the Environmental Protection Authority under Section 16(j) of the Environmental Protection Act 1986. Available from <https://www.epa.wa.gov.au/policies-guidance/carnaby%E2%80%99s-cockatoo-environmental-impact-assessment-perth-and-peel-region>.
- Government of Western Australia (2019a) 2018 Statewide Vegetation Statistics (formerly the CAR Reserve Analysis): Full Report. Remote Sensing and Spatial Analysis Program. Biodiversity and Conservation Science. Department of Biodiversity, Conservation and Attractions (DBCA). Published March 2019.
- Government of Western Australia (2019b) 2018 South West Vegetation Complex Statistics Report. Remote Sensing and Spatial Analysis Program. Biodiversity and Conservation Science. Department of Biodiversity, Conservation and Attractions. Published March 2019.
- Keighery, B.J. (1994) Bushland Plant Survey: A Guide to Plant Community Survey for the Community. Wildflower Society of WA (Inc). Nedlands, Western Australia.
- Mattiske, E.M. and Havel, J.J. (1998) Vegetation Complexes of the South-west Forest Region of Western Australia. Maps and report prepared as part of the Regional Forest Agreement, Western Australia for the Department of Conservation and Land Management and Environment Australia.
- Shire of Wandering (2019a) Correspondence regarding an application for a clearing permit, dated 11 October 2019 – Application for a clearing permit (DWER Reference: DWERD211183).
- Shire of Wandering (2020a) Correspondence regarding revised application area – confirming retention of Tree 4 and photographs, dated 29 January 2020 (DWER Reference: A1867495).
- Shire of Wandering (2020b) Correspondence regarding revised application area – confirming the retention of mature *Eucalyptus wandoo* and Tree 4, dated 21 February 2020 (DWER Reference: A1871612).
- Threatened Species Scientific Committee (2016) Conservation Advice: *Phascogale calura*, red-tailed phascogale. Department of the Environment and Energy, Canberra.
- Western Australian Herbarium (1998-) FloraBase - The Western Australian Flora. Department of Biodiversity, Conservation and Attractions. Available from: <http://florabase.dpaw.wa.gov.au/> (accessed January 2020).

## 6. GIS Datasets

- Aboriginal Sites of Significance
- DBCA Managed Estate
- Directory of Important Wetlands
- Geomorphic Wetlands Swan Coastal Plain
- Hydrography, hierarchy
- Hydrography, linear
- Land Degradation datasets
- NatureMap
- Perth Groundwater Mapping (DWER)
- Remnant Vegetation
- SAC Bio Datasets
- Soils, Statewide
- TPFL Data
- Vegetation Complexes, IBRA Bioregion
- WA Herbarium Data
- WA TEC/PEC Boundaries and Buffers