



CLEARING PERMIT

Granted under section 51E of the Environmental Protection Act 1986

Purpose Permit number:	CPS 8037/2
Permit Holder:	DevelopmentWA
Duration of Permit:	6 October 2018 – 6 October 2023

The Permit Holder is authorised to clear native vegetation subject to the following conditions of this Permit.

PART I – CLEARING AUTHORISED

1. Purpose for which clearing may be done

Clearing for the purpose of installation and extension of trunk services infrastructure (sewer, water and power)

2. Land on which clearing is to be done

Gordon Road reserve (PIN 1244646), Parklands
Lakes Road reserve (PIN 1244645, 11749414, 11749415 and 1376987), Greenfields, Parklands and Stake Hill
Fowler/Fishhawk Reserve (PIN 1376978), Stake Hill
Paterson Road Reserve (PIN 1346043, 1346040, 1346041, 1346042, 1346039, 1346038, 1346037, 1361813), Nambeelup and Ravenswood
Lot 329 on Deposited Plan 50766, Stake Hill
Lot 9001 on Deposited Plan 416070, Stake Hill
Lot 604 on Deposited Plan 59103, Stake Hill
Lot 1221 on Deposited Plan 418859, Nambeelup

3. Area of Clearing

The Permit Holder must not clear more than 3.154 hectares of native vegetation within the area cross-hatched yellow on attached Plans 8037/2a and 8037/2b.

4. 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.

PART II – MANAGEMENT CONDITIONS

5. 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:

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

6. 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.

7. Fauna management – *Black cockatoo species*

(a) 48 hours prior to undertaking any clearing authorised under this Permit, the *black cockatoo breeding tree* located within the area cross-hatched red on attached Plan 8037/2c shall be inspected by a *fauna specialist* for *evidence* of current or past breeding use by *black cockatoo species*.

(b) If the *black cockatoo breeding tree* shows *evidence* of current breeding use by *black cockatoo species* and cannot be avoided in accordance with condition 5(a) of this Permit, the tree shall be monitored by a *fauna specialist* to determine when it is no longer in use for that breeding season.

(c) If the *black cockatoo breeding tree* shows *evidence* of current breeding use by *black cockatoo species* and cannot be avoided in accordance with condition 5(a) of this Permit, it shall not be cleared whilst it is in use for that breeding season, as determined by the *fauna specialist* under condition 7(b) of this Permit.

(d) If the *black cockatoo breeding tree* shows *evidence* of breeding use by *black cockatoo species* and cannot be avoided in accordance with condition 5(a) of this Permit, that tree shall only be cleared:

- (i) outside the *black cockatoo species breeding season*; or
- (ii) later on the same day of the inspection required by condition 7(a) of this Permit; or
- (iii) later on the same day of a repeat inspection undertaken by a *fauna specialist*, if that inspection does not identify *evidence* of current breeding use.

(e) Within six months of clearing of the *black cockatoo breeding tree* within the area cross-hatched red on attached Plan 8037/2c, and before the following breeding season, the Permit Holder shall install one artificial black cockatoo nest hollow if the *black cockatoo breeding tree* showed *evidence* of current or past breeding use by *black cockatoo species*.

(f) Each artificial black cockatoo nest hollow required by condition 7(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 required by condition 7(e) of this Permit must be installed within one of the three locations outlined below:

- (i) Goegrup Lake Nature Reserve (R 26351), Barragup;
- (ii) Un-named Nature Reserve (R 44986), Stake Hill; or
- (iii) Un-named Nature Reserve (R 35283), Barragup.

(h) The artificial black cockatoo nest hollow required by condition 7(e) of this Permit must:

- (i) be designed and placed in accordance with the guidelines provided in Schedule 1 to this Permit; and
- (ii) be monitored and maintained in accordance with the guidelines provided in Schedule 2 to this Permit, for a period of at least ten years.

8. Fauna management – South-western brush-tailed phascogale

(a) 48 hours prior to undertaking any clearing authorised under this Permit, the potential *South-western brush-tailed phascogale habitat tree* within the area cross-hatched red on attached Plan 8037/2c shall be inspected by a *fauna specialist* for *evidence* of use by South-western brush-tailed phascogale (*Phascogale tapoatafa* subsp. *wambenger*).

- (b) If the potential *South-western brush-tailed phascogale habitat tree(s)* is identified to be occupied by South-western brush-tailed phascogale and cannot be avoided in accordance with condition 5(a) of this Permit, the tree shall only be cleared:
 - (i) immediately after a repeat inspection undertaken by a *fauna specialist* if that inspection confirms it is not occupied by South-western brush-tailed phascogale.
- (c) If the potential *South-western brush-tailed phascogale habitat tree* shows evidence of use (but not occupied) by South-western brush-tailed phascogale and cannot be avoided in accordance with condition 5(a) of this Permit, the tree 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 South-western brush-tailed phascogale.
- (d) Within six months of clearing of the potential *South-western brush-tailed phascogale habitat tree* within the area cross-hatched red on attached Plan 8037/2c, and before the following breeding season, the Permit Holder shall install one artificial nest box if the potential *South-western brush-tailed phascogale habitat tree* showed evidence of current or past breeding use by South-western brush-tailed phascogale.
- (e) The nest boxes required by condition 8(d) of this Permit must be installed within one of the three locations outlined below:
 - (i) Goegrup Lake Nature Reserve (R 26351), Barragup;
 - (ii) Un-named Nature Reserve (R 44986), Stake Hill; or
 - (iii) Un-named Nature Reserve (R 35283), Barragup.
- (f) The nest boxes required by condition 8(d) of this Permit:
 - (i) must be designed and placed in accordance with the guidelines provided in Schedule 3 to this Permit;
 - (ii) the diameter of the entrance hole should be approximately 40 millimetres, in order to suite South-western brush-tailed phascogale; and
 - (iii) be monitored and maintained in accordance with the guidelines provided in Schedule 3 to this Permit, for a period of at least ten years.

9. Flora Management

- (a) Prior to undertaking any clearing authorised under this Permit, the Permit Holder shall engage an *environmental specialist* to demarcate all *priority flora* individuals located within Lot 329 on Deposited Plan 50766, Stake Hill, within the area cross-hatched yellow on attached Plan 8037/2d 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; and
- (b) The Permit Holder shall ensure that clearing of *priority flora* is limited to six individuals of *Jacksonia gracillima*.

PART III - RECORD KEEPING AND REPORTING

10. Records must be kept

The Permit Holder must maintain the following records for activities done pursuant to this Permit:

- (a) In relation to the clearing of native vegetation authorised under this Permit:
 - (i) the boundaries of clearing undertaken, 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;
 - (ii) the date(s) that clearing occurred;
 - (iii) the size of the area cleared (in hectares);
 - (iv) actions taken to avoid, minimise and reduce the impacts and extent of clearing in accordance with condition 5 of this Permit;
 - (v) actions taken to minimise the risk of the introduction and spread of *weeds* and *dieback* in accordance with condition 6 of this Permit;

- (vi) the location of the artificial black cockatoo nest hollow in accordance with condition 7(g) of this Permit;
 - (vii) fauna management actions taken in accordance with condition 7 of the Permit;
 - (viii) the location of the nest box in accordance with condition 8(e) of this Permit; and
 - (ix) fauna management actions taken in accordance with condition 8 of the Permit.
- (b) In relation to flora management pursuant to condition 9 of this Permit:
- (i) the name and location of each *priority flora* 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;
 - (ii) actions taken to demarcate each *priority flora* recorded; and
 - (iii) the number of individuals of each *priority flora* cleared and their locations.

11. 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) The Permit Holder must provide to the *CEO* on or before 30 June of each year, a written report:
 - (i) of records required under condition 10 of this Permit; and
 - (ii) concerning activities done by the Permit Holder under this Permit between 1 January to 31 December of the preceding calendar year.
- (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 carried out, must be provided to the *CEO* on or before 30 June of each year.
- (d) Prior to 6 July 2023, the Permit Holder must provide to the *CEO* a written report of records required under condition 10 of this Permit where these records have not already been provided under condition 11(a) 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;

environmental specialist means a person who is engaged by the Permit Holder for the purpose of providing environmental advice, who holds a tertiary qualification in environmental science or equivalent, and has experience relevant to the type of environmental advice that an environmental specialist is required to provide under this Permit;

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;

priority flora means those plant taxa described as priority flora classes 1, 2, 3 or 4 in the *Department of Biodiversity, Conservation and Attractions' Threatened and Priority Flora List for Western Australia* (as amended);

South-western brush-tailed phascogale habitat tree(s) means a tree that contains a hollow(s) suitable to be used by South-western brush-tailed phascogale (*Phascogale tapoatafa* subsp. *wambenger*).

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 species-led ecological impact and invasiveness ranking summary, regardless of ranking; or
- (c) not indigenous to the area concerned.



Meenu Vitarana
A/MANAGER
NATIVE VEGETATION REGULATION

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

18 August 2020



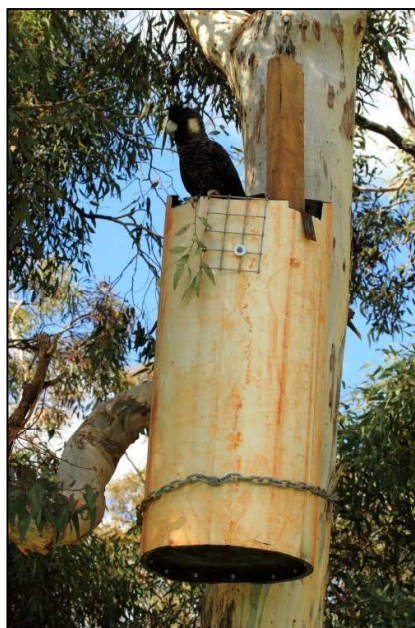
How to design and place artificial hollows for Carnaby's cockatoo

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.

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

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.

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

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.

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.

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>

Further information

Last updated 28/04/2015

Contact fauna@dpaw.wa.gov.au or your local office of the Department of Parks and Wildlife

See the department's website for the latest information: www.dpaw.wa.gov.au

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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).

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.

Observing parent behaviour around the hollow

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

Parent behaviour	Approximate age/stage of young
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)

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).

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.

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.

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.

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.

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.

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.

Monitoring of artificial hollows:

Monitoring aim	Frequency of visits	Monitoring techniques
To determine possible use by Carnaby's cockatoo	At least once during peak breeding season (i.e. between September and December)	<ul style="list-style-type: none"> • Observing behaviour of adults around hollow • Tapping to see if female will flush from hollow (best undertaken between 10am and 3pm when females most likely to be sitting) • Listening for nestlings • Looking for evidence of chewing • Looking inside nest
To confirm use by Carnaby's cockatoo	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"> • Breeding behaviour of adults around hollow or evidence of chewing • Female flushed from hollow • Noises from nestlings in hollow <p>Or to observe:</p> <ul style="list-style-type: none"> • Nestlings or eggs in nest
To determine nesting success by Carnaby's cockatoo	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"> • Looking inside nest to observe eggs or nestlings.
To determine use by any species	As often as possible.	<ul style="list-style-type: none"> • Inspection from ground as a minimum. • Looking inside nest for detailed observations.
To determine maintenance requirements	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"> • 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

Acknowledgements

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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.

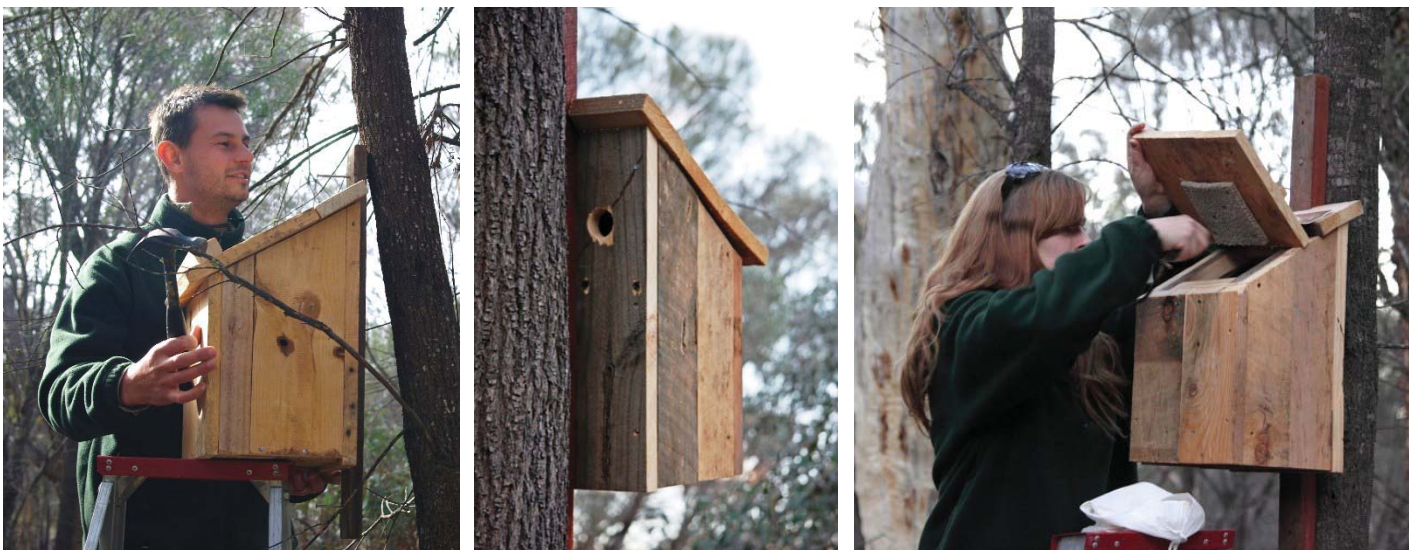
Table 1: Criteria to determine if a site is suitable for the placement of nest boxes

1.	The site contains suitable habitat within the known breeding range of the species	
	<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.	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).	
	<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.	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.	
	<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.	A suitable artificial hollow design is used.	
	<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 hole (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).

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. 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"> • Choose a place to sit within 2 -5 m of the nest box and within sight of its entrance holes • Sit quietly from at least 10 minutes before dusk until at least 30 minutes after sunset. • 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. • Take notes of the important information (see above).
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

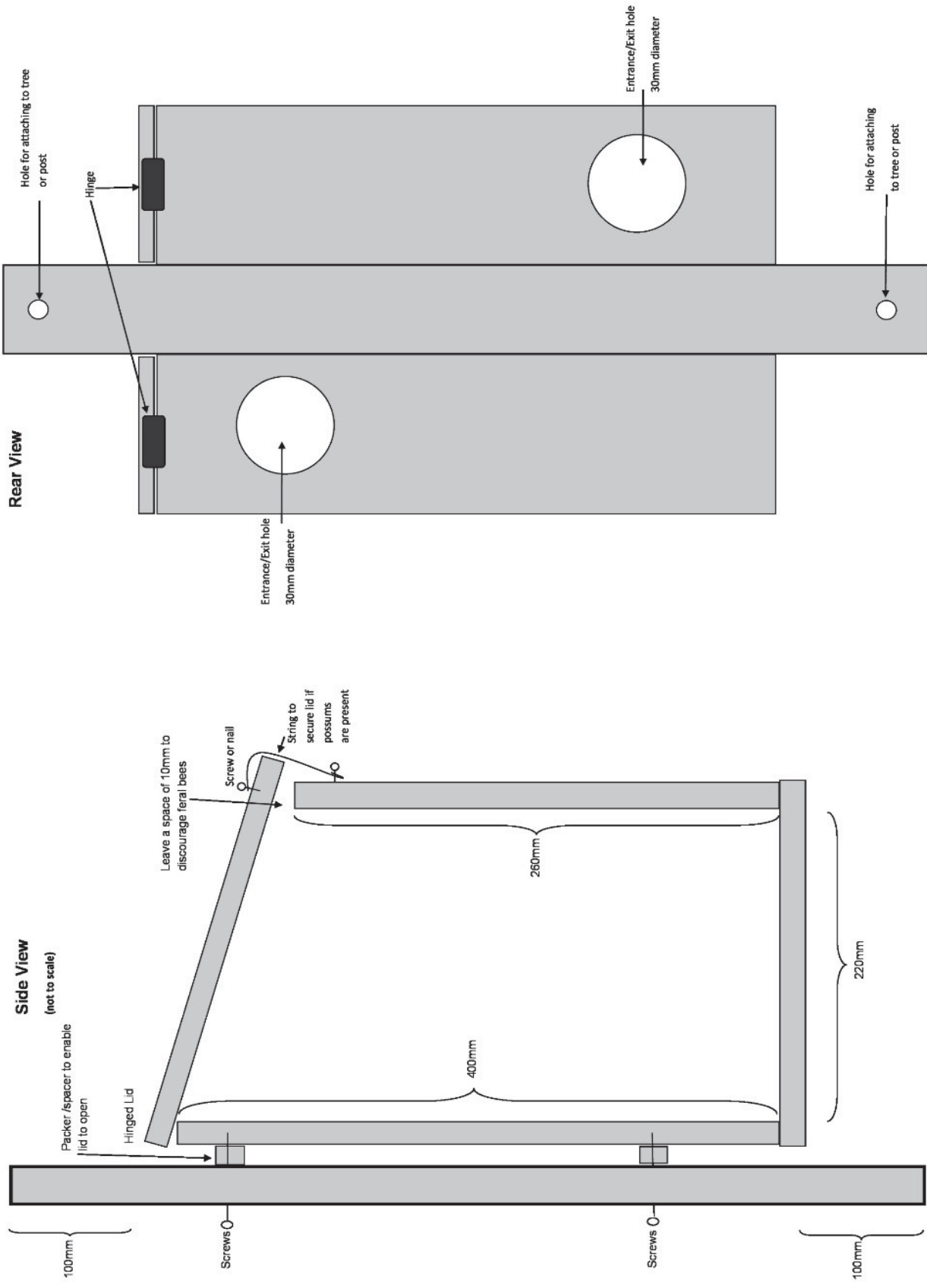
This information sheet was developed with contributions on monitoring methods and nest box design from Bush Heritage Australia.

Citation

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

Plan 8037/2a

115°48'0.000"E

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32°30'0.000"S




115°48'0.000"E


CPS layers

 CPS areas approved to clear

base layers

 Road Centrelines

 Cadastre - LGATE 218

 Local Government Authority (LGA) Boundaries (LGATE-233)

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Environmental Protection Act 1986




GOVERNMENT OF
WESTERN AUSTRALIA

MGA Zone 50
Geocentric Datum of Australia 1994

Plan 8037/2b



CPS layers

 CPS areas approved to clear

base layers

 Road Centrelines

 Cadastre - LGATE 218

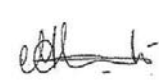
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GOVERNMENT OF
 WESTERN AUSTRALIA

MGA Zone 50
 Geocentric Datum of Australia 1994

Plan 8037/2c

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115°47'49.200"E

115°47'51.000"E

115°47'52.800"E

CPS layers

-  CPS areas approved to clear
-  CPS subject to conditions
-  Road Centrelines
- Cadastre - LGATE 218
-  Local Government Authority (LGA) Boundaries (LGATE-233)



MGA Zone 50
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GOVERNMENT OF
WESTERN AUSTRALIA

Plan 8037/2d

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32°30'36.000"S

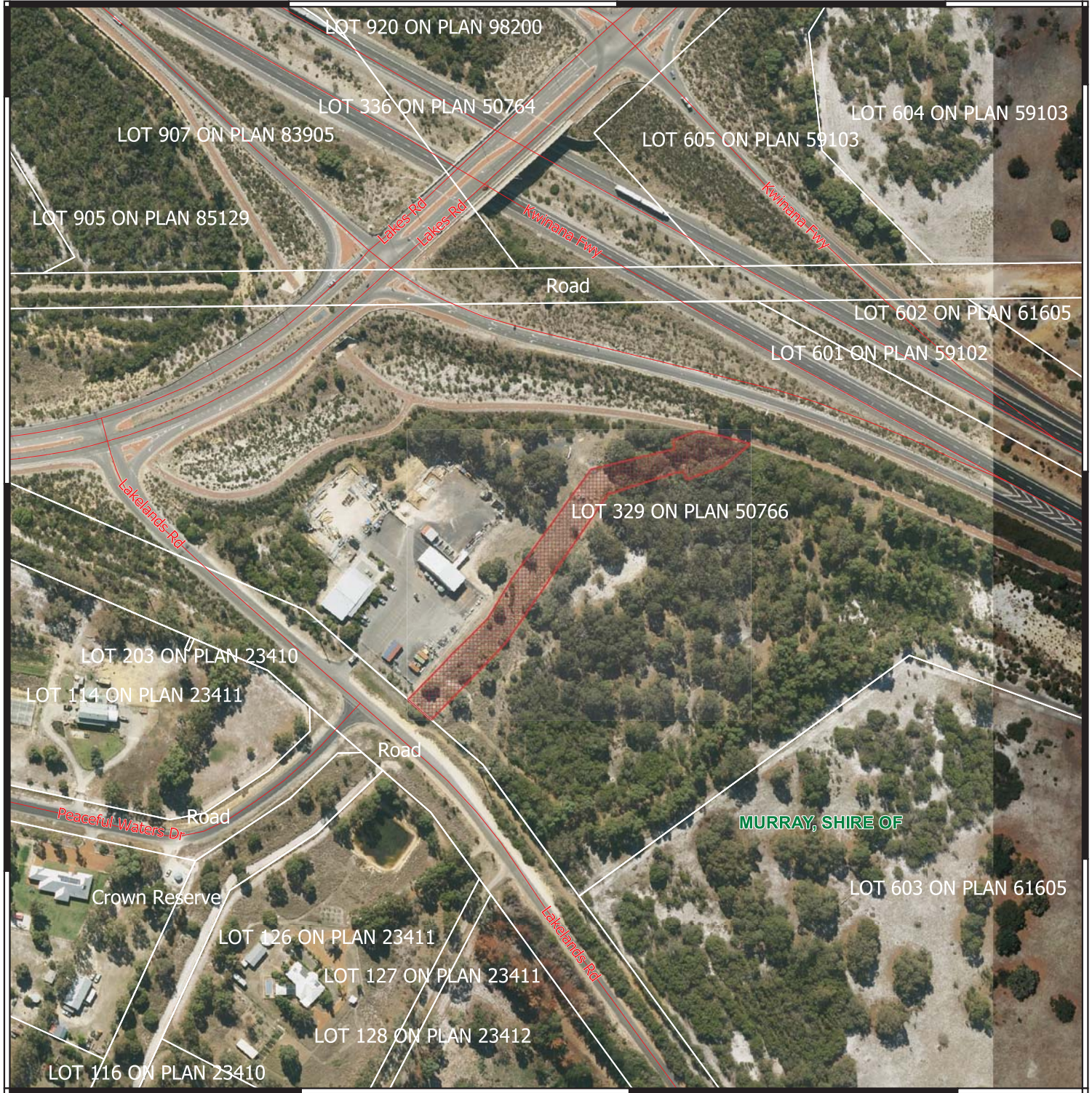
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115°47'45.600"E

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115°48'0.000"E

CPS layers

-  CPS subject to conditions
-  Road Centrelines
- Cadastre - LGATE 218
-  Local Government Authority (LGA) Boundaries (LGATE-233)



MGA Zone 50
Geocentric Datum of Australia 1994

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Environmental Protection Act 1986



GOVERNMENT OF
WESTERN AUSTRALIA



Clearing Permit Decision Report

1. Application details and outcome

1.1. Permit application details

Permit number:	CPS 8037/2
Permit type:	Purpose permit
Applicant name:	Development WA
Application received:	28 February 2020
Application area:	3.154 hectares
Purpose of clearing:	To accommodate sewer and water infrastructure
Method of clearing:	Mechanical removal
Properties:	Gordon Road reserve (PIN 1244646), Parklands, Greenfields and Stake Hill Lakes Road reserve (PINs 1244645, 11749414, 11749415 and 1376987), Fowler/Fishhawk Reserve (PIN 1376978), Stake Hill Paterson Road Reserve (PINs 1346043, 1346040, 1346041, 1346042, 1346039, 1346038, 1346037 and 1361813), Nambeelup and Ravenswood Lot 329 on Deposited Plan 50766, Stake Hill Lot 9001 on Deposited Plan 416070, Stake Hill Lot 604 on Deposited Plan 59103, Stake Hill Lot 1221 on Deposited Plan 418859, Nambeelup
Location (LGA area/s):	City of Mandurah, Shire of Murray
Localities (suburb/s):	Parklands Greenfields Stake Hill Nambeelup Ravenswood

1.2. Description of clearing activities

The application is to amend the clearing area approved under CPS 8037/1 to accommodate a variation in the installation of the trunk infrastructure (water and sewer) to address the Water Corporation's requirements. The amendment will allow for the clearing of 3.154 hectares of native vegetation within a footprint of 17.4 hectares, which is an increase of 0.135 hectares from the approved 3.015 hectares area under CPS 8037/1. The extent of the proposed clearing is indicated in Figures 1 and 2 (see Section 1.5).

The clearing area has been amended to include the Eastern side of Fowler and Fishhawk Road reserves, Stake Hill, and Lot 329 on Deposited Plan 50766, Stake Hill. The total area of additional clearing calculates to approximately 0.685 hectares. However, it is noted that 0.546 hectares of clearing on the Western side of Fowler and Fishhawk Road reserves that was approved under CPS 8037/1 has been excluded from the application area, which results in a total increase in the amended clearing area of 0.135 hectares (RPS Environment, 2020a).

1.3. Decision on application and key considerations

Decision:	Granted
Decision date:	18 August 2020
Decision area:	3.154 hectares (ha) of native vegetation, as depicted in Section 1.5, below.

1.4. Reasons for decision

This clearing permit application was made in accordance with section 51E of the *Environmental Protection Act 1986* (EP Act) and was received by the Department of Water and Environmental Regulation (DWER) on 28 February 2020. DWER advertised the application for public comment and no submissions were received.

In undertaking their assessment, the Delegated Officer had regard for the site characteristics (see Appendix A), relevant data sets (see Appendix E), biological survey information (see Appendix D), the Clearing Principles in Schedule 5 of the EP Act (see Appendix B), and any other matters considered relevant to the assessment (see Section 3).

In particular, the Delegated Officer has determined that:

- the clearing is not likely to have a significant impact on the local population or conservation status of the Priority 3 flora species *Jacksonia gracillima* (see Section 3.2.1) and that the implementation of a condition that ensures the clearing is limited to six individuals within the approved clearing area is appropriate to minimise the impact of clearing on this species;
- the implementation of a suitable weed and dieback management condition is appropriate to mitigate the impact of spreading weeds and dieback into adjacent vegetation associated to a federally listed threatened ecological community (TEC) (see Section 3.2.1);
- the application area contains one tree with hollows that may be suitable for conservation significant fauna including the Carnaby's Cockatoo (*Calyptorhynchus latirostris*), forest red-tailed black cockatoo (*Calyptorhynchus banksii* subsp. *naso*), Baudins cockatoo (*Calyptorhynchus baudinii*) and south-western brush-tailed phascogale (*Phascogale tapoatafa* subsp. *wambenger*). Although no evidence of use was identified during a targeted inspection, the proposed clearing may result in impacts to potential breeding habitat for these species, therefore a fauna management condition has been placed on the clearing permit to require inspection of the nesting tree immediately prior to and during clearing to minimise these impacts;
- the applicant will be required to install an artificial nesting hollow within secure land tenure if the nesting tree shows evidence of use during the targeted inspection; and
- the applicant has suitably demonstrated avoidance and minimisation measures (see Section 3.1)

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

1.5. Site maps



Figure 1. Map of areas approved to clear.

The areas cross-hatched yellow indicate the areas authorised to be cleared under the granted clearing permit.



Figure 2. Map of areas approved to clear.

The area cross-hatched yellow indicate the area authorised to be cleared under the granted clearing permit.

2. Legislative context

The clearing of native vegetation in Western Australia is regulated under the EP Act and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (Clearing Regulations).

In addition to the matters considered in accordance with section 51O of the EP Act (see Section 1.3), the Delegated Officer has also had regard to the objects and principles under section 4A of the EP Act, particularly:

1. the precautionary principle;
2. the principle of intergenerational equity; and
3. the principle of the conservation of biological diversity and ecological integrity.

Other legislation of relevance for this assessment include:

- *Biodiversity Conservation Act 2016* (WA) (BC Act);
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act); and
- *Rights in Water and Irrigation Act 1914* (RIWI Act).

The key guidance documents which inform this assessment are:

- *A guide to the assessment of applications to clear native vegetation* (December 2013);
- *Procedure: Native vegetation clearing permits* (DWER, October 2019); and
- Technical guidance – *Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA, 2016)

3. Detailed assessment of application

3.1. Avoidance and mitigation measures

The Water Corporation had advised that alternative approaches to the siting and construction of the sewer and water infrastructure between the wastewater treatment plant and the Peel Business Park are required, including situating the infrastructure on the opposite side of Fowler and Fishhawk Road (RPS Environment, 2020a) (see Section 1.2) and changing construction methodologies from boring to trenching (RPS Environment, 2020c).

The proposed amendment to CPS 8037/1 will result in a 0.139 hectare reduction in suitable black cockatoo foraging habitat (RPS Environment, 2020a). As discussed further under Section 3.3, in order to compensate for the loss of the large nesting tree with hollows, the applicant has committed to installing one artificial nesting hollow within the Beau Sovereign Court Road Reserve, North Dandalup. The artificial nesting hollow was installed by Landcare SJ on 14 April 2020 (RPS Environment, 2020b).

Clearing of native vegetation along the foreshore of the Serpentine River and Nambeelup Brook has been avoided. Clearing of native vegetation within the mapped extent of conservation category wetlands (CCW) has been avoided (RPS Environment, 2020a). Minor clearing is proposed within the mapped buffers of the CCW's, however the extent of clearing is less than that previously approved under CPS 8037/1.

Within the additional clearing area located in Lot 329 on Deposited Plan 50766, Stake Hill, the applicant has maximised the use of the area in a completely degraded (Keighery, 1994) condition, avoided the Flooded gum trees and avoided 10 of the 16 *Jacksonia gracillima* Priority 3 flora species identified during RPS Environments Reconnaissance Flora and Vegetation survey (RPS Environment, 2020a).

The Delegated Officer was satisfied that the applicant has made a reasonable effort to avoid and minimise potential impacts of the proposed clearing on environmental values.

3.2. Assessment of environmental impacts

In assessing the application in accordance with section 51O of the EP Act, the Delegated Officer has examined the application and site characteristics (Appendix A) and considered whether the clearing poses a risk to environmental values. The assessment against the Clearing Principles is contained in Appendix B.

This assessment identified that the clearing may pose a risk to the environmental values of biological values, conservation areas, and land and water resources, and that these required further consideration. The detailed consideration and assessment of the clearing impacts against the specific environmental values is provided below. Where the assessment found that the clearing presents an unacceptable risk to environmental values, conditions aimed at controlling and/or ameliorating the impacts have been imposed under sections 51H and 51I of the EP Act. These are also identified below.

3.2.1. Environmental value: biological values (fauna) – Clearing Principle (b)

Assessment:

According to available databases, there are 17 Threatened fauna species, 10 Priority fauna species, 22 species protected under international agreement, one 'conservation dependent' and one specially protected fauna species within the local area. The majority of these species are waterbird species that utilise the wetlands that occur within the local area. A small portion of the application area may provide suitable habitat for these waterbird species where waterbodies are in close proximity (refer to Section 3.2.4), however the application area is unlikely to comprise a significant habitat for this species.

Based on the Reconnaissance Flora and Vegetation surveys undertaken by RPS Environment, fauna habitat preferences, and records from the local area; the application area may provide suitable habitat for five conservation significant fauna listed under the BC Act within the *Wildlife Conservation (Specially Protected Fauna) Notice 2018 (WC Notice)* including:

- Carnaby's Cockatoo (listed as Endangered under the EPBC Act and the BC Act);
- forest red-tailed black cockatoo (listed as Vulnerable under the EPBC Act and the BC Act);
- Baudins cockatoo (listed as Endangered under the EPBC Act and the BC Act);
- South-western brush-tailed phascogale (listed as Conservation Dependent under the BC Act); and
- Quenda (*Isoodon fusciventer*) (state listed as Priority 4).

Carnaby's cockatoo, Baudin's cockatoo and Forest Red-tailed black cockatoo (collectively referred to as black cockatoos within the report) forage on the seeds, nuts and flowers of a large variety of plants including Proteaceous species (Banksia, Hakea, Grevillea), Eucalyptus, Corymbia species and a range of introduced species (Valentine

and Stock, 2008). As outlined in Appendix D, the Reconnaissance Flora and Vegetation surveys undertaken by RPS Environment in September 2017 and November 2019 identified five of the nine vegetation units within the application area as having the potential to provide suitable foraging habitat for black cockatoo species described as 'Banksia Woodland', 'Remnant Mixed Trees', 'Remnant Marri', 'Remnant Jarrah' and 'Remnant Tuart' (RPS Environment, 2018a; RPS Environment, 2020a; RPS Environment, 2020c). The amended clearing area is located approximately 30 metres north west of a forest red-tailed black cockatoo confirmed sighting/roost site. Five other forest red-tailed black cockatoo records are located within 500 metres from the additional clearing located at Fowler Road.

The Reconnaissance Flora and Vegetation surveys identified approximately 1.050 hectares of potential black cockatoo foraging habitat within the application area and represents a small stand of foraging plants or individual trees within the 17.4 hectare footprint area (RPS Environment, 2018a; RPS Environment, 2020a; RPS Environment 2020c). Approximately 0.967 hectares of the potential black cockatoo habitat is considered to be in a degraded (Keighery, 1994) or worse condition, whilst the extent of potential foraging habitat in good (Keighery, 1994) or better condition comprises 0.083 hectares of vegetation within the footprint area (RPS Environment, 2020a).

Of the abovementioned vegetation types, the 'Banksia woodland', 'Remnant Jarrah' and 'Remnant Marri' vegetation types may comprise of high quality foraging habitat for the black cockatoo species (0.451 hectares), approximately 0.368 hectares of this high quality foraging habitat is in a degraded to completely degraded (Keighery, 1994) condition. The applicant has advised that no tuart trees are proposed to be cleared within the amended area. The clearing of 0.451 hectares of potentially high quality foraging habitat within a larger footprint of 19 hectares and along a 14.5 kilometre linear stretch is not likely to have an impact on significant habitat for these species. Furthermore, the entire clearing footprint area is not proposed to be cleared and foraging habitat including banksia woodland, jarrah and marri will remain within the clearing footprint area.

Black cockatoos breed in large hollow-bearing trees, generally within woodlands or forests or in isolated trees (Commonwealth of Australia, 2012). These species nest in hollows in live or dead trees of karri (*Eucalyptus diversicolor*), marri, wandoo, tuart (*Eucalyptus gomphocephala*), salmon gum (*Eucalyptus salmonophloia*), jarrah, flooded gum, York gum (*Eucalyptus loxophleba*), powder bark (*Eucalyptus accedens*), bullich (*Eucalyptus megacarpa*) and blackbutt (*Eucalyptus* spp.) (Commonwealth of Australia, 2012). To be suitable as a black cockatoo breeding site, trees require a suitable nest hollow or need to be of a suitable diameter at breast height (DBH) to develop a nest hollow. For most tree species, a suitable DBH is 500 millimetres (Commonwealth of Australia, 2012).

The two Reconnaissance Flora and Vegetation surveys which were inclusive of a targeted black cockatoo tree assessment, identified 96 remnant trees within the footprint area with a diameter at breast height (DBH) greater than 500 millimetres (mm) (RPS Environment, 2018a; RPS Environment, 2020a). These native trees are considered potential breeding and roosting habitat for black cockatoo species. Of the 96 remnant trees, only 16 are proposed to be cleared, which includes one dead Jarrah tree located in the additional clearing area located on the eastern side of Fishhawk Road (RPS Environment, 2020c). Terrestrial Ecosystems conducted a targeted inspection of the hollows in the Jarrah tree on 10 December 2019 and confirmed that none of the hollows had any evidence of existing or previous use by black cockatoos for nesting (RPS Environment, 2020a). The 16 potential breeding trees to be cleared include:

- nine remnant marri (*Corymbia calophylla*), of which seven are alive, two are dead and none have hollows
- four remnant jarrah (*Eucalyptus marginata*) which are all alive with no hollows;
- two remnant flooded gum (*Eucalyptus rudis*) which are alive with no hollows; (RPS Environment, 2018a and 2018b) and
- one remnant jarrah (*Eucalyptus marginata*) which is dead with hollows (RPS Environment, 2020c).

Noting there was no evidence of use identified during the targeted inspection of jarrah tree with hollows and noting the closest breeding area is approximately 18 kilometres from the amended application area, the proposed clearing is not likely to result in a significant impact to black cockatoo breeding habitat. However, as the jarrah tree does contain hollows of a suitable size for black cockatoo nesting, a fauna management condition requiring inspection of the jarrah tree with hollows immediately prior to and for the duration of clearing will be placed on the clearing permit to mitigate impacts to black cockatoo species. If there is evidence of use identified during inspection, the applicant will be required to install an artificial nesting hollow within the local area of the Shire of Murray and within secure land tenure.

The south-western brush-tailed phascogale is classified as 'fauna that is of special conservation need as conservation dependent fauna' under the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*. The preferred habitat for this species in Western Australia is within dry sclerophyll forests and open woodlands that contain hollow-bearing trees (Department of Environment and Conservation (DEC), 2012a). Given there is one

hollow-bearing tree located within the application area, it may be occasionally utilised by the south-western brush-tailed phascogale. However, the fauna survey did not identify any signs of use by fauna (RPS Environment, 2020a). Better quality suitable habitat is likely to occur within the adjacent Goegrup Nature Reserve and the unnamed nature reserve located 40 metres from the application area. Given this, the proposed clearing is unlikely to significantly impact upon the conservation status of this species. A fauna management condition to inspect the suitable hollow for use by south-western brush-tailed phascogale immediately prior to and for the duration of clearing will be placed on the clearing permit to mitigate potential impacts.

On the Swan Coastal Plain, the south-western brown bandicoot/quenda typically prefers dense understorey often associated with wetland vegetation (Department of Biodiversity, Conservation and Attractions (DBCA), 2017; DEC, 2012b). The areas of wetland vegetation within the application area may be intermittently utilised by the quenda, however the wetland surrounding the application area is likely to be the preferred habitat for this species. Noting that the understorey within the application is largely in a degraded condition and dominated by weeds, that the application area is in close proximity to patches of remnant vegetation, and that native vegetation will remain within the road reserve, the application area is unlikely to comprise a significant habitat for this ground-dwelling species.

The South West Regional Ecological Linkage (SWREL) technical report (Molloy et al., 2009) identified one regional ecological linkage that intersects with the application area near 'Nambeelup Brook' and one ecological linkage mapped approximately 35 metres from the application area that runs along 'Serpentine River'. While the proposed clearing may impact upon vegetation associated within this linkage, the proposed clearing is narrow, linear in shape, predominantly in a degraded (Keighery, 1994) condition and follows an existing road. Furthermore, the applicant has advised that vegetation growing in association with Serpentine River and Nambeelup Brook will be avoided. It is considered that the proposed clearing is unlikely to have a significant impact on the environmental values of this ecological linkage via fragmentation or removal of large areas of native vegetation.

Outcome: Based on the above assessment, the Delegated Officer has determined that the impacts of the proposed clearing on black cockatoo foraging habitat and potential breeding habitat can be managed to be environmentally acceptable through the implementation of a fauna management condition on the clearing permit as discussed below.

Conditions: To address the above impacts, the following condition will be added to the permit:

- **Fauna management – artificial nest hollows for black cockatoos and south-western brush-tailed phascogale:** The applicant will be required to inspect the jarrah tree with hollows immediately prior to and for the duration of clearing for evidence of use. The applicant will be required to install an artificial nesting hollow within the locations specified on the clearing permit if the hollow shows signs of nesting.

3.2.2. Environmental value: biological values (flora) – Clearing Principles (a) and (d)

Assessment:

3.2.2.1 Conservation-significant flora

According to available databases, 11 threatened and 43 Priority (P) flora have been recorded in the local area. RPS Environment conducted a Reconnaissance Flora and Vegetation survey in September 2017 which comprised the majority of the application area and November 2019 which included the additional clearing area subject to this application (RPS Environment, 2018a; RPS Environment, 2020a). There were no conservation significant flora identified during the appropriately-timed survey undertaken in September 2018 (RPS Environment, 2018a). The November 2019 survey that encompassed the additional clearing area identified a new population of 16 individuals of the Priority 3 flora species *Jacksonia gracillima* located within Lot 329, Lakelands Road, Barragup (RPS Environment, 2020a). Six of these individuals were found within the application area in *Melaleuca preissiana* remnant trees over a degraded understorey of herbs and grasses (RPS Environment, 2020a). No other flora species of conservation significance were recorded during the additional survey in November 2019.

Jacksonia gracillima has been recorded in seventeen locations with only five records in the Mundurah/Mundijong locality (DBCA, 2020). These five records are dated with aerial imagery indicating that several of these locations have now been heavily cleared or are not within secure conservation tenure, therefore plants may no longer be present at these sites (DBCA, 2020). Most populations of *Jacksonia gracillima* are not located within conservation estate and have been recorded during flora surveys required for development proposals (DBCA, 2020). Advice from the Swan Region suggests that there may be no large populations remaining within the Swan Coastal Plain due to historical land use (DBCA, 2020).

DBCA have advised that "the removal of six individuals (37.5%) from this new population is likely to have a significant impact at the local level, given the association given the association of known locations with development, the historical use of its preferred habitat and lack of survey throughout the Swan Coastal Plain". However, as the species

is known from a number of locations and has an extensive range from Perth to Busselton, the proposed clearing is unlikely to have a significant impact on the conservation status of the species (DBCA, 2020).

Outcome: Based on the above assessment, the Delegated Officer has determined that the proposed clearing is considered acceptable in relation to this environmental value.

Conditions: To address the above impacts, the following condition will be added to the permit:

- **Flora Management:** To minimise the impact of the proposed clearing to the population of the Priority 3 flora species *Jacksonia gracillima* identified within the amended application area.

Assessment:

3.2.2.2 Conservation-significant ecological communities

According to available datasets, small portions of the application area are located within and adjacent to occurrences of the Banksia Woodlands of the Swan Coastal Plain threatened ecological community (TEC), which is federally listed as endangered under the EPBC Act and as a 'Priority 3' Priority Ecological Community (PEC) by DBCA (Department of the Environment and Energy [DotEE], 2016).

The Banksia Woodlands ecological community is restricted to areas in and immediately adjacent to the Swan Coastal Plain IBRA bioregion, including the Dandaragan plateau. This coastal plain stretches from around Jurien Bay in the north, to Dunsborough in the south (DotEE, 2016). The Approved Conservation Advice for the TEC states that to be considered representative of the TEC a remnant in the Swan Coastal Plain bioregion must include at least one of four Banksia species being *Banksia attenuata* (candlestick banksia), *Banksia menziesii* (firewood banksia), *Banksia prionotes* (acorn banksia) and/or *Banksia ilicifolia* (holly-leaved banksia); must include an emergent tree layer often including marri, jarrah, or tuart, and other medium trees including *Eucalyptus todtiana* (pricklybark), *Nuytsia floribunda* (WA Christmas tree), western sheoak, *Callitris arenaria* (sandplain cypress), *Callitris pyramidalis* (swamp cypress) or *Xylomelum occidentale* (woody pear); and must include an often highly species-rich understorey (TSSC, 2016).

The vegetation must meet the minimum patch size thresholds which includes 'Pristine' (Keighery, 1994) condition: no patch size applies, 'Excellent' (Keighery, 1994) condition: 0.5 hectares minimum, 'Very Good' condition: on hectare minimum and 'Good' condition: two hectare minimum. To be considered part of the TEC a patch should meet at least good (Keighery, 1994) condition (DotEE, 2016).

The Banksia woodland vegetation type that occurs on the eastern side of the Fowler and Fishhawk Road reserves is predominately in a completely degraded (Keighery, 1994) condition, with the exception of three small patches that are in a good (Keighery, 1994) condition. Although the Banksia woodland meets the key diagnostic characteristics for the TEC and minimum condition, it does not meet the minimum patch size requirements, with the total of these three patches in a good (Keighery, 1994) condition being less than one hectare. A small portion of the proposed clearing within Lot 329 (approximately 0.06 hectares) is located within the boundary of a mapped occurrence of the 'Banksia Dominated Woodlands of the Swan Coastal Plain' TEC. The Reconnaissance Flora and Vegetation Survey undertaken by RPS on 19 November 2019 confirmed that the vegetation types within Lot 329 consist of Remnant *Melaleuca pressiana*, Remnant mixed trees and Planted trees and shrubs which is not consistent to this TEC (RPS Environment, 2020c). Given this, the application area is not considered to be representative of the Banksia woodlands TEC.

The Subtropical and Temperate Coastal Saltmarsh TEC, listed as vulnerable under the EPBC Act has been mapped approximately 36 metres from the application area. The Reconnaissance Flora and Vegetation survey undertaken in September 2018 identified an occurrence of this TEC within the survey area near Preston River (RPS Environment, 2018a), however this occurrence is located outside of the application area (approximately 90 metres south) and the proposed clearing is not likely to have an impact on the TEC.

The Reconnaissance and Vegetation Survey undertaken in November 2019 conducted an assessment of the 'Remnant Tuart' vegetation types identified within the application area during the 2018 survey against the diagnostic characteristics set out in the Conservation Advice for the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' (Tuart woodlands) TEC. The TEC was listed as Critically Endangered under the EPBC Act on 4 July 2019 following the approval of CPS 8037/1. The assessment determined that the patch of 'Remnant Tuart' vegetation located within Lakes Road Reserve (approximately 0.422 hectares of the application area) meets all of the diagnostic requirements, as well as the minimum patch size and condition of the TEC. Although the patch is in a degraded to completely degraded (Keighery, 1994) condition, it comprises of numerous mature and large tuart trees and covers an area of more than 5 hectares (RPS Environment, 2020c). The assessment also identified that the patch of 'Remnant Tuart' vegetation located at the western-most end of Lakes Road represents a 'potential' record of the TEC. The size of the patch is 2.02 hectares in size and is in a degraded to completely degraded (Keighery, 1994) condition. The patch on its own would not meet the minimum size and condition thresholds of the

ecological community, however aerial imagery demonstrates that this patch is continuous with a large area of remnant vegetation which is greater than five hectares in size and mapped as this TEC.

As noted above, the application area contains approximately 0.422 hectares of vegetation representative of the Tuart woodlands TEC. However, the applicant has advised that there will be no clearing of Tuart trees within the application area (RPS Environment, 2020a). Given this, the proposed clearing is not likely to have a significant impact on the conservation status of this TEC. The proposed clearing may indirectly impact the adjacent vegetation determined to be representative of the TEC through the spread of weeds and dieback.

Outcome: Based on the above assessment, the Delegated Officer has determined that the proposed clearing is considered acceptable subject to relevant conditions in relation to this environmental value.

Conditions: To address the above impacts, the following condition will be added to the permit:

- **Dieback and weed control:** To minimise the risk of the introduction and spread of weeds and dieback into adjacent TEC vegetation.

3.2.3. Environmental value: significant remnant vegetation and conservation areas – Clearing Principles (e) and (h)

Assessment:

3.2.3.1 Significant remnant vegetation

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).

All of the mapped vegetation types contain higher than the recommended 30 per cent threshold, with the exception of the 'Bassendean Complex-Central and South' which retains approximately 26.87 per cent of its pre-European vegetation extent within the Swan Coastal Plain IBRA bioregion (Appendix A). Additionally, within the local area, only 20.9 per cent remnant vegetation remains, most of which is highly fragmented. Noting this, the application area is considered to occur within an extensively cleared landscape.

The amended application area contains one vegetation type that has similar characteristics to the 'Bassendean Complex-Central and South' Heddle complex described as 'Remnant Mixed Trees' (refer to Appendix D). This vegetation type occurs within the additional clearing area in Lot 329 and comprises of approximately 0.16 hectares of native vegetation in a degraded (Keighery, 1994) condition. This vegetation type is not considered to be representative of the Bassendean Complex-Central and South' Heddle complex given the degraded (Keighery, 1994) condition and composition of the vegetation present.

As discussed under section 3.2.1, impacts to biological values are not likely to be significant and flora, fauna, and weed/dieback management conditions will minimise any potential impacts identified. On this basis, and with regard for the largely degraded (Keighery, 1994) condition of the vegetation present, the application area is not considered to be a significant remnant in an extensively cleared area.

Assessment:

3.2.3.2 Conservation areas

The application area is located adjacent to the Goegrup Lake Nature Reserve and is 40 metres from an unnamed nature reserve. There is no clearing within the nature reserve proposed, however clearing of minor extents of native vegetation within the road reserve adjacent to the nature reserve is proposed. Given the close proximity of Goegrup Lake Nature Reserve, the proposed clearing may indirectly impact this conservation area through the spread of weeds and dieback.

As discussed above under Section 3.2.1, the proposed clearing may impact upon vegetation growing in association with one SWREL regional ecological linkage that intersects the application area near 'Nambelup Brook' and one SWREL ecological linkage mapped approximately 35 metres from the application area that runs along 'Serpentine River'. Noting that the proposed clearing follows an existing road, is predominately in a degraded to completely degraded condition, and that no clearing of vegetation growing in association with the Serpentine River and Nambelup River will occur, the proposed clearing is not likely to significantly impact upon the environmental values of this ecological linkage.

Outcome: Based on the above assessment, the Delegated Officer has determined that the proposed clearing is considered acceptable subject to relevant conditions in relation to this environmental value.

Conditions: To address the above impacts, the following condition will be added to the permit:

- **Dieback and weed control:** To minimise the risk of the introduction and spread of weeds and dieback into remnant vegetation associated to conservation areas.

3.2.4. Environmental value: land and water resources – Clearing Principle (f)

Assessment:

The application area intersects one watercourse known as the 'Nambeelup Brook' and is located 15 metres from a second major watercourse known as the 'Serpentine River'.

These watercourses are also mapped as conservation category wetlands. Conservation category wetlands are considered to be highest priority wetland that support a high level of ecological attributes and functions (Water and Rivers Commission, 2001). A minimum 50 metre buffer is recommended to conservation category wetlands ((Water and Rivers Commission, 2001).

The applicant has advised that clearing of native vegetation along the foreshore of the Serpentine River and Nambeelup Brook will be avoided. However, clearing within the 50 metre buffer of each of these wetlands is proposed.

Portions of the application area are mapped within a large palusplain multiple use wetland. Multiple use wetlands are considered wetlands within few important ecological attributes and functions remaining (Water and Rivers Commission, 2001). Furthermore, the reconnaissance flora and vegetation surveys determined that the vegetation proposed to be cleared within this mapped wetland is predominantly in a degraded (Keighery, 1994) or worse condition.

Given the above the application area is considered to be growing in association with a watercourse and wetland.

However, given the long linear nature of the application area that involves clearing 3.154 hectares of native vegetation over a 14.5 kilometre stretch and that only a small portion of the application area occurs within Nambeelup Brook and the buffers of both conservation category wetlands, the proposed clearing is not likely to have a significant impact on the environmental values of the mapped watercourses and wetlands.

The applicant has advised that clearing of native vegetation within the mapped extent of Conservation Category wetlands has been avoided, however some minor clearing has been proposed within the mapped buffers of the wetlands. However, minor extents of native vegetation proposed to be cleared within the buffers of the conservation category wetlands is generally in degraded (Keighery, 1994) or worse condition (RPS Environment, 2018a).

Outcome: Based on the above assessment, the Delegated Officer has determined that the proposed clearing is considered acceptable in relation to this environmental value.

Conditions: To address the above impacts, the following conditions will be added to the permit:

- **Avoid, minimise and reduce the impacts and extent of clearing:** To minimise the impacts to riparian vegetation growing in association to a watercourse and wetland.

3.3. Relevant planning instruments and other matters

The application area is located within Murray Groundwater Area and Murray River System Surface Water Area proclaimed under the *Rights in Water and Irrigation Act 1914* (RIWI Act).

The applicant is unlikely to require a bore licence, however dewatering may be necessary as part of construction to temporarily lower groundwater, which will require a licence under the RIWI Act. It will be the expectation that groundwater is recharged nearby to abstraction sites.

A licence to interfere with bed and banks of watercourse will be required if the applicant intends to clear native vegetation associated with the Serpentine River. The applicant has advised that no clearing is required within the Serpentine River and has removed this area from the application area.

The Shire of Murray (the Shire) agreed to the proposed clearing of native vegetation within their road reserves on the basis that the loss of the large jarrah tree with hollows suitable for black cockatoo nesting located within the Fishhawk Road reserve is compensated through the installation of an artificial nesting box within a suitable location

in close proximity to the clearing area (RPS Environment, 2020c). Landcare SJ installed the artificial nesting hollow on behalf of the applicant on 14 April 2020 within the Beau Sovereign Court Road Reserve, North Dandalup (RPS Environment, 2020c). The selection of the site was driven by the Shire with local expertise input by Landcare SJ to ensure the artificial nesting hollow was installed within a location that would have a high chance of being utilised by black cockatoos. The artificial nesting hollow has been installed just to the north of the Goomaljerup creekline in a portion of Beau Sovereign Court which is subject to a long term rehabilitation program being implemented by local school and community groups (RPS Environment, 2020c).

Three Aboriginal sites of significance have been mapped within the application area. It is the permit holder's responsibility to comply with the *Aboriginal Heritage Act 1972 (WA)* and ensure that no Aboriginal Sites of Significance are damaged through the clearing process.

Appendix A – Site characteristics

The information provided below describes the key characteristics of the area proposed to be cleared and is based on the best information available to DWER at the time of this assessment. This information was used to inform the assessment of the clearing against the Clearing Principles, contained in Appendix B.

1. Site characteristics

Site characteristic	Details
Local context	<p>The application area comprises of intact and parkland cleared native vegetation that occurs adjacent to an existing road formation that traverses through residential and agricultural land within the City of Mandurah and the Shire of Murray. The native vegetation within Gordon, Fowler and Fishhawk Road Reserves and Lot 329 is relatively intact with areas of Tuart Woodland, Banksia Woodland, wetland-fringing <i>Eucalyptus rudis</i> and <i>Melaleuca</i> spp. over sedgeland. The vegetation within the remaining Road reserves and land parcels comprises of scattered native trees and shrubs.</p> <p>The local area, being that within a 10 kilometre radius of the application area, retains approximately 8622.16 ha of native vegetation. This represents approximately 20.1 per cent of the pre-European vegetation extent.</p>
Vegetation description	<p>The vegetation within the application area intersects three of the mapped Hedde vegetation complexes, described as:</p> <ul style="list-style-type: none"> • Bassendean Complex-Central And\South : Vegetation ranges from woodland of <i>Eucalyptus marginata</i> (Jarrah) - <i>Allocasuarina fraseriana</i> (Sheoak) - <i>Banksia</i> species to low woodland of <i>Melaleuca</i> species, and sedgelands on the moister sites. This area includes the transition of <i>Eucalyptus marginata</i> (Jarrah) to <i>Eucalyptus todtiana</i> (Pricklybark) in the vicinity of Perth (Hedde et al., 1980); • Yoongarillup Complex : Woodland to tall woodland of <i>Eucalyptus gomphocephala</i> (Tuart) with <i>Agonis flexuosa</i> in the second storey. Less consistently an open forest of <i>Eucalyptus gomphocephala</i> (Tuart) - <i>Eucalyptus marginata</i> (Jarrah) - <i>Corymbia calophylla</i> (Marri). South of Bunbury is characterized by <i>Eucalyptus rudis</i> (Flooded Gum)-<i>Melaleuca</i> species open forests (Hedde et al., 1980); and • Herdsmen Complex : Sedgelands and fringing woodland of <i>Eucalyptus rudis</i> (Flooded Gum) - <i>Melaleuca</i> species (Hedde et al., 1980); <p>RPS Environment conducted a Reconnaissance Flora and Vegetation Survey in September 2017 and November 2019 which identified nine vegetation units within the amended application area (RPS Environment 2018, RPS Environment, 2020). The full survey descriptions are available in Appendix D.</p>
Vegetation condition	<p>Vegetation condition was determined from the Reconnaissance Flora and Vegetation Survey's conducted by RPS Environment (RPS Environment 2018a, RPS Environment, 2020a). The vegetation proposed to be cleared ranges from completely degraded to very good condition,</p>

Site characteristic	Details
	with the majority being a degraded condition on the scale described by Keighery (1994) scale (see Appendix C). The full Keighery condition rating scale is provided in Appendix C, below.
Soil and landform descriptions	<p>The application area has been mapped by the Department of Primary Industries and Regional Development (DPIRD) as the following soil-landscape map units:</p> <ul style="list-style-type: none"> • Spearwood S1a Phase: Dune ridges with shallow to moderately deep siliceous yellow-brown sands, very common limestone outcrop and slopes up to 15%; • Spearwood S4a Phase: Flat to gently undulating sandplain with deep, pale and sometimes bleached, sands with yellow-brown subsoils; • Bassendean B2 Phase: (Fowler and Fishhawk Road reserve additional clearing): Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m; • Vasse V1 Phase: Saline tidal flats composed of grey, black and brown foetid muds and humic sandy clays with locally common shell and limestone fragments; • Vasse wet, lake Phase: Lake; • Bassendean B3 Phase: Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic; • Bassendean B4 Phase (Lot 329 additional clearing): Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan; • Bassendean B5 Phase: Shallowly incised stream channels of minor creeks and rivers with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan; and • Bassendean B1 Phase: Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant (Schoknecht <i>et al.</i>, 2004).
Land degradation risk	The sandy soils mapped within the application area may be prone to wind erosion, however the proposed clearing of 3.154 hectares along a 14.5 kilometre linear stretch predominantly in a degraded to completely degraded (Keighery, 1994) condition and along an existing road, is not likely to cause appreciable land degradation through water erosion, water logging, wind erosion, salinity or eutrophication.
Waterbodies	The desktop assessment and aerial imagery indicated that one watercourse known as the 'Nabeelup Brook' intersects the application area. A second major watercourse known as the 'Serpentine River' is mapped approximately 15 metres from the application area. These watercourses are also mapped as conservation category wetlands.
Conservation areas	Ten conservations areas have been recorded within the local area. The application area is located adjacent to Goegrup Lake Nature Reserve and 40 metres from an unnamed nature reserve. No clearing within the nature reserve is proposed, however clearing of minor extents of native vegetation with the road reserve adjacent to the nature reserve is proposed.
Climate	Rainfall: 1000 and 900 Evapotranspiration: 800 and 900 Geology: Alluvial, shoreline, and eolian deposits Groundwater Salinity (Total Dissolved Solids): 1000-3000 mg/L

2. Vegetation extent

Remnant Vegetation Statistics (Government of Western Australia, 2019)

	Pre-European extent (ha)	Current extent (ha)	% remaining	Current extent in all DBCA ¹ managed land (ha)	% current extent in all DBCA managed land (proportion of pre-European extent)
IBRA ² bioregion					
Swan Coastal Plain	1,501,221.93	579,813.47	38.62	222,916.97	38.45
Swan Coastal Plain Vegetation complex					
Bassendean Complex-Central And\South:	87,476.26	23,508.66	26.87	4,377.36	5
Yoongarillup Complex	27,977.93	10,018.14	35.81	5,151.57	18.41
Herdsmen Complex :	9,665.15	3,103.70	32.11	1,058.25	10.95

¹ Department of Biodiversity, Conservation and Attractions. Current extent as proportion of pre-European extent within DBCA-managed lands.

² Interim Biogeographic Regionalisation for Australia.

Appendix B – Assessment against the Clearing Principles

Assessment against the Clearing Principles	Variance level	Is further consideration required?
Environmental value: biological values		
<p><u>Principle (a):</u> “Native vegetation should not be cleared if it comprises a high level of biodiversity.”</p> <p><u>Assessment:</u> The application area contains native vegetation representative of a federally listed TEC, a population of priority 3 flora species and foraging habitat for black cockatoos. Given this, the application area is considered to contain a high level of biodiversity. However impacts to the biological values identified within the application area are not likely to be significant.</p>	May be at variance	Yes Refer to Section 3.2.2 above.
<p><u>Principle (b):</u> “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.”</p> <p><u>Assessment:</u> The proposed clearing area contains suitable foraging habitat and potential breeding habitat for conservation significant fauna recorded within the local area.</p>	May be at variance	Yes Refer to Section 3.2.1 above.
<p><u>Principle (c):</u> “Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, threatened flora.”</p> <p><u>Assessment:</u> Eleven threatened flora species have been mapped within the local area (10km radius). The closest threatened flora species is <i>Drakaea</i></p>	Not likely to be at variance	No

Assessment against the Clearing Principles	Variance level	Is further consideration required?
<p><i>elastica</i> located approximately 290 metres north west of the additional clearing proposed within Lot 329. The additional clearing area along Fishhawk Road is likely to provide suitable habitat for this species given the presence of the Banksia woodland vegetation type. The Reconnaissance Flora and Vegetation survey that was conducted in September 2018 covered this additional clearing area and included a targeted search for this species. There were no threatened flora species detected during the survey, therefore the application area is not likely to include or be necessary for the continued existence of threatened flora.</p>		
<p><u>Principle (d):</u> <i>“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.”</i></p> <p><u>Assessment:</u> Ten state listed TEC’s have been recorded within the local area. Noting the vegetation types and vegetation condition within the application area which is largely degraded, it is unlikely that the vegetation under application is considered to be representative of any state listed TEC, or be necessary for the maintenance of a TEC. In addition, the Reconnaissance Flora and Vegetation surveys confirmed that the vegetation within the application area is not consistent with any state listed TEC’s.</p>	Not likely to be at variance	No
Environmental values: significant remnant vegetation and conservation areas		
<p><u>Principle (e):</u> <i>“Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.”</i></p> <p><u>Assessment:</u> The application area is considered to occur within an extensively cleared area given the remnant native vegetation remaining in the local area is approximately 20.9 per cent. However noting that the application area is largely in a degraded (Keighery, 1994) condition, and that impacts to biological values are not considered to be significant as discussed further under Section 3.2.1, it is unlikely to be a significant remnant.</p>	May be at variance	Yes Refer to Section 3.2.3 above.
<p><u>Principle (h):</u> <i>“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.”</i></p> <p><u>Assessment:</u> The application area is located adjacent to Goegrup Lake Nature Reserve and 40 metres from an unnamed nature reserve. No clearing within the nature reserve is proposed, however clearing of minor extents of native vegetation with the road reserve adjacent to the nature reserve is proposed. The South West Regional Ecological Linkage Technical Report (Molloy <i>et al.</i>, 2009) identified one regional ecological linkage near ‘Nambelup Brook’ and one ecological linkage mapped approximately 35 metres from the application area that runs along ‘Serpentine River’. Noting this, the proposed clearing may impact upon native vegetation associated to this linkage.</p>	May be at variance	Yes Refer to Section 3.2.3 above.
Environmental values: land and water resources		
<p><u>Principle (f):</u> <i>“Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.”</i></p> <p><u>Assessment:</u> The application area intersects one watercourse known as the ‘Nambelup Brook’ and is located 15 metres from a second major watercourse known as the ‘Serpentine River’. These watercourses are also mapped as conservation category wetlands. Portions of the application area are also situated within a mapped occurrence of a large palusplain multiple use</p>	Is at variance	Yes Refer to Section 3.2.4 above.

Assessment against the Clearing Principles	Variance level	Is further consideration required?
wetland. Given this, the vegetation within the application area is growing in association with these waterbodies.		
<p><u>Principle (g):</u> <i>“Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.”</i></p> <p><u>Assessment:</u> The main land degradation risk associated with the predominately sandy soil types mapped across the application area is the risk of land degradation in the form of wind erosion as a result of the proposed clearing. Noting the extent of the proposed clearing, the largely degraded to completely degraded condition of the vegetation, and its location adjacent to an existing road, the proposed clearing is unlikely to cause appreciable land degradation.</p>	Not likely to be at variance	No
<p><u>Principle (i):</u> <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.”</i></p> <p><u>Assessment:</u> Noting the close proximity of the Serpentine River and associated conservation category wetland and the presence of the multiple use wetland within the application area, the proposed clearing is likely to increase sedimentation and run off into these watercourses and wetlands. However, given the linear nature of the proposed clearing area that is predominantly in a degraded (Keighery, 1994) condition impacts are likely to be minimal and short term and the proposed clearing is not likely cause long term deterioration in the quality of surface water.</p>	Not likely to be at variance	No
<p><u>Principle (j):</u> <i>“Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.”</i></p> <p><u>Assessment:</u> The majority of the application area has been mapped as a low level of flood risk. Noting this, the vegetation condition, extent of the application area, and that the applicant has avoided clearing native vegetation within known watercourses, it is unlikely the proposed clearing will cause or exacerbate flooding.</p>	Not likely to be at variance	No

Appendix C – Vegetation condition rating scale

Vegetation condition is a rating given to a defined area of vegetation to categorise and rank disturbance related to human activities. The rating refers to the degree of change in the vegetation structure, density and species present in relation to undisturbed vegetation of the same type. The degree of disturbance impacts upon the vegetation's ability to regenerate. Disturbance at a site can be a cumulative effect from a number of interacting disturbance types.

Measuring Vegetation Condition for the South West and Interzone Botanical Province (Keighery, 1994)

Condition	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, with disturbance affecting individual species; weeds are non-aggressive species.
Very Good	Vegetation structure altered, with obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and/or grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and/or grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and/or grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Appendix D – Biological survey information excerpts

RPS Environment conducted a Reconnaissance Flora and Vegetation Survey in September 2017 and November 2019 which identified nine vegetation units within the amended application area, being:

- **Scrub** - *Kunzea glabrescens* / *Adenanthos cygnorum* / *Jacksonia furcellata* Closed Tall Scrub to Tall Shrubland over a degraded understorey of naturalised alien (weed) herbs and grasses;
- **Planted Trees and Shrubs** - planted (non-endemic) eucalypts over emergent and planted native shrubs (Lot 329 – additional clearing area);
- **Banksia Woodland** - Scattered *Eucalyptus marginata* (Jarrah) and *Corymbia calophylla* (Marri) over *Banksia menziesii*, *B attenuata* and *ilicifolia* Low Open Woodland over mixed Shrubland over an exotic Closed Grassland (Fishhawk Road reserve-additional clearing area);
- **Remnant Mixed Trees** - Scattered *Eucalyptus marginata* (Jarrah), *Corymbia calophylla* (marri), *Allocasuarina fraseriana* (Sheoak), *Banksia* spp. and *Melaleuca preissiana* trees over a degraded understorey of naturalised alien (weed) herbs and grasses (Lot 329 – additional clearing area);
- **Remnant Melaleuca preissiana** - *Melaleuca preissiana* remnant trees over a degraded understorey of exotic grasses (Lot 329 –additional clearing area);
- **Flooded Gum Woodland** - *Eucalyptus rudis* subsp. *rudis* Low Open Woodland over *Jacksonia sternbergiana*, *J furcellata* and *Kunzea glabrescens* Tall Shrubland over *Grevillea vestita* and *Regelia inops* Shrubland over a mixed Open Sedgeland / Herbland / Grassland;
- **Flooded Gum Forest over Sedgeland** - *Eucalyptus rudis* subsp. *rudis* and *Melaleuca raphiophylla* Low Open to Closed Forest over *Baumea juncea* and *Lepidosperma* sp. Closed Sedgeland;

- **Remnant Tuart** - *Eucalyptus gomphocephala* (tuart) remnant trees over a degraded understorey of annual and perennial naturalised alien (weed) herbs and grasses; and
- **Remnant Marri** - *Corymbia calophylla* (marri) remnant trees over a degraded understorey of naturalised alien (weed) herbs and grasses (RPS Environment 2018a, RPS Environment, 2020a).

Potential black cockatoo foraging habitat within the amended clearing area (RPS Environment, 2020b)

Vegetation type	Vegetation condition	Clearing area extent
Banksia Woodland	"Good"	0.083
	"Degraded" or worse	0.175
Remnant Mixed Trees	"Degraded" or worse	0.593
Remnant Marri	"Degraded" or worse	0.151
Remnant Jarrah	"Degraded"	0.042
Remnant Tuart	"Degraded" or worse	0.005
Total		1.050 ha

Appendix E – References and databases

1. GIS datasets

Publicly available GIS Databases used (sourced from www.data.wa.gov.au):

- Aboriginal Heritage Places (DPLH-001)
- Cadastre Address (LGATE-002)
- Contours (DPIRD-073)
- DBCA – Lands of Interest (DBCA-012)
- DBCA Legislated Lands and Waters (DBCA-011)
- Directory of Important Wetlands in Australia – Western Australia (DBCA-045)
- Environmentally Sensitive Areas (DWER-046)
- Flood Risk (DPIRD-007)
- Groundwater Salinity Statewide (DWER-026)
- IBRA Vegetation Statistics
- Local Planning Scheme – Zones and Reserves (DPLH-071)
- Regional Parks (DBCA-026)
- Soil and Landscape Mapping – Best Available

Restricted GIS Databases used:

- ICMS (Incident Complaints Management System) – Points and Polygons
- Threatened Flora (TPFL)
- Threatened Flora (WAHerb)
- Threatened Fauna
- Threatened Ecological Communities and Priority Ecological Communities
- Threatened Ecological Communities and Priority Ecological Communities (Buffers)

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RPS (2018b) Clearing Permit Application: Peel Business Park Trunk Services Extensions Supporting Information. Western Australia (DWER Ref: A1648518)

RPS Environment (2020a) Amendment to Clearing Permit (CPS 8037/1): Peel Business Park trunk services extension Clearing Permit Form and Supporting Information, Western Australia (DWER Ref: A1872743).

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RPS Environment (2020c) EEL11266.011, Reconnaissance Flora and Vegetation Survey Addendum. Peel Business Park, 18 February 2020, Western Australia (DWER Ref: A1883581)

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